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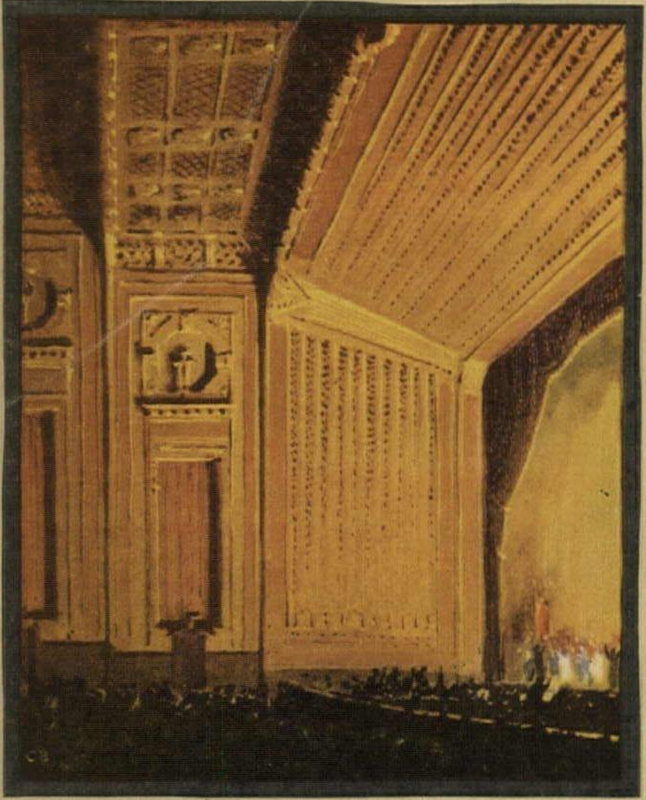

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APRIL 1930

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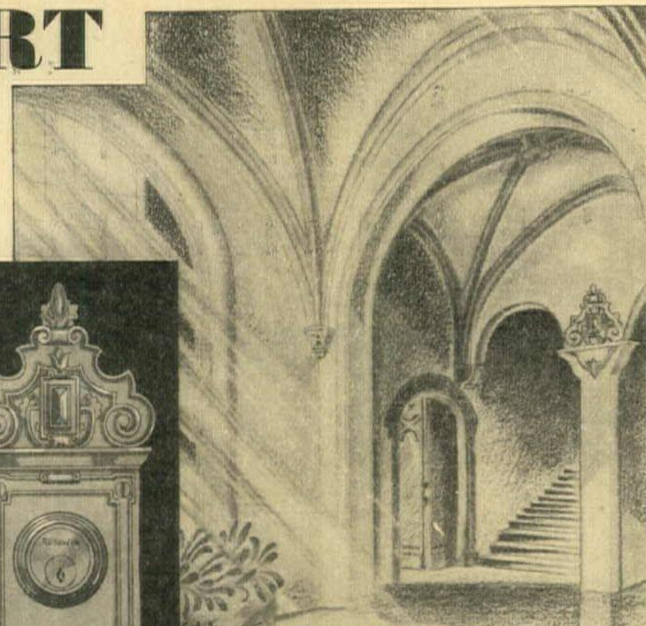

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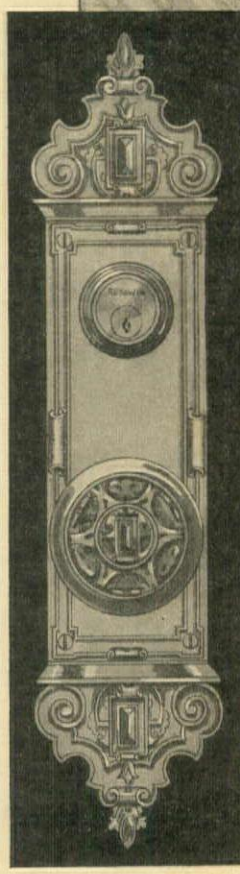

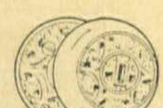

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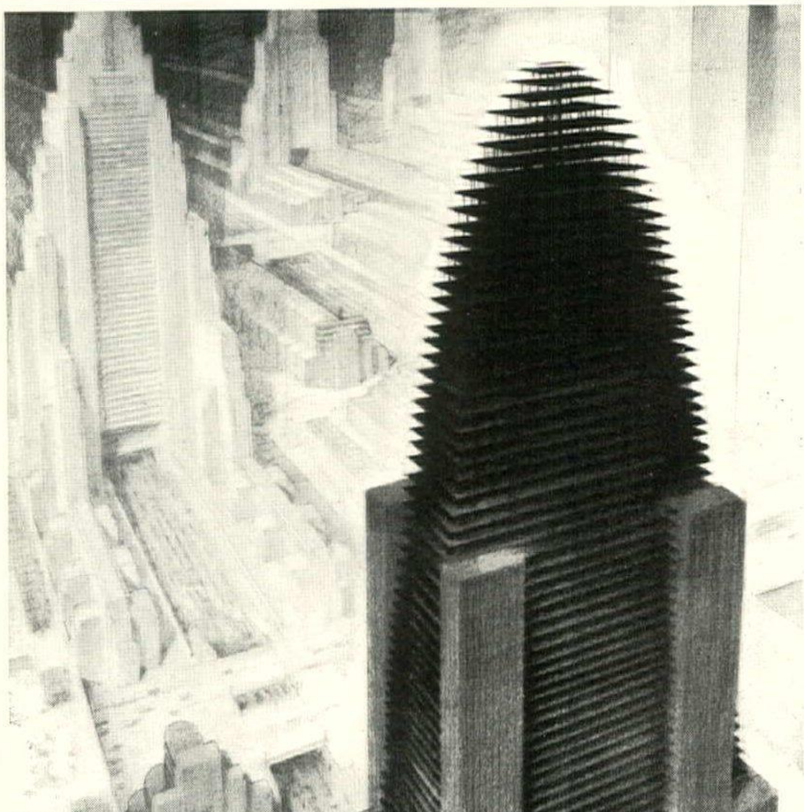
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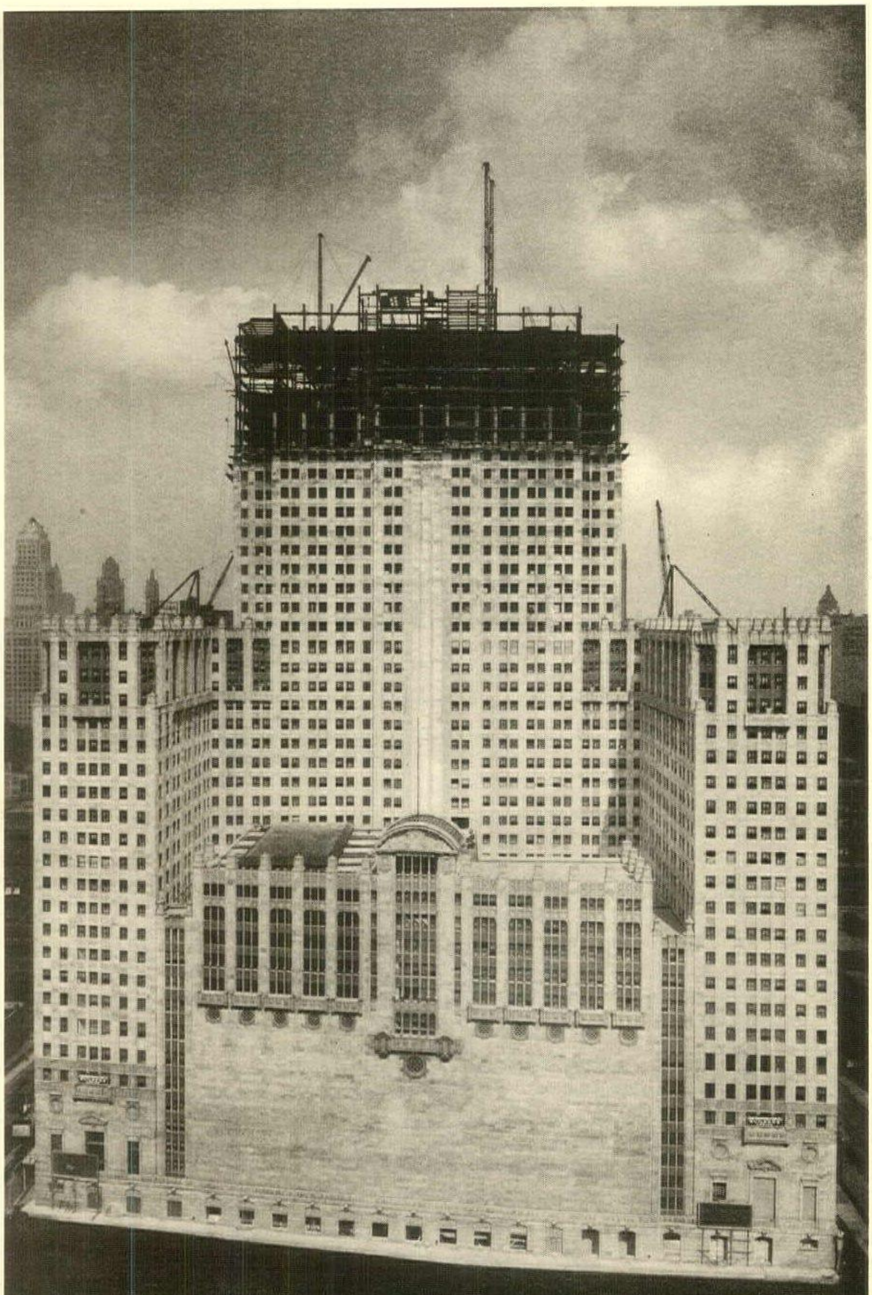


THE CHICAGO CIVIC OPERA BUILDING
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

THE ARCHITECTURAL FORUM

VOLUME LII NUMBER FOUR

APRIL 1930

THE STRUCTURAL DESIGN OF THE CHICAGO CIVIC OPERA BUILDING

BY

MAGNUS GUNDERSEN

STRUCTURAL ENGINEER

GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

SEVERAL unusual conditions were encountered in the planning and construction of the 20 Wacker Drive Building, caused by its adjacency to the Chicago River and by the inclusion of the Civic Opera and the Civic Theater.

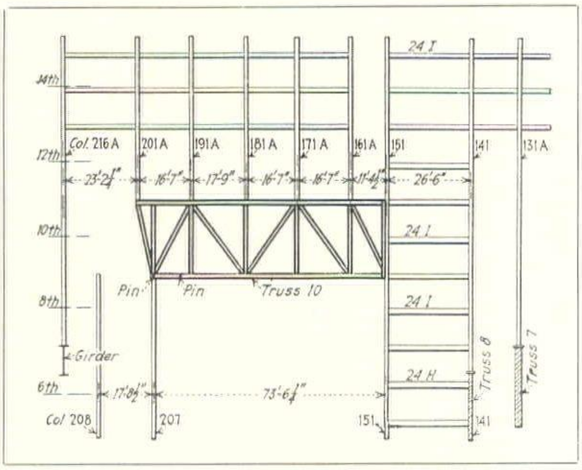
FOUNDATIONS. The preparation for the foundation construction required the erection of a cofferdam along the Chicago River front extending from the Madison to the Washington Street bridge piers, which enabled the work to proceed under comparatively dry conditions. The remnants of old foundations and former docks caused some difficulty in excavating for a new concrete dock and river wall. The old dock wall had been pushed about 2 feet out of alignment. The new concrete dock wall will always maintain the correct alignment.

A concrete river wall about 3 feet thick extends from about 4 feet below the river bottom at the dock line up to the top of the dock wall. This wall is interlocked with cylindrical concrete caissons or piers which support the columns of the building. In front of this river wall, extending several feet below the water level of the Chicago River, there is a concrete dock wall 5 feet wide and 8 feet high. This dock wall was poured in lengths of about 100 feet, the joints being sealed with a soft sheet copper stop placed 4 inches inside of the face of the wall and the joint filled with an asphaltic composition. Special precautions were taken to produce a very dense and watertight concrete in the river wall.

From the concrete foundation piers along the river line there was constructed a system of concrete cantilever beams below the basement floor. These beams are interlocked with the inner rows of concrete piers and act as a series of horizontal struts which serve to transmit and distribute to the interior piers the lateral pressure of the river and impact from vessels against the dock wall. The foundation concrete caissons or piers, in general, extend to bedrock, which is about 115 feet below the street level. The columns under the auditoriums and stages are supported by piers which extend down to hardpan, which is about 60 feet below city datum. In some instances, existing concrete piers which were used in the former buildings on this site were utilized. New piers were carried down alongside the old piers, and the column loads were distributed to them by steel plate girders. The piers extending to rock are made of a 1:1:2 concrete mix, and those extending to hardpan were made of a 1:2:4 mix. These proportions were found to be the most economical because the largest pier extending to bedrock is 11 feet in diameter and, if built of weaker concrete, it would be 13 feet, 3 inches in diameter. The excess cost of the stronger concrete is offset by the reduced amount of excavation and caisson lagging. The piers extending to hardpan present exactly the opposite condition, as 4 feet is the minimum diameter for digging, and that size could not be reduced by using a stronger concrete. The presence of large quantities of sand and water above the rock made it necessary to use light steel sheet piling in lengths of from 15 to 30 feet instead of the usual wood lagging, which is placed in lengths of about 4 feet. The steel sheet piling was driven by hand. The extension of the concrete river wall some 4 feet below the bed of the river was necessary in order to provide an effective waterseal between the river and the interior of the building. The danger was in the possibility of the backwash of the steamers undermining the wall by scouring out the earth and causing hydrostatic pressure under the basement floor.

STRUCTURAL DESIGN. The special structural layouts required for the auditorium and theater portions in the lower part of the building, in connection with the superimposed office building portion in the upper part, made it necessary to use a steel frame construction throughout. The upper portion was designed as a typical office building with hollow tile floors and concrete fireproofing on the steel work. The association of these two distinct styles of building construction necessitated some very intricate construction in the transition from one to the other. Frequently, column loads had to be transmitted from one location to another, which required the introduction of some one hundred and twenty-one heavy steel girders and seventeen steel trusses. A rearrangement in column centers to a considerable extent was made at the 23d floor, from which the columns extend upward to the 44th floor. From the 23d floor the re-located columns extend downward to the ceiling of the auditorium, where they are supported by trusses which transmit the loads to columns that extend directly to the foundations. A series of heavy steel girders is introduced at the 7th floor of the south wing to span a ceiling of the wide foyer. The columns of the north wing in general are carried down to the 4th floor level, which forms the ceiling of the Civic Theater, where their loads are transmitted by trusses to columns extending down to the foundations. Unusually high column loads,—the maximum being 7,500,000 pounds on one foundation,—result from the necessity at times of concentrating several column loads on one lower column by means of girders or trusses. Steel slabs were used for column bases, the largest circular slab weighing about 14 tons and having a diameter of 8 feet, 2 inches and 13½ inches thick.

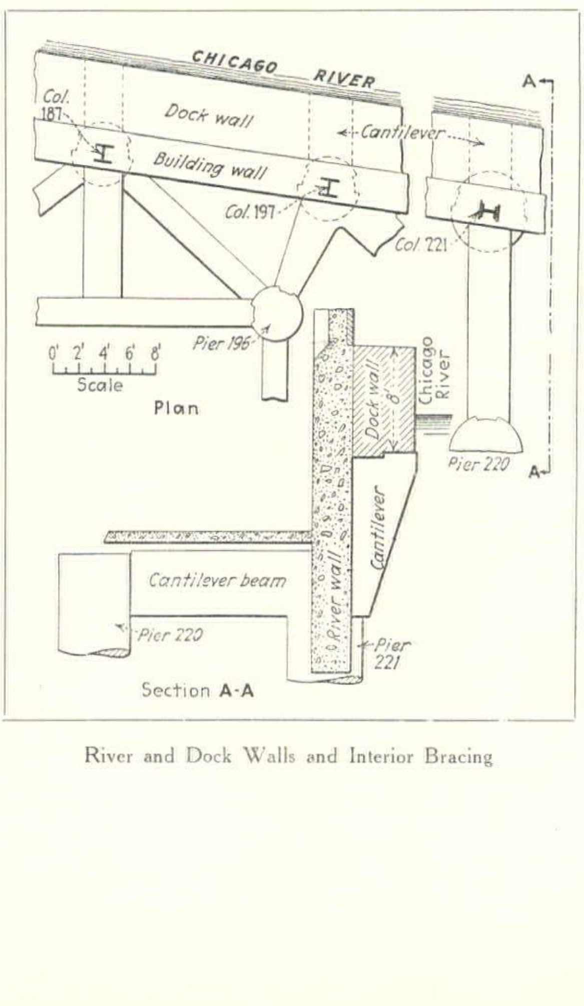
The design of the trusses spanning the main auditorium embraced several features unusual in building construction. One end of these trusses supports the columns for the upper 37 stories of the tower, causing a much greater load on one end than on the other. This unbalanced loading condition made different types of details for the ends necessary. The high reactions involved caused the abandonment of the usual riveted end connections which would have introduced high secondary stresses tending to develop unusual bending in the columns. To overcome this dif-



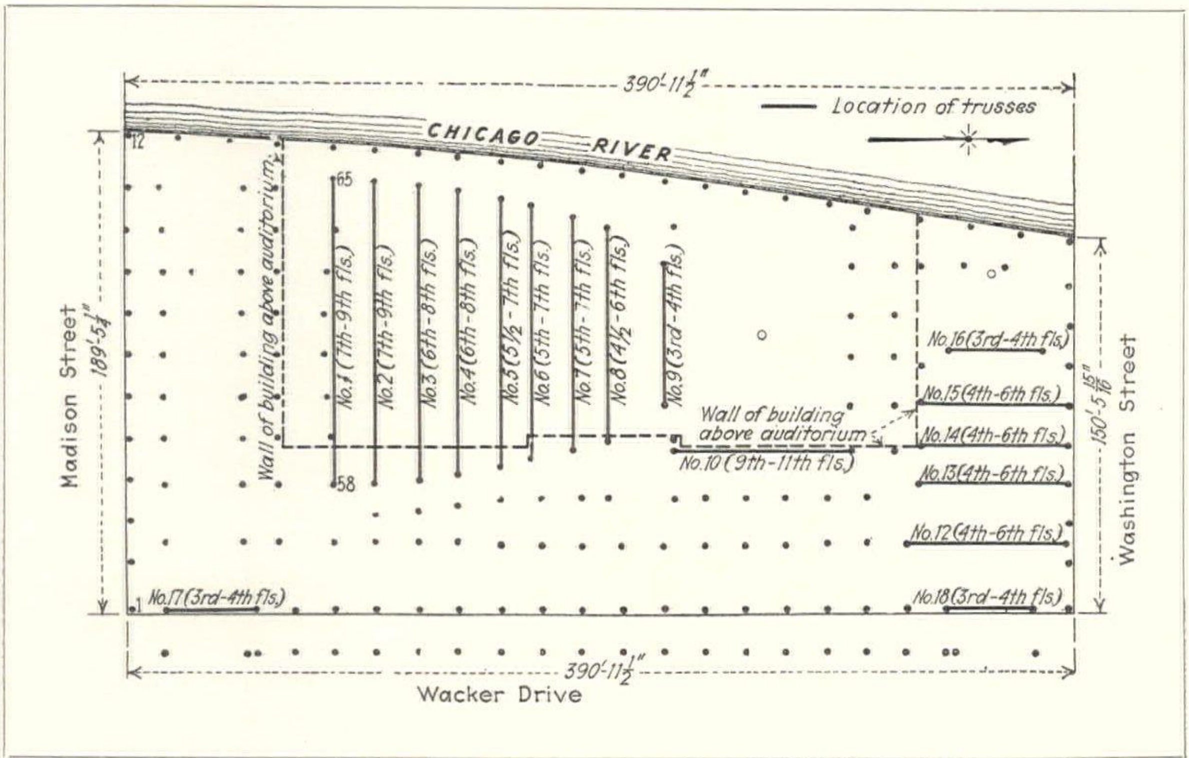
Truss No. 10 Supporting Five Columns

ficulty, it was decided to use pin and rocker shoe bearings. Five columns are supported on truss No. 10, at one end of which a compression member transmits to the pin a load of 5,700,000 pounds, and another compression member transmits 1,200,000 pounds, together with a tension member carrying 2,300,000 pounds. The total reaction at this end is 6,300,000, and the total load on this truss is 11,000,000 pounds.

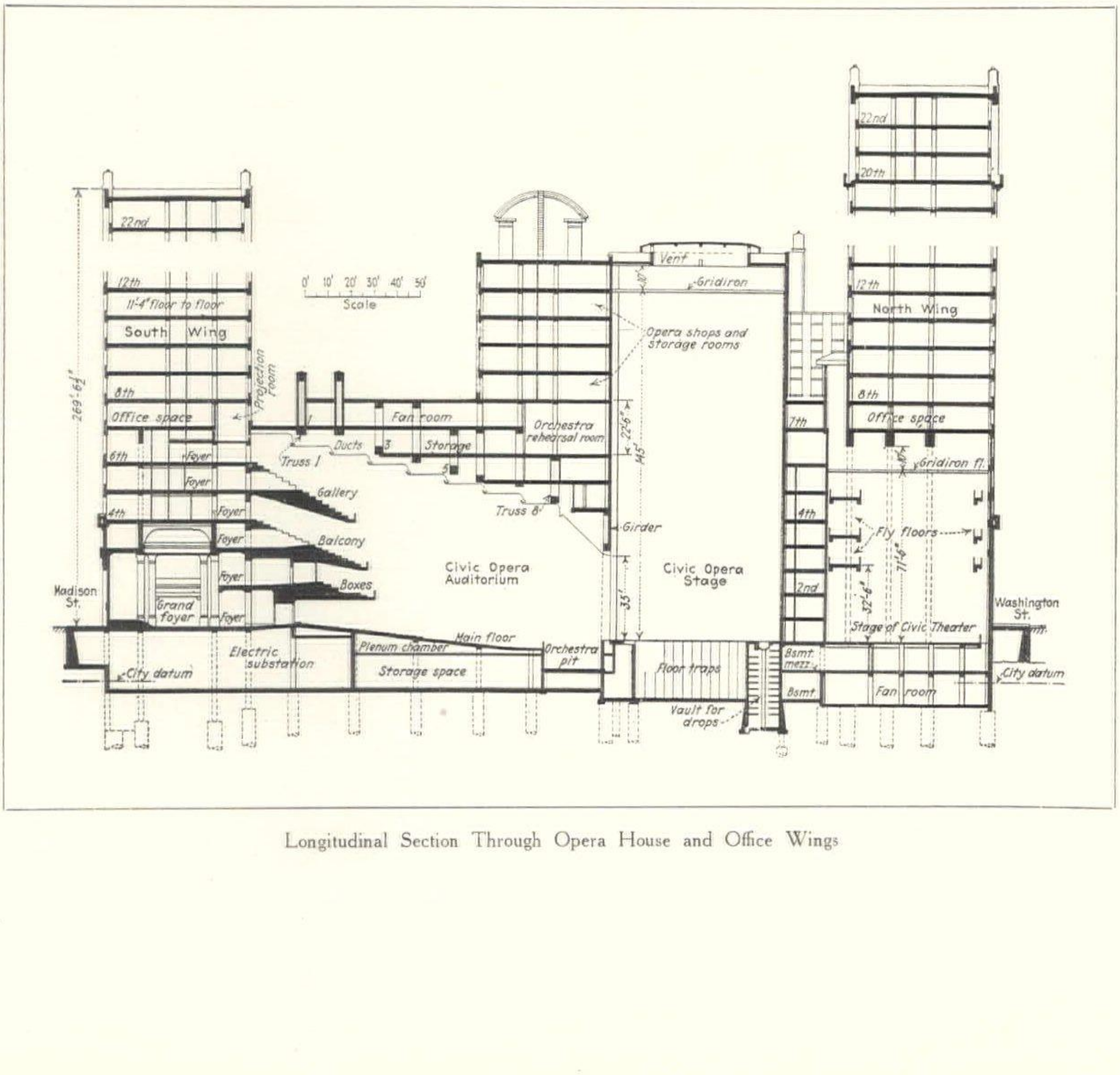
To take care of these extremely high stresses, a 20-inch pin was used supported in a steel casting. This truss has a comparatively short span of only 73 feet and weighs 325 tons, one of the members of which weighs 46 tons. Trusses Nos. 1 to 8 over the main auditorium have spans ranging



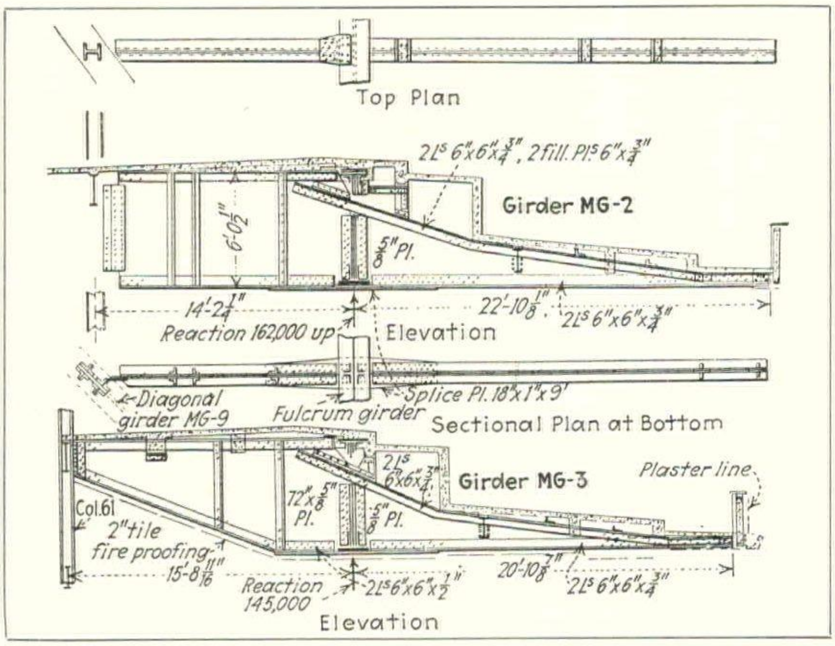
River and Dock Walls and Interior Bracing



Plan Showing Location of Trusses. Trusses 1 and 2, Seventh to Ninth Floor; 3 and 4, Sixth to Eighth Floor; 5, 6 and 7, Fifth to Seventh Floor; 8, 4½ to Sixth Floor; 9, Third to Fourth Floor; 10, Ninth to Eleventh Floor; 12 to 15, Fourth to Sixth Floor; 16, 17 and 18, Third to Fourth Floor



Longitudinal Section Through Opera House and Office Wings



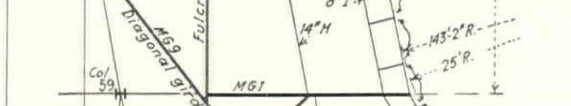
Cantilever Girders for the Balcony Showing the Method of Passing Them Through the Fulcrum Girder

from 90 to 120 feet, with loads of from 3,200,000 pounds on truss No. 1 to 7,400,000 pounds on truss No. 6. The extreme size and weight of the members necessitated their erection in the field.

Wind Bracing. A wind pressure of 20 pounds per square foot was used on the main building and 30 pounds per square foot on the tower for the designing of the structural steel frame. Where the top and bottom shelf connections made of wide flange I-beams were insufficient, gusset plate brackets were used. Across the narrow width of the tower it was necessary to use these special flange wind-brace connections on the exterior and all of the interior columns from east to west. In the north and south direction it was necessary to use them only on the exterior wall columns. Horizontal wind-bracing diagonals made of 8 x ½-inch bars were used at the 23rd, 13th and 7th floors, utilizing the floor beams and girders to form the chords. Because of the necessity of providing open spaces or courts on both sides of the main auditorium, required by city ordinance, special bracing was needed on either side of the auditorium. The rear wall of the stage of the Civic Opera House, extending from the basement to the 13th floor, was braced with a system of vertical diagonals. A mezzanine and two balconies extend across the opera auditorium. It required much skill and ingenuity to maintain the proper sight lines and provide the necessary structural construction within the limited headroom. This necessitated the combination of cantilever balcony girders with fulcrum girders.

The cantilever could not be supported on top of the fulcrum girder and the tension member of the cantilever girder was passed through the web of the fulcrum girder, and because of this the compression member of the fulcrum girder was reinforced at these points. The compression member of the cantilever girder is in the same plane with the bottom member of the fulcrum girder, and the load is transmitted through it by means of a tie-plate. Diagonal girders used in the balconies support the fulcrum girder. This materially reduces the length of the fulcrum girder, which in the mezzanine balcony is 84 feet, 9 inches long. These reductions in girder length materially reduce the deflections.

Note. The illustrations for this article were furnished by courtesy of *The Engineering News-Record.*



Steel Framing of the Balcony

ACOUSTICS OF THE CHICAGO CIVIC OPERA HOUSE

BY

PAUL E. SABINE

FOREWORD

WHEN the design of the Civic Opera House was started by the architects, one of the three primary considerations had to do with the acoustics. The tradition of the great acoustical reputation of the old Auditorium made the subject important, and the best available information was studied and the foremost acoustical engineers were consulted. The defects and advantages of existing buildings were observed, and out of it all the three essentials which were kept in mind came to be (1) the proper reverberation period, (2) the absence of echo, and (3) the proper reinforcement for the distant seats.

With as general an understanding of sound reflection as could be obtained, the section was studied to let sounds carry to distant seats and to be unechoed except for inaudible differences. The volume was checked roughly with the volume of the nearest sized auditorium available,—the Chicago Auditorium,—with the knowledge that absorbing areas could be increased or decreased. General criticism of curved walls and ceilings as concentrating influences on sound waves caused us to use square lines, and with these general requirements an architectural scheme dividing the auditorium into equal bays, stepping up, was evolved.

In carrying out the general purpose to insure an auditorium that should have excellent acoustical properties, the architects were guided by the general principles laid down by Wallace Clement Sabine, founder of the science of architectural acoustics. In order to apply these principles most effectively to the immediate problem in hand, preliminary plans were submitted to Paul E. Sabine of the Riverbank Laboratories, who had made previous studies of the acoustics of a number of concert halls, and the final plans were developed with the results of these studies in mind, incorporating those features that seemed desirable for acoustical reasons, and which were not incompatible with other necessities of design. The developed plans were then submitted to other men whose prestige was national and whose opinion was of value. The reports of all of them, now on file in the architects' office, were favorable, and the building was designed accordingly.

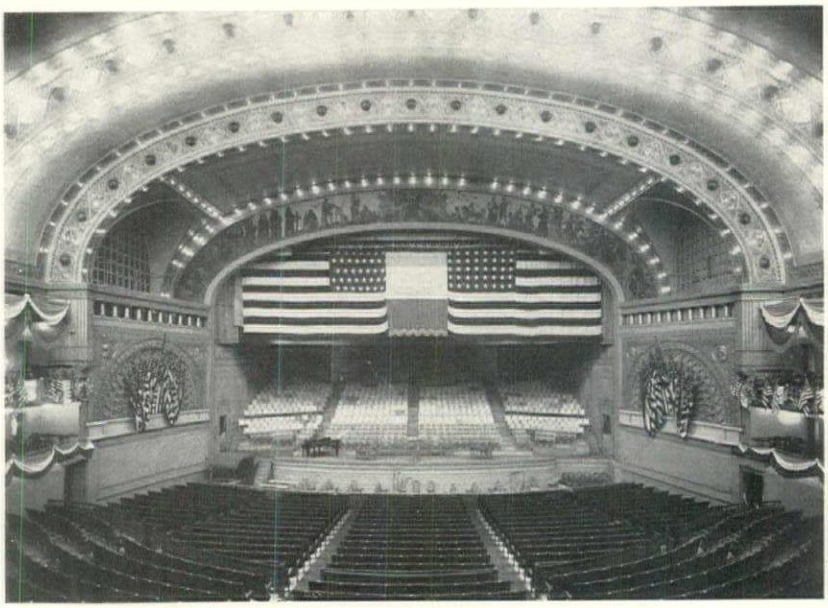
In this connection it is a pleasure for me to acknowledge gratefully the services of Dr. Sabine, and the coöperation of Professor Dayton C. Miller of the Case School of Applied Science, Clifford M. Swan of New York, R. V. Parsons of the Johns-Manville Corporation, and Wallace Waterfall of the Celotex Company.

ALFRED SHAW,
For Graham, Anderson, Probst & White

WITH due apologies for use of a hackneyed and overworked phrase, it may be said that within the last 25 years the American public has become "acoustic conscious." Slowly but surely people generally have come to realize that good hearing conditions in an audience room are no longer the result of a combination of happy accidents, but that they may be provided for with the same assurance as are good lighting and adequate ventilation. As a result, the architect who plans an auditorium that turns out acoustically impossible is no longer excused as being a victim of lamentable but pardonable circumstances. Conversely, when a new auditorium proves to be what its name implies,—a place where would-be hearers can *hear*,—the happy result is credited to the architect's successful planning rather than to his good luck.

With this fact in mind, the architects for the new Civic Opera House, Messrs. Graham, Anderson, Probst & White, admitted at the very outset that acoustical requirements were of primary importance in the design of the new Opera House. The results have proved so satisfactory alike to musicians, critics and the public generally, that it seems worth while to set forth briefly the principles that were taken into consideration in the design of this hall. The writer of this article takes credit only for the very minor part of supplying the specialized technical information called for in successful acoustic design. Credit for the far more difficult task of applying this information to the particular problem in hand, without doing violence to the simultaneous demands of good construction and good architecture, must go to the architects.

There are three main requirements in the acoustic design of a large concert hall. First, contours should be such as to eliminate the possibility of there being undesirable reflections and concentration of reflected sound. Second, contours should be such that the reflection of sound from the bounding surfaces will serve the useful purpose of reinforcing the direct sound, particularly for



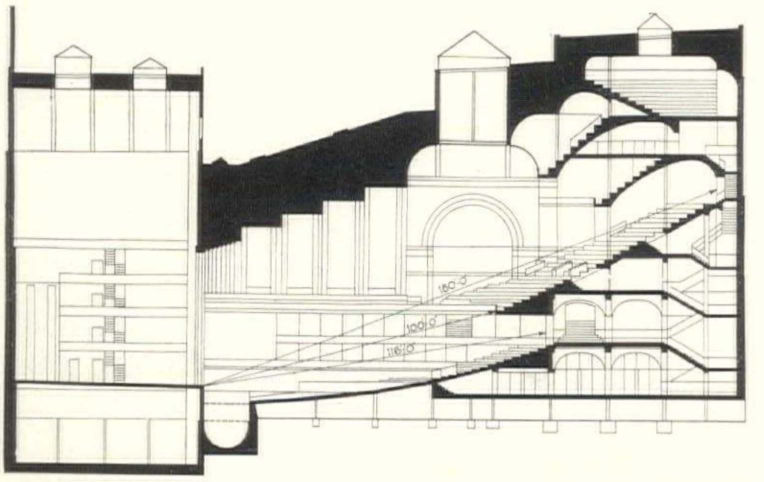
The Chicago Auditorium Ceiling is Elliptical in Cross Section, with Four Horizontal Planes in Longitudinal Section

those in the rear portions of the hall, and third, the total sound absorption in the hall should be adjusted to the volume, so as to give a desirable reverberation time. The first and second requirements are not independent. They are perhaps only the negative and positive statements of the same thing,—namely, to provide that the inevitable reflections from walls and ceiling shall promote rather than interfere with good hearing.

In order to deal intelligently with the particular problem, the results of comparative studies of a number of existing concert halls which are acoustically satisfactory were used. Of these, the hall approximating most closely in required seating capacity was the Chicago Auditorium, the former home of the Chicago Civic Opera, which has for years held a well deserved reputation for having good acoustics. Moreover, a somewhat detailed study of this hall had been made by the writer several years earlier, so that it served as a useful point of departure for the acoustical though not the architectural design of the new Opera House. A comparison of the two halls may therefore prove instructive.

As will be noted, the plan of the Auditorium is essentially rectangular. The two rows of boxes, extending almost entirely around the main floor, give the familiar "horseshoe." The lower line of the first balcony begins immediately above the second tier of boxes, and as seen on the section, this first balcony has an extended sweep free from the overhang of the gallery above. It will be noted further that the line of the balcony slope is considerably lower than the sight line from the stage, a fact which lessens the diminution of sound for those in the rear of the balcony, due to its passage immediately over the absorbing surface of the audience seated in front of them. Furthermore, there is a certain degree of useful reflection of sound to a portion of the balcony from the last of the main ceiling arches, so that this first balcony affords a large number of seats in which, through features of design, the hearing conditions are excellent. The experience of auditors in these seats is an outstanding asset of the reputation for having good acoustics which the Auditorium enjoys.

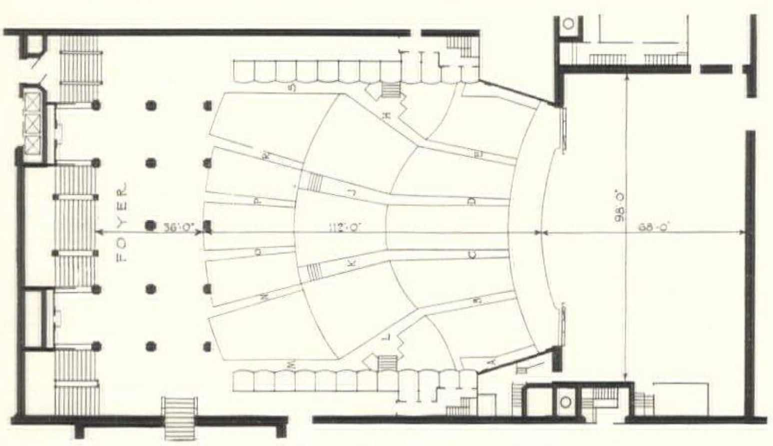
The design of the main ceiling has certain acoustical virtues. Viewed in transverse section, this is a series of expanding semi-elliptical arches. This stepped design reduces the ceiling height at the front over the main floor to only 45 feet, a distance which is sufficiently small to obviate there being perceptible echo in the front seats due to reflection from the ceiling. This height increases to 65 feet at the last of the series of arches, but the oblique incidence of sound originating on the stage upon this portion of the ceiling surface throws the reflected sound back into the balcony where the path difference between the direct and reflected sound is sufficiently small to render the reflection an aid to hearing rather than an annoying echo. Furthermore, the vertical breaks in the ceiling line serve to render the entire ceiling a series of limited areas from which the sound is, to a large extent, diffracted diffusely rather than reflected geometrically, as would be the case from a continuous unbroken ceiling surface. Finally, and most important of all, this arrangement effects a considerable reduction in the total volume of the hall, thus decreasing the amount of the reverberation, which according to the Sabine equation is directly proportional to the volume and inversely proportional to the total absorption. The radius of the main curvature of the ceiling arches in the transverse section is ap-



Longitudinal Section of the Chicago Auditorium, Showing the Distances from Various Points to the Stage

proximately twice the ceiling height, giving a curvature sufficiently slight to prevent focusing of sound reflected from the ceiling. These are the more important features of the design which contribute to the desired acoustical result. In the light of our present knowledge of the subject, there are certain alterations that would be in the direction of an improvement, and these will be pointed out in our consideration of the new Opera House.

As will be seen, the plan of the latter is spatulate, a shape which gives no cross room reflection from the side walls. It will be noted that the side wall reflections are to the rear, with in every case a path difference between direct and reflected sound sufficiently small to produce useful reinforcement. Acoustically this is a better plan than that of the old Auditorium, since the reflections from the side walls improve the hearing conditions in the extreme rear seats of the main floor under the boxes. Turning to the longitudinal section, we find a series of expanding bays, with the ceiling stepped up at equal intervals to the extreme rear above the balcony. It will be noted that the slope of the proscenium is such as to reflect sound from the stage upward into the second balcony, and further, that the successive ceiling steps, with the exception of the first, serve to give useful reflection into the balconies where it is needed rather than to the main floor, where it would be worse than useless. The result of this direction of the reflected sound to the rear is so marked that conversation between the extreme rear of the upper balcony and the stage, a distance of about 185 feet, can be carried on with remarkable ease and clarity, so that the seats in the upper balcony are quite as satisfactory from the standpoint of hearing as are the seats nearer the stage. This effect, be it noted, is secured without resorting to any unusual architectural means. Architecturally, the ceiling line is easy and natural and clearly dictated by the practical structural necessities of the situation to provide spaces for the heating and ventilating apparatus.



Floor Plan of the Chicago Auditorium, Showing the Principal Dimensions

The Civic Opera Auditorium, Showing the Horizontal Ceiling Planes of Different Levels

REVERBERATION

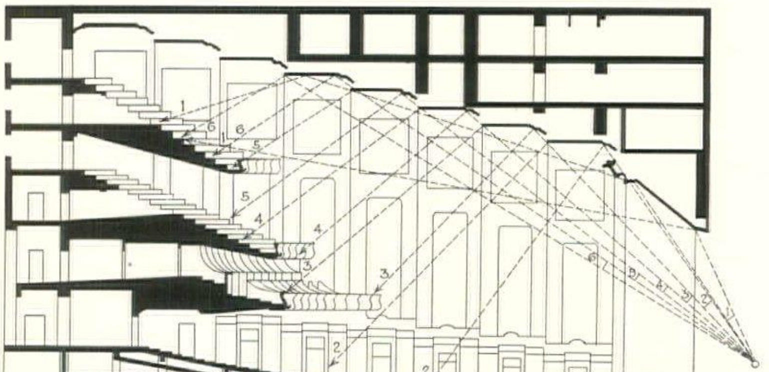
The prolongation of sound in a room after the source has ceased to operate is technically known as reverberation, and experience has shown that this is the most important single factor entering into the acoustic properties of a room as a whole. The numerical measure of reverberation has been defined in two ways, either as the time required for a sound of any given average initial intensity to decrease to 1/1,000,000 of that intensity, or as the duration of audible sound from a sustained source of specified acoustic power, measured in terms of the threshold of audibility, to decrease to the minimum audible intensity. The first leads to the very well known equation:

(1) $$T_0 = \frac{.05V}{a}$$

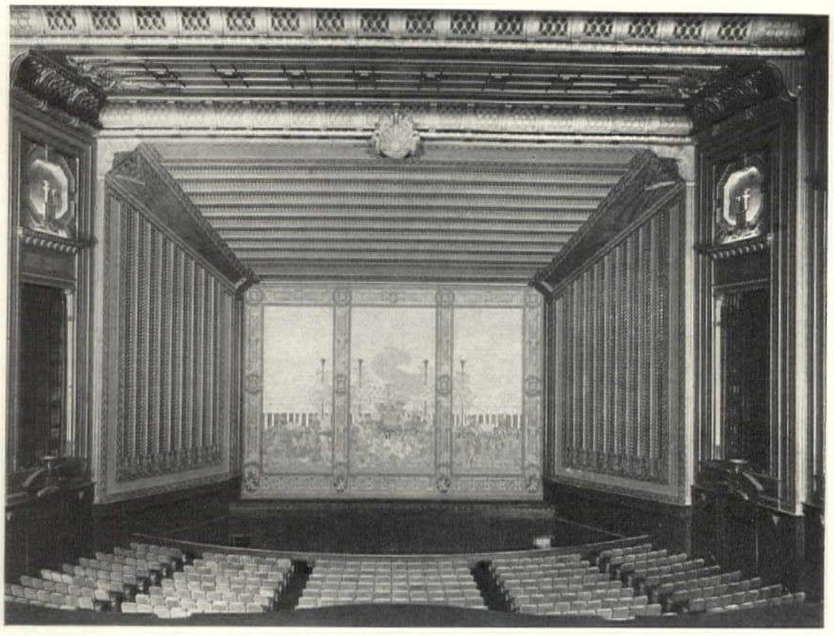
in which V is the volume of the room in cubic feet, and a is its total absorbing power in square feet of perfectly absorbing surface. The second gives the equation:

(2) $$T_1 = .0083\frac{V}{a}(9.1 - \log a)$$

If the reverberation time is too great, the overlapping of successive sounds blurs the fine effects of music, and is fatal to the clear understanding of speech. If it is too small, the effect is to produce dullness and loss of tone volume, objectionable chiefly to the performers, who experience



Longitudinal Section of the Civic Opera Auditorium, Showing the Zones of Sound Reflected from the Horizontal Planes



The Civic Opera Auditorium, Showing the Surroundings of the Stage and the Horizontal Ceiling

a sense of not securing musical results commensurate with their efforts. One seeks for the golden mean. In the present instance, the reverberation time of the Auditorium, which had been determined in the study already referred to, was taken as the most desirable value to be attained.

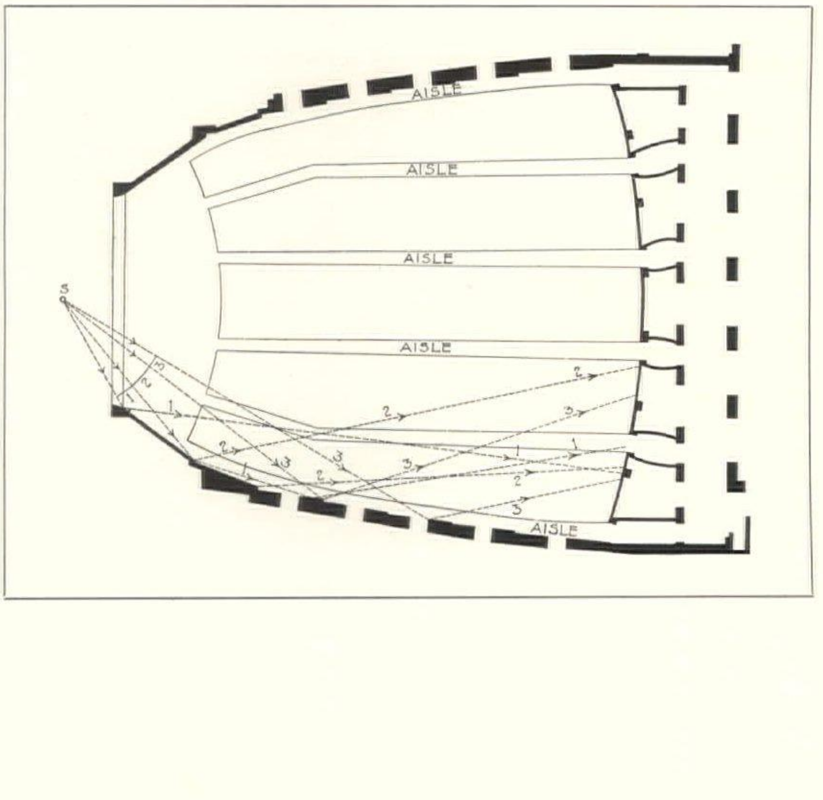
In measuring the reverberation time an organ pipe (pitch 512 vibs. sec.) was used. The acoustic output of this pipe was determined by measurement of the reverberation time, using it as a source of sound in the sound chamber of the Riverbank Laboratories. With this source, the reverberation in the Auditorium was measured, and from this time and the known acoustic output of the pipe, the total absorbing power of the empty Auditorium was determined. The results obtained were:

Volume, estimated from plans	924,000 cu. ft.
Seats	3,400 cu. ft.
Total measured absorbing power, empty room	16,600 units
Total computed absorbing power, seats occupied	24,400 units

$$Reverberation\ Time = \frac{.0083\ V}{a}(9.1—\log a)$$

Empty room	2.3 seconds
With capacity audience	1.48 seconds

The problem then was to provide conditions that would give these same reverberation times in the new hall. The estimated volume was 842,000, with a seating capacity of 3,600. The estimated



Plan of the Civic Opera Auditorium, Showing the Zones of Sound Reflected from the Side Walls items of absorption were:

Absorbing power of unfurnished room (walls, floor and ceiling)	3,210 units
Openings and furnishings of boxes	896 units
Carpets in aisles 3200 x .25	800 units
Wall draperies 2500 x .40	1,000 units
Upholstered chairs (3600 x 2.3)	8,280 units
Total absorbing power	14,186 units

Computing the reverberation times, using this value for a in the formula, we have, without audience

$$T_1 = \frac{.0083 \times 842{,}000}{14{,}186}(9.1-4.15) = 2.44 \text{ secs.}$$

To compute the time with an audience, we substitute for the 3,600 empty seats with an absorbing power of 2.3 per seat, 3,600 occupied seats with an absorbing power of 4.6, giving a total absorbing power with an audience of 22,460 units. For a capacity audience, then, we have,

$$T_1 = \frac{.0083 \times 842{,}000}{22{,}460}(9.1-4.36) = 1.47 \text{ secs.}$$

The collected data for the two rooms are:

	Volume	Seating	*Absorbing Power (empty)*	*Absorbing Power (occupied)*
Auditorium	924,000	3400	*16,600	*24,400
Civic Opera House	842,000	3600	**14,186	**22,460

* measured. ** computed.

Reverberation Time $T_1 = .0083\,\frac{V}{a}(9.1-\log a)$

	Auditorium	*Civic Opera House*
No audience	2.30	2.44
Capacity audience	1.48	1.47

Using the older formula

$T_0 = .05\,V/a$ we have

No audience	2.78	2.96
Capacity audience	1.90	1.88

The foregoing are the results anticipated in the new hall. Upon completion, careful tests were made in the empty hall to determine how closely actual conditions approached those predicted. Using a source of sound calibrated by timing the reverberation in the sound chamber, the reverberation in the hall was measured, and from this measured time the total absorbing power was computed. This measured value was 13,830 units, as compared with a computed value of 14,186 units, an agreement which is probably closer than would ordinarily be expected. This difference of 2½ per cent between the predicted and actual values of the absorption of the unoccupied hall makes an equal percentage difference in the reverberation time for the empty room, and of less than 2 per cent when the seats are all filled. This difference is below what can be observed by ordinary auditory experience, and certainly well within the limits of accuracy of experimental determination, so that one may say that the actual reverberation is in excellent agreement with that predicted in advance of construction.

Moreover, this value of the reverberation time is very close to the average of that of the existing concert halls studied in connection with this problem. Included in the list were halls with volumes ranging from 320,000 to 900,000 cubic feet and with seating capacities of between 1600 and 3400. The shapes varied from the "horseshoe" of the older type of opera house to the rectangular form of the usual orchestral concert hall. Of the examples studied, the reverberation times T_1 all lay between 1.20 and 1.64 seconds with an average value of 1.43 seconds. The close approximation to this value of the reverberation time of the new hall with its satisfactory acoustic properties emphasizes the paramount importance of regarding reverberation as a determining factor.

Summarizing the results of this experience, and the studies made in connection with it, we may say first, that in designing for good acoustics, plan and section contours should be such as to give a general reflection of sound to the extreme section of the area rather than to portions near the stage, and second, that the absorbing power should be adjusted to the volume, so that the reverberation time for rooms of from 300,000 to 1,000,000 cubic feet in volume will be 1.4 seconds with a tolerance of 0.2 second on either side of this value.

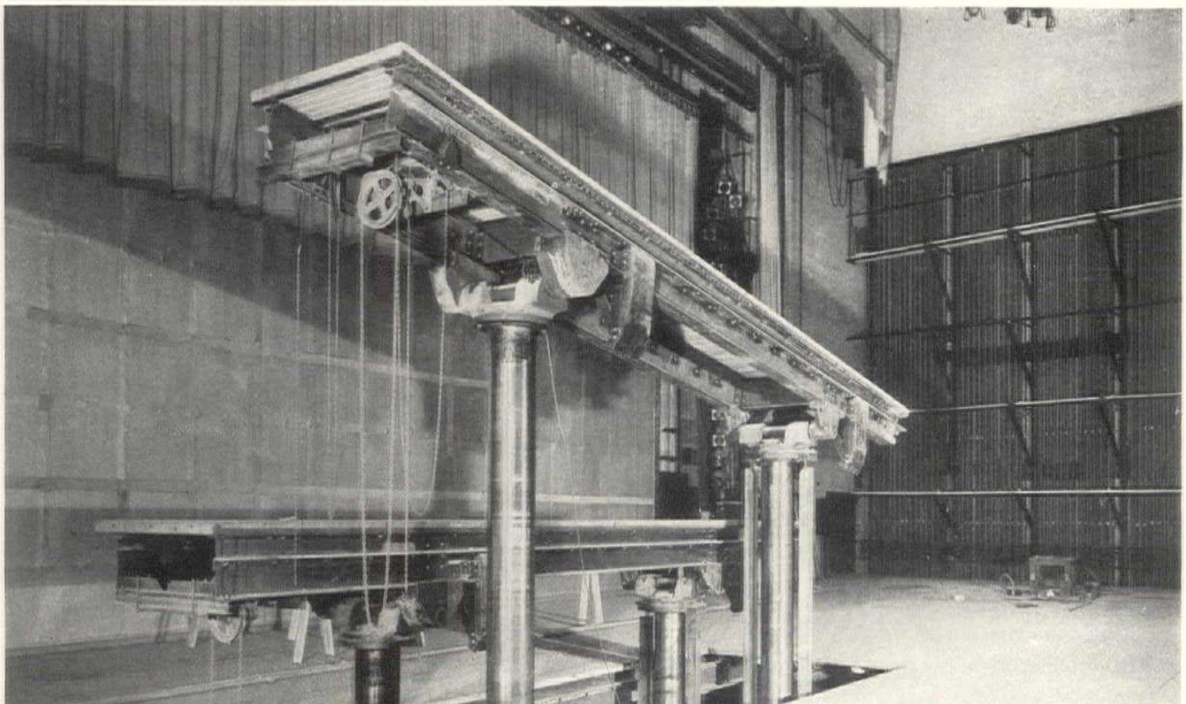
STAGE EQUIPMENT AND LIGHTING

BY
R. D. BERRY
OF GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

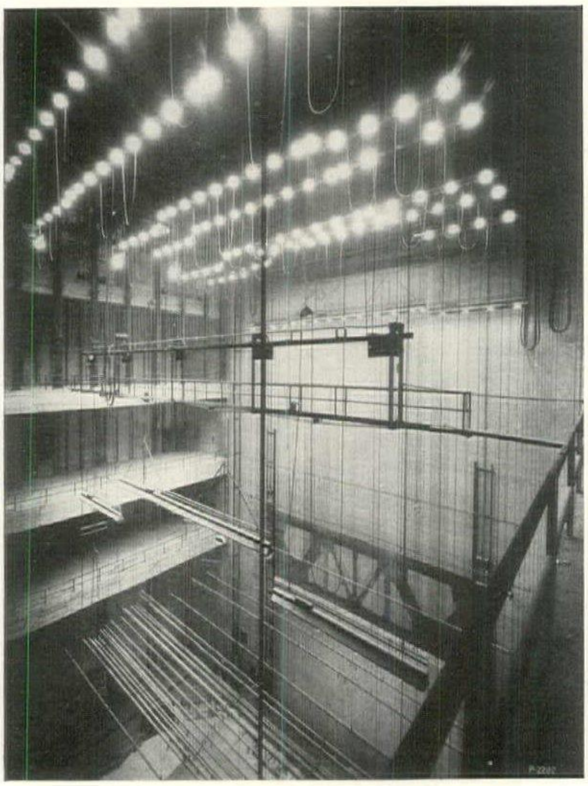
THE stage equipment provided in the new Chicago Civic Opera House is probably the most highly developed and elaborate of any in this country. It has many unique features and is exceptionally complete and carefully considered in every detail. The stage is 120 feet in width at its widest point and 75 feet in depth, and the gridiron floor is 145 feet above the stage level. The gridiron height is of great importance, as it governs the possible sizes of drop curtains, cycloramas, trees, foliage, and so forth, for outdoor scenes. The proscenium opening is 55 feet wide and 35 feet high.

STAGE FLOOR AND TRAPS. The working stage is arranged in an unusual manner to make it extremely flexible for various productions. About 6 feet back of the proscenium a steam device is provided which produces a cloud effect covering the entire proscenium opening with vapor when desired. Immediately behind this are three sections of stage floor which roll away to the sides. They vary in depth from 2 to 4 feet, and each section is 4 feet wide. They are of value in the setting of flights of stairs, individual traps, and so forth, and are controlled from below the stage. An area 40 feet deep by 50 feet wide is arranged in sections on hydraulic rams so that any portion of the stage can be raised, lowered or tilted to an angle above 35 degrees. Each such section is 4 feet by 25 feet wide and is controlled from a main station located on the basement mezzanine floor at the right of the stage. A roll-away floor can be pulled in from the side to fill in the space left by the lowering of any section.

A unique storage chamber for rolled drop curtains is provided just in front of the rear wall of the stage. This consists of a large trap 5 feet by 75 feet in width which can be raised 5 feet above the stage and which can be lowered to 35 feet below the stage. It descends into a vertical vault, provided with racks for the drop curtains, which provides storage space for 2,000 drops. The vault is both fireproof and dampproof and is shown in the sectional drawing on page 597. Pressure for the hydraulic system is provided by a compression tank pumping system in the sub-



The Stage is Divided into Sections Which can be Raised or Lowered



View Back-Stage Showing Equipment

basement. There are two pressure tanks, one exhaust tank, and three 500-gallon-per-minute centrifugal pumps driven by 50-horsepower motors with automatic starters and pressure regulators. Two air compressors are provided to keep the proper air pressure in the tanks. A pressure of 125 pounds per square inch is carried throughout this system, and the lifting capacity of the largest trap is seven tons.

CURTAINS. There is a hydraulically-operated steel fire curtain of 15 tons in weight, equipped with a system of double equalizing counterweights controlled from either side of the stage. It is made of special steel plates braced and trussed on the rear, which is covered with vitrified asbestos. The curtain can be operated in 20 seconds.

Immediately behind the steel curtain are two fast-working, hydraulically-operated curtains which have a maximum speed of 15 feet per second and which can be operated from a control station at the right of the stage at any lower speed desired. One machine operates the main curtain, which is of the drape type, the other being a straight-lift "act" curtain. Variable speed in the operation of these curtains is essential, and the hydraulic machines make them noiseless.

The stage rigging consists, in part, of 106 scenery pipes located on 6¼-inch centers and occupying all space not required for border lights and cycloramas. They are 70 feet long, of special construction, provided with 5-cable suspension. The scenery pipes are of 1¼-inch extra heavy tubing, welded together and trussed. Each pipe is arranged with nine special batten clamps of the self-locking type, and all arbor frames are arranged for 1 ton of counterweight over the pipe balance. The guides are of special channel iron bolted to the steel structure on the right stage wall. All cable is flexible, ⅜ inch in diameter. One feature of this equipment is the mounting of all sheaves on the ceiling of the gridiron floor, leaving the floor entirely clear for working space. The counterweight well for the system extends to the basement floor, and all tension sheaves are located there, allowing full travel.

CYCLORAMAS. Three feet from the rear wall and extending across the entire stage between the fly floors and along the sides of the stage, are three cyclorama curtains 8 inches on centers. These are 240 feet in length and 115 feet high, mounted on channel iron and pipe framing. The enormous amount of equipment taxed the capacity of the gridiron for the location of cables, sheaves, and so forth, but the use of steel tape saved considerable space. Each cyclorama weighs about 3 tons and can be raised or lowered in about 30 seconds by an operator at the central control station on the stage floor. Cycloramas have been used very successfully in outdoor scenes.

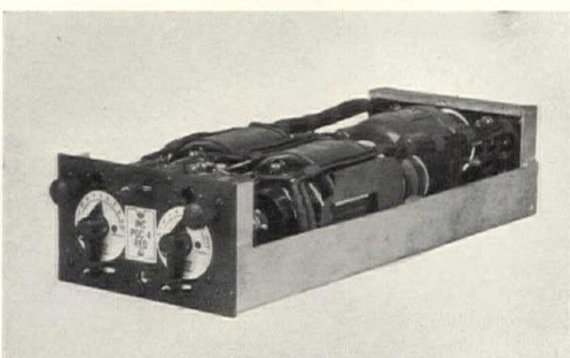
STAGE LIGHTING CONTROL. One of the most striking innovations in the equipment of the Chicago Civic Opera House is the system of stage lighting control. For the first time in theatrical history, the lighting director is placed in front of

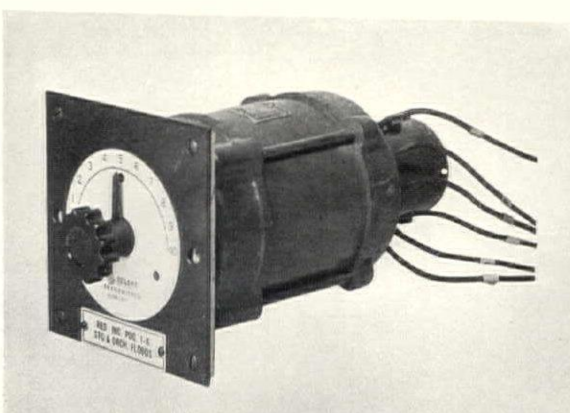
Portable Control Board for Bank Lights

The Main Stage Lighting Control Board, Occupying a Position Next to the Prompter's Box

the curtain, in a station close to the prompter's box where he can obtain a full view of the stage as he controls the lighting. This is a distinct advantage over the old system where the lighting operator worked back-stage at the side and operated manually row upon row of dimmers with large lever handles. Such a bulky switchboard in the wings is no longer necessary. The new system minimizes time, labor and valuable space, and allows the lighting to be controlled from the front where every effect is in full view. By the mere manipulation of a small knob, the lights can be controlled in color and intensity at any point at the proper moment. Scenes requiring complex lighting effects, such as sunsets, thunderstorms, ballet lighting, and so forth, require no more effort in their control than is necessary to flick a lighting switch in the home or to turn a knob.

There are 141 individual lighting circuits in the Civic Opera House equipment, each of which





Left. Voltage Regulator Unit
Right. Group Master Transmitter

includes lights of but one of the four colors used on a theater stage,—amber, white, blue and red. A typical circuit may cover the amber lights at one side or the center of the footlights, the red lights in one of the light bridges, or the white lights in one of the pockets. The operator could control the lights by manipulating the knobs on every individual circuit, but to do so would involve the turning of too many knobs. A method has been devised, therefore, to govern all the lighting circuits through one knob, or to split the control into major and minor divisions, depending on color, location and function, each group in turn being controllable through the agency of a single knob. Thus there are the individual controls and the master controls. The individual circuits are grouped under master knobs governing, for example, all the blue lights in the borders and footlights, all the amber in the pocket lights, all the white lights on the bridges, etc. In addition, all the lights of each color, no matter where located, are controlled by a single color master knob. Finally, all the color masters may be operated simultaneously by a grand master knob. The energy required for the control of any of the individual lighting circuits is approximately one tenth of that consumed by an ordinary pocket flashlight. The energy controlled, however, may run as high as 30,000 watts in a given circuit, and the total energy used in maximum lighting may be as much as 1,250 kilowatts, or nearly 1,700 horsepower. This control system involves the use of three important devices,—the self-synchronous motor, the low-vacuum rectifying tube, and a new type of saturated-core reactor. Reactors have been used previously in stage lighting, but a new type was designed to fit this system. Illustrations show the control switchboard with all knobs within easy reach of the operator, and also a typical control unit of the board.

Systems of Stage Lights. There are nine rows of border lights spaced on 7-foot centers. Each row is in three sections, and the sections move from the gridiron floor to stage level, controlled by a selective station located on the stage floor. Operation of the equipment by power represents a great saving in labor costs in producing an opera. The flexible light-feeding cables are counterweighted in such a way as to always carry the cables above the lights and keep them clear of the line of sight.

In addition to the 27 sections of border lights, there are 16 bank lights, eight on either side of the stage directly in front of the cyclorama curtains. These are controlled in the same way as the border lights. There are also three large light bridges accommodating one hundred spotlights each, which can be moved from the stage floor to the gridiron by an operator on the car or at the main control station. These light bridges are of steel construction and have multiple cable suspension, each bridge, with its spotlight equipment, weighing about 5 tons. Electric interlocking systems prevent the bridges from striking the border lights. This elaborate spotlight and border light system is very flexible in use, and changes in scenery are accomplished with great rapidity and with a minimum of labor.

A large number of automatic hoisting machines are mounted on fly floors at the left of the stage. They are controlled from a central station located on the proscenium wall at the right of the stage. This station is a key-operated panel similar to a telephone switchboard, and it gives the operator complete control of the moving of bank lights, border lights, bridges, cycloramas and spot lights. In addition to this main control station, there are three small relay stations with plug-in connectors which are so arranged that the operator may carry a portable control to the center of the stage.

ELECTRICAL INSTALLATIONS, 20 WACKER DRIVE BUILDING

BY
F. LOUCKS
OF GRAHAM, ANDERSON, PROBST & WHITE

THE most convenient method of studying the electrical installation of a building is to have in mind at the start the distinct divisions of space. This building has four classes of space: (1) the Opera House, (2) the Civic Theater, (3) rentable area and (4) public space. The type of current for power and light, metering of current, control and signal system are separate for each.

Risers, Feeders and Conduits. Above the sixth floor the building is served by seven riser shafts, almost all of which have cut-out cabinets at each floor for local branch circuits. To keep the cable diameters down to a workable copper size, not more than four floors are served by one feeder in any shaft. Each feeder is run in a separate conduit. On the sixth floor, the conduits from all shafts but the main tower shaft are gathered together, and in one group are carried down to the main switchboard. The tower shaft conduits are continued down to the basement and there join the main group for the remainder of the distance. The power conduits are carried with lighting feeders in the shafts as far as possible before being directed to the local panels.

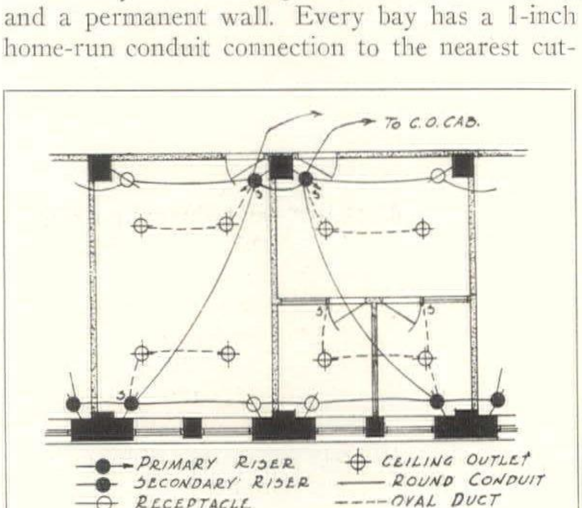
Power and Light Service. The main power and light service for the building is 220 volts, D. C. for power and 220/110 volts, D. C. for lighting. This load is taken from the main building switchboard located in the basement near the Edison Company's substation wall.

Telephone. The main telephone and telegraph service conduits terminate in a separate room in the basement. From this room the cables are run in conduits in a separate shaft to the sixth floor. A small room is provided on the sixth floor for terminal space for each service. From these rooms conduits are run to the open slots in the riser shafts. At each floor, connections are made to the public corridor wire mould for floor distribution. Ordinary service for tenants requiring a few telephones is taken from the nearest terminal cabinet in the corridor. A small square sheet metal tube connects the corridor wire mould in each bay with the removable base board on the tenants' side of the corridor partition.

The Public Lighting in the building is served from one riser in the main tower shaft. The corridor lights are controlled alternately by wall switches beside the freight elevator in each story.

The Emergency Lighting, such as outlets in stairways, exit signs and approximately every fourth outlet in public corridors is fed by two risers from the main tower shaft. Both systems are controlled by remote control switches in the first story elevator lobby. The Opera and Theater emergency lighting is kept entirely separate from that of the office building.

Rentable Area Wiring. To meet the up-to-date electrical requirements for small power units and lights, the entire rentable area in the building is divided into bays. A bay is considered the area enclosed by four building columns or two columns and a permanent wall. Every bay has a 1-inch home-run conduit connection to the nearest cut-



"Z" Type Wiring of Office Space

out cabinet. The conduit within the bay is ¾-inch and is arranged in the form of a letter "Z" with a base receptacle outlet at each of the ends of the three lines making the letter's shape. The "Z" is reversed, or back to back, in alternate bays. On permanent walls or columns on each end of the diagonal stroke of the letter "Z" a two-gang switch outlet is placed above the plug receptacle outlet. At the ceiling a single gang outlet box is installed above each switch outlet and connected through the switch outlet to the base outlet with a ¾-inch conduit. The home-run enters the bay in the base receptacle outlet nearest to the cut-out closet at one end of the diagonal. All the "Z"s are connected by ¾-inch conduits on outer walls and corridor columns. The purpose of this was to form a conduit skeleton raceway from which the tenant layout can be picked up with the minimum of damage by cutting of permanent building construction. All ceiling outlets are connected by a flat thin wall conduit. With this layout each tenant, regardless of the formation of his space, can be fed from the cut-out closet without entering the adjoining neighbor's space. This is necessary, as tenants are charged for current used, and no confusion of wiring can be permitted. The cut-out cabinets are provided with 66 per cent spare branch circuits.

Alarm Systems. The building is not provided with a fire alarm system for the rentable area or the public spaces. A watchman's system, consisting of 140 wall-mounted keys with three patrol clocks, has been installed.

The Opera Auditorium Lighting is mainly indirect, except for a small portion under the balconies. The principal light sources are in coves at the ceiling and in troughs on the balcony rails. The proscenium arch is lighted from troughs in the proscenium wall. The bracket fixtures on rear and side walls are used only for emergency lighting and, aside from giving a decorative effect, add very little to the general lighting. At present the wiring is arranged for only one color of light.

The entire general illumination of the auditorium is controlled from the stage switchboard. The ceiling cove lighting is on direct current and is served from a motor-driven dimmer bank above the auditorium. The remainder of the general illumination is fed from the alternating current supply and control by re-actor dimmers.

Hazard Lights. In the event of failure of all general lighting current supply, a hazard light system becomes operative. This consists of four 500-watt lamps in ceiling coves, one in each exit stair tower on each side of the auditorium and two in the grand foyer. This system furnishes enough illumination, with the help of the exit signs, to guide patrons to the street.

MECHANICAL EQUIPMENT OF THE CHICAGO CIVIC OPERA BUILDING

INCLUDING HEATING, VENTILATING, FIRE PROTECTION, PLUMBING AND ELEVATORS

BY

C. A. FRAZIER

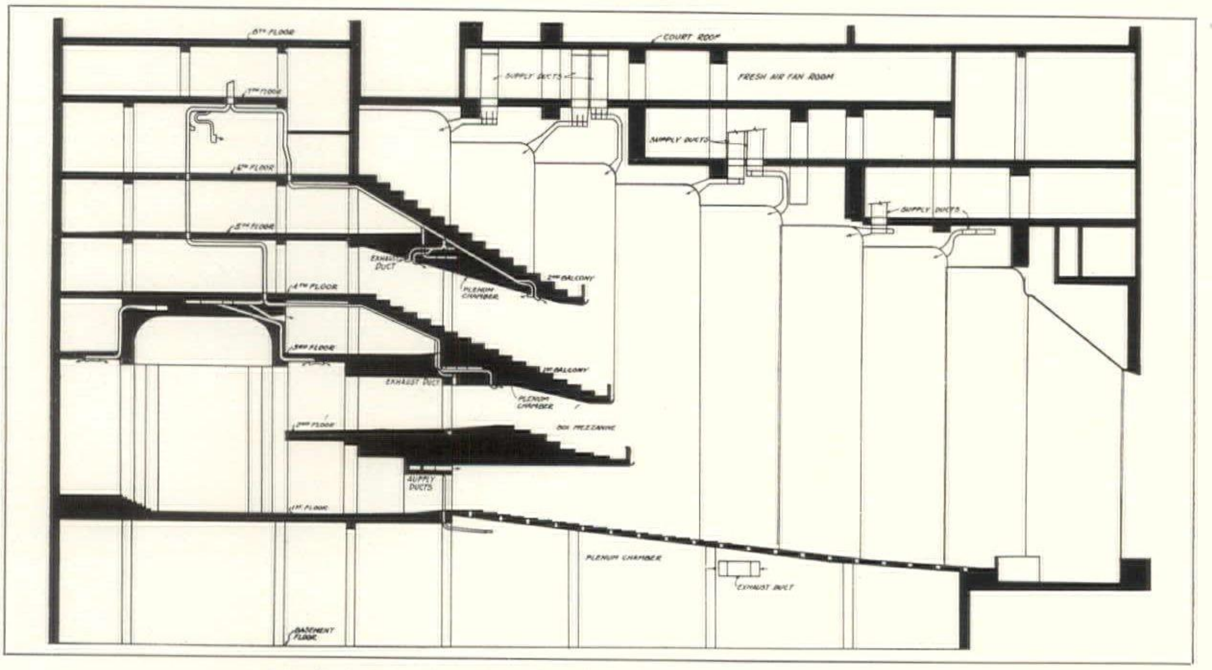
OF GRAHAM, ANDERSON, PROBST & WHITE

THE problem of heating the Civic Opera House auditorium was intimately associated with the ventilation because there is no direct radiation in the auditorium itself. The side walls are substantially outside walls, since there is a fire escape court along the entire length of each side, and the heat that is radiated through these walls is replaced with that in the air used for ventilation. The fresh air fans for the ventilating system of the auditorium and foyers normally take air from the outside. The air is cleaned in oil filters, heated to the proper temperature, and then delivered into the rooms. The exhaust fans remove the air and discharge it to atmosphere at the top of the building, except for a short time prior to the opening of the auditorium, when the ventilating system is operated normally in order to heat the area to the proper temperature. At such times it is a matter of economy to avoid wasting the heat, and the air is re-circulated and re-heated continuously. When the audience assembles, the exhaust fans discharge the vitiated air to atmosphere, and the entire volume of fresh air is taken directly from the outside.

Considerable heat is given off by the occupants of the auditorium and by the lighting system, which is sufficient to increase gradually the temperature of the air well beyond that of maximum comfort. On account of this, the temperature of the air must be regulated in order to maintain a constant temperature at the breathing line without objectionable drafts.

The ventilation requirements of the Chicago building code are the result of much experiment and investigation, and it is seldom necessary to do more than to comply with them. In an auditorium where the occupants are massed closely together it is customary to supply 25 cubic feet of air per minute per person, but this system is designed to supply 30 cubic feet of air per minute per person in order to further insure adequate ventilation. Four fresh air units supply air through the ceiling of the auditorium, and two units supply air at the rear and below the first and second balconies and to the foyers. Of the 127,850 cubic feet of air supplied per minute, 74,100 cubic feet are admitted through the plaster grilles in the ceiling of the auditorium. The fresh air is drawn through oil filters, after which it passes through cast iron heaters, and the temperature is raised to a point somewhat below the final temperature required. It then passes through the fan into another chamber and through a second set of heaters. By-pass arrangements to pass the air around and through the heaters, graduated temperature control valves and thermostatic control of the steam supply and dampers are provided. The thermostats are set manually and can be changed at will as required by the conditions in the auditorium and, also, the temperature of the air supplied through one duct can be different from that supplied through another, thus supplying air to one part of the auditorium at a different temperature from that to another. Under actual operating conditions these temperatures vary between 70° and 82°. Each auditorium air supply unit is so arranged that a future air cooling apparatus can be installed to deliver refrigerated air so as to permit a more intensive use of the auditorium during the hot summer months.

The ceiling of the Civic Opera House auditorium is from 65 to 75 feet above the main floor, and the heating and ventilating system is so arranged that the air enters through practically the entire area of the ceiling. There are seven rows of approximately 20 inlets each. The inlets are arranged in such a manner that the air enters horizontally into the room with an initial velocity of from 200 to 300 feet per minute and is spent before the air settles downward. The exhaust air passes out at the floor through mushroom ventilators located under the seats into a large plenum chamber from which the air is taken through a system of exhaust ducts and discharged to atmosphere. There are similar plenum chambers beneath both the first and second balconies. The mushrooms in the main floor, and first and second balconies are arranged symmetrically in order to provide outlets throughout the entire seating area. The lower strata of the air are removed, and the



Distribution of Warm Air Through Auditorium Showing Duct Systems

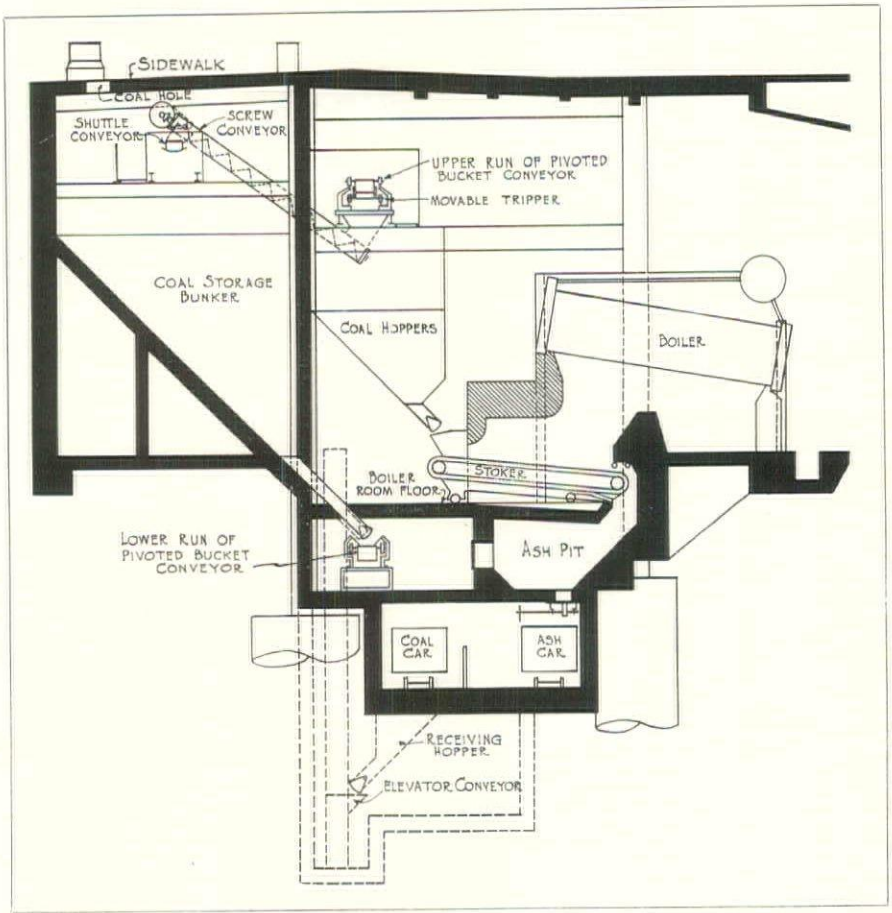
fresh air settles down slowly and is in turn removed in the same manner. The utility spaces for the building, such as dressing rooms, rehearsal rooms and scenery storage spaces, are mechanically ventilated with six changes of air per hour.

There are ten fresh air supply units for the Civic Opera House space, having 214,000 cubic feet of air per minute total capacity and 12,790 square feet of fan heater surface. The radiation used in these fan units is equivalent to one half of the total direct radiation in the entire 20 Wacker Drive Building. There are five exhaust system units for the Civic Opera House space, having 130,700 cubic feet of air per minute total capacity. The 15 fans used in connection with the Civic Opera House space have a total capacity of 344,700 cubic feet of air per minute.

A ventilating system is provided for the Civic Theater, all basement space, the mechanical plant, shops in the first story, toilet rooms, and rentable area which do not have adequate natural ventilation. The ventilating system for the Civic Theater is substantially a small-scale duplication of the Civic Opera House system. There is one supply fan for the auditorium, foyers, dressing rooms, etc., having a total capacity of 30,900 cubic feet per minute, and one exhaust fan having a capacity of 17,875 cubic feet per minute. All other spaces in the building requiring mechanical ventilation, except the mechanical plant and toilet rooms, have air supplied at the rate of six changes per hour and, except in rentable area, have an equal amount of air exhausted. Air in the mechanical plant is changed ten times per hour. Exhaust only is provided in the toilet rooms when without windows at the rate of 20 changes per hour, and 10 changes per hour when with windows.

The rentable area, exclusive of shops, is provided with fresh air only. Adequate natural ventilation for spaces having windows is determined on this plan: Windows of the double-hung type, that is, where one sash telescopes into the same horizontal space as the other sash, leaving one half the total window as net opening, are considered sufficient to ventilate adequately a floor area equal to ten times the gross window area. It is necessary, therefore, to provide mechanical ventilation of six changes per hour to the spaces or portions of spaces which are not provided with the proper amount of natural window ventilation. The sizes of the windows and the depth from wall to central corridor in the office portion of the building are such that the window area is just sufficient to ventilate the space. The window areas for natural ventilation are insufficient, and fresh air supply and exhaust are necessary in the broadcasting studios in the upper stories and in the kitchens and dining rooms in a suite occupied by a club.

All remaining portions of the building having outside exposure are provided with direct radiation, irrespective of whether heated air is supplied or not, in order to maintain the desired temperature during the night and at such other times as the ventilating system is normally shut down. The system is of the two-pipe, vacuum type, with one set of supply and return mains in the basement and risers for all of the building below the 38th floor. Another system is provided for the 38th to 45th stories, inclusive, having a supply main at



Coal service to and ash disposal from the five boilers. Coal received in the Chicago Tunnel Company's cars or by sidewalk delivery. From the elevator boot coal is raised to a horizontal bucket conveyor below the boiler room floor, again elevated to the boiler room ceiling, again carried horizontally and discharged into the coal hoppers. Ashes are discharged in the tunnel cars

the 45th story ceiling and returns joining those for the lower system. This division of the heating system was made to enable the tenants occupying the upper floors of the building,—among them is a radio broadcasting studio,—to have an uninterrupted supply of steam for heating purposes independent of the office portion of the building. High-pressure steam is reduced at the boiler room for the lower system and in the 45th story for the upper system to from zero to 5-pound pressure. The radiators throughout the office portion of the building are each equipped with an automatic thermostat-controlled supply valve, and each radiator is equipped with a vacuum return trap. A system of air-pressure control, located in the basement, permits the regulation of the steam supply to risers and radiators throughout the structure. The system is so divided that great flexibility of steam distribution is obtained with consequent economies in steam consumption.

The stage of the Civic Opera House is 155 feet high, having at the top openings leading to atmosphere, each equipped with dampers so arranged that they can readily be opened in case of fire. Owing to the extreme height and the large amount of heat loss at the top through the roof, side and rear walls, it was necessary to bank a large amount of direct radiation near the top in order to prevent cold air from descending to the stage floor and producing unpleasant drafts. The additional radiation not only compensates for the heat which is lost by exposure and infiltration, but it maintains a column of heated air sufficient to force it downward and outward.

The heating of the entrances to the Civic Opera House and the Civic Theater presented a very serious problem. Revolving doors are not suitable for entrances such as those to the Civic Opera House or Civic Theater, and although vestibule doors have been provided, there are occasions when for a considerable period of time both sets of doors are continuously open. Under these conditions, the cold air naturally rushes in with great velocity, and the heating system must have adequate capacity at these points. An unusually large amount of direct radiation is installed at each of these entrances, through which fresh preheated air is supplied to the vestibules. The air supplied to the Civic Opera House entrances alone amounts to 10,500 cubic feet per minute. This heated air mixes with and tempers the inrushing air, the temperature of which is still further raised by the direct radiation placed in the lobby and foyers.

The piping used throughout the heating system is wrought steel, black, with cast iron fittings covered with canvas-wrapped 85 per cent magnesia. The vacuum pumps in connection with this system are in duplicate, each of full capacity for the entire system. The vacuum pumps discharge the condensation into a receiving and separating tank where any air contained therein is released, and from which the condensation is discharged back to the boilers by boiler feed pumps. The vacuum pumps and boiler feed pumps are of the steam-driven type, the exhaust steam being delivered to the low-pressure steam piping system for further use in heating the building. There are in the entire building 132,800 square feet of direct radiation, comprising approximately one half of the entire heating load of the building.

The total warm air supply for the entire building is 360,600 cubic feet of air per minute supplied by a total of 18 fresh air fans in connection with 19,700 square feet of cast iron fan heater surface. Likewise, a total of 337,000 cubic feet of air per minute is removed by 18 exhaust fans. The heating surface in the fresh air fan units, when resolved to a common basis for comparison with the direct radiation in the entire building, is almost exactly equal thereto and, taken together with it under maximum steam demand, requires approximately 66,500 pounds of steam per hour or 1,925 boiler horse power.

FIRE PROTECTION AND PLUMBING

A FIRE protection system is provided in this building which enables it to obtain fire insurance at the lowest rate possible with a minimum initial installation cost. The office portion of the building is protected by a standpipe system consisting of fire pumps, distributing mains, and risers, the latter having in each story outlets equipped with hose. The entire system is kept filled and under pressure at all times.

The height of the building is such that with a single system of standpipes the pressure on the lowest floors would be too great. Two systems, therefore, were provided, each complete in itself. In the lower system a distributing main at the basement ceiling supplies standpipes for the Civic Opera space, which terminate at approximately the 12th floor, and additional standpipes for the office portion of the building. This system is supplied by a motor-driven fire pump which automatically keeps it filled under a static pressure of 50 pounds per square inch at the highest outlet. This pump is automatically controlled to maintain this pressure. Provision is also made for the system to be supplied with water by Chicago River fire boats through two connections adjacent to the river and by fire department apparatus in the streets. Two additional connections are provided from the basement main, which is located on the outside walls of the building, for the use of the city firemen for fighting fires in adjacent buildings without the necessity of entering the premises. The upper system consists of a separate automatic fire pump which takes suction from the discharge of the lower system fire pump and supplies a riser extending from the basement to the 22nd story, where it connects to a distributing main supplying two standpipes in the upper portion of the building extending to the 45th story. The upper system is also supplied with water from Chicago River fire boats and by fire engines on the streets, and is provided with a connection located on the outside of the building for the use of city firemen for fighting fires in adjacent buildings.

On each story there are standpipe connections and hose of sufficient length to reach any portion of the floor. The city firemen can also attach their standard fire hose, on each floor, to these standpipes when required for more serious fires.

In most Chicago office buildings, and elsewhere, it is customary to provide fire escapes on the outsides of the buildings. This building is unique in that, instead, four fire tower stairways, enclosed in 13-inch brick walls, are built entirely inside the building. Each stairway has a small vertical shaft or court, approximately 40 square feet in area, extending from a point near the first floor to the top of the building and open to atmosphere. Each court or smoke flue is connected to the stairway at each landing to relieve it of smoke, should it accumulate therein. Each court is also connected to the outside of the building at approximately every fourth story by means of a window having a sliding sash held closed by a fusible link which, in case of fire, will permit the window to open by gravity.

Two of these fire tower stairways are located in the wings of the building, terminating in the roof at the 23rd floor line. The other two stairways are located at the center of the building, extending up through the tower to the 45th story, where they connect to atmosphere through an opening in the side of the building immediately below the sloping roof. Each of these fire tower stairways has a standpipe installed therein in such a way that firemen entering the building can connect their hose to the outlets before entering a floor in which a fire exists. The remaining standpipes are so located that the length of hose at each outlet reaches all portions of the building. An automatic sprinkler system is provided for the Civic Opera and the Civic Theater portions only, having sprinkler heads on the stages for both, and in all utility spaces, dressing rooms, scenery storage areas, rehearsal rooms, plenum chambers and other spaces in connection therewith. The sprinkler system has a 25,000-gallon storage tank, approximately 18 feet in diameter and two stories in height, located on the 18th floor, and from this tank piping of the sprinkler system is kept filled with water under pressure at all times.

WATER SUPPLY. To insure an uninterrupted supply of water, connections were made to two city mains in the street, and two independent service pipes were installed, each of capacity to meet all the needs of the building. The water filter plant has a capacity of 60,000 gallons of water per hour and discharges into an open tank which supplies the house pumps. Two systems of water supply are provided, one each for the lower and the upper portions of the building, for reasons of economy and service. The lower system is supplied by two 5,000-gallon house tanks located in the 24th story. The distributing risers of the lower system are supplied from a main at the basement ceiling, which is connected to the supply riser for the house tanks. The upper floors' system is similarly supplied by two 5,000-gallon gravity tanks located in the 45th story, from which the water is supplied to a system of risers through a main located in the 43rd story.

The cold water supply to fixtures in the basement and basement mezzanine, to the mechanical equipment, for cooling purposes, etc., is distributed through a separate main under the city main pressure, thus saving the cost of pumping this additional volume. The continuous hot water circulating system is likewise divided into two parts. Water for the lower system is taken from the discharge of the house pumps for the lower stories and heated in two closed type water heaters supplying the risers through a main located in the basement. The hot water system for the upper stories is arranged similarly. In general, the standpipes are located throughout the building on alternate columns of the first interior row of columns, so making it possible to supply water to fixtures in the different offices with a minimum length of local branches. The piping for the hot and cold water system throughout is of galvanized wrought steel, and all of the piping is covered.

ELEVATORS

THE problem involved in arranging the elevators was to give equal service to all parts of the building. The tenants on the upper floors insist on having just as rapid elevator transportation as is available for those in the lower stories. In order to accomplish this the passenger elevators in this building are arranged in three groups, a local group having ten elevators which serve the lower 15 stories of the building, an express group having eight elevators which serve the 15th to 22nd stories inclusive, and a group of eight tower elevators which serve the 22nd to 42nd stories inclusive. All elevators start from the first story, so that they can receive intending passengers as they enter the building and convey them to the story desired without transfer and, vice versa, so that they can carry passengers from any story direct to the street floor. Two of the elevators in the tower group have shaft door openings at all floors in the building for use at night and on holidays.

All of the passenger elevators have a live load carrying capacity of 2,500 pounds. The speed of the local elevators is 600 feet per minute. The express elevators travel at a speed of 700 feet per minute through the express zone and at a speed of 600 feet per minute from the 15th to the 22nd floors, inclusive. The passenger elevators are of the gearless, traction, direct lift type and are each provided with all of the latest type of safety devices.

The two tower elevators which are designed for use as night service cars, serving all floors in the building, are each equipped with a flash light annunciator. Each annunciator has two rows of illuminated numerals, one for "Up" and one for "Down," and each numeral is that of a floor in the building. The numerals become illuminated as the push buttons on the various floors are pressed, indicating to the operator when and at which floors there are waiting passengers, thereby making it necessary for the night service car to travel only at such times as there are waiting passengers. In addition to the passenger and freight elevators for the office building there are three passenger elevators for the patrons of the Civic Opera, three passenger elevators for the stars and stage personnel of both the Civic Opera and the Civic Theater, serving all the floors on which dressing and rehearsal rooms are located; and there is one Civic Opera scenery lift.

POLICY AND OPINION

SHALL LAWS LOWER ARCHITECTURAL STANDARDS?

MOST states recognize the necessity of requiring that buildings of all kinds be designed by competent people. To this end they have framed exacting laws for the registration of architects, setting forth the qualifications necessary,—the requisite education, training and experience. A high standard has been set but one that is by no means too high or exacting to conserve the public safety and health. Any attempt to lower this standard is to be looked upon as retrogression, and yet in one state bills have been introduced that would, if made laws, allow persons without the qualifications of architects to virtually practice architecture. Other states might follow this lead, to their detriment, by considering similar bills to allow any licensed engineer to file plans for a building.

There are undoubtedly engineers who are competent to design buildings of certain kinds. They are usually structural engineers. However, until these men separate themselves from the many types of licensed engineers who are unqualified to deal with building problems, they will probably be classed with the latter. Structural engineers might well set up standards of professional training and experience similar to those of architects, and they might also introduce bills for recognition by registration. In this way the grave danger of granting to incompetents the privileges of designing buildings and filing plans would be obviated.

The new Multiple Dwellings Law of New York requires that all plans for such structures be filed with the Building Department by registered architects. Before the passage of this law such plans could be filed by architects, owners, or the owners' agents. As agents of the owners, licensed professional engineers made and filed such plans. The new law deprived the owner and the licensed professional engineer, as agent, of this privilege. To reëstablish their former status, the New York Association of Licensed Engineers and Land Surveyors and others have secured the introduction of several bills in the state legislature granting to licensed professional engineers the right to file plans for such buildings coequally with registered architects. The bills are Assembly Bills Nos. 1157, 1183, 1294, 1379, 1517 and 1555, and Senate Bill No. 977.

The license of Professional Engineer is granted to one who has had six years of practical experience in engineering,—engineering is defined as projects of an engineering nature. There are actually 27 species of the genus engineer licensed as professional engineers under the law of 1920.

It is required of architects registered after the passage of the registration law of 1915 that they shall have had a certain amount of technical and liberal education at schools of the United States or Canada accredited by the State Education Department and a period of practical experience in the office of a reputable architect or architects; be examined by the State Board of Examiners; or registered in another state having an equal standard of requirements.

It is evident that there is a vast difference between the requirements for architectural registration and for professional engineering licensing. Before the two professional groups can even be considered as co-equal they must have had equal degrees of education and practical experience. Only a very slight knowledge of building construction is needed to differentiate the structural engineer from the ceramic, sanitary, chemical or any of the remaining 23 varieties of engineers who are Licensed Professional Engineers. As long as the state adheres to its archaic and indefensible grouping of the twenty-seven identified varieties of engineers into one classification, it is unthinkable that the safe and sanitary planning and construction of buildings should be entrusted to such a tehnically nondescript miscellany of persons.

Registered architects have no objection to the state's granting certain privileges of designing and of filing plans to structural engineers who have adequate qualifications of education and practical experience. It is found that the proponents of the laws mentioned consist principally of engineers who are not engaged in independent practice as structural engineers but who seek to enjoy some of the advantages that accrue to registered architects.

Opposition, immediate, insistent and widespread, should be made to the passage of any bills which threaten to lower the standard of the professional qualifications of those engaged in planning buildings, and to endanger thereby the safety and sanitation of buildings and the security of building investments. *A. T. N.*

RECENT AIRPLANE HANGAR CONSTRUCTION IN EUROPE

BY

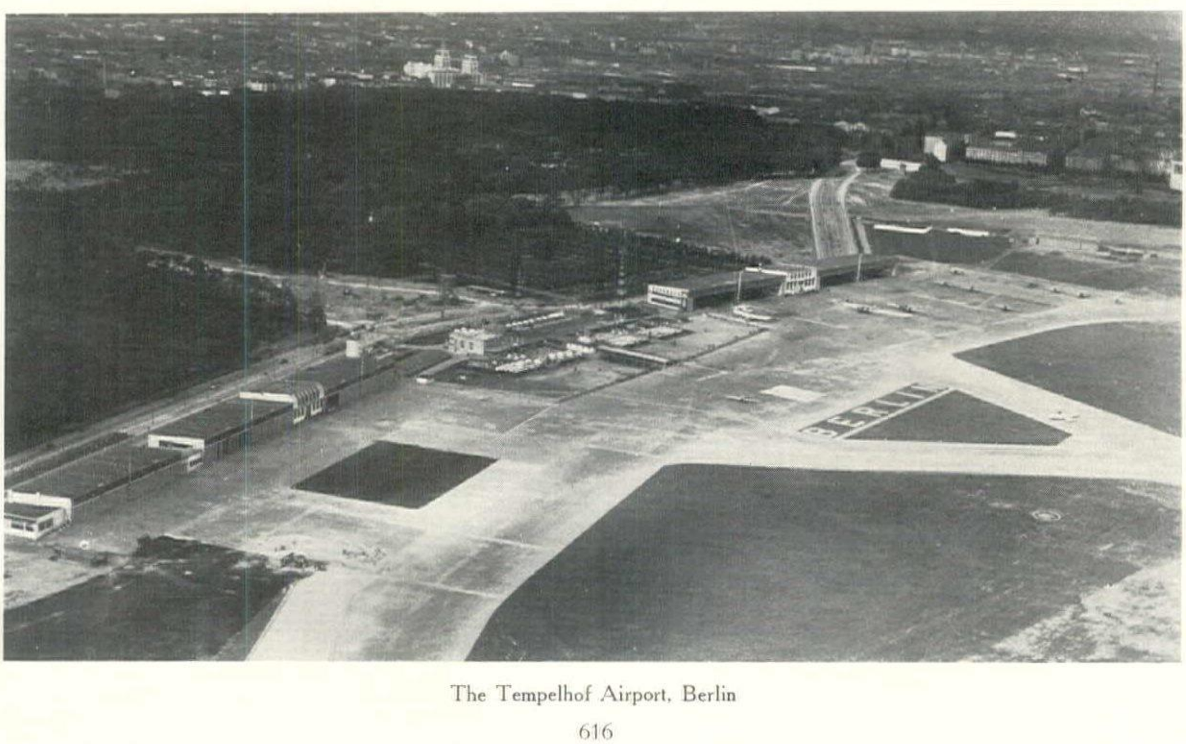
EUGENE W. STERN

CONSULTING ENGINEER

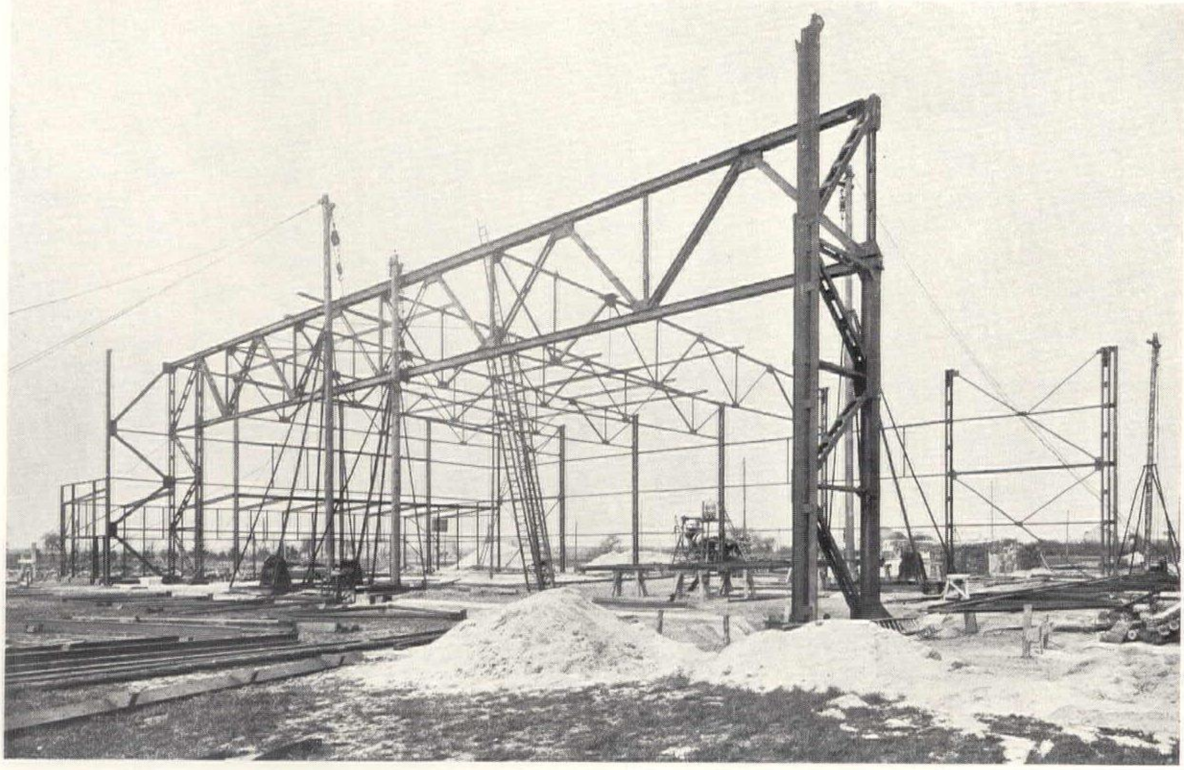
WHILE in Europe last summer, I inspected a number of airports in Germany and France and shall describe some interesting hangar construction which is well worth studying. Among the outstanding features of these hangars may be mentioned the great height of the door openings, the simple but efficient mechanical operation of the doors, the liberal use of glass both in skylights and walls, and the universal use of fireproof construction. A notable feature of these hangars is the provision made for the comfort of both passengers and employes. The magnificent airship hangar at Orly, near Paris, is a remarkable example of the daring use of reinforced concrete by French engineers.

In France the construction of the framework of the latest type of hangar is principally of reinforced concrete. In Germany, on the other hand, both reinforced concrete and steel are in common use, and use of the latter seems to predominate in the more recent structures. The walls are usually of terra cotta blocks covered with stucco or of reinforced concrete between steel uprights. The new hangar at Munich has walls of glass tile about 3½ inches thick, made somewhat like an ordinary terra cotta tile. The roofs are generally made of reinforced concrete slabs or reinforced terra cotta blocks covered with composition roofing. A great deal of glass is used in skylights and windows, and it is almost as light inside the hangars during the daytime as out of doors. The floors are of cement, and the wide traffic aprons in front are paved with concrete. The French hangar usually has sliding doors made in panels each about 12 feet wide, while in Germany the folding "accordion" door is in general use. In both countries they are operated by power or hand.

There are several good examples of modern hangars at the Tempelhof Field, at Berlin, the work of H. Fricke, Consulting Engineer, and D. Hirsch, E. de La Sauce & Kloss, Contractors. These are of steel construction, 288 feet long and 100 feet deep, with one column at the center of the front, making two clear spans of 144 feet each. This center front column is of the twin type and consists of two cross-braced uprights spaced 8 feet apart. The inner upright supports the main longitudinal roof truss, which is 10 feet high and 144 feet long. This longitudinal truss supports the transverse roof trusses, which have a 90-foot span and are spaced 20 feet apart. The steel framework above the door openings is covered entirely with glass and is supported by cantilever brackets which are attached to the main



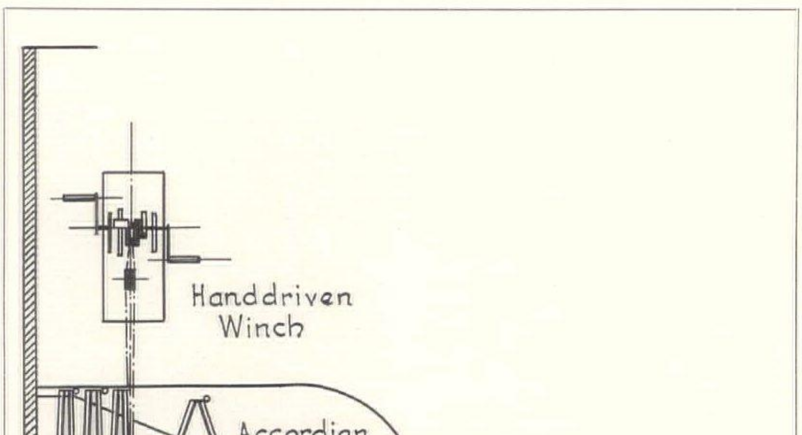
The Tempelhof Airport, Berlin



Erecting the Steel Frame of a Hangar, Tempelhof Airport, Berlin

longitudinal truss. The upper track of the accordion doors is fastened to the lower part of this steel frame. The door openings are each 130 feet long and 27 feet high. The doors are of the accordion folding type having panels 6½ feet wide, operated by an electrically-driven winch and a wire cable below the floor. The frames of the wooden door panels are all made of steel angles.

There is an excellent hangar of steel construction recently completed in Munich which embodies some novel features. It was designed by K. J. Mossner, architect, of Munich and Berlin, and was constructed by B. Seibert, of Saarbruecken. The building is 270 feet long and 230 feet wide. The door openings on the two sides of the building are 200 feet wide, and on the

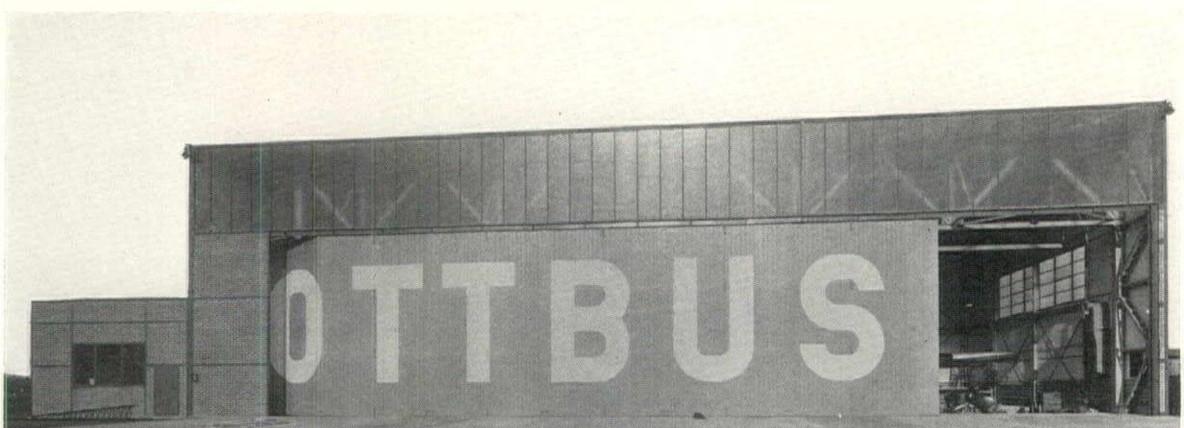


The Folding "Accordion" Hangar Doors are Operated by a Continuous Steel Cable Placed Either Underground or Above the Doors and an Electrically Driven or Hand Power Winch. Illustration Shows Doors at Kottbus Hangar Temporarily Hand-operated

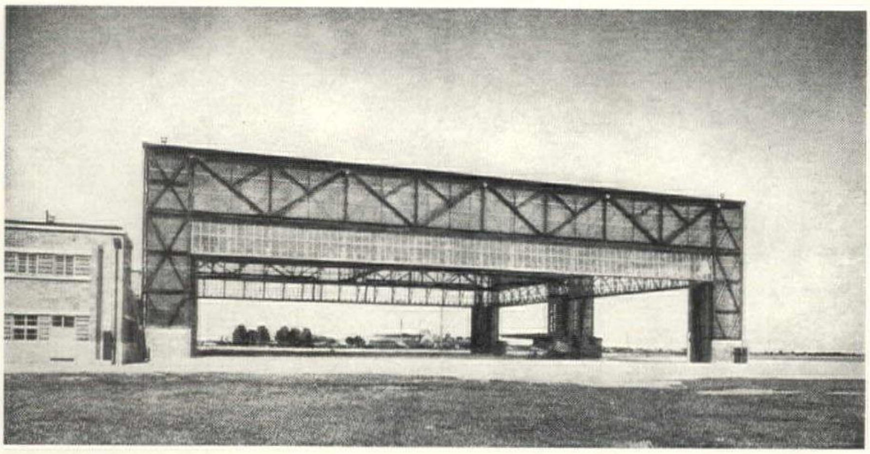
Interior of Tempelhof Hangar with Doors Open

front of the building there are two door openings each 102 feet wide. All of these door openings are 33 feet high. The doors are of the accordion type and are hung from overhead tracks supported by the truss work of the roof. Each door is operated by an overhead wire cable and electrically-driven winch. The exterior is particularly effective, due largely to the fact that the entire steel framework is vigorously silhouetted against the glass tile walls, which are about 3½ inches in thickness. The hangar is extraordinarily well daylighted by the eight rows of skylights in the roof and the glass tile construction of the walls. The building is heated by a very complete system of heaters, blowers, and hot air ducts.

Many of the important air fields in Germany



Opening the Accordion Doors at the Kottbus Hangar



The Munich - Oberwiesenfeld Airport Hangar with all of the Doors Open on Three Sides of the Structure

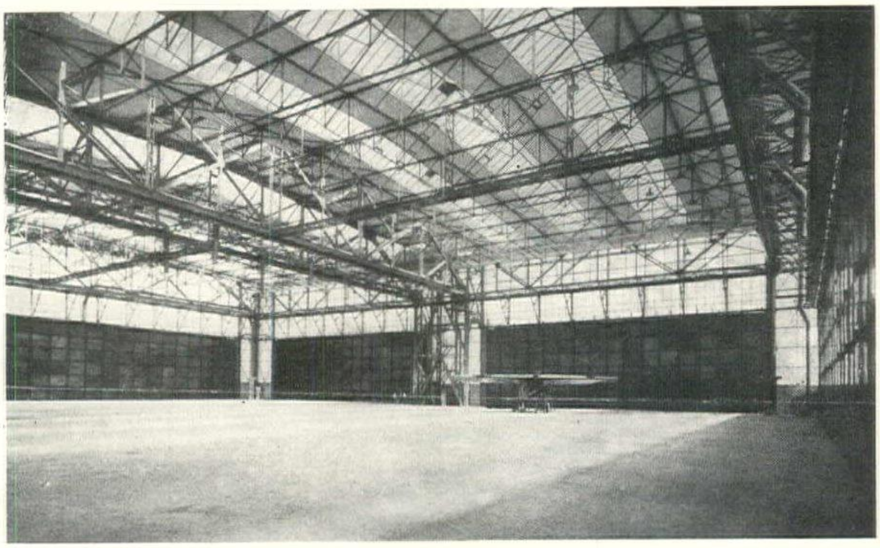
are planned not only for the particular business of despatching and receiving passengers, mail and so forth, but also with a view to attracting the general public. Tea gardens with music for dancing are provided, and in many instances hotel accommodations and other overnight facilities are provided for the convenience and comfort of passengers and visitors. This is particularly true of the airfields at Chemnitz, Berlin, and Frankfurt. There is an extensive balcony on the roof of the main building at Tempelhof Field, Berlin, which affords a splendid view of the field. Tempelhof is only 20 minutes away, by underground rail, from the heart of Berlin, and it is a delightful place in which to spend an afternoon. It is well patronized. In the main building a lecture room is equipped with a complete plan of the grounds and models of the buildings and hangars. Lectures are given frequently, explaining everything of interest to the general public regarding the plant and the operation of the field. Guides conduct parties through the buildings and hangars at regular intervals, giving instructive talks and describing in detail the various types of airplanes. I remember being much interested in a working model of the great doors of a hangar, operated by electric power, displayed in the lecture hall. Throughout Germany everything possible is done to make aviation popular with the people.

All of the recently built hangars in Le Bourget, near Paris, are of reinforced concrete construction. They are of about 165 feet span and 165 feet deep, with a clear door height of 30 feet. The doors are of the sliding type, operated by hand. The trusses have a parabolic-shaped top chord.

There are two splendid examples of reinforced concrete hangars at Palyvestre, near Toulon, which were built by the Limousin Company, of Paris. They are of 180 feet span and 200 feet deep. The doors are of the sliding type and have the great height of 49 feet, permitting the entrance of the largest plane in existence, the recently built "Dornier EOX." The "Dornier EOX" has a wing spread of 160 feet, a fusilage length of 132 feet, and a height of 33 feet.

Orly is a military airport about ten miles south of Paris. Orly has two airship hangars built of reinforced concrete, erected between 1922 and 1924. They are decidedly bold and original in design, constructed by the Limousin Company. E. Freyssinet is the engineer responsible for the design. He is, in my opinion, a genius. These hangars have a span of 285 feet, a rise of 185 feet, and a length of 985 feet. They are made of reinforced concrete corrugated plate, without beams or girders in the construction. The corrugations are from 10 to 17 feet deep and are spaced 25 feet on centers, the sides and top of

Glass Tile Walls in the Munich Hangar

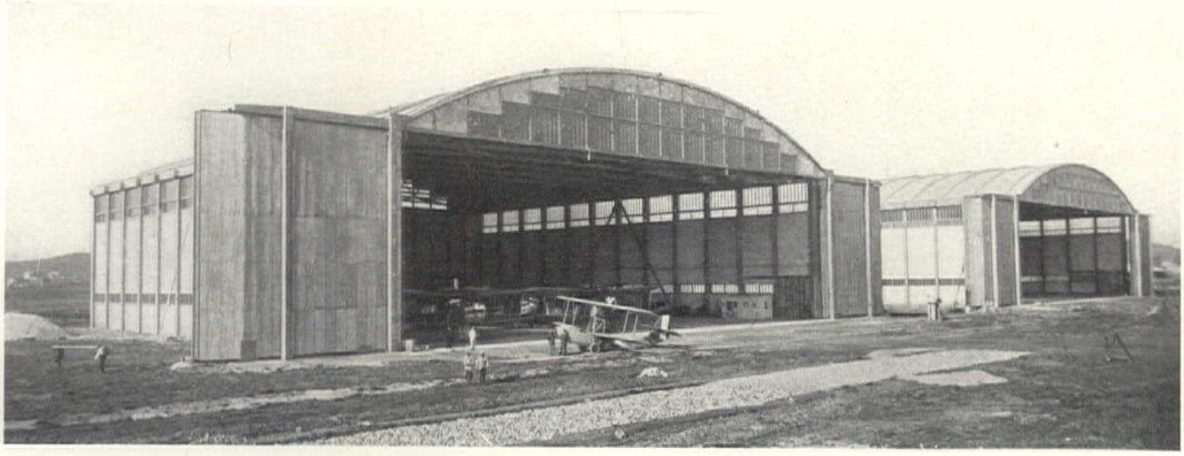


Interior of the Munich-Oberwiesenfeld Hangar Showing Interior Daylighting with the Doors Closed

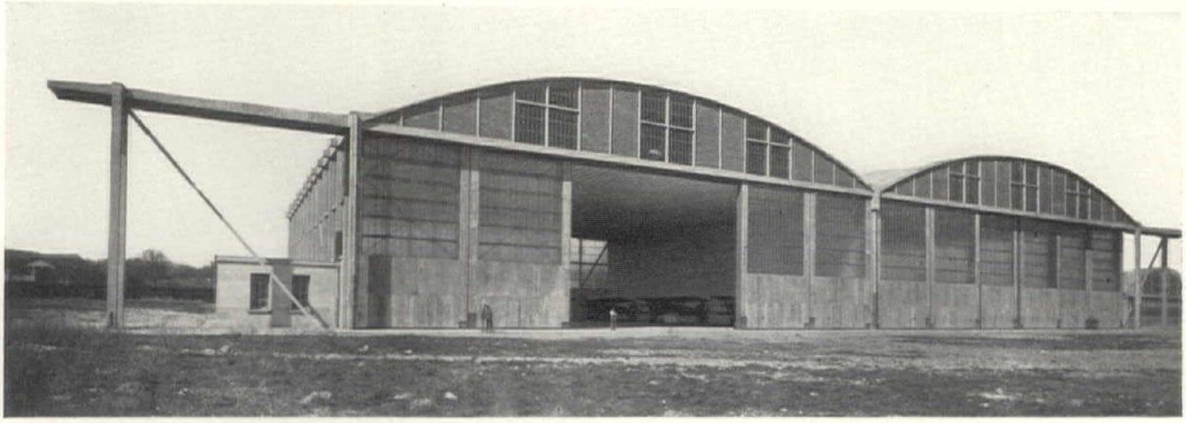
which are only 3½ inches thick, and the bottom 8 inches thick. There is a continuous line of windows extending around the arch at the top of each of the corrugations. A ventilating hood with louvers is placed at the peak of the roof. There is very little reinforcing steel in the arches, as their curve follows exactly the theoretical line of pressure for the dead load,—an inverted catenary. The depth of the corrugations varies from 17 feet at the bottom of the arch to 10 feet at the top, in order to provide for the wind pressure stresses.

An interesting feature in this construction is that no special provision for longitudinal expansion was considered necessary for variations in length due to the temperature changes, which are taken up in the corrugations. Although the hangars are almost 1,000 feet long, no cracks have developed in the four years since the work was completed. No leaking has occurred through the envelope, notwithstanding the fact that there is no roof covering or finish other than the construction concrete to which no surface applica-

Le Bourget Airport, Paris



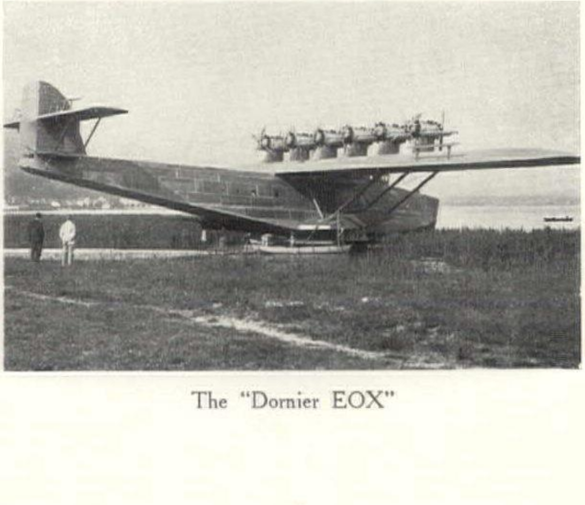
The Reinforced Concrete Hangars at the Palyvestre Airport, near Toulon



Reinforced Concrete Hangar at Bion

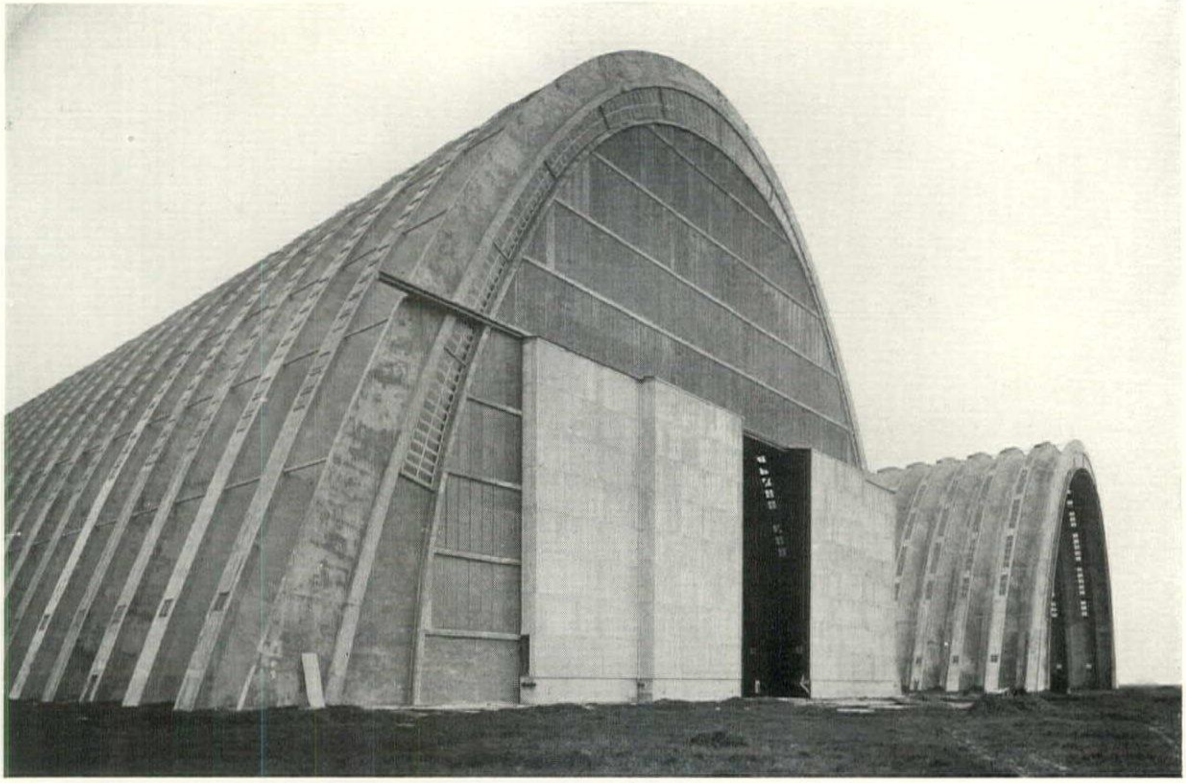
tions have been made. The interiors of these hangars have a network of steel trolley beams extending from end to end, so that they may be used for the construction of airships.

The doors, built about two years ago, are sliding and are operated by power and hand. They are not intended to be permanent, the design adopted being selected only for reasons of economy. The cost of the hangars, including the foundations, which are of reinforced concrete slabs 1 meter thick, but not including the cost of the temporary doors and end covering, was about 12,500,000 francs each in 1926. With the change in the value of the franc, and also in the rate of wages and cost of materials that have come about since 1926, these would cost much more today in French currency.



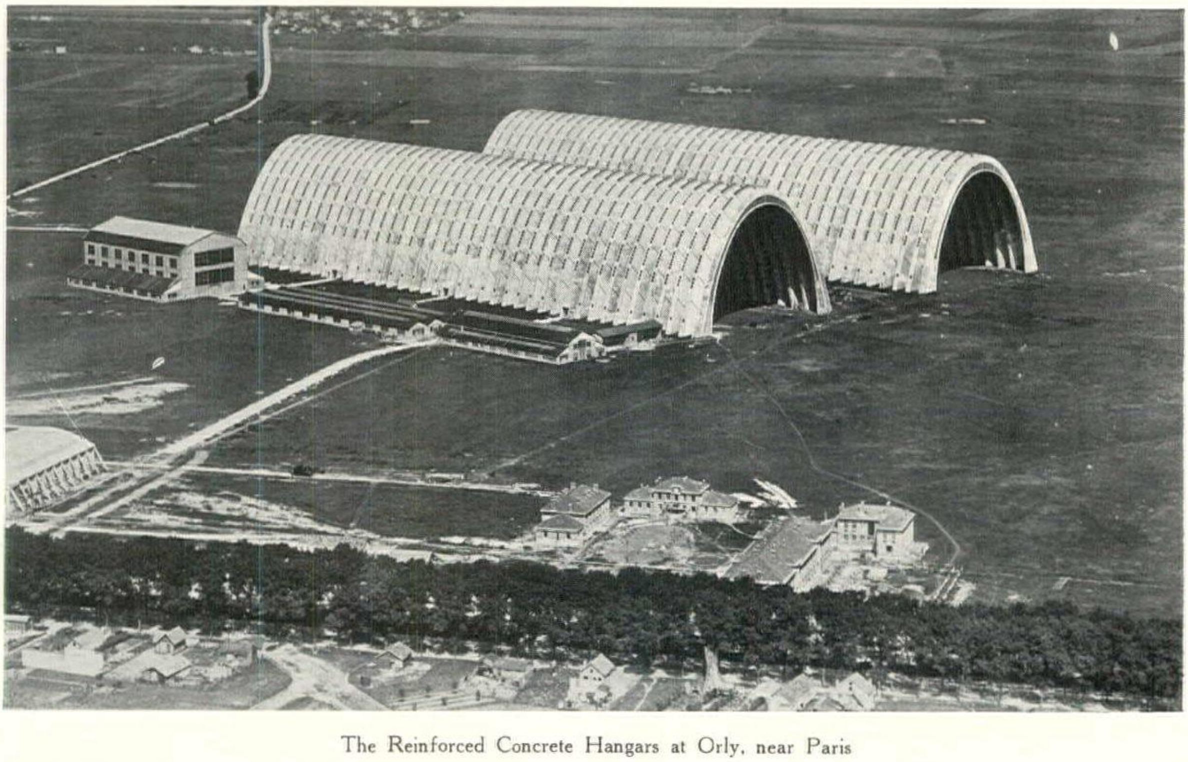
The "Dornier EOX"

For military purposes I cannot imagine anything better in the way of hangar construction than that exemplified at Orly. A shell would pass through the envelope without doing much damage. The hangar could be riddled with shells and still remain standing. As a practical demonstration of the extraordinary inherent collateral or interlocking strength of this form of construction, an example is given of an actual occurrence. Last year it was decided to enlarge some of the side doors of the hangar, both in height and width. This required cutting through one of the corrugated ribs, and it was done without the use of needles or supports, the load distributing itself diagonally into the adjoining ribs.



The Hangars at Orly with Temporary End Enclosure and Doors

Altogether, for boldness of conception, engineering skill of the highest order and first class workmanship, I have never seen anything to equal the hangars at Orly, and they are an object lesson to American engineers and architects in the possibilities of reinforced concrete.



The Reinforced Concrete Hangars at Orly, near Paris

HOUSING BUSINESS ORGANIZATIONS FOR EFFICIENT OPERATION*

BY

HARRY ARTHUR HOPF**

IN the past two decades the factor of rapidly increasing size has become an outstanding characteristic of American business organizations. This factor has made its influence felt to such an extent that special housing problems have forced themselves upon the consideration of business executives and they have been compelled to seek solutions mainly by the trial and error method. needless to say, the solutions arrived at in this manner have not always satisfied the needs.

With increasing size of business organizations we usually find as concomitants the development of functionalization, specialization and mass production, accompanied by mechanization of work and standardization of equipment. These increasingly complex conditions, in turn, create special operating requirements which have an important influence on housing considerations. Among the requirements which must be taken into account in planning the physical setting to be provided for the performance of work are these:

1. Need for more effective organization and control.
2. Need for increased accuracy and dispatch in connection with routine operations.
3. Need for better adjustability of space to operating requirements.
4. Necessity for achieving higher standards of illumination, ventilation, acoustics and other physiological factors.
5. Introduction of mechanical intercommunicating devices.
6. Suitable location of centralized suites for executives, as well as of offices for department heads.
7. Proper location of vaults, storage rooms and supply departments.
8. Provision of adequate service elements.
9. Provision of adequate facilities for reception of public.
10. Provision of adequate facilities for receiving, storage, shipping, etc.
11. Adaptability of space to varying rates of departmental growth.
12. Maintenance of sound balance between horizontal and vertical expansion.

The architect who is faced with the problem of bringing to expression in a building which he has been commissioned to plan, a logical and comprehensive scheme of utilization which will meet the needs just mentioned, together with many other needs of related character, often finds himself hampered from the very beginning of his study by the fact that, as a rule, the client either does not know his own operating requirements or is unable to express them in terms which the architect can understand. Furthermore, it is frequently the case that the client has committed himself to the purchase of a site without consultation with those competent to advise him, and thus, regardless of operating requirements, the possibilities open to the architect are sharply limited by the fixed conditions.

For the purposes of the present discussion, and in order logically to develop the theme of building economics as affected by operating requirements of business organizations, let us accept as a postulate the principle that in all building planning, and particularly in the case of a special purpose office building intended for exclusive occupancy by one organization, the proper point of departure is a study of the organization and its requirements. I shall endeavor to outline the major elements in a practical program covering a special purpose office building project and, against such a background, to describe briefly the specific manner in which the physical conditions of the building must be adapted to operating requirements.

OPERATING REQUIREMENTS AND THEIR EFFECT ON PLANNING

Assuming that a business organization is about to embark upon a new building project, the first practical step to be taken is to ascertain the effect of its operating requirements on the planning of the structure. In order to secure the basic facts, a study of departmental organization should be undertaken and a statement prepared giving the names of the various operating units, together with comprehensive descriptions of the functions performed by each. With such a statement available, the next step is to identify all the depart-

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ments particularly concerned with service to the public, for it is obviously necessary to give such departments preferential locations so as to facilitate their contacts with the public.

Having determined in a preliminary way the manner in which outside contacts are to be maintained, the next step is to ascertain in a tentative manner the desirable physical grouping and location of operating units, based upon:

1. Character of supervision required.
2. Related nature of work.
3. Frequency of personal intercommunication.
4. Proximity of supervising officials.

The influences on space planning exerted by these four factors often prove to be of conflicting character. It therefore becomes a nice problem to determine which of the four factors shall be given the most weight and how reconcilement of differences may be achieved. Unless the problems involved in departmental location and layouts are solved from the broad point of view of benefit to the whole, it will be impossible to avoid costly changes and alterations after the organization is housed in the new building.

Mechanization of Work. One of the outstanding characteristics of modern management is the trend toward mechanization of work. The increasing need for accuracy and speed occasioned by the exacting demands of business makes it impossible to continue to achieve satisfactory results through the application of human energy alone. Consequently, in the last decade or two, we have witnessed enormous developments in the field of office machinery and the subordination of office procedures and systems to the possibilities presented by the use of standardized machinery.

The introduction of such machinery has, perforce, had an influence over the provision of space and the modification of space standards, as well as over the augmentation of wiring services, far beyond anything which could have been imagined ten years ago. It has, moreover, brought about the necessity of installing acoustical treatment so as to reduce to a minimum the strain upon the nervous systems of workers caused by the noise of machine operation. To be convinced of the profound influence of the trend toward mechanization of office work upon the physical conditions of the environment in which the work has to be performed, one has only to make a comparison between the characteristics of the modern-day office building and those of the office building of ten or fifteen years ago.

Intercommunication. Among the more important operating requirements, viewed from the effect upon office planning, may be mentioned the need for more rapid performance of work and more expeditious intercommunication. The pace of business today is far faster than it was ten years ago. Whatever the cause for this condition, modern office planning must take account of it as a factor of the highest importance. In practice, the solution of the problem of accelerated activity is predicated upon the effective location of operating units in both the horizontal and vertical relationships and the provision of mechanical and electrical intercommunicating devices which overcome distance and which dispatch messages and papers at a rate of speed far exceeding the highest standard possible of attainment by human means.

Departmental Space. Another factor linked with operating requirements is the determination of departmental space standards and of the varying rates of growth experienced by different departments of the organization, so that adequate provision of space may be made for both present and future needs and the twin dangers of scanty or over-liberal space allowances may be guarded against. The importance of determining accurate space standards cannot be too strongly stressed, and this task should be approached by established techniques which have been devised for determining net areas required.

In a large bank whose rapid growth had necessitated the occupancy of several buildings in the financial district of an eastern city, it required a period of nearly three months of painstakingly careful analysis and study to measure present and prospective space requirements preparatory to planning a new bank building. The study was undertaken by trained engineers in the employ of the bank planning committee, and every single element entering into the detailed space calculations was checked back with the department heads concerned before the definitive space schedules covering existing requirements were ultimately compiled. After this had been done, the engineers prepared estimates of the personnel and equipment requirements as of the approximate time of completion of the new building and for a period of five years thereafter, and from these they finally determined the probable space requirements for the same dates.

It will readily be seen from the foregoing discussion of operating requirements and their effect upon planning, that studies along the several lines indicated are essential in order to provide the owner and architect with information of valid and detailed character for the purpose of undertaking a new building program on a sound basis. Unless the influence of operating requirements over building planning is thoroughly recognized and its implications are pursued to logical limits, the success of any new building program will be open to question.

DETERMINING THE CHARACTER OF THE BUILDING

After operating requirements have been ascertained, the next practical step involves the determination of the character of the building which is to be erected. Eliminating from discussion the subject of building regulations—which differ in various parts of the country—we may proceed to a consideration of the questions of size and general proportions. Both of these usually present interesting and many-sided problems. We will assume that, although the question of financial investment is naturally an important one, organizations whose affairs justify housing in a special building are usually in a position, within reasonable limits, to subordinate problems of building finance to other practical considerations. As a rule such organizations are governed by the desire to erect rather monumental buildings and at the same time to provide suitable space to meet their requirements for an indefinite period of years.

In the past, however, it has frequently happened that business organizations such as banks, insurance companies and important commercial and industrial concerns, which have planned more or less elaborate buildings, have failed adequately to forecast their space requirements. Consequently, within a brief period of years of occupancy of the new offices, they have found that their quarters were becoming crowded and have been compelled either to increase the density of space occupancy or to add in makeshift fashion to the existing buildings. In recognition of this situation the pendulum has now swung in the opposite direction, and a tendency has developed to erect buildings larger than reasonable estimates of future space requirements warrant. This condition has caused the adoption of extravagant space standards, the tying up of capital in unproductive investment and excessive maintenance costs.

Factor of Organization. It should be recognized at the outset that the factor of organization has an important bearing upon size and proportions of the building. Most businesses will find, after study of their organization characteristics, that there are relatively few major functions to be performed. As a rule these embrace, specifically, finance, production, distribution, accounting, engineering and service. Properly to integrate these functions, it is often found advisable to locate the departments responsible for their performance on different floors of the building, or at least to group them on three or four levels. Such an arrangement obviates the creation of conflicts due to the demand for additional space caused by varying rates of departmental growth. The functions named are hardly ever found to require areas of like size, and the proper grouping of them usually makes it possible to provide for their future growth by means of horizontal expansion.

From the foregoing considerations, it appears that the practice of estimating space requirements for many years in advance need no longer be followed and that the problem of size resolves itself into finding the practical answer not to the query, "How big a building shall we build?" but rather to the question, "How small a structure will reasonably meet operating requirements for a limited period of time?" When the need for additional space evidences itself, this may be provided by the erection of wings attached to the first unit, and this procedure may be continued until the optimum size of the building, taking into account design and mechanical facilities, as well as limitation of the plot of land upon which the structure is erected, has been reached.

It is essential, of course, in considering size and general proportions of the building, to study carefully such questions as ceiling heights, elevators, exposure to light and air, location of fixed service elements, number of subterranean levels and introduction of special features such as vaults, storage rooms, building service units, etc.

Horizontal and Vertical Expansion. For every organization it becomes necessary sooner or later to determine and maintain a balance between horizontal and vertical expansion. If the building is so designed as to violate permissible limits in either of these directions, it may be assumed with certainty that excessive operating costs, insofar as staff and equipment are concerned, will be experienced. In one instance, the office layout which had been planned resulted in separating, by a distance of about two hundred and forty feet in the horizontal direction, two important groups of executives, the character of whose activities necessitated constant personal contacts. When this defect was pointed out to the organization, the validity of the criticism was admitted but the conclusion was expressed that nothing could be done about it since all arrangements had already been consummated. It remained for the engineer whose advice had been sought with respect to the space problem, to make the obvious suggestion that the organization arrange to exchange one-half of the space on the floor in question for an equal area on the next floor above, in direct vertical relationship to the half floor to be retained. This plan was finally adopted, a separate stairway connecting the two floors was introduced, and the two groups of executives found themselves located within fifteen feet of each other in the vertical direction. Easy communication was, of course, furnished by the stairway, and the result of the change was to facilitate extremely important contacts of constant occurrence throughout the business day and thus to save a substantial expenditure of time, money and energy.

CEILING HEIGHTS. In considering further the problems of size and general proportions of the building, a factor of great importance is the provision of adequate ceiling heights. The modern trend in planning offices is entirely in the direction of the application of the open office principle. No longer are clerical staffs separated from each other by partitioned spaces which obstruct the flow of the work and foster the "departmental" instead of the "organization" viewpoint. In the well planned office, groups of clerical workers are brought together in large, open, unobstructed areas which strengthen *esprit de corps* and permit of planning for expeditious procedure according to the principle of forward movement of work. For such offices, ceiling heights of more than the usual commercial standards must be provided.

One defect of the commercial type of office building for planning large areas to be occupied by scores if not hundreds of clerks lies in the fact that, with standard ceiling heights of ten feet or thereabouts, the provision of adequate artificial illumination at desk level brings the remote fixtures into the line of vision of clerks and thus creates an unsatisfactory lighting condition. Moreover, from the psychological point of view, a relatively low ceiling height in a large open office causes an unpleasant sense of space restriction and consequently has an adverse effect upon the desire of employes to work. For these reasons and others which might be mentioned, ceiling heights of buildings designed in accordance with the requirements of large clerical organizations should be at least eleven to twelve feet in the clear; the extra cost involved in supplying this feature is, according to experience, more than offset by its favorable influence upon work productivity.

LIGHT AND AIR. Considering now the questions of exposure to light and air, it is essential in order to capitalize the relatively large investment constituted by the annual payroll of a clerical organization, to provide good conditions of illumination and ventilation. Therefore, in determining the problems of size and general proportions, we must bear in mind that, until such time as dependence may be placed entirely on artificial illumination, fenestration should approach fifty per cent of the total wall space, and wings should, as a rule, not exceed fifty feet in width. If these two standards are adhered to, one may be assured that the clerical staffs to be housed in the building will, for the major portion of the business day, enjoy natural illumination and the most favorable conditions of ventilation which can be provided in the absence of an artificial system, to which specific reference will be made later.

ARCHITECTURAL AND WORK OBJECTIVES. As far as design of a special purpose office building is concerned, it may be permitted to a layman to venture the opinion that it should be characterized by simplicity, individuality and impressiveness. In general, business organizations which contemplate the erection of an office building for their own occupancy, are likely to consider first of all the architectural elements of the problem. With the highest possible regard for the importance of these elements, it should be recognized that the prime purpose of erection of a building of the type described is to further the work objectives of those whom the building is intended to house. Physical environment exercises a tremendous influence over work productivity, and the first and last problems of all special purpose building planning should be concerned with the creation of conditions which will be conducive to the achievement of a decrease in operating costs.

Many years of experience in dealing with problems involved in special purpose building planning justify the opinion that the difference in work accomplishments between an organization located in a poorly planned, badly lighted and crowded office and one housed in a building which brings to expression the results of purposeful planning, based upon intelligent analysis and adherence to high standards, amounts usually to an increase of from fifteen to twenty-five per cent in the productivity of the staff. Translated into terms more readily understood, this means that the increase in staff productivity is often sufficiently great to exceed the interest on the complete investment required to finance the cost of the new building.

From the foregoing discussion, the conclusion is justified that the determination of the character of the building must be based upon elements such as those referred to and that a definite relationship may be worked out between the needs of the organization and the characteristics of the building which is to house it. It should be especially noted at this point that careful study of all the factors to which reference has been made should logically precede the architectural planning stage. Unfortunately, this consideration is honored more in the breach than in the observance, with the result that the burden of responsibility of the architect, in any case great, is needlessly augmented, and a series of delays, compromises and adjustments of conflicting viewpoints complicate the creative period of his work. The majority of architects who have had experience in the planning of special purpose buildings have learned to their cost how discouraging and detrimental such a condition can be. It is therefore regrettable that architects, as a rule, are without influence in the shaping of the program which should logically lead up to the planning stage.

(*Concluded in* THE ARCHITECTURAL FORUM, *May*, 1930)

STANDARDIZING APPRAISALS

BY

JOHN TAYLOR BOYD, JR.

AN appraisal is used in deciding the amount of money to be loaned on a projected building or in determining the value of an existing building as an investment or speculation. Appraisal is the means of determining the risk, qualitatively and quantitatively. The method of appraisal, as everyone knows, is a much disputed issue. We in the building industry have no authoritative standard of appraisal today,—we cannot even agree on the factors that enter into the production cost of a building. There is constant complaint on various phases of the subject; mortgage loan issues are in default too frequently for the good of the industry; confusion exists. One is reminded of Mark Twain's famous remark about the weather. After four centuries of trouble with appraisals, it is time that the building industry should do something about it. How otherwise can we convince the public of the investment value of building securities?

Fortunately, a powerful interest has recently taken appraisal in hand. The Investment Bankers' Association of America has formally adopted, "in convention assembled," the 1929 Report of its Committee on Real Estate Securities, outlining those particular items that should be included in real estate appraisals for purposes of a bond issue. A full summary of this important report will be found in the *Commercial and Financial Chronicle,* November 2, 1929, Vol. 129, pp. 2754-2757. I quote freely from that part of the summary dealing with real estate appraisals. The Committee reports: "While a great many have studied this involved subject for a good many years, very few organizations or groups have actually set down on paper any final conditions as to what does and what does not, in their estimation, constitute good practice. This is a subject hard to standardize and one which presents new angles for each case considered. Your Committee has, however, after consulting with representative men, institutions and organizations throughout the country, formed a general opinion as to what might well be considered good practice, and it wishes to outline the reasons for its conclusions.

"A very commonly used phrase is that 'no property is worth more than it can earn,' but it is pointed out that an appraisal should not 'be based on the capitalization of earnings alone.'

"If an individual desires to purchase a building as an investment, he has undoubtedly become interested because of the present and expected future earnings of the property. He engages a real estate expert to check the entire situation. He in turn must be satisfied with the trend of growth of the district of the city in which the building is located, and with its adaptability to the site on which it is located and many other factors contributing to the worth of the property as an investment. He checks the available pieces of property in the immediate vicinity, endeavoring to inform himself as to whether or not a building can be erected on another piece of property for less than the asked price of the first building, keeping in mind, of course, that the standards of construction and the earning capacities of the buildings should be the same. He figures the replacement cost of the building under consideration, and the value of the land; he figures the earnings and capitalizes them at a proper per cent to arrive at a capitalized earning value. He checks all related data, and from all this arrives at the final appraisal value. For a similar building, an appraisal for purposes of a loan issue should be made along substantially these same lines. Opinion on proper appraisal will probably not differ widely in the case of an existing building, but the procedure to be followed in making an appraisal to be used in connection with a construction loan presents some debatable and very difficult questions:

"First. What items can properly be included in the physical value of a building when completed and ready for occupancy? Second. If the capitalized estimated earning value is greater than the physical value, should any increased value be given to the physical in arriving at the final appraisal value? A more concise statement of the situation could hardly be made."

PHYSICAL VALUE. As was mentioned in last year's report, there are those who believe that every item going into the cost of a building, from labor cost and materials to the discount on the bonds, should be included to make up the physical value for the purpose of a loan issue, while, on the other hand, a certain large insurance company considers in physical value only the cost of material plus the cost of labor with no allowance for contractors' profit and architects' fees, reducing this to market value for purposes of a loan. Incidentally, at a regional conference of A. I. A. Chapters of New York State in 1929, it was said that a savings bank in up-state New York would not count the architect's fee in appraisal as part of the cost of a building. On this point the Committee says: "Those two examples probably could be said to represent the two extremes in thought, between which there must be a middle ground supporting sound practice. Therefore, after careful study and also realizing that appraisal practice does not lend itself easily to standardization, your Committee believes that in most instances only these items should be included in the total estimated physical value of a project that is being appraised for purposes of a construction bond issue.

Market Value of Land.
Cost of Materials.
Cost of Labor.
Contractors' Fees.
Architects' Fees.
Interest paid, Insurance and Taxes during Construction."

As to including discounts on bonds, the Committee rejects the idea, remarking that "the poorer the credit of the borrower, the greater the bond discount, which added to the physical value of the property would make a higher appraisal, and eventually, in the hands of an optimistic lender, probably a larger loan. The addition of each succeeding item of this type, although representing a cost to the owner, nevertheless cuts down, if the bond issue is made on the basis of a fixed percentage value, the real tangible security back of the loan. Items of this type should be excluded." The reference to the use of a high discount to inflate the loan has a familiar ring to those architects who have protested against the cubage system that is employed by some mortgage institutions for computing construction cost on the ground that the higher the proportion of waste space in a building the greater will be the appraisal of its physical value,—a method which penalizes good design and puts a premium on bad planning.

Capitalized Earnings. On the subject of capitalized earnings values, the report observes: "In the case of a building already up and producing earnings, it is a simple matter to compute this value with a real degree of confidence. Where a construction loan is contemplated, however, the capitalized earnings value cannot be based on an earnings experience, because obviously no earnings will exist until the building is actually up. These earnings, therefore, must be estimated. In cases where large and responsible concerns have contracted for space on long time leases and a large percentage of the total available space has been leased in this manner, it is possible of course, to arrive at a much more accurate estimate of prospective earnings than would be the case were the building to depend on reaching normal occupancy through the ordinary course of interesting a large number of smaller tenants.

"Until the building is actually completed, operating and seasoned, it cannot definitely be told whether or not it is to be a profitable investment. For that reason your Committee believes, with last year's Committee, that in the case of appraisals to be used in connection with construction loans no added value for capitalized earnings should be given. In the case of an established improved property, it is sometimes found that an added value beyond the physical value is possible because of an attractive earning history and expectancy, but in the case of a project under construction the expectancy is not backed up by a history of earnings and should receive no added capitalization. For purposes of a bond issue your Committee believes that the loan should be made on the physical value of the property, land and buildings, this value being checked with the capitalized earnings value as a check on the soundness of the entire project. Naturally, if the capitalized earnings value is less than the physical, the project is unsound.

"These points cover, your Committee believes, the main points of trouble in appraisal of construction projects for purposes of a bond issue. The appraisal itself, of course, should be full and informative; in fact, should place the lender in possession of all information needed by him in determining the quality of the loan. It should for the information of the investment banker, cover in addition to the expected and customary data, these details:

1. Need for the building (including a complete survey of the district).
2. Physical value of land.
3. Physical value of buildings (giving the separate items making up the totals).
4. Estimate of earnings.
5. Capitalized earnings value.
6. Final appraisal value.

This report is based on representative opinions collected from various parts of the country, and the recommendations suggested apply to practice in no one locality, but to the country in general."

In this report of the Investment Bankers' Association are seen the outlines of a real standard,—a standard formulated on the basis of scientific study of facts, after obtaining the considered opinions of experienced men all over the country as to what the standards of appraisal should be. This standard is expressed in a few clear principles that can be applied in practice. Doubtless further refinement of this outlined standard may be needed, but the building industry might well consider adopting it, without waiting until someone invents a better. In accepting such a standard, it is essential to have an equally definite, uniform classification of security issues. Although the report is confined to bonds, there is no reason why its findings should not apply to stocks.

Taking a broad view of the appraisal standard outlined by the Investment Bankers' Association, one perceives that it rests (1) on a clear grasp at every point of the distinction between investment and speculative risk in properties; (2) on the necessity of calculating accurately the speculative factor in appraising a specific property; and (3) on admitting the fact that, in general, buildings under construction and not rented in advance are decidedly more speculative than are income-producing properties. Obviously, building securities should be classified and sold to the public on this basis, with special reference to the third point,—the speculative character of buildings under construction and not yet rented. Failure to recognize this principle is, I believe, the cause of much of the trouble with appraisals.

OVER-CAPITALIZATION OR OVER-PRODUCTION. Default of bond issues is often ascribed to over-capitalization, but failure to rent is often at the bottom of loss in the investment value of a building. The most careful appraisal survey of trend of growth, rental conditions, etc., in a district cannot guarantee that a building will not be put up that will not rent. Practical experience proves that assertion. Failure to rent is caused not merely by a number of minor, intangible factors that cannot always be foreseen, but,—much more important,—by the over-production in a district of competing buildings, coming on the rental market soon after the building in question was completed. The promoters of the later buildings causing the over-production should not have built at all, but nevertheless, they often do, and in practice there seems to be no way to stop them. Results of this all too common experience are seen in the indications of surplus production of both hotels and office buildings in some sections. The report of the Renting Committee of the National Association of Building Managers and Owners says that the conditions of increasing vacancy percentage in the office building field of the country as a whole have been getting worse for the past few years; and that to a condition of 11.55 per cent of vacancy in October, 1929, in the 1676 structures surveyed, almost another 10 per cent of office space is coming on the market in 1930. Now, why did not the appraisers of this latest crop of buildings foresee this situation?

PREVENTING FORECLOSURE. More important still, would a conservative capitalization be sure to keep all these structures from foreclosure? It might, as far as bonds are concerned, but junior and equity issues could scarcely escape a heavy shrinkage in value. Here I think is a good argument for the new finance. There should be less over-production of buildings where responsibility for the value supporting junior long term issues is accepted by the issuing house. Many people believe that the first mortgage institutions do not worry too much about the investment value of buildings on which they lend. Their immediate interest is to see that the percentage of building cost is so low that even a great shrinkage in value will not endanger their mortgage risk. The promoter takes the risk of over-production. He takes the risk all too frequently, and as a result the industry is much too defenseless against the ravages of the weak marginal producer. Therefore, until the building industry, through more accurate statistics and knowledge of expansion trends in districts and cities, is in a better position to protect itself against the ravages of the marginal producer, we cannot well deny the statement in the Investment Bankers' Association report, already quoted.

"CONSTRUCTION BONDS." "Until the building is actually completed, operating and seasoned, it cannot definitely be told whether it is to be a profitable investment." This being the case, is it correct to label a security issued as a construction loan a "mortgage bond" or a "first mortgage bond" with all the implication of 100 per cent investment value that is associated with these terms? Possibly the answer is "Yes, if the percentage of cost represented by the issue is low enough." Even here, I suggest the defense that the use of the words "mortgage" and "first mortgage" bonds is a bit too technical. In practice, loan issues become much less frequent and less spectacular in their injurious effect on the building industry through loss of prestige with the investing public. Until that day, it seems justifiable to ask the question, Is not the correct term to use of a security issued for purposes of a construction loan, a "construction bond"?

That would be fairer also to the institutions that market to the public conservative first mortgage bonds or certificates, guaranteed or not by the issuing company, on income-producing properties. One of the very safest investments of this class are the guaranteed first mortgage certificates of the "old line" first mortgage institutions, issued against first mortgages on a number of income-producing properties. Defaults on this class of securities have been practically unknown for a number of years, at least; they are excellent investments for that large class of "widow and orphan" investors to whom the building industry wishes to appeal, and these issues are entitled to use the "conservative" label.

STANDARD CLASSIFICATION OF REAL ESTATE SECURITIES. It would seem, then, that the building industry, for its own protection as well as for that of the public, should establish a uniform standard for labeling securities, somewhat on this basis:

1. *A Mortgage Bond,* or *a First Mortgage Bond,* guaranteed or not in either case, should be issued on a conservative basis against income-

producing properties, either singly or in groups.

2. If bonds are issued for the purpose of construction loans, they should be labeled *Construction Bonds.* Where construction loan is "guaranteed," a *Debenture Bond* of the company making the guarantee should be the correct form.

3. If desirable, issues floated for purposes of a construction loan may correctly have provisions for conversion into various classes of securities issued on an income-producing building, and would be *Convertible Construction Bonds.* An example is the 6 per cent notes of the Henry Mandel Associates, convertible into 6 per cent accumulative preferred stock (which is preceded by a mortgage) of the building within one year after completion of the building, etc.

4. After the building is completed and its income is proved, it is correct to issue conservative *First Mortgage Bonds* against it; *Preferred Stocks* representing junior mortgage portions of earnings and physical assets values; and *Common Stocks* against the earnings and equity.

5. Standards for issuing preferred stocks against buildings under construction and not yet well occupied by tenants, should be thoroughly protected.

It would seem that this suggested standard for labeling building securities is fair and accurate; that it is adapted to the special nature of real estate, that it is based on the standard of appraisal of the Investment Bankers' Association, and finally that it is in accordance with common usage both in financial quarters and among the general public, since Wall Street is usually rather careful about placing the right labels on its various issues.

The character of preferred and common stocks should be as clearly settled as part of any standard of classification. In Wall Street, a preferred stock is usually considered to be a fixed income share, junior to bonds only (or mortgages in the case of real estate), or else it is the senior security where there are no other obligations. It may be secured to some extent by physical assets, and in most buildings it necessarily would be; but in any case it should be amply protected by a good margin of earnings.

As to common stocks,—there's the rub. The star of the common stock has risen high in the zenith in recent years, except that, for a few days in October and November, 1929, many people wondered whether it had been knocked out in collision with a comet or the sun. The supposed collision, so our financial astronomers are informing us, was no more than an eclipse, and the star of the common stock is not on the wane. Doubtless that is true, but one cannot escape a suspicion that the "new finance" has not fully proved its case.

Common Share Values are based chiefly on earning power and public confidence in the management and in the competitive strength of the enterprise. There is much to be said for the theory that judicious purchase of common shares in our great enterprises, which participate in the expansion of the country, is a desirable method of increasing one's income in an era of rising living standards. On the other hand, the very intangible nature of common stocks makes agreement on their "normal value" more difficult even than is real estate appraising. The only way so far discovered to establish their value is through the consensus of opinion of experts and public. A security exchange provides the only practical yardstick for appraising its values. The prices fixed in the trading represent the consensus of both public and experts as to the merits of any stock, or in other words, as to the future prospects of the real estate properties on which the stock is issued. Thus in its trading a securities exchange is useful in appraising individual stocks and classes of stocks. Nevertheless, the common stock still fluctuates to an extraordinary degree at times.

The Present Trend. I believe that the construction interests of the building industry will welcome the proposal to standardize appraisals and to label correctly all building securities. It will remind them of the extensive collaborative movement in the construction industry, aided by the U. S. Department of Commerce, under Mr. Hoover's secretaryship, to standardize building products, and to adopt a clear, just and uniform system of grading construction materials, following the method first used in the steel and cement industries. The success of this effort has saved hundreds of millions of dollars for the industry and has created confidence in its products. It is possible that architects, engineers, construction men, material manufacturers and supply houses will not think that the trouble and effort required to make the change will be a valid argument against making the attempt. They will recall that the same arguments were advanced against the movement to establish grading of materials of construction.

When, similarly, a uniform standard of appraising properties is established, recognizing the basic distinction between investment and speculation; and when a fair and reasonable system of labeling securities, also based on the distinction between speculation and investment, is adopted, then, supplied with these two standards, the building industry will itself understand accurately its complex finances. And it will be in a position correctly to inform the public. The building industry should take this step for its own protection.

THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 15, MASONRY (*Continued*)

EDITOR'S NOTE. In the discussion of the supervision of the masonry, Mr. Beach, in the previous installment, published in the February issue of THE ARCHITECTURAL FORUM, was discussing the trouble that frequently arises in the laying of brick. When it is specified that the brick must be "drenched" in warm or dry weather, the duty of the superintendent to enforce this is sometimes difficult. Mr. Beach here continues the discussion of this phase of masonry construction.

THERE is therefore, a constant inclination on the part of masons to want less water applied to such materials than the superintendent understands is essential. Again, the experienced man makes use of his knowledge and tact to establish correct procedure. "Drenched just before placement" does not mean that each brick shall be dripping or soaking wet when the mason picks it up, but drenched in the pile before being loaded into hods or barrows. Then, if not laid within half an hour, they will, if exposed to hot sunshine, need re-drenching. After a rain, they may not need further wetting all day, though it may be found that only those in the outer tiers absorbed the rain, the remainder being still too dry. All of this is up to the superintendent to determine. He knows that each brick or tile must be neither too wet nor too dry, that there is no danger of the former, but that he must enforce the latter demand, or expect to suffer the humiliation later of seeing his employer picking out worthless mortar with his finger nail. But he also knows that, if he goes a shade too far in his demands, the brick layers are likely to quit in disgust, and the work be at a standstill, and then delay will result.

Our superintendent also experienced difficulty in getting some of the masons to "shove" the brick as laid. This was distinctly called for, and is considered the only sure way to guarantee that a wall will be solidly built; but it is easier just to lay the brick in the mortar and tap them down, depending entirely upon "slushing" in the mortar to fill the vertical joints. If these have been squeezed down to ¼ inch or so, the act of slushing will not drive the mortar in very far. Additional requirements were that the brick must be "bonded completely through the wall every sixth course," and that "all walls shall be laid to a line inside and out, except that all brick and tile walls that are to be plastered need be laid to a line on one side only. All walls shall be carried up true and plumb and, as nearly as possible, at uniform height around the building. All walls shall be securely braced and shall be covered on top when work on them is interrupted." Various bondings for brick facing are in vogue, depending upon the demands of building ordinances and the requirements of design. If it is to be bonded to the backing by means of metal anchors, the inspector must see that these are of the kind and quality specified and properly spaced and placed, ordinarily, one or two to each superficial square foot of wall. If the facing is against concrete, the anchors must be inserted in the forms.

CHAPTER 16
TERRA COTTA, CUT STONE AND PRE-CAST STONE

THE production of terra cotta in the United States is in the main confined to a few companies whose standing is well known. Architects are therefore accustomed to award such work to concerns in which they have confidence, preferring not to take the chance of delaying construction by having to reject members that might require weeks to duplicate. Terra cotta is a favorite material with many designers because it so readily lends itself to ornamentation and to the use of desired colors and textures; and yet there is no material brought to a job which a novice is less capable of judging. The writer has seen samples of terra cotta, reputed to be 4,000 years old, and still in good condition. He has also witnessed the disintegration of terra cotta that had not lasted through a decade. One is quite naturally inclined to favor those manufacturers whose product has lasted longer than ten years.

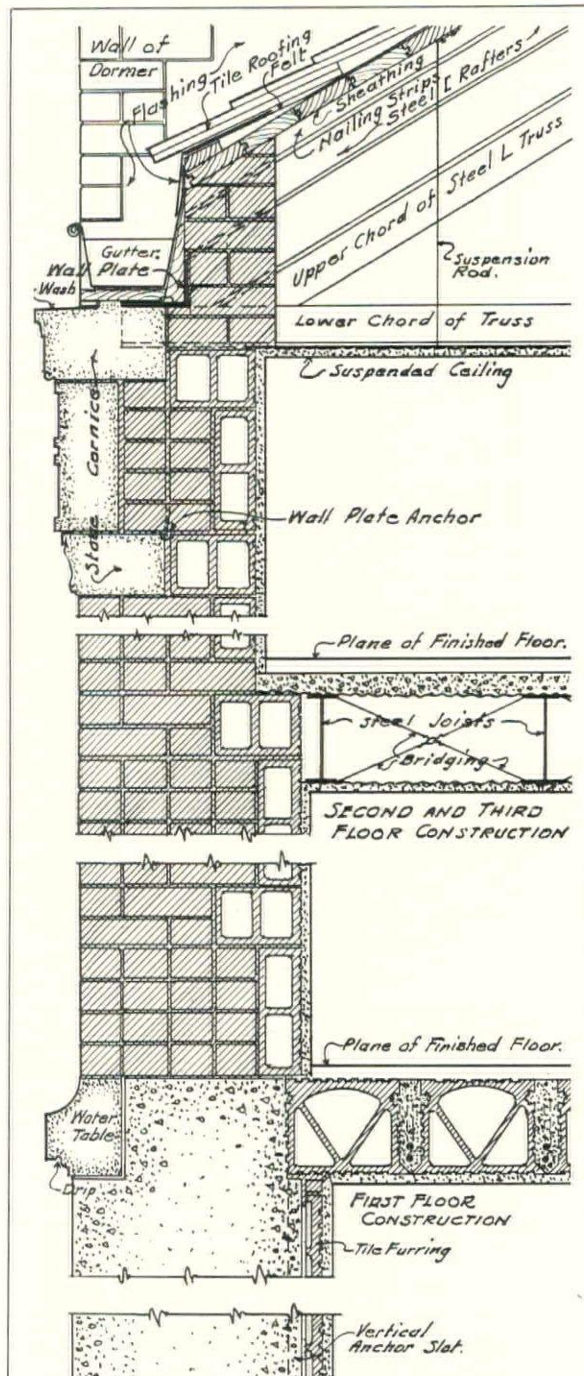
A superintendent's interest in the subject may begin with an inspection of shop drawings (including full-sized details made at a scale of 13 inches to the foot, to allow for shrinkage in the kilns) or with a trip to the plant to expedite delivery. * The shop drawings are reviewed for general and specific compliance with the architect's details, but it is well likewise to observe the scheme of numbering on the setting diagrams. Members numbered consecutively, regardless of location, are not easily identified by sorters. Each course should have its individual number or letter, following which the next digit should be one that will locate the member with fair accuracy, some-

*See discussion of "expediting" in chapter preceding.

where in that course. A system of numbering which would locate a block marked "C-46" immediately above "B-21" means a great deal of extra work for the sorter. The better designation would be a system that would locate "3-C-46" over "2-C-45, 46 or 47"; the first digit referring to the course, the second to the pier or spandrel (or whatever), and the third to the exact location. With the exercise of a little tact, the manufacturer may be persuaded to so change a poor numbering system as to cause worth-while saving of time and annoyance at the site.

Checking of shop drawings and the expediting of materials are functions of the superintendent only when specifically directed by his employer, and yet he is supposedly fully capable of attending to them when called upon to do so. In any event, he must make himself familiar with all drawings and must keep posted as to the progress of material through factories and yards and to the premises.

In addition to internal defects possible in terra cotta, it is subject to serious deformations in burning and, due to its extreme brittleness, it demands most careful handling. After being taken from the kiln and allowed to cool, each piece is examined for serious checks and inequalities, then laid out on the fitting floor and fitted against its adjoining members in the structure. If its defects are slight, they are ignored, or edges may be cut or ground to produce a fairly even joint of the size called for. There is an awkward chance here of there being disagreement between maker and architect, but most producers have learned not to take too many chances (having an eye to their reputations), and most architects have learned not to be too particular on the subject of terra cotta, but to accept it for what it is. This is especially true for work above the first story, where minor defects will not be discernible. Terra cotta is most difficult when intended to produce long straight lines in belt courses and in fluted columns, pilasters and the like. Owing to limitations in the burning, the blocks are generally from 24 to 30 inches in maximum dimensions, and the edges are not always absolutely straight. Experienced setters will compensate for imperfections in the laying, if not too serious,—and, in order to keep going, also those that are quite serious,—if permitted. It is here that the judgment of the superintendent is brought into play, —and he should be very sure of the stand he is about to take,—before he takes it.



Wall, Floor and Roof Section of School House

Pieces of terra cotta are rejected because of (1) chipped edges, (2) crazed surfaces (hairline cracks in the finishing), (3) undue warping of plain surfaces, (4) crooked edges, (5) too much or insufficient allowance for jointing, (6) deformations preventing good alignment, (7) poor modeling, and (8) failure to accord with samples as to texture, color, etc. But, since none can be counted upon to be absolutely perfect, it is obvious that the man who passes upon it must know what he is about, else the work will soon be in turmoil, and be unnecessarily delayed, and the inspector forced to weaken on some of his decisions. The present tendency of designers to depart from the kind of masonry that demanded fine "buttered" joints and the near-perfection of each unit in a wall surface that was thereby made necessary, has materially simplified the terra cotta man's problems and, correspondingly, those of his critics. A terra cotta inspector must learn to be discriminating, rather than intolerant.

Much of the foregoing applies as well to cut stone as to burnt clay products, but stone is even more diversified as to structure and density than is the manufactured material. The chief concerns of the superintendent as to stone are to see that all that is supplied shall conform to sample, shall be practically free from defects when in place, and that it is properly set and anchored in the wall. Except in the case of strictly first class work, such as the finest of monumental construction, one can perhaps be slightly less meticulous in the matter of permitting patching of chipped stone than should be the case with terra cotta, due to the fact that stone is a homogeneous material, whereas the facing of terra cotta differs materially from its body; also because this facing, once broken, is permanently damaged. One of the most palpable inconsistencies confronting a superintendent is a specification definitely prohibiting any and all patching of cut stone on work where minor patching could well be left to his discretion, as the contractor is likely to suppose it was intended to be.

This school building which we are discussing having been designed with brick facing and cut stone trim, our superintendent was absolved from any terra cotta worry, but he concerned himself most assiduously with the cut stone. In order to be properly efficient in the inspection of this material, it is essential that one possess a general knowledge of building stones, their chief characteristics, the various methods of preparing them for use, and the proper manner of handling the finished product until it finds its ultimate destination in the structure. He cannot derive all this information from a set of specifications; but, having acquired a fundamental education on the subject as a background, he should then be able to interpret the terms of a particular stone specification with comparative accuracy and fairness.

Building stone falls naturally into three classes: (1) that used for rough work in walls or foundations, either in block, rubble, or crushed for concrete; (2) that used for base courses and wearing surfaces; and (3) that used for other exposed and ornamental work. The use of stone for foundation work, other than in concrete, has become so rare that no mention was made of it in the chapter on "Masonry." However, in a few locations close to quarries, stone walls are still being constructed. In building these, the chief concerns of the inspector are to see that the mortar is fresh, that it fills all interstices, that the stones are not so dry when laid as to be unduly absorbent, and that they are laid with good bond, both longitudinally and through the wall. Stone masons are accustomed, in such work, to follow their own lead and can generally be counted upon to produce surfaces of as good appearance as is feasible with the material at hand, but one finds them less concerned with the stability of a wall. These rough stone wall surfaces vary from the crudest of uncoursed rough quarry or split-faced work to carefully designed polygonal, cobble or range masonry, random or coursed. For any finished work, a sample wall should be approved in advance, as otherwise there is no fixed criterion, and each mason may use too much individuality. This will be apparent, not only in the size, shape and relation of the rubble or ashlar, but also in the thickness and character of the jointing.

For base courses, steps, door sills, platforms and other members subject to hard usage, it is customary to specify granite unless, for reasons of economy, a sandstone or limestone of known hardness is used. Slate, bluestone, soapstone and other hard stones are also used for wearing surfaces, but seldom for wall facing. For steps and door sills subject to extra heavy wear, granite, concrete, steel or cast iron are most commonly designated. Granite is ordinarily segregated from other cut stone work, owing to trade customs and to the frequent desire of the architect to compare its cost with that of a cheaper substitute. Due to its great density, its working is more difficult and expensive than that of any other building stone; but the characteristics of the finished blocks and their setting, items in which the inspector is most concerned, are no different from those of other building stone similarly specified.

Besides familiarizing himself with the working and shop drawings and the models (as discussed under the subject of "Terra Cotta" at the beginning of this chapter), the superintendent must have on hand approved samples of cut stone and granite, showing permissible color ranges and the textures of surfaces. These latter may be specified to be any one or more of all the variants from the coarsest of rock-faced surfaces through sawed, sanded and the variously tooled textures, to the honed or polished finishes of marble and granite.

The cut stone for our school house was of limestone with a sanded finish. It arrived in due time, and trouble started at once. One of the board members was interested in the trucking company which did the general contractor's hauling. This was the ordinary small city type of concern, with no special equipment for handling the stone off of the cars. Consequently, they made use of "dollies" (rollers) and crowbars on the first load, and several blocks had the mouldings and arrises so badly chipped as to necessitate ordering substitutes. The mason foreman produced the inevitable can of "dugan" (stone-patching cement), and the setter did his best to so patch the damaged places as to render them invisible. The superintendent, nevertheless, rejected all but a few pieces on which the spalling was trivial. He would permit no patching whatever on projecting members. It was evident that the contractor had a charge against the trucking company, and therefore it was not long before the interested member of the board put in an appearance. He insisted that the patching should be deemed acceptable and that the superintendent was too arbitrary in saying that some stone would pass muster and some would not; whereupon the superintendent declined to accept *any* patched members and referred the whole subject to the architect. The latter, at the time of his next visit, supported the superintendent, and *all* the damaged pieces were ordered replaced, since, in case of a law suit, it would have been difficult to establish just where the line should have been drawn. Confronted with this, the contractor advised the trucking company to consult a lawyer, to whom he made it plain that there would be money saved if the superintendent were persuaded to revert to his original stand, and not interfered with. This course was adopted, and the truck owners were thereby excused from making good the inconspicuous defects.

In this matter of handling, the superintendent found that the use of improper tools by truckmen was not his only cause for complaint. The weather being fair, they were likely to dump the stone on the soft ground, rather than take time to deposit it carefully on the specified planking, apparently oblivious of the fact that the next storm might cause serious staining. They were therefore taught to lay each stone carefully on well supported planks, in such manner that the numbering could be easily read, and that no finished surface of any stone was turned upward or supported its own or other weight. Children at play (and laborers as well) have a fondness for using a row of cut stone or terra cotta for a raceway, especially on muddy days. Damages from all such causes must be carefully guarded against, particularly when the building operations are not protected by fences.

The entire subject of the treatment of cut stone, its cutting, handling and setting, is so well and exhaustively treated in the "Specification Manual" of the Indiana Limestone Co. (Bedford, Ind.), that every building inspector and superintendent should by all means familiarize himself with that publication. This and the specifications for his particular work, combined with the aforementioned fundamental general education on the subject, will supply sufficient foundation upon which to base judgment of such material and its placement and protection. The experienced observer will closely watch the bedding and anchorage of the stone, the alignment and thickness of the jointing, and, in the case of Indiana limestone or other stone subject to staining, the adequate protection of embedded surfaces by whatever method may be called for. Except for this latter precaution, the practice in setting cut stone is likewise that for terra cotta, except that heavier stone demands the use of a derrick, and that all cavities which occur in terra cotta within the outside plane of the wall must be well filled. Whereas cut stone is a load-bearing material, terra cotta is not, and this fact is not to be ignored. Terra cotta, therefore, demands closer attention to bonding, both by metal anchors (as detailed on shop drawings) and by the masonry backing, in order that it shall be truly integrant with the wall. In the setting, either material may vary, due to slight inequalities in successive course members. If not closely watched, a cornice (or other belt) course, the joints of which should center over brackets or other certain members, may be allowed to "crawl" to such an extent as to be an inch or more out of place at the end of a run. The setter will then want to trim a member to get back to position, but he must be compelled to re-lay as much of the course as is necessary.

The man of experience also sees that lug sills are bedded at ends only, until time for pointing; that no mortar or other material is permitted to carry weight on top of projecting mouldings; that the wooden wedges sometimes used by setters are thoroughly wet when placed; and that outside steps and platforms are not set until adjoining walls have received their settlement, if any. The footings under steps and their buttresses (or cheek walls) are frequently (and unavoidably) disproportionate to those under bearing walls, and hence much care should be exercised in joining onto the latter, to obviate all chance of there being settlement cracks. Sometimes such joining is slotted, to permit slight settlement without damage. The door sills of the school were granite slip sills; the platforms and steps of concrete, with nosings of paving brick; the buttresses of limestone; all of which construction was deferred until the exterior work of the building was otherwise completed.

(*Chapter* 16 *will be continued in the May issue of* THE ARCHITECTURAL FORUM)

BOOK DEPARTMENT

"SMALL HOMES OF ARCHITECTURAL DISTINCTION"

A REVIEW BY

CLIFFORD WAYNE SPENCER

MOST members of the architectural profession are familiar with the purposes and services of the Architects' Small House Service Bureau, but probably few realize the extent to which its plans have matured and the lasting effect its endeavors have had on the quality of American domestic architecture. For those who are unfamiliar with the Bureau, we might say that it is a non-profit organization established by a large group of architects for the purpose of helping to improve the character of small house architecture in the United States. It is closely affiliated with the American Institute of Architects which exercises an indirect control over its policies by being able to appoint a majority of the directors. It offers to home builders, who for any reason do not consider themselves able to employ the services of an architect, a service which, as far as it goes, is based on the best architectural practice. Most of the plans are contributed by architects gratis for the purpose of improving the quality of small houses from the standpoint of good appearance and construction.

With many of the gifted architectural designers of the country contributing their efforts, it is not surprising that the Bureau has accumulated an excellent collection of house designs, each of which is a leader in its own particular class. The Bureau has further added to its usefulness by making careful selection from among these designs and publishing them in a volume for the use of prospective home owners, and incidentally of architects and builders everywhere. Here the man who is planning to build himself a house of not more than six rooms may find a design to fit almost any requirement that may govern in his particular case, and if he is not able to avail

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himself of the actual services of an architect, either because there is none within reach of his particular location or because he feels that an architect's fee, however small it be, is beyond his means, he may obtain from the Architects' Small House Service Bureau a set of plans, specifications, details, lists of materials, contract forms and other working documents which will give him, up to a certain point, the services usually rendered by an architect. The Bureau strongly urges its clients to employ the services of an architect in supervising the execution of the work. The volume of course will be invaluable to the contractors and speculative builders as a source of ideas and plans for their work, and it is to be hoped that the architectural quality of such buildings will be improved in many cases by the use of these designs.

In this review it is our purpose to consider the work of the Architects' Small House Service Bureau, as typified in the recently published book of designs, as it affects the individual architect. Many will say that by furnishing plans to home builders on a wholesale scale the Bureau is taking work away from architects who would otherwise be called upon to do it. As a matter of fact, the amount of money lost to the profession in this manner is so small as to be negligible, and the benefits which are derived greatly outweigh the disadvantages. In the first place, it is probably true that the designing of small houses, such as fall within the scope of operations of the Bureau, on an individual basis is highly unprofitable, and most architects do not care to engage in it at all. People who use the Bureau in most instances, if deprived of it, would not employ an architect in any case and would be forced to build without plans or else to secure them from some one of the great wholesale planning organizations, and the quality of the design would be quite likely to be far inferior to that which could be had through the Architects' Small House Service Bureau. Another benefit which architects receive from the work of the Bureau results from the publication of a large number of designs representing the best efforts of a large group of highly skilled architects. These furnish precedent and ideas for use in their own work, be it in small or large houses. The present volume is in itself a cross section of the best in small house architecture for all parts of the country from Maine to California. It furnishes ideas easily adaptable.

As is to be expected in a volume of this sort, the outstanding feature is the illustrations. Floor plans of course are most essential and are clearly reproduced in all cases, giving an infinite variety of arrangement for houses of all kinds up to the six-room limit. Elevations and perspectives are presented either as black and white renderings or from photographs of buildings actually constructed from the plans of the Bureau. Interiors and close-up details of interesting features add greatly to the charm and practical value of the work. In some instances variations in the plans are possible and alternate schemes are presented. Each example is accompanied by a brief discussion covering such important problems as the type of construction and advice as to materials to be used. Much lee-way is allowed in this respect, and in many cases two or more houses are built from exactly identical plans but of different materials with considerable variation in the appearance of the buildings. In one or two cases where this has been done views of both houses are shown. These should be of great interest to the architect,

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since they afford an interesting illustration of the effect that the choice of materials may have on the appearance of buildings. The suggested interiors as shown in small sketches and illustrations from photographs for many of the houses are rich in ideas, and in all cases are strictly in keeping with the exterior characteristics of the buildings. Many treatments of the all-important mantel and its surroundings and details enrich the material included in the volume. There are also details of effective dormer treatments, close-ups of simple but attractive entrance door details with their railings and steps for all styles of houses, balconies for the Spanish type of house and other details to go with nearly all the examples shown. Naturally in such a varied collection there will be some designs which will not appeal to the individual taste of all who see them, and the trained and discerning eye of the architect will discover many features and details of which he may not approve. However, it is by the very detection of such defects that his own taste is improved, and he will be prepared to guard against them in his own designs. Picturesqueness has always been the keynote in the design of small houses, and when carried to excesses it has been responsible for much that is trash and ugliness. This quality is much in evidence in the pages of this work, but in practically all cases it has been subjected to such dignified restraint that the collection of houses cannot fail to be generally pleasing even to the most exacting taste.

The arrangement and grouping of the examples are particularly good. Starting with several little architectural gems in the form of three-room cottages, the size and importance of the houses develop until the limit of six major rooms and $10,000 cost is reached. Nor has style been neglected. All the popular periods and national styles are represented, including the Colonial, English, French, Spanish and Italian, and there are even one or two based on more unusual precedent. Such a house is a charming little, five-room cottage which takes its precedent directly from the Swiss chalet. Every detail is carefully worked out into as picturesque and convenient a modern home as one could wish to find. The plans are made still more helpful by being grouped in the index under practical headings,—"Plans for Narrow Lots," "Plans With Living Rooms Across the Front," "Plans With Living Rooms at the Side," "Living Rooms in Miscellaneous Positions," "Plans with Bedrooms or Space for them on Two Floors," "Plans Without Dining Rooms." All the million and one little improvements that go to make the modern small house convenient and attractive are presented in some one of the many illustrations, and countless suggestions for making the most of a house are made. For instance, there is an illustration showing how the space in an attic high under the rafters may be transformed into a bedroom of the greatest charm imaginable and at the expenditure of very little money. With its exposed studs and rafters and pine boarding it would make an ideal setting for early American furniture, and even the collar beams are made to play a part in the decoration. As the Architects' Small House Service Bureau is constantly having new designs sent in, the editor of the volume has included some plans and views received after the book was partly made up. These were felt to be so unusual that it was decided to add them to the already large collection. They are shown at the end of the volume and add greatly to its value.

The architect who is called upon from time to time to design a small house will find that a copy of this work will be a great aid in ascertaining the wishes of his clients and will be instrumental in establishing a starting point from which he may develop the project in accordance with his own ideas and to suit the wishes of the owner. In this way a great deal of time will be saved and small house design be made much more profitable. The text descriptions accompanying each of the 250 plans for homes are full of good advice for the home builder, and much can also be learned by professional builders and planners as to the advantages of the various styles of houses and as to their suitability to specialized conditions. The work of the Small House Service Bureau has already had a marked effect on the quality of domestic architecture, and the publication of this new volume is bound to increase immeasurably the influence for good that this organization exercises in its special field. The book is especially timely, since all indications seem to point toward greatly increased activity in this department of the building industry in the near future. Builders and architects who have copies of it in their libraries will be in a position to take advantage of all opportunities and give up-to-the-minute advice and suggestions to their clients. It is so seldom that we come across a so-called plan book in which the designs are not either freakish or merely dull that we feel sure the present volume will prove very popular with homebuilders.

SMALL HOMES OF ARCHITECTURAL DISTINCTION. **A Book of Suggested Plans Designed by the Architects Small House Service Bureau, Inc. 278 pp., 8½ x 12 ins. Price $5. Harper & Brothers, New York.**

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THE EDITORS' FORUM

NEW YORK THE EVER-CHANGING

By William Schack

IN writing of the New York Life Insurance Building about a year ago, I noted that when I suggested to the telescope man in Madison Square that he turn his instrument away from the heavens toward this creation of Cass Gilbert's he looked at me as if I were crazy. My simple intention, of course, was to increase his business, but he did not understand it so. Now I note that the man in Bryant Park has pointed his telescope at the towering top of the Chrysler Building just nearing completion and is making money on it. The peaks of the six gilt obelisks which crown the new Lefcourt-Colonial Building are turned by the morning sun into six glowing torches. If those tall structures which do not sufficiently emphasize their verticality are faulty in principle, they do at least provide us with "castles in the air."

Among the new white office buildings which surround it, the Brunswick Building at Fifth Avenue and 26th Street looks hopelessly old fashioned. Its red brick alone would date it as an antique. And how can a 13-story structure pay so little homage to the skyscraper principle without incurring such a penalty? Its bracketed cornice above the second story, the frieze at the third, the balcony at the 12th floor running the entire length of the building, and the cornice with its decorative crest,—all are emphatic horizontal lines to compass the building into a formal unit firmly attached to the ground. It thus seems like an ancient monument. Nor is it only skyscrapers embodying the principles of a new style in architecture which possess this insidious advantage. The tall apartment structures on Fifth Avenue north of 59th Street also make their formerly distinguished neighbors, —Renaissance palaces,—seem somewhat puffy and ridiculous. As most of these tall buildings have no architectural distinction beyond that of size, their superiority is merely that of contemporaneity, of fashion in a narrow sense, as, in a period when long dresses are worn, every long dress,—no matter how indifferently designed,—makes every short dress of a preceding era,—no matter how well designed,—seem ridiculous and old fashioned.

Architecture is the most obliging of the arts. It builds what must be built and asks no questions. It did not say to the Pharaohs: "How can you have the colossal vanity to demand such pyramids for your tombs, when the worms and vandals will get you anyway?" Instead, it set to work on a construction that presumably would keep worms and vandals away. It did not say to the feudal lords: "Why do you, with drawbridge, tower and battlement, shut yourself off from a world you had better learn to know?" Instead, it set to work to build the most secure and handsomest drawbridge, tower and battlement that it knew how to build. It did not say to Louis XIV or the two hundred princelings who imitated him: "Do you really find such bejeweled palaces fitting for the *homunculi* who fill the world and whom you have such fair samples here?" Nor does it ask today, "Must you pile up 50 stories with a Gothic ardor to house offices and showrooms of dealers in cotton goods and real estate, millinery and radio supplies, towels and tin cans, publishers, and dealers in hot water bottles . . . ?" It simply goes ahead and builds. It is only during the last few years that the stressing of the vertical as the basic principle of skyscraper design has been fully accepted by any considerable number of architects. One can hardly think of its purity being infringed on already. Yet the new Stewart Building, for example, demonstrates that a tall structure need not emphasize the vertical very much. The argument depends on the definition of "tall." Twenty years ago anything beyond five stories was tall. Now there are a great many houses of 12 and 14 stories. With 50-story buildings going up, our standard of tallness is once more stretched, and it becomes difficult to say when a building is tall enough to be known as a skyscraper. Against a 50-story edifice shooting upwards, may a 15-story structure, thus hopelessly outdistanced, logically revert to Greek temple earthiness? Perhaps the less tall of the skyscrapers of the future, may, from choice, adopt more horizontal modifications of design similar to those made out of compromise before the skyscraper principle was accepted. Such a turn would be a powerful symbol of our age, for purism has in the past died much harder. When the raking cornice of the Doric pediment was first broken up, it shocked the purist and no doubt also a good many who did not consider themselves purists. That horrid gap where there used to be the apex of an inevitable triangle? Impossible. But the gap was filled with an urn or a cartouche; the broken ends were composed into a curve; the "fragments" of the raking cornice in time also took wing and curved. Soon the pure Doric pediment was itself an archaic looking thing, impotent to scold its changed descendants. But the change took several centuries. We do things much more quickly now.

ROSTER OF CALIFORNIA ARCHITECTS

ONE of the most complete books of its kind, the revised pocket edition of The Architects' Directory of California, has just been issued by Cornell T. Malone, of the Los Angeles Builders' Exchange, Chamber of Commerce Arcade, Los Angeles, and Pacific Building, San Francisco. The new edition is now ready.

The new Directory lists southern California architects alphabetically, giving individual and firm names, also names of architects connected with firms, as well as the names of licensed architects employed as designers, draftsmen or superintendents. Following the alphabetical list, practicing architects in the Los Angeles downtown district are arranged by streets and buildings, giving the names of the architects in each building, together with room numbers, names of designers, specification writers, draftsmen, mechanical, heating and ventilating, electrical, structural and consulting engineers and superintendents with each firm as well as those engineers practicing independently, and the class of work specialized in is named.

THE ARCHITECTURAL FORUM

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PART TWO—ARCHITECTURAL ENGINEERING AND BUSINESS

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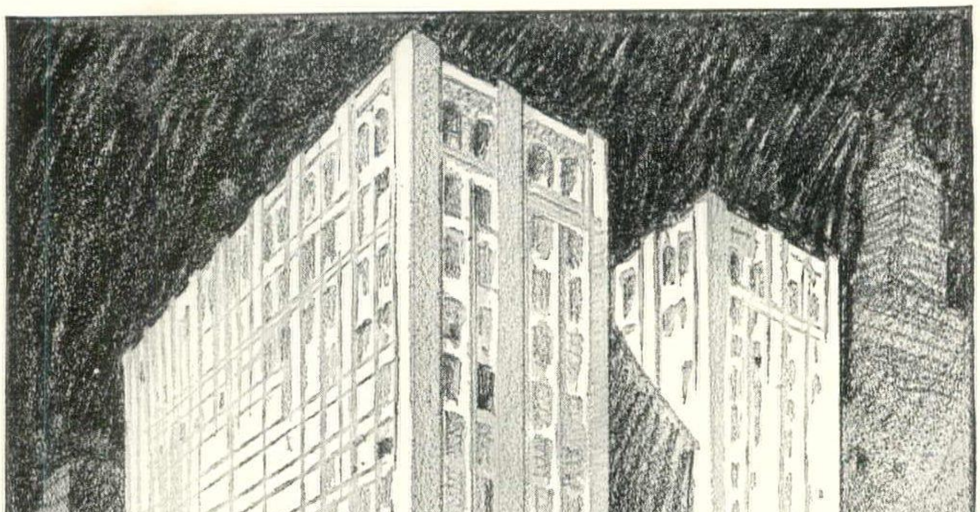
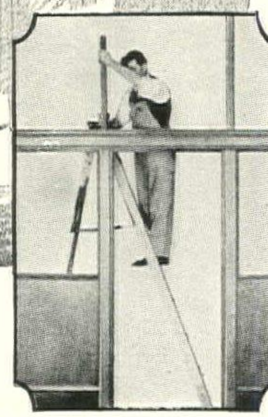


The National Savings Bank of the City of Albany, N.Y. Halsey, McCormack and Helmer, Inc., Architects . . . Insert shows how easily Telesco can be adjusted to various ceiling heights. Carpenter is raising telescoping posts and securing them to the ceiling strips.



Borrow *from these* Banks

. . this style trend in interior woodwork . . . . . .

THREE bank buildings in a row have recently chosen the same kind of wood for partitioning offices. The Irving Trust Co. chose walnut for their new building at Number One Wall Street. The Baltimore Trust Company chose walnut. And now the National Savings Bank of Albany, after viewing the products of every other nationally known wood and steel partition manufacturer in the country, has chosen walnut, too.

Each of these bank buildings chose the same kind of walnut partition. Each of them chose New Telesco. For New Telesco is the only partition that offers rich-grained American walnut at the cost of sorry imitations that fool nobody with their paint or stain or photographic similarity.

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IT TELESCOPES

We take great pleasure in announcing that on the first of May

ROYAL CORTISSOZ

will become a contributor to THE ARCHITECTURAL FORUM.

This brilliant writer and recognized authority on architecture and the allied arts will write each month on a topic of immediate interest and inspiration to the profession. For the subject of his first article, in the May issue, he has selected, "The Vitality of Tradition."

PARKER MORSE HOOPER,

Editor

THE CHICAGO CIVIC OPERA BUILDING
FROM THE ETCHING BY ANTON SCHUTZ
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

THE
ARCHITECTURAL
FORUM

VOLUME LII | NUMBER FOUR

APRIL 1930

THE CHICAGO CIVIC OPERA BUILDING

GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

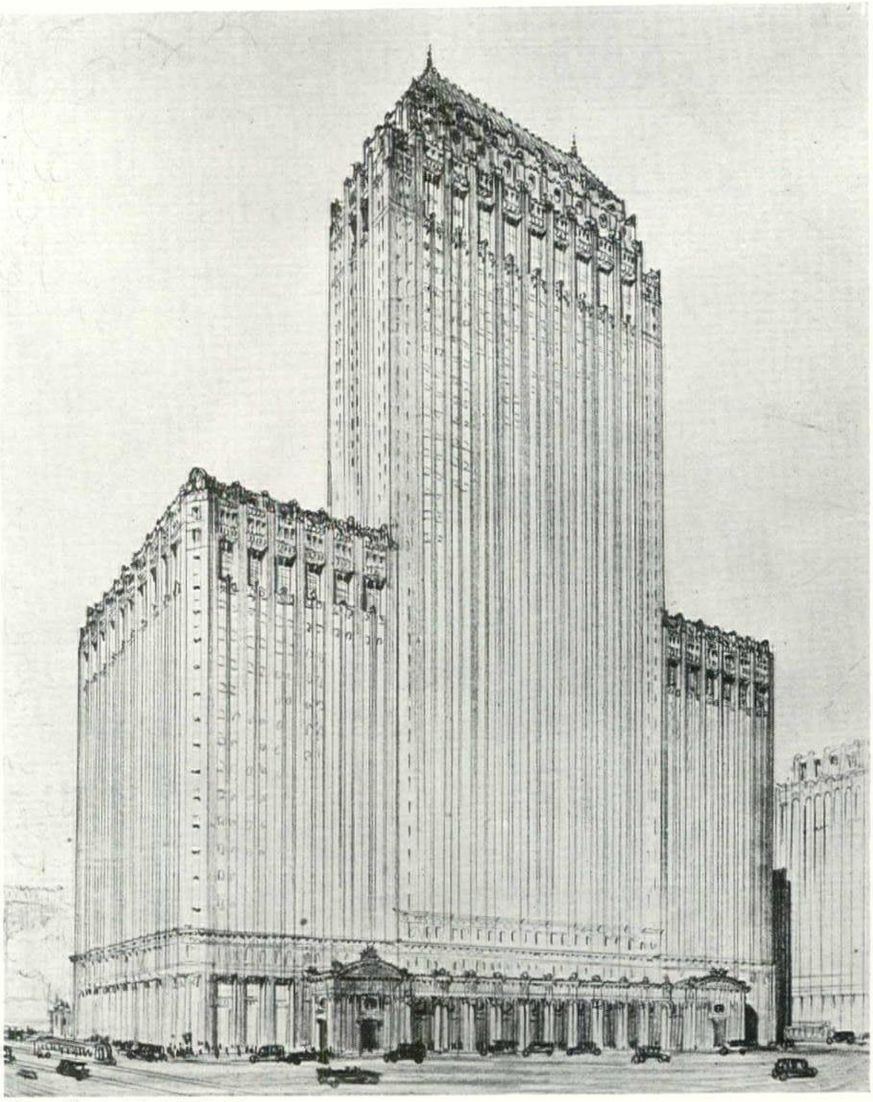
BY
ANNE LEE

CHICAGO'S new Civic Opera Building is the pride of that mid-west metropolis. The city points to it as proof of its cultural attainments in spite of its reputation for gunmen and political imbroglios; points to it as one of the fruits of coöperative effort under the powerful leadership of Samuel Insull, who likewise is accredited with having put the opera company itself in sound financial condition by use of "big business" methods. The project has aroused the interest of opera lovers everywhere,—in cities such as New York, where opera goers are clamoring for a new and better auditorium, as well as in other communities large and small throughout this country, and perhaps in other countries also, where the struggle to provide such a music center has come to naught because of the probability of facing a deficit.

Graham, Anderson, Probst & White of Chicago are the architects of this building, an achievement of three-fold magnitude,—opera house, skyscraper and financing plan. Ranking first in importance, there is, of course, the Opera House unit, the *raison d'etre* of the entire project, but very important in its own right is the 44-story modern office building, a skyscraper of imposing design, built like a protecting shell around three sides of the Civic Opera House, and containing in one of its wings the Civic Theater, a completely equipped, modern theater seating 878.

The financing plan involved in this undertaking is the third factor of importance. The Opera House project became a truly civic venture when half of its total cost of $20,000,000 was raised by the sale of stock to 10,000 subscribers, many of whom are numbered among the Opera's 3200 guarantors (80 per cent of the guarantors pay $100 or less per year), the remainder having been raised by mortgage. Sanguine, and believing in their idea, its backers look forward to a self-supporting opera by reason of the yield the building will eventually net, it having a possible annual income of $2,000,000 in rentals from the 739,600 square feet of rentable floor area,—662,000 square feet aside from the floor space devoted to the Civic Opera House and Civic Theater. This phase of the project is attracting the attention and study of numerous cities and organizations interested in the experiment.

Although officially known as "The 20 Wacker Drive Building," the structure will inevitably be referred to by the more popular sobriquet of the "Civic Opera" for whose use it was built. The location of the building in a mercantile district, some distance from the Opera's former home and from the hotel and theater centers, has become a much discussed question. The building assumes the role of a pioneer in a district where it will set a new pace for development which is certain to materialize. With a frontage of 391 feet, the building occupies the block bounded by Wacker Drive and the Chicago River, between Madison and Washington Streets, directly across the river from the new Chicago Daily News Building. Situated outside the congested night traffic area, the building it is hoped will prove to be readily accessible. Wacker Drive, a double-decked boulevard connection with Michigan Avenue, Chicago's main artery between the north and south sides, affords ready access to the heart of the city.



From the Architects' Sketch

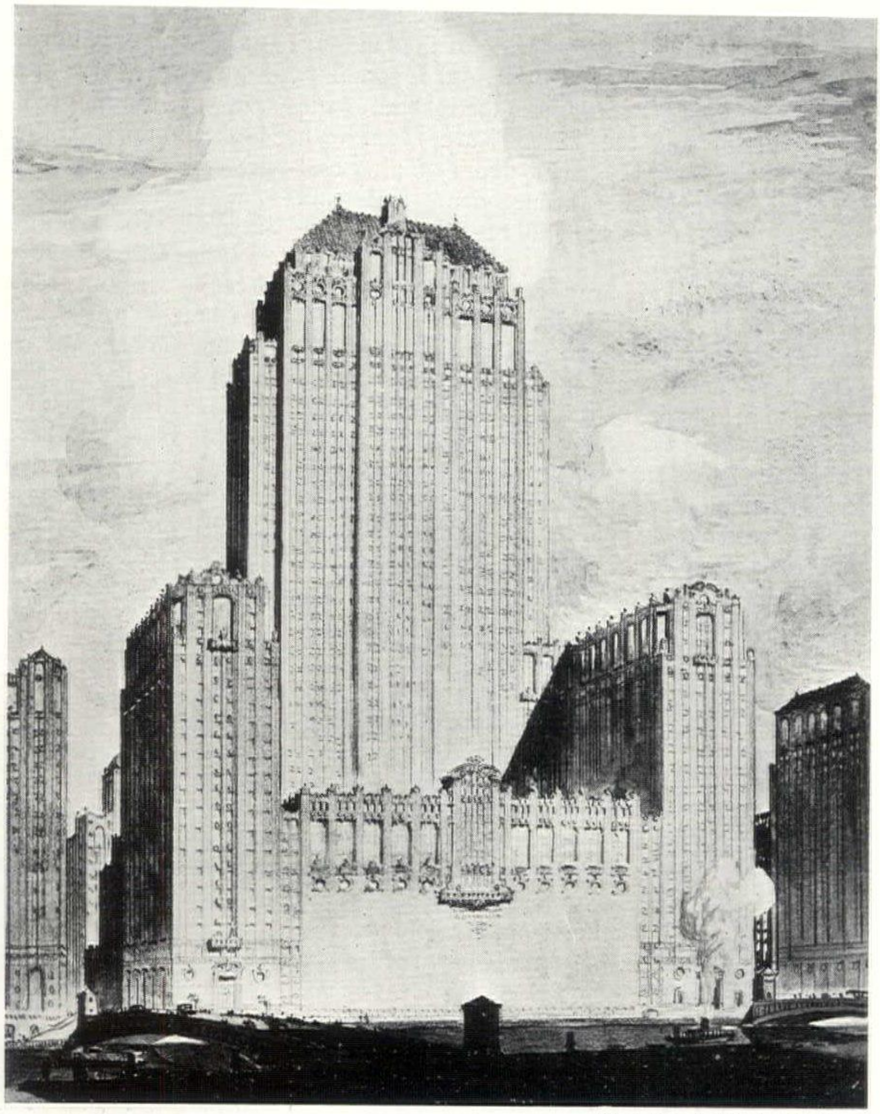
Entrance Front, Chicago Civic Opera Building. Graham, Anderson, Probst & White, Architects

Just across the river are two railway terminals, the Union Station and the Chicago & North Western Station, serving suburbanites using four railroads. Adjacent thereto the contemplated west and northwest side super-highways will have their termini. All of these factors influenced the decision in choosing this site in a mercantile district which is now entering upon a new stage of development. The extraordinary width of the drive in front of the building will facilitate the planning of a desirable approach,—the development of a beautiful plaza as a setting for the Opera House,—as soon as the proposed removal of the present elevated railroad extension can be brought about.

By raising the level of the plaza above the present street grade, it will be possible to extend the lower level of Wacker Drive which now ends a short distance from the site. This lower drive will give ready access to the building, along the front of which 400 feet of curb space will be provided, just as on the street level, to facilitate the arrival and departure of cars. Entrances directly into the building from the lower level were arranged for when the plans were drawn. Another desirable feature of this lower drive is that it will provide a vast, sheltered automobile parking space.

It was with such an opera plaza in mind that the architects designed the splendid colonnade which runs the full width of the building and provides a sheltered walk for passengers discharged simultaneously from as many as 40 automobiles. This is but one of a whole series of details that received careful consideration to add to the comfort and pleasure of opera going. For instance, the box office was separated from the main lobby in order that those with seats need not crowd through lines of ticket buyers, and there is ample space so that the waiting purchasers may stand indoors, protected from the elements.

Somewhat reminiscent of the Paris Opera



River Elevation, Chicago Civic Opera Building. Graham, Anderson, Probst & White, Architects

From the Architects' Rendering

House, intentionally so, is the impressive roofed colonnade with 17 bays between octagonal piers, 35 feet in height, at either end of which there is a spacious portico with sculptured pediment to mark the entrances to the Opera House and the Theater. In the center of the colonnade is the entrance to the office building lobby which is flanked by high class shop space. There is access, too, to the stage regions of both Opera and Theater. French Renaissance is the architectural type employed for exterior and interior designs, the style having been modernized for adaptation to American skyscraper construction. According to Alfred Shaw, the member of the architectural firm most directly associated with the work of designing the building, a strictly modern style of architecture failed to offer as sympathetic a background for the old, conservative traditions of opera as did the type of design chosen.

Built of limestone with terra cotta trim, the building is of steel frame, fireproof construction. Long, vertical lines emphasize its height. By means of cast iron window spandrels interesting vertical effects are obtained in the upper portions of the main tower and the 22-story wings that flank it. That the architects took advantage of the unimpeded view from the west is proved by the effectiveness of the river facade. Monotony has been avoided in the design, the building rising majestically from its arcaded embankment to the peak of its tiled roof. In the upper floors of the Opera House unit, located between the wings of the river elevation, vertical treatment has been repeated most successfully, with a pedimented portico as the central motif. A similar motif appears at the extreme top of the structure. Roof lines of the several units are broken by finials. They also appear at the set-backs and elsewhere as ornamental details. Rows of circular windows and decorative balustrades contain lyre, palm leaf, laurel wreath and trumpet motifs which are repeated in the ornamental details throughout the interiors. Decoration is harmonious and balanced.

The entire Madison Street wing of the building is devoted to the lobby and the grand foyer. The lobby of the Opera House, like the lobbies of the office building and the Theater, are faced with filled Roman travertine, with floors of pink and gray Tennessee marble, bronze doors and trim, including elevator doors, and restrained decorations in salmon and gold in the ceilings. Off of the opera lobby there are three elevators to carry patrons to all floors, including boxes, dress circle and balconies.

It is upon entering the magnificent and spacious rectangular grand foyer that one gets the first impression of the sumptuousness of the interior. This lofty foyer, measuring 52 x 84 feet and 44 feet in height, is flanked by fluted, marble piers surmounted by carved capitals decorated with gold leaf. The ceiling, with an elaborate and deep cornice, is salmon and gold. Ornamental metal lighting fixtures and balustrades show the conventionalized palm leaf and the masks of Comedy and Tragedy in their designs. Other decorative motifs include the laurel wreath, the lyre and trumpets, as used also on the exterior and in the auditorium itself. Broad stairways, with carpeting in a burnt orange tone, lead to a wide corridor that surrounds the foyer on three sides, on one of which it becomes part of a broader promenade through which the boxes are reached. On the same level one finds the women's lounge, with decorated, vaulted ceiling; the women's dressing rooms; the spacious quarters of the Opera Club, with luxurious carpets and hangings, oak-paneled walls and broad, brown leather chairs; and the men's rooms. On each of the other levels,—dress circle, first balcony and two floors of the second balcony,—there is a lobby promenade with drinking fountain and men's and women's lounging rooms.

The auditorium, lavishly decorated in the salmon and gold scheme used in varying degrees throughout the building, succeeds in focusing attention on the stage, the eye being drawn stageward by means of a series of panels and lines leading in that direction. The effect is heightened by the unusual treatment of the proscenium arch, which like a deep, gold frame serves as the setting for a painting which decorates the 35 x 55-foot steel curtain. This painting by Jules Guerin, representing a pageant of characters from a number of operas, carries out the general color scheme, and according to the artist and the architect was planned as the fourth wall of the auditorium rather than as an independent decoration. Painted on canvas and applied to the steel curtain, this mural serves both to beautify and to safeguard the auditorium. It is surprising that this decorative method of meeting fire laws apparently has not been used before. The lower part of the auditorium is paneled in oak, above which are velour-hung niches. The ceiling consists of decorative, horizontal panels which step back and up from the proscenium arch, separated by concealed openings for light and ventilation. An unusually wide and deep orchestra pit will accommodate 120 musicians on a platform which may be raised or lowered by electrical apparatus. The proscenium arch on either side of the orchestra pit consists of ornamental plaster organ grilles, so that the organ music may be blended with that of the orchestra.

The floor plan of the auditorium is considerably broader at the rear than at the stage, this plan having been adopted to assure a full view of the stage from every seat. The idea of securing good vision governed also in the first and second balconies, from the very last rows of which patrons have excellent views and audibility. Built on the theory "that those who come to the opera want to look at the stage and not at each other," the opera's famous "diamond horseshoe" was eliminated, reducing the number of boxes from the 56 of the old Auditorium to 31—17 front and 14 back boxes, richly upholstered in salmon velour and equipped with brocaded arm chairs in a similar hue. The box tiers are behind the main body of the orchestra seats. Arranged in five sections, with ample space between the rows, the orchestra seats, numbering 1682, meet every demand for comfort with large, deeply upholstered arm chairs covered in rose colored velour. Seats in the dress circle and the balconies are just as comfortable and are similarly upholstered. In the pitch of the second balcony a great improvement over other similar auditoriums or theaters is apparent.

Although the Opera House seats a total of 3,471, only 113 less than the old Auditorium, there is a feeling of intimacy about it that is seldom had in a large auditorium. According to Mr. Guerin, who had charge of the entire color scheme for the building, this effect has been attained largely through the intentional constant raising of the scale of the detail and the blendings of rose and gold without any abrupt transitions. Incidentally, the artist's part in the interior decoration represents the most complete coöperation between artist and architect, in that the colors of all carpets, upholstery fabrics, walls and ornament, as well as all decorative painting were chosen in accordance with the artist's scheme.

The five requisites which the architects were asked to provide for the new Opera House included safety, good acoustics, good vision, comfortable seats, and pleasant surroundings. The building of the fire escapes in large spaces provided between the fireproof walls of the main building and the walls of the Opera House unit, illustrates the provision made for safety. No fire can reach the escape stairways, and the open spaces likewise serve to eliminate street noises from the auditorium. Comfortable and attractive dressing rooms, well lighted and ventilated, with private baths are provided for principals and choruses, dressing room No. 1, for the use of the prima donna, having a connecting reception room.

Similar to the Opera House in its appointments, its dressing room facilities and its modern stage equipment, only on a smaller scale, is the Civic Theater which occupies the Washington Street wing of the building. With a seating capacity of 878, this theater was especially designed for experimental or intimate types of productions. Its stage is seven stories in height. The stepped-up auditorium ceiling provides space between the fourth and eighth floor levels for coaching rooms, storage, and orchestra and chorus rehearsal rooms. Ample storage area is available in the basement and mezzanine-basement, the latter having access to the shipping dock. An important sub-station of the Commonwealth Edison Company is situated in the basement.

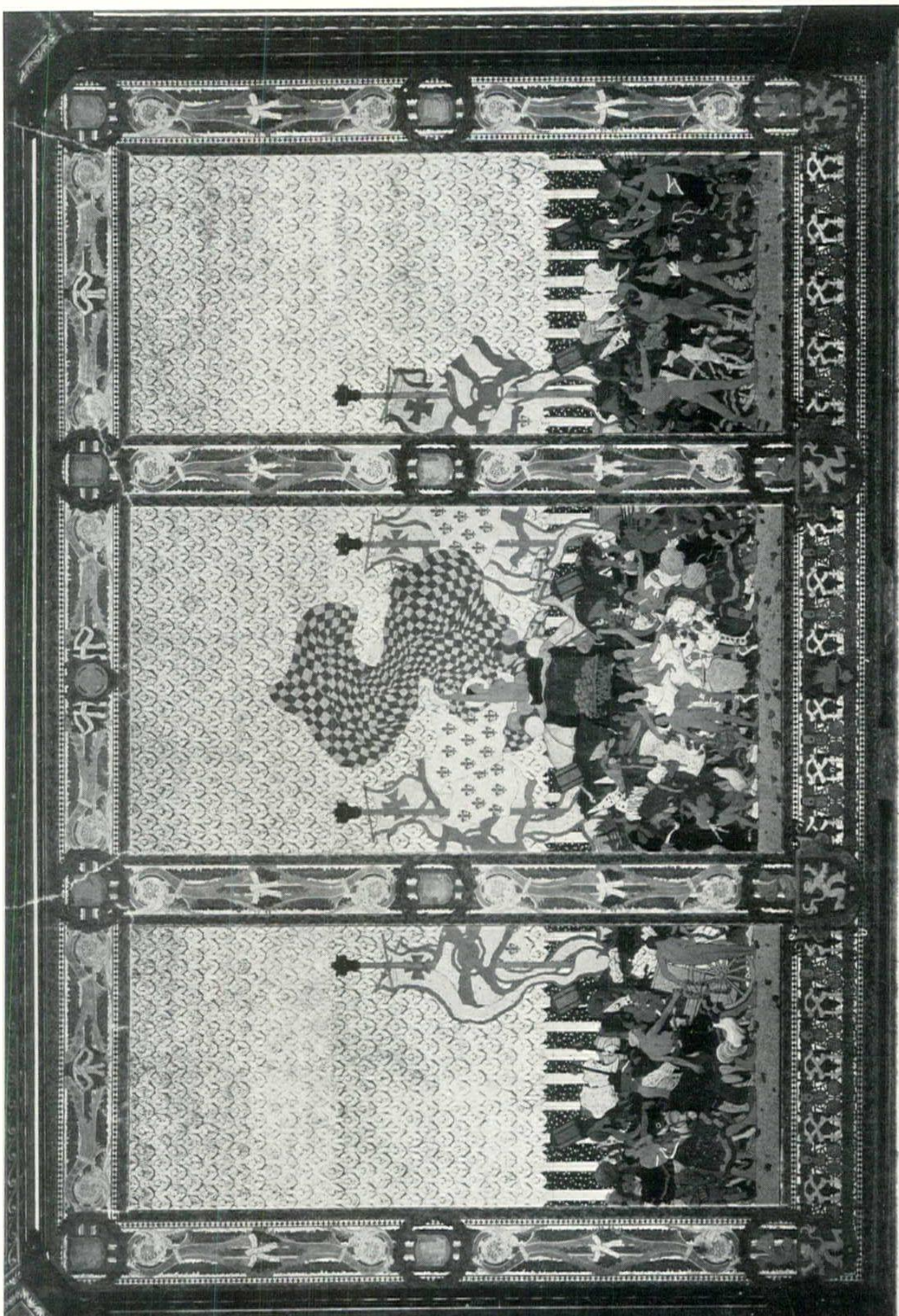
The rentable area of the structure commences on the third floor in the main tower and on the fourth and fifth floors of the Madison and Washington Street wings respectively, all the space above the seventh floor of this U-shaped building and all the space in the tower above it being utilized for offices, outside rooms entirely with unusually liberal daylight provision for the tenants.

Terra cotta was used for the decorative belt courses on all facades of the building and for the ashlar facing between these courses; the ornamental features (masks, urns, etc.) and some ashlar on upper stories, practically all spandrels, as well as the brightly colored roof. Over 2,500 tons of terra cotta were used, which cover more than 33 per cent of the superficial area of the building.

The attention and ingenuity exercised to assure Chicago opera goers,—the occupant of the cheapest seat as well as the one of the most expensive location,—comfort, audibility and good vision in beautiful surroundings have been justified by the results. This building, which was planned, constructed and put into operation in 22 months after the project was approved, represents something of a record, too, particularly in view of the complicated nature of the structure which includes an opera house with its various dependencies, a huge, modern office building, a theater, an electric sub-station, a group of broadcasting studios, a club, quarters for a safe deposit company, and numbers of tenants with extensive requirements in the arrangement of their space. Thus, one does not hesitate to say that Chicago may rightfully boast of its new Civic Opera House Building as an achievement of significance.

Editor's Note. The unusually difficult engineering problems successfully solved in the construction of the Chicago Civic Opera Building are described at length in Part Two of this issue, as is also the problem of obtaining perfect acoustical conditions, which work was in charge of Professor Paul E. Sabine of Geneva, Ill., who has written for us an authoritative article on this subject. The description of the stage lighting system and the stage equipment will also be found in Part Two.

Upper Balcony of the Chicago Civic Opera House.
Graham, Anderson, Probst & White, Architects



Photos. Chicago Architectural Photographing Co.

DECORATED CURTAIN, DESIGNED AND PAINTED BY JULES GUERIN
FOR THE CHICAGO CIVIC OPERA HOUSE
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

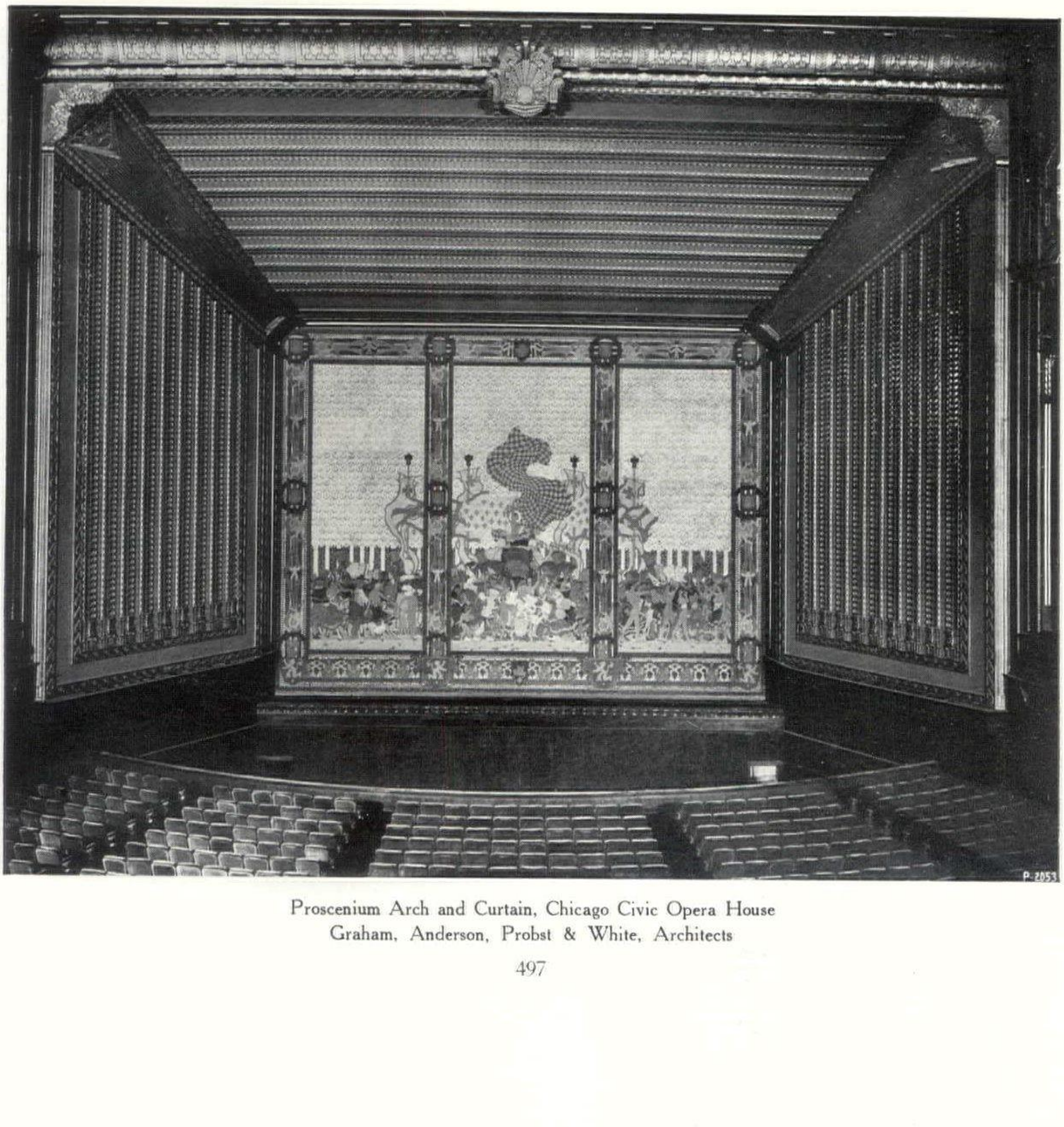
THE COLOR AND THE CURTAIN

CHICAGO CIVIC OPERA HOUSE

AN extremely wise choice was made when Jules Guerin was selected to collaborate with the architects, Graham, Anderson, Probst & White, to determine the color scheme of the Chicago Civic Opera House and the Chicago Civic Theater. It is fortunate also that this leading painter and colorist was chosen to paint the curtain in order that the interior of the Civic Opera House might be a harmonious whole. One notes the warmth and richness of color on entering the high-ceilinged foyer with its gracefully pilastered piers of travertine. The colors are warm and rich,—orange, vermilion and gold; these are the dominant colors throughout the entire Opera House. The light warmth of the travertine enhances the effect of the rich color. The American travertine is admirable in texture for the purposes of this interior. In some cases, where it was felt that the natural markings in the stone were too evident, portions were filled with a special cement mixed with ground travertine in order that the color might be the same.

The auditorium is a symphony in delicate nuances of vermilion and orange, with the added richness of the lavish use of gold leaf where it is most effective. This lavishness, however, is never overdone, and Mr. Guerin has secured an atmosphere of richness where another might easily have made the auditorium gaudy. Each color for every purpose was chosen with that color sense which is one of this artist's rare gifts. He selected the fabrics and colors and had the fabrics dyed especially in order that they might be of the exact hue and tone desired. Incidentally, it is interesting to know that all of the fabrics were fireproofed without in any way affecting either their color or texture.

To Mr. Guerin, the curtain enframed by the proscenium is logically the fourth wall of an auditorium. With the attention of the audience



Proscenium Arch and Curtain, Chicago Civic Opera House
Graham, Anderson, Probst & White, Architects

naturally directed toward the curtain, it becomes the important focal point of the entire decorative scheme. Sensing the character of the architecture with its side wall and ceiling panels, Mr. Guerin added to this effect by dividing the curtain subtly into three panels. The setting of the curtain is a rich enframement unusual in its size and effectiveness as it leads back from the edge of the orchestra pit to the footlights. In the richness of line, color and tone it is an excellent frame for the spirited curtain,—far more effective than the ordinary proscenium arch flanked with boxes.

The spirit of the curtain is that of high carnival. A gay procession is on its way early in the night,—stars are seen through the tree trunks against the dark blue sky beyond. The trees bear leaves of gold in rich pattern, forming the upper background of the curtain; festive standards of emerald green with gold caps carry waving banners and pennants which are gray, as a foil for the gay colors. The fleur de lis of the flags are a painted gold,—not the toned gold leaf of the foliage background. The central figure waves a great checkered cloth of orange and vermilion above her head, and one of the balloons forms a setting or background for her profile and dark hair, as she rides one of the camels at the center of the procession. Surrounding her is the crowd of merrymakers with all the accessories that make for gaiety,—drums and trumpets and clanging cymbals. Baskets of fruit and grapes are being taken along, and wine will flow, too, for there are bottles of Chianti in the crowd. Everyone is entering into the spirit of the occasion,—children joining in the throng,—even the fowls strut along with the procession. One sees Pagliacci with his whitened face and ruche; Madame Butterfly is there, too,—and Carmen,—and two dancers pause to pirouette in the center. All are going somewhere for a night of revelry; all face in the same direction,—with the single exception of the girl at the extreme right who beckons on the procession.

The figures are approximately life size or possibly slightly larger, and are carefully drawn in outline and painted in flat colors with practically no modeling. The flesh tones are treated in orange in key with the warmth of the entire curtain. The costumes and accessories are in blues and greens which relieve, emphasize and enliven the entire composition,—the organ in the first panel, for instance, being an emerald green; the clown in vermilion.

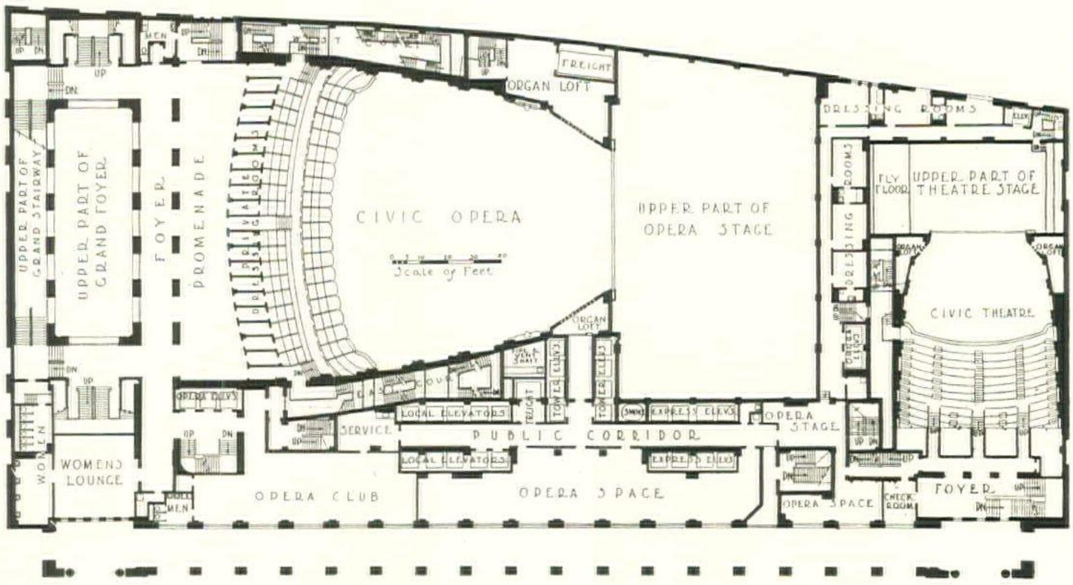
The enframing borders of the three panels into which the composition is divided carry out in conventionalized design the romantic quality of the curtain, the scrolls and swags, masks and ribbons, being carefully studied to enhance the effect of the whole without attracting undue attention to themselves,—giving the effect of a tapestry border. The curtain was painted in the studio and then mounted in place on the steel curtain which was very carefully prepared and which made an excellent surface for the mounting of the painting. The curtain, bathed in orange light, enlivens the imagination of the audience and stimulates its expectation, thereby heightening the enjoyment of the opera it serves to introduce. The gaiety and carnival spirit of the curtain provide the first joy of a night at the Civic Opera.

CHICAGO CIVIC OPERA BUILDING

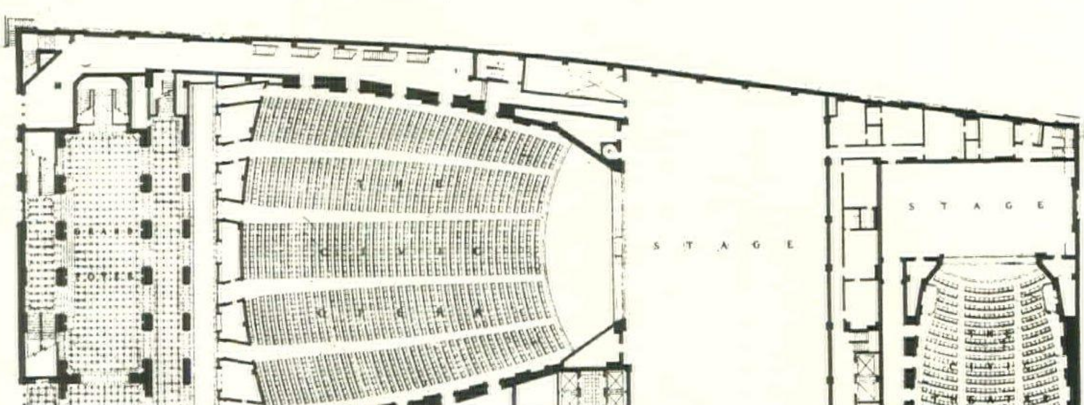
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

Photos: Chicago Architectural Photographing Co.

ONE OF THE ENTRANCES
TO THE OPERA HOUSE



SECOND FLOOR PLAN

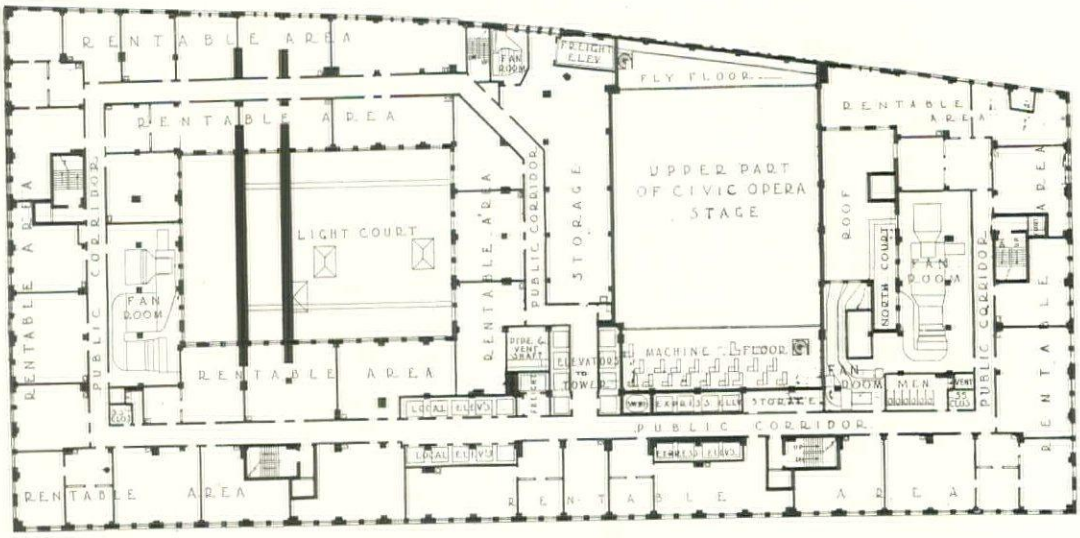


FIRST FLOOR PLAN

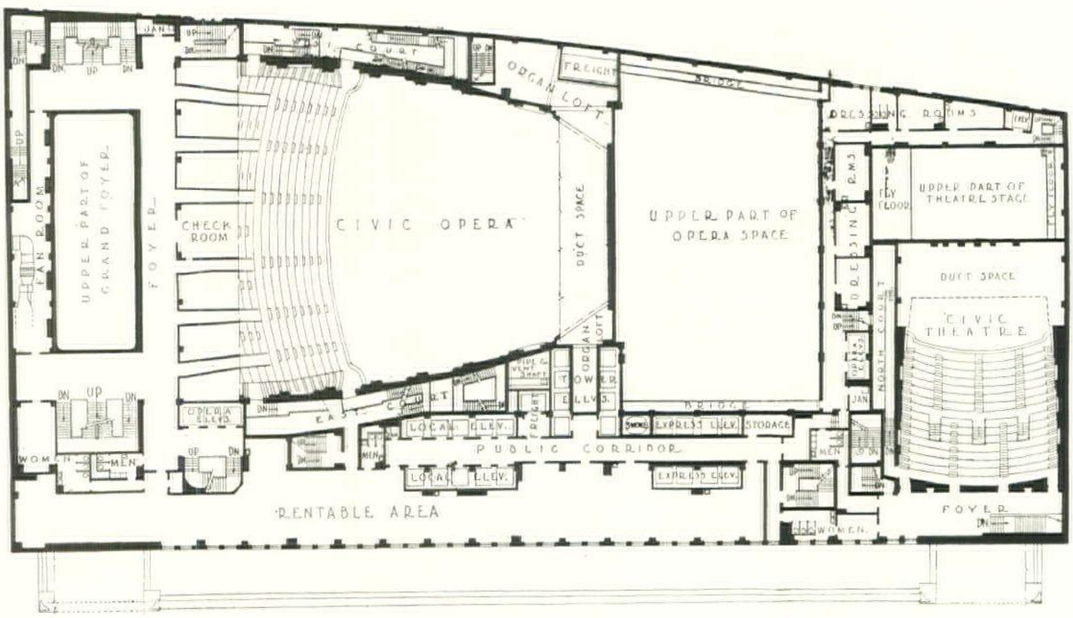
CHICAGO CIVIC OPERA BUILDING
GRAHAM, ANDERSON, PROBST & WHITE
ARCHITECTS

VIEW FROM THE WEST

CHICAGO CIVIC OPERA BUILDING
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS



FOURTH FLOOR PLAN



THIRD FLOOR PLAN

CHICAGO CIVIC OPERA BUILDING
GRAHAM, ANDERSON, PROBST & WHITE
ARCHITECTS

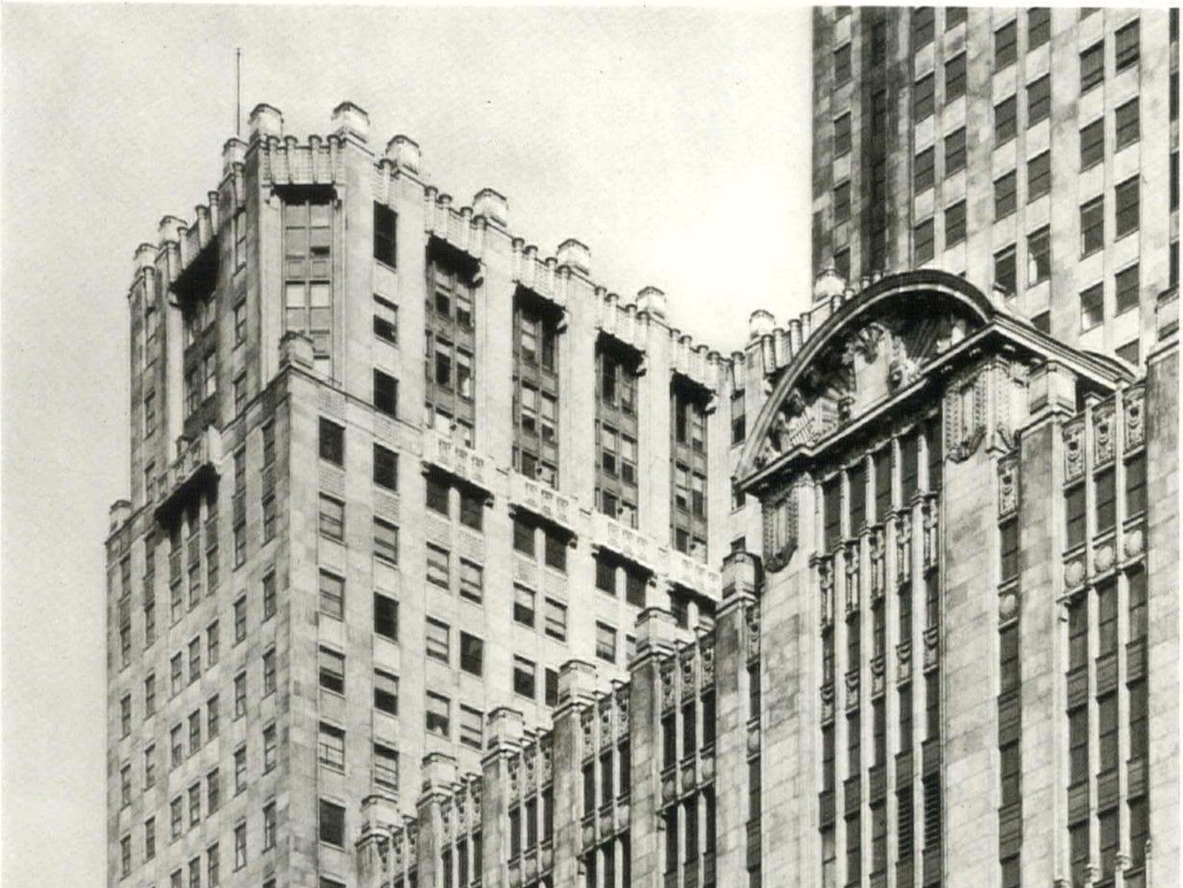
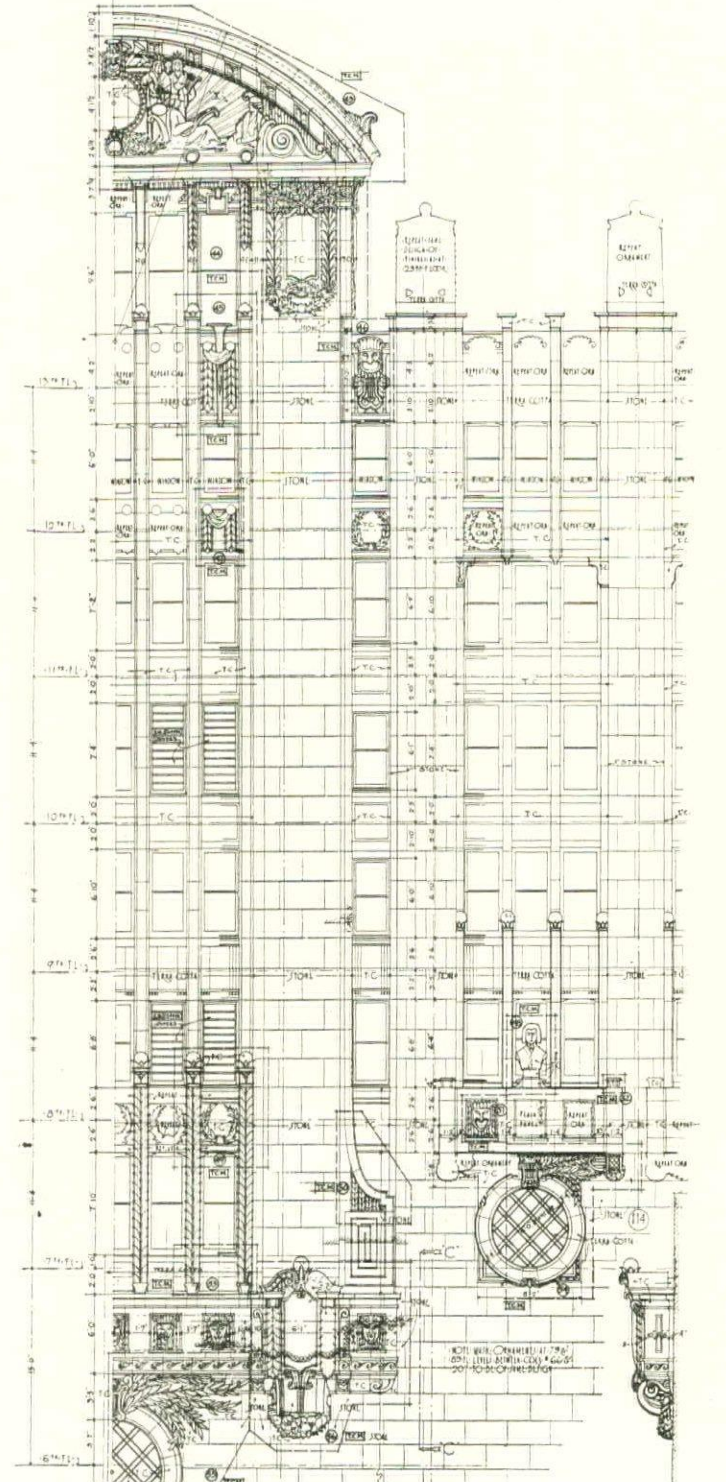


Photo. Trowbridge

DETAIL OF RIVER FACADE

CHICAGO CIVIC OPERA BUILDING
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

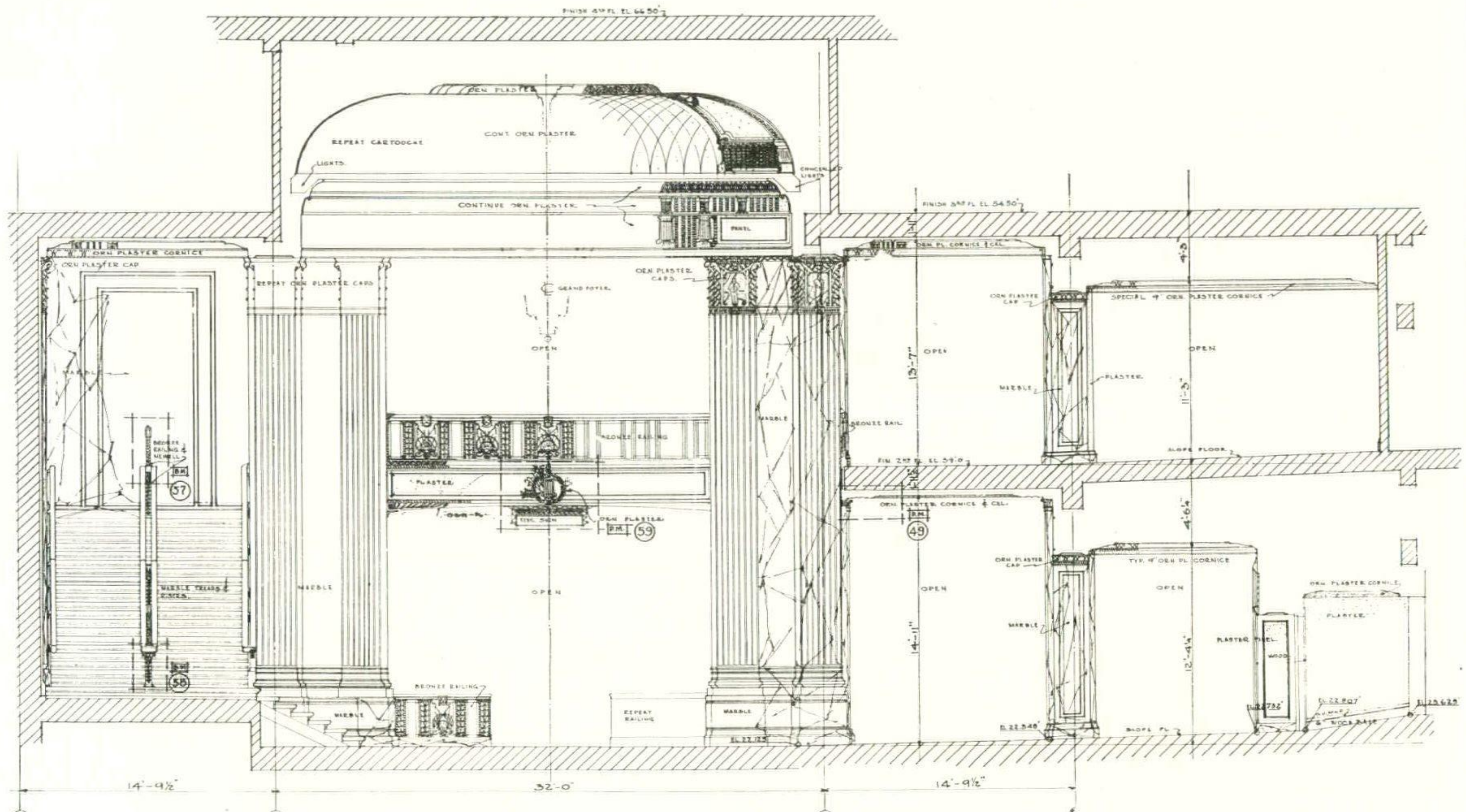


DETAIL OF RIVER FACADE

CHICAGO CIVIC OPERA BUILDING
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

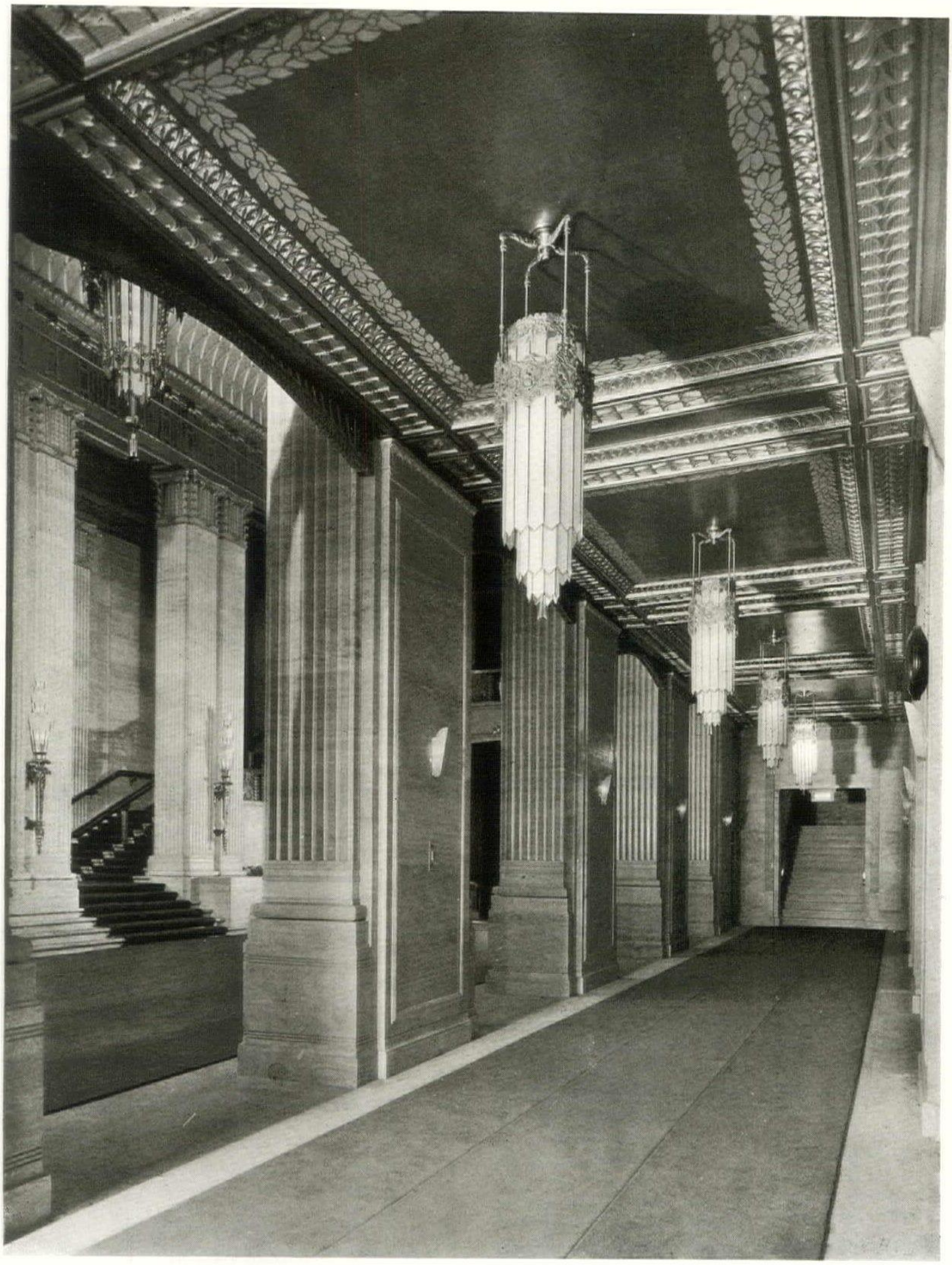
GRAND FOYER

CHICAGO CIVIC OPERA HOUSE
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS



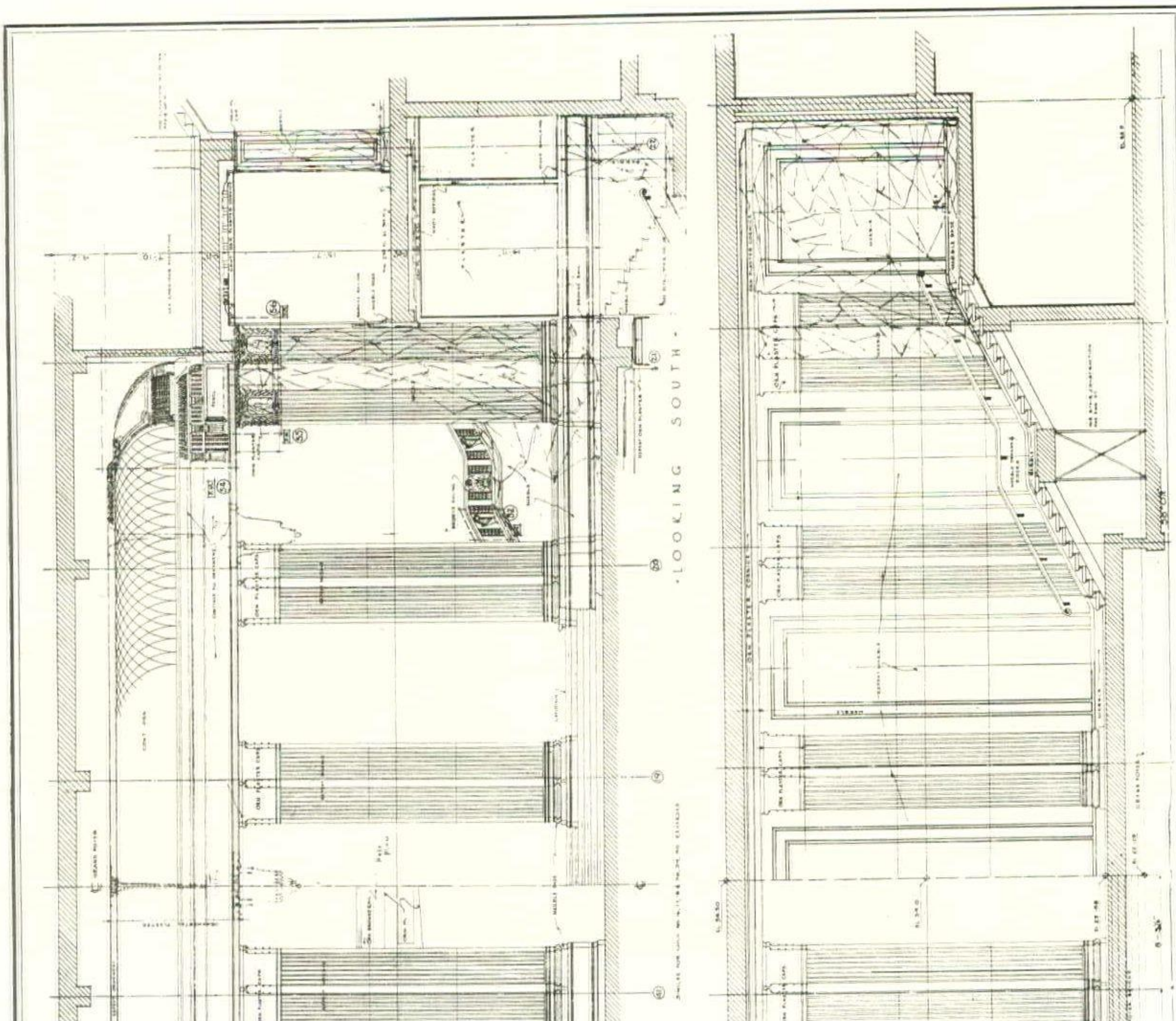
DETAIL, CROSS SECTION LOOKING WEST THROUGH GRAND FOYER

CHICAGO CIVIC OPERA HOUSE
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

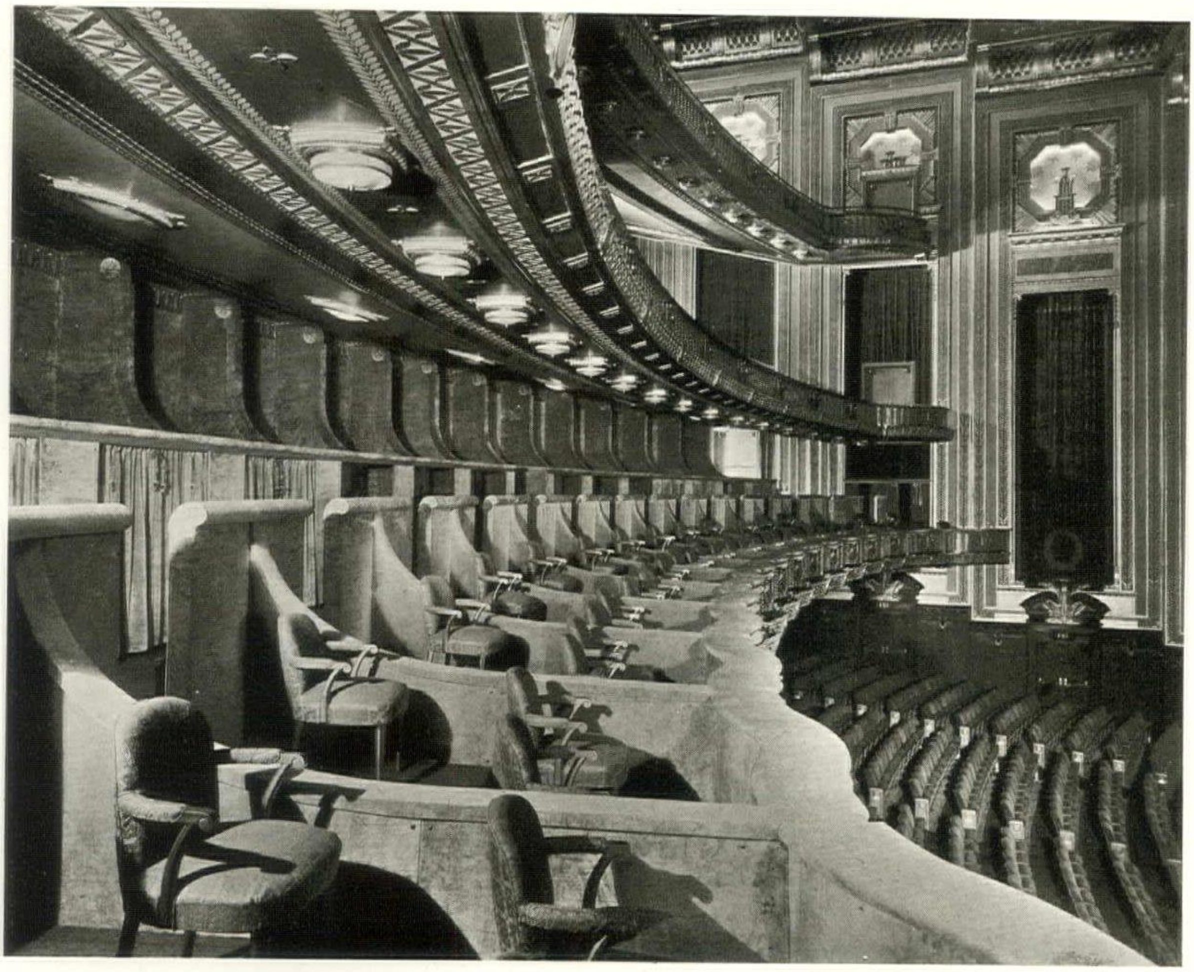


PORTION OF THE FOYER

CHICAGO CIVIC OPERA HOUSE
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

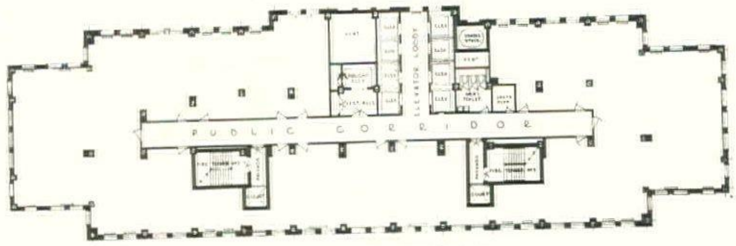


LONGITUDINAL SECTIONS THROUGH GRAND FOYER

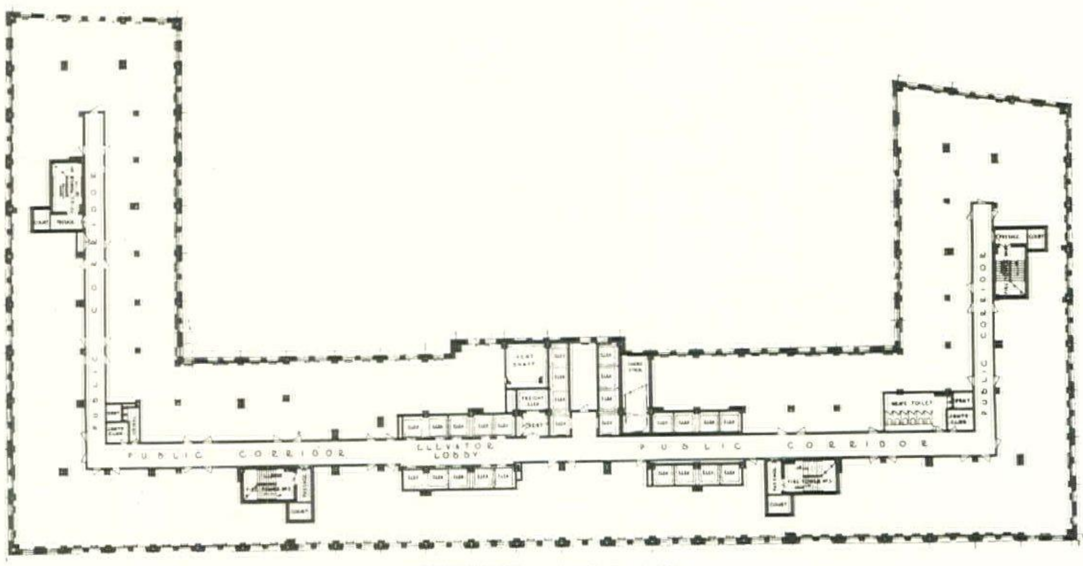


FIRST TIER BOXES

CHICAGO CIVIC OPERA HOUSE
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

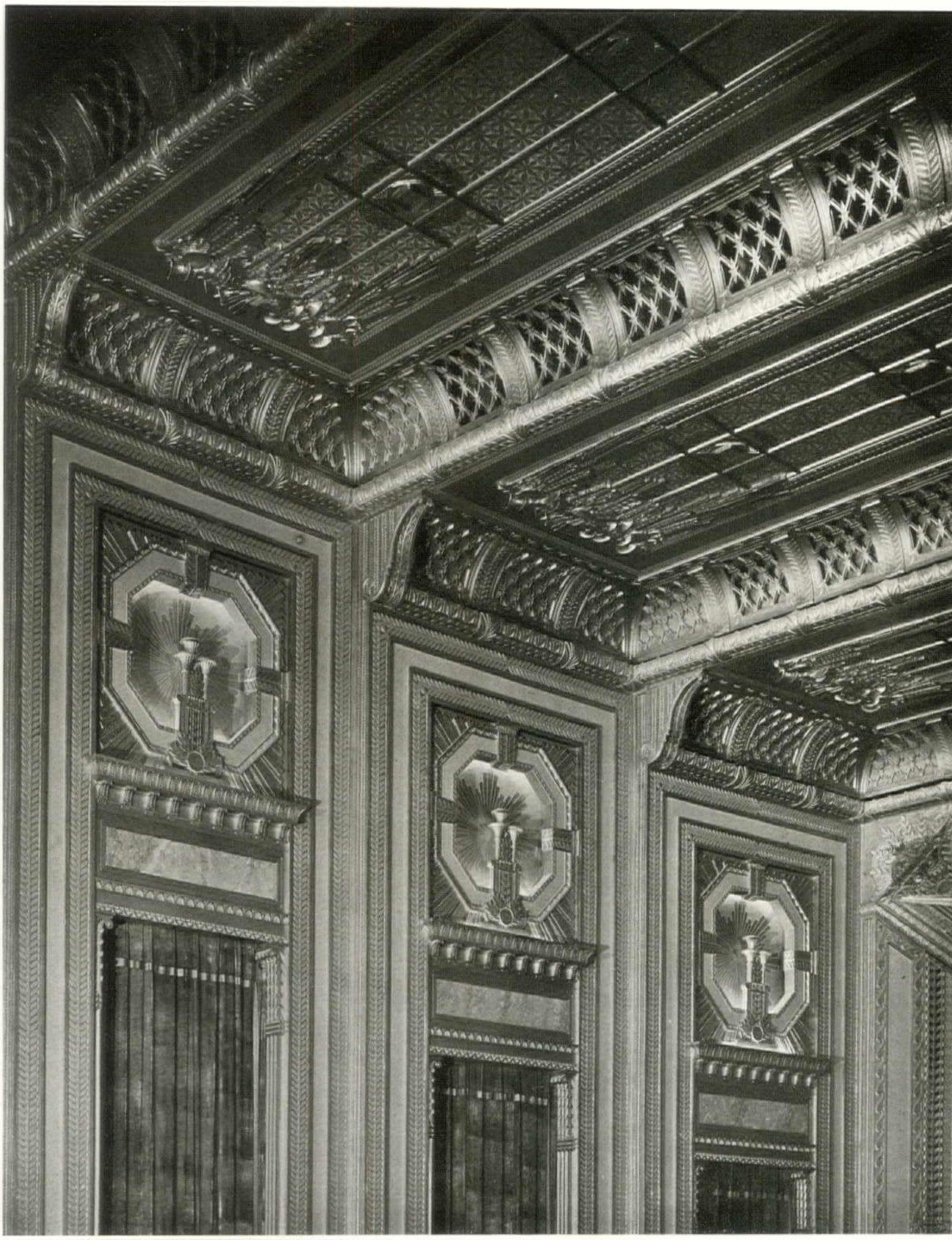


TWENTY-SIXTH FLOOR PLAN



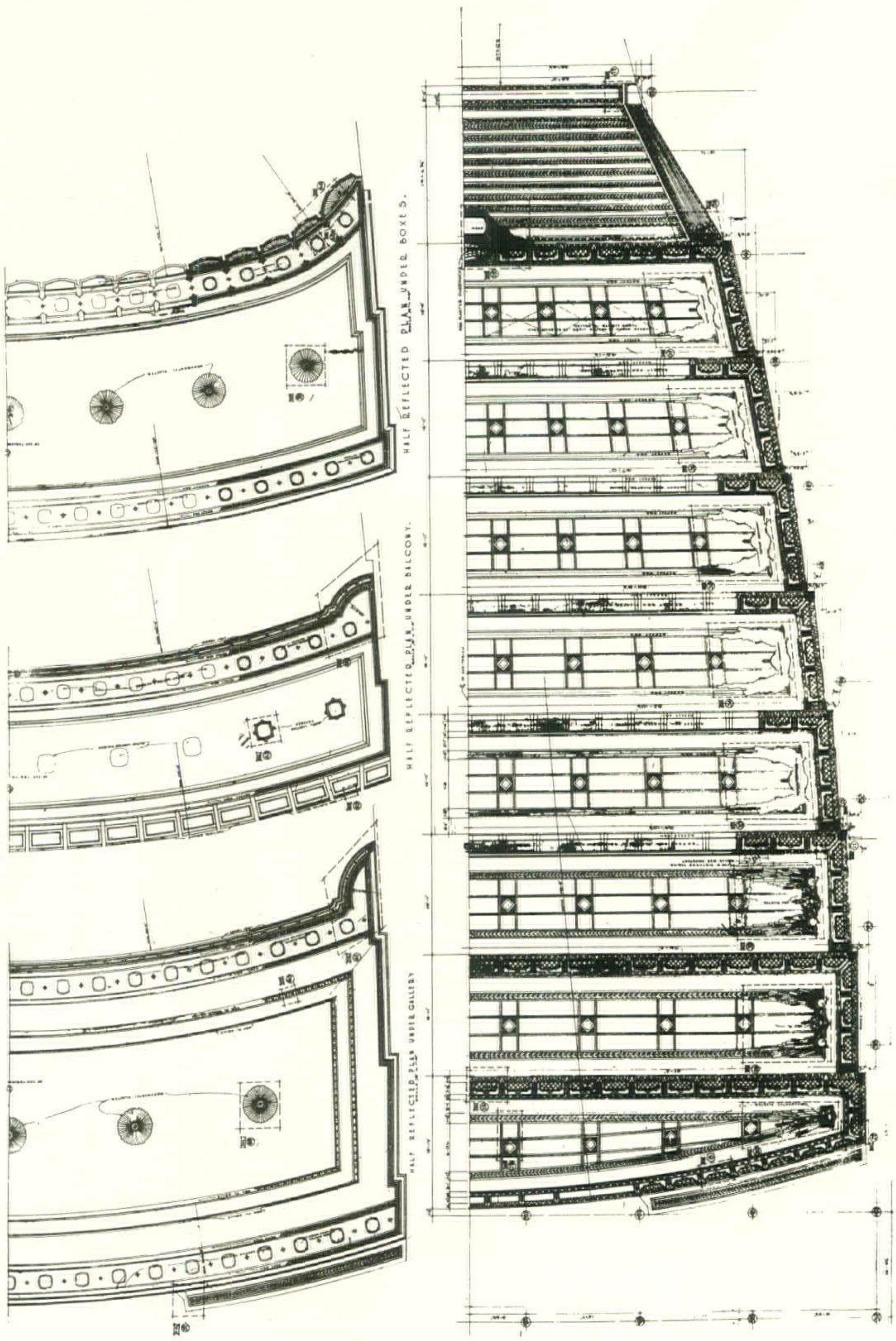
THIRTEENTH FLOOR PLAN

CHICAGO CIVIC OPERA BUILDING
GRAHAM, ANDERSON, PROBST & WHITE
ARCHITECTS



DETAIL, SIDE WALL TREATMENT

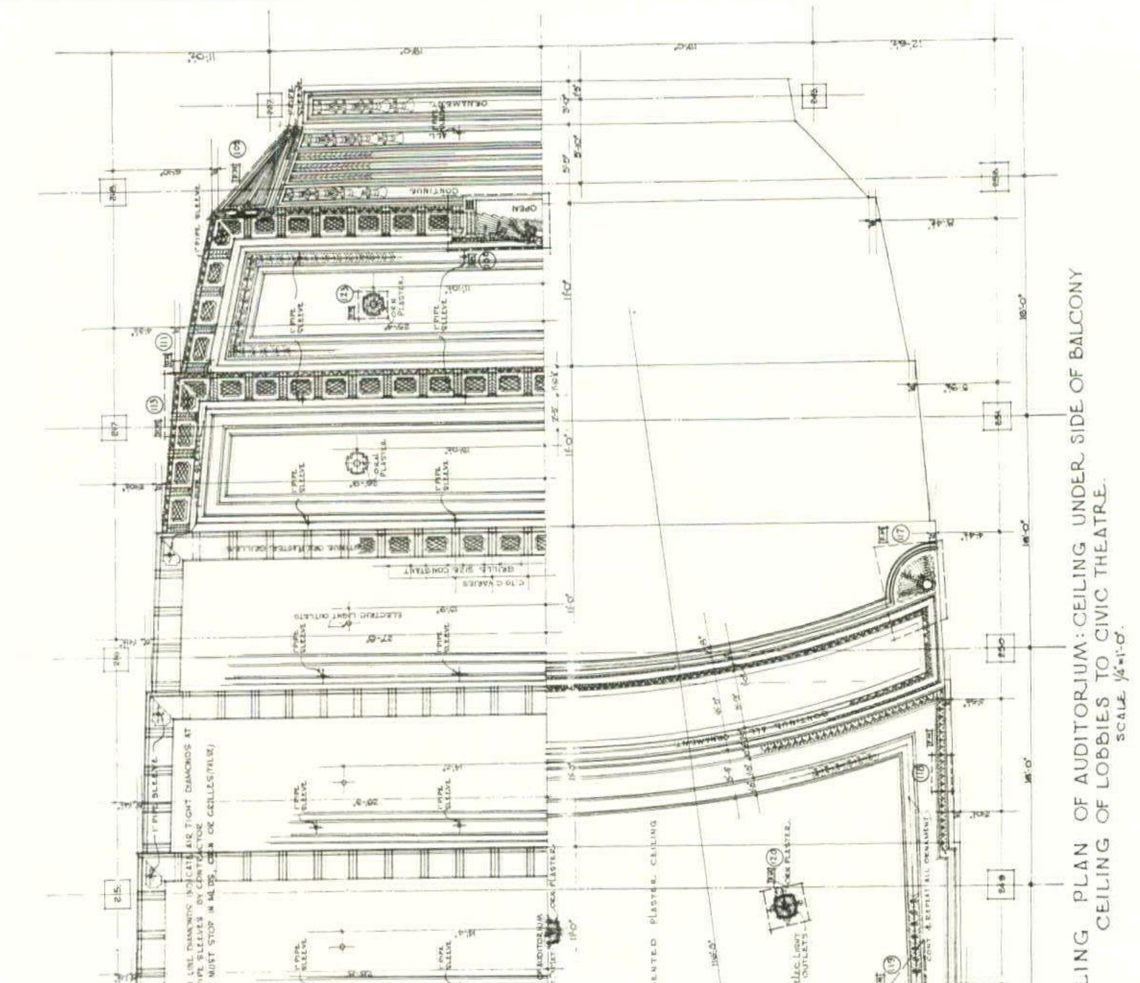
CHICAGO CIVIC OPERA HOUSE
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS



DETAILS, SHOWING VARIOUS CEILING PLANS

CHICAGO CIVIC OPERA HOUSE
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

CHICAGO CIVIC THEATER
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS



DETAIL, CEILING PLAN OF CIVIC THEATRE

CHICAGO CIVIC OPERA THEATRE
GRAHAM, ANDERSON, PROBST & WHITE,
ARCHITECTS

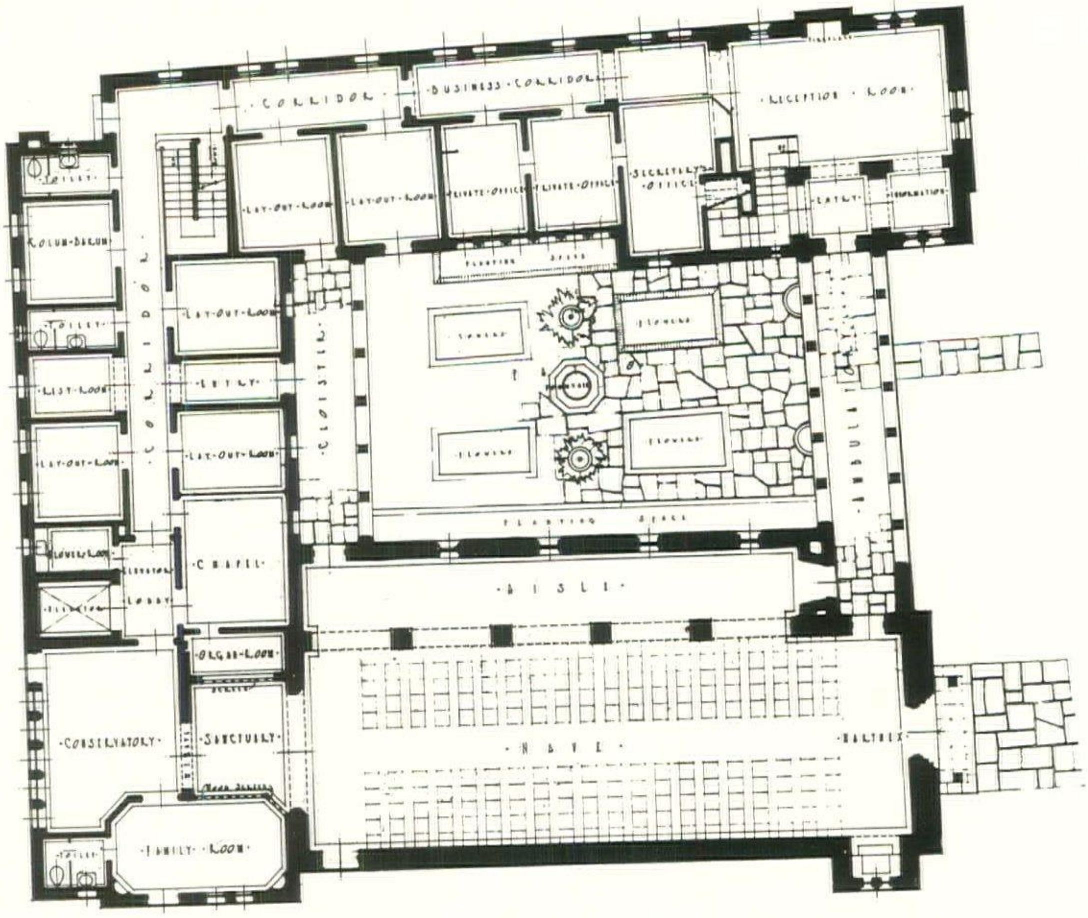
A SPANISH CHAPEL IN CALIFORNIA

Photos, George Haight

FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT LONG BEACH, CAL. HUGH R. DAVIES, ARCHITECT

ARCADED CLOISTERS CONNECT
CHAPEL AND FUNERAL PARLORS

FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT
LONG BEACH, CAL. HUGH R. DAVIES, ARCHITECT

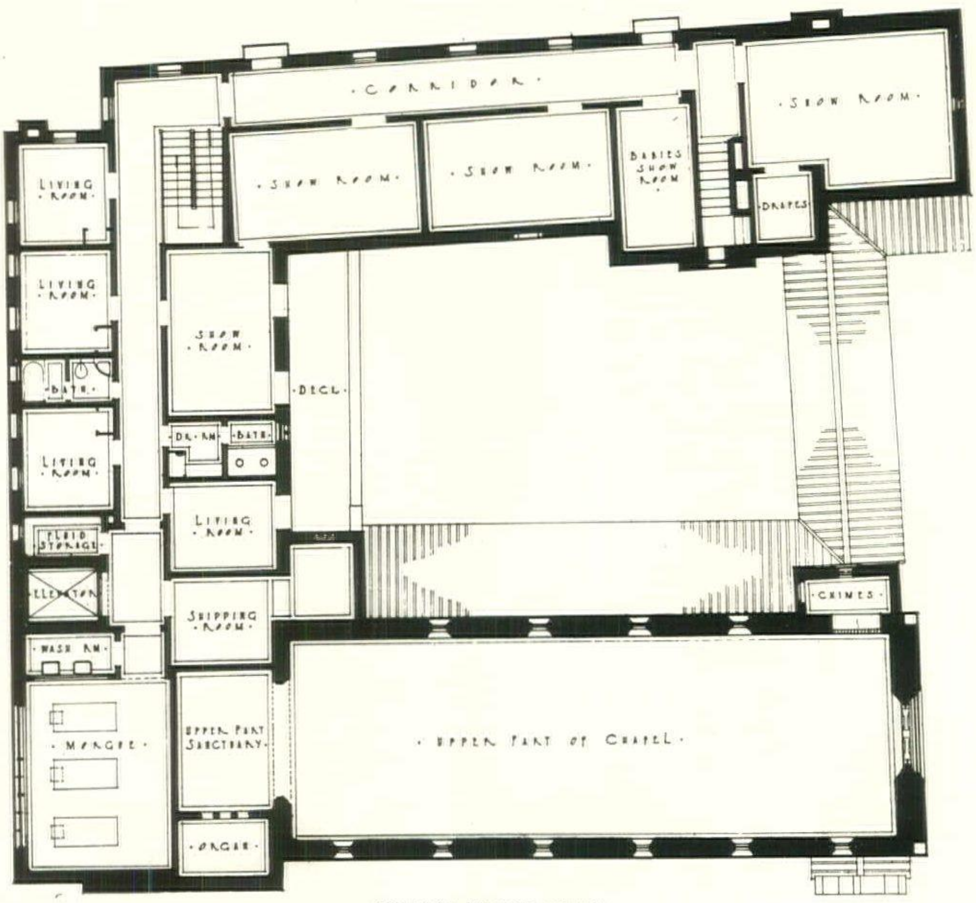


FIRST FLOOR PLAN

CHAPEL FOR J. J. MOTTELL, INC.
AT LONG BEACH, CAL.
HUGH R. DAVIES, ARCHITECT

THE TOWER

FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT
LONG BEACH, CAL. HUGH R. DAVIES, ARCHITECT



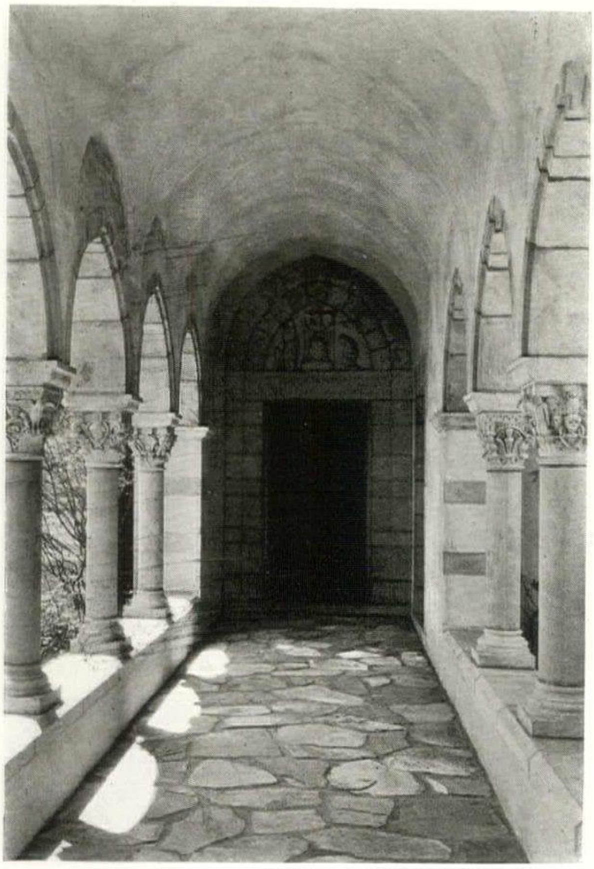
SECOND FLOOR PLAN

CHAPEL FOR J. J. MOTTELL, INC.
AT LONG BEACH, CAL.
HUGH R. DAVIES, ARCHITECT

THE PATIO FROM THE CLOISTER

FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT
LONG BEACH, CAL. HUGH R. DAVIES, ARCHITECT

THE AMBULATORY



SIDE ENTRANCE TO CHAPEL

FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT LONG BEACH, CAL. HUGH R. DAVIES, ARCHITECT

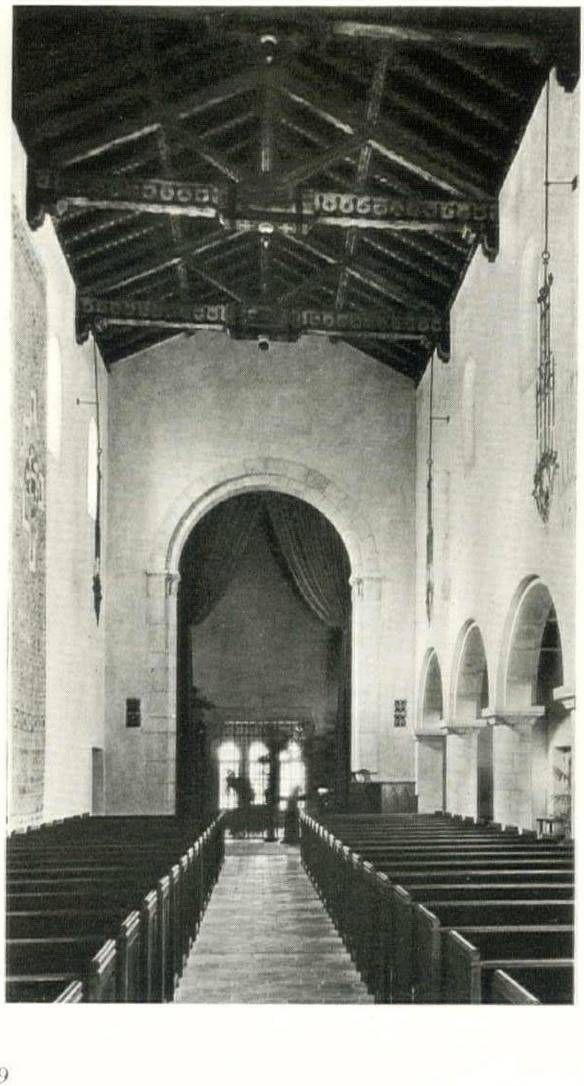
THE PATIO FROM THE AMBULATORY

FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT LONG BEACH, CALIFORNIA. HUGH R. DAVIES, ARCHITECT

ENTRANCE TO BUSINESS ROOMS

FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT LONG BEACH, CAL. HUGH R. DAVIES, ARCHITECT

(ABOVE) THE NAVE FROM THE SANCTUARY. (BELOW) VIEW OF CHAPEL WITH THE SANCTUARY BEYOND



FUNERAL CHAPEL FOR J. J. MOTTELL, INC., AT LONG BEACH, CAL. HUGH R. DAVIES, ARCHITECT

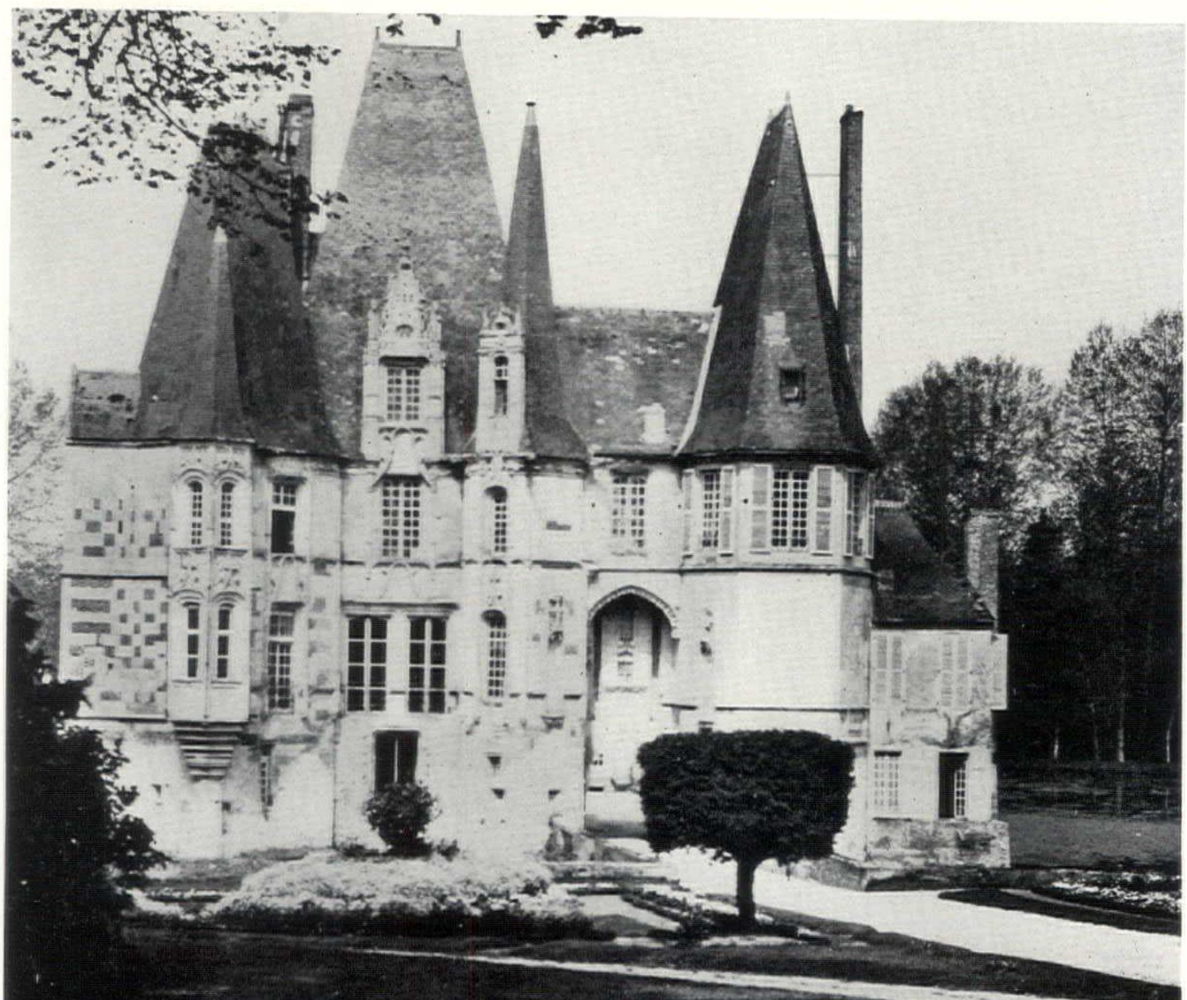
CHATEAU D'O, NEAR MORTREE

TEXT, PHOTOGRAPHS AND DRAWINGS BY

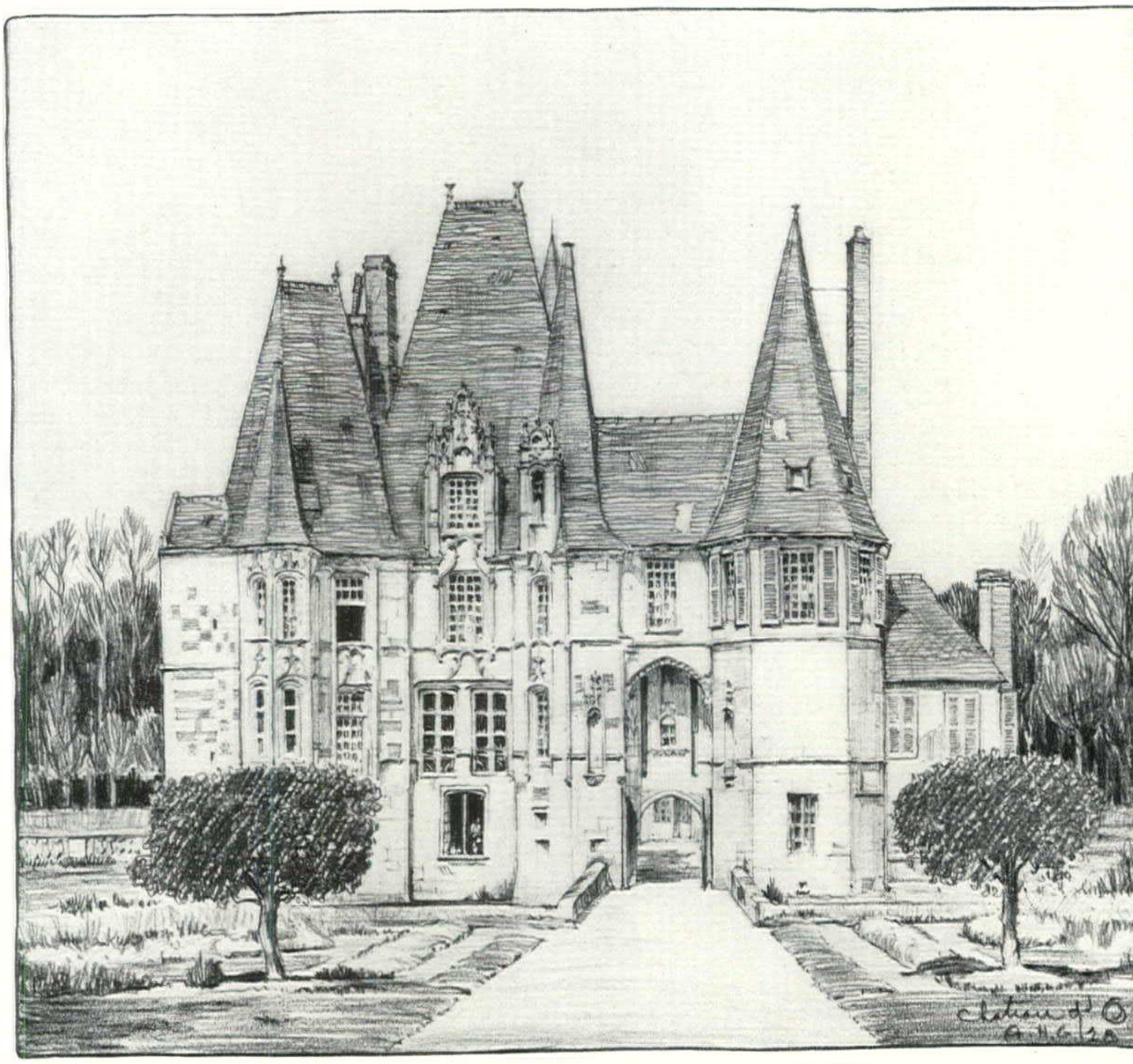
ARTHUR H. GILKISON

IN a second-hand car, piled high with luggage, sketching material and a dog, we set out for the byways, avoiding the highways of France, in search of small chateaux and manor houses. A car, no matter how insignificant, gives a sense of freedom from trains and schedules, porters and taxicabs and grants flexibility of movement that is unequaled by any other manner of touring. It would not be out of the way to add a word concerning the economy of motoring in this fashion. Twice I have bought cars on pilgrimages in France. Each time they were easily disposed of before sailing at a price which made their cost ridiculously small. I have heard friends recommend taking over a car, but if the trip is for three months or less, it is wiser to buy a new car abroad, since one can be bought and arrangements made with the factory to re-purchase within that time at about three hundred and fifty dollars less than cost price. Arrangements can be made for this in New York with the agency of one of the largest French auto manufacturers, and the car will be delivered at the boat pier ready for your arrival.

There is only one objection to motoring; that is speed. It seems to be human nature to want to go on and on, the faster the better. This is particularly true, if a definite goal is set for the day's journey. Try as one will, it is hard not to feel that one must hurry on; consequently the intervening towns are apt to be slighted. To overcome this, we found it best not to make a definite objective for the day, deciding where to stop for



The Old Chateau D'O, Near Mortree, in the Department of Orne



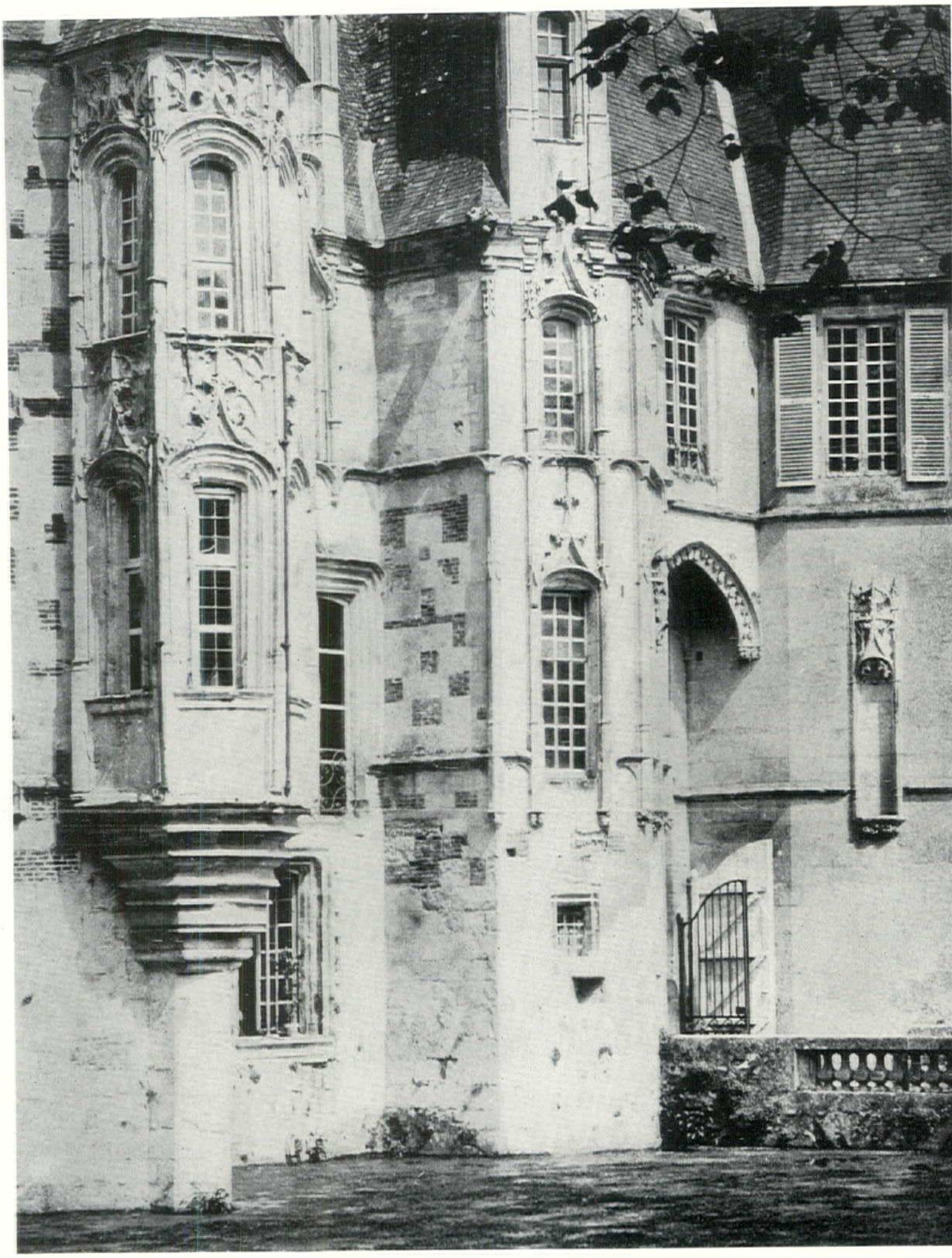
Front of Chateau D'O from a Pencil Sketch by Arthur H. Gilkison

the night only when the light began to fail. A town with a good inn can invariably be found within a short ride, for with few exceptions every French village has a small hotel with well cooked food and excellent wine. Also, should there be a chateau in the neighborhood, the inn keeper is more than willing to give the history and any details he may know concerning it. Then, too, motoring gives one a greater range in the choice of inns. If traveling on limited means, one can always go on if the prices seem exorbitant, as one soon learns not to unload the luggage until the terms are settled. Many of the smaller inns make no charge for garage space, but, if the car is small, they may park it in with the cow and the chickens. The more pretentious places usually charge about five or six francs for storing a small car, increasing the rate with the horse power and general magnificence. It was on one of our scouting trips that we stumbled on one of the most charming of small chateaux, the Chateau d'O. It is located slightly over one hundred miles away from and almost directly west of Paris, in the department of the Orne, on the outskirts of the village of Mortree. Baedeker gives it only one line, but calls it a "magnificent edifice of the Renaissance," and truly it is deserving of more space from Mr. Baedeker. Built in 1505, by Charles d'O and his wife Louise, on the remnant of an older feudal castle and passing through various periods of restoration, particularly that of 1770, in which the east facade was so unfortunately altered that it is scarely recognizable as part of the original building, it still retains its early charm and gives one, here in its quiet situation remote from guides and bus-loads of persistent tourists, a much better conception of the great homes of the period, than the large museum-

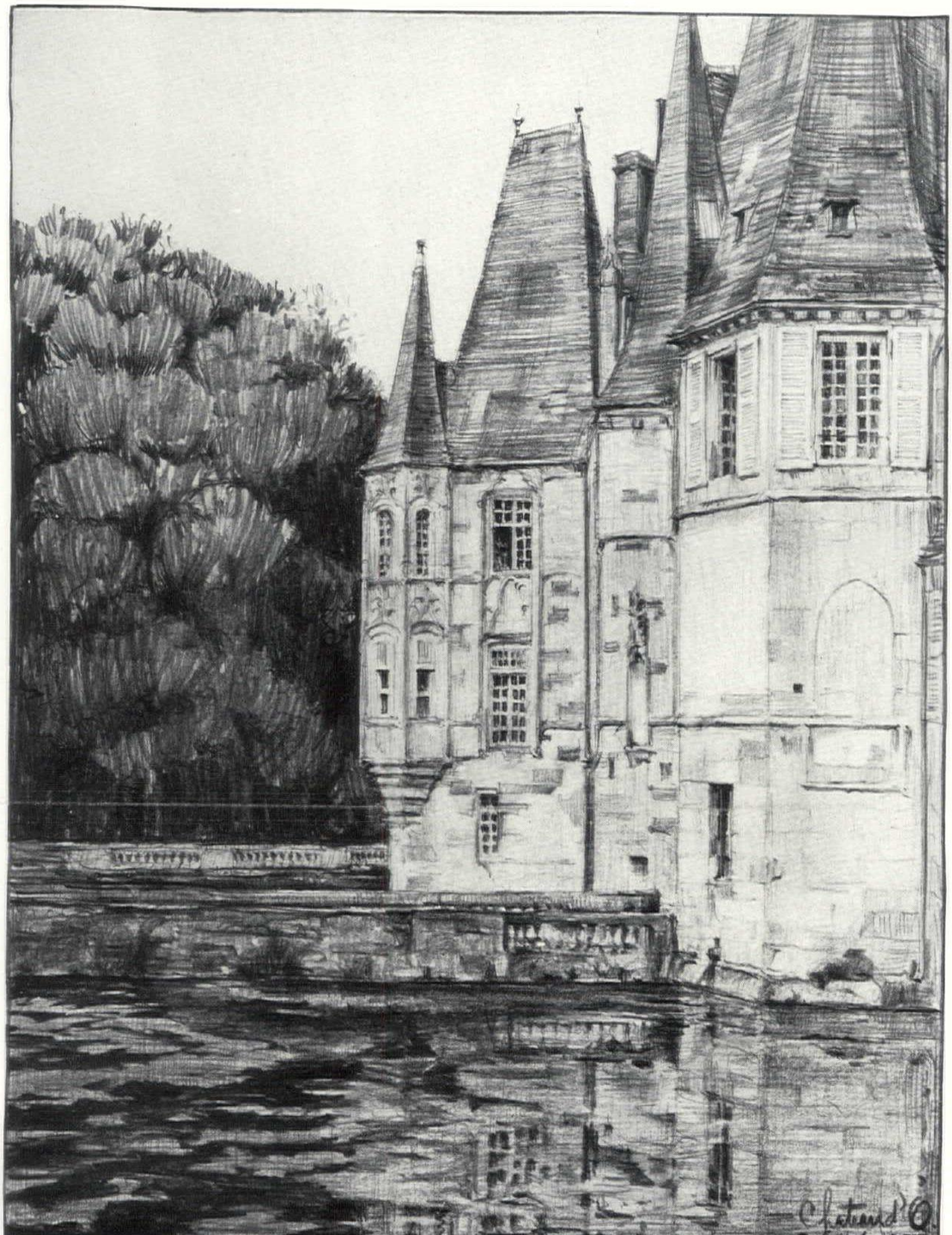
Side Elevation from Across the Moat

like chateaux of the Loire Valley, one hundred miles southward. The famous or shall we say infamous grandson of Charles d'O, that Francois d'O, who appears as one of the butchers of St. Bartholomew's Eve, was at one time its notorious owner. Mignon of Henry III, he figures in French history as Governor of Paris, Minister of Finance, first treasurer of Henry IV and an all around villain. It is probable that a portion of the public funds, which he freely appropriated for his own use, were spent in beautifying his chateau.

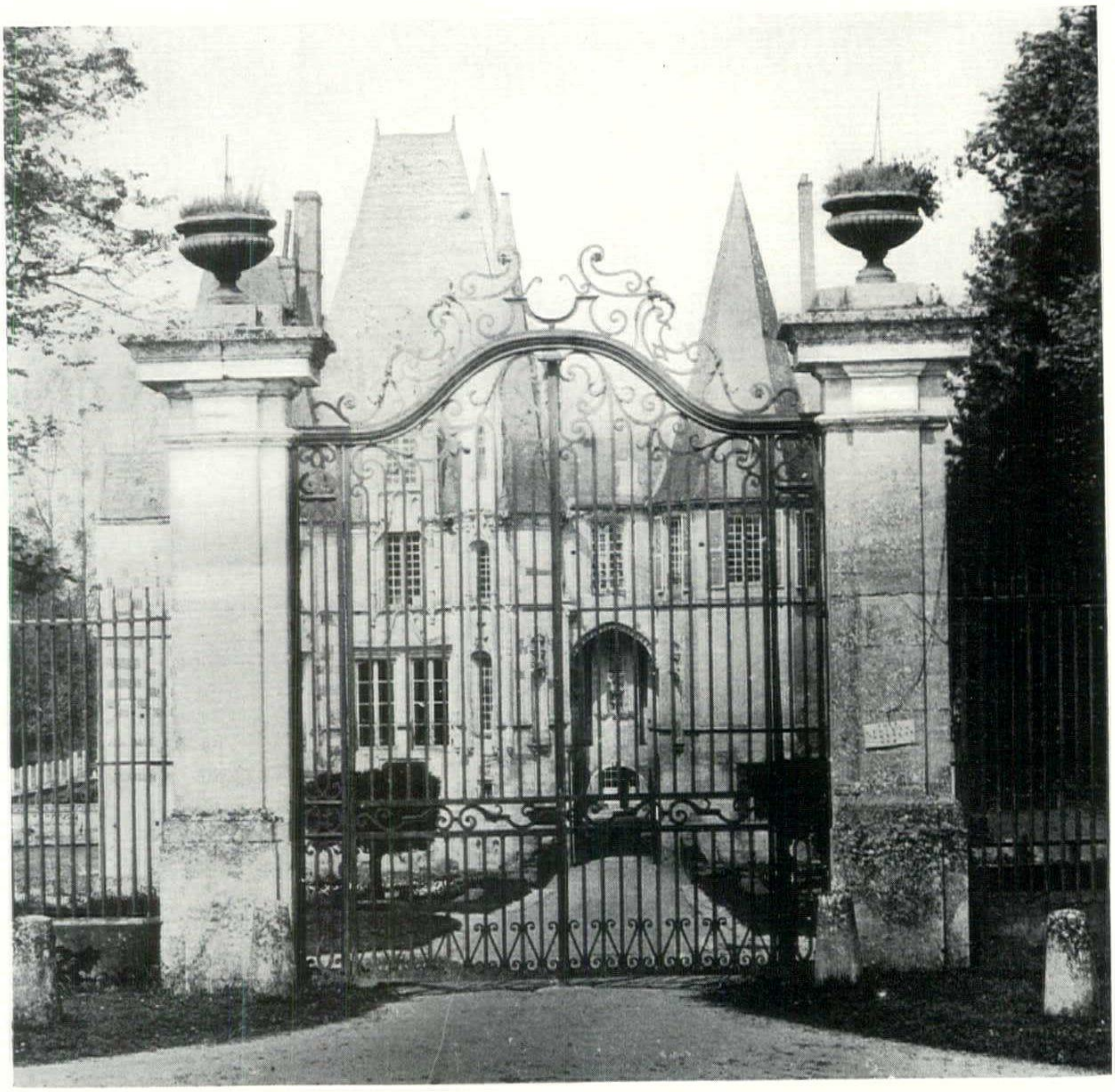
So much we learn from history; legend adds to it, and tells of the room without a door. The story goes that Francois' young wife, Marie d'O, found too much comfort, spiritual and otherwise, in her religious adviser. One day the suspicious Francois met the cure leaving a room in the chapel. As the cure looked embarrassed, Francois demanded of him, whether there was anyone else in the room he had just left; the cure lying to save a lady's honor replied "No," whereupon Francois immediately ordered the doorway walled



DETAIL OF THE MAIN ENTRANCE
SHOWING TREATMENT OF WINDOWS



ENTRANCE, CHATEAU D'O, FROM A
PENCIL SKETCH BY ARTHUR H. GILKISON



Entrance Gates, Chateau D'O

up with the unfortunate Marie d'O inside. Be that as it may, Francois' sins did not remain entirely unpunished in his lifetime, for he died of a horrible disease in 1594, leaving Chateau d'O in the hands of the bailiff.

Comparatively small, as chateaux go, it is no larger than many of our own country houses. The old moat has been retained and broadens out into a small lake on the west side. There are two wings; the south, of an earlier date, still possesses a semi-fortified mediæval character, with the traditional slate-roofed circular towers of defense at the corners. The north wing I have illustrated here. These two wings are joined by a loggia, thus forming the three sides of a courtyard opening on the lake at the west. Being totally different in design, the wings give a curious effect, half castle, half mansion. The north wing has one of the most charming facades to be found on any of the French chateaux. Its high pitched roofs broken with richly ornamented dormers and tall chimneys, give it all the characteristic confusion, richness of sky line and picturesqueness of the period. Banister Fletcher tells us that the early French Renaissance is "a period of transition, in which Renaissance details were grafted on to Gothic forms." Here we have an excellent example of this period, with the small scale of the mouldings, the shell ornament on the dormers, the Gothic feeling of the design, the high pitched roofs and general vertical treatment, all showing the transition from Gothic to Renaissance. Built of light colored, dressed stone, a pleasing interpolation of brickwork is used with sufficient restraint to give a necessary intimate domestic quality lacking in some of the more famous chateaux. After being unoccupied for years, the chateau is now the residence of the family of General d'Aubigny.

A VENETIAN VILLA IN TEXAS

WILLIAM McKNIGHT BOWMAN, ARCHITECT

TEXT BY
EDMUND B. GILCHRIST

IN a day when there seems to be almost undue pressure to be original in our creations; when the normal creative desire is so likely to be harried and hurried to the point of becoming a struggle rather than a pleasure; when minds commence to have the habit of thinking in grooves immeasurably more restricted in their chosen way than during almost any one of all the ample epochs of unified design that have gone before, it is reassuring to come upon an architect who goes the pleasant pace, unhurried and self reliant,—one who obviously, to judge by the accompanying illustrations and plans, has affection and understanding for all that Italy has ever said to him and which he now tempers so well with his own touch.

The plan of this house in the Venetian manner, taking it as a whole, embracing the entire plot, has been worked into nicely balanced and well organized parts. As is true of all good plans, it is rational and organized. It is evident that the author has conceived his problem as starting at the very edges of the property and, working inwards, has solved the necessities of the house itself only as a *part* of the entire scheme. The questionable American tradition, that of building a house on the line of the proverbial backset from the street,—establishing a main and a service entrance, placing a garage and clothes yard where they are inconspicuous, and then scattering the shapeless grounds with meaningless masses of deciduous shrubs and conifers, was decidedly not considered here. Here there is good planning,—every element of the program is turned to effective account and made to play an important part in rounding out the whole. The elements of the program in the average American house problem are all too few to omit any of them from the category of effective architectural capital. The plan of the house should be an incident in the plan of the grounds. Before asking whether or no our ground plans are good, one should first ask—*is* there such a plan? How many plans and sumptuous presentations we see for large houses with hardly a line to indicate that the author has been thinking of the grounds, or the general aspect of the whole scheme, together with the plan of the building. These things cannot be thought of separately with any more success than were one to complete the first floor plan of a building before giving any thought to that of the second.

Without pointing directly to any of the many simple effective and unusual conceptions in the plan of this house itself, all of which are obvious to one who will study and compare it with the illustrations, it is clearly a plan that has the beauty of simple organization and smooth outline. It is a plan that one can pass through without question or explanation, and at no point is there the effort to squeeze more into it than it will hold. The elevations are the direct reflection of a good plan, —robust and gay, not overburdened with simplicity and restraint,—most openly, tastefully and skillfully accomplished in a manner perfectly in accord with its locale. The observation that time will do much toward giving surface quality to this work is, as usual, both inevitable and true. Standing at the foot of the long axis at Villa d'Este last fall, and looking back, I wondered how it all must have seemed immediately following its completion. I fear the lay judgment of today would have been fairly severe with it! As for the interior, these illustrations speak with authority of enthusiasm and invention, a unique and sensitive touch, strength contrasted with delicacy and detail nicely related to mass. As beauty rarely seems to exist objectively but rather to be a quality brought to the work by the observer according to his own fancy, it would seem best to let the reader go his own quiet and unescorted way through these rooms.

To me there is no delight and stimulus on coming away from a work such as this quite so poignant as the impress, providing one is blessed with the gift of receiving it, that connects the work with the architect and makes it his alone. This quality appears without struggle, its source is purely personal, it is always original and generally beautiful. It flourishes only in the imaginative mind, and its very substance is called inspiration. It is in the light of this quality in Mr. Bowman's present work that I am drawn to it.

Notes by the Architect

THE house is composed, like so many Venetian houses, of a central gabled mass, which contains the large second floor salon or drawing room, flanked by slightly lower wings, and these in turn are extended by a sleeping porch pavilion on one side and a semi-attached garage on the other. The house is situated on the brow of a hill, so that in front there is an elevated terrace, while the opposite side opens on a level with the garden. The front terrace is reached by a flight of steps at each end, one for pedestrian approach, the other for those using automobiles. The house is built of brick covered with stucco. The trimming, balconies, balustrades, urns, etc., are of cast stone. The whole exterior is whitewashed over both stucco and stone. The blinds are green, and the roof tiles a pale clay color. Terrace pavings are of a soft salmon brick made locally. The *bambini* on the front terrace balustrade are antiques from Venice, of pure white Istrian stone. As in all houses in this part of Texas, the servants live in a separate building. This simplifies the plan problem and also provides another element in the design of a residence in the southwest. The servants' house has the same color scheme as the main building,—whitewashed walls, green shutters, and a tile roof. The garage and connecting archway provide a beautiful terrace above, opening off the library. This garage is not only an ornamental and integral part of the design but is also useful in providing the upper terrace. Part of this terrace will be shaded by grape vines on a trellis, while the outer portion will always be left open for enjoyment of the dazzling southern nights.

On entering the house one is immediately impressed by there being a sense of cool, shaded space. As in Italy, on the hottest days this house with its blinds closed is cool and delightful. The large entrance hall has for its chief decoration a patterned tile floor in yellow, black and white bands, with a black and white cartouche at the center. The walls are painted a grayish mauve, the base is marbleized verd antique, and the doors are veneered in walnut in a diamond pattern. Double doors at the left of the hall lead to the dining room, on the right to the guest room, and at the back to the breakfast room, where the doors are glazed in the upper parts.

The guest room opposite the dining room has a tile floor of gray, black, white, and two tones of buff. Its walls, trim and cornice are painted robin's egg blue, and curtains and bed spread are of the same color. The bedstead is an unusually fine old carved piece from a villa on Lake Como. The Venetian furniture is painted olive green with red decorations and has coverings of rose and ivory damask. The breakfast room has a floor of buff, mauve and white tiles. Its walls, trim, cornice and ceiling are white. At the windows hang antique taffeta curtains of a faded shell pink. The antique chairs are yellow with decorations of dull green. They are upholstered in soft pink damask, while the reverse of their backs still have the turkey red, happily introduced by some former owner.

The stairway, which leaves the entrance hall between walls, begins with two low steps; then comes a landing flanked by decorated doors, veneered in walnut with black and gold mouldings and having mirrors in the upper panels, the lower panels being ornamented with gilded banjos. One door leads to a coat closet, the other to the play room, the side entrance and the garage. The stairs continue up to the next landing, where there is a high leaded glass window. From here the open stair well rises 15 feet to the vaulted ceiling, from which hangs a Venetian lantern. At the top of these stairs are the wide doors to the drawing room. This stairway is built entirely of wood. The treads and risers are painted stone color, and the massive railing is marbleized to imitate red Verona, as are the stringers and the trim. The walls and ceiling the same grayish mauve as the entrance hall; carpet is dull yellow.

The drawing room, placed as it is in the central portion of the house, on the second floor, has a very lofty ceiling with exposed beams. Screens of leaded glass fill the ends, beyond which are the arches and balconies that form the chief decorative features of the exterior. The drawing room walls are painted a dull gray-green which forms a fine background for antique Italian paintings. The rug is camel's hair color, and the curtains are aubergine brocade with a floral design in green and pale yellow. The furniture is an agreeable mixture of antique Venetian and more comfortable modern pieces. Bright notes of rich yellow and red are introduced in the upholstery. Two crystal chandeliers provide general lighting, while lamps are conveniently placed for reading. The doors leading to the stairway and the master's suite are walnut veneer, with raised black mouldings and panels of crotched myrtle. The trim around doors and the baseboard are marbleized Levanto. The floor is walnut parquetry.

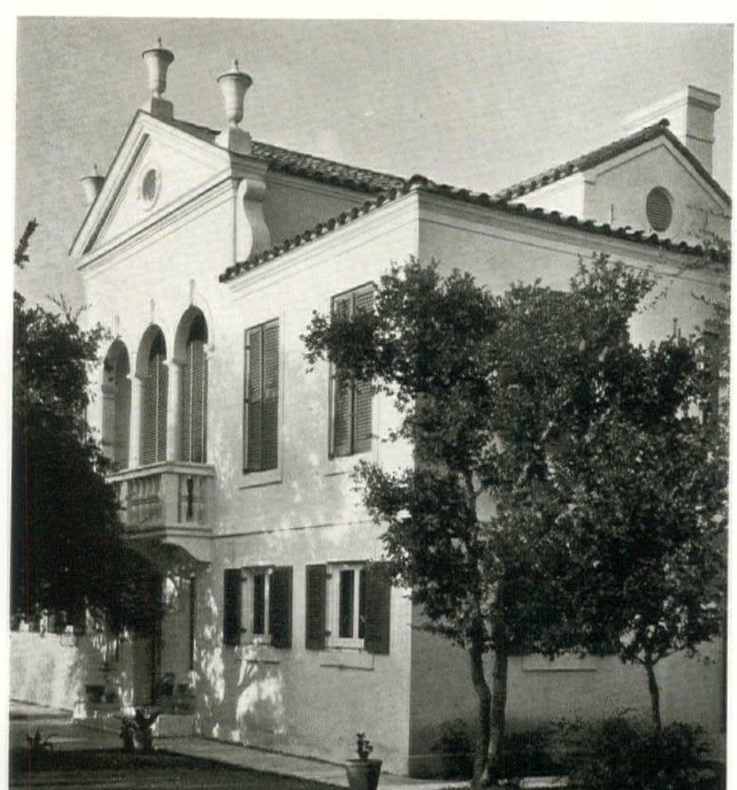
The library has walls and ceiling of pine. The walls are finished in amber tones with a high satin finish. The recesses for books and the book shelves and also the shells in the cornice are painted dark green and picked out in gold. The field of the ceiling is painted the same dark green, while the raised mouldings are finished like the walls and picked out in gold. The sun bursts and other raised ornaments are gold, and the painted design is in grisaille with touches of plum color. The curtains are green brocatelle, the rug egg plant color, and the furniture a pleasant mixture of greens and browns. Two fine crystal appliques flank the fireplace, the facings and hearth of which are verd antique marble. The French door leads to the terrace which covers the garage. The master's bedroom is painted a pale yellow-green with toile curtains having considerable mauve. The furniture is painted dark green with ivory panels having flower designs. Throughout the entire house color has been used in greater strength and in greater quantity than is usually found in American houses. Italian precedent permitted it, and the good taste of the owner encouraged it.

A VENETIAN VILLA
AT SAN ANTONIO, TEXAS

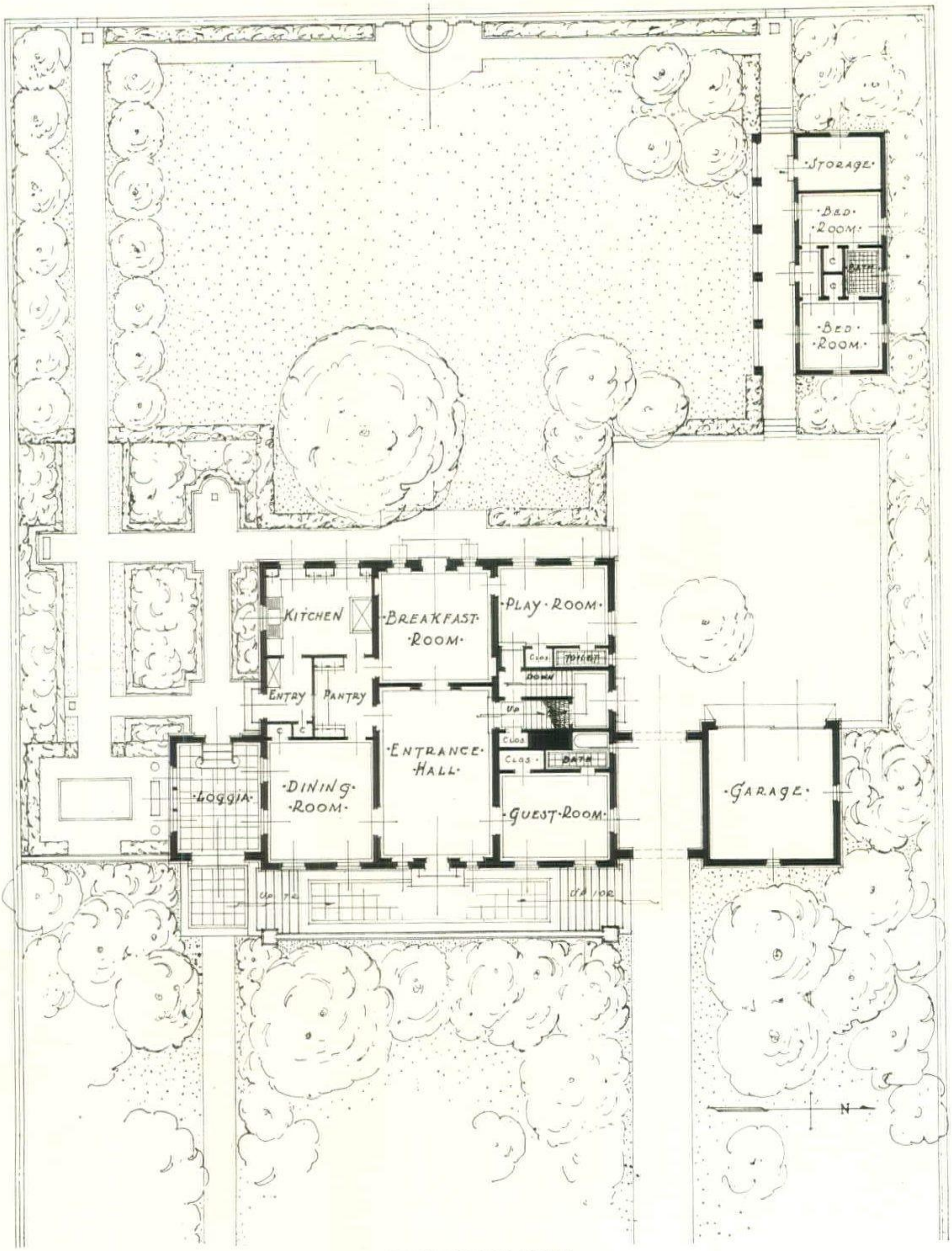
Photos, Masterson

HOUSE FOR J. B. ROBERTSON, ESQUIRE
WILLIAM McKNIGHT BOWMAN, ARCHITECT

SIMILAR BALCONIES AND TRIPLE ARCADES DECORATE THE EAST FACADE SHOWN ABOVE AND THAT OF THE WEST SHOWN BELOW

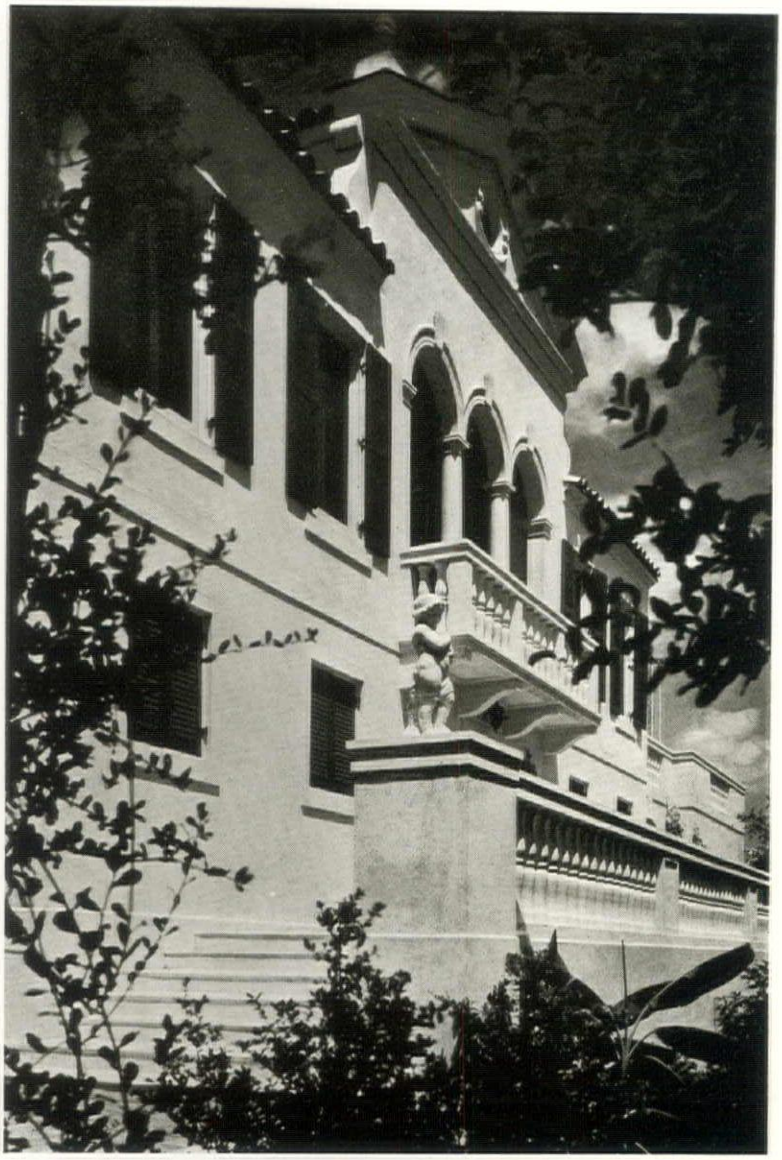


HOUSE FOR J. B. ROBERTSON, ESQ., AT SAN ANTONIO. WILLIAM McKNIGHT BOWMAN, ARCHITECT



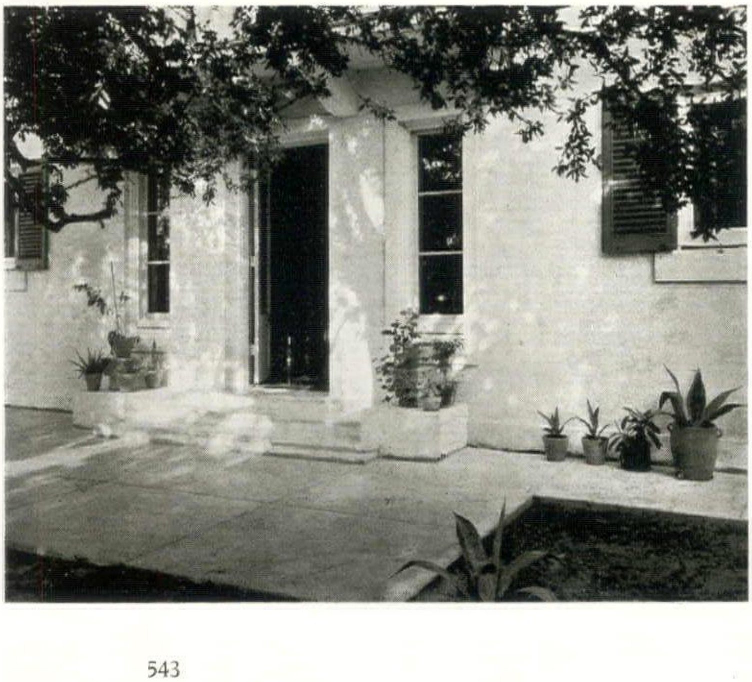
FIRST FLOOR PLAN

RESIDENCE OF J. B. ROBERTSON, ESQ., SAN ANTONIO
WILLIAM McKNIGHT BOWMAN, ARCHITECT

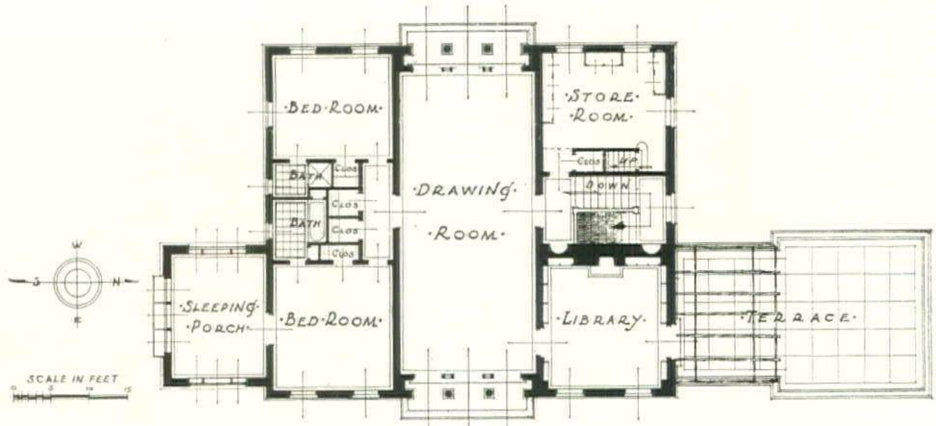


BELOW, THE DOOR OF THE BREAKFAST ROOM OPENS ONTO THE WEST TERRACE

LOWER TERRACE, BALUSTRADE AND STEPS ON THE EAST SIDE SHOW STRONG ITALIAN FEELING

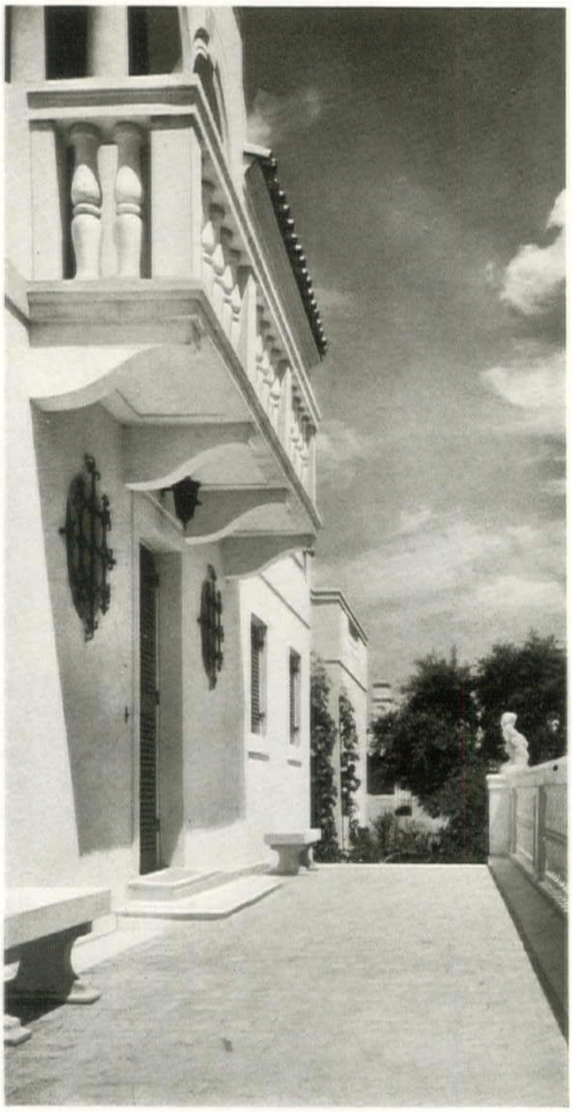


HOUSE FOR J. B. ROBERTSON, ESQ., AT SAN ANTONIO. WILLIAM McKNIGHT BOWMAN, ARCHITECT

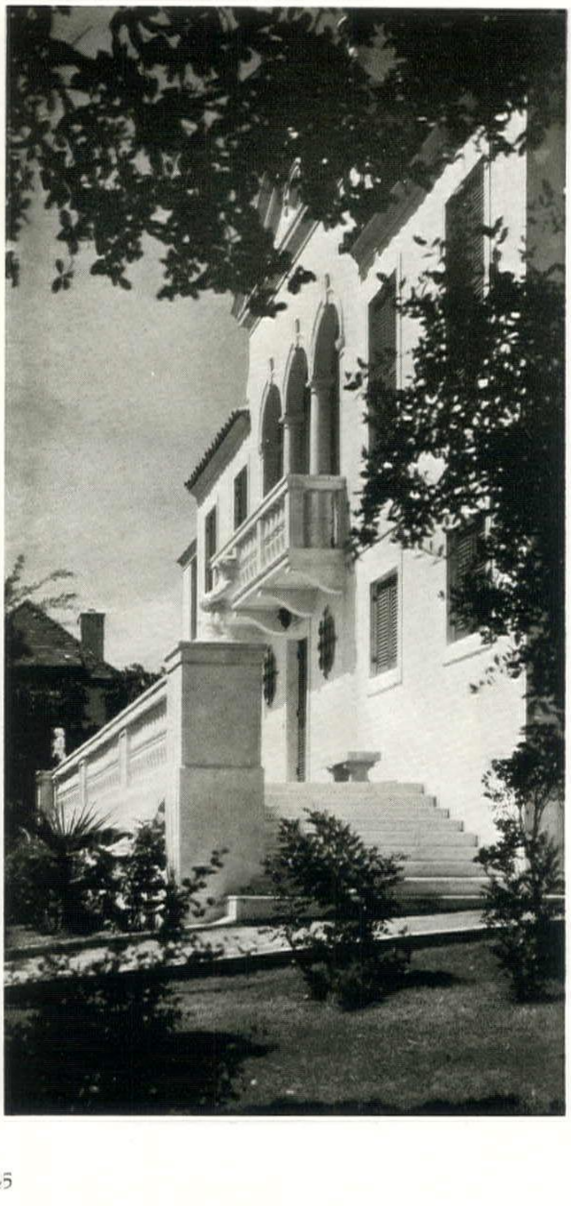


SECOND FLOOR PLAN

RESIDENCE OF J. B. ROBERTSON, ESQ., SAN ANTONIO
WILLIAM McKNIGHT BOWMAN, ARCHITECT



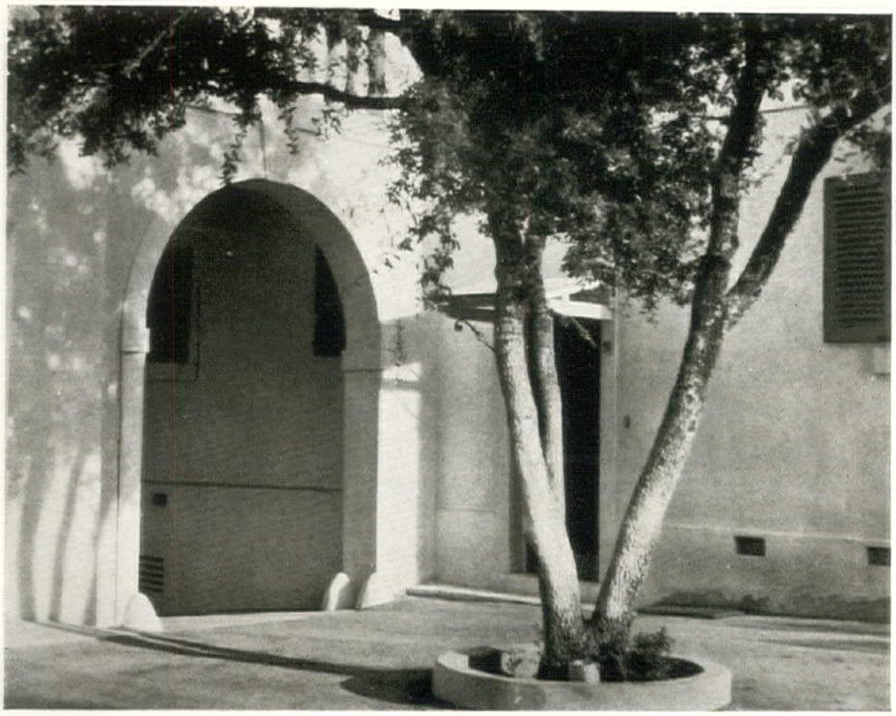
TWO VIEWS OF THE EAST TERRACE WITH OVERHANGING BALCONY AND LOGGIA ABOVE



HOUSE FOR J. B. ROBERTSON, ESQ., AT SAN ANTONIO. WILLIAM McKNIGHT BOWMAN, ARCHITECT

THE COURTYARD AND SERVANTS' QUARTERS
HOUSE FOR J. B. ROBERTSON, ESQ., SAN ANTONIO
WILLIAM McKNIGHT BOWMAN, ARCHITECT

LOGGIA AT SOUTH END OF FIRST FLOOR OPENS THROUGH ARCHWAY ONTO THE EAST TERRACE AND GARDEN PATH



DRIVEWAY ARCH, SIDE DOOR AND REAR COURTYARD WITH OLD TREE

HOUSE FOR J. B. ROBERTSON, ESQ., AT SAN ANTONIO. WILLIAM McKNIGHT BOWMAN, ARCHITECT

VIEWS OF THE ENTRANCE HALL

HOUSE FOR J. B. ROBERTSON, ESQ.,
AT SAN ANTONIO. WILLIAM
McKNIGHT BOWMAN, ARCHITECT

DOORWAY FROM DRAWING ROOM INTO STAIR HALL

HOUSE FOR J. B. ROBERTSON, ESQ., SAN ANTONIO
WILLIAM McKNIGHT BOWMAN, ARCHITECT

VIEWS OF EACH END OF THE
DRAWING ROOM SHOWING THE
WINDOWS OPENING ON LOGGIAS

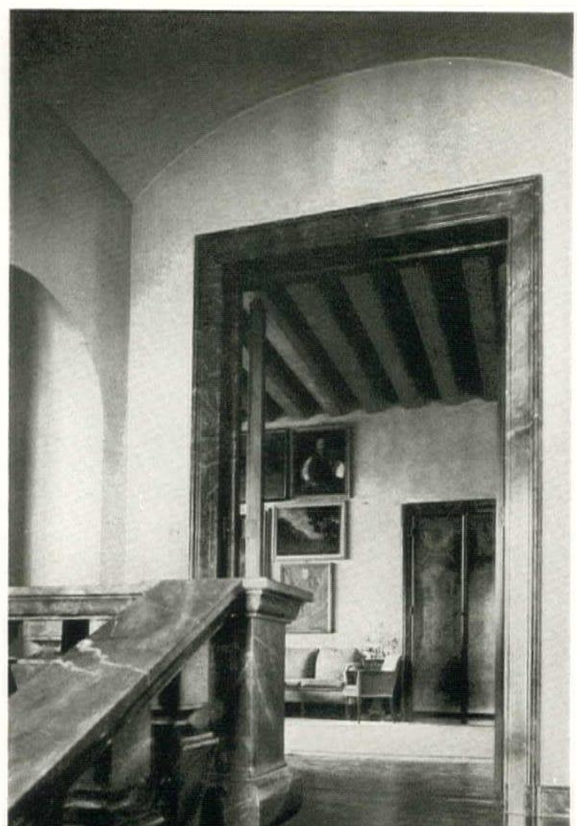
HOUSE FOR J. B. ROBERTSON, ESQ.,
AT SAN ANTONIO. WILLIAM
McKNIGHT BOWMAN, ARCHITECT

(ABOVE) CORNER OF DRAWING ROOM. FLOOR AND CEILING BEAMS ARE WALNUT. TRIM AND BASEBOARD ARE MARBLEIZED LEVANTO. DOORS ARE WALNUT VENEER WITH RAISED BLACK MOULDINGS AND PANELS OF CROTCHED MYRTLE. THE WALLS ARE PAINTED A DULL GRAY-GREEN. (BELOW) DOOR TO CLOSET AT FOOT OF STAIRWAY ON FIRST FLOOR

COLORFUL DINING ROOM ON THE MAIN FLOOR

HOUSE FOR J. B. ROBERTSON, ESQ., SAN ANTONIO
WILLIAM McKNIGHT BOWMAN, ARCHITECT

GUEST ROOM FROM ENTRANCE HALL. (BELOW) DOORWAY INTO DRAWING ROOM AT HEAD OF MAIN STAIRS



HOUSE FOR J. B. ROBERTSON, ESQ., AT SAN ANTONIO. WILLIAM McKNIGHT BOWMAN, ARCHITECT

THE PINE PANELED LIBRARY IS CARRIED OUT IN AMBER, GREEN AND GOLD WITH A RUG IN MAGENTA

HOUSE FOR J. B. ROBERTSON, ESQ., AT SAN ANTONIO. WILLIAM McKNIGHT BOWMAN, ARCHITECT

WHITE BREAKFAST ROOM ON THE FIRST FLOOR

HOUSE FOR J. B. ROBERTSON, ESQ., SAN ANTONIO
WILLIAM McKNIGHT BOWMAN, ARCHITECT

BREAKFAST ROOM ON THE FIRST FLOOR HAS WHITE PAINTED WALLS, WOODWORK AND CEILING. THE CURTAINS ARE SHELL PINK, AND THE TILE FLOOR BUFF AND MAUVE

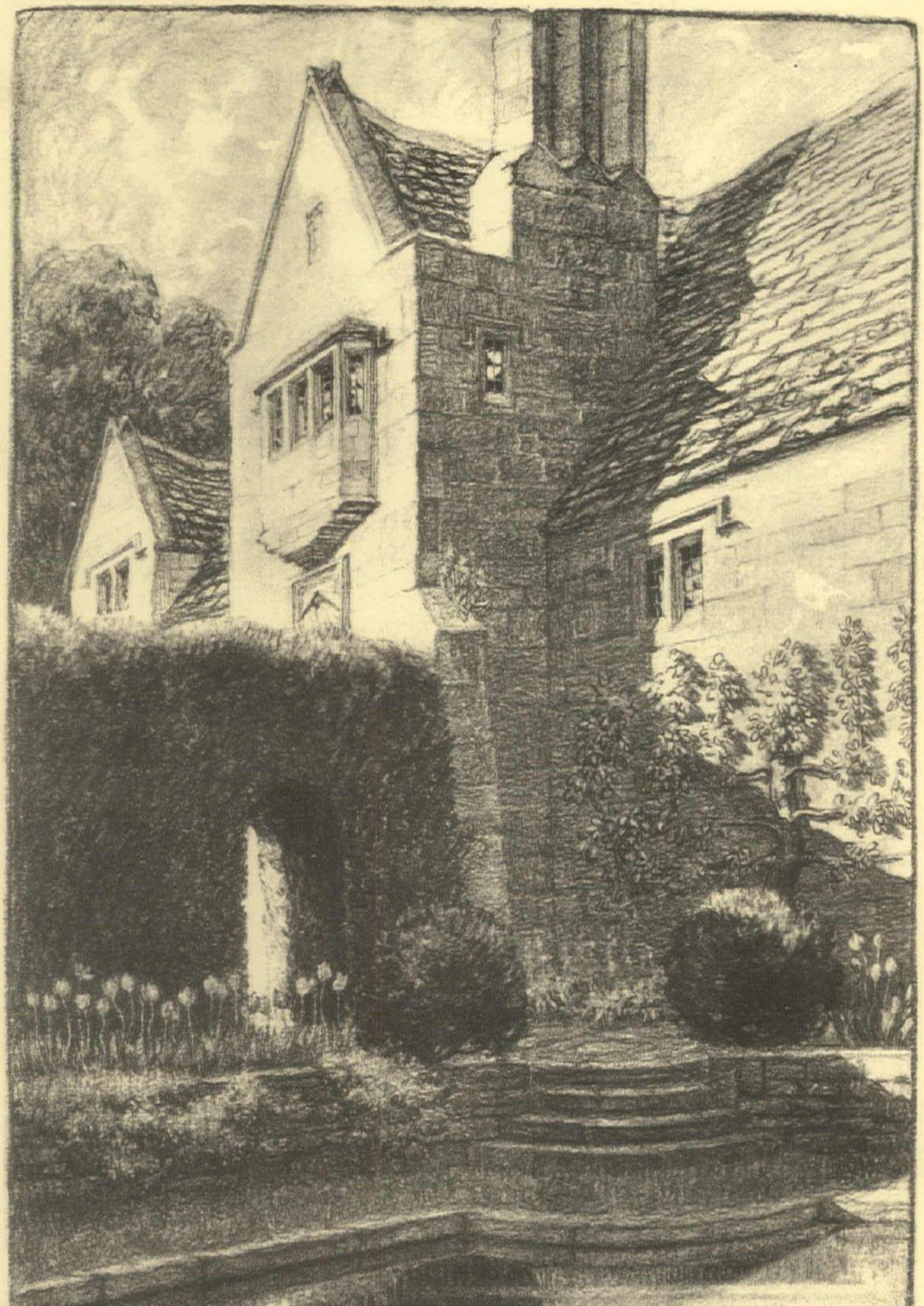
PANELED DOORS FROM ENTRANCE HALL ONTO THE EAST TERRACE

HOUSE FOR J. B. ROBERTSON, ESQ., AT SAN ANTONIO. WILLIAM McKNIGHT BOWMAN, ARCHITECT

BLUE BEDROOM ON THE FIRST FLOOR HAS AN ANTIQUE BED

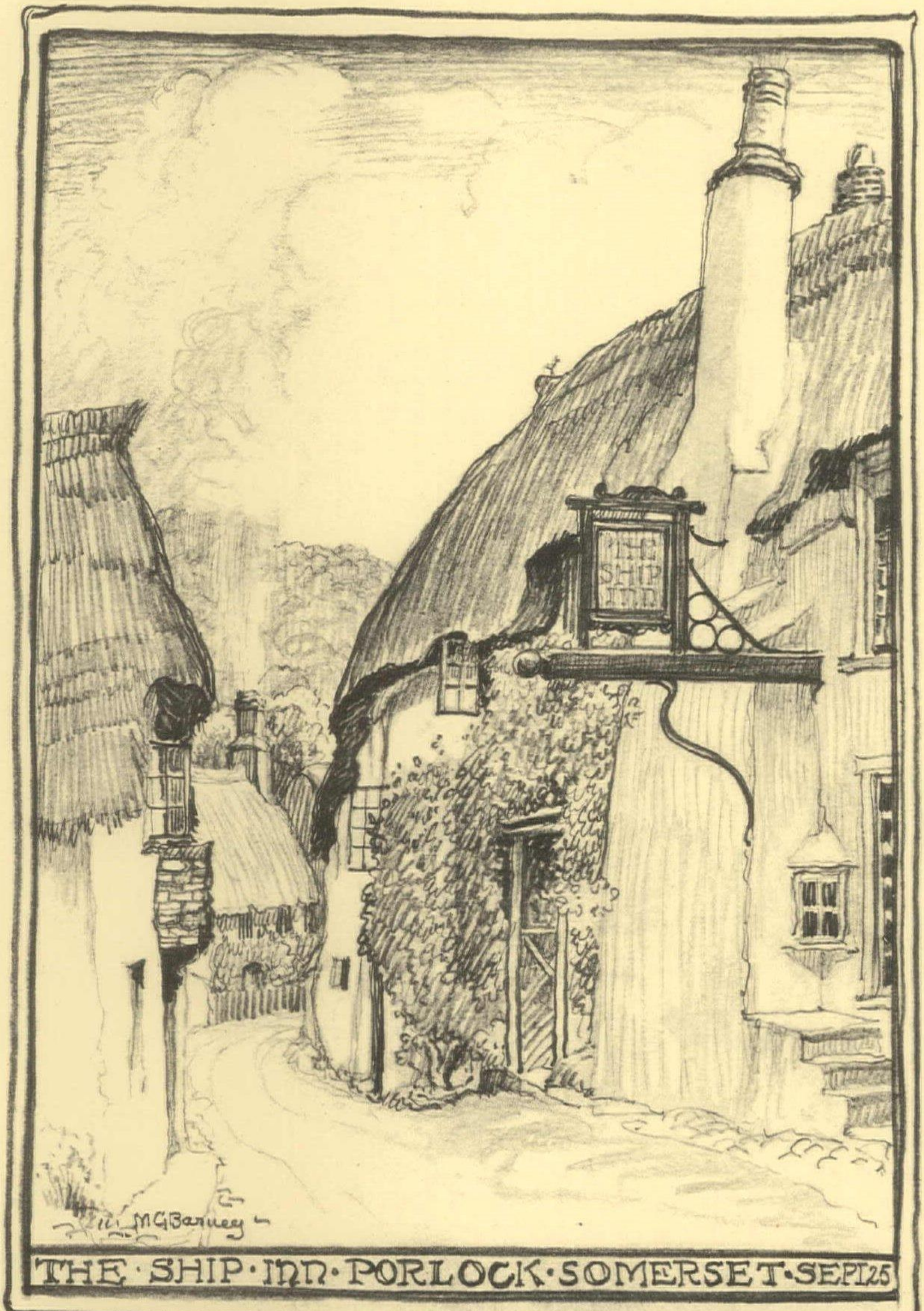
EAST BEDROOM, SECOND FLOOR, IS DECORATED IN LAVENDER

HOUSE FOR J. B. ROBERTSON, ESQ., SAN ANTONIO
WILLIAM McKNIGHT BOWMAN, ARCHITECT

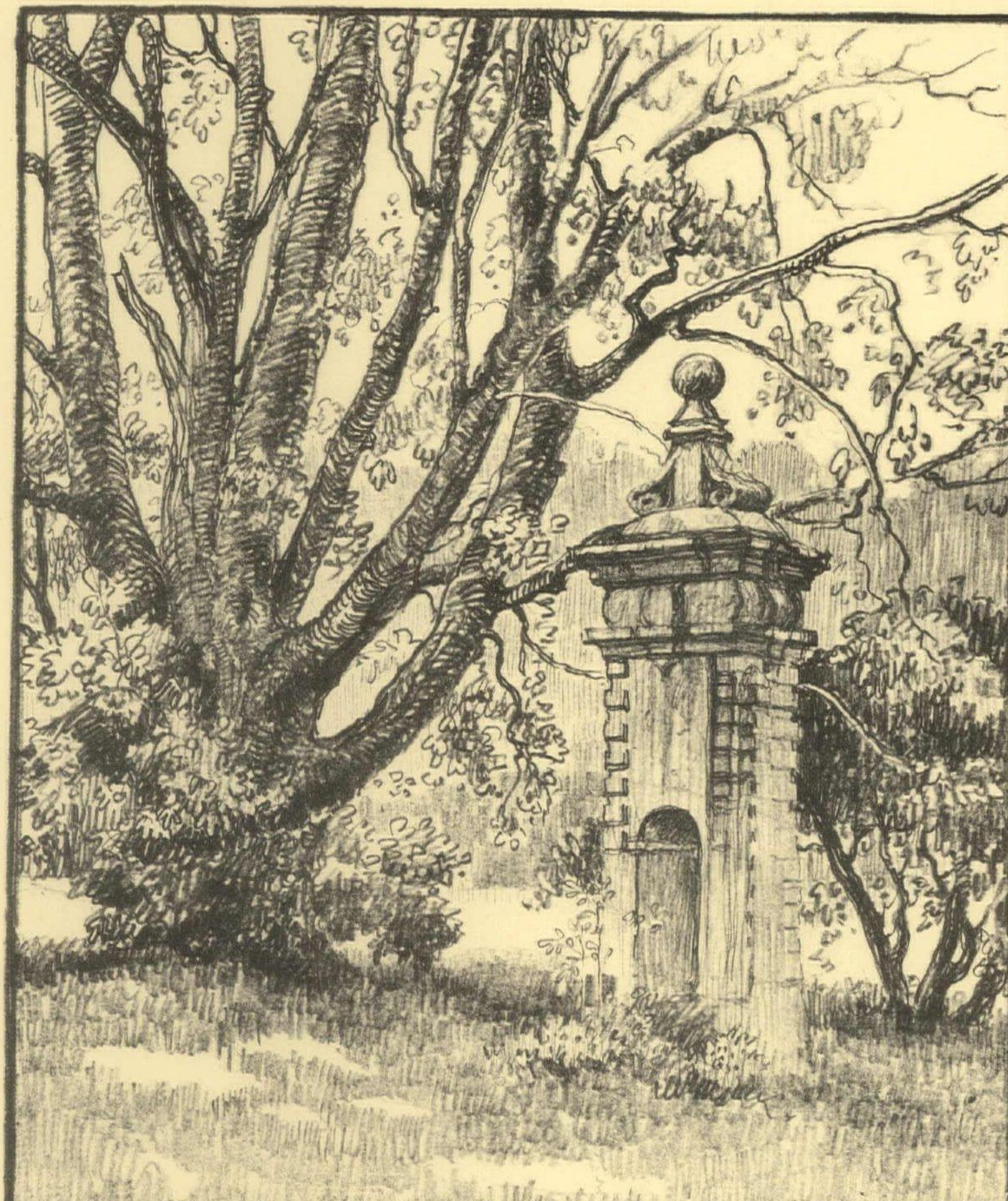


AN OLD COTSWOLD HOUSE
FROM A PENCIL SKETCH BY
MARIAN GREENE BARNEY

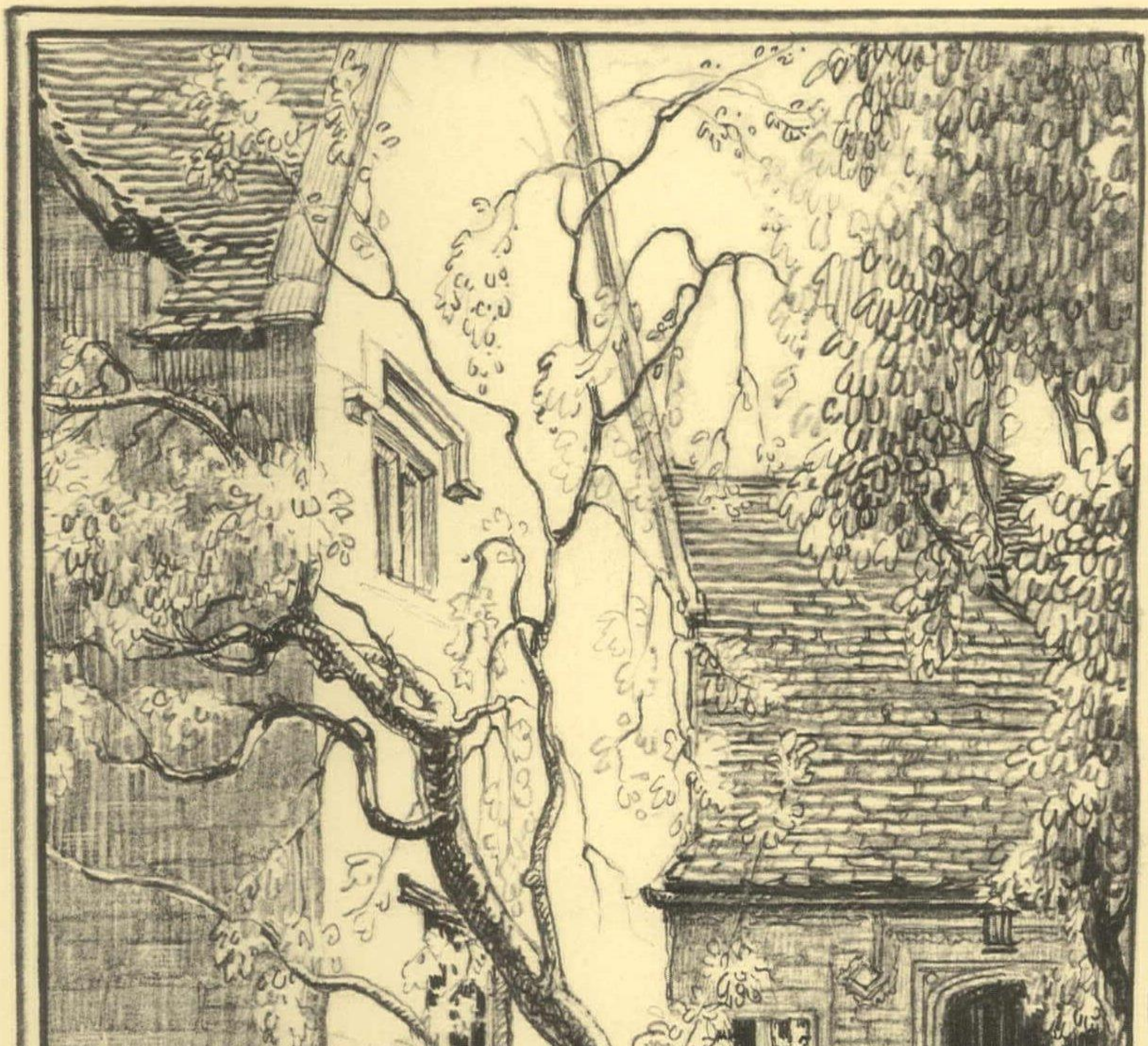
COURTYARD AND COTTAGES
FROM A PENCIL SKETCH BY
MARIAN GREENE BARNEY



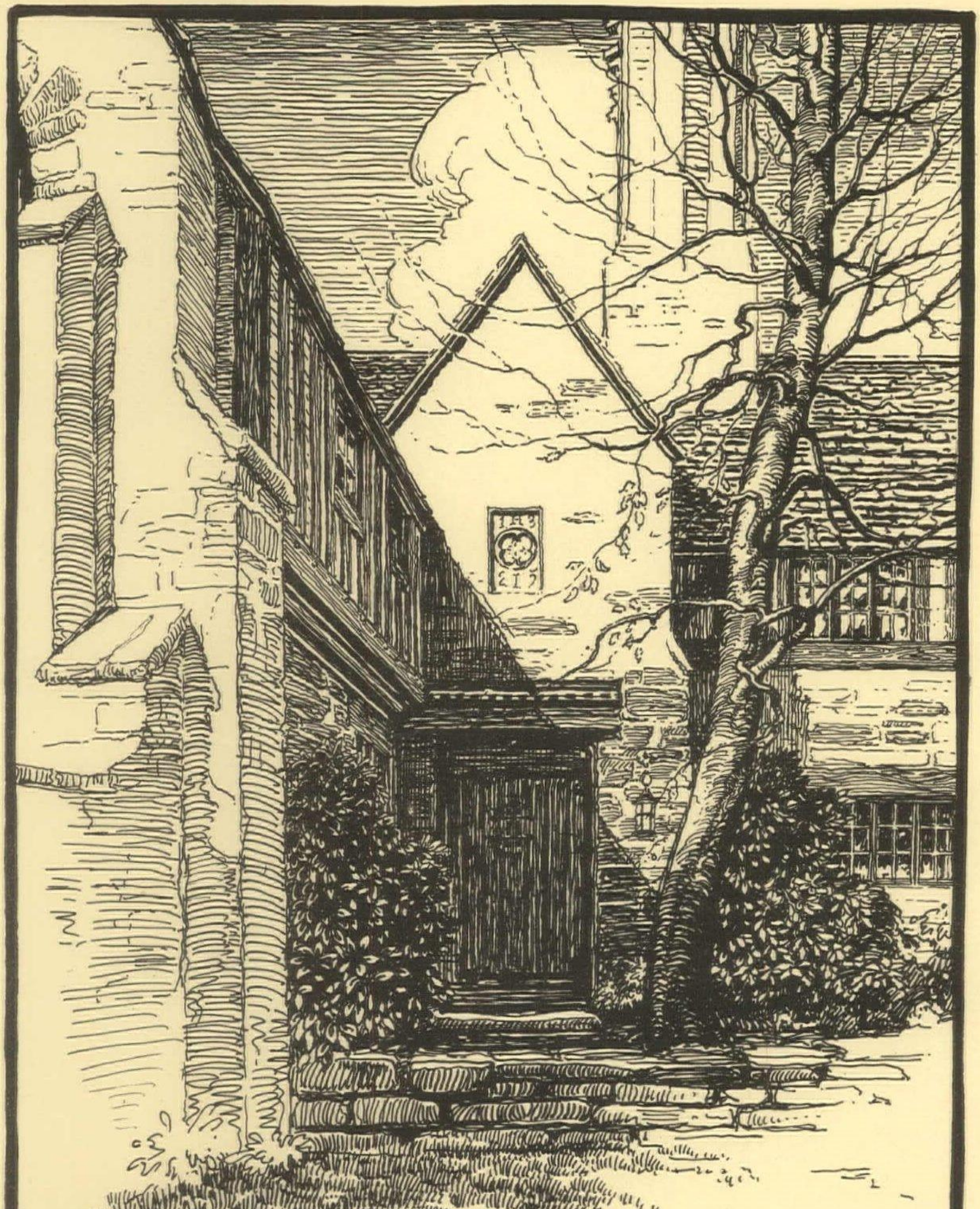
FROM A PENCIL SKETCH BY
MARIAN GREENE BARNEY



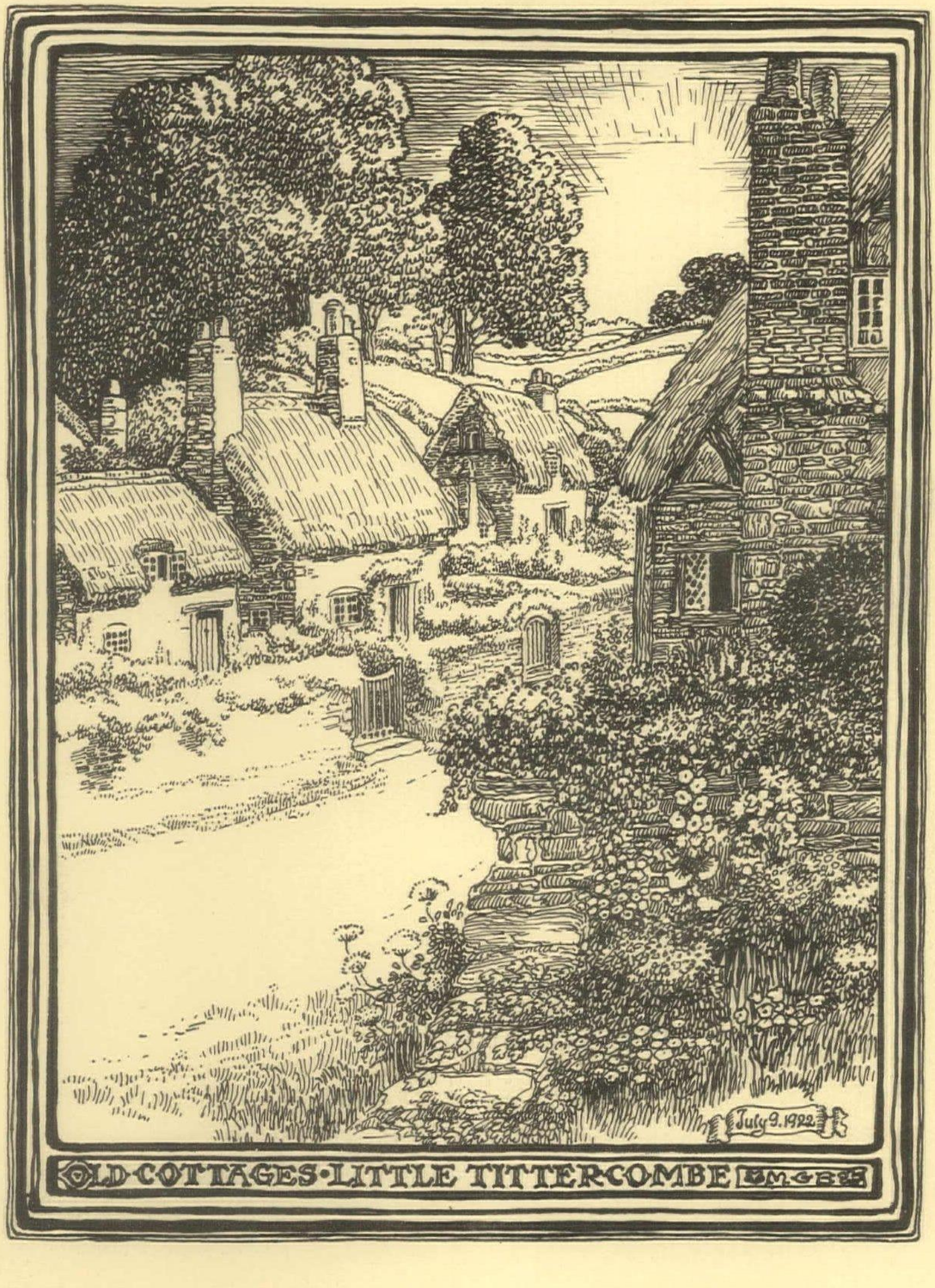
EARLY RENAISSANCE POST
AT BESSELSLEIGH, BERKS,
FROM A PENCIL SKETCH BY
MARIAN GREENE BARNEY



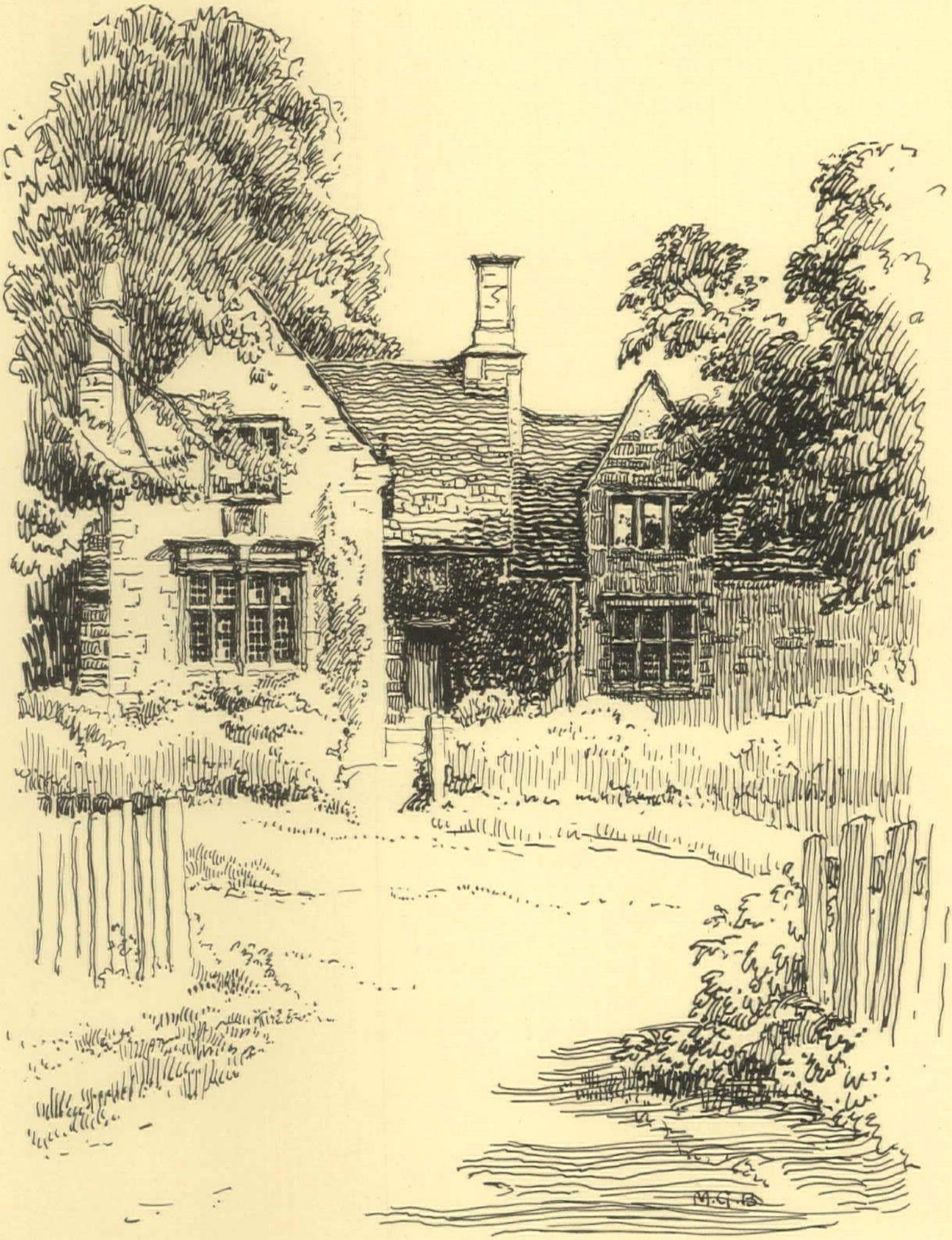
FROM A PENCIL SKETCH BY
MARIAN GREENE BARNEY



ENTRANCE DOOR AND TERRACE
FROM A PENCIL SKETCH BY
MARIAN GREENE BARNEY



THATCHED-ROOFED COTTAGES
WITH FRONT GARDENS, FROM
A PEN AND INK DRAWING BY
MARIAN GREENE BARNEY



TYPICAL COTSWOLD COTTAGE
BUILT OF STONE WITH WINGS,
DORMERS AND GROUPED WINDOWS
FROM A PEN AND INK DRAWING
BY MARIAN GREENE BARNEY

COTTAGES OF THE COTSWOLDS

BY

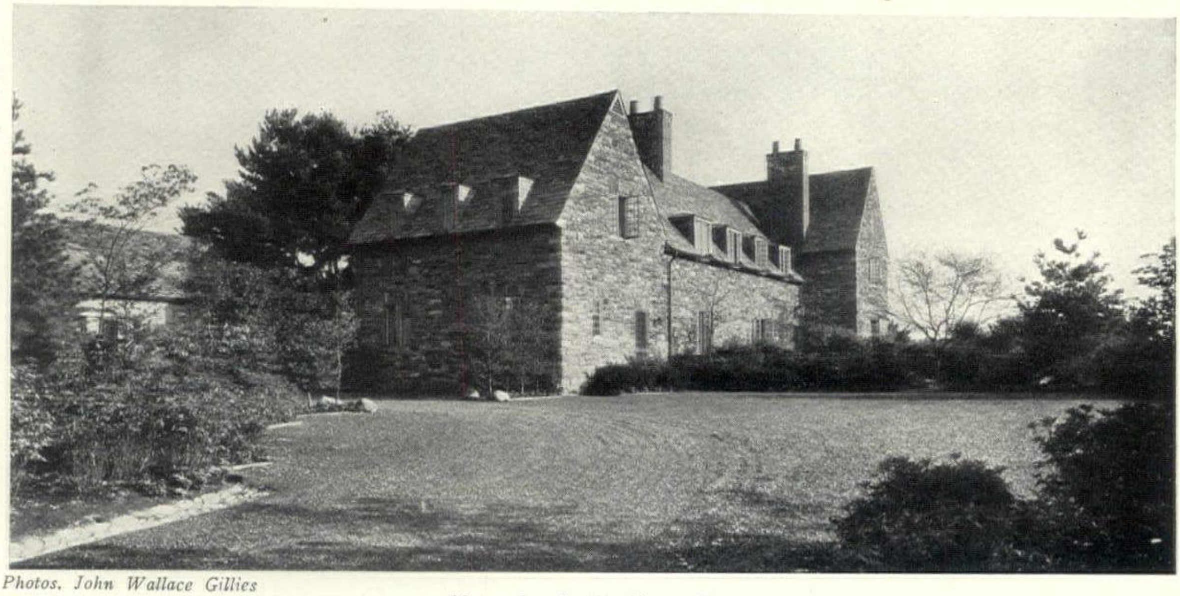
HAROLD DONALDSON EBERLEIN

THE domestic architecture of the Cotswolds is an architecture to a singular degree conditioned by the native materials suitable for building. These are, first and foremost, a limestone of peculiarly rich quality, found plentifully on every hand throughout the region. Next come half-timber work with stuccoed nogging, weather boarding with undressed edges, and, for the roofs, when not covered with stone tiles, thatch of straw. This is not a very extensive list of resources, perhaps, but with them the local builders of centuries past contrived to get marvelous variety, and the legacy they left is a veritable wellspring of inspiration today for architects and artists.

The Cotswold limestone is a material so beautiful, and so tractable in the hands of the masons, that it has always been used for every purpose to which stone can possibly be put. The walls are built of it, with masonry of every kind of face; the roofs are covered with stone tiles or "slats" made of it, after it has been split into thin layers by exposing fresh-hewn blocks of it to the cleaving action of rain and frost throughout a winter; copings, finials, window mullions, mouldings, doorways and all manner of exterior details are carved from it; indoors, fireplaces are chiseled from it, stairs are often built of it, and many a room is paved with slabs of it worn smooth by years of scrubbing and the treading of successive generations. It is durable enough to stand the weather without crumbling, and it is of a texture fine enough to be a medium for the most delicate carving. Even perforated finials and other deftly wrought details exposed to the elements show comparatively little erosion, and the roof tiles are so time-resisting that *old* tiles, on account of their mellow color and lichen growths, are at a high premium for new roofs throughout the Cotswolds.

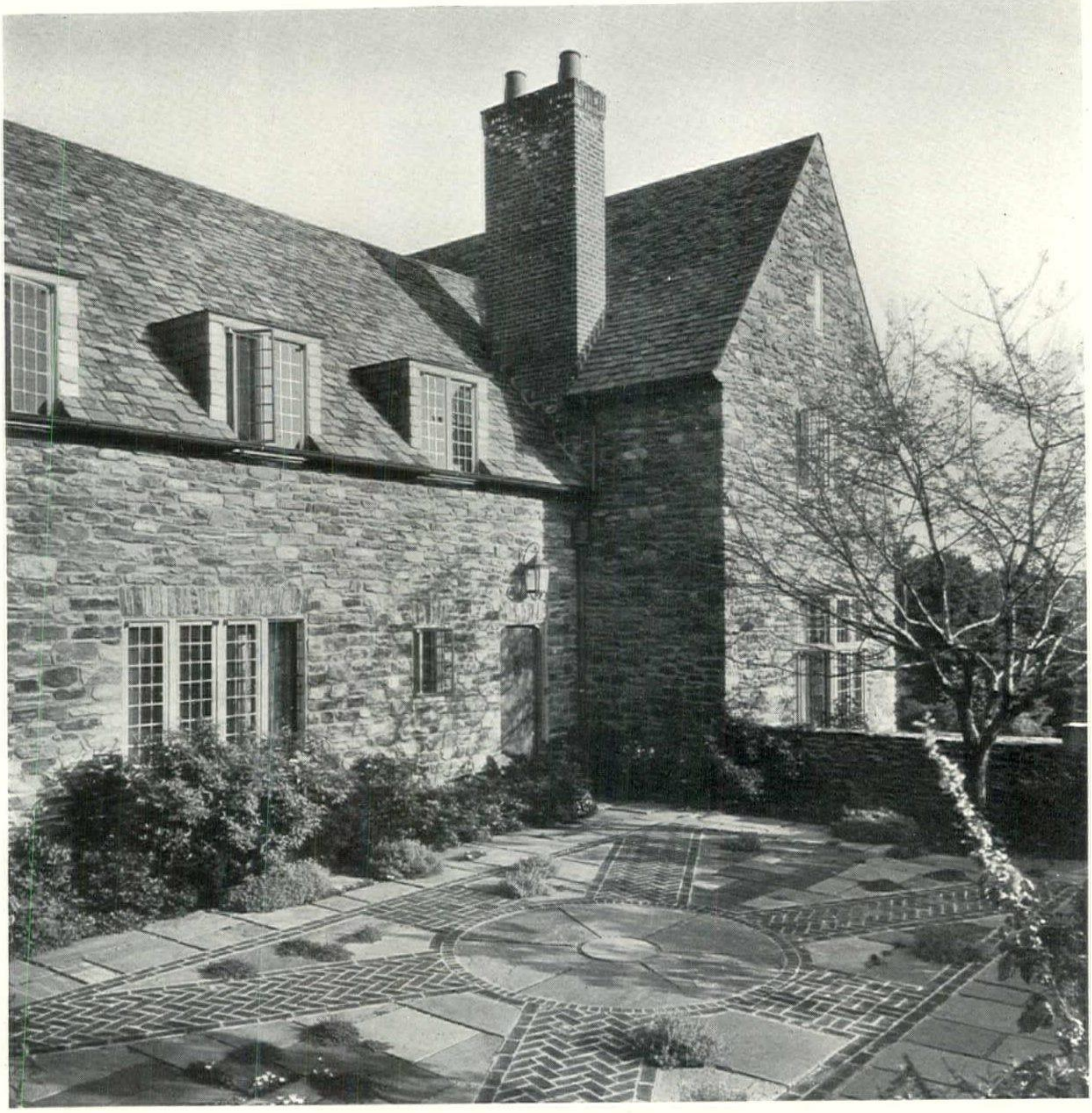
When fresh-hewn from the quarry, the limestone is of a beautiful creamy color and so soft and close-grained that it can readily be cut with a knife. Used indoors, it either retains this color or bleaches to an ashen hue. Outdoors it weathers to a diversity of colors, hardening the while. In walls it ranges from silver gray to rich tans, tawny browns, olive browns and orange; on roofs it turns an indescribable silvery brown and harbors all kinds of mossy growths and lichens. It is, in fine, *par excellence* the great and omnipresent building material of the Cotswolds and one of the chief factors of their architectural beauty.

Half-timberwork of oak, with parged or stuccoed nogging that was sometimes pebble-dashed, played a part in many of the older Cotswold houses, but the "black and white" work was usually of a subsidiary nature. The filling or pugging between the timbers, in many cases, was wattled and dabbed, that is to say, the space between



Photos. John Wallace Gillies

House for O. B. Capen, Esq.
Built at Bedford, N. Y. By
Waldron Faulkner, Architect

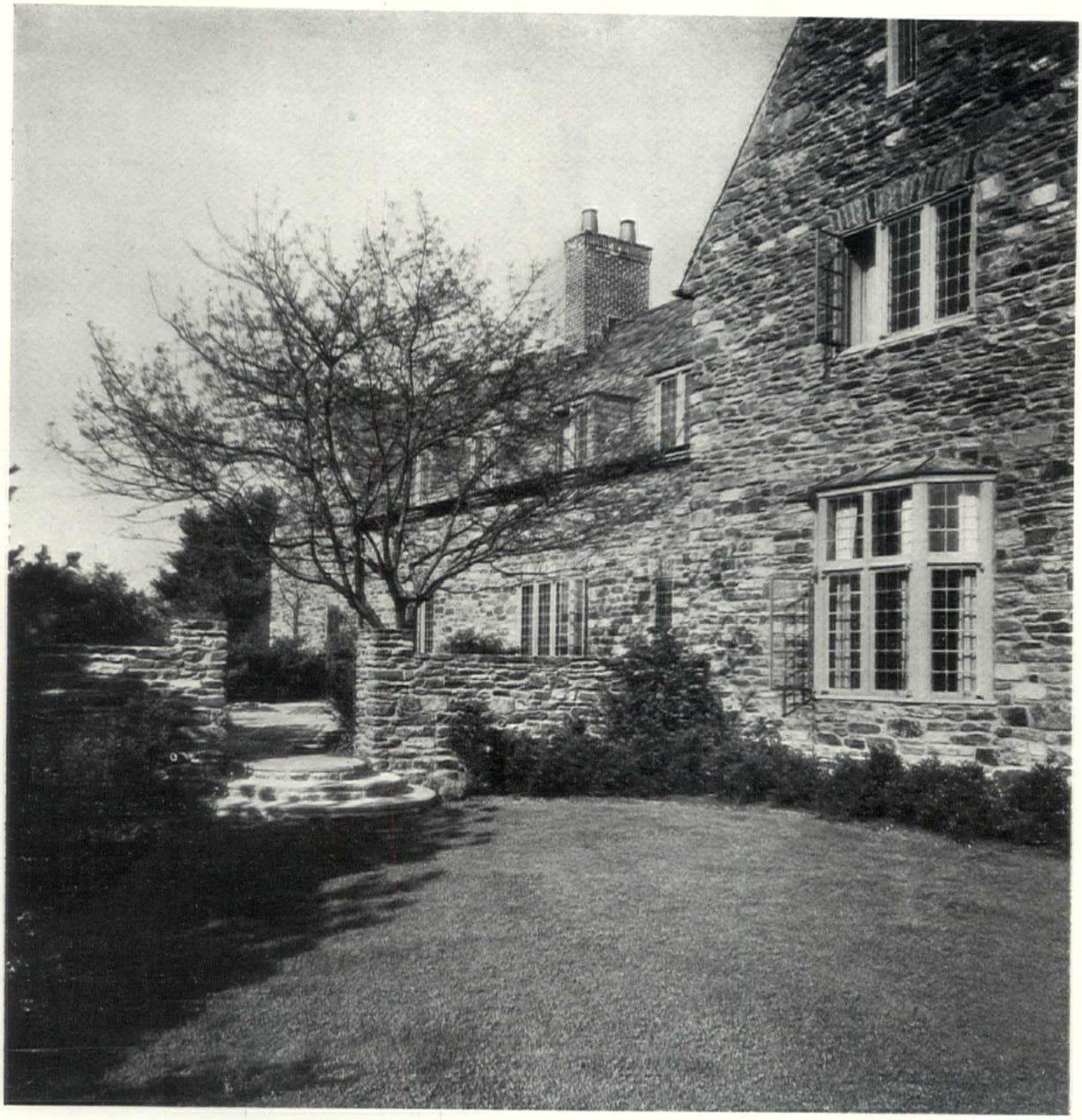


Courtyard at Main Entrance
House for O. B. Capen, Esq.
Built at Bedford, N. Y. By
Waldron Faulkner, Architect

timbers was wattled with osiers, and clay was plastered over this background; upon this "wattle and dab" work was spread the outer coat of parge or stucco. The weather boarding occurs chiefly in barns. Thatched roofs are almost invariably made of straw, except in cases where some special effort was made to fetch reeds or rushes from East Anglia.

There is neither coal nor iron in the Cotswold hills,—only limestone. It has, therefore, always been a purely pastoral and agricultural region. It was once a great wool raising country and the source of much of England's wealth. In the days of the great wool merchants large sums were spent on building, and the best craftsmen found constant employment. As is the wont of pastoral and agricultural communities, the people have always been intensely conservative, and old manners and traditions have lingered with little change. With them have remained the old traditions of the best craftsmanship, and even today many an old mason or thatcher has a stock of traditionary building lore at his fingers' ends.

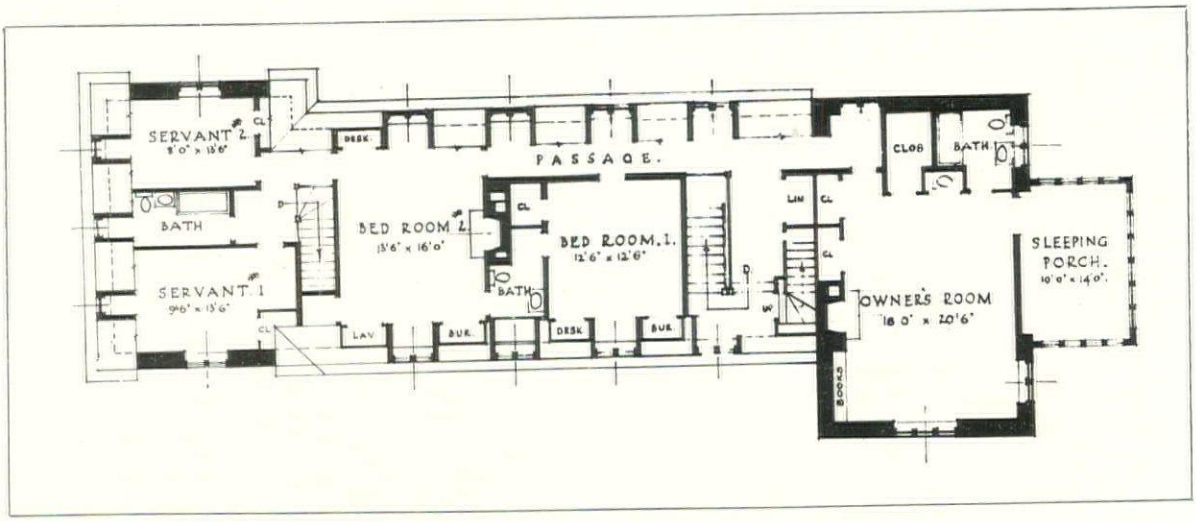
Most of the Cotswold domestic architecture is strongly tinctured with old Gothic building tradition. Many of the houses, both large and small,



Entrance Court from Lawn.
House for O. B. Capen, Esq.
Built at Bedford, N. Y. By
Waldron Faulkner, Architect

were built during the sixteenth and early seventeenth centuries, and not a few date from the fifteenth, while here and there one comes across treasures remaining untouched from an even earlier period. The prevailing manner of building is of the Tudor and early Stuart type with certain distinctive local peculiarities which add zest to the charm. Even the houses of the latter half of the seventeenth century, and some of those built in the fore part of the eighteenth, show a close adherence to the earlier style which seems singularly suited to interpretation in Cotswold materials, a style sanctioned by the use of centuries.

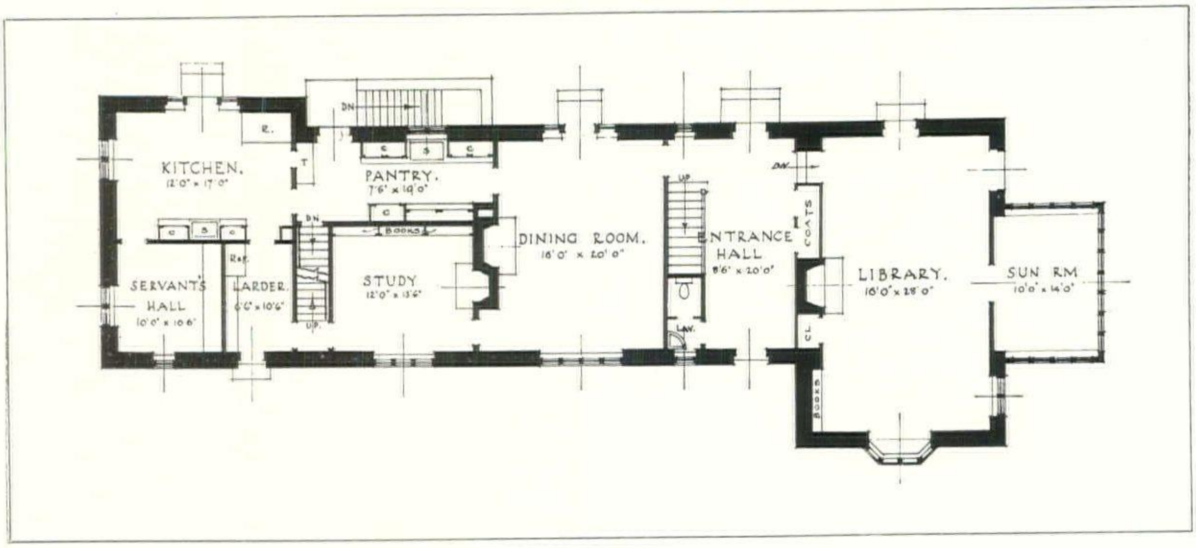
Cotswold domestic architecture, however, is not one-sided, and it would be inaccurate to say that there is only one Cotswold manner, for the various phases of eighteenth century classicism found frequent interpretation,—and very pleasant interpretation, too,—in the different Cotswold towns and villages. Indeed, the earlier influence of Sir Christopher Wren, and even that of Inigo Jones, may be seen plainly reflected in more than one instance. Then, too, the manner of the early nineteenth century left easily distinguishable traces, so that Cotswold house building through the centuries assumes a diversity of shapes. But if we



SECOND FLOOR PLAN

cannot say that there was only one Cotswold manner, we can truthfully say that there was only one *favorite* and generally used Cotswold manner, and that was the Tudor and early Stuart manner with Gothic reminiscences, employed long after its use had been discontinued elsewhere.

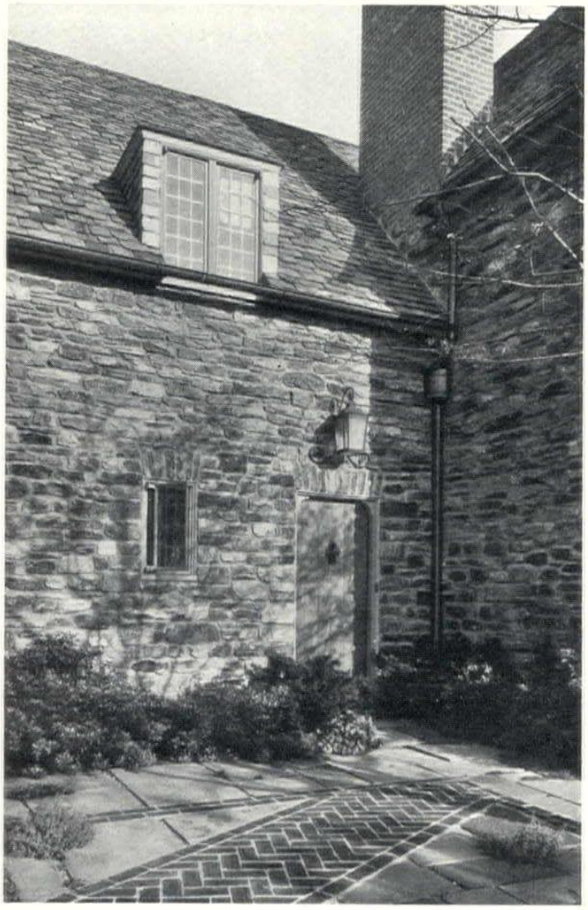
One of the most striking characteristics of Cotswold domestic architecture is its picturesque quality, a quality that has made it such a favorite theme for adaptation in America. But this picturesque quality which invests the houses with such compelling charm and prompts a spirit of emulation in architects and clients of the present generation is likely to prove a snare and to betray its imitators into absurdities and inconsistencies. That is, it is likely to prove a snare unless they first take the trouble to go into a little analysis and discover whence it proceeds. Analysis will reveal the fact that Cotswold architecture is picturesque, not because of deliberate and premeditated intent, but incidentally because of its absolute, straightforward simplicity and the honest and ingenuous use of materials according to their nature. In every respect, it is altogether spontaneous. The drawings and sketches, for which this introduction is written, have faithfully caught the spirit of building in the Cotswold hills and reveal its eminently picturesque value with a literal exactitude free from any exaggeration or artist's license of idealization. But fairness to the Cotswold builders of old demands that we of today accept their work in the spirit in which it was wrought, not stressing romantic and pictorial quality as the first and dominant essential but obtaining it as the consequence of candor in plan and of direct and sympathetic use of materials.



FIRST FLOOR PLAN

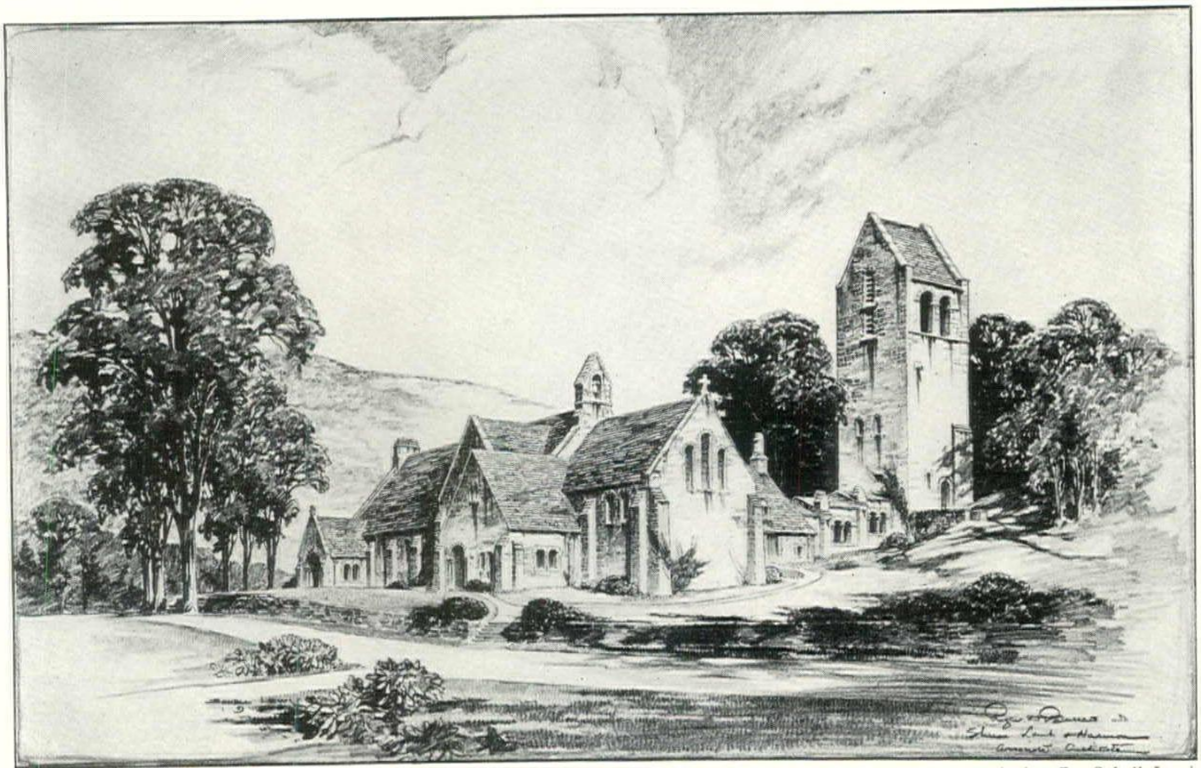
HOUSE FOR O. B. CAPEN, ESQ.
BUILT AT BEDFORD, N. Y. BY
WALDRON FAULKNER, ARCHITECT

GARDEN FRONT



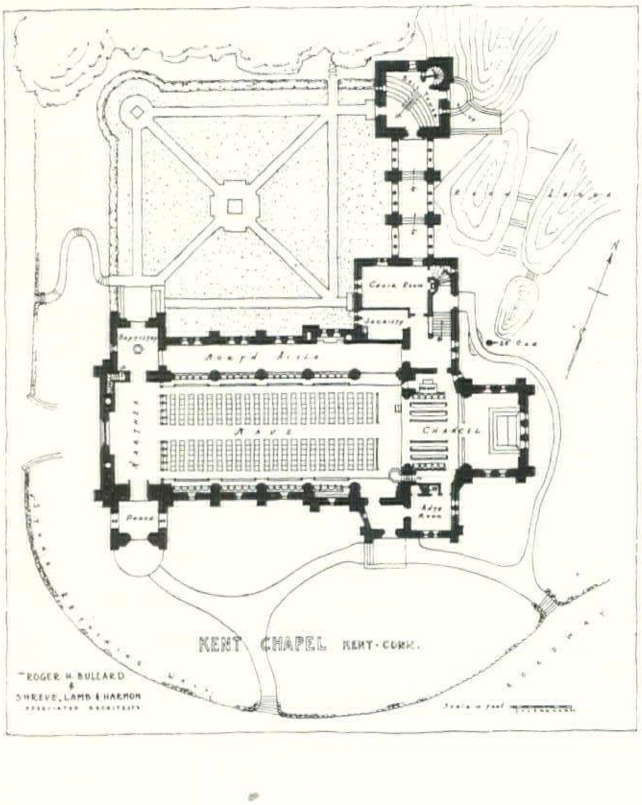
ENTRANCE DOOR

HOUSE FOR O. B. CAPEN, ESQ.
BUILT AT BEDFORD, N. Y. BY
WALDRON FAULKNER, ARCHITECT



Photos. Van Anda

From A Rendering By Schell Lewis



KENT CHAPEL, KENT, CONN.
ROGER H. BULLARD AND
SHREVE, LAMB & HARMON,
ASSOCIATED, ARCHITECTS

From A Rendering By Schell Lewis

KENT CHAPEL, KENT, CONN.
ROGER H. BULLARD AND
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ASSOCIATED, ARCHITECTS

BEACH CLUBS

BY

KENNETH M. MURCHISON

BEACH clubs are beach clubs, and there you are! Beach clubbing is a new form of amusement which has sprung into being since that time when people wanted to be a little exclusive, when our beaches got so full of trippers and basket parties and hot dogs and live dogs that something just *had* to be done. So the beach club was born, and it has now attained a definite place in our social setup,—say what we may about democracy. Of course, to have a beach club one must have a beach, but near New York the beaches are growing less and less attractive, and the water is getting more and more full of dead and un-alluring debris; therefore beach clubs must have swimming pools, and really, once a club builds a pool, the ocean or the sound or whatever else the club faces on, becomes deserted, and all the clubby stuff is done right in the pool.

The Sands Point Bath Club is located quite near New York (one might say just a nice drinking distance away!), on a spit of sand extending out into Manhasset Bay on the north shore of Long Island. It has a preëminent position, and the marine life one sees from the veranda of the club reminds one of Fifth Avenue, with the motorboats as numerous as the Fifth Avenue buses, and still, nevertheless, with a band playing every night and moonlight on the water and lights flashing on the pool, it makes the tired business man from the city glad that some smart fellow had the idea of a beach club in the first place.

The Dunes Club at Narragansett, R. I., is a much larger proposition than the Sands Point Bath Club, inasmuch as it has 30 sleeping rooms and baths and a so-called "week end house" for bachelors only, especially for those who are overcome by the fumes of salt water. Here again the French provincial style was followed,—not because the architects didn't know any other style, but because it seemed to lend itself best to the sand dunes surrounding it and to suggest that it always had belonged there.

The most enjoyed feature of The Dunes is the group of 48 cabins, laid out in three semi-circles, all facing the beach. The single cabin is 12 x 10 feet in size, the double 16 x 12 feet. The Club rents a single cabin to a member for 20 years for $700 plus a small service charge, a double cabin for $1600. The Club provides the building with a shower, one electric outlet, an awning, and the exterior painting. Everything else is done by the tenant, but with gay cretonnes, cushioned chairs, cellarettes and bars, they are the talk of Rhode Island and have attracted an enormous amount of attention during their one-year career.

The Dunes has a pool for children and also many, many bathhouses, over half of them with showers. A large sun yard is provided for the males, where they gather and swap stories and compare sunburns. Everyone there dines on the porch too, during the summer, so at least they are spending most of the time in the open air where the sun is supposed to draw out most of the impurities in one's system and in one's disposition!

Photo. Underwood & Underwood

Dunes Club, Narragansett, R. I.
Kenneth M. Murchison, Architect