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THE HALL OF SCIENCE

A CENTURY OF PROGRESS EXPOSITION

BY

PAUL PHILIPPE CRET

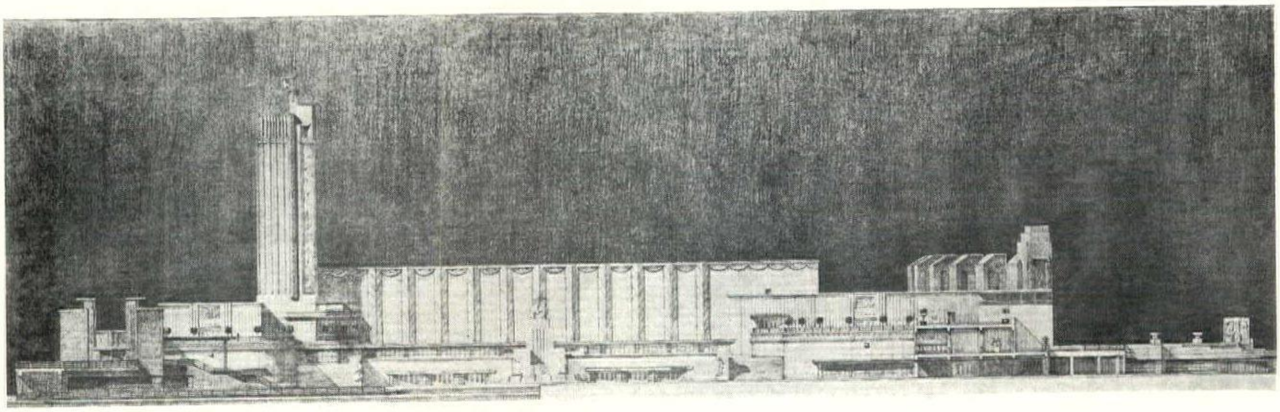
THE description of a building as a supplement to illustrations and addressed to a public of architects, savors of an apology, or of an impertinent attempt to sway the judgment of those who look at the photographs.

In the case of the Hall of Science of the Century of Progress, the only excuse I can give for these notes is that certain conditions, somewhat different from the accepted program of this type of buildings, had to be met, and can be stated, while I am apologizing. I may add that without its final coat of paint, its sculptural decoration (soon to be placed), without the roads and most of the planting, and above all, without the exhibits and the crowds of visitors, the parasols and seats over the terraces, the building shown by these advance photographs is reduced to the sad appearance of an unfurnished apartment.

The program elaborated by the Architectural Commission and the Department of Works of the Fair, departed from the usual exhibition building in two ways. First of all, the public was to enter it on the second floor. The usual exposition building provides a large area on the first floor, and then a few galleries (usually half deserted but for a few earnest and adventurous souls). The Chicago buildings are planned two or three stories high. If these stories were to have an equal renting value, something had to be done to coax the public to the upper level and let old gravity take its course afterward.

The north access to the Hall of Science is, therefore, from an incline (continuation of Leif Eriksen Drive) reaching a vast circular plaza around and above the first floor atrium. This plaza communicates on a level with the bridge to the Electrical Group, with the east terrace or outdoor auditorium overlooking the lagoon, and to the south, with the open gallery connecting the various buildings of the General Exhibits Group which is the third second-floor access. Inside, four ramps and several staircases lead to the first floor or to the auditoriums and terraces of the third floor. This complete aerial thoroughfare not only gives to the second floor the same importance as that of the first, but relieves all chances of congestion at the ground level. It also makes accessible a large development of terraces which adds greatly to the interest of an otherwise flat shore. That this principle of planning is more than an attractive theory, remains to be shown by the only valuable test, that of the moving crowds when the exposition opens.

The second departure was to rely entirely on artificial lighting. The case of small buildings excepted (where each exhibit is located in advance in the most favorable way), natural light does not allow an economical use of a large exhibition floor. There are, of necessity, dark corners or rentable areas with a light unsuitable for an effective display. The result is that in recent fairs the exhibitors have, in most cases, shut out the natural light from the skylights, replacing it by artificial lighting disposed so as to attract the visitor and display the exhibits to the best advantage. The mixing of natural and artificial lighting in the same room was rather unsatisfactory. To provide natural light also limits the exhibition hall to one story and a few galleries and prevents the use of the roofs for promenades, gardens or restaurants. This led to the adoption of the second principle or departure, which, as much



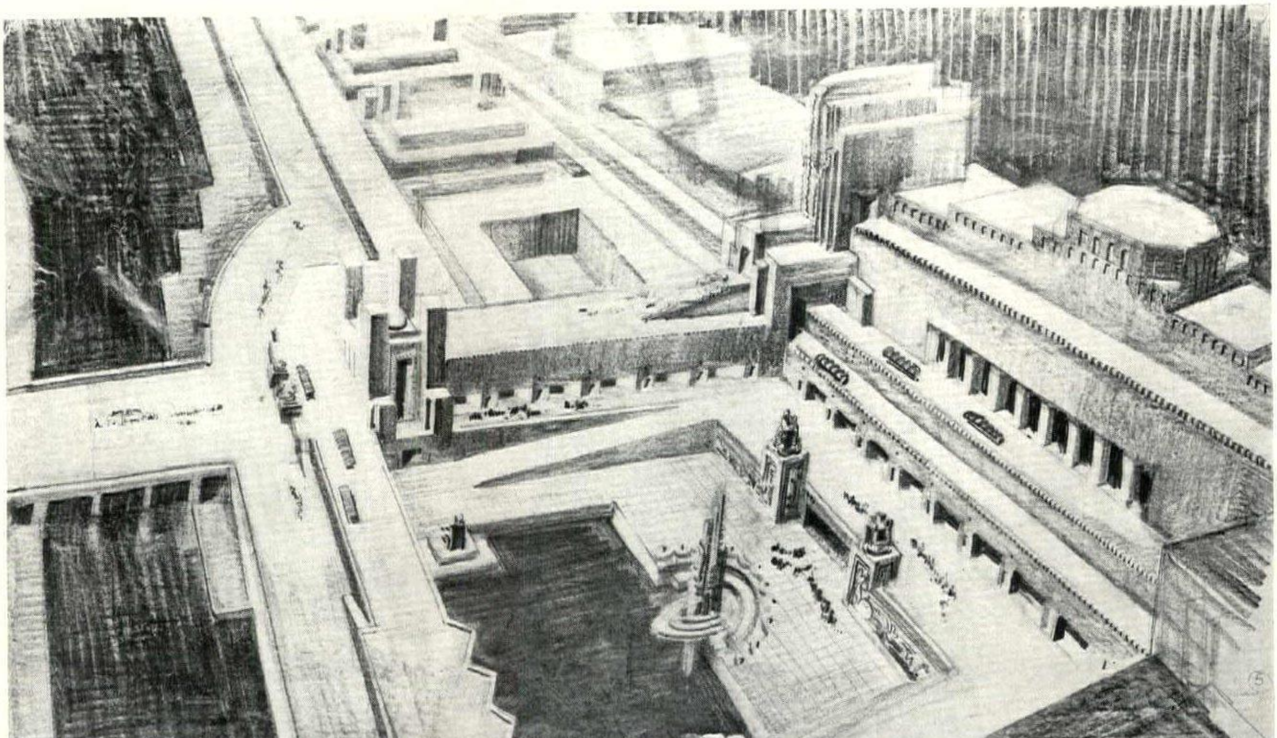
Section looking west

as the first, had a far-reaching effect on the exterior treatment of the exterior of the building.

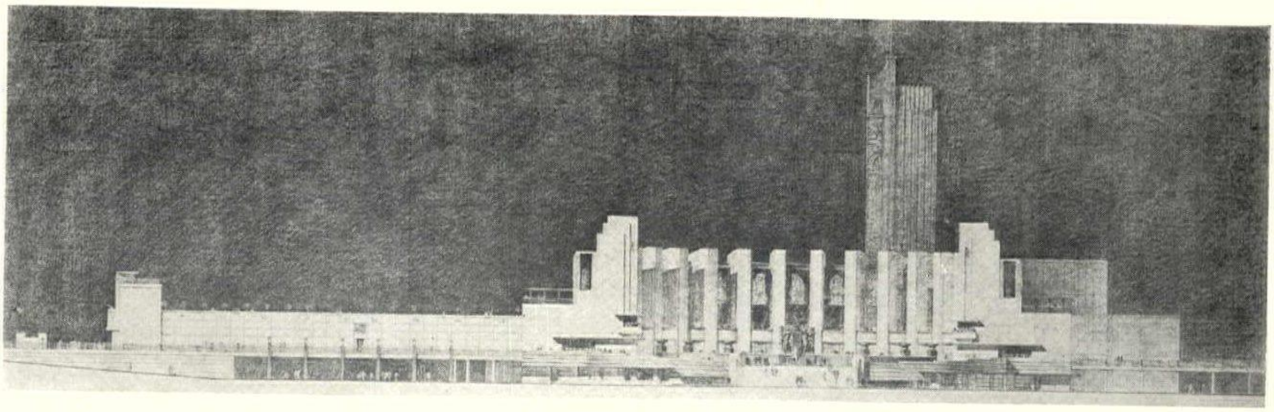
I realize that my duty here calls clearly for the usual "*aria di bravura*" on the functionalism, the exterior of a building shown as a consequence of its interior arrangement, the Beauty of Truth, the Truth of Beauty, etc. I know, on the other hand, that such themes have been developed in magazines and newspapers in the last few years with such abundance and talent that my own variations are not urgently needed.

So I will limit myself to note that there is very little "architecture" on the Hall of Science, at least in the sense that Ruskin gave to the word in his "Seven Lamps." The outside walls shamelessly confess that they are built of a thin veneer which, like fish scales or armor plates, can withstand the settlements to be expected on the made-up ground of the lake shore.

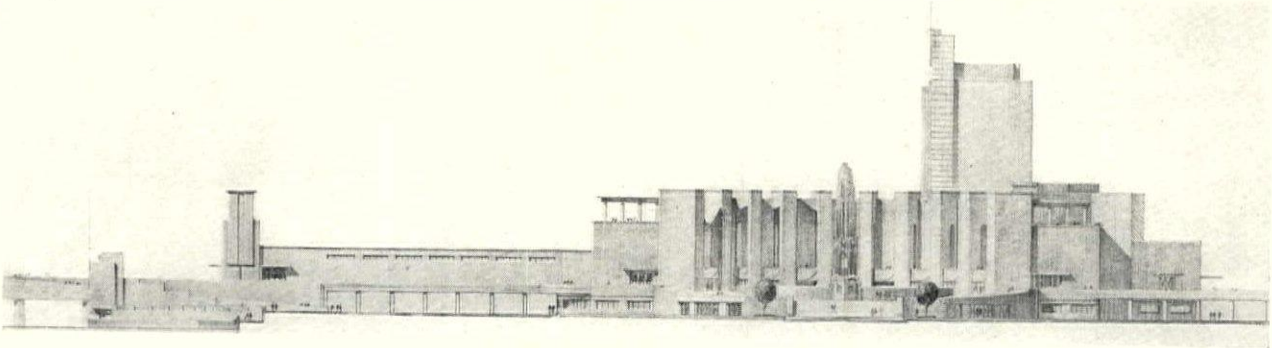
They do not attempt to suggest the mass stability of masonry walls. They hope to get from John Storrs, sculpture; from Joseph Urban, color; and from Ferrucio Vitale, planting, some of the charm which they lack. And above all, they require the public on their empty stage. Buildings of this type are, at best, only a successful background for crowds.



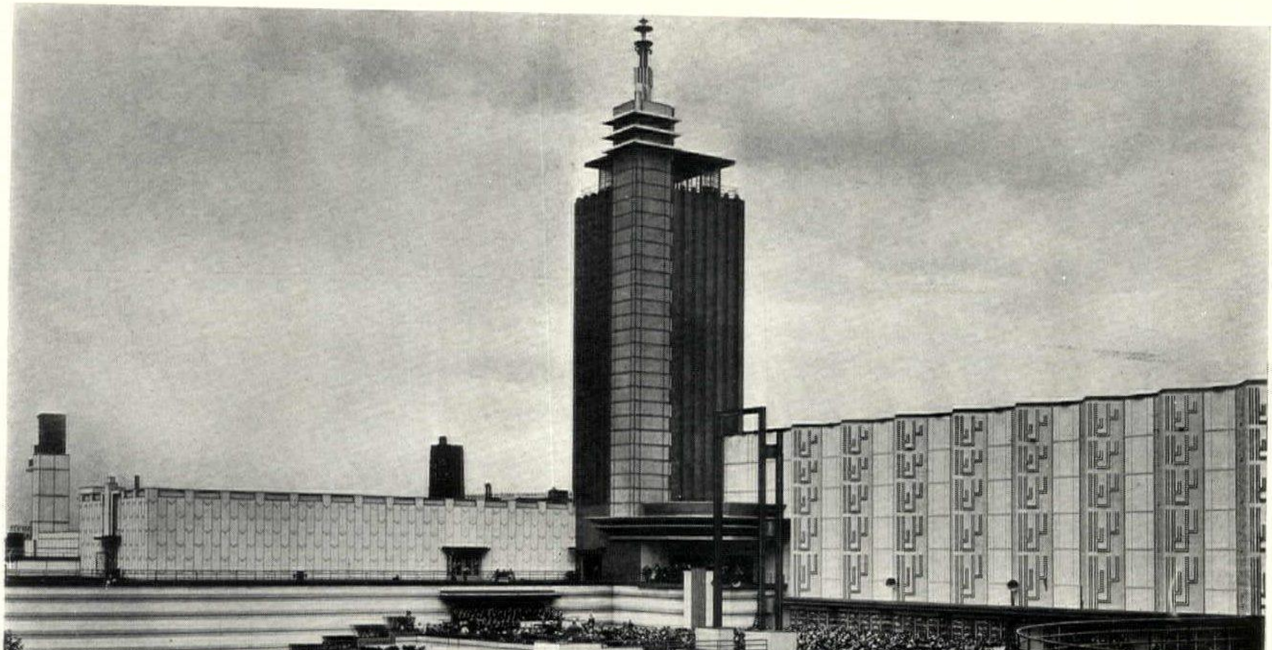
Early study looking down into the court, showing a proposed fountain



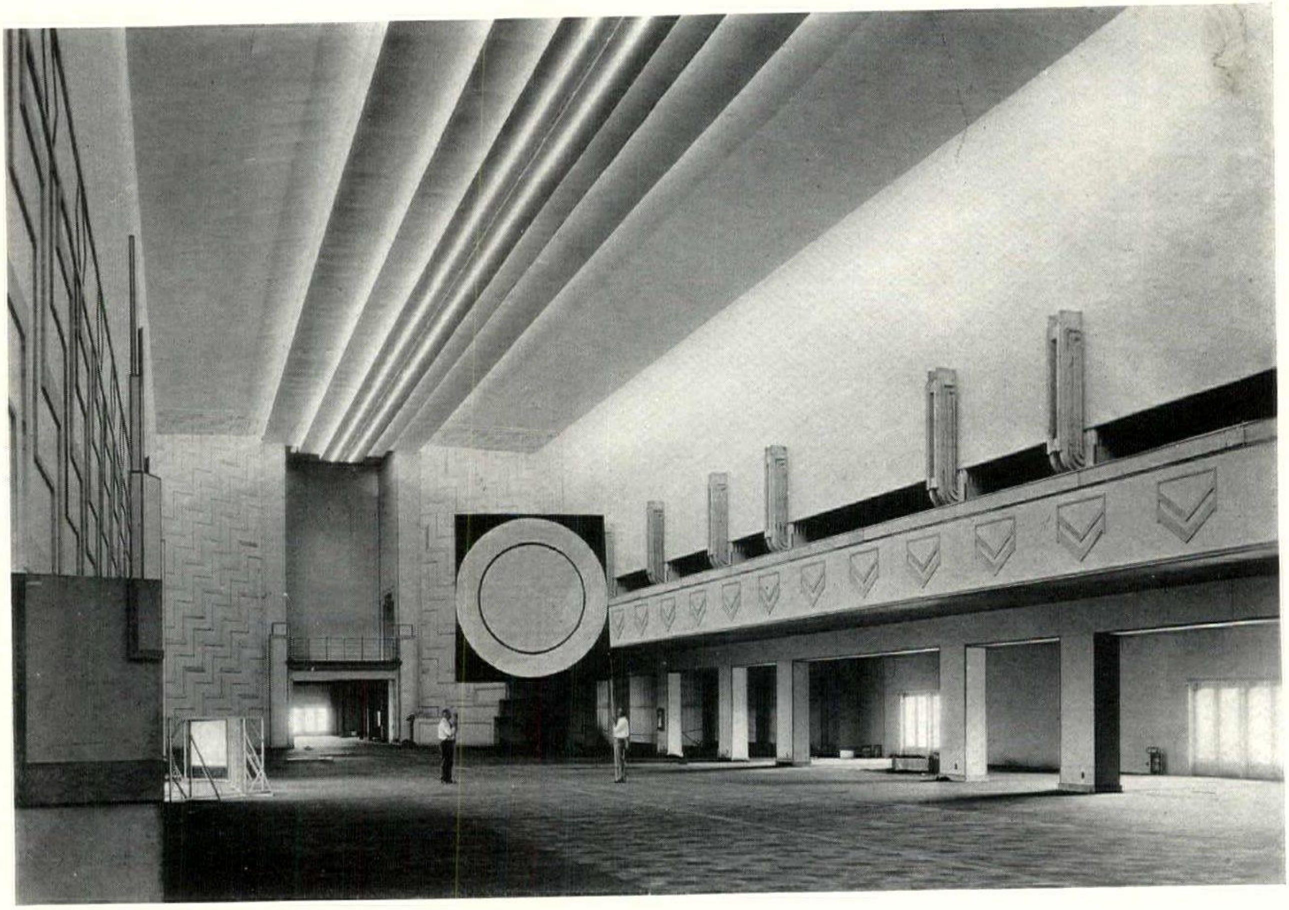
North elevation

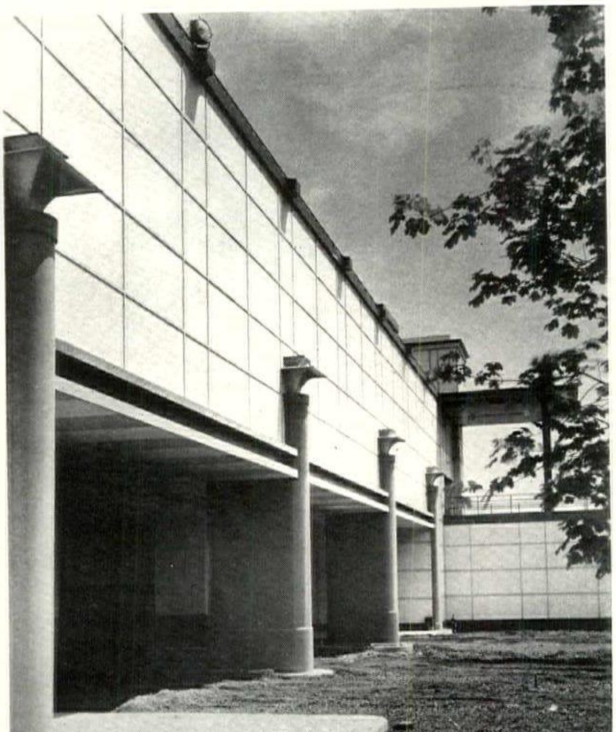


Early study for north elevation



Photograph taken at dedication ceremonies looking down into the court





ABOVE is a view of the interior of The Great Hall, almost completed. One of the most interesting features of the hall is the successful combination of incandescent bulb lighting and gaseous tube lighting for illumination and decoration. The three narrow bands of light in the center of the ceiling are blue and green neon tubes, and there are eight louvered coves running the full length of the hall in which the bulbs are concealed. At the left is a detail of a vehicular entrance

THE HALL OF SCIENCE

A CENTURY OF PROGRESS EXPOSITION

PAUL PHILIPPE CRET, ARCHITECT

MIRRORS IN INTERIOR ARCHITECTURE

BY

WILLIAM LAWRENCE BOTTOMLEY

FROM that ill-fated day when Narcissus gazed at his own beauty in a Peloponnesian pool and stood transfixed by his own beauty, we have been conscious of the fascination of reflection. Evidence that man learned early, however, that he did not have to depend on natural surfaces to see his image is found in the disks of silver and other metals unearthed by archæologists in ancient Egypt, Persia, Greece and Rome. Existing always as an aid to personal adornment, and sometimes as a decorative element, the mirror has been present in all centuries down to the present one.

Not until the last few decades, however, had there been any appreciable advance in the production of reflecting surfaces. Glass itself was available only in small panes and was expensive to manufacture, so that mirrors were considered only slightly less valuable than precious stones. The *salle des glaces* at Versailles, with its thousands of candles and its mirrored doors, was one of the marvels of Europe and up to our own time was the outstanding example of the use of mirrors as a decorative keynote.

The art of manufacturing mirrors, once as closely guarded as an alchemist's secret, is today a science of quantity as well as quality production. Not only are mirrors produced at a price sufficiently low to warrant their extensive use as a decorative element, but the types of available mirrors and new methods of treatment have increased considerably their possible uses. Designers are thinking of mirrors, not as an inconsequential decorative accessory, but as an architectural surface. Architects are incorporating mirror spaces into the original plans, which is particularly necessary when large wall areas are to be covered.

Appropriate for any style of design, the mirror contributes much more than itself to the atmosphere of a room. Although its most frequently expressed justification is that it increases the apparent size of a room, the mirror possesses several other virtues which are almost equally important. For instance, the sunlight streaming through the window is thrown about the room by a wisely placed mirror. One could almost believe that a mirror persuades the sun to enter. How often, too, has the mirror proved to be the savior of a haphazardly decorated room, by repeating designs and creating a room pattern where there had been none before.

Mattie Edwards Hewitt

Small apartment elevator lobby, in which mirror panels have been used for the walls and for the ceiling, greatly increasing the apparent size, and enlivening and enhancing the architecture. Milton Blum was the decorator

The mirror serves the further happy function of drawing each reflected area into it, unifying it with a frame. Interesting details of interior treatment which might otherwise be unnoticed are grouped in a mirror reflection. The psychological effect of reflection is probably the most nebulous but still the most real of all the mirror virtues. If there were coefficients of animation just as there are coefficients of acoustics, mirrors would rank high.

Sonia, Courtesy of Elsie de Wolfe

Two interesting uses of mirror are made in this Parisian dressing room. The recessed area enframing the bath is a flat mirror surface, with strips of mirror at right angles progressing out to the wall line. Mirrored shelves are attached to the strips as well. Around the wall a painted mirror frieze, in color and subject matter harmonious with the treatment and character of the room, gives an accent that is needed to the white marble walls. Elsie de Wolfe, designer

But these are general virtues, common to all mirrors. Consideration of the more specific uses will, I think, give us a chance to examine some of the things that are being done with mirrors that have never been done before.

Bathrooms and dressing rooms are receiving a great deal of attention as suitable for mirror treatments. Perhaps they serve a more utilitarian purpose when so used than they would in any other space. There is always the danger of over-use. It is a temptation to push out the walls of a bathroom with completely mirrored walls, but better practice seems to indicate the advisability of bordering the mirror with a material of similar character to control the reflection. In all small rooms the untrimmed mirror is likely to prove unwise.

Dressing rooms offer more latitude to the architect and more opportunity for the use of unusual color treatments. A painted mirror frieze encircling the entire room can be very successful in small dressing rooms and bathrooms. Although painted mirrors are commonly used in dressing rooms, it is confusing if decorated mirrors face reflective mirrors.

The mirror is an essential in the entrance hall, serving a utilitarian, a decorative and a psychological purpose. In the first place, the mirror throws the light from the street into the hall and gives the incoming guest a vista into the rooms beyond. It opens up the space effectively, and is of course necessary for the adjustment of clothes for arriving and departing guests. Perhaps the small hanging mirror will be sufficient, or even a girandole, if the style of treatment will permit.

In the other rooms of a house or apartment the mirror has been used least, but there it can be used very effectively. The dining room is particularly well suited for mirror treatment. Perhaps one wall, preferably one not opposite the entrance to the kitchen or pantry, can be treated entirely in mirrors. The coloring, since almost all color treatments are possible, can be any one of a number of tones in harmony with the general color scheme of the room. Scenic designs are often the proper solution for dining room walls. The mirrored frieze is another possibility, or it may be that mirror trim will prove more effective. The mirror base, supplemented by window and door surrounds of mirrors, adds a note of distinction. Glass for this purpose is usually more than one-half inch thick and is sometimes etched or carved, but seldom painted.

Generous or limited use of mirrored surfaces may be made in the living room, depending upon the general treatment. One of the effects that has been successful is the mirrored pier between two windows, permitting treatment of the entire space as one window. This plan is particularly satisfactory when the mirrored area is perfectly plain, the edges being accentuated as little as possible.

Further than this, mirror uses in living rooms are confined to paneling, and whatever other incidental decorative employment may seem necessary. The narrow space that occasionally occurs between two doors is an excellent location for a mirrored strip; or, when two such narrow wall spaces occur, strips of identical treatment, either painted or etched, may prove to be a happy solution. If the room receives a small amount of sunlight, mirrors are often valuable simply to intensify whatever sunlight finds its way into the room.

The stair well presents a splendid opportunity for mirror treatment, not for the sake of the mirror itself, but for its effect upon what is sometimes an uninteresting part of the house. Narrow strips, spaced to coincide with the shape of the stair well, will probably be found best suited for the purpose. Another similar use for a mirror is at the end of a long hallway that depends entirely upon artificial illumination.

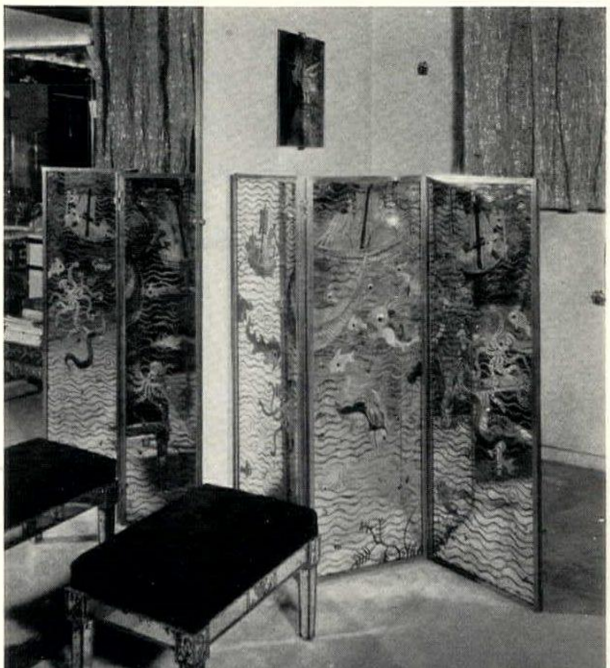
Bedroom uses for mirrors are variant, consisting usually of adjuncts to furniture. One interesting use that suggests itself is the installation of decorated mirror head-boards for beds. Experimentation with dressing tables has been carried on with interesting results by almost every designer of furniture. It is regarded as essential to provide adequate vision space somewhere in the room, either in the panel of a door or as part of the dressing table design.

One other splendid general use for mirrors is for the lining of niches. This not only adds to the apparent size of the room but gives reflection in all directions. It is well also to be on the lookout for an opportunity to employ mirrors on horizontal surfaces. Mirror-topped tables we are familiar with, but there is also the possibility of using mirrors for radiator tops and fronts with movable louvres, where the opportunity for relaying light into the room is not to be overlooked. A few successful installations have been made of mirrored ceilings. While the result is certain to be startling, such an extensive use is likely to prove disastrous in any but a small room, or where the design and the color treatment are wisely carried out.

Once one has decided to use mirrors, a host of interesting new decorative treatments may be drawn upon to obtain whatever effect is required. In the en-

Photos, Courtesy of Elsie de Wolfe

The photographs on this page and the one on the opposite page are of the dressing room of Lady Mendl, the former Elsie de Wolfe, who designed the room. Above, the effect of the painted mirror frieze in contrast with the white marble walls and white rug is more apparent. Over the fireplace the marine motives of the frieze are repeated in the border of the mirror. And below, the same motive is again recalled in the painted mirror screen. To complete the unusual color scheme, the furniture is covered in beige and brown, and the drapes are of a rough silver metal fabric



Sigurd Fisher

Above is the alcove of the dressing room in the residence of Mrs. William Ziegler, Jr. Behind the doors, grouped in a triple arch motive, are shelved closets and storage for all the accessories for the bath. The mirrors are bevel edged with rosettes at the intersections, and the doors are hinged to permit the greatest usefulness. William Lawrence Bottomley, architect. A rather unusual mirror use is apparent in the photograph below, where mirror panels completely surround a fireplace that is set out from the wall. Here the method of attaching mirror to the wall is that of using the bubble-head screw over the screw which is actually doing the work

trance hall and loggia of the River House, the exclusive New York apartment building, the series of mirrors painted by Jan Juta is typical of the effective treatments now possible.

For the reception of paint, the mirrors were slightly buffed or frosted on the back to dim the reflection. After the incredibly difficult work of painting on the back had been finished, the glass was treated with brilliant mercury for certain planes, particularly the sky and water, and oxidized mercury for other parts, giving it a gray and tawny color, varied in value. The paintings are in sanguine red with a few judicious accents of black.

Another interesting illustration of concentrated mirror use is in the Embassy Club in New York, where the sides of the walls between the pilasters are made entirely of mirrors, with the delicate arches and supporting pilasters of clear emerald green glass. Above the arches the mirrors are gold, and between the coupled pilasters, which are repeated at intervals around the room, are lozenges of gold mirrors set in a field of amethyst colored mirrors. The fourth side of the room, however, has four large paintings by Ernest Peixotto, done in a transparent technique on gold backgrounds in sepia and cobalt. The result of these shimmering decorations reflected back and forth in mirrors gives a character to the room which would be lacking with nothing but the brilliance of the mirrors.

There is also a danger in setting large unbroken mirror surfaces opposite each other, since the infinite reflections extending back at either side absorb light and are apt to give an eery and mysterious effect.

Drix Duryea

Mary Howard, Inc.

Mattie Edwards Hewitt

The fanciful treatment of the mirrored surfaces surrounding the tub is repeated endlessly by the reflecting mirrors on the walls opposite, giving the room a rather gay and spacious appearance. Ysel, Inc., decorator

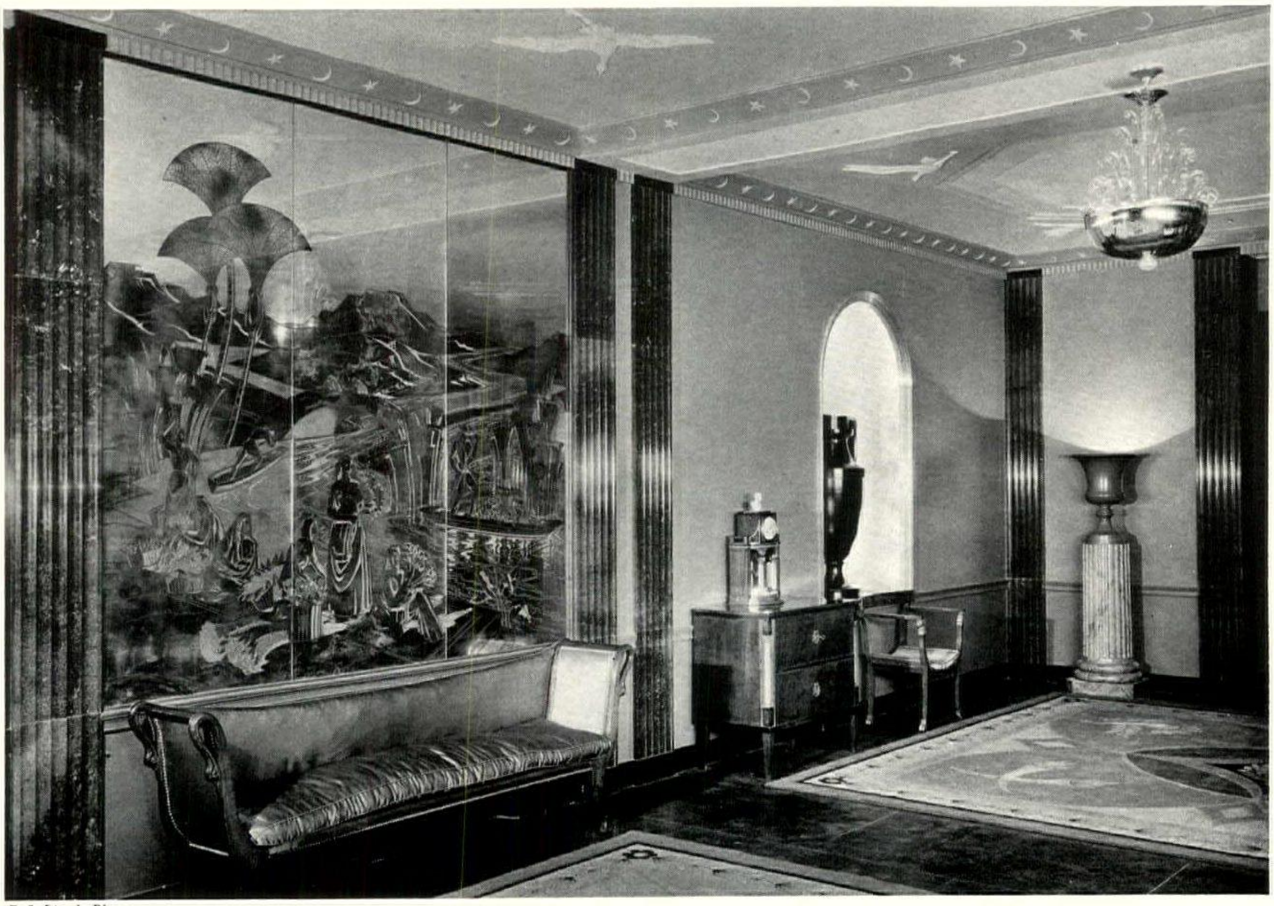
The combination of different types of mirror backing in one mirror has been successfully accomplished in several instances. The silhouette pattern of a cartoon is transferred to the back of clear glass plates, and then the design is painted from the back, usually in oils. An asphaltum or other protective coating is then applied over the painted portion in preparation for the mirror baths, which may be gun-metal and silver, copper and silver, gold and silver or other combinations.

Mirrors may be made in a great variety of color and value. They may be had in tones of blue from the deepest cobalt and ultramarine to the pale color of a star sapphire or aquamarine. It must be remembered in selecting the glass that the intensity of color is doubled by the reflection. A pale blue mirror is produced, for example, from a sheet of glass so delicate in tint that when held up to the light it appears almost white. A medium shade of glass when backed by silver will appear very dark and very intense. To select different values for a subtle scheme, the samples should all be silvered, selected, and tested in different lights, in different rooms, and constantly compared with a clear silver mirror.

Joints may be made of half-inch chrome-nickel steel or a similar metal, since these are almost invisible. The usual device for holding in place is a counter-sunk screw overlaid with a thin disk of mirror flush with the surface. Sometimes, however, a screw with a glass bubble head trim affixed to the screw that actually holds the mirror can be used. Small, flat chromium-finished metal hangers also are satisfactory.

With such expanded possibilities for the use of mirrors as have been discussed here, it is perfectly apparent why there has been renewed interest in this material among architects and decorators. When one considers that no other material offers values — utilitarian, æsthetic, and psychological — to the same degree that the mirror does, it is amazing that development of its uses has been postponed for so long a time. Although period and modern design alike are receptive to the virtues of mirrors, the opportunity for the unusual is greater in modern architecture.

Increasing the apparent size of a room, and increasing the intensity of light are common virtues in other decorative elements, but what other material

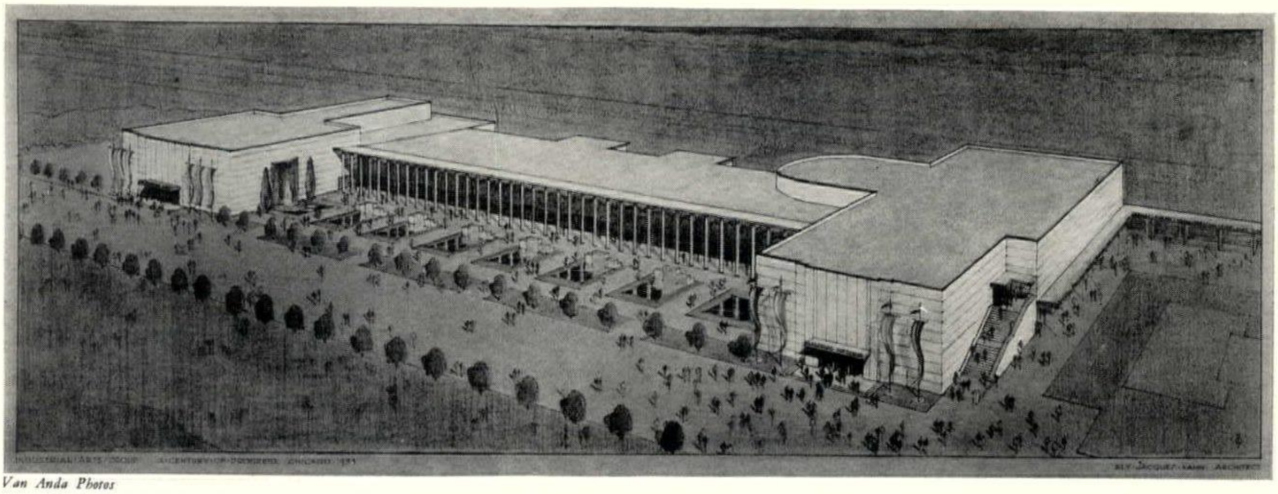


F. S. Lincoln Photos

Above is the entrance lobby of River House, showing one of the mirrors painted by Jan Juta on the reverse side of the glass after the mirror had been frosted to tone down the reflection. At the left is the mirror lined powder room in the residence of Mr. Alfred Morris, Scarsdale, N. Y., showing the effective use of plain silvered mirror. A. Kimbel & Son, decorator

offers as well the psychological effect of gaiety and brilliance? By reflecting light, the movement of people, predominant colors and patterns, mirrors contribute to a room more than their own appearance. No other product does that. From the purely decorative standpoint, mirrors, whether framed or without trim entirely, whether decorated or left plain, are decided assets. If decorated, they are in themselves elements of interest; if plain, they give to the other elements of decoration an added value.

Finally, it is well to remember Narcissus. The same trait of character which caused him to gaze too long is still present in all of us. We like to see ourselves as others see us. It is seldom enough to place mirrors in dressing rooms, bathrooms, entrance halls, and bedrooms. There is a place for a mirror in almost any room, provided it is treated not only as an expression of personal vanity, but as an important decorative element which has manifold virtues that can be intelligently utilized.



Van Anda Photos

DESIGNS FOR A MURAL IN MARBLE

For The Industrial Arts Building, A Century of Progress Exposition

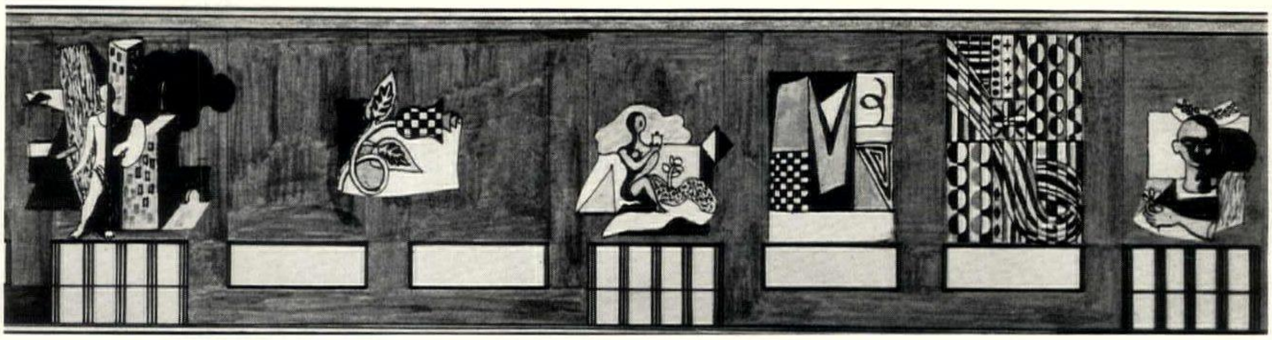
ELY JACQUES KAHN

ARCHITECT

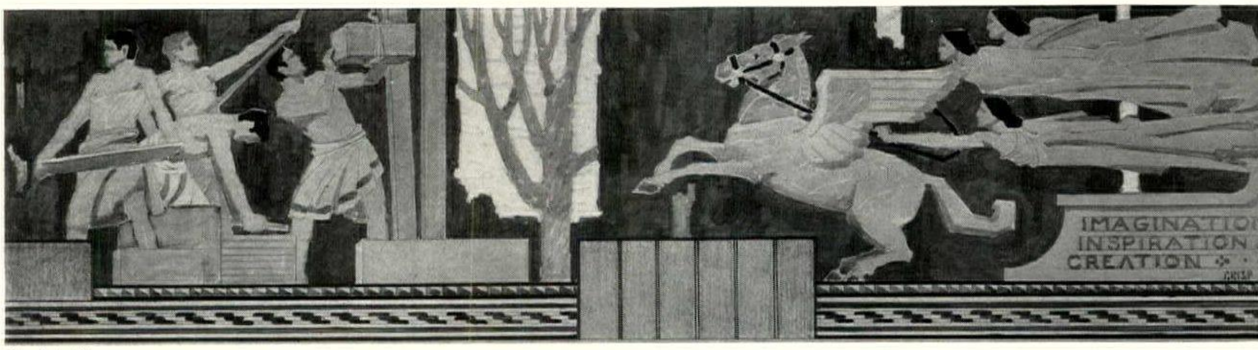
THE buildings of the Century of Progress Exposition are windowless in order that all objects may be properly lighted from constant sources and directions. This necessarily means large expanses of wall space, and for the Industrial Arts Building the idea was developed of creating a gigantic mural in marble which would be some 300 ft. in length by 30 ft. in height. This mural would occupy the entire wall under the colonnade which is shown in the perspective above, and would dramatically symbolize the exhibits within.

At the request of the architect, a selected group of mural painters and designers submitted sketches in order that one might be chosen to execute the final cartoons. Limitations of space permit only portions of a few of the designs to be reproduced.

The jury which selected the design of Buk Ulreich, shown below, consisted of Messrs. Ely Jacques Kahn, Raymond M. Hood, Ralph T. Walker, Joseph Urban, Kenneth K. Stowell, J. A. Pisani and David F. Traitelle. Most of the designers took cognizance of the limitations of the material and very ingeniously made these limitations virtues of the designs. The practical limitations of color, availability and expense also had bearing on the problem. It was finally decided that the design reproduced below had great possibilities in being susceptible to such modification as the exigencies of the final problem might dictate, or to further development of the symbolism of design to express the purposes of the building. It also would permit the incorporation of several suggestions, made by members of the jury.



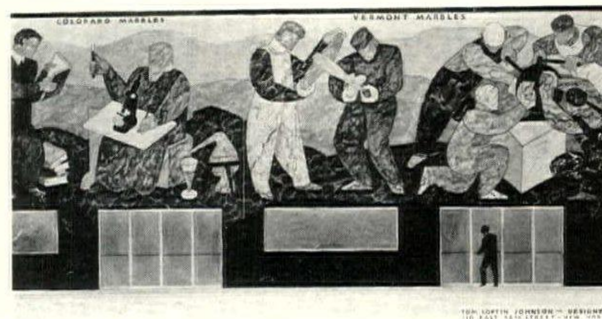
Design by Buk Ulreich, selected by the jury



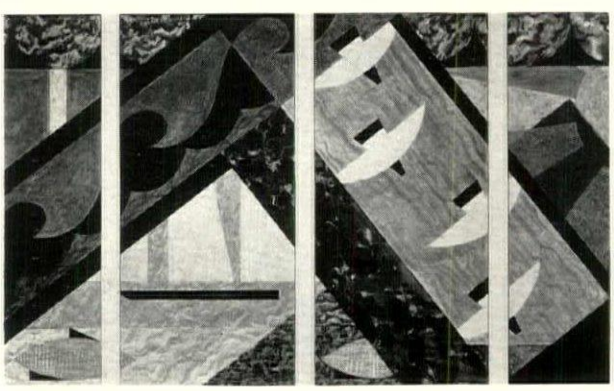
Van Anda Photos

Design by Arthur Crisp

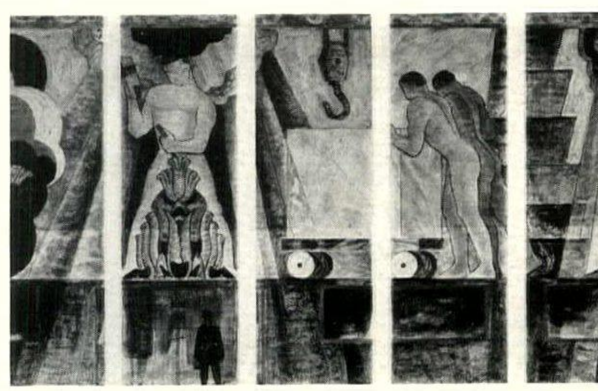
Design by D. Putnam Brinley



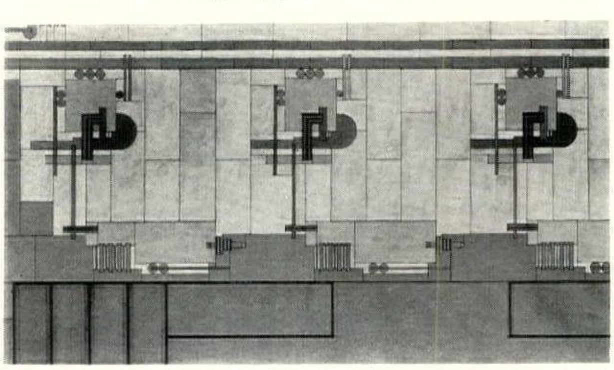
Design by Tom Loftin Johnson



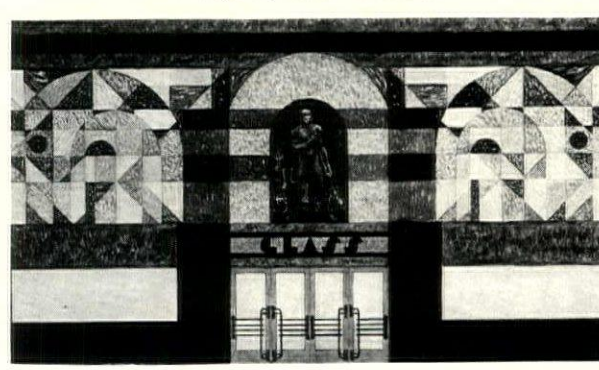
Design by John W. Norton



Design by Olle Nordmark



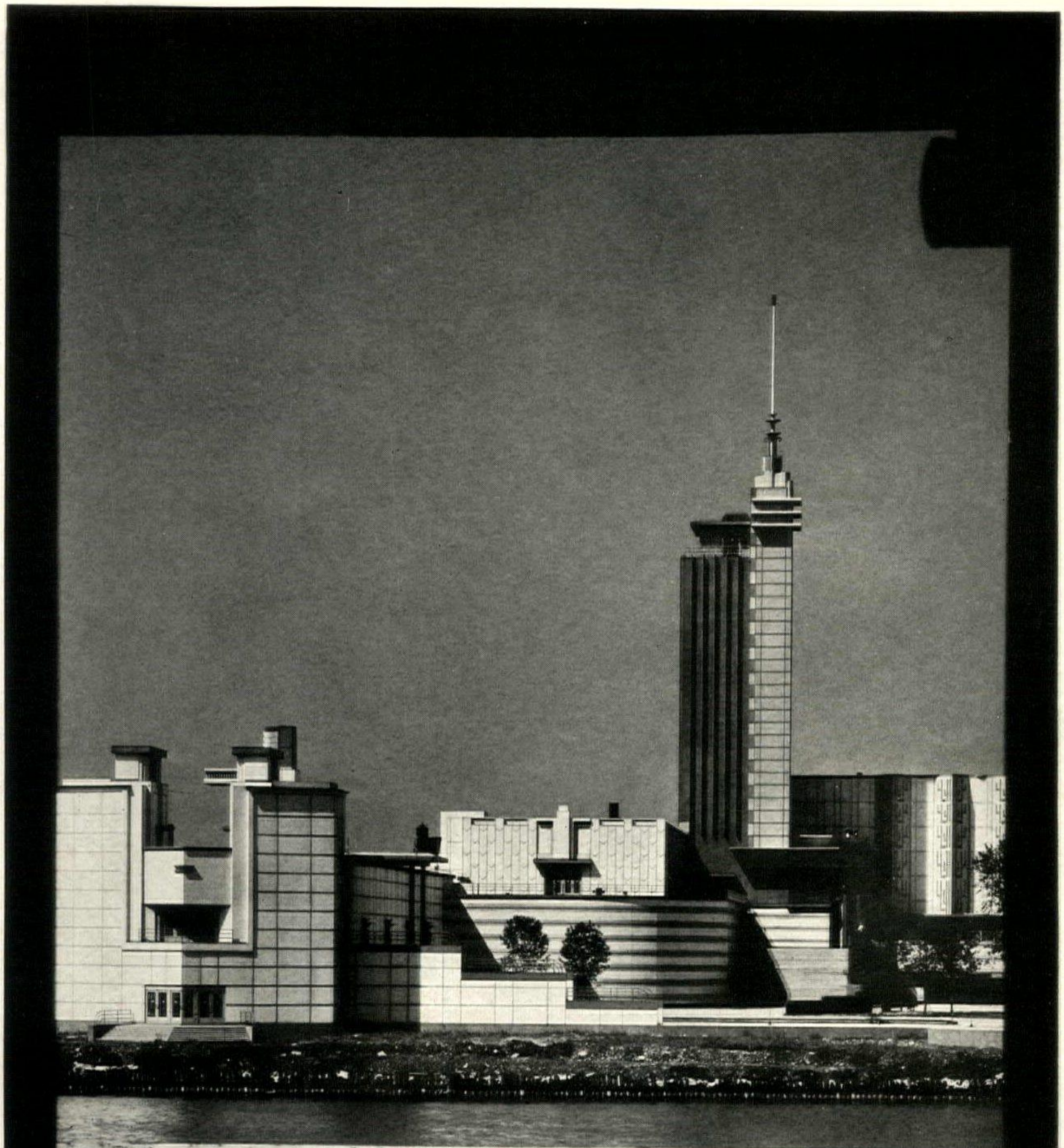
Design by Bart Van der Woerd



Design by Eric Mose

MURAL DESIGNS FOR INDUSTRIAL ARTS BUILDING, A CENTURY OF PROGRESS EXPOSITION

ELY JACQUES KAHN, ARCHITECT



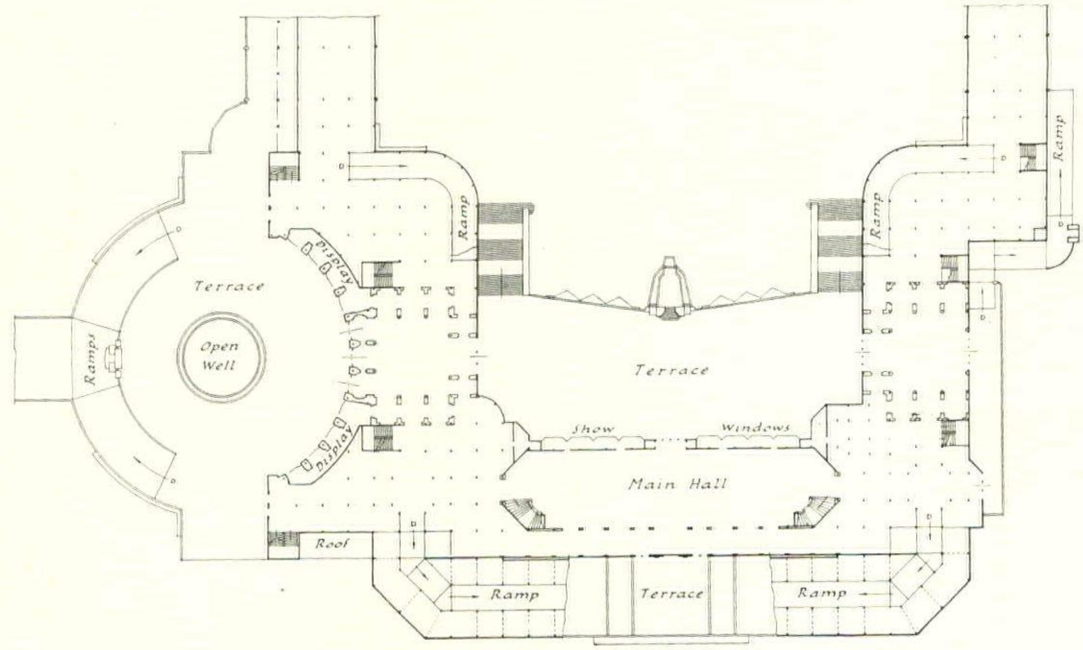
Hedrich-Blessing

THE HALL OF SCIENCE

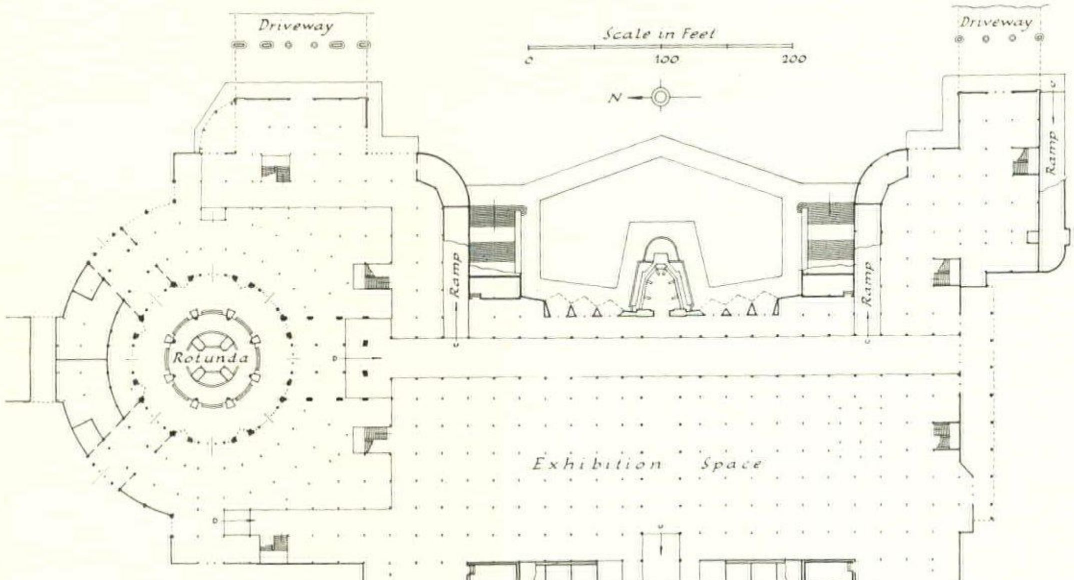
A CENTURY OF PROGRESS EXPOSITION

CHICAGO, ILLINOIS

PAUL PHILIPPE CRET, ARCHITECT



MAIN FLOOR PLAN



GROUND FLOOR PLAN

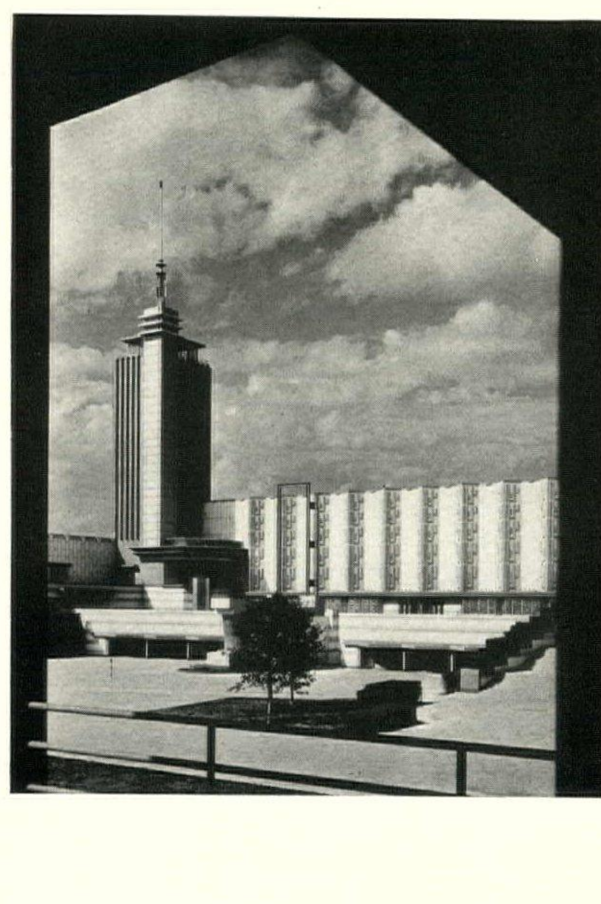
THE HALL OF SCIENCE

A CENTURY OF PROGRESS EXPOSITION

PAUL PHILIPPE CRET, ARCHITECT

Hedrich-Blessing Photos

THE Hall of Science, a preliminary presentation of which was made in the August issue of The Architectural Forum, is one of the major exhibition buildings in the 1933 exposition. Designed to attract attendants both day and night, the illumination of the building, as shown above, was incorporated into the architecture of the building itself. The pictures on this page, looking across the court at the Great Hall of the building, with the 175-foot tower rising from the southwest corner, illustrate how effective the dramatic use of materials has been. Study of the plans reveals an ease of circulation to encourage guests to visit the entire exhibition space



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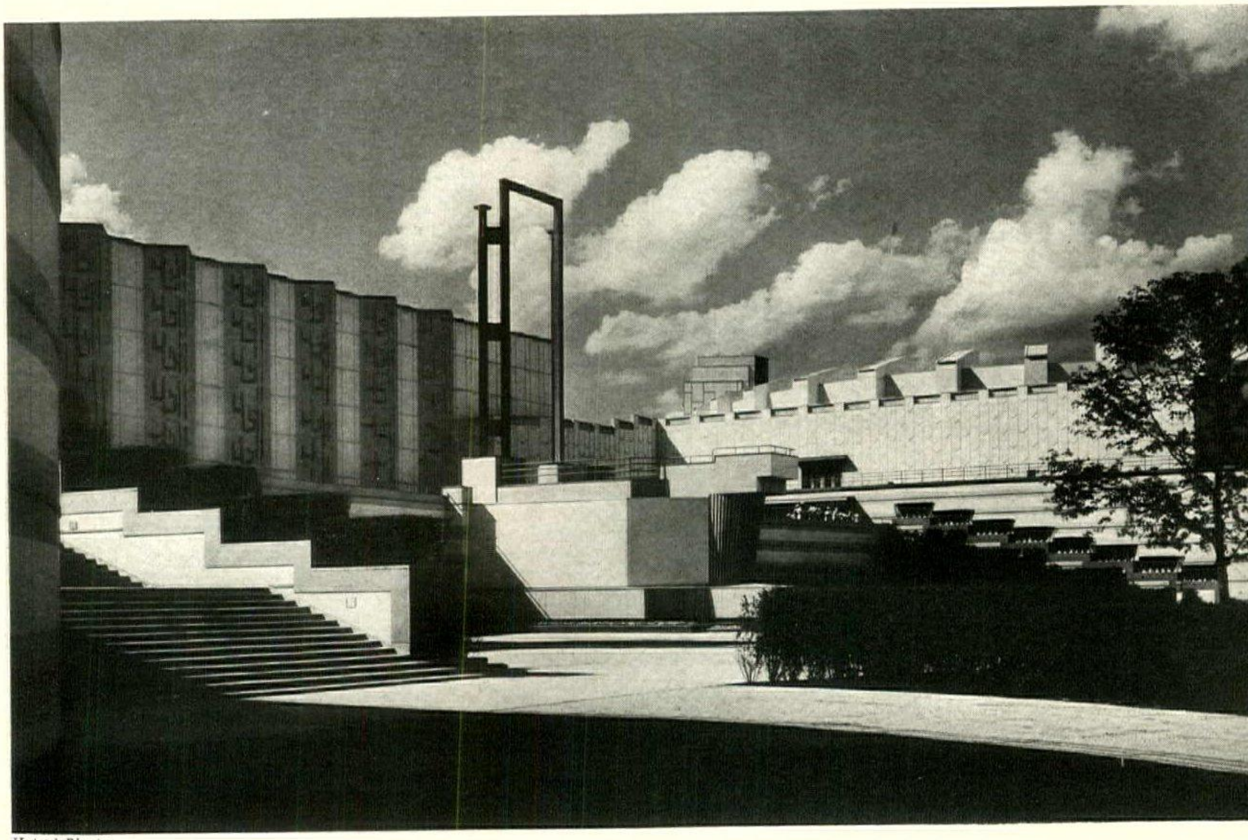
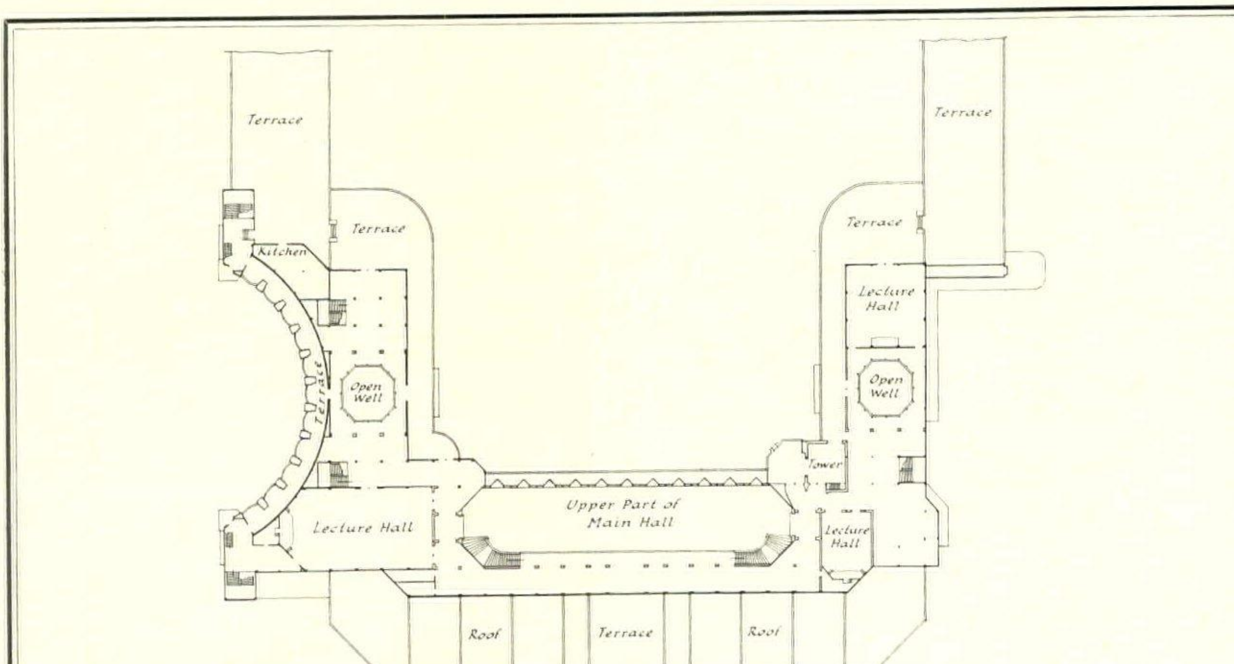


Hedrich-Blessing



MEZZANINE FLOOR PLAN

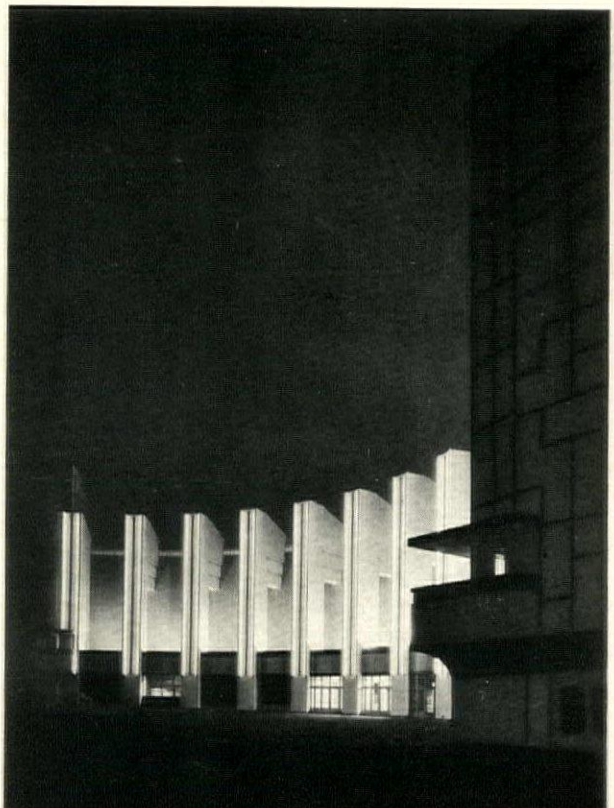
THE HALL OF SCIENCE

A CENTURY OF PROGRESS EXPOSITION

PAUL PHILIPPE CRET, ARCHITECT

Hedrich-Blessing

DAY and night views of the tall pylons which rise at the north approach, and on the opposite page, another view across the court showing the rostrum which extends out into it from the terrace of the Great Hall. The lighting of the pylons is accomplished by the use of colored gaseous tubes, which give the shadowless lines of light that accentuate the bold character of the design. The same system of lighting has been employed for illumination of the tower as well as for the walls of the Great Hall. Elimination of windows made possible the effectiveness of this unusual lighting treatment



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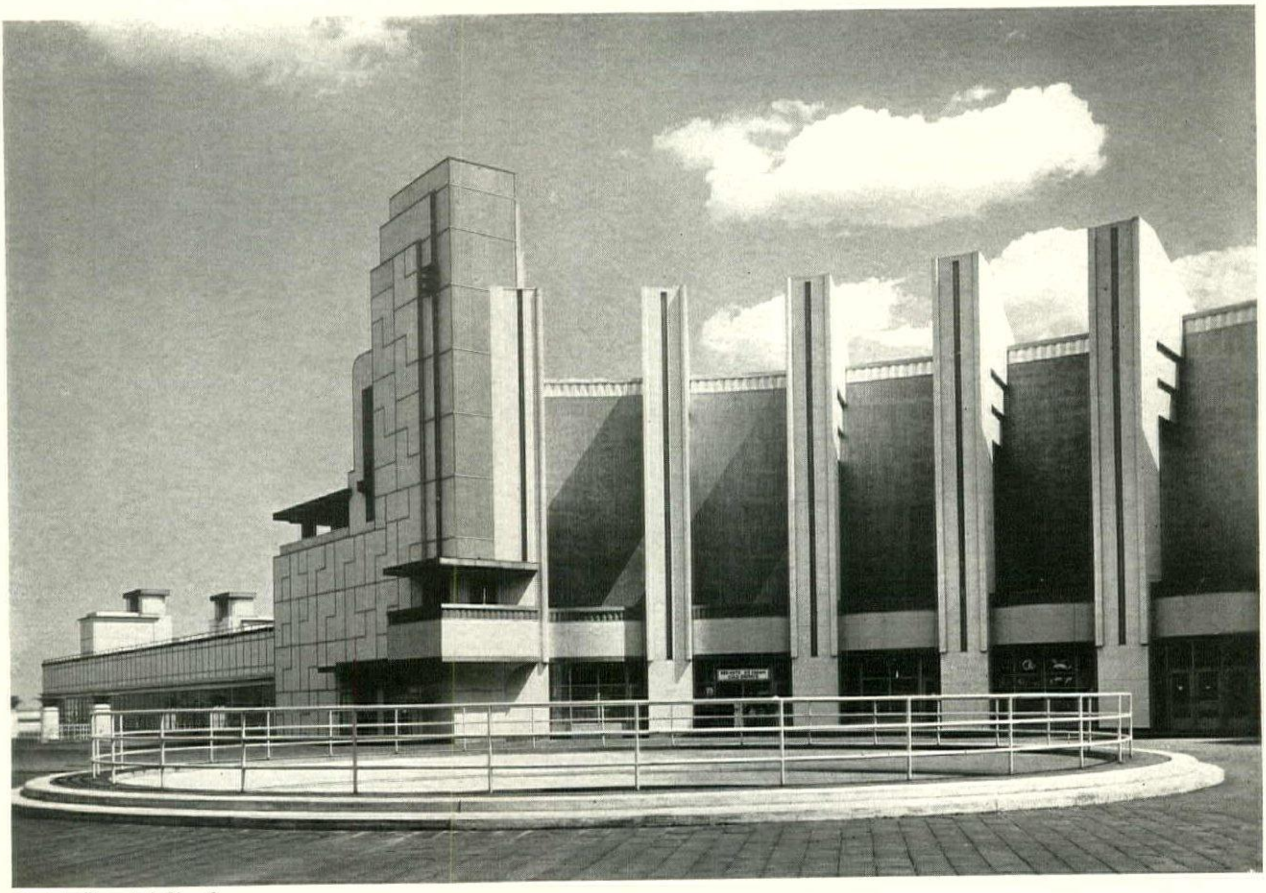


Copyright, Chicago Arch. Photo. Co.

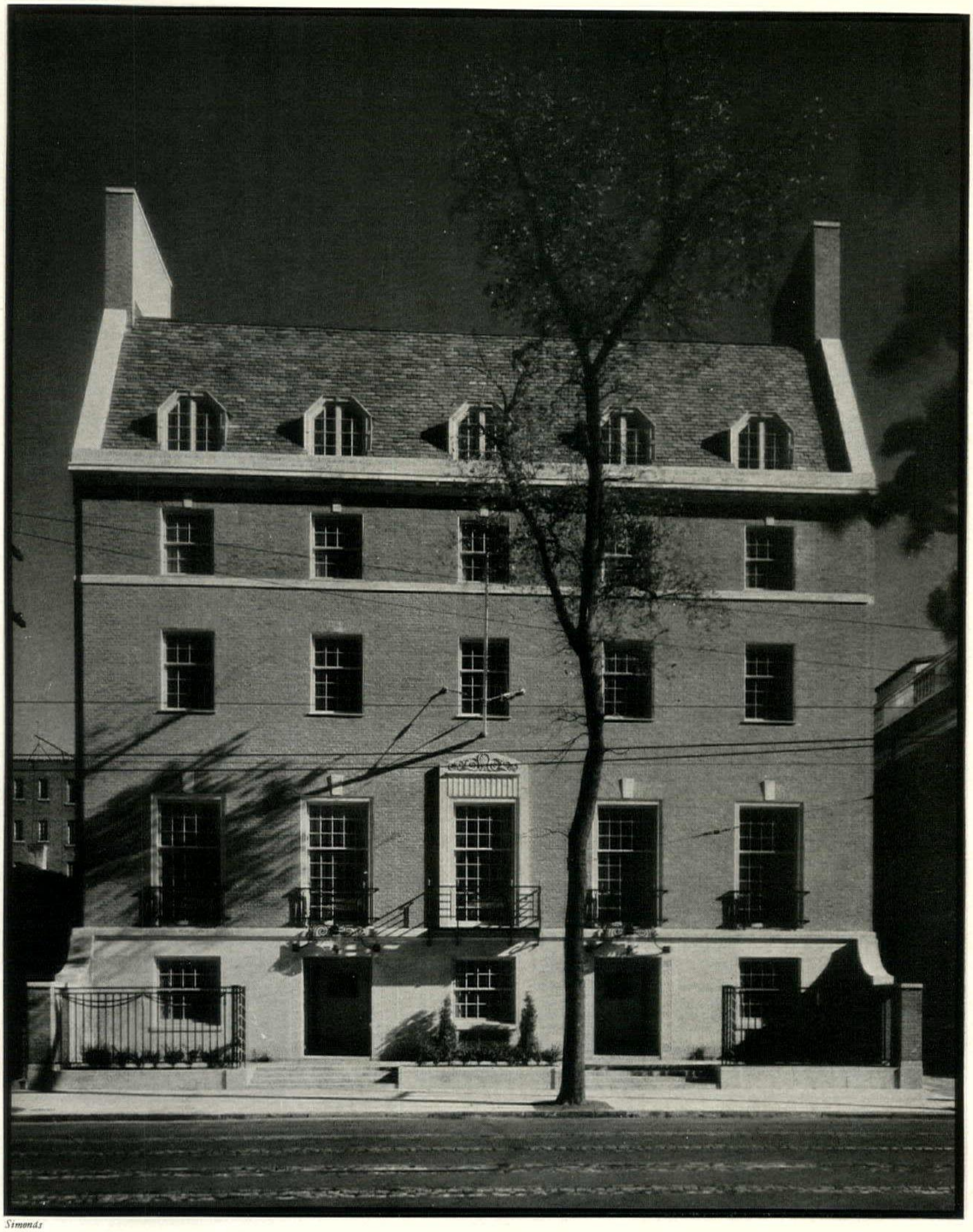
Hedrich-Blessing

ABOVE is a view of the terrace, lined with shops, which surrounds the north approach. The open well in the foreground looks down into a rotunda on the ground floor. Since most of the approaches to the building lead to this level, the exhibition space on this floor shares prominence with the main exhibition space on the level below. The detail at the left shows the general character of the wall construction, which is five-ply laminated board, secured to the studs by battens in 4 x 8 ft. sections. A complete discussion of materials and construction methods will be found on page 361 of this issue

THE HALL OF SCIENCE

A CENTURY OF PROGRESS EXPOSITION

PAUL PHILIPPE CRET, ARCHITECT

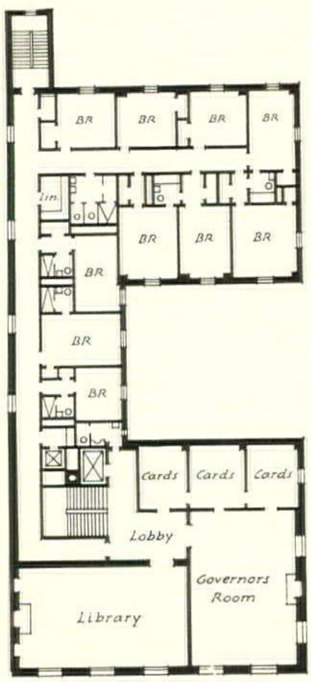


Simonds

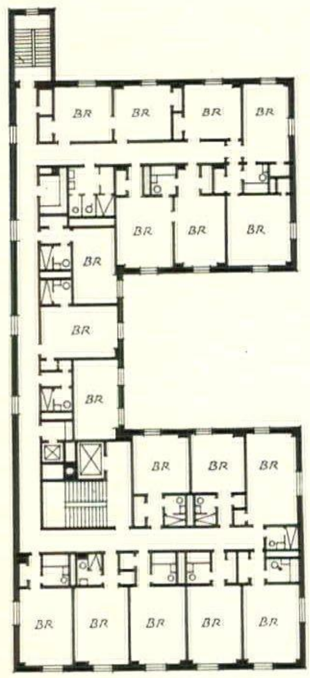
QUINNIPIACK CLUB

NEW HAVEN, CONNECTICUT

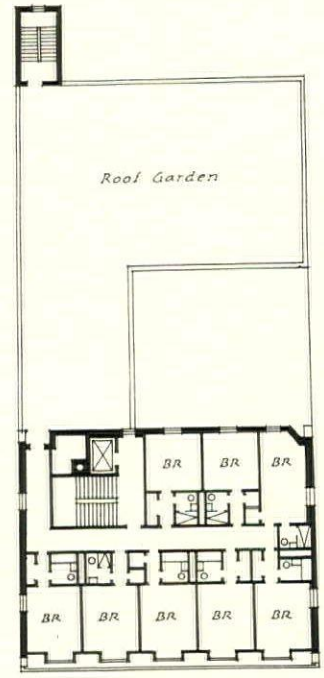
DOUGLAS ORR, ARCHITECT



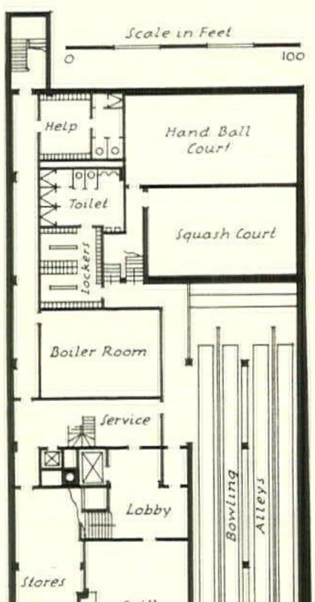
SECOND FLOOR PLAN



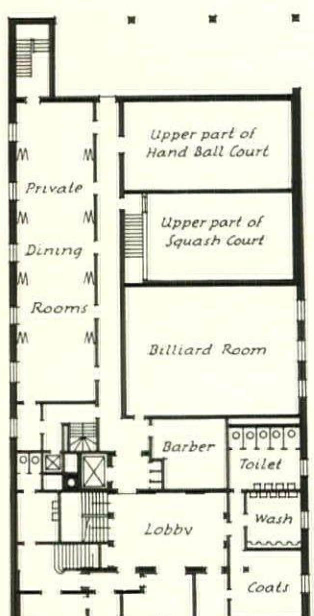
THIRD FLOOR PLAN



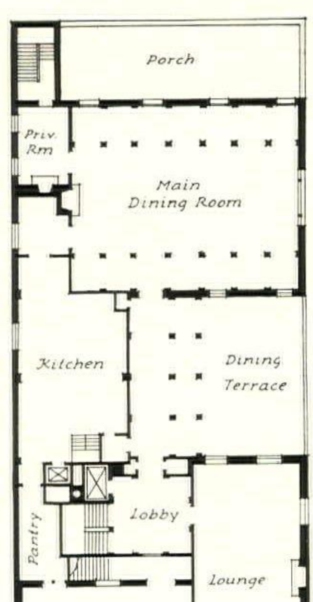
FOURTH FLOOR PLAN



BASEMENT FLOOR PLAN



GROUND FLOOR PLAN



MAIN FLOOR PLAN

QUINNIPIACK CLUB

NEW HAVEN, CONNECTICUT

DOUGLAS ORR, ARCHITECT

Simonds Photos

TWO views of the lounge — above the east elevation, and at the right the south elevation. Walnut paneling and polished brass lighting fixtures establish the tone of the room. The wood floor is covered with oriental rugs, and the furniture is principally leather upholstered in deep reds and blacks

QUINNIPIACK CLUB

NEW HAVEN, CONNECTICUT

DOUGLAS ORR, ARCHITECT

Simonds

CORNER of the main dining room, the general color scheme of which is a soft green with hangings in red. The flooring is black and green rubber tile, with a verde antique marble base and Belgian black marble fireplace facing. The wall panels and cornice are hard-finished plaster, the columns, door trim, wainscot, and mantel being wood. The Colonial character of the building, maintained in all the interiors, is carried out on the exterior in dark red brick with limestone trim, ivory painted wood trim, and dark purple slate roof. The building is of steel frame construction with aerocrete floor arches. Total cost for 530,000 cu. ft., at 55 cents per cu. ft., was $290,689, with an additional $94,000 for furnishings

QUINNIPIACK CLUB

NEW HAVEN, CONNECTICUT

DOUGLAS ORR, ARCHITECT

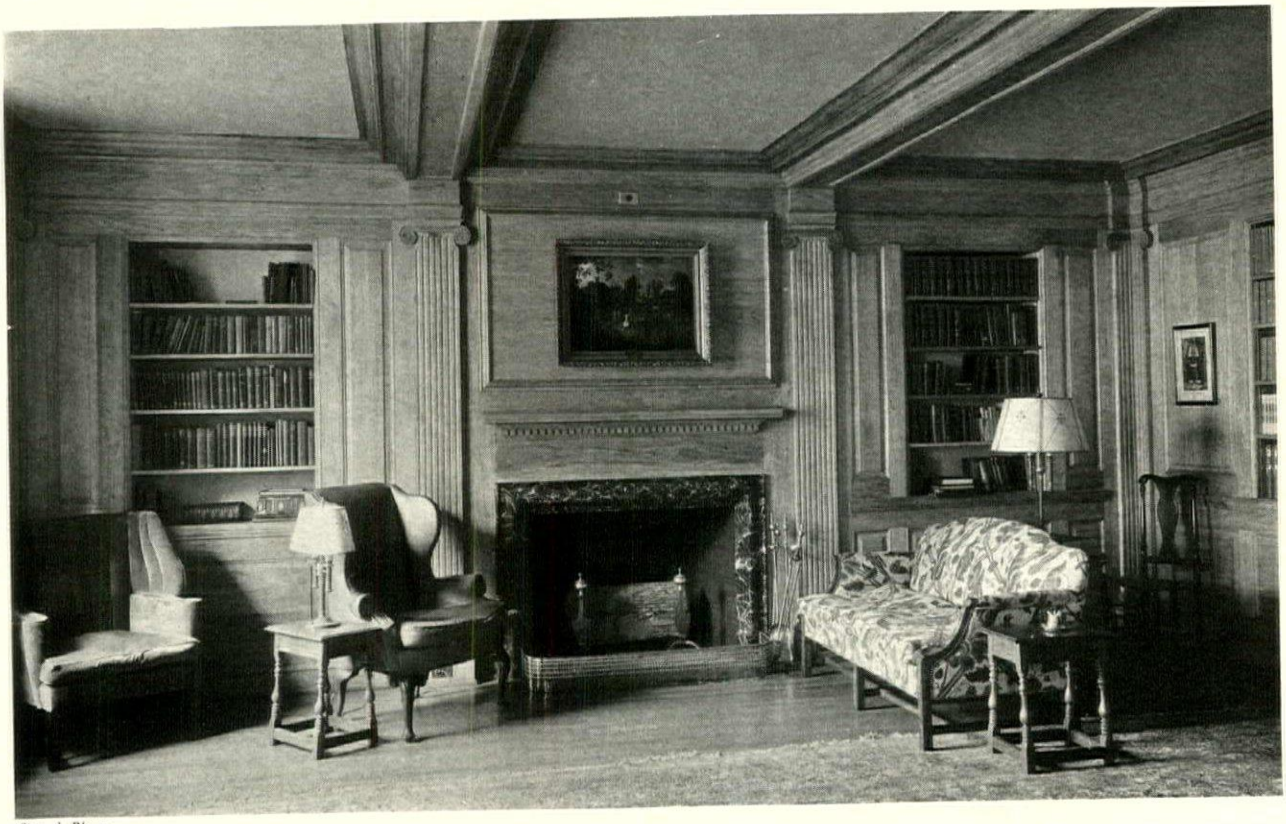
Simonds

THE women's dining room, which has a blue and yellow color scheme, derived from the blue carpeted floor and the yellow painted plaster walls. The hangings, blue with gold figures, and the yellow maple chairs are supplementary. The light fixtures are copper and blue glass with crystals, and the fireplace facing is Belgian black marble. This room, which is a part of the women's portion, has a separate entrance from the street and from the women's reception room on the floor below. Although complete separation of the men's portion of the club from the women's necessitated a double street entrance, the problem of control was solved by placing the office between them. There are five private dining rooms on the ground floor

QUINNIPIACK CLUB

NEW HAVEN, CONNECTICUT

DOUGLAS ORR, ARCHITECT



Simonds Photos

ABOVE, the library on the second floor, and at the left, the main floor terrace. The library walls and beams are butternut, the ceiling light blue. An oriental rug covers the wood floor. The terrace has a terrazzo floor, with a red Levanto marble base. Walls, ceiling, cornice, arches, and panels over doors are hard-finished plaster. The columns are of wood. The predominant color is light yellow

QUINNIPIACK CLUB

NEW HAVEN, CONNECTICUT

DOUGLAS ORR, ARCHITECT

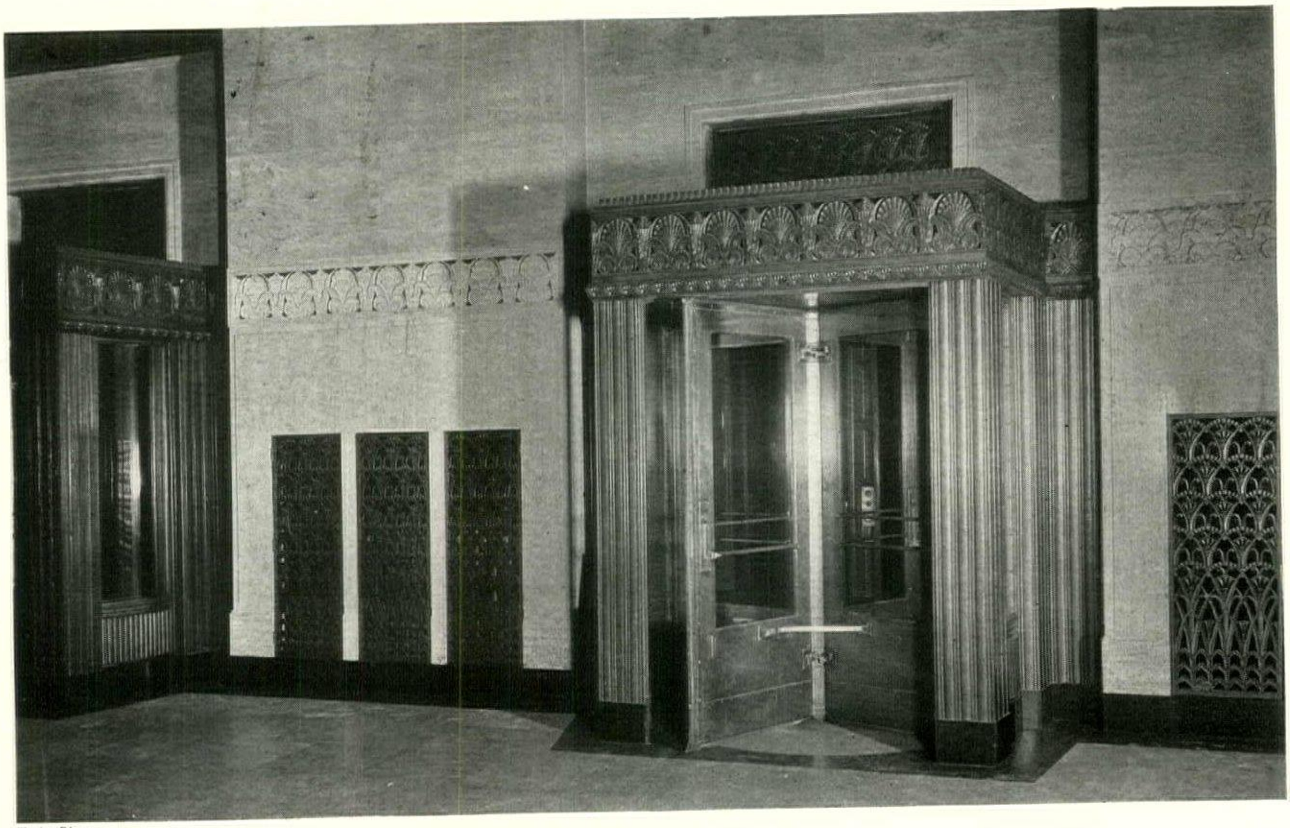
Trefts

VIEW ACROSS PLAZA

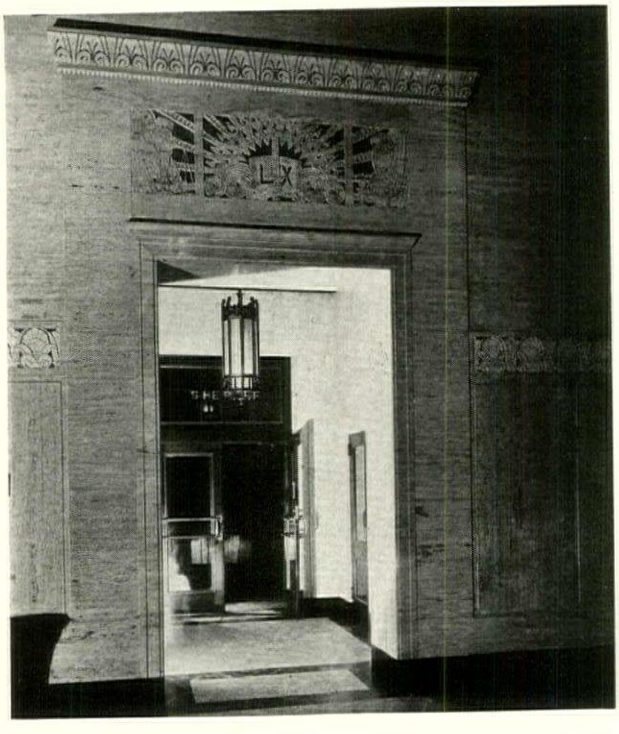
CIVIL COURTS BUILDING

ST. LOUIS, MISSOURI

THE PLAZA COMMISSION, INC., ARCHITECTS



Trefts Photos



THE Civil Courts Building, which is part of the Plaza development of St. Louis, was designed by Klipstein & Rathmann, architects, a member firm of The Plaza Commission, Inc. The latter is composed of several prominent architectural firms in the city. In keeping with the general character of the plaza, the courts building is conservative in design. The building is of steel frame construction, with concrete fireproofing, and reinforced concrete structural floors. The exterior walls are limestone, and the roofing of aluminum. For the interiors the materials were selected with a view to permanence. The ceilings of all court rooms and the assignment room are treated acoustically. Washed air is supplied to the public spaces and court rooms. The total cost was $5,059,920, which was 72.7 cents per cu. ft. for 6,969,000 cu. ft.

CIVIL COURTS BUILDING

ST. LOUIS, MISSOURI

THE PLAZA COMMISSION, INC., ARCHITECTS

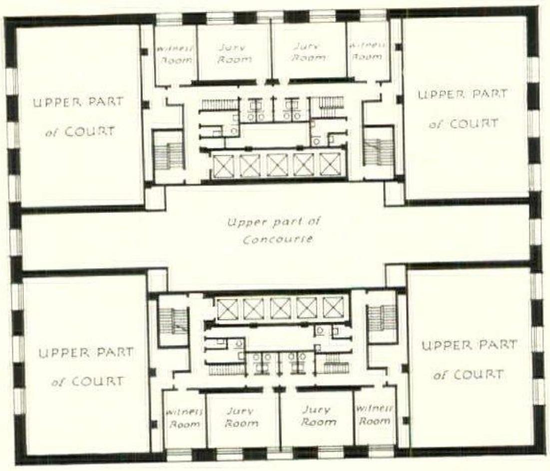
Trefts

ENTRANCE TO CONCOURSE

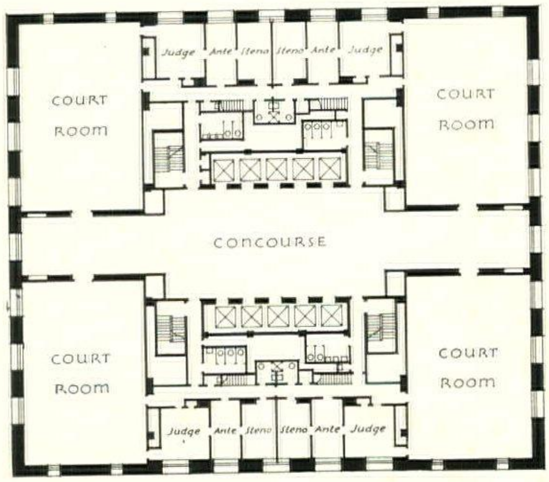
CIVIL COURTS BUILDING

ST. LOUIS, MISSOURI

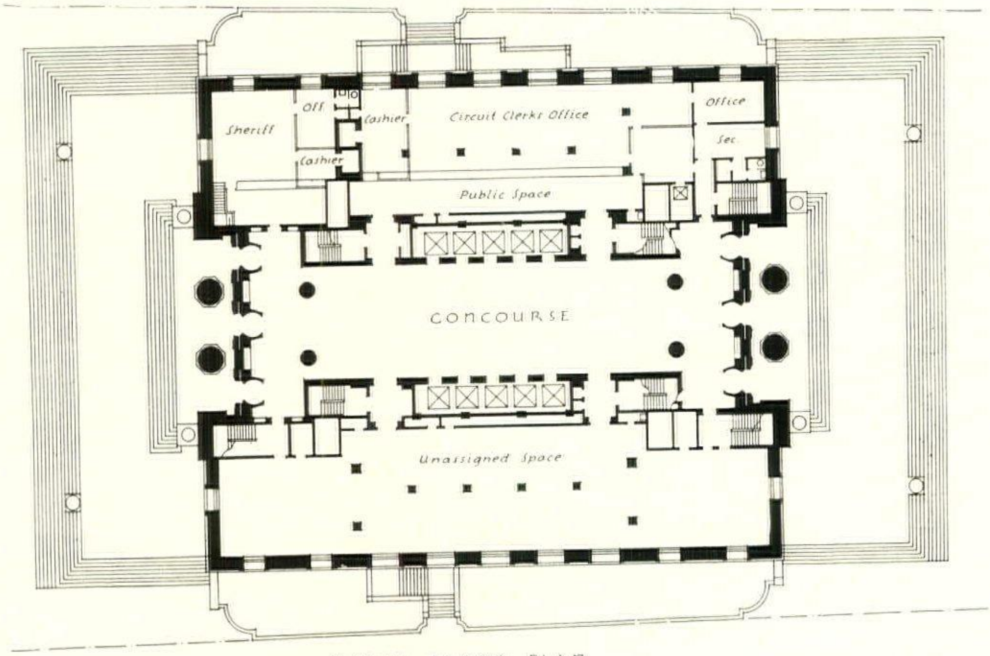
THE PLAZA COMMISSION, INC., ARCHITECTS



TYPICAL MEZZANINE FLOOR Floors 5-6-7
Scale 0 — 50 in Feet



TYPICAL FLOOR PLAN Floors 5-6-7
Scale 0 — 50 in Feet



FIRST FLOOR PLAN
Scale 0 — 50 in Feet

CIVIL COURTS BUILDING

ST. LOUIS, MISSOURI

THE PLAZA COMMISSION, INC., ARCHITECTS

THE EDITOR'S FORUM

APATHY AND ATROPHY—OR ACTION?

OF THE many projects submitted or about to go before the Board of Engineers, to be passed upon for financing by the R. F. C., only 3 per cent, we understand, are for slum clearance and housing. So far as we know, these projects come from only four States: viz., New York, Pennsylvania, Illinois and Ohio. Of those States, New York alone has at this writing the necessary laws to enable the projects to qualify under the Emergency Relief and Construction Act of 1932. Illinois and Ohio have prepared bills for special sessions of their legislatures for prompt action; Wisconsin and New Jersey are developing such bills; Pennsylvania and Indiana will make renewed efforts to see that the proper laws are passed. But where are the other States? Have they no cities with slums or low cost housing problems? Have they no architects alive to the opportunity offered to do constructive work in housing? Is it not within the sphere of architects' activity to engage in framing and sponsoring housing legislation in their states or cities? Why have the cities failed to pass qualifying laws? Cannot architects take the initiative in getting the requisite municipal laws?

It may be taken for granted that the chief interest of architects is in designing buildings that will be efficient in plan and structure and expressive of purpose. In normal times opportunities are not lacking for exercising their talents in line with this interest. But these are not normal times and clients with needs real or imaginary are not flocking in with their problems to be solved. The interest of the architect must for the time being shift therefore to finding the *needs* for building in his community, and taking steps to interest others in cooperating to meet those needs.

WHETHER we like it or not, the self-preservation of the profession demands this change in interest and activity. Unfortunately, the architect is a factor in an industry which has never investigated scientifically either the present or the possible future needs which it can meet even in a given locality. The law of "supply and demand" has been counted on to function — and how it has functioned! With the interest in speculative profits and the ease in financing, "supply" naturally outran "demand" in almost all types of commercial structures. If one new building succeeded, two more were put up on the strength of its success, and so on *ad moratorium*. Needs were forgotten and the result of the whirlwind is now being reaped.

It is easy to see these things now; hindsight is so much more accurate than foresight. But why the architectural apathy toward the one type of structure most needed — *better housing?* Hindsight shows that there has never been an excess of good housing at low rentals and that the few conservative projects of this kind have been able to weather the storm. Foresight shows that the need can be analyzed and that there seems to be no possibility of an over-production of these housing projects. Are the difficulties too great for the architect to attempt to overcome them? Must the architect wait for a housing promoter to commission him to prepare plans for a particular project? Or do the implications of architectural leadership of the building industry not force on us the necessity of analyzing the needs and actively sponsoring the steps necessary to meet those needs even though they transcend problems of "architectural design?"

THE Reconstruction Finance Corporation has recently issued Circular No. 3 which gives the specific information regarding applications for "self-liquidating" projects. The Principles of Housing Laws were printed in the August issue of THE ARCHITECTURAL FORUM. In the present issue, the financing problems of housing are discussed by Alton L. Wells. THE ARCHITECTURAL FORUM, following its policy of furthering the interests of the architectural profession, will continue to do everything in its power to be helpful to architects who see the opportunities in housing. But action on the part of architects individually and in groups is essential immediately if the opportunities are not to be lost.

Through the Committee on Economics and Site Planning of the A. I. A., a meeting has been arranged to be held in Pittsburgh on Monday, November 14, 1932, to consider matters of procedure in large scale housing developments. This meeting is being held in connection with the convention of the city planners who also plan to devote one session of their conference to this subject. The program developed by the A. I. A. Committee for its meeting includes the practical presentation of the housing problems and their solutions, and the list of speakers includes most of the leading authorities in this field. It is not planned to make this a theoretical discussion but a very practical presentation of ways and means of furthering housing projects immediately. It should be attended by representatives from every section of the country.

Kenneth K. Stowell

EDITOR

HOUSING HOOEY!

A CRITIQUE OF SOME CURRENT CULTS

BY

EUGENE H. KLABER

WIDESPREAD interest has been awakened in the subject of housing by a realization of the fact that here is one field of construction in which there has been no overbuilding, so far as the needs of a majority of the population of our country are concerned. Technicians of all kinds have been busily working on possible solutions of this or that phase of the problem, but, whereas many of them have presented ideas that are of interest, it is surprising how few have any conception of the problem as a whole. The results have been repeated attacks at corners of the field and the development of many half-digested notions that do not square up with facts or that overemphasize the importance of minor factors.

Again and again, architects have been guilty of forgetting elementary knowledge that they have acquired by experience, in their worship of untried notions, alluring catchwords or formulas of design that they have gleaned here and there around the world and which they have adopted as unthinkingly as the devotees of Vignola ever did the Five Orders. Those most prone to this are the very men who prate of modernism and functionalism and pretend to a new expression of life. The old gods are torn from the altars, but new ones have been substituted and worshipped as blindly as were the old. Chief of these new idols is the Great God Hooey, the god of half-truths, of slogans and of advertising. It would be impossible to detail all the manifestations of the worship of the new god. A few examples will suffice to illustrate the loose thinking that is being done on the subject of housing.

Utility. First a word on the cult of utility. This is largely a product of post-war Germany. Perhaps no other nation has faced its housing problem as courageously as have the Germans. Laboring under a staggering burden of debt and economic depression, they have grappled with their difficulties. Money was scarce and the need of it enormous. Every mark had to buy the maximum amount of building; there was nothing to waste on the non-essential. It was logical, therefore, that their buildings should be of the utmost simplicity, even to the point of being mere boxes. New norms of sanitation were established, exposure carefully studied. Repetition and standardization naturally resulted.

All this was both necessary and laudable. But in their bitter struggle with physical factors, with their entire attention centered on the practical, it was fatal that they should make a virtue of necessity. What they had to do was rationalized to appear as what they wanted to do. At this point utility became a cult. What was useful became *ipso facto* beautiful; proportion and design were mere abstractions, ornament was taboo. If a given orientation was deemed best, then all houses must conform to it, regardless of monotony.

The error of this cult is a failure to recognize certain basic human values. In their insistence on rationality the Germans and their followers in this country have forgotten that, although human nature is partly rational, the emotional factors in our makeup are far more potent than is our reason. They demand satisfaction that cannot be denied. Out of the wellspring of emotion emerge not only love and hate, but our sense of beauty that finds its expression in poetry, music and all other forms of creative art, and the essence of artistic creation is the addition to the bare framework of a medium, be it a language or a building, of elements that are not inherent in the medium itself. In architecture, this may be merely a question of choice of proportion or it may involve color, texture, or ornament. Our nature demands these added elements that are of the spirit. In much German housing they are missing.

Compare one of the more recent German developments in Kassel with a typical row of London slum houses. Doubtless the former affords the occupant a much better opportunity for physical well-being and in that measure increases his chances of leading the good life, but emotionally there is nothing to choose between the two. Both are monotonous, dreary, deadening and only the possibilities of good landscape design can save Kassel from being an emotional slum.

The Machine Age. This is another favorite theme for loose reasoning. The usual argument runs about as follows: This is a machine age; machines produce more quickly, more accurately and cheaper than handcraft production; rather than resist it, let us embrace it; behold what mass machine production has done for the automobile, a marvelous product at a low price. Building construction processes are antiquated and wasteful; let us turn to mass production of prefabricated houses and the consequent reduced cost will bring good housing within the reach of all.

In this neat little train of thought there are just three things forgotten. In the first place, only half the final cost of a home is labor and materials. If labor and material costs of a house that now sells for $16,000 can be reduced 75 per cent, the house would still have to sell for $10,000, unless at the same time we can cut down the cost of those other elements that are usually so blithely ignored: viz., land cost, cost of improvements and utilities, sales costs and profits.

It is easy to assume that houses can be produced *en masse*, just as automobiles are made, but the analogy is not valid because of one cardinal factor: depreciation. If I buy a car, I expect it to have a life of three or four years at most. I tell myself at the end of that time I will be able to afford a new car, or, if not, I may have to do without one.

But a home is quite different; it is a cardinal necessity, and when I buy one I expect it to have a life of at least 30 years. Let us examine approximately what this means. There are 120,000,000 persons in the nation, or (at an average of four per family), 30,000,000 families. If the depreciation period of a house is 30 years, then 1,000,000 homes should be replaced annually. But people who would scorn a 1924 car are still content to use an 1884 home, and we must assume that at least 60 per cent of our million will be used long after they should have been scrapped, if not by the original owner, then by others less fortunate. This brings us down to 400,000 new dwellings. Of these, how many will be in multi-family buildings, how many will be special types to meet individual needs, how many plank shacks in the backwoods and adobe in the desert? If these constitute only 30 per cent of new dwellings, there remain a possible 280,000 susceptible to standardized production. Divide by 300 working days and we have a production of 933 houses a day for the entire country. Consider the thousands of cars that a single modern plant can turn out in a day and ask yourself whether a production of 933 houses a day warrants the building of the colossal organizations and making the expensive machinery that mass production entails. Hooey!

The third thing that our logicians forget is the tendency of the machine to destroy itself and the civilization that has created it. At the very moment that the vaunted automobile industry has perfected mechanical marvels at low prices, it finds itself at the point where the product can no longer be bought. Those machines must be fed! Millions have been spent to foster the demand for cars, constant technical improvements devised, nation-wide advertising campaigns conducted and when these have failed to make buying keep pace with the machine, style changes have been introduced that rival the activities of the Paris couturiers. And yet — the effort fails and must fail.

I hasten to correct the impression that I would do away with machinery; unquestionably it has its uses. But I cannot accept the thesis that it offers more than an incidental aid in our struggle with what is basically an economic problem.

Own Your Own Home. One of the more elementary forms of Housing Hooey is the "Own Your Own Home" movement which has received support and encouragement in high governmental circles. We may assume that a vast number, probably a good majority, of Americans would prefer to have a home of their own. The President has pointed out that "My Little Gray Home in the West" lies closer to the hearts of the people than any song that might be written about an apartment. But we know that under present conditions it is economically possible to build individual homes for only a very small part of our population. I shall not digress into a presentation of facts and figures that substantiate this statement: suffice that it is not in the cards. However, it might be of interest to note one or two of the factors that help to keep this illusion alive.

Foremost among these is land speculation. If the business of subdividing were dependent on sale of tracts for large scale development, it would soon disappear. Its very life is sale to individuals. Some subdivisions are well conceived, honestly sold and give due consideration to the future protection of the purchaser, but all too many go to bits on the rock of speculation. Something for nothing is their lure. The subdivider is interested only in the price increment between acreage and plottage, the realtor in commissions on the sale and resale of poker chips called lots and the purchaser in the resale profit which the other two have led him to anticipate. It is hardly necessary to cite instances; for an early instance, see Dickens' Eden.

Modern Design. We come now to the question of design. Here the prevalent ideas among architects who profess to be modern seem to be: (1) that we must be different at all costs; (2) that a building is a diagram of a bright idea. Of course this statement is exaggerated, but it is astounding to note the absurdities presented by many of the designs shown in the professional press, which are considered epoch making. Only one example is given here, but their number is legion.

Even a casual study of an apartment house design recently featured in the architectural press reveals the following: in case of fire, there is no possible escape from six of the nine floors except up or down a narrow spiral staircase; it is impossible to get furniture up or down from the apartment entrance floors. There is one elevator for nine stories comprising 72 apartments; what happens when the cables are renewed? There is no way of disposing of garbage or rubbish except by the single elevator and at that it must be carried one flight and past the bedroom and bathroom. The apartment entrances are between the bedroom and bathroom, instead of on the living room floor, probably because the plan would not work otherwise. It is to this sort of thing that I refer, when I speak of a building being conceived as a mere diagram of an idea. If the solution of a problem is not easy, it is calmly ignored.

Materials. As with design, so also with materials. Hooey. It is very well to use new materials, but before selling ourselves body and soul to the use of a new material, let us try out its physical properties and all that its use implies. A truce to stainless materials that rust, rigid wall panels that buckle, structural systems that cannot fit the variety of conditions that arise in a home and need so much special work that they are uneconomical, no matter how cheaply produced in the factory.

It is easy to state that steel and glass are the structural materials of the future. Well, did you ever ride in a Pullman on a hot day? That blistering heat is not produced by special ovens in the yards; it is the result of the materials used. Of course the answer is snapped back: "Insulation and air conditioning." The porridge is too hot; put ice in it. But why overheat the porridge?

Is this the counsel of economical construction? Why insist on the use of materials that transmit heat and cold so readily and are subject to extreme expansion and contraction, when others of low conductivity, but of sufficient strength, can be used? Air conditioning is expensive and involves machinery and, in its physical aspects, the way to cheaper housing is not through more machinery, but less.

Slum Clearance. Today slum reclamation is claiming widespread attention. On this score it will be necessary to get our minds clear as to just what we propose to accomplish by rebuilding our blighted areas. Shall our object be to provide living quarters at as low a cost as possible to the tenant, or shall it be to reestablish deflated real estate values? In some cases it may be possible to accomplish both, but we must make up our minds which is to be the prime consideration.

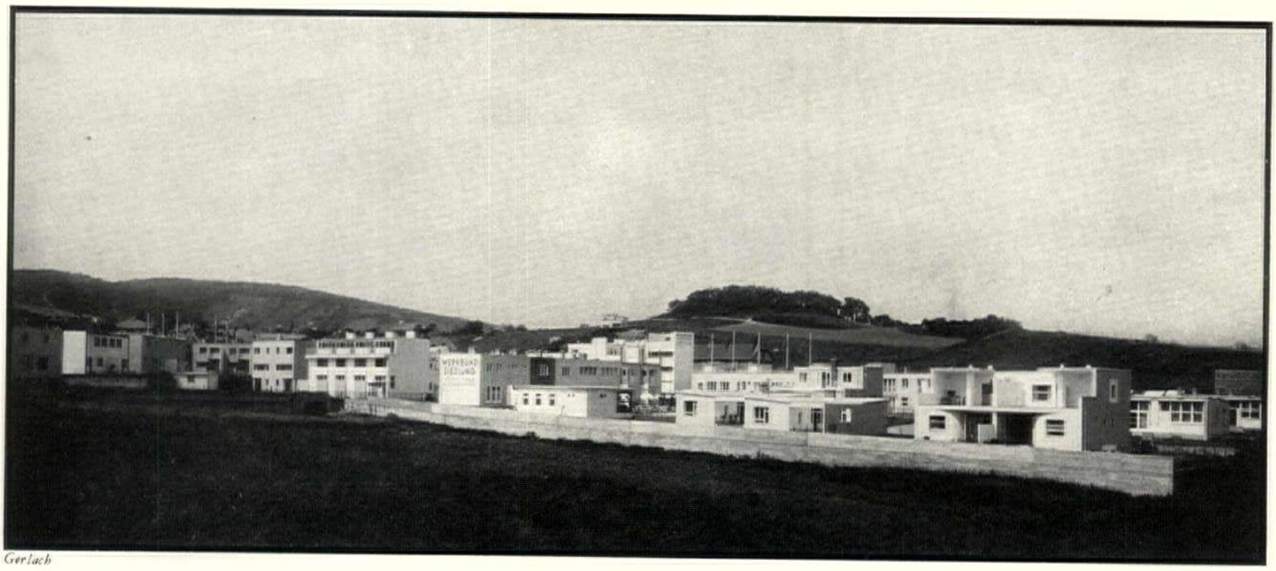
Nowhere do we find a better example of this dichotomy than on the Lower East Side of New York. Here is a section that lost half its population between 1910 and 1930. Rents disappeared and, by the same token, values vanished. The residential buildings are largely old-law tenements that are unfit to live in and have been, or should have been, amortized long ago. Their real value is therefore practically *nil* and the land too has lost value because of them.

And yet, because these properties have a nuisance value in case of condemnation and because financial institutions still have large sums invested in mortgages in this section, we find that most rehousing schemes for the neighborhood contemplate relatively high buildings. On account of the added cost of construction and operation, a ten-story apartment cannot furnish accommodations as cheaply as can a four-story building. If the land cost nothing, there is no question that the lower building would be used, and the fact that these schemes show high buildings demonstrates that the guiding thought of the designers is not to produce a low rental but to revalorize the land. Property that costs too much to permit the use of inexpensive buildings should not be used for rehousing schemes for the lower wage categories.

What is true of New York is also true elsewhere. Cheap housing can be the result only of cheap land, low cost building and favorable financing. To center our efforts on the re-creation of land values and delude ourselves with the idea that we are really interested in lower rents is just kidding ourselves along.

In this discussion I have attempted to examine critically a few current manifestations of loose thinking about housing. It may well be objected that the criticism is entirely destructive, that no solution of the problem is even suggested. True; but were I to enounce some simple solution, I would be guilty of the very thing against which I protest: the attempt to solve by a simple device a problem that is inherently complex. If there were a simple solution of the housing problem, it would not be a problem. Any forward move must be by trial and error. We must have sufficient humility to regard our efforts as experiments and our conclusions as tentative. Salvation is not to be won by grasping the knees of the glittering idol on the altar, for in the shadow behind grins the Great God Hooey.

Mr. Klaber has constructively studied the problems of housing with an analytical and critical mind. In this article he has frankly written some of his observations and opinions. THE ARCHITECTURAL FORUM welcomes the comment of others either in accord with or differing from the ideas here expressed.



Gerlach

INTERNATIONAL HOUSING EXPOSITION

VIENNA, AUSTRIA

BY

JOSEF FRANK*

THIS exposition was originally designed to show as many architectural solutions as possible to the problem of the small one-family house. It is therefore a collection of samples. Every exhibit has been planned to serve as a "serial house" (row house), or as the ground element for a whole suburban development. For such a development, however, the Werkbundsiedlung as a whole can hardly be taken as a model. For the rational planning of a villa settlement one would have to manage with fewer types. In the interests of economy, all parts of the construction would have to be chosen from units which could be duplicated indefinitely.

The grounds on which stands the Werkbundsiedlung still belong to the City of Vienna and are not being sold, but simply rented to the buyer of the houses free of all costs up until the year 2000. In 2001 the Vienna municipality may buy back the use of it by indemnifying the house holders. In buying, 40 per cent of the whole purchase price is paid down at once. The remaining sum is paid in monthly installments through fifteen years. For every house the mere costs of construction amount to about 65 Austrian shillings per cubic meter (approximately 27 cents per cu. ft.), while development costs and the establishment of the garden vary between 5,000 and 10,000 Austrian shillings ($700 to $1,400).

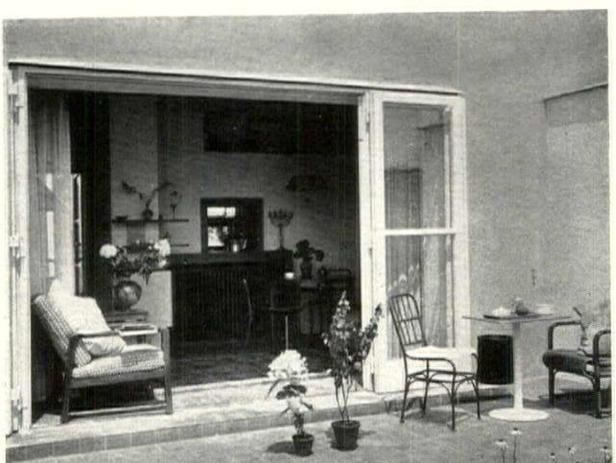
Every house stands on a lot of but 200 square meters (2,150 sq. ft.). Such a constricted building space has necessitated narrow construction. "Serial" or row houses predominate. The grounds are rolling and in order to construct the roads and sewers it was often necessary to lay down more than three yards of gravel as foundation. Because of these necessary leveling operations, all the houses have had to be built with cellars. The roads slope gently. At some places there are differences of level amounting to nearly ten yards. Of course building on ground which must be leveled is in general inadvisable, yet this particular terrain has been favorable for exhibition purposes because it affords a picturesque variety.

The settlement includes 70 houses designed by 31 architects. The majority of the architects were Viennese, yet in order to show how housing problems are being handled in other countries, represent-

*Director of Works and Planning, International Housing Exposition, Vienna, Austria. Mr. Frank is also the architect for the house shown on page 335 of this issue.

Franz Mayer

The attractiveness and simplicity of this room are matched by its usefulness. The draped curtain permits the easy division of the room into two parts. J. Groag, Architect, Vienna



Franz Mayer

To make the terrace and garden a very real part of the living quarters, the doors open wide and easily. Hugo Gorge, Architect, Vienna

ative men from France, Holland, Germany and the United States were asked to collaborate.

Construction. A uniform technique has been followed. All the houses have been made of the same material in the interest of the economy of the whole development, although some were designed for other materials. In order to make the actual work of construction easier, windows, doors and other elements have been, as far as possible, confined to a few types. The walls are made of hollow tile, measuring in total thickness about 32 cm. (12.8 in.). That is, two walls of 12 cm. each (4.8 in.) are separated by a hollow space of about 8 cm. (3.6 in.). The hollow spaces are filled with wire nettings and stucco.

The roof and floor construction is of wood, except the first floors above the cellar which are of reinforced concrete. To afford protection against the Viennese winter, all windows are double, and, like that of the doors, their framework is also of wood. Entrance doors are covered with tin or with a veneer of asbestos. Floors are of oak, linoleum or rubber; in kitchens and bathrooms of tile, paving plates, or composition. Most of the roofs are flat. Those which are not made to be walked on are of wood. Those which may be used as terraces are made of concrete and insulated with asbestos or with gravel. The railings are made of iron.

The staircases in almost all the houses are made of wood. Their incline is 20:23. The rooms are 2.80 meters (9.18 ft.) above ground, so that fourteen steps lead to the upper floors. The actual rooms are about 2.50 meters (8.20 ft.) high. On the outside the walls are whitewashed and covered with a waterproof coating. Both gutter pipes and sewers, of galvanized sheet iron, are on the outside of the houses. To protect the cellars against dampness they have been given an application of asphalt. The cellar windows are made of iron. All wooden and iron parts are lacquered.

Styles and Types. The housing program has been practically the same in all cases. It is the problem of the one-family house of the smallest type, which can be built, if need be, as a series-house in rows. In ground plan the two-story houses occupy between 34 and 50 square meters (366 sq. ft. and 538 sq. ft., respectively), the one-story houses about twice that much. Each comprises a living room, two or three bedrooms, kitchen, bath and toilet. In the larger types there is also a room for a maid, while some houses have a studio or work-room built as an upper story. The heating apparatus, the laundry and the drying racks are in the basement. The houses are heated by stoves or by central heating arrangements burning coke or oil. The kitchen stoves and all water-heating appliances burn gas.

Narrowly limited as this problem is, it none the less offers many possibilities. Had no general regulations existed, the colony as a whole would have been too heterogeneous. As it is, each of the individual houses is very different from its neighbors. Practice has shown that but very few general regulations are sufficient in order to secure a general effect of harmony. The planners of the Werkbund contented themselves with demanding smooth plaster, flat roofs and identical garden fences. The uniformity of the roofs is, after all, the main purpose of the flat roofs which are so fashionable nowadays. Their principal factor has been an harmonious architectural effect through a similar treatment of the roof problem. The most dissimilar houses, if they have flat roofs, make an harmonious impression when placed side by side. The flat roof and the fashionable smooth facades are the foundations of our modern style. They make it possible for the contemporary architect to build with the simplest means houses which fit well into their surroundings.

Color has been deftly used in the Werkbundsiedlung. Although in shape the houses do differ, their differences do not clash. That is why each house, or each group of houses, although it has its own color scheme, has been so attuned to a general color harmony that, from whatever place one looks at the colony, it fits into the whole. The colors of the doors and windows are in keeping with those of the houses. An effect which is at the same time varied and harmonious has been attained.

Three types of house dominate the colony. The most popular is that of the two-story dwelling, which has living rooms on the lower and bedrooms on the upper floor. This type probably adapts itself best to small building lots, for it requires the least space. A second type has turned over the ground floor to the cellars and has the living rooms above. This type has the advantage that all rooms are equally well lighted, but the disadvantage that one has to descend from the living rooms to the garden by a staircase. This is, of course, not in accordance with the Viennese habits of life. The garden loses its intimate connection with the home.

A third type is the one-story dwelling which has all the advantages of easier housekeeping on its side, because all mounting and descending steps can be avoided. There is no doubt about the fact that this is really the ideal home, yet it has the great disadvantage of requiring more building space. The larger roof and the larger foundations make it, naturally, more expensive. It is also best fitted for dry climates only, for when it stands in a damp region the ground fogs are likely to come into the bedrooms at night, making them less healthy. A variation of this one-story house is the type that has a roof terrace on which are a few working rooms. Indeed, in many of the houses the available living space is enlarged by terraces and roofs on which one can walk.

On principle, the architects have designed each

J. Scherb

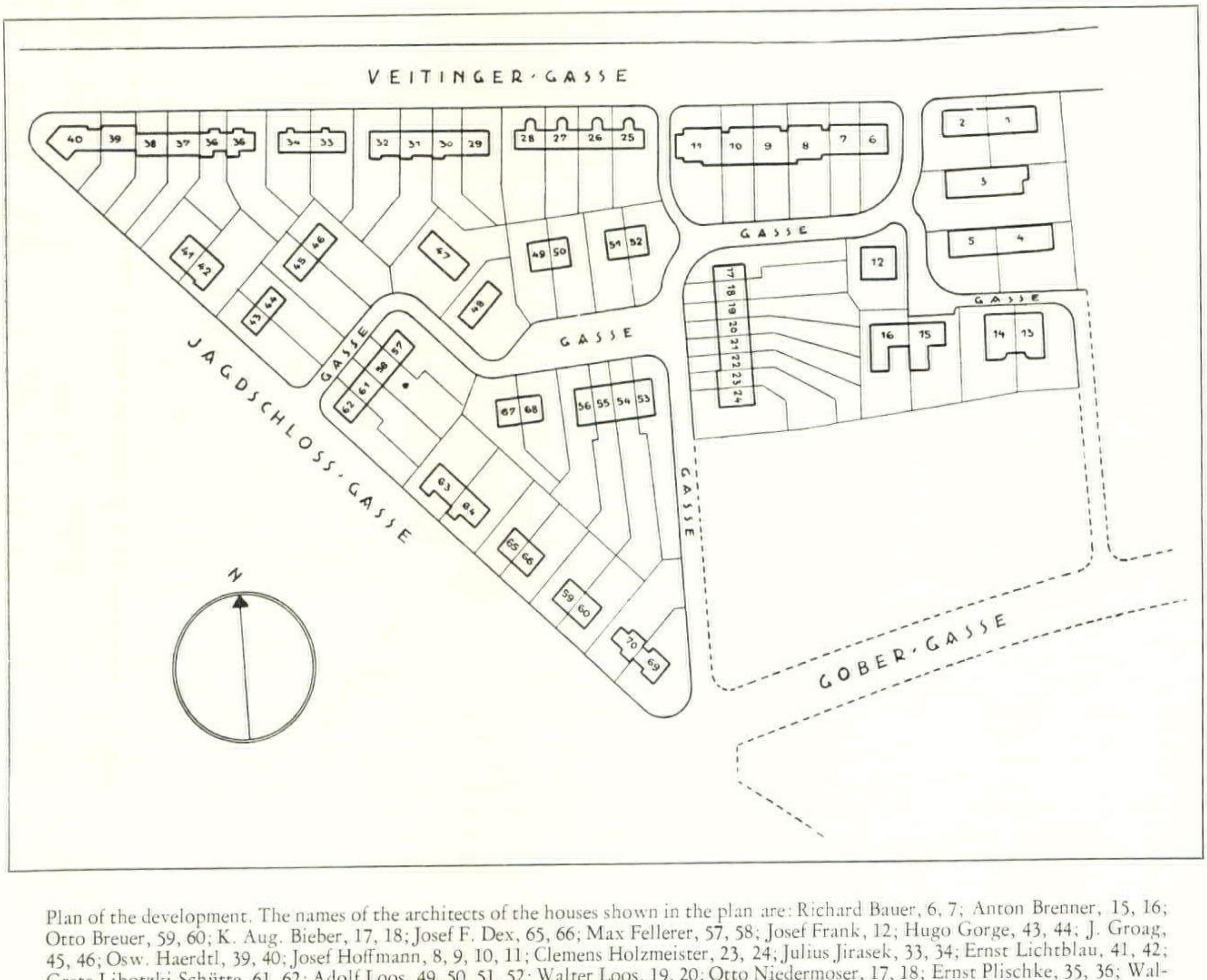
The heating equipment of these small houses can be of the simplest type. The modern heating stove is adequate and unobtrusive. Hans Schlesinger and Willy Wiesner, Architects, Vienna

Gerlach

A view of one of the streets. The refuse containers are well placed behind the posts instead of being unsightly ash-cans littering the sidewalk room with an absolute minimum of furniture. Every effort has been made to keep the small living space from being unnecessarily clogged. Without exception, all the cupboards are built in, occupying entire walls or filling niches. The guiding principle for the selection of furniture to be placed freely about the rooms has been that of complete lack of principle. Everywhere things have been so arranged that not one room should be uniformly furnished. Nowhere the same kind of wood or chintz has been used throughout. Thus it is possible to introduce new things anywhere, to put in new chintzes anywhere or to hang pictures anywhere. At all times it is possible to exchange any object or to complete the furniture however desired. It goes without saying that the furnishing has had to be as inexpensive as possible, and that generally, therefore, factory products have had to be used.

Thus while great stress has been put on outward uniformity, so as to bring about an harmonious outward impression, yet in the interior the exactly contrary principle has come into force, since here there was no need of uniformity. Everyone is to live according to his own personal taste within his own four walls, and to give his home its own character without being in the least dependent upon the demands of style or formality.

The Osterreichischer Werkbund has built this colony in order to give as many examples as possible of the arrangement of one-family houses of the smallest type. It has tried to build the most varied structures, and no single model has been put into the foreground, as is so often the case in similar expositions. The Werkbund takes the point of view that different types of people need different types of houses. Later on one may determine which model has been the most popular. Of course one will probably never be able to come to a general conclusion as to whether the one-story house or the apartment house best answers our needs. But this is not only impossible, it is also unnecessary. Since the oldest times all kinds of houses have existed one beside the other, and all kinds of houses probably will go on existing one beside the other for a long time to come.



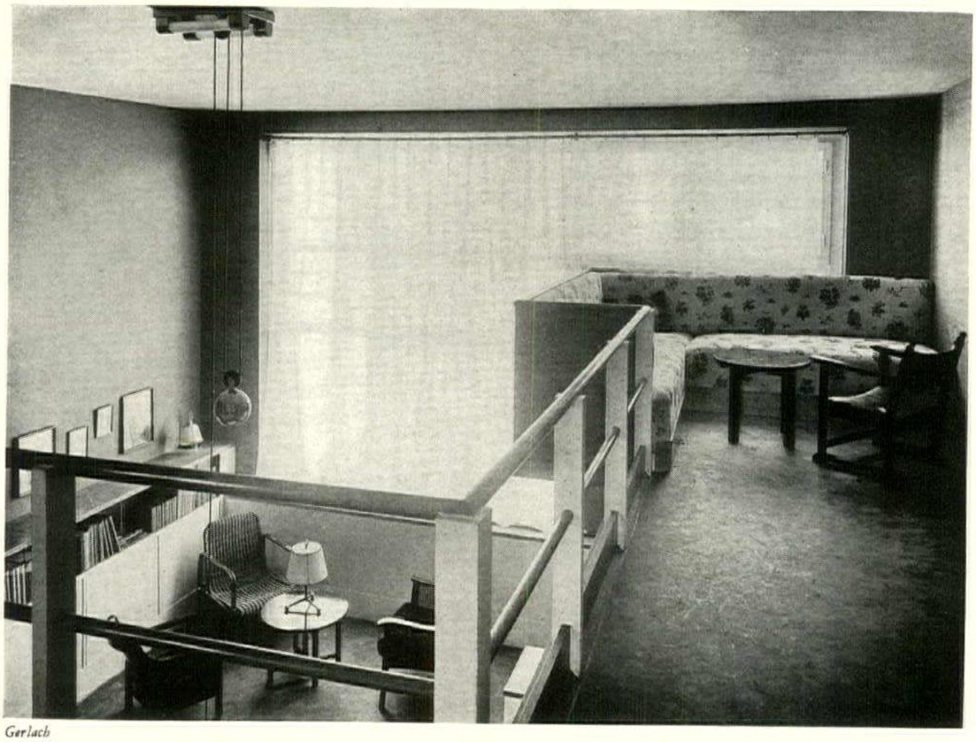
Plan of the development. The names of the architects of the houses shown in the plan are: Richard Bauer, 6, 7; Anton Brenner, 15, 16; Otto Breuer, 59, 60; K. Aug. Bieber, 17, 18; Josef F. Dex, 65, 66; Max Fellerer, 57, 58; Josef Frank, 12; Hugo Gorge, 43, 44; J. Groag, 45, 46; Osw. Haerdtl, 39, 40; Josef Hoffmann, 8, 9, 10, 11; Clemens Holzmeister, 23, 24; Julius Jirasek, 33, 34; Ernst Lichtblau, 41, 42; Grete Lihotzki-Schütte, 61, 62; Adolf Loos, 49, 50, 51, 52; Walter Loos, 19, 20; Otto Niedermoser, 17, 18; Ernst Plischke, 35, 36; Walter Sobotka, 29, 30; Oskar Strnad, 13, 14; Hans Vetter, 48; Eugen Wachberger, 21, 22; Helmut Wagner-Freynsheim, 69, 70; Josef Wenzei, 37, 38; Oskar Wlach, 31, 32; H. Häring, 1, 2, 3, 4, 5; A. Grünberger, 63, 64; Richard J. Neutra, 47; G. Rietveld, 53, 54, 55, 56; Gabriel Guevrekian, 67, 68; André Lurcat, 25, 26, 27, 28

Scherb

THIRTY-THREE architects from five countries designed the seventy different one-family houses for the International Housing Exposition in Vienna. Constructed of the same materials, each of the houses was planned as a typical house unit, suitable for repetition and modification in the planning of a complete suburban development. They are of hollow tile construction with waterproofed exteriors and smooth plaster interiors. Windows, doors, stairs, and other woodwork are standard for each type. The average cost of construction per cubic meter was $9.15. A complete description of the project by Josef Frank will be found on page 325

INTERNATIONAL HOUSING EXPOSITION

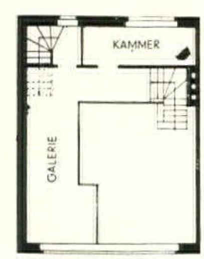
VIENNA, AUSTRIA



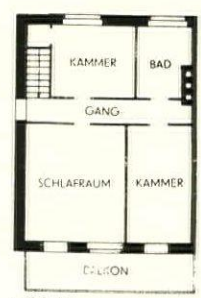
Gerlach

Exterior and interior of two-family house designed by Adolf Loos, Vienna

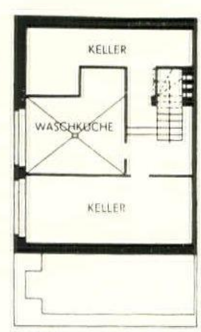
Scherb



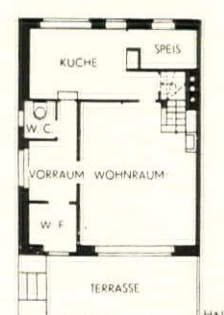
ZWISCHENGESCHOSS
HAUSER Nr. 49 UND 51



1. STOCK
HAUSER Nr. 49 UND 51



KELLER
HAUSER Nr. 49 UND 51



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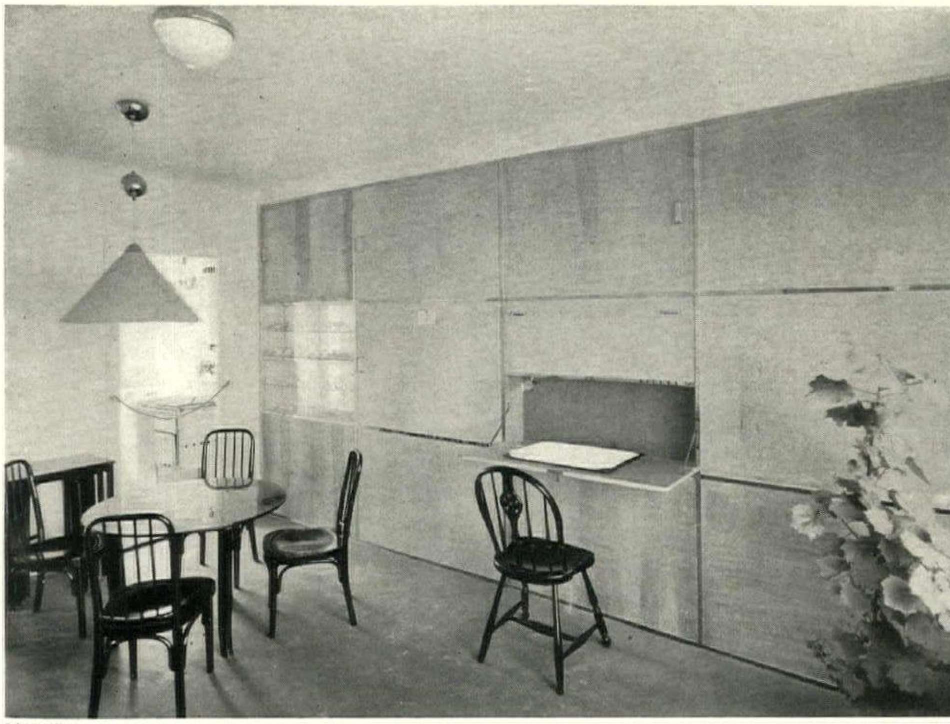
HAUSER Nr. 49 UND 51

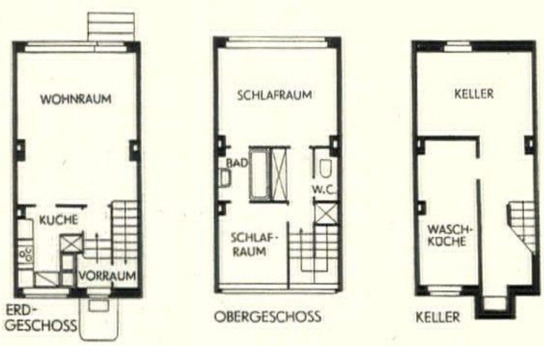
INTERNATIONAL HOUSING EXPOSITION

VIENNA, AUSTRIA

Multiple-use living room and exterior of row house unit by Walter Loos, Vienna



Scherb Photos

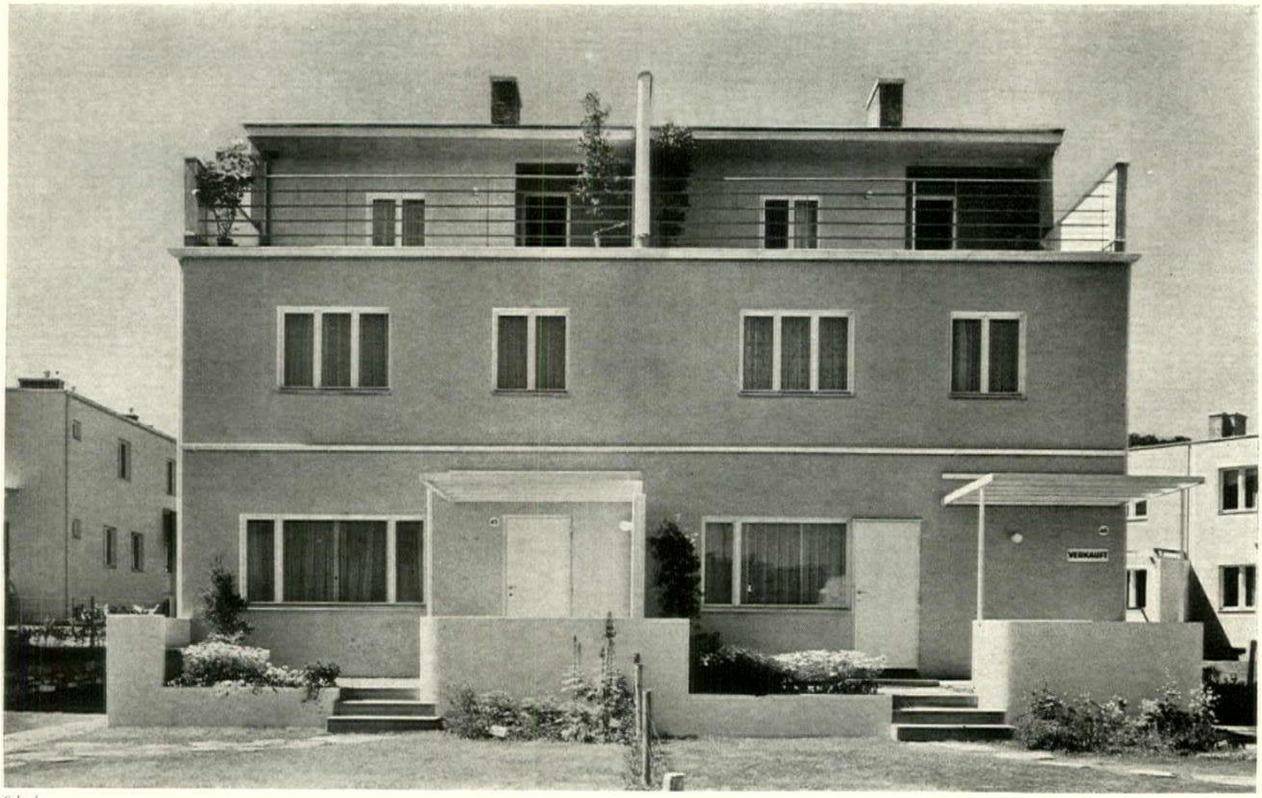


PLAN DESIGNATIONS TRANSLATED

Abstellraum — Storage
Bad — Bath
Dachaugbau — Roof projection
Erdegeschoss — First floor
Gang — Hall
Gedeckterplatz — Porch
Holz — Wood (storage)
Kammer — Chamber
Keller — Cellar
Kohle — Coal (storage)
Kuche — Kitchen
Laube — Arbor
Obergeschoss — Second floor
Schlaufraum — Bedroom
Schlaufzimmer — Bedroom
Speis — Pantry
Stock — Floor
Vorraum — Entrance Hall
Waschkuche — Laundry
Windfang — Air trap
Wohnhof — Courtyard
Wohnraum — Living room
Wohnzimmer — Living room
Zwischengeschoss — Mezzanine

INTERNATIONAL HOUSING EXPOSITION

VIENNA, AUSTRIA



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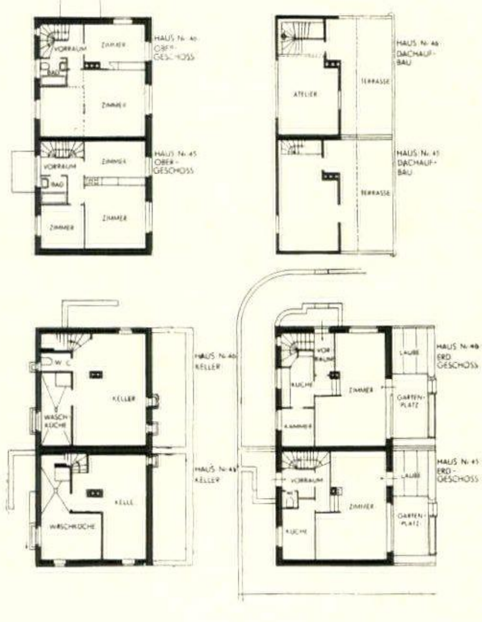
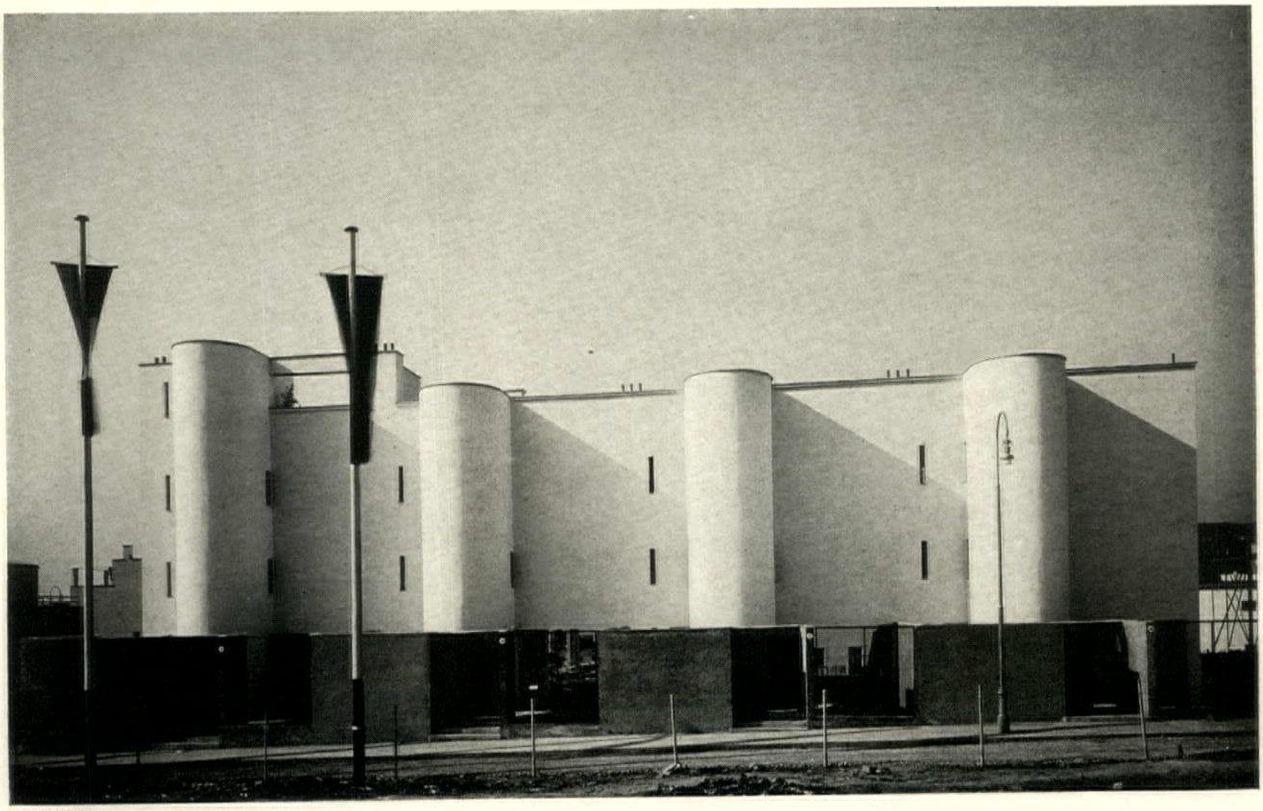


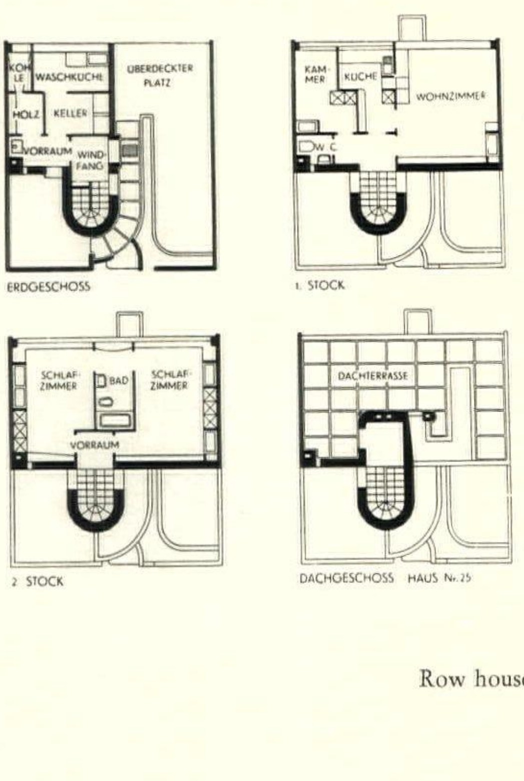
Two-family house, Jacques Groag, Architect, Vienna

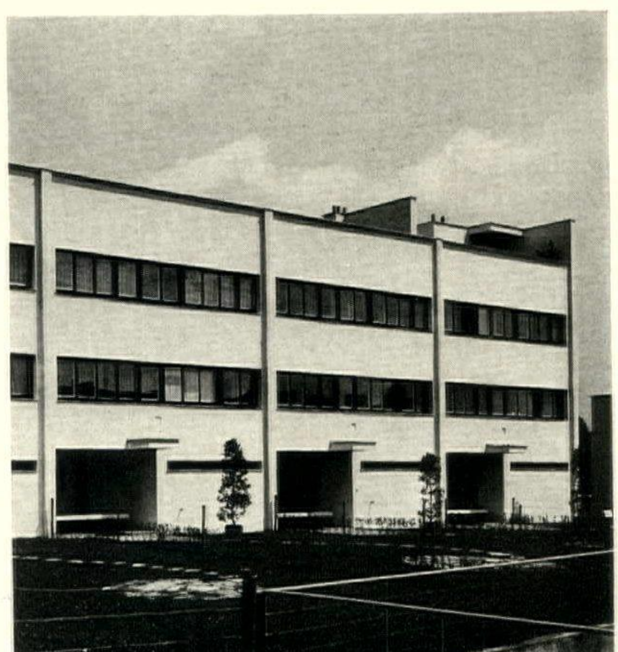
INTERNATIONAL HOUSING EXPOSITION

VIENNA, AUSTRIA



Gerlach Photos

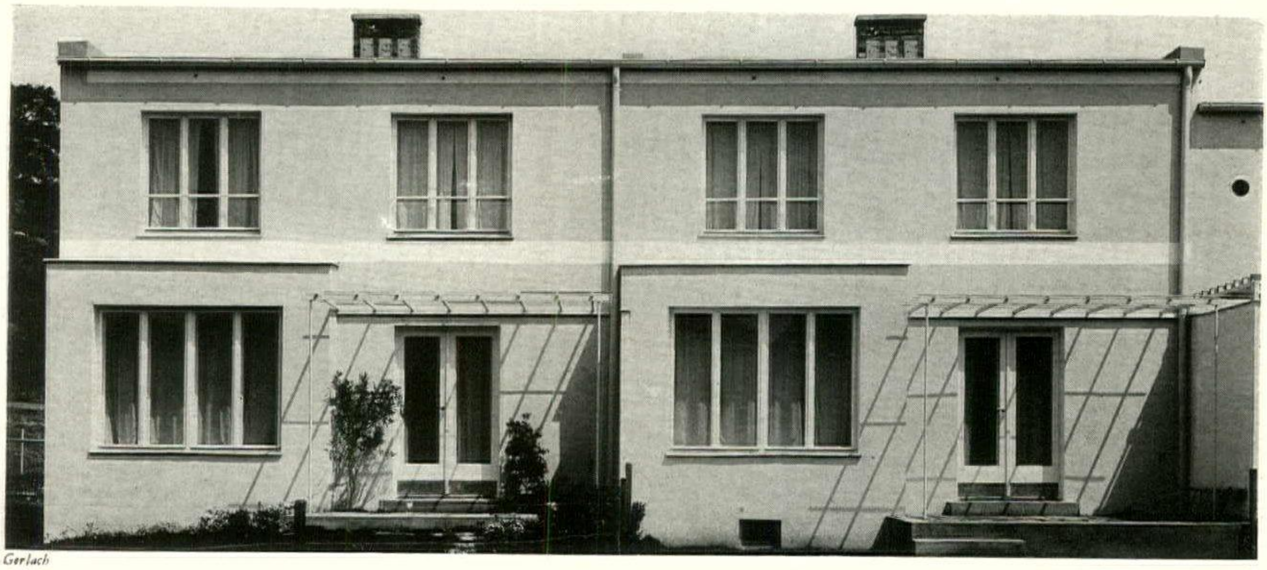




Row house, André Lurcat, Architect, Paris

INTERNATIONAL HOUSING EXPOSITION

VIENNA, AUSTRIA



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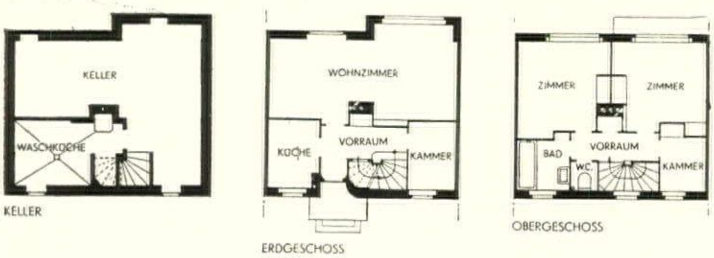
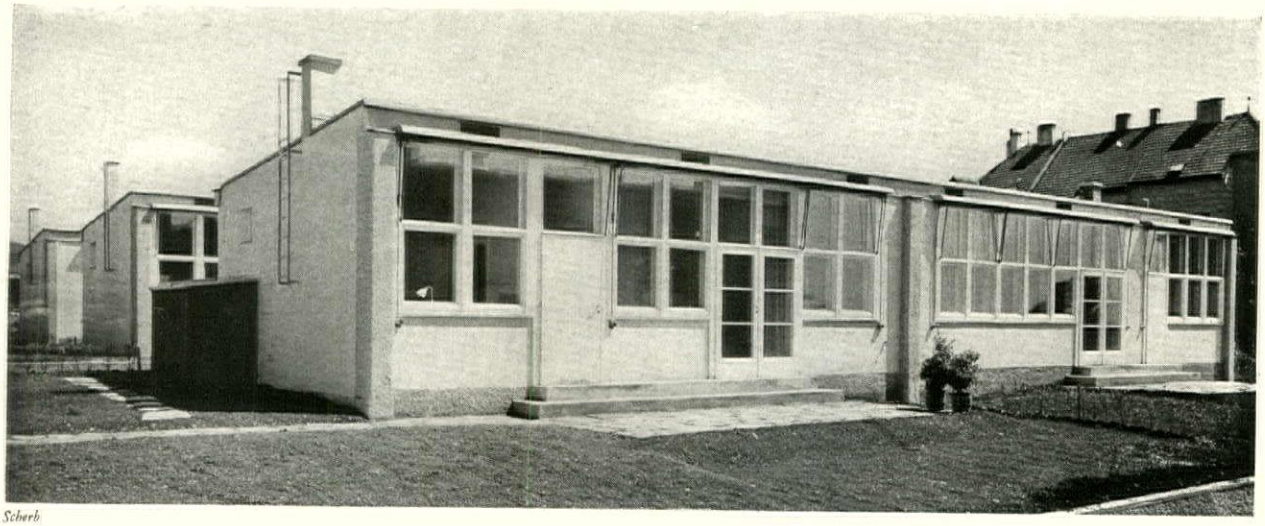


Designed by Oskar Wlach of Vienna, this two-story row house is typical in plan of current housing practice, with a large multiple-use room on the first floor. As is more common abroad than here, the bath and toilet are separate



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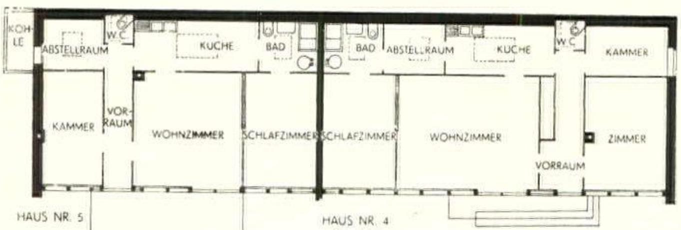
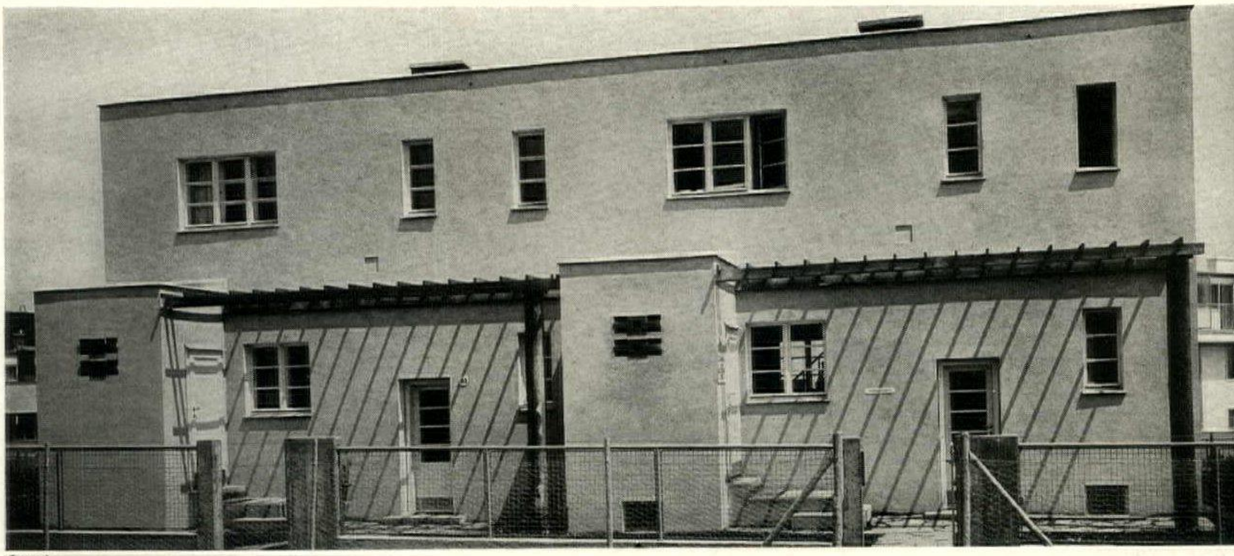
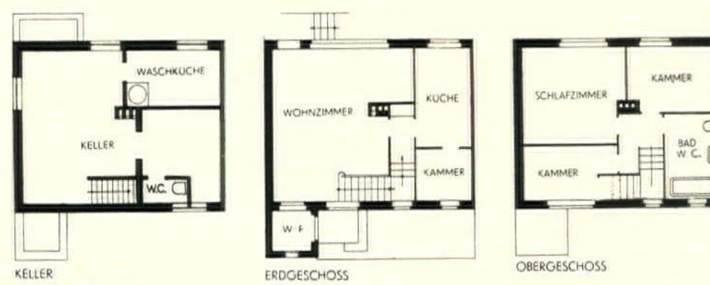


An open type one-story bungalow, designed by Hugo Häring of Berlin. With only two bedrooms, a living room, and the necessary service and storage facilities, an interesting system of ventilation has been worked out as well as a method for quantity production



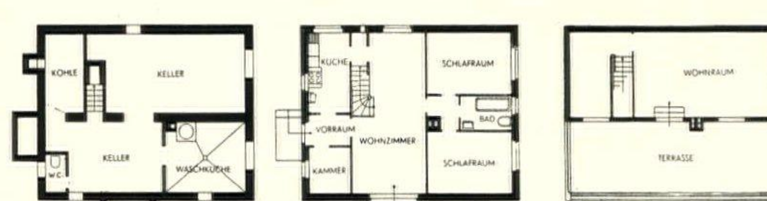
Gerlach

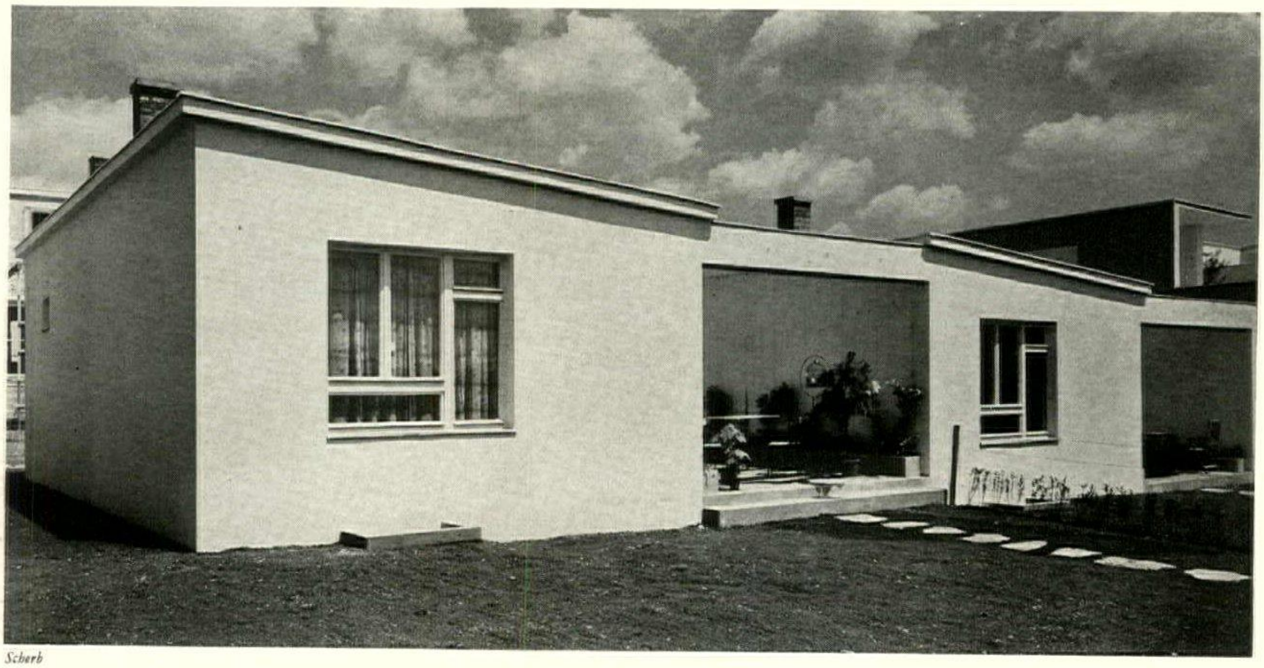
One of the few American projects constructed for the exposition, the work of Arthur Grünberger, of Hollywood, California. Like all the other houses, this one is dependent upon landscaping to relieve the monotony of repetition



Scherb

This two-story unit is the work of Josef Frank, director of the exposition. Utilizing the ground floor for sleeping quarters, with the principal living room giving out on the terrace, Mr. Frank has followed a trend that is beginning to gain headway here and abroad





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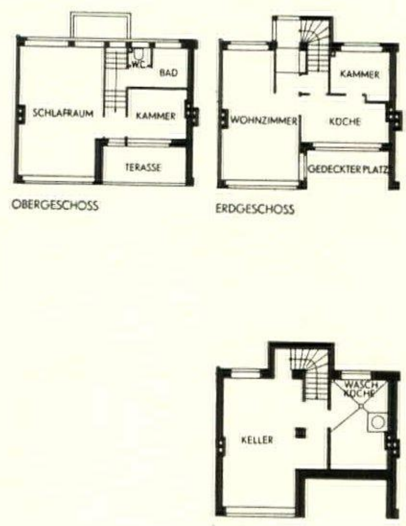
A rather unusual L-shaped bungalow designed by Anton Brenner of Vienna. Simpler in form than almost any other house in the exposition, the cost of construction is remarkably low. The private court for each unit and the grouped service facilities are commendable features of the plan

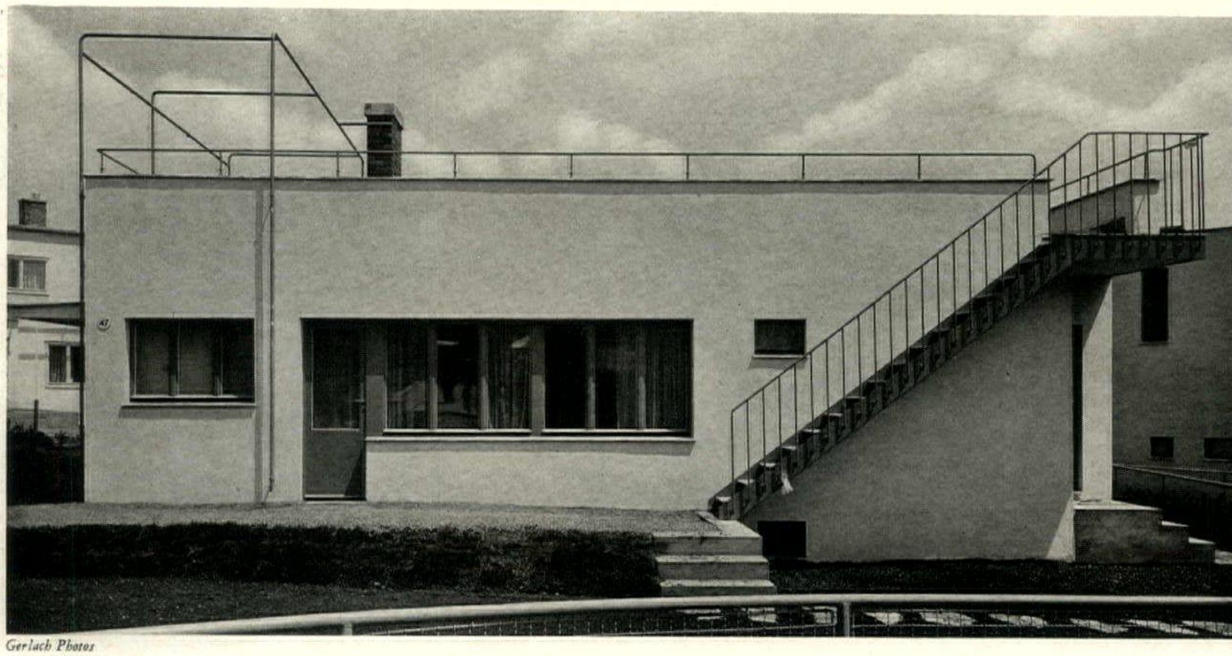
Gerlach



Ernst Plischke, Architect, Vienna

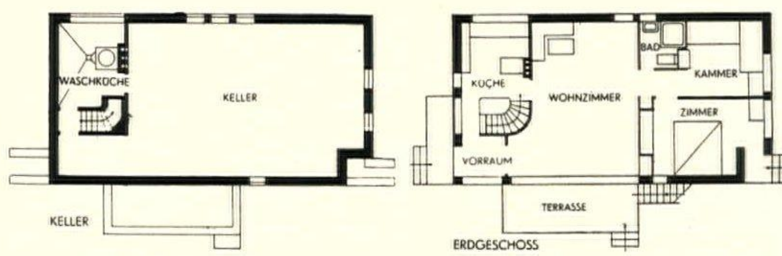
INTERNATIONAL HOUSING EXPOSITION

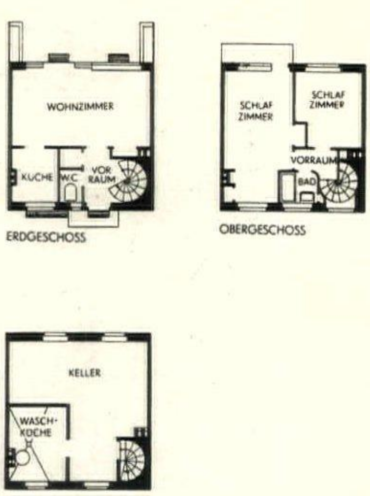
VIENNA, AUSTRIA

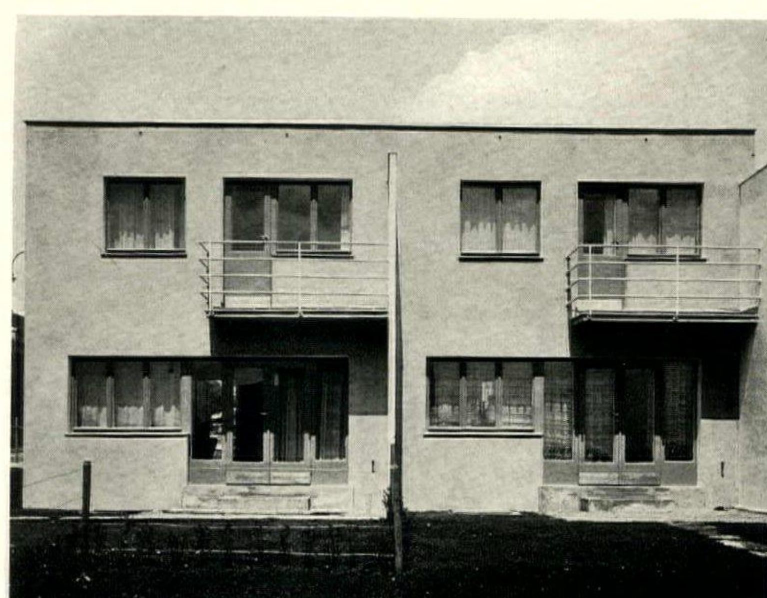


Gerlach Photos

Constant use of the roof terrace is intended in this rather unusual one-story unit by Richard Neutra of Los Angeles. Typical of the work he has been doing on the Pacific Coast, it was highly commended for the convenience of its plan and efficient use of limited space



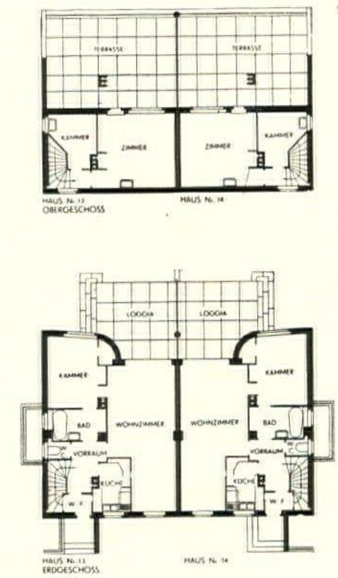




Grete Lihotzki-Schütte, Architect, Moscow

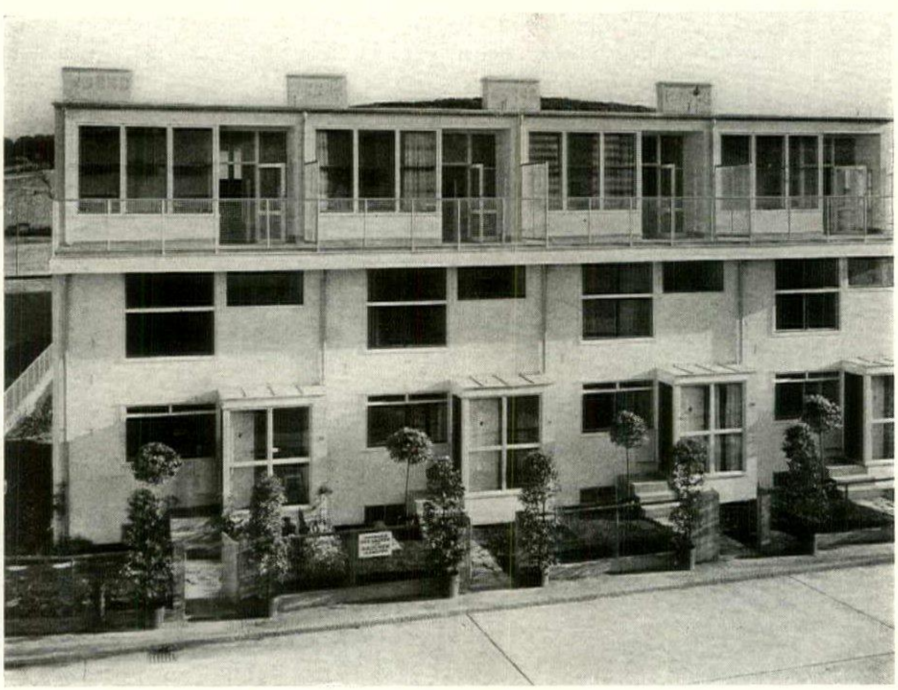
INTERNATIONAL HOUSING EXPOSITION

VIENNA, AUSTRIA



Scherb Photos

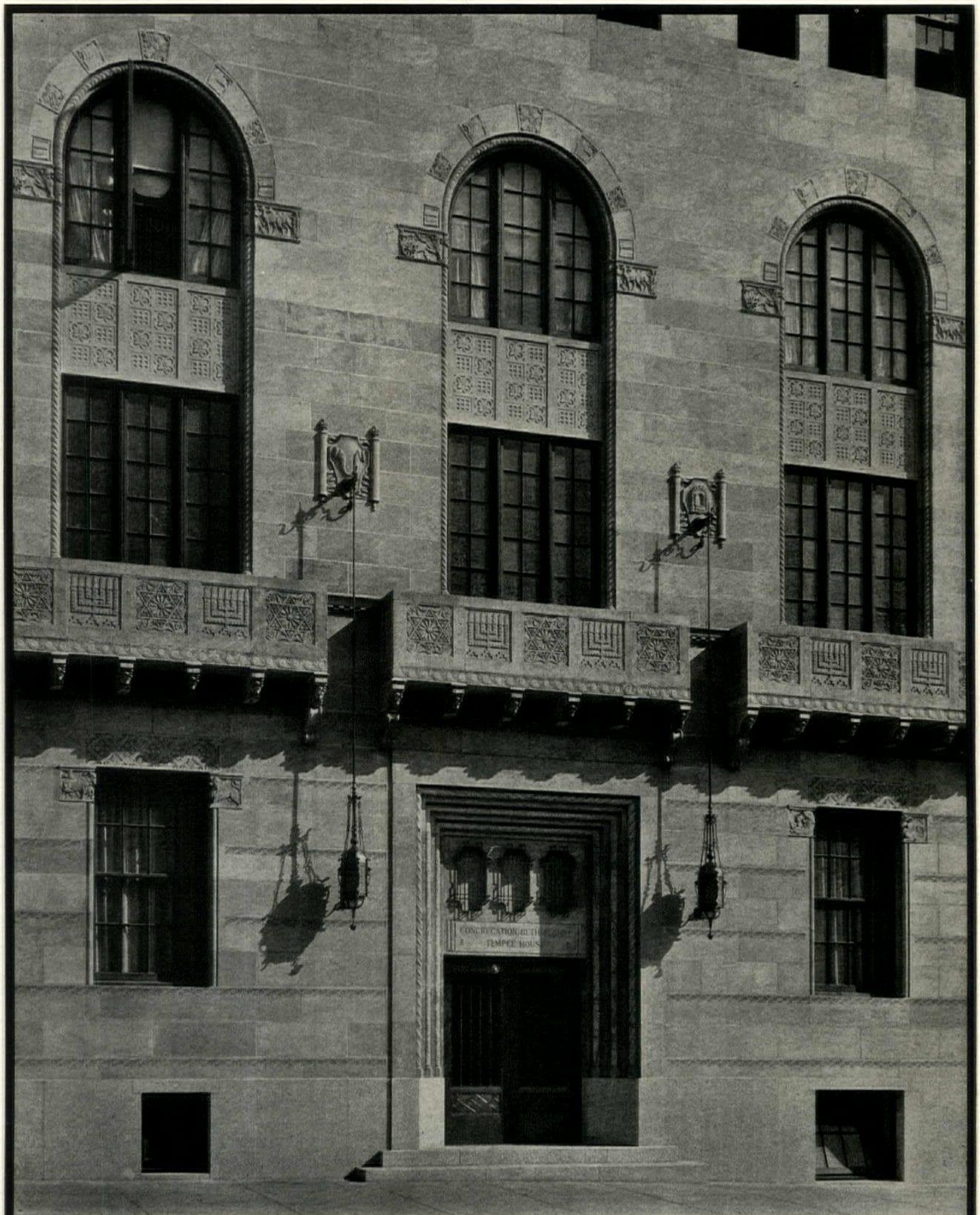
Designed by Oskar Strnad, of Vienna, the rather unusual plan of this two-story house is notable for the privacy which it gives its occupants



The only Holland entry in the exposition, designed by G. Rietveld of Utrecht. It is one of the few three-story houses, designed for narrow lots

INTERNATIONAL HOUSING EXPOSITION

VIENNA, AUSTRIA

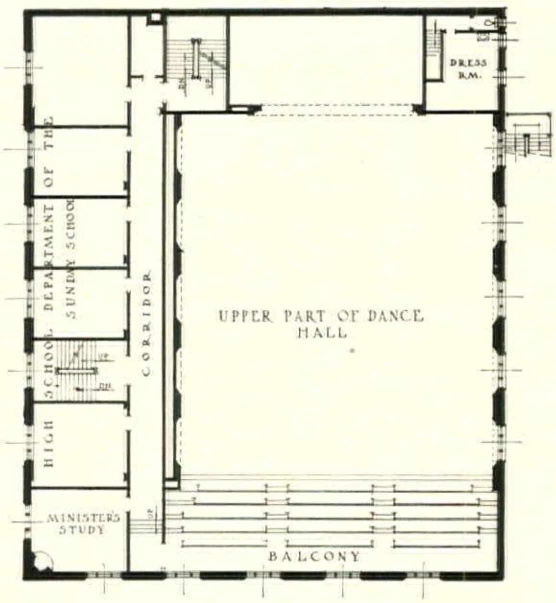


Gottscho

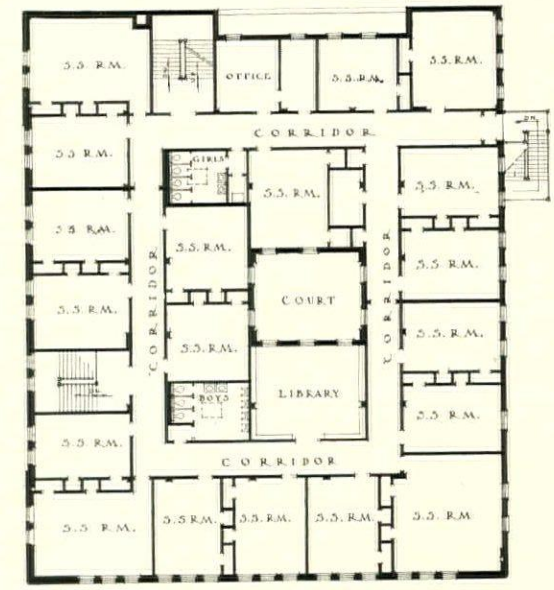
BETH ELOHIM TEMPLE HOUSE

BROOKLYN, N. Y.

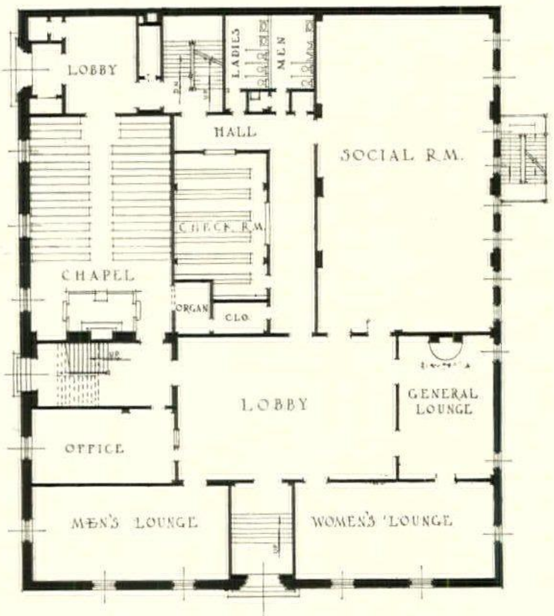
DAVID LEVY & MORTIMER E. FREEHOF, ASSOCIATED ARCHITECTS



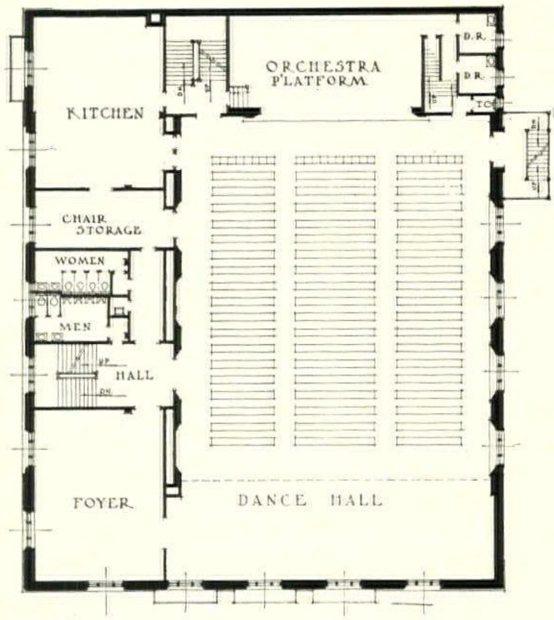
THIRD FLOOR PLAN



FOURTH FLOOR PLAN



FIRST FLOOR PLAN



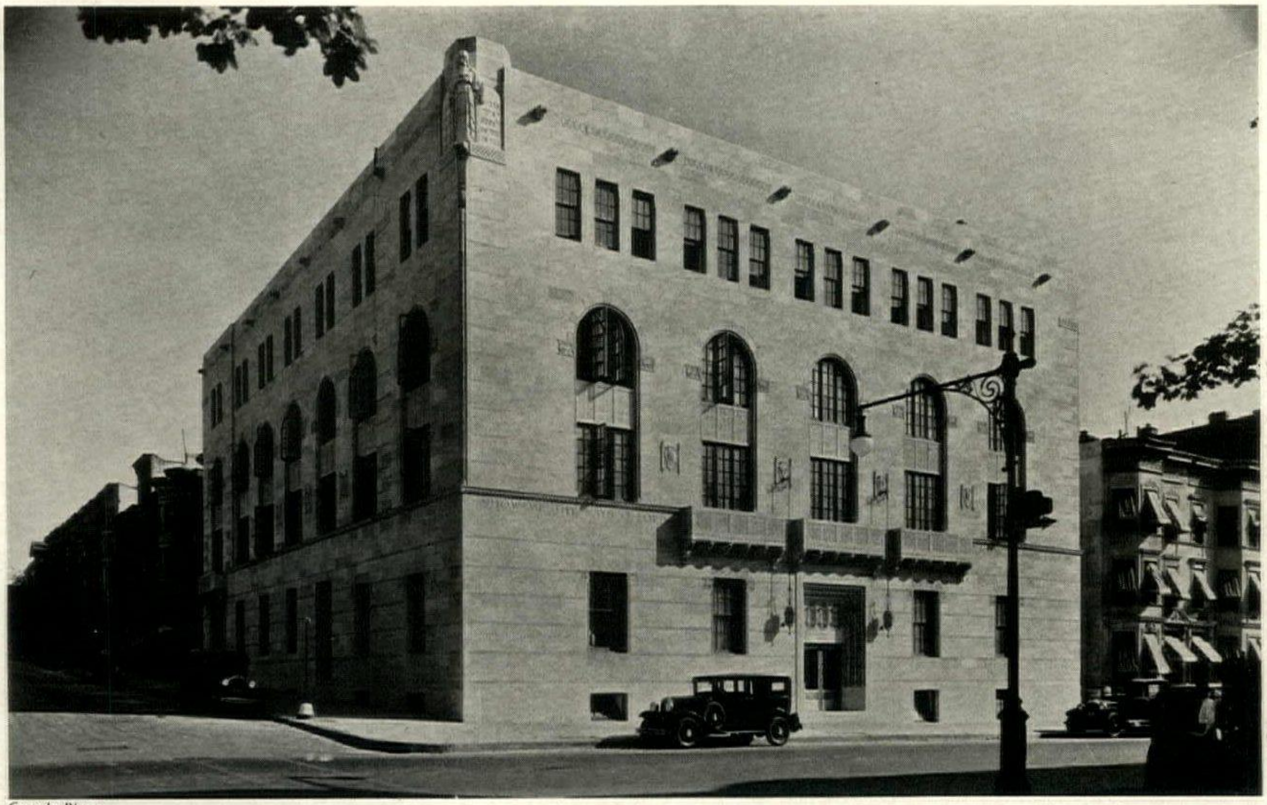
SECOND FLOOR PLAN

SCALE 0 5 10 15 20 FT

BETH ELOHIM TEMPLE HOUSE

BROOKLYN, N. Y.

DAVID LEVY & MORTIMER E. FREEHOF, ASSOCIATED ARCHITECTS



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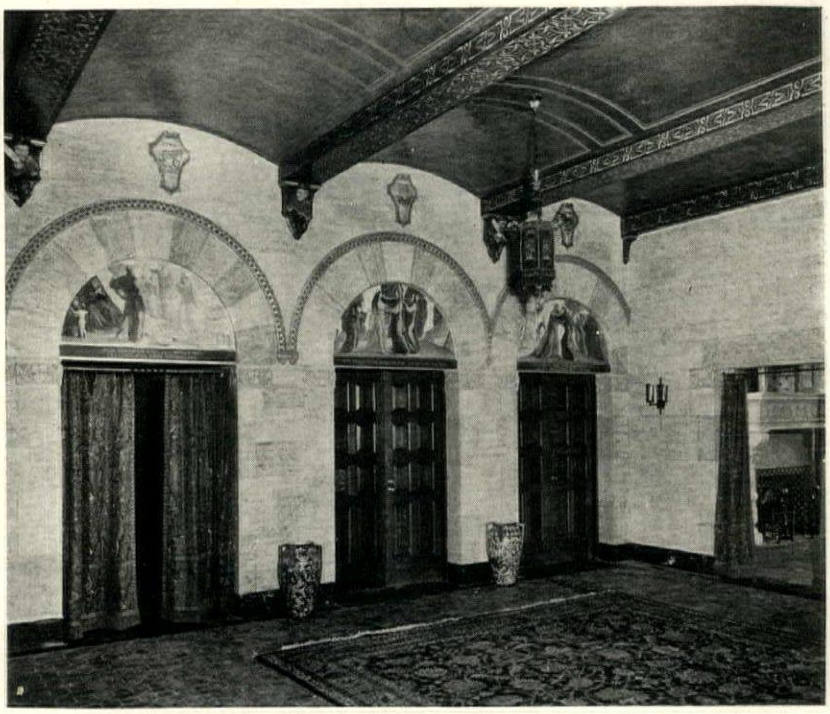


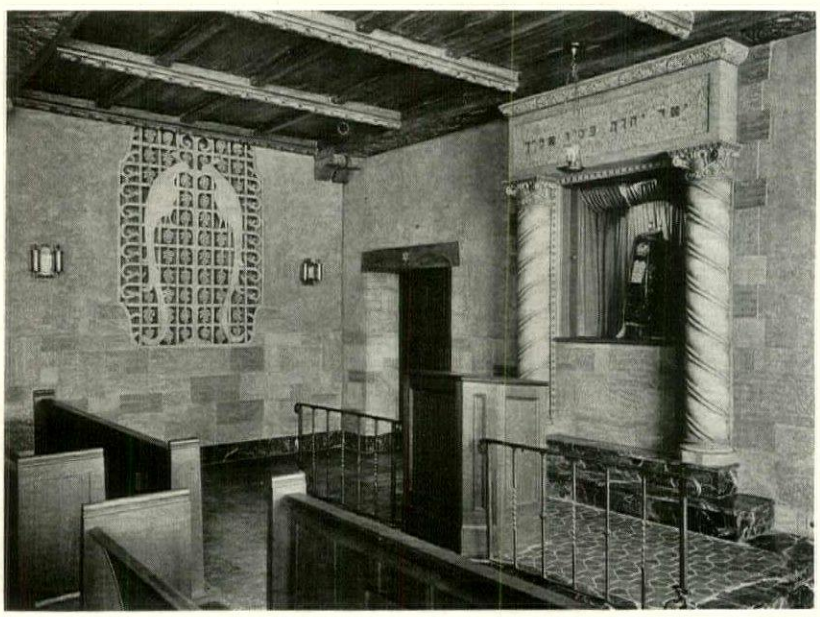
THE Beth Elohim Temple House is used primarily as a Sunday School, but it has been planned and equipped for community and congregational activities of all sorts. The building is of steel frame construction, with steel and concrete floors, and cast stone exterior walls backed by brick. At the right is the lobby, which has precast travertine walls, tile floor, and rough-troweled ceiling. The painted decorations have Biblical significance

BETH ELOHIM TEMPLE HOUSE

BROOKLYN, N. Y.

DAVID LEVY & MORTIMER E. FREEHOF, ASSOCIATED ARCHITECTS

Gottscho Photos

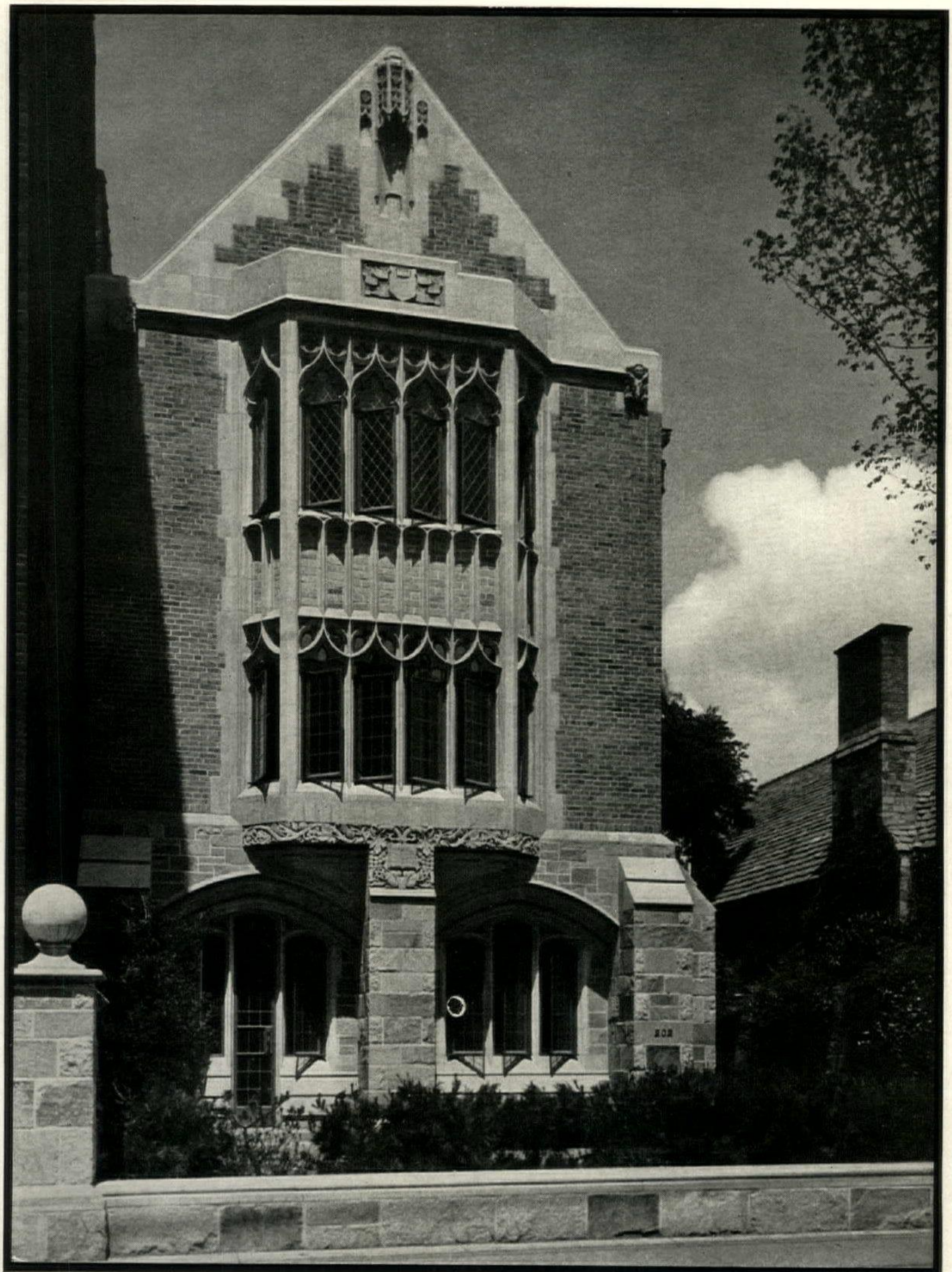


ABOVE is a general view of the auditorium, and at the left, one of the chapel. A similar treatment is employed in both — rough plaster walls with travertine block dado wainscoting and trim, and both ornamented by symbolic painting and carving. The total cost of the building, which has a cubage of 750,000 cu. ft., was $400,000, or 55 cents per cu. ft.

BETH ELOHIM TEMPLE HOUSE

BROOKLYN, N. Y.

DAVID LEVY & MORTIMER E. FREEHOF, ASSOCIATED ARCHITECTS



Shannon

YALE NEWS BUILDING
NEW HAVEN, CONNECTICUT
ADAMS & PRENTICE, ARCHITECTS

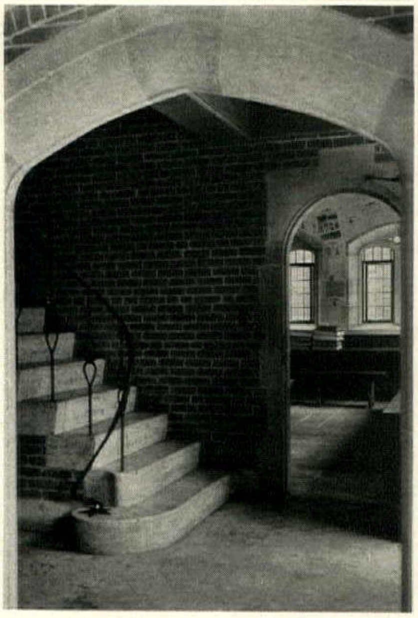
Shannon

YALE NEWS BUILDING

NEW HAVEN, CONNECTICUT

ADAMS & PRENTICE, ARCHITECTS

Shannon Photos

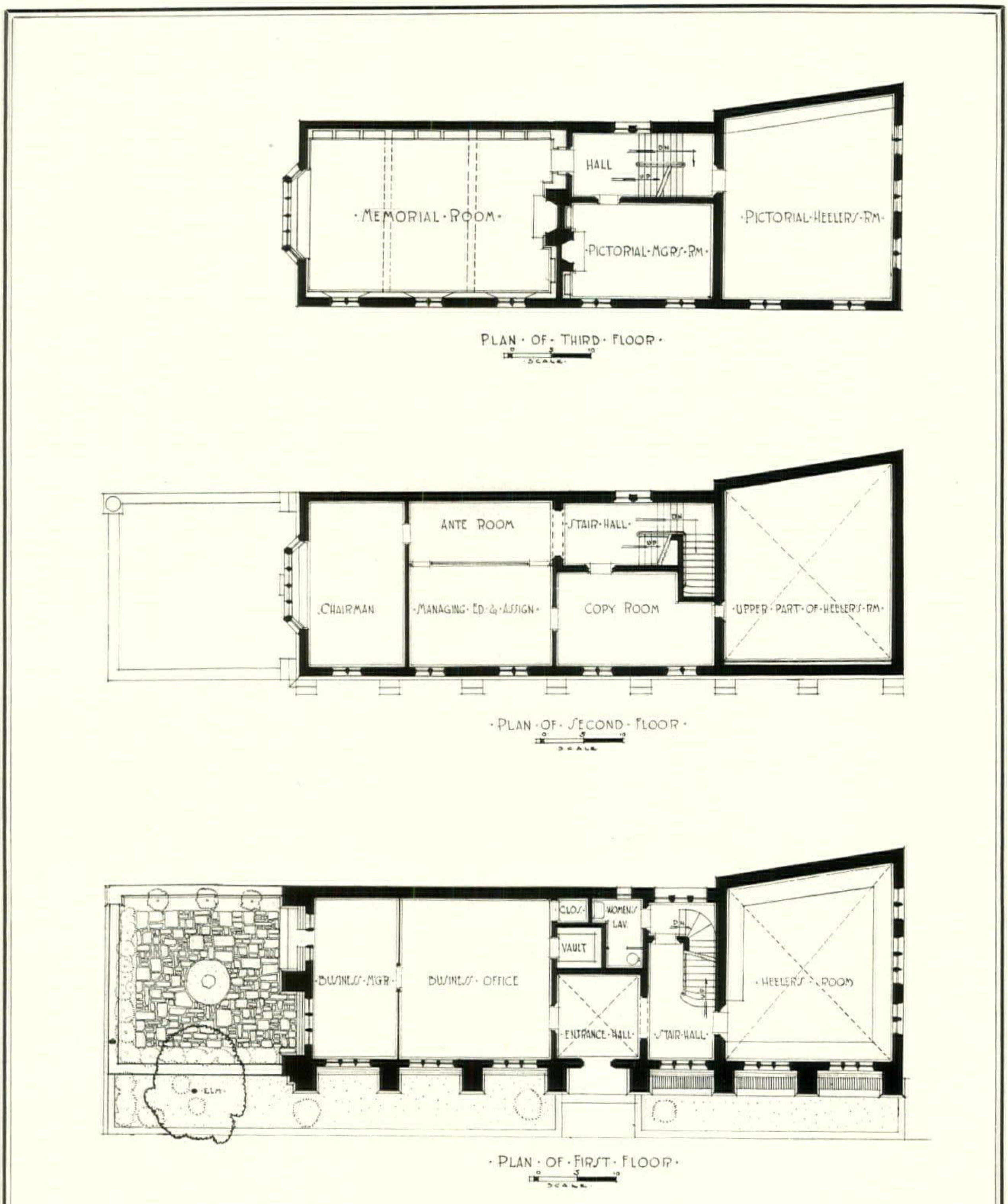


THE Yale News Building, which is a memorial to Briton Hadden, co-founder with Henry Luce of the magazine *Time*, is the publication office of the college daily newspaper. The exterior walls are of brick, with limestone trim, and granite buttresses. The windows are of the steel sash type with leaded lights. The Briton Hadden Memorial room, above, has oak plank flooring, with panels, trusses and rafters of knotty white oak. Sheathing between rafters is knotty pine, stained blue. Hardware and fixtures are wrought iron. In the hall, at the right, the floor and stairs are travertine, the walls brick with limestone trim, and the ceiling plaster with oak beams

YALE NEWS BUILDING

NEW HAVEN, CONNECTICUT

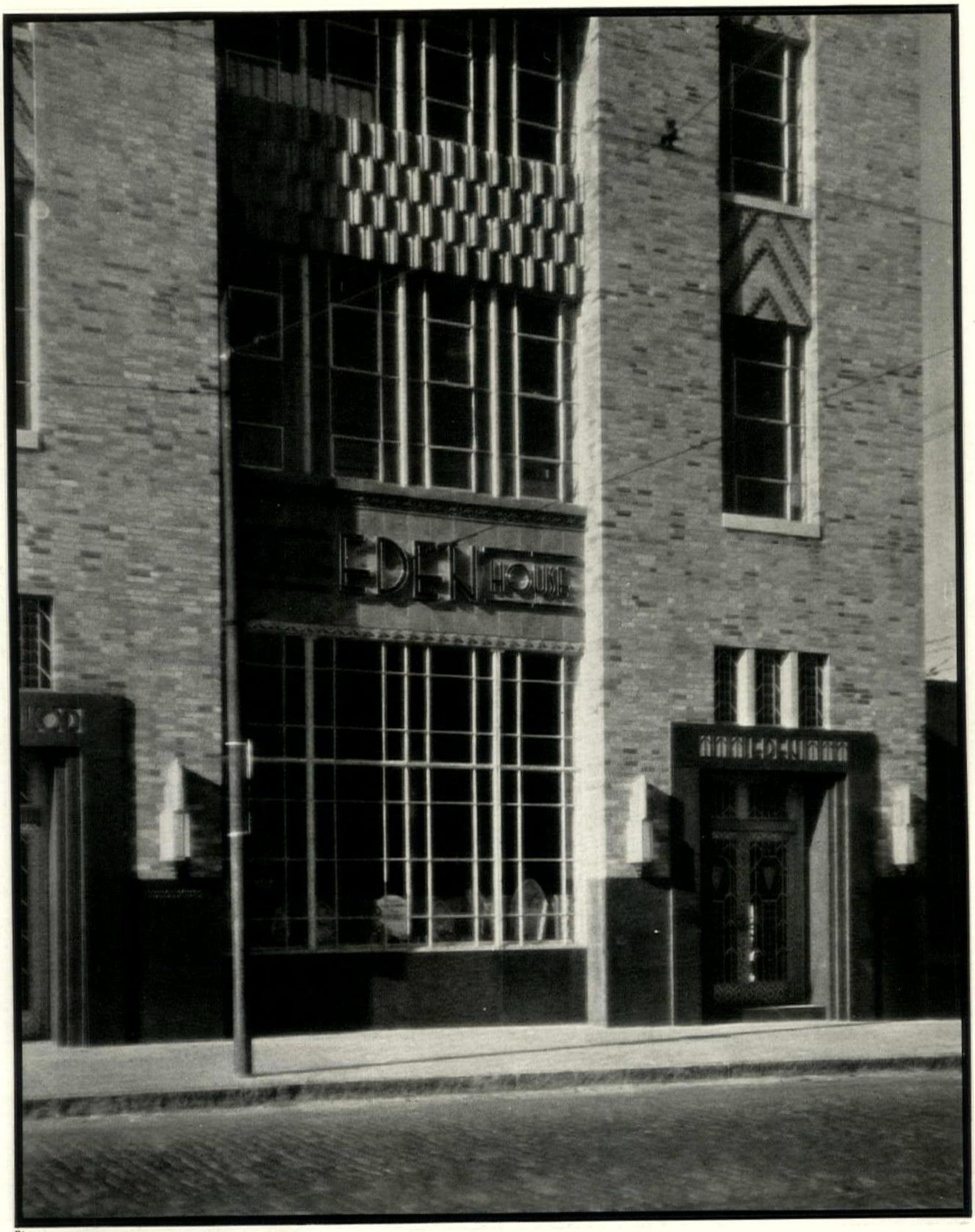
ADAMS & PRENTICE, ARCHITECTS



YALE NEWS BUILDING

NEW HAVEN, CONNECTICUT

ADAMS & PRENTICE, ARCHITECTS

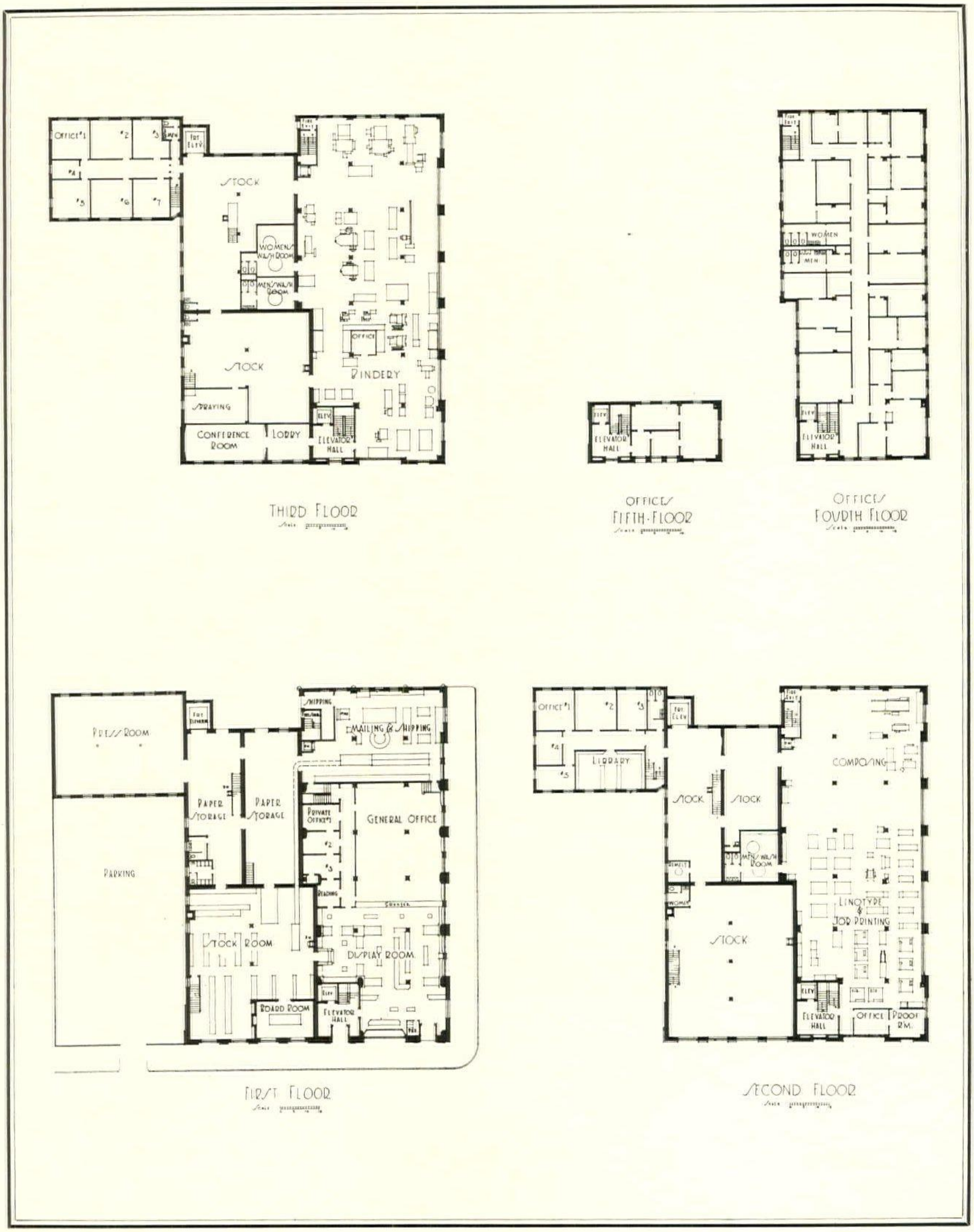


Piaget

EVANGELICAL SYNOD BUILDING

ST. LOUIS, MISSOURI

HOENER, BAUM & FROESE, ARCHITECTS



EVANGELICAL SYNOD BUILDING

ST. LOUIS, MISSOURI

HOENER, BAUM & FROESE, ARCHITECTS

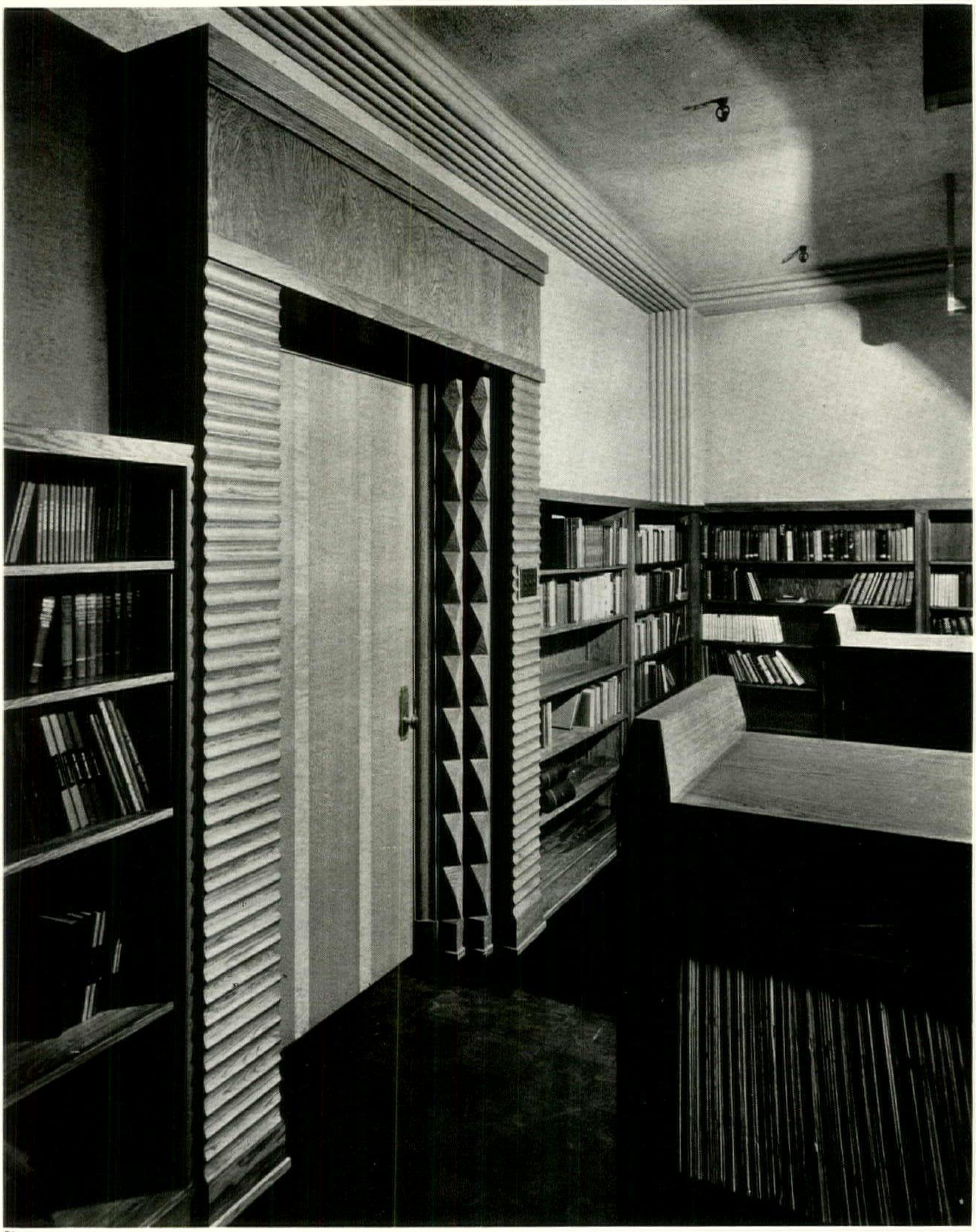
Piaget

THE exterior of the Evangelical Synod Building, which houses a printing and publishing company, is of varying shades of smooth tan and buff brick. The base and door trim are polished black granite, while the spandrels and other trim are full range fire flashed terra cotta. Etched aluminum has been used for the entrance doors and grilles, and the crestings and cornice are also of aluminum. The windows are of the projected type, with wrought iron frames painted aluminum. The beacon light, which surmounts the building, and the decorative lamps which flank the doorways, are of aluminum and wire glass

EVANGELICAL SYNOD BUILDING

ST. LOUIS, MISSOURI

HOENER, BAUM & FROESE, ARCHITECTS



Piaget

EVANGELICAL SYNOD BUILDING

ST. LOUIS, MISSOURI

HOENER, BAUM & FROESE, ARCHITECTS

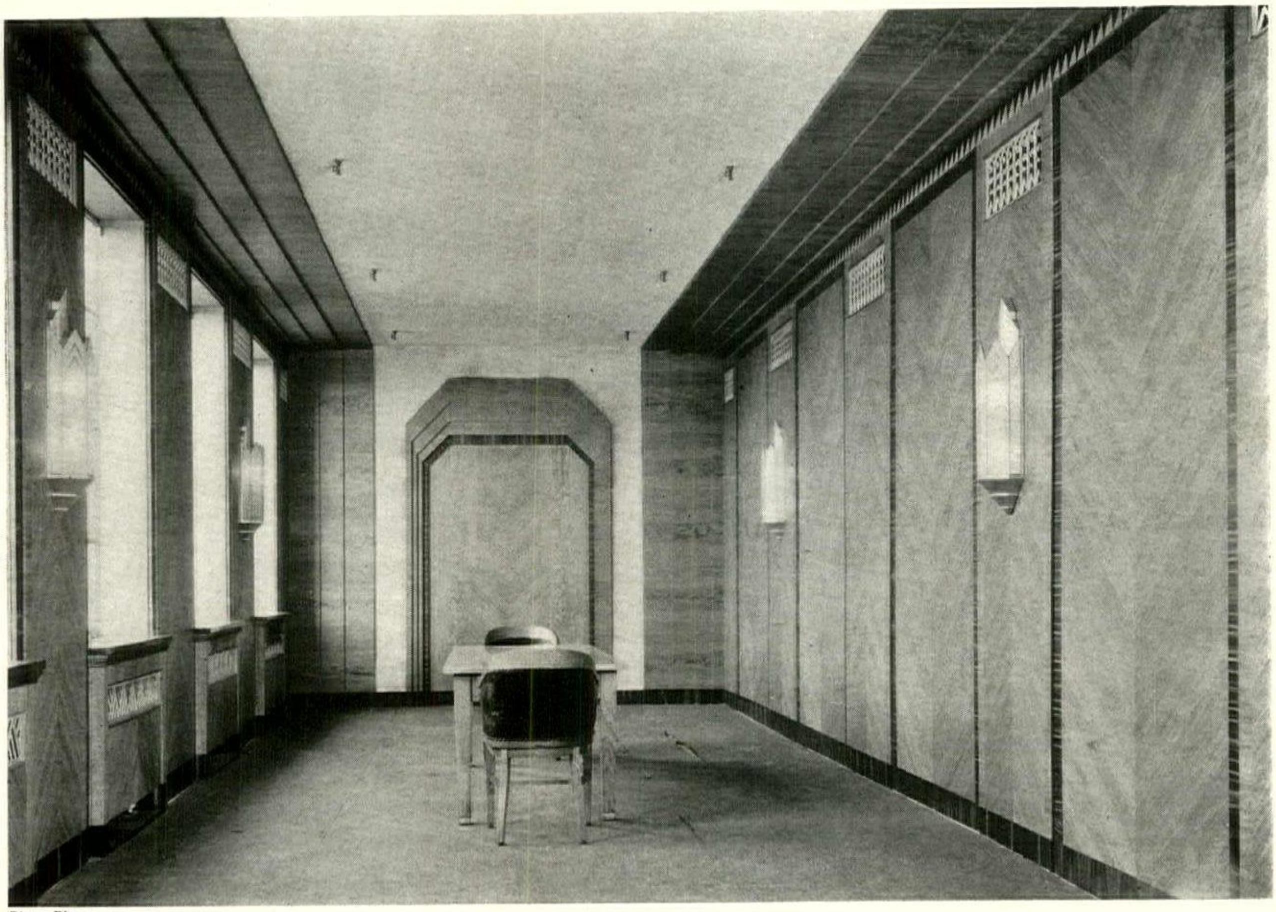
Piaget

ALTHOUGH there is wide variation in treatment of the interiors, unity has been preserved through modified repetition of certain design details and general similarity in tone. On the page opposite is a corner of the editorial library, used only by employes of the company. The woodwork is American red oak and Australian silky oak. The upper walls and ceiling have been treated with an acoustical plaster, and the flooring is asphalt tile. The fluted cornice and columns add interest to the treatment. Above is a view of the directors' room, which has walls paneled in satinwood and Brazilian rosewood. Here, too, the upper walls and ceiling have been finished in acoustical plaster, buff in color. The flooring is carpet, bold in color and striking in design

EVANGELICAL SYNOD BUILDING

ST. LOUIS, MISSOURI

HOENER, BAUM & FROESE, ARCHITECTS



Piaget Photos

ABOVE is the synod conference room, with walls paneled in teak and Macassar ebony, and a ceiling of acoustical plaster. Fixtures and grilles are of aluminum. The floor is to be carpeted. At the left is the book shop and general offices. Terrazzo in two shades of gray with black stripes is used for the floor, and the columns are of polished black vitrolite with aluminum corners. The woodwork is Australian laurel, with ceiling and walls pistachio green trimmed with aluminum and black bands. Drapes are black, gray, and silver

EVANGELICAL SYNOD BUILDING

ST. LOUIS, MISSOURI

HOENER, BAUM & FROESE, ARCHITECTS

THE STORY OF ROCKEFELLER CENTER

X. THE ALLIED ARTS

BY

EUGENE CLUTE

In no other building development have architecture and the kindred arts been so closely allied as they are in Rockefeller Center. With an established theme for the entire decorative treatment — man's successive crossings of the frontiers of materialism — many of the world's finest designers have been assigned to translate their ideas into stone, wood, paint, metal and tile. Part of the story of the allied arts is presented here. Later developments will be reported in other chapters of The Story of Rockefeller Center

Eckman

Curved one-eighth size study of the Ezra Winter mural, with color reference samples on the work table of materials to be used in the foyer

MURAL painters and sculptors, craftsmen in metals and in enamel, workers in mosaic, and others representing the arts allied to architecture are beginning to do their part in rounding out the æsthetic development of Rockefeller Center.

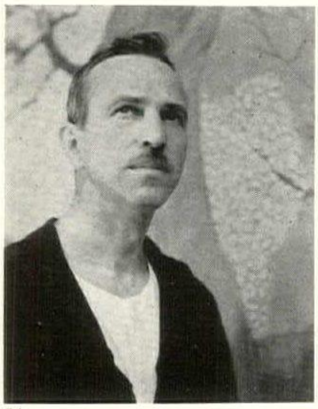
Under the guiding and coordinating influence of the architects, Reinhard & Hofmeister; Corbett, Harrison & MacMurray; and Hood & Fouilhoux, the chosen artists are giving beauty, significance and consistency to the various parts of the decorative scheme. They are working freely, as the old-time craftsmen worked, each expressing his own ideas, in the spirit of our day. They are interpreting modern science and industry, the radio, television, the arts of music and the drama and many of the other elements that go to make up nation-wide and world-wide activities that will center here. They are reaching out for the spiritual significance back of these things and recording man's approach to the Infinite through the conquest of the material.

The impressive, four-square, piled up masses of the buildings, with their plain, rich-textured limestone walls, broken only by the windows that are united in long vertical lines by low-toned, silvery gray metal spandrels, provide an excellent foil for the sculptural adornment and for the colossal enrichments of beaten and polychrome enameled metal that will be placed at focal points upon the exteriors. These features will be placed low, where they can be seen and enjoyed. There will be a plaza or sunken garden in front of the tallest building of the group, which will form the setting for one of the chief works of art, a beautiful sculptural fountain.

The interiors, no less than the exteriors, afford unusual opportunities for the display of the work of artists and craftsmen. The large interior walls of the principal public areas will be unbroken by pilasters, pedimented doorways and the paneling of the familiar treatments, derived from Classic or Renaissance sources, and equally free from the eccentric forms that are the common marks of modernism. They will, consequently, give full scope to the mural painter and provide plain surfaces to be relieved with decorations by craftsmen in different materials.

One of the most important decorations will be the large mural painting by Ezra Winter which will cover one entire end wall of the grand foyer of the International Music Hall. This painting will be 60 ft. in width and 41 ft. in height, on a curved surface.

The theme of the decoration is taken from an



Eckman

Ezra Winter, at left, and above, work in progress on one section of the mural. A deep Tuscan red provides the background, with pale gold in the crags, the garden, and cloud rims as the high note, relieved by the grays in the procession and clouds

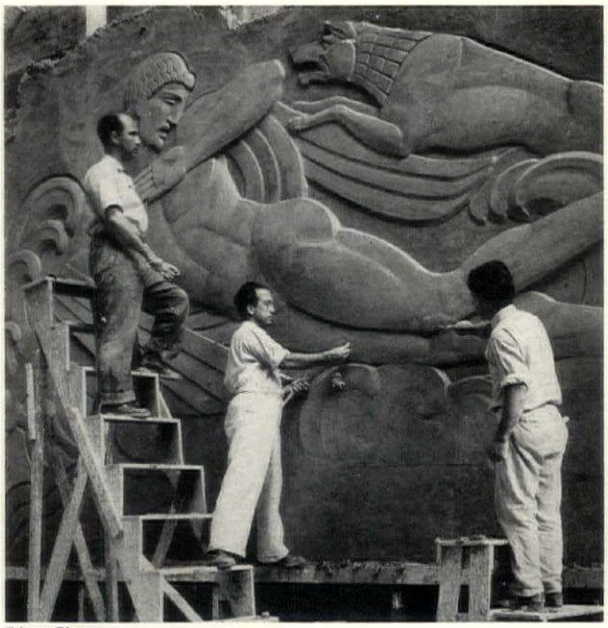
ancient legend which relates that very long ago there was a beautiful garden in which was a fountain of perpetual youth. Then, the earth was shaken and rent; great impassable chasms yawned on all sides of the fountain, which remained as beautiful as ever, but inaccessible to man. Inborn in every human being is a memory of this magical garden of the fountain of youth, so the legend tells us, and all men go through life seeking it.

Here, Mr. Winter shows us an aged pilgrim gazing towards this unattainable goal. At his right are some of those who have perished in the struggle to reach the same ephemeral objective, men turned to stone and broken. As the pilgrim stands on the cliff, unmindful of the rock's grip already closing upon his feet, a vision of human desires and vanities passes before him; youth and gaiety; plenty and romance; victory and the spoils; and fame. The cloudland swallows them all.

In presenting his theme the artist has used terms that every one can understand. The coloring assists in the interpretation. The mount of the fountain of youth is a thing of pale, golden sunshine, with light blue-gray in the shadows, unearthly in its beauty. Painting the vision in grisaille makes its unreality evident. The somber, dark gray edge of the cloud mass into which the vision is passing suggests the natural dread of death, which is quickly passed and is overcome by the flood of soft golden light from beyond. Heavy, dull coloring expresses the hampering earth in the foreground. The unreality of both the mount and the vision is intensified by the strength of the plain, rich, red background.

For the sound motion picture theater a ceiling of classic beauty and dignity, thoughtfully studied in its significance, has been modeled by René Chambellan and Oronzio Maldarelli, under the supervision of the architects. These sculptors believe that people come to the theater to forget, for a time, their humdrum existence and to give their spirits an opportunity to expand in a realm of fantasy. Accordingly, they are causing to float overhead in this auditorium figures from Classic mythology and symbols that carry the mind to Olympus and beyond. A knowledge of mythology is not needed to appreciate the splendor of Apollo, the lithe strength of Mercury, the beauty of Venus and the grace of Diana in these reliefs. The same thing is true of the other figures. Then there are the chimeras — grotesque, composite creatures that suggest vague, age-old fears and unknown dangers; groups of flying birds that give one a sense of the freedom of the upper air; and the sun, moon and stars that carry the mind into the limitless reaches of interplanetary space.

The figures are modeled in low relief in such a way that they seem to emerge from the ceiling; and the technique is so excellent that one is not conscious of the medium, but only of the impression.

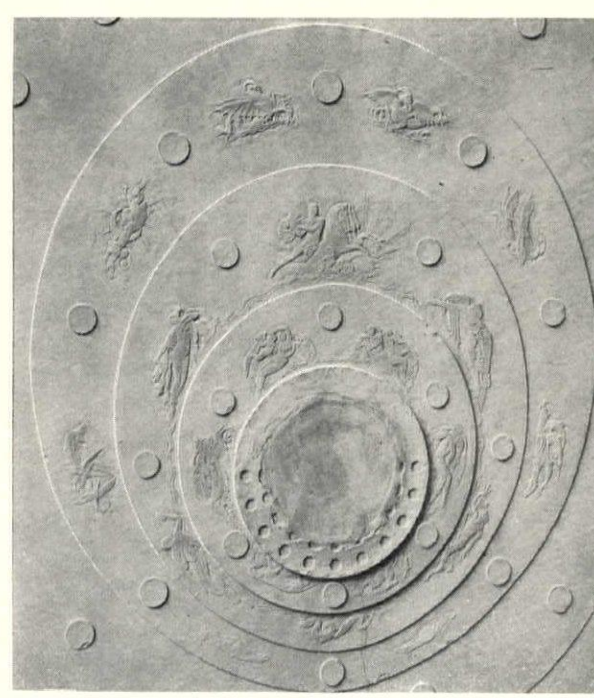


Eckman Photos

Above left, Messrs. Chambellan and Maldarelli at work on the clay model of the cinema ceiling, a small model of which is shown below. Above right, workmen making plaster cast of model, and at the right is a photograph of Mr. Chambellan

In its general design, this ceiling is very unusual and interesting, being composed of more or less circular sections, one within another, slightly stepped down in succession to a great crystal chandelier of drum shape, 30 ft. in diameter, that will be set tight against the ceiling, somewhat off the center of the room. This can be seen in the photograph of the small scale model for the ceiling, on which the figures and other relief sculptures are indicated. The small disks distributed over the surface represent the plaster-covered circular baffle plates that will be suspended a few inches below the mouths of the ducts through which the conditioned air will be admitted to the auditorium. Their function is to disperse the air so that it will settle gently down to the audience. The small circular depressions around the chandelier mark the location of diffusing lenses that will be set in the ceiling with flood-lighting units recessed above them to supply additional illumination, when required.

One of the most unusual features of the entire decorative scheme of Rockefeller Center is the colossal enrichments of combined metals that will be applied to the exterior of the International Music Hall and the cinema. Designed by Hildreth Meiere and executed by Oscar B. Bach, this series of plaques is a marvel of artistry and technical skill. The plaques are beaten in relief from copper, bronze, aluminum, chrome-nickel steel and other metals. Their coloring is enlivened by the play of light upon varied metallic surfaces, some with the addition of full-colored vitreous enamels. They will stand out effectively against the background of the limestone walls which will be seen through the pierced portions of the designs. The rhythmic sweep of line, the combined clarity and richness of form and color, together with their expressiveness



Eckman Photos

The decorative repoussé plaque to be placed over the entrance to the cinema

At the left is Hildreth Meire, designer of the plaque; and at the right is Oscar Bach, who will execute it

and beauty, will make them superb decorations.

Three of these metal ornaments are circular plaques, 18 ft. in diameter, for the south facade of the International Music Hall, where they will be seen 60 ft. above the sidewalk. They express the spirit of song, drama and the dance.*

*The designs for these plaques were shown in the July issue of THE ARCHITECTURAL FORUM.

Largest of all, 42 ft. wide by 24 ft. high, will be the decoration of combined metals in repoussé which will be placed over the entrance to the cinema. It represents electrical energy sending out radio and television transmission.

This metal work marks a great advance in technique, because of the seriousness and the number of the practical difficulties that had to be overcome. It is believed that this is the first time that repoussé work in different metals has been employed at large scale out of doors. The use of various metals together, for the sake of their coloring, has been growing lately but has been confined, as a rule, to combinations of metals of a somewhat similar nature, because of the danger of destructive electrolytic action between certain dissimilar metals, especially when exposed to outdoor air and moisture.

These decorations for Rockefeller Center will know no such limitations; they will be in a full range of the colors of different metals, which will be electrically insulated from each other by means of a new process. Vitreous enamels will be used very freely upon the three circular plaques, and their successful handling at this scale is much more difficult than in the usual small scale metal work. Sections of metals of the size required tend to warp out of their proper shape, due to the pull of the cooling enamel after it is fired. This also has been overcome by a special process. Then, too, the enameled surfaces in this work are not flat, but modeled in relief; consequently, the tendency of the molten enamel to run off the high parts into the depression had to be checked. Only a few of the many difficulties, any one of which would have prevented the successful consummation of the work, have been mentioned. This has called not only for unusual inventive ingenuity, but for great skill in manipulation and suitable shop equipment.

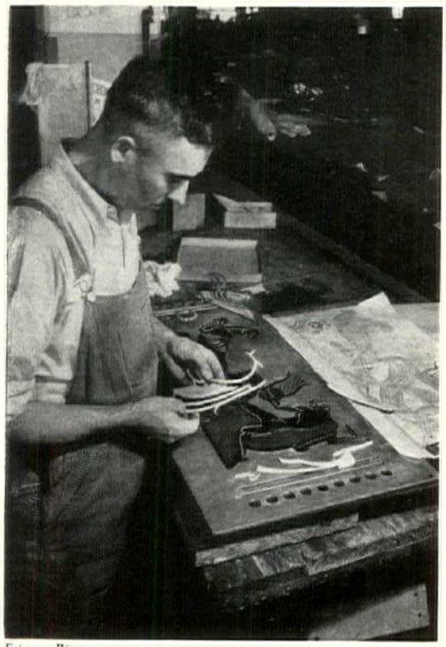
Work in progress upon parts of these plaques is shown by photographs taken in the shop, illustrating the repoussé work and enameling. In one of these pictures a craftsman is seen beating the form from a flat sheet of metal by striking it with a hammer while he holds an iron underneath the metal. This is only one of the many methods employed in repoussé work. When the main forms have been beaten out in this way, the work is placed face upward, upon a bed of hot pitch composition, into which it is pressed firmly. Then the finer detail is worked in with punches, by driving down the metal into the backing of pitch, which is at once yielding and firm.

When the repoussé work is finished, the metal next goes to an enameler, if it is a part that is to be further enriched in this way, for this calls for skill of a different kind. Vitreous enamel, a form of glass that comes in many different colors, consists of coarse, irregular fragments which the craftsman grinds to a fine powder, using a primitive mortar and pestle. The pulverized material is then mixed with water, to the consistency of cream, and applied evenly to the metal surface with a steel spreader. The next step is the firing, which fuses the particles and causes them to unite, forming a thin glaze of enamel which adheres firmly to the metal, virtually colored glass, with the beauty of that material and its durability.

In addition to the metal decorations described above, Mr. Bach is executing a large number of varied and interesting works for Rockefeller Center, involving many different techniques. Among these are the panels of bronze inlaid with black bakelite. The parts are cut out and fitted together like a puzzle. As all parts are beveled and the work is put together from the back, all is held securely when the back cover plate is in place. The bakelite is painted white to permit tracing the design upon it. Bronze elevator doors for the cinema are being engraved by hand and a series of over-door decorations for the foyer of this building are being cut out of steel, given

Eckman

The rich treatment and scale of the plaques for the International Theater, which are to be executed in metals and enamels, are evident from this photograph taken in the workshop of Mr. Bach



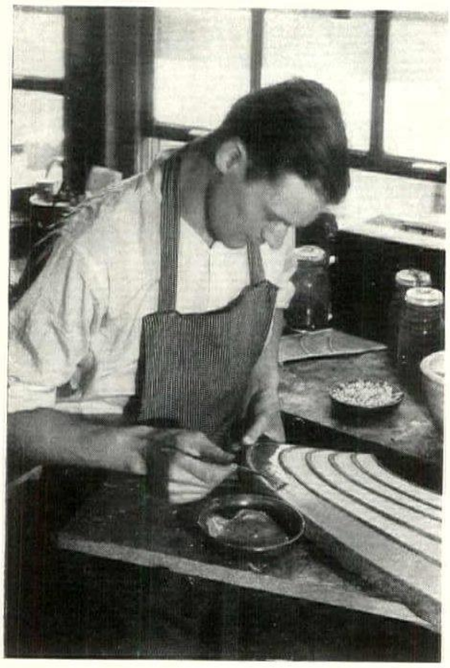
Eckman Photos

Craftsman fitting together one of the bronze panels inlaid with bakelite. The cartoon from which he is working is directly before him

At the right is a photograph of an engraving operation, done entirely by hand, for one of the bronze elevator doors in the cinema building

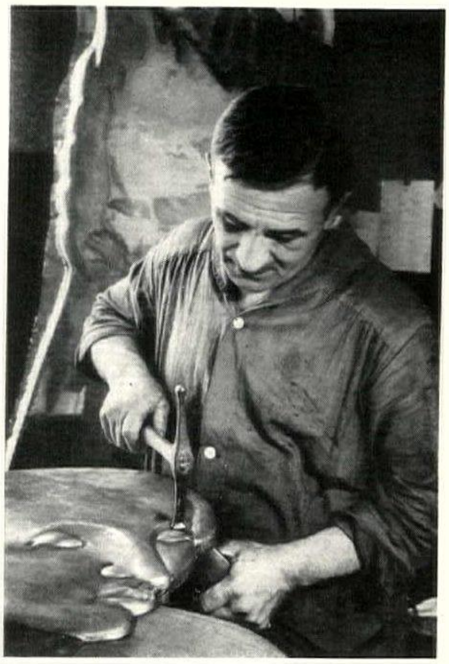
a permanent satiny black finish and inlaid with lines of bright nickel-chrome steel. They will be inserted in the rich brown wooden lining of the wall, flush with the surface.

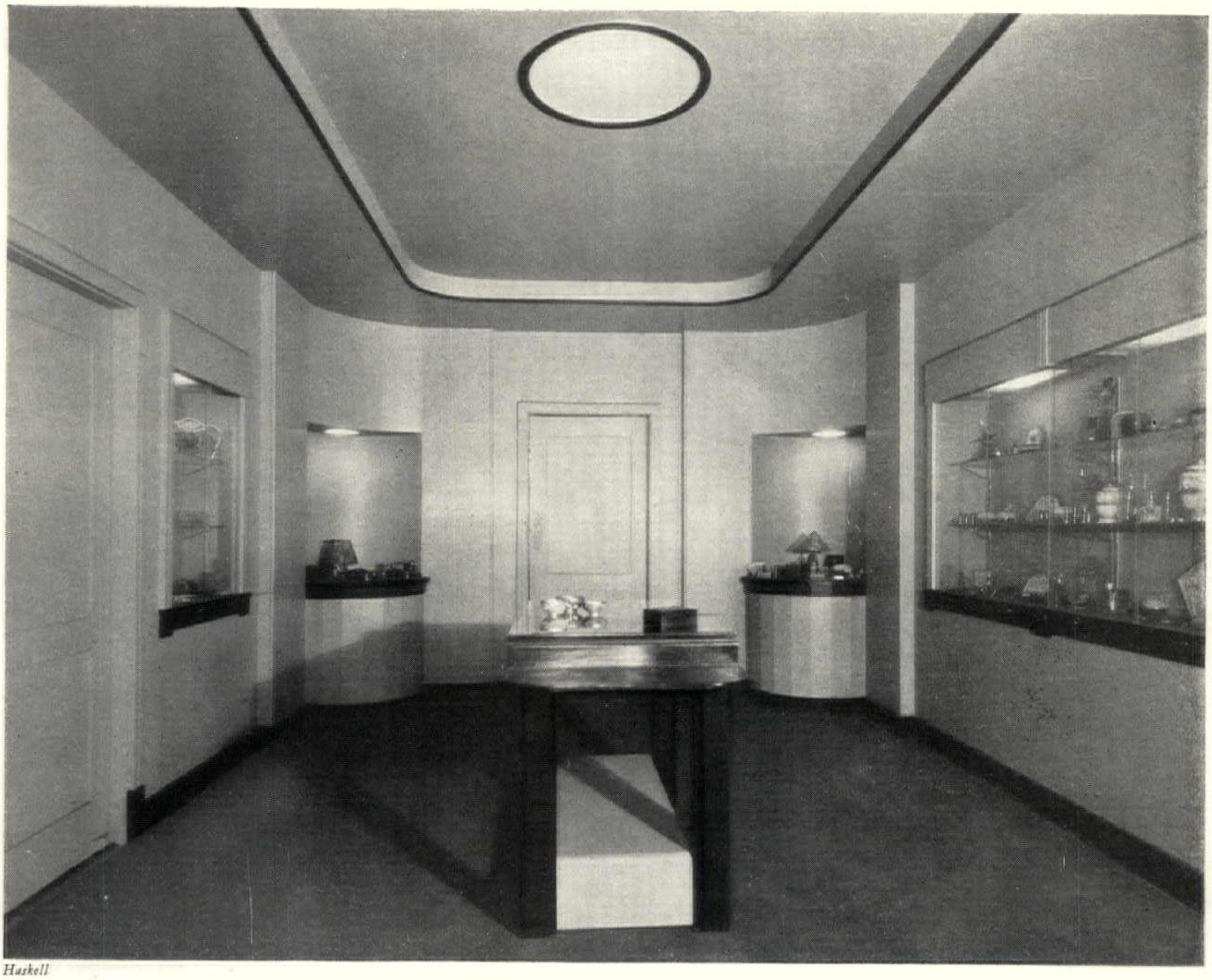
The list of other artists who are working on projects is growing. For example, Barry Faulkner is making the half-size drawings for his large decoration, 79 x 14 ft., for the loggia of the 70-story building to be executed in enamel mosaic by Ravenna Mosaics, Inc.; Gaston La Chaise is developing the studies for his four sculptural panels for the west front of the same building, while other mural painters and sculptors are in the preliminary stages of their commissions. Boardman Robinson is at work on an imposing mural for the lobby of the RKO building. For the sculptural treatment of the entrance to the building, Roberts Garrison has been commissioned to execute three panels symbolizing the endless activity of radio. Representatives of Rockefeller Center are abroad at the present time engaging English, Italian, Spanish, and French artists to execute the ten mural panels for the great hall of the seventy-story office building, to be known as the R.C.A. Building. Photographs and descriptions of these works will be presented here as soon as they have progressed far enough to make this possible.



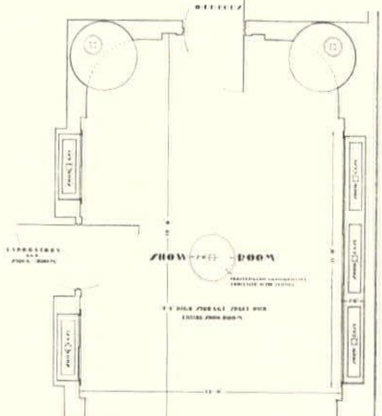
Spreading soft enamel for one of the plaques after the repoussé work had been finished. The enamel is then baked to form a thin glaze

At the right, one of the steps in repoussé work, beating out the form from a flat sheet with a hammer, while holding an iron underneath





Haskell



THE display room of the Franco-American Corporation, perfumers, is built of sheet rock painted light gray, except for the pink backgrounds of the show-cases and the central portion of the ceiling. The moldings are dull black, and the carpet is maroon. By dropping the ceiling 4 ft. 6 in., storage facilities, with access from the stock room, have been provided over the shop, and a flush central lighting fixture has been installed. The corners are utilized for display niches and counters, supplemented by the center table

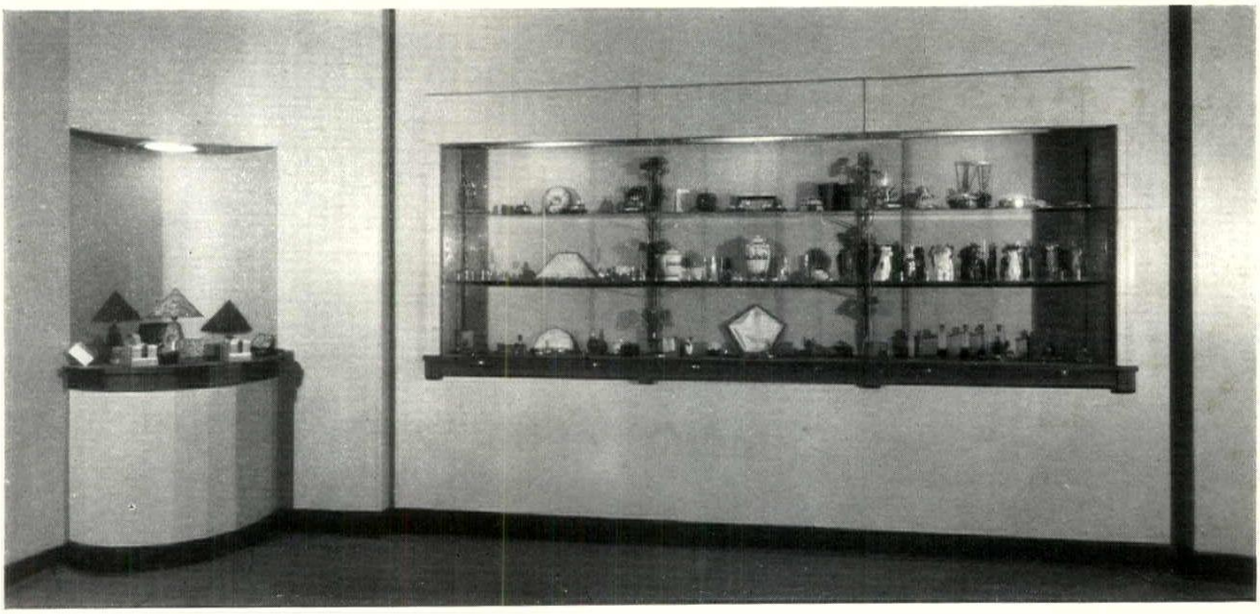
DISPLAY ROOM, FRANCO-AMERICAN CORP.,

BOSTON, MASSACHUSETTS

ZAREH M. SOURIAN, DESIGNER

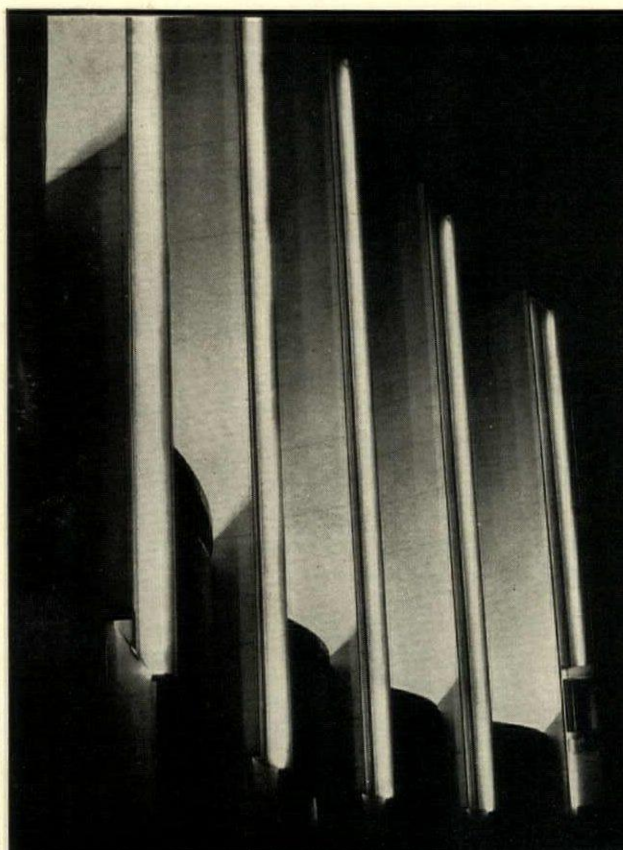
Haskell Photos

At the left, one of the corner niches, adequately lighted by a flush fixture. Below is a view of the long side of the room, showing the recessed display shelves



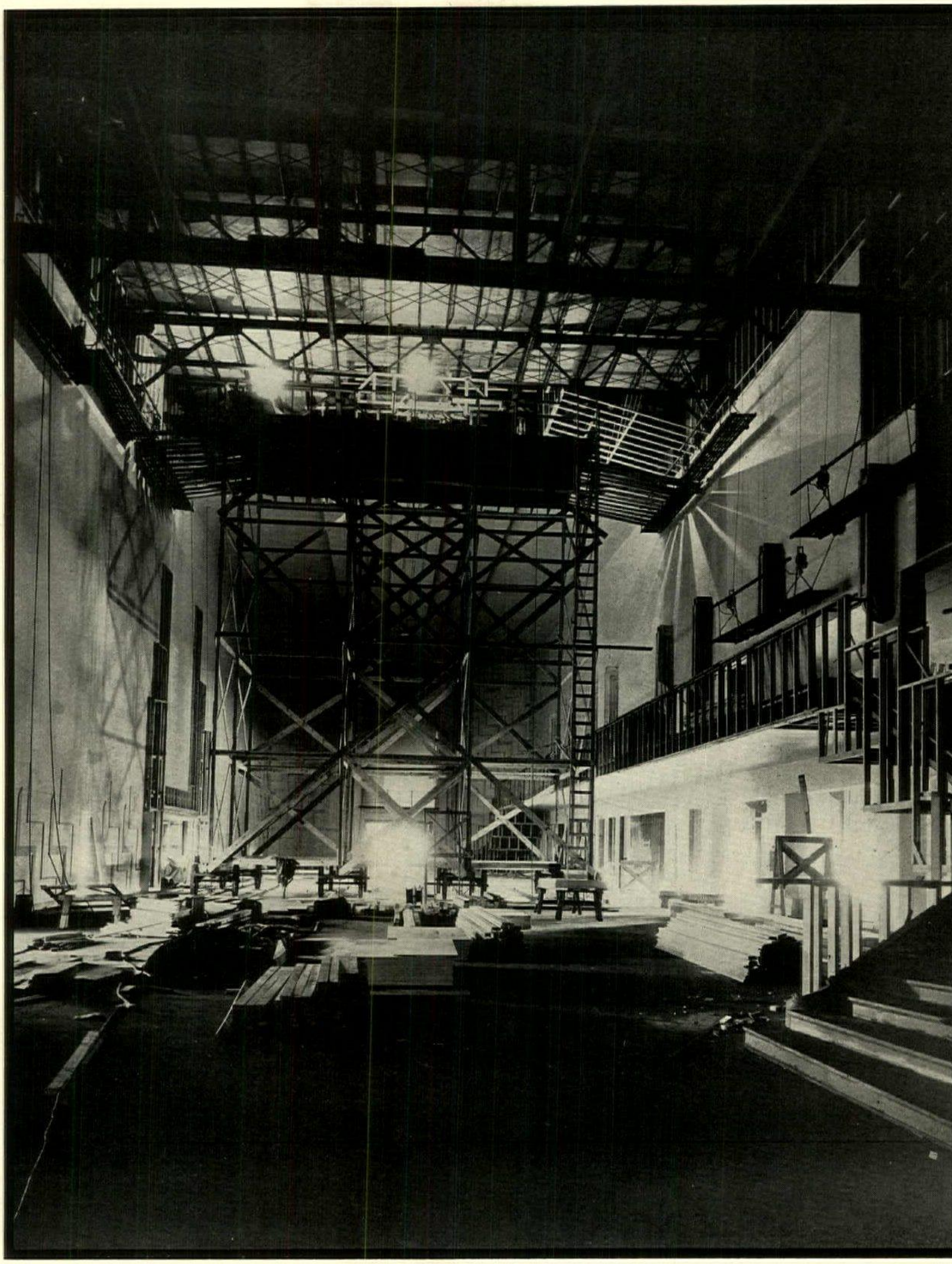
DISPLAY ROOM, FRANCO-AMERICAN CORP.,
BOSTON, MASSACHUSETTS
ZAREH M. SOURIAN, DESIGNER

ENGINEERING & BUSINESS



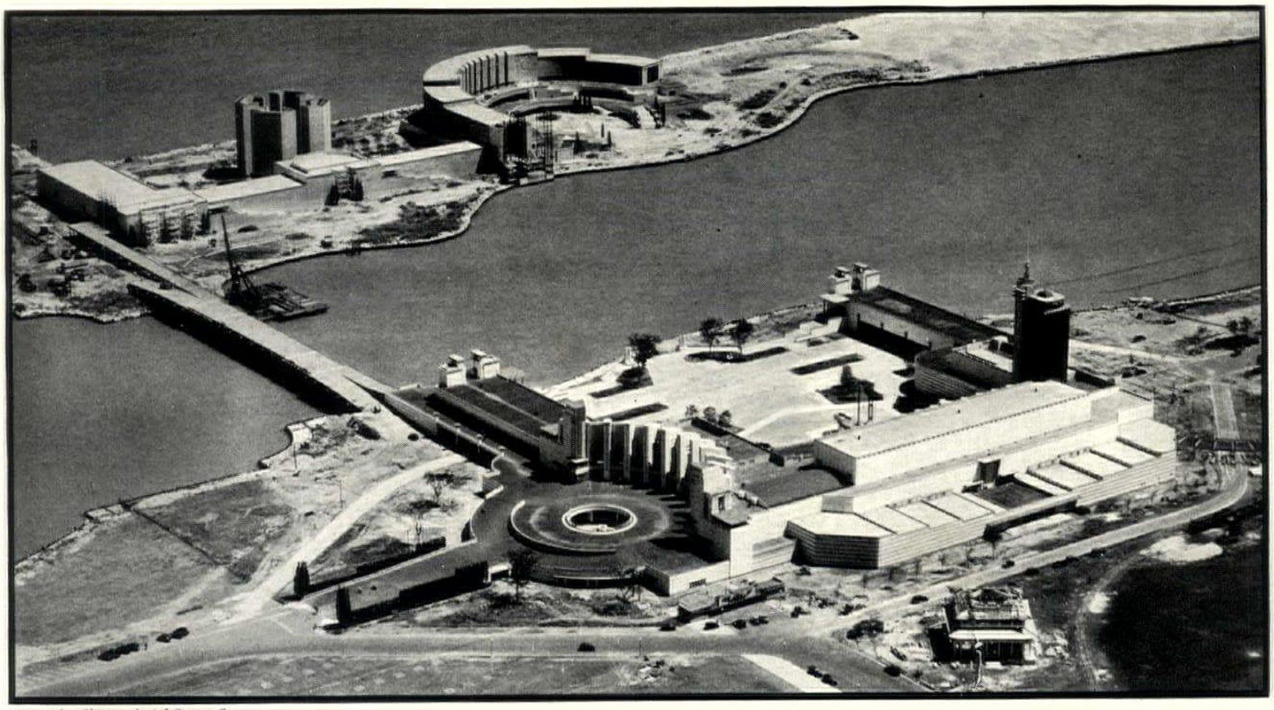
Hedrich-Blessing

DETAILS OF CONSTRUCTION AND EQUIPMENT FOR THE HALL OF SCIENCE . . . CAN HOUSING BE FINANCED? . . . A COMPARISON OF COSTS AND CONSTRUCTION FOR A MASS-PRODUCED HOUSE . . . ARCHITECTURAL FORUM DATA AND DETAILS OF HOUSE EQUIPMENT . . . SOUND MOTION PICTURE DATA



CONSTRUCTING THE GREAT HALL

HALL OF SCIENCE, A CENTURY OF PROGRESS
EXPOSITION, PAUL PHILIPPE CRET, ARCHITECT



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THE HALL OF SCIENCE

A CENTURY OF PROGRESS EXPOSITION

DETAILS OF STRUCTURE AND EQUIPMENT

BY

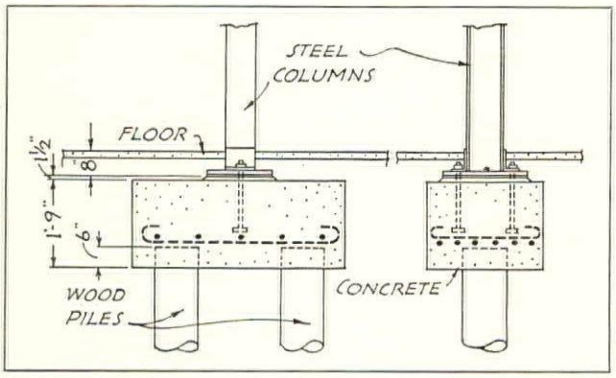
LOUIS SKIDMORE, CHIEF OF DESIGN

A NUMBER of structural innovations have been introduced into the Hall of Science, for which Paul Philippe Cret of Philadelphia was the architect. Since the building was designed to last only for the duration of A Century of Progress Exposition — June 1 to November 1, 1933 — economy was a vital consideration. Yet the building had to conform to the best engineering and structural practices to provide adequate display space for the exhibits and safe and comfortable circulation of great crowds of people.

Since all the exposition buildings must be removed after the expiration of the fair, materials economical in original cost, having some salvage value and permitting of dissembly at low cost, were selected. The use of machine-made materials, assembled on the job, has resulted in some economies.

The Hall of Science is approximately 400 x 700 ft. It is in the form of a "U," placed on the edge of a lagoon, with two long arms stretching down toward the water by a series of terraces. It is a two-story structure with a mezzanine. The quadrangular court formed inside the "U" space covers 130,000 sq. ft. A tower 34 x 38 ft. extends 175 ft. above the ground at the southwest corner of the court. There is a small turret at the top in which a 25-note carillon has been installed. A great rostrum extends into the center of the court from a terrace 100 ft. wide x 300 ft. long, adjoining the main floor. The Great Hall of Science, the building's most impressive interior feature, overlooks this terrace. The Great Hall is 260 ft. long, 60 ft. wide and 50 ft. high, with a balcony fringing the west wall.

On the north a ramp 176 ft. long and 60 ft. wide leads up to a great circular terrace enclosed by a row of pylons, extending 59 ft. above the terrace, with the curved main walls set back between the pylons and extending 52 ft. high.



At the left is a view of the interior of the Great Hall showing the method of framing the walls and roof. Most of the structural steel frame is secured by bolts and the joists, secured by clamps to the beams, are stiffened with bridging. The drawing above is typical of the foundation system. Two piles under a concrete footing support the interior columns and one pile only is used beneath the exterior columns

The Foundation. The foundation of the Hall of Science is a piling system covered with concrete footings. This was made necessary by the nature of the land. The site is on "made" ground which a few years ago was under the surface of Lake Michigan. The fill, averaging 20 to 30 ft. in depth, comprises rubble of all kinds and some good sand. Underneath is a layer of siltlike clay and sand, and below it is hardpan. Test borings at closely adjacent points through the fill revealed widely different results. Load tests indicated a decided settlement below the loaded area and a raising of the area immediately adjacent.

A highly economical system of piling has been developed which has reduced the number of piles required. Instead of using a minimum of three piles under each column, which would have resulted in relatively expensive foundations, a system of one pile under exterior columns and two piles under interior columns has been followed. Exterior pile caps are tied to interior pile caps with tie-rods below the surface of the ground to keep the wall piling from spreading out. The piling is utilized to its ultimate capacity.

Level foundation surfaces are of reinforced concrete. Concrete has similarly been used for the wall beams to connect exterior column footings and to receive the exterior stud walls.

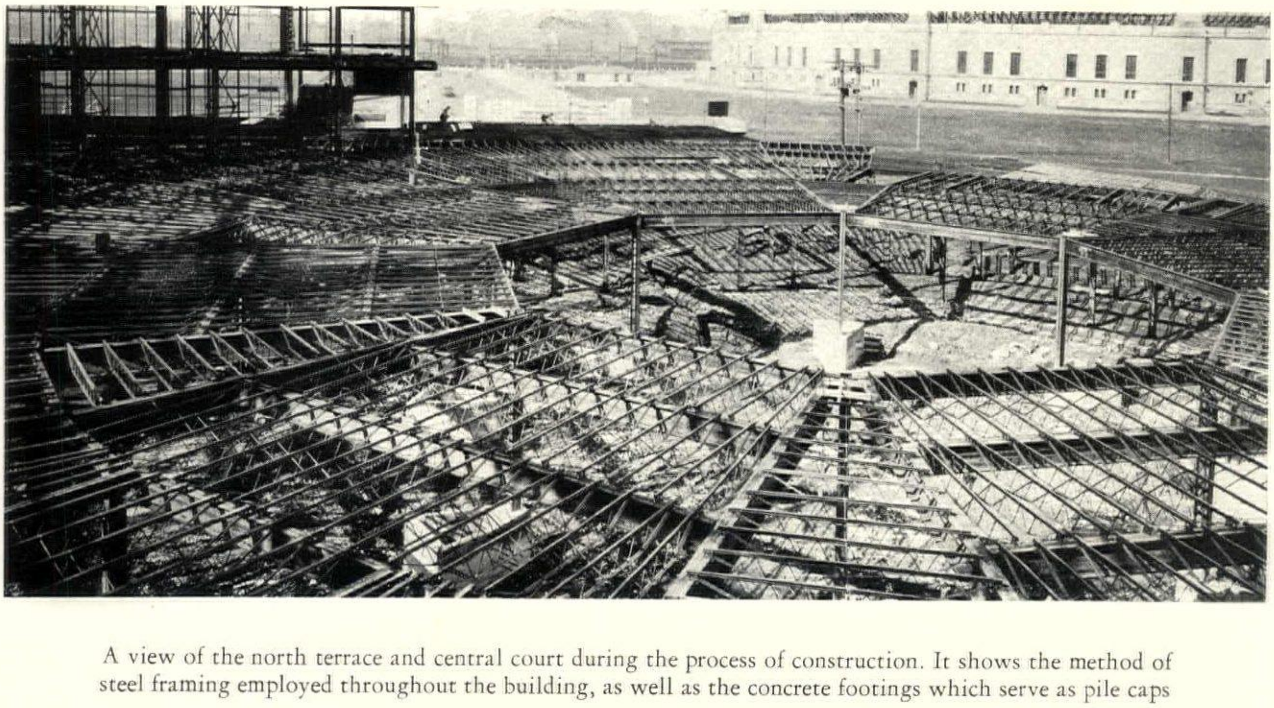
Structural Steel. The frame of the Hall of Science is of structural steel girders and columns, with steel joists extending lengthwise, framed to the girders. The structural steel is designed for unit stresses not to exceed 21,000 pounds per sq. in. The steel joists are designed for stresses of 18,000 pounds per sq. ft., limiting deflections 1/360 of the span.

The structural steel frame has been bolted to facilitate demolition. But in cases where greater wind bracing is required, the connections have been riveted. A simple bolted clip secures the joists to the beam. This is then stiffened with bridging clipped to the top and bottom chord and spot-welded to the steel beams. This method has made possible considerable economies, at the same time permitting the use of the space between the finished ceiling and the finished floor as a ventilating duct.

The Great Hall of the building is framed with bents of trusses and columns, 20 ft. on centers, supporting steel truss joists. The hall occurs over the second floor and the first story extends out into the court, its roof forming the terrace framed in panels. At the west side of this hall the mezzanine projects 10 ft. into the hall as a cantilevered balcony.

The tower is framed with columns, spandrels and diagonal bracing in the exterior walls only, the enclosed space being entirely free of columns.

The framework of the circular terrace and open well on the north approach, reached by the great ramp, is of concentric rows of columns, with girders framed on the chords, or radially, supporting panels of steel joists. The semicircular row of pylons guarding the north approach is framed of light section vertical struts, horizontal girts and diagonal bracing members, connecting with the typical floor framing of the portion of the building adjoining them to the south.

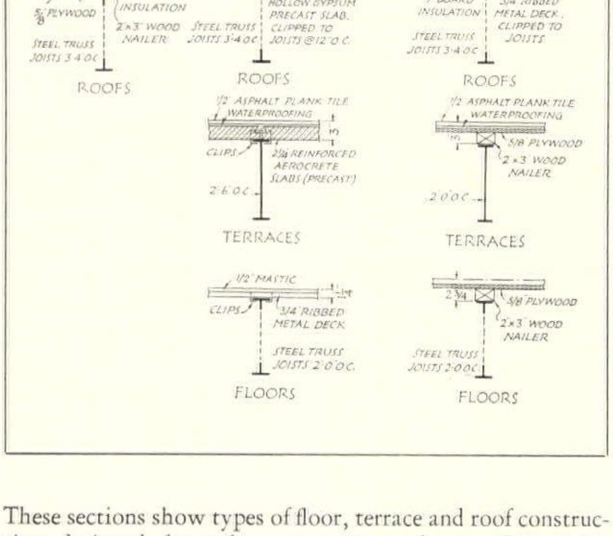


A view of the north terrace and central court during the process of construction. It shows the method of steel framing employed throughout the building, as well as the concrete footings which serve as pile caps

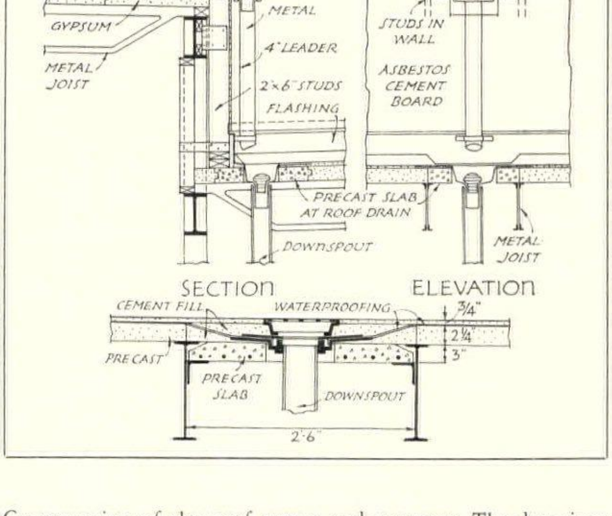
Floors and Terraces. The floor deck on the Hall of Science is of laminated plywood. This has proved a thoroughly safe and highly economical material. It conforms, too, with the exposition's practice of furnishing a finished corridor floor and a good sub-floor for exhibit space on which the exhibitor may lay a flooring suited to his needs. The plywood is a five-ply, ⅝ in. Douglas fir board, laid with tongue and groove joints, in 3 x 8 ft. panels. Besides serving as a sub-floor for exhibit space without additional covering, it provides a high insulating value.

The floor finish in the Great Hall of the building, in the octagonal lobbies and in the corridors leading to them, is of ground cork manufactured into tile, which is cemented to the plywood sub-floor. The floor finish in the corridor and exhibit areas elsewhere in the building has not yet been determined. Practical tests of various floor finishings are being made to determine the best and most economical finish.

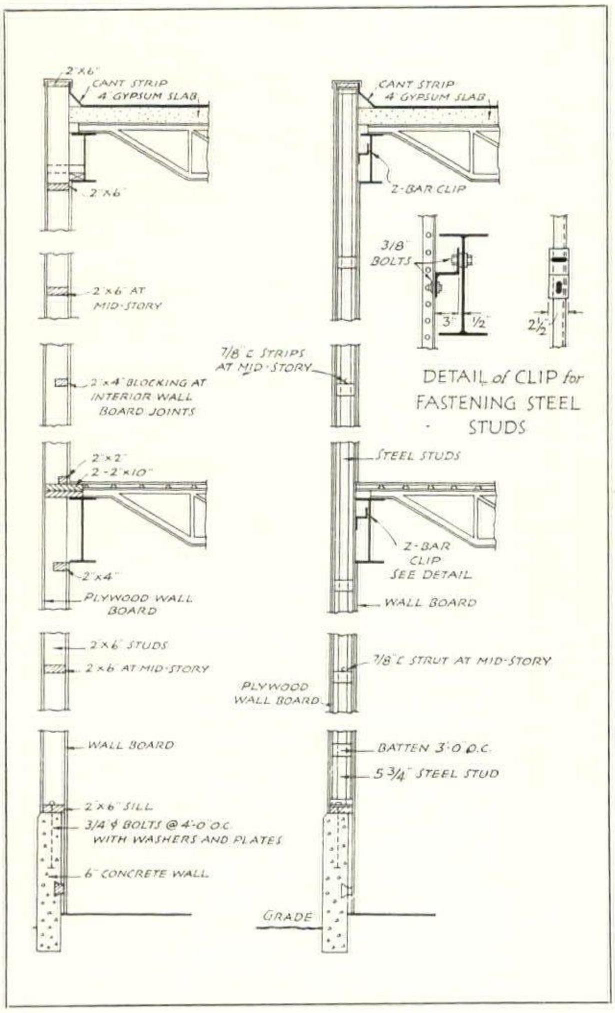
The terraces at the north approach, the central terrace overlooking the great courtyard and the



These sections show types of floor, terrace and roof construction designed for safety, economy and easy demolition



Construction of the roof sumps and parapets. The drawings above illustrate the drainage from one roof level to another



The construction of the Hall of Science is somewhat similar to that of the Administration Building published in the August 1931 issue of The Architectural Forum. In the Administration Building the wall membrane material was transite; here plywood has been used secured to a stud framing outside of the steel frame. Below are two types of stairways used

terraces on each side of the "U" space are paved with a ¾ in. precast plank tile. This is laid over a two-ply membrane roofing. A considerable saving in materials has been accomplished by the use of this tile. At the same time it provides safety for the pedestrians, because of its resiliency and non-slip character.

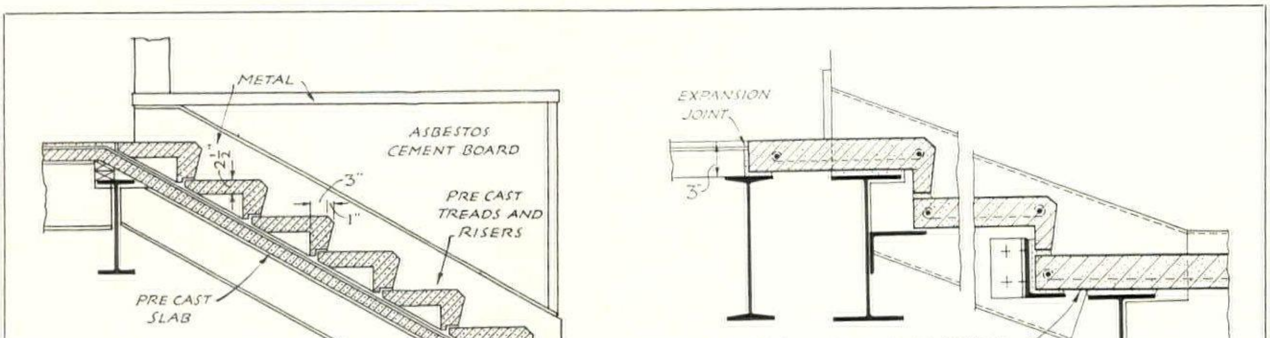
All floors and terraces have been designed for a live load of 100 pounds per sq. ft. The roofs are designed for a live load of 25 pounds per sq. ft.

Walls. The Hall of Science, as is the case with other buildings of the exposition, is practically windowless, a feature dictated by practical considerations. Sunlight for daytime illumination is a variable factor, whereas the volume and intensity of artificial light may be completely controlled at every hour of the day or night — an advantage to exhibitors and visitors alike. At the same time the absence of windows has made possible some important savings through the elimination of sash and window glass, which costs as much in a temporary structure as in a permanent one.

The windowless wall areas required a covering that had a certain degree of flexibility and could absorb expansion and contraction. The covering likewise had to be of an economical material, suited to easy erection and capable of providing a satisfactory surface for painting.

The walls of the Hall of Science are of ½ in. five-ply Douglas fir laminated board, secured to the wall studs by battens, in units 4 x 8 ft. In cases where the battens were used vertically it was butt-jointed, and on horizontal joints and where joints were exposed it was ship-lapped.

The stud wall construction is kept outside the steel frame, with the wall covering (both exterior and interior) placed on either side of the studs. The air space between the outside and inside covering serves as wall insulation. A fire stop, the full depth of the studs, is placed at the mid-point of each story.



Railings on stairways and around terraces on the building are of an open type. A welded pipe rail which clips over the coping has been used, the roofing membrane being carried over parapet under coping to serve as flashing. It thus eliminates piercing and expensive flashing.

Ventilation. Since the Hall of Science will be in use only during the summer and autumn months, no provisions for a heating system have been necessary. Artificial ventilation was required, however, and is supplied by an exhaust system expelling 4 cu. ft. of air per minute for every sq. ft. of space. With all the lights in operation and the crowds of people within the space, the amount of air moved in the building is based on a sufficient removal to maintain an interior temperature within 5° of the exterior. Door openings, of which there are a great many, provide the fresh air supply.

The space between the suspended ceiling and the floor above is used for plenum chambers. The air is introduced by means of grilles properly distributed in the ceiling. Fan rooms are located in spaces not usable for other purposes.

Two types of fans are used for circulating air. One is a propeller type with a direct connection motor. The other is a blower type with a belted driver. The fans are well distributed to provide as equal distribution of air as possible. There are eighteen blower type fans in operation, located in the Great Hall, the octagonal lobbies, and the first floor below. Eighteen propeller type fans are located in other parts of the building. A total of 1,250,000 cu. ft. of air per minute is expelled from the building by the use of this ventilation system.

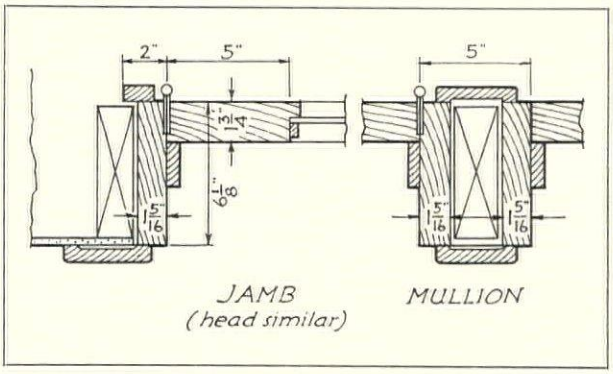
Lighting. The Hall of Science presents some interesting developments in architectural lighting at night. By making the lighting a part of the architecture, with provision for the installation of lights in the plans, the possibilities of lighting as a decorative feature accenting the architectural effects have been realized. All the architectural lighting is indirect.

Gaseous tubes, 15 mm. in diameter, have been used to a great extent on the exterior. Altogether, 4,760 ft. of tubing have been used — the largest amount ever employed on any one surface in the annals of architectural lighting.

The faces of the twelve tall pylons which rise at the north approach are indirectly lighted by 1,280 ft. of red colored tubing. The effect is that of long, shadowless lines of light. The variation in intensity is almost imperceptible to the eye, regardless of how close to the lights the spectator stands or how far away he is from them. The four sides of the 176-ft. tower are illuminated by 2,700 ft. of gaseous tubing. On the south and west sides of the tower the tubing is red; on the east and north sides it is blue.

The electrodes in the tubes are of an advanced design. All lead-covered cables are used in the secondary leads, and an unusual method of holding the tubing in the mullion has been developed, so that no socket is required, thus effecting considerable economies in installation. A total of 123 transformers is required to provide energy for illuminating these tubes and those employed in the Great Hall.

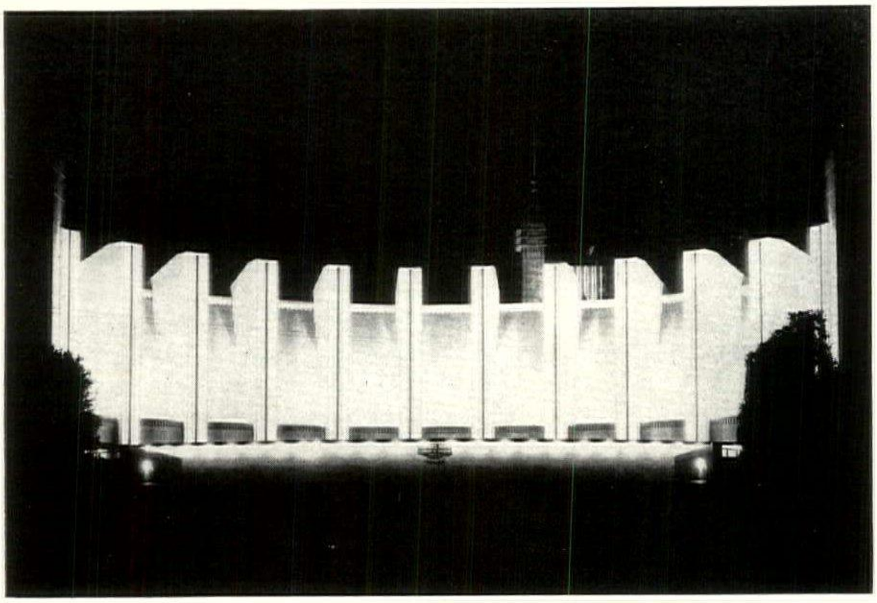
The exterior wall surface of the Great Hall facing the courtyard presents an unusual illumination in silhouetted grilles. V-shaped bays, extending the full height of the façade have been installed with a facing perforated in a pattern representing an abstract design of three branches. They extend 300 ft. along the entire width of the wall. Behind each V-shaped bay a revolving shaft has been placed on which are mounted various colored projectors the entire height of the bay. As the projectors revolve behind the grille slowly changing tints of colored light follow one another.



A typical detail of one of the entrance door jambs and mullions. The doors are installed in the stud walls shown in section on the opposite page

On the stairways leading from the terrace into the courtyard, louvered lights have been placed on each side of the stairs on 10-ft. centers. In the courtyard and at other effective points floodlights have been placed to complement the gaseous tube illumination, so as to emphasize the mass of the architecture.

The interior lighting of the Hall of Science offers some unique effects. In the Great Hall incandescent lamps provide the desired intensity of light and Neon tubes are used for decorative purposes. Along the axis of the ceiling three ribbons of light are produced by concealed tubing. In all, 780 ft. of tubing in blue and green are utilized for this effect. Eight sets of louvered coves in a series of drop ceilings that extend the full length of the hall provide an unusual lighting spectacle. This scheme has been worked out from a design point of view to obtain sufficient illumination in the room and to produce the effect of light grading gradually down from full illumina-



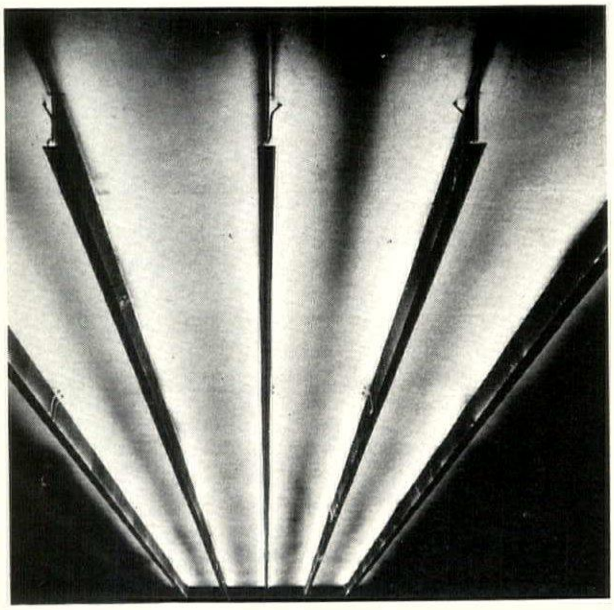
Two methods employed in lighting the Hall of Science. At the left is a night view of the north facade. The twelve pylons are illuminated by means of neon tubes complemented by floodlights at the base. Below is a view of the interior lighting in the Great Hall where the neon tubes are concealed by a system of suspended coves

tion at the ceiling to a dim effect at the floor. By this means exhibits placed on the floor or in booths surrounding the floor will dominate, due to their individual light. They will stand out in contrast to the seemingly dim lighting effects around them.

A standard booth system has been developed which will provide four 200-watt fixtures per unit, making a total of 800 watts per booth, or two watts per sq. ft. An ingenious method to provide part of the corridor lighting from the illuminated signs of exhibit booths has been worked out. In sign troughs 25-watt sockets are installed on 1-ft. centers. An indirect light is achieved to illuminate the sign in front of each exhibit booth and to utilize the waste light to illuminate the corridor. The sign troughs used can be wired at the bench and installed in place at a minimum cost. The intensity of the corridor lighting will be about 75 per cent of the intensity of the light of the exhibit booths. The interior stairways and ramps leading from one level to another will be illuminated by indirect lighting.

The method of electrical wiring in the Hall of Science is one of the most unique construction features. The main feeders entering the building are distributed in a 5 x 5 in. metallic raceway. This raceway will hold sixteen 00 cables. Fuse boxes are attached to the raceway at any convenient point, thus reducing the secondary distribution to about one-third of what is ordinarily used. For signs and corridor lighting a smaller metallic raceway, 2 x 2½ in., punched for the sign type of socket, is utilized. This smaller raceway can be made on the bench and installed at a minimum cost.

The standardization of the sizes of wire has been an important economy measure. Practically all the wire for feeders is 00, and No. 12 for secondary distribution. The four fireproof transformer vaults in



the Hall of Science are of 600 kva capacity each. The switchboard, which is located in a fireproof vault adjacent to the transformer room, is of wood construction on which are mounted totally enclosed bus bars and safety switches, making it a dead front panel.

On account of the windowless nature of the building, it has been necessary to install an emergency lighting system. This is installed at frequent intervals through all corridors, halls and exits. The corridor lighting is a duplex system. It operates on a regular A.C. system, but in case of interruption the lighting is thrown on to batteries, from which it may be switched back to the A.C. system when it resumes service.

CAN HOUSING BE FINANCED?

BY

ALTON L. WELLS

FROM the standpoint of the architect, housing presents some interesting possibilities both for professional achievement and for profit, when, if and as it can be financed. Better design, simplification of construction methods, enactment of remedial and constructive legislation and provision for adequate financing are necessary to progress in this field. Of all the problems involved, financing appears to be the most difficult of solution, and architects can no longer, "Let George do it." They must help in finding "George."

The financing of group housing is especially difficult because of its peculiar conditions. For instance:

1. Group housing involves the expenditure of large sums of money which necessitates securing capital and mortgage money in large amounts. This requirement automatically eliminates thousands of capital sources and lending agencies which are unable to handle transactions of this size.

2. Funds must be secured at low interest or dividend rates. It has been pointed out, for example, that a 1 per cent reduction in interest rates would permit an 8 per cent reduction in rental charges. Experience indicates that mortgage loans should not bear a higher interest rate than 5 per cent, and that annual dividends should not exceed 6 per cent.

3. Provision must be made for amortizing borrowed money over a long period of time, on an easy payment basis.

4. Money must be secured, both for equity and mortgage financing, at a low initial cost as regards commissions, brokerage or other lending charges.

In addition to these rather onerous restrictions it must be remembered that group housing is still in its infancy, and while it has shown, in a considerable number of instances, sound earning records, it by no means has proved itself entirely attractive to financial interests and the general run of investors.

There is no established system of group housing finance. In the past, when projects have been initiated, funds have been found wherever and however possible. Financing methods were adapted to circumstances. With increasing interest in group housing, however, more thought is being given to the formation of plans that consistently will provide needed capital for sound undertakings.

Up to date a high percentage of all group housing has been sponsored and financed by two general groups of organizations: (1) philanthropic or semi-philanthropic individuals or groups and by industrial concerns, (2) limited dividend corporations. From the first class of sponsors there is little help to be drawn in the formulation of a general financing system for future use because the financing in these cases has usually been provided by individuals, estates, foundations or insurance or industrial companies. Their experience is valuable, however, in so far as it pertains to the earning records of the projects erected by them. Furthermore, the fact that a very considerable portion of all group housing has been developed by individuals or organizations of this nature should indicate to the live prospector for new business that here is a field well worth consideration on the assumption that its possibilities have by no means been exhausted.

Limited Dividend Housing Companies. These companies, as a rule, have secured their primary financing by means of institutional mortgage loans. Equity funds and operating capital usually have been provided by means of stock sales. The fact that limited dividend companies have been able, even in the pioneering stage of large scale housing, to secure financial backing for an impressive number of projects, the total costs of which amount to millions of dollars, offers encouragement to the belief that sound undertakings of this kind can be financed.

Limited dividend housing companies constitute, in practice, a partnership between private capital and the State. The companies are limited in the earnings which they may pay on indebtedness, and in some other particulars, while the State, by way of compensating advantages, allows them tax exemption for long periods on the buildings which they erect, and on the income derived from the funds invested.

The New York State Housing Law, enacted in 1926, is a good example of this type of cooperating legislation. This Act provides that any three or more citizens may go into the business of building houses by limiting their dividends to 6 per cent of the equity invested; that the rental of buildings erected be limited to $12.50 per room per month in Manhattan and to $11 per room per month elsewhere; that they may borrow not to exceed two-thirds of the total cost of their projects at 5 per cent per annum; that cities in which they operate may exempt their buildings from taxation for 20 years; that the income from moneys invested, both as to mortgage and as to equity, is exempted from all

State taxes; and that a member of the State Housing Board shall be always a member of their boards of directors. The law also provides that out of excess income a reserve fund of 12½ per cent be set aside to provide for possible deficits, and that all further surplus be applied toward a reduction of rents. The law especially encourages cooperative ownership.

Organizations under this law may borrow up to two-thirds of the cost of its operations. The balance must be provided by raising capital funds, which, in no event, are to receive more than 6 per cent annual dividends. This plan and somewhat similar ones operating under like laws in other States have proved to be quite uniformly successful when carried out under competent management.

Conditions Governing Large Scale Housing Promotion. From an examination of the whole subject of large scale housing, with special attention given to the financing of such projects, it is apparent that conformity to certain conditions is essential if the promotion of such undertakings is to be carried out with success.

1. Large scale housing is contemplated primarily for the lower income groups. Hence the revenue to be expected from such projects, whether it be in the form of rental charges or sales returns is sure to be small in comparison with other non-group operations. This condition imposes the absolute necessity of economical building and financing, as well as experienced and skillful management, if funds invested are to earn a satisfactory return.

2. Large or speculative returns cannot be expected from funds invested in large scale housing. This fact indicates that financial backing for such projects must be sought principally from conservative investors and institutions, from public-spirited private wealth or from Government sources.

3. Money invested in large scale housing will not be returned quickly, because of the nature of the undertaking.

4. Outside of philanthropic and industrial enterprises funds for equity financing must be obtained largely from the investing public. While the earning experience of housing projects to date has been generally favorable, this type of investment is still in its initial stages. Extensive promotional and educational work will have to be done with potential investors before their dollars flow freely into operations of this kind.

5. Financial requirements will vary with the type of operation contemplated. More capital funds will be needed for a rental project than will be needed for a cooperative undertaking where down payments will help finance the cost.

6. Federal and State governments can help to insure stable and ample income on large scale housing investments by passing legislation that will help operating companies to lower costs. The help of these bodies should be sought. Examples of such helpful legislation include tax exemption statutes, laws giving housing companies the right of eminent domain in the assembling of building plots, authorizations for the installation of publicly financed utilities, and financial aid such as that provided by the Federal Emergency Relief and Construction Act of 1932 which permits the Reconstruction Finance Corporation to lend funds to meritorious large scale housing projects.

7. Real housing, because of the size of its operations, must be classed with big business. Consequently, it seems certain that only companies organized for large scale operations, with ample funds available, and with an experienced and capable personnel, will be likely to enjoy the confidence of investors and financial institutions.

8. Durability of the investment will be an important factor in attracting funds to large scale housing. Quality of materials and workmanship must not be sacrificed to low first cost if this field is to secure and hold financial backing.

Plans Suggested for Securing Financial Backing. A considerable number of plans for financing large scale housing operations were brought forth at the President's Conference on Home Building and Home Ownership. Included were:

1. Housing to be built and financed by Federal, State and municipal governments.

2. Government cash subsidies to limited dividend companies.

3. Loans on easy terms to limited dividend companies. Such funds to be secured from the sale of Federal or State bond issues, or by means of a central mortgage bank, intermediate credit banks, or State housing banks.

4. Partnerships between public authorities and private enterprise: The Government to obtain and clear sites and develop parts of them as parks; the balance of the land to be sold to private operators as sites for housing projects to be erected under Government supervision or control.

5. Organization of private finance corporations which would supply equity money to meritorious undertakings. Funds to be provided by manufacturers of building materials, or by the sale of housing bonds to the investing public.

6. Special unemployment relief funds to be raised by local campaigns through contributions, or by the sale of housing securities. These funds to be used to provide equity financing for limited dividend housing companies which would erect large scale housing, on which jobs unemployed mechanics would be used.

7. Cooperative housing to be financed in part by labor unions or other special groups, some of the members of which would purchase apartments in the buildings to be erected.

8. Buildings, by municipalities, of housing to be rented to their own employes.

9. Investment, by foundations and philanthropic organizations, of their capital funds in large scale housing.

10. The organization, by the Federal Government, of a series of Intermediate Credit Banks similar to the Federal Intermediate Credit Banking System now in operation in the agricultural field, the capital of such banks to be supplied by the Government or by subscribing member institutions. This system to provide ready discount facilities for equity financing and to supplement the resources of existing mortgage lending institutions.

11. The development of a financial pool, or acceptance corporation, which would provide credit instead of equity financing. This credit to be used in the purchase of building materials. Such a corporation to be organized by the larger and more substantial manufacturing industries in the building material field.

12. The investment by the Federal Government of contemplated unemployment relief appropriations in large scale housing; the Government to supply one-half of the equity money, the balance to be provided by private investors, with a 50 per cent first mortgage as primary financing.

How many of these suggestions will ever be developed to the point of definite action is problematical. In one instance, at least, actual aid will have been provided by the Federal Government under the terms of the "Emergency Relief and Construction Act of 1932," if the requirements of the act can be met by prospective borrowers.

Section 201 (2) of this Act reads: "The Reconstruction Finance Corporation is authorized and empowered to make loans to corporations formed wholly for the purpose of providing housing for families of low income, or for reconstruction of slum areas, which are regulated by State or municipal law as to rents, charges, capital structure, rate of return, and areas and methods of operation, to aid in financing projects undertaken by such corporations which are self-liquidating in character."

Details of the regulations governing the granting of housing loans and directions for making application for them, are given in a circular (Circular No. 3) issued by the Reconstruction Finance Corporation. The principal regulations set forth are:

1. Loans may be made only to corporations formed wholly for the purpose of providing housing for families of low income, or for the reconstruction of slum areas.

2. No loan can be made unless the applicant corporation is regulated by State or municipal law as to rents, charges, capital structure, etc. Borrowers who contemplate making application for loans are directed to determine whether such a law is in force in the place where projects are to be erected.

3. Projects must be self-liquidating in character.

4. Projects should be approved by local regulatory bodies before applications are made for loans.

5. Loans may be made for a period not exceeding ten years.

6. All loans must be adequately secured.

7. Loans must be made prior to January 23, 1934.

8. Loans will not be made for the purpose of refunding or refinancing obligations already outstanding.

9. No fee or commission may be charged for making loans.

10. No restriction seems to have been made in the Act, or in the circular (No. 3), which would prevent the use of loaned money for equity financing.

The greatest stumbling block to immediate action for borrowers would appear to be the possible lack of a local law regulating rents, charges, capital structure, etc., of borrowing corporations. Fortunately, the Act provides that such a law may be either a State statute or a municipal ordinance. This proviso gives borrowing corporations the opportunity of seeking needed legislation from their municipal authorities with the chance of getting quicker results than would be possible were it necessary to wait for the enactment of a law by State legislators.

Applications for housing loans must be made in writing to the Reconstruction Finance Corporation at its office, 1825 H Street, N. W., Washington, D. C. No fixed or printed form of application has been provided, but the information required of each applicant is described at length in the circular. Necessary data include a full description of the project, its nature and cost, proposed plan of financing, estimated revenues, credit standing of the applicant and legal status of the undertaking.

And the Equity? Looking ahead, with long-range perspective, and apart from any financial aid which may be provided by the Federal or State governments, it is evident that the major problem in large scale housing finance is going to be the ability of housing companies to secure a sufficient volume of equity funds, at reasonable cost. With a continued favorable earning experience, ample first mortgage money probably can be obtained from institutional sources. But equity money, in volume, must come mostly from the investing public. No great number of investors at the present time have been excited or much interested in this type of securities. A long period of intelligent promotion work, on the part of architects, builders, material manufacturers, investment bankers and other interested parties will be required before these needed dollars will gravitate readily toward large scale housing projects. The time to begin such promotion work is now.

In the meantime, it is by no means necessary to abandon the idea of large scale housing developments. Such projects can, and will, be financed, although it will not be possible to obtain equity funds now with the ease which may be expected when investors have been educated to a point where they will readily absorb stock issues for such purposes.

Plans for raising equity money today, that are worth considering and worth putting to the test, may well include:

1. The attempt to interest some public-spirited foundation, estate, or individual of sufficient resources, in the financing of an undertaking of this type; the social and economic purposes of the enterprise, rather than "profits," being the principal selling argument.

2. The formation of a *group* of less wealthy institutions or individuals, of the character mentioned above, whose pooled resources would provide the required funds.

3. The finding of an owner of an unencumbered tract of ground suitable for housing development, who would be willing to take a stock interest in the project in lieu of a cash payment for his property.

4. The organization of a group composed of the owners of the ground, the builder, the architect, and possibly some of their close friends or business associates, each of whom would be willing to contribute land, services or cash to a joint fund sufficient in amount to provide equity financing.

5. The offering of a regular stock issue, by the sponsors of the project, to a selected list of prospects known to be favorably disposed toward undertakings furthering the public welfare.

6. Enlistment of the services of an investment banking house which would underwrite or place a stock issue covering equity financing.

7. The interesting of some large industrial or commercial company which might participate in a large scale development for the purpose of providing its employes with low-cost homes.

8. The inauguration of a civic campaign, backed by local commercial bodies, social service agencies, fraternal groups, and other similar organizations, the purpose of which would be to arouse interest in providing suitable low-cost housing for the community's less wealthy citizens. The raising of the needed funds to be undertaken by the various groups interested.

Experience of Existing Projects. Complete details of the financial set-up and experience of most housing projects are not available. A number of undertakings have not been in operation long enough to make their experience of value. Still others are now only in process of development. However, the following data relating to several well-known operations supply a partial picture of what has been taking place in this department of building finance.

MICHIGAN BOULEVARD APARTMENTS. Erected in Chicago for colored at a cost of $2,700,000. Mortgage of about 50 per cent was used. Equity financed by Julius Rosenwald. Apartments are rented. Have had about 95 per cent occupancy. Project paid 5 per cent net in 1930.

JOHN D. ROCKEFELLER, JR. PROPERTIES. Comprise five projects erected at Bayonne, N. J., Mott Avenue, Bronx, New York City, and Harlem, New York City, where the Paul Laurence Dunbar Apartments for the colored were built. Total cost about $8,500,000. Except Bayonne buildings, all were sold as cooperatives. Financial experience has been satisfactory except at Mott Avenue.

METROPOLITAN LIFE INSURANCE COMPANY. Erected apartments on Long Island about 1924 for about 2,000 families. Rented at $9 per room. Total investment between $8,000,000 and $9,000,000. Limited dividend operation under special statute. Practically 100 per cent occupied at all times. Large waiting list. Financed by company. Has shown net earnings of better than 6 per cent.

BRIDGEPORT HOUSING COMPANY, BRIDGEPORT, CONN. Purchased from Federal War Housing Boards, or has erected, about 900 houses located in five different communities. Used principally by industrial workers. Financed mostly by local industries. Has been in operation from ten to twelve years. Shows consistent earning of 6 per cent.

CITY AND SUBURBAN HOMES COMPANY, NEW YORK, N. Y. One of the pioneer companies in group housing. Investment reported to be about $11,000,000. Have been operating for a number of years. Earnings 10 per cent. Pay 6 per cent dividend on stock. Are reinvesting surplus in additional housing.

The following are limited dividend housing companies:

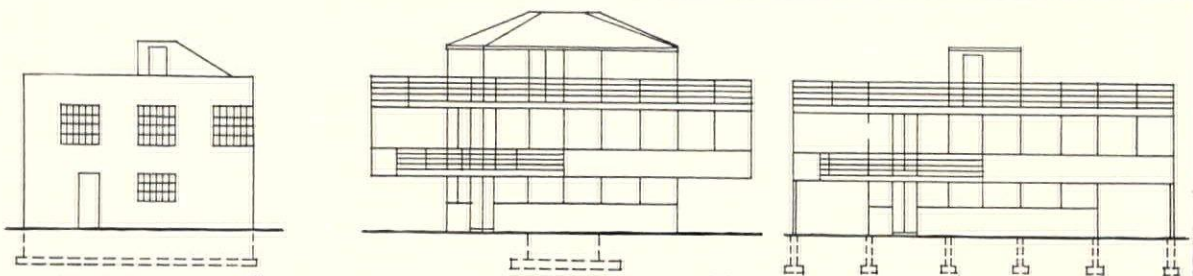
AMALGAMATED CLOTHING WORKERS UNION. Erected a cooperative unit in the Upper Bronx, New York City, for its members. Cost $1,925,000. Metropolitan Life Insurance Company loaned $1,200,000 on this project for 20 years at 5 per cent. Equity sold to owners at rate of $500 per room. One-half of this amount was provided for each purchaser by the Amalgamated Credit Union, a subsidiary. The balance of $250 per room was covered by notes of purchaser, which notes were endorsed by *The Forward*, a foreign language newspaper, and then discounted by the Amalgamated's bank.

A second unit was erected on Grand St., New York City. Cost $1,500,000. First mortgage loan of $900,000 made by Bowery Savings Bank. Apartments sold at rate of $500 per room, $150 cash down payment, the balance payable over a period of ten years at 5 per cent.

WASHINGTON SANITARY HOUSING COMPANY, WASHINGTON, D. C. This is a limited dividend company that has been in operation for 35 years. The company has confined itself to building two-story apartments. It aims to provide rented quarters for the people of most moderate incomes. Apartments range from two rooms and bath to five rooms. Apartments are all rented and the company has never sold any buildings. The company was organized with stockholders having philanthropic motives. Dividends, originally, were limited to 4 per cent but this rate was later raised to 5 per cent. Earnings have been sufficient to pay all dividends and in addition a depreciation fund of 2 per cent per annum has been set aside. There is also a surplus fund. When additional funds for operating were needed, they were borrowed temporarily from some financial institution.

AN INDUSTRIAL APPROACH TO HOUSING

A COMPARISON OF COSTS AND CONSTRUCTION*



COMMON TYPE (A)

CONTINUOUS WALL FOOTINGS FOR EXTERIOR BEARING WALLS

ITEMS		COST
HAND EXCAVATION	39 YDS @ 2.00	$78.00
FORMS	720 SQ. FT. @ 15¢	108.00
CONCRETE FOOTINGS	9 YDS @ 12.00	108.00
CONCRETE FOUNDATION	13 YDS @ 12.00	156.00
BACK FILLING	17 YDS @ 1.50	25.50
	TOTAL	$475.50

TIME REQUIRED 14 DAYS

BOWMAN LATEST TYPE (B)

ONE FOUNDATION SLAB ONLY UNDER STAIR TOWER

ITEMS		COST
STEAM SHOVEL EXCAV.	15 YDS @ 60¢	$9.00
" "	EXTRA (MIN. RATE $20.00 DAY)	11.00
NO FORMS OR FOUNDATION WALLS		0.00
CONCRETE FILL	2 YDS @ 10.00	20.00
BACKFILLING	2 YDS @ 1.50	3.00
	SUB TOTAL	$43.00
6 STEEL ROOF TRUSSES (ALIKE) SHOP MADE	280 LBS EACH	62.00
	TOTAL	$105.00

TIME REQUIRED 1 DAY

BOWMAN PRELIMINARY TYPE (C)

COLUMN FOOTINGS UNDER ALTERNATE MULLIONS

ITEMS		COST
HAND EXCAVATION	21 YDS @ 2.00	$42.00
NO FORMS REQUIRED		0.00
CONCRETE FOOTINGS.	5 YDS. @ 12.00	60.00
" FOUNDATIONS	NONE	0.00
BACK FILLING	16 YDS @ 1.50	24.00
	SUB TOTAL	$126.00
MULLIONS USED AS COMPRESSION COL'S. LARGER SIZE, ADDITIONAL COST 10¢-FT.		16.00
	TOTAL	$142.00

TIME REQUIRED 4 DAYS

TABLE ONE

The accompanying tables with their explanations by IRVING H. BOWMAN supplement his article published in the July issue, regarding a series of houses for industrialized reproduction designed by BOWMAN BROTHERS, architects. The tables deal largely with the structure of the houses and constitute an interesting method of analysis as an aid in the final selection of material assemblies

THE cost and erection time data given in the following tables have been supplied by material manufacturers and the most reliable contractors in the Chicago area. Performance data on each material have been supplied by tests of the United States Bureau of Standards, Columbia University Laboratories, Armour Institute Laboratories, and in some cases by tests in the material manufacturers' own laboratories.

Countless materials and methods of fabrication were eliminated in a preliminary survey, in which all available known materials were listed under their respective utilization headings, and a small number in each category were sifted out for further consideration. In preliminary elimination the considerations of primary importance were: (1) Adaptability to industrial reproduction, national merchandising, erection and distribution from a central fabricating plant; (2) utilitarian efficiency; (3) economy.

*EDITOR'S NOTE: The material both in the tables and in the explanatory text has been compiled entirely by Mr. Irving H. Bowman of Bowman Brothers, architects, in the progress of their own work. THE ARCHITECTURAL FORUM can assume no responsibility for the methods of compilation or the results.

Table One. The table above shows comparative time and material cost data of the excavating and concrete work for three houses of identical size and facilities.

The figures for type "A" illustrate the large amount of hand labor, time and material required, which caused its elimination.

If the steel tubing window mullions are used as compression columns as in type "C", they must be increased in size, whereas if they are used as tension columns, they must be supported by trusses attached to the central stair tower. Both additions in cost have been taken into consideration.

The foundation for the stair tower in type "B" is one square pit, large enough for steam shovel operations, into which is poured mass concrete for leveling. The economy in the use of the steam shovel is greatest when several homes are being erected in the same community.

The minimum of erection time required by "B" permits the distributor to carry a smaller payroll, and yields a quicker turnover on his invested capital, which results in a saving to the consumer.

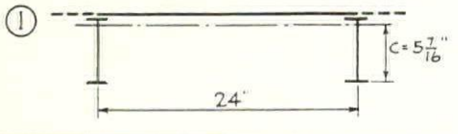
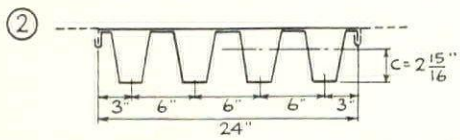
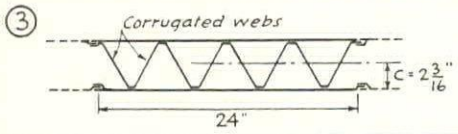
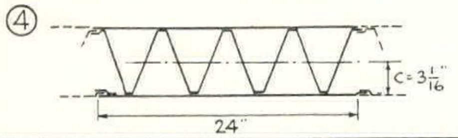
STRUCTURAL FLOORS							
DIAGRAMS	SIZES OF METAL	WEIGHT OF FL. PER SQ. FT.	TOTAL THICKNESS	SAFE LOAD LBS PER SQ. FT.	SECTION MODULUS	RELATIVE EFFICIENCY = $\frac{S}{LBS/\square}$	COST PER SQ. FT. ERECTED
1 	3/16" PLATE 6" JUNIOR BM.	10.36	$6\frac{3}{16}$"	143.0	3.015	$\frac{3.015}{10.36}$ = 29.1%	41.5¢
2 	16 GA. TOP 16 GA. BOTTOM	8.4	$4\frac{5}{8}$"	128.0	2.7	$\frac{2.7}{8.4}$ = 32.2%	38.6¢
3 	16 GA. TOP 20 GA. WEB 18 GA. BOTTOM	6.8	$4\frac{1}{8}$"	136.5	2.88	$\frac{2.88}{6.8}$ = 42%	31.3¢
4 	16 GA TOP 20 GA. WEB 18 GA. BOTTOM	8.06	$6\frac{1}{8}$"	259.0	5.47	$\frac{5.88}{8.06}$ = 72.7%	37.07¢

TABLE TWO

Table Two. The three types of structural floor construction shown above being practically equal from the standpoint of adaptability to mass production, distribution and erection facility, they were next considered for utilitarian efficiency and economy. The typical unit under loaded conditions was found to require a section modulus of 2.70. Type No. 1 could have been made thinner by using I-beams instead of junior beams, but the floor weight would have been increased and a thickness less than 6 in. was not desirable, due to the plan of circulating the warm air of the house heating system through the hollow spaces of the floor construction. In this design sheet metal ductwork would be required especially for this purpose. The 16-gauge web of type No. 2 is stiffened against buckling by rolled-in corrugations. The design, not being perfectly symmetrical about its neutral axis, is not as efficient as possible and was not easily adapted as a natural duct system for heat distribution. A new floor, type No. 3, was adopted, nearly symmetrical about its neutral axis, which yielded its entire cross section area for duct space without additional sheet metal work. The webs are corrugated, the material being spot-welded in the shop by automatic machine. Type No. 4 was then developed from No. 3 to serve better as a duct system because of its greater area of cells.

Table Three. For finish flooring wear and resilience were considered of first importance. The second consideration was cost. Cleanability was a third essential and acoustic value was last in importance. The first combination of materials was selected as best fulfilling the requirements in comparison with costs.

Table Four. All of the assemblies have sufficient rigidity in 1 in. thick slabs to maintain their own shapes, which is one of the fundamental requirements. Weights of the materials do not vary enough to be an important consideration, all being lighter than plaster of an equal thickness. The first was considered due to its almost impervious surface, which requires practically no maintenance. It was discarded because of its slight fire-retardance and its high cost. The second would be good acoustically if the cane fiber side were exposed but would be difficult to clean. The third, though easily cleaned, is acoustically poor and was therefore discarded. The high cost of the fourth assembly caused its elimination. The fifth type was selected as the cheapest, most fireproof, acoustically best assembly considered.

Table Five. Partitions are non-bearing in all houses and need only be sufficiently strong to resist the loads of persons leaning against them, but must be sufficiently elastic to avoid fracture thereby. Partition materials were selected which gave the highest performance in (1) sound absorption, (2) minimized maintenance, (3) fireproofness, for the

FINISH FLOORING							
FINISH FLOOR MATERIAL	SUB-FLOORING WHERE REQUIRED	TOTAL THICKNESS INCLUDING SUB-FLOOR	TOTAL WEIGHT PER SQ. FT.	RESILIENCE	RELATIVE ACOUSTIC ABSORPTION	WEAR	TOTAL COST PER SQ. FT. INSTALLED
1/8" LINOLEUM	1/2" CORKBOARD	5/8"	1.93	GOOD	EXCELLENT	GOOD	16¢
3/16" RUBBER TILE	FELT	5/16"	1.80	EXCELLENT	GOOD	EXCELLENT	34¢
5/16" CORK TILE	FELT	7/16"	.72	EXCELLENT	EXCELLENT	FAIR	29¢
1/2" MASONITE TILE	FELT	5/8"	2.50	FAIR	FAIR	GOOD	28¢
3/16" ASPHALTIC TILE	FELT	5/16"	1.63	BRITTLE	NOT GOOD	GOOD	8¢

TABLE THREE

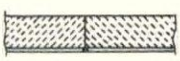
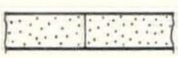
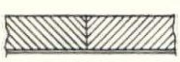
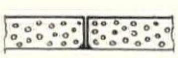
CEILING FINISH								
DIAGRAM SHOWING JOINT	DESCRIPTION		FINISHED THICKNESS	WEIGHT IN LBS. PER SQ. FT.	SWELLING AND SHRINKAGE	FIRE RETARDANCE	RELATIVE ACOUSTIC ABSORPTION	COST COMPLETE INSTALLED
	CORE	SURFACE						
	1"-5 PLY FIR PANEL	1/16" SHEET OF PHENOLIC RESIN CEMENTED TO BOTH SIDES	1 1/8"	3.8	SUSCEPTIBLE	SLIGHT	SLIGHT	95¢
	1"-2 PLY CELOTEX	1/8" ASBESTOS CEMENT BOARD VENEERED TO ONE SIDE ONLY	1 1/8"	2.6	SUSCEPTIBLE	SLIGHT	NONE	18¢
	1"-BOARD OF CEMENT COATED WOOD FIBER	24 GA. SHEET STEEL BOTH SIDES	1 1/16"	3.5	SLIGHT	EXCELLENT	NONE	25¢
	1"-BOARD OF CEMENT COATED WOOD FIBER	1/16" SHEET OF CASEIN PLASTIC ONE SIDE ONLY	1 1/16"	2.2	SLIGHT	GOOD	SLIGHT	26¢
	1"-BOARD OF ROCK WOOL WITH 22 GA. STEEL BACKING	NATURAL SURFACE NOT VENEERED	1 1/16"	2.5	NONE	EXCELLENT	GOOD	14¢

TABLE FOUR

PARTITIONS							
No.	VENEERING MATERIAL	CORE MATERIAL	FINISHED THICKNESS	WEIGHT PER SQUARE FOOT	FIRE RETARDANCE	REPAINTING	COST PER SQ. FT.
1	1/8" ASBESTOS CEMENT BOARD	2 PLY CANE FIBER BOARD	1 1/4"	2.2	SLIGHT	REQUIRED	$0.22
2	STEEL 24 GAGE	CEM. COATED WOOD FIBER	1 1/16"	3.5	EXCELLENT	"	$0.25
3	" " "	PLYWOOD	1 1/32"	3.6	SLIGHT	"	$0.20
4	CELLULOSE ACETATE SHEET	WOOD FIBER BOARD	1 1/16"	3.1	NONE	NOT REQUIR'D	$0.55
5	CASEIN PLASTIC SHEET	ROCKWOOL BOARD	1 1/16"	2.5	EXCELLENT	" "	$0.30
6	PHENOLIC RESIN SHEET	PLYWOOD	1 1/8"	3.8	NONE	" "	$0.95

TABLE FIVE

EXTERIOR WALL METALS							
MATERIAL	DESCRIPTION	WEIGHT IN LBS PER SQ. FT.	ULT. TENSILE STRENGTH	COLOR WHEN NEW	COLOR AFTER WEATHERING	RE-PAINTING FREQUENCY	COST PER SQ. FT. (FORMED)
BLUE ANNEALED STEEL 20 GA. (U.S.)	MILD STEEL SHEET	1.5	65,000	PAINTED	———	5 YEARS	11¢
GALVANNEALED STEEL 20 GA. (U.S.)	ZINC COATING BY HOT BATH PROCESS	1.5	65,000	"	———	"	14¢
COPPER 20 GA. (B.E.S.)	COMMERCIAL HARD ROLLED	1.46	50,000	BRIGHT GOLD	REDDISH BROWN TO GREEN	NONE REQ'D	42¢
ALUMINUM 3-SH 18 GA. (B.E.S.)	1.25% MANGANESE, 98.75% AL. GRAY PLATE FINISH	0.58	30,000	LIGHT GREY	DARK GREY	"	26¢
STAINLESS STEEL 22 GA. (U.S.)	18% CHROM., 8% NICKEL 1-COLD ROLL PASS.	1.25	85,000	SILVER	DULL SILVER	"	50¢

TABLE SIX

least cost. The assembly of type No. 5 most nearly answered the requirements and was consequently adopted as a standard.

Table Six. The above insulating materials are all adaptable to mass production methods of fabrication and all are sufficiently rigid to stiffen the sheet metal stamping which is to protect them from the weather when the wall unit has been completely fabricated. The brittleness of Calicel is a handicap on account of possible cracking in insulators shown, were ruled out tentatively due to their costs, cork having the additional handicap of being combustible at high temperatures. The additional insulating value of rock wool board was not considered sufficient to warrant the additional cost. Since structural features had predetermined the insulation thickness at 3 in. even the poorest yielded a good value. Aerocrete had the advantage as to shipping weight, thermal conductivity, fire retardance and cost. It was therefore tentatively selected as the present insulating material.

EXTERIOR WALL INSULATION							
MATERIAL	DESCRIPTION	THICKNESS USED	WEIGHT PER SQ. FT.	RIGIDITY	FIRE RETARDANCE	THERMAL CONDUCTIVITY B.T.U. per INCH etc.	COST PER SQ. FT. 3" PRECAST
AEROCRETE (SPECIAL DENSITY)	AERATED MIXTURE - CEMENT SAND PATENTED COMPOUND. PRECAST - WIRE REINFORCEMENT	$3\frac{1}{4}$"	5.5	VERY GOOD	VERY GOOD	.38	10¢
ROCK WOOL BOARD (SPECIAL FORM)	AIR ANNEALED LIMESTONE SLAG	"	5.0	SATISFACTORY	VERY GOOD	.29	18¢
CALICEL	LIMESTONE SLAG	"	8.0	BRITTLE	VERY GOOD	.50	16¢
THERMAX	WOOD FIBERS COATED WITH CEMENT - PRECAST	"	6.5	GOOD	GOOD	.46	12¢
CORK	CORK TREE BARK LUMPS, COMPRESSED AND BAKED WITHOUT ARTIFICIAL BINDER	"	3.5	GOOD	NONE	.34	21¢

TABLE SEVEN

shipment, for due to the high temperature at which this material is made it does not lend itself to reinforcement. Cork * and rock wool board, the best

Table Seven. Although blue annealed steel costs less than zinc coated steel, it corrodes more readily, and was not used on this account. The zinc coated steel was selected as a standard because of its economy and its susceptibility to a variety of

* The thermal conductivity of cork should be .24 instead of .34 as listed in the table.

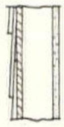
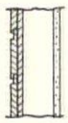
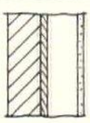
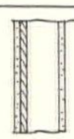
EXTERIOR WALL CONSTRUCTION						
DIAGRAM	DESCRIPTION	OVERALL THICKNESS	SPACE EFFICIENCY % OF GROSS FLOOR AREA OF HOUSE 25'×35' OCCUPIED BY WALL	FIRE RETARDANCE	HEATING COST COEFF.	COST ERECTED PER SQ. FT.
① 	16" SHINGLES - 5 BUTTS TO 2" LAID AT 7 1/2" EXPOSURE. BUILDING PAPER. 1" WOOD SHEATHING, WOOD STUDS. WOOD LATH AND 3/4" PLASTER	$5\frac{1}{2}$"	6.28%	NONE	$2.62	39¢
② 	SIDING BUILDING PAPER 1" WOOD SHEATHING WOOD STUDS WOOD LATH AND 3/4" PLASTER	6"	6.86%	NONE	$2.62	46¢
③ 	BRICK VENEER BUILDING PAPER 1" WOOD SHEATHING WOOD STUDS WOOD LATH AND 3/4" PLASTER	$9\frac{1}{2}$"	10.86%	SEMI-FIREPROOF	$2.47	70¢
④ 	STUCCO 8" HOLLOW CLAY TILE 1/2" PLASTER	$9\frac{1}{2}$"	10.86%	FIREPROOF	$2.96	76¢
⑤ 	STUCCO ON WOOD LATH BUILDING PAPER 1" WOOD SHEATHING WOOD STUDS WOOD LATH AND 3/4" PLASTER	$6\frac{1}{4}$"	7.13%	NONE	$3.02	47¢
⑥ 	SHOP FABRICATED STAMPED STEEL PAN, FILLED WITH PRECAST AERO-CRETE SLAB, SMOOTH INTERIOR FINISH, SHOP DIPPED IN PAINT. 2" □ STEEL TUBING MULLIONS.	$3\frac{1}{4}$"	3.7%	FIREPROOF	$1.00	24¢ (NOT INCLUDING PAINT COST)

TABLE EIGHT

colored finishes. Copper, aluminum and stainless steel can be used in its place at a slight additional cost. Aluminum, the best bargain of the non-rusting metals, may be adopted as standard after the houses are in production on a large scale.

Table Eight. Constructions 1 to 5, inclusive, are unadaptable to mass production but the data on each show the relative utilitarian efficiency and economy when compared with a prefabricated wall unit.

All types except No. 6 require maintenance in varying degrees, either replacement, painting, patching or tuckpointing. If steel is selected for type No. 6, it will also require repainting, but not oftener than type No. 2. Type No. 6, not subject to warping, moisture absorption, termites, shrinkage and general decay, can be maintained at a minimum cost.

Type No. 6 has been designed to a minimum thickness which permits the owner of a 20- or 25-ft. lot to make maximum use of his property. The weight of the wall unit is only 170 pounds, which permits erection with lighter machinery and easier adjustment of erection bolts than would be possible with a thicker unit.

The heating cost coefficient has been worked out on the basis of the relative thermal conductivities of the various systems of construction using the conductivity of type No. 6, which is the most efficient, as unity. The insulation value of the construction is of primary importance in that a plan for housing persons of limited income must be so worked out that the cost of home maintenance is reduced in proportion to the reduction in initial investment in order to be successful.

It may be argued that the above comparison of cost is unfair because types Nos. 1 to 5 are wall bearing and type No. 6 is non-bearing. To balance the comparison, add 5 cents per sq. ft. to type No. 6, which is the mullion cost, pro rated on each square foot of wall surface.

WINDOWS							
TYPE	SIZE	GLAZING	REPAINTING INTERVAL	SWELLING & SHRINKAGE	HEATING COST COEFF.	INFILTRATION LOSSES	TOTAL COST ERECTED
① WOODEN DOUBLE HUNG	5'-0" x 6'-0"	SINGLE D.S.A.	4 YEARS	APRECIABLE	2.40	CONSIDERABLE	$18.00
② STEEL CASEMENT	"	"	2 "	NONE	"	"	$14.00
③ STEEL DOUBLE HUNG	"	"	2 "	"	"	"	$27.00
④ ALUMINUM CASEMENT	"	"	NONE	"	"	"	$87.00
⑤ ALUMINUM DOUBLE HUNG	"	"	"	"	"	"	$80.00
⑥ BOWMAN SIDE SLIDING (ALUMINUM)	"	DOUBLE D.S.A.	"	"	1.20	SLIGHT	$35.00
⑦ BOWMAN FIXED (COMPO. FRAME)	"	"	"	"	1.00	APPROX. O	$20.00

TABLE NINE

Table Nine. The wooden double hung window is shown above only to illustrate its relative efficiency and cost and was never considered adaptable to shop fabricated construction because of its physical limititations, such as warping, shrinkage, combustibility, infiltration loss, etc. Standard double hung metal windows require at least a 7 in. thick wall in order to finish flush interior and exterior. The spring balance types were not considered, due to possible disorders in wearing parts. The casement sash considered were both too high in infiltration loss and the aluminum casement was too expensive, neither being adaptable to efficient double glazing because the space between panes would be so small as to permit considerable conductivity.

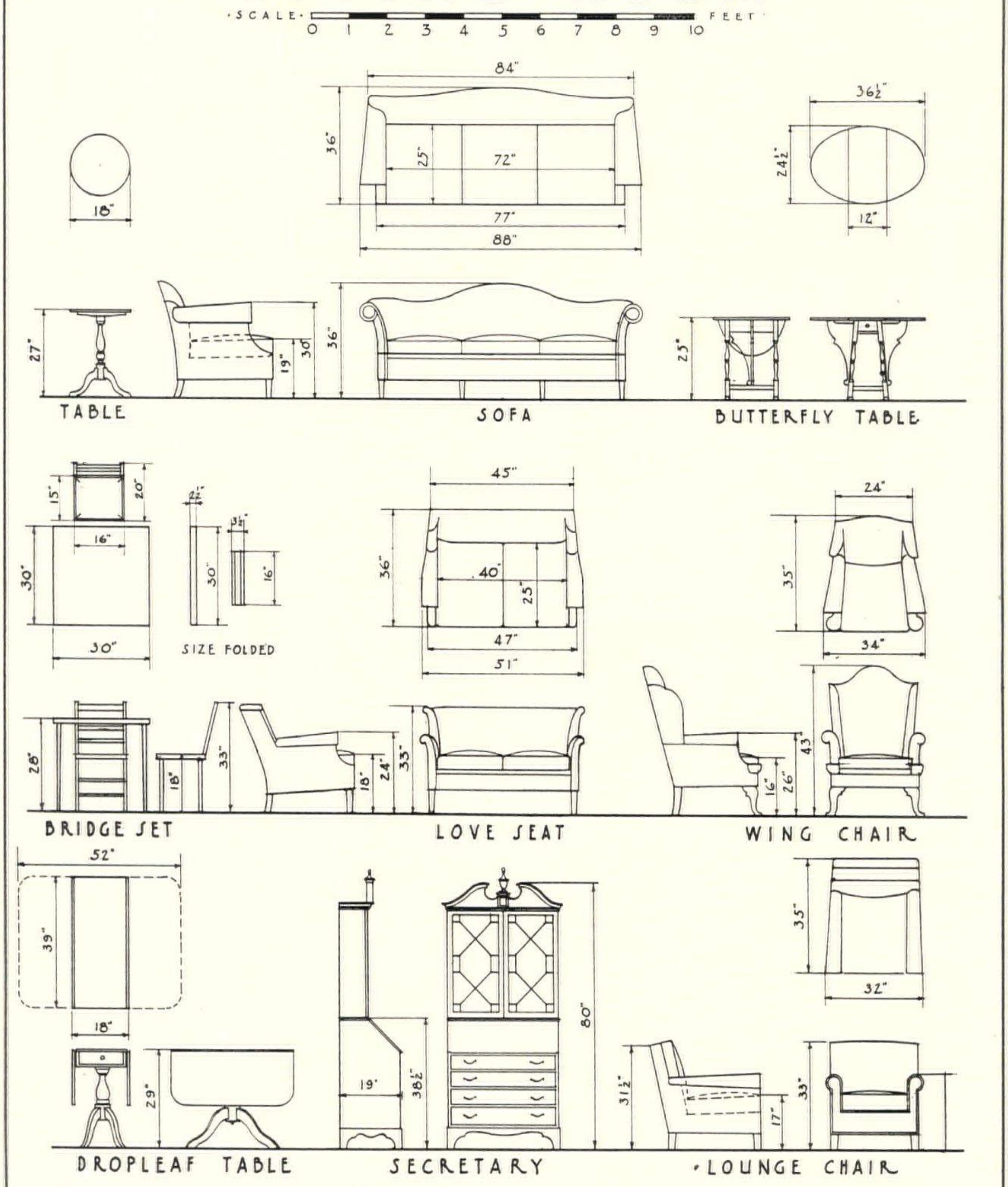
The first window designed to meet the specific requirements was (type No. 6) an aluminum, double glazed, side sliding type. This proved efficient but expensive and not so low in infiltration loss as was expected. Since the air conditioning plants in all houses had been designed to operate economically all year round, fixed sash seemed to be the logical solution. Type No. 7, a double glazed fixed sash made of phenolic resin compound, proved to be the most efficient and economical and was adopted as a standard.

Table Ten. While aluminum and mild steel tubing will show approximately the same ultimate tensile strengths, their yield points are not proportional and their moduli of elasticity are considerably different, aluminum having a modulus of elasticity of 10 million and steel a modulus of 30 million. This modulus being an important factor in computing deflection, the aluminum tubing mullions required a greater wall thickness. Stainless steel mullions require less wall thickness because of a higher yield point than mild steel. It would appear that the light weight of the aluminum mullions would compensate for their additional cost after shipping charges are considered. This is not the case, however, since after shipping charges are added there remains on the average size house about $75 difference in favor of steel.

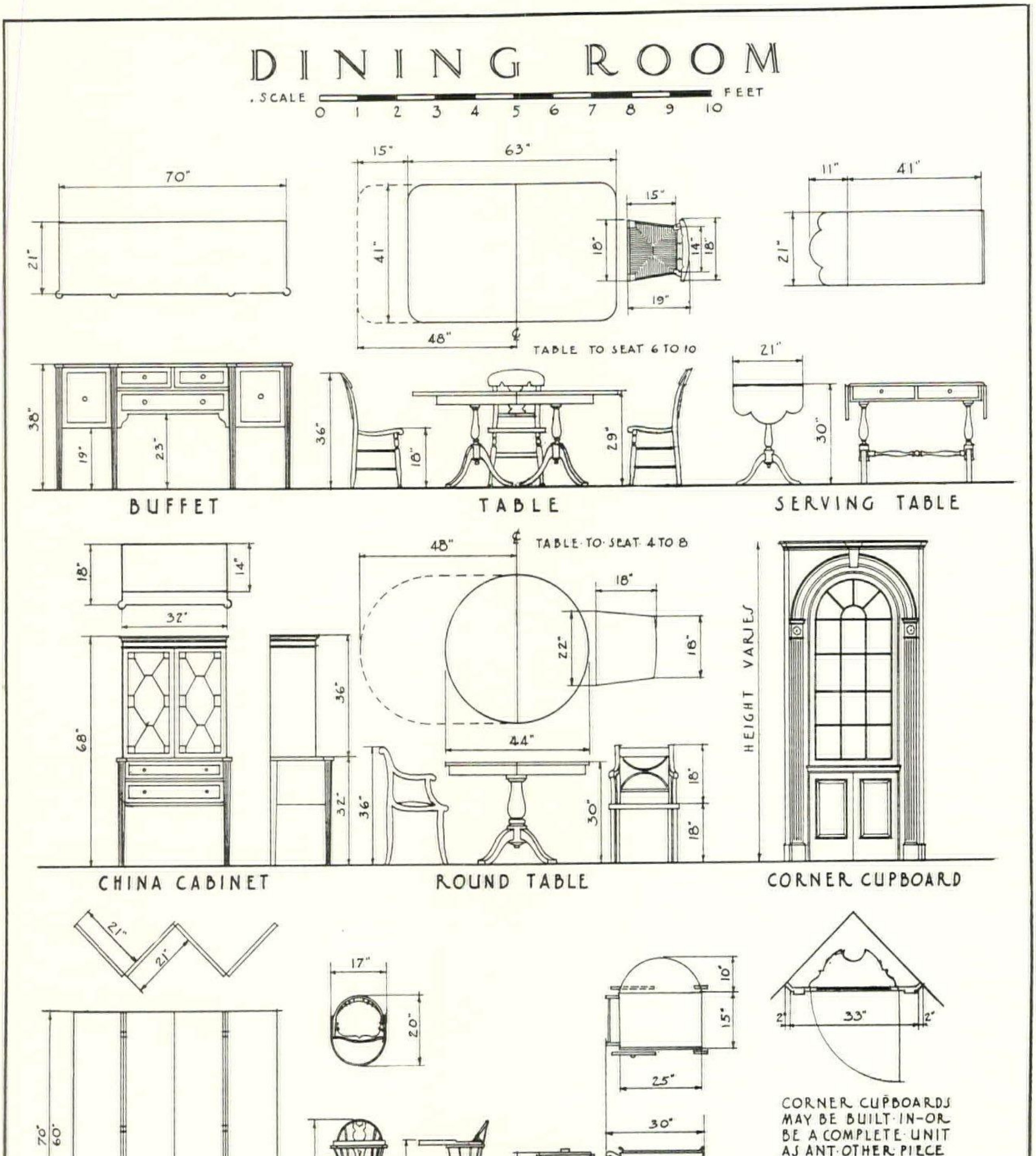
MULLIONS FOR WALL & WINDOW UNITS							
MATERIAL	TYPE	SIZE	WALL GAGE	REPAINTING INTERVAL	WEIGHT OF EACH	TENSILE ƒ PER SQ. IN.	COST EACH ERECTED
STEEL TUBING	SEAMLESS	2" x 2"	3/16"	2 YEARS	46.0	65,000	$2.16
" "	WELDED	"	"	"	46.0	65,000	$1.26
ALUMINUM " (17 S.T. ALLOY)	SEAMLESS	"	1/4"	NONE	20.85	60,000	$3.15
" " (17 S.T. ALLOY)	WELDED	"	"	"	20.85	60,000	$2.70
STAINLESS STEEL "	SEAMLESS	"	1/8"	"	30.6	85,000	$4.50

TABLE TEN

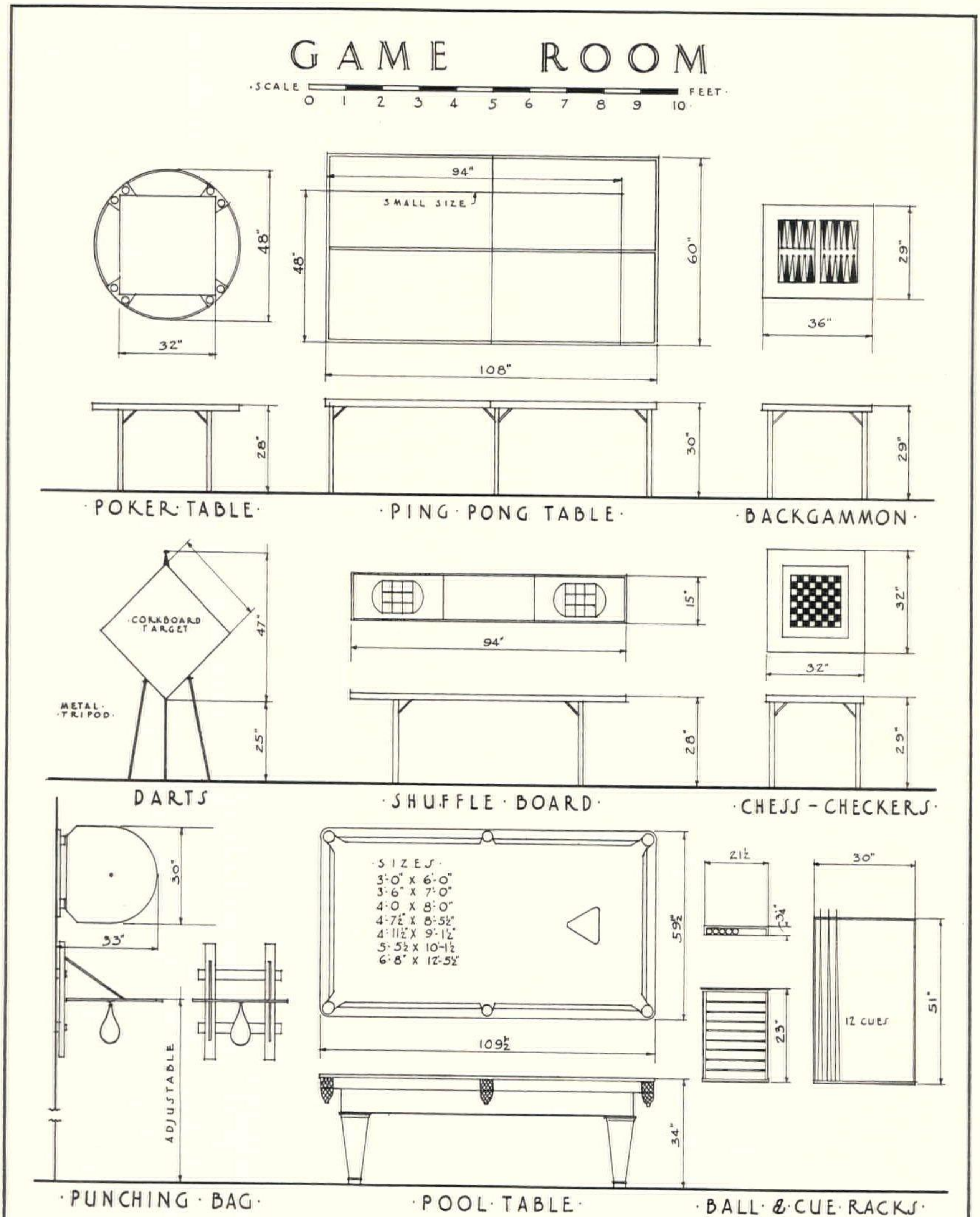
LIVING ROOM



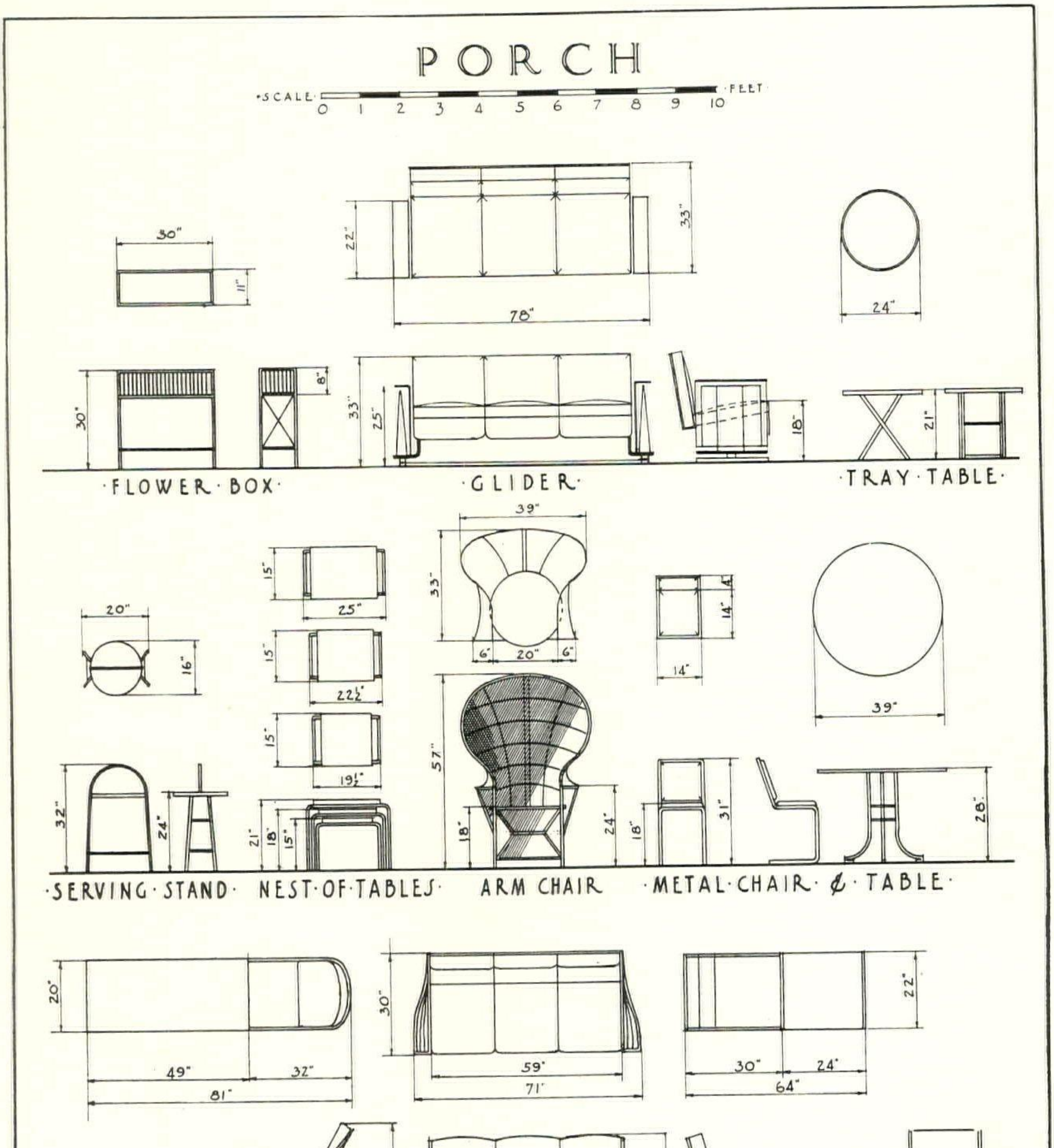
These drawings of living room furniture and equipment are reproduced at ¼ in. scale and may be used to check sizes and clearances of living room spaces. The sizes given are average only and it is possible to obtain many other proportions than those shown here. The types have been selected to include those commonly used in the small house or apartment



It is impossible to include every item of furniture used in the dining room, as individual problems of space and furnishings may differ within wide limits. Those reproduced here, however, at ¼ in. scale are items commonly used in the small house or apartment. The sizes given are an average determined from furniture of many styles and sizes



The interest of the American public in games is becoming increasingly widespread. Although many popular games are portable and may be stored in closets or racks, most of the game equipment shown at ¼ in. scale on this sheet require special space provisions and in some instances structural provisions as well. The sizes shown are the approved, current standards



The porch, sun parlor and conservatory are assuming a more and more important place in the American home. Furniture and equipment for such spaces is of a special nature not usually adapted to an interior. On this sheet at ¼ in. scale are typical pieces which may be safely used for outdoor spaces. Many are adaptable for a games room as well

SOUND MOTION PICTURE REQUIREMENTS

BY

HARRY B. BRAUN*

Few scientific developments have been accorded such universal and immediate favor as the talking motion picture. Since the advent of "talkies," a large number of public and private schools, institutions of every description, clubs, ocean liners, and even private homes have been equipped with sound motion picture reproducing devices. Installations of this nature are constantly increasing, provision for the apparatus being made in many new as well as old buildings hitherto unused for such a purpose. Consequently the subject deserves the consideration of architects and engineers.

EQUIPPING an auditorium for "sound movies" is a simple procedure, being merely a matter of selecting the necessary equipment and making provision for proper installation in conformation with applicable laws or ordinances and in accordance with manufacturers' specifications.

In designing a sound motion picture installation, the first consideration is usually that of space requirements. Figure 1 shows a typical projection room layout for two standard 35 mm. film projectors and one of the standard all A.C. operated sound-on-film reproducing systems. The dimensions given on the drawing conform generally to existing applicable laws or ordinances governing the use of motion picture apparatus. It is recommended, however, that such local laws, rules or ordinances as may be in force be consulted in order to preclude possible violations in any particular locality.

Selecting Projection Equipment. One of the first steps in selecting the proper apparatus to be used is to determine upon the most desirable screen size. According to the Society of Motion Picture Engineers, the width of the projected picture should be approximately one foot for each foot of distance between the screen and the front row of seats. Screen sizes may also be determined by the distance between the rear seats and the screen, in which case the image width, as a rule, should not exceed one-sixth of this distance. If, however, the auditorium is large or very wide and the front seats are close to the screen, a sacrifice or compromise must be made either by abandoning some of the seats on each side of the front rows or by favoring them. Such a compromise should be arrived at by securing the most favorable viewing conditions from the greatest number of seats in the auditorium.

It is important that the sound screen selected be of a type approved for use by the sound equipment manufacturer. This is essential, as the loudspeakers serving the auditorium are placed directly behind the screen, and a screen lacking the proper sound transmission properties may seriously impair the quality of reproduction. Lists of approved screens are obtainable upon request from manufacturers of sound equipment.

The size of the screen is determined by the distance from the projector and the focal length of available projector lenses. Having found approximately the screen width by the rule of thumb method indicated above, its more exact width is determined by consulting the chart (No. 1) which indicates the width procurable with various size lenses. Thus the screen width and the proper focal length lens are determined. For purposes of masking or "framing" the projected picture, the screen proper should be larger than the actual picture by a minimum of 6 in. in both dimensions.

The type or model of light source used depends upon the dimensions of the projected image. Two types of light sources are available: namely, the Mazda lamp and the electric arc lamp. Use of the former is restricted usually to projection throws (distance from projector to screen) of 70 ft. or less and to screen images not exceeding 8 x 10 ft. Where more brilliant or larger pictures are desired, the arc lamp is given preference.

Direct current is required for arc lamps, making power conversion equipment necessary where alternating current only is available. Motor-generators, converters and vacuum tube rectifiers are widely used for this purpose. The latter device is entirely satisfactory for reflector type arc lamps using a maximum current of 30 amperes. Where larger currents are desirable, either a motor-generator set or a rotary converter should be supplied. With direct-current power and either motor-generators or converters, ballast rheostats must be installed to control the current supply to the lamps. Rheostats are not needed with vacuum tube rectifiers.

When power conversion equipment is to be installed, the apparatus should be located, if possible, at least 7 ft. away from the reproducing system amplifier or soundhead attachment. An enclosure, or room, as shown on Figure 1, for power conversion equipment, rheostats, etc., should be provided, if

* Member of engineering staff, Photophone Division, RCA Victor Co., Inc.

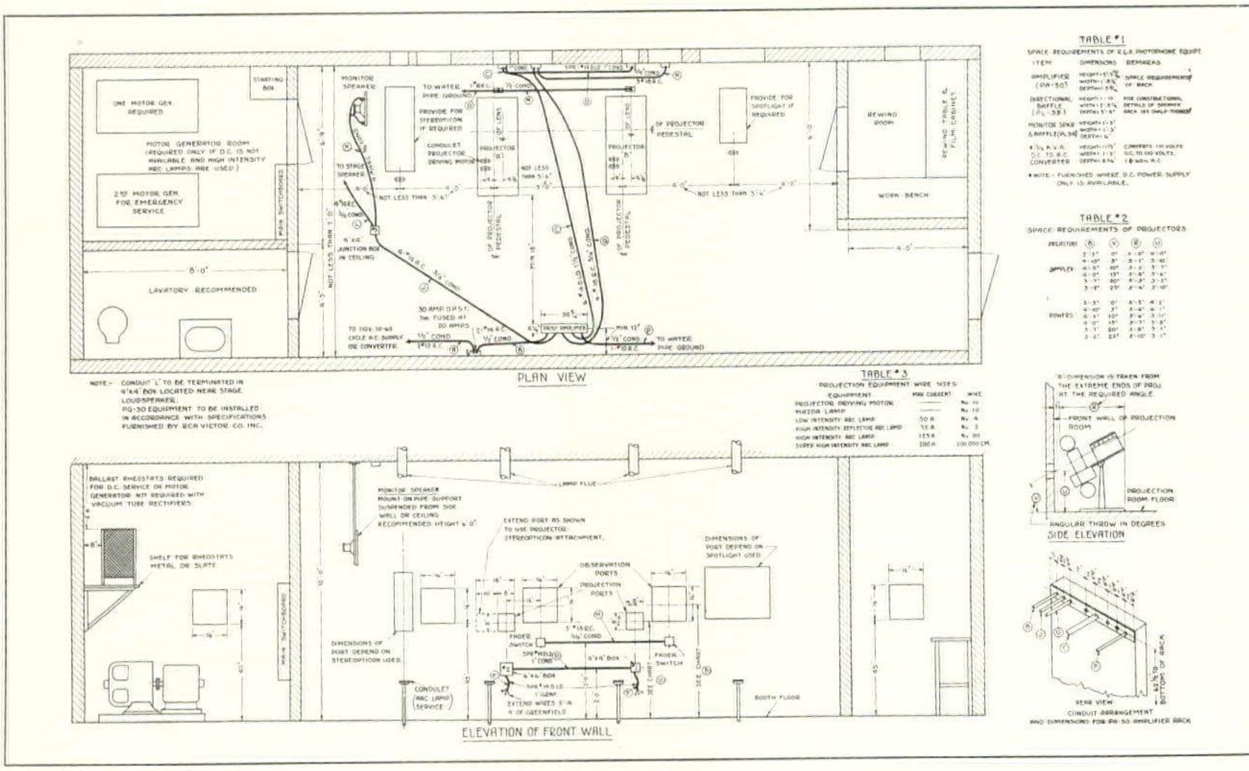


Figure 1. Typical projection room layout for two standard 35 mm. projectors and one reproducing system. Provision has been made for motor generator room, rewind room, lavatory, and for light and effect equipment

possible. If not, this equipment may be located in the projection room (permissible in certain localities) or may be installed at a convenient point outside.

Since the film reproducing devices (commercially called soundhead attachments) must be of the proper type for attachment to the designated projection machines, it is necessary in a specification calling for sound equipment to designate the particular type and model of projector to be used. Given below is a list of the apparatus generally required for a complete installation of projection equipment. Spare equipment for emergency use is not included.

Quantity	*Apparatus*
2	Projectors complete with pedestals and magazines, less motors and controls
2	Objective lenses of suitable focal length
2	Suitable arc or Mazda lamphouses, complete
2	Rheostats or regulators, if required. Power conversion equipment, if required
1	Pr. Changeover devices with foot switches
1	Film storage cabinet
1	Rewind table
1	Pr. Film rewinders
1	Film splicing machine
10	Reels
2	Mazda projection lamps (1000 W. or 30 V.—30A, as required). Or quantity of proper size carbons for arc lamps, if used
1	Approved sound screen and mounting frame

Selecting Sound Reproducing System. The factors which determine the satisfactoriness of a sound-reproducing system are similar to those which are applicable to any electro-mechanical device. Among the most important are: quality of performance, dependability, all A.C. operation, ease of installation, simplicity of operation, absence of batteries and rotating or complicated machinery, low initial and upkeep costs, availability of manufacturers' engineers for installation supervision and service, reliability of the manufacturer and assurance of continued availability of replacement parts.

Sound-reproducing systems generally consist of:

2 Soundhead attachments
2 Soundhead drives
2 Projector drive motors and controls
1 Reproducing amplifier
1 Set of tubes, photocells, exciter lamps and pilot lamps
1 Monitor loudspeaker
Stage loudspeakers (number specified above)
1 Spare parts kit and cabinet

Loudspeaker Space Requirements. As previously indicated, the loudspeakers serving the auditorium are mounted directly in back of a sound screen to create the illusion that the reproduced sound emanates directly from the motion picture image. Experience has shown that it is best to elevate the loudspeaker axis (or axes) to a point approximately two-thirds of the height of the picture. Sufficient space in back of the screen must be provided for the installation of speakers. Two types of directional baffles (horns), both equipped with identical driving mechanisms, are available. Each has particular advantages, and the type used depends upon the particular auditorium and the type of reproducing system installed. The overall length of the loudspeaker customarily furnished with special sizes is 40 in. A larger baffle, 63 in. long, is usually supplied with the larger installations. A minimum clearance of 12 in. between wall and loudspeaker should be provided for flaring (adjusting the angular direction of the loudspeakers with respect to the screen). The speaker mouth may be placed very close to, but not touching, the screen.

Loudspeakers have marked directional properties, radiating sound in a sharply defined beam. In some cases it is necessary to install more than the standard number of loudspeakers furnished with a reproducing system. The angular coverage of the sound beam emitted by the 63 in. long speaker is 50° in the vertical and 55° in the horizontal direction. The angular coverage of the 40 in. long speaker is 55° in the vertical and 70° in the horizontal.

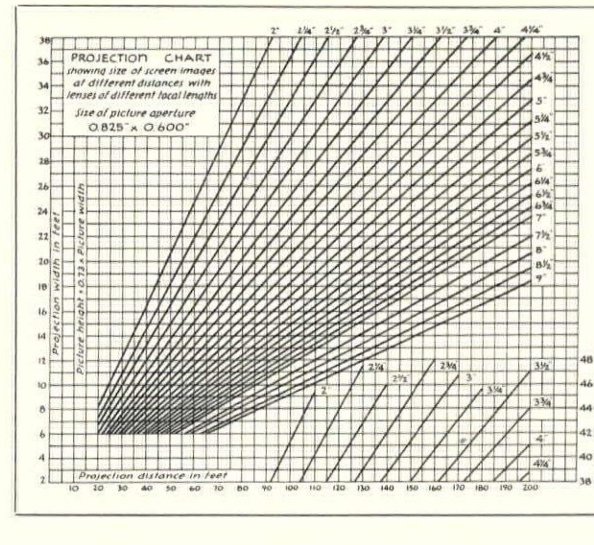


Figure 2. This chart may be used to determine the proper relation between screen width and the projection distance, from which, with a lens of proper focal length, ideal projection may be obtained

Projection Room Construction. The following recommendations have been compiled in accordance with the National Electrical Code and the Projection Practice Committee of the Society of Motion Picture Engineers.

1. Construction: Projection room shall be of fireproof construction and all walls exposed to the theater shall be of tile brick, gypsum, or any approved fire-resisting material. The enclosure shall be properly lighted and shall be large enough to permit the operator to walk freely on either side or in back of the projectors. The walls of a projection room shall be not less than 6 in. thick and shall be covered inside and outside with a layer of plaster at least ¾ in. thick. The inside walls and ceiling of the projection room shall be coated with an approved sound-absorbing material. The ceiling shall be of plaster or concrete suspended on metal laths, and the floor slab should be not less than 4 in. thick, having a 2 in. cinder-fill above and a 2 in. cement finish above the cinder-fill. The walls of rooms adjacent to the projection room shall be not less than 4 in. thick, plastered inside and outside.

2. Exits: Two exits shall be provided — one at each end of the projection room. All ports or exits in the booth and adjacent rooms shall be equipped with doors or shutters of fire-resistive material, equivalent to that of the enclosure. Such doors shall swing outwardly from the projection room, shall entirely close its opening and shall be arranged to be held in the closed position by spring hinges or equivalent devices.

3. Ventilation: Ventilation shall be provided by means of a vent pipe having a cross-sectional area of not less than 78 sq. in. and such vent pipe shall lead to the outside of the building or to a special non-combustible flue. The vent pipe shall be kept at least 1 in. from combustible material, or separated therefrom by approved non-combustible heat insulating material not less than ½ in. in thickness. Draft in vent pipe shall be maintained by an exhaust fan having a capacity of at least 50 cu. ft. per minute. The fan motor shall be so installed that it is not exposed to fumes passing through the flue. The motor shall be connected to the emergency service and shall not be controlled from the projection room.

4. Projection Port Shutters: The projection port shutter frames, between which the shutters slide, shall be constructed of not less than 16-gauge iron guides, built up of iron flats 2 in. wide and ⅛ in. thick, with spacers 1 in. wide and ¼ in. thick. The shutter shall be made of not less than 10-gauge iron. Each port shutter shall be connected to a master rod by a string and ring attached to a pin on the master rod. The master rod is to be fastened securely to the front wall approximately 18 in. below the ceiling. It should be provided with a sufficient number of bearings properly aligned to assure smooth operation, connected through pulleys and fusible links located over each projector, and capable of being controlled at the exit so that it may instantly be tripped. All observation ports shall be provided with metal guides to receive ¼ in. clear glass. This glass to be at an angle opposite to the projection angle and arranged to be easily removable for cleaning.

5. Observation Ports: The bottom of the opening of the port shall be splayed 15° downward. In cases where the thickness of the projection room will exceed 12 in., each side shall be splayed 15°.

6. Projector Ports: The bottom and sides of the

Courtesy, RCA Victor Co., Inc.

Common room, St. Lawrence University, Ernest Sibley, architect, in which the projection equipment is effectively concealed in panels on each side of the fireplace. The screen is lowered from one of the ceiling beams at this end

opening shall be splayed in the same manner as the observation ports. The distance from the floor to the bottom of the opening shall be in accordance with the table of projection angles as given in Figure 1. Projection ports may be equipped with glass, similar to the observation ports, provided however that optical glass be used.

7. Floor Covering: The floor of the projection room shall be covered with a good grade of "Battleship" linoleum or rubber tile securely glued down. The floor covering should be laid before the equipment is installed. The floors of rooms adjacent to the projection room should be painted with a good grade of concrete paint.

8. Projection Room Lighting: An individual ceiling fixture with canopy switch shall be installed for each piece of equipment and shall be placed in line parallel to the front wall at a distance of not less than 18 in. or more than 24 in. from the front wall. Small projection rooms shall be equipped with one "reel" light, and large projection rooms with two such lights, conveniently located. Two convenience outlets on the front wall, one at each projector station, shall be provided.

9. Location of Arc Generators: Arc generators may be located in a room adjacent to the projection room. Where the generators are large, making it necessary to reinforce the structure carrying them, they may be placed in the basement. Where generators are placed near the projection room, this room shall be soundproofed and a foundation for the generator arranged to eliminate thoroughly the noise and vibration of the generator. Generators so installed shall have the commutator end or ends suitably protected from mechanical injury by wire screens or other suitable means.

10. Fire Extinguisher Equipment: The local fire department or safety commission should be consulted regarding the proper type, amount and location of fire extinguisher equipment. In all cases there shall be provision for such equipment.

11. Film Rewinding and Storage: Rewinding of films shall be performed in the projection room, if permissible; otherwise in a separate fireproof enclosure provided at a location approved for the purpose. Extra films shall be kept in individual metal boxes having tight-fitting covers, and projection rooms shall be equipped with an approved fireproof box for the storage of films not on the projection machine.

12. Preparation of Architect's Specification: It is recommended that invitations for bids be divided into three sections, (1) Sound-reproducing system, complete, to be furnished by manufacturer. (2) Projection equipment to be furnished either by sound equipment manufacturer or projection equipment dealer. (3) Work of installation and electrical wiring to be done by qualified electrical contractor.

Concealed Installations. Many installations have been made in rooms, lounges, ballrooms, on shipboard, etc., where conventional theater equipment is lacking. In such cases it is usually desirable to conceal projection room ports, screen and loudspeaker in order to preserve the decorative scheme.

For installations of this type, the following suggestions will be found helpful:

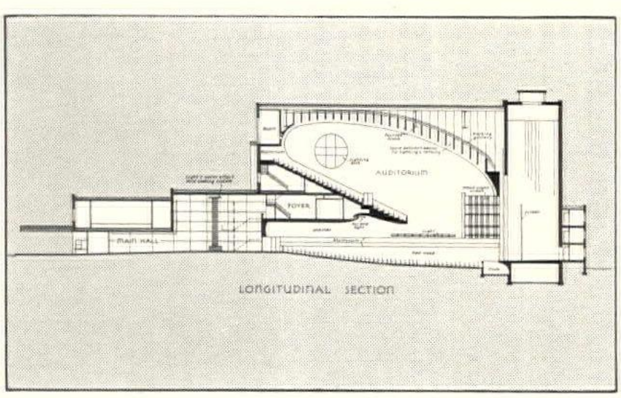
1. Elevate the projection room as much as possible to prevent interference with the picture by the audience and to permit use of entire floor area for seating.
2. Mount the screen so that the bottom of the picture is not less than 4 ft. 6 in. from floor. A portable screen may be used where desirable.
3. If a permanent loudspeaker installation is not feasible, a portable mount may be used and the loudspeaker stored when not in use.
4. Locate lighting fixtures to prevent interference with projected picture.
5. Provide auxiliary control of room lighting in the projection room.
6. Provide window drapes or other suitable means of darkening room.
7. Soundproof the projection booth to prevent transmission of noise into the auditorium.

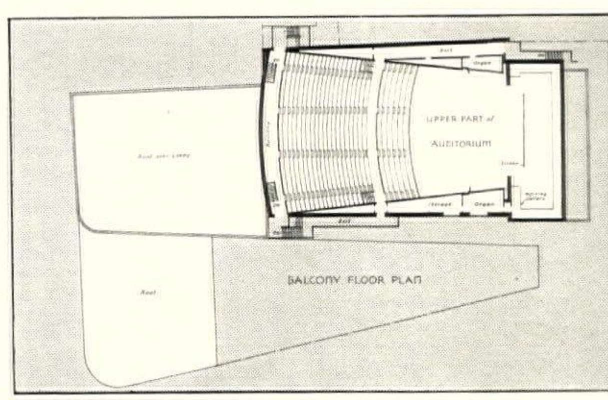
Acoustic Requirements. With the exception of small rooms, most spaces used for sound motion pictures will require some sort of acoustic treatment to obtain high quality reproduction. Poor acoustic conditions invariably exist in auditoriums constructed of hard plaster walls, ceilings and cement floors where wooden seats are used and furnishings are lacking. When filled by capacity audiences, however, a substantial improvement results.

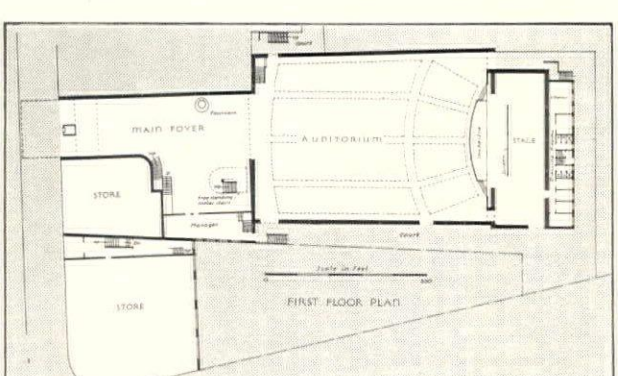
Objectionable effects originating from reverberation, echo, resonance and other sound-interference phenomena may be eliminated or reduced by observing the following general precautions:

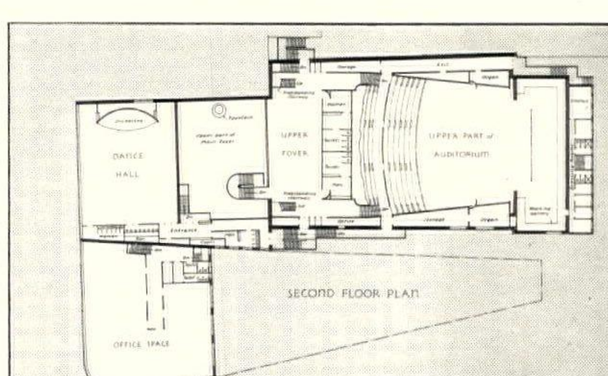
1. Use heavily upholstered seats.
2. Install padded carpeting (preferably over entire floor area).
3. Treat all surfaces remote from the stage (or loudspeaker location), particularly the rear wall, with drapes or other sound-absorbing material.
4. Avoid curved surfaces. If curved surfaces are employed, their radii of curvature should be the greatest possible, and such surfaces should be coffered or treated with sound-absorbing material.
5. Avoid long, narrow auditoriums, high ceilings and excessively long balcony overhangs.
6. Avoid large unbroken surface areas.

By following the above recommendations satisfactory acoustical conditions may be anticipated in small auditoriums (approximate volume — 100,000 cu. ft.) of the single-floor type and in balcony type auditoriums of moderate size.

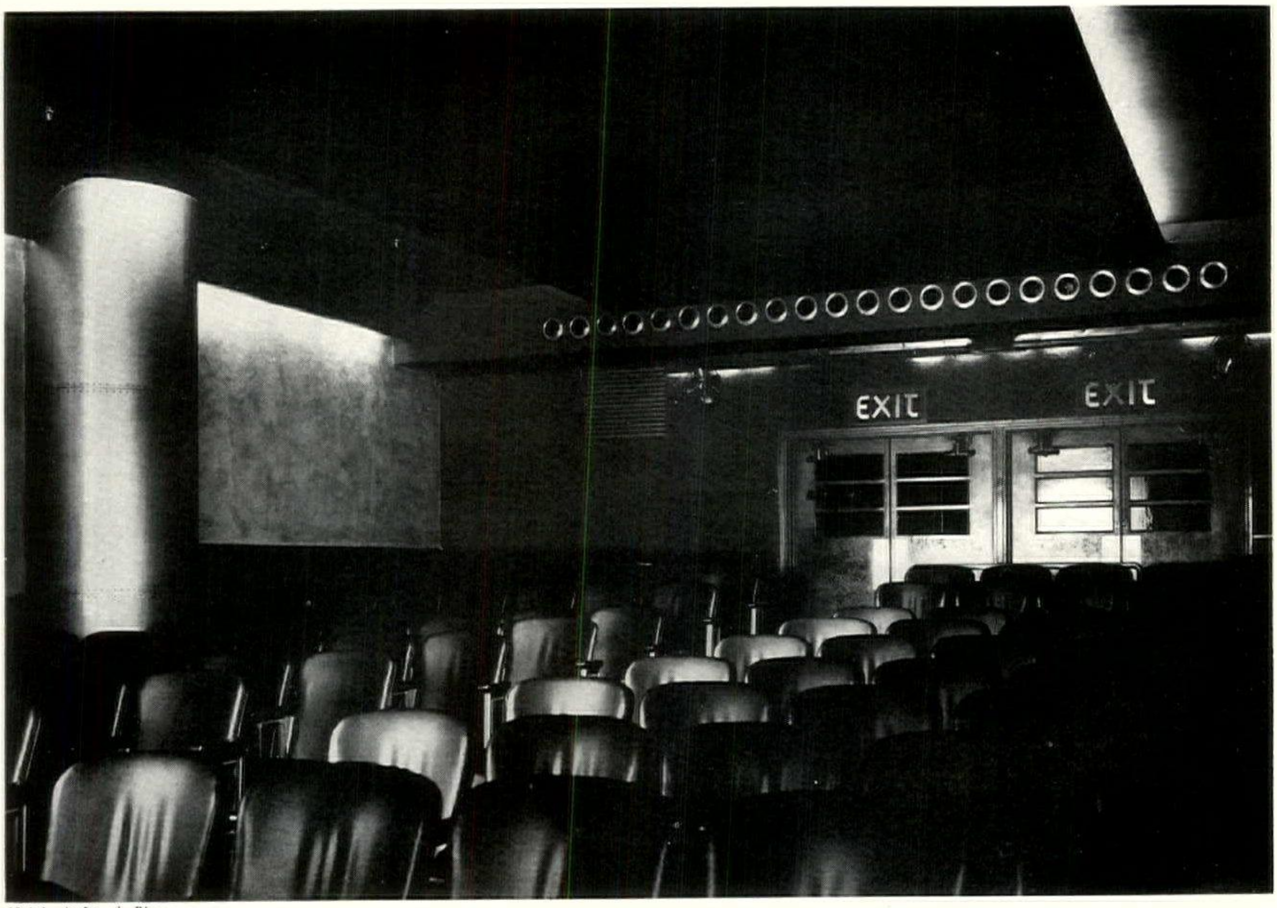






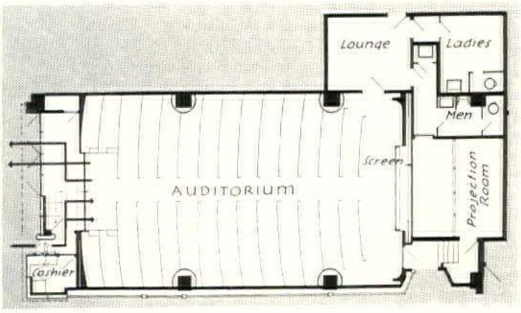


Longitudinal section and floor plans for proposed theater and stores building, Howe & Lescaze, architects. Designed for both stage and screen presentations, the theater has a seating capacity of approximately 3,000



Nyholm & Lincoln Photos

Using chemically treated screen and other patented devices, the film in this theater is projected from behind the screen in an ordinarily lighted auditorium. Showing only news reels and short features, the theater operates profitably by having 30-minute performances at low prices. In this space, which housed a store at one time, comfortable seating has been provided for more than 150



TRANS-LUX THEATER, NEW YORK

HOWE & LESCAZE, ARCHITECTS

THE FORUM OF EVENTS

NEWS ▪ PRODUCTS AND PRACTICE ▪ BOOKS

BANGS THE "BOOMERS"

CHALLENGING the wisdom of the administration in calling a prosperity conference of big business leaders, Robert D. Kohn protested against the tendency of the government to force the country back into another "so-called boom era."

"Whose prosperity will these big bankers and big business men help us back to?" Mr. Kohn asked. "How can they lead the nation toward any worthy goal, tied as they are, each of them, to a particular self-interested group?"

Mr. Kohn cited the building industry in which he said "there had been a decade of racketeering and perfect irresponsibility of a certain type of investment banker and speculative builder, who have been interested only in their rake-off rather than in bonds that might become the safest of investments for the small holder.

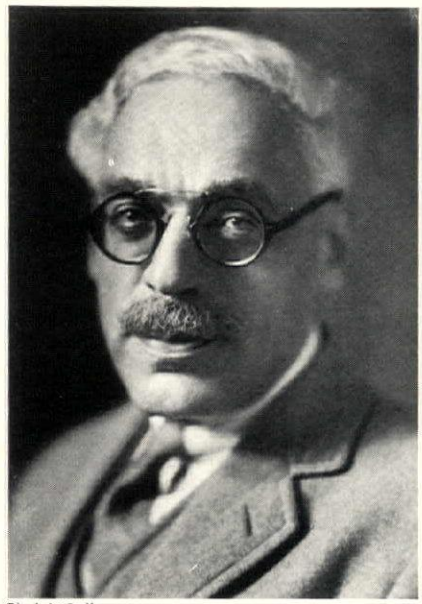
"For the protection of the public," Mr. Kohn continued, "we need the restraint of some form of certificate of necessity before building securities are offered for investment, much as the Interstate Commerce Commission restrains the railroads in this respect.

"It would, indeed, be desperate if we schemed out of this trouble into another so-called boom era without having learned the terrible results of this go-as-you-please plus the devil-take-the-hindmost policy which has prevailed in the past.

"Where among the list of men called to the Washington conference are the real leaders of thought in our country, the men who have a vision of another state of affairs, the philosophers, the great teachers, those professional men who are truly professional because they have no masters but their conscience? Where are these men of vision by whom alone the course of our national economic life can be steered in a new channel leading us to a more worthy goal?"

CONSTRUCTION CENSUS

THE eagerly awaited report of the first building industry census ever taken, made in connection with the government 1930 census, was released last month. It revealed that in 1929 there were 30,597 contractors who did an annual business of more than $25,000, and 113,799 contractors doing business less than that amount. Together in 1929, they did a gross business of $7,286,000,000, of which the first group was responsible for $6,250,266,665, and the second group for $1,035,453,579.



Blank & Stoller

Robert D. Kohn, who asks why real leaders of thought are not at Washington business parley

DUN'S BUILDING SURVEY

MORE timely than the U. S. Census is the recent building survey of R. G. Dun & Co. Finding evidence of "a much better feeling" in the industry, the survey states that approximately $44,600,000 has been pledged for modernizing in 62 cities, and that the potential modernization market for home, commercial and industrial buildings is $5,000,000,000.

"Reports from several hundred cities," the report continues, "reveal an actual 10 per cent shortage of homes, and that only 14 per cent of the cities are in an overbuilt state."

PLATT, HEWLETT HONORED

CHARLES A. PLATT, president of the American Academy, in Rome, and J. Monroe Hewlett, recently elected director of the Academy, were jointly honored by the Architectural League of New York at a dinner September 15. The dinner was also a farewell to Mr. Hewlett who sailed to take up his duties. Julian Clarence Levi presided, and the speakers were James K. Smith, academy alumni president, Eugene Savage, mural painter, and Cass Gilbert.

SOVIET DEVELOPMENTS

ENGINEERS and other Soviet hirelings usually return from Moscow to the United States with tales of dissatisfaction. Prices of food, prices of clothing, and prices of shelter consume the theoretically large salaries they receive. One who had no complaints upon his return here was Hector O. Hamilton, winner last Spring of the competition for the Soviet Palace.

Among other enthusiastic comments, Mr. Hamilton said, "They are paying me so much that in three years I shall be independently wealthy. My salary is paid monthly in American money and I have special permission to take money out of Russia. I tell you it's a paradise for an architect like me!"

Besides the Soviet Palace, he is designing sixteen stadiums, among them one which will be "the world's largest."

"They have 1,200 men and women working on excavations for the Palace of Soviets. It will be ridiculous — positively ridiculous — if American firms do not obtain at least $20,000,000 worth of orders in connection with the projects I am undertaking for Russia."

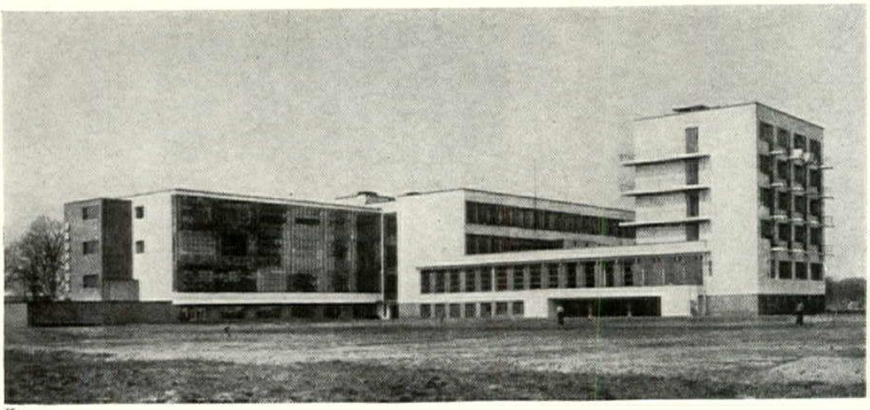
▪ ▪ ▪

Another imported architect at work in Moscow is Le Corbusier, who has, according to the Moscow *Daily News*, designed a building to house the Commissariat of Light Industry that has "no stairs, no ground floor, no windows." Moving corridors, escalators, and elevators replace the stairs. The building is elevated above the ground on columns, the first floor area being used for parking. With a reinforced concrete frame, the walls will be constructed entirely of a new type unfinished mirror glass which partially dissipates the sun's rays. Six million rubles is the estimated cost of the building, which will be eight stories high, with a cubage of 160,000 cubic meters.

(*Continued on adv. page 16*)

Hector O. Hamilton, seated, conferring with Kenneth K. Stowell of THE FORUM, before Soviet sojourn

THE FORUM OF EVENTS



Keystone

The Bauhaus at Dessau, Germany, closed by Nazi order

ARCHITECTURAL GUILD OF SMALL HOME DESIGN

FOLLOWING the heated controversy over A. I. A. sponsorship of the Small House Service Bureau, a group of Chicago architects has launched the Architectural Guild of Small Home Design, a directly competing organization. Architects only will be permitted to purchase plans from the Guild, $5 for members, $25 for non-members. Profit to plan buyers will result in fees for supervision.

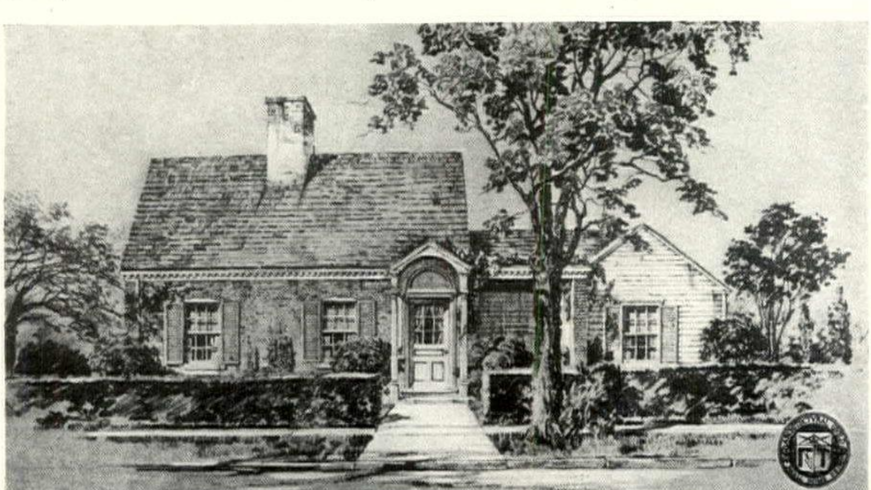
Behind the Guild's formation is the realization that more than a billion dollars pour annually into the pockets of builders, dealers, manufacturers for the construction of houses in which the architect plays no part. His services, the builder thinks, cost too much. By supplying the architect with complete drawings for as little as agencies outside the profession can obtain them, the Guild hopes to give members an unbeatable weapon in combating the price argument.

Working drawings are available of the houses illustrated in the Guild plan books, the first of which has already been issued. One feature of the plan books, not found in others, is the presence on each page of at least one suggestion to "consult an architect." Like other plan books, the Guild documents will be sold to lumber dealers and contractors for distribution to prospective home buyers.

Albert R. Martin, Guild secretary, anticipates an organization of 500 architects before September 1, 1933. Headquarters are at 540 North Michigan Ave., Chicago.

WASHINGTON CONFERENCE

MORE than fifty of the allied branches of the building industry will meet in Washington October 13 and 14 for the National Conference on Construction. Elimination of waste, better information and planning, and improved organization as a means to economic construction, will be the subjects of discussion. Consideration will be given to the activities of the Home Loan Banking System and the Reconstruction Finance Corporation in relation to the work of the Conference. The architectural profession will be represented on the executive committee by E. J. Russell, A. I. A. president.



Colonial design, typical of those being offered by the Architectural Guild

BAUHAUS CLOSED

THE Bauhaus at Dessau, Germany, Walter Gropius's internationally famous architectural school, and an important center of the modern European style movement, was closed last month as the result of political pressure put upon it by the Nazis, National Socialist party controlled by Adolf Hitler. The action, surprising to Americans unfamiliar with the close link between architecture and politics in Germany, was taken as part of the general trend toward the suppression of the social-architectural ideas espoused by Professor Gropius and his associates at the Bauhaus.

Bell tower of the recently completed 26-story Lincoln-Liberty Building, Philadelphia, which houses the new Wanamaker store. John T. Windrim, Architect

ARCHITECTURAL LEAGUE PLANS

CONFIDENT that 1932–1933 will see an important increase in business for architects, The Architectural League of New York has planned the most vigorous program in the League's history for the coming year. Coupled with the announcement that the annual show would be held the last week in February and the first two weeks in March, the following committee chairmen were appointed: A. L. Harmon, architecture; D. Putnam Brinley, decorative painting; Ernest W. Keyser, sculpture; Otto W. Heinigke, crafts; Noel Chamberlain, landscape architecture; Harvey W. Corbett, catalogue. Other committee chairmen appointed were G. A. Holmes, house; H. L. Walker, competitions and awards; L. Andrew Reinhard, membership; Frederick G. Frost, audit; Julian C. Levi, finance; and Leon V. Solon, current work.

(*Continued on adv. page 18*)