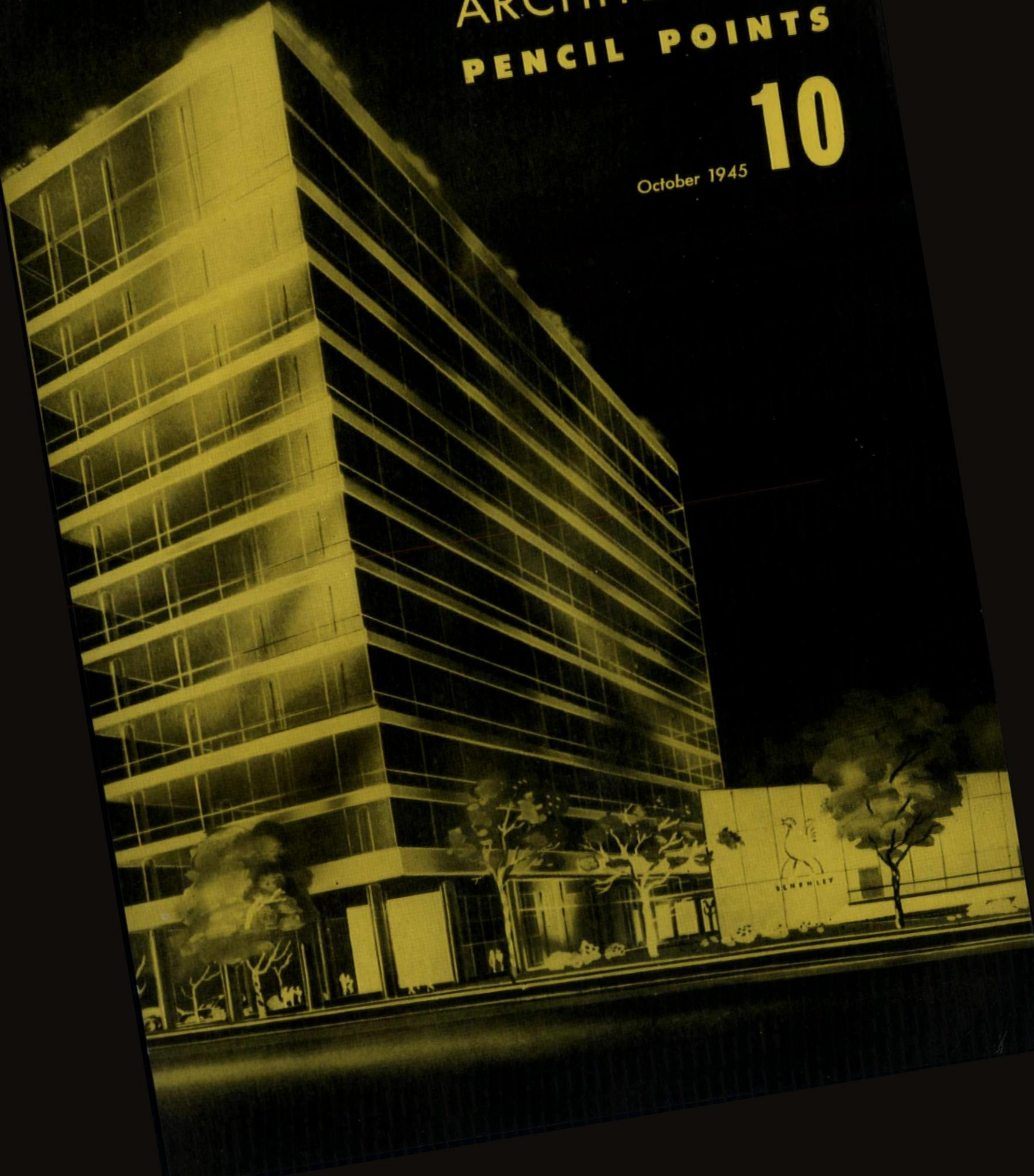
PROGRESSIVE ARCHITECTURE
PENCIL POINTS

10

October 1945



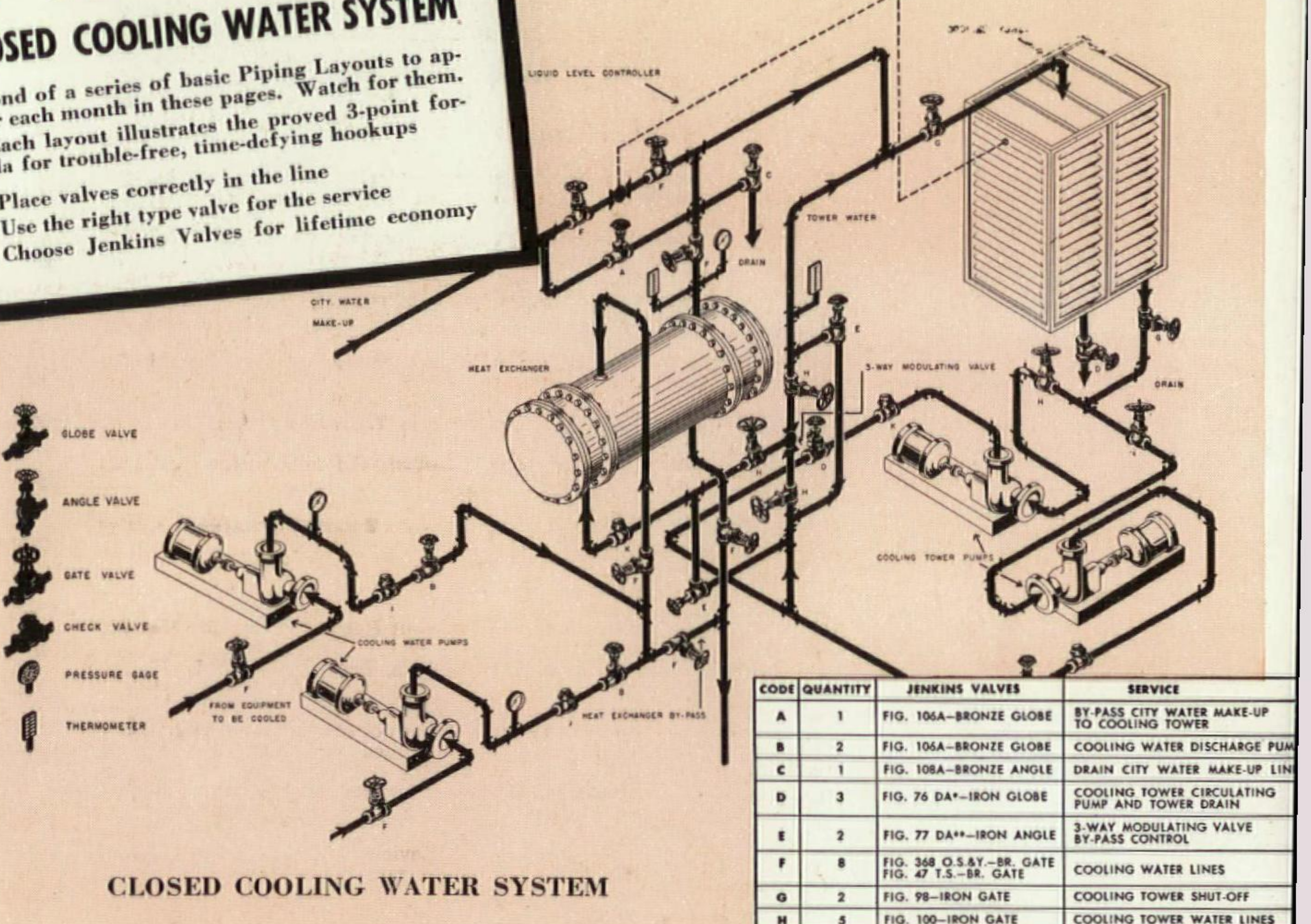
Jenkins PRACTICAL PIPING LAYOUTS 2

How to plan a
CLOSED COOLING WATER SYSTEM

Second of a series of basic Piping Layouts to appear each month in these pages. Watch for them.

Each layout illustrates the proved 3-point formula for trouble-free, time-defying hookups

1. Place valves correctly in the line
2. Use the right type valve for the service
3. Choose Jenkins Valves for lifetime economy



CLOSED COOLING WATER SYSTEM

CODE	QUANTITY	JENKINS VALVES	SERVICE
A	1	FIG. 106A–BRONZE GLOBE	BY-PASS CITY WATER MAKE-UP TO COOLING TOWER
B	2	FIG. 106A–BRONZE GLOBE	COOLING WATER DISCHARGE PUM
C	1	FIG. 108A–BRONZE ANGLE	DRAIN CITY WATER MAKE-UP LIN
D	3	FIG. 76 DA*–IRON GLOBE	COOLING TOWER CIRCULATING PUMP AND TOWER DRAIN
E	2	FIG. 77 DA**–IRON ANGLE	3-WAY MODULATING VALVE BY-PASS CONTROL
F	8	FIG. 368 O.S.&Y.–BR. GATE FIG. 47 T.S.–BR. GATE	COOLING WATER LINES
G	2	FIG. 98–IRON GATE	COOLING TOWER SHUT-OFF
H	5	FIG. 100–IRON GATE	COOLING TOWER WATER LINES
J	2	FIG. 352–BRONZE CHECK	COOLING WATER PUMP CHECK
K	3	FIG. 624–IRON CHECK	COOLING TOWER PUMP CHECK

COOLING TOWERS are frequently employed to reduce the expense of city water for installations using cooling water, such as air conditioning units, refrigerating systems, and Diesel plants. Many local building codes prohibit the use of water for cooling purposes unless a system is installed which permits the continuous re-use of the water. This layout meets these conditions, and also takes into account the absorption of corrosive elements into the tower water from smoke-laden atmosphere.

MANY TYPES AND PRESSURE RANGES of Jenkins Valves, other than those listed here, are suitable for a Closed Cooling Water System, according to the nature of the intallation. Jenkins recommends consultation with accredited piping engineers and contractors, either when adapting these suggestions to your own requirements, or when planning any major piping installations.

COPIES OF THIS LAYOUT No. 2, with additional explanation of all valve specifications, will be sent on request.

OVER 600 JENKINS VALVES TO CHOOSE FROM

Whatever types of valves your plans call for, you can find them, with few exceptions, in the Jenkins Catalog. This complete line includes over 600 different patterns designed by Jenkins Valve specialists for every service.

To save time – to simplify planning–to make sure of the *lowest cost in the long run* – select all the valves you need from the Jenkins catalog.

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal; London, England.

LOOK FOR THIS TRADE JENKINS MARK **DIAMOND MARK**

SINCE *Jenkins Bros.* 1864

JENKINS VALVES

For Domestic, Commercial, Engineering and Industrial Service . . . In Bronze, Iron, Cast Steel and Corrosion-resisting Alloys . . . 125 to 600 lbs. pressure.

Sold Through Reliable Industrial Distributors Everywhere

PROGRESSIVE
ARCHITECTURE
PENCIL POINTS

REMEMBER TO PLAN FOR SAFETY

The most obvious and generally accepted things in the world are the very ones we all need to be periodically reminded about.

Take, for example, the matter of safety as a factor in the design of buildings. Every architect knows that he must exercise constant forethought to guard against the many hazards that can be involved in the use of the structures he creates. Yet the records compiled year after year show a startlingly large number of accidents, many of them fatal, that might have been prevented had the designers of buildings been just a little more thoughtful.

People persist in falling down badly lighted or poorly proportioned stairs, or out of windows, or into areaways improperly protected by guardrails or handrails. They still succeed in electrocuting themselves in buildings in an astonishing variety of ways. To say that they would do these things anyway through carelessness is no answer. It is a real responsibility of the architect to do everything he can during the design phase of his work to foresee and provide against the omnipresent human failings that allow people to disregard simple warnings and rules of common sense.

The subject of safety is of particular importance right now. Not only are we about to enter upon a huge building program which will undoubtedly last a number of years and add thousands of new building hazards to the existing ones, but we are confronted with a much larger than usual proportion of our population who will be handicapped in getting about as a result of wounds suffered during the war.

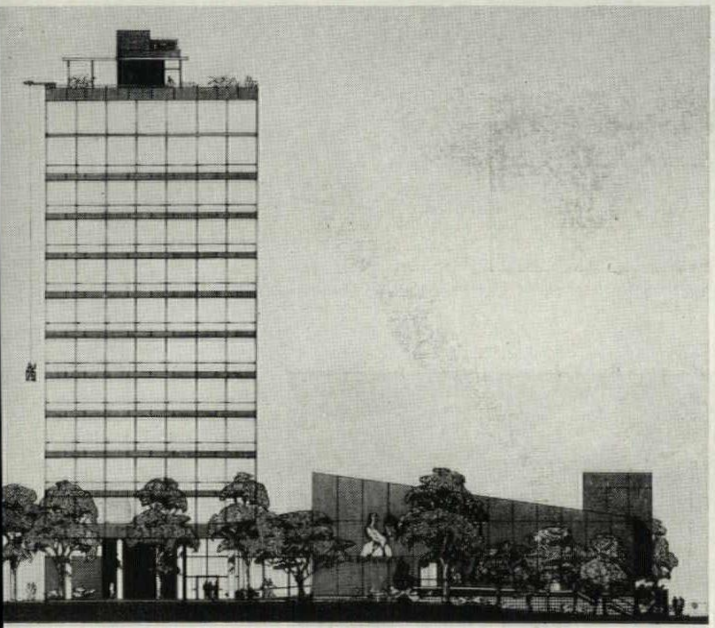
We all want the disabled veterans to be reabsorbed into civilian life as completely as possible and we all want to give them every opportunity to participate in business, industry, and recreation along with everybody else. They will need to enter offices, factories, stores, and public buildings. During their leisure they will want to attend theaters, museums, sports arenas, churches, libraries, and a great many other places of interest.

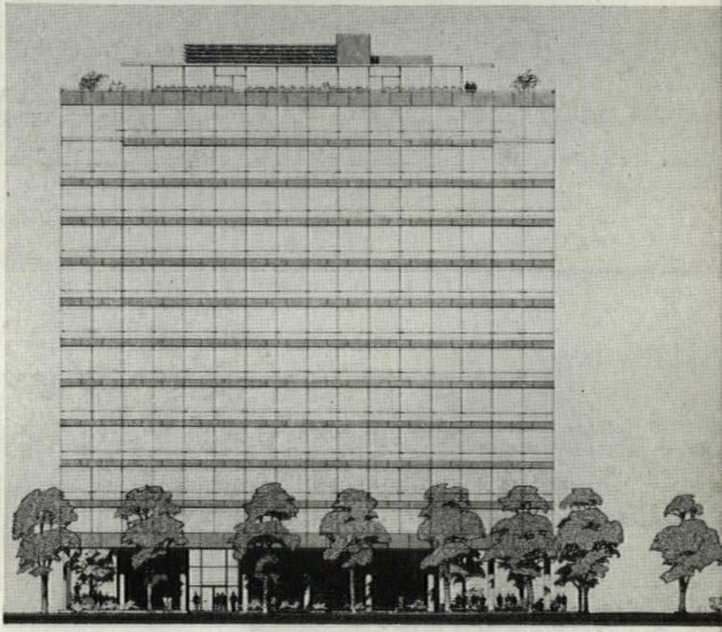
Much can be done to safeguard them and make their movements in and around buildings easy and comfortable. Entrances at ground level, elevators between floors, handrails at all steps, and the elimination of unnecessary steps and obstacles are but a few of the items that the designer should keep in mind. Let it not be said after the buildings are already up that the architectural profession has neglected to insure against unnecessary bodily injury or even physical discomfort for the men to whom we owe an admittedly everlasting debt. In making things better for them we may find that we have made them better for all.

Kenneth Reid


SCHENLEY

PROPOSED OFFICE BUILDING





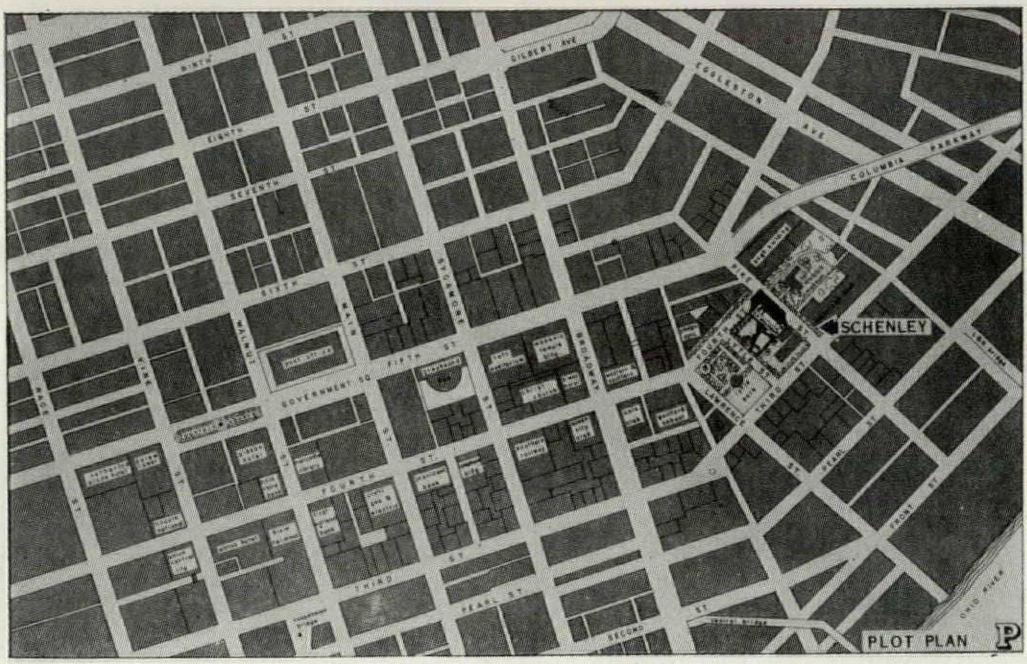
For Schenley Distillers, Inc., Cincinnati, Ohio

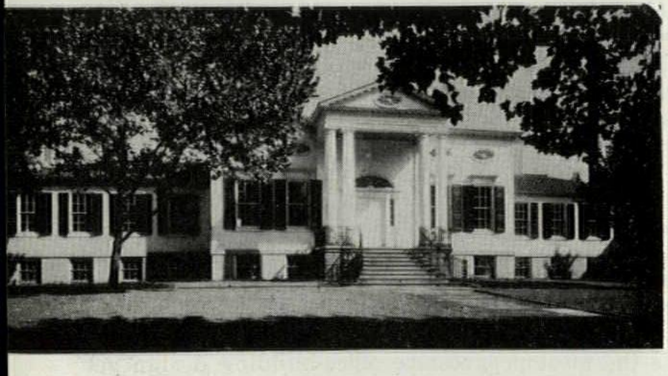
Woodie Garber, Industrial Designer

Foreword

The design of this proposed building was of a speculative nature with the ultimate hope that it would be erected by others for long-term occupancy by Schenley Distillers, Inc. The designer, therefore, was not selected by Schenley; nor were the preliminary drawings done at their request; nor, indeed, did Schenley see the drawings until they were finished. The corporation did, however, provide a statement of its basic business requirements—uses to which they would put such a building, facilities and space needed, and general character desired—which was the reference point used in the development of the design.

Schenley has made no commitments of any kind to construct this building according to these plans at the present time. It is, however, such a remarkable example of progressive architecture—we would be the first to cheer should the corporation decide to proceed with this scheme, or something like it—that we choose to make it our major presentation this month, and to discuss it in considerable detail for the instruction and inspiration of others who may be commissioned to design office buildings. In every respect—planning, design, construction, equipment, and facilities for employes—this building represents a sincere attempt to improve existing standards; to restudy the fundamental needs in the design of a good office building for tomorrow and to translate these needs, through the new methods and materials which modern technology provides, into vital architecture. So far as we know, this is the most progressive office-building design yet to appear in this country.





Above: map of Cincinnati showing location of project, and downtown Cincinnati, showing exceptional site. Left: the Taft Museum, a next door neighbor.

Right: present condition of site, and, above, Lytle Park, another next door neighbor.

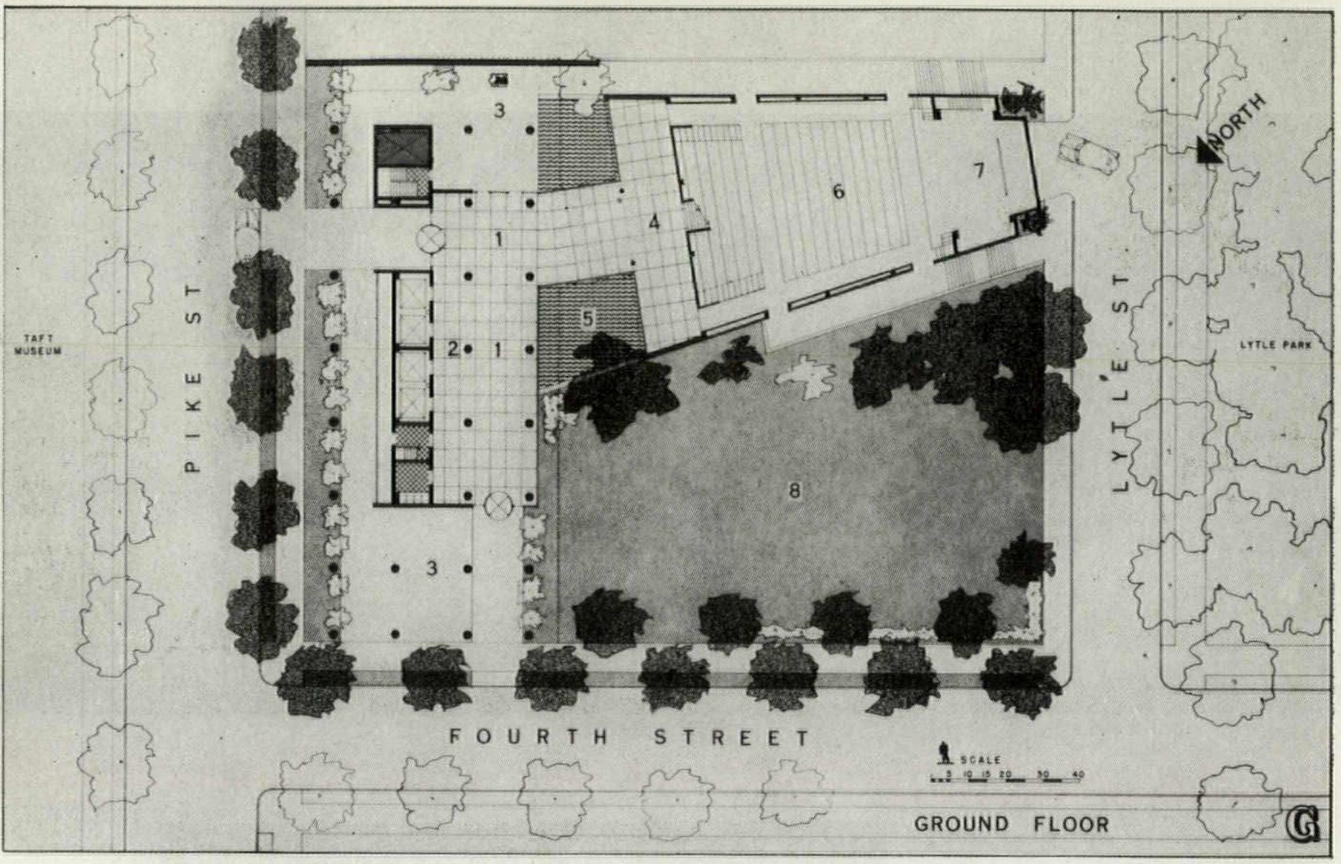
Needs and Circumstances

The primary stated function was that the building should house and serve the central offices of Schenley Distillers, Inc. Five specific use areas were described:

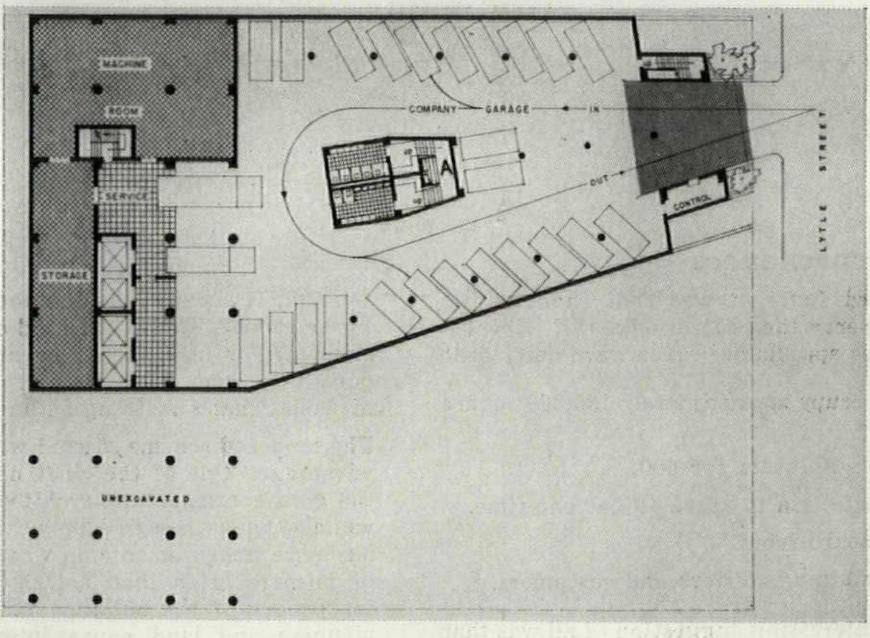
1. Office space to occupy approximately 100,000 square feet.
2. An auditorium with seats for 600.
3. An employes' cafeteria to serve 400 at one time.
4. A corporation board room.
5. A bar for entertaining visitors and customers.

Perhaps the most interesting suggestion of all was that the building should be a focal point and reflect in its general character the progressiveness of the company and that it should provide more than usual amenities for employes. This is the kind of a program which we applaud; for no designer or architect, however competent, can hope to do his best unless the client shares his belief that something better is possible.

The proposed scheme started with yet another distinct advantage. One of the chief difficulties that confront the good contemporary architectural designer is that, while he knows how to supply things that on any logical basis are improvements on what has appeared to date, he is more often than not thwarted by the cramped inadequacy of the building lots provided by the non-planners and land abuse interests among us. The Cincinnati site proposed for the building shown here is a rare exception.

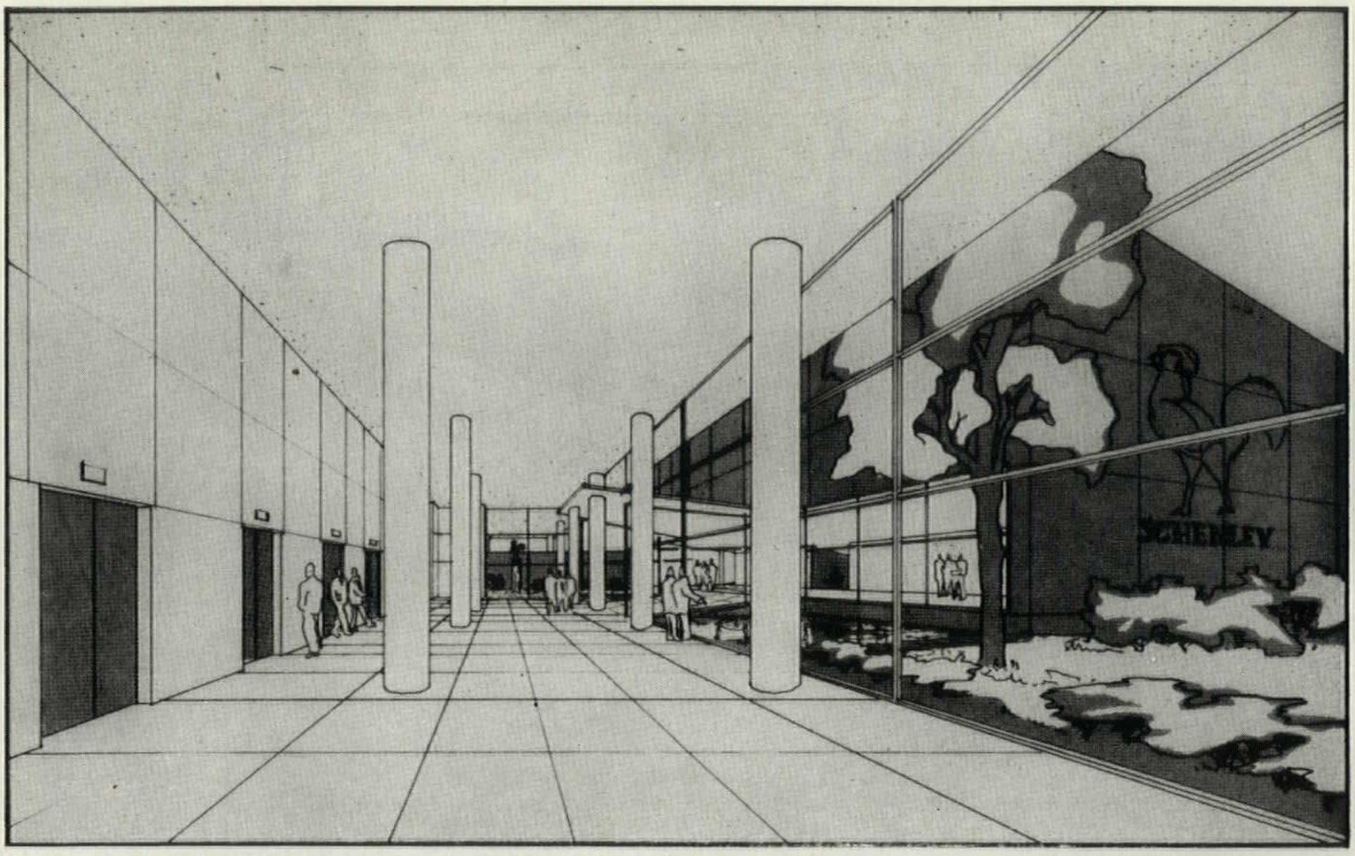


NORTH
3
6
7
4
1
TAFT MUSEUM
PIKE ST
2
1
5
LYTLE ST
LYTLE PARK
8
3
FOURTH STREET
SCALE
5 10 15 20 30 40
GROUND FLOOR
G



MACHINE
ROOM
COMPANY GARAGE
IN
SERVICE
A
OUT
CONTROL
LYTLE STREET
STORAGE
UNEXCAVATED

Basement



Lobby, looking toward passage to auditorium.

Site

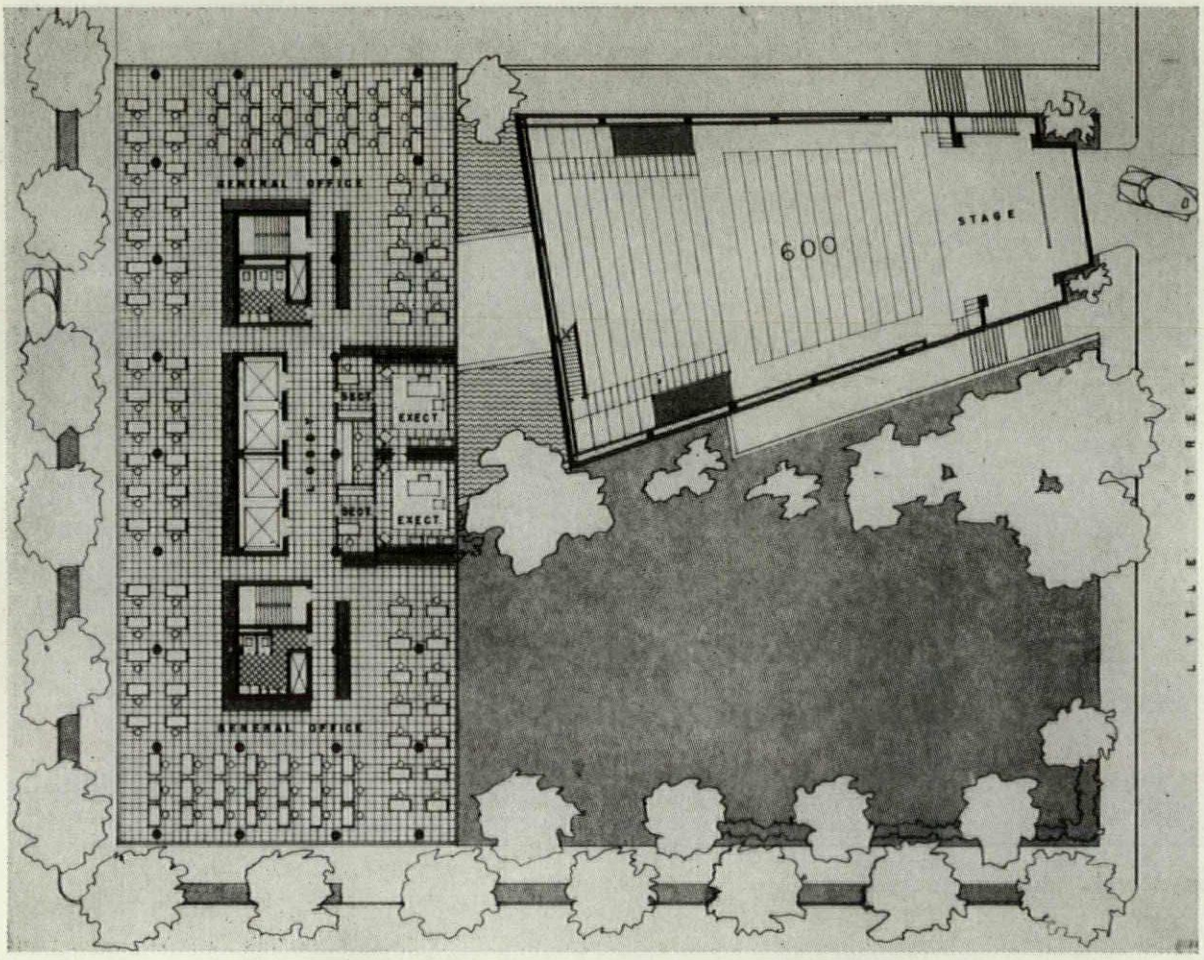
Located centrally at Fourth Street (see map) not far from where Columbia Parkway brings a large volume of traffic into downtown Cincinnati, it is not only flanked by a well-treed small park on one side and the lush grounds of the Taft Museum on the other, but it is itself a most unusual block to find in a downtown section. Only two residences now exist on the site, and the rest is lawn and trees. In evolving his site plan, the designer has sensed the extraordinary advantages of this circumstance and, except for the demolition of the existing buildings and the felling of two trees, he has retained intact the pleasant park-like character of the site. Not only this: in the scheme for the site development, planting around the building and the inclusion of small reflecting pools are proposed that would actually enhance the already exceptional property.

Building Plan

To preserve as much as possible of the natural beauty while providing proper functioning of the building, Mr. Garber oriented the major portion (the multi-story block) of the structure across the shorter dimension of the 160 by 200-foot site. Thus, offices have an uninterrupted view across the adjoining museum property and park. Further respecting the amenity of the existing planting, the ground floor of the office portion of the building is 22 feet in height, largely sheathed in glass, so that the present visual continuity between green areas is preserved from every viewpoint. Another and different sort of economical consideration was the limitation of excavation largely to the area at present occupied by the two residences.

The auditorium wing, schemed so that it could readily be used for outside functions (as well as for company affairs), is planned as a separate structure, although it is integrally connected with the main building lobby by a glazed covered passage between two reflecting pools. Under the auditorium area is a parking garage for executives' cars and off-street access for service and delivery trucks leading to a dock adjoining the elevators. A near-by lot provides car parking for most employes.

The typical floor plan is laid out to gain maximum daylight and flexibility of arrangement; the mechanical and circulation core is surrounded on all sides by 25 feet of clear floor space, which is enclosed on the outside by walls of glass extending from floor to ceiling. This space (as with practically everything in the building design) is laid out on a 40-inch modular basis. This dimension was chosen because it corresponds exactly with a system of standard, prefabricated partitioning which is now available. Throughout—in planning, construction, equipment, and control systems—every opportunity has been taken of the advantages and economies (less construction time, lower unit cost, greater ease of maintenance, repair, or replacement) to be gained through use of standard dimensioning and repetitive use of standard elements.

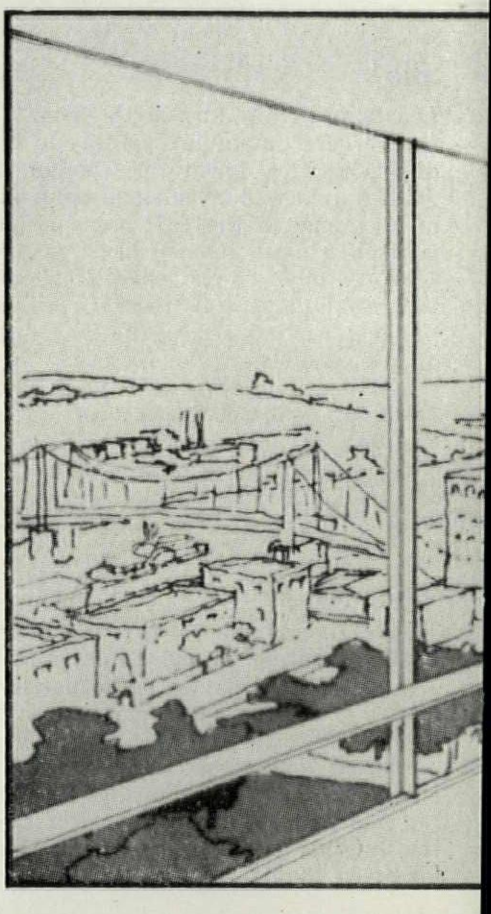


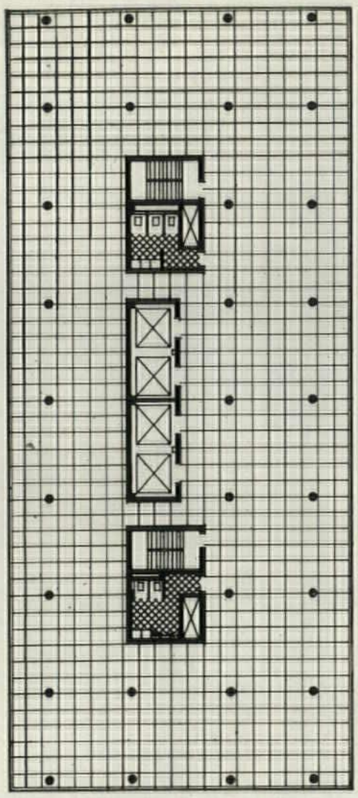
Second Floo

Structural System

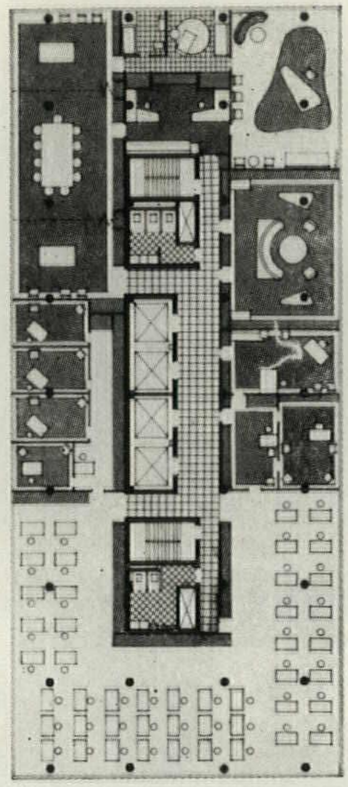
The supporting structure is of reinforced concrete columns and floor slabs arranged in multiples of the basic 40-inch module. The glass divisions of the outside wall (standard throughout with the exception of portions of the two top floors) are 3 modules (10 feet) on center, and the structural columns of the building are 6 modules (20 feet) on center in both directions. The columns run from the roof to the footings without offset.

An immediate question is whether the system of all-glass walls may not be excessive—hard to heat, too bright, etc. The designer adopted this system only after considerable research and experimentation with a glass-manufacturing company. To start with, the glass panels are of double-layer, insulating glass consisting of two plates of ¼-in. heat-absorbing glass separated by ½ inch of air space. Use of the heat-absorbing type of glass accomplishes several desirable results which make the system practicable, according to the designer. It combines the insulative qualities of regular double-layer glass and the re-radiating qualities of the heat-absorbing type. By using the latter on *both* faces, heat is not only re-radiated from outside walls in summer, but panel heat inside the building in winter is re-radiated inward. Another advantageous quality of this type of glazing of which the designer has taken advantage is its pale green color deriving from a high metal content. This quality very materially reduces glare, acting in much the same manner as a pair of sun glasses. In an actual experiment in the



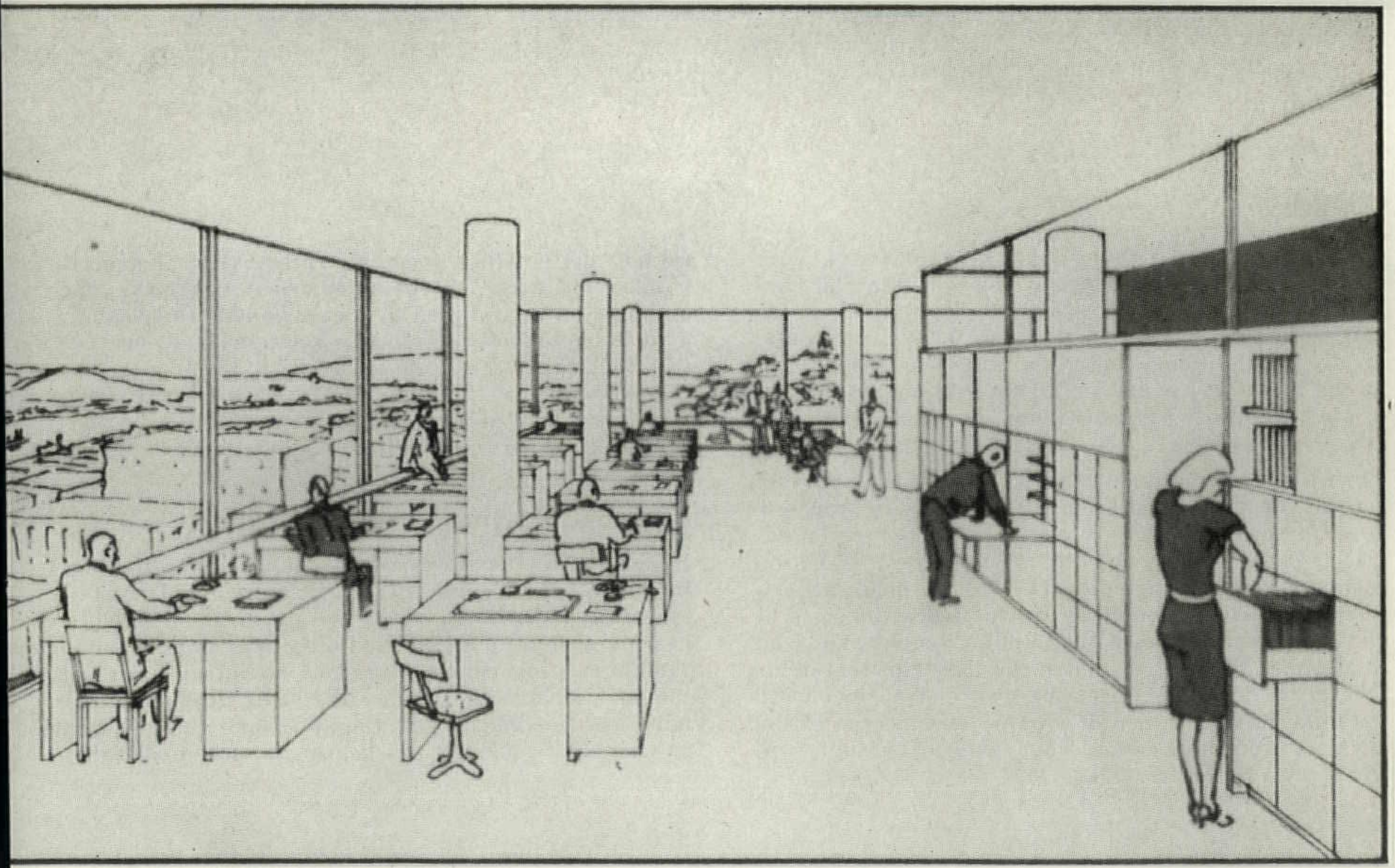


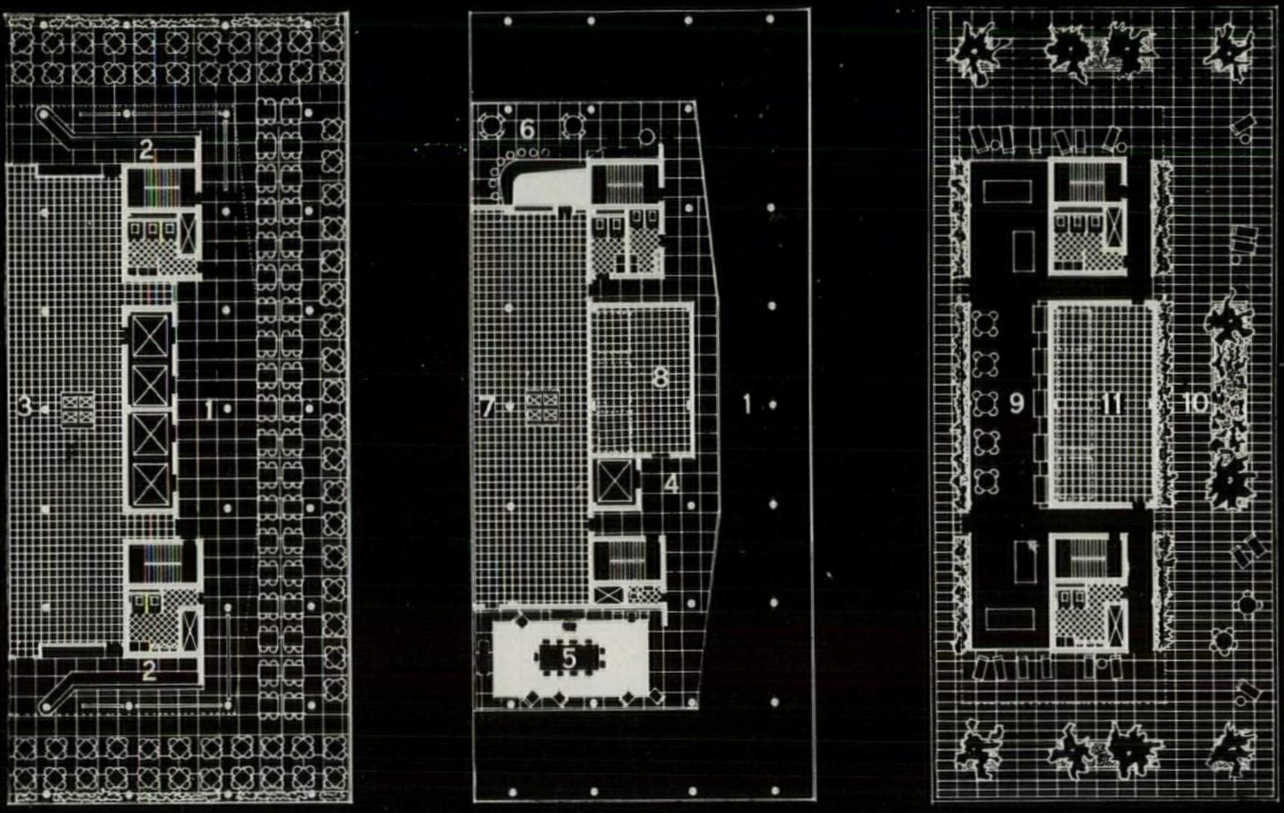
Typical Floor



Typical Floor, Subdivided

Typical office space, with floor-to-ceiling window walls.





DINING ROOM
1 DINING ROOM-400
2 CAFETERIAS-2
3 KITCHEN

MEZZANINE
4 OBSERVATION GALLERY
5 EXECUTIVE DINING ROOM
6 GUEST BAR
7 FOOD STORAGE & PREPERATION
8 ELEVATOR MACHINE RM.

ROOF
9 RECREATION ROOM
10 ROOF GARDEN
11 ELEVATOR SHEAVES

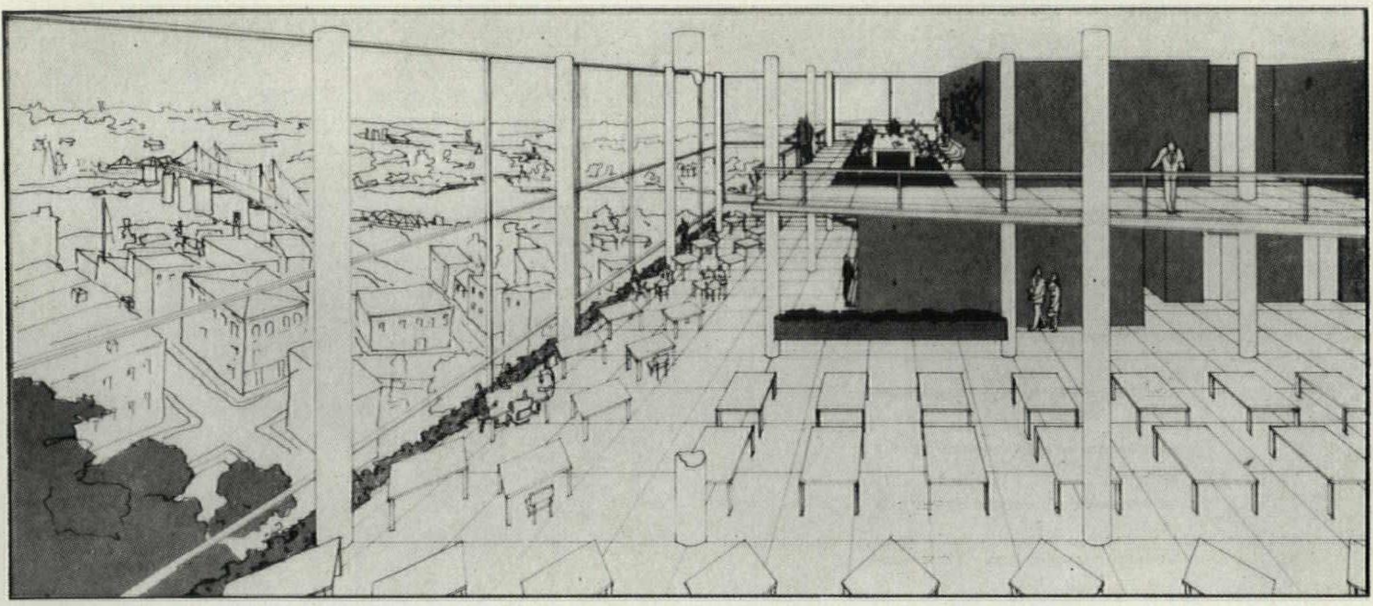
SCALE 5 10 20 30 40

designer's office, he found that he could work with comfort beside a wall panel of this glass in full sunlight. Due to the large areas of glass proposed for this building, actual intensities are far above those in an average building, and it is proposed to sandblast at the top of the inside sealed face of the outer plate of glass to diffuse any remaining sky glare. The lower area of both plates is left clear for free vision.

For washing the outside of these glass walls, a remote-control car, suspended from a roof track, is proposed. A surprising fact turned up in construction estimates was that the use of this car reduced the installation costs of the glass (avoiding need of toe holds, attachment clips, etc.) enough to pay for twice the costs of the equipment. To keep the building bright and clean at all times, the thin, insulated closure strips that occur where the floor lines meet the wall and all incidental external finish are also of glass—polished, red structural glass in these cases. Thus, exterior washing will actually be building washing, rather than the interminable little corners of numberless windows. The building washer will, so to speak, be able to splash at a veritable ten-league canvas (whether or not brushes of comet's hair are to be used is not specified). The interior finish of the lobby is of yellow-blasted structural glass, and all kinds of glass proposed are standardized to one size each throughout the main building.

Heating, Cooling, and Ventilation

Because of the flexibility of floor layout, with the idea in mind that through the years there might well be numerous changes in room arrangements desired, a heating system of equal flexibility was worked out—radiant heating panels poured as an integral part of the floor construction. Since the slabs throughout the building are standardized, the designer found out that it was practicable for all heating panels to be shop



Cafeteria, with executive mezzanine over.

fabricated as standard units, welded to the steel reinforcing (to be used in the floor slabs) and brought to the site under test pressure ready to be installed on the forms—a structural synthesis which produced sizable cost savings. Heating feed lines are located in trenches and will be connected to the heating-coil panels after the concrete is poured.

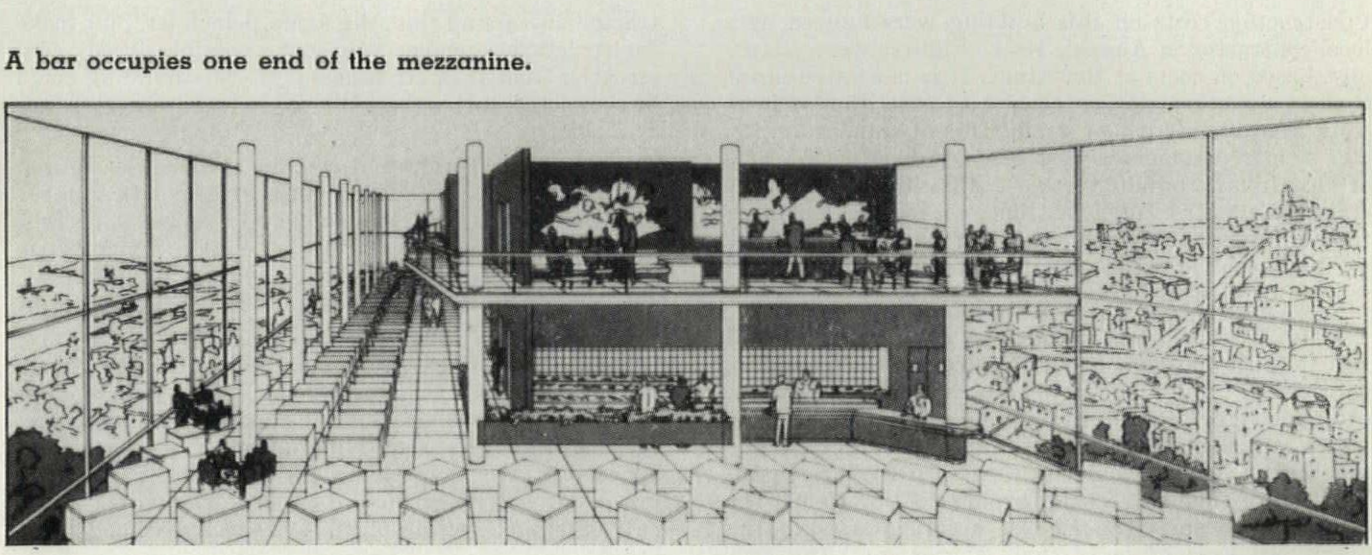
In the entire building, the only openings between indoors and out are at the ground floor and on the roof garden. There is not a single opening window; thus all air will be purified, dust filtered, and humidity controlled throughout the building and circulated through high-velocity ducts of small size. Not the least advantage gained by this is the relative simplicity of inside maintenance, cleaning, etc.

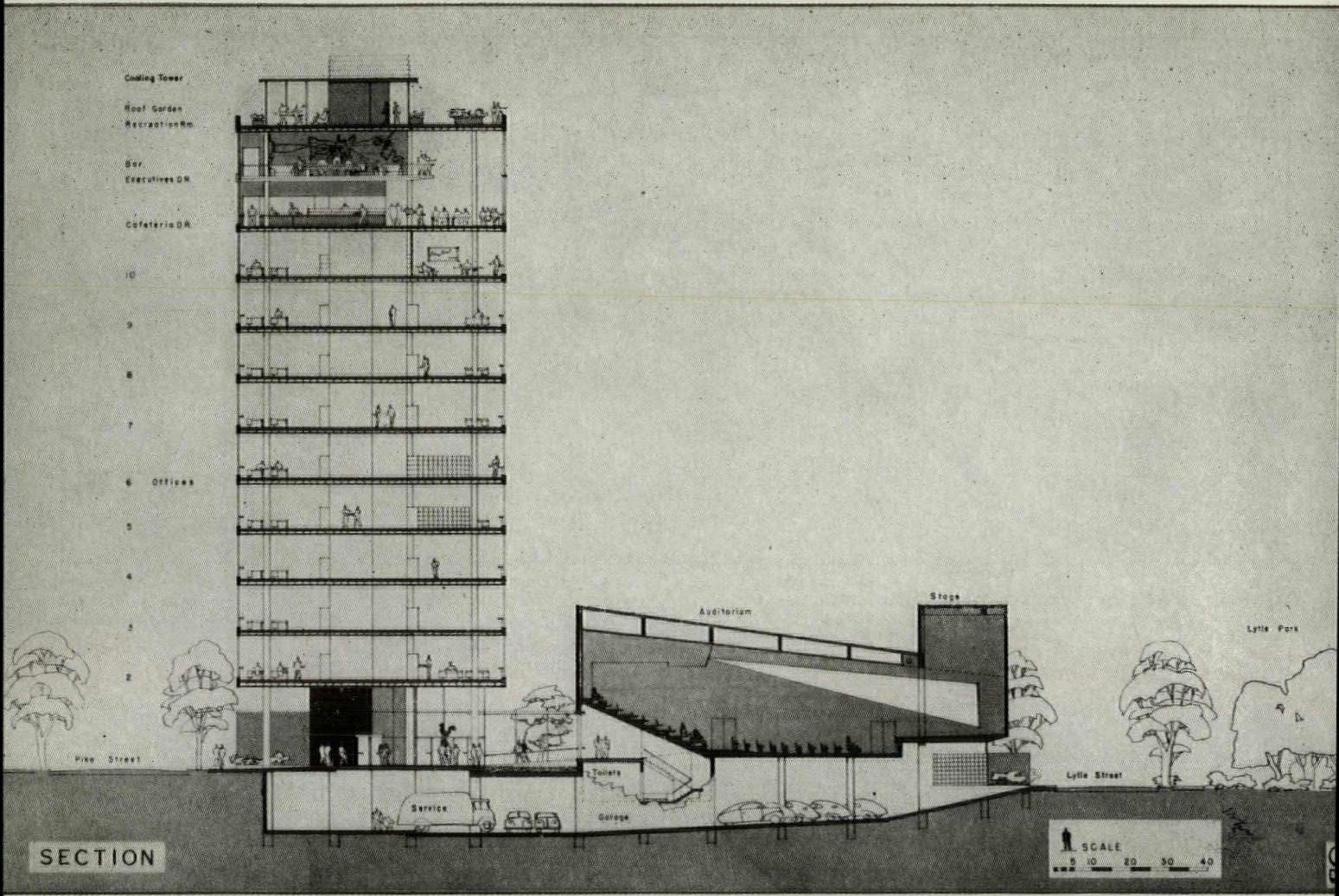
Summer cooling will be provided by circulating cold water in the floor panels, with the possibility of eliminating condensation through use of air-humidity control. Thus, the idea is that body heat of occupants will be removed by radiation to the cool floor, completely reversing the winter heating cycle. The auditorium and garage are heated and cooled by individual, conventional air-circulating systems.

Sound Control and Light

The interior of the building is protected from outside noise chiefly through the insulating exterior double-layer glass panels; inside noise is absorbed through the perforated acoustical ceiling tile, which are sized in increments of the partition module size. The ceiling light units are for flush installation and dimensioned so that they are interchangeable with the acoustic ceiling surface at any point that artificial lighting may be required.

A bar occupies one end of the mezzanine.





SECTION

Costs

Construction costs on this building were figured by a local contractor in August, 1944. Figures were, naturally, based on costs at that time. It is most significant that, in structural design, consistent repetition of form work, coordinated use of a minimum of standard units, etc., so many economies were made that estimated costs of this luxury building were comparable to those of standard, un-air-conditioned office space, even including the auditorium, cafeteria, and roof garden. If this be so, it is not blind admiration to state that this proposed scheme is phenomenal on all counts.

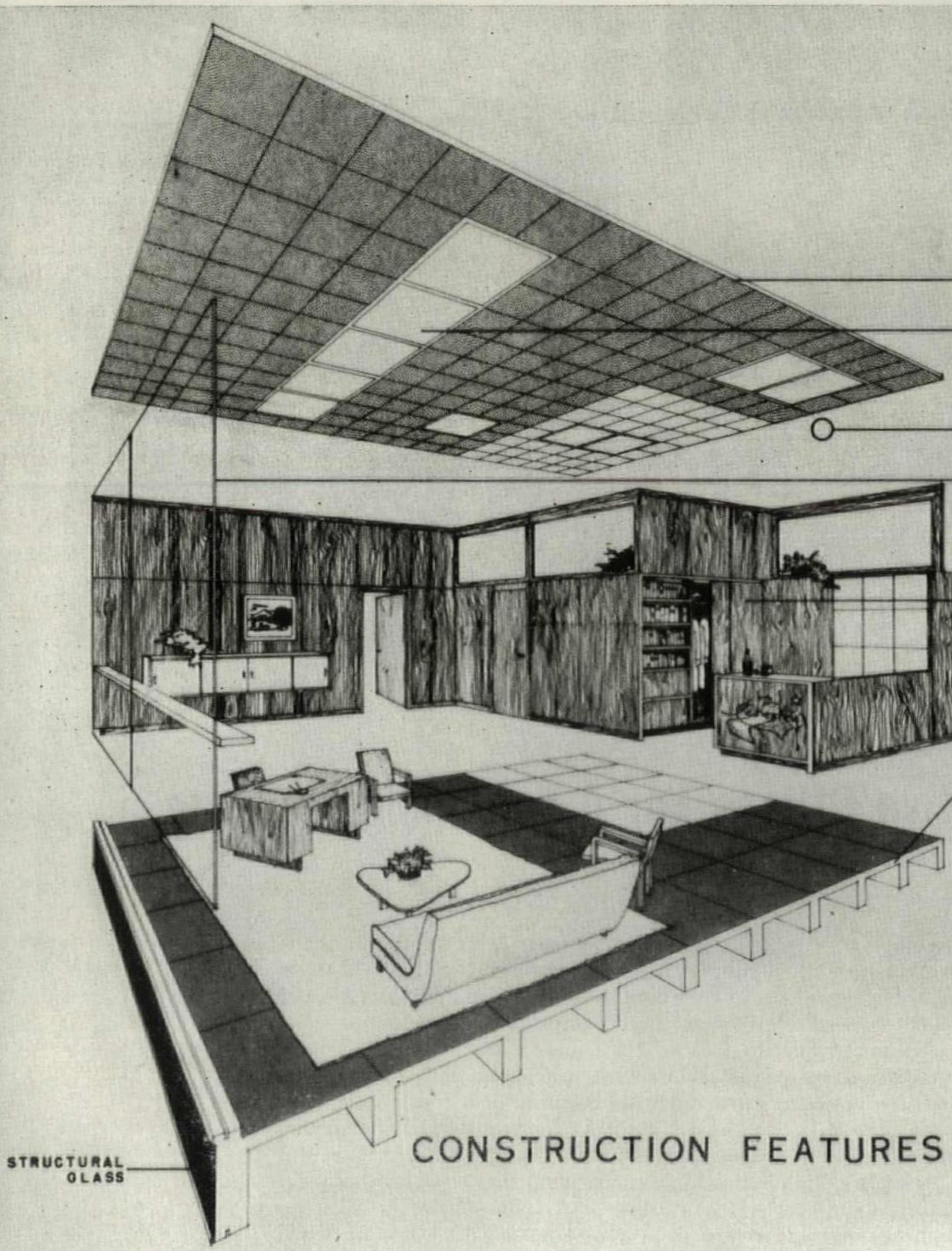
Estimates, including mechanical equipment, totaled less than $1,500,000. In this figure are all fees. The only things not included are the interior partitions, equipment for the cafeteria and kitchen, the seats, screen, curtain and projection room equipment for the auditorium, which would be furnished by the tenant. This figure equals $9.09 per square foot or $0.599 per cubic foot, despite the rise of building costs in the Cincinnati area of more than 37 percent. The contractor also found that the same principles that make for structural economy also make possible speedy construction, and that (if necessary), this building could be completed in less than 120 days—once materials are available.

The proposed heating and cooling system was figured against the conventional convector system with summer air conditioning, and was found to cost but 1 percent more for the initial installation, with a maintenance and operation saving that amounted up to 30 percent, not to mention the area saved and the greater resultant flexibility of interior layout.

Other matters where savings and advantages—conservative elements—are gained from the easy maintenance of the clean, sealed interior and the increased personnel efficiency; reduction or elimination of dust-carrying air convection currents through the use of panel heating is not easy to estimate but, in a city with Cincinnati's dirt and dust problem, it is surely a considerable benefit.

Total Facilities

General	
Central location	
Garden setting	
Visibility of building	
Basement	
All service	
Garage	24 cars
Machine room	
Storage	
Auditorium rest rooms	
Ground Floor	
Office building	
Entrances	3 streets
Lobby	2,600 sq. ft.
Auditorium	
Lobby	1,700 sq. ft.
Seating	600 people
Stage	1,200 sq. ft.
Projection booth	
Garden	
Open	12,320 sq. ft.
Covered terraces	6,200 sq. ft.
Reflecting pool	
Typical Office Floors	
(9 Floors) Area each	11,200 sq. ft.
Total office area	100,800 sq. ft.
Office Space	
Toilets (2)	
Stairs (2)	
Elevators (4)	
Dining Room Floor	
Cafeteria counters (2)	
Dining room (ceiling height—24′)	7,200 sq. ft.
Kitchen	2,400 sq. ft.
Toilets (2)	
Dining Room Mezzanine	
Observation Gallery	
Executive dining room	760 sq. ft.
Guest bar	640 sq. ft.
Food preparation and storage	1,968 sq. ft.
Toilets (3)	
Elevator machine rooms	
Roof	
Recreation room	1,600 sq. ft.
Covered terrace	820 sq. ft.
Roof garden	8,400 sq. ft.
Toilets (2)	
Elevator sheaves	



SOUND CONTROL
Acoustic ceiling throughout.

ARTFICIAL LIGHT CONTROL
Flush fixtures-interchangeable with ceiling panels at any desired location.

AIR CONTROL
Purified, dustproof, humidity-controlled, circulating air.

NATURAL LIGHT CONTROL
Double glazed Thermopane, insulating, heat and light absorbing glass. No shades or blinds needed.

SPACE CONTROL
Modular partitions and storage units, movable to any desired location in any desired combination.

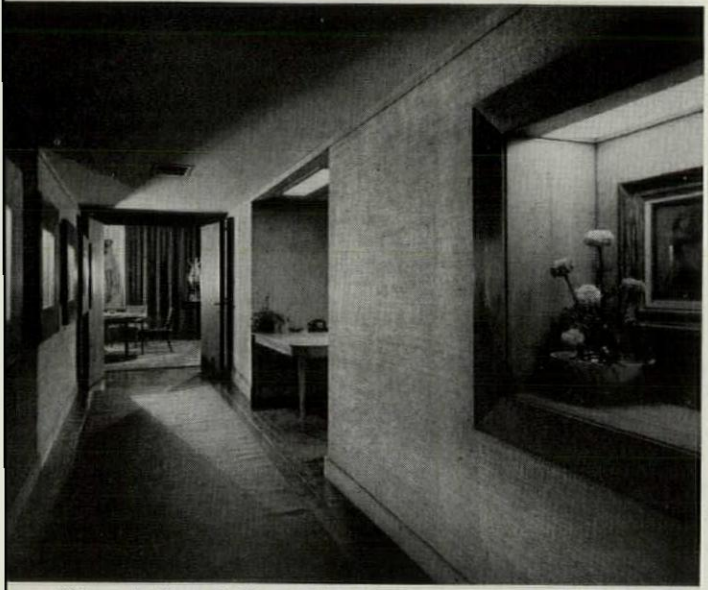
TEMPERATURE CONTROL
Floor slab contains heating and cooling coils to control temperature evenly in all areas, large or small.

NOTE
All elements are standardize and mass-produced for the maximum quality at the minimum cost.

NOTE
All glass exterior (windows and structural glass) is washed from an electrically controlled scaffold operating from continuous track on roof.

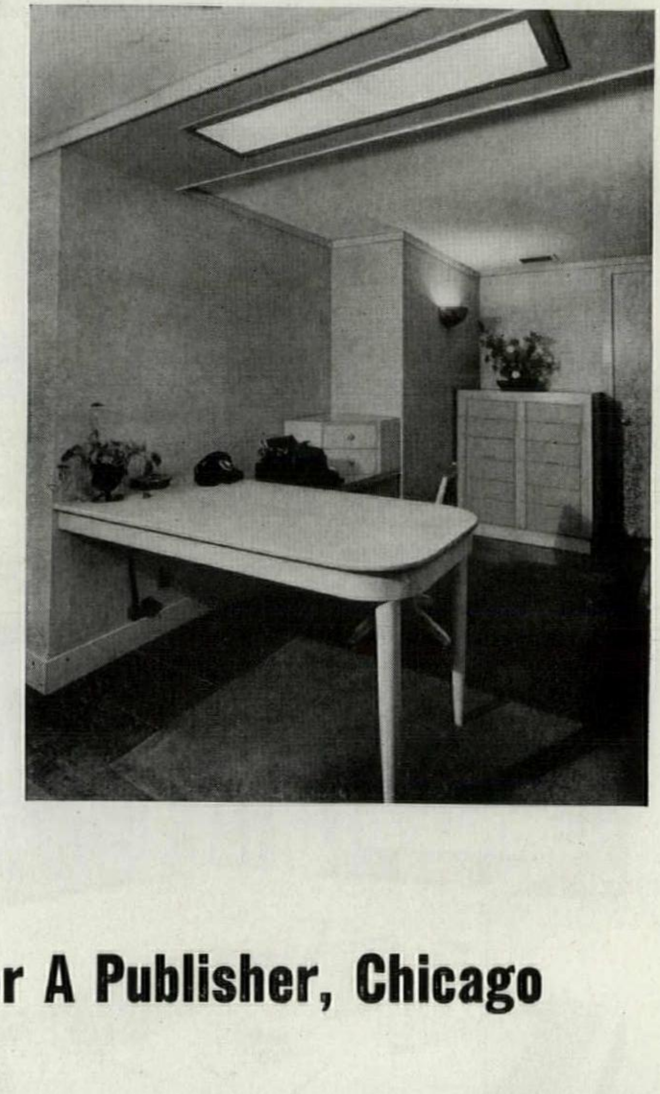
CONSTRUCTION FEATURES

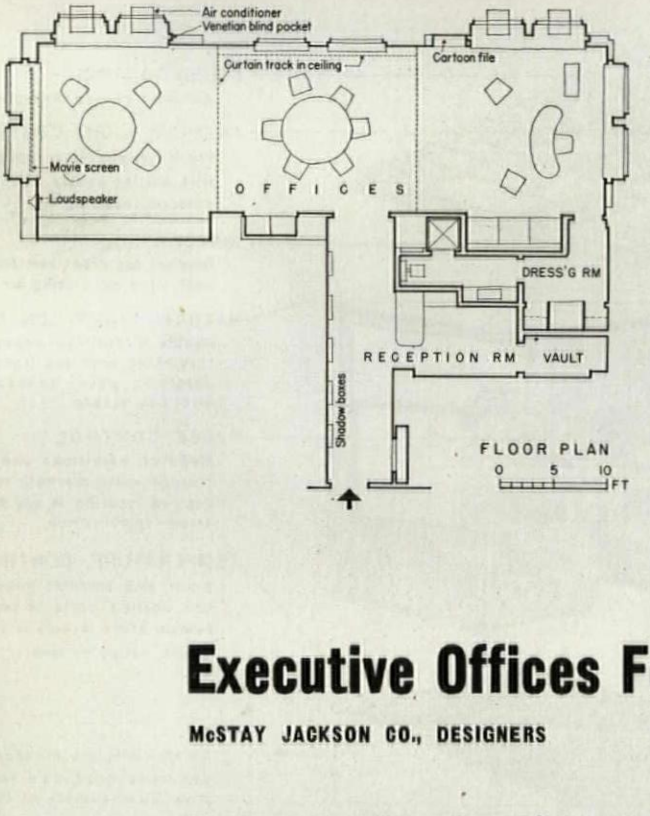
Structural elements—standardized from unit dimensioning all the way down to equipment and furnishing.



Chicago Architectural Photographing Com.

Entrance passageway. Shadow boxes at left display magazine covers. Secretarial space (right); as with the entrance, walls are natural grass cloth with birch trim. Specially designed file cabinets, table, and chair are of natural birch.



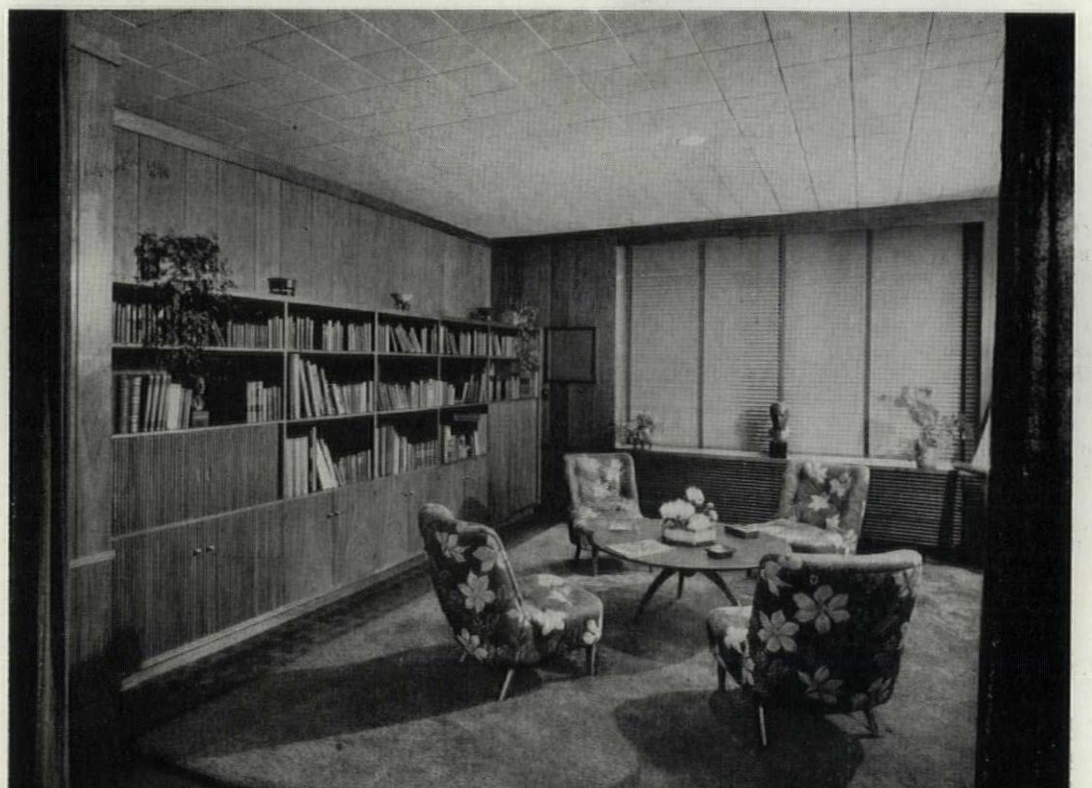


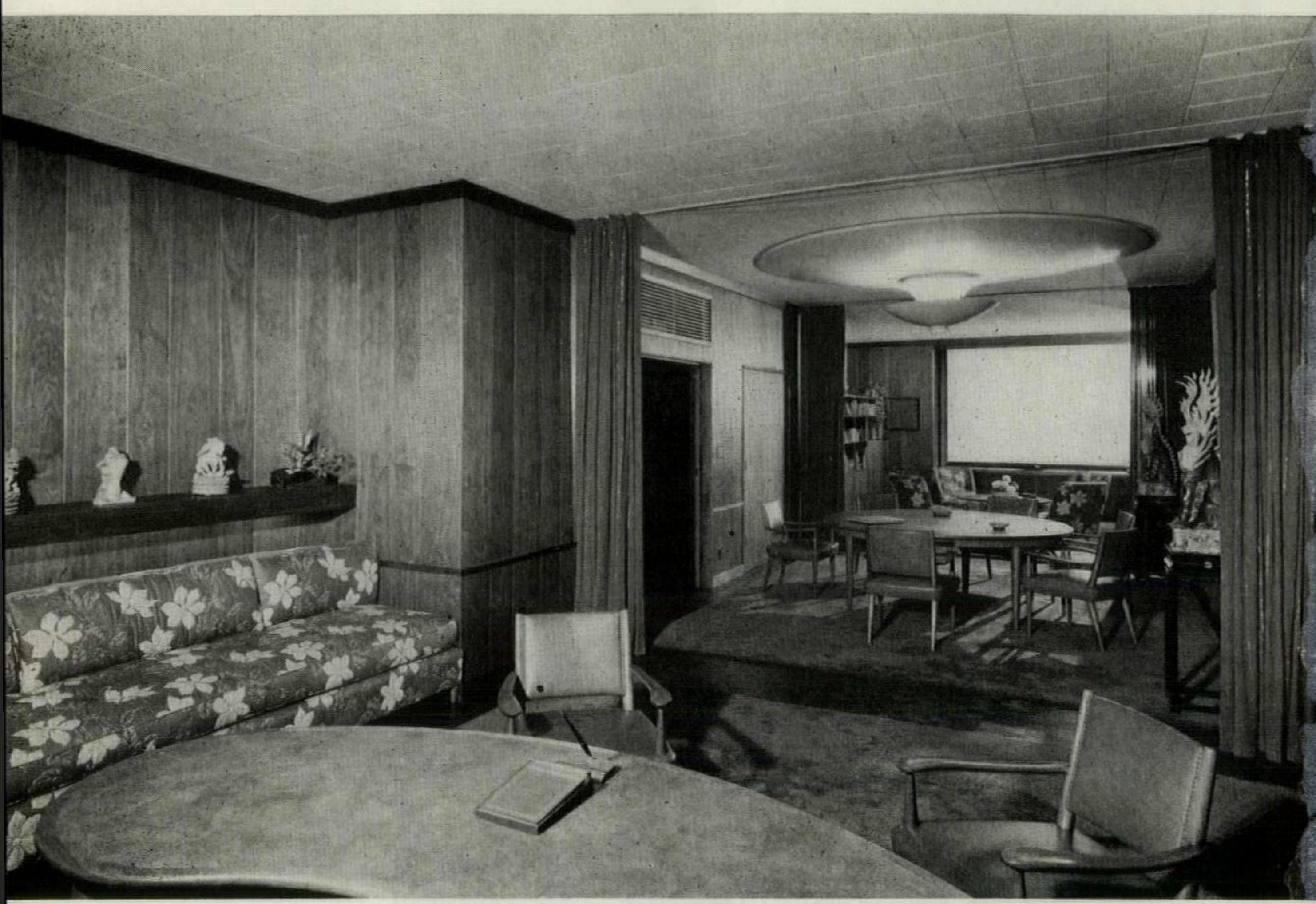
Executive Offices For A Publisher, Chicago

McSTAY JACKSON CO., DESIGNERS

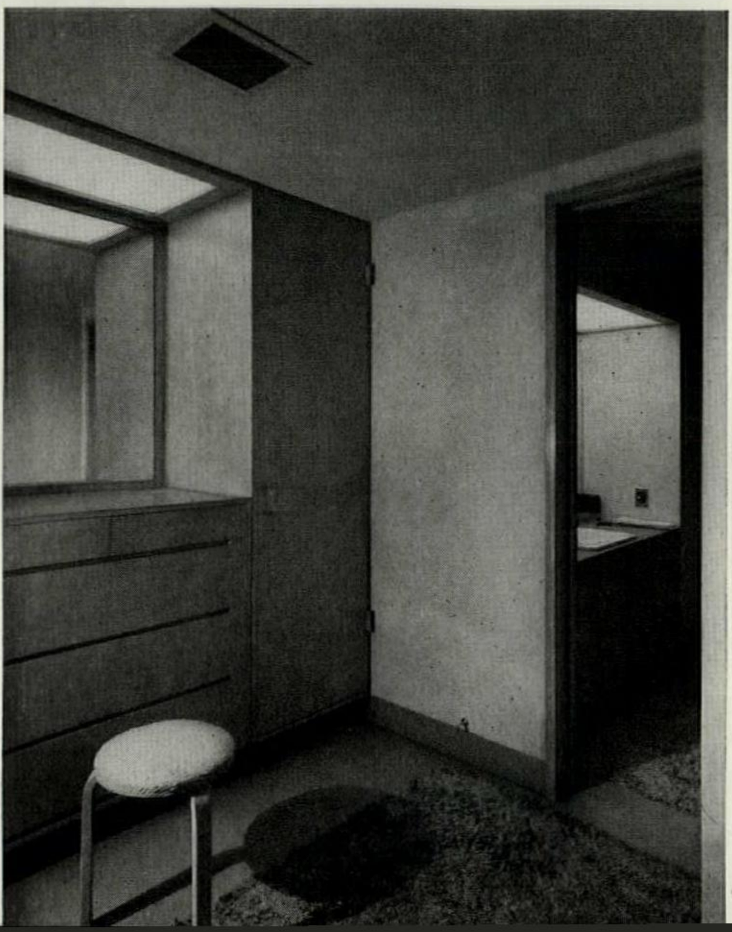
The executive offices of a publishing house frequently demand certain qualities that distinguish them from other types of offices. In many cases, those who come to discuss business are authors or artists—specialized types of highly intelligent persons with whom the organization may expect to work out collaborative arrangements that will redound to their mutual benefit. Hence, it is important, or at least salutary, to provide an environment that is rather more prepossessing than might be required of a routine business office where the impression on the visitor is of comparatively little importance. In the office suite shown on these pages, contrived within rental space in the Palmolive Building, a highly individual character has been developed, creating an atmosphere that appears to fall somewhere between that of a business office and rooms in a private home. The designers are responsible for all of the furniture as well as for the architectural treatment and incidental decoration.

The executive office above is equipped with a built-in sofa-bed. A light trough conceals the light source above the sofa. Conference-lounge space (below). Walls are paneled in walnut. In the lounge end of the suite, the specially designed chairs are upholstered in brown, green, and beige quilted linen. Built-in features include a radio-phonograph, space for recordings, bookshelves, and a small bar.





Conference area, which may be separated by curtains. Rug, bright green chenille; curtains, green textured, shot through with copper threads; furniture, brown mahogany with brown leather upholstery; acoustical ceiling. The light dome gives both direct and indirect lighting. Right: dressing room and bath; built-in cabinets and wardrobe, natural birch.



Offices For Northwest Airlines, Portland, Oregon

PIETRO BELLUSCHI, ARCHITECT

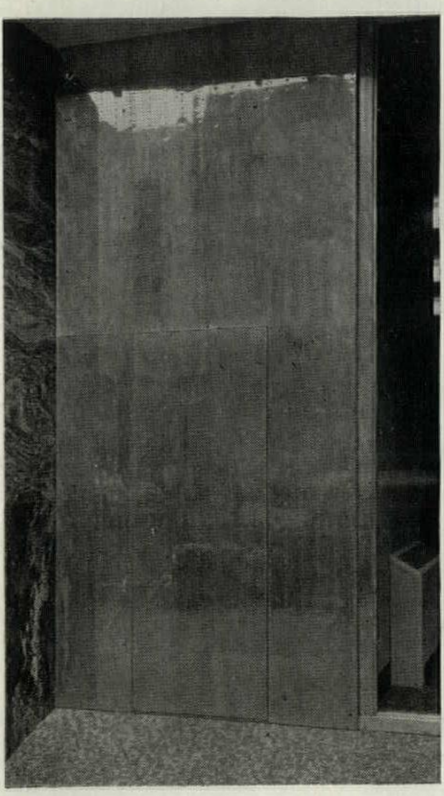


Photo-Art Commercial Studios

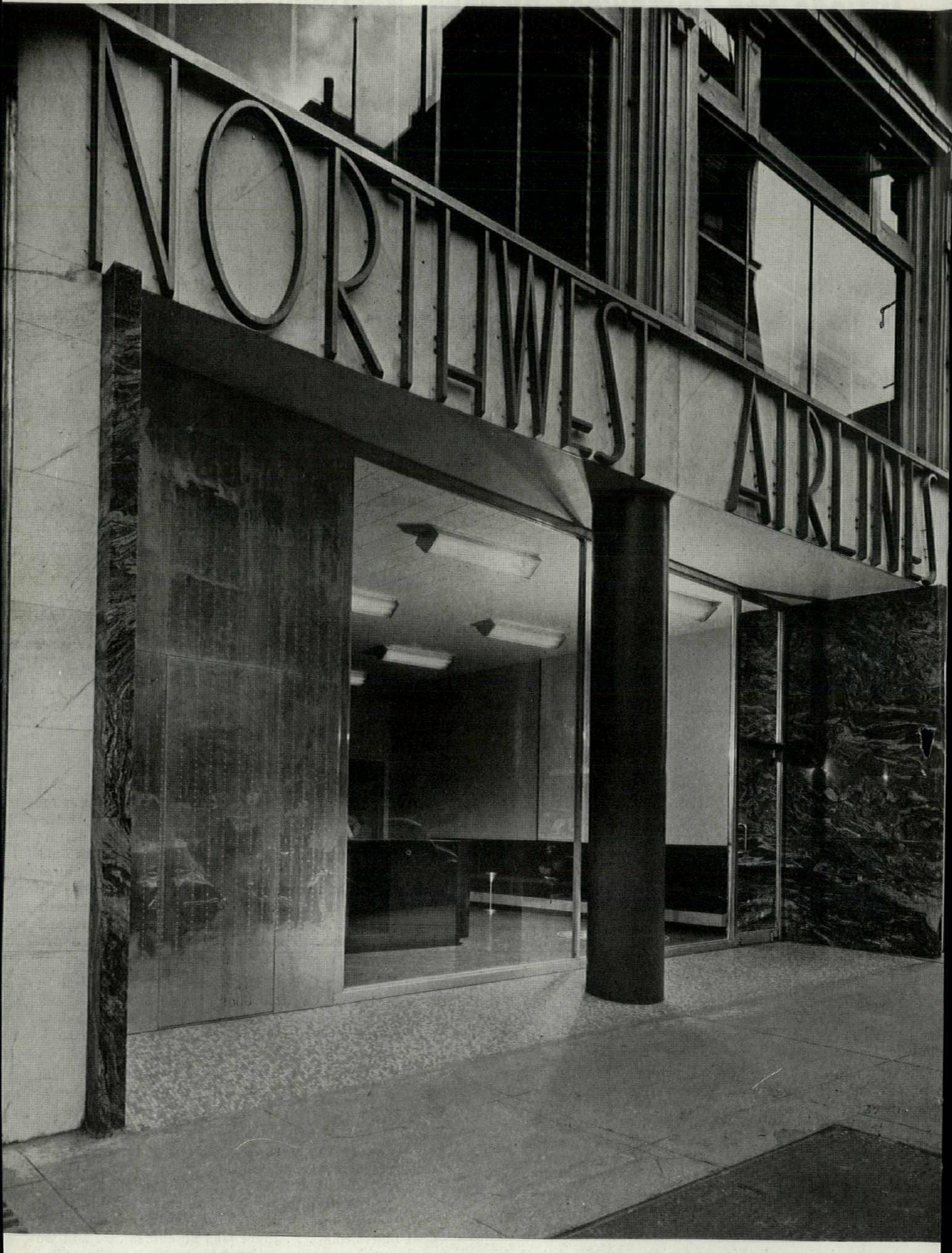
After an absence of two years, Northwest Airlines decided to reopen downtown Portland offices. The project shown on these three pages is the result. An example of what the architect can accomplish through judicious selection from a war-limited list of materials, this remodeling job is also a fresh answer to the problem of developing a suitable contemporary scheme within rental space in an older structure. As the exterior photograph on Page 72 shows, the existing building is a typical, well constructed store and office building—but hardly one designed with the air age in mind. Within this familiar framework, Mr. Belluschi had to provide ticket-sale space, passenger facilities, and business offices that would not only be efficient and convenient but would reflect some of the dash and directness that are characteristic of air travel.

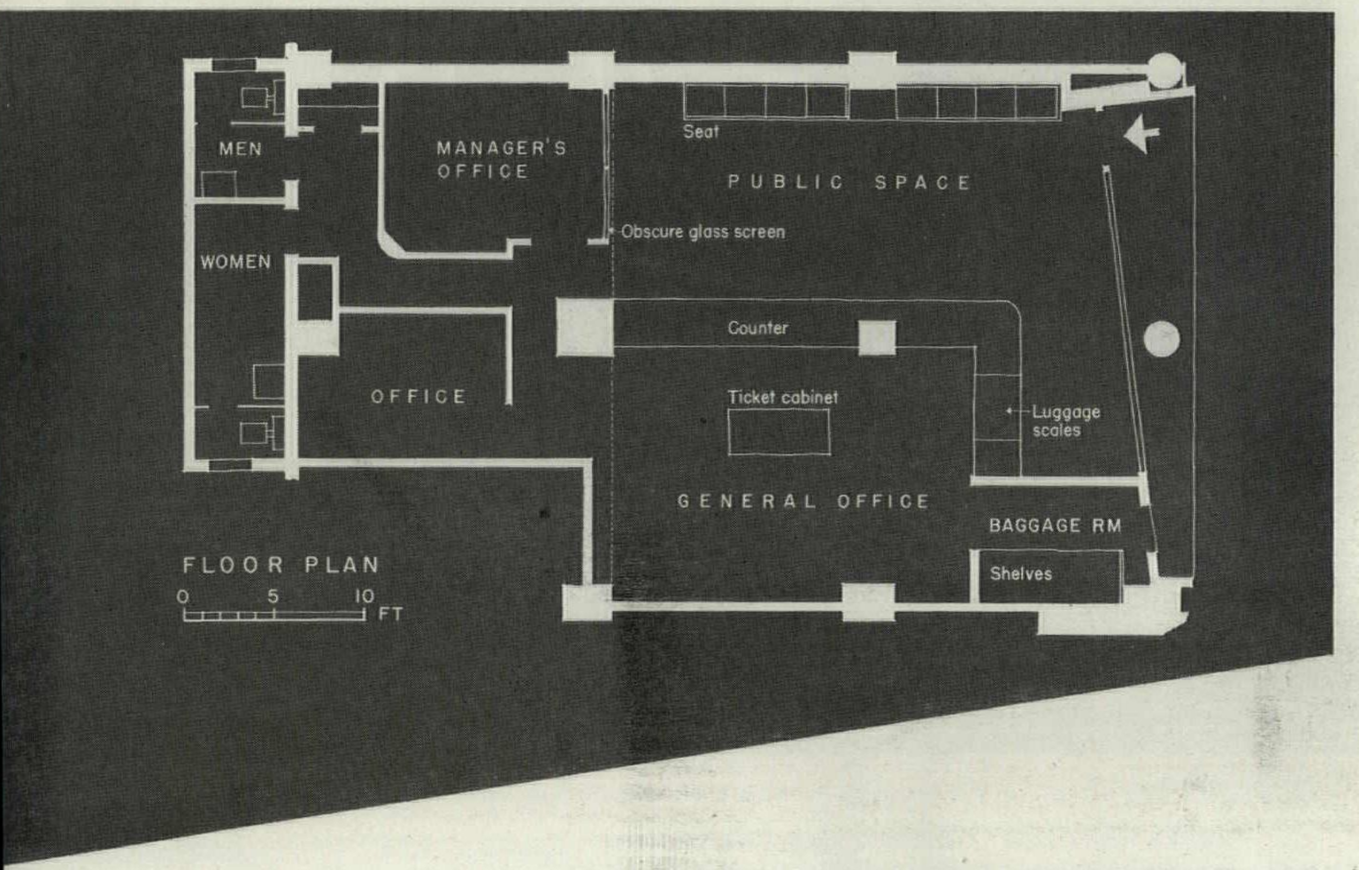
The simplest of devices were called upon to work out the solution; existing interior plaster walls are painted in carefully selected tones of gray, blue, and yellow; the ticket counter is a totally unaffected design, finished both on top and at front with a hard, black, plastic-surfaced sheet material. An installation of fluorescent lighting fixtures provides high levels of bright illumination, particularly effective at night when the whole public space is on display through the front wall of glass.

In the design of this front, the architect had his greatest opportunity for free expression. The detail of splaying the window away from the sidewalk at an angle in no way interferes with the full view of the interior which was desired, while it clearly distinguishes this particular "front" from the conventional alignment of its neighbors. A central structural column has been turned into a decorative feature. This column, originally round, was smoothed down and given seven coats of a glossy, gray-blue hard paint, topped off with varnish. The two jambs of the recess are surfaced with wave-patterned granite.

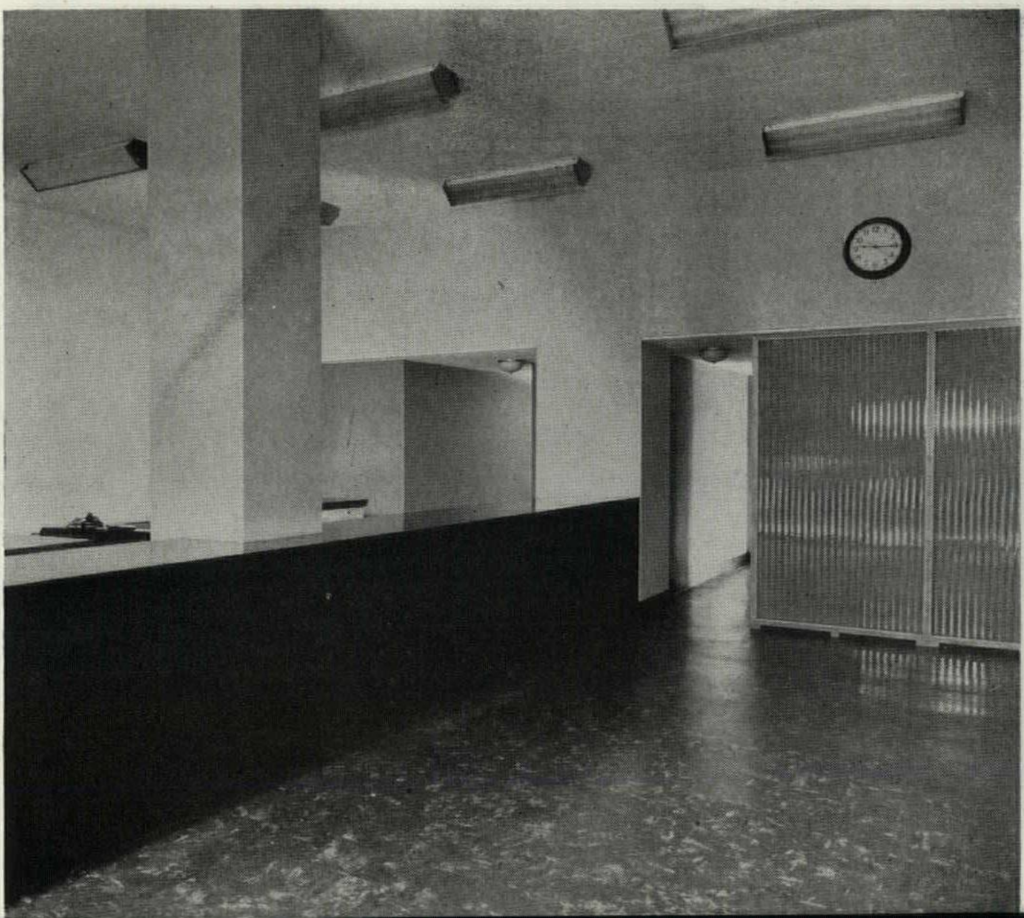
The solid wall panel at left of the window, including the baggage room exit door, employs a novel and appropriately symbolic surfacing material—sheet aluminum, secured to a wood backing by means of round-headed nails. "Without being too obvious," says Mr. Belluschi, "we were trying to introduce something symbolic of the airplane into the design of the business office. . . ."

The company name sign above the recess is made up of both letters and marble-slab background which were retrieved from the offices the airline had previously occupied in Portland. As to other materials and their selection, the architect only comments that the front was designed and built "during the worst period of WPB limitations . . . there was no choice . . . and we simply used whatever existed or became available."


NORTHWEST AIRLINES



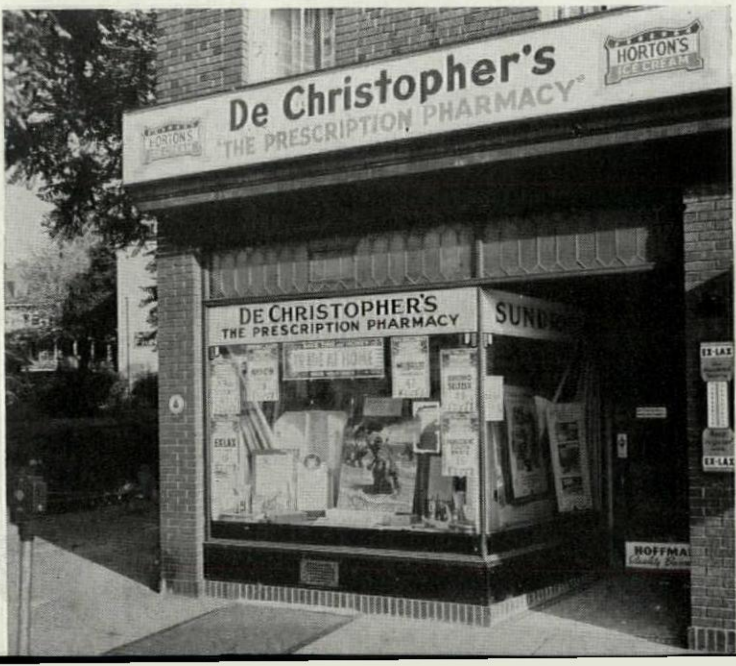
Interior walls are mainly of existing plaster, painted in variations of gray, blue, and yellow.



Rodney McCay Morgan

De Christopher's Drug Store, Peekskill, N. Y.

FRANCIS M. TUCCI, DESIGNER



At left, the old De Christopher store. The new store front is made up of as much clear glass as possible, providing ample daylight and brilliant display at night when other stores are closed. The frame is of white pine, painted light gray. The recessed wall cheek is striped white and yellow; the canopy has a white-painted stucco soffit.

Overlooking the exceptions, it is probably fair to say that the design of the drug store ranges between poor and "average." In other words, there is plenty of room for architectural progress in this category, and the "before" and "after" aspects of the project shown on these pages constitute one of the happiest illustrations of the possibilities we have seen.

Surely the original De Christopher store (see photo at bottom of facing page) is as typical of the "average" as one could find; in striking contrast, the new store, located just next door to the old premises, seems to us to synthesize much of what is most significant in the term "progressive architecture." Its accomplishment is encouraging proof that achievement of better architecture, even in a category so heavily weighted with dated standards as the drug store, is largely dependent on the willingness of the owner and the designer to sit down and ask anew all the fundamental questions, rechart the desired facilities, and translate these criteria into an honest contemporary expression.

Naturally, the creative ability of the designer is a big ingredient in the success of the result. The job done on the De Christopher store is all the more remarkable when it is realized that a very limited budget required re-use of all old fixtures and the existing soda fountain; that the store front was designed around materials that were immediately available; and that even the old pressed tin ceiling was left intact.

The owner did work with his designer in a most collaborative way, according to Mr. Tucci. In the very first conference, several sensible basic decisions were reached. Among them:

a. In an establishment that specializes (as does the De Christopher store) in prescriptions and not in trinkets, luncheonette, etc., the public does not window shop for drug items.

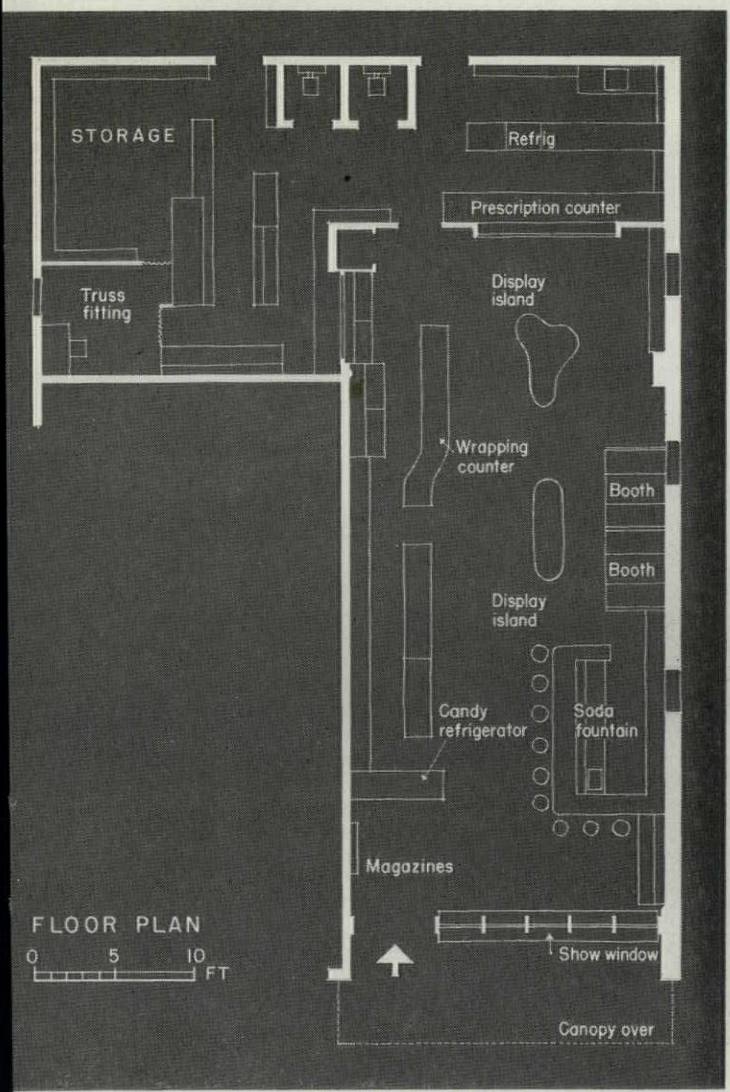
b. The customer's mind as to purchases is made up before he goes to the drug store; therefore, the problem is to get him into *your* store rather than the competitor's; when he is there, there is opportunity to sell additional merchandise.

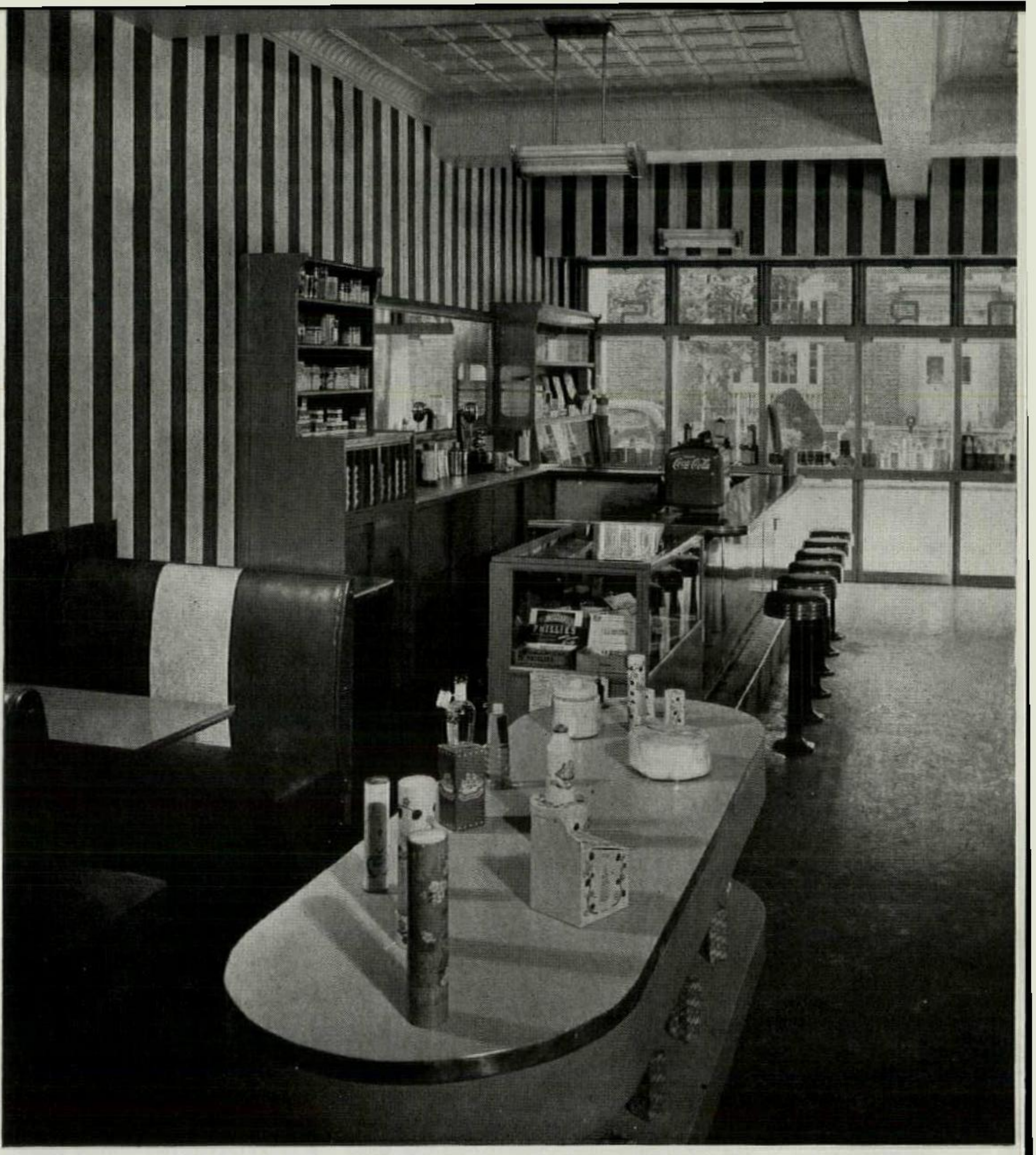
c. The prescription room should be designed to have a laboratory- or hospital-like appearance and should be prominently located and equipped with a large glass panel so that customers will notice its cleanliness.

d. The store front should have only enough display window space for clear designation of the establishment as a drug store; its chief purpose is to provide maximum visibility into the store, the entire premises serving as the display.

e. In the prescription room, distracting noise should be eliminated through effective sound control.

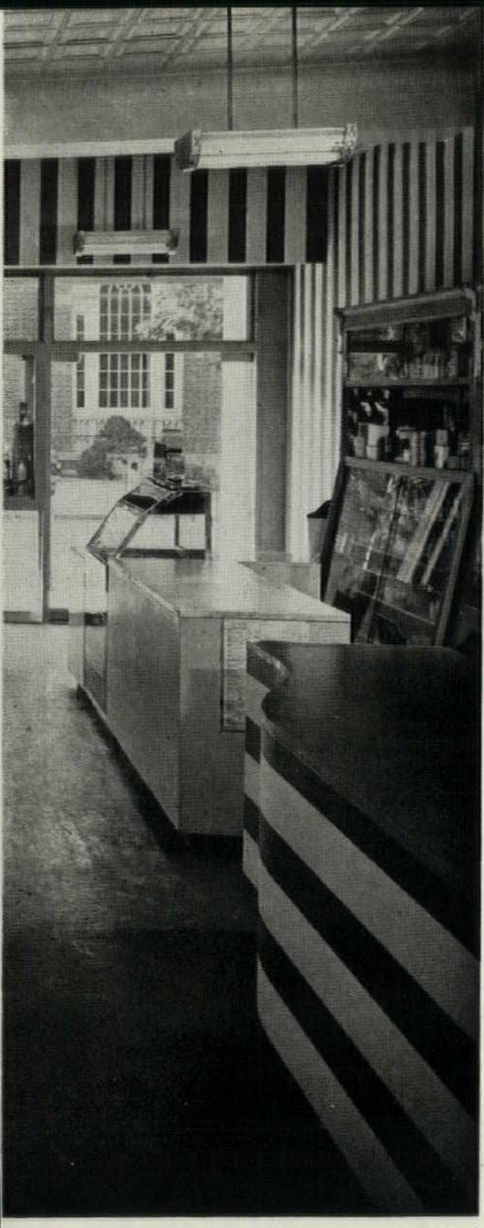
In every case, these requirements are logically met in the completed store.

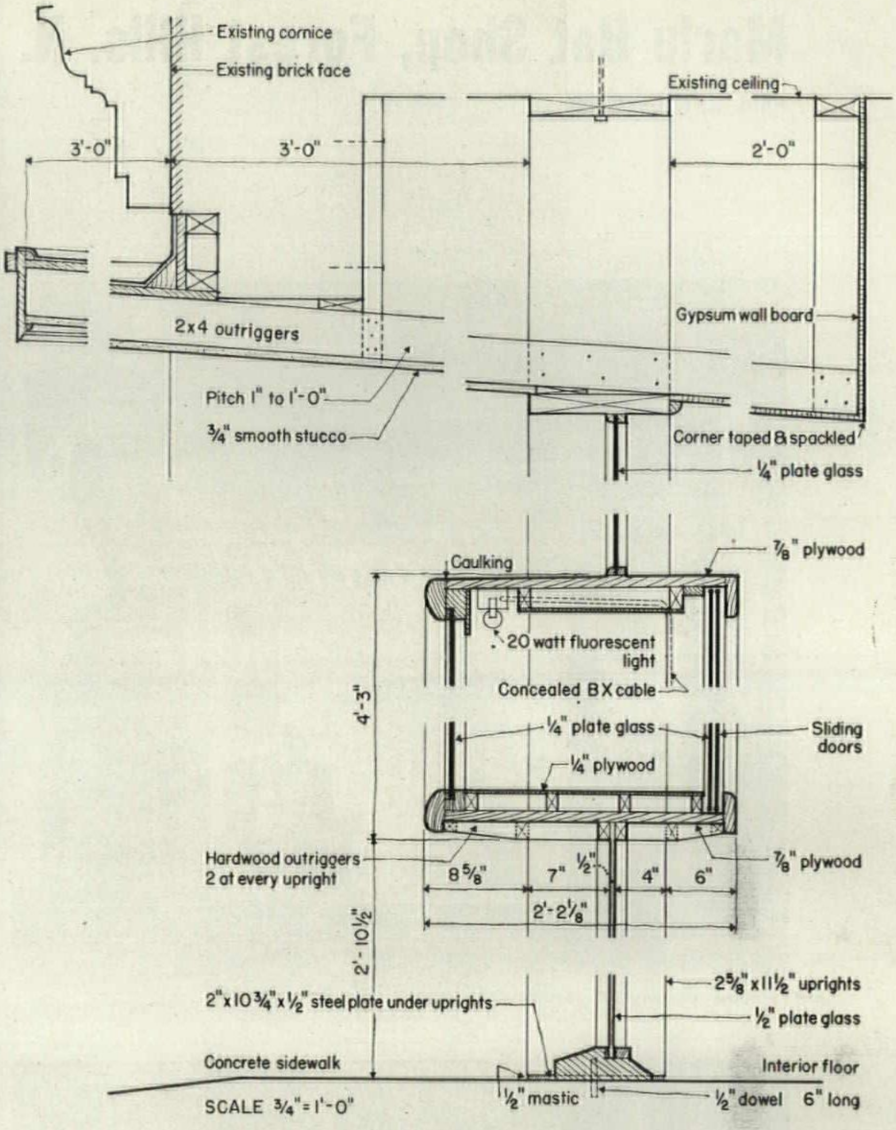




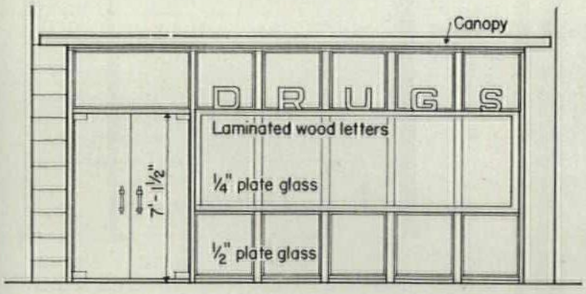
The old casework and shelving—one unit of which dates back to 1890—were merely rearranged and joined and painted the same color. The budget allowed only the addition of one new counter and two island displays. The shapes of these islands and wrapping counter were developed specifically to perform two different functions: direct circulation past all displayed items and to the prescription counter; split traffic during congested hours of business.

Gray asphalt tile floor; fixtures, gray; walls covered with bold blue and white striped paper. The island displays and the wrapping counter are of plywood; the islands are painted gray and have yellow linoleum tops. All counter tops are also linoleum.

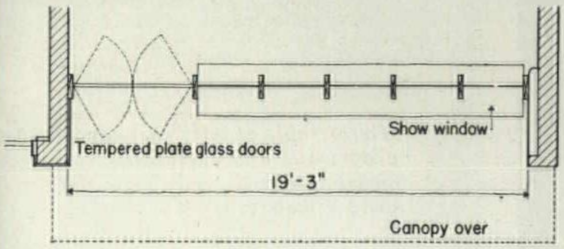




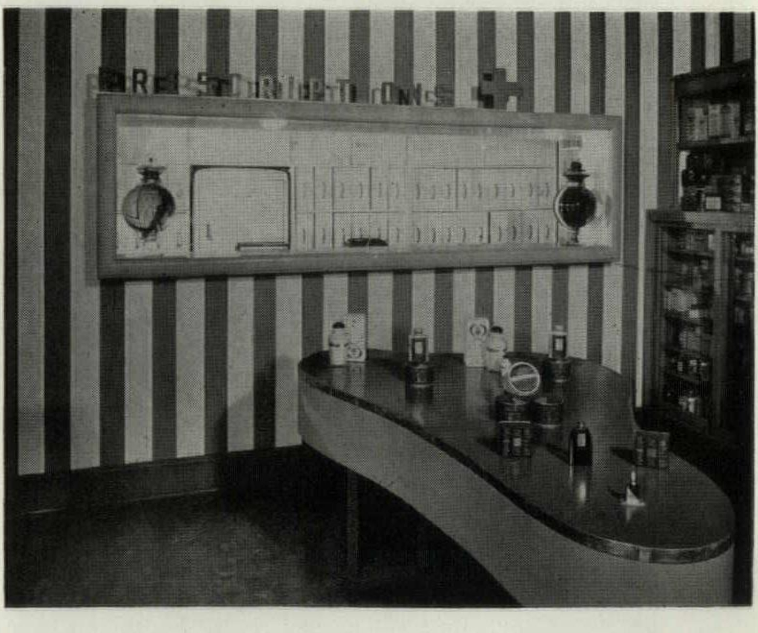
SECTION THROUGH SHOW WINDOW AND CANOPY



ELEVATION

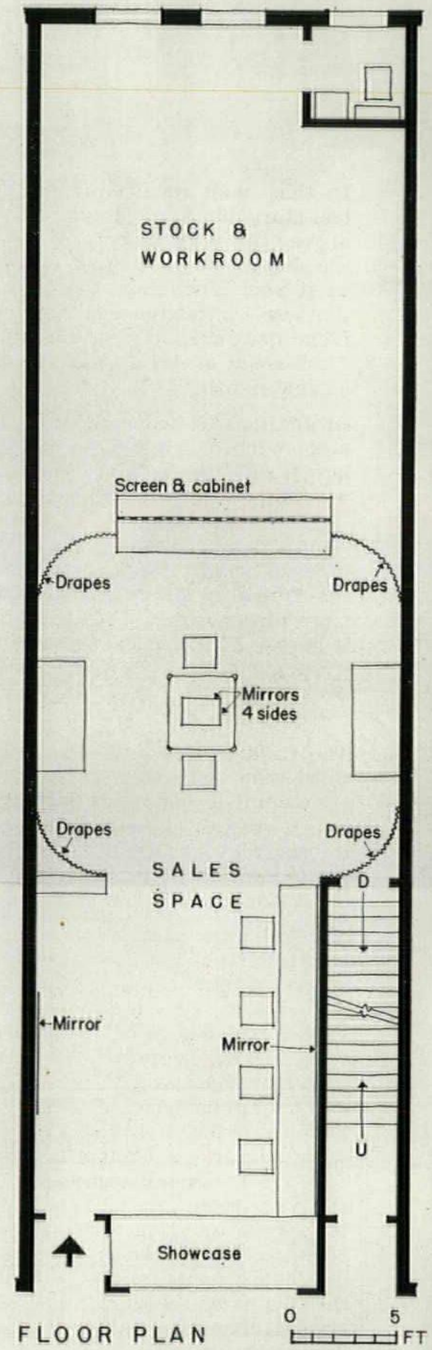


PLAN

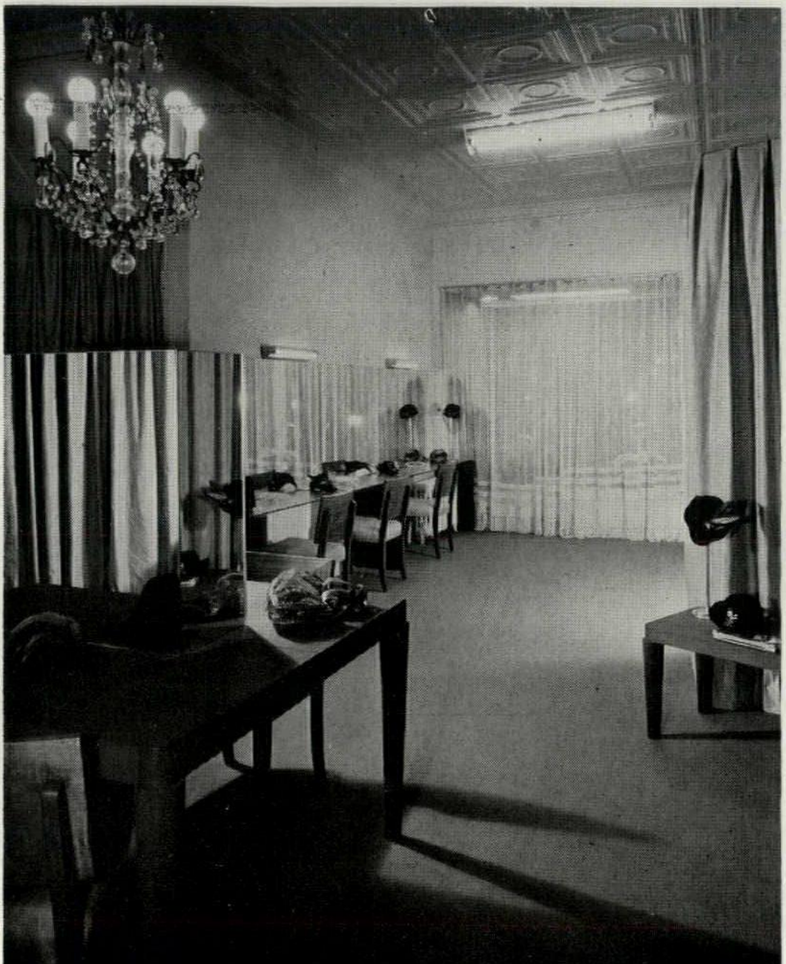


Marlu Hat Shop, Forest Hills, N. Y.

PAUL BRY, DESIGNER



FLOOR PLAN



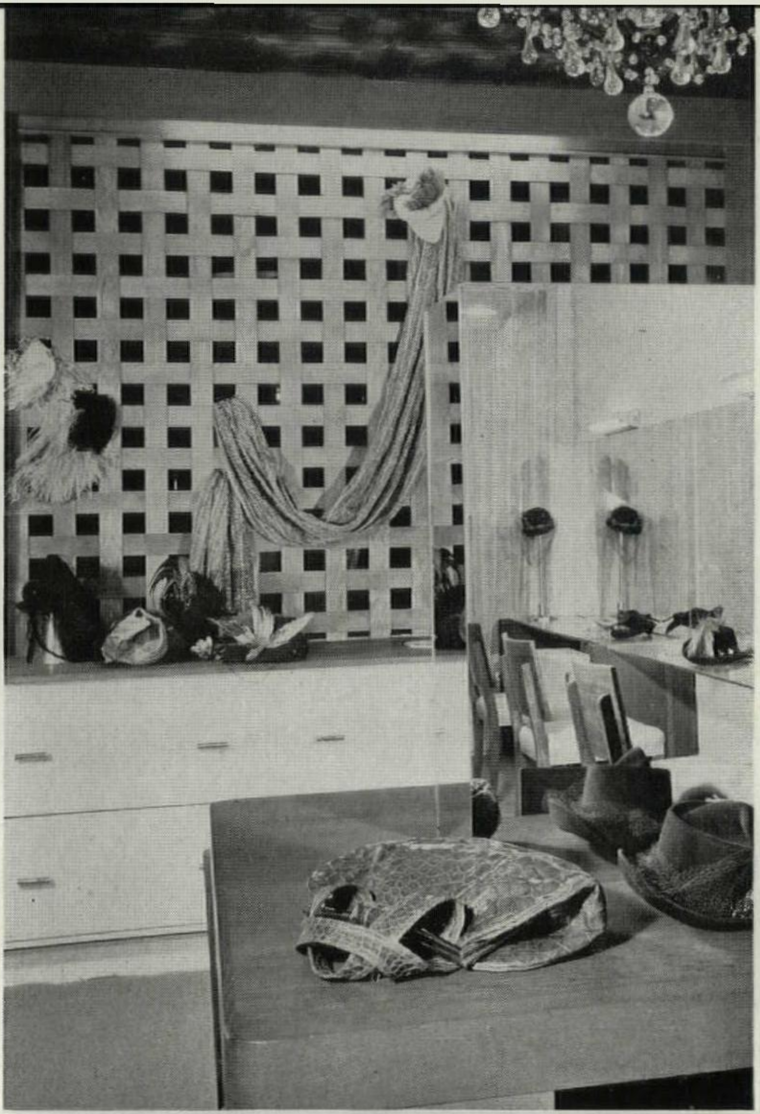
Mirror table at left; rust carpet; gray walls and curtaining; furniture, waxed redwood, with gray upholstery.

In this small remodeling job, located in a two-story block of stores with apartments above, the only structural change was in the shop front; otherwise, everything is just as it was (including the tin ceiling), and the new character was developed entirely from new carpeting, furniture, draperies, fresh coats of paint, and a modest amount of new lighting.

In addition to demonstrating what may be accomplished at minimum cost, it also shows how far a little creative effort can go toward providing an attractive, contemporary shop. By its utter simplicity, it stands head and shoulders above the average shop of this type. The large square window combines the functions of both the traditional and more modern theories of shop-front design. It serves as a display for merchandise, but since the back is omitted, it also functions like an open-front scheme to frame a view of the entire store.

The front is of waxed redwood siding, with wood trim and lettering painted flat white; the awning is rust color. Since hats in themselves are full of color, the idea within was to provide a simple neutral-toned background which would allow the millinery to speak for itself.

The walls are painted gray; the mercerized cotton curtaining and the furniture upholstery are also gray; the all-over carpet is a rust tone, chosen to harmonize with the waxed redwood of the furniture and casework. In the center of the rear sales space is a four-sided mirror table that accommodates four customers at once; along one wall near the front of the shop, a sales counter with mirrors is equipped with chairs for four more. Dividing the shop proper from the work room behind, is a case of drawers topped by an open lattice screen made of redwood veneer strips. This is used as a display background and permits a view of the shop from the work-room. The elaborate crystal chandelier is supplemented by new fluorescent fixtures.



PHOTOGRAPHY FOR THE ARCHITECT

By G. E. Kidder Smith, A.I.A., A.S.P.A.

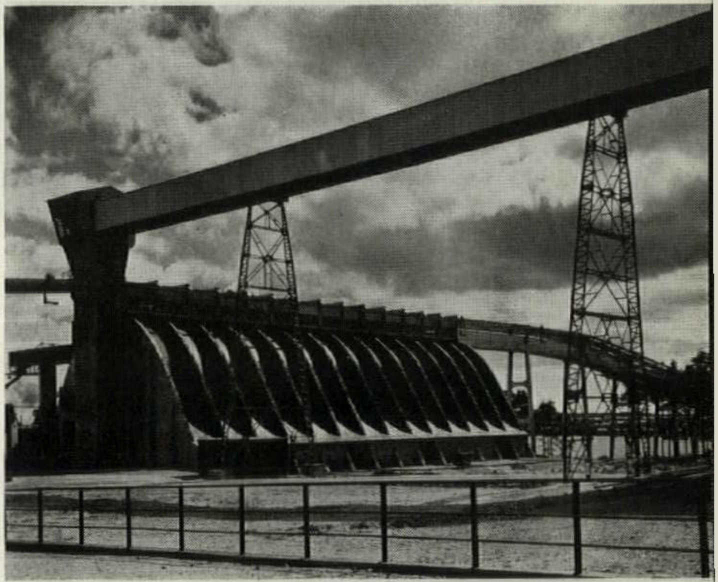
Having a natural interest in photography and several unusual opportunities to develop it in the last half dozen years, I have picked up by much trial and considerable error some useful points of procedure. A professional would undoubtedly disagree with many of them, and of course all have exceptions, but in the main I believe them to be helpful. Almost all of them revolve about expressing a brilliant play of light and shade, for to me this is the essence of architectural photography (1, facing page).

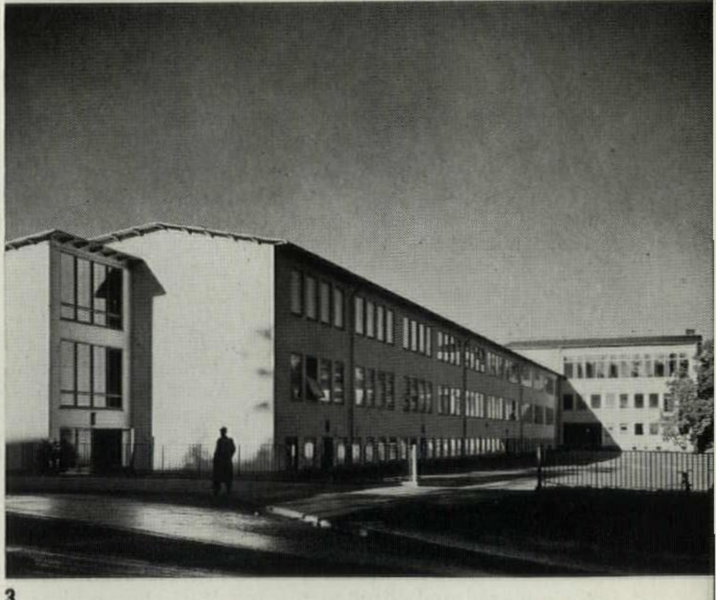
Throughout the day the sun plays on our buildings, producing changing effects, emphasizing certain features we wish emphasized or vice versa, bringing out by quantity and angle of sun the three-dimensionality and rhythm of the design (2). Most of us forget this when we set forth to photograph even our own buildings, and snap with little consideration of what the light might be two hours earlier or later.

What then should be our approach; how had we best begin to photograph our buildings? Start with a bright, sunshiny day, preferably with a few harmless clouds thrown in to break up sky areas. Then, site plan and red pencil in hand, stroll leisurely around the entire project, forward and backward, noting the angle of the sun and estimating at what time it will be best on the sides or sections you wish to photograph. This can be done almost any time of day and forces you to imagine light conditions at other times. I make small arrows on the plan with 9:00-10:00, noon-2:00, 4:30-5:00, etc., indicating where the sun is (or should be) good at these times. By a "good" sun is meant one—and this is immensely important—which is strong on *one* facade, generally the main one, and *not* on the adjoining one (3)—in other words, with the sun from the side or even slightly in front (4), but not directly behind. Select only the most expressive and revealing illumination; make the building play with light and shade; make the chiaroscuro sing (5). Composition must be "felt," but lighting can be analyzed, and there is no excuse for bad examples. Note when eaves cast interesting wall patterns, when trees project shadows in the early morning or late afternoon, when the foreground will be in shade and the main subject highlighted (8), when a hole in passing clouds spotlights the subject (7), when contrasts sparkle. (Incidentally, this consideration of the amount of sun on various facades never did any architect harm.)

Having chosen the lighting, we must interpret the atmosphere and character of the subject. Beware, however, of snapping without thinking. We often have what might

2

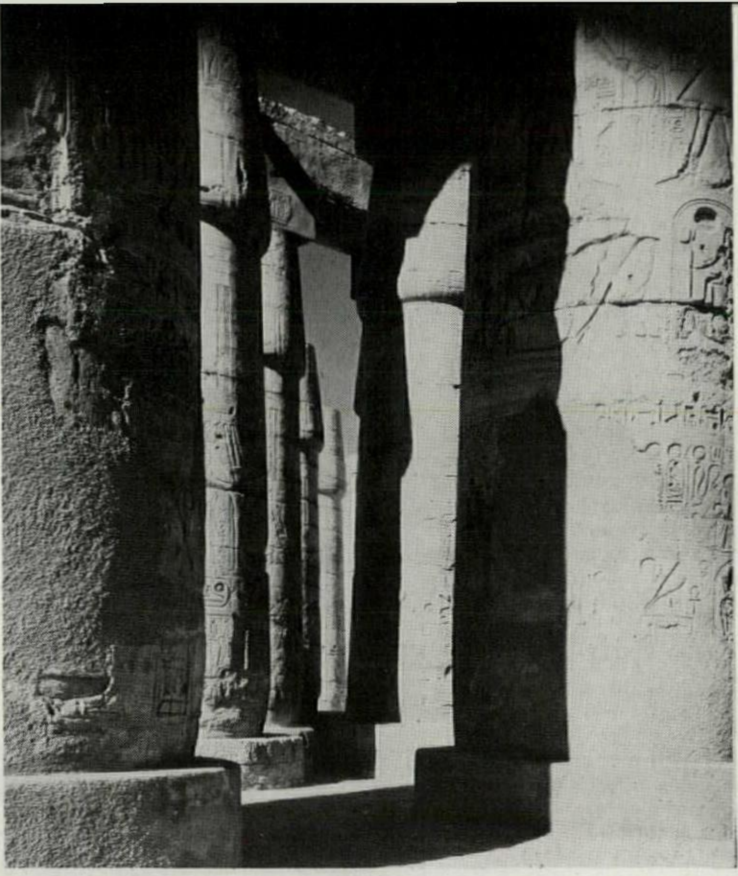




3

4

1. (facing page) The Theseum, Athens—"a brilliant play of light and shade." 2. Sunila Pulp Mill, Finland. Alvar Aalto, Architect—"the sun . . . emphasizing certain features." 3. Elementary School, Stockholm. Paul Hedquist, Architect—"sun strong on one facade." 4. The Parthenon and Erechtheum—"sun from the side . . . but not directly behind."



5

be called "preposition trouble" in that we seek only a picture *of* the building instead of one *in* the building. If we *concentrate more on getting a good picture*, than on the amount of subject shown (6), we will in most cases get what we want in the building; but if our conscious end is directed only toward a picture of the building and the camera is used merely to record that end, we will get no more than this record.

We will first want to show the subject as a whole, and the initial reaction is simply to move back far enough so that the lens subtends the structure from end to end. However, this will seldom produce a complete impression, for we have included only the building and little of what goes on around it. It is therefore generally wise to get off far enough to relate building and landscape, and tie it to surrounding trees, rocks, water, or other buildings (7, 9, 10). If the building hangs over a lake, by all means include it; if near a forest, go in and shoot out (often better than with the woods merely as a background); if hemmed in by city buildings, try the roof across the street. But whatever is done, do not walk up and thoughtlessly shoot from the hip.

Having taken the subject from a distance as an entity related to setting, let us approach for more specific views, revolving about the subject as we draw near, to obtain a series of photos that is complete from over-all to detail. (11) is an example, being a detail of the church in (7). Seek, then, the character-giving parts which tell the story, the important points, the features. Eliminate the superfluous which obscures the structure. As an example, note the photograph of the school with the prominent outside stair (12). This is obviously the feature of the entire building, yet if the camera had been placed to include the whole school, the stairway would have been lost.

Even after we have found the best light and the part we wish to accent most, we must still arrive at a composition. This is obviously of the essence, and one could argue about it for a hundred and three years, but it is the architect's strong point—or at least one with which he has nodding acquaintance. Many ingredients are needed: a dominant (usually), a certain equilibrium (*very* rarely symmetry), variety of line, mass, light and shade, rhythm, and other abstruse elements which one can read about in the savants' notebooks. I try to sidetrack all divine triangles and optical metaphysics by the simple device of squinting. Squinting gives contrasts similar to that on the final print and helps flatten the three dimensions of the scene into the two of the photograph.

Although the "framing school" with vistas through pretty arches is trite, the device of holding down the foreground with parts of another building, trees, figures, etc., will often give depth, especially if the foreground value is darker than the background. Note, in the picture of the Old City in Stockholm (13), how the main subject matter is projected back in space by the foreground. In addition to giving depth, a strong foreground can be the basis of the whole composition (14). If this foreground can recall the main element architecturally, so much the better. An example of this is seen in (16), where the column bases are really details of the columns beyond.

If our subject matter is composed of a number of separate buildings, there will be many opportunities of projecting them in space by light and shade. Do not approach a group with the idea of getting only individual shots of each, but relate them to each other, tie them together, give an impression of spatial composition. It is not necessary to include whole sides of each to do this. As a matter of fact, more can often be said by a choice detail than any over-all panorama. In the two pictures shown in (15) and (16), taken on the Acropolis, an attempt was made to give *impressions* of the relations of the buildings—not catalog them archeologically with every column and cornice showing. Is this not more satisfactory than a sunless photograph showing every mortar joint of each block of marble? Relating two buildings as shown can be termed an extension of the point mentioned above with regard to having some element in the foreground to give depth; in these cases it fills a dual function.

The second of the two illustrations recalls another point which it is useful to bear in mind—camera height. I wanted in this case to give some feeling of the crowning quality of the Parthenon. If the camera had been at eye-level it would only partially have succeeded, but by placing it almost on the ground the whole building is made to seem on a pinnacle. Furthermore, by including a small section of the Propylæa in the foreground, with its rather rhythmic shadow, the composition was given depth and plasticity. (It was of course necessary to stop the lens down as far as it would go to give sufficient depth of focus, and also to make use of the swing front.) Note that the picture was delayed until the sun just picked out the edges of the columns at left, giving life to the shadow side. As (17) will show, a high camera position is sometimes more expressive than a low one.

The use of scale figures as commonly done on drawings can be carried over into photography as well. In architectural sketches we make them part of the composition or include them unobtrusively for reference only. In photography we can do likewise; however, avoid at all costs backing some unfortunate up against the wall, whence he self-consciously stares into the camera. Make the figure fit into the picture naturally; make it a considered part of the composition. Try placing a friend in the spot you think best, have him face *away from* the camera, and in the act of taking a step—not standing stiffly (18 and 19). Figures can be used in a number of ways; for reference only, to lead the eye into the picture, or as a strong point of the composition to hold down a whole side of the picture (18). To show how essential the figure is in this last shot, cover it up and note how the composition falls apart. In photograph (20), the figure was used to lead the eye into the picture. In this case there was no posing. I merely waited until someone came along, and used a fast enough shutter speed (1/50 of a second) to stop him.

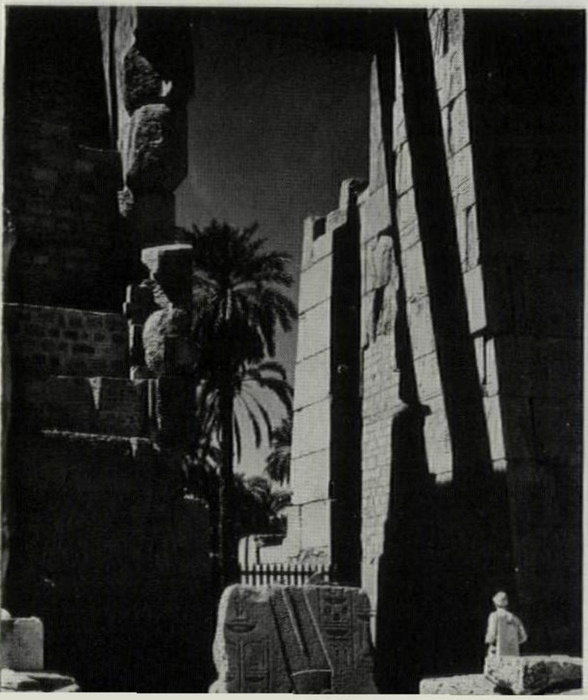
Interiors are undoubtedly difficult. In addition to the obvious need for wide-angle lenses, a battery of lights seems necessary. The main idea, as I understand it, is to illuminate the room so that contrasts are weaker than you think they should be, with dark corners non-existent. At any rate, this is the safest way to start. However, I find that a surprising amount can be done with natural daylight, sometimes supplemented by fixtures in the room. The lovely Hedquist auditorium (21) was taken in the very early morning when the sun was streaming across the entire width. Beware of trying to contain, in naturally lit rooms, scenes through open windows and outside doors; either the interior will be under-exposed or the outside over—or both! Also, in taking interiors, move out some furniture, or the picture will make the room look more cluttered than it actually is.

Equipment and technical apparatus have been purposely left to the end, as their importance is always less than that of the man. The best camera in the world can take the poorest pictures, yet the expert can produce top-notch stuff with even a Brownie. Architectural photography does, however, make demands unknown to most other outdoor work. Good pictures can be made with almost any camera, but a moderately good one will let you take more and better ones—IF you know how to use it. In any case, get a simple machine first and graduate only when you find yourself limited. I believe the best kind for architects is the rectangular ground-glass back, folding variety,

5. Rameseum, Thebes—"make the chiaroscuro sing." 6. Temple of Karnak, Egypt— "amount *of subject secondary." 7. Ouro Preto, Brazil—"a hole in a cloud spotlights the subject." 8. Royal Palace, Stockholm (Early 18th century)—"foreground in shade . . . main subject highlighted."*

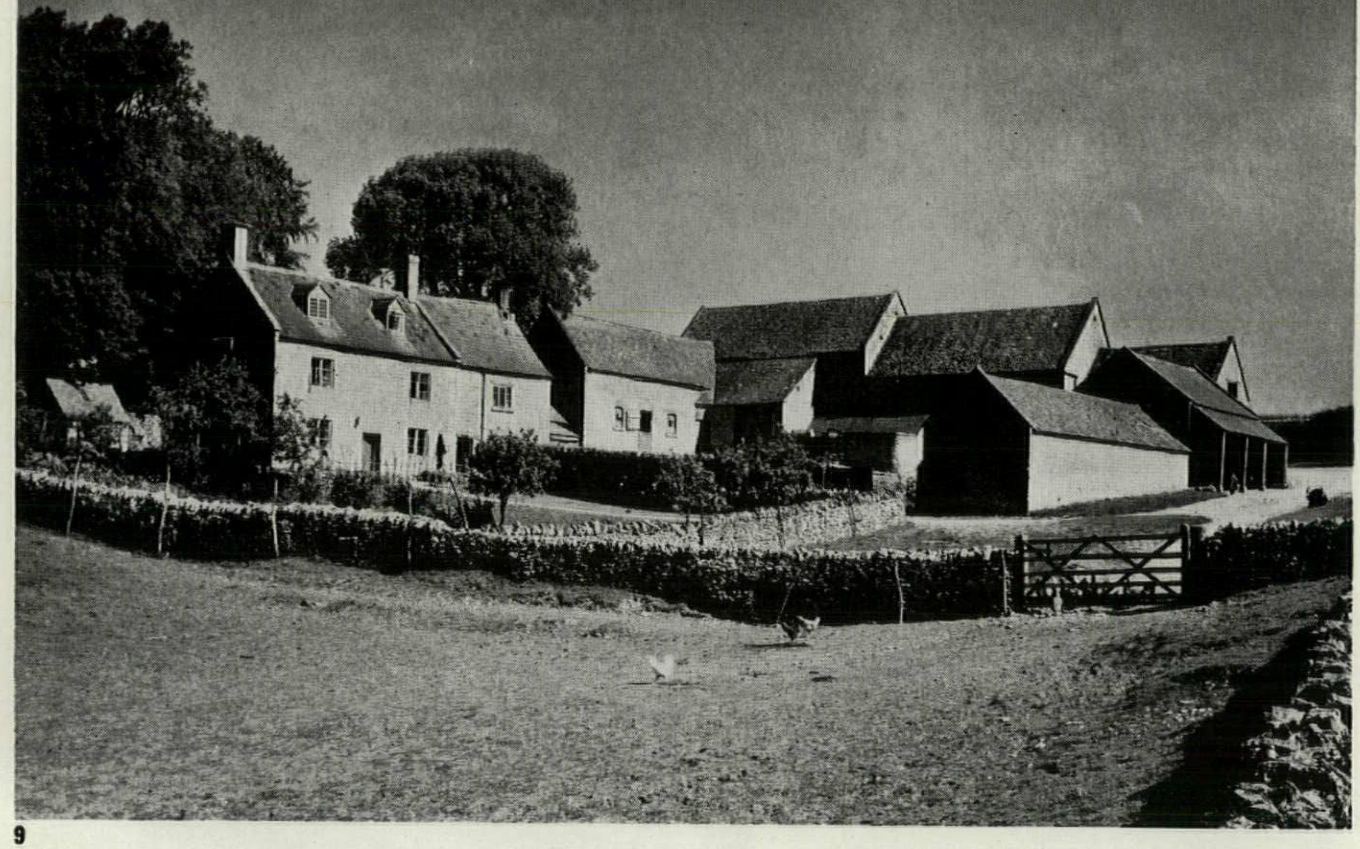
7

6



8

9



9. Cotswold Farm, Gloucestershire—"relate building and landscape." 10. Cooperative Apartments, Stockholm.

10

11

12

11. Ouro Preto, Brazil—"approach for more specific views." 12. Industrial School, Stockholm. Paul Hedquist, Architect—"seek the character-giving parts."

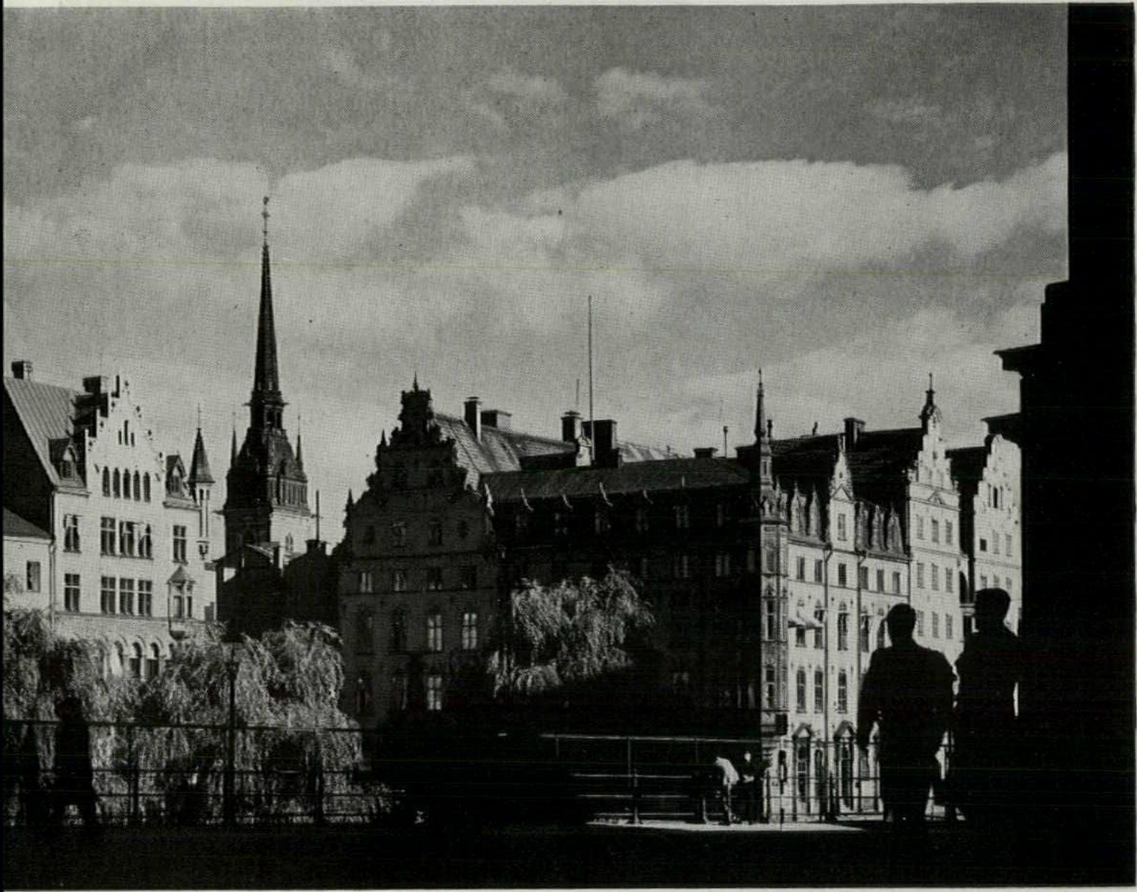
equipped with rising and sliding front, and taking film packs. This is best used on a tripod, for several reasons. *One*—with the ground-glass back, one sees what the lens takes, *exactly and full size,* before it takes it. No matter how accurate the usual finder may be (and this includes those corrected for parallax), there is always a degree of uncertainty which the ground glass obviates. Nor will an optical finder give anywhere near the image size of the final print. By focusing and composing on ground glass, we are not only sure of the amount the lens subtends but of its focus as well. *Two*—the ground glass translates the three dimensions of the scene into only two. This is extremely important in any photography but especially so in architectural work where a difference of several feet might cause considerable change in the picture. It is obviously easier to determine a composition relative to two dimensions than to three. Ground-glass viewing, with its ease of composing and focusing, is the main reason for the great success of the twin-lens reflex cameras such as the Rolliflex, Ikoflex, Argoflex, etc. *Three*—the ground-glass, film-pack type of camera almost always has what is called a rising, falling, and sliding front, a feature almost no miniature and few roll-film cameras possess. This simply permits you to keep the camera back level and elevate the lens front relative to the back to include the subject from top to bottom as shown in (19). The distorted perspective which results from tilting a camera which does not have this feature is well known and is inevitable unless the back is parallel to the building. Many cameras of this type also have "swings"—which means that the lens front and back can be turned to various angles—a feature useful in more advanced work, in that it gives more freedom in focusing and composing.

There are other advantages in this kind of camera, such as interchangeability of lenses, etc., etc., but the ones mentioned are sufficient to justify its choice. Fortunately, such cameras are not overly expensive—not nearly as costly as some of the fancy miniatures—and several makes, both domestic and imported, can (or could) be had. The preferred sizes are 2¼" by 3¼", 3¼" by 4¼", or even 4" by 5". I think that either of the first two would be handier and cheaper than the latter, especially for the beginner. I feel that the 35 mm. camera is more or less a waste of time, especially for the architect. Others will disagree, but I find I use mine only for color.

After the camera, a tripod comes next in importance. The mention of "tripod" may make you think you are getting in for a lot of fuss and bother just for a few pictures, but if you want results you must expend the effort. You will soon find that a light metal folding support (although the bulkier wooden ones are sturdier) will become second nature. I carry thirty pounds now, fifteen on each shoulder, and don't give it a thought. The theory of the miniature—take a dozen shots, one is bound to be good—will never produce results equal to one thoughtful composition with a ground-glass camera on a tripod.

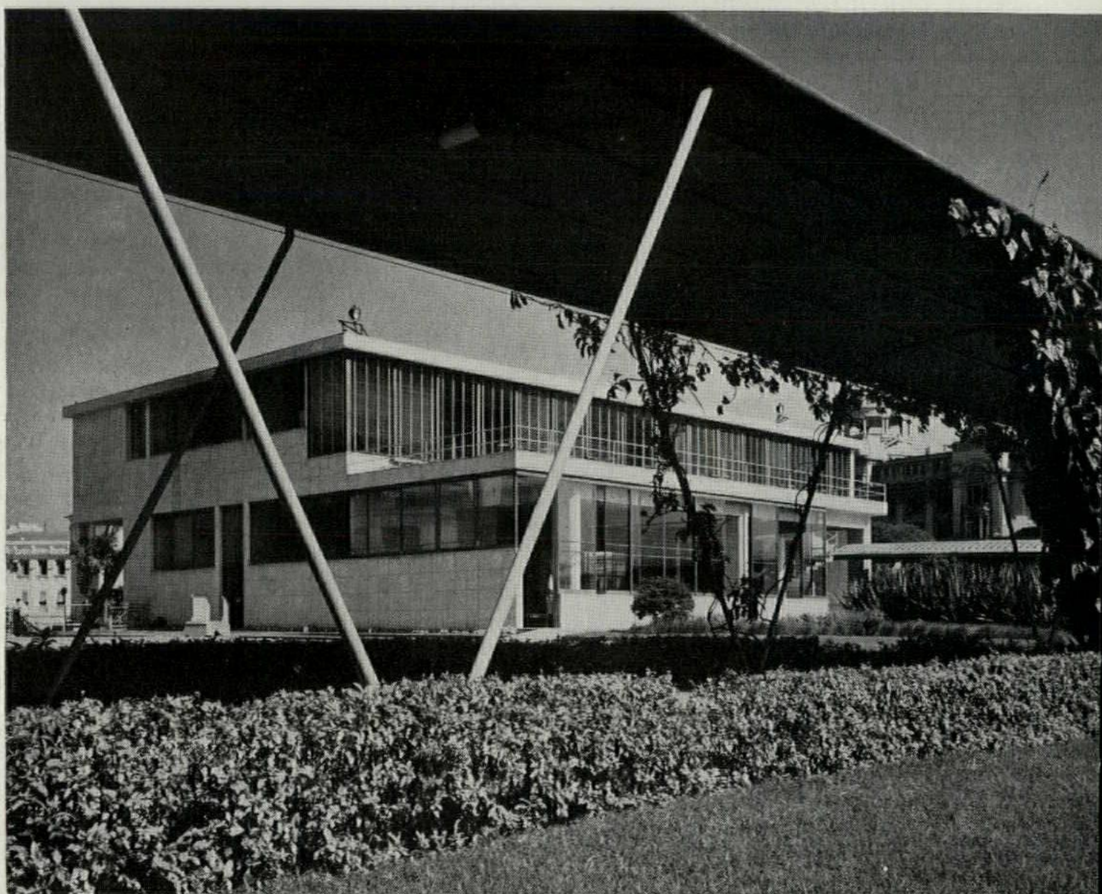
A medium yellow filter to give quality to the sky and bring out the clouds, an exposure meter to determine diaphragm opening, and a lens hood to keep the direct sun off the lens, more or less complete our outfit. It can eventually run into many lenses, a dozen filters, and countless other useful (or shiny) gadgets. It need not go beyond one lens, one or two filters, the meter, and a lens hood.

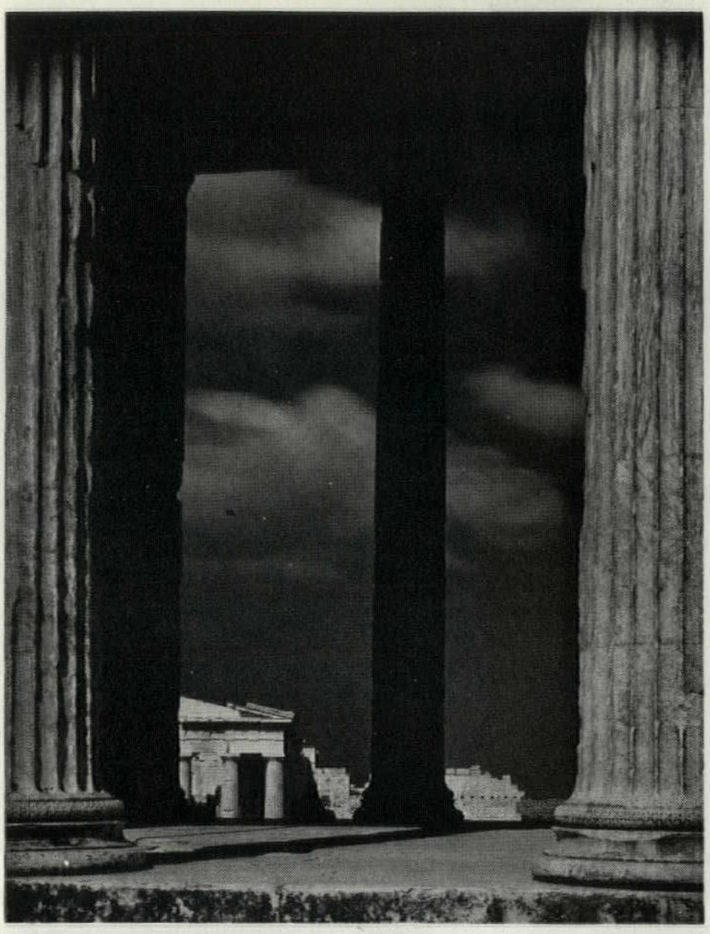
The best results undoubtedly come from enlarging your own negatives—*if* you have the desire, ability, and experience. But the "if" is a big one, and unless the itch is there, let some competent professional finishing service do the job for you (rarely the corner drug store). When you think you have something really first rate, have what is rather juicily called a "salon" print made. Costing two to three dollars, a "salon" print is no more than an enlargement very carefully made, with more thought and attention to paper, exposure, emphasis, etc., than is possible with run-of-the-mill work. A few of these will give your morale a great boost.



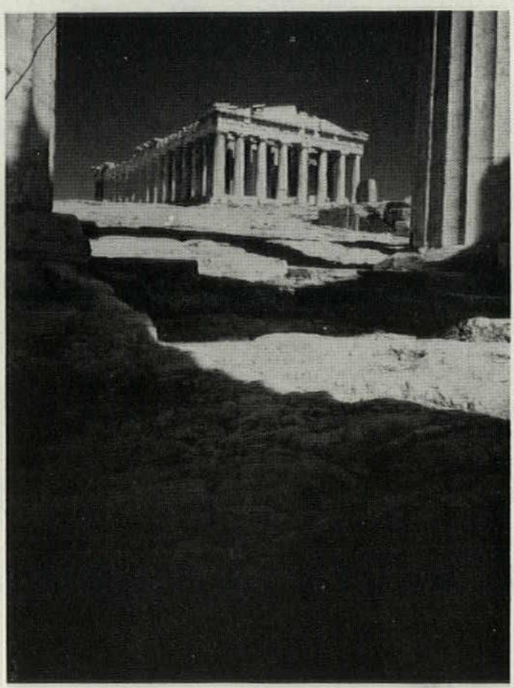
13

14



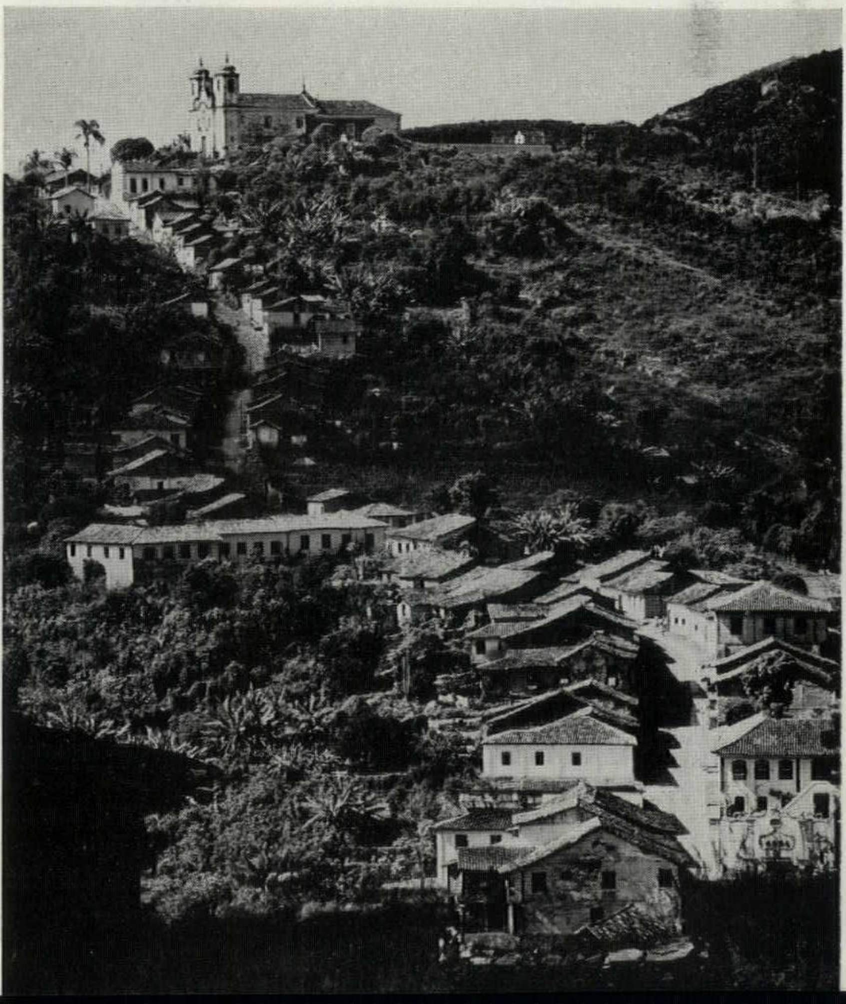


15



16

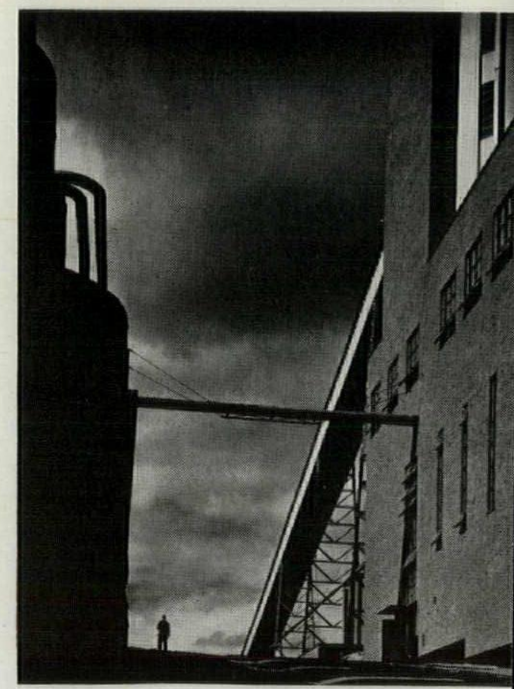
17



13. The Old City, Stockholm—"holding down the foreground." 14. Santos Dumont Airport, Rio de Janeiro. Correia Lima, Architect—"a strong foreground." 15. The Propylæa from the Erechtheum—"relate them to each other." 16. The Parthenon from the Propylæa—"given an impression of spatial composition." 17. Ouro Preto, Brazil—"a high camera angle."

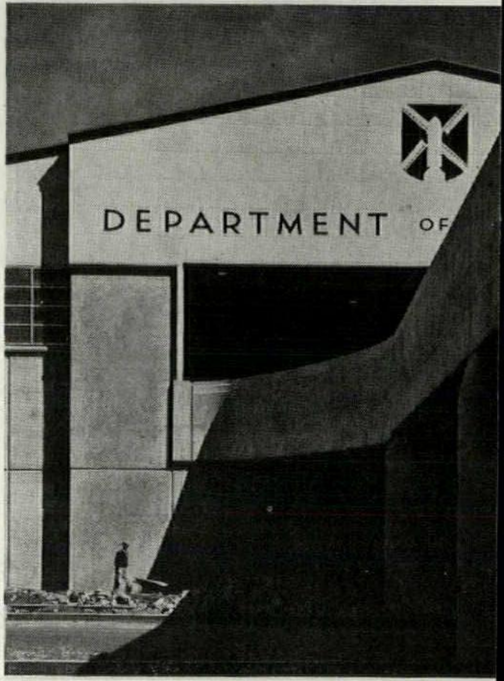
18

19

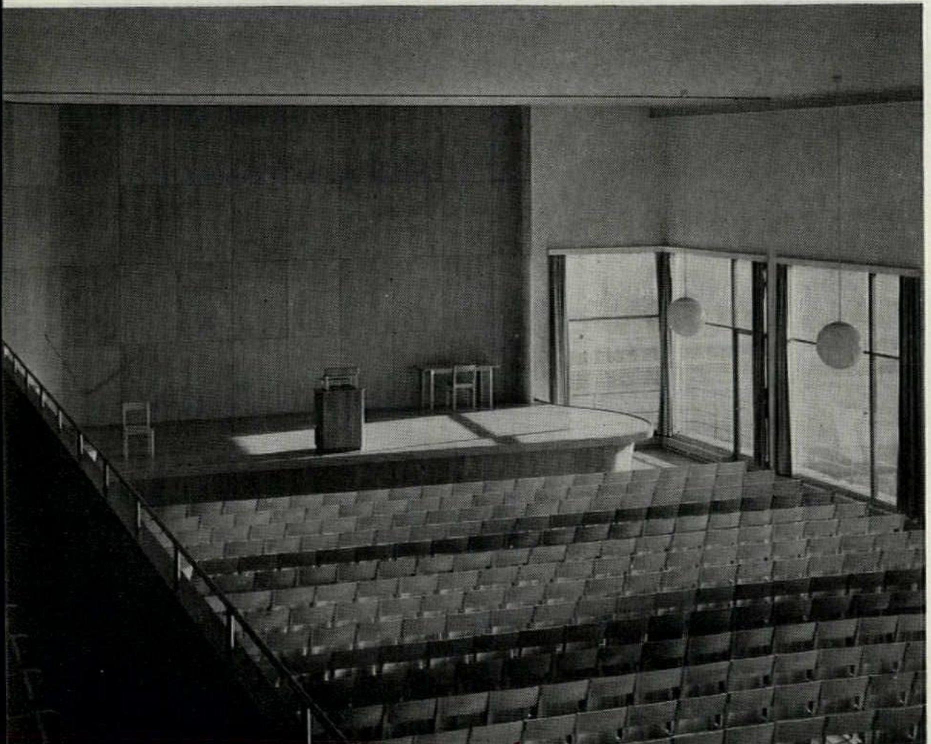


18. Fredhall Apartments, Stockholm—"try placing a friend in the picture." 19. Sunila Pulp Mill, Finland. Alvar Aalto, Architect—"including the subject from top to bottom." 20. Department of Sanitation, East River Drive, New York City—"the figure, used to lead the eye into the picture. 21. School, Stockholm. Paul Hedquist, Architect —"a surprising amount can be done with natural daylight."

20



21



Progressive Architecture – Rich's, Inc.
Architectural Competition

PROGRAM

For the Design of

A Realistic House for a Family in Georgia

CLOSING DATE – JANUARY 21, 1946

PRIZES

First Prize	**$ 3,000.00**
Second Prize	**1,500.00**
Third Prize	**1,000.00**
Fourth Prize.	**500.00**
25 Mentions at $100 each .	**2,500.00**
Special Georgia Prize . . .	**1,500.00**
TOTAL . .	**$10,000.00**

JUDGES

Thomas Harlan Ellett, F.A.I.A., New York
Ernest A. Grunsfeld, Jr., F.A.I.A., Chicago
Richard Koch, F.A.I.A., New Orleans
Ernest J. Kump, A.I.A., San Francisco
Roy F. Larson, F.A.I.A., Philadelphia
Roland A. Wank, A.I.A., Detroit
Robert Law Weed, A.I.A., Miami

All parties to this competition agree that the Jury of Award has authority to make the awards and that its decisions shall be final.

This competition is open to all architects, architectural draftsmen, and architectural students. Under a ruling by the Committee on Competitions of the American Institute of Architects, Institute members are permitted to enter. Any contestant may submit more than one design. No employee of either Reinhold Publishing Corporation or the sponsors is eligible.

Authorized by Reinhold Publishing Corporation
Sponsored by Rich's, Inc., Atlanta, Georgia
Conducted by Henry J. Toombs, A.I.A., Professional Adviser
and Kenneth Reid, A.I.A., Associate Professional Adviser

PROGRAM

Despite all the efforts made by architects and others to help solve the problem of the Small House, there seems to be some inherent difficulty that makes these attempts fall short of complete success. Like the pot of gold at the end of the rainbow the perfect small dwelling is yet to be discovered. The result is that, looking about the country, one finds that the vast majority of small houses are badly designed or badly constructed or both and that the best of them still have some faults, either in the eyes of their occupants or in those of their neighbors.

It is true that over the years there has been some improvement, which may be traced to the thinking that has been done in each decade by the best architectural designers. Wide publication of comparatively few examples of good houses actually built and of designs prepared for periodic competitions have helped in the gradual spread of improved planning ideas which are then adopted and imitated in houses built during the ensuing period.

Competitions, however, often result in winning designs which, though brilliant and helpfully prophetic, involve expensive construction beyond the pocketbook of the average family. Such designs also sometimes rely on the introduction of some special materials or equipment known to be in the research stage but unlikely to be economically available within the near future.

It is the wish of both **Progressive Architecture (Pencil Points)** and the sponsor, **Rich's, Inc.**, of Atlanta, Georgia, that this competition shall be a realistic one, seriously aimed to encourage design of small houses that will not only be "better" but within the reach of the $3,000-a-year white-collar family that wants to build a home right after the war.

Rich's, Inc., naturally vitally interested in the well-being of the state it serves, is thinking particularly of houses "good to live in in Georgia." Since the difference in climate between Georgia and all but the northern group of states is in degree only, however, it is probable that the resulting designs will have a broad application so that designers need not feel that the problem is of limited scope.

PROBLEM

To design a house that could really be economically built in the State of Georgia in the immediate post-war period out of building products known to have been on the market before the war or known to be actually ready for production when plants are reconverted. Beyond this limitation, plus consideration of a reasonable cost for the family of clients described, the designer is free to choose the materials and equipment he considers most appropriate.

The house is for an American family of four—father, mother, and two small children—a boy of five and a girl of two. Their income is $3,000 a year. For reasons of convenience to work, school, shopping, etc., their building site must be in an established residential section of a still growing city. Although they would like to have a larger piece of land, they can afford only an inside lot 60 feet wide and 150 feet deep. They have a choice of four approximately level lots of four different orientations—on the north or south side of a paved street running east and west, or on the east or west side of a street running north and south. You as their architect will guide their choice and will design their house and some appropriate type of garage to fit the site chosen.

After the lot is paid for, the family budget will allow the building of a house containing a maximum of 1,350 square feet of floor area for the house exclusive of a garage and a heater room which may be either above or below grade. Basements and usable attic floors must be included in this total area.

Local restrictions permit no part of the house to be nearer than 20 feet to the street or nearer than 10 feet to the side and rear lot lines. (Fences, however, and walls not exceeding 6 feet high may be built on the restricted part of the property.)

The clients for whom you are to design the house are average people who have been looking forward for a long time to having their own home. They have been studying the pages of current magazines and are sympathetically aware of the contemporary trend in design, especially in regard to its greater promise of comfort, convenience, and freedom from a good deal of household drudgery. They definitely do not wish conformity with any traditional "style." At the same time they are desirous that the house they build shall take its place gracefully among its older neighbors. They have an idea that a good architect can give them something that is thoroughly modern and thoroughly appropriate to the region, not at all stodgy and imitative, yet so well proportioned and pleasant of aspect that it will excite general admiration rather than amazement.

The designer will keep in mind not only the present needs of the family but its future needs as the children grow up. He should also have an answer to the problem of caring for an occasional guest or a visiting parent. Realizing that a house never has too much storage space, he will contrive in an attic or cellar or otherwise to provide at least 900 cubic feet of easily accessible and well-disposed storage space for the miscellaneous needs that occur in every ordinary household over and above the usual closets and kitchen cabinets.

The designer will keep in mind the Georgia climate which has a fairly wide range. It is generally accepted that an up-to-date house in Georgia is not comfortable in the winter without a heating system. (Gas is available in this area and is relatively cheap.) It can be very cold in winter and very hot in summer. March ordinarily sees the last of winter and the numerous flowering plants begin to bloom in the latter part of March. April brings full spring. May is warm and inclined to be hot towards its end. June, July, August, and most of September are definitely hot. One seeks the shade, particularly in the middle of the day. Spring and summer rains may be frequent and are apt to be sudden and heavy. Breezes in summer are most generally from the southwest, usually arise in the evening, and help to relieve the heat of the day. In October and November the leaves turn and the evenings are cool. December, January, February, and the early part of March are commonly cold and raw with occasional warm sunny days. The prevailing winter winds come from the northwest. There are freezes, sometimes of several weeks' duration, but there is litttle snow. Elevation above sea level ranges from 500 to 1,000 feet. Average temperatures, rainfall, and sunny days for the vicinity of Atlanta are as follows:

	WINTER	SPRING	SUMMER	FALL
AVERAGE OF MAXIMA	52°	70°	80°	70°
ABSOLUTE MAXIMA	78°	97°	103°	102°
AVERAGE OF MINIMA	36°	52°	69°	54°
ABSOLUTE MINIMA	8°	8°	39°	14°
TOTAL PRECIPITATION FOR DRYEST YEAR	9.4"	6"	12"	5.7"
TOTAL PRECIPITATION FOR WETTEST YEAR	26.7"	16"	14"	11.1"
AVERAGE HOURS SUNSHINE	463	700	814	696

The comfort of a house in Georgia would be increased by

(a) Cross ventilation. While exhaust fans are widely used to pull in cool evening air in summer they do not materially help daytime comfort. (It is assumed that summer air conditioning is not financially possible at this time to the family described.)

(b) Porches can be thought of as summer living rooms but to be useful they must be screened for insects (as all other openings must be). It should be noted that porches are not pleasant when flooded with summer sun.

(c) Terraces, shaded from the sun in summer and yet open to it in winter are most pleasant contributions to the enjoyment of out-of-doors.

(d) Trees and shrubbery, thoughtfully located, can materially contribute to the comfort, privacy, and pleasure of a Georgia home.

Considerations of the Jury of Award

(1) The architectural merit of the design, including its regional suitability and the skill with which the plans are worked out to fit the needs of the hypothetical client.

(2) Practicability and economy of construction, wherewith the client's budget may be met.

(3) The special prize will be awarded for the best house submitted by an architect or designer who lives and works in Georgia.

(4) The judges will not be influenced by quality of delineation.

COMPUTATION OF FLOOR AREA (Mandatory)

Measurement of enclosed spaces shall be taken from the inside of exterior walls with no deductions for partitions. Horizontal area occupied by stairs shall be counted as a part of the floor from which they rise. Open porches or screened porches shall be counted at half their full area. Entirely glassed-in porches shall be counted at their full area. Designs that exceed 1,350 square feet total floor area (exclusive of garage and heater room) will not be considered.

DRAWINGS (Mandatory)

All required drawings for each design shall be composed on a single sheet of opaque white paper, trimmed to exactly 25" x 36". The sheet is to be read with its long dimension vertical and shall contain the following items in **opaque black ink.** (No diluted ink, color, wash, airbrush, or applied transparent shading tissue.) All lettering shall be at least ⅛" high.

(1) Plans at ¼" equals a foot. The use and dimensions of each room or space shall be indicated so that they will be clearly legible when reproduced at one-quarter size. Suggested furniture arrangement shall be shown.

(2) Perspective of the house as seen from the street, rendered in ink with pen or brush and so laid out that true heights may be measured at a scale of ¼" = a foot on the corner nearest the observer.

(3) Elevations, at ⅛" equals a foot, of the two sides of the house not shown in perspective.

(4) Plot plan at any convenient legible scale showing location of house and garage and arrangement of the property.

(5) Separate single line diagram of floor plans at small scale indicating method of computing total inside floor areas.

(6) Drawings shall bear the title A REALISTIC HOUSE FOR GEORGIA with the subtitle PROGRESSIVE ARCHITECTURE—RICH'S, INC. COMPETITION and shall be signed with a device or *nom-de-guerre.*

(7) A single sheet of 8½" x 11" paper, to be enclosed with the drawing, shall contain a typewritten outline specification listing principal materials and items of equipment for the house.

(8) **Optional.** It would be interesting to include on the drawing, at small scale, a diagram showing how the same house might be placed on each of the three lots of different orientation which were rejected by the client upon your advice.

ANONYMITY (Mandatory)

Drawings shall contain no identifying mark other than a device or *nom-de-guerre*. Each drawing shall be accompanied by a plain opaque sealed envelope bearing the same device or *nom-de-guerre* as the drawing and containing a slip of paper on which the true name and complete address of the competitor are stated. In the case of drawings submitted by architects or designers now living and working in Georgia or by residents of Georgia now temporarily absent from the State because of war service, the accompanying envelope shall bear, in addition to the *nom-de-guerre*, a capital "G," lettered ½" high, on its upper right-hand corner. This is for the purpose of identifying to the Professional Adviser but not to the Jury the drawings eligible for the Special Georgia Prize. The envelopes will be opened by the Professional Adviser in the presence of the Jury, only after the awards have been made.

DELIVERY OF DRAWINGS (Mandatory)

The drawings shall be securely wrapped, either flat or in a strong tube not less than 2½" in diameter and addressed to Kenneth Reid, **Progressive Architecture—Rich's, Inc. Competition**, 330 West 42nd Street, New York 18, N. Y. In the case of drawings sent registered, competitors must not demand a return receipt. Drawings shall be delivered to the office of **Progressive Architecture** or placed in the hands of the post office or express companies not later than 6 P.M., standard time, Monday, January 21, 1946. Drawings will be accepted at any time before the close of the competition. They will be fully insured from the hour of their receipt.

Drawings are submitted at the competitor's risk but reasonable care will be exercised in their handling, safekeeping, and packaging for return.

EXAMINATION OF DESIGNS

The Professional Advisers will see that the drawings are expertly checked to insure that they comply with the mandatory requirements. No award will be made to any design that fails to comply. No drawing, whenever received, will be shown or made public until after the awards by the Jury.

JUDGMENT

The Jury of Award will meet at the Bon Air Hotel, Augusta, Georgia, on February 13, 14, and 15, 1946.

ANNOUNCEMENT OF AWARDS

The Professional Advisers will send by mail, to each competitor, the names of the winners of the Prizes and Mentions as soon as possible after the judgment. This information will be published in the March, 1946, issue of **Progressive Architecture.**

REPORT OF THE JURY

The winning designs and a full critical report by the judges will be published in **Progressive Architecture** for April, 1946. Each competitor will receive a copy of this report.

THE PRIZE WINNING DESIGNS

The designs awarded Prizes and Mentions are to become the property of the sponsors, who agree that whenever and wherever any of the drawings are published or exhibited, the names and addresses of the designers will be clearly displayed and all resulting inquiries will be forwarded to them. The sponsors further agree that any models that may be built from any of the designs for exhibition purposes will be faithfully executed in exact conformity with the original design.

The sponsor reserves the right to build, for demonstration purposes, one house from each of one or more of the premiated designs. In this event, the sponsor will pay to the architectural author of each design so used, a professional fee of six percent of the contract cost. This fee will be in addition to the Prize or Mention award. For this fee the recipient agrees to furnish a full set of contract working drawings, necessary details, and specifications, which must be adequate in the judgment of the Professional Adviser.

RETURN OF DRAWINGS

Non-premiated drawings which are not reserved for exhibition or publication will be returned in a reasonable time, postage and $50.00 insurance prepaid.

NOTICE TO COMPETITORS

Any competitor who has difficulty in securing paper of the size called for will be provided by **Progressive Architecture** with a sheet of Whatman's 133-pound Hot Pressed paper, Double Elephant size, for one dollar. The paper will be shipped prepaid in a tube suitable for remailing the finished design. Address remittance to **Progressive Architecture**, 330 West 42nd Street, New York 18, N. Y.

RADIANT HEATING LAYOUT SIMPLIFIED

BY R. G. VANDERWEIL, Heating Engineer

The author, who has had considerable experience in this country and abroad, is now Project Engineer with the Chase Brass & Copper Co. Aware of the inter-relationship between panel construction and other factors, he has reduced complicated theorems to charts and graphs, taking into account materials of which panels are built.

I. THE FLOW OF HEAT IN PANEL HEATED ROOMS

Room Heat Flow

However complicated the theory, heat flow in a room may be visualized by a very simple diagram, such as **Fig. 1.** Heat supplied by means of a ceiling panel is transmitted by conduction through the panel (wave lines) and from the panel surface by convection (C_a) to the room air, and by radiation (R_1 and R_2) to the outside wall and glass, or *dissipating surface*, as well as to the inside of neutral surfaces. The neutral surfaces cannot absorb heat, and for this reason reflect it by radiation (R_3) to the dissipating surface and by convection (C_b) to the room's air. The air in turn loses the heat gained from the panel and neutral wall to the dissipating surface, C_c.

For certain simplifying assumptions, the graphic representation of the panel's heat output proves even simpler and is given in **Charts A and C.**

Room Temperature Conditions

It is well known that the air in rooms heated by panels is of lower temperature than in conventionally heated rooms. However, this depression of the air temperature is often greatly overestimated; it usually amounts to only 2F to 5F. Together with this lower air temperature, a higher temperature of the room enclosures *(MRT)* is met in radiant heated rooms, which in combination with well distributed low temperature heating surfaces, explains the excellent health and comfort conditions that have caused so many Continental schools and hospitals to adopt radiant heating.

Expressed in terms of heat flow there is a distinct difference in the radiation output of conventional and radiant heating systems. Less than 20% of a radiator's output is transmitted to the room by radiation. This radiation component increases to about 50% in rooms heated by floor panels and to 65% in rooms using ceiling panels. Comparing the total heat output by convection and radiation of floor and ceiling panels, it will be seen that due to restrictions imposed upon the temperature of floor panels, the ceiling panel proves more economical. In rooms of 70F the floor panel output is restricted to approximately 40 Btu hr, per sq ft of panel; while the ceiling panel output may prove to be 70 Btu hr per sq ft or more. The radiant principle may be carried to an extreme—possibly desirable in tuberculosis hospitals, etc.—by supplying great amounts of cool air to the room. Only under these conditions is it possible to provide room air temperatures of 60F or less, which, combined with an MRT of 80° or more, will still result in comfort conditions. In this case, Charts A and C cannot be used.

Location of Panel

Advantages and disadvantages inherent in floor, wall, and ceiling panels are so evenly distributed that the selection of the heated surfaces requires careful study.[*] No hard and fast rule can be given as to the selection of location; each case must be considered alone.

Panel Heat Flow

Although little difficulty was encountered in presenting a simplified graphic room heat flow solution, the development of such a solution for panel heat flow proved to be a tedious task. The author tried to apply a number of simplifying assumptions to heat flow from tube to panel surface, but whenever test data and theory were compared, the assumptions proved to be in vigorous disagreement with actual conditions. He finally resorted to the basic theory of flow—which like all laws of nature is simple—and stated that heat at any point of the heating panel "flows" perpendicular to the isotherms (lines of constant temperature) just as water at any point on a hill flows perpendicular to the contour lines (lines of constant elevation). This law may be expressed more simply by the statement that wherever "flow" occurs, it must progress in the direction of least resistance, or along the steepest slope.

Fig. 2 shows in cross-section a panel of constant conductivity throughout (e.g., concrete floor). The measured temperatures at various cross-sections of the panel were plotted and points of same temperature connected by heavy red lines—the *isotherms*. Perpendicular to these are *heat-flow lines*, shown in black. The equations representing this panel flow are complicated, but could be solved and plotted in graphs for various panels.

Fig. 3 shows such a graphic solution for a well insulated roof, R1, with tubes embedded in gypsum plaster; and **Fig. 4** shows one for a simplified case in which the coil is embedded in concrete on dry ground. It may be used for any finished floor structure but only if no "reversed" heat flow (see **Fig. 2**) is met; that is, only for panels on the ground. In panels located in intermediate floors, roofs, or walls, heat leaves the tube in two principal directions and the conditions become so involved that a number of graphs similar to Fig. 3 had to be developed. Fig. 2 shows that in a ceiling panel the greater part of the heat is conducted through the lower part of the panel and supplied to the room, but also that some of the heat leaving the tube flows in the reverse direction, upward and into the space above. With panels in intermediate floors, this heat is usefully applied to the upper floor; with roof panels, it is lost.

II. LAYOUT OF RADIANT HEATING SYSTEM EXPLAINED BY A PRACTICAL EXAMPLE

Fig. 5 shows a residence to be heated. Basic design considerations are comfort and efficiency of fuel consumption. The transmittance of the walls is given by $U = .17$, double glass is provided throughout and the roof is insulated so as to give a coefficient of transmittance of .08. This low coefficient is of importance whenever it is planned to install panels in the roof.

The owner has expressed the desire to provide for low room air temperature, if possible (that is, high rate of radiation output) and for this reason ceiling panels will be selected where possible. In rooms with sloping ceilings, where the air has a tendency to move to the highest point, the coils will be located

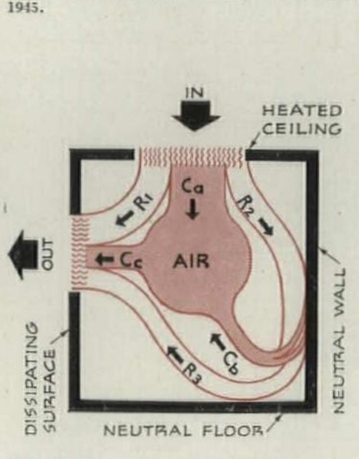


Fig. 1, above: Room heat flow

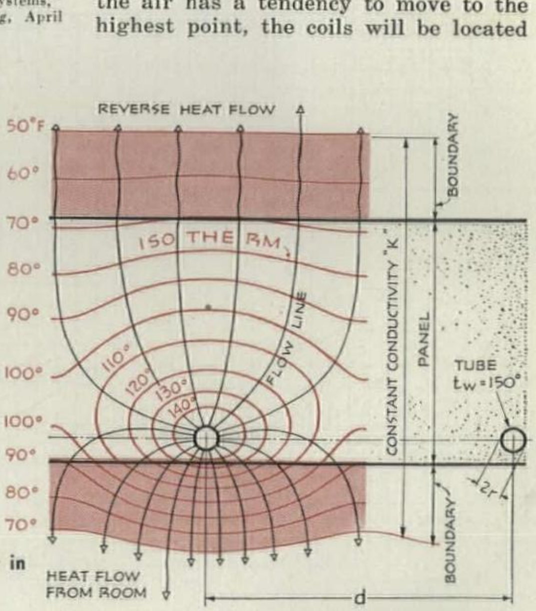


Fig. 2, right: Flow of heat in the panel

---

[*] See "Locating the Panel in Radiant Heating Systems," by R. G. Vanderweil, *Heating and Ventilating*, April 1945.

at the lower part of the ceiling. Extra consideration is given to the children's rooms. With young children it is desirable to provide floors of high temperature; for this reason panels there will be located in the floor. If in any room the heat requirement cannot be covered by the panel surface selected as above, supporting panels will have to be arranged.

Assumption of Panel Surface Temperatures (t_h)

In order to achieve an economical layout, surface temperatures should be as high as possible. They are, however, restricted by comfort considerations. In rooms with low ceilings, the mean temperature is assumed to be 105F; and in rooms with sloping ceilings, 110F, which surface temperature will still result in excellent comfort conditions up to an elevation of 7'6" above the floor and even higher near the monitor. Assumed floor panel temperature is 85F.

Panel Heat Output

With room temperatures known—75F in the bathroom, and 70F everywhere else—and panel temperatures selected, the various panels' heat output may be read off **Panel Output Charts A and C.**

TABLE I—PANEL HEAT OUTPUT "QI" BTU/SQ.FT.,HR. FOR VARIOUS SELECTED SURFACE TEMPERATURES

	CEILING PANEL SURF. TEMP. °F.		FLOOR PANEL SURF. TEMP. °F.
ROOM TEMP., °F.	110	105	85
70F	62	53	30
75F	—	45	—

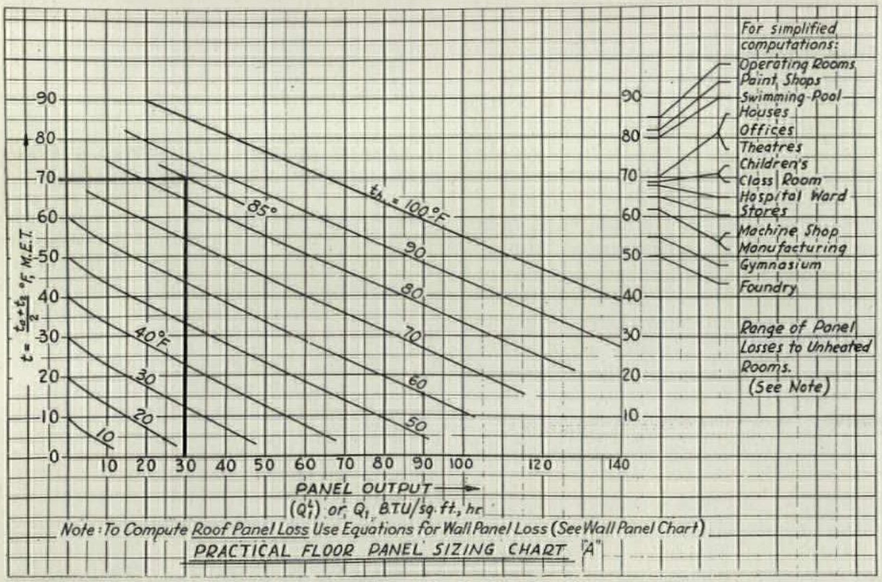
Room Heat Losses and Panel Size

Since whenever the panel is located in the ceiling whatever heat is lost through the roof comes directly from the coil, and is to a great extent compensated for by the panel's location, heat loss through the roof may be deducted from the room heat requirement. It is desirable to subdivide the computed heat losses as shown in *Table II, left.* In rooms where both floor and ceiling panels are used, floor and ceiling heat losses are shown in separate columns.

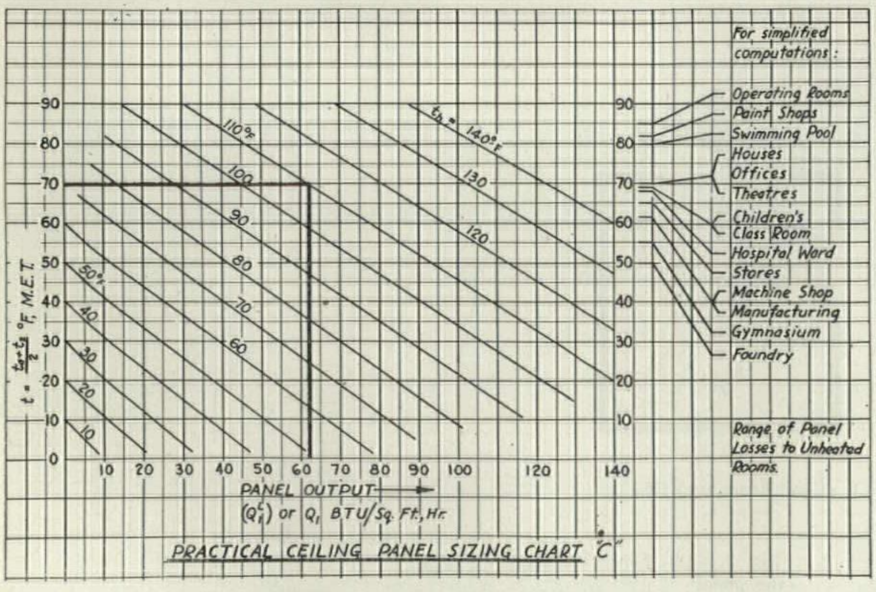
In order to determine which rooms require both floor and ceiling panels, the maximum available panel area as previously selected, and the maximum panel output obtainable, are noted on the *right-hand* side of *Table II.* (Output is found by multiplying the *areas* in Column 6 by the appropriate *unit panel heat output given in Table I.)*

All computations were made by slide rule and the figures are rounded out. Cols. 1, 2, and 3 show individual losses computed according to the ASHVE *Guide.* Col. 4 shows the sum of all losses. 35,650 Btu hr would represent the total room heat requirement if the rooms were heated by conventional methods. If the ceilings of the first four rooms and the floors and ceilings of the last three rooms were entirely covered by panels, the room heat requirement would be 30,200 Btu hr. Since the heating panels should not extend too close to the outside walls, in order to avoid excessive losses, they will not cover the entire floor or ceiling area and for this reason the + sign is used in Col. 5.

Comparing the room heat requirement (Table II, Col. 5) with the available heat from one panel (Col. 8), it will be found that the last three rooms require both floor and ceiling panels. Although the high heat loss of the corridor could be compensated for by increasing the size of the living room panel, this would result in a cold zone near the south entrance door. Consequently this alternate solution is disregarded, and a supplemental floor panel is used at the door. With all final decisions as to panel locations made, little effort is required to substitute the values in Table III, and decrease or increase the actual panel areas (Table III, Cols. 2 and 5) in order to obtain a balance between panel heat output and room heat loss (Cols. 16 and 15). Again, slide rule accuracy is considered sufficient and errors in the balance of plus or minus 2% are neglected. Cols. 2 and 5 show final panel areas obtained after balancing. Cols. 3 and 6 give panel unit output according to Table I, and Cols. 4 and 7 the total panel output obtained by multiplying the area by the unit output. Cols. 8 and 14 give the room's total ceiling and floor areas, Col. 9 the balance between Col. 8 and Col. 2, that is, the unheated ceiling area. Ceiling heat loss, Col. 10, is determined by multiplying the unheated areas, in sq ft (Col. 9) by the unit heat loss of the roof, 5.6 Btu sq ft (Q^{L_1}=desired temperature times conductance = $\triangle t \times C = 70 \times .08 = 5.6$). Similarly, Cols. 13 and 12 are computed. The arrows in these columns indicate that the floor loss in the first four rooms is included in Col. 11; Col. 15 is the sum of Cols. 10, 11, and 12; Col. 16 the sum of Cols. 4 and 7.



Above, Chart A, Floor Panels. Below, **Chart C,** Ceiling Panels



Coil Layout, Tube Spacing and Diameter

According to previous specifications the surface temperature of all high (sloping) ceilings should be: $t_h = 110F$. Reading the table at the lower left of Fig. 3, the reference temperature t_r, for Zero outside temperature, equals $t_h - 69.5$ or 40.5F. Now, connect the room temperature at the left-hand scale of the figure, 70F, with $t_r = 40.5$—full line—and read the results, some of which are shown in Table IV under $t_h = 110$, from the intersection of this full line with the center diagram.

Similarly, several possible solutions are found for the cooler ceiling panel with $t_h = 105$, $t_r = 105—69.5 = 35.5F$ and $t = 70F$—see dashed line in Fig. 5—and tabulated under $t_h = 105F$.

t_w of Figs. 3 and 4 signifies the mean water temperature; d the tube spacing; 2r the nominal tube diameter. t_b of Fig. 3 represents the temperature of the "opposite" panel surface, the roof.

Obviously the finally selected ceiling and floor panels will have to operate with the same mean water temperature (t_w of Table IV), but may use various tube diameters (2r) and tube center spacings (d). In order to enable us to pick the most favorable water temperature Table IV finally shows, under $t_h = 85F$, several combinations of d, 2r, and t_w, for the floor panel. These combinations were taken off Fig. 4 which was used because the floors, in the rooms to be heated by floor coils, rest over the unexcavated basement. The value "a" ($= a^1 + x_1 (12/k_1) + 12/C_1$) in Fig. 4 is computed for the floor structure shown in Fig. 7 as: $a = 1½ + .75\ (12/1) + 12/1.1 = 21.4$ and the results are read as indicated in full lines in Fig. 4.

Table IV indicates that, due to a relatively heavy "insulating layer" (finished floor) on the concrete floor, it is possible to select a relatively high water temperature, for instance $t_w = 145F$, without exceeding a floor surface temperature of 85F. Herewith all three panels are given as follows: Water temperature 145F, tube diameter ⅜" nominal on the following center spacings; 5¼" in the ceiling panels of 110F surface temperature; 6½" in the ceiling panels of 105F surface temperature; and 12" on the floor panel of 85F temperature.

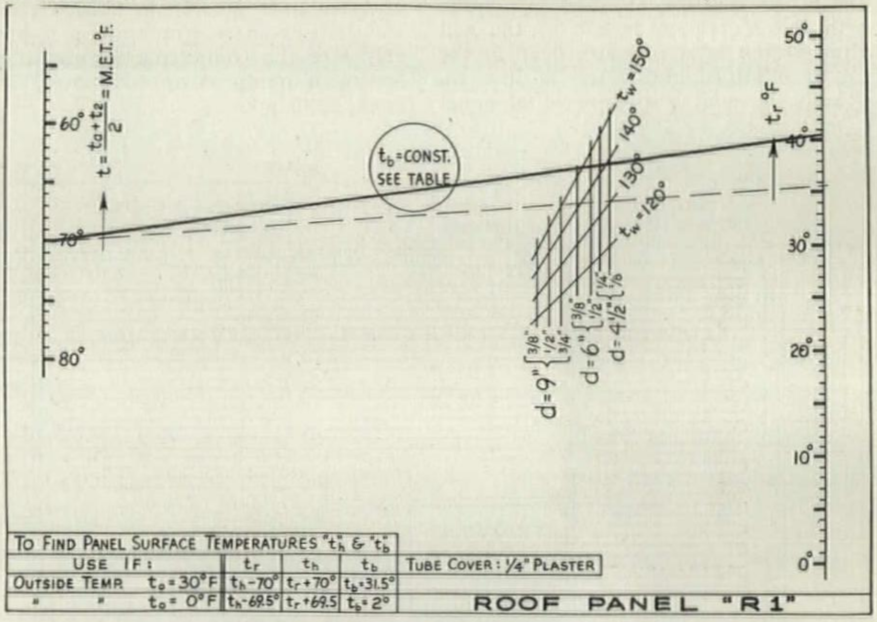
The bathroom, because of its higher design temperature (75F) is provided with a ⅜" coil at 7¼" centers according to Fig. 3.

⅜" tubes were selected throughout because tubes of this diameter may be buried in plaster of standard thickness.

Reverse Heat Flow

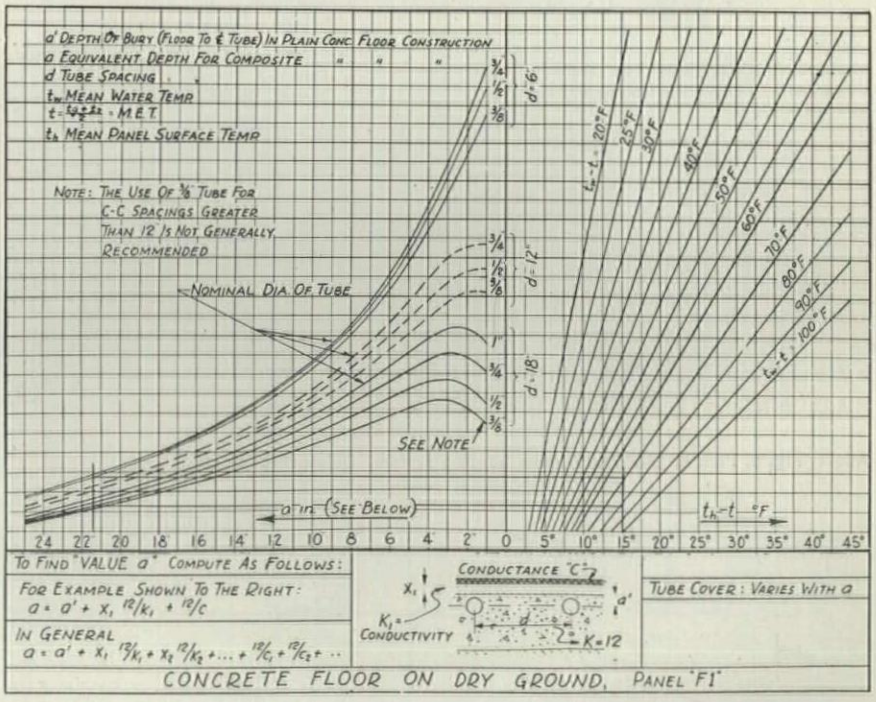
The last step in the coil layout is concerned with computation of the reverse heat flow (see Fig. 2) which, in a one story building, is equivalent to the panel's heat loss since all heat flowing either upward in the ceiling panels, or downward in the floor panels, is lost. The heat loss in panels on dry ground may be assumed to be 10% of the panel output, the losses of the ceiling panel may be computed if the surface temperature of the "opposite" or "reverse" surface (in this case the roof) is known. This temperature, t_b, may be found and is noted on Fig. 3. It is constant for this particular panel. For an outside temperature of zero, it is 2F according to the table at the lower left of Fig. 3. Since the air film coefficient for outside walls and roof, according to the ASHVE *Guide*, is 6 Btu sq ft °F hr, the heat loss is: $(2\text{-}0) + 6 = 12$ Btu/sq ft hr. With the heat losses per sq ft known, the individual panel's heat requirements are tabulated in Table V.

Furthermore, Table V gives the data required later for computing pipe sizes. Its first line is copied from Table III, its third line indicates the previously computed center distance of the tubes and the fourth line the number of parallel tubes in the coil. According to Fig. 5, the over-all dimensions of the coil are noted in line 2; for instance, 6.6 × 13.56 = 89 sq ft for the kitchen. Since the heated panel field of the two outermost tubes extends to both sides of these tubes, the total panel surface is 95 sq ft rather than 90 sq ft. For the same reason all other areas computed according to line 2 are smaller than those of line 1. Line 5 gives the equivalent length of the pipe coils plus the bends, line 6 the computed panel heat output from Table III. In line 7 the panel heat loss



TO FIND PANEL SURFACE TEMPERATURES "t_h" & "t_b"			
USE IF:	t_r	t_h	t_b
OUTSIDE TEMP. $t_o = 30°F$	$t_h - 70°$	$t_r + 70°$	$t_b = 31.5°$
" " $t_o = 0°F$	$t_h - 69.5°$	$t_r + 69.5$	$t_b = 2°$

Above, **Fig. 3,** Roof Panel. Below, **Fig. 4,** Concrete Floor Panel on Ground



is marked, based on 12 Btu sq ft hr for ceiling panels and the aforementioned 10% for floor panels. Line 8, sum of 6 and 7, gives the total heat input into the coil and line 9 the circulating water required per coil per hour. Line 9 is obtained by dividing the values of line 8 by 30, 30F being the temperature drop of the water in the coil and also the Btu's delivered by one pound of circulating water. This value is allowable for all ceilings and all well insulated floors.

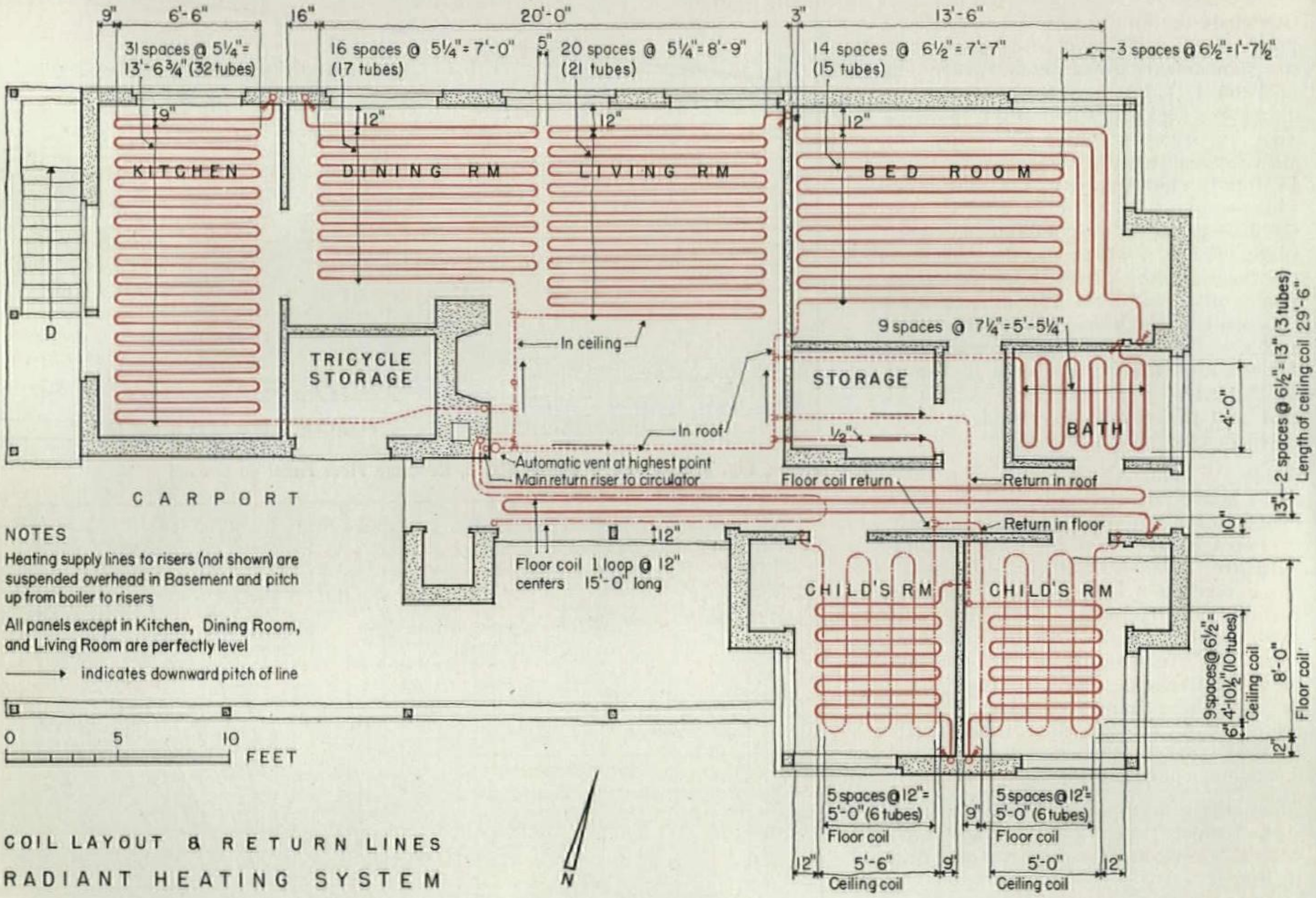
Pressure Drop in Coil, Pump, and Boiler

A number of tables and graphs are available giving the pressure drop per ft of ⅜" nominal (and other) tubes in inches for any given flow rate through the pipe, lb/hr, as noted in Table V, line 9. By multiplication of this value with the equivalent length of the coil (line 5) the total pressure drop in the coil is obtained and noted in line 10. Finally, by adding all individual panel heat inputs (line 8), their total, 39,050 Btu hr, is obtained and the boiler may be selected accordingly. The booster pump capacity is (39050 × 1.2)/30 = 1560 lb/hr, at which load pumps of from 5 to 12 ft pressure head are available. In order to find the actual pressure head of the pump, it is necessary to size the piping according to conventional procedure. Due to space restrictions, it is not possible to describe this sizing step for the given example; however, it should be noted that the pressure drop in the largest coil is 150" or 12.5 ft which is too great for a small circulator. For this reason, the living room coil was divided into two coils of approximately equal over-all dimensions, resulting in a small pressure drop for each coil. The remaining largest drop is in the kitchen and amounts to 44" or 3.67 ft; and sufficient pressure drop remains to properly size the connecting piping, if selecting a pump of approximately 7 ft head.

Discussion of Layout, Fig. 5

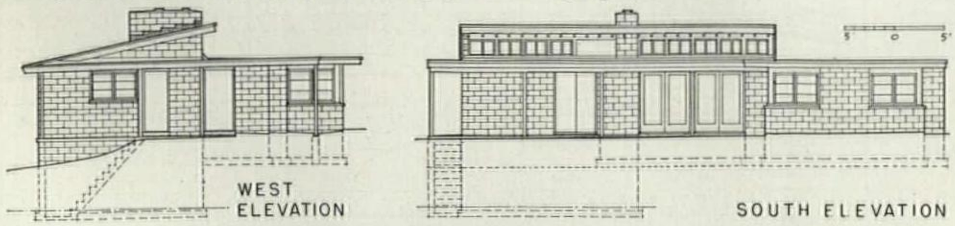
Ceiling coils are shown in full lines, floor coils in dot-dashed lines and all returns in dashed lines. The over-all center line dimensions of each coil are noted. As previously mentioned, the heated panel area is greater than the coils' outer center line dimensions; for this reason lines 1 and 2 of Table V differ. In the course of the layout, it seemed feasible to provide only three parallel tubes in the corridor ceiling.

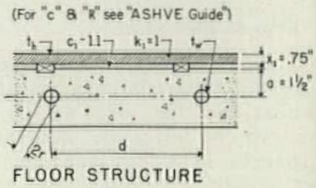
The resulting "total heated" ceiling area of this coil is still smaller than the required 56 sq ft noted in Table V and for this reason the total heated area of the corridor's floor (2 x 16 = 32 sq ft) is increased over the 24 sq ft of Table V. All coils are laid out level, except in kitchen and living room, and are supplied by heated water, rising from the mains below. Their return lines are lifted to the roof level and are there connected to a return header which is



Above, Fig. 5, Plan of house and panel heating system. Below, Fig. 6, Elevations

Below, Fig. 7, Floor panel





vented at its highest point. The drain of the automatic vent should be extended to the nearest plumbing or to the roof drain. The regulating valves are indicated in the supply line to each ceiling panel. They are installed behind wall plates. It was not considered essential to regulate the floor coils, since in all rooms heated by such coils, the greater portion of heat is supplied by the ceilings. ⅜" nominal type L soft copper tubing is used throughout. In the kitchen and living room coils, which slope with the ceiling, water is supplied at the coil end near the outside wall of north exposure. In the bedroom, the coil is shaped in such a manner that its high temperature section—near the point of water supply—runs along both outside walls. Such a layout is proper but is impossible in the kitchen due to its sloping ceiling. Provision of the coils in the corridor will amply compensate for leakage through the doors. The boiler expansion tank, hot water heater, and main distribution lines as well as the return line to the pump, are all located in the cellar (which is partly unexcavated) and are of conventional design and not shown due to lack of space. The mixing valve at the boiler is used to reduce the heating water temperature yet maintain the temperature of domestic hot water. It is governed by indoor and outdoor thermostat. If the mixing valve fully bypasses the boiler, the circulating pump is turned off.

TABLE II—TO FIND SUPPLEMENTARY PANEL AREAS

	COMPUTED HEAT LOSS				AVAILABLE OUTPUT OF ONE PANEL PER ROOM			
ROOM	1 FLOOR LOSS BTU/HR.	2 ROOF LOSS BTU/HR.	3 ALL OTHER LOSSES BTU/HR.	4 TOTAL BTU/HR.	5 APPROX. HEAT REQUIREMENT WITH ONE PANEL ONLY	6 AVAIL. PANEL AREA SQ/FT	7 PANEL TEMP. °F.	8 AVAIL. PANEL OUTPUT BTU/HR.
KITCHEN	INCLUDED IN COL. 3	750	5,700	6,450	CEILING PAN. 5,700+	94	110	5,820
L.R. & D.R.		1700	9,000	10,700	" 9,000+	224	110	13,900
BED.R.		1000	5,550	6,550	" 5,550+	126	105	6,680
BATH		200	1,150	1,350	" 1,150+	26	105	1,170
CORRIDOR	200	500	3,400	4,100	" 3,600+	56	105	2,960
WEST CHILD.	150	400	2,800	3,350	FLOOR PAN. 3,200+	48	85	1,440
EAST CHILD.	150	400	2,600	3,150	" 3,000+	48	85	1,440
	500	4950	30,200	35,650				

TABLE III—(FINAL PANEL SIZES SHOWN IN COLS. 2 and 5.)

	PANEL'S HEAT OUTPUT						ROOM'S HEAT LOSS								
	CEILING			FLOOR			CEILING			OTHER	FLOOR			BALANCE	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	AREA	UNIT OUT-PUT	TOTAL OUT-PUT	AREA	UNIT OUT-PUT	TOTAL OUT-PUT	TOTAL CEIL. AREA	UN-HT'D CEIL AREA	HEAT LOST THRU UN-HT'D CEIL. AREA	ALL OTHER LOSSES FROM TABLE II COL. 3	HEAT LOST THRU UN-HT'D FLOOR AREA	UN-HT'D FLOOR AREA	TOTAL FLOOR AREA	ROOM HEAT LOSS TOTAL	PANEL HEAT OUT-PUT TOTAL
	SQ. FT.	BTU/SQ. FT.	BTU/HR.	SQ. FT.	BTU/SQ. FT.	BTU/HR.	SQ. FT.	SQ. FT.	BTU/HR.	BTU/HR.	BTU/HR.	SQ. FT.	SQ. FT.	BTU/HR.	BTU/HR.
KITCHEN	95	62	5900	—	—	—	131	36	200	5700	←	——	119	5900	5900
L.R. & D.R.	160	62	9900	—	—	—	315	155	865	9000	←	——	289	9865	9900
BEDR.	112	53	5920	—	—	—	163	51	285	5550	←	——	163	5835	5920
BATH	26	45	1170	—	—	—	33	7	40	1150	←	——	33	1190	1170
CORRIDOR	56	53	2970	24	30	720	87	31	175	3400	125	63	87	3700	3690
W.CHILD.	32	53	1700	48	30	1440	77	45	250	2800	60	29	77	3110	3140
E.CHILD.	28	53	1480	48	30	1440	77	49	275	2600	60	29	77	2935	2920

TABLE IV—VARIOUS COILS, Resulting in the Desired Panel Surface Temp.

	$t_h=110$°F.					$t_h=105$°F.			$t_h=85°$; $(t_h-t)=15°$		
t_w	138	143	145	146	152	135	141	145	138	145	158
2r	⅜	¼	⅜	½	⅜	½	⅜	⅜	⅜	⅜	½
d	4½	4½	5¼	6	6	6	6	6½	6	12	18

TABLE V—TOTAL HEAT REQUIREMENT AND SCHEME FOR PRESSURE DROP CALCULATION

					CORRIDOR		WEST CHILD.		EAST CHILD.		
ROOM	KITCHEN	L.R. & D.R.	BED R.	BATH	CEIL.	FLOOR	CEIL.	FLOOR	CEIL.	FLOOR	COLUMN
SQ.FT. PANEL AREA	95	160	112	26	56	24	32	48	28	48	1
COIL OVERALL DIMEN.	6.6x13.56	7.8x20	7.6x13.5	4x5.44	1.1x28.5	1x15	4.88x5.5	5x8	4.88x5	5x8	2
TUBE CENT. DIST.	5¼"	5¼"	6½"	7¼"	6½"	12"	6½"	12"	6½"	12"	3
No. OF STR'T RUNS	32	19	15	10	3	2	10	6	9	6	4
EQUIV. LGTH. PIPE COIL PLUS BENDS	260	440	240	60	130	40	70	60	65	60	5
PANEL HEAT OUTPUT	5900	9900	5920	1170	2970	720	1700	1440	1480	1440	6
PANEL HEAT LOSS	1140	1900	1300	310	670	70	380	150	340	150	7
PANEL HEAT INPUT	7040	11800	7220	1480	3640	790	2080	1590	1820	1590	8
CIRCUL. LB/HR.	235	360	240	50	120	30	70	55	60	55	9
TOTAL PRESS. DROP	44	150	43	SMALL	6.5	SMALL	SMALL	SMALL	SMALL	SMALL	10

III. GENERAL NOTES ON PIPING AND INSTALLATION

Pipe Sizes

As previously mentioned, pipe sizing procedure is entirely the same as that used with conventional heating systems.

Layout of Piping, Drain, and Vent

Again the layout conforms to the conventional hot water layout. However, *special* care should be taken to provide for a continuous slope of the piping from the boiler to the highest point of the system. The coils proper have to be laid out perfectly level and for this reason it is advisable that the air, in any other point of the piping system, can escape freely, if possible in the direction of the circulating water.*

Regulating the Flow in the Piping System

If, in the pipe sizing process, all circuits were sized carefully to result in a balanced pressure drop throughout each individual circuit, no individual plug cocks or orifices are required in the coil connections. In this case a regulating valve for each panel, preferably located in a closet or behind a wall plate, will suffice. If the system is not carefully balanced by computation or in cases where it seems undesirable to use very small piping sizes in order to balance the system, plug cocks or orifices should be installed in series with the regulating valves.

Coil Installation

Particular care should be given to the *level* installation of coils. Floor coils are usually laid out freely, either on a concrete layer or on the reinforcing mesh. In the latter case, they may be attached to the mesh. Ceiling coils, when made of copper, are usually formed on the floor, lifted to their final location and attached under the metal lath to joists or furring strips by straps.

Testing the Panel

Before the coils are embedded in concrete or plaster, they must be tested for level layout as well as for leaks. Each coil should be exposed to a hydraulic pressure of 300 psi (or, in high buildings, to a pressure exceeding the combined static and dynamic by 100 psi). No pressure drops due to leaks should occur during a two- to three-hour testing period. In order to avoid damage, all coils should be embedded in concrete or plaster immediately after conclusion of tests.

---

*For further details see "Panel Layout and Coil Installation for Radiant Heating Systems," by R. G. Vanderweil, *Heating and Ventilating*, July and August 1945.

THE ACOUSTICS OF MUSIC SHELLS — Part II

By **HENRY L. KAMPHOEFNER, A.I.A.**

This is the second and concluding portion of Professor Kamphoefner's article. It deals with the theory and design of shells for large audiences.

SIDE WALLS?

Vern O. Knudsen, Professor of Physics at the University of California at Los Angeles, began a series of calculations in his book *Architectural Acoustics*, which shows the distribution of average speech in front of a stage enclosed by a flat vertical rear wall, diverging side walls, and a sloping ceiling. F. L. McMillan, Graduate Assistant in the Department of Physics at the University of Oklahoma, has extended and continued the calculations of Mr. Knudsen in an effort to show the properties of the simple reflecting shell and to determine whether or not the efficiency of the shell is increased by the addition of diverging sides.

Figs. 17 through 26 show sound intensities at various points in the theater due to the presence of the shell.

The total effect at any one point is here taken to be the sum of effects caused by the primary source and the several effective images. A point source having an acoustical output of one hundred microwatts is placed at various locations in front of the shell, whose walls have a coefficient of reflection of 0.96. The sound energy at any point can therefore be found by means of the inverse square law.

Three positions of the sound source are given consideration here. This method can only give a first approximation; as only primary images are used in the calculation, the sound levels given at the various points are only approximately correct. Since acoustical images are not as clearly defined as optical images, only the first order images have been considered. Variations in sound intensities due to the interference of the primary sound wave and reflected sound waves are herein neglected.

SOUND IMAGES AND THEIR EFFECTS

First, it is of value to present a few qualitative considerations. In general, the image I_3 will affect the entire auditorium. "The cone of influence" of I_3 can be seen from **Figs. 17 and 18** to depend on the extent of the rear reflecting surface and the location of the source. I_1 and I_2, the images of the source in the diverging side walls, will affect various parts of the auditorium depending upon the angle of diversion of the walls and the location of the source. I_4 will in most cases produce no beneficial effects as its "cone of influence" passes above the audience **(Fig. 20)**. The image I_5, of the source in the sloping ceiling, will depend upon the extent of the ceiling and the angle of slope **(Figs. 19 and 20)**.

From a quantitative point of view, only slight changes in sound levels at various points occur with differences in locations of the source. It is also shown that the absence of the diverging side walls changes only slightly the distribution of sound energy. This is probably due to the fact that at large distances from the source the images I_1 and I_2 are somewhat farther away from the source and therefore produce only relatively small effect.

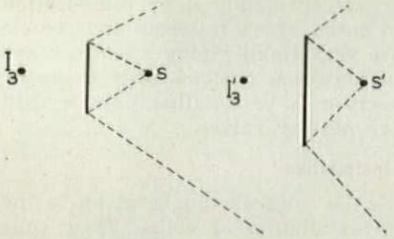
In **Figs. 17 through 26** the figures shown are sound levels in decibels due to the source plus the images shown.

One precaution should be employed in location of the source with respect to the reflecting surfaces. If the source is placed at too great a distance from the reflecting surfaces, or about 50 to 65 feet, troublesome echoes and resulting interferences will follow.

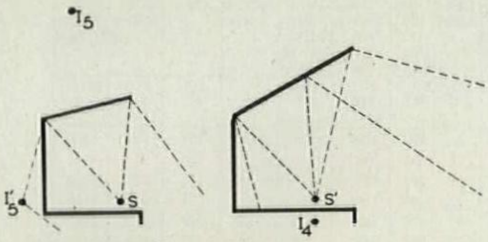
It may be said that the distribution of sound energy, at least for the first approximation, is independent of the location of the source and that the presence of the diverging side walls does not increase the efficiency of the shell enough to justify the expense of their construction.

MORE RECENT EXAMPLES

Several shells have been built during the last few years in which a flat rear wall, sloping ceiling, and diverging side walls have been used. Since the results of calculations herein show that diverging side walls do not increase the efficiency of the shell, they are, of course, not recommended as an addition to the sound shell. However, this form has been used in both the Ra-



Figs. 17 (left) and 18 (right)



Figs. 19 (left) and 20 (right)

Fig. 21

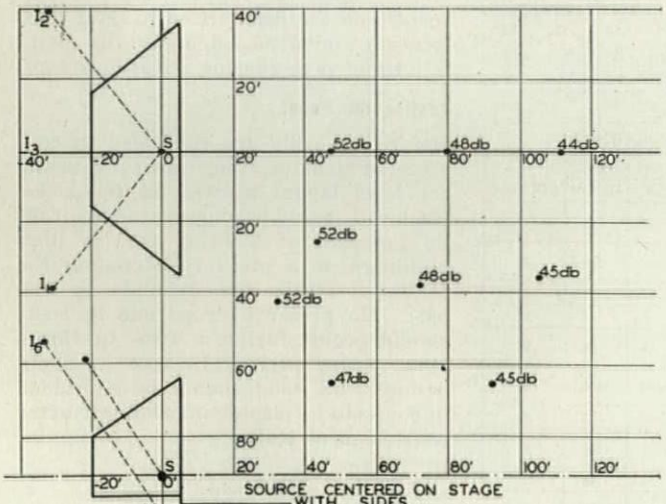
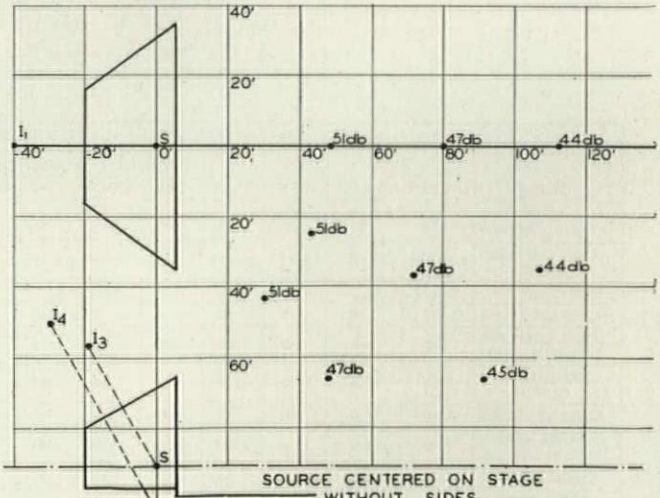


Fig. 22



vinia Park Opera Shell (**Fig. 27**) and the Sears Roebuck Pavilion at the New York World's Fair (**Fig. 28**). The method of breaking up the ceiling into horizontal bands to adjust properly the slope in the Ravinia Shell makes it the most satisfactory of the two. The sides serve only as stage setting. The Sears Roebuck shell would have functioned more effectively had it been designed in like manner. However, since the site was extremely noisy the shell did not operate as a simple sound reflector, and a public address system had to be used at all times.

CONICAL SHELLS

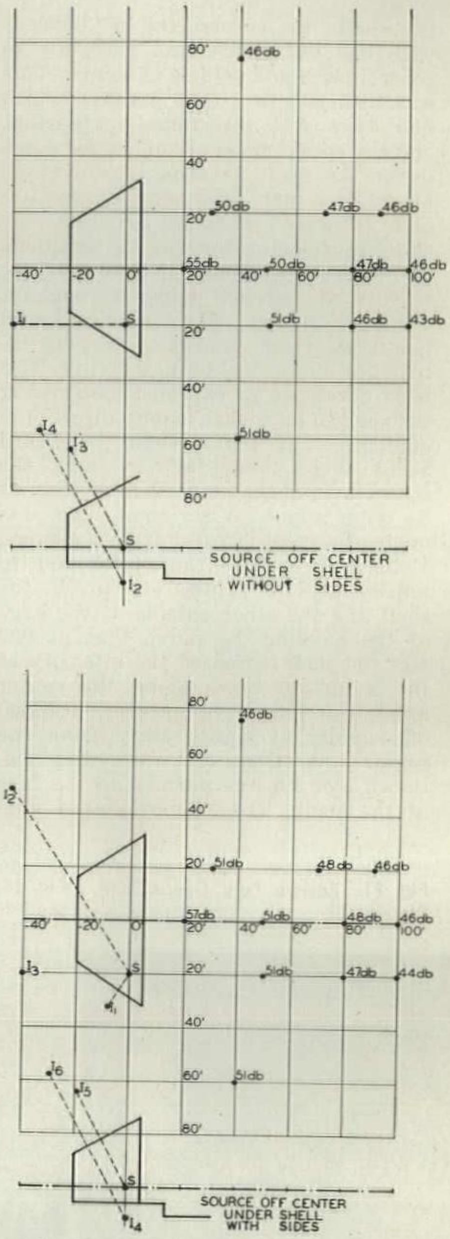
The research and study that went into the Hollywood Bowl was available for the designer of the Grandview Music Pavilion at Sioux City, Iowa (**Fig. 29**). That research proved that a simple semi-conical shape would direct sound from the stage down the center line of the amphitheater much farther than the shell with the vertical rear wall and inclined ceiling could send it. The Peterson Memorial Pavilion in Davenport, Iowa (**Fig. 30**), appears to be an archetype of the conical shell. The architects freely admit that acoustical information was not available at the time the building was designed. Although they apparently believed that the shape of the horn was the fundamental solution to their problem, they used it without exact knowledge of the ultimate refinement of the shape. In the completed shell, the rear wall serves the purpose of a reflector, but the side walls and ceiling are too nearly parallel to each other and to the floor to function properly.

The seating area for 6,000 persons at the Grandview Pavilion is inclined at an angle of approximately 10 degrees above the horizontal, as shown on the section. The last row of seats, which is not quite 300 feet from the center of the stage, is about 35 feet above stage level. Research during development of the Hollywood Bowl indicates that when a reflecting shell of this type is used, it should be tilted forward at an angle of approximately 45 degrees if the audience is seated on the level and at the same elevation as the orchestra. An amphitheater which is inclined on a hillside and rises above the orchestra level requires the angle of the cone to be more nearly vertical than 45 degrees—actually 45 degrees plus one-half of the inclination of the amphitheater slope. This formula dictated a slope of 45 plus $\frac{10}{2}$ or 50 degrees for the angle of the cone. Professional musicians say that the harmonics of a violin are easily heard at a point well beyond the last row of seats and a stage whisper is audible at 300 feet from its source on the stage. The soffit of the great arch is horizontal in the Grandview Pavilion, but the designer could have increased the efficiency of the shell by inclining the soffit of the arch at the same angle as the remainder of the cone.

The audience area at the Fort Dodge Pavilion (**Fig. 31**) is level and accommodates 3,000 spectators. The angle of the cone is therefore set at 45 degrees and the angle is constant over the entire inclined area including the soffit of the great arch. The amphitheater is long and narrow and well adapted to this directional type of shell. The site is a secluded one in a public park. The edges are well screened by trees. Because the roads at the sides are blocked during concerts, background noise is reduced to a minimum.

TESTS ON A CONICAL SHELL

H. Lynn Bloxom, physicist of Fort Dodge, has made a series of elementary sound tests at the Fort Dodge Pavilion in an attempt to show the distribution of sound reflection and the efficiency of



Figs. 25 (center) and **26** (top)

Fig. 23

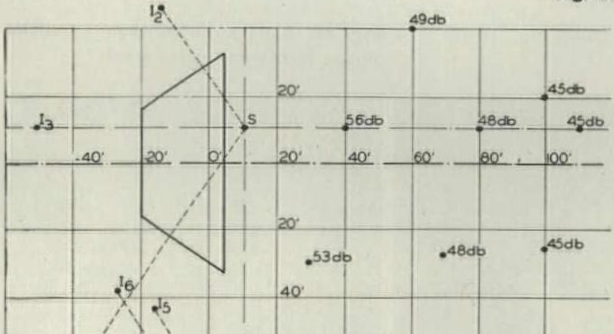
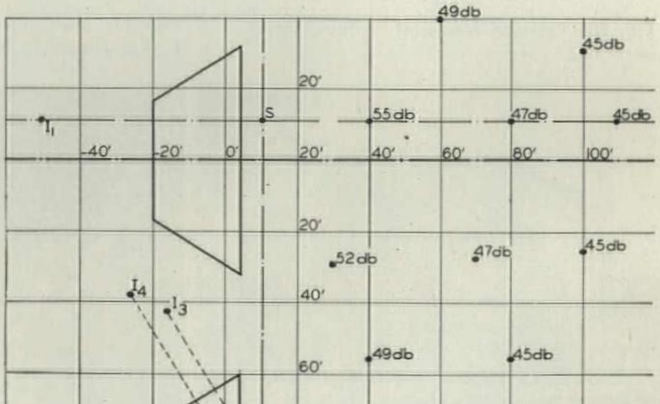


Fig. 24



the shell. He constructed a "howler" with one radio tube and rheostats to control pitch and volume of sound. This was attached to a cone speaker which had very few directional properties, and the speaker was set up on the stage under the shell at about the average height of a man. Although he was unable to attain extreme accuracy because a decibel-meter was not available Mr. Bloxom stationed listeners or observers at various points throughout the amphitheater. The observers found points at which sounds of varying intensities diminished to inaudibility. The tests developed as expected by showing the shell to have such strong directional qualities that sound could be heard about three times farther along the center axis of the amphitheater than at its outer edges. A series of tests was made at a point 600 feet from the stage. Using a note of the same pitch and intensity at two points, one inside the shell and the other outside at the edge of the pavilion, he found that at 600 feet the shell increased the intensity of the sound 36 times along the center axis. The intensity, however, dropped off rapidly at points away from the center axis. Observers were then stationed along a line parallel to the face of the shell. They found that a note which could be heard at 600 feet along the center axis could be heard only 100 feet along the base line. The test seemed to give conclusive proof of the directional qualities of the conical shell.

An interesting incident that shows the necessity for care in the design of conical shells occurred in Oklahoma City during the summer of 1939. A temporary shell of frame and pressed wood construction was being planned for the summer concerts of the Works Progress Administration Symphony. The site selected was the local high school football stadium. The shell was to be placed at the bottom of the end stadium seats, and the angle of the reflecting cone was set according to the principles just mentioned, in relation to the upward slope of the stadium seats, which were already constructed of concrete. After completion of the shell the acoustics were pronounced good. When the popularity of the concerts demanded more space for spectators, the shell was moved backward to the opposite end of the football field. It was soon noticed that music could be heard more distinctly along the top wall of the stadium seats, some 450 feet from the stage, than at the rear of the seats on the field, only 300 feet away. The directional shell designed for one condition could not be used successfully unless the slope of the shell was changed. Since making the change would mean nearly a complete rebuilding, the shell has been left as it was originally planned.

Another shell using the simple conical section is the Blatz Music Pavilion in Milwaukee (Fig. 32). Built as a monolith in concrete, it shows influence of the Grandview Pavilion in Sioux City, in the monumental form of the main mass and in the form of the great arch. The site, in a public park, was not chosen with care to eliminate background noise, and so a public address system has been installed.

FOR LARGER AUDIENCES

For great audiences of from ten to twenty thousand persons it is necessary to control the direction of the sound even more closely. The designer of the Hollywood Bowl (Fig. 33) solved this problem effectively by breaking the surface of the simple conical section into a series of concentric rings or ridges. The purpose of such a form is to place the reflecting surfaces as close as possible to the sound source. Al-


Fig. 27. Ravinia Park Opera Shell, Ravinia, Ill.


Fig. 28. Sears Roebuck Pavilion, New York World's Fair; Scott Irwin, Archt.


Fig. 29. Grandview Music Pavilion, Sioux City, Ia. H. L. Kamphoefner, Archt.


Fig. 30. Peterson Memorial Pavilion, Davenport, Ia.


Fig. 31. Music Pavilion, Fort Dodge, Ia. Henry L. Kamphoefner, Archt.

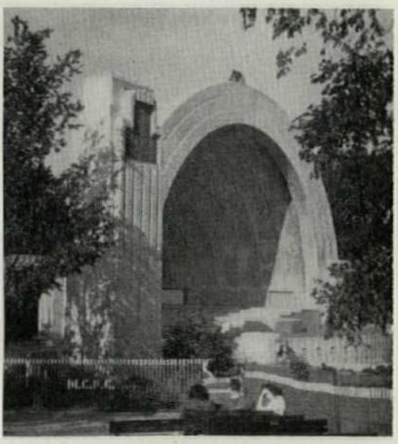


Fig. 32. Blatz Music Pavilion, Milwaukee, Wisc. Fitzburgh Scott, Archt.

though the plain conical section is simpler structurally and easier to build, its reflecting surface tends to get too far away from the sound source, especially if the slope of the amphitheater is steep and the angle of inclination of the cone is high. For orchestra and band and even for vocalists the simple conical Grandview shell seems to be adequate as a reflector for audiences of up to 8,000 persons. When reflecting surfaces are lowered and local conditions are ideal, as they are at the Hollywood Bowl, it is possible to reach audiences of up to 20,000 people.

Because of the amount of descriptive material already written on the Hollywood Bowl it would be superfluous to write in detail again of its structure and its acoustical functioning. A brief summary of its acoustical performance will suffice here. The seating area of the Bowl is inclined upward from the shell at an angle of about 12 degrees. The last row of seats is about 550 feet from the stage. Most of the sound is thrown from the shell upward to the top rows of seats. The closer rows receive plenty of sound directly from the source without need of reflection in addition. The design produces a most democratic result, since the cheaper seats at the rear of the amphitheater are in reality much better, except for detailed vision.

Several acoustical authorities have complained that the conical shell, especially this ridged type which controls the direction of sound so definitely, tends to focus high frequency vibrations down the center axis of the amphitheater whereas low frequency vibrations are spread out over the entire audience area. H. Lynn Bloxom in his tests on the Fort Dodge Pavilion intimates that this defect might exist. If it were noticeably serious it would definitely distort musical harmony and make the conical shell undesirable as a reflector. However, Vern O. Knudsen says that sound of 128 cycles and above is reflected evenly by the Hollywood Bowl and even vibrations of lower frequency are not distorted noticeably.

This type of shell, with the conical section in a series of concentric ridges, has been used at Grant Park in Chicago (**Fig. 34**) for the summer concerts of the Chicago Symphony and for very widely diversified municipal uses. Because the audience area is level the visibility of the stage is poor. The park, furthermore, is so noisy that a public address system was required. The shell, however, is sound acoustically and under better conditions would be ideal as a reflector. The Park Board evidently did not believe that the world would beat a path to the door of the

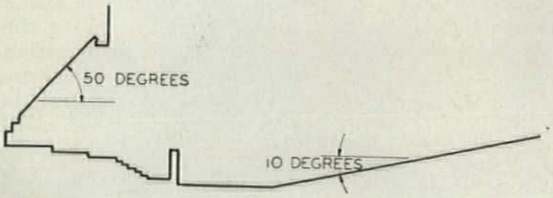
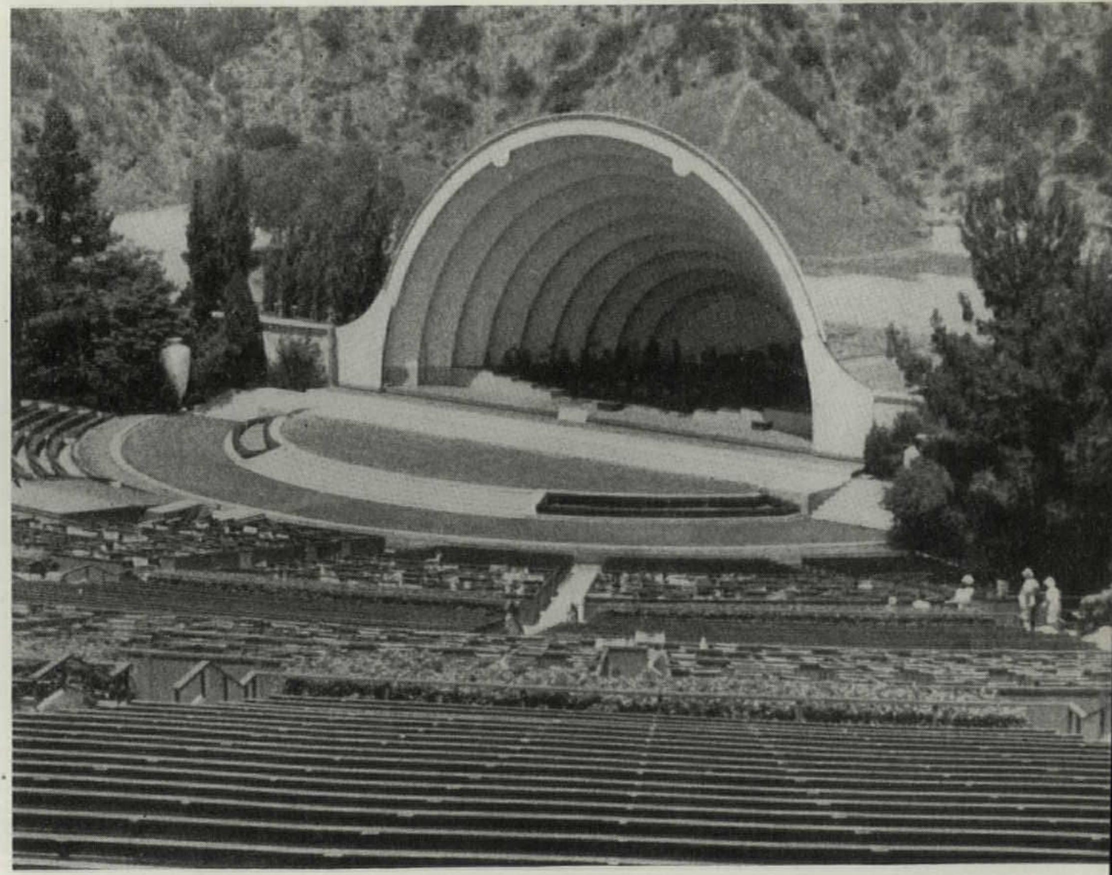


Fig. 29A. Section through Grandview Pavilion, Sioux City, Ia.

Fig. 30. Hollywood Bowl, Hollywood, Calif. Vern O. Knudsen, consultant on acoustics; Frank Lloyd Wright, Archt. Reflecting surfaces are designed for audiences of up to 20,000 people.



man who invented a perfect mousetrap, no matter where he lived. Nor did they realize that a good shell would draw listeners, wherever it was. Rather, having a good shell, they thought they must put it in a public place, where it could be seen. They should have known that a secluded site would draw a more critical audience than the poorly located shell, and probably as large a one.

The ostentatious Walbridge Park Pavilion in Toledo, Ohio (Fig. 35), built with pride by the WPA, is another shell constructed on principles used in the Hollywood Bowl. The amphitheater is secluded in a controlled section of a public park where the background noise is at a minimum, and the acoustics are good.

The Ford Music Pavilion built for the San Diego Exposition (Fig. 36) is a derivative of the conical shell. It uses a series of flat planes to accomplish the same result. This change works for a more simplified structural system and in theory directs the sound with less concentration.

GETTING RID OF ECHOES

The most interesting feature of the shell is the method the architect has used to free the acoustical system from all echo. Careless placing of such surfaces as backs of seats and retaining walls, in other amphitheaters, has produced an echo effect when the sound has been reflected from such surfaces back to the shell and then out to the audience again a fraction of a second later. Such an echo can be very bothersome. In the Ford Bowl the angles of all seat backs and retaining walls are slanted back from the vertical as shown on the accompanying diagram and the sound is reflected up into the sky as shown in Fig. 37.

Fig. 34. Grant Park Music Shell, Chicago, Ill. Designed by Chicago's South Park Board.

Fig. 35. Shell, Walbridge Park, Toledo, Ohio. Michael O'Shea, Archt.

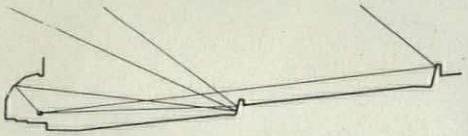
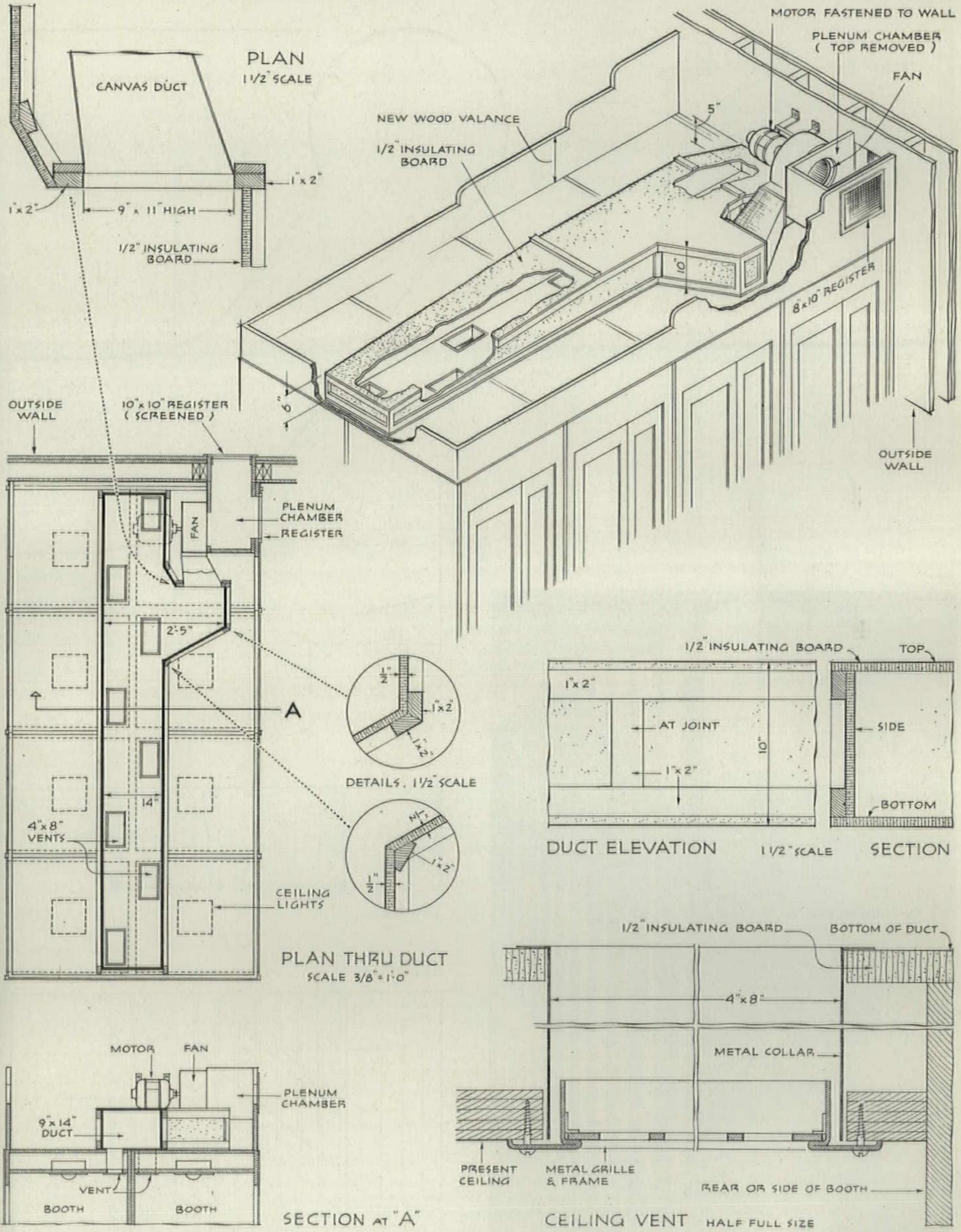


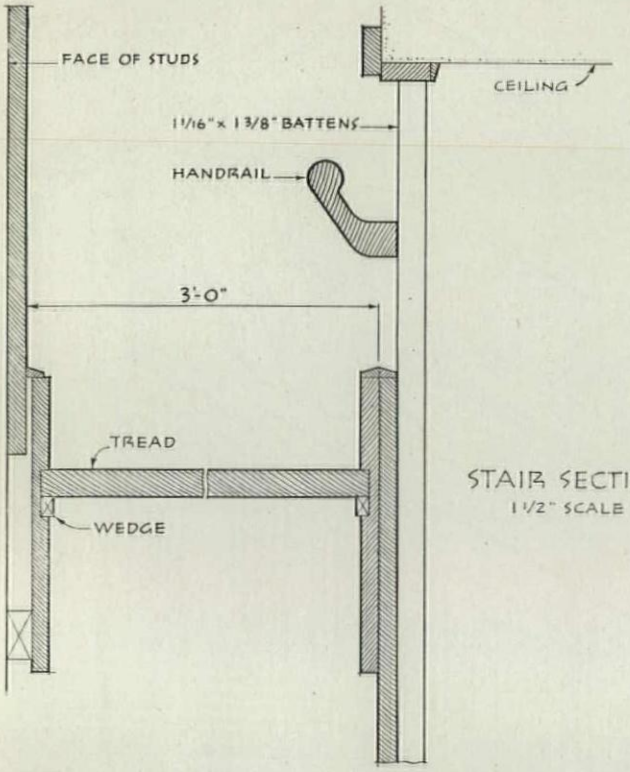
Fig. 37. Section through the Ford Music Shell and amphitheater, showing seat backs and retaining walls slanted to reduce echoes.

Fig. 36. Ford Music Shell, San Diego Exposition, San Diego, Calif. Richard Requa, Archt.

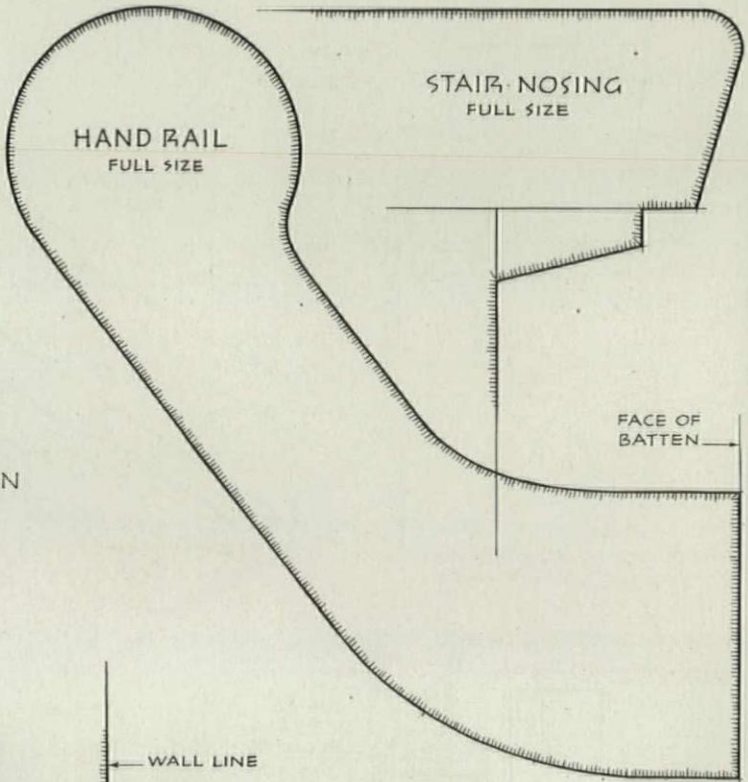
TELEPHONE BOOTH VENTILATION — F. D. Jockley, Engineer



DETAILS: STAIR — Rudolph Mock, Architect

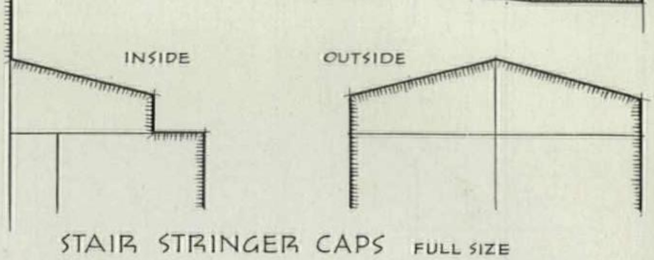


STAIR SECTION
1 1/2" SCALE



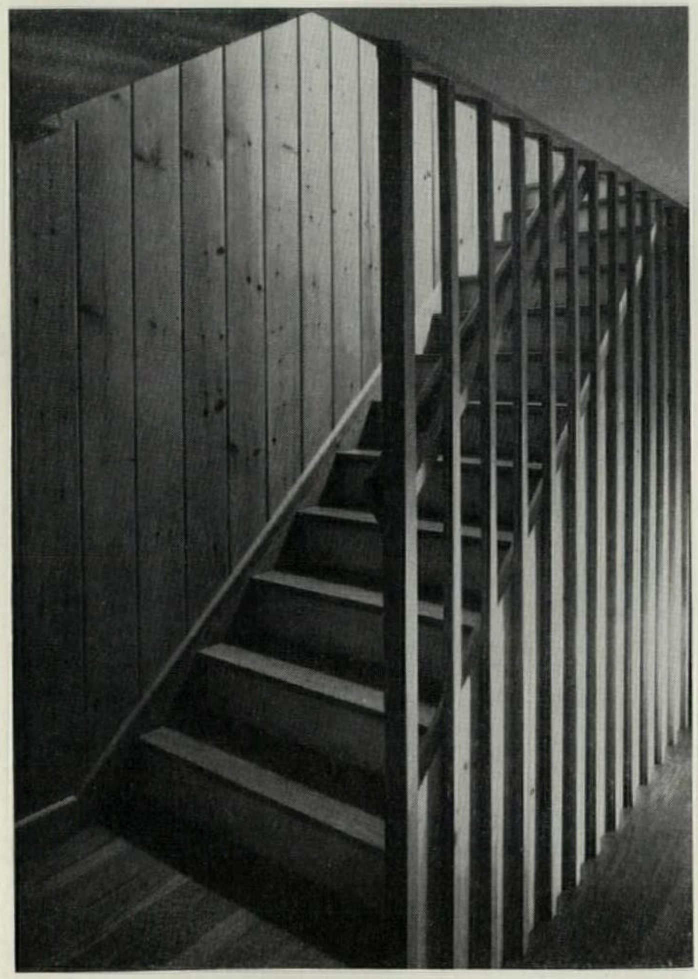
HAND RAIL
FULL SIZE

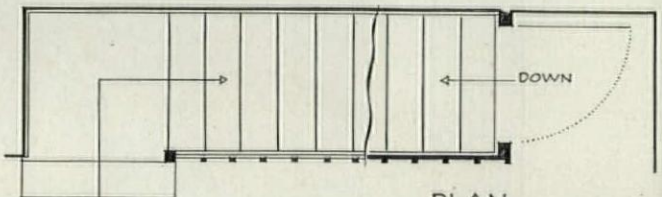
STAIR NOSING
FULL SIZE



STAIR STRINGER CAPS FULL SIZE

RODNEY McCAY MORGAN





PLAN

ELEVATION 1/4" SCALE