THE AMERICAN ARCHITECT
The ARCHITECTURAL REVIEW

VOL. CXXII WEDNESDAY, DECEMBER 20, 1922 NUMBER 2409

An entrance suggestive of the unpretentious refinement of a summer dwelling on old-fashioned lines

ENTRANCE GATEWAYS

BY W. K. RAINSFORD

PROBABLY no other feature of the house, of so small a relative cost, counts so strongly in its effect as the entrance gateway. It is the sign-manual to the world at large of the character of the dwelling and of the quality of welcome which may be expected within. As to his casual acquaintances may a man be known by the character of his handshake, with or without its accompanying smile, so to the passerby is a house known by its entrance gateway. An opinion based upon either may be ill-founded; but the thing is worth taking trouble about.

The writer has in mind a pleasant country house which changed owners, and immediately grew a high brick wall enclosing its garden. It is not a pretty brick wall, and it is very high, concealing, from the vantage ground of its terrace, nearly everything but the roof; while its gateway is as narrow as the rich man's gate to heaven. Without ever having met the present owners the writer has conceived for them the warmest dislike. One is reminded of the poem in which:

"A man around his orchard built
A wall, and crowned his labors
By placing glass along the top
To lacerate his neighbors,
If ever they should feel inclined
To touch or see what lay behind."

or, from earlier literary precedent, of the old woman in the fairy tale who inherited a beautiful garden, and who compassed it round with a wall, which grew ever higher and higher, shutting out the sunshine; and all day the old woman walked about her garden feeling the stones of her wall and muttering: "It's all my own. It's all my own." Until, there being apparently no gateway whatever, she died of malnutrition—a conclusion quite unforeseen and, to some extent, deplorable.

Types of gateways are almost innumerable. They may be formal and imposing, quaintly old-fashioned, whimsical, simple, anything and everything save forbidding. Privacy is a most proper desideratum; but the difference is marked between seclusion and exclusion, and one may obtain privacy without the expedient of solitary confinement. This, to be sure, applies only to the main entrance. Where a service entrance also occurs, it is very necessary that their different functions be quite evident; and hospitality will go too far if it entices the arriving guest into the stable or

Entrance Gateway, Rothenberg

(From the original sketch by the Author)

laundry yard. This desirable difference of character cannot well be expressed by dimensions alone, for the required dimensions may be identical, and often is best done by a certain bleakness of treatment, which will warn off all save those who are sure of their ground.

Returning, then, to the main entrance, if for practical reasons a high wall be desirable, it is rather gracious to plant it on the outside as well as the inside; and the gateway should be very ample, or else it should be intimate. It should either afford a reasonable view of the house or grounds, or should itself take the responsibility of smiling on the outer world. The quality of welcome to be expected is expressed here or nowhere; and can any architect forego the pleasure of here expressing it? In wrought iron, in carved oak or rough timber, in brick, stone, or white-washed pickets so much of character and charm may here be sketched in so small a compass.

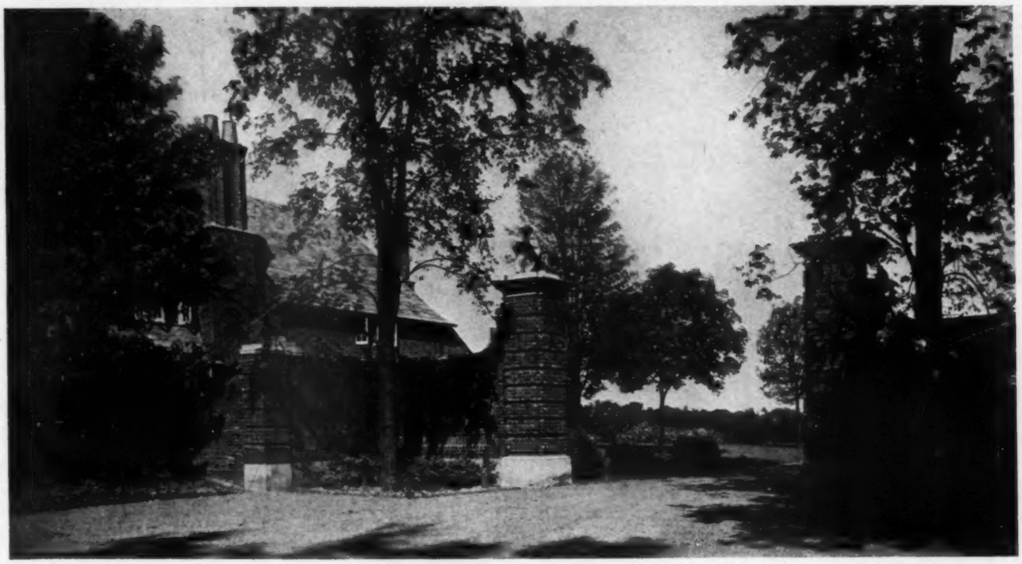
From an artistic viewpoint it is often regrettable that modern conditions require the arrival by motor or carriage at the very steps of the house. How charming in many of the English country churches are the old Lych Gates, where the coffin was set down on its journey to the funeral, and the pall-bearers might enjoy a seat and a shelter from the habitual English weather. But, even if permitted, the architect has never the right to sacrifice genuine convenience to a pleasing anachronism; while a straightforward problem has always the right to a straightforward solution. It is the architect's business to determine first and with certainty the requirements of convenience before beginning his design; but, where an entrance for foot-passengers alone is sufficient, the problem is brought down to a scale in which charm and intimacy are more easily attained. A change of levels will in this case usually be an advantage—two or three steps, or even one, leading down through the gate to the public way. The reverse direction of slope will lend itself almost as well to the quaint and old-fashioned, but will scarcely be successful in a formal design.

Before leaving the churchyard, and although not directly germane to the present topic, the writer wishes to air a personal opinion on French cathedrals; and, with regard to their best accepted entrance motif, to suggest the thought that it may not, after all, be a good entrance motif. The typical West façade of the Gothic cathedral—

Gateway, Siena

(From the original sketch by the Author)

elsewhere to some extent, but almost invariably in France, its true home—is composed of two towers, surmounted by spires, and framing the main doorway. Now spires are intended to soar —which is done much better singly than in pairs. The law of diminishing returns is immediately felt, and two spires soar not twice as much, but



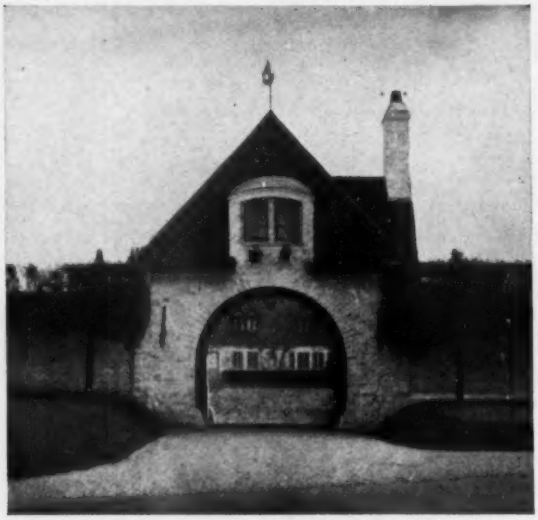
A fine type of formal entrance to a large estate

Keevil Manor, Wiltshire, England

The gateway appears to be of a later date than the Elizabethan house

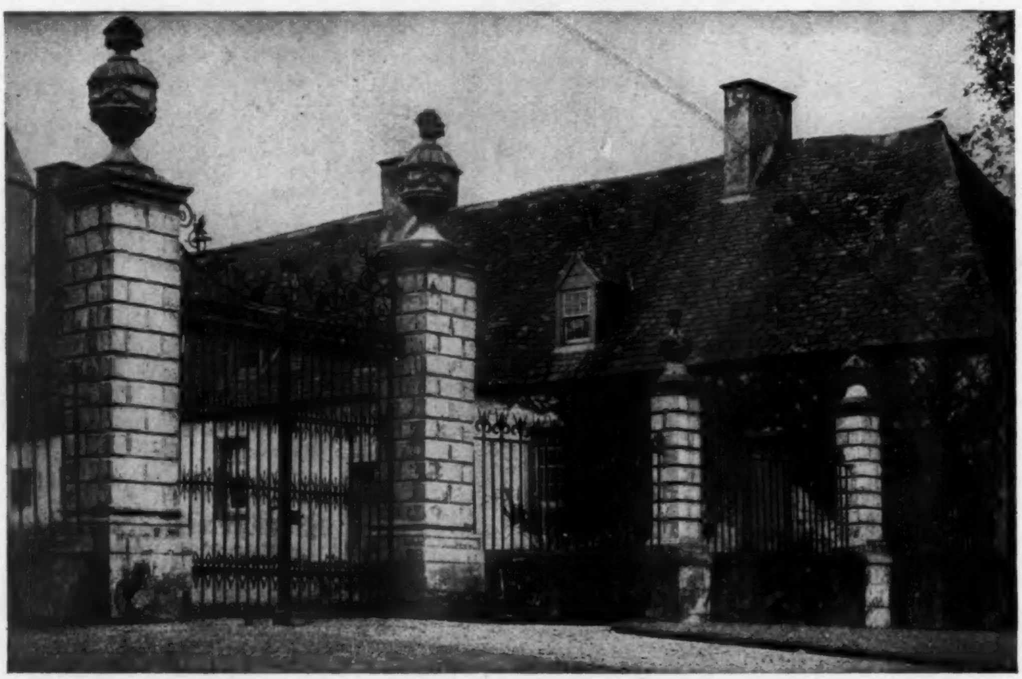
(Reproduced from "Garden Ornament" by permission of Charles Scribner's Sons, publishers)

one-half as much, as one. Whoever has seen and delighted in the fairy grace of the spire of Antwerp cathedral, dominating the city, can offer thanksgiving that funds were never available for building its twin sister beside it —as was intended. Spires also must taper; and, as their buttressed bases spread, the entrance between them becomes crushed, and is no longer welcoming. In short an entrance flanked by twin towers is essentially a fortress motif —well exemplified by the Cannon Gate at Mont St. Michel—and suggestive of culverins from either side and boiling oil from above, rather than of the open arms of Mother Church.



An effective use of planting, combining quaintness of character exactly to suit the architecture

To generalize in theories of design is always difficult; for one will either state that which is but questionably true, or else give expression to the obvious; yet a few principles, evolved from observation, may here be ventured. Open piers surmounted by ornament are usually more imposing than an arched gateway. The ornament may be anything from a simple sphere or obelisk to a group of statuary—with a preference for the former—but it should be studied almost wholly for silhouette. For this reason, too, the summit rather than the face of the pier is the place for ornament. For centuries such piers have been surmounted by vases, of varying grace, and by shield-bearing lions. Yet there is comfort perhaps in the adage that: "Originality lies not with him who does a thing first, but with him who does it best." And for all the flora and fauna which may be seen beautifying or marring the gateposts of the world, the writer



Entrance Gates to Traquair House, Peebleshire, England

A good example of the treatment of iron gates in the time of James II

(Reproduced from "Garden Ornament" by permission of Charles Scribner's Sons, publishers)

still feels a general preference for these.

Where an iron grille is used between such piers the question of relative scale or value is of delicate importance, and it had best be settled at a very early date which of the two is to predominate. This cannot be left to "trial by battle," and before relinquishing his task the architect should be very sure that he has established a basis of permanent

A service gateway to express its character can afford to be somewhat forbidding, and that which would be impossible in a main entrance is here very pleasing

peace. Varying with the character desired in such a grille one may further generalize to the extent of saying that, in the upper member, the rising line is more imposing than the straight, and the latter more so than the drooping curve. Actually the drooping curve is not very often seen, but may sometimes be used with distinct effect, and is, as a corollary to the above, more easily than others adapted to an informal character.

Yet for usual country work a high grille of any sort is probably not the best choice, suggesting too readily either the institution or the *parvenu;* while an arch of iron, springing from the top of either pier, and supporting a lantern above the drive, can express whatever is demanded of it in the best of taste. The ironwork here may be very rich or utterly simple—an intricate network of woven curves, or a single bar; but the masonry will of necessity be simple, and the more severely so the better.

Where the line of the wall is very pronounced, and especially where also it is rather close to the main dwelling, so that a *cour d'honneur* is suggested, or perhaps where the entrance is heavily shadowed by foliage, it may often be that the open pier motif seems unsatisfying—that the need is felt for greater continuity. Here, no doubt, is a place for the arched gateway—and much may be done with it. Its material and treatment will relate closely to that of the house, but in simpler form. Delicacy of ornament is here almost surely out of place—for no one will probably linger to observe it; and in the Jacobean gateways of England one often is struck by the obvious charm of stone ornament whose coarseness of scale would be very unsuccessful elsewhere.

Where the entrance is at considerable distance from the house, so that perhaps the latter is not even visible from it, there is room for argument as to whether such entrance belongs more particularly to the house or to the public way on which it stands. Here one had probably best be guided by the character of the grounds and of the wall rather than of the house itself. Spacious lawns, an avenue of trees, or a rocky slope of dogwood

An effect of richness upon somewhat informal lines, where the elaboration of ironwork is pleasantly relieved and contrasted with the utter simplicity of masonry and sumach will have a very determining influence upon the entrance, but at least the same material as in the house should be used.

The wooden entrance is apt to be a matter less of open choice than of predetermination. The writer remembers having seen a frame dwelling surrounded by a wall of cut stone with stone gateposts, upon which a pair of cast iron hounds gave evidence of their deathless fidelity to their master's interests—not realizing that the supreme sacrifice was the very least that could be required of them. But such efforts are fortunately too rare to merit our present-day attention. Rough timber, sometimes even carried high, may be used successfully with a dwelling of brick or stone, though one might properly expect some recall of the material in the upper story; but the entrance of white painted woodwork is, in the nature of things, demanded by the white frame dwelling, and not elsewhere. It is of all materials the one most readily adapted to the sunshine of open welcome. Here one loses the pleasure of the further company of the shield-bearing lion, and is confined almost exclusively to the vase—nor could anything be more charming than its best development. The scale of the whole motif will require that whatever ornament is used be delicate, and the amount that is advisable will depend largely upon the distance at which it stands from the house. Especially in the pathway entrance, and where the house is felt as a close background, a more delicate scale than the house is very permissible, but, where the house is distant, much ornament will seem to lack support.

For the gatehouse with *loge-du-concierge,* so frequently seen in Europe, there is not often sufficient justification in this country; but, when occasion offers, it affords a very charming opportunity for the architect's skill. Almost surely the roof is to be strongly featured—since the problem is primarily one of silhouette, and will probably be cast on picturesque lines—and the lower the stilting of the arch the more informal will be its character. Ornament of any sort is of doubtful value, for, if the problem of arch and roof has been well handled, the need of ornament will probably not be felt, and in other case no amount of ornament will assist it to success. A good rule in all design is: "When in doubt, don't." For the rest nearly every problem in design is new, and, though solutions be many and excellent, they will not often bear transplanting; but there are few problems, as compared to the entrance gateway, in which the æsthetic is so little controlled by the practical, and where success in solution is so pleasantly obvious.

A Roadside Shrine, near Florence, Italy

From the Photograph by R. M. Blackall

DESIGN AND CONSTRUCTION OF THEATERS

BY ROI L. MORIN

Part IV—The Projection Booth

IT is only during the past few years that legitimate theaters have been designed to admit of a projection booth. All except the recently constructed houses find it necessary, now and then, to station spotlights and an operator at the second balcony rail for certain productions. Nowadays every theater, regardless of category, should be provided with an excellent projection booth, with the latest equipment, (this equipment is being constantly improved).

The size and equipment of the booth are definitely related to the character of the house. In a legitimate dramatic house the booth is only an accessory, used as occasion demands, whereas in a large motion picture theater it is the very heart of the building. The equipment of projector booths consists of the following:

1. The projectors
2. Spotlights
3. Stereopticon
4. Motor-generator set (Rotary converters)
5. Rewind machine
6. Switchboard panel
7. Film cabinet
8. Forced draft ventilating apparatus
9. Signal & Telephone system to stage, Orch. pit & Box office
10. Fire fighting apparatus, Hand extinguishers, Sand buckets, etc.

Different types of theaters require the following:

Legitimate dramatic houses:

1. Battery of two projectors
2. One spotlight, with an iris douser, gelatin slide and color wheel
3. Pr. hand rewinders

Theaters devoted to vaudeville and motion pictures, or to motion pictures exclusively (small theaters) should have:

1. A battery of two projectors and an alternate machine, or two batteries of two machines if the management can afford it
2. A spotlight (with all its accessories for vaudeville)
3. Stereopticon
4. Rewind machine

The large motion picture concert houses should be equipped with:

1. Five or six projectors (Three batteries of two)
2. Stereopticon

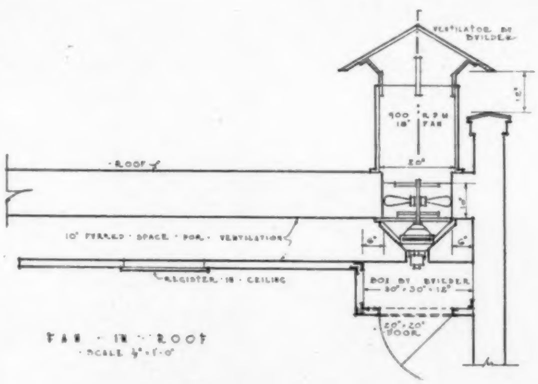


Fig. 1B. Detail of Fan Chamber for a Projection Booth

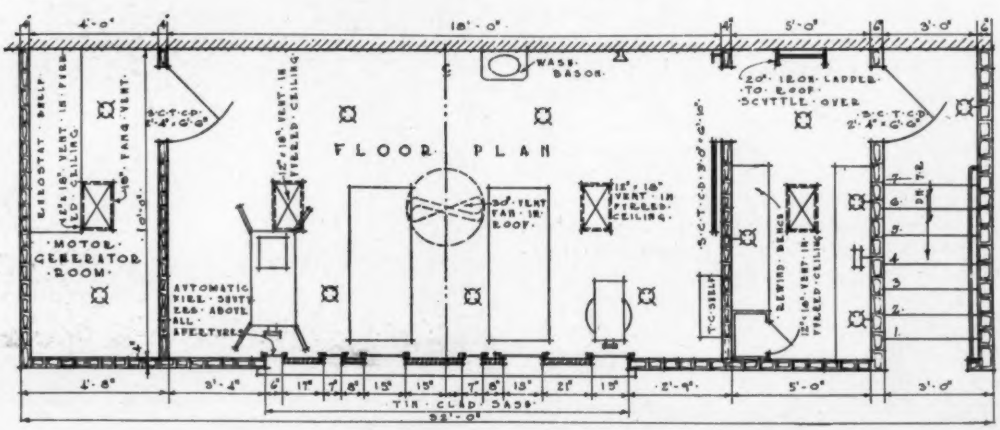


Fig. 1A. Layout of a typical Projection Booth, for a legitimate theater, vaudeville house or small motion picture theater

Fig. 2A. The Auditorium from the stage, Munich Art Theater
Note seating arrangement—No aisles

3. Several spotlights (as many as the orchestration and effects may require). The Capitol Theater in New York has a dozen
4. Machine rewinders

Projectors have three kinds of lamp apparatus, nitrogen lamps of high wattage, ordinary arc (as in a spotlight), or the new high-intensity arc. The first is used only for amateur or semi-professional apparatus, lecture halls, etc., the second is used in small picture theaters in the provinces while the third is now installed in all first class houses, to replace the second. There are two types of high-intensity apparatus, the General Electric, which is constant feed, burning the carbon at a steady rate, and the Sunlight, which is an automatic, magnetic feed, as the carbon requires. The second would appear the more logical machine, yet both are excellent and the author prefers not to recommend one in preference to the other.

If only one spotlight is installed, it should be a heavy type, counterbalanced and equipped for all sorts of work; if several, then a number of different sizes and types.

A motor generator set is installed either to convert the alternating current from the power lines to direct current for the projector and spotlight lamps, or to stabilize the direct current, if this is fed from the mains. There are a large number of different types of converters made, all efficient, but the one of size and make recommended by the manufacturers of the high-intensity lamp should be used. The switchboard panel is part of the motor generator apparatus.

Legitimate houses and small motion picture theaters require only small, hand-driven rewinders, and large theaters should have the motor driven apparatus. All booths should have the cast iron film cabinets, not the cheap sheet metal type, approved by the Underwriters Laboratories. A six section 15″ reel should be large enough for the average house, and two of them for the largest motion picture theaters.

The forced draft apparatus should be independent of the theater ventilating system (the projectors give forth a pungent, noxious gas), and should be large enough to turn over 30 cubic feet of air per minute. See accompanying cut for details.

The booth (it is still called a booth as it was originally although it has grown into a distinct, isolated part of the building), should be thoroughly fireproof, with reinforced concrete floor and roof and 8″ T. C. walls, on a steel frame. The whole should be strong enough to conceal the vibration and noise of the motor generator apparatus (this latter should be on a thick cork mat with a layer of Flaxlinum between and not bolted to the floor). This "booth" consists of four rooms, all separated by 4″ T. C. partitions and self-closing, kalamein doors, the projector room, the motor-generator room, the rewind room and the operators' room, with small toilet, basin, lockers and lounge. If fire hazard was great backstage, it is far greater in the booth as the celluloid film is the most inflammable material which is introduced into a theater building.

Designers do not give enough attention to the layout of projection booths. A booth with ample space and facilities, clean and tolerable surroundings for operators is rare. An average temperature of 100 degrees or more is not uncommon, and work in them is akin to that in a stokehold.

Logical dimensions of the rooms are as follows:

Projector Room	Width	Length	Height
Legitimate & Vaudeville	10′-0″	18′-0″	8′-0″
Motion picture theater	12′-0″	22′-0″	8′-0″
Concert motion picture theater	12′-0″	28′-0″ or 30′-0″	8′-6″

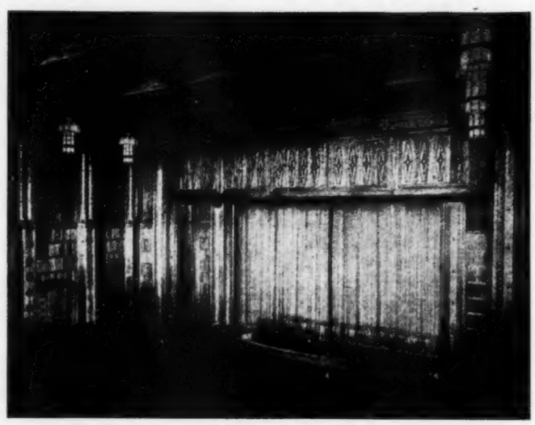


Fig. 2B. The Proscenium, Munich Art Theater

Rewind room and Motor-generator room	Width	Length	Height
(All types of theaters)	6′-0″	10′-0″	8′-0″

The accompanying cut shows a typical layout for a small booth, as required for a legitimate theater, vaudeville, or small motion picture theater. All furniture, lockers, shelving, etc., should be of steel, all doors and windows kalameined, and the port-holes, both lookout and machine, must be equipped with fireproof shutters (either asbestos or sheet metal) and fusible links.

The average throw (the distance from the machine to the screen) is from 85′ to 110′. The throw should never be less than 50′ and rarely be more than 200′, unless a powerful high intensity lamp and motor-generator set are installed, (at least 100-100 Amp.). The pitch of the throw (i.e., the angle which the center line of the light makes with the horizontal) will depend upon the design of the theater and location of the booth, but the architect should take precautions never to allow it to exceed 25 degrees, and as much less as possible, in order to have a minimum amount of distortion in projection.

The best type of screen is the silver, linen on a rubber ground, that may be washed. An average size is 16′ by 18′. Both the screen and the battery of machines, should, of course, be centered on the house.

The Auditorium

THE auditorium is the part of any theater building, especially in the commercial theater, upon which the most care and study will be lavished in its design and appointments, and the successful theater architect today is he who can crowd the largest auditorium, i.e., the greatest number of seats, on a small lot. This practice has been carried beyond all semblance of reason, and if persisted in, the theatrical men, and those men who show themselves so eager to minister to their wants, however cheap and banal, will defeat their own ends. There is no class of buildings in the United States today, not even churches, which are so ugly and so badly designed as theaters.

The greatest evil that exists is precedent. As Irving Pichel writes in his book, On Building a Theater, "Architectural ineptitudes are more

Fig. 3. Auditorium of the Little Theater, New York

Harry Creighton Ingalls and F. Burrall Hoffman, Jr., Associated Architects likely to be perpetuated and in time condoned than those in any other art. Generally speaking, a bad painting is scrapped, poor music remains unpublished and unplayed (along with much good music, no doubt), and bad books, after a time, cease to be read. But a building is somehow inescapable. Having a durability that needs no treasuring, and being erected more often for use than for beauty, a building generally achieves longevity, and bad art crumbles no sooner than good stone. Usefulness, great initial cost, sturdy stuff, are all against a building's being put out of the way merely because it is ugly. Or even, as a matter of fact, because it does not successfully serve the purpose for which it was erected.

"As people live in a house, or work, day after day, in a store or factory building, they become accustomed to its inconveniences, bad arrangement, and lack of proper facilities. They complain for a time, perhaps, and then forget. And after a while, when the house has become a home, or the large building has gathered tradition, a sort of admiration settles upon it. What is really plain, ugly, wrong or bad appears quaint and full of 'atmosphere.' And is imitated. Style and tradition embalm the very features that make the building a bad building.

Fig. 4. The Lyceum Theater, New York
Herts & Tallant, Architects

"In the theater, this perpetuation of musty, tradition-hallowed faults of construction has been carried to an extraordinary extreme. There is more ritual, one might believe, in constructing a stage and auditorium in accordance with honored custom than there is in the building of a church."

If a clever designer had never seen a theater, and was given instructions as to its purpose and requirements, he would probably turn out a more interesting, more practical and beautiful building than most specialists. The theater expert approaches the problem with his head filled with conventional motives—32″ back to back, 14 seats between aisles, center bank, proscenium arch frame, building laws and boxes, etc.

When the New (Century) Theater in New York, proved a financial failure, much talk was bandied about its design. The critical forefinger to the contrary notwithstanding, with the exception of the acoustical difficulties of this theater which were encountered at its incipiency and have since been corrected, the Century Theater stands today by all odds the finest example of theater construction and beauty in this country. Its failure was solely on the æsthetic grounds of its productions. Public taste is not yet sufficiently cultivated to support repertory of the high quaiity and magnitude of the original conception of the New Theater, as any competent local critic can testify. What fills theaters are "Lightnin's," "Bats" and "Turn To The Rights," not art, beauty or perhaps intelligence.

The soundest cure for this blight of precedent is to introduce a new type of men in the field of theater design, as new types have already come into the realms of scenic artist and producer, men cultured, learned and dignified. In the theater proper, Arthur Hopkins, the producer, is such a figure, as are scenic artists like Robert Edmund Jones and Lee Simonson. These men are wholly of the theater, however, and are forced through existing circumstances to perform their magic in buildings designed by men who are far beneath them in culture and intelligence. An immediate relief might be effected by forcing the men who design theaters to go to them, to experience their discomforts and realize their inadequacies. Then should we have each new theater studied to make it an original conception, and not copied to incorporate the most economical features of what has gone before. But I fear that I divert from the theme.

THERE are three distinct types of auditoriums, the horseshoe type, the modern American fan-shaped type, and the Greek amphitheater type as modified and designed to suit the modern theater. The last was first tried in Wagner's theater at Bayreuth.

The first, or horseshoe type, may be summarily dismissed on the grounds that it is impractical and out of fashion. Every student of the theater is familiar with it. Today no one uses it, or even considers using it, either in Europe or America. Arnold Bennett, commenting on Garnier's masterpiece, the magnificent Paris Opera-House, a theater of the horseshoe type, has the following to say in his book, Paris Nights, and Other Impressions: "The box was a stage box. It consisted of a suite of two drawing rooms, softly upholstered, lit with electric light, and furnished with easy chairs and mirrors. A hostess might well have offered tea to a score of guests therein. And as a fact there were a dozen people in it. Its size indicated the dimensions of the auditorium, in which it was a mere cell. The curious thing about it was the purely incidental character of its relation to the stage. The front of it was a narrow terrace, like the mouth of a bottle, which offered a magnificent panorama of the auditorium, with a longitudinal slice of the stage at one extremity. From the terrace one glanced vertically down at the stage, as at a street pavement from a first story window. Three persons could be comfortable, and four

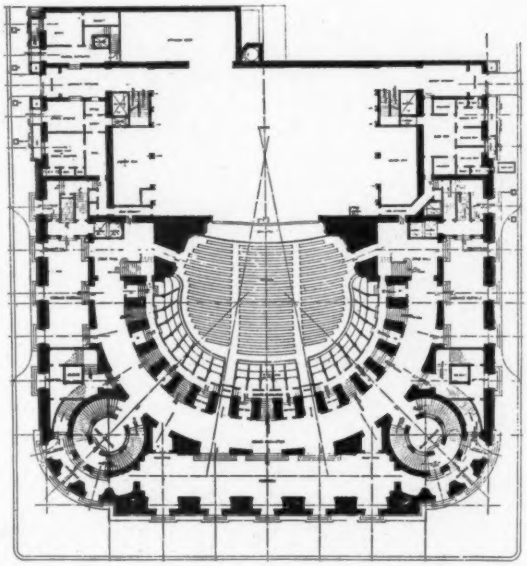


Fig. 5A. Orchestra plan

The New (Century) Theater, New York

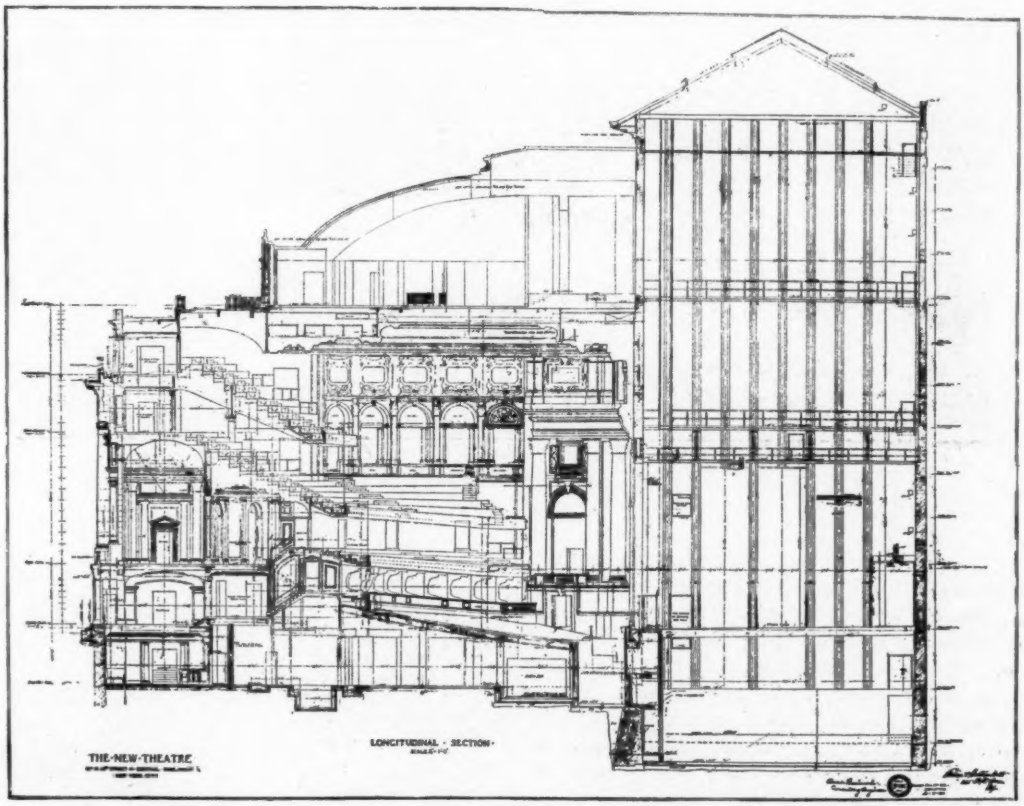


Fig. 5

Carrere & Hastings, Architects.

could be uncomfortable, on the terrace. One or two more, by leaning against chairbacks and coiffures could see half of the longitudinal slice of the stage. The remaining half-dozen were at liberty to meditate in the luxurious twilight of the drawing room. The Republic, as operatic manager, sells every night some scores, and on brilliant nights some hundreds, of expensive seats which it is perfectly well aware give no view whatever of the stage."

The second is the most common modern type and is used in the commercial theater the world over—England, Australia, France and the United States. It is an excellent design, simple and practical, and is a great improvement on the old horseshoe type. The third is the latest and is usually associated with the theaters in the Teuton countries, where the finest stages and mechanics originate. Its ear-marks are that there are no aisles, —one enters from the end of the row,—the entire auditorium is a solid bank of seats, there are no balconies, and the auditorium is the safest, most practical and most comfortable ever devised. It is not ideal in every respect as the very requirements and laws which govern theater building place upon it certain limitations which it is impossible to overcome, yet its faults are very few.

Let us take up first the typical fan-shaped theater, with its picture-frame stage. The auditoriums of this type of theater have aisles, as everyone knows, that cut down through the seats, from the rear of the auditorium to the stage. The building code, which was framed from and for theaters which were built in this manner (like a puppy merrily chasing its own tail), does not allow theaters to be built without these aisles and allows no more than 14 seats between aisles. All aisles must be 3′ wide at their beginning and increase $1\frac{1}{2}''$ in width to every 5 running feet. An aisle should never run up through the center of a theater (as some of them do), as this is the very heart of the seats, and space may be more easily sacrificed near the two side walls. Always have a center bank. The pitch of any aisle (without steps) should never be more than 2″ per running foot at the steepest place, though even this pitch is forbidden in some municipalities. Wherever possible there should be an even number of seats in a row between aisles, as seats usually sell in twos, or multiples of two.

Fig. 6. Seating Arrangement, Music Box Theater, New York
C. Howard Crane, Architect

Seating arrangement should be such as to provide for aisles along the side walls (except the first few rows in the front of the house where the walls converge in towards the stage) because both sides of the auditorium must open to either a street or

(*Continued on Page* 553)

·EDITORIAL·COMMENT·

THE QUESTION of how to separate the sheep from the goats in business has resulted in the coining of trade names which are then copyrighted or protected as trademarks.

The first name to attract widespread attention was "Realtor," which is used to designate real estate operators who conduct their business on a high plane. Now the former National Association of Electrical Contractors and Dealers announce that the name has been changed to "Association of Electragists, International." This was due to the desire to incorporate in the title the trademarked word Electragist, meaning a member using high standards of practice. The new title also gives recognition to the large number of members located outside of the United States.

It is reported that the General Contractors' Association of America may adopt a copyrighted name by which the members will be known. The idea underlying the movement is good but the public attitude is expressed in the old query "What's in a name?" Architects and other professional men have had high grade professional societies for many years and the use of letters following names of individuals pleases the *amour propre* of the members. The effect upon the public has been small and examinations in many states now force public recognition.

After all it is largely a question of the individual. Each man has his following and degrees of probity exist that are adapted to the circles in which men live, move and have their being. There are average, above average and below average men in every profession. There are shrewd, more shrewd and simple men in every line of business. There are efficient, capable and inefficient artizans in every line of work. Every man is known by his work and the public is aware that some men are better or more honest than others. New names mean nothing, even when protected by law. Performance alone counts.

* * *

CERTIFICATES OF COMPETENCY issued as a result of examinations have one drawback in that they also serve as licenses to practice. Until the two functions can be separated no system of examinations can be successful. This was illustrated recently in the trial of an attorney charged with aiding his clients in not only evading certain legal requirements but in actually defrauding trustful investors. His clients were punished and he was disbarred for three years, his defense being that he did what he was paid to do and did not violate the confidence of his clients. To them at least he was faithful, thus illustrating once more that in many cases an honest man is one who stays bought.

That this man was not recreant to the trust placed in him by his clients saved him because of ambiguity in the law relating to certificates of competency and licenses to practice. It should not be difficult to have the laws so amended that a certificate of competency given in one state should be good in all the states; but licenses to practice should be granted only upon proven business honesty after a certificate of competency is first granted. The so-called evidence of good moral character obtained before an examination of the educational qualifications of a man is rarely taken seriously enough. Given however a certificate of competency and turned loose upon the business world his acceptance of the limitations imposed by the canons of business morality alone should determine his fitness to deal with the public. A certificate of competency granted by a public examining board oftentimes has a tendency to nullify the effectiveness of *Caveat Emptor* and makes the state an accessory in behavior of an unmoral nature.

* * *

LICENSING OF BUILDERS is again to the fore. Some architects and engineers fear that certificates of competency issued to builders may in time relegate their professions to a state of relative importance. This fear keeps with us the scamping builders and shoe-string operators who are merely traders. The certifying of the ability of builders should be confined to those men who can prove that they are already licensed to follow some trade or profession connected with building operations; or to men who have been actively connected with building construction as a sole means of livelihood for a period of years, the necessary experience having been obtained on the job and not in the office. To architects and engineers alone should be issued certificates of competency to design and the certificates given to builders should be nothing more than notice that the holder is possessed of sufficient experience to co-operate with competent designers. Properly formulated, such regulation of the building business will in time produce needed stabilization.

* * *

SCHOOLS FOR FOREMEN are on the program of the Associated Building Contractors of Illinois as a preliminary step toward a program for the training of apprentices. Not all foremen are born and the best are those who are trained to be foremen. Under the program of the Illinois organization future foremen will be selected from among workmen who have studied the principles of social psychology, cost-keeping, efficiency methods, buying and the managing of men. These things are to be taught in schools operated under the supervision of, and in close co-operation with, the employers. In some of the subjects it is believed many employers will enroll in order that they may not prove themselves inferior in such knowledge to their employees. To further encourage men who will take up such work the adoption of some form of certification of ability of builders seems really to be necessary. The calling of the builder should be a few degrees better than a quick-rich scheme of traders and shrewd buyers.

* * *

THE CUSTOM appears to be growing in favor of dispensing with general contractors and placing control of building operations in the hands of architects. This is a reversion to first principles, when the architect was the master builder. He was chosen by the owner to assemble a band of designers, sculptors, painters and master masons to plan a structure and these men, each in his own line, hired the best workmen to be had and directed their work under the general supervision of the architect.

In these days the school trained architect after some years of practical experience should be better fitted to take general charge than was the architect of earlier days. He must have a knowledge of more things because he has a much wider choice of materials and processes, but the broader knowledge makes him a broader man. There is an advantage to the owner in having the planner deal personally with all the artizans and tradesmen involved. The special advantage to the owner lies in the ability to make changes without piling up staggering extra costs. The special advantage to the planner lies in the fact that his dream structure may be realized without exhausting and irritating arguments with men who see deviations where oftentimes none exist and claim the right to profit thereby. More cheerful co-operation is had from the sub-contractors and, altogether, the idea of having one responsible specialist in the employ of the owner is working well.

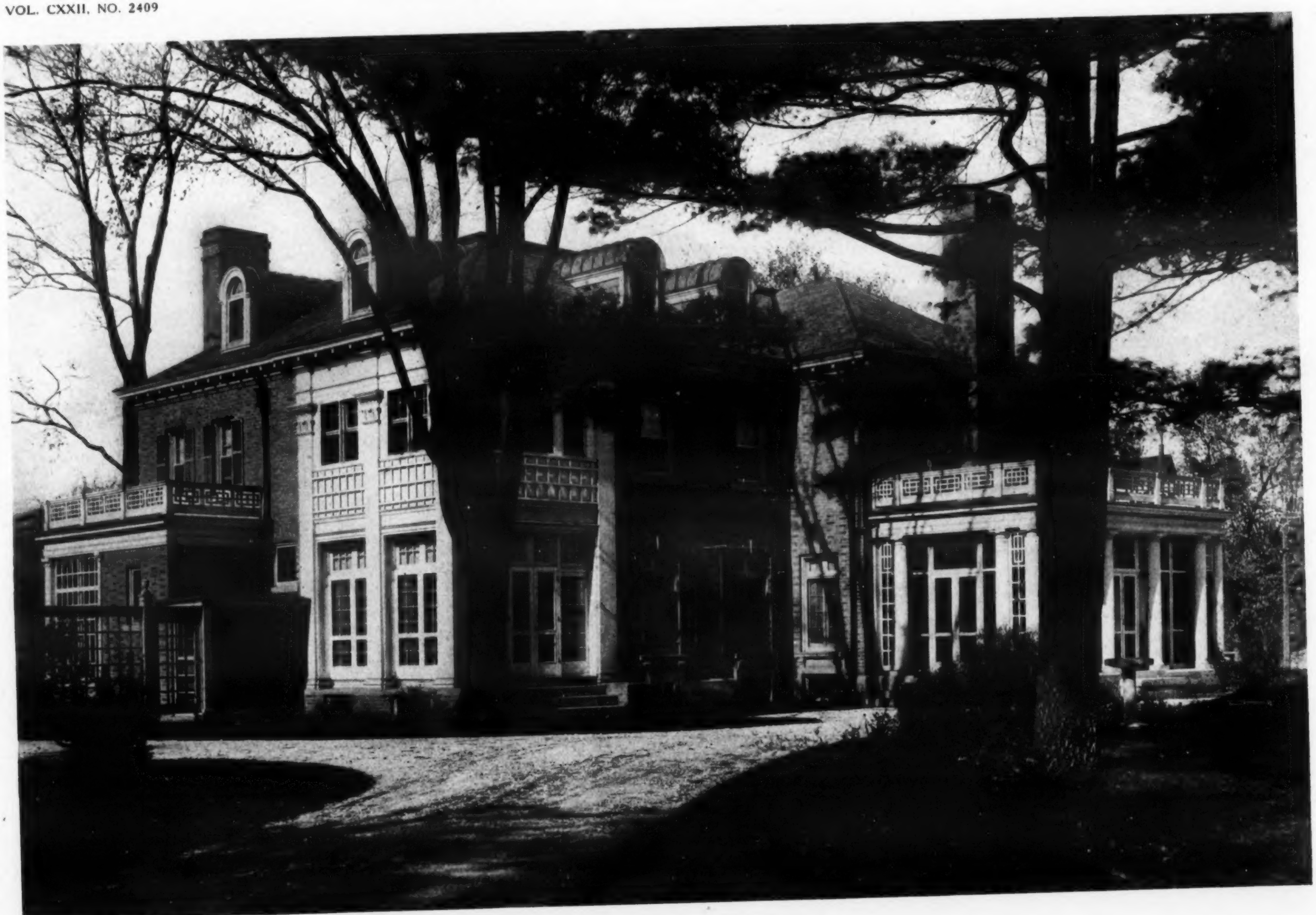
* * *

THE LUMP-SUM CONTRACT has defects that have caused other methods of contracting for work to be introduced. The one in most common use is the percentage, or "cost-plus," which is favored because many contractors who work only in this way also undertake the financing. The rush of work during the recent war, all of which had to be done in this manner because of lack of preparedness, caused much criticism so that the government is now suing a number of companies for a return of profits claimed to have been illegally earned. Cost plus fee with guarantee was another method that once had considerable vogue, but in the final analysis the difference between it and a lump-sum contract is hard to find. For a time a method was tried that was used on railway work in which a careful estimate was made of the cost and a contractor took it on a fee basis. If the work cost more than was estimated, his fee was reduced in an amount proportioned to the increase. If the work cost less than the estimate, he received one-half the saving in addition to his fee. Then followed the cost plus fixed fee but it is not attractive to general contractors. It has, however, attracted technically trained men, architects and engineers, much to the discomfiture of the general contractor. These trained men are, as a rule, of a superior type to those hastily hired in the open market after a contractor has signed a contract. Their fixed fee, translated into monthly salary, is larger and their interest in the work is greater. One step farther and the planner of the structure becomes the superintendent retained on a fee basis and the architect is once more the master-builder. It seems to be logical and it is gratifying to learn that the spread of the custom is regarded with dismay in the offices of general contractors. Its general adoption will go far toward a settlement of many misunderstandings between contractors and labor organizations.

* * *

EDUCATION HAS PERFORMED such wonders in every line of industry and human endeavor that its effect upon health should not be forgotten. A generation ago tuberculosis was accounted the greatest scourge of humanity. Today, thanks to education in sanitation and personal hygiene, much of it due to the eagerness with which architects have preached beauty and availed themselves of every advance in science so that habitations and working spaces have been made safe, the scourge of this malady has been greatly diminished. Much remains to be done and to the architect at this season of the year the sale of Christmas Seals holds a special plea. The decorative effect of such a seal is sincere and it is sincerity that counts most in life.

DECEMBER 20, 1922 THE AMERICAN ARCHITECT—THE ARCHITECTURAL REVIEW



HOUSE OF C. G. HERGET, ESQ., PEKIN, ILL.

HEWITT & EMERSON, ARCHITECTS

REAR VIEW, SHOWING GARDEN SCREEN AND GARAGE

HOUSE OF C. G. HERGET, ESQ., PEKIN, ILL.

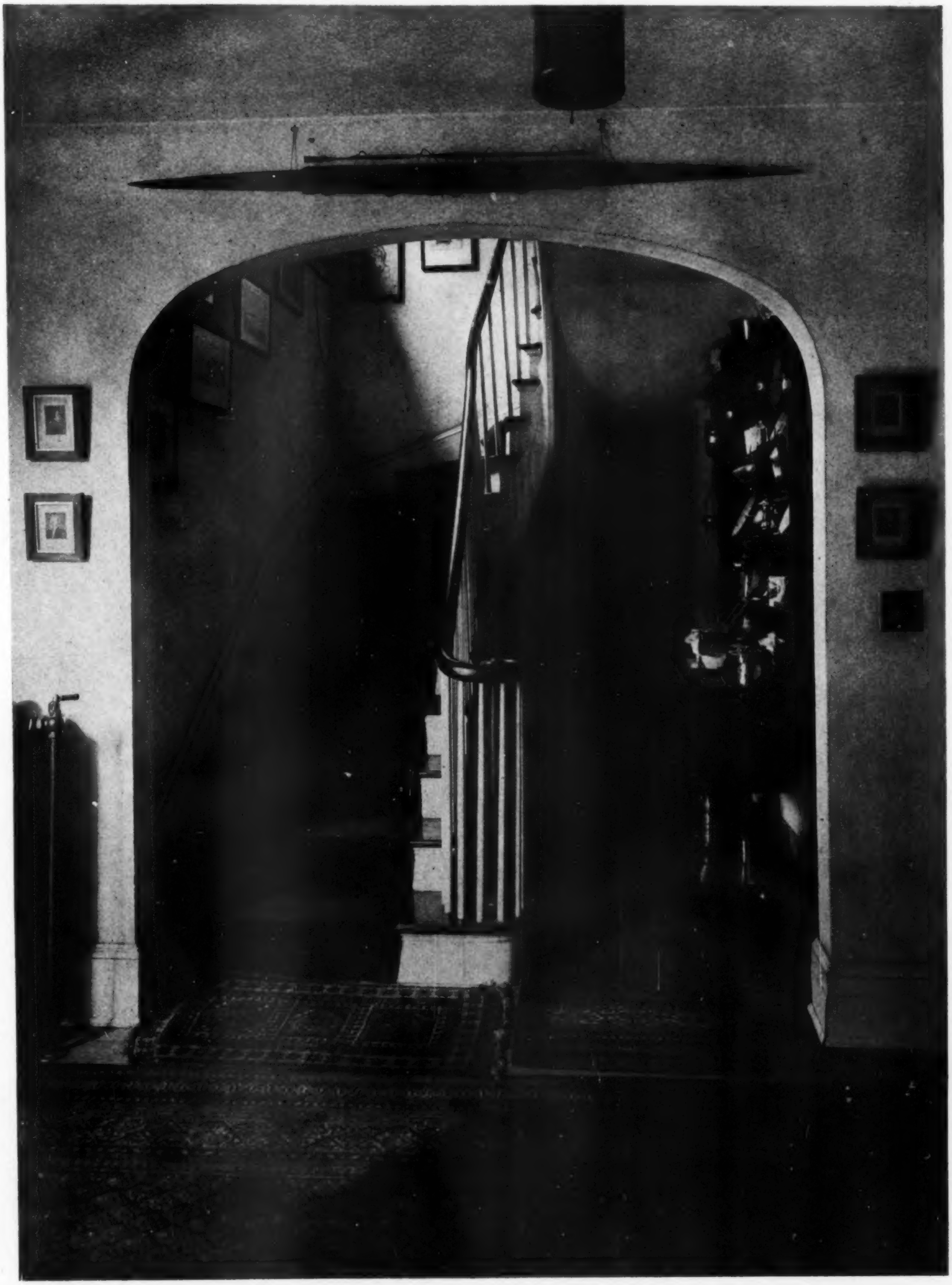
HEWITT & EMERSON, ARCHITECTS

MANTEL IN HOUSE OF C. G. HERGET, ESQ., PEKIN, ILL.
HEWITT & EMERSON, ARCHITECTS

HOUSE OF E. BURTON LYON, ESQ., HEMPSTEAD, L. I., N. Y.
DWIGHT JAMES BAUM, ARCHITECT

HOUSE OF E. BURTON LYON, ESQ., HEMPSTEAD, L. I., N. Y.

DWIGHT JAMES BAUM, ARCHITECT



HOUSE OF E. BURTON LYON, ESQ., HEMPSTEAD, L. I., N. Y.
DWIGHT JAMES BAUM, ARCHITECT

HOUSE OF M. CHOTINER, ESQ., LOS ANGELES, CAL.

PIERPONT & WALTER S. DAVIS, ARCHITECTS

MOUNTAIN LODGE

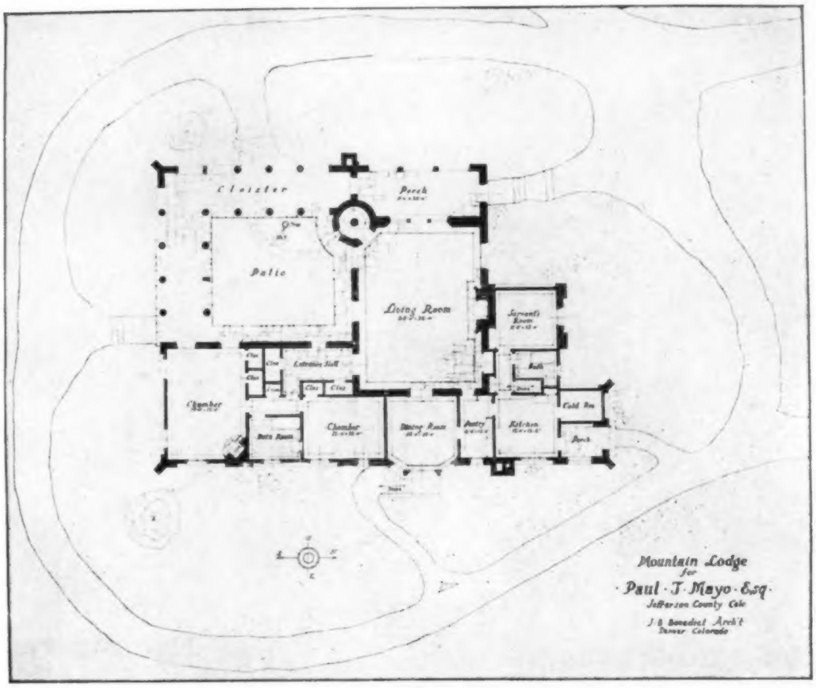
FOR

PAUL T. MAYO, ESQ.

JEFFERSON COUNTY, COL.

J. B. BENEDICT

ARCHITECT



MOUNTAIN LODGE
FOR
PAUL T. MAYO, ESQ.
JEFFERSON COUNTY, COL.

J. B. BENEDICT
ARCHITECT

LANDSCAPE EFFECTS ON ESTATE OF H. A. FULLER, ESQ., SAN RAFAEL HEIGHTS, PASADENA, CAL.
PAUL G. THIENE, LANDSCAPE ARCHITECT

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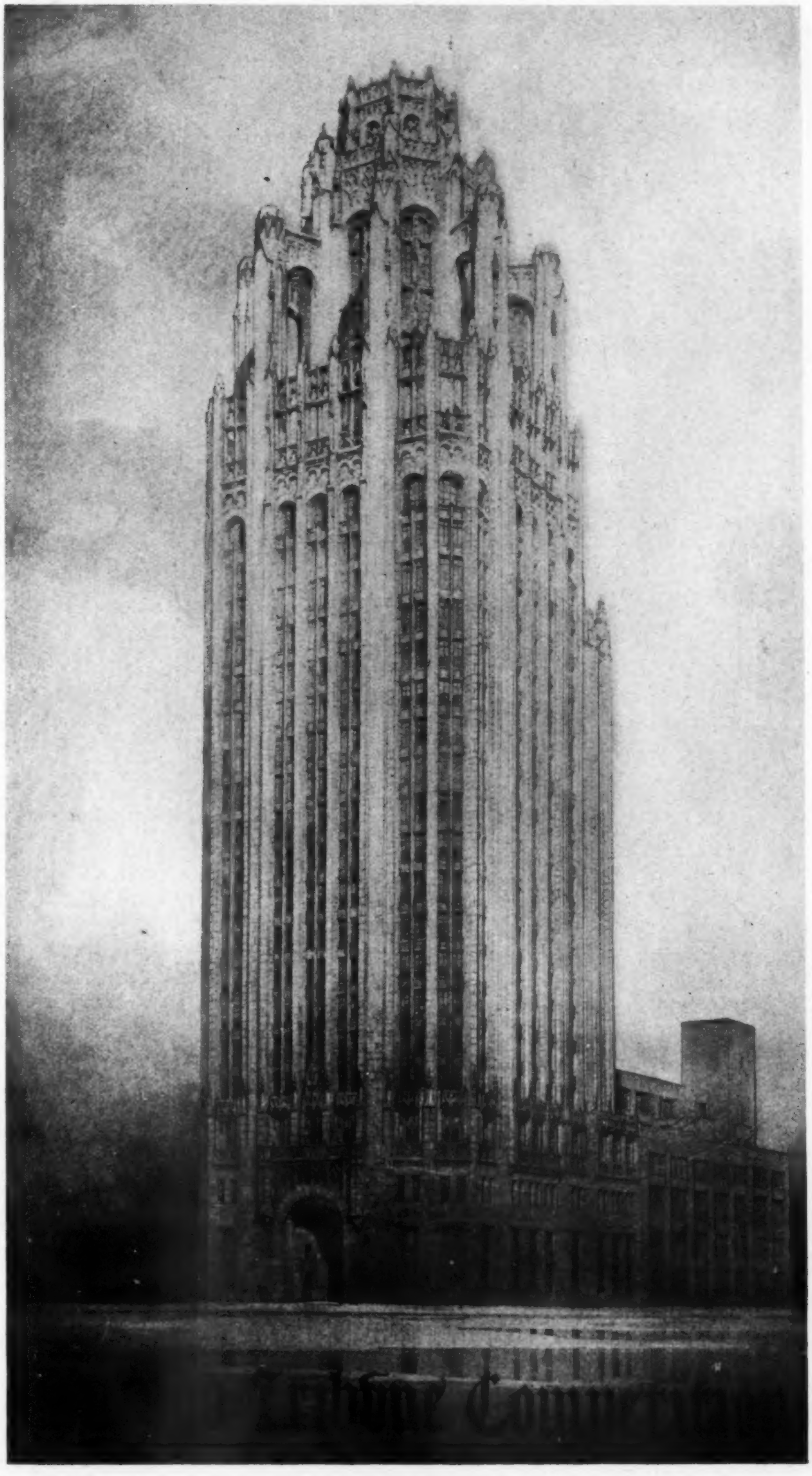
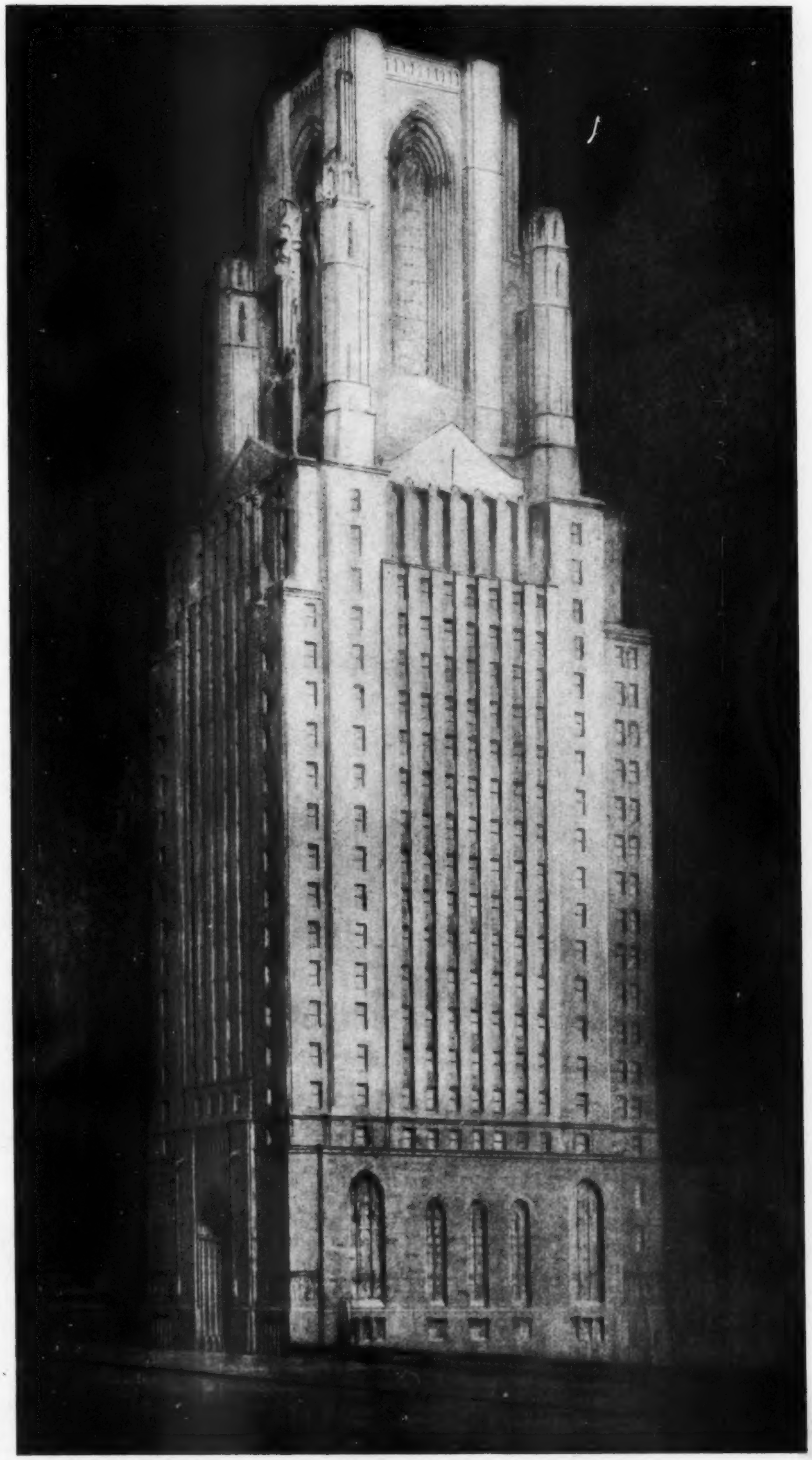


FIRST PRIZE
CHICAGO TRIBUNE BUILDING COMPETITION
JOHN MEAD HOWELLS, ARCHITECT
RAYMOND M. HOOD, ASSOCIATED ARCHITECT

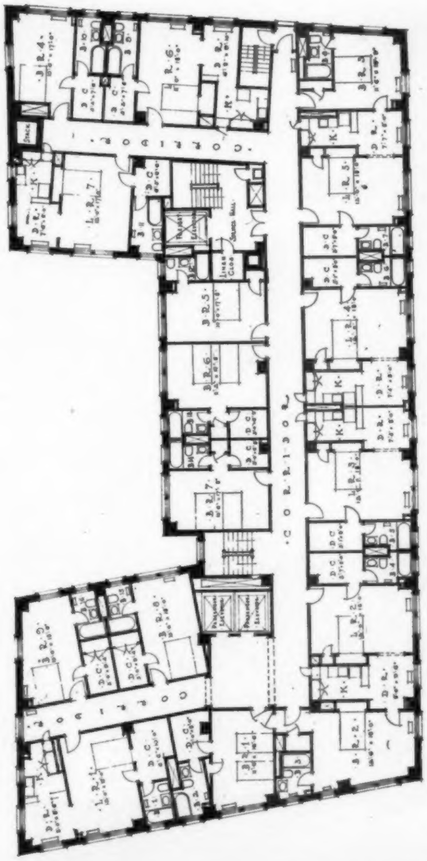
SECOND PRIZE
CHICAGO TRIBUNE BUILDING COMPETITION
ELIEL SAARINEN, ARCHITECT
DWIGHT G. WALLACE AND BERTELL GRENMAN, ASSOCIATED ARCHITECTS



THIRD PRIZE
CHICAGO TRIBUNE BUILDING COMPETITION
HOLABIRD & ROCHE, ARCHITECTS

MELBOURNE HOTEL, ST. LOUIS, MO.

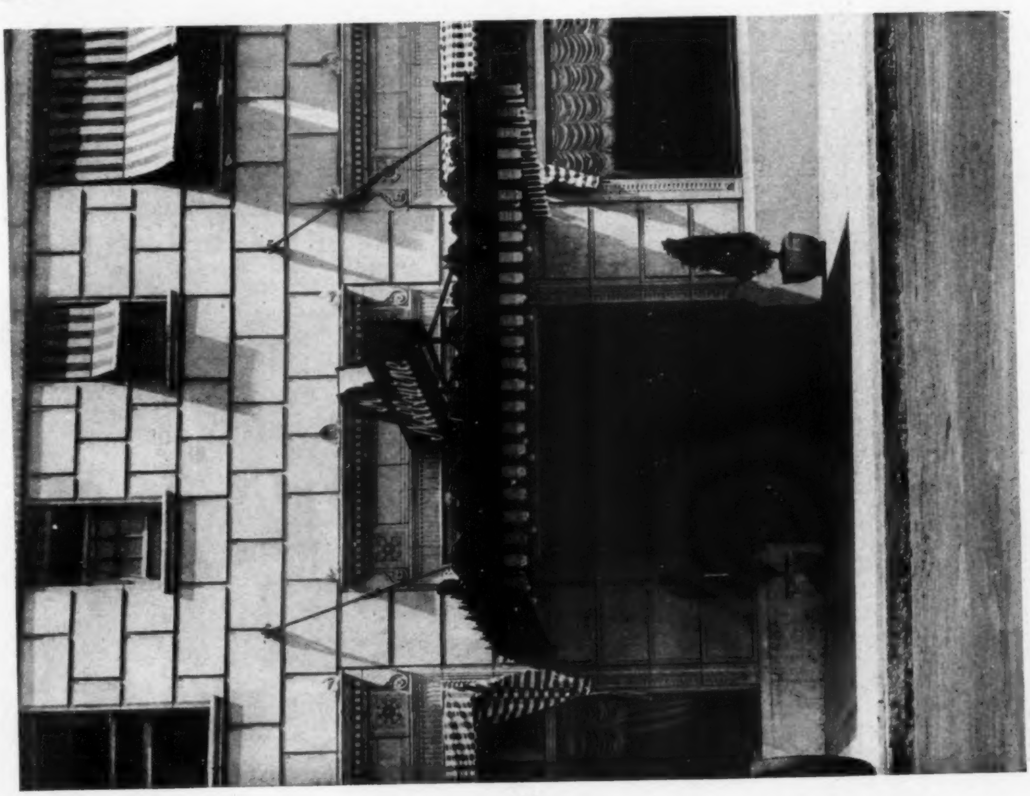
PRESTON J. BRADSHAW, ARCHITECT



TYPICAL FLOOR PLAN

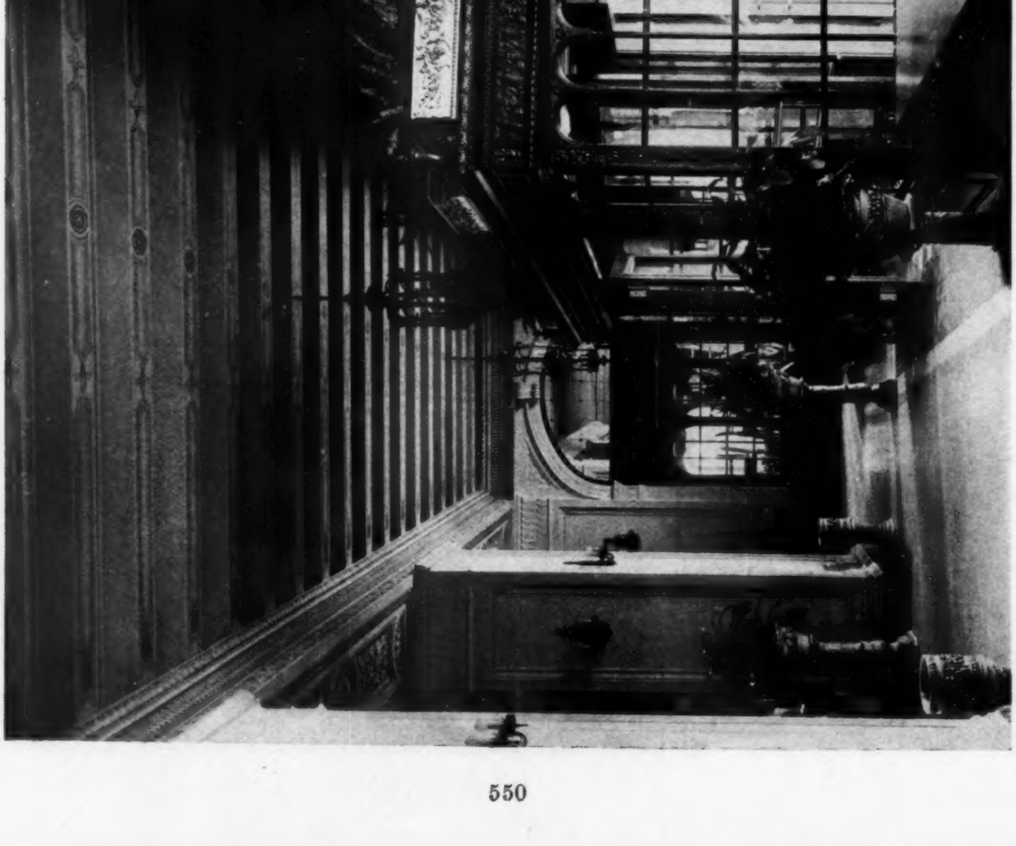
MELBOURNE HOTEL, ST. LOUIS, MO.

PRESTON J. BRADSHAW, ARCHITECT



MELBOURNE HOTEL, ST. LOUIS, MO.

PRESTON J. BRADSHAW, ARCHITECT



MELBOURNE HOTEL, ST. LOUIS, MO.

PRESTON J. BRADSHAW, ARCHITECT

MELBOURNE HOTEL, ST. LOUIS, MO.
PRESTON J. BRADSHAW, ARCHITECT

Design and Construction of Theaters

(*Continued from Page* 542)

exit courts. The designer will go through a careful cut and try game until he gets the proper relation between his plot, the seating layout and the corridors, lobbies, exits, etc.

The standard seating dimensions are 32″ back to back, and the seats are 19″, 20″, 21″ and 22″ wide, with 21″ predominating. The author recommends 36″ back to back, and 24″ seats.

The number of rows is related to the limit of audibility. In a legitimate theater where fine gradations of speech and gesture must be preserved, the limit of audibility is about 75′, though in a well shaped auditorium, without interference from an overhanging balcony this might be increased to 100′. In any event it is wise not to plan for any more rows of seats than there are letters in the alphabet, i.e., 26—then the auditorium will be of a safe depth. In vaudeville houses where the virtuosity of the entertainment is varied, the auditorium may be 150′ deep. Opera houses and musical comedy houses are from 100 to 110 feet deep (measuring from the curtain line to the last row of seats). A theater that will seat a thousand people, (an average legitimate theater) requires a plot 100 to 110′ wide by 125 to 150′ deep. A theater that will seat 2000 (a vaudeville house) requires a plot 110 to 120′ wide by 175 to 200′ deep.

Strindberg, the Swedish dramatist, laid down the rule that the lowest seat in the auditorium should bring the spectator's eyes on a level with the actor's knees. The average person, sitting, has his eyes about 4′-2″ above the floor. An actor's knees are about 1′-8″ above the stage floor. Thus follows the syllogism that the first row of seats should not be more than 2′-6″ below the stage level. In Europe, the lowest part of the auditorium floor varies from 2′-3″ to 3′-0″ below the stage level. 3′-0″ is an excellent figure to follow. The standard in this country is 3′-4″ (as shown by the accompanying cut) but sometimes this is stretched to 4′ to gain more seats in the rear of the auditorium. This latter is bad practice.

The auditorium floor is saucer shaped, pitching up at a gradually increasing rate. It is made of a reinforced concrete slab (the plenum chamber and

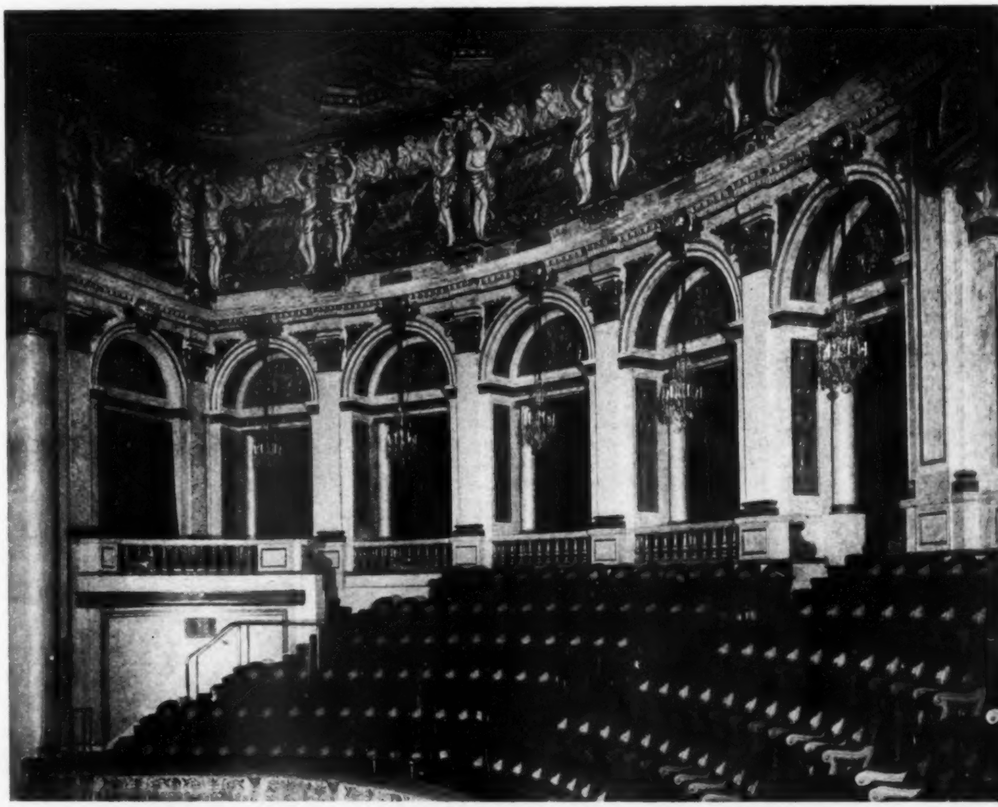
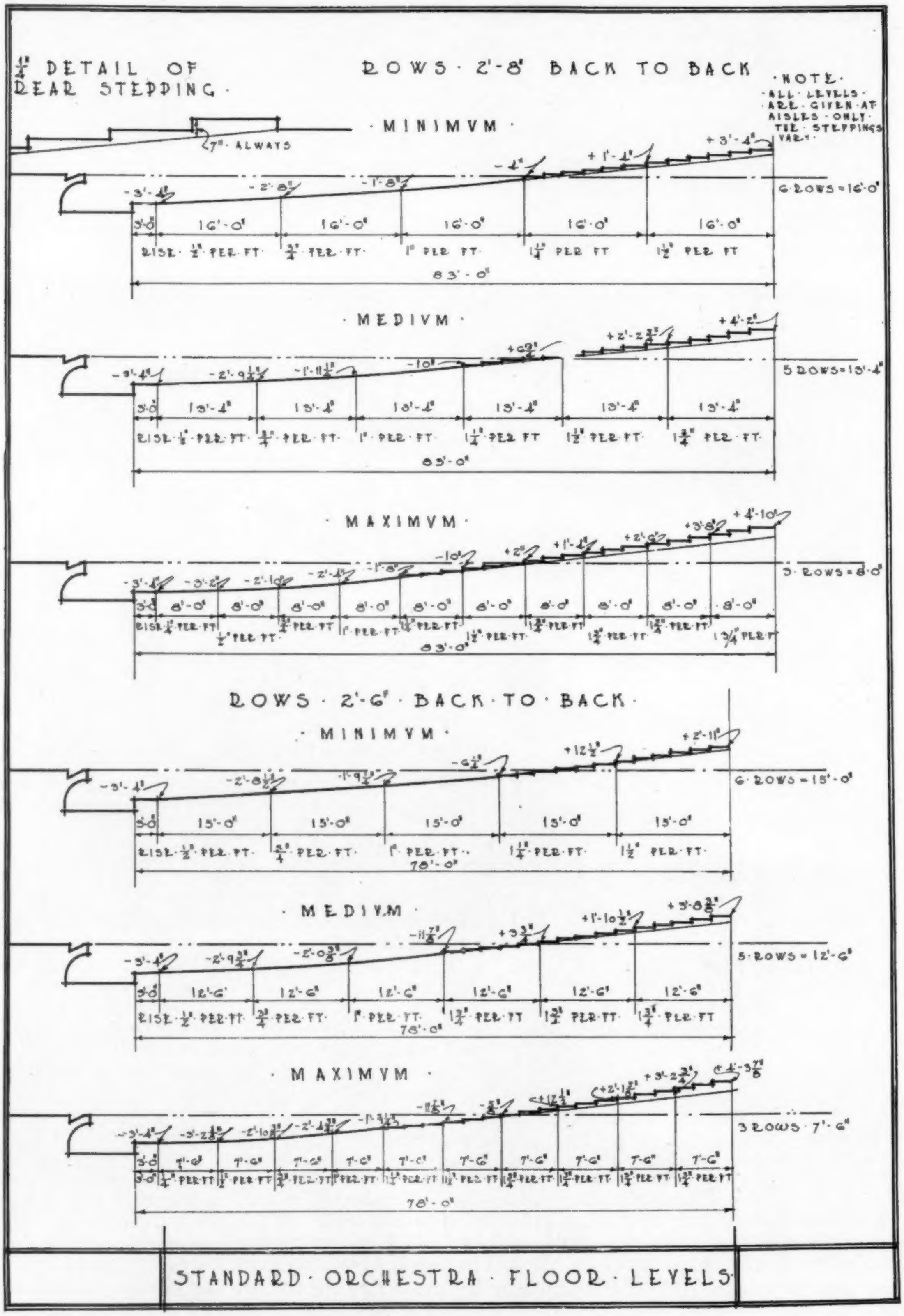


Fig. 7. View of Balcony, showing seating arrangement, The New (Century) Theater, New York

PRESTON J. BRADSHAW, ARCHITECT



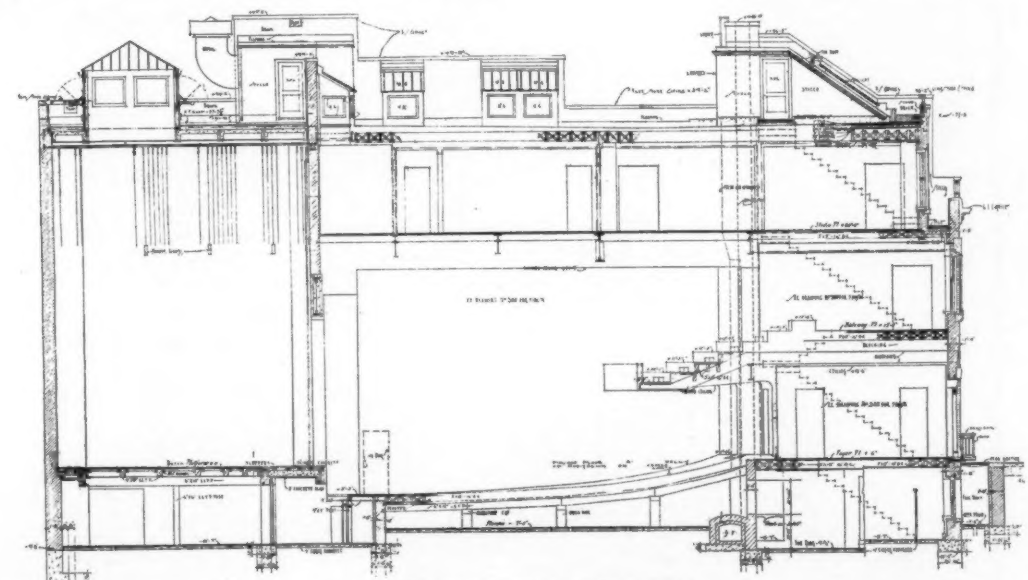
1/4" DETAIL OF REAR STEPPING
7" ALWAYS
ROWS · 2'-8" BACK TO BACK
· NOTE · ALL · LEVELS · ARE · GIVEN · AT · AISLES · ONLY · THE · STEPPINGS · VARY ·
· MINIMVM ·
6 · ROWS = 16'-0"
83'-0"
· MEDIVM ·
5 ROWS = 13'-4"
83'-0"
· MAXIMVM ·
3 · ROWS = 8'-0"
83'-0"
ROWS · 2'-6" · BACK · TO · BACK ·
· MINIMVM ·
6 · ROWS = 15'-0"
78'-0"
· MEDIVM ·
5 · ROWS = 12'-6"
78'-0"
· MAXIMVM ·
3 ROWS · 7'-6"
78'-0"
STANDARD · ORCHESTRA · FLOOR · LEVELS ·

Fig. 8

ventilating machinery are usually placed under it) and given a 2″ clear cement finish (no stone concrete) so as not to interfere with the expansion bolts to fasten the seats to the floor.

Directly behind the last row of seats should be a foyer, or orchestra promenade, at least 12′ wide, the wider the better, and cut off from the auditorium proper by a partition directly behind the last seats. Unless building the cheapest sort of a theater, do not provide a so-called standee rail. The standee is one of our recent accursed innovations. He hates himself for being inveigled into paying good money for standing two hours in a draught, and he annoys the people sitting directly in front of him. This partition, instead of the standee rail, protects the audience from street noises and draughts.

The stairs to the balcony should be at either end of this foyer, or if only one stair is provided, it should be directly in the center, developing, above a landing, into two stairs going up in opposite directions. These stairs sometimes go up in a fire tower, and open directly on the rear of the balcony, at other times they are frankly a part of the auditorium and land in a mezzanine promenade, from whence other stairs lead up to the rear of the balcony or vomitories (inclines as the *vomitorias* in the old Roman amphitheaters) lead up to a cross aisle, somewhere in the center of the balcony, from where one may go up or down steps to seats. It was a former custom to build stairs rising from the outer lobby, passageway or even around the side street to the second, or even the first balcony. This custom has happily disappeared, partly with the disappearance of the second balcony and partly through the improvement of auditoriums. The writer recalls an experience at a theater on Forty-second Street in New York. I had come in through the main lobby of the Forty-second Street entrance when my hat and coat were immediately snapped up and disappeared into the check room. I was ushered by numberless menials, up many flights of stairs, to a seat in the second balcony. The entertainment, a current musical rage, was not to my liking and I made haste to depart with the lowering of the first curtain. To my astonishment all means of egress were blocked with the exception of a stair tower giving out on Forty-third Street, from whence it was necessary, to make my way, on a cold and wintry night, three blocks around to the main entrance, to regain my hat and coat.



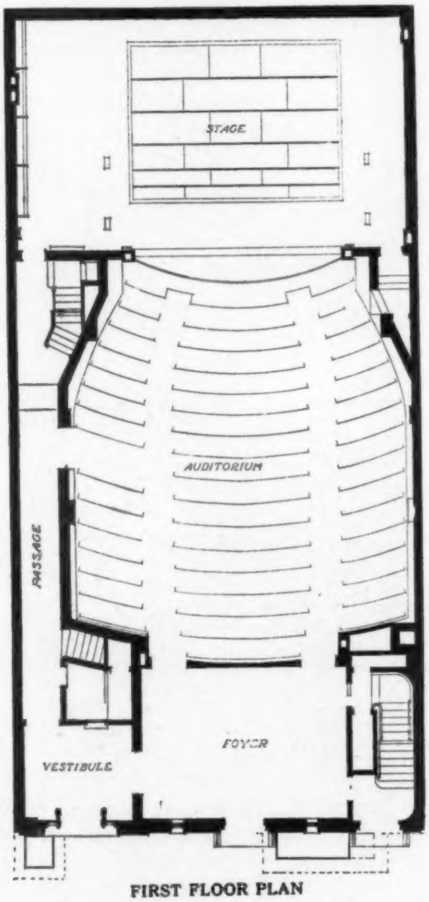
LONGITUDINAL SECTION THROUGH AUDITORIUM

Fig. 9. Neighborhood Playhouse, New York

Harry Creighton Ingalls and F. Burrall Hoffman, Jr., Associated Architects

To illustrate a concrete case where the type of theater bears directly on the layout, in a vaudeville theater boxes are the highest priced and best selling seats in the house whereas in a legitimate theater it is almost impossible to sell them, at any price. In the average legitimate house in New York box seats are nearly always complimentary, given to the host of people who go to the theater without paying. In such a winner as "The Bat" it was necessary to sell the box seats at the same price as the seats in the rear part of the balcony in order to dispose of them, and even then they were the last seats sold. Nowadays the legitimate theaters have abandoned the boxes, along with the second balcony, whereas in the vaudeville houses boxes are built in one or more tiers, all around the front of the balcony. These are called loges, and sell for the same price as the proscenium boxes.

The modern auditorium has been so simplified that the problem of sight lines has become an elementary one. With the elimination of the second balcony and the proscenium boxes, the two factors which were primarily responsible for bad seats



FIRST FLOOR PLAN

Fig. 9A. Neighborhood Playhouse

have been disposed of. When the reform is carried still further and all balconies are eliminated and the stage is pushed out into the auditorium, bad seats, or even worse seats, will be unheard of. Sight lines should be so drawn that the furthest seat along the side may command a view of at least two-thirds of the stage, (the two extreme sight lines should meet on the center line of the auditorium at a point ten feet behind the backstage wall). The spectator in the last row under the balcony should be able to see 20′ up on the

Fig. 10. Maxine Elliott Theater, New York

Marshall & Fox, Architects

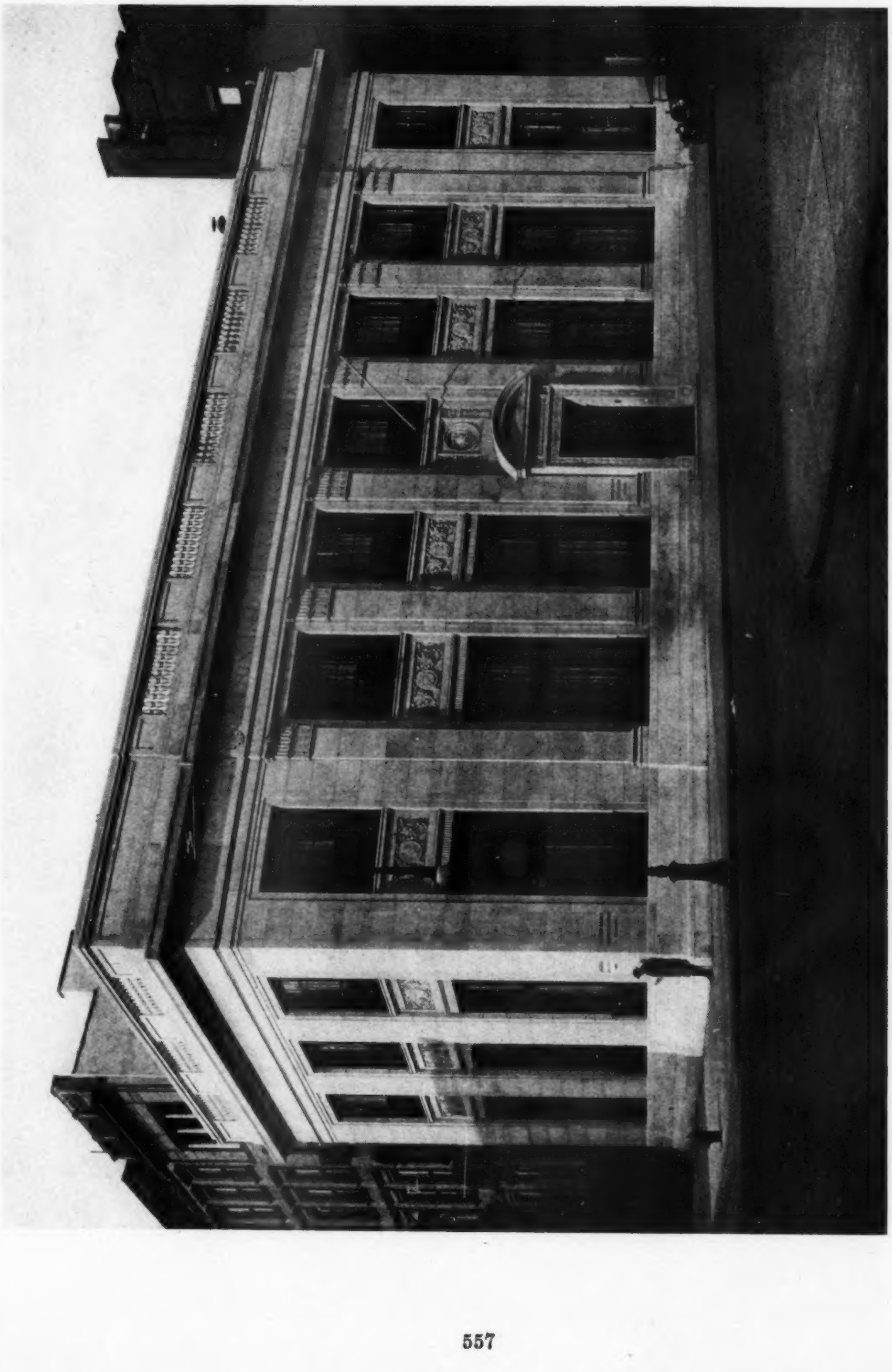
curtain line, while the spectator in the last row in the balcony should have an unobstructed view of the orchestra pit and be able to see the bottom of the backstage wall, under the proscenium arch.

(*To be continued*)

The Word "Art"

IN an article under the above heading, *The American Magazine of Art,* in one of its recent issues, says some very true things. It states, in part:

"Art is not something tangible, to be labelled, pigeonholed, cataloged, or to be pasted upon something as a designation. It enters into all design, if the design be good, but it is a means to an end. It is infinitely personal. It cannot be mechanical. A bed, a chair, an automobile can and should be artistically designed, but even so do not become works of art unless perchance created by an artist who is a skilled craftsman. The element of art through design enters into all or almost all industrial products, but even so does not constitute the sum total of art itself, which is bigger and broader and more significant. The art of Rembrandt, Titian, Velasquez, gave to the world some of the greatest masterpieces of painting; the art of Phidias made the sculptures of the Parthenon possible; to the art of the builders of the Middle Ages we owe the magnificent cathedrals of Europe. Art of this order is ennobling, inspiring, enriching. By it nations as well as individuals find in history lasting honor and remembrance. To use the word carelessly, loosely, inappropriately, is to change its meaning, to rob it of its real significance, to belittle it in the minds of the people and in their esteem. Let those who know better help to stem the tide of custom before it is too late, or a new word will have to be found to take the place of that which, like the traveller of old, has 'fallen among thieves.'"



UNITED STATES MORTGAGE AND TRUST CO. BUILDING, 940 MADISON AVE., NEW YORK

HENRY O. CHAPMAN, ARCHITECT

AWARDED THE FIRST PRIZE OF THE FIFTH AVENUE ASSOCIATION FOR NEW BUILDINGS ERECTED IN 1922

FRANKLIN, SIMON & CO. BUILDING, 414-20 FIFTH AVENUE, NEW YORK

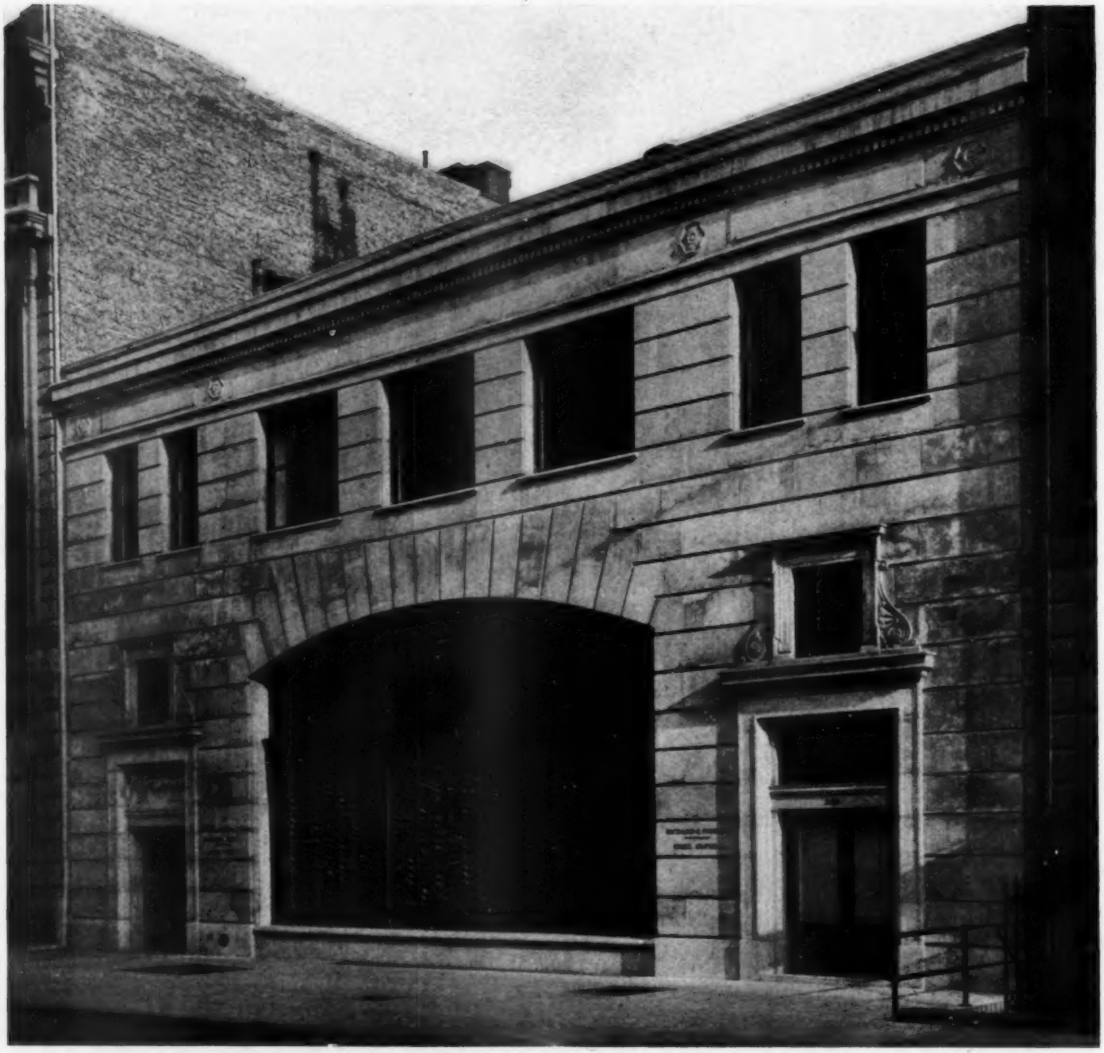
NECARSULMER & LEHLBACH, ARCHITECTS

AWARDED THE FIRST PRIZE OF THE FIFTH AVENUE ASSOCIATION FOR BUILDINGS ALTERED IN 1922

AMERICAN ART ASSOCIATION AND GALLERY, 571-91 MADISON AVENUE, NEW YORK

JOSEPH D. LELAND & CO., ARCHITECTS

AWARDED THE SECOND PRIZE OF THE FIFTH AVENUE ASSOCIATION FOR BUILDINGS ALTERED IN 1922



THIBAUT BUILDING, 269-71 MADISON AVENUE, NEW YORK

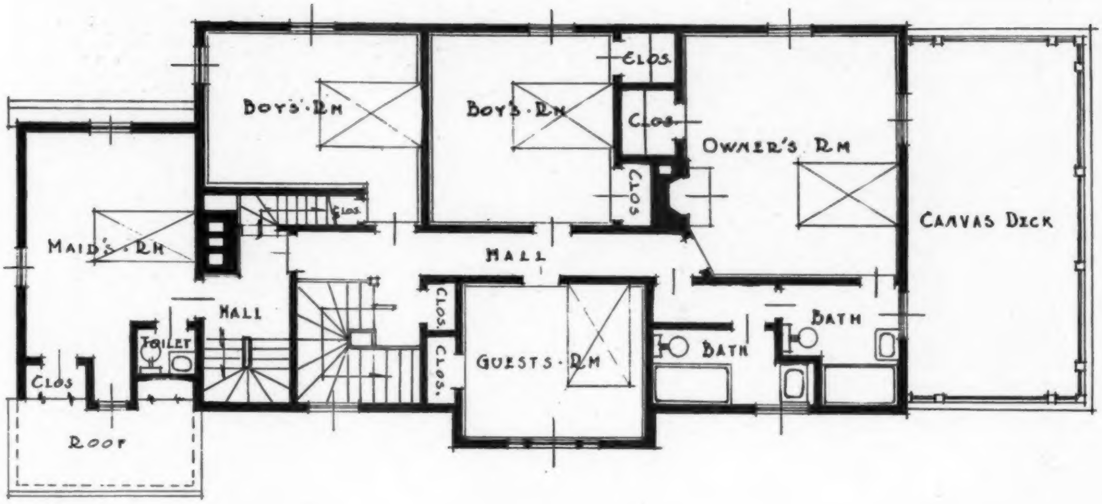
TROWBRIDGE & LIVINGSTON, ARCHITECTS

AWARDED SECOND PRIZE OF THE FIFTH AVENUE ASSOCIATION FOR NEW BUILDINGS ERECTED IN 1922

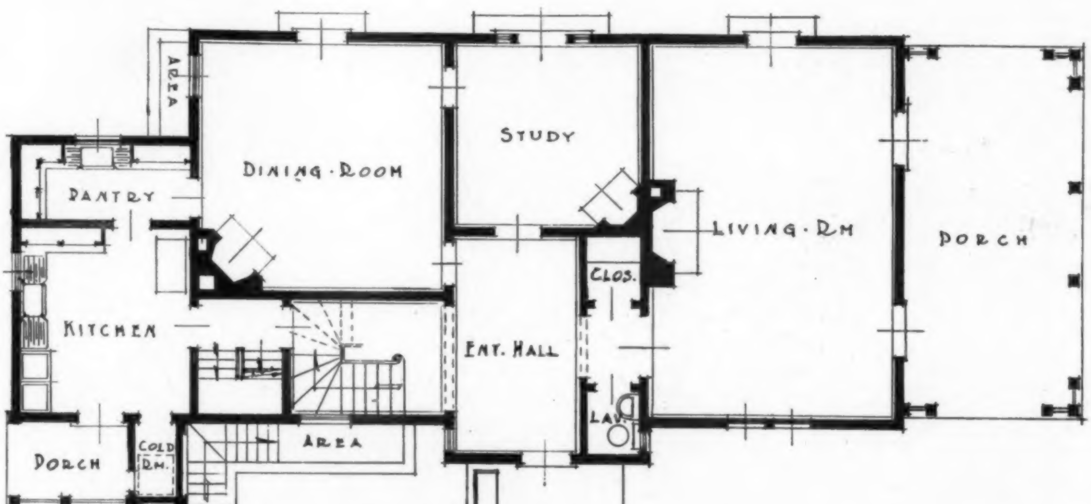
THE FIFTH AVENUE ASSOCIATION AWARDS

THE Architectural Harmony Committee of the Fifth Avenue Association, New York City, annually awards prizes for new buildings and buildings altered during the year within the limits of the district guarded by the Association. The professional members of the committee for the 1922 awards were Robert D. Kohn, Eliot Cross and Harry C. Ingalls, representing the New York Chapter of The American Institute of Architects.

The building owners received gold medals with diplomas for first prizes and silver medals with diplomas for second prizes. The architects received certificates of merit.



— SECOND·FLOOR·PLAN —

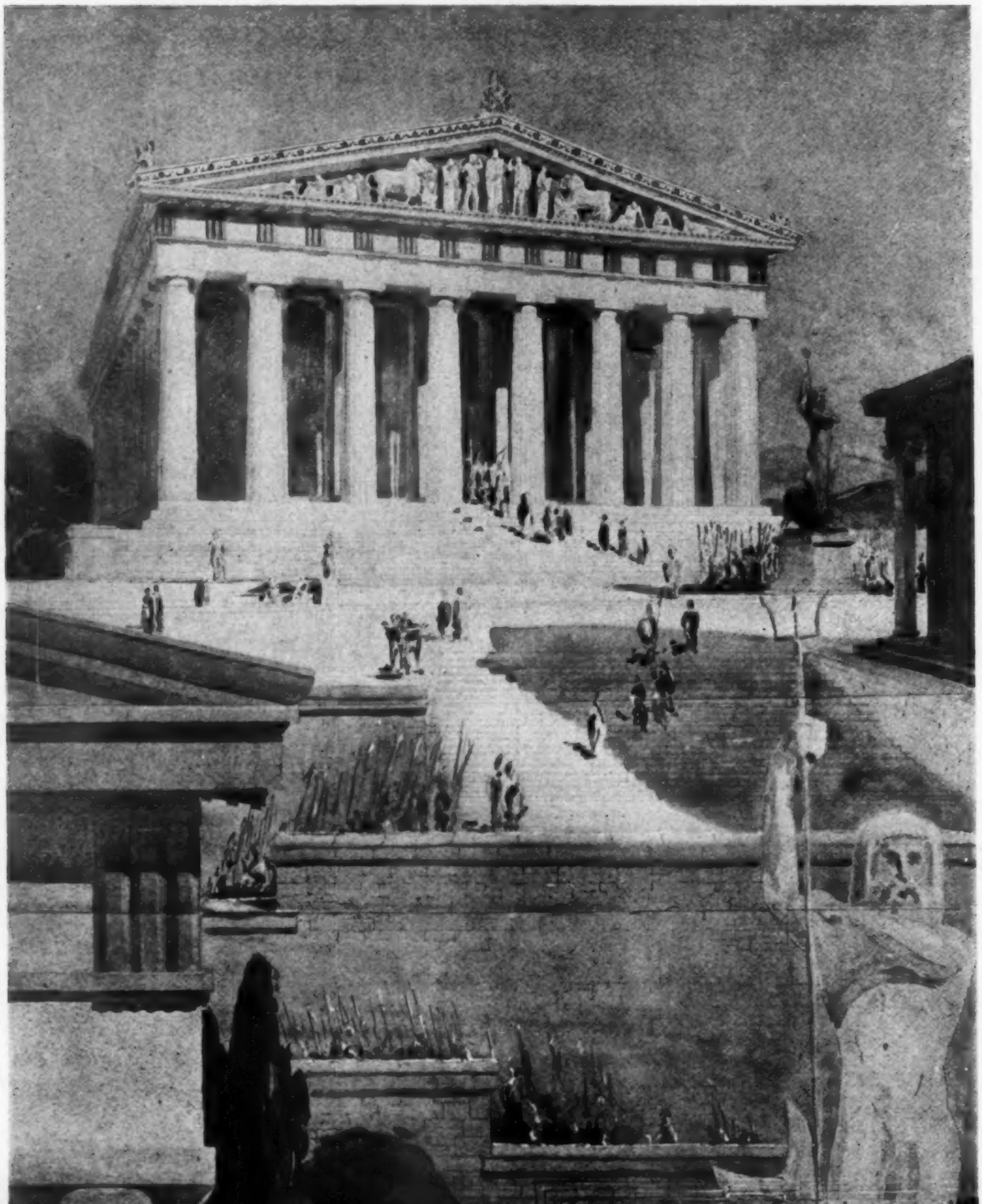


— FIRST·FLOOR·PLAN —

HOUSE OF E. BURTON LYON, ESQ., HEMPSTEAD, L. I., N. Y.

DWIGHT JAMES BAUM, ARCHITECT

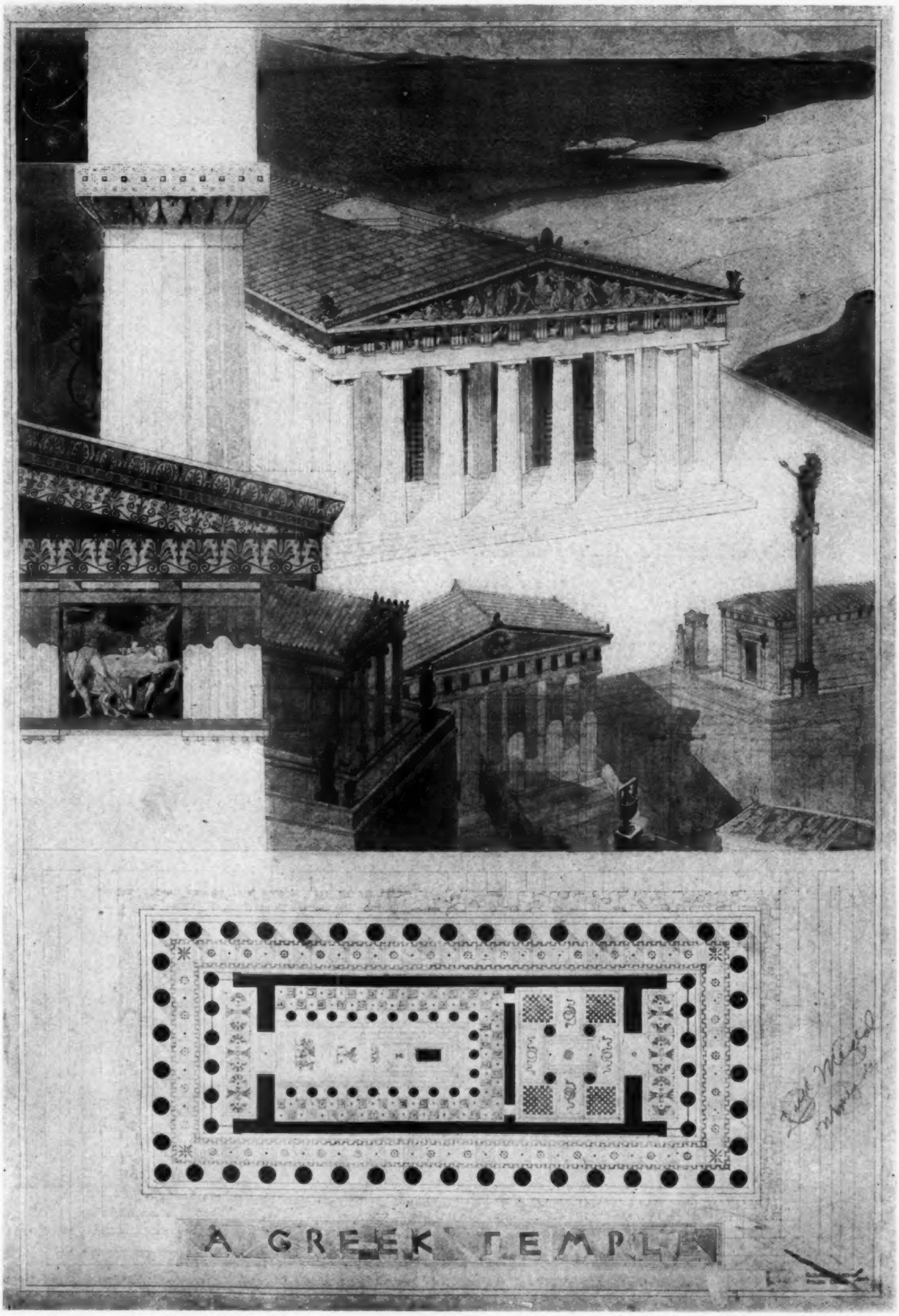
(For illustrations of this house see Plate Section)



O. W. WILSON SECOND MEDAL COLUMBIA UNIVERSITY

CLASS "A" AND "B" ARCHAEOLOGY—I PROJET—A GREEK TEMPLE

STUDENT WORK. SOCIETY OF BEAUX-ARTS ARCHITECTS



R. L. LINDER

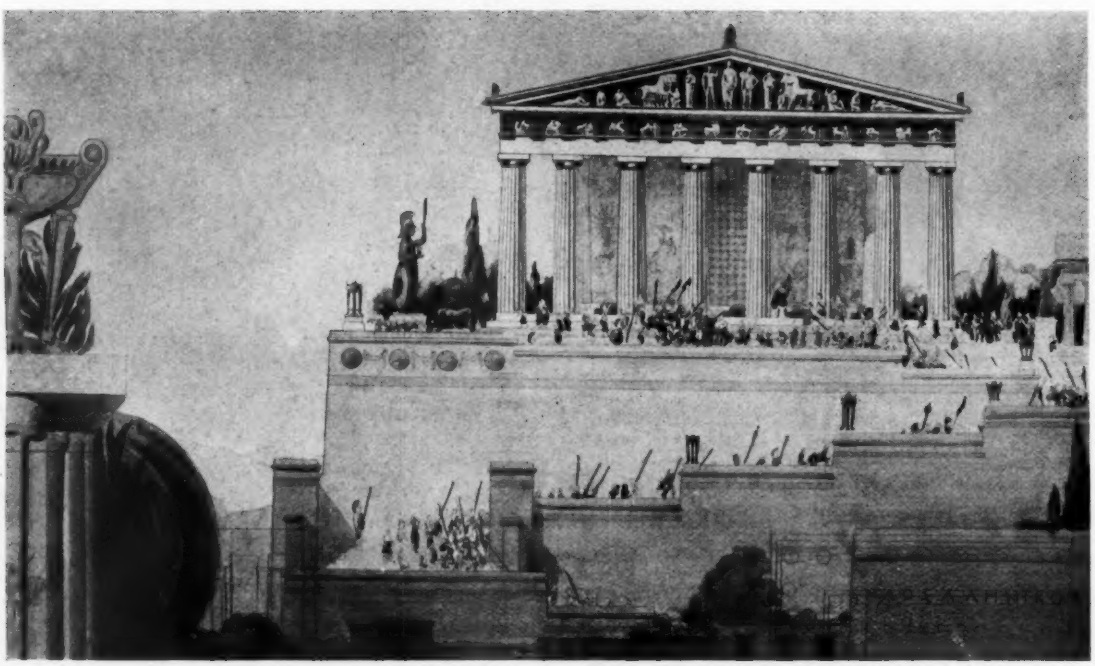
SECOND MEDAL

ATELIER DENVER

CLASS "A" AND "B" ARCHAEOLOGY—I PROJET—A GREEK TEMPLE

STUDENT WORK, SOCIETY OF BEAUX-ARTS ARCHITECTS

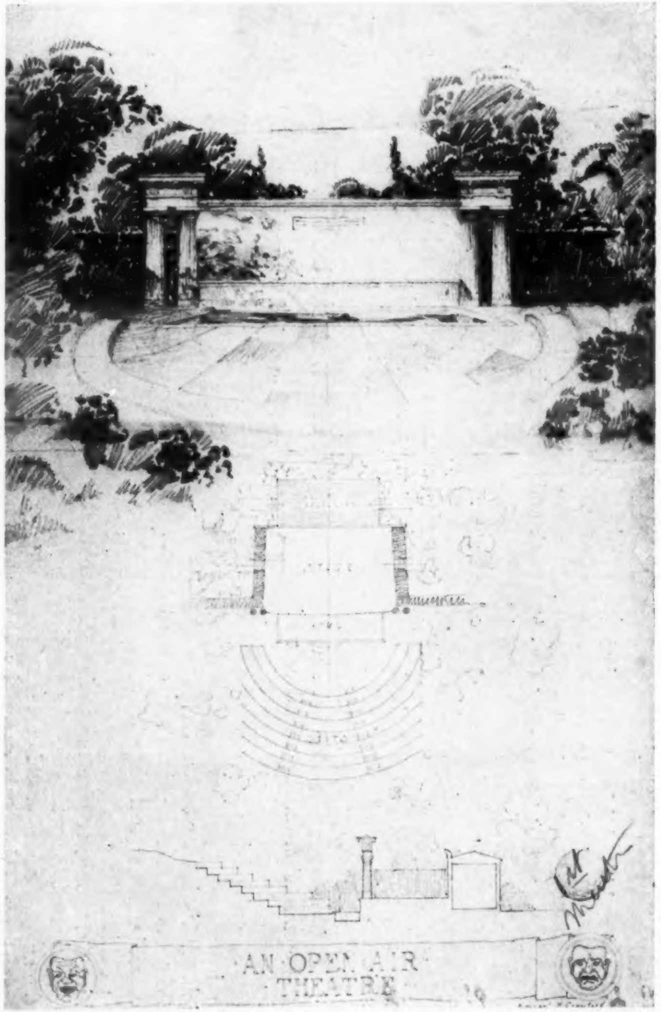
S. L. ROCKOWER — SECOND MEDAL — COLUMBIA UNIVERSITY



N. B. MEAD, JR. — SECOND MEDAL — COLUMBIA UNIVERSITY

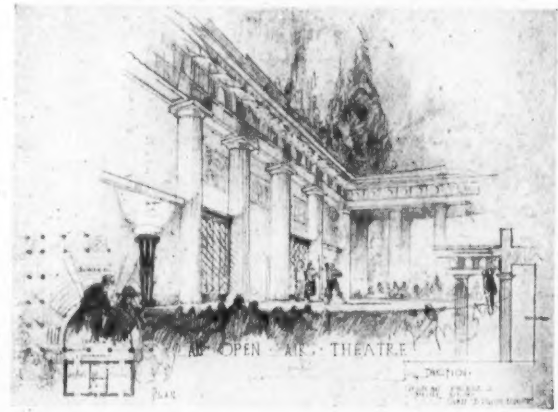
CLASS "A" AND "B" ARCHAEOLOGY—I PROJET—A GREEK TEMPLE

STUDENT WORK, SOCIETY OF BEAUX-ARTS ARCHITECTS



FIRST MENTION
R. H. CRAWFORD UNIV. OF SO. CAL.

SECOND MENTION
R. W. RAMSDELL YALE UNIVERSITY



SECOND MENTION
G. GONZALEZ ATELIER HIRONS, N. Y. C.

CLASS "B"—I ESQUISSE-ESQUISSE—AN OPEN AIR THEATRE
STUDENT WORK, SOCIETY OF BEAUX-ARTS ARCHITECTS

LEGAL DEPARTMENT

Conducted by

CLINTON H. BLAKE, Jr., of the New York Bar

PARAGRAPH 7 of the Schedule of minimum charges of the American Institute of Architects provides that, where the owner makes a decision requiring, for its proper execution, extra services and expense for changes in the drawings, specifications or other documents, the architect shall be paid the fair value of such extra service and expense. This corresponds to paragraph 8 in the earlier forms of the Institute Schedule. The intent, however, both in the prior form and the present form is identical, namely, to safeguard the architect against the possibility of doing a large amount of extra work made necessary by the client's changes of mind, without adequate compensation.

Recently, I have had occasion to note that in the minds of some, including members of my own profession not perhaps closely in touch with building law, the intent and proper interpretation of this provision of the Schedule are not clearly understood. Where changes are made, increasing the cost of the work and necessitating extra charges by the contractor, the architect naturally is entitled to receive his additional commission, in accordance with his basic fee rate, on the cost of the additional work. It is claimed by some that this is all that he is entitled to receive, and that, by receiving this additional amount, he is fully compensated for the work done and has received the full payment to which he is entitled under the rules of the Institute.

This is, of course, not correct. The basic rate of commission is one thing. The extra compensation contemplated, as provided for by paragraph 7, is another. It is a charge outside of, and in addition to, the commission on the added cost of the work.

The architect is entitled in any event to receive the agreed basic rate of commission on the total cost of the job. This is so whether the job costs $5,000 or $5,000,000. If the building is erected as originally projected and designed, with no changes made during the course of construction, then the architect can only receive the basic commission of 6% or 10% or whatever the parties have agreed the amount shall be. If changes from the original plans are ordered, however, by the client, then the architect is at once compelled to expend additional time and study on the changed problem thus presented to him. He is compelled to study the new layout and pay out additional monies for the new drawings and specifications. He must himself give, and have his assistants give, more time than would have been required if the work had proceeded without change.

For all of this, the architect is entitled to compensation—to compensation in addition to and distinct from the compensation which accrues to him under his basic charge on the final cost of the work.

A client comes to an architect and employs him to make plans and specifications for a $1,000,000 building. The architect does so. The rate agreed upon is 6%. After the plans are completed, the owner changes his mind regarding his requirements, and decides that the building be radically changed in design or layout, and this is done and new plans and specifications are prepared. The altered building costs $1,500,000. The architect is entitled to his 6% on the additional $500,000 of cost, but he is also entitled to an additional amount for the changes made. He has done more work, and been put to greater expense and overhead charges and lost more time than would have been the case if the owner had originally ordered the $1,500,000 building and allowed the architect to push it through to completion without change. The architect is entitled, under the Institute Schedule, to compensation for the extra work and expense involved.

It is the old case of "two bites to the cherry," the total cost of the building corresponding to the cherry. The architect is entitled to his commission on the cherry, but he is also entitled to his compensation for the extra bite.

LEGAL DECISIONS

THE owner entered into possession of the building. The contractor sued for the amount due him under the contract and the owner defended on the ground that there were various deviations from the contract and omissions. It appeared that these were neither wilful nor fraudulent, and consisted of defects in the plumbing, heating and ventilating systems, which could be removed or compensated for at a total cost of less than $100. The total contract covering the plumbing, heating and ventilating, was for $27,000. and the total cost of the building about $186,000. The contract performed required that the work be done to the satisfaction of the architects who were named therein. These architects were, however, discharged and another architect employed, without any agreement by the builder for his substitution. The court held that, under these conditions, the architect's certificates were not required and performance to the satisfaction of the architect was not a condition of the contractor's right to recover; that the owner, having taken possession of the building and enjoying the results of the contractor's work, cannot refuse to pay the contractor the amount due him under the contract, less an amount representing the damage caused by the omissions, where these omissions do not substantially affect the usefulness of the building for the purpose for which it was intended; that the omissions in this case were so trivial that the doctrine of substantial performance should be applied, and that the contractor might recover the amount due him, less an allowance for the defects.

Thomas Haverty Co. v. Jones, 197 *Pacific* 105.

(Note: It may be noted that the above decision, with respect to the discharge of the architect and the holding that, under these conditions, the contractor is not bound to secure the approval of the architect, is in line with a discussion which appeared in these columns some months ago. This pointed out the fact that the contractor, as well as the clients, was interested in the character and ability of the architect, that the architect was called upon to act as arbitrator between them, in effect, in many cases, and that a change of architects, without the contractor's consent, might release him from his obligations under the contract.)

SECTION 57 of Chapter 615 of the New York Laws of 1922 provides as follows:

> Sec. 57. Restriction on issue of permits unless compensation is secured. The head of a state or municipal department, board, commission or office authorized or required by law to issue any permit for or in connection with any work involving the employment of employees in a hazardous employment defined by this chapter, and notwithstanding any general or special statute requiring or authorizing the issue of such permits, shall not issue such permit to the employer unless such employer shall produce satisfactory proof that compensation has been secured as provided by this chapter. Nothing herein, however, shall be construed as creating any liability on the part of such state or municipal department, board, commission or office to pay any compensation to any such employee if so employed.

(Note: The foregoing is interesting in its effect on the issuance of permits to architects by the Building Department and the fact that, under the new law, the architect, while filing the plans as before, will definitely be notified of their approval only when the contractor or person authorized to do the work files a certificate showing that he has secured insurance under the Workmen's Compensation Law. Architects practicing in New York City are already familiar, doubtless, with the new procedure and with the necessary forms to be filled out in connection with it.)

A GENERAL contractor made a contract with a person who desired to erect a building, as a gift, on land owned by a Women's Christian Association. There was no contract between the contractor and the Association. A sub-contractor of the contractor endeavored to enforce a lien for the amount due him in connection with the erection of the building. It appeared that the person who was to pay for the erection of the building had likewise conveyed the land to the organization, as a gift. The case arose under the Connecticut Lien Law, and the court held that the mere fact that the Association, as the owner of the property, knew of the contract between the donor and the contractor and knew that the work was going on did not constitute consent within the meaning of the statute, and that there could be no consent unless there appeared more clearly an implied agreement on the part of the owner to pay for work or materials. The court further held that the person who conveyed the land and paid for the erection of the building was not the equitable owner of the land, so as to subject the latter to a mechanic's lien in favor of the sub-contractor, on the theory that the general contractor's contract with the donor was, in effect, a contract with the true equitable owner of the property. On the question of consent, the court said:

> "The meaning of 'consent' as used in the mechanic's lien statute has been discussed in both Huntley v. Holt and Lyon v. Champion. In both of these cases the owner knew of the contract, and that the work was going on and in the Champion Case at least gave some minor directions, yet the court held that these facts did not constitute the consent the statute required. In each case there was no consent that the work should be done at the owner's expense. On the contrary, it was specifically understood by the owner that the work was not to cause any expense to him. So here, we think the utmost that is shown is that the association was willing to let Avery build and give the recreation hall to it on Avery's proposition that it was to be a gift, and not the source of any expense to it. The consent meant by the statute must be a consent that indicates an agreement that the owner of at least the land shall be or may be liable for the materials or labor."

Avery v Smith, 113 *Atlantic* 313.

DEPARTMENT OF SPECIFICATIONS

SPECIFICATIONS FOR STRUCTURAL STEEL

(Continued)

THE previous discussion of specifications for structural steel ended with suggestions regarding the subject of inspection and tests. Next in sequence should come Shop Fabrication. This matter has been covered to some extent in the last discussion by referring to the standard of the Structural Steel Society. On the ordinary work perhaps the more important phases of shop fabrication which stand out with the greatest prominence are the protection of steel as it is delivered from the mill; straightening of material; templates; shearing and chipping; punching; reaming; turn bolts; drilling; assembling; riveting; annealing; milling, planing and hot-straightening; rods, turnbuckles and clevises; bearing plates; separators; holes for anchors; and shop assembling for match marking.

The material as delivered to the mills should be specified to be kept free from rust which requires that it be stored under cover while unpainted.

All material should be straightened before work on it is laid out; any distortion naturally would not permit the laying flat of templates or the correct marking of measurements.

Specifications should require that templates be laid out flat and that all work requiring exceptionally close fitting should be laid out only from templates.

All shearing and chipping of structural steel should be done in a most accurate manner and where edges, ends or other portions of the work are visible, a neat finish should be made.

Specifications for the remaining items listed above as published by The American Specification Institute cover the method of writing specifications in a very good manner. These specifications, which incidentally do not comprise the specification of this organization for Structural Steel, are as follows:

PUNCHING: In material whose thickness is not greater than the diameter of the rivets, plus ⅛", holes may be punched full size. Holes in material of greater thickness shall be drilled. Where reaming is not required, the diameter of the punch shall be not more than 1/16" greater than the nominal diameter of the rivet; nor the diameter of the die more than 3/32" greater than the diameter of the punch. All punching shall be done accurately. Drifting to enlarge unfair holes will not be allowed. Where reaming is required, the punch used shall have a diameter smaller than the nominal diameter of the rivet by at least 3/16". Subpunching for reamed work shall be done so accurately that after reaming no punched surface shall appear in the periphery of the hole.

REAMING: Reaming, where required, shall be done after the pieces forming one built-up member are assembled and so firmly bolted together that the surfaces shall be in complete contacts. Holes then shall be reamed up to a diameter not more than 1/16" greater than the nominal diameter of the rivet. If any burrs from reaming are forced between the pieces of a member the pieces shall be taken apart and all burrs removed before riveting. If necessary to take the pieces apart after reaming, the respective pieces reamed together shall be so marked that they may be reassembled in the same position in the final setting up. No interchange of reamed parts will be allowed. The outside burrs on reamed holes shall be removed.

TURN BOLTS: Where turn bolts are used to transmit shear the holes shall be reamed cylindrical and perpendicular to the face of the member and the bolts shall make a driving fit, with the threads entirely outside of the holes. A washer not less than 1/4" thick shall be used under each nut.

DRILLING: Holes for rivets in material more than 1/8" thicker than the nominal diameter of the rivet shall be drilled 1/16" larger than the nominal diameter of the rivet. Burrs on the surface shall be removed.

ASSEMBLING: Riveted members shall have all parts well pinned up and firmly drawn together with bolts before riveting is commenced. Surfaces in contact are to be cleaned and painted before riveting. Abutting joints shall be cut or dressed true and straight and fitted closely together. In compression joints depending on contact bearing, the surfaces shall be truly faced so as to have even bearing after they are riveted up complete and when perfectly aligned. Stiffeners shall be faced where noted on drawings and shall be brought to a true contact bearing with the flange angles. Fillers and splash plates shall fit within 1/4" at each end. The several pieces forming one built-up member shall be straight and shall fit closely together and finished members shall be free from twists, bends or open joints. Web plates of girders which have no cover plates may be 1/8" above or below the backs of the top flange angles. Web plates of girders which have cover plates may be 1/2" less in width than the distance back to back of flange angles. When web plates are splashed, not more than 3/8" clearance between ends of plates will be permitted.

RIVETING: The size of rivets called for on the drawings shall be understood to mean the actual size of the cold rivet before heating. Rivets when heated and ready for driving, shall be free from slag, scale and carbon deposit and shall be driven by pressure tools wherever possible. Pressure riveters shall be used; pneumatic hammers shall be used only where pressure riveters cannot be used. Rivets shall look neat and finished with heads of approved shape, full and of equal size and shall completely fill the holes. Heads shall be central on shank and shall grip the assembled pieces firmly. Recupping and caulking will not be allowed.

Annealing: Steel, except in minor details, that has been partially heated shall be properly annealed. All steel castings shall be annealed.

Welds: Welds in steel will not be permitted.

Milling, Planing, Hot Straightening: The top and bottom surfaces of base and cap plates of columns and pedestals, except those surfaces to be in contact with masonry, shall be planed or hot straightened and parts of members in contact with them shall be milled to fit. Connection angles and ring plates for base plates and cap plates shall be riveted to compression members before the members are milled. Sole plates of plate girders shall have full contact with the girder flanges. Sole plates shall be planed or hot straightened. Cast pedestals shall be planed on the surfaces to be in contact with steel, and shall have the bottom surfaces resting on masonry, rough finished.

Specifications for rods, turn buckles and clevises, except in unusual cases, need only call attention to the locations of such items and perhaps require that threaded ends of rods intensioned shall be upset before threading and that turn buckles or clevises shall be of any particular type not indicated on the drawings.

Separators may be either cast iron, steel, or, in many cases, steel pipe may be used. If the drawings do not show exactly of what material these separators are to be made or their size or shape, specifications should call for the use of standard separators as given in one of the steel manufacturer's handbooks.

In all of the above specifications quoted from those of The American Specification Institute, the reader will observe that the requirements are sufficient for the largest job that an architect would have. In smaller jobs, especially where the structural steel consists of miscellaneous beams with a column or so, it would not be necessary to use paragraphs at all as complete as those quoted above. In such cases, it would be sufficient to refer only to the standards of the Structural Steel Society or to any other standards that seem to be authoritative in the region where used.

The subject of painting structural steel which should follow next in sequence is a tremendously large subject and cannot very well be discussed with a great deal of accuracy in these columns. For fairly accurate information on the various classes of steel protective paints, the reader is referred to the files of publications of the American Society for Testing Materials and to books by Mr. Henry A. Gardner of the United States Bureau of Research, Washington, D. C.

In the last issue of this department the kinds of paint and other matters regarding this important item were covered in a discussion of the quality of materials.

The application of paint does not require such a detailed study in order to arrive at good practice. The specifications should require that all loose rust, scale, or any foreign particles be removed, and that paint be applied only on clean, warm surfaces under roof. Paint should not be applied until after all shop work on the pieces has been done and the erection marks should not be painted over. No painted material should be handled until the paint has become thoroughly dry. The specifications should not fail to require that surfaces inaccessible after shop assembling and fabrication, will be painted two coats before assembling with the exception of bearing surfaces and other milled surfaces that are to be in contact, which surfaces shall be protected with a thick coat of parafine or tallow. The subject of field painting will be discussed later under the erection of steel.

Oftentimes the character of the work will require that material be shop assembled and match marked to insure proper erection in the field. Oftentimes trusses must be so assembled later to be shipped in two or more pieces to facilitate handling and shipment.

When material is to be shipped on railroad cars or by truck, it should be so loaded that movement of the car will not displace the pieces or cause distortion or damage of any kind to any of the material. For rail shipments the steel should be so piled that rain will run off freely. Where the specifications have called for the delivery of the structural steel f.o.b. job, the responsibility of the contractor is unquestioned. For material to be shipped otherwise, the specifications must be so drawn as to place all responsibility for damages because of incorrect packing, marking, or loading, upon the contractor.

In the delivery of materials in the field, damage to the structural members may occur through mishandling in unloading and piling. The specifications should require that this work be done with care, especially in the matter of fabricated trusses or portions of trusses or other exceptionally large members, all of which must be handled so as not to cause distortion, or to bring undue stresses on fabricated joints. The material should be so piled that rain water will drain off and if the specification writer wishes to be quite explicit, he should require that the pile be so arranged that material needed at once will be piled on top of the pile, thus reducing the handling and the consequent possible opportunities for damage because of the rehandling in the restricted spaces so often assigned to the storage of construction materials. This will require a certain amount of sorting, the doing of which should not be dodged either by the contractor or by the architect's superintendent where there is any great quantity of structural steel delivered at one time.

In the erection of structural steel there may be several schemes evolved for the order of erection work. Having in mind the sequence of other building operations as determined by availability of masonry or certain materials furnished by other contractors, it may be necessary because of the character of steel construction to require that the order of work and sequence of operation in the erection of steel be predetermined by the architect and contractor. It would be expected that some such program would be laid out by the contractor, especially in a large operation, but for work of any importance the architect should have something to say, having in view the work of other contractors. For instance, it may be necessary to leave out certain structural steel members in floor systems to permit the delivery of large units of machinery, such as boilers, safe deposit vault doors, water storage tanks, or similar apparatus. Again, it may be the intention of the architect to have the work of other contractors so conducted that the work of steel contractors should start at a particular point in the building. The determination of some of these factors cannot be left until the erection is commenced. In order to assure the proper sequence in shipment from the fabricating plant, some such scheme must have been contemplated from the beginning.

The time of completion for the erection of structural steel either should be determined in the specifications or should be left to the determination of the contractor in his proposal. This question of time is quite important in assigning shipping dates to other contractors' work, especially the character of work that requires a large amount of storage space which would not be available in restricted areas because of the presence of structural steel.

If the specifications are to state the time of completion, it may be done either by specifying the total number of working days after the award of the contract, or a specific date which it would seem possible to meet under ordinary conditions.

If any material should be damaged through neglect of the contractor after delivery on the job, the responsibility therefor must lie with him. This is an item that should not be avoided especially in cases where the owner furnishes structural steel on the job for erection by another contractor. Specifications covering this point should, of course, require that the contractor inspect the items of steel as they are received from the shipper and should make sure that all invoices are correct and that the material, as delivered, is free from defects that might have been caused in shipment. If there are any such defects or damages, the contractor should report such facts to the architect at once.

Before erection, all structural steel should be cleaned so that it will be in the proper condition to paint after erection. If the material has been carefully piled on skids, the amount of cleaning required should not be great.

The structural steel contractor should set all centers and levels in an accurate manner. Oftentimes the services of a responsible surveyor are required for such work. Since the contractor is to be held responsible for the proper erection of the material, he should be allowed to determine how these centers and levels are to be secured for his work, otherwise his responsibility might cease.

Where grillages and base plates are used under steel columns, they should be set on shims to receive grouting and must of course be set absolutely plumb and level. The grouting usually is to be furnished by the masonry contractor.

As the material is erected, the various connections shall be bolted temporarily where field riveting is to be done until a sufficient amount has been placed so that columns may be plumb. The standard practice of the Structural Steel Society covering the plumbing of structural steel is as follows:

> "The steel erector shall see that his work is plumb and level and shall pay all engineers' or surveyors' costs necessary to accomplish this result, and shall affix and attach all necessary guides and braces to insure reasonably that his work will remain plumb and level. Upon erection completion by the steel contractor, the buyer should assure himself by whatever agencies he may elect, that the steel erector's work is plumb and level and properly guyed. If not, he should immediately notify the erector and direct him to perfect his work. After the steel erector has guyed and plumbed the work once, to the satisfaction of the buyer, his responsibility is ended. Any further work in guying or plumbing shall be performed entirely at the buyer's expense. In setting or erecting structural work, individual pieces less than 12 ft. long will be considered to be plumb and level, where the error does not exceed 1/8". For individual pieces over 12 ft. long, the allowable error will be figured at the rate of 1" in 12 ft. and the structure as a whole will be considered plumb and level where the error does not exceed 1/8" in 16 ft."

Most structural steel work of any importance is riveted in the field. On work of lesser importance,

(*Concluded on Page* 14)

DEPARTMENT OF ARCHITECTURAL ENGINEERING

PRESERVATION OF DECAYING WOOD ROOFS

General Theory of Wood Decay—Methods Employed in Preserving Wood Roofs—Economic Considerations in Prolonging the Useful Life of Repaired Roofs

BY WENDELL S. BROWN, Mem. Am. Soc. M. E.*

RAPID development in industry, like the accelerated progress of civilization, is often and perhaps inevitably accompanied by certain afflictions and disorders. And in the last quarter century one of the disturbing conditions which has arisen and which is demanding increasing attention in certain sections of the industrial world has been the serious decay of wood roofs.

Now a roof is a cover of a building, according to one dictionary definition. But unfortunately, since the advent, in buildings of home-made weather, either in the form of artificially high or naturally high relative humidities—due to some necessary process—a roof must have other attributes than covering only, if it is to act as a real shelter. For, under certain conditions instead of constituting a protection, the reverse is true, and the roof becomes a positive source of trouble. This happens when the formation of condensation (commonly called sweating) on the ceiling is so rapid as to cause dripping into the room below, with consequent annoyance to the occupants and often serious damage to machinery, building, and materials in process.

Happily, it is a comparatively simple matter, by adopting suitable insulation, to prevent the formation of condensation on, and dripping from, the under surface of the roof, for any usual condition encountered. That is, theory and laboratory tests, authenticated by actual installations, have provided accurate methods for rationally designing many different types of roofs to meet varying requirements as to relative humidity and temperature carried in the room below.[2]

But with respect to wood roofs, prevention of visible condensation is only part of the story, for the reason that cracks between the plank afford a more or less direct channel by which warm, moist air from the room below reaches the roofing paper, which latter is practically at the temperature of the outside air. If this temperature is below the dewpoint of the said contacting room air, precipitation of moisture or condensation results; which means nothing more nor less than that the first ply of roofing paper and the top of the wood roof itself are saturated with water during the greater part of the heating season in temperate or colder climates. Laboratory tests and the experience of those who have removed old mill roofs bear this out.

In fact, this rot-inducing feature is the outstanding bugbear and cause of excessive mortality in wood roofs of those manufacturing buildings—such as textile mills, finishing plants, paper mills and food factories—which utilize or by nature house high relative humidities. The damage is enormous—greater than generally realized—amounting to hundreds of thousands of dollars annually in building material alone, besides occasioning often more serious losses in production and general derangement. Many such unenviable records exhibit useful roof lives as short as three years, with a possible average of ten years and a maximum of twenty-five years, depending upon the severity of atmospheric conditions within and without the building, and the species and quality of lumber used.

Notwithstanding the subject under consideration is the preservation of old wood roofs, it would be remiss not to admit that some of them are not worth saving. The correct determination of whether or not a roof is worth saving lies in a full

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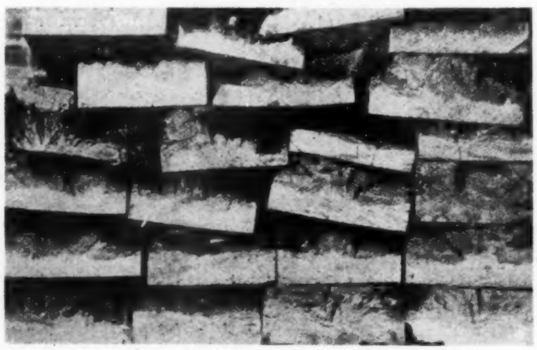
[2] *Presented at the Springfield Regional Meeting of* THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Springfield, *Mass., September 25-27, 1922. Slightly abridged.*

consideration of the problem from a purely utilitarian viewpoint, and the paper aims to indicate general principles by which this often debatable question may be settled, and also to describe one method by which the desired result has apparently been attained.

General Theory of Wood Decay

The almost exclusive cause of decay in wood is the destroying action of certain fungi, of which there are several varieties. These, however, in order to accomplish their destructive work, must have a favorable environment, which, in addition to suitable media in the form of wood fiber from which their food supply may be obtained, consists of the proper amount of moisture, temperature and air supply. There are two general classifications of such fungi:

1. The "dry rot" group, thriving in a comparatively narrow range of cool to moderate temperatures and not requiring great amounts of moisture;
2. The "damp rot" or "mill roof" group, thriving over wider and generally warmer temperature ranges. These fungi must have relatively large amounts of moisture combined with air for normal development.



(Photo by F. J. Hoxie)

Fig. 1. Showing typical decay in roof plank starting at top surface

As indicated in the name, we are concerned particularly with the second group, which requires either air at practically 100 per cent relative humidity or a free supply of water in its liquid state. Incidentally, since air is necessary for fungus growth, the presence of water to such an extent as to prevent admission of air to the wood cells is fatal.

Wood roofs over buildings housing ordinary temperatures and humidities lack only one requirement to make them excellent media for infection and decay from the second group. This one deficiency is moisture, which, in the case of those special roofs under consideration, is supplied by condensation.

There are perhaps half a dozen kinds of fungi most commonly found attacking mill roofs, and the limits of temperature and moisture most favorable to their development vary somewhat with the species. Many investigators both here and abroad, have devoted considerable study to the classification of fungus diseases, and the conditions affecting their germination, dissemination, and subsequent development and viability. For instance it has been found that the temperature at which most of the mill roof fungi grow and spread lies between the approximate limits of 35 deg. fahr. and 110 deg. fahr., the optimum limits for development being considerably narrower than the above—approximately 75 deg. fahr. to 100 deg. fahr. Alternate wetting and drying is destructive to the spores cast off by certain fungi; and some varieties develop best in darkness, while others require diffused light, but not direct sunlight.

Ordinarily, decay in roof plank starts at the top surface (see Fig. 1), especially if the first ply of paper is dry sheathing not mopped down. Sometimes, however, infection seems to get a foothold first just above the tongue and groove or spline and progresses more rapidly within the central portion of the plank lying between the two extremes of moisture.

In sawtooth buildings, valley plank usually decay first, this being generally traceable to one or more of the following contributory causes:

a. Since sawtooth lighting areas ordinarily face approximately north, the valleys are considerably shaded by adjacent sawteeth, which latter intercept the warming effect of the direct solar rays when the sun is at low altitude during the heating season.

b. Often heating coils are located solely under the glass or at some distance up the wooden back of the sawtooth, leaving the valley portion chilled, and subject, therefore, to excessive condensation.

c. There is a tendency for moisture or condensation to drain toward the low point of the roof.

An indication of the comparative extent to which rotting has progressed in various portions of a roof may often be had from the brown extractive matter deposited in rusty streaks on rafters and plank. Decay is usually greatest in plank and beams at bearings because, due to the additional insulating properties of the supporting members, the locus of condensation dips at each supporting cross timber. A "Locus of Condensation" may be defined as a plane whose temperature equals the dewpoint temperature of the contacting room air. Below this plane no condensation takes place; above it, condensation occurs with increasing activity as the top surface of the roof is approached. Tops of roof rafters and girders rot first—usually for the same reason; and other conditions being equal, decay is more active in the vicinity of ventilators, cold conductor pipes, etc.

But the quality of lumber as well as species or variety is also a vital factor in its longevity, and

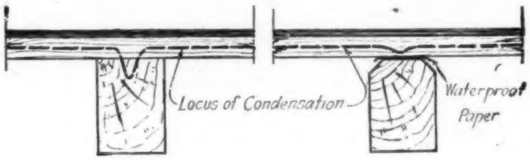


Fig. 2 Fig. 3

Fig. 2. Showing how Locus of Condensation dips over a beam or rafter

Fig. 3. Showing how Locus of Condensation may be raised by chamfering corners of beam or rafter

variations in the former often tend to upset too close generalizations concerning the placement of decay. For instance, three years ago two bays of roof plank and one roof rafter in a Rhode Island weave shed were replaced with entirely new but unsuitable material having a high percentage of sap wood. The plank is already more than one-half rotten and is in a worse condition than the remainder of the roof which is thirteen years old.

Methods Employed in Preserving Wood Roofs

Taking up the question of treatment, there seems to be no practicable means of preventing exposure to infection, or of eliminating rot-inducing conditions, as far as temperature alone is concerned.

For new wood roofs antiseptic treatment is possible, and several processes, such as creosoting and kyanizing, may be adopted for the preservation of plank. One creosoting concern has recently introduced a priming paint and claims that it is not penetrable by creosote, thus making possible the application of white ceiling paint directly without sheathing. Girders and beams may be made of steel, but if untreated timber is used the upper edges of beams may be chamfered and covered with a layer of waterproof paper, as shown in Fig. 3. Chamfering tends to raise the locus of condensation, and the paper still further assists in keeping the top of the beams dry.

In the case of existing roofs the treatment must of necessity be ameliorative rather than preventive or curative; and it should be clearly understood that the term "preservation" is meant to indicate merely the economic postponement of ultimate roof renewal and not the attainment of permanency. Briefly, the treatment consists in removing from the fungus its water supply by preventing condensation so far as is practicable. And condensation is decreased by insulating the outer roof surface, the extent of inhibition depending upon the amount and proper application of insulation.

There are certain inherent limitations to this treatment which prevent the full attainment either of water-supply removal or of sterilization. First, it is impracticable on account of excessive initial expense to lay enough insulation wholly to prevent condensation within the roof plank even in moderately cold winter weather. Second, certain fungi are suspected of having a faculty—once they are well developed—of manufacturing water to a limited extent through a decomposition of the wood structure itself, provided said decay is deep seated and protected from too rapid evaporation. That is, water in its liquid state is not absolutely necessary for their maintenance. The important characteristic of this treatment is therefore a retarding action accomplished by making the environment as unfavorable as practicable.

Top insulation has the effect of moving the plane or locus of condensation for any given set of atmospheric conditions nearer the outer surface of the plank than before, and in mild weather of eliminating it entirely. In other words, the rate of condensation is reduced, as is also its duration, resulting in checking inroads of disease already established, and also in lessening the susceptibility of timber to further infection.

Insulation should be in sufficient amount entirely to prevent condensation on the under side of

Fig. 4. Typical decay in yellow-pine girders

the roof in most severe weather, and if wood, should itself be antiseptically treated. Creosoted yellow-pine boarding nailed to furring strips has been found to be an economical type of insulation.

Cheap, open-grained lumber, preferably sap wood, should be used, since it readily absorbs the necessary amount of wood preservative. By laying it over furring strips, additional and especially effective and inexpensive insulation in the form of an air space is obtained. This type of insulation also adds materially to the strength of the roof plank; in fact, it may be made thick enough to support the old plank if the latter have become seriously weakened, and the importance of not interrupting production is paramount. The old plank, where dangerously decayed, would then be spiked to the new plank from below.

In order to prevent entrance into the new insulating air space of warm, humid air from the room below (and therefore condensation which would otherwise occur within the upper insulating deck and would drip upon the lower untreated plank), it is necessary to have a waterproof membrane between the old roof and the new insulation. The old roofing paper may be left intact and used for this purpose, if practical. On one large weave shed the new insulation was laid directly on the tar-and-gravel roof without removal of gravel, except what could be easily brushed off. If considerable structural renewal becomes necessary, however, it will generally be found advisable to remove the roofing paper entirely, and after necessary replacements have been made, to lay down a two-ply roof over the same before applying the insulation.

Fig. 5. General view of contractors' plant

An economic consideration of the question invariably shows that the additional insulation saves enough heat to help very materially in meeting fixed charges on the initial cost of installation. This is illustrated later. Furthermore, dripping from the ceiling, which may have been experienced previously, will be stopped.

Sometimes it is advisable to rearrange the heating system so as to obtain a more uniform distribution. In sawtooth buildings a portion of the heating surface should be placed under the plank and a portion under the glass, the object being to obtain a balance (that is, as little circulation of air as possible directly under the sawtooth) and thus maintain a uniform and somewhat higher temperature here, without, however, increasing the room temperature on the working plane. The effect is to decrease still further the rate of condensation within the old roof and the number of days of its occurrence during the year.

The most recent installation with which the author is familiar was completed a month ago under the direction of F. P. Sheldon & Son, Engineers and Architects, with which firm he is connected. The building is a sawtooth weave shed with a projected roof area of 116,000 sq. ft.

The weave shed is now twenty-three years old, and during the past ten years considerable portions of the roof have been replaced. For humidity, during approximately the first twenty years, it depended upon the admission of moist basement air through belt holes in the floor at each individual loom, the basement being traversed by a canal and containing more or less standing water. Recently, mechanical humidifiers were installed with the intention of maintaining a more constant relative humidity (approximately 75 per cent) than was before possible. The humidifier installation probably has accelerated roof decay somewhat, but, on the other hand, the basement may now be properly ventilated, and the present ravages of decay in floor plank, beams, and columns prevented, or at least materially retarded.

Sixty per cent of the roof plank was so rotted as to need renewal. Two per cent of the 6-in. by 12-in. yellow-pine rafters, and 25 per cent of the 11-in. by 14-in. yellow-pine girders were replaced for the same reason. The good condition of the rafters is worth noting and is doubtless due in part to their narrowness, which tends to prevent any marked dip in the locus of condensation—see Fig. 3.

The technique in this particular instance was briefly as follows: The insulation consisted of 7/8-in. square-edged, creosoted yellow-pine boarding nailed on 7/8-in. creosoted furring pieces, resulting in a 7/8-in. air space between the old roof and the new boards. The lumber was treated on the job by the hot-dip process, being unloaded direct from the cars to a storage pile within 40 ft. of the creosoting tank, which latter was of steel, 20 ft. long, 7 ft. wide and 5 ft. deep, and had ample capacity for 3000 ft. B. M. of lumber used daily. Boards were stuck with 6-ft. pieces every six boards and were divided into two sections for a given charge, each section fastened with a cable sling. An A-frame derrick (Fig. 6) made of two 50-ft. telegraph poles was used for lifting the sections into the tank. It also served in removing batches from the tank and hoisting them to the weave-shed roof. Heavy timbers were used to ballast the lumber being treated, and these were taken to and from the tank on a carriage moving on rollers, and were lifted from it by the derrick. A batch, after being lifted out of the hot creosote, was held over the tank and allowed to drain for three or four minutes. It was then hoisted to the roof, after which practically no more dripping occurred; the partial vacuum set up by the air and steam in wood cells, cooling, contracting, and, therefore, sucking in the excess surface oil.

The creosote oil used on the job was furnished in a tank car placed on a siding some 300 ft. from

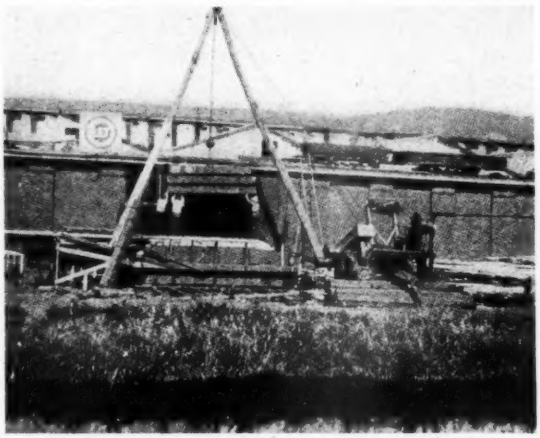


Fig. 6. View of derrick and creosoting tank

and considerably above the creosoting tank, thus allowing a gravity flow in the pipe line connecting the two. Make-up oil was added each time a batch was removed, except that toward the end of the creosoting process, after all the oil had been placed in the tank, the amount of lumber per batch had to be gradually reduced. During treatment the oil was held at a temperature of about 230 deg. fahr. by means of high-pressure-steam coils having a total heating surface of 270 sq. ft., placed in the bottom of the tank.

The use of wet or unseasoned wood was apparently not detrimental, except for the fact that a longer treatment was necessary in order to insure thorough penetration by first boiling out the entrained water.

The creosote oil used was a modification of Grade 1, American Railway Association Specification, having a specific gravity at 59 deg. fahr. of at least 1.08, and giving, when distilled, no distillate below 392 deg. fahr., not more than 1 per cent below 410 deg. fahr., and not more than 10 per cent below 455 deg. fahr.

The penetration was quite thorough, the amount of oil used averaging 9.4 lb. per cu. ft. for a 20-hour treatment. The creosote cost $0.29 per gal. delivered, which, reduced to a board-measure basis, added $0.022 to the unit lumber cost of $0.03, and made a total of $0.06 per board foot for treated boards—labor and overhead for treatment included, but not laying. The labor of laying on roof amounted to about $0.02 per ft. B. M.

Where plank were rotted at bearings, but fairly sound elsewhere, new bearing strips were spiked to each side of the rafter for necessary support.

Not more than one sawtooth for half its length was opened up at any one time, with consequent interruption to only that machinery under this particular section. This usually amounted to less than eighty looms for a period not over nine or ten hours.

Economic Considerations in Prolonging the Useful Life of Repaired Roofs

Consideration of the problem from the standpoint of economics shows, for this particular building, if the given insulation prolongs the useful roof life no more than *five* years, that it was warranted and preferable to an entirely new durable roof. Each additional year of life is therefore a net gain, as is also the very real and important (but in this case uncapitalized) saving due to substantially postponing the period in which greater interruption to manufacturing, incident with entirely new roof construction, would occur. The solution was based on the following approximate assumptions made after the necessary study of existing conditions:

1. Regardless of building decay, the felt-and-slag roof, on account of its age and condition, would have required replacement within one year at an estimated cost of $17,000.

2. If decayed members in need of immediate renewal were to be merely replaced by men, without the insulation feature, it was estimated that equal replacements would again be necessary within fifteen years.

Problem: Determine the minimum number of years by which the given insulation must prolong the useful life of the repaired roof in order to prove a financially sound investment, and preferable at this time to an entirely new durable roof.

a. The cost of the project was approximately as follows:

Insulation, i.e., creosoted plank in place, including extra two-ply waterproof membrane	$18,000
Felt- and -slag roofing	17,000
Necessary renewals of plank, rafters, and girders, removal of old roofing, painting, etc.	28 000
Total	$63,000

b. The minimum cost of an entirely new and durable treated wood roof on yellow-pine rafters and steel girders, including painting, complete erection, etc., was estimated at $110,000.

Working out several trial examples, it is found that the said insulation in order to be justified should add at least *five years* to the useful roof life. Sample computations follow.

(1) The approximate 20-year cost of the repaired roof *with insulation* (that is, the cost over its augmented useful life of $15 + 5 = 20$ years) may be calculated as follows:

Initial cost (wholly depreciated)	$63,000	
Yearly interest at 6% = $3,780 having a value in 20 years if compounded annually at 6 per cent of	139,000	
		$202,000
150 tons of coal saved annually at $7 per ton = $1050, having a value in 20 years if compounded annually at 6 per cent of		39,000
Total 20-year cost		$163,000

It is worthy of note that the insulation saves annually in coal 1,050/18,000 or 6 per cent gross of its cost and vitally affects the computations by reducing the number of years by which the said insulation must lengthen the roof life in order to be justified.

(2) The approximate comparative 20-year cost of repaired roof ***without insulation*** is obtained as follows:

Cost of repairs good for 15 years and then wholly depreciated, $17,000 for roofing plus $28,000 for replacements [see (*a*) above]	$45,000
Yearly interest at 6 per cent = $2700, having a value in 20 years if compounded annually at 6 per cent of	99,000
Cost of equal repairs 15 years hence (probably reduced to $30,000), depreciation at 5/15	10,000
Yearly interest at 6 per cent = $1800, having a value in 5 years if compounded annually at 6 per cent of	10,000
No coal saved	......
Total 20-year cost	$164,000

(3) The approximate comparative 20-year cost of a new and durable roof having an assumed life of forty years is obtained as follows:

Initial cost, $110,000, depreciation at 20/40	$55,000	
Yearly interest at 6 per cent = $6600, having a value in 20 years if compounded annually at 6 per cent of	242,000	
		$297,000
100 tons of coal saved annually at $7 per ton = $700, having a value in 20 years if compounded annually at 6 per cent of		26,000
Total 20-year cost		$271,000

Conclusion

While it is realized that the foregoing assumptions concerning future prices are conjectural, there is apparently ample margin in the result to show the described treatment to be, in this case, an economical procedure. This factor is especially emphasized when the avoidance of serious interruption to production, which would have attended entirely new construction, is considered; as well as the fact that dripping from the ceiling, which occurred previously during severe winter weather, is prevented.

Several other decayed wood roofs have been similarly insulated within the past three or four years with apparently beneficial results, so that this treatment has passed beyond the purely theoretical or experimental stage.

It is easy for an engineer to recommend sweepingly entire roof renewal with more permanent material, such as concrete, treated plank, redwood, etc., as the only real satisfactory solution of a given problem, but the correct answer is ordinarily determined only after careful analysis and evaluating and balancing every factor pertaining to each individual case. Each situation has its own especial features which should be critically examined; and to an executive considering ultimate costs, the question of maintaining production is often of greater weight than building economics pure and simple.

The tremendous damage caused by "damp rot," which is progressing insidiously in many industrial plants today, should be brought to light and more fully realized. In some brick buildings with wood roofs disintegration has occurred amounting in three years to one-quarter the value of the structure; other buildings entirely of wood have been practically a total loss above the foundations in the same time. Even less rapid depreciation instanced in the nearer normal example given has more than a merely local effect. Besides handicapping the manufactory itself, and being reflected in the cost of goods to consumers, such losses must ultimately have an appreciable effect upon international trade, and are intolerable if this nation is to enter into forward-looking competition in world markets. Plainly, damp rot constitutes one affliction of which our modern industry must purge itself if the United States is to play its rightful part with increasing service as a great vital and industrial nation.

Relative Building Costs

INQUIRIES are occasionally received for relative costs of buildings with walls of materials in ordinary use.

The Portland Cement Association gives the following figures:

Frame walls	100
Frame covered with back plastered stucco	101
Concrete blocks covered with stucco	104
Clay tile covered with stucco	105.5
Brick walls 8-in. thick	110

The American Face Brick Association reports as a result of an investigation that the average difference in the cost of a house with brick walls and a frame house was 6.4 per cent in 1919.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OUTLINE FOR TENTATIVE SPECIFICATION FOR ARCHITECTURAL TERRA COTTA

(The form of this bulletin conforms to the arrangement of Elements of a Specification as given in Bulletin No. 5 Analysis of a Specification.)

I. CONTRACT AND LEGAL

1. Parties:
2. Agreement:
3. Terms of Payments:
4. General Conditions:
5. Regulations:
6. Standards:
7. Patents:

II. ECONOMIC

SCOPE OF CONTRACT:

8. Drawings:
9. Work Included:
10. Methods of Analysis and Comparison of Bids:
11. Conditional Payments:

III. GENERAL DESCRIPTIVE

12. Characteristics, Service Conditions and Ultimate Requirements:

IV. PRELIMINARY PREPARATION

13. Field Measurements:

SHOP DRAWINGS:

14. Contours:
15. Working Drawings:
16. Setting Drawings:
17. Examination of Architect's Drawings:
18. Joints:
19. Beginning of Manufacture:

SAMPLES:

20. Work Samples:
21. Record Samples:

MODELS:

22. Execution and Approval:
23. Photographs:

V. MATERIALS

PROPERTIES, CHEMICAL AND PHYSICAL:

24. Quality:
25. Sizes, Weights, Gauges: Thicknesses:
26. Quantities:

VI. METHODS

27. Processes:
28. Workmanship:

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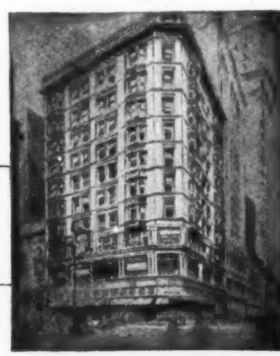

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35. Authority of Setter:

FINISH:

36. Color and Finish:
37. Descriptions:
38. Co-operation with Other Contractors:
39. Protection of Work:

VII. SCHEDULES

40. Delivery and Completion:
41. Marking and Shipment:

VIII. RESULTS

42. Inspection and Performance:
43. Guarantees:

TESTS:

44. Checking:
45. Rejection:

Department of Specifications

(*Continued from Page* 570)

such as connections of roof trusses to columns or roof purlins to roof trusses, or where the number of field connections is so small as to render the cost of a riveting plant excessive, bolting the members is resorted to. Where bolting of connections is to be done, the bolts must make tight fits and should have the nuts drawn up tight. Where there is any possible chance of vibration loosening the nuts, a good type of locknut should be furnished. Where concrete encases the structural steel, locknuts should not be required as the concrete should hold the nuts in their position. Riveted connections should be made with a riveting machine and not by hand. Hand riveting should be permitted only in situations where machine riveting cannot be accomplished successfully.

The field rivets should be formed with heads concentric on shank and the heads should be well cupped.

The specifications should call for field inspection by an inspection engineer wherever there is a number of fabricated joints. The architect usually is not disposed to inspect riveted connections or bolted connections with a great deal of care because of being unaccustomed to reaching the places to be inspected. If the architect is to have a superintendent on the ground all the time it is presumed that the matter of field inspection may be handled all right, except perhaps in cases where an extremely large tonnage is required, or exceptionally difficult field connections are made where the expense of a trained inspector would be warranted by the results obtained.

All structural steel after being erected should be painted one coat after all erection marks have been touched up. Abraded places should be touched up also. The field coat should contrast in color with the shop coat sufficiently to insure that the two coats may be distinguished. Any surfaces of structural steel which will be inaccessible after erection should be painted the second coat before erection. It is quite customary to omit the painting of structural steel where it is to be encased completely in concrete and is above ground water level, or in positions where water seepage could not get to the steel. This matter must, of course, be covered both in the specifications for shop painting and field painting.

Quite often it is usual for specifications to call for the furnishing of progress photographs taken from angles that will present a pictorial record of the erection work. A sufficient number of photographs is specified to insure a good record.