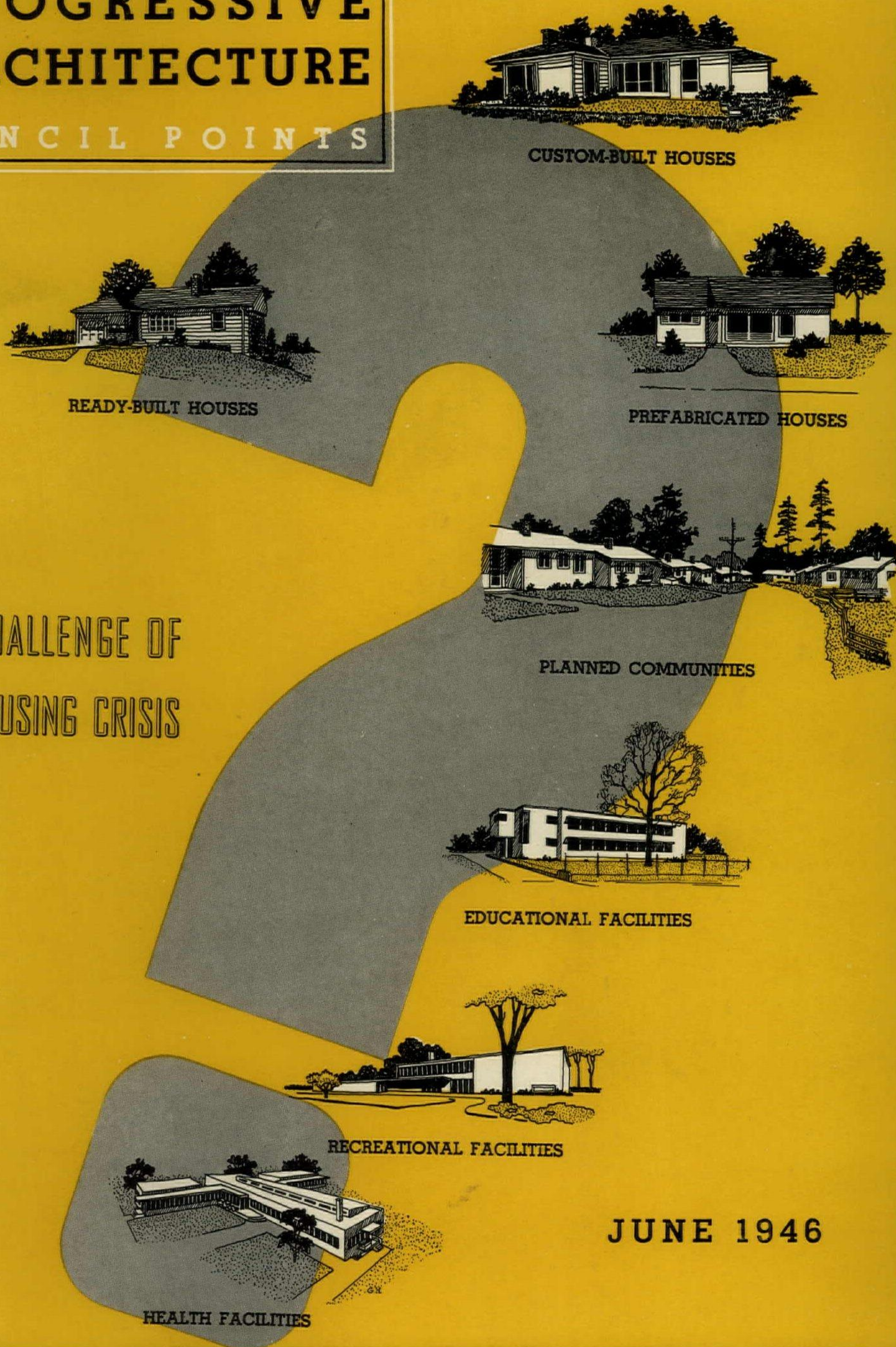
PROGRESSIVE
ARCHITECTURE
PENCIL POINTS

THE CHALLENGE OF THE HOUSING CRISIS



JUNE 1946

Jenkins PRACTICAL PIPING LAYOUTS 11

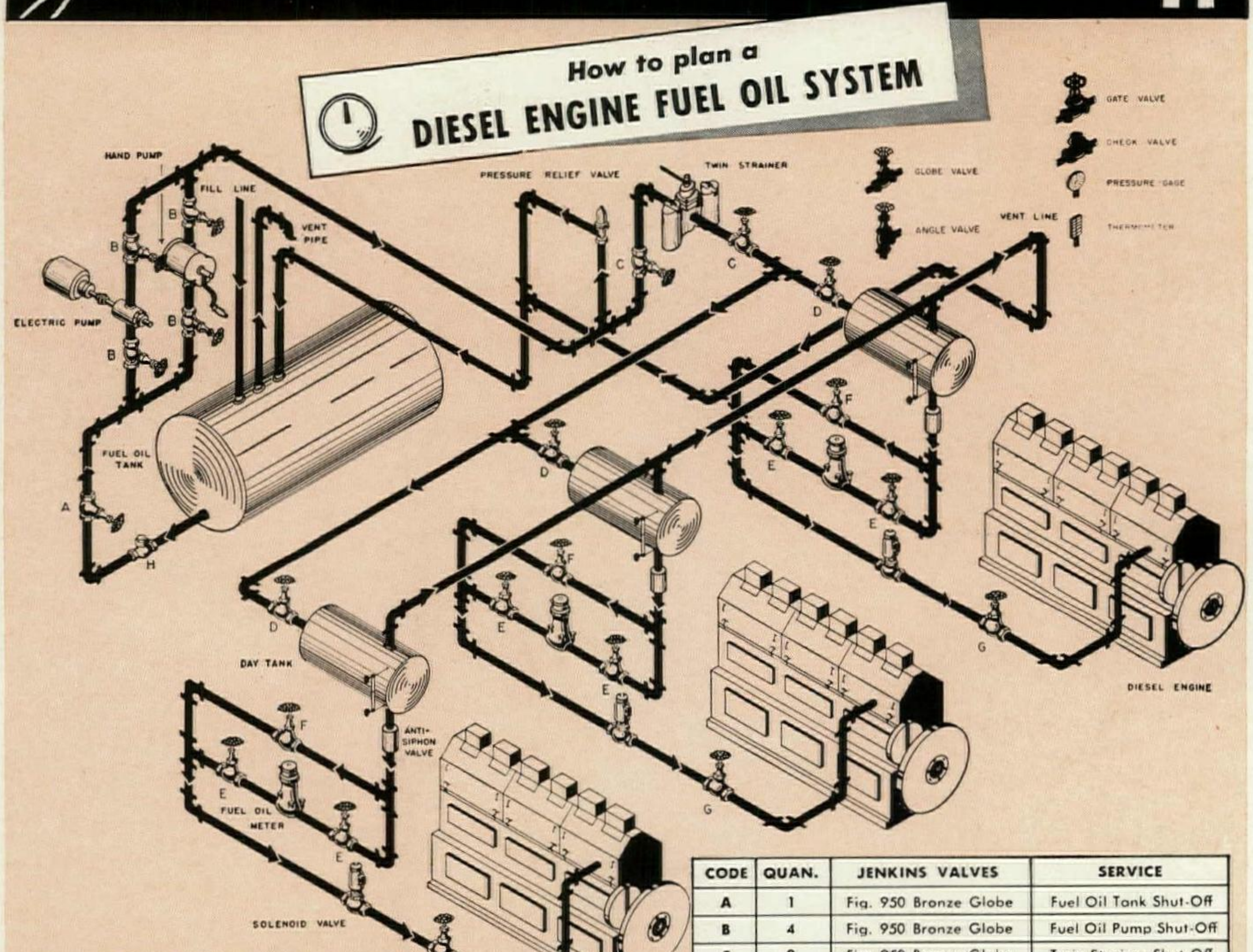


Diagram by Huxley Madeheim, Consulting Engineer

CODE	QUAN.	JENKINS VALVES	SERVICE
A	1	Fig. 950 Bronze Globe	Fuel Oil Tank Shut-Off
B	4	Fig. 950 Bronze Globe	Fuel Oil Pump Shut-Off
C	2	Fig. 950 Bronze Globe	Twin Strainer Shut-Off
D	3	Fig. 950 Bronze Globe	Day Tank Admission Control
E	6	Fig. 950 Bronze Globe	Meter Shut-Off
F	3	Fig. 950 Bronze Globe	Meter By-Pass
G	3	Fig. 950 Bronze Globe	Engine Shut-Off
H	1	Fig. 762 Bronze Swing Check	Suction Line

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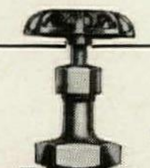

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PROGRESSIVE
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MAKE THAT HOUSING GOOD!

The situation of the architect, here in mid-1946, is a paradoxical one—plenty of substantial work on the boards but comparatively little that can be built now. Yet there are signs that the frustrations to which creative spirits have become inured during these decades of depression and war will not last much longer. Another spring will surely see an adequate supply of materials and labor so that the paper plans and specifications of today will become lumber and steel and brick and stone realities.

While we wait, however, for the more ambitious projects to materialize, there is a pressing program of humbler nature but of vast scope and social importance to be accomplished. Homes must be provided for millions of ordinary American families—including veterans and non-veterans of average or below average incomes. These houses must be of all varieties, ranging from single, duplex, and row houses to large scale, low-rent apartments. Many will be prefabricated but more will be conventionally built. Hundreds of thousands of units will unfortunately be erected with little or no architectural guidance, either as to plan or supervision.

Yet the influence of good progressive design on this postwar housing will not be negligible. The public has learned a great deal from the better work that has been published during these past few years and it has a much better understanding than ever before of the possibilities for greater comfort, convenience, economy, and beauty that lie in good planning and the application of modern methods and materials to building. An increasing number of individual clients, intelligent developing builders and promoters of group housing will be smart enough to make direct use of the best architectural talent that is available. They will find it good business to do so.

There is great danger, of course, that with all the pressure for speed in construction and low cost for the finished results there will be a tendency to produce cheap and flimsy buildings to house the American people. Where quantity is the watchword, the merit of the product is likely to decline. It is the architect's place to exert every ounce of influence he possesses toward the maintenance of high quality in this housing—not only in the structure, materials, and craftsmanship, but in the design of both the individual units and the communities into which they are composed. This he can do directly and indirectly in a variety of ways. We hope he will assume the responsibility and thus prove himself truly a professional man.

It is to the architectural profession—within which we include all serious, able, and conscientious building designers of no matter what official title—that the public must look for improved rather than declining standards. No other group should care as much. No other group has the necessary combination of abilities. The present emergency will provide a revealing test of its claims for wider public approval and support.

Kenneth Reid

WILSON W. WYATT, National Housing Expediter Administrator, National Housing Agency

THE ARCHITECT AND THE HOUSING

The Veterans' Emergency Housing Program calls for the starting of 1,200,000 homes this year and 1,500,000 in 1947 to meet the critical shortage of homes which faces returning veterans and other citizens.

This rapid acceleration in home building makes it necessary to guard against unplanned, incompletely planned, or improperly planned projects. When builders throughout the country are asked to construct houses to the limits of their ability, there will be some who will propose building in the wrong places, or without sufficient attention being paid to such necessary community facilities as schools, hospitals, utilities, stores, transportation, and employment.

Obviously control over community planning cannot and should not be exerted from Washington or even from the office of the regional expediter. That is why we are urging Veterans' Emergency Housing Committees to work with planning groups in each community to get the best possible locations and site arrangements. Certainly, none of us wants the housing that is built in this emergency to become future slums.

There is another important community committee—separate from the one mentioned above. That is the Civilian Production Administration Committee set up to help the local CPA representative determine what non-residential construction is essential and should be allowed to go forward. It is the responsibility of these committees to see that new housing is not starved for health, educational, and even shop-

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READY-BUILT HOUSES
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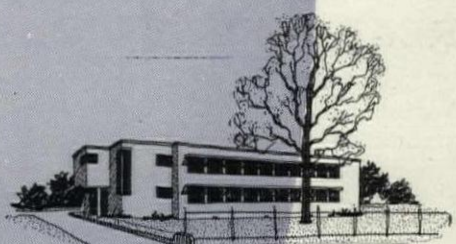

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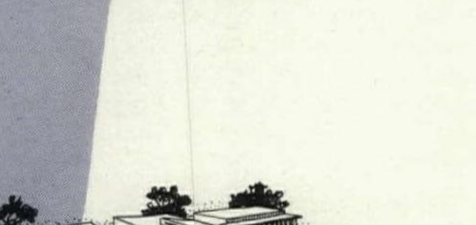

RECREATIONAL FACILITIES
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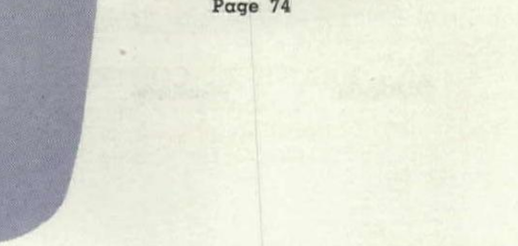
CRISIS

ping centers, which will be needed to service new residential developments.

The architects and city planners throughout the country thus have a definite responsibility and part in this program, not only as designers of individual homes, but as members of and advisers to both of these committees.

Architectural groups and individual architects should see to it that planners are represented on these committees so that they may make their voices heard throughout the country, on the side of *good housing* and *well planned housing,* as well as *enough housing.*



HEALTH FACILITIES
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As an illustration of the agreeable type of home community that can result when an aggressive homebuilder commissions competent architects to lay out the pattern of the development as well as design the house types, "Wedgwood" is instructive. While the houses can hardly be classed among the most progressive residential work extant, the careful organization of the floor plans and the willingness to improve upon convention in design elements represent laudable advance in this conservative field of architecture. Twenty-four basic designs are used for the various two- and three-bedroom houses. It is of more than passing interest that this particular builder-architect team has successfully worked together for 10 years, with some 1,500 completed homes to their credit.

READY-BUILT HOUSES

Various schemes have been tried to compensate an architect for standard designs which can be varied. The compensation must be such that he can afford to give real thought to plan and construction and materials and the expression of these things in the design of the building. Perhaps the ideal arrangement would be a cost plus fixed fee payment to the architect. Failing this, an agreed upon fixed sum determined by an estimate of the architect's cost plus a reasonable amount for profit and overhead is a workable arrangement, and one which is being used in many cases. Either of these plans seems preferable to a percentage fee, which today may fluctuate and turn out to be arbitrary and unfair to one or the other party, and even better than a small payment for an original design with royalties for "repeats"—an arrangement which bears little relationship to the actual investment or cost on the architect's part.

Whatever financial arrangement is made, there should be an allowance for a certain amount of consultation during construction. The architect's part in the site layout, and the development of a planned community rather than an aggregation of houses, is another aspect which is important and must not be overlooked.

Meeting more discriminating buyers—families who have read about and studied the new trends in planning and are curious about new materials, modern equipment functionally arranged, and in many cases a contemporary appearance—the builder will increasingly rely on the design ability of architects who are modern-minded and trained in the new idiom. Changes and improvements in technics in the home building industry should bring closer together those two professions—those who design and those who build.

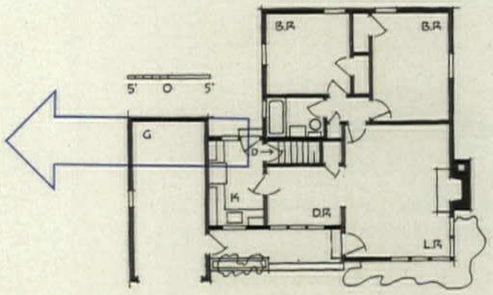
FRANK W. CORTRIGHT
Executive Vice-President,
National Association of Home
Builders of the United States

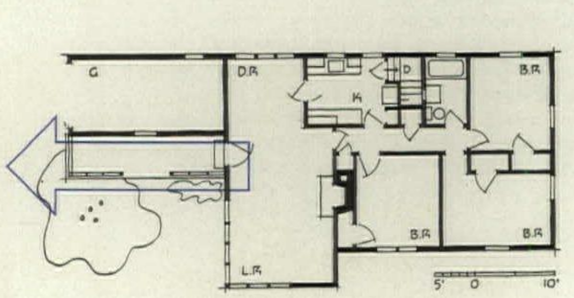
TYPICAL two- and three-bedroom houses.

Photos by K. S. Brown

"WEDGWOOD," SEATTLE, WASHINGTON

THOMAS, GRAINGER & THOMAS, Architects — ALBERT BALCH and MAURY SETZER, Developers and Builders





In general, the houses at "Wedgwood" are wider than they are deep and built on wide, shallow lots. Dining space is usually a continuation of the living room, providing an increased sense of space, and all houses have a fireplace, an attached garage, and a full basement; the whole development is carefully landscaped and includes land-respecting curved streets—elements which not only facilitate sales but produce a harmonious, integrated neighborhood pattern.

Use of standard lumber sizes, and repetition and variation of basic floor plans made for economical wholesale construction methods. As the development progressed, two bulldozers constantly cleared land for new houses, leveling a temporary road in back of each house for easy truck access. Large power saws occupied an on-site cutting shop for precutting framing lumber to length; a smaller power saw, in one of the under-construction houses, cut trim and finished lumber as needed.

CUSTOM-BUILT HOUSES

Many architects will find themselves, in the next few years, forced to consider small house design, despite doubts about the possibility of doing a progressive job and at the same time making a living.

We asked two architects active in this field to tell us of their difficulties and their rewards. Theodore C. Bernardi, of Wurster, Bernardi and Emmons, San Francisco, California, and Don Hershey, of Rochester, New York, agree on many points.

Hershey says the architect who would design houses successfully should "accept only those clients who are interested in doing a thorough and complete job with an open mind. Choose what you firmly believe and stick to it! Study materials, codes, and labor in your area; then design accordingly."

Bernardi points to William Wilson Wurster's success: "He devoted himself to his work, giving each client the benefit of his knowledge, imagination, and personal attention. This led to a recognition which brought a steady stream of jobs. He never 'went after a job.' Yet he kept a sizable office busy."

Hershey's business formula is simple and realistic: "Make certain your project is sound; charge at least 8% and hold to it; keep overhead low (efficiency is more essential than glamor); provide complete and compact plans, details, specifications; insist on supervision."

On the quality of clients' taste, both architects are encouraging. Says Bernardi, "The house-hungry people wait in line for plans from the architect and for lumber from the yard, and they are beset by high and uncertain building costs. It would be little wonder if they were satisfied with whatever is offered regardless of quality. But it is not so. More than ever they want good plans, carefully thought out amenities, outdoor living, the exhilaration of glass."

And Hershey reports from upstate New York, "I have found that by steady, constant strokes the public has gradually come to contemporary thinking."

Don Hershey (along with many others) is content to stay in the field of individual residence design. "Here is a real challenge to the architect and to the profession. Don't let them tell you that it's impossible to make a good living out of residential work. It can be done if you calculate carefully and set your office up accordingly."

Theodore Bernardi agrees, in essence, but thinks, if good architecture is to reach the very small house, that "the architect with imagination must, in turn, capture the imagination of developers and prefabricators so that they will consider his services a prime requirement."

Our correspondents appear to agree that it is possible and it is rewarding, although it requires careful maneuvering, to engage in a small individual house practice, and that anyone so engaged should look ahead and find ways to participate in the speculative and the prefabricated house fields.

Photos by Roger Sturtevant

The architect-commentators quoted at left come from California and New York. So do the two projects we have selected to illustrate progress in the individually designed small house. Both are two-bedroom houses, and both are specifically designed to meet particular family needs. In neither of them was there any effort to force a family within a preconceived design idea. That they also employ certain materials and equipment made possible by today's technological advance further places them in the progressive category.

THE REAR of the house faces south.

HOUSE IN ATHERTON, CALIFORNIA

WILLIAM F. HEMPEL, Architect

Designed for a young couple in a community near the campus of Leland Stanford, Jr., University and within easy commuting distance of San Francisco, this big-windowed house is built on a level site among the superb trees of an old estate that is now being subdivided. A study of the floor plan on the following page shows how by skillful organization of space the architect has achieved far more livability and amenity than are usually found in a house of this size. The large photograph above illustrates one of the most successful plan elements—the projection of the living room on the lawn side of the house, automatically producing two separated living terraces—the one on the right (opening off the dining room and kitchen) which is used for outdoor dining; the one at left (reached from the living room) provided for informal lounging.

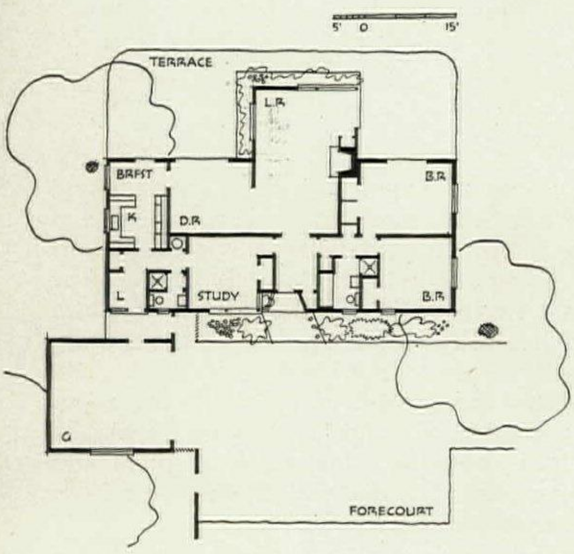
ENTRANCE COURT: Garage at left. Exterior walls: combed redwood siding. Cedar shingles on the roof.

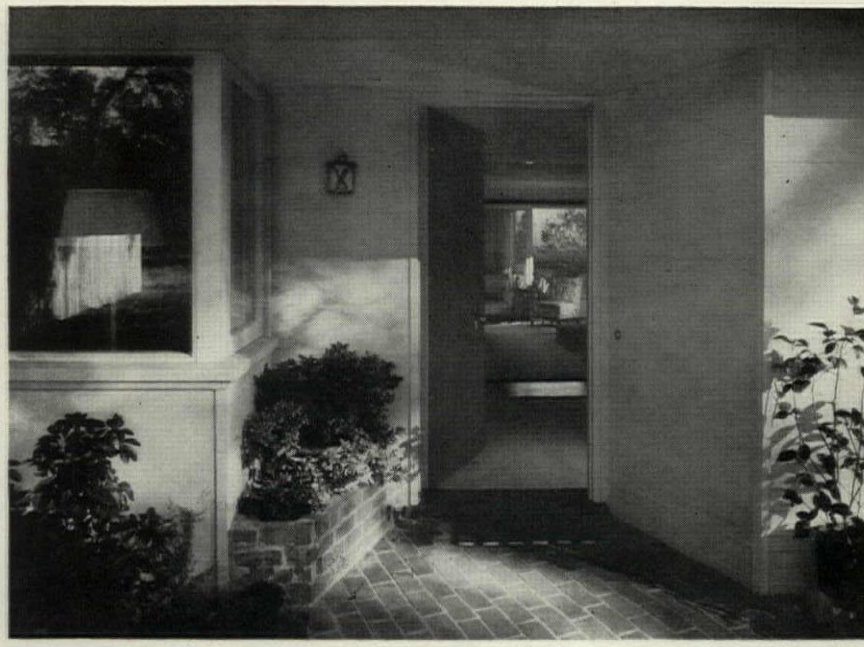
HOUSE IN ATHERTON, CALIFORNIA

WILLIAM F. HEMPEL, Architect

The owners had the usual requirements, the architect says, "of wanting more house and finish than the pocketbook would allow." So, after determining their most important "musts," he persuaded them to leave on a month's vacation, only to present them on their return with the plan essentially as it was built.

The compact arrangement provides surprising flexibility. The bedroom wing is reached directly from the entry; the study, with adjoining small bath, may be variously used—as a study with a back-door bath for cleaning up after gardening; as a maid's room; as a guest suite, or as a rental unit. The outdoor living rooms formed by the projecting living room have already been noted. The relation between the living room and the front door creates an illusion of almost endless space; for, from the door, the eye travels through the entry, across the diagonal of the living room, and on through the great corner windows out to the terrace, lawn, and trees beyond.





FRONT DOOR: Room placement provides a vista through the entire house.

LIVING ROOM: Mahogany veneer on the fireplace wall; pale blue paint on the others and on the ceiling; draperies, hand-blocked with a ginger-color pattern.

THE LIVING TERRACE.

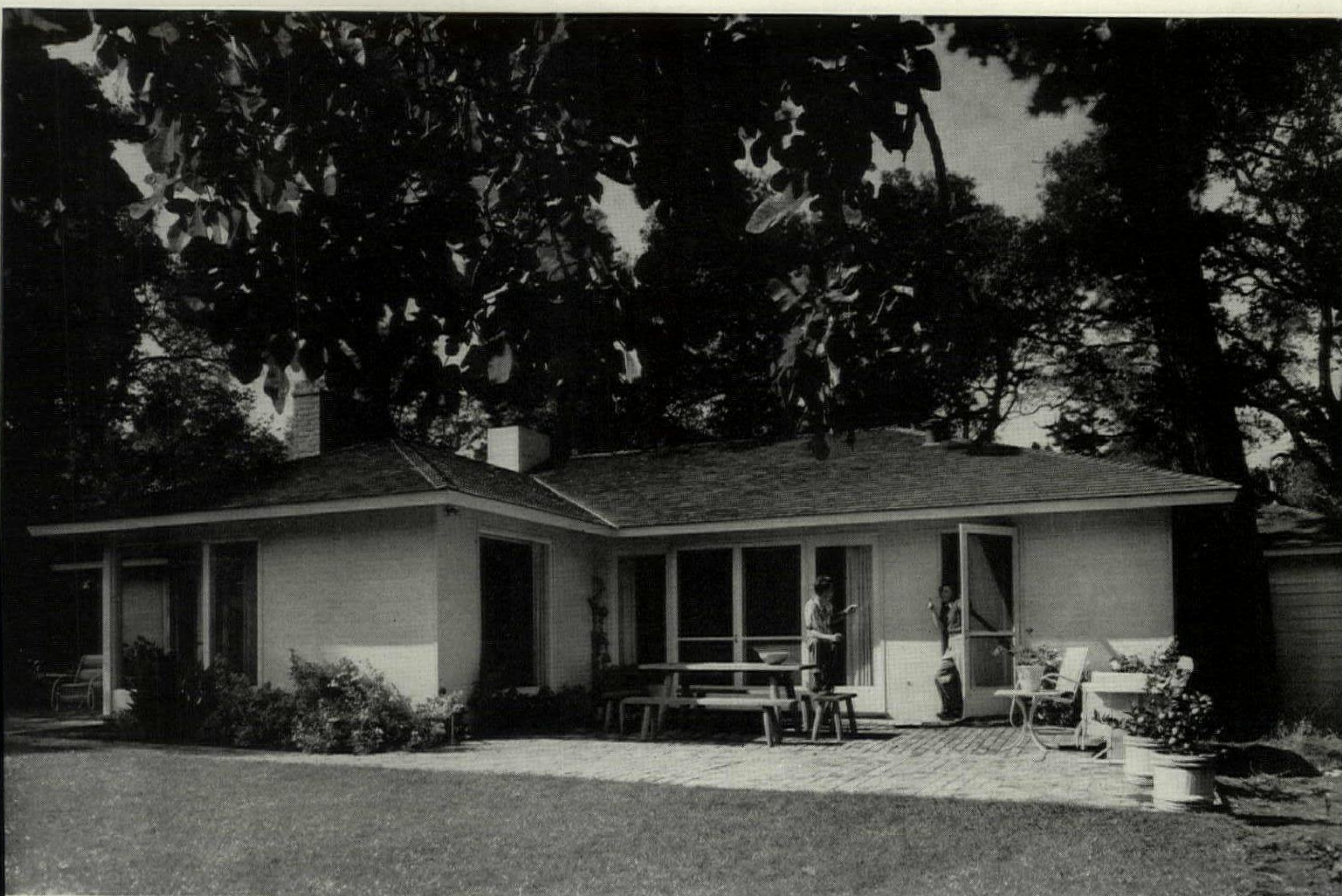
HOUSE IN ATHERTON, CALIFORNIA

WILLIAM F. HEMPEL, Architect

Originally, the plan called for trellises above the two terraces; but the budget required a choice between these and the floor-to-ceiling glazing on the southern front. The latter was chosen, with the thought in mind that trellises might be added later.

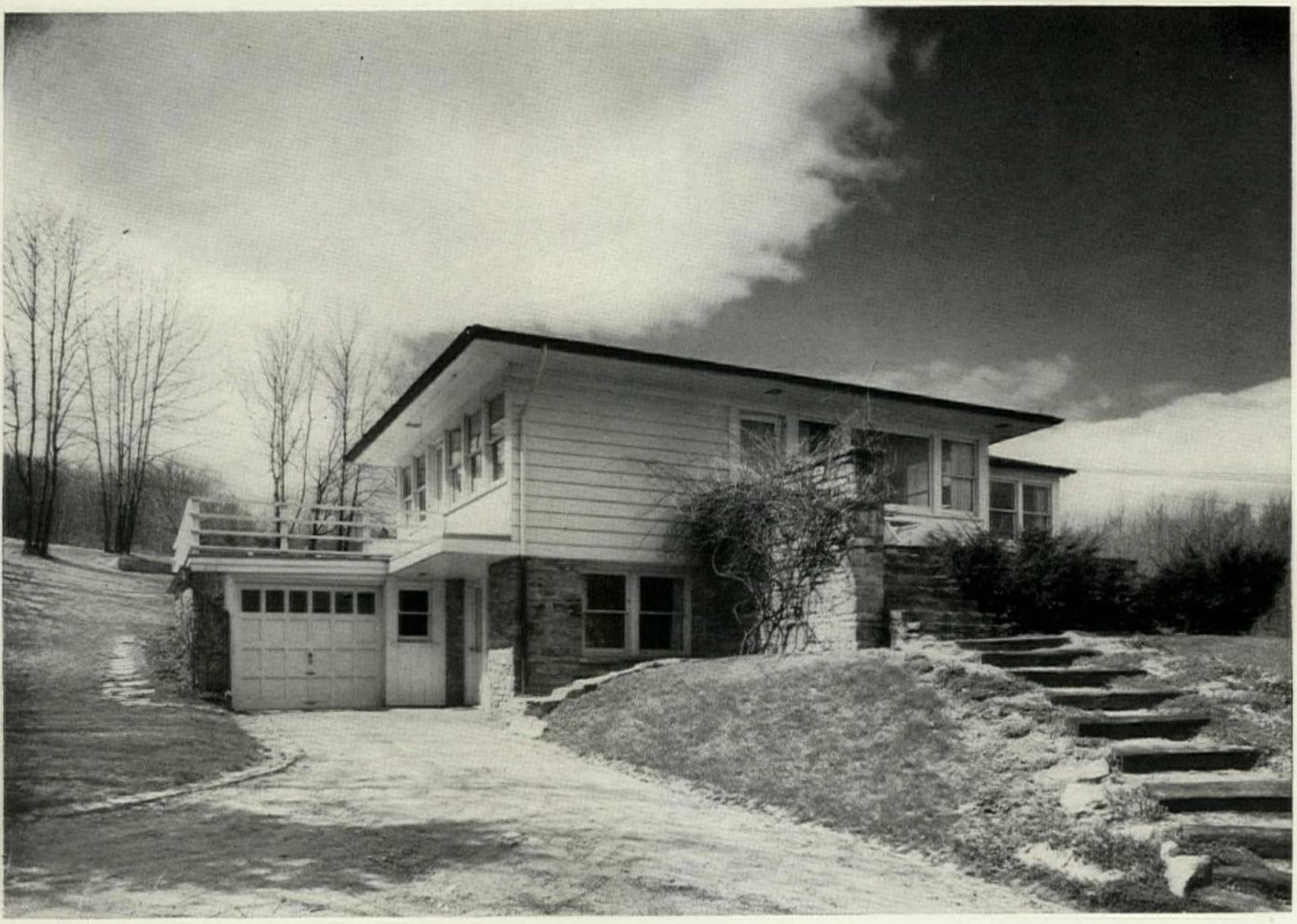
The photographs on these two pages illustrate the outdoor living rooms at the back of the house. From the living room, doors open to the smaller terrace in the southwest corner where midday sun is ever present; the southeast terrace, the larger of the two, has access from the dining room, receives afternoon shade, and ample space for outdoor eating facilities.

LIVING ROOM CORNER WINDOW adjoining terrace.



THE DINING TERRACE.

VIEW THROUGH DINING ROOM toward terrace.



Photos by Gottscho-Schleisner

HOUSE IN DUTCHESS COUNTY, NEW YORK

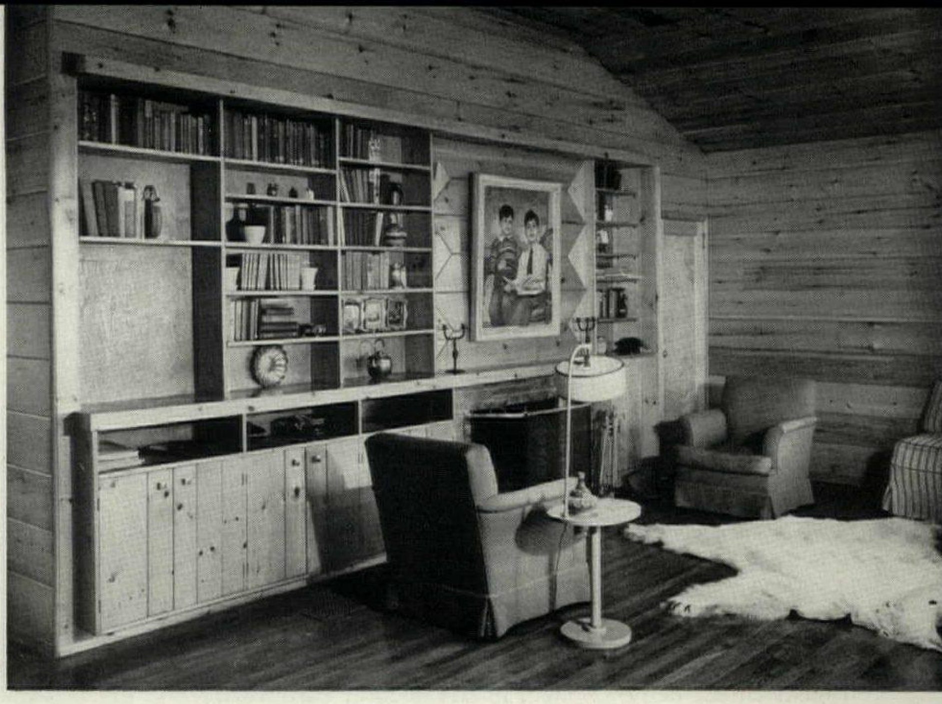
DANIEL SCHWARTZMAN, Architect

Completed just before the war, this house was designed for a professional man, his wife, and two sons. It was built initially for weekend and vacation use; eventually it is to be their year-round home. A magnificent view to the southeast and a pleasant outlook toward a hillside orchard and brook toward the west determined the orientation. Extensive excavation was impossible because of a natural rock outcropping; hence, the split level plan. Beneath the main living-room area are an above-grade playroom, with windows on the south and west, an interior boiler room, and a large storage closet off the entrance hall. Upstairs are the large living room, kitchen, bedrooms, and outside living deck, over the garage.

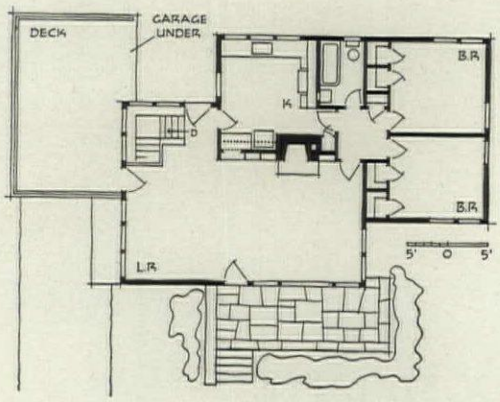
Much of the construction work was done by a farmer-part-time-carpenter and a farmer-part-time-mason. Approximate total cost was $5,000.

A VAST VIEW to the southeast set the orientation.

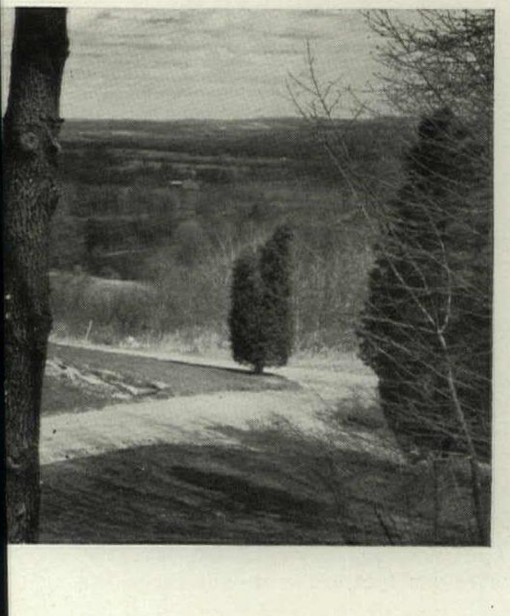
The foundations are local stone; exterior walls are finished with V-joint pine siding and horizontal cedar siding; asphalt shingles are used for roofing.



FIREPLACE CORNER; walls and ceiling, knotty pine; floor, oak.



THE BAND OF WINDOWS at the corner frames the distant view.



THE SPACIOUS, many-windowed kitchen.

PREFABRICATED HOUSES

Application of modern production techniques is creating for the first time in history a large-scale demand for architectural services in the field of low-cost housing.

Good design, which creates eye appeal, is an essential characteristic of these mass-produced homes. The need for good design has been recognized by manufacturers of toasters, automobiles, cosmetic packages, and hundreds of other items, who have employed the country's best industrial designers. If important in these products, it is a thousand times more important in a man's castle.

Good planning, from the standpoint of the efficient and economical use of space, is the second essential, because low-cost housing must provide the most home for the least money.

Livability, that less clearly defined attribute of a good home—that forethought that makes for convenience, easy arrangement of furnishings, and efficient housekeeping—is the third cardinal requirement, all three of which must be supplied by the architect.

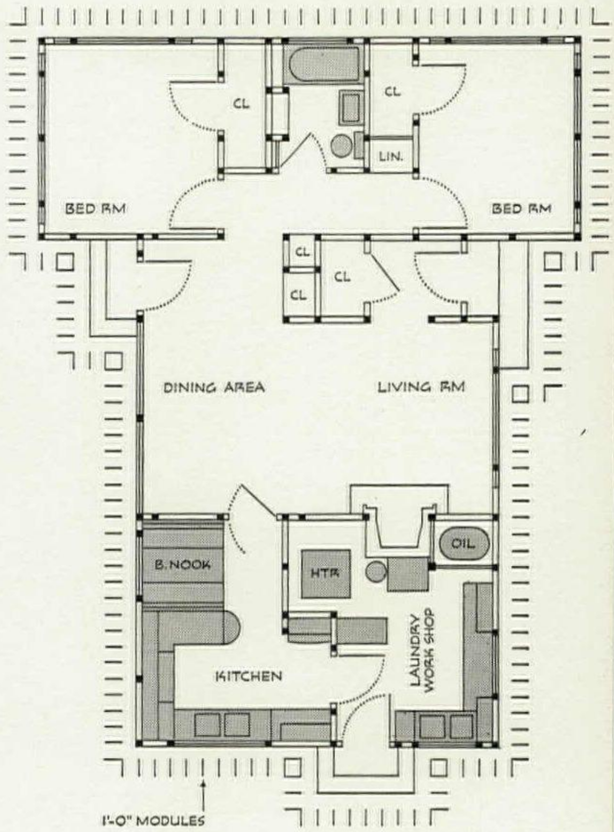
Chief among the possibilities for reducing housing costs is reduction of the materials used. This calls for the most intelligent use of existing materials and the proper application of new materials.

No matter how nearly perfect the individual unit—the harmonious community requires good lot arrangement, pleasing variation of colors and textures, and proper placement of homes. These too reflect further opportunities that are unfolding to architects in this promising field of home prefabrication.

They are *new* opportunities because seldom, if ever, are the benefits of architectural service extended to homes under $7500. They are *expanding* opportunities because they can be made to awaken a new and keener appreciation of good design, efficient planning, high standards of livability, better use of materials, and more attractive community development which will find expression when these new property owners can afford to buy larger homes.

HARRY H. STEIDLE
Manager, Prefabricated Home
Manufacturer's Institute

Two points in Mr. Steidle's statement are illustrated by the house construction here presented. Through intelligent use of a simple prefabrication system, the small home purchaser (in a region not always known to be progressive) will gain the benefits of good materials used to full advantage. In addition, the satisfactory plan expression and such things as the "solar window" with the overhang of eaves carefully studied will, through prefabrication, bring progressive architectural design to a consumer group which could not otherwise afford it.



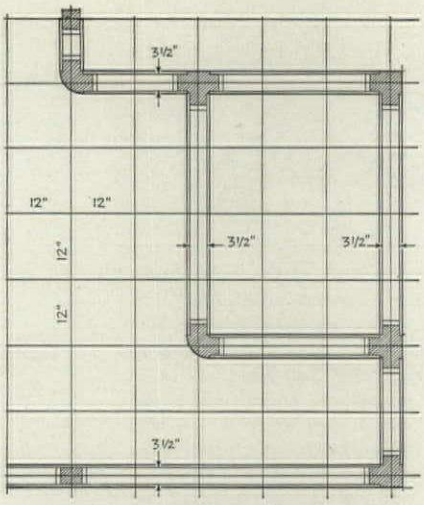
Typical Plan

COMPLETE, CONTEMPORARY, AND PREFABRICATED

This summer, in conservative Brattleboro, the Solar Homes Company expects to start selling complete houses, fully equipped. The houses will embrace most of the contemporary developments of design, construction, and equipment that are immediately feasible.

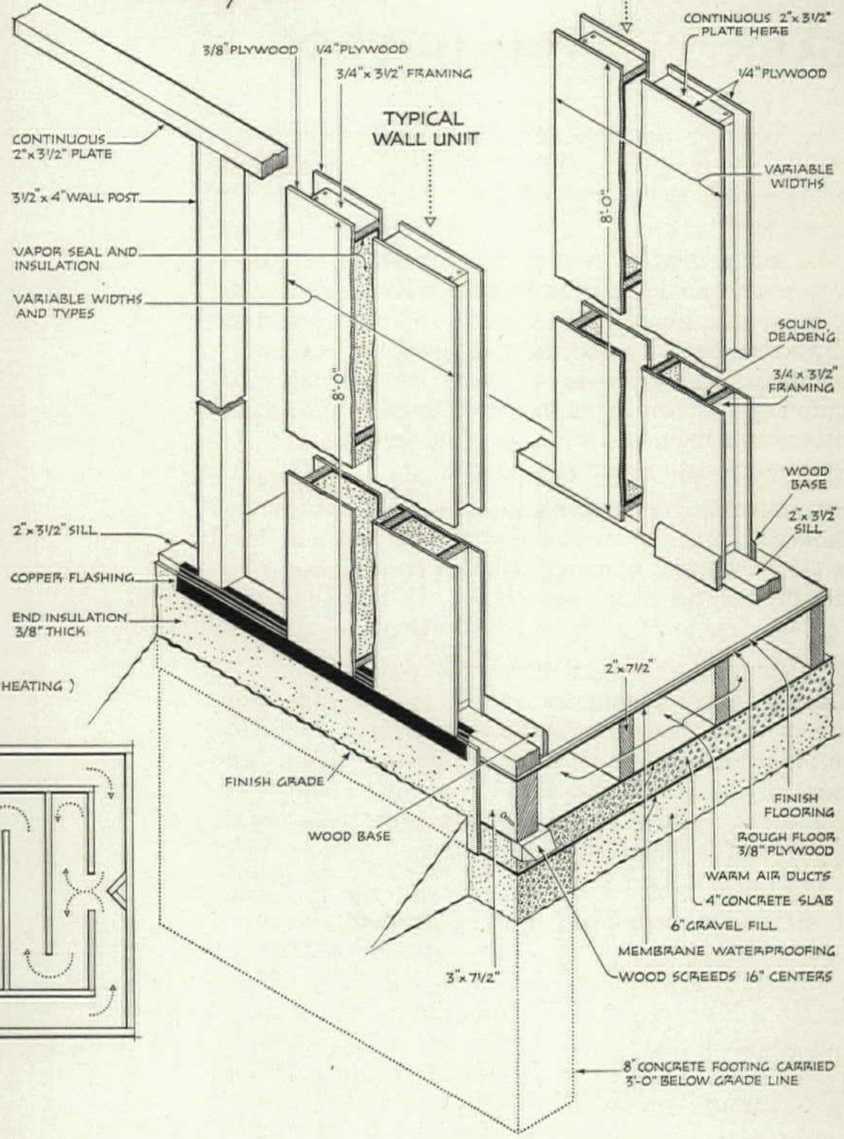
The prefabrication system, adapted from a Forest Products Laboratories development, is a post-and-stressed-skin-panel type. Panel-and-post systems do require wood, but in a locality like Brattleboro there are inevitably local sources of supply, local prejudices in favor of wood, and such factors as transportation costs to consider.

The company is organized for true mass production, with assembly-line

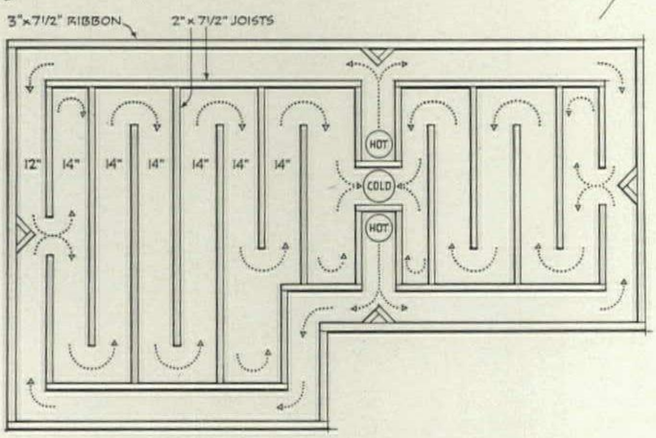


Module Diagram

Assembly Detail



Joist Layout (SCHEMATIC FOR RADIANT WARM AIR HEATING)



SOLAR HOMES CO., Brattleboro, Vt. DONALD DURELL and ASSOC., Designers and Builders

production techniques. It will not only design and produce building units and houses, but will also perform the function of operative builder, so that the buyer will find himself involved with one seller only, with a single fee to pay, and with one set of contract documents. Yet for all this business-like approach, Mr. Durell emphasizes that: *"We are never for a minute losing sight of good design, finesse, or the amenities which good architecture and good expression can produce."*

The houses are laid out on a 12" grid, a module small enough for flexibility and freedom in design, yet large enough to permit reasonable standardization. The design approach is contemporary, and recognizes local tastes and conditions. Thus the houses are oriented to take advantage of sun heat and light, with eaves overhangs to eliminate objectionable summer sun but admit winter sunlight; yet the glazed areas, though larger than ordinary Vermont windows, are smaller than "solar" windows in more temperate climates. Glazing is all fixed, double plate glass; ventilation is obtained through controllable louver panels.

Heating is a radiant floor-panel system, using warm air circulated through the joist spaces. Direct warm air circulation can also be provided by inserting floor registers; fireplaces are to be of the heat-circulating type. Much of the lighting is to be built-in fluorescent; doors are to be flush, eliminating dust-catchers; finish of the plywood surfaces is to be one of the newly developed synthetics, factory-applied and well rubbed.

There are to be a dozen or so standard plans, all subject to variation in layout and exterior and interior treatment, and designed to permit expansion. Eventually the Company will have a full professional staff, ranging from architects and landscape architects to interior decorators and plumbers; and it will be prepared to provide houses complete to the last drapery, or unfinished, to be finished by the purchaser at his leisure, or finished to some degree between these extremes, at prices ranging from $5,000 to $16,000.

PLANNED COMMUNITIES

In the present emergency it is of the utmost importance not to lose sight of the eventual value of developments as neighborhoods. The Local CPA Committees in charge of the approval of developments for priorities have a responsibility to their towns not to approve subdivisions which are lacking in proper neighborhood design: provision for shopping, recreation, accessibility to schools. Naturally, the need for these things will vary with the size and location of the development, but they should be given due consideration by the reviewing boards.

The major need of any neighborhood is play space for small children and adolescents. No subdivision should be approved that does not set aside at least one fairly central open area large enough for playing softball and other activities. In addition, it is highly desirable to provide small areas for the little kids in as many blocks as possible.

In large developments, especially if they are more than a mile from reasonable existing facilities, shopping should be provided. Food, drug, and general stores are the first—and often only—requirements. Ample parking space must be allowed, with room for expansion. Commercial structures of this kind are often a source of profit to the developer.

These two requirements, and the proper relation of the dwellings to schools, are something that all local committees should look into carefully. Upon them, to a large degree, depends the eventual stability of the neighborhood. Where the subdivision-plat regulations of a city or county fail to require reasonable community facilities, the committee itself should insist on their being provided *by the subdivider,* as a condition precedent to approval.

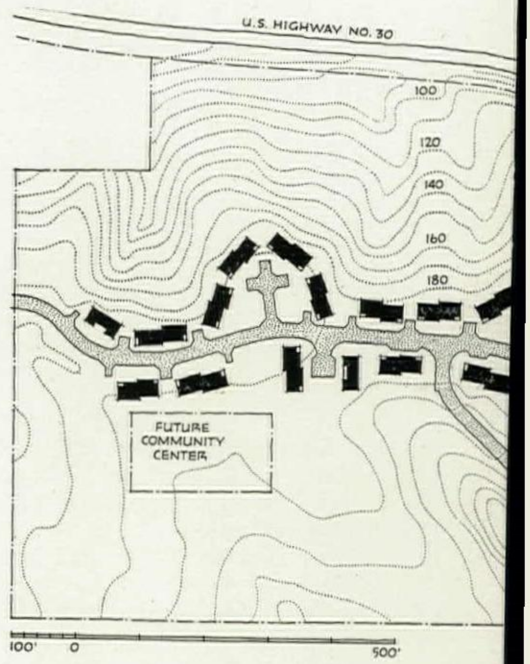
As a matter of fact, the intelligent subdivider and large-scale builder full well realizes the desirability of neighborhood planning. It makes his land and buildings sell faster, it sets up values that will help him get rid of the last parcels. The soundly planned neighborhood development is the one that will ride out the crash that is going to follow the present insanity and continue to pay taxes; so the mortgage holders too have a vital stake in the quality of the development.

There are, of course, many other things which should at least be considered in appraising neighborhood quality. The eventual capacity of schools to care for the total child population within a half-mile radius of the school; the capacity of water and sewage lines; major recreation facilities for the whole future area; the provision of health centers, community buildings, libraries, and many other things—these factors may determine the fiscal future of the community.

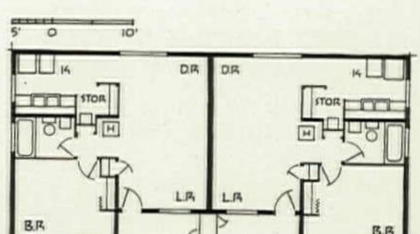
What we build now, in haste, will last a long time. We cannot afford to build less wisely for the needs of people now than we did as a "temporary" measure during the war.

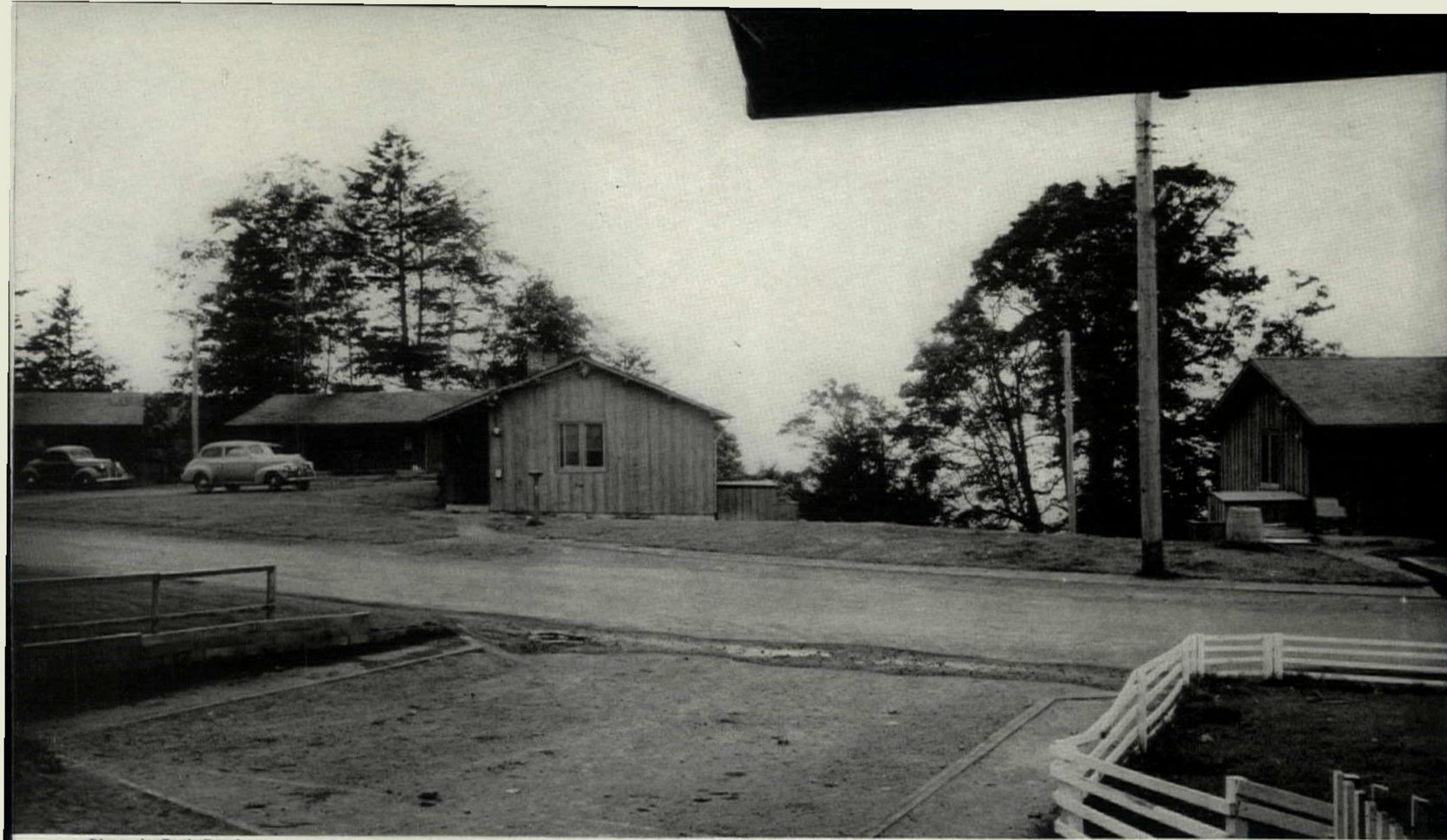
HENRY S. CHURCHILL, A.I.A., A.I.P.,
Author of *The City Is The People*

To illustrate certain of the advantages of community planning which Mr. Churchill enumerates, we have selected two projects that are widely separated in both purpose and time—one, a Naval housing development hacked out of the wild that was begun early in the war as a permanent community and later was subjected to the unavoidable restrictions and economies imposed by full-war exigencies; the other, a long-range plan, still in project form, that has been developed for the healthy growth of an existing but unplanned suburban community.



TYPE A

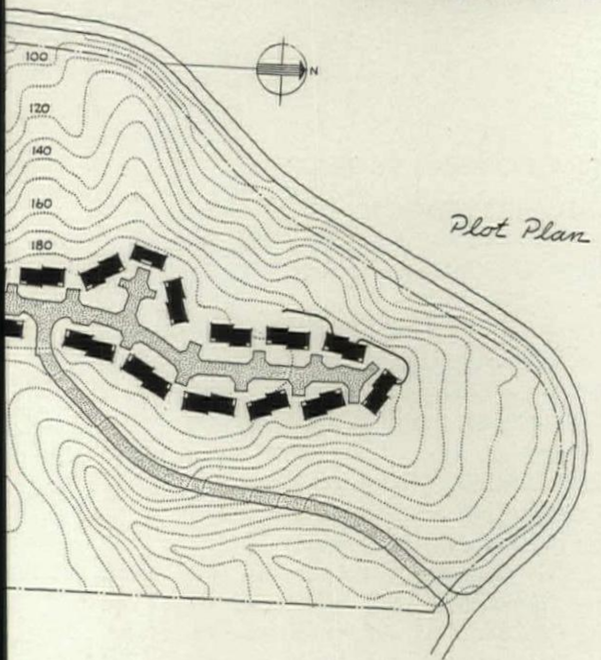




Photos by P. A. Dearborn

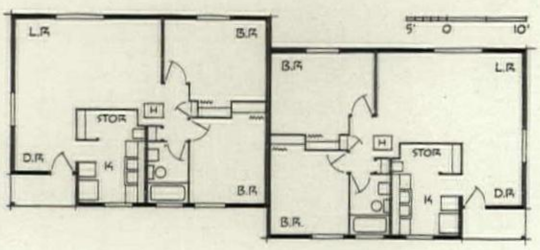
FPHA PROJECT TO SERVE A NAVAL AIR STATION, ASTORIA, OREGON

VAN EVERA BAILEY, Architect

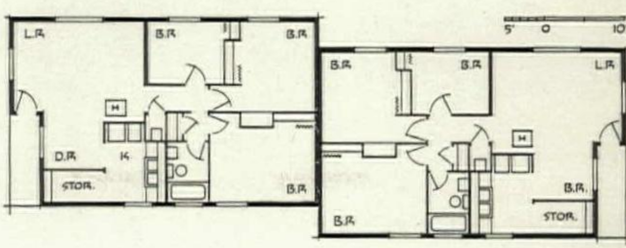


Initiated as a 100-unit PBA project, this community was redesigned (in collaboration with the office of F. J. McCarthy, San Francisco architect) after all housing was transferred to FPHA, though the units were designed before the "standards for minimum housing" were set up. Shown is the half (50 units) of the project built first. The rugged site proved considerably at variance with the survey, and the architect says, "Much of my time was taken up in site grading and re-establishing grades to fit actual conditions." The buildings contain 6 one-bedroom, 34 two-bedroom, and 10 three-bedroom units, arranged in duplex plans. Offset of adjacent units was variously employed to reconcile building placement with grade conditions and bring the floor lines close to grade. Off-street parking bays and allocation of space for a community center (though not built) are noteworthy elements of the over-all plan.

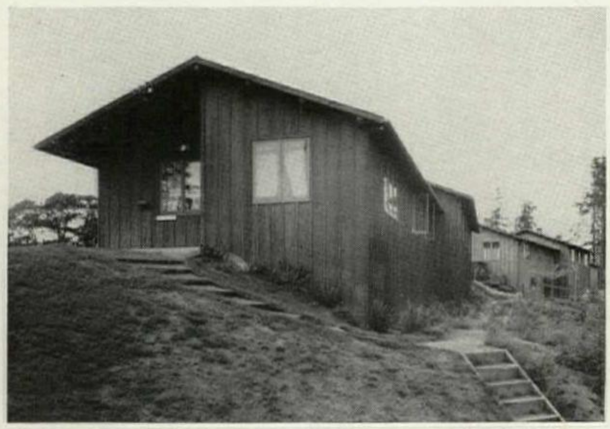
TYPE **B**



TYPE **C**



OUTSIDE FINISH: Stained rough boards and battens. Every dwelling unit has its off-street parking bay.



The offset, stepdown pattern of units follows the contour lines.

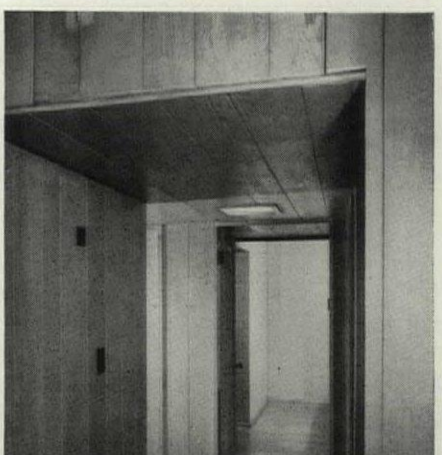
ENTRANCE to one of the two-bedroom units.

FPHA HOUSING PROJECT
ASTORIA, OREGON

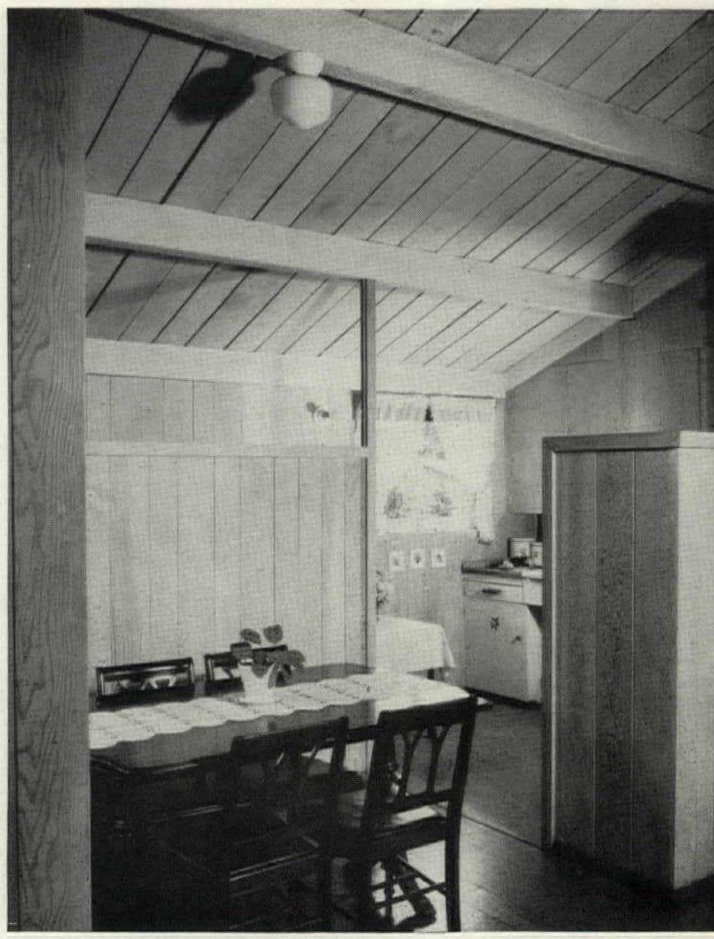
VAN EVERA BAILEY, Architect

Since FPHA standards had not been worked up in full at the time this project was built, Mr. Bailey points out, "There was much latitude to design as we saw fit . . . The market was glutted with lumber (bless the days!)." Floor construction consisted of 2-inch T&G flooring spanning beams about 4 feet apart. Similar construction was used for the ceiling, left exposed. Only the outside walls are of double construction, interior partitions being single-board T&G for economy. Purlin roof construction did away with the necessity of ties across from plate to plate. Interior storage space instead of a vestibule type —later becoming standard with FPHA —adds to the spaciousness of the interior. Casement windows were used; millwork is "narrow" in appearance and simple in detail.

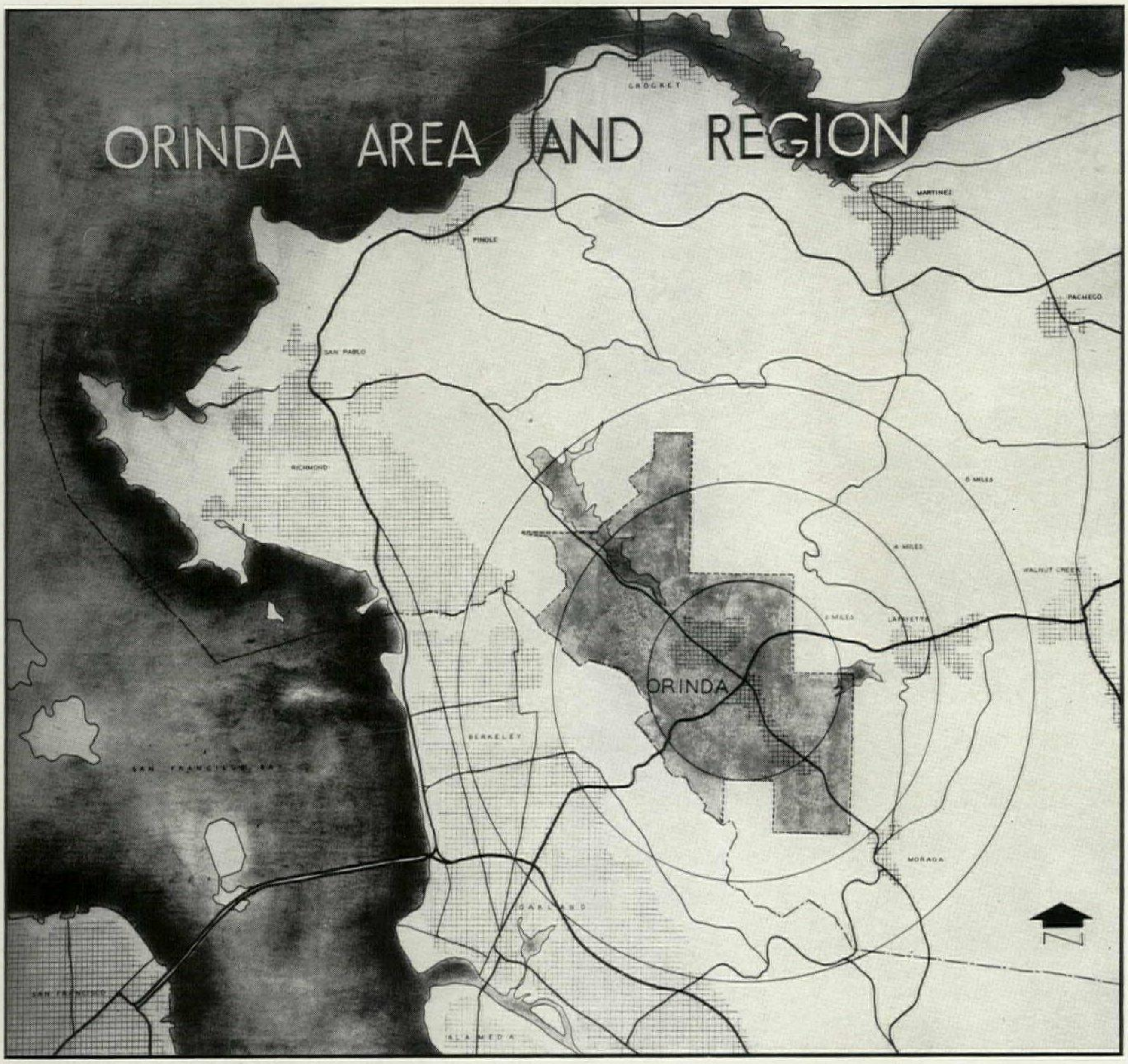
Typical "two-bedroom" living room. Corner of storage unit at left.



INTERIOR PASSAGE in a three-bedroom unit. In addition to considerable closet space and a large storage space off the kitchen, overhead access door makes use of under-roof space.



"Three-bedroom" dining space, looking toward kitchen.



Located in a valley just over the hills from the cities of Berkeley, Oakland, and (across the Bay) San Francisco, Orinda is assured continued growth. "With proper foresight and planning," the study emphasizes, "the people of Orinda can make it an ideal suburban community."

PLAN FOR FUTURE DEVELOPMENT OF ORINDA, CALIF.

STUDY CONDUCTED BY THE SCHOOL OF ARCHITECTURE, UNIVERSITY OF CALIFORNIA

Under the direction of
Prof. HOWARD MOISE
Architect

ELLIOTT JOHNSON
TEFVIK KUTAY
HENRY LAGORIO
Graduate Students

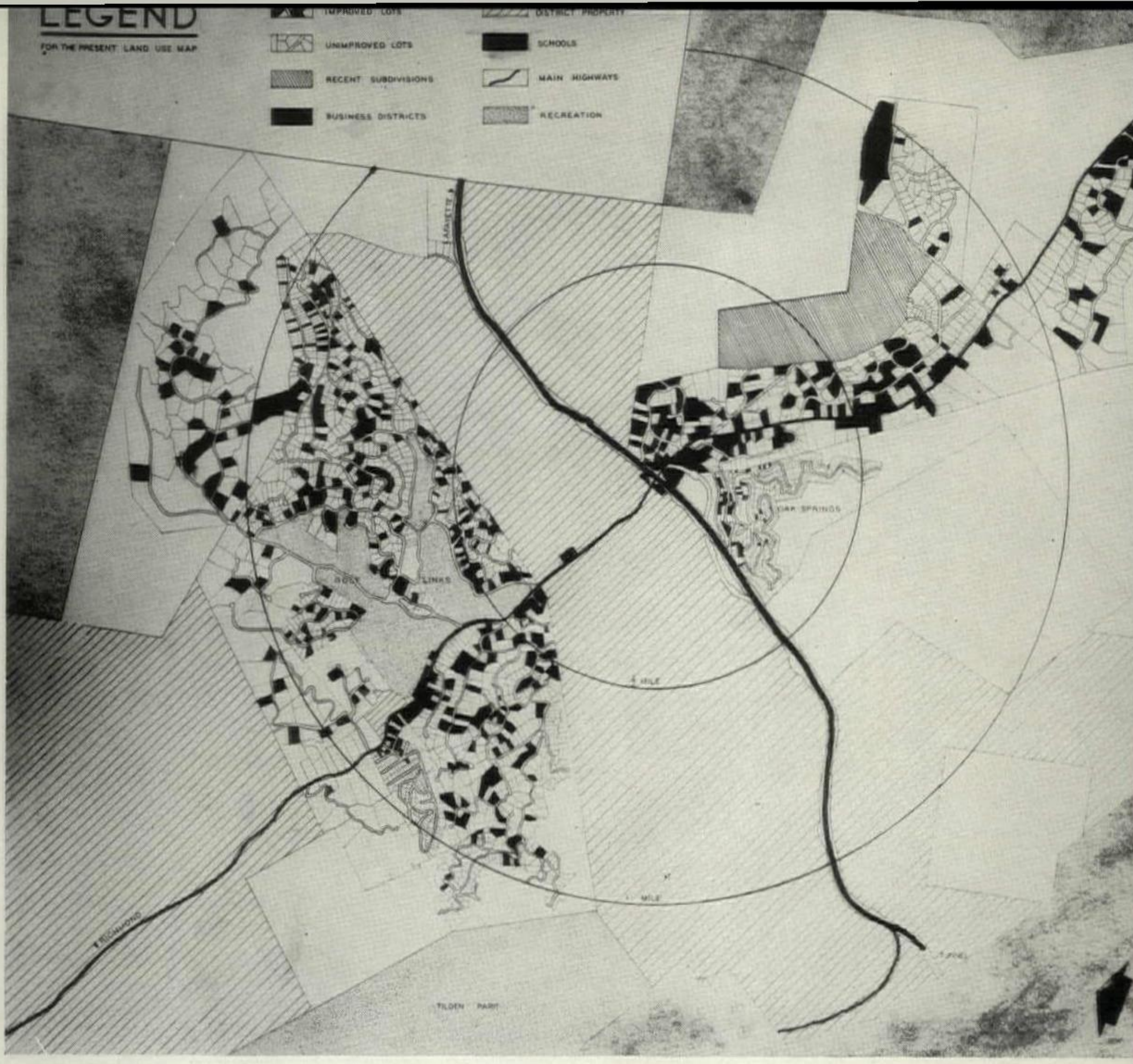
ELVA SPIESS
Senior Student in Economics

The Orinda study, a plan for the development of the residential community of Orinda, was undertaken at the request of Orindans, Inc., a citizens' group organized to promote their community's betterment. Orinda is an unincorporated community, with no specific boundaries; so, the boundary of the primary school district was selected as the most suitable area for study. Throughout, every effort was made to keep the project realistic. The students consulted with the sponsoring group, County Planning Commission, School Board members, representatives of the State Department of Education and Division of Highways, and County Park Commission, as well as with the local fire chief and several professional planners—among them, Deming Tilton, director of the San Francisco Planning Commission, and Ronald Campbell, director of the San Mateo County Planning Commission. Architects with whom problems were discussed included Michael Goodman of the School of Architecture faculty, and John Reid of Ernest Kump's office.

PRESENT LAND USE MAP

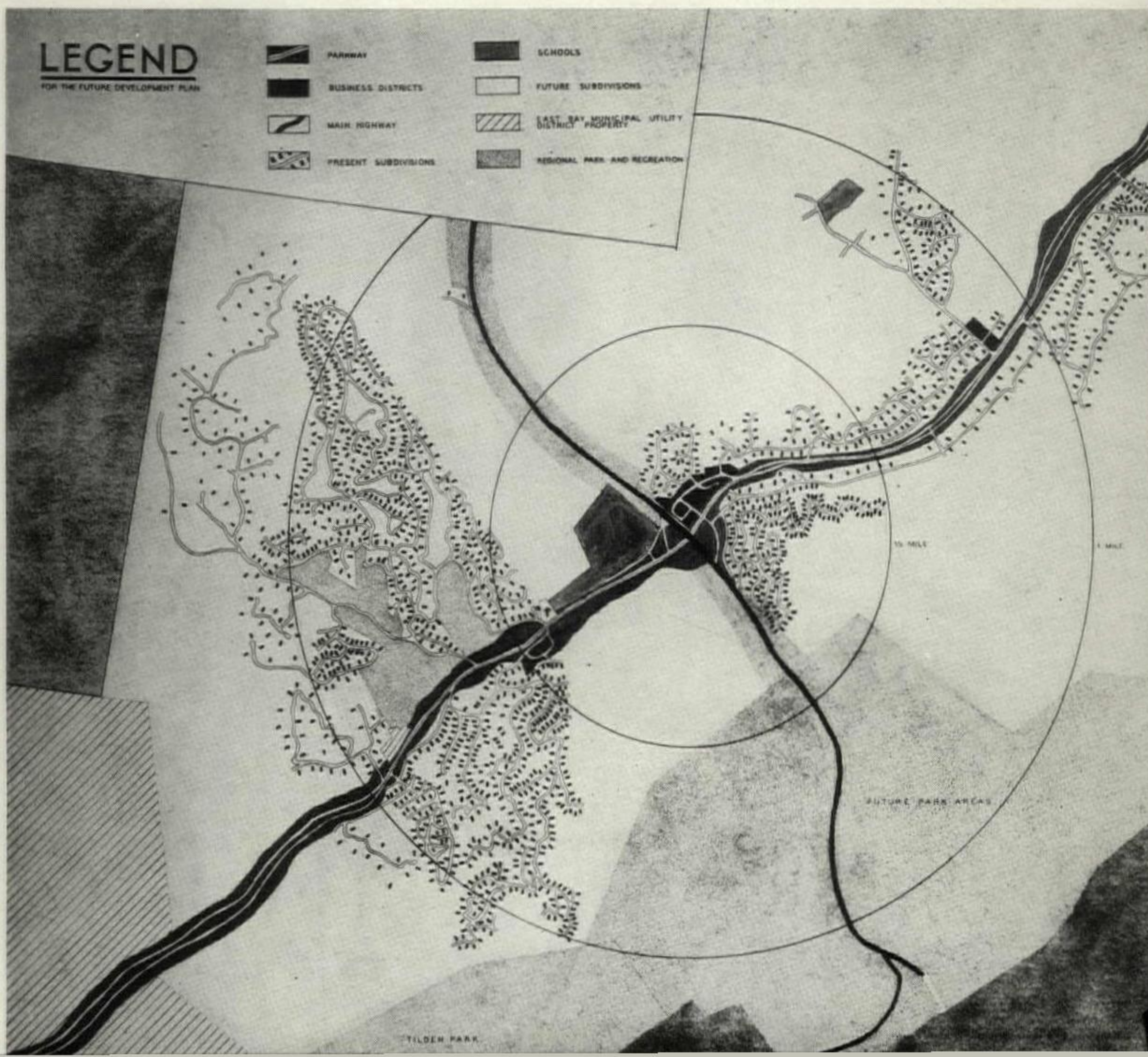
According to the planners, the major community problems at present are:

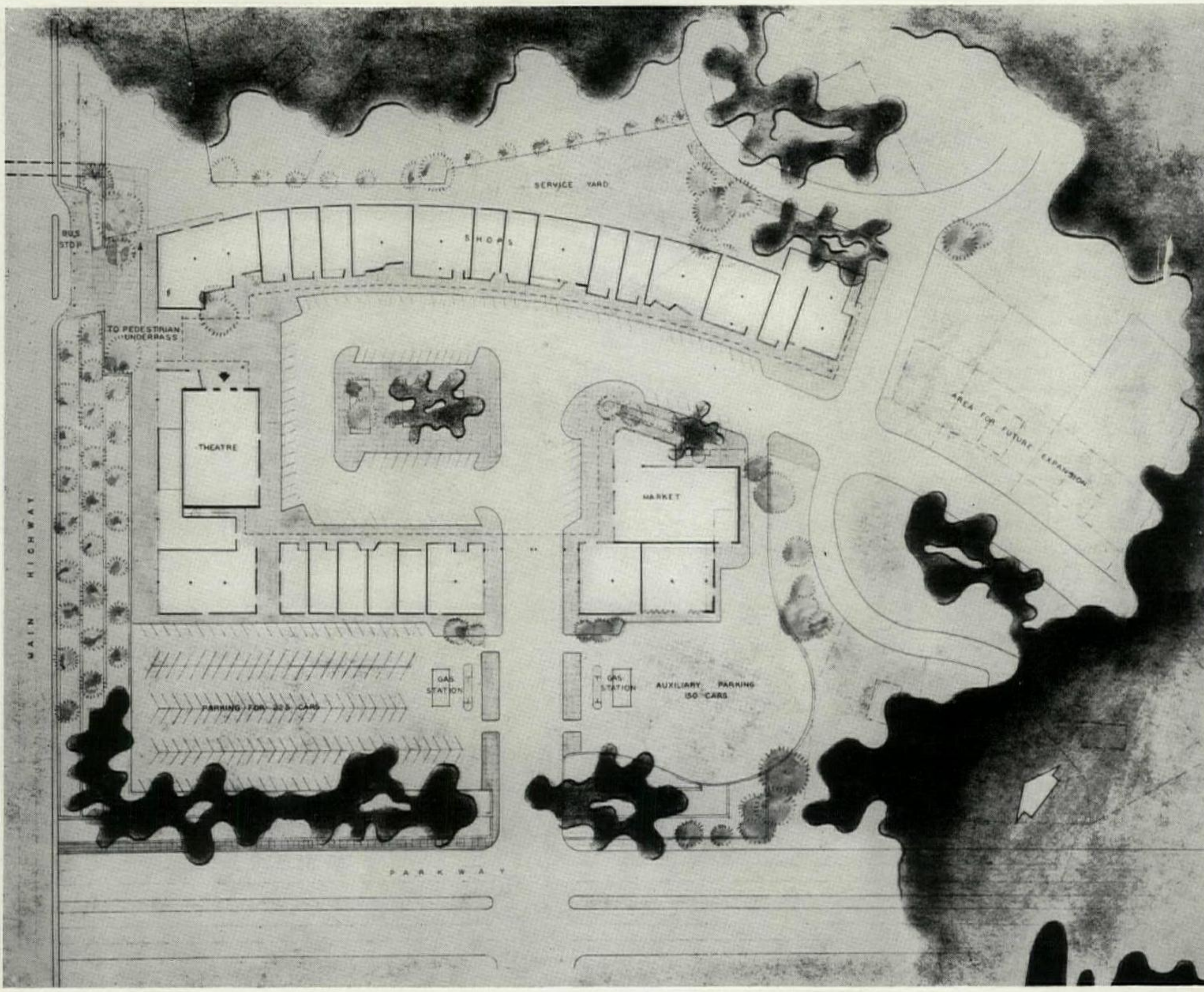
1. It is cut in two by the highway (northeast-southwest) and the Moraga-Richmond road in the other direction.
2. No means exist to protect the community against the increasing traffic hazards.
3. Present haphazard growth straddling the highway is undesirable.
4. Land values are unprotected by adequate zoning.
5. School facilities are inadequate.
6. Recreational facilities are inadequate.
7. Increasing population cannot be accommodated by the present use of septic tanks.



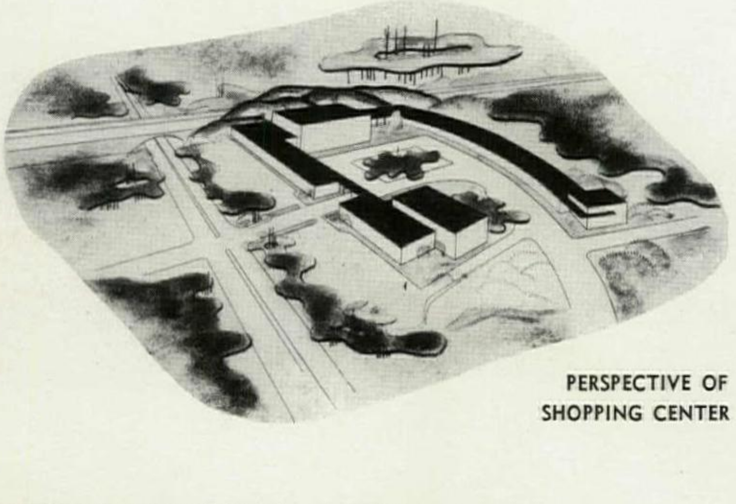
FUTURE DEVELOPMENT PLAN

A questionnaire sent to every boxholder in the postal district yielded a surprising return of more than 33⅓ percent. From this were gained the breakdown on church affiliations, recreation needs, a strong affirmative vote for a sewerage system, the desired shopping facilities, types of professional and business services offered, and sizes of families by age groups (to indicate the school needs). In this future development plan are shown the proposed limited-access parkway to replace the present Moraga-Richmond road, zoned business districts (in black), best areas for continued residential expansion, school districts, and areas to be used for park and recreation.





PLAN OF THE SHOPPING CENTER. The theater is an existing structure; parking is both within the plaza and in an area toward the new parkway.



PERSPECTIVE OF SHOPPING CENTER

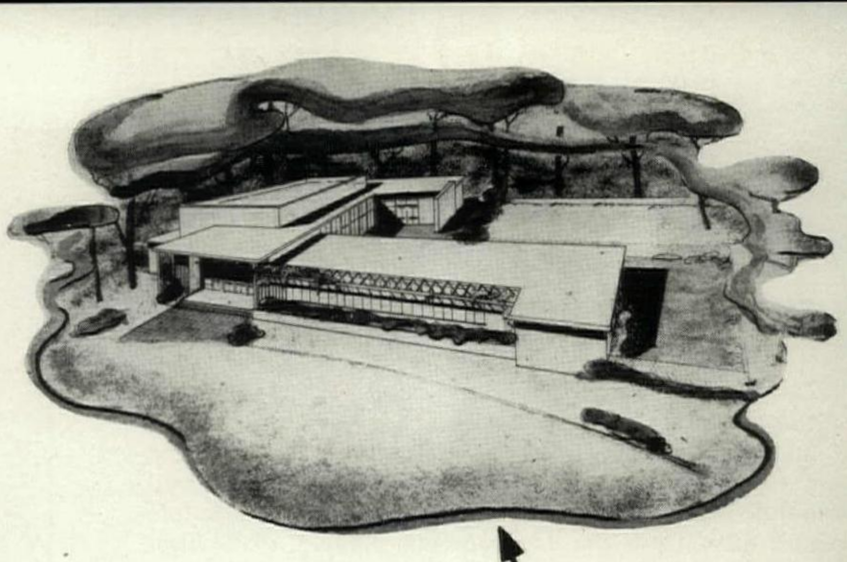
PLAN FOR ORINDA, CALIFORNIA

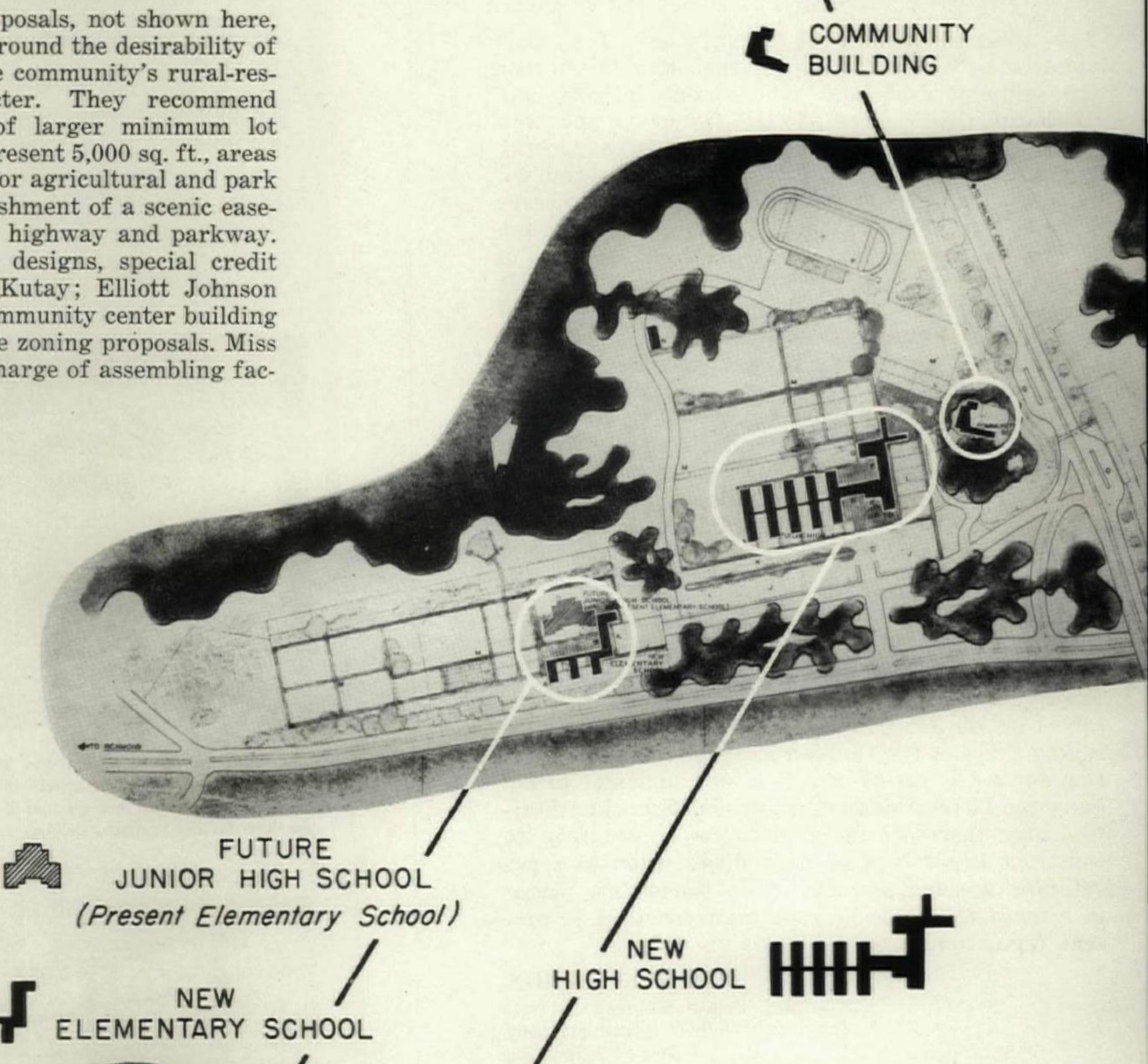
The proposed shopping center (planned for possible expansion) is located at the main crossroads, but free from highway conflicts, with the highway an overpass at this point, and the proposed parkway passing under it (see perspective). This grade separation is deemed essential for the protection of life and amenity of adjacent building sites and to prevent the ultimate deterioration of the community. By locating the parkway somewhat south of the existing Moraga-Richmond road, the old road becomes the turnoff into the shopping plaza. Henry Lagorio is chiefly responsible for the shopping center design.

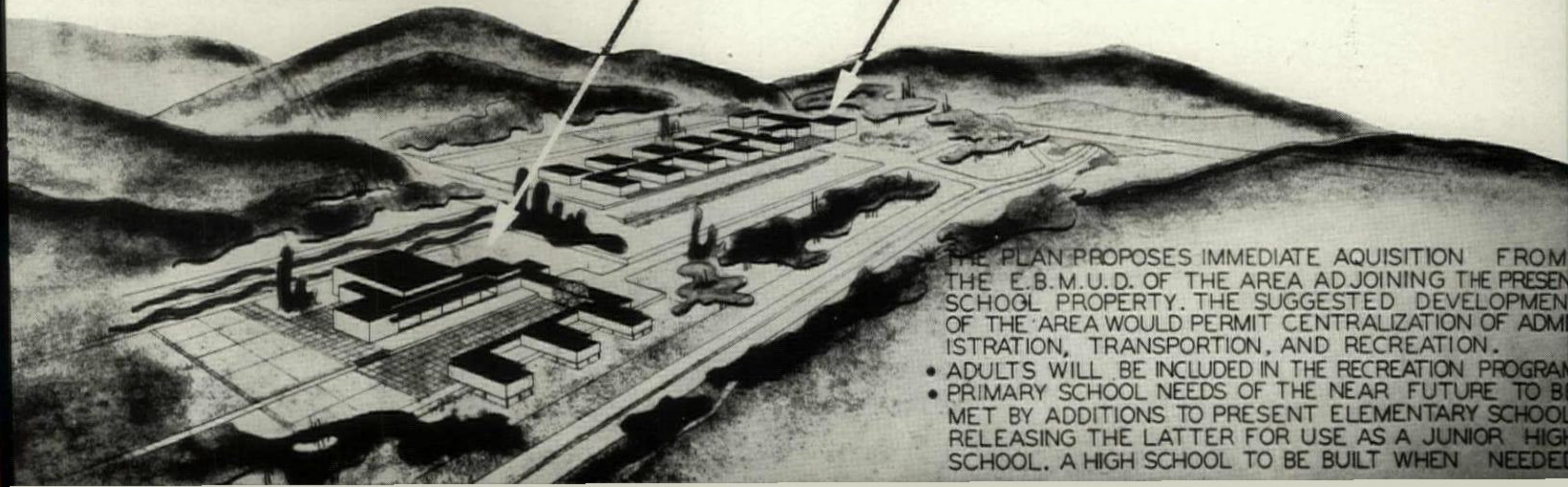
SCHOOLS AND COMMUNITY CENTER

One of the most gratifying things to come out of the study to date is that the school board promptly set about trying to acquire the only suitable land available for future use. The community center plan includes a large "amusement room," with stage; storage rooms for various activity groups, a public lounge, several club-meeting rooms and an outdoor terrace, horseshoe pits, play space for children. Location near school buildings assumes that many facilities would be used interchangeably.

The zoning proposals, not shown here, are developed around the desirability of maintaining the community's rural-residential character. They recommend establishment of larger minimum lot sizes than the present 5,000 sq. ft., areas to be set aside for agricultural and park use, and establishment of a scenic easement along the highway and parkway. For the school designs, special credit is due Tefvik Kutay; Elliott Johnson designed the community center building and drew up the zoning proposals. Miss Spiess was in charge of assembling factual data.







EDUCATIONAL FACILITIES

During the period of reconversion of the construction industry, there will not be sufficient building materials to meet all the demands of the five-year backlog of residential, industrial, commercial, and public building construction. It seems reasonable and just that the Government should give high priority to the construction of homes for veterans.

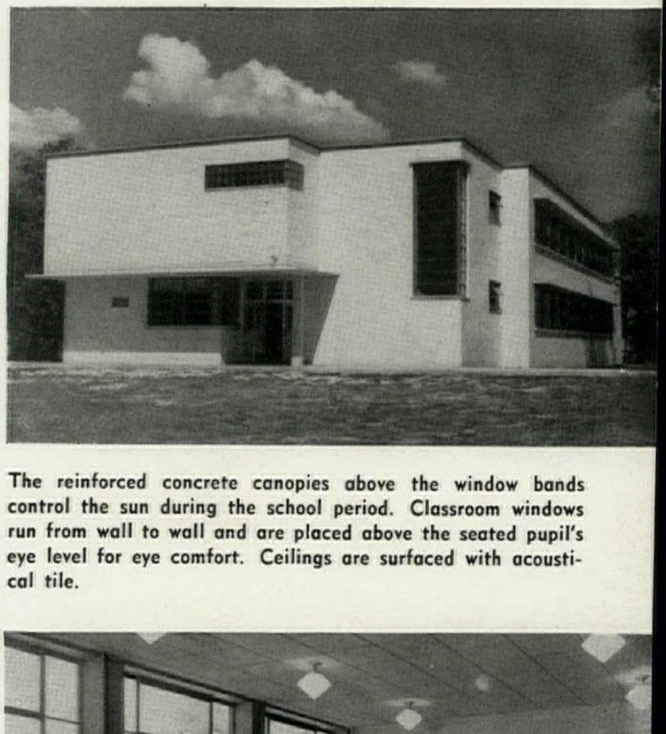
The veterans will want schoolrooms for their children as well as homes for their families. Since the military draft did not exempt fathers, and discharge points were allotted for wives and children, a large percentage of veterans now wishing homes have children of school age. It is estimated that it will require about 75,000 classrooms to serve the 2,700,000 veterans' homes in the Wyatt program. It may be argued that these children are now in school and that many of the new homes will be built in the same districts where the children now attend school. This, however, is only a half truth. Many of the veterans' homes will be erected where very inadequate school facilities exist. It may also be expected that much of the housing will be developed in areas where there are no schools at all. By and large, the schools are as inadequately housed as the veterans' families. The schools of the nation are now suffering from a three billion dollar shortage in physical facilities due to deferred construction.

School boards are now required to file applications for construction authority on Form CPA-4423 with one of the 71 CPA Construction Field Offices. If priority assistance is required to secure materials, school boards file CPA-541A forms with the Washington Office of the Civilian Production Administration for a CC rating which is not sufficient to acquire the 11 most critical materials. School authorities may therefore be denied the opportunity to construct urgently needed facilities, even to serve veterans' housing projects, unless schools are placed in a more favorable bracket than provided in present regulations.

RAY L. HAMON
Chief, School Housing Section,
Division of School Administration,
U. S. Office of Education

Mr. Hamon's plea for a higher priority rating for school construction points up an aspect of the present situation which is not generally understood: even though the local CPA office may grant the right to build, this merely permits the applicant to join in the mad scramble for available materials. Nothing except a high priority rating helps in this free-for-all (for all PERMITTED construction). Failing the high priority rating, the necessary structure—such as a school—becomes a design problem in non-critical materials, just exactly as many structures permitted during the war were. THE EDITORS

In the present building emergency, what may well happen in many cases is that a portion of a job will go ahead, even though the total project cannot be realized at once. The Haughton school here presented is a pertinent instance of a school planned so that future expansion would require but a minimum of change to the existing structure.



The reinforced concrete canopies above the window bands control the sun during the school period. Classroom windows run from wall to wall and are placed above the seated pupil's eye level for eye comfort. Ceilings are surfaced with acoustical tile.

Photos by Doug Perry

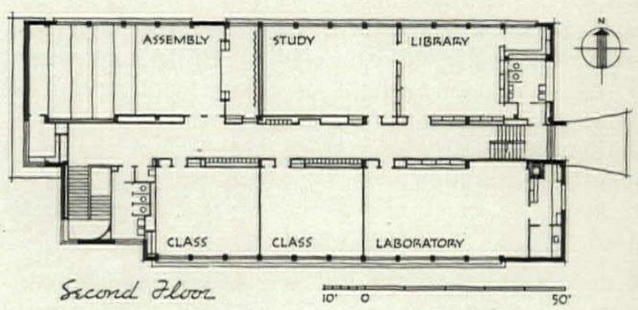
HAUGHTON HIGH SCHOOL, HAUGHTON, LOUISIANA

SAMUEL G. WIENER, Architect

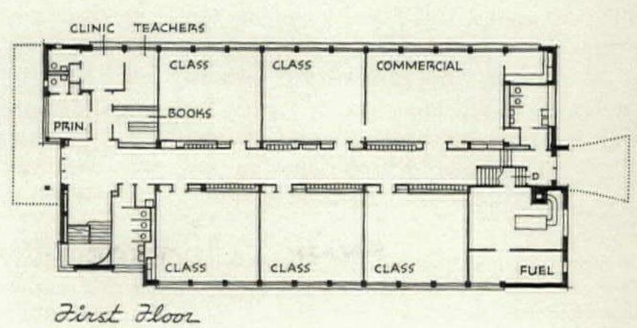
The new high school shares use of a gymnasium and auditorium that are connected with an older, elementary school on the same site.

The new school plans are essentially self-explanatory. As high-school needs expand, the building may be extended to accommodate additional classroom space without upsetting present arrangements. Another feature of flexibility is the modular mullion-column framing system that allows change in size of rooms (by simple shift in partition location) without conflicting with odd-shaped interior piers or necessitating change in external appearance.

The assembly room on the second floor is used for band practice, dramatics, and community assemblies in addition to its use as a meeting room for the entire school body. There is no basement, but the heater room is two feet below the first floor level. Construction is of concrete frame with brick walls.



Second Floor



First Floor

RECREATIONAL FACILITIES

Recreation is an essential phase of individual and community life. Throughout the country local authorities have accepted responsibility for providing recreation areas, facilities, and programs on a neighborhood and city-wide basis. People are increasingly demanding that adequate recreation opportunities be made available near their homes and during twelve months of the year.

Cities today are spending great sums of money to acquire needed recreation space in built-up neighborhoods where a few years ago land was available at low cost. The execution of the proposed National Housing Program will reduce the open space in existing neighborhoods and will cover with homes large areas in and near cities where limited recreation properties are already inadequate. To prevent a duplication of past mistakes and to assure residents of new housing developments a reasonable opportunity for a well balanced recreation life, recreation needs must be considered in the initial conception of every housing project.

The provision of recreation areas to serve people to be accommodated in new housing is primarily a problem in neighborhood and city planning. The individual or agency developing a project should therefore consult with the city planning authorities and the recreation, school, or other local municipal agencies responsible for the city's recreation service, and together with them work out a plan that will assure the provision of adequate permanent recreation space to meet the needs of the people to be housed.

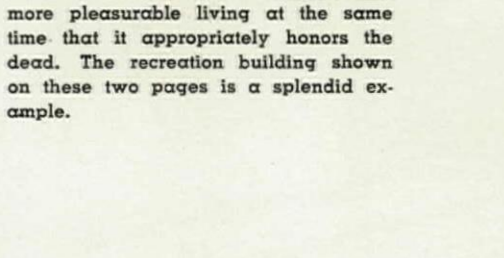
The development of the outdoor areas and the construction of essential recreation buildings may need to be postponed until the present housing shortage becomes less acute. We must make sure, however, that in solving the immediate housing problem we do not create future slums. In all large-scale home building plans, provision must be made for permanent open spaces which are so essential to the fullest enjoyment of life in the new neighborhoods to be created.

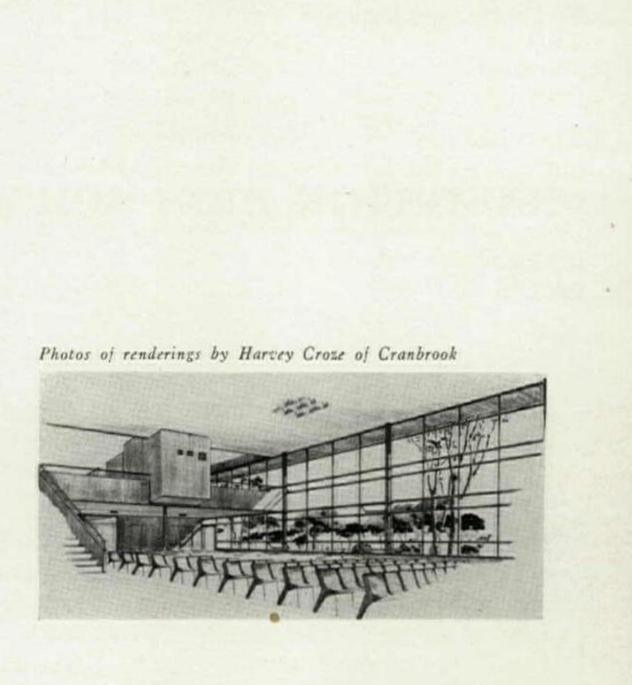
HOWARD BRAUCHER
President, National Recreation Association

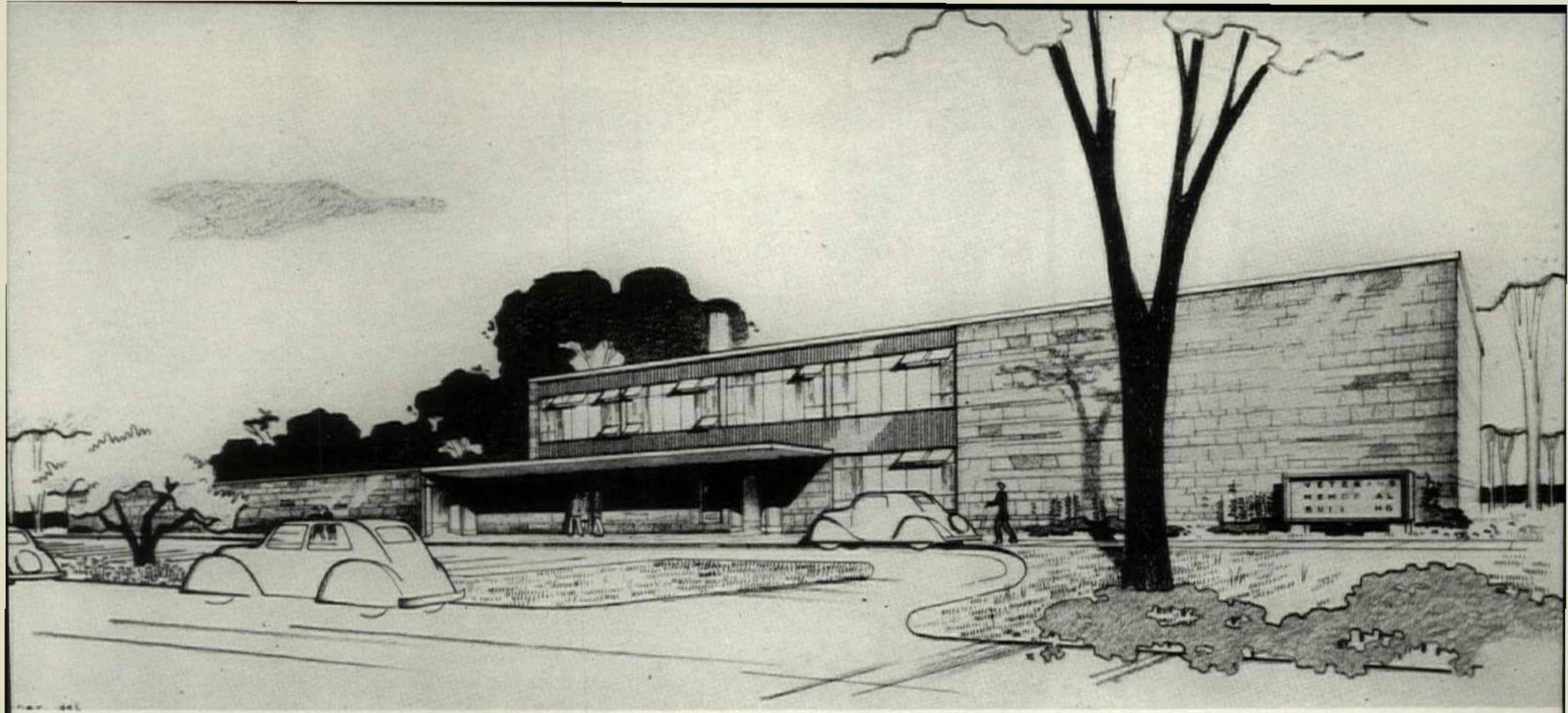
Mr. Braucher points out the importance of including proper recreation facilities in any soundly planned community.

One of the best ways possible to make this ideal a reality is through the medium of the war memorial, the living memorial that makes for healthier and more pleasurable living at the same time that it appropriately honors the dead. The recreation building shown on these two pages is a splendid example.

Photos of renderings by Harvey Croze of Cranbrook





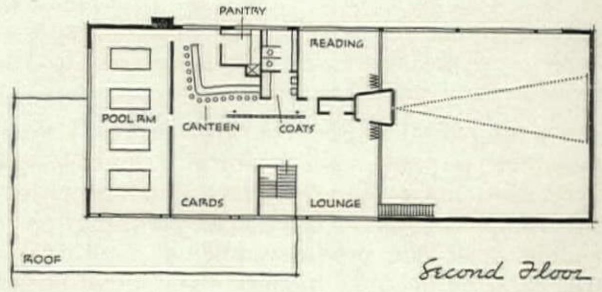


VETERANS MEMORIAL BUILDING, LAPEER, MICHIGAN

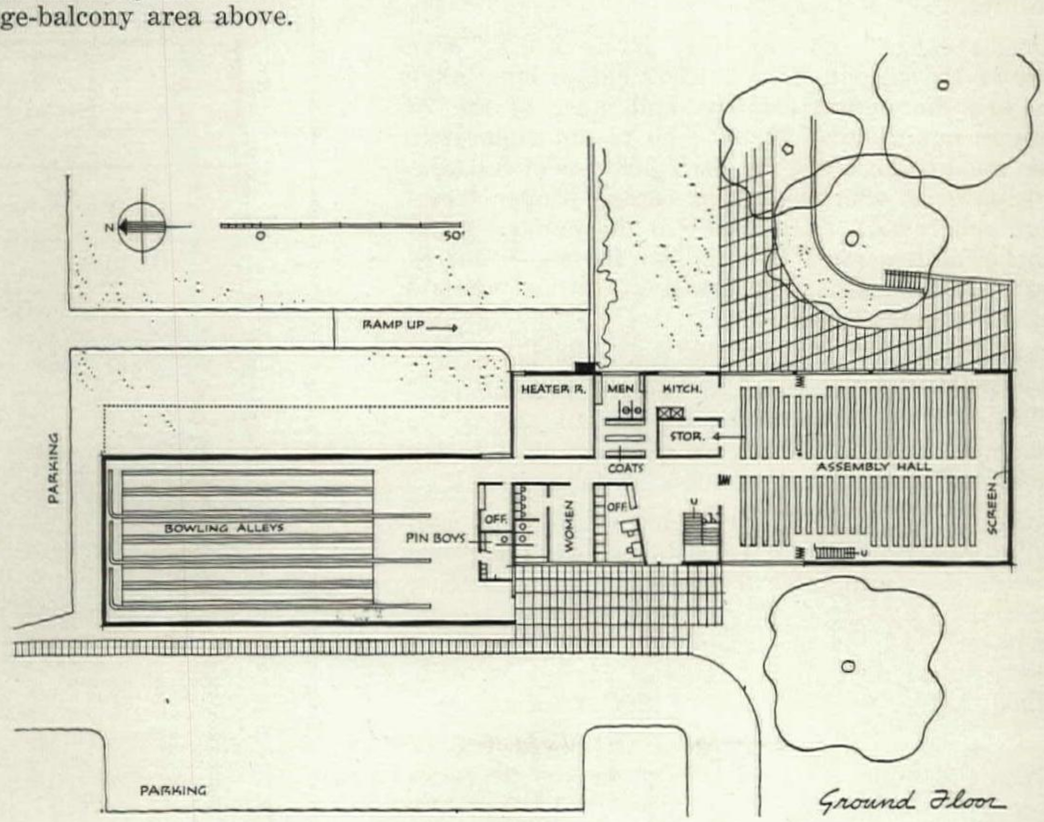
SAARINEN, SWANSON and SAARINEN, Architects

Initiated by veterans' groups, chiefly the American Legion, this is a project that is receiving enthusiastic support from the entire community. As soon as construction is permitted, plans will go ahead with as much of the building as the budget will allow. Since the building is in project stage, specifics are not as yet determined.

The assembly room, with serving kitchen alongside, anticipates varied use—as a lecture hall, movie house or (cleared of chairs) for formal functions, dances, etc. Remarkable flexibility is achieved by the folding partitions at the rear of the assembly hall on the ground floor and in the lounge-balcony area above.



Second Floor



Ground Floor

HEALTH FACILITIES

Even before the war, the rapidly increasing health and hospital consciousness of the general public was being reflected in the tremendous expansion of coverage by the Blue Cross and similar prepayment hospital plans. Today, almost one out of every four individuals in the United States is covered in some type of such plan, and these plans have only within the past few years progressed beyond the experimental stage.

Our soldiers experienced a high quality of medical care during their sojourn in "the healthiest army in history." They are going to expect similar standards for their families in civilian life.

Offices and other facilities must be provided for medical personnel released by the armed forces if they are to make their services available to the communities so urgently in need.

There are at present 1250 counties in the United States which do not have hospital facilities. Of these counties, more than 700 have populations exceeding 10,000 people. Only wise planning on a tremendous scale can provide sufficient facilities to meet the existing need for hospitals and allied health facilities.

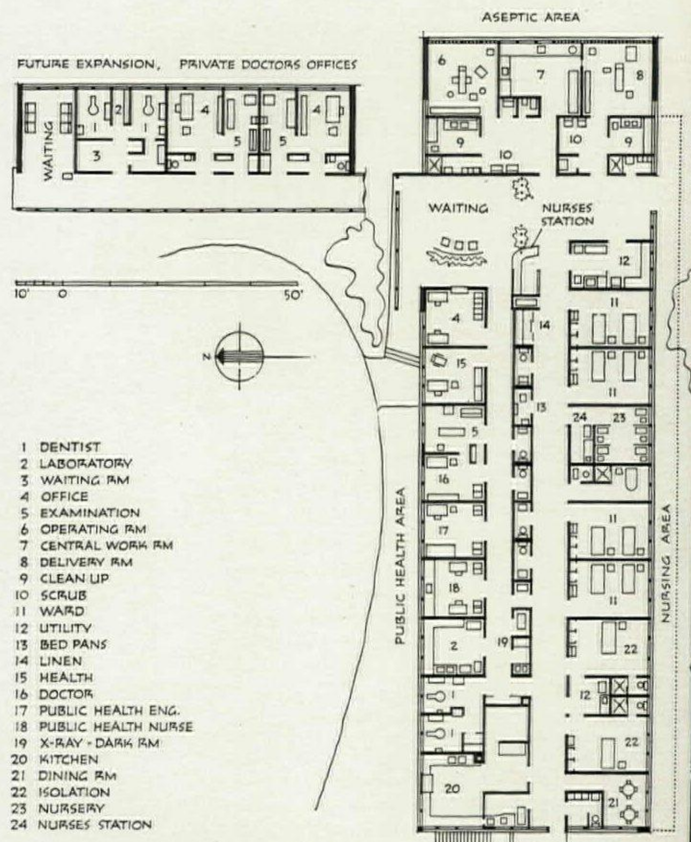
Immediate action is necessary if we are to save more of the 40 out of each 1,000 babies born alive but who die within infancy, and more of the 25 mothers out of each 10,000 who die in childbirth. Beds must be provided for the thousands of tuberculosis patients who now must forego proper treatment and remain as menaces to the public. Additional facilities must be supplied for the 5 out of every 1,000 persons who are now the unfortunate victims of mental disease.

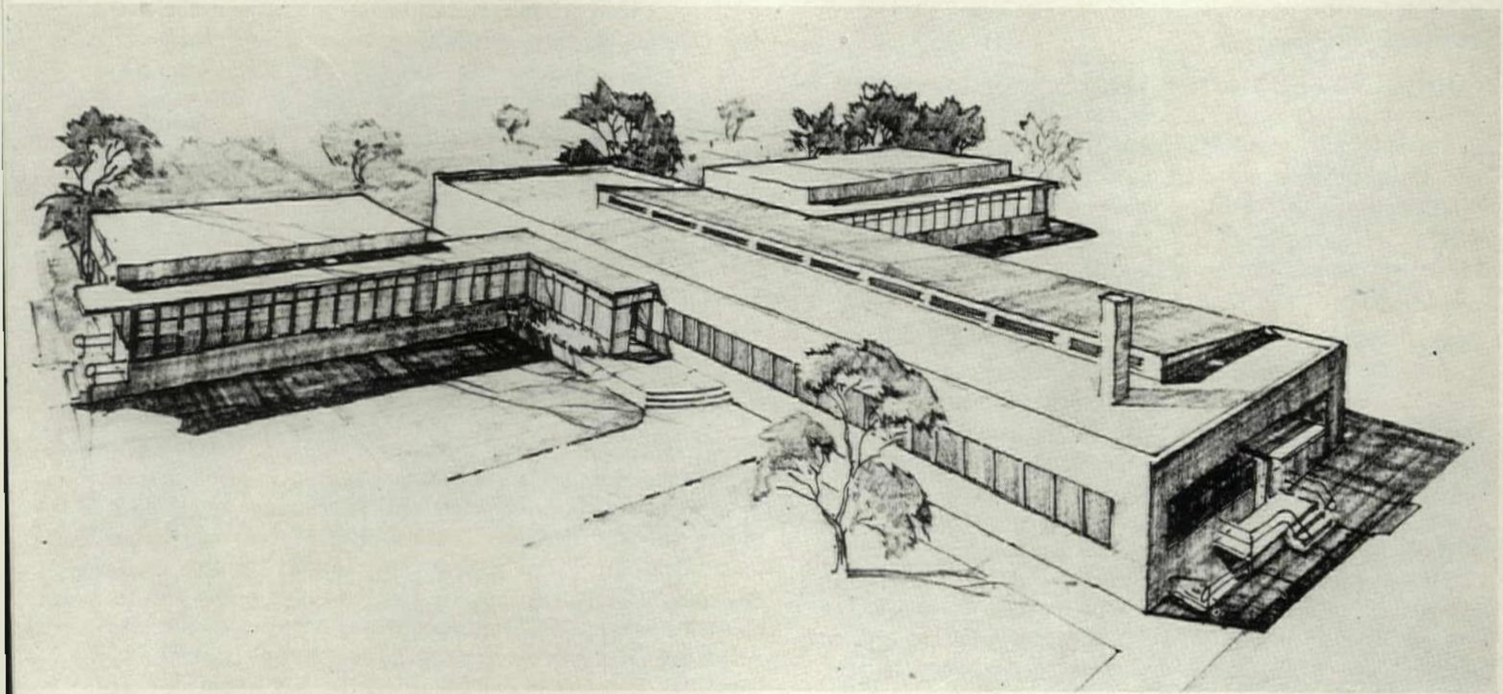
Sickness, disability, and death rates are too closely correlated with adequacy of health and hospital facilities to be questioned. We cannot afford the economic loss even though we close our eyes to the human suffering that is a necessary concomitant.

The architects of this nation have a distinct and leading responsibility to assist in guiding their own communities into logical channels in allocating materials, funds, and efforts in arriving at a solution which will be most beneficial now and later. Proper solution of these problems cannot be made without active participation of the architect.

V. M. HOGE
Senior Surgeon-in-Charge,
Hospital Facilities Section,
States Relations Division

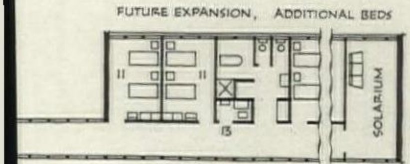
As a possible answer to one of the most difficult of the health-facility needs of which Dr. Hoge speaks—the rural health center-hospital—this USPHS design is exceptional in that it suggests inclusion of surgery, inpatient nursing units, and even private offices for local doctors and dentists along with the basic health-center facilities. As Dr. McGibony cautions in the discussion across the page, however, this combination, while highly desirable in certain localities, is by no means to be generally recommended, and that the health-center facilities are not affected if some of the elements are omitted. Laid out on a modular basis, the scheme is flexibly arranged so that the local architect may readily adapt it to specific community requirements.





THE SMALL HEALTH CENTER-HOSPITAL

HOSPITAL FACILITIES SECTION, U. S. Public Health Service



PLAN HIGHLIGHTS

Nursing and administrative supervision maintained from a central point; desirable exposure for inpatient areas. Compact emergency surgery and obstetrics unit, with only a pass window for sterile supplies between work and delivery rooms. Limited driveways for both service and main entrances.

For economy and to avoid over-building, minimum initial construction is recommended, with future expansion (to meet any of a number of specialized local needs) possible on any axis of circulation; this scheme also permits separate nursing units for different categories of patients by simple duplication of the nursing unit shown.

Special credit for development of the plan should go to Basil Yurchenco, one of the staff architects of the Hospital Facilities Section.

Knowing full well that the proposal here made—that a small rural health center might be combined with some limited inpatient care—is a controversial one, we are happy to present a digest of a realistic, objective study of the facility prepared by Dr. J. R. McGibony, Senior Surgeon, Hospital Facilities Section, U. S. Public Health Service.

ARGUMENTS CON: The construction of hospitals of less than 30 to 50 beds has long been controversial despite the fact that about 50 percent of the general hospitals have less than this number. Admittedly they are disproportionately expensive both to build and maintain. Thus, under ordinary circumstances one would hesitate to recommend that a community embark on such an expensive and possibly unsatisfactory venture. Every alternative should be fully explored.

ARGUMENTS PRO: Despite the higher costs involved in the construction and operation of small hospitals, many communities desire such institutions. They point out correctly that local facilities are essential to serve their health needs. Family physicians are not prone to transfer average cases to hospitals even 15 to 20 miles distant, nor is such an arrangement satisfactory to patients and their families.

COORDINATED PROGRAM: Any community plan will benefit by coordination with the total state program. Operation of the local institution should contemplate affiliation with neighboring hospitals and medical centers. Only by some such arrangement can fully adequate care be assured with limited facilities, staff, personnel, and equipment.

BED ESTIMATE: The figure of 4.5 beds per thousand of population has been determined necessary to meet total needs, but in rural areas it is believed that 2.5 beds per thousand should be sufficient for the average community. Primary and secondary medical centers in which are concentrated specialized skills and facilities will serve patients referred from outlying areas as well as from their immediate areas; the ratio of beds then naturally becomes higher for the resident population of a given urban area. This does not mean a different requirement for rural and urban people, but an adjustment of bed concentration in accordance with ability to render a comprehensive service.

The rural health center-hospital will tend to make the community healthy and hospital conscious by concentrating on normal obstetrics. Hospital care for general disease conditions would, of course, be furnished to the limit of adequacy of facilities.

SITE: Generally speaking, the small rural health center is better patronized and can discharge its community obligations more efficiently if it is located as near as possible to the center of the town or the village. This is particularly true if public clinic and private physicians' offices are combined with bed facilities. Traffic and other objections in cities are not often of great import in the smaller community.

FACILITIES: For hospital purposes alone, approximately 575 square feet per bed are necessary to provide bed space and all adjunct services. Bed rooms are designed preferably for two but never for more than four beds in a small facility, each bed requiring at least 80 square feet in the room. Additional space required for public health activity will of course vary, but at least 2,000 square feet will probably be necessary. For private physicians' and dentists' offices and examining rooms, a minimum of 300 square feet for each office may suffice, exclusive of waiting rooms.

REMODELING: An existing home or a building not designed as a hospital usually proves the most expensive of ventures when converted to hospital use. Upkeep is higher, efficiency, safety, and sanitation more difficult, remodeling expensive, constant, never satisfactory.

CONSTRUCTION COSTS: To the local costs of ordinary building construction must be added approximately 20 percent to cover the unusual and expensive methods, materials, and equipment required for hospitals. Loose equipment will amount to from $500 to $800 per bed, or approximately $1 per square foot of hospital floor area. Supplies, to begin operating, amount to about $200 per bed.

OPERATING COSTS: Only hospital services are considered, as public health activities will vary. The major expenditures for the average small hospital are for personnel, food, and other supplies, all of which are proportionately higher than for larger institutions. Experience indicates a rough budget divided as follows:

Salaries and wages	50%
Supplies and equipment	20%
Foodstuffs	15%
Heat, light, power	5%
Repairs and replacement	5%
Insurance and miscellaneous	5%

PERSONNEL: The smaller the institution the higher the proportion of salaries, as there is a limit to patient-personnel ratio in rendering even minimum adequate care. Hospital administrators recommend 1.5 employees per patient in the smaller units. An absolute minimum for the 10-bed health center-hospital might be considered one employee per bed. Additional services would have to be contributed through clubs or other organizations and by private nurses. The following minimum is suggested:

1 Director-chief nurse	$3,000
2 Staff nurses @ $1,800	3,600
1 Clerk-stenographer	1,500
1 Technician	1,800
2 Attendants	1,200
1 Cook	1,500
1 Assistant cook	1,200
1 Laborer	1,200
Total personnel	$15,000

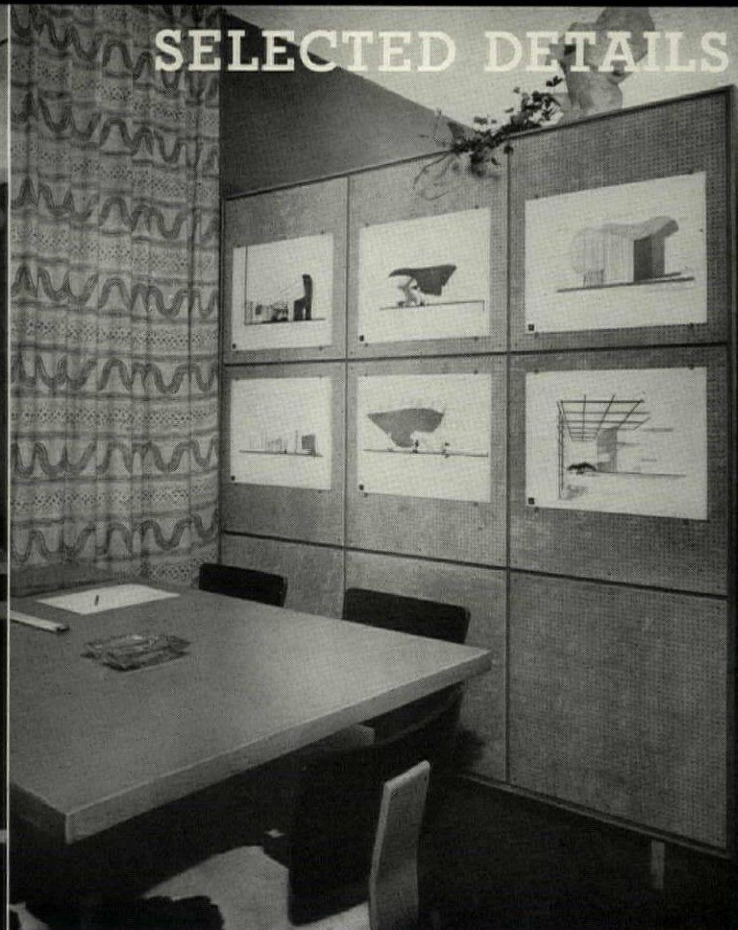
BUDGET: Total estimates, based on experience, would indicate that the 10-bed unit would cost the community as follows:

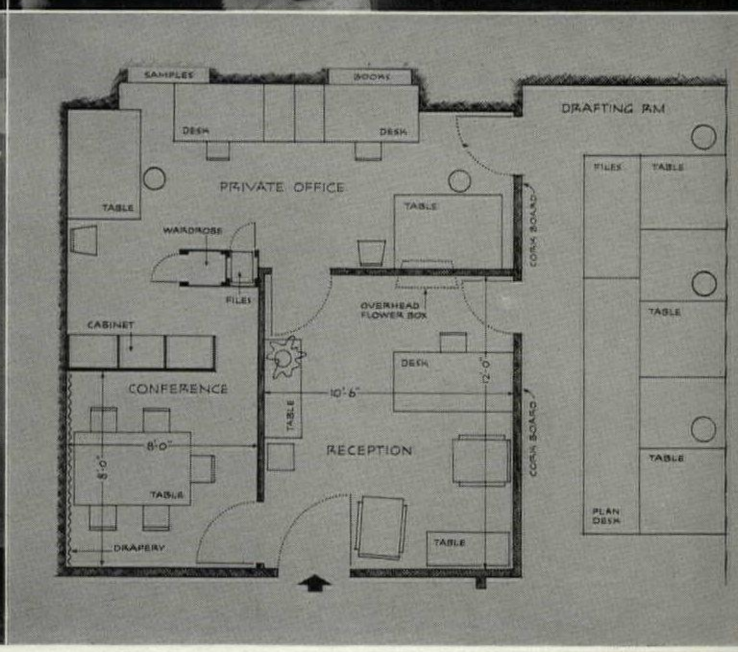
Salaries and wages	$15,000
Supplies	4,700
Equipment	800
Laundry	1,500
Light, power, repairs	1,000
Insurance, miscellaneous	1,000
Total annual cost	$24,000

Since no hospital can expect 100 percent occupancy (we can assume that there will be an average of 7 patients for 10 beds), the cost per patient would be $9.40 each day, and this with a minimum staff.

These theoretical figures can probably be reduced in actual practice, but it can be seen that hospitals are expensive institutions and, the smaller they are, the more expensive they become per patient. It may be difficult for the average community requiring only this small unit to operate it successfully without outside aid or by some assured method of prepayment.

However, from the standpoint of cost, the question may be, not that the community cannot afford it, but, measured in lives and suffering, that it cannot afford to be without it.





Photos by P. A. Dearborn

(Details on following page)

INTERIOR OFFICE DEVELOPMENT

ARCHITECT'S OWN OFFICE
NEW YORK, N. Y.

REISNER & URBAHN
Architects

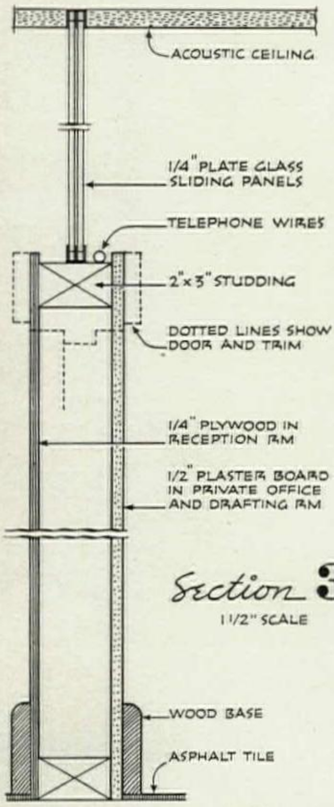
Interior office space, 20-odd ft. from windows, required special treatment:
- Partitions door height, sliding glass above for light, ventilation, unity
- Portable cases separate office, conference room; simplify any future moves
- Conventional techniques and materials used throughout to reduce costs

Result: Contemporary design approach provides good working conditions and surroundings which impress clients favorably.

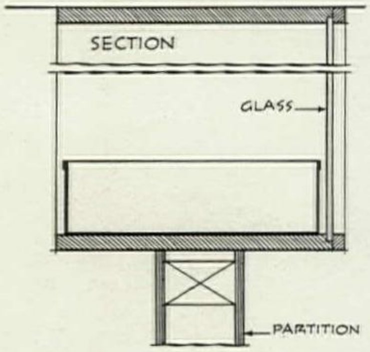
Photos show, top left, reception; top right, conference; below, drafting room.

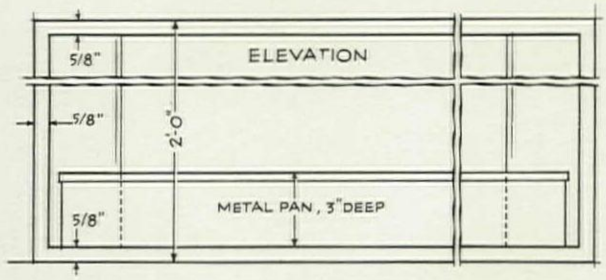
INTERIOR OFFICE

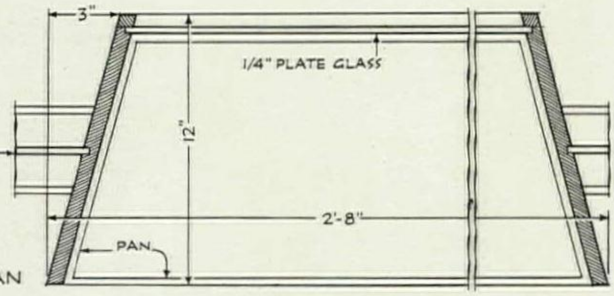
(Photos on preceding page)



Section **3**
1 1/2" SCALE

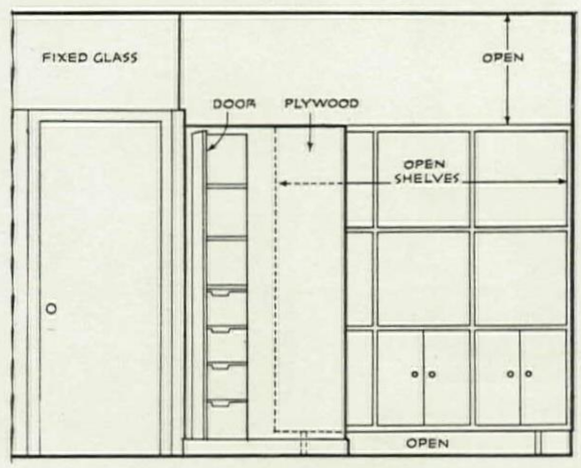


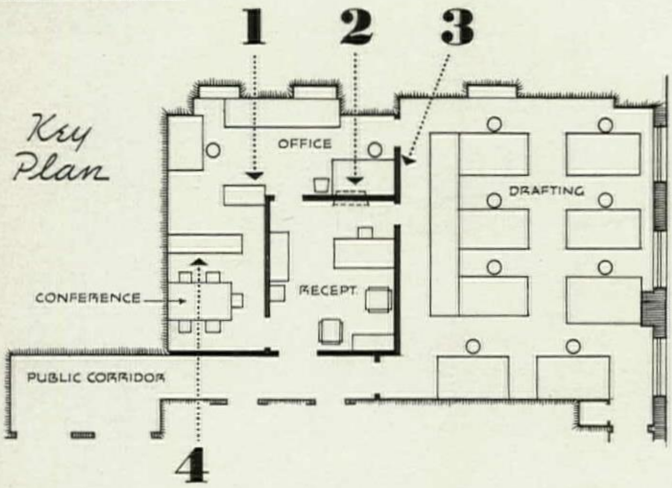




Detail at **2**
1 1/2" SCALE

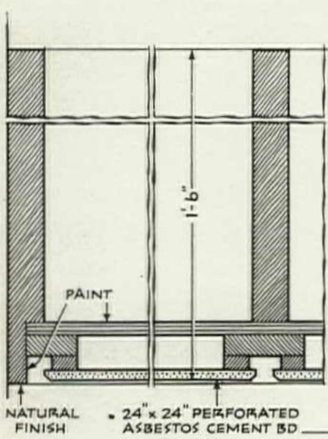
Section at **1** 1/4" SCALE

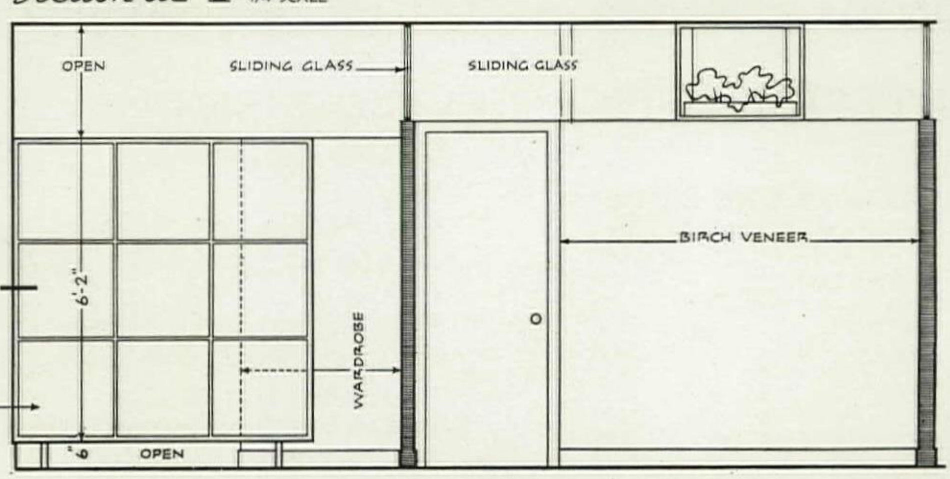




Key Plan

Section at **4** 1/4" SCALE





Plan of Cabinet 3" SCALE

ARCHITECT'S OWN OFFICE
NEW YORK, N. Y.

REISNER & URBAHN
Architects

DISPLAY OFFICE

(Details on following page)

Hedrich-Blessing

NO-SAG SPRING CO.
CHICAGO, ILL.

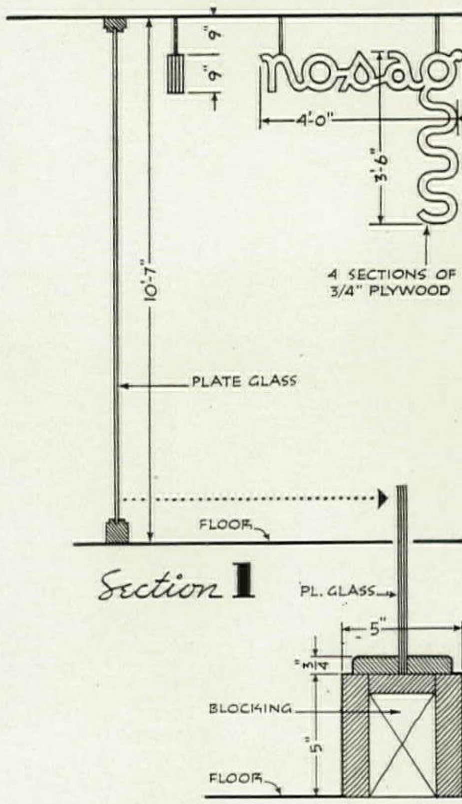
ALEXANDER GIRARD
Architect

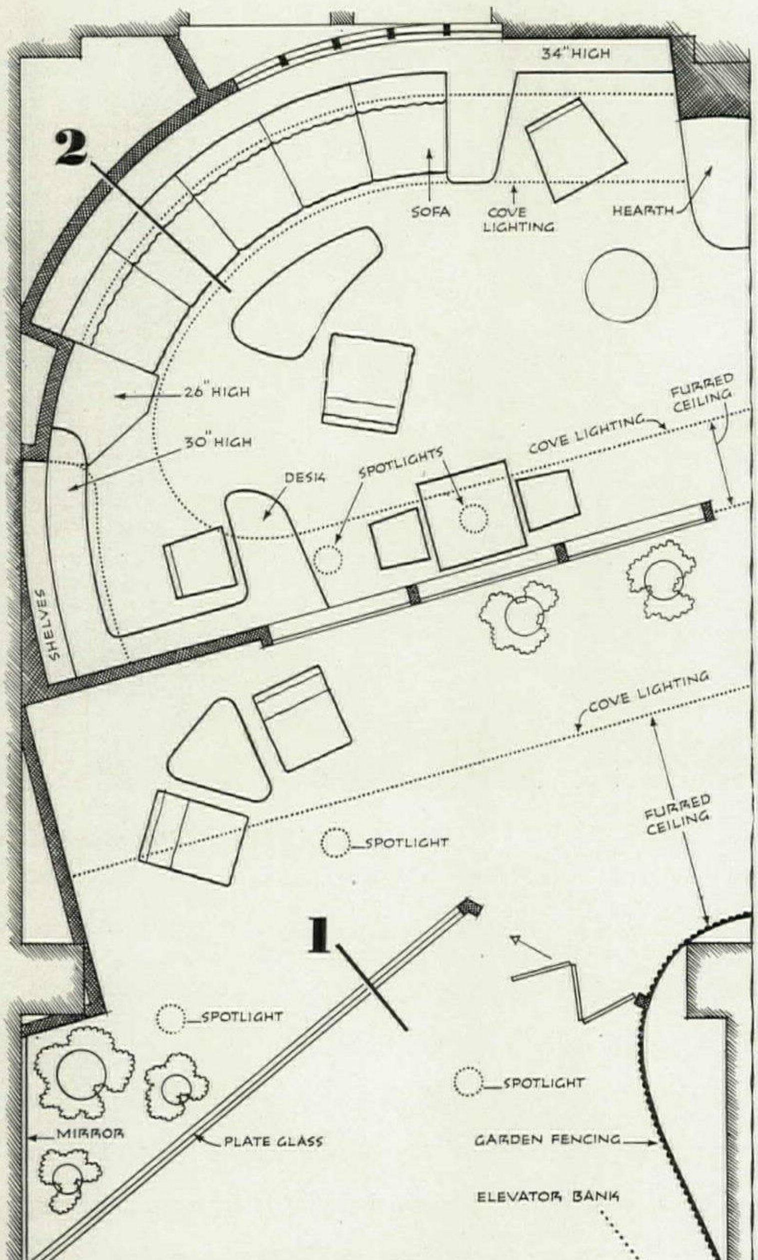
The problem here was to design offices containing a showroom in which the No-Sag Spring Co. could display its products (springs for upholstered furniture—hence the slogan on the wall); and also, as the plan on the following page shows, to make the full depth of the display space apparent from the elevator lobby. To assist in both purposes, lighting is by means of ceiling coves designed to pull attention to the interior of the space. The lobby wall is full glazed, with an adjacent mirror wall which makes even the remote corners visible from the elevator doors.

DISPLAY OFFICE

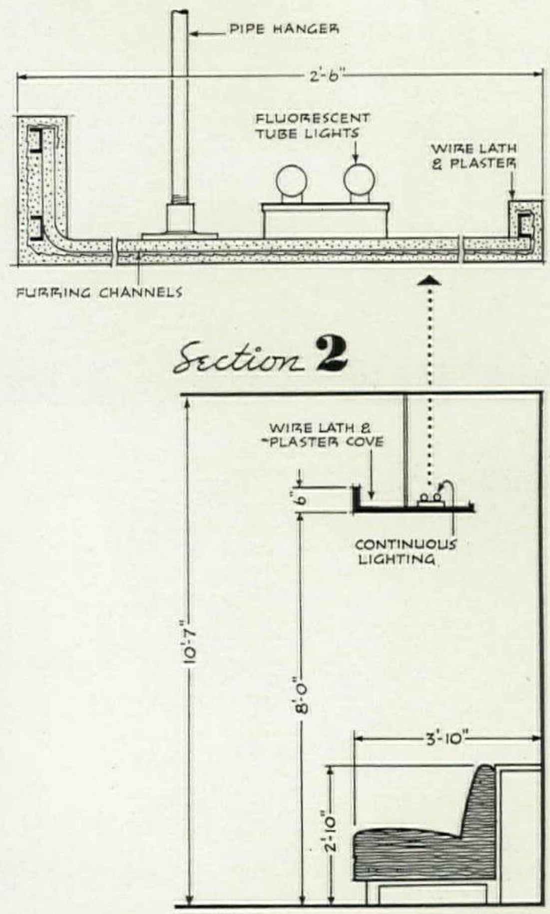
(Photo on preceding page)

Hedrich-Blessing





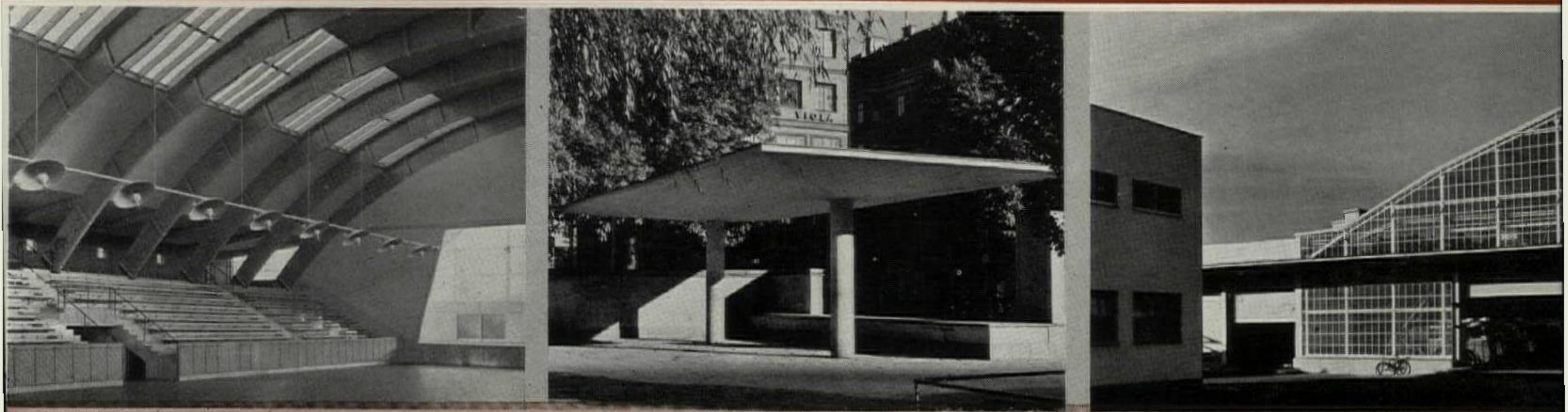
Floor Plan 3/16" SCALE



NO-SAG SPRING CO.
CHICAGO, ILL.

ALEXANDER GIRARD
Architect

Photos by G. E. Kidder-Smith



Left to right, three Swedish examples of sincere cooperation: wood arches, indoor tennis court, Ahrbom & Zindal, architects; reinforced concrete trolley-passenger shelter; steel-arched bus garage, Stockholm, Eskil Sundahl, architect.

COOPERATION? BETWEEN ARCHITECTS AND ENGINEERS

by PAUL WEIDLINGER

Based on a lecture delivered at the Harvard University Graduate School of Design in January 1946.

Any kind of technical project incorporates, in some stage of its development, the work of the structural engineer or stress analyst. The importance of his work, along with that of other specialists, varies with the character of the project, which is largely determined in the frame of the whole technical design work.

The design of buildings, though superficially it bears quite a similarity to other types of technical design problems (see illustrations), somehow does not parallel them exactly —at least *in our time*, and I like to emphasize this—in that structural considerations are less important as criteria. I do not intend to discuss the reasons for this, but because there is no clearly determined place for the structural concept, collaboration between architect and structural engineer is generally far from perfect. This is most regrettable. I am quite sure the situation can be improved by both architect and engineer, if both will attain mutual understanding, insight into, knowledge of, and respect for each other's fields. As I said, all this has to be mutual. But, because I am an engineer among architects, I am going to concentrate first of all on the kind of knowledge and understanding we engineers prefer you to have. Also, because I am sure that you have ample opportunity to obtain all the specific information you need, there is no need to go into detail about this knowledge; but I shall discuss the controversies and trends in contemporary structural engineering.

Discussion of differences among engineers, although it is taboo and not to be debated with architects, can be helpful in understanding the way of thinking and method of approach of the structural engineer, with whom the architect's fate, for better or worse, brings him into contact.

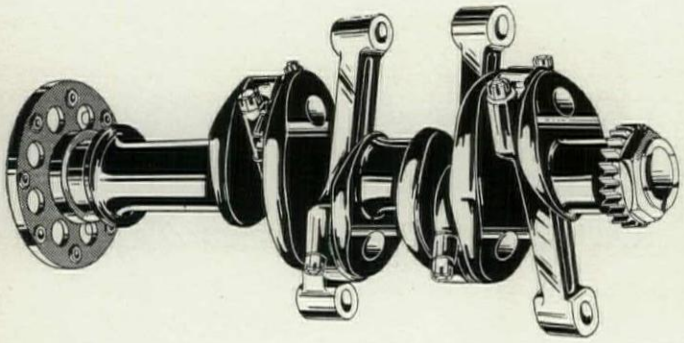
INFLUENCE OF THE ARCHITECT

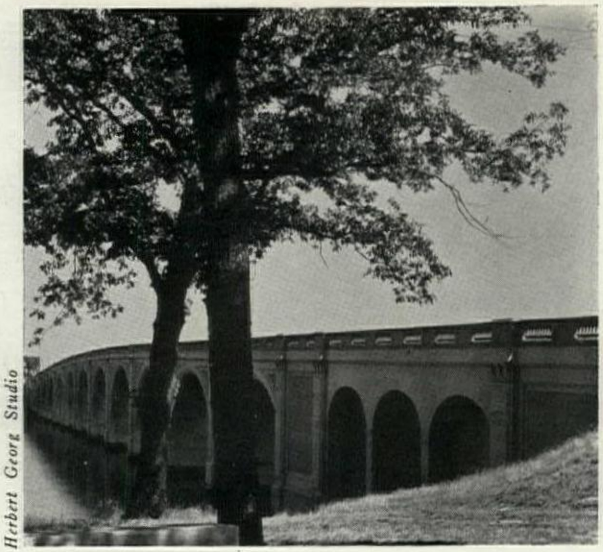
The architect's contribution to the structural design of a project is quite important. The architect is usually expected to have a so-called "working knowledge" of engineering. This (of course, with notable exceptions) could more properly be called "working ignorance." That situation has to be remedied in the very near future if architecture is to survive and play an active role in the advancement of civilization. Unfortunately architects have to budget their time and energy carefully to acquire knowledge of their own complex field, and consequently cannot reasonably be expected to master thoroughly all problems of advanced engineering. Substituting this so-called "working knowledge" for a thorough knowlege leads almost invariably to one of two attitudes. *Number one:* The architect believes that his engineering knowledge covers everything which can possibly be known on this subject. He believes himself to be almost an engineer who, except for lack of time, interest, or the accident of circumstance, would be able to take over the structural design of his project. In reality his knowledge, a few years after he has left college, boils down to a memory of a much abused formula, $M=\frac{wl^2}{8}$. . . .

Attitude number two: He believes engineering is a subject which can be approached only by those who are highly skilled in the mysterious and inexplicable art of higher mathematics and the use of the slide rule. He furthermore believes that, although he lacks such talents, the Lord has provided the architect with the equally inexplicable, mysterious faculty of intuition, which gives him an insight into all structural matters . . . it must be added, though, in all truthfulness, that when it comes to actual execution of his design he would rather rely on the engineer's slide rule than on his own intuition.

Obviously neither of these attitudes is very satisfactory. Fortunately one has but to look around to find architects whose work, not only in its structural but in its other concepts, reflects a knowledge and understanding of *all* the problems involved. In spite of the somewhat dark picture I have painted, a great many good examples of this type of work can be found.

At its best, the design of a building is the result of an intelligent and creative collaboration between architect and engineer; at its worst, a compromise. To obtain the best results, the architect not only has to be acquainted with the most complex structural problems which might arise, but





1 STRUCTURAL ENGINEERING PREDOMINANTLY ANALYTICAL: crankshaft of an internal combustion engine transmits known forces over a given distance, but with little efficiency as far as structure is concerned; the purpose of the mechanism dominates design. Structural engineering in this case is almost entirely restricted to checking dimensions, occasionally to varying form slightly in order to hold stresses and strains to safe limits. Illustration courtesy *Aviation*.

2 In the reinforced concrete Vachel Lindsay Memorial Bridge, Springfield, Ill., the requirement of traditional masonry-arch shapes—a totally unnecessary postulate—reduced the engineer's creative design work to little more than checking stresses in the arches and foundations. The arch soffits are arbitrarily semi-elliptical.

COOPERATION BETWEEN ARCHITECTS AND ENGINEERS

he has to understand all their implications—although he is not required to solve them; more important is the ability to explain these problems to the engineer in intelligent, familiar language.

I also believe that an intuitive understanding of structural problems has a proper place if it is supported by factual knowledge which is not limited to a small, elementary region of engineering, but is extensive and well informed. The architect thus armed is able to make the most use of the skills of his structural engineer.

NATURE OF ENGINEERING DESIGN

The architect is in a position from the beginning to exert great influence on the approach to the problem. The engineer's initial approach often depends on the restrictions or freedom inherent in the project in its over-all concept of structure. The engineer might begin by analyzing some typical parts of a design and determining from them the character of the whole; or he might use his imagination in finding the structure most suited to the design as a whole.

These two basically different approaches roughly correspond, in their broadest interpretation, to the processes of *analysis* and *design*.

Analysis can be defined as a method of determining all important conditions in a given structure under the action of known forces. In the simplest case this corresponds to checking stresses and other data pertaining to a structure against the provisions of a building code or against the physical characteristics of the materials used. Such a process clearly comes under the headings of "strength of materials" and "stress analysis." (See illustration No. 1.)

Design is the method used to obtain a structure for the specific purpose of transmitting known forces over definite distances. The meaning of this definition is illustrated by the problem of designing a simple roof truss: this involves first of all finding the most suitable type of truss for the specific purpose, which is design in its clearest form.

Ordinarily neither of these two methods can be used alone. They supplement each other in almost all problems, but the predominance of either one of them in the initial approach—and also during the whole work—has great importance. At first thought it may seem illogical to try to represent them as two distinct, controversially opposed methods. But, as I will show, there is opportunity for quite a bit of heated discussion of the subject. It is obvious that certain kinds of problems predetermine the approach: the spillway section of a gravity dam is predetermined by hydraulic requirements and what remains is stress analysis, i.e., checking to see if it is strong enough to resist the exerted water pressure. But in the design of an industrial building, the type of framing selected has a great influence on the predominance of design or analysis. For a given clear span, height, and column spacing several types of roof framing could be selected. The choice itself, of course, is clearly a design consideration, but once this choice is made the question of predominance is easy to see. If steel trusses are used, the main problem is developing the particular framing system of the roof truss. Once this has been accomplished, the rest is routine checking and selection of members.

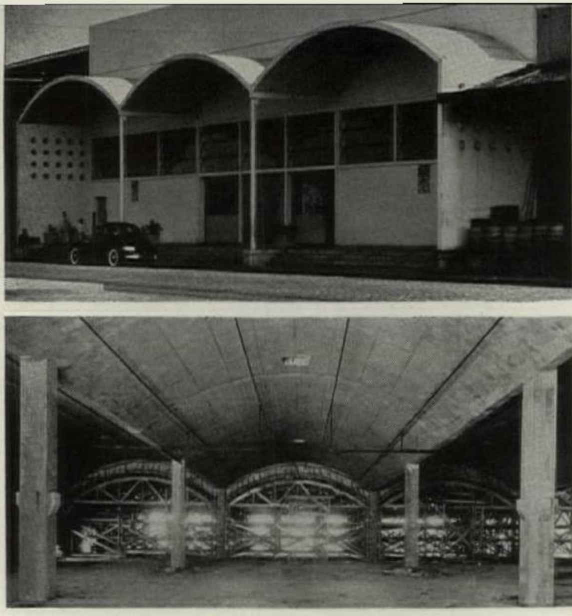
On the other hand, if a reinforced concrete barrel-shell roof is chosen, the shape of the structure is predetermined by the selection of the barrel shell, but the main dimensions are obtained by analytical work.

Naturally the decision as to whether to use a structural steel truss or a reinforced concrete barrel shell is not based solely on the particular architect's like or dislike for this shape or that, or on the disposition of the engineer toward stress analysis or design, but we have to admit that very often it is greatly—sometimes unnecessarily—influenced by these factors.

Let us take a closer look at these two concepts.

THE SHERLOCK HOLMES APPROACH . . .

The **analytical solution** requires in some problems quite an impressive mathematical instrumentation. This might easily frighten off the uninitiated; unfortunately it also offers an excellent opportunity to hide behind scientific-looking formu-

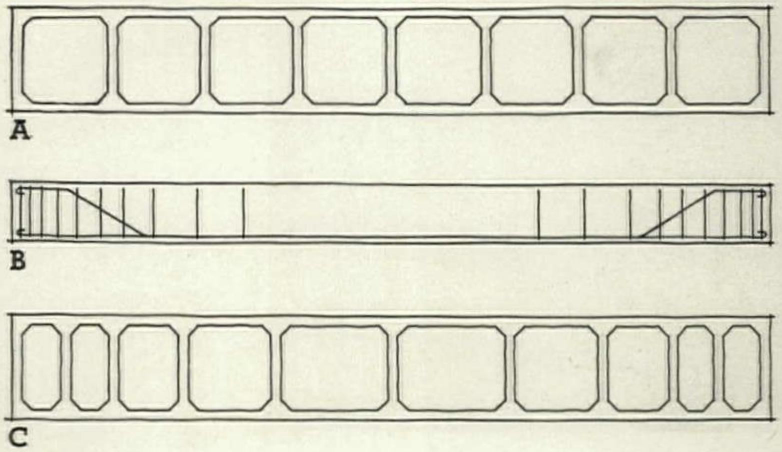


G. E. Kidder Smith

Portland Cement Assn.

3

Top, boat passenger station, Rio de Janeiro, Brazil (Corrêa Lima, Architect); below, Armstrong Tire and Rubber Co. plant, Natchez, Miss. (Roberts & Schaefer Co., Engineers). In both reinforced concrete barrel-shells, once the desired span and column spacing are determined the engineer's work becomes analysis, highly intricate, of stresses in shell, edge beams, and diaphragms. To comprehend the theory of thin shells deep insight and knowledge of mathematics are required.



4

The Vierendeel truss, essentially a series of hyperstatic frames of rectangular or trapezoidal panels, has been and is still opposed for such stated reasons as lack of rigidity and economy. In truth, the opposition is more probably due to the almost prohibitive amount of work required in its complex analysis, which has obscured its value as far as purely design considerations are concerned. Yet up to 10 years ago more than a hundred bridges of this type had been built in both steel and reinforced concrete, also arc-welded steel trusses. The usual design appears in sketch *A;* but the verticals act similarly to stirrups in reinforced concrete beams *(B);* ideal Vierendeel truss *(C)* has even more complex analysis.

las a lack of imagination, or an inability to cope with problems in their over-all aspects. What it really requires is not so much great mathematical knowledge, but, rather, courageous, logical thinking and inventive talents in the field of the exact sciences. Mathematics plays the role of a very sharp instrument, and all assumptions have to be quite precise, but the final results have to be adjusted to the crude reality of our presently available construction practices and methods.

Professor Hardy Cross expressed this quite pointedly in the discussion of a paper on the design of symmetrical concrete arches, the content of which has since become standard equipment of the structural engineer. His words also show the sharpness of the controversy on this subject:

"The writer thinks, however, that from the viewpoint of practical design the mathematical theory of the rigid fixed arch is being overdone. . . . The theories of arch analysis which are now being elaborated in engineering literature are distinctly 'highbrow' in that their elaborateness camouflages with erudition uncertainties and inaccuracies which are inevitable." And finally he writes, ". . . Arch designs would be improved if a great deal more time were spent on studying foundations at the expense of the time devoted to the arch stress. . . ." *(Trans. Am. Soc. C. E., 1925, Vol. 88, p. 1076.)*

This criticism by Cross is that much more justified because he was not content merely to criticize a practice of which he disapproved, but also contributed very excellent suggestions and developed brilliantly simplified methods of analysis to replace what he calls "highbrow" theories.

But an equally distinguished engineer finds quite enthusiastic words of praise for the methods of exact and clear analysis. He writes:

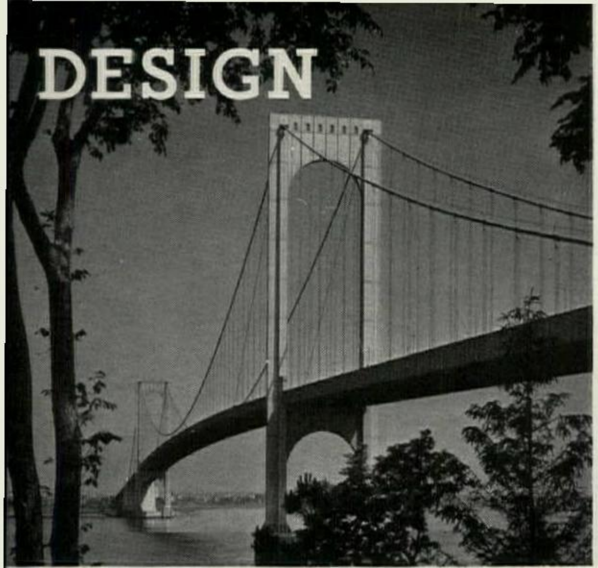
"The analysis of engineering problems . . . can be an exceedingly fascinating pursuit; as fascinating, say, as a game of bridge, a cross-word puzzle, or a cryptogram. One starts with a supply of fundamental physical knowledge, and, with mathematics and physical knowledge as tools, attempts to build the solution to his problem. . . . His (the engineer's) mathematical tools must be sharp, so that he can more easily manipulate his material. . . . Most problems necessitate considerable mental effort . . . where he (the engineer) must be ready to put forth his best efforts. It is this part of analysis which is the most fascinating and challenging . . . mathematics has a double role in engineering: that of providing a quantitative basis for analysis and that of providing the background for a more clear and thoroughly physical understanding of engineering phenomena. The former function is an obvious one and of recognized importance in all branches of technical engineering, but it must be admitted that most practicing engineers use, in their day-to-day work, only a small portion of the mathematics they once studied." (W. C. Johnson: *Math. & Phy. Prin. of Eng. Analysis, McGraw-Hill, 1944.)*

This point of view emphasizes, in addition to the usefulness of the analytical approach, the heuristic pleasure derived from such work. There is a great temptation to lose one's self in a playful search of theoretically accurate solutions and to forget the ultimate aim of obtaining a workable design, even if all data cannot be established with an accuracy which would justify the exactness of the analysis.

VS. EMPHASIS ON STRUCTURAL FITNESS

The conception of the design approach takes just these facts very much into consideration. The work is synthetic. One concentrates on the idea of finding a specific structure which is capable of transmitting forces over a definite distance. Quality of design is judged on the basis of economy in number of elements and simplicity and clearness of their forms. This kind of approach results at its best in daring, original solutions, but like its counterpart, can easily become a hiding place for those who lack elementary understanding of scientific discipline. Good design solutions are often spectacular in their conception. The temptation to strive for originality, with disregard for all other requirements, is very great, as anyone who has tried it can testify.

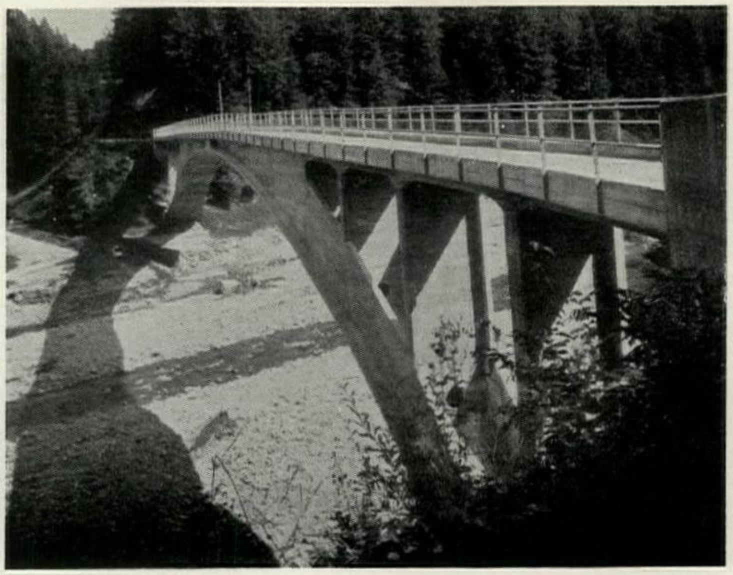
Every architectural problem can be regarded as a challenge to invent the structure most suitable for its purpose. All



Rodney McCay Morgen

1

STRUCTURAL ENGINEERING PREDOMINANTLY DESIGN: Bronx-Whitestone Bridge, New York. Bridge design is closer than other structural problems to the definition of the "design" approach: to find a structure for the specific purpose of transmitting known forces over definite distances. This principle, if followed uncompromisingly, should satisfy all formal or esthetic requirements. Suspension bridges utilize tensile qualities of cables or chains to the utmost; their curves are determined by structural requirements.



from Circle, Faber and Faber

2

Rosengraben Bridge, near Schwarzenburg, Switzerland (Robert Maillart, Engineer). Built in 1932, this bridge employs an arch shaped to utilize fully the compressive strength of concrete. Note the discontinuous soffit curve, pointed in the center like a gothic arch. Maillart satisfactorily proved, in 1934, the rationality of this shape based solely on structural considerations; he also criticized the practice of making soffit curves look like traditional masonry arches.

COOPERATION BETWEEN ARCHITECTS AND ENGINEERS

too often this tends to cause concentration on the specific differences of the given project in order to obtain an original, sometimes extravagant solution, instead of accentuating its relationship to other similar structures. I think in our civilization the solution based on a skillful application and adaptation of a reduced number of standard elements deserves more attention than the ever-so-much-more original but "custom-made" solution, which represents rather an escape from the social and economical realities of our time.

Both design and analysis have their important place in the workshop of the structural engineer. The methods are far from being irreconcilable, and the architect can reasonably expect the engineer to master both even if he has a preference for one. It is important that the architect understand and find out from the beginning of their cooperation which the engineer prefers, and try to adjust and complement it with his own ideas during the initial stages of the mutual creative process.

AS TO ACCEPTANCE OF INNOVATIONS

Speaking of particular preferences, it is useful to keep in mind that, all in all, there no doubt has been more harm than good done to the advance of engineering by incessantly calling attention to the uselessness of exact, refined analysis of problems. In general, the knowledge of the average engineer lags behind scientific advance in his own field. As in other technical professions, there is resistance to any innovation which requires either additional learning or the use of more than elementary arithmetic. Fortunately the resourceful pioneer has found ways of overcoming his own colleagues' passive resistance. It is very interesting to examine the methods (and tricks) used to introduce through the back door advanced ideas which otherwise would be refused entrance. These ideas enter after unsuccessful attempts in several disguises. One common "trick," if I may use the expression, is to reduce all mathematical work to the very simplest arithmetic, either by the preparation of extensive tables and curves or by inventing ingenious methods which do not require any mathematical instrumentation at all. One of the most brilliant is the now widely used moment-distribution method, introduced by Cross. This method accomplishes the solution of continuous girders and rigid frames by a series of simple arithmetical operations, and also focuses attention on the physical phenomena of deformations, which are so characteristic of continuous rigid structures.

Previously, the same problem required at least the solution of a great number of simultaneous equations, or the use of extensive, cumbersome tables. In this sense the moment-distribution method is probably one of the most important contributions of the last decades, as it has made accessible to a large number of engineers a field of analysis which previously was avoided or replaced by sometimes naive approximations.*

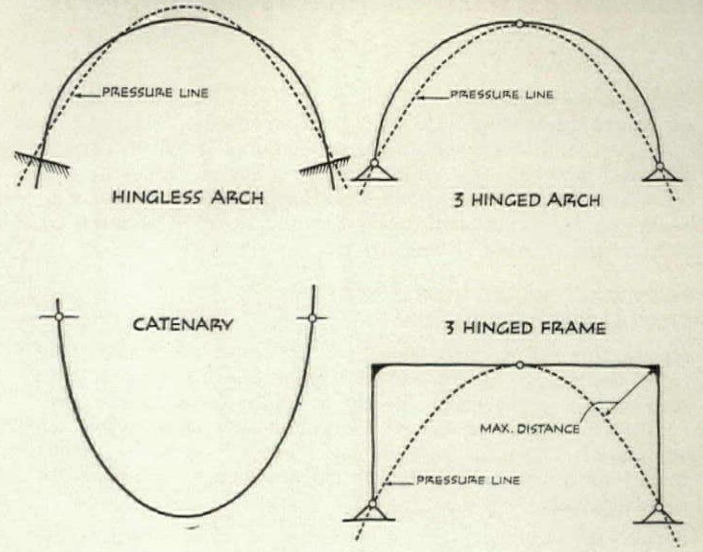
It is not often realized how much the willingness of engineers to investigate new methods has to do with acceptance of new or improved structural systems. New systems cannot find wide acceptance if their analysis is cumbersome. This, to give at least one example, is the only reason why the excellent Vierendeel trusses cannot attain their proper place among other types of structural framing. The Vieren-

* Another frequently employed "trick" is more interesting. It consists of translating the results of analysis into a language familiar to the engineer, by the use of analogies; the device permits use of terminology connected with the analogy, which is assumed to be well known. There are a number of examples. Problems in solving the deflection of beams require setting up and solving differential equations, but under certain conditions the deflection curve can be interpreted as a bending moment diagram, which to the practicing engineer is—and I should say, unfortunately—a more familiar concept than the deflection curve. Consequently deflection problems are solved by the familiar "conjugate beam method." Similarly, influence lines of continuous beams can be interpreted as deflection curves of the same beams under certain conditions. In a more recent innovation, the "column analogy," bents and beams of complicated shapes and varying cross-sections are laid down flat and considered as short columns, or rather as foundations. The pressure exerted by them on the soil is proportional under given circumstances to the stresses existing in them when they are "used" as bents or beams. Equally instructive is the "membrane analogy" used in the solution of torsional problems.

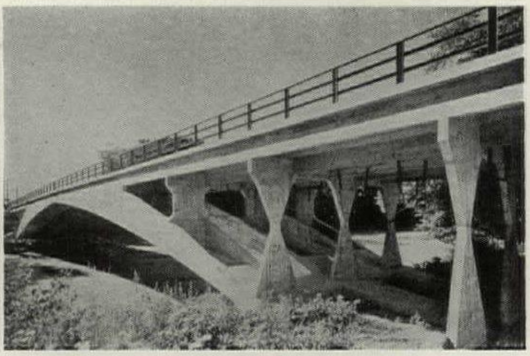
The common property of all of these analogies is the quite striking fact that their use does not represent any saving in calculations; their sole value lies in the ease with which the designer who uses them can grasp and memorize a procedure, due to the use of familiar terminology. As a matter of fact some of these methods even obscure the underlying physical principles. Whatever the methods' merits, they are extensively used, accepted, and considered quite traditional tools of the structural engineer. They deserve attention because they reflect a certain way of thinking which should be familiar to the architect who has to work with engineers.

P. A. Dearborn

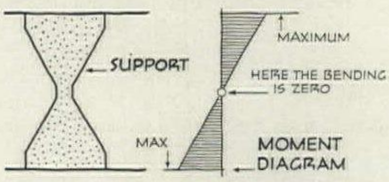
3 Bridge, Mt. Vernon Memorial Highway, Virginia. This "stone" bridge is in reality composed of reinforced concrete rigid frames of excellent design—camouflaged in deference to tradition. Remarkably enough, a photograph of this bridge is reproduced on page one of an excellent book on continuous concrete frames; the author, an authority on reinforced concrete design, is apparently embarrassed by forms developed exclusively from uncompromising design and analysis, for which he is an outstanding spokesman.

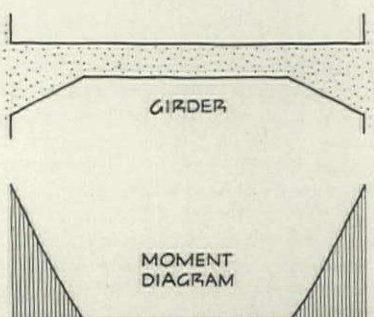


4 The "pressure line" shows whether a frame or arch is subject predominantly to compression or to bending. The nearer the pressure line approaches the center line of the structure, the less is the bending induced by loads. Where the pressure line intercepts the axis of the structure, bending is zero. Hinges cannot transmit bending (rotation); therefore the pressure line always passes through them. Note how the pressure line "hugs" the hingeless arch, which is predominantly in compression. Corners of the three-hinged frame are farthest from the pressure line; at these points maximum bending is induced and heavy haunches are required. The "catenary" is the "pressure" line—more properly, "tension" line—of a heavy chain or cable; both are flexible (a series of closely spaced hinges) and therefore unable to transmit any bending; the suspended cable coincides with its "pressure line."

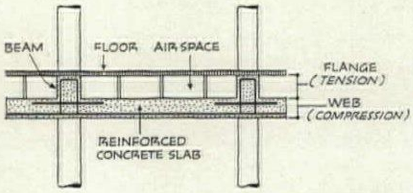


from Architectural Review, London



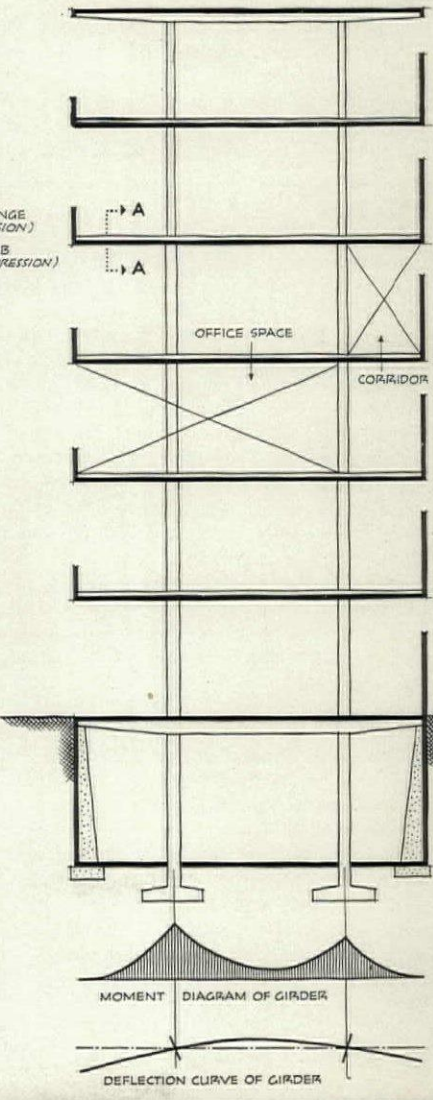


5 Top, Pont de Vessy, over the River Aare, Switzerland (Robert Maillart, Engineer). Note the shape of the supports, which conform exactly to structural requirements for transmitting linearly distributed bending moments and shear. This somewhat unfamiliar form is based on the identical principle that governs the haunched shape of beams restrained at their ends, as shown in lower sketch.



Section A-A

6 Reinforced concrete office building, La Paz, Bolivia, designed by the author. The intent here was to satisfy the functional requirements of the office building: maximum flexibility for office space, furthered by eliminating exterior rows of columns; maximum daylighting (windows run to the ceiling); sound-insulating floors (aided by construction system); facilities for running electrical wiring, heating and plumbing piping (in the floor construction). Structural design is based on the typical reinforced concrete T-section, but since girders are continuous and cantilevered, deflection is such that their top portions are in tension, bottom in compression, and the T was inverted to bring the web and flange into proper position to resist each type of stress.



deel truss is neglected even today, in spite of the availability of several perfectly safe analytical methods. As there is no really compelling reason for its use, and it can be always replaced with the triangular truss, no design tables or satisfactory simplified methods have been developed, and consequently the structural engineers' inventory is missing an item of great interest and merit.

PRACTICAL CIRCUMSTANCES FOSTER WORTHWHILE INNOVATIONS

Up to this point such small controversies might seem to be on the purely theoretical or academic level. To put them into proper perspective one must relate them to the general advancement of technical civilization and economic development. If we do this, the little tempest in the academic teapot gains an added, deeper significance which is worth investigating.

Structural engineering not being an exact science, its development and advancement do not depend on basic research alone. It gets its impulse toward development of new techniques through the introduction and invention of new building methods and materials. The success of these new building practices or materials can break down the resistance of conservative engineers, especially if their conservatism is based not so much on a general philosophy as on resistance against acquiring additional knowledge.

AN EXAMPLE: REINFORCED CONCRETE

Let us consider the introduction and acceptance of reinforced concrete, which once certainly was a revolutionary innovation in the construction field. At its beginning, around 1850, there was no underlying theory for its proper use. Construction practice was based on crude experiment and imitation of other, already familiar, structures. In Europe it quickly became popular, although until the first scientific investigators published and tested the results of their methods, a number of erroneous conceptions were deeply rooted convictions among builders and contractors. Quite typical is the story of Monière, the inventor of reinforced concrete, who until his last day maintained that engineers who suggested placing reinforcement near the top or bottom of concrete beams, instead of in the center as he did, were misinterpreting and misunderstanding his invention. Only a number of quite disastrous accidents at the end of the 19th and the beginning of the 20th centuries convinced builders of the necessity of careful analysis and design.

But the design of reinforced concrete structures is inherently more complex than, for instance, that of riveted steel structures. The reason is two-fold. The material is heterogeneous, consisting of steel and concrete, and yet columns, plates, and girders poured in one piece become continuous and rigid frames. Both of these characteristics make analysis much more complicated than the design of independent columns supporting simple beams, which is the characteristic of simple riveted steel structures. To this complexity I attribute much of the early resistance reinforced concrete encountered in the United States, a resistance which, I think, can be felt even at the present time. As far back as 1888 three great reinforced concrete hotels were built in St. Augustine, Florida; and in 1903 the very notable 18-story Ingalls Building was erected in Cincinnati, Ohio, with a reinforced concrete frame. But these were notable exceptions. Fortunately, in addition to the academic interest of progressive scientists and engineers, the more powerful interests of the cement industry entered into the picture, and their powers of persuasion exceeded those of the engineers.

THE MANUFACTURER'S INFLUENCE

Those who manufacture Portland cement—and theirs is now one of the ten leading industries—exerted great pressure to encourage general acceptance of their product. This pressure was applied not only in general promotion work, but in furthering research, theoretical as well as practical. Eventually the industrial interests succeeded, in the sense that concrete and reinforced concrete are now widely accepted, but the ensuing situation is somewhat awkward. Small contractors and conservative engineers continue to erect large numbers of reinforced concrete structures designed in the manner used in the design of riveted steel structures, with maximum economy and minimum effort, not in cost or materials, but in thought, creative spirit, and brainwork on the part of the authors. This is really not necessarily an entirely negative qualification. I believe that these types of construction have their place, justification, and significance in the economic and social order in which they are conceived and built. But if the effort is to advance our civilization, I think we have reached a saturation of this type of building. It is time to concentrate on more advanced, more suitable, methods. It is fortunate that the work of a large number of engineers and architects reflects comparable convictions. Their excellent structures exist today, side by side with the unimaginative ones. The same discrepancy is reflected in our building codes. Codes incorporate low working stresses to take care of the blundering of some, while at the same time they adopt design methods which take advantage of the results of latest developments and advanced research.

Naturally more compelling reasons formerly influenced American builders to try to avoid reinforced concrete buildings. An important one is the fact that reinforced concrete construction practice was more of a handicraft than the erection of shop-fabricated structural steel sections. Modern reinforced concrete practice has eliminated this difficulty to a great extent, and the material has proved itself comparable to steel construction in speed of erection as well as in economy. Nothing but the prejudice of certain engineers against the analysis of continuous rigid structures can explain the resistance which reinforced concrete encounters at the present time.

CONTROVERSY OVER WELDING

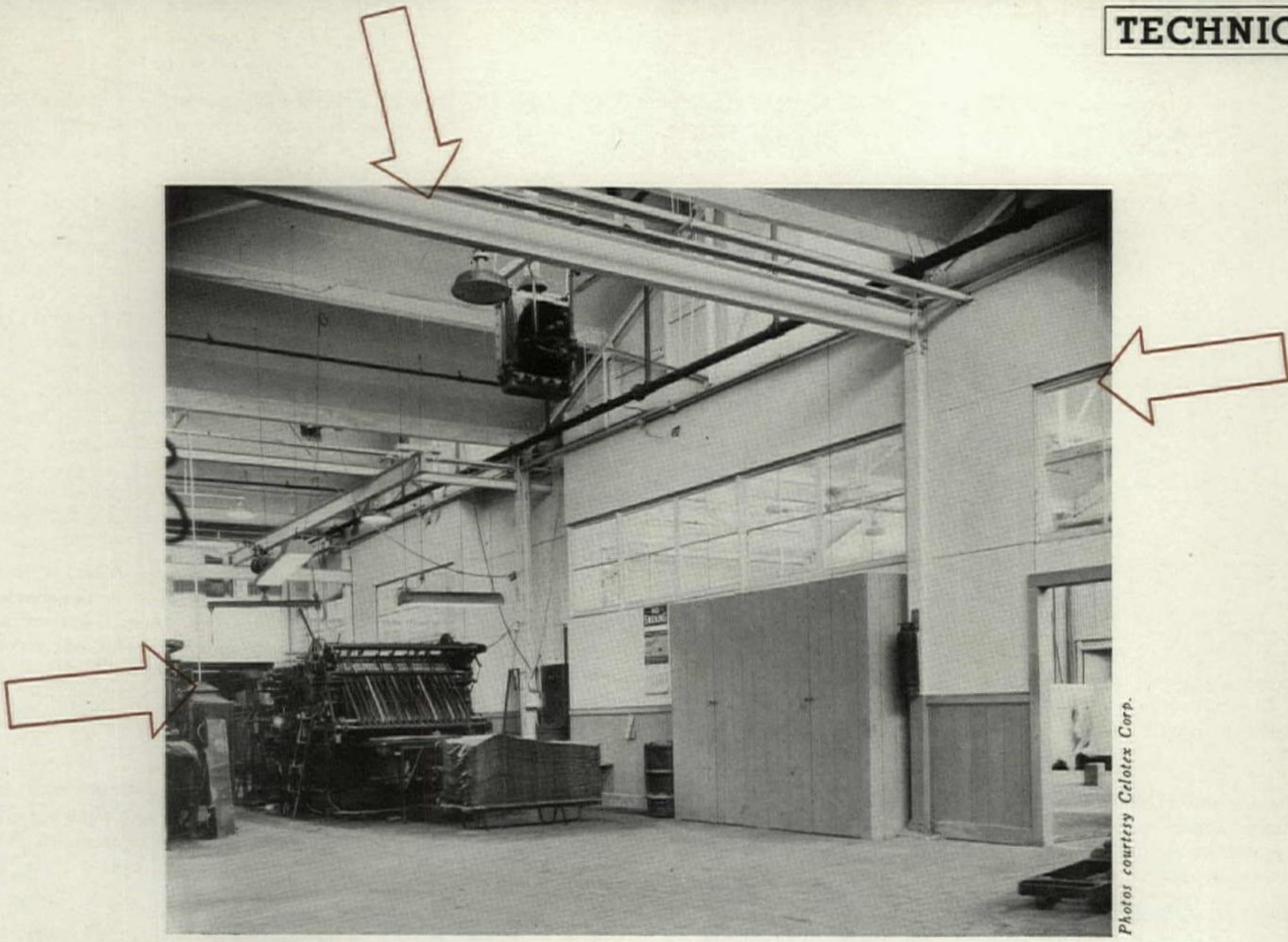
Quite a similar situation can be observed in the case of welded steel structures. Apparently here also, to those who try relentlessly to prevent its use, the continuity of the structure seems to present insurmountable difficulties in design. While welding of pipes and tanks has practically displaced riveting, the use of welded connections and parts in structural steel was not generally permitted under any city building codes before 1940. The pressure of material shortages and continued efforts of progressive engineers has at last succeeded in giving a good start to a great development, signs of which probably will be seen in the years to come.

KNOWLEDGE GAINED IN WAR: THE ARCHITECT'S RESPONSIBILITY

The knowledge of the practicing engineer, in analysis as well as design, increases constantly. Great experience has been gained and substantial advances have been made in stress analysis, thanks to the impulse given by the requirements of aircraft design.

For the architect, the most important aspects of this advance are embodied in experience gained in the analysis of shapes which previously were considered almost inaccessible to precise computation, and also the use of new metals, alloys, plywood, and plastics. Experience in designing and analyzing odd curved shapes has familiarized the engineer with the process of three-dimensional consideration of his problems, and has enabled him to derive advantages which previously would have been considered extravagances. The whole trend is toward considering and analyzing structures not in their component parts, but as entities. I cannot over-emphasize the importance of this.

Finally, I would like to say that, though advancement in structural design is the business of engineers, the architect will have to bear no small responsibility for its application. Sharp methods of analysis and revolutionary design ideas recently developed will be used by structural engineers only if they are required—even forced—to use them. If architects are going to be satisfied to continue to request run-of-the-mill structural design for their projects, I am sure they will get it. But if they want to take advantage of engineering knowledge, of new developments and new materials, they themselves will have to become thoroughly familiar with them.



Sound-conditioned paper mill showing application of acoustical material to ceiling and side wall of a sawtooth building. Material used is Acousti-Celotex.

FACTORY NOISE

by HALE J. SABINE and ALLEN WILSON, Celotex Corp.

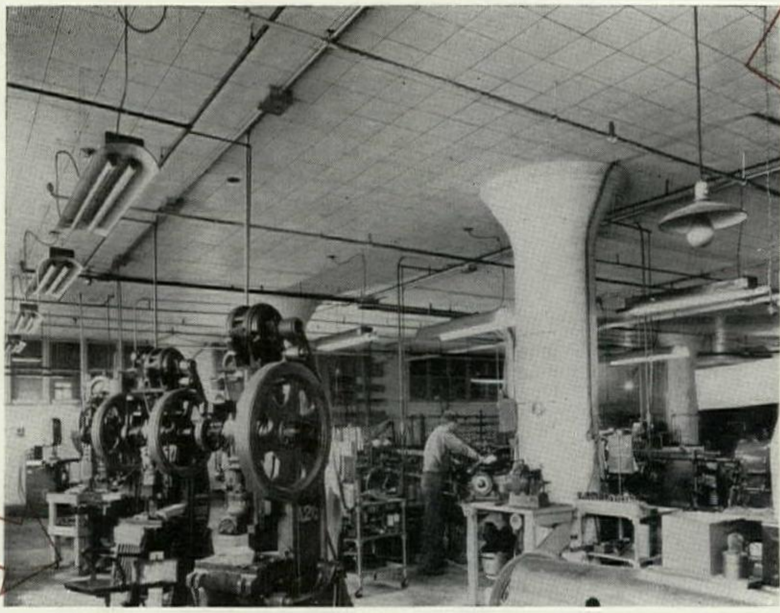
While there is little the factory architect can do about plant noise, there is much that he can do in determining to what extent workers within the plant are annoyed and distracted by it. The type of operation, the machines employed, the kind of materials being machined will set the intensity levels within the various plant areas. What happens to the sound after it leaves the machines and how the machines are placed or grouped in relation to each other will in most instances have as much to do with the "noisiness" of the plant in general as will the original intensity.

LOUDNESS DOES NOT ALWAYS ANNOY

Within the range of average factory noises, **loudness** and **annoyance** are far from being synonymous. Practical control of industrial plant noises must be approached with a full appreciation and understanding of the fact that loudness, which we accept generally as having a simple meaning defining the force of sound as heard by the ear, is in truth a complex reaction that results from the combination of sound pressure, or **intensity**, and the frequency of vibration, or **pitch**. Since there are very few, if any, pure tones in factory sounds, another factor enters, that is the sum total of all frequencies contained in the sound being heard at one instant. This combination is known as the **spectrum** of the sound. As the spectrum of a given sound increases in complexity, the ear's reaction is often one of increasing loudness even though the pressure, or intensity, remains fixed. It is this characteristic of sound that makes certain sounds seem louder, or "noisier," than others although their measured energy may vary little, or not at all.

However, these physical characteristics of sound do not label a given sound or sounds as noise. In searching for a term with well defined meaning for common use to designate noise, the Acoustical Society of America some years ago recommended **unwanted sound.** This term was adopted by the American Standards Association and is now in common use. When this definition is used, time, place, and psychological reactions become factors in noise along with the physical characteristics noted.

Considering all the known characteristics of noise, it is seen that the simple measurement of noise intensity is far from an absolute measure of annoyance. Experiment and



Acoustical ceiling kills reverberation in this machine shop. Acousti-Celotex applied to under side of concrete deck.

field results have shown that exposure to a sound having "raw edges" produces more discomfort than a similar exposure to sounds having less annoying qualities but higher intensity levels.

PRACTICAL NOISE CONTROL

Practical noise control, then, embraces manipulation of sound frequencies so as to filter out the most harassing components of noise; general suppression of the over-all intensity of a specific sound or ambient sound level; and prevention of noise spread into areas where it isn't wanted.

While it is beyond the scope of this article to discuss in detail the physiological and psychological effects of noise upon workers, the efficacy of proposed noise-control measures cannot be evaluated accurately without considering some outstanding reactions manifested by exposed workers. To reemphasize, the purpose of noise control is to reduce annoyance and distraction caused by noise, which in turn produce fatigue and contribute to physical ill health. Therefore, successful noise control is in essence control and restraint of annoyance factors as well as suppression of physical sound. Since it cannot be hoped that a manufacturing process for shaping, forming, or assembling parts in metal, wood, stone, or plastic can ever be a truly quiet procedure, factories will probably always be noisy in comparison with offices. The aim of practical noise control should be that of creating a favorable environment for workers in the presence of necessary noise, as well as direct elimination of noise where possible.

NOISE LEVELS IN EXISTING PLANTS

Shortly after this country entered World War II, stepped-up production schedules centered considerable attention on the problem of industrial noise. As a result, the writers were engaged for some months in a field investigation program devoted to studying the behavior and effects of noise in manufacturing plants, and means of alleviating it by sound conditioning and other methods. The initial step in the survey was to determine the range of noise levels encountered in typical factories. Noise level measurements were made in 33 separate plants covering a wide diversity of industries and machine operations. Of all the readings taken in actual work areas, the highest was 130 db and the lowest 65 db. In the large majority of cases, the observed noise levels ranged quite uniformly between approximately 85 and 105 db. In order to obtain comparative data on the noise output of various types of machines, readings were taken wherever possible at a fixed distance of 3 feet from the principal noise-producing point of the machine. A few representative figures are as follows:

TABLE I. Noise levels of various machines at distance of 3 feet.

Punch presses, various types	96-103
Headers	101-105
Drop hammers	99-101
Bumping hammer	100
Hydraulic press	130
Automatic riveters	95-99
Lathes (average)	80
Automatic screw machines	93-100
Airplane riveting guns	94-105
Airplane propeller grinding	100-105
Cotton spinning	84-87
Looms	94-101
Sewing machines	93-96
Wood planers	98-110
Wood saw	100
Wire rope stranding machines	100-104
Ball mill	99

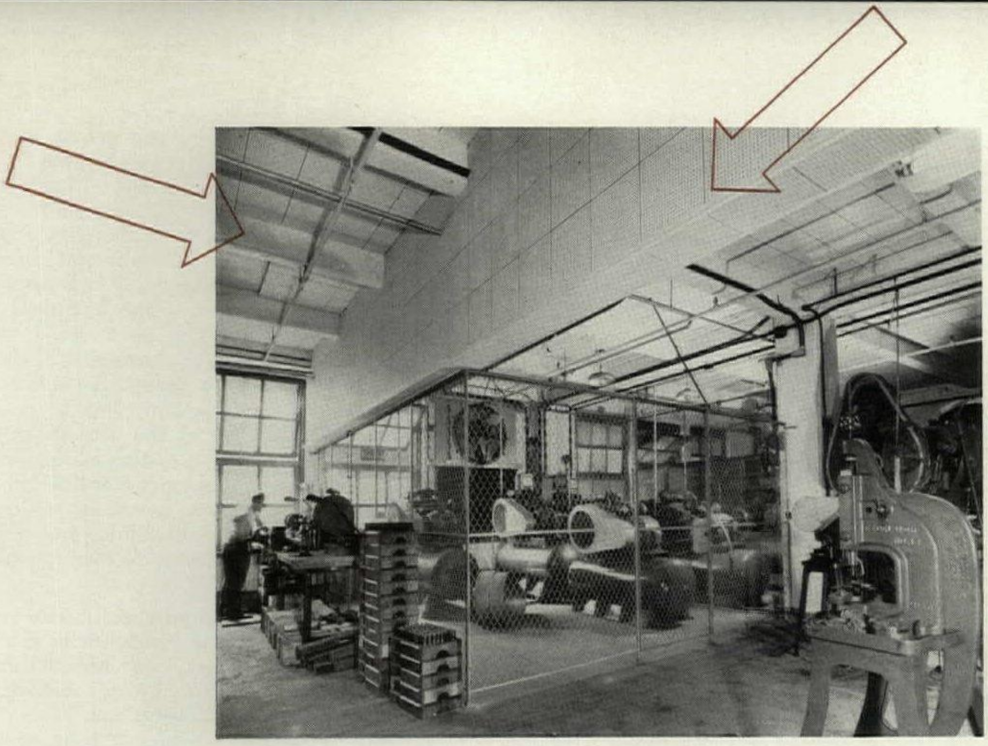
The decibel is the standard measure of acoustic energy. In the middle ranges of the decibel scale, a single decibel is approximately equal to the least change in loudness perceptible to the average ear. However, this relationship changes as the lower and upper limits of the scale are approached. At lower levels a change in an over-all noise level of four or five decibels is barely perceptible, whereas a change of about 0.3 is noticeable at noise levels in the 80's and higher.[1]

On the decibel scale, zero (0) marks a fixed value of sound intensity which is slightly below the threshold of hearing of the average ear, and 120 db marks the approximate point at which sound pressure becomes strong enough to be felt. This sensation of feeling is usually experienced as pain. The energy ratio between these two points is one trillion to one. An increase in intensity of 1 db represents an energy increase of 26%; a 10 db increase represents tenfold energy increase.

The data shown should be considered only as illustrative, since in many cases the noise level may vary considerably depending on the type of work or material on which the machine is operating. It should also be noted that since the operator frequently is closer to the noise source than 3 feet, the noise level at his ear may be somewhat higher than the values shown.

One of the first of several questions which arose was whether reductions in noise levels of the order of 5 to 10 decibels, theoretically attainable by means of sound condi-

[1] McCord, C. P.; Teal, E. E.; and Witheridge, W. N.: *Noise and its Effects on Human Beings*, Journal A.M.A., 19:110, 1554. (May 7, 1933)



Noise from these compressors is confined to the immediate area by combination of sound-conditioned ceiling and sound-absorbent baffle.

tioning, were enough to afford really worthwhile relief when applied to the range of noise levels (approximately 85 to 105 db) to which the average factory worker is exposed. Experience with a number of acoustical installations showed that very substantial relief from annoyance was possible, even under conditions where noise meter readings showed no significant reduction in noise level.

FACTORS OTHER THAN NOISE ITSELF

Corollary experiences revealed that it was often possible for an acoustically treated area to be more comfortable from the noise standpoint than an untreated area having an average noise level actually lower. From these observations it was soon concluded that factors other than the noise level itself contributed important elements to the over-all noise picture.

Frequency. One of the outstanding characteristics of the human ear is its extreme sensitiveness to different sound frequencies. Those sounds which lie within the frequency range to which the ear is most sensitive (approximately 1000 to 6000 cycles per second) will as a result of this tendency almost always "cut through" and be clearly audible above lower-frequency sounds which have considerably higher intensities. One researcher stated to the writers that his observations had led him to conclude that this would occur in some instances where intensities of the respective sounds differed as much as 20 db.

It has been known for some time that high frequencies not only are more annoying, but are also more harmful than the lower pitches. Perlman[2] reported from his experiments on human listeners that "sounds of low frequency produced less acoustic trauma than those of high frequency."

Recently the Armour Research Foundation was commissioned to make studies of and redesign a calculating machine for the specific purpose of reducing the noise it generated. During this program, the Foundation compared two calculating machines, "A" and "B," whose sound levels (weighting network C of General Radio 759B Sound Level Meter) were 70 and 73 decibels respectively. In acoustic energy, machine B emitted just twice the amount of machine A. Forty observers were requested to listen to each of these machines, and each was asked, "To which machine would you prefer to listen all day?" Of the forty observers, twenty-nine selected machine B, nine chose machine A, two were undecided.

Frequency analyses of these two machines showed machine A to have a lower sound level in the frequency ranges of 25 to 75, 75 to 750, and 750 to 2500 cycles per second, but that machine A had a higher sound level in the range of 2500 to 7500 cycles per second. The obvious conclusion is that, although machine A had a lower over-all sound level, it was nevertheless considered the more objectionable by twenty-nine out of the forty observers because of the larger percentage of its sound concentrated in the higher frequency range—2500 to 7500 cycles per second.

Source of noise. From the workers' viewpoint one of the cardinal points of noise control was found to be that no one seems to mind noise of his own making as long as that noise is below the level of actual physical pain. This holds true in ordinary factory operations, even when the noise produced reaches intensities known to result in hearing impairment after lengthy exposure. It is the "other fellow's noise" that wears the worker down. Noises coming from machines and operations other than his own, over which he has no control, always have an element of unexpectedness.

An equally important point appears to be the desire to be able to speak and be heard, and to hear when spoken to, without undue effort. An interesting sidelight on the effects of good hearing conditions is given in a reply one worker in an automatic packaging room made on a questionnaire inquiring into workers' opinions of improved noise conditions. He said, "Safety is affected. Warnings are heard easier. If I cry for help I could be heard quicker and easier."

An environment that protects a worker from the other fellow's noise, and permits him to carry on a conversation—necessary or otherwise—will, in comparison to other environments which do not meet these conditions, be judged relatively "quiet."

Reflected sound. It has been noted that noises traveling or spreading with little diminution in intensity, from sources located at a considerable distance from the hearer, have an irritating effect far out of proportion to their actual intensity. In many such instances, a modest increase in attenuation, or drop-off per unit of distance traveled, between the source and the worker will serve to submerge such noises below the level of his immediate vicinity. In effect, the source is moved out of his range. Investigation showed that these reactions are very nearly independent of the intensity levels involved.

Sound conditioning (by means of acoustical materials) acts upon the ambient sound level by soaking up a large percentage of sound that would otherwise be reflected back into the room occupant's ear. Consequently, in highly reverberant rooms, sound conditioning is especially effective

[2] Perlman, H. B.: *Acoustic Trauma in Man*, Arch., Otolaryng, 34:429, (Sept., 1941)

in lowering the general level by removing some portion of the total volume which is built up through multiple reflections of the original sound. This effect is manifested to the ear as removal of the "ringing" and "roaring" that characterize reverberant rooms, and imparting of a "deadened," "muffled" quality to the remaining noise.

Dr. Paul E. Sabine points out: "In a reverberant space, the worker has the sensation of working at a noisy machine in a noisy environment. Replacing the reflecting surfaces by absorbing surfaces reduces the environment factor, thus markedly reducing the annoyance, even though the measured level is not greatly reduced." [3]

WHAT DOES ACOUSTICAL TREATMENT ACCOMPLISH?

Frequency. Sound conditioning has an even greater effect in its capacity to change the frequency spectrum of the over-all sound. In general, higher frequencies are absorbed more readily than low frequencies. As higher frequencies usually constitute the more annoying component of the total intensity, the result is often marked relief, even with a very minor change in over-all intensity. At average factory noise levels greater relief may be expected from this function of acoustical materials than from its probable effect in lowering the total level. The National Safety Council[4] states: "It would appear that the character and quality of noise are of the greatest importance and, where noise cannot be eliminated, efforts at changing or supplanting the character of the sound have met with remarkable success."

In most factories high frequencies at high intensities constitute the greatest obstacle to intelligible speech. In checking the observable results of sound conditioning in the cupping and drawing department of a cartridge plant, the headquarters engineer reported that upon entering the plant after the treatment had been installed, the most noticeable effect was comparative ease of conversing. Yet general sound levels in these areas are in the neighborhood of 90 db.

Confinement of sound. Another consideration in using acoustical material is its influence upon the "spreading effect" of sound. In an open space the intensity of sound from a given source falls off rapidly as distance increases. In reverberant rooms the intensity of sound from a single source is almost independent of distance from the source—the sound spreads with little diminution in relation to distance. As absorbent treatment greatly reduces this spreading effect, the man working at a noisy machine has the feeling of a relatively quiet surrounding.[3]

The amount of relief obtainable by cutting down the spread of noise is influenced greatly by the spacing and layout of the machines in a given area, and by the type of noise they produce. The manner in which these factors affect the final result can be understood by considering the spreading effect in somewhat greater detail. It is well known that introduction of absorbing material in a room reduces the intensity of distant noise sources more than the intensity of sources close to the point of observation. Absorption is most effective at any given position as far as the ear is concerned, when before treatment the noise of distant sources is audible in the presence of nearby sources. In other words, no good will result from quieting distant sources if their noise is already completely masked by the noise of sources in the immediate vicinity. This means that wide spacing of machines, differing qualities of noise from various units, and intermittent operation of the machines, are all conditions favorable to the attainment of good results. For example, treatment applied over punch press areas in which the machines are spaced at least 5 or 6 feet apart has proved a distinct benefit to the operators.

AN EXAMPLE

Excellent results were obtained in the drop hammer and press room of a New England jewelry plant. This room is 60 ft. wide and 160 ft. long. Nearly half the room was occupied by drop hammers and presses. The other portion was occupied by small, relatively quiet machine operations. Noise from the drop hammers and presses spread throughout the entire area, in such volume that distraction and nervous fatigue interfered with the efficiency of the workers in the second department. Construction of any type of partition between the departments was impractical. Acoustical treatment was applied over the hammers and presses to a line forty feet beyond the location of the hammers nearest the small-machine department. The noise from the drop hammer and press department was damped sufficiently so that residual sound entering the second department was effectively masked out by the relatively low noise level in that department. As to the effect in the immediate vicinity of the hammer and press operators, the management reports . . . "Since the machine operators stand very close to their machines, we did not expect too much reduction in the noise level at these particular points, but after the installation was complete, there was a decided improvement for which the men are grateful."

Investigation showed that this improvement came largely from the removal of reverberation. Each hammer blow had previously set up an intensity level, near the 100 db mark, that was sustained for some seconds by the room itself. It is known that a certain amount of time is required for the ear to adjust itself to its full sound-intensity perception. Removing the sustained portion of the sound shortened its audible period and had the effect of decreasing its loudness.

OTHER CONSIDERATIONS

The manner in which hearing perception builds up to loudness as a sound persists is easily comprehended in the case of a sequence of short sounds. It has been observed that a full burst of six test shots in rapid succession from a 20 mm. cannon seems considerably louder than a single discharge.

The disturbing effect of noise spreading from a considerable distance can sometimes be further lessened, or completely eliminated, by the use of properly designed acoustical baffles placed near the source of the noise. These baffles are suspended from the ceiling to a height as near the source as practical. While the exact action of such baffles has not as yet been completely analyzed, observations and measurements made in actual installations indicate that the observed effects result from a combination of its action as a partial barrier and sound trap, and the high concentration of absorbing materials over the noise source.

When a number of continuously operating machines, having identical noise characteristics, are spaced very closely together, there is negligible possibility of relief by the use of absorption for workers in the midst of the machines. If, however, only a part of the room is occupied by these machines and absorbing materials are applied over the entire room, those workers who regularly occupy the portion away from the machines will receive the full benefit of the treatment because the spread of noise into their area is reduced; the effect will be a feeling that the noise is "pushed back" to where it belongs. The operators of the machines observe an immediate and pronounced drop-off in the noise in moving only a few steps from the edge of the machine area, and insofar as their duties permit they are, from time to time, afforded periods of relief which experience has shown to be very worthwhile.

While the use of a given factory area is subject to change now and then as to machines, equipment, and number of personnel occupying it, and while it is known that some types of operations receive greater benefits from sound conditioning than do others, evidence collected to date is ample to conclude that the factory building that is designed and built to contribute to the quick decay of noise will provide in general a far more comfortable working environment than the usual building, which by its very nature sustains and prolongs every noise generated within its walls.

The money value to any individual plant can be determined only in accordance with the method used by that plant in placing dollar values upon the comfort and well-being of its employees.

[3] Sabine, Paul E.: *The Problem of Industrial Noise*, American Journal of Public Health, 34:3. (March, 1944)

[4] National Safety Council: Safe Practices Pamphlet #50, *Practical Methods for Reducing Fatigue*

FIG. 1
Section of 2" iron pipe removed from hot water system of a New York City building less than 10 years old. Rust has almost filled the pipe.

CORROSION
AND PIPE SELECTION

By HENRY L. SHULDENER, President, Water Service Laboratories, N. Y.

The corrosion of water piping systems involves two major factors—the kind of water and the kind of pipe. A few years after the introduction of brass and copper as domestic water piping material, and before troubles with these materials had an opportunity to develop, it was generally believed that they supplied the solution to the corrosion problem in buildings. Now that weaknesses have developed, stock is again being taken of the situation and the question: "What kind of pipe should I use?" is again being asked.

Lending institutions, designing engineers, and architects are beginning to appreciate more fully the significance of water quality, as well as pipe quality, as a prime factor in the design of water distribution systems in apartment houses, hotels, hospitals, office buildings, and houses. It is now generally recognized that no metal is immune to corrosion and that the rate of corrosion for a given material depends principally upon the chemical characteristics of the water involved. There is, and has been, considerable difference of opinion with respect to the durability of the various pipe materials, but much of the conflicting testimony about the same kind of pipe in different locations is due, as stated, to the different composition and characteristics of the water supplies involved—a fact which has been completely overlooked too many times. Thus, it is not feasible to make general recommendations as to the best material to be used under all circumstances. Each individual case must be studied with particular reference to local experience and to composition of the water supply.

NATURE OF WATER

To appreciate the problem it is necessary to understand better the nature of water, a substance so commonplace that it is taken for granted. Simply stated, all municipal and private water supplies are extremely dilute water solutions of gases and mineral salts. The gases are atmospheric oxygen and carbon dioxide dissolved by rain in its fall through the atmosphere. The salts are mineral matter dissolved from the earth's crust by water flowing over and through it in the form of rivers, streams, or wells. These salts are predominantly bicarbonates, sulphates, and chlorides of calcium and magnesium which give water its "hardness." These are the minerals which destroy soap, that is, which make it difficult to raise a lather, and which form the whitish lime scale common in hot water tanks and boilers.

Since all the gases and minerals are in solution, unlike particles of sediment or vegetable matter, they cannot be removed by filtration, just as you cannot remove dissolved sugar from coffee by filtering it.

GASES CAUSE CORROSION

The few parts of dissolved atmospheric gases per million parts of water are the cause of widespread corrosive destruction of pipe in municipal distribution systems or in the piping system of a building, hotel, or private house. Such corrosion is primarily due to dissolved oxygen, aided and abetted by carbon dioxide. The extent and rate of corrosion is controlled by the chemical balance of the other constituents mentioned. Distinction should be made between oxygen dissolved from the air and oxygen which constitutes part of the compound we know as water, H_2O. The oxygen that forms part of the compound H_2O is chemically bound and inert. The amount of dissolved atmospheric oxygen in natural surface waters is about three to eight parts of oxygen per million parts of water, which is the limit of its solubility at usually prevailing temperatures.

The content of carbon dioxide, or carbonic acid gas, in most natural waters ranges from two to twenty-five parts per million. This gas directly affects acidity of water and has the effect of accelerating the rate of oxygen corrosion.

Expressed in non-technical language, the total gas content of natural waters is, roughly, several cubic centimeters of gas per gallon of water. The total content of various mineral salts dissolved in natural waters usually ranges from thirty to two hundred and forty parts per million parts of water. This is equivalent to approximately one-tenth of an aspirin tablet per glass of water. Sea water contains over two hundred times as much total dissolved matter.

While the total of these impurities is very small and represents the extremely dilute solution described, nevertheless the composition of "water" varies widely as regards the amounts of individual constituents. This fact has controlling influence on the potential corrosiveness of the dissolved gases, which are either inhibited or accelerated in their reaction with the metal of the pipe. When the characteristics of

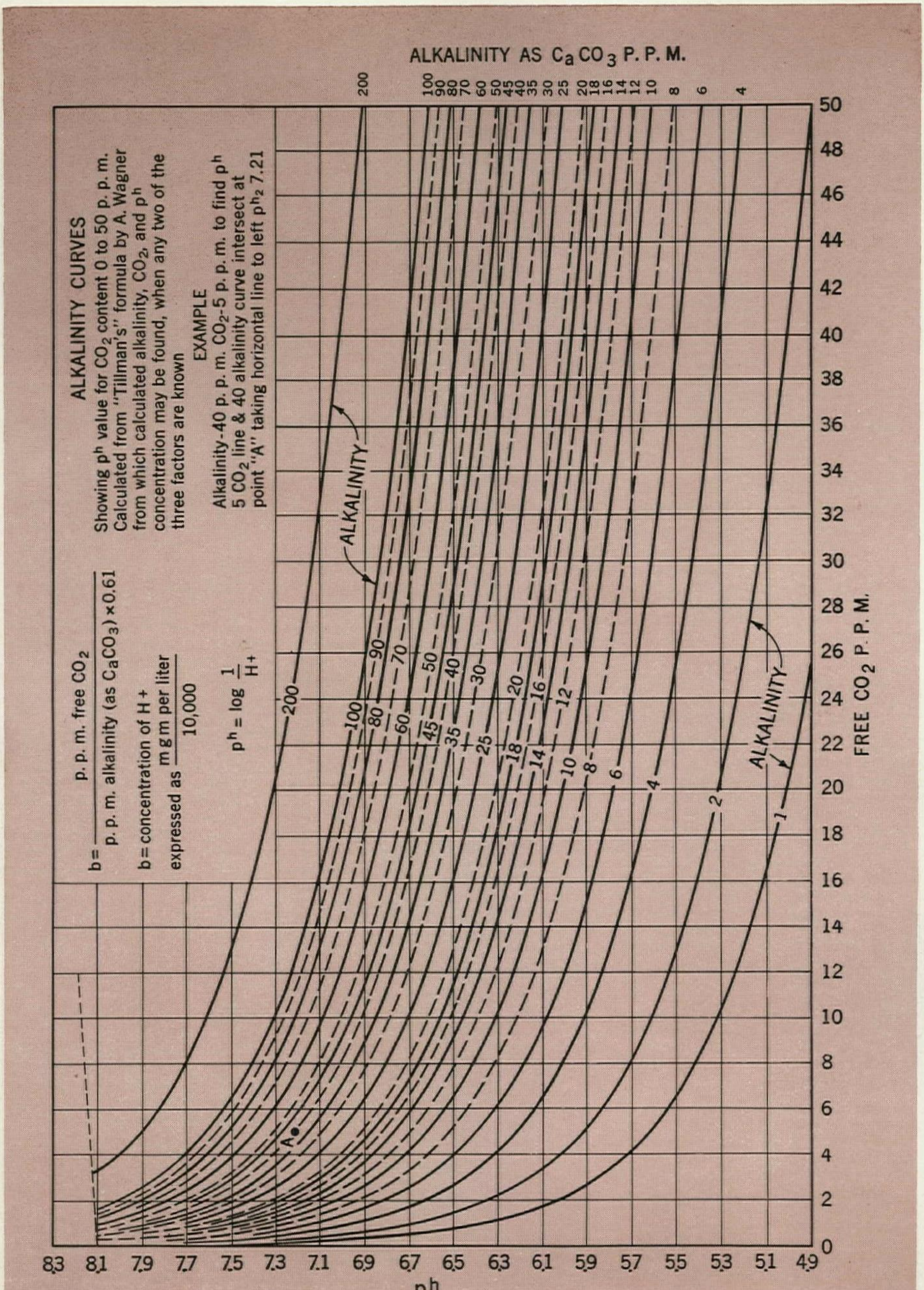

ALKALINITY CURVES
Showing p^h value for CO_2 content 0 to 50 p. p. m. Calculated from "Tillman's" formula by A. Wagner from which calculated alkalinity, CO_2, and p^h concentration may be found, when any two of the three factors are known
EXAMPLE
Alkalinity-40 p. p. m. CO_2-5 p. p. m. to find p^h 5 CO_2 line & 40 alkalinity curve intersect at point "A" taking horizontal line to left p^h 7.21
$b = \frac{\text{p. p. m. free } CO_2}{\text{p. p. m. alkalinity (as } CaCO_3) \times 0.61}$
b = concentration of H + expressed as $\frac{\text{m g m per liter}}{10{,}000}$
$p^h = \log \frac{1}{H+}$
ALKALINITY AS $CaCO_3$ P. P. M.
FREE CO_2 P. P. M.
p^h
ALKALINITY
A

FIG. 2

a water are such as to inhibit oxygen reaction, the water is classed as non-corrosive.

CORROSION FACTORS

In evaluating the corrosiveness of a natural water, four factors are considered of prime importance, namely: **hardness, alkalinity, pH, and silica content.**

Hardness. Generally speaking, those waters containing relatively large amounts of hardness in the form of the alkaline salts, calcium and magnesium bicarbonates, are less corrosive than the so-called soft waters, which are comparatively free of these salts. The non-corrosive water supply usually deposits a calcium carbonate scale on the inside of pipes. It is this protective mineral coating which some municipal chemists deposit artificially in their city distribution mains. However, artificial deposits lack permanence under service conditions unless a definite composition of the water itself is maintained to stabilize the protective coating.

Alkalinity; pH. The ratio of dissolved carbon dioxide to total alkalinity of water is another important factor in the rate of corrosion. This ratio controls the water's acidity, or hydrogen ion concentration, and is known as the *pH* of the water. A water having five parts per million of carbon dioxide (expressed as CO_2) and ten parts per million of total alkalinity (expressed as $CaCO_3$) would have the same pH as a water having twenty parts per million of carbon dioxide and forty parts per million total alkalinity. Both waters have a carbon dioxide:alkalinity ratio of 1:2 and have the same pH, which happens to be 6.6 (see **Fig. 2**).

It is apparent that the corrosiveness of a water will increase with the addition of acid, such as carbonic acid, because the concentration of H ions will increase, which is the same as saying that the pH will be lowered. The pH of most natural waters generally lies within the range of pH 6.0 to 8.0.

Temperature. In addition to chemical factors affecting corrosion, temperature is the most important physical factor controlling the rate of reaction. It is considered that a rise in temperature of about 25 to 40 F will double the speed of reaction. Thus, while a particular water may be only mildly corrosive to the cold water piping of a building, it may be very corrosive to the hot water piping. The reason for frequent specification of less expensive pipe material in the cold water system, and more expensive, more corrosion-resistant, piping material in the hot water system of a building, becomes obvious.

EFFECTS ON DIFFERENT METALS

The various pipe materials in common use are steel, wrought iron, the several brass alloys, and copper.

The effect of corrosive waters upon **iron** piping, even when galvanized, is usually evidenced by loss of carrying capacity in the piping, which becomes clogged with rust (iron oxide) caused by the direct combination of iron and oxygen. Rust has about ten to fifteen times the volume of the iron of the pipe wall from which it was formed. Thus it is evident that iron pipe lines can become completely clogged by the rusting of only a small percentage of the pipe wall thickness. Another form of iron pipe failure results in leaks caused by local pitting, in which case the oxygen attack is confined to small areas. In addition, a common nuisance frequently arises when some of the very fine rust particles remain suspended in water, causing the familiar "red" or rusty water.

The effect of corrosive waters upon **brass** piping takes the form of dissolving the zinc from the copper-zinc alloy. This action is known as "dezincification;" it appears to be caused by combined action of oxygen and carbon dioxide in water. Typical examples of the two most common types of dezincification, the so-called "plug" and "layer" types, are shown in the accompanying photographs (**Figs. 3 and 4**). The net result of this action is the removal of the zinc, leaving a porous, brittle form of copper which eventually causes pipe failure. Leaks usually occur first at the root diameter of threaded joints, where the metal is thinnest. Moreover, the pipe breaks easily at such points when repairs are attempted.

FIG. 3

Section of yellow brass pipe showing copper plugs typical of plug dezincification.

Dezincification has been found to be confined to the so-called "**yellow**" brasses. Three brass alloys are commonly used: "low" brass, or Muntz metal (60% copper, 40% zinc); "high" brass (67% copper, 33% zinc); and "red" brass (85% copper, 15% zinc). The first two are called yellow brasses. In many localities these low copper-content alloys have proved disappointing as compared with previously used iron piping. In fact, many municipal authorities discourage the use of the yellow brasses, and in some instances have gone so far as actually to forbid their use.

Red brass and **copper** are considered the most generally resistant to corrosion. Their increasing use, following poor experiences with the yellow brasses, has indicated, however, that even these materials should be used with discretion. When a corrosive water acts on copper it may dissolve a sufficient amount to produce green staining of white plumbing fixtures and laundered articles. When soap or any other alkaline material is added, the water will turn blue. Indiscriminate choice of copper pipe or tubing without regard for the composition of the local water has produced many such complaints.

WATER TREATMENT

Many municipalities are chemically treating their water supplies in order to reduce corrosion. Briefly, chemical treatment involves changing the corrosive characteristics of the water by changing nature's original amount and ratio of dissolved mineral salts and gases. Addition of lime or soda ash to increase alkalinity and reduce carbon dioxide content, thus raising the pH, is the common method. However, many factors limit this practice, two of which are the cost of chemicals to treat an entire municipal supply and the effect of the changed water characteristics upon existing industrial processes and power plant operation.

Many owners of large commercial buildings and hotels engage chemical engineering assistance to adjust the mineral content of the municipal supply as it enters their properties, in order to check corrosion of piping. The principle is the same as the municipal method, except that more effective results can be obtained because, for individual building supplies, liquid sodium silicate is the alkali used as the basis for the treatment. Carbon dioxide is neutralized, alkalinity and pH of the water are raised, and in addition, a protective siliceous film is formed on the internal surfaces of the pipe. The nature of this film depends on the composition of both the water and the pipe. By thus conveniently inhibiting corrosion, less expensive pipe materials are given extended life and costly pipe repairs are reduced.

For example, during the past few years it has been necessary to utilize ferrous piping materials for water distribution systems in new building construction due to wartime restrictions on use of copper and brass. As a result, some serious problems have presented themselves in localities where the public water supply is corrosive. Rapid development of "red water" troubles, and even pipe failures due to pitting or clogging with rust, are characteristic of past experience in those localities (see **Fig. 1**).

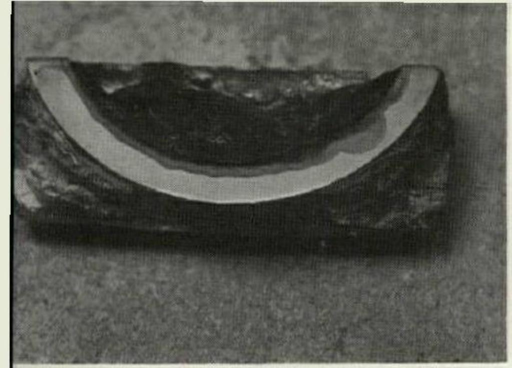


FIG. 4

Typical layer dezincification, yellow brass pipe. Darker areas in the section are dezincified.

Typical was the experience of a large U. S. Public Health Hospital where black ferrous piping had been installed. A very distressing red water condition developed within six months after the buildings were opened; it became extremely difficult for the hospital to function because of the impossibility of keeping surgical instruments, laundry, and drinking water fit for use. This trouble was completely eliminated within a few weeks by corrective water treatment which reduced the corrosiveness of the water.

However, whether water treatment is applied, or whether the proper choice of pipe material for the available water supply has been made, there are important, fundamental considerations other than corrosion which directly affect the useful life of a piping system. These may be discussed under the headings of design, fabrication, and operation.

DESIGN

Many of the ills which develop in piping systems which must carry a corrosive water supply can be minimized, sometimes avoided entirely, by proper design. The following suggestions were all inspired by operating troubles which contributed materially to reduced useful life of the water distribution systems involved.

Hot Water Systems. Positive hot water circulation should be provided by means of thermostatically controlled circulation pumps in order to reduce temperature fluctuations, thereby minimizing the expansion and contraction strains which are a common cause of leaks at joints. Moreover, in a hot water system in which temperature fluctuation and the resulting expansion and contraction of piping are held to a minimum, the initial formation of scale or rust film will not flake off to provide fresh metal surfaces for corrosive attack. Good results with ferrous piping systems in many hotels, when provision has been made for maintenance of uniform temperatures twenty-four hours a day, stand out in marked contrast to the much shorter life of hot water systems in apartment houses in which water temperature fluctuates from high during the day to low at night.

Incidental advantages of good circulation and controlled temperatures are avoidance of complaints from tenants and of waste of water and heat, caused when tenants draw large quantities of luke-warm water in order to get hot water.

If a loop or overhead system (**Figs. 5 and 6**) of distribution is used, check valves should be provided on the horizontal part of each individual return line in order to prevent two-way flow. Two-way flow is objectionable because it causes quick temperature fluctuations with consequent strains at joints, causing leaks. Moreover, such reversal of flow is a common cause of rusty discoloration in iron systems.

Valves. When practicable, it would be well to use iron body valves with iron piping, instead of brass valves. This will minimize galvanic corrosion, which often takes place between the brass valve and the iron threads of the connecting iron nipple or pipe.

Gate valves are recommended rather than globe valves, because they offer considerably less resistance to flow; moreover, they do not accumulate sediment as readily as globe valves. The latter are traps for loose scale, dirt, or rust particles and have frequently developed into bottlenecks in the piping system, restricting flow so severely that extensive piping replacements have mistakenly been made when the mere removal of the globe bottleneck would have solved the problem. Also, the excessive turbulence caused by a globe valve appears to increase the rate of corrosion of attached piping.

The use of quick-closing valves should be avoided; they are the worst offenders in causing water hammer. Water hammer not only causes mechanical damage to piping systems, but increases the rate of corrosion by breaking the protective coating of scale that has formed on the inside of piping and tanks.

Storage Tanks. Hot water storage tanks should be provided with manholes to allow for proper cleaning. Storage tanks are natural catch basins for sediment contained in the water supply or originating in the circulating hot water system. This is so because the water's velocity decreases greatly while it is flowing through a hot water tank. If the tank is not drained and thoroughly flushed at least once a year, there is danger that a disturbance may carry a considerable amount of this sediment into the circulating system, where it will lodge in horizontal lines, valves, elbows, and reducing fittings, to cause troublesome bottlenecks and consequent flow reductions. Moreover, the accumulation of dirt, scale, and rust, if not removed, forms a sludge which causes rapid failure of the tank at the interface of the sludge and water line due to the difference of potential.

Risers. Dirt traps should be provided at the bottom of all vertical hot and cold water risers. This may be done conveniently by installing a cleanout tee, preferably with a draw-off valve (**Fig. 7**). Similarly, it is desirable to provide flush-out fittings at the ends of all horizontal lines.

Controls. Automatic controls should be provided for keeping hot water temperatures at approximately 140F, the life of the piping is very closely related to the temperature of the water it conveys. It is a recognized fact that at temperatures above 140F corrosion accelerates rapidly. Every operator and householder can do much to reduce corrosion losses simply by controlling temperature. In large buildings

FIGS. 5, 6, 7, and 8 show piping layouts for hot water systems designed to reduce corrosion.

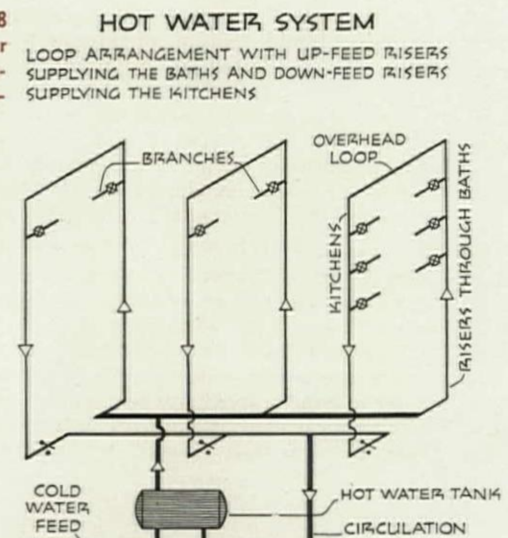


FIG. 5

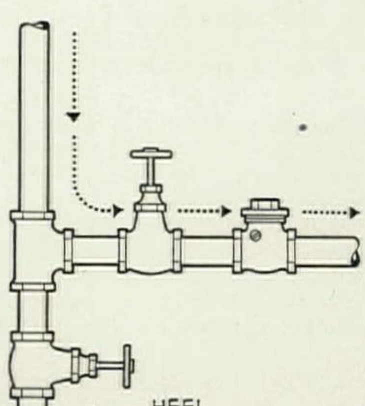


FIG. 6

a temperature recorder is very helpful in maintaining good control.

Pipe Sizes. Pipe should be ample in size to allow for frictional resistance, a particularly important point in the case of small iron pipes. Initial incrustation frequently renders such small pipes useless in a short time, whereas in a larger sized line it acts as helpful protection against further corrosion without materially reducing the pipe's capacity. It would be well to limit the minimum size of iron pipes in buildings to ¾" or 1" in diameter. The difference in cost between ½", ¾", and 1" pipe is so small that it ordinarily is economically unsound to use the smaller pipe. Also, small piping diameter means higher water velocities which, up to a critical velocity for each diameter, increase both the rate of corrosion and mechanical damage due to water hammer.

Particular attention should be paid to sizes of return lines in an overhead, or direct-feed, hot water system (**Figs. 6** and 8) because not much resistance is required to retard circulation, or even to stop it. Circulation is dependent on the fact that the hot water in the pipes continually loses heat. Therefore, water in the return risers is cooler than water in the up-feed risers, and has a slightly greater weight per unit of volume. This difference in weight creates circulation. For example, if water leaves the hot water tank at a temperature of 160 F and returns at a temperature of 100 F, and the building is six stories high, the pressure available to keep the water circulating is only ¼ lb per sq in. Therefore a small accumulation of corrosion products in undersized return lines soon renders the return system useless. For this reason the loop system has an advantage in that circulation is caused as tenants draw water from the return loop (**Fig.** 5).

FABRICATION

In fabrication, as in design, experience also dictates certain precautions which will result in longer pipe life. The following suggestions are simple but important.

Every effort should be made to ream the burrs caused in cutting pipe. Burrs provide a good, sharp, rake-like surface for catching sediment and cause high turbulence which induces excessive corrosion at the joint. Burrs are a frequent cause of bottlenecks, particularly in small pipes.

The use of bushings, street ells, and reducing fittings should be minimized as they, too, are causes of bottlenecks, because they provide shoulders against which deposits accumulate. Troubles caused by such fittings have been recognized by authorities who are studying the possibilities of improved design of pipe joints, fittings, and couplings, including the use of fewer fittings, in lieu of which pipe can be bent on the job by portable hydraulic pipe benders, thus increasing the efficiency of the entire piping system.

Pipe compound should be spread on pipe threads only, not on the thread of the fitting. If the latter is done, compound may be pushed into the fitting, where it frequently hardens and acts as a shoulder for further accumulations and the eventual formation of still another type of bottleneck.

OPERATION

Intelligent analysis of plumbing troubles will keep maintenance costs down and increase the over-all life of the piping system. For example, a common trouble, "poor flow" of water from faucets, is caused by deposits in the piping. Horizontal iron pipes, particularly branch lines from risers to taps, are usually the first to become clogged. The trouble can usually be located by comparing the flow from the same riser on different floors. For instance, if the flow from a certain faucet is poor, but there is good flow from the faucets on the floors directly above and below, it is evident that the flow in the riser is adequate but there is a stoppage in the branch line.

Such stoppages may be due to loose particles of scale, dirt, or rust which may have accumulated in the pipe at an elbow or reducing fitting, and often can be dislodged by the simple expedient of reversing the flow. This can be done by shutting off the hot water riser, connecting the cold water faucet to the hot water faucet at the basin or tub with a piece of rubber hose, and flushing out by opening another hot water faucet on the same riser. Flushing out through the bottom of the hot water riser is even more effective. Similarly, hot water pressure can be used to clear out the cold water branch. This procedure may work in relieving local stoppages, but will accomplish little when poor flow is due to general corrosion.

Hot water storage tanks should be cleaned annually at regular intervals, by flushing the sludge out with a stream of water from a hose. When tubercles and accumulations require mechanical removal, bristle brushes (not wire brushes) should be used because the hard adherent rust is excellent insulation against corrosion and should not be removed. After loosening all material with a bristle brush, the tank should be hosed out with a stream of water.

Hot water heating coils and tankless heaters should likewise be cleaned at regular intervals. The plumbing contractor usually does not provide proper connections for convenient flushing. It is important that they be installed, because poor heat transfer prompts the engineer to force the boilers to get hot water, thus causing a cycle of boiler problems.

Risers and distribution lines should be flushed annually. The longer this is neglected, the less effective will it be when eventually done, because the effectiveness of the flush depends upon the velocity of flow. In systems in which deposits have already accumulated, potential velocity is reduced due to increased resistance to flow.

The corrosive characteristics of the local water supply, and local experience with various kinds of piping, should be studied, and if necessary water treatment may be employed. Many of the suggestions reviewed under the headings of design and fabrication may be applied even after a building has been erected. The suggestions arise from experience gained in the inspection and study of approximately ten thousand buildings, in each of which some trouble had developed.

HOT WATER SYSTEM "OVERHEAD" FEED

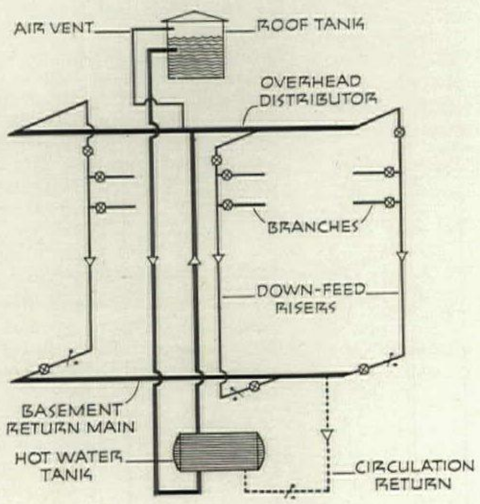


FIG. 7

HOT WATER SYSTEM

DIRECT FEED WITH RETURN LINE FOR EACH RISER

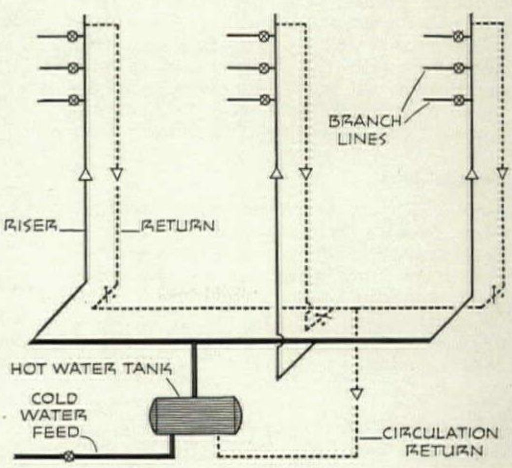


FIG. 8

MANUFACTURERS' LITERATURE

EDITORS' NOTE: Items starred are particularly noteworthy, due to immediate and widespread interest in their contents, to the conciseness and clarity with which information is presented, to announcement of a new, important product, or to some other factor which makes them especially valuable.

Acoustics

1-45. *Burgess Acousti-Booth Scout Model No. 602,* Burgess-Manning Co. Reviewed May.

Adhesives

1-36. *Manual of Technical Data,* U. S. Plywood Corp., Industrial Adhesives Div. Reviewed May.

Air Treatment

1-43. *Electro-Matic Self-Cleaning Air Filter, Model E (Bulletin 250-E),* American Air Filter Co., Inc. Reviewed May.

1-46. *Filtered Air (Form 501),* American Air Filter Co., Inc. Reviewed May.

1-47. *Roto-Clone (Dust Control) (Form 270),* American Air Filter Co., Inc. Reviewed May.

1-48. *Steam-Jet Air Ejectors (RP-284),* 10 pp. Data sheet from *Power* on multistage ejectors, and reprint of an article by Philip Freneau on fundamentals of air removal equipment. Worthington Pump & Machinery Corp.

Communications Systems

3-60. *Executone Inter-Communication for the Home,* Executone, Inc. Reviewed May.

9-48. *Talk-A-Phone Presents Complete Inter-Communication Systems (Cat. 1944),* Talk-A-Phone Mfg. Co. Reviewed May.

Concrete, Air Entraining

3-58. *Manual for Using Darex AEA,* Dewey and Almy Chemical Co. Reviewed May.

Corrosion Resistance

3-63. *Corrosion-Resistant Materials and Equipment (Bulletin E),* U. S. Stoneware Co. Reviewed May.

Design, Plant

4-49. *Looking Ahead with the Bottling Industry,* 24-p. booklet (10½x13½). Presenting 8 layouts and renderings of basic arrangements of equipment for bottling plants. The firm states: "We are not undertaking to offer an architectural service . . . We are concerned, however, with the installation of our equipment to best advantage and to make it work for you most profitably." Crown Cork & Seal Co., Machinery Div.

Design, Store

4-50. *Setting the Scene for Selling,* 34-p. booklet (11x14) pointing up importance of cooperation between merchandiser and architect in planning sales displays—floor covering displays in particular. Floor plans, photos, drawings, recommendations. Lees-Cochrane Co., Inc.

Drafting Room Equipment

4-46. *More Useful from Any Angle (triangles),* Charles Bruning Co. Reviewed May.

4-48. *Protect and Preserve with Bruning Dulseal,* Charles Bruning Co. Reviewed May.

4-52. *Kodak Transfax Process,* illus. folder on method of reproducing (white-line positive) drawings on metal, plastics, and other flat surfaces by means of a light-sensitive surface spray. Eastman Kodak Co.

4-53. *The Solarmeter Solves Them—Instantly,* 8-p. illus. folder (3¾x7¼) on features of a device for measuring sun azimuth and declination, for use in determining building orientation. R. W. Justice.

Engineering Equipment

5-30. *Gurley Engineering Instruments (Bulletin 50),* 90-p. illus. condensed catalog (6x9) and price list on: transits, engineers' levels, topographic instruments, hydraulic measuring instruments (current meters) water level recorders, field supplies. W. & L. E. Gurley.

Floors, Concrete

6-65. *Concrete Floors with Lone Star Cements,* 14-p. illus. booklet recommending construction practices for normal and heavy-duty concrete floors; test data. Lone Star Cement Corp.

Floor Finishes

H. H. Robertson Company; reviewed May:

6-63. *Hubbellite (T-1-45).*

6-64. *How to Prepare Sub-Floors for Hubbellite Floor Surfacing (T-4-44).*

Gypsum Products

7-50. *The Four Protections of Modern Home Building (X-26),* 48-p. handbook (5½x8½) illustrating various wall and ceiling assemblies, with brief paragraphs on gypsum products used in each; protection ratings against fire, vapor, heat, cold, noise. U. S. Gypsum Co.

7-46. *Pyrobar Gypsum Short Span Roof Tile,* U. S. Gypsum Co. Reviewed May.

7-47. *Gyplap Measures Up (sheathing),* U. S. Gypsum Co. Reviewed May.

7-48. *"Quiet, Please" with Auditone (SC-53-Rev.) (acoustical tile),* U. S. Gypsum Co. Reviewed May.

Hardware

8-102. *Hardware for Commercial Entrances (Cat. K570),* 36 pp., illus. Catalog of hardware designs for store doors: bars, butts, checks, closers, handles, hinges, kickplates, locks, thresholds, etc. P. & F. Corbin.

8-91. *Corbin Locking Devices and Special Hardware for Metal Application Specification Products (Cat. K396, 7th ed., revised),* P. & F. Corbin. Reviewed May.

8-88. *Hardware for Sound-Deadening Doors (K-335),* P. & F. Corbin. Reviewed May.

Heating and Heating Equipment

8-92. *Standard Electric-Welded Steel Boilers (Bulletin S-67), AIA File 30C-1,* Brownell Co. Reviewed May.

8-83. *A Step Ahead in Hospital Heating (Bulletin 633), AIA File 30-C23,* C. A. Dunham Co. Reviewed May.

8-85. *Series 15 Unit Heater, AIA-30-D11 (Cat. 15C-2),* Fedders Mfg. Co., Inc., Industrial Heating Div. Reviewed May.

8-100. *SK Radiafin Tubes (11sa),* 4-p. bulletin on fin-wound steel pipe for increased heat radiation in steam or hot water systems. Correction and application tables; dimensions and area. Schutte & Koerting Co.

8-101. *Sarcotherm Manual,* 35 pp., on a system of controls and hook-ups for existing hot water and radiant heating systems. A painstaking and not-too-technical explanation of the system's functions, various parts, capacities, controls, etc. Wiring diagrams, detail drawings. Sarcotherm Controls, Inc.

Hospital Equipment

8-93. *Capital Cubicles Turn Hospital Wards Into Private Rooms,* Capital Cubicle Co. Reviewed May.

Lighting and Lighting Equipment

From General Electric Co., Lamp Dept., reviewed May:

12-63. *Flexible Lighting to Step Up Furniture and Appliance Displays (Y-548).*

12-59. *G-E Slimline and Circline Lamps Seen in Many Roles (LM-20).*

12-64. *Let There Be Light (data on light for reading purposes).*

12-65. *Light for Tomorrow's Food Store.*

12-66. *Slimline Diameters and Lengths Presage Expansion of the Lighting Art.*

12-69. *Commercial Fluorescent Luminaires (Cat. 285),* 16-p. illus. catalog of new fluorescent luminaires for use in offices, stores, schools, public buildings. Mounting and servicing information. Mitchell Manufacturing Co.

12-70. *Essential Data on Sylvania Fluorescent Lamps,* 2-p. list from technical section of *Sylvania Lighting News, Vol. 5, No. 6:* lamp wattage, length, bulb, and base sizes; amps, volts, rated life cycles, lumens, foot-lamberts—for 4 types of fluorescent lamps. Sylvania Electric Products, Inc.

Load Transportation

12-72. *Material-Handling Equipment,* 56-p. "guide for analysis of material-handling operations and application of power industrial trucks"; sections on material-handling management; organizing an industrial-truck handling system; practical truck engineering. Background information for architects, engineers. Electric Industrial Truck Association.

Metal, Ornamental

13-34. *Pan American Bronze,* 4-p. illus. folder on types of bronze memorial tablets, signs, nameplates, mausoleum equipment, etc. Pan American Bronze Co.

PROGRESSIVE ARCHITECTURE
PENCIL POINTS

THE SMALL HOUSE DREAM WORLD

Architects can design better small houses than anybody—but with few exceptions they claim always to lose money on such jobs. Why, then, do they continue to kid themselves and the public by undertaking what often costs the client more than he thinks it is worth and costs the architect more than he is paid?

Several reasons occur. First, there is the undeniable fascination of the small house problem, which like a tantalizing puzzle promises a thrill of satisfaction when one finds the right solution for a tight set of conditions. Second, there is the altruistic impulse which makes the professional man feel that something must be done to improve the standards of small house design and that he is the man to do it. Third, there is the ever-present possibility of doing such a successful job that its merit will lead to larger commissions.

These are all understandable lures, yet under the conditions of this moment they are somewhat unrealistic and not very effective in leading to the provision of the hundreds of thousands of good small houses that are so sorely needed throughout the country. Architects in general are too busy with more substantial work to be expected to put much of their time into unprofitable activity.

There are various well-known ways—some good, some bad—whereby some architects have attempted to get better small homes built for America's ordinary people. They have worked directly for the developing builder to whom they have sold site plans and designs of several basic houses out of which to compose a group. They have worked for and with the prefabricator to pass on to the public the savings of mass production. They have provided stock plans through plan services sponsored by professional groups, magazines, material dealers, etc. A few have become small house specialists who know the problem so thoroughly that they can work economically and efficiently within a limited time budget and thus make a decent and honest living on small houses alone. But all of these methods are comparatively marginal in their rewards and often questionable in the quality of their results. There is, we think, a better way.

Most logically the architect could go all the way into the business of providing completed small houses for sale. Here he could show his superior skill as a designer, his common sense as a practical planner, his ability as an organizer, and his integrity as a professionally trained man. If this practice were adopted by a substantial number of men throughout the country, not only would the small home public get better value for its money than could be had in any other way, but there would be assurance of a fair profit for the men who furnish the creative thinking. Those who would frown on such procedure as unorthodox are living in a dream world. The urgent needs of these times must be met somehow, and, if there is truth in the oft-heard contention that the architect should be the master-builder, here is his opportunity to become one in a very real sense.

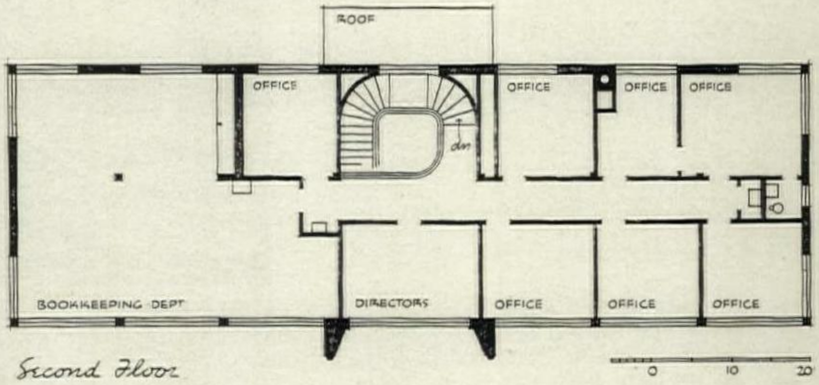
Kenneth Reid


AMERICAN DISCOUNT CO.

AMERICAN DISCOUNT COMPANY, ATLANTA, GA.

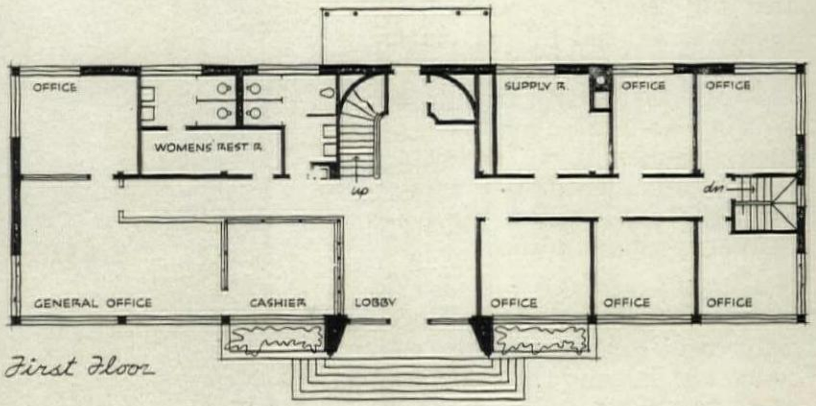
BURGE & STEVENS, Architects and Engineers

The independent office building often reaches for impressiveness through pompous architecture, with twentieth-century working needs fitting in as best they may. Here, such a design assignment has been handled on the basis of simplicity, ease of access, good light conditions for the conduct of business, etc.

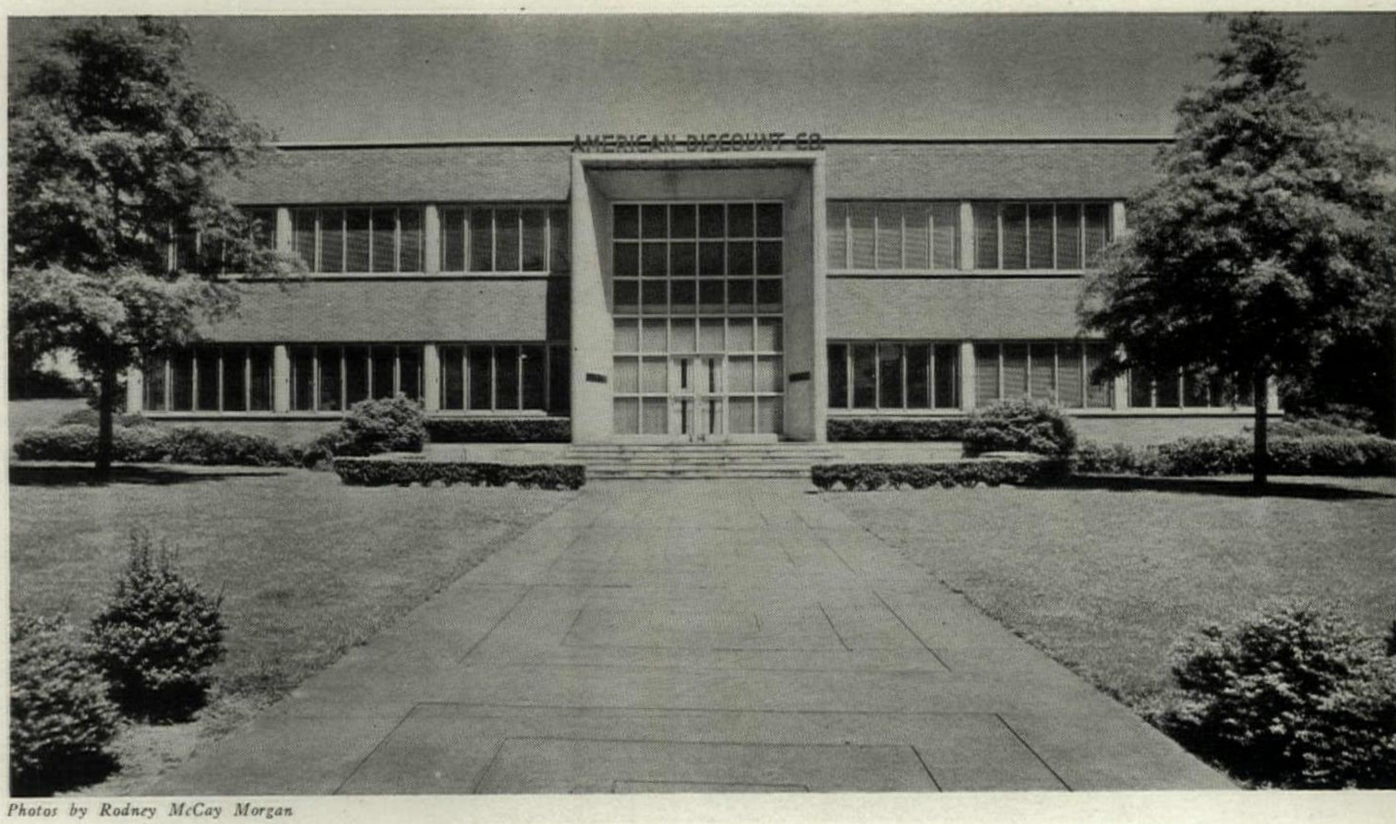


Second Floor

Designed for an automobile-loan company, this building is used by appraisers, clerical workers, and officers of the company. The location is away from the crowded downtown area. Central entrances at both front and rear assist the direct transaction of business by customers whether they arrive on foot or by car. A spacious parking area at the rear is provided for both customers and employes. Both the general and private offices are simply disposed around a central corridor. The continuous windows on the front allow partition rearrangement without basic structural alteration.



First Floor



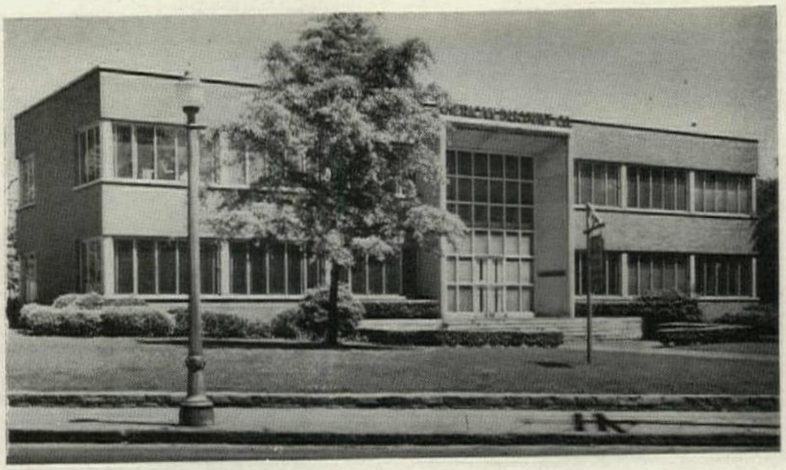
Photos by Rodney McCay Morgan

AMERICAN DISCOUNT CO.

ATLANTA, GEORGIA

BURGE & STEVENS

Architects and Engineers



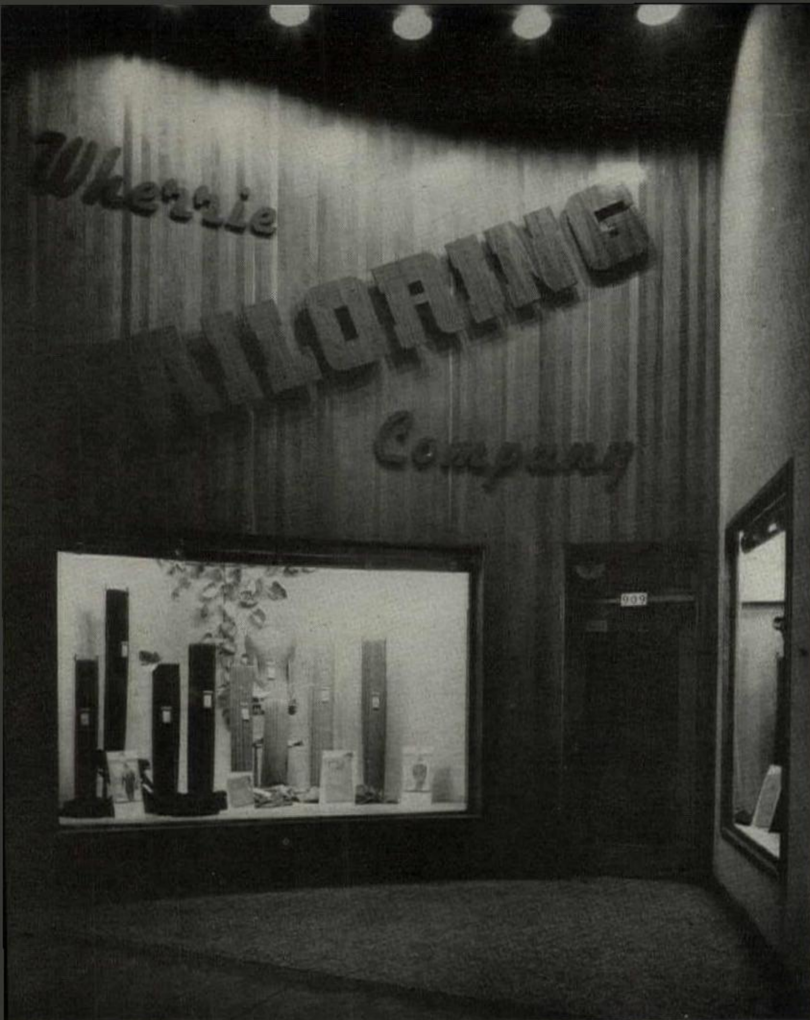
STREET FRONT.

There is a striking contrast between the design treatment of the front and rear of the building. Toward the street, at the end of a landscaped approach, the full-height, on-center entrance is flanked by continuous window bands at both floor levels. At the back, facing the parking area, the treatment is almost residential in character, suggesting in design the "family entrance" as opposed to the more formal, public entrance.

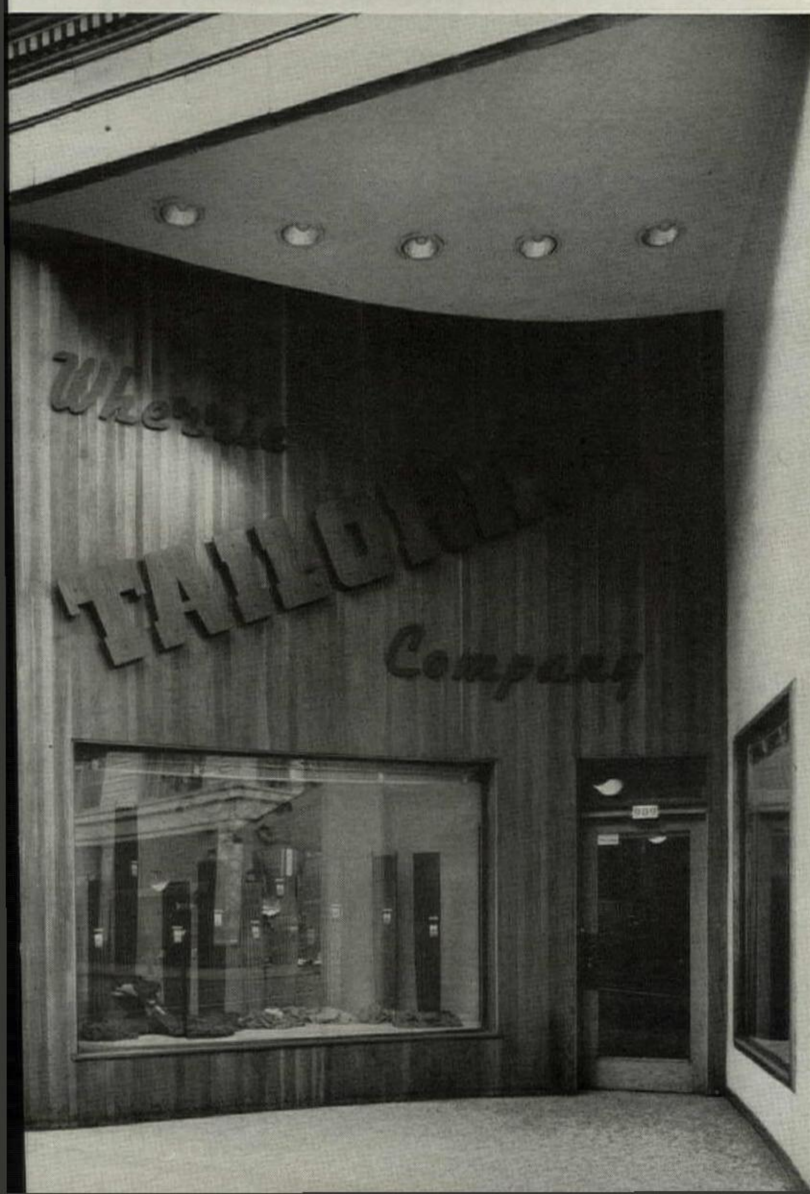
Standard practice is followed in the construction of the building. Structural steel is used for columns and beams; the joists are wood. Exterior surfaces are of brick or limestone; inside, floors are linoleum surfaced, walls are either plywood or plaster, and the ceilings are finished with acoustical material. The building is year-round air conditioned.

LOOKING ACROSS THE PARKING AREA.

The well lighted main lobby with information and public-business desk. Linoleum floor; plaster walls; sound-conditioned ceiling.



Photos by P. A. Dearborn



SHOP FRONT, PORTLAND, ORE.

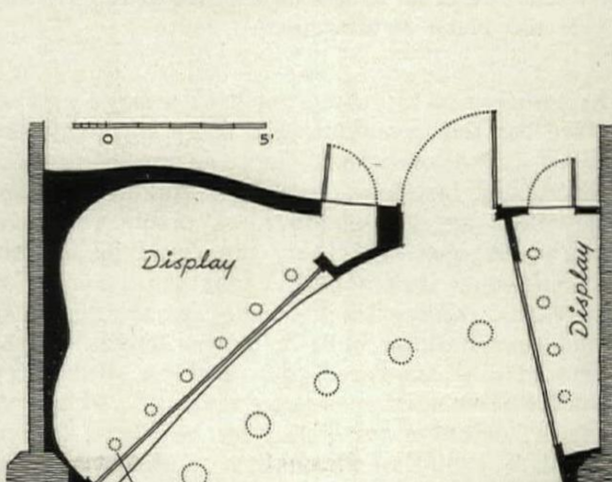
PIETRO BELLUSCHI, Architect

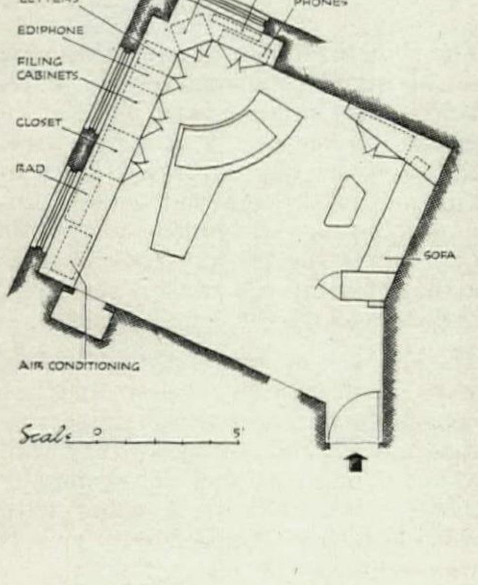
A shop-front remodeling job in which wood is a major material.

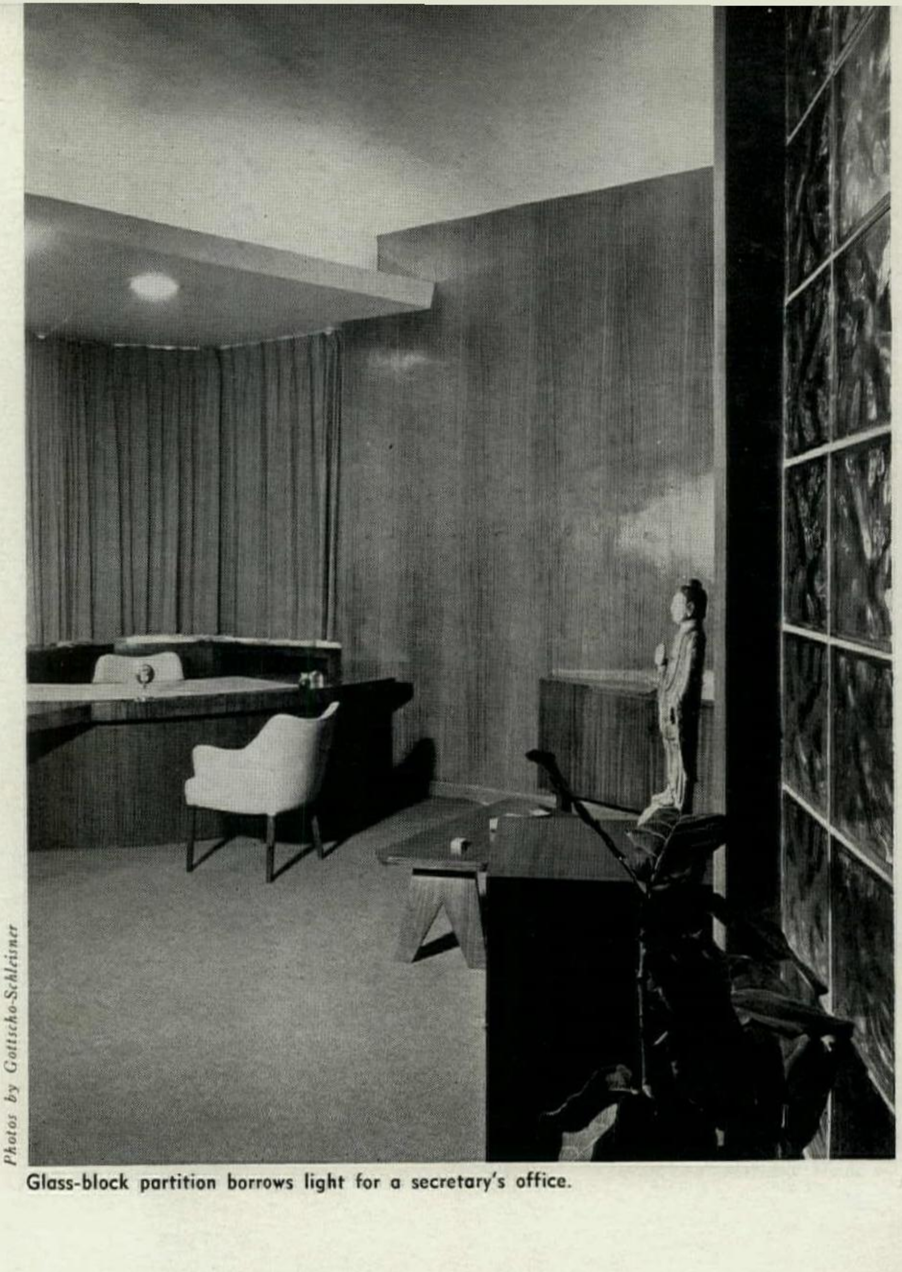
The structural columns at either side of this standard shop space in a Portland office building are 14 feet, 6 inches, on center. Within this area, the architect has developed a three-dimensional scheme that makes window-shopping an almost automatic act, brings the prospective customer actually within the store rental area, and dramatizes the company name.

The simplest of materials and devices were used. Narrow cedar matched boards applied on nailing strips surface the irregular-shape display wall at left. The base is oak. The company name is worked out in relief with wood lettering. A special city permit was required to allow this use of wood, which, the architect reports, "has stood up remarkably well under sidewalk abuse."

Concealed wall outlets above the window heads illuminate the display windows, and the vestibule itself is night lighted by recessed down lights installed flush with the vestibule ceiling. This ceiling and the right-hand wall are painted plaster. Total cost: $1,350.







Photos by Gottscho-Schleisner

Glass-block partition borrows light for a secretary's office.

CORPORATION EXECUTIVE'S OFFICE, NEW YORK CITY

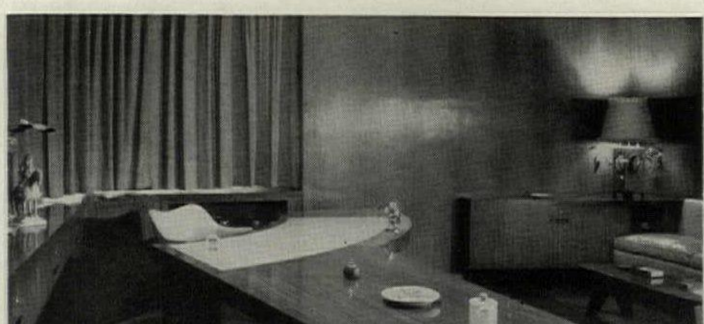
A background for business, with an extraordinarily versatile piece of furniture.

In addition to the usual needs of a large private office for the president of a large company, the client wished his office to serve as a meeting room for various business, charitable, and civic groups of which he is a member. A prime requisite, therefore, was that the room could be quickly transformed into a board room or a room for informal entertainment. The remarkable desk and surrounding built-in units shown in the photographs answered this need. A sliding top conceals two correspondence trays at a moment's notice; cabinets for files may be closed out of sight; by swinging the chair around, the desk extension becomes a board-meeting table with the desk position at the head of the table.

A sofa, small bar, and radio occupy one corner.

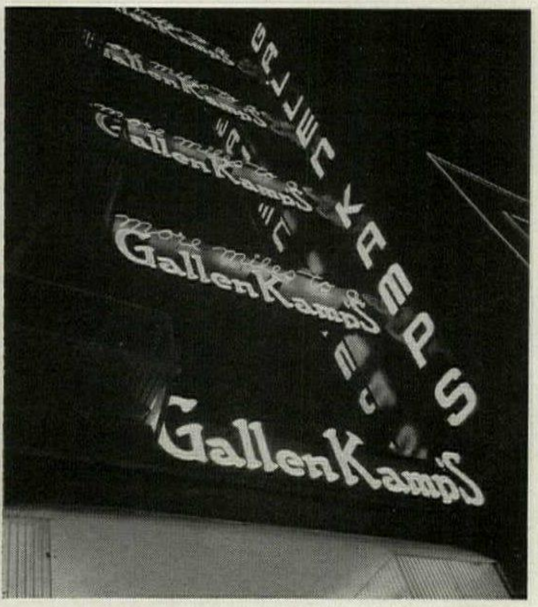
To shield the view, yet allow ventilation, top and bottom glass hinge louvers were installed over existing windows.

MORRIS LAPIDUS, Architect



Furniture and wall veneer: natural-finish Philippine mahogany; draperies, carpet, and furred down ceiling: apple green.

GALLEN KAMP'S SHOE STORE, LOS ANGELES, CALIF.



Photos by Baskerville

This store is an interesting solution to the familiar problem of organizing effective display and sales units and company offices within a rather awkward existing structure. The gracious Southern California climate has prompted the development of a novel open-front scheme that is quite literally "open."

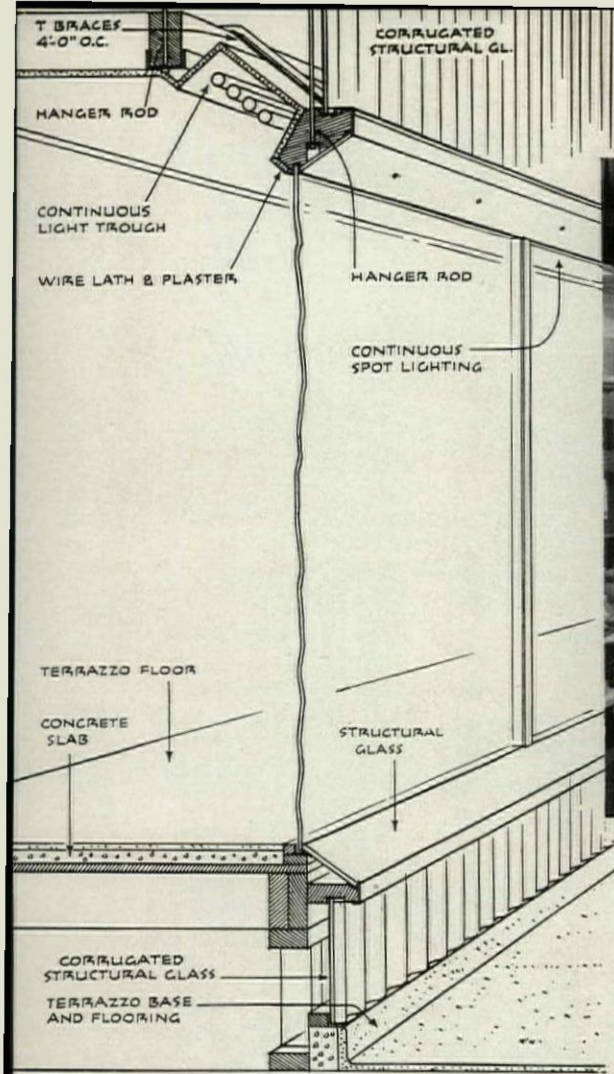
The existing, leased five-story building was 137 feet deep and only 24 feet wide. Building regulations required the maintenance of the applied fire escape on the front. In basic organization, the first floor, balcony, second and third floors are given over to merchandising; executive offices are located on the fourth floor, and the top floor accommodates general business offices.

The main sales floor and balcony are given strong

GRUEN AND KRUMMECK, Designers

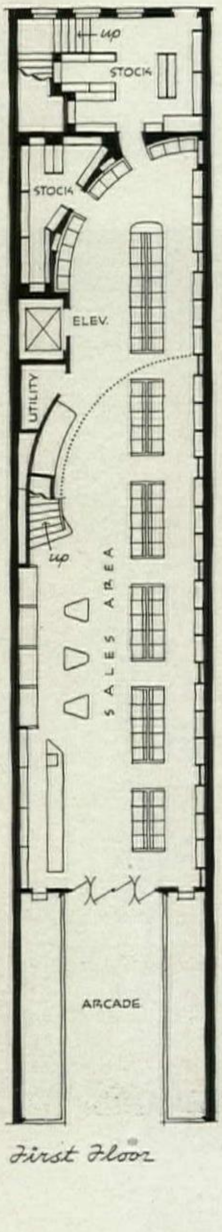
visual emphasis in the design, the scheme for the entrance being made up of a combination of the time-honored device of the show-window and the newer open-front, entire-store-display principle.

A particularly notable element (which depends considerably on exceptional climate) is the treatment of the entrance unit itself. The doors, transoms, and entrance frames are arranged as a suspended panel which may be raised by a mechanical device wholly out of sight, up into the second-floor space. In actual use, this unit is always so raised except in bad weather and at night. Thus, the outdoors and the shop interior are wholly without an intermediate barrier. Yet further luring the passer-by, inserts in the shape of entering footsteps are made a part of the pattern of the terrazzo floor.

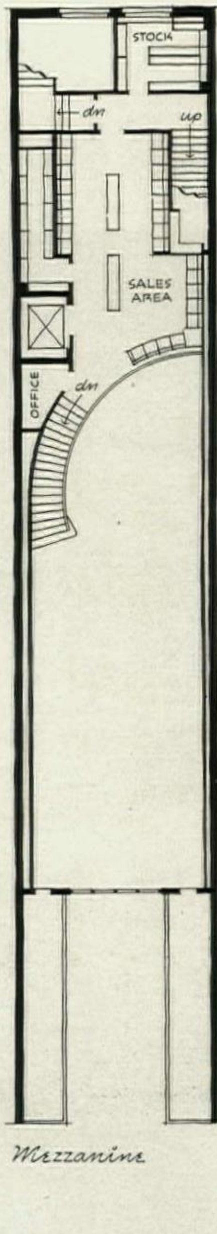


ENTRANCE VESTIBULE

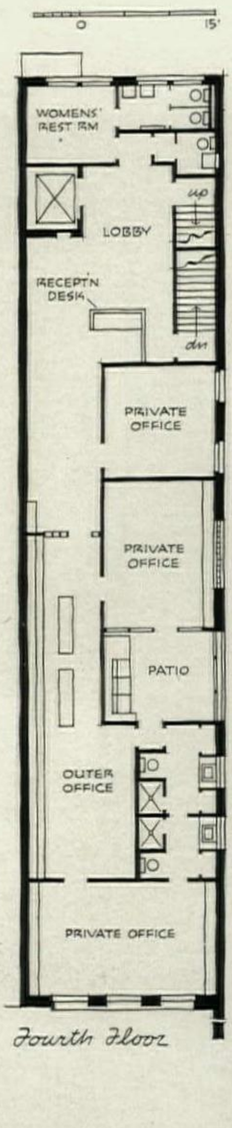
Pairs of show windows balance the entrance doors, which are here raised out of sight, permitting an unhindered view of the shop interior.



First Floor



Mezzanine



Fourth Floor

PLANS

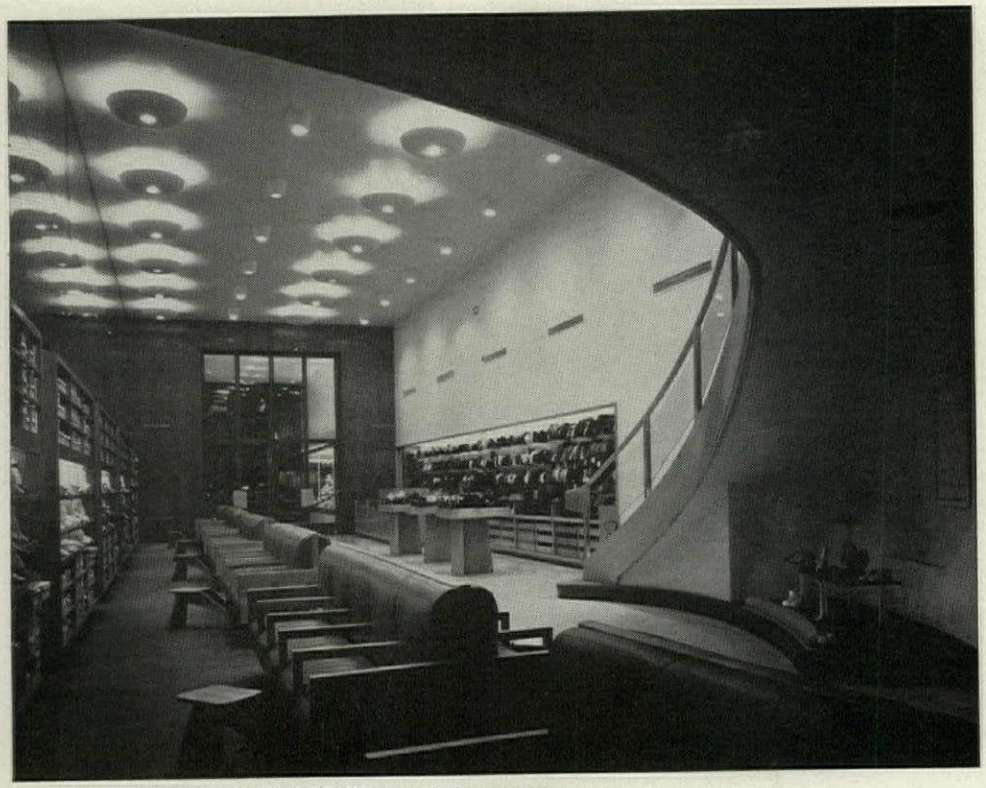
In addition to the plans shown, the second and third floors are merchandising floors, and the general business offices are located on the fifth floor. The fourth-floor executive offices are rather elaborate, including two private bathrooms with showers, a small kitchen, and a living-room type of study-office for the woman owner of the firm.

GALLEN KAMP'S SHOE STORE, LOS ANGELES

GRUEN AND KRUMMECK, Designers

The area above the show windows is closed off with back-lighted translucent corrugated glass; the window frames are finished with maroon structural glass. To double the apparent size of the narrow sales floor, the whole right-hand wall is mirror surfaced.

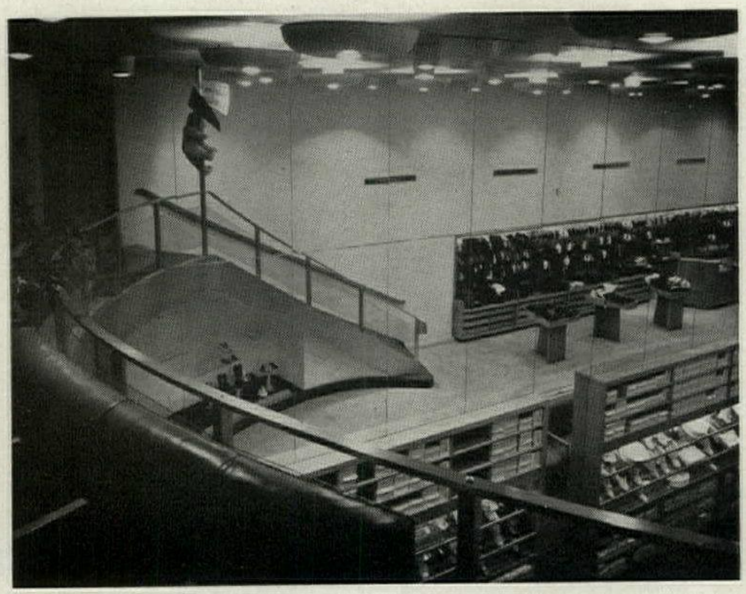
The exterior wall of the building is yellow; window frames and projecting sign are maroon. Walls and ceiling of the main sales floor are maroon; woodwork is natural prima vera, and hunter's pink is the color of the carpeting as well as the walls and ceiling of the balcony area.



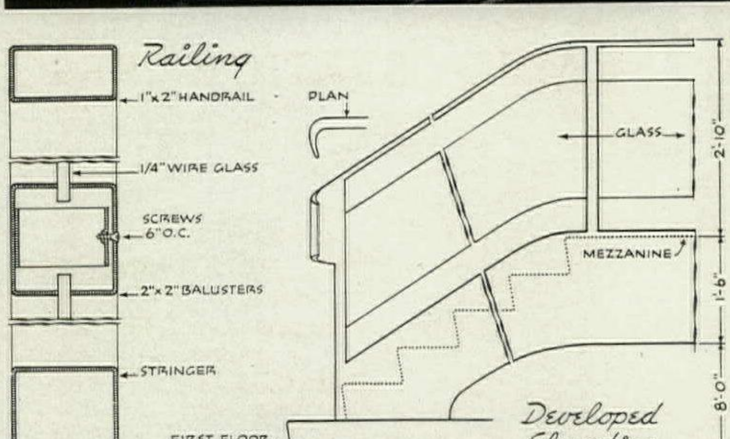
VIEW FROM UNDER THE BALCONY toward the entrance.

GALLEN KAMP'S SHOE STORE
LOS ANGELES, CALIF.

GRUEN AND KRUMMECK
Designers



Looking down on the main sales floor from the balcony.



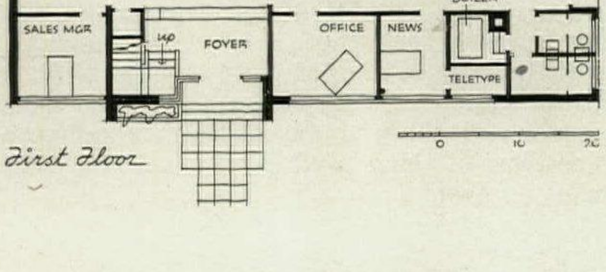
DETAIL of the balustrade and balcony railing.

Photos by P. A. Dearborn

RADIO STATION KRSC, SEATTLE, WASH.

DONALD DWIGHT WILLIAMS, Architect

The independent radio station in a building of its own is one of the newest of building types. Efforts to arrive at suitable design expressions have shown the inevitable awkwardness of growing pains—from makeshift locations in any available old buildings, to pompous and sentimental "temples of entertainment," to occasional blossomings out in the latest trappings of "modern style." It is refreshing to present here a simply conceived unit which makes no pretense of being anything it is not and which achieves a definite character of its own.



THE PLAN
A well lighted and ventilated control room, surrounded by work shop, studios, and storage for thousands of recordings and transcriptions. The upper level takes care of the visitor problem.

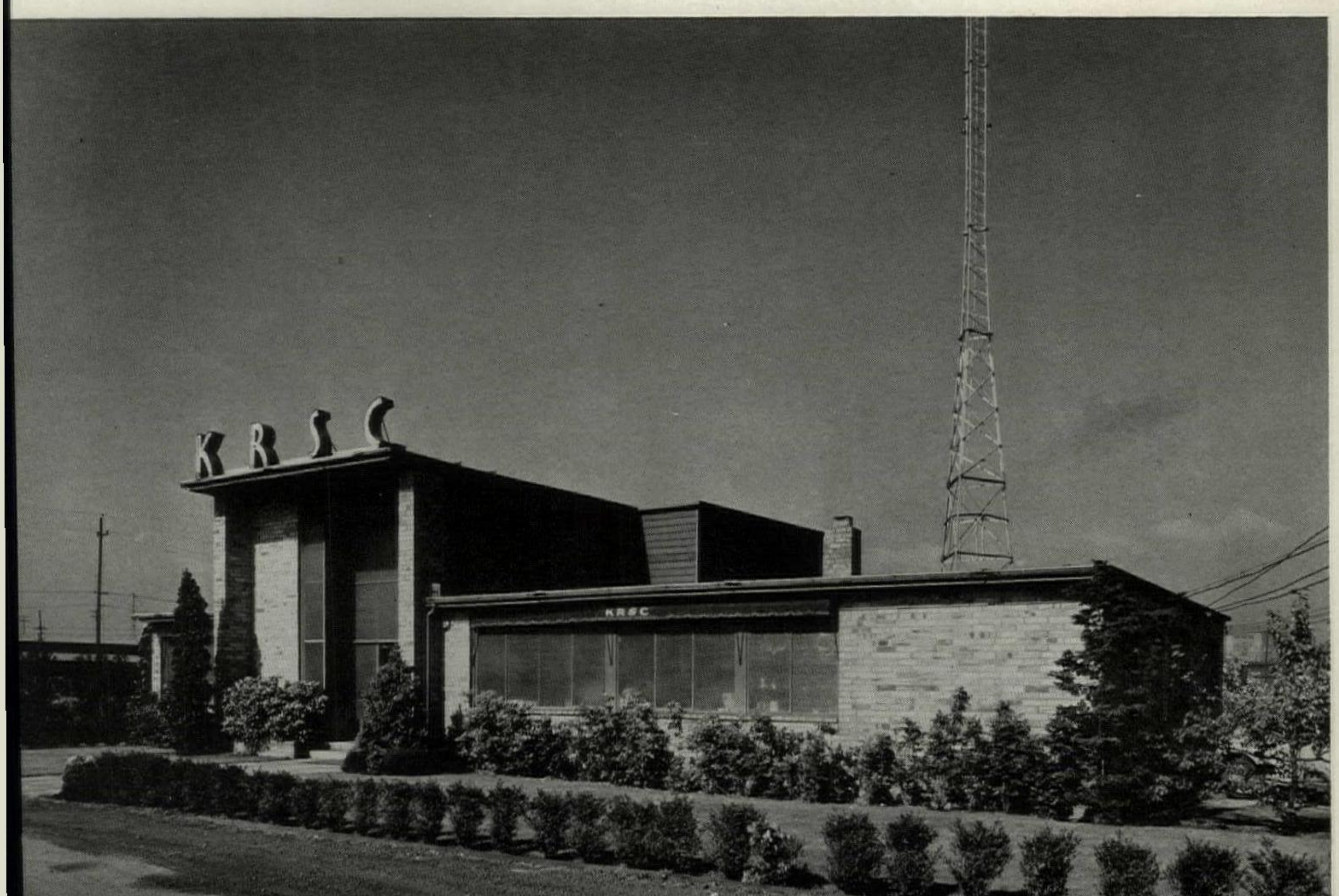
RADIO STATION KRSC, SEATTLE, WASHINGTON

DONALD DWIGHT WILLIAMS, Architect

The design problem for KRSC, Seattle's only full-time independent, 1,000-watt station, was to work out a specialty building that, in addition to being functional, would have the distinction required of a semi-public institution.

It was desirable to have a location fairly close to the main business section; yet a good ground for the antenna tower was essential. The solution was a site that was originally tide lands (involving 8 to 10 feet of fill) but which was only a short drive uptown. Inclusion of all essential services in the scheme results in economical centralized control.

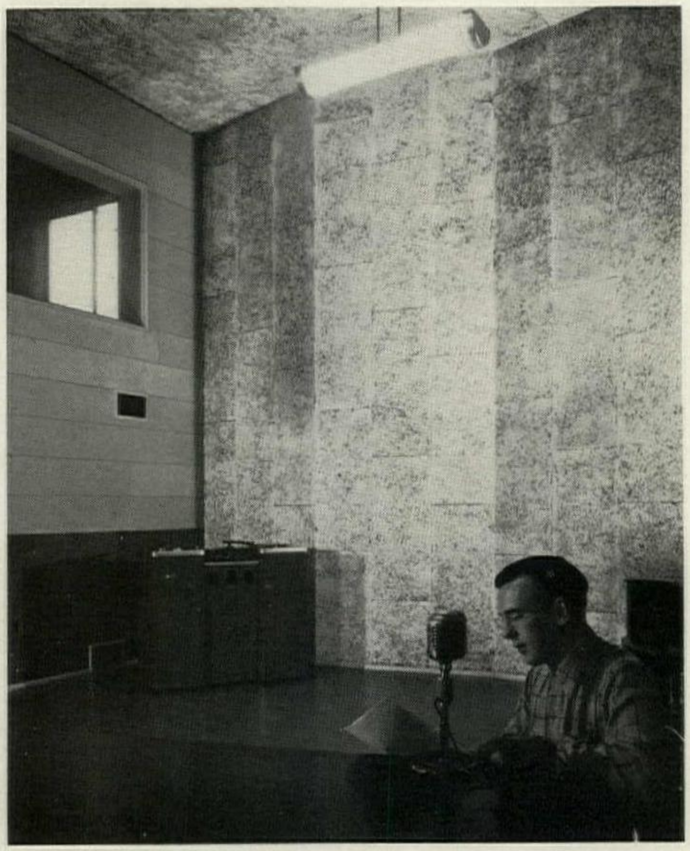
The main studio's balcony provides for public viewing of live shows though the public never actually enters any working area. Construction is frame and brick veneer; interior walls are dry built, finished with acoustical materials.



STATION KRSC
SEATTLE, WASHINGTON

DONALD DWIGHT WILLIAMS

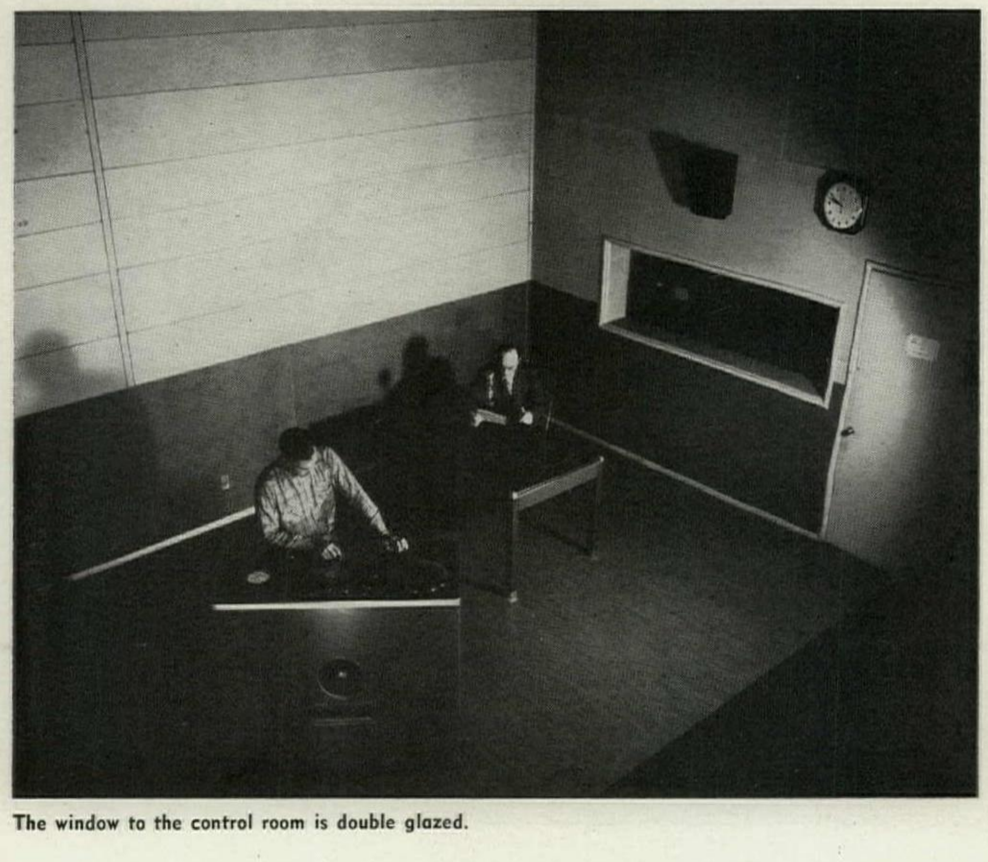
Architect



MAIN STUDIO

The north wall of the studio is finished with hard board and high gloss paint to provide a sound-reflective surface; the south wall, arranged in an irregular plan, is of acoustical plank, providing desired absorption.

The balcony window for visitors viewing live shows appears at top left of photograph.



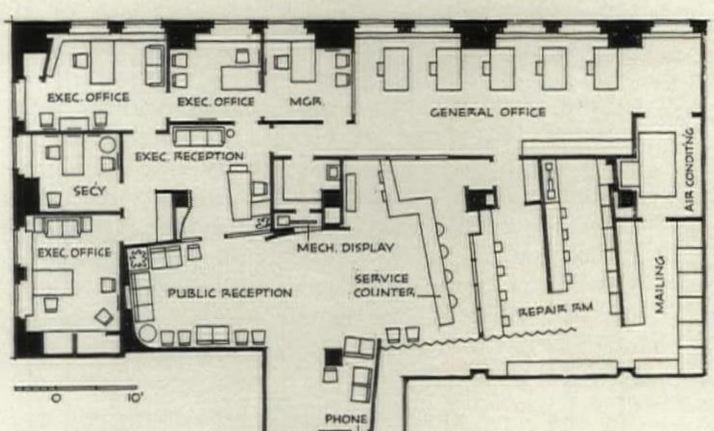
The window to the control room is double glazed.

FACING THE ENTRANCE is a panel with a mobile display. Executive offices at left; repair department at right.

Photos by Gottscho-Schleisner

OFFICES FOR EVERSHARP, INC., NEW YORK CITY

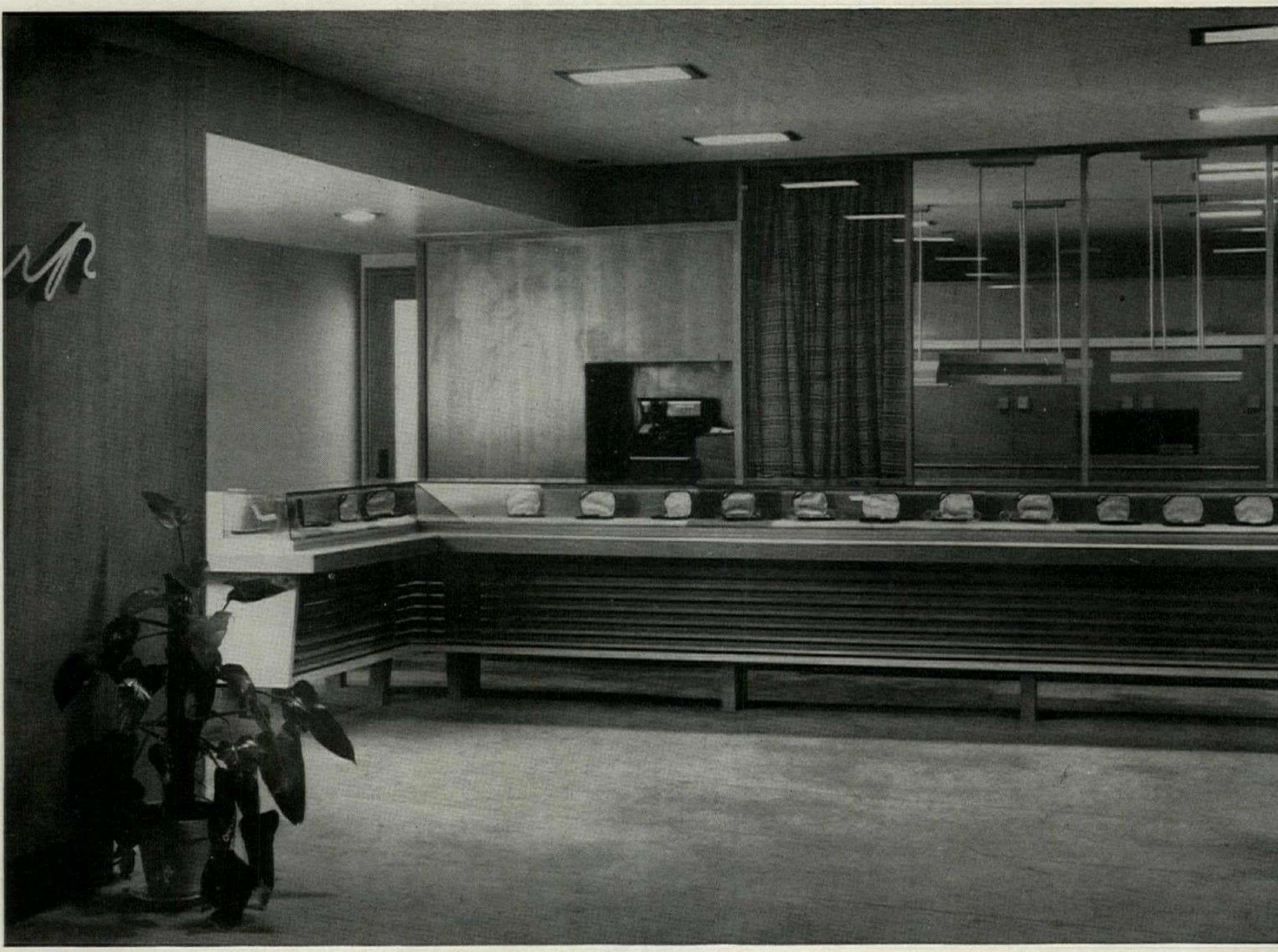
Designed Under the Direction of JULIAN VON DER LANCKEN, Architect, RAYMOND LOEWY ASSOCIATES



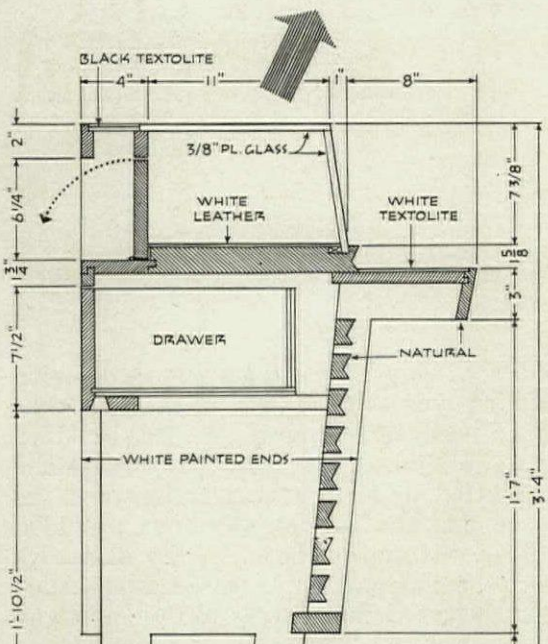
Floor Plan

A triple-use plan worked out within standard office-building space.

Organization of this leased space in the Empire State Building was complicated by the fact that the entrance was at the end of an office-building corridor, and a bank of elevators (to serve other floors) projected to form a barrier between the leased space and the service elevators provided for this floor. Separation between the executive suite and repair department was accomplished by locating these two main areas to the right and left of the entrance. The service entrance was worked out by partitioning a corridor at the left of the interrupting elevator block and continuing it around to the service rooms by means of a less-than-full-height, sawtooth acoustical panel.



SERVICE COUNTER.



OFFICES FOR EVERSHARP, INC., NEW YORK CITY

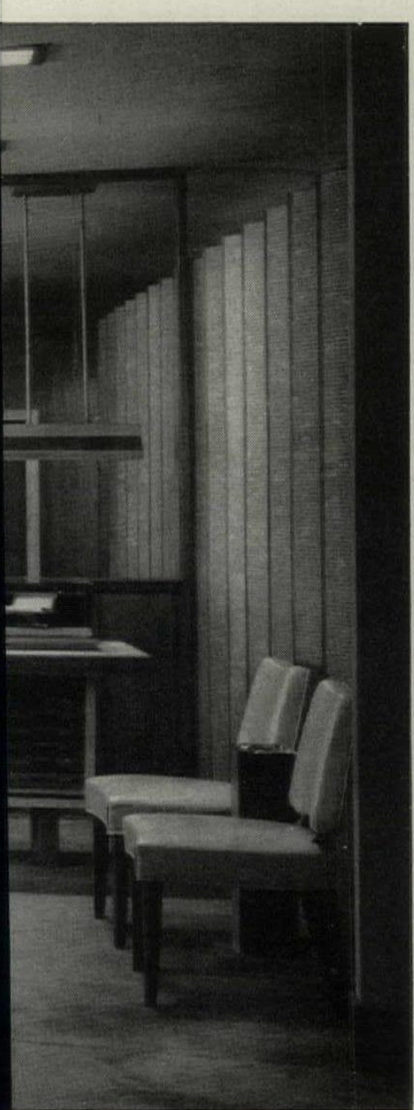
Designed Under the Direction of

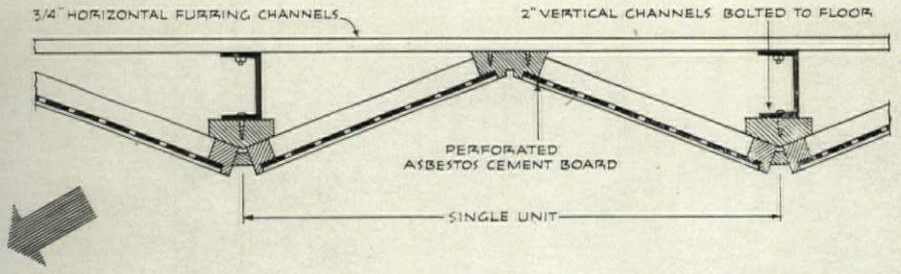
JULIAN VON DER LANCKEN, Architect

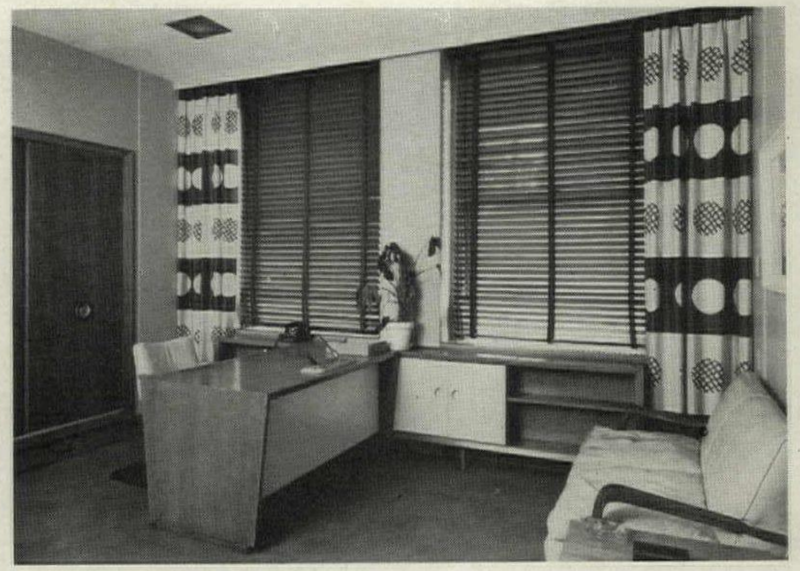
RAYMOND LOEWY ASSOCIATES

In the main reception and service-counter area (photos above and at bottom of facing page), walls are painted gray; woodwork, including the slatted counter, are of natural-finished oak; the carpet is a pale gray-green, and the chairs are predominantly yellow and jade-green leather. Behind the service counter is a glass screen allowing full view of the repair section. When the latter is not in use, a curtain is drawn across this glass screen.

The sawtooth partition at the right of the counter (shielding the passage from the service elevator to the repair and mail rooms) is made of perforated acoustical board. Since this partition is less than ceiling height, it assists natural ventilation as well as providing desirable sound control.

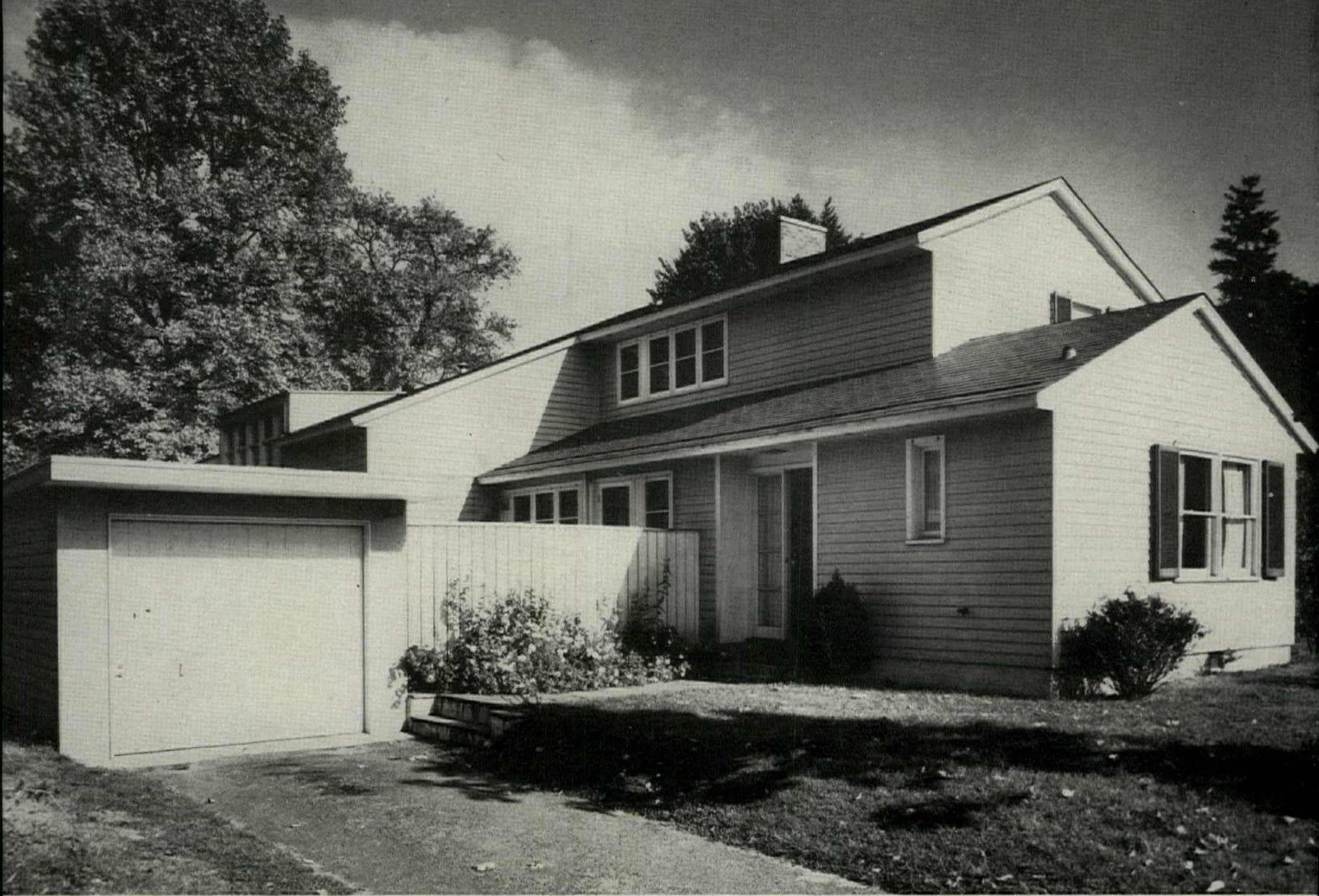






EXECUTIVE'S OFFICE.

RECEPTION AREA
outside executive suite.



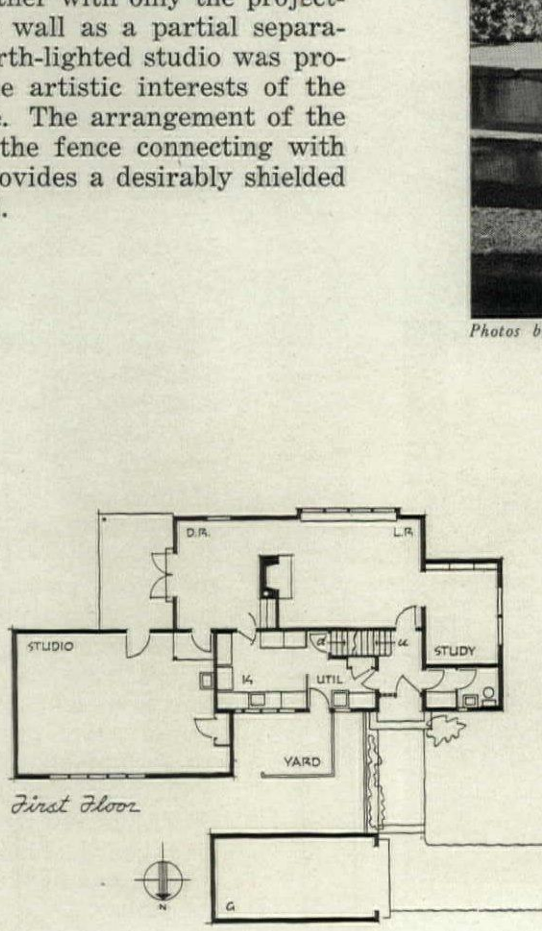
HOUSE IN PRINCETON, NEW JERSEY

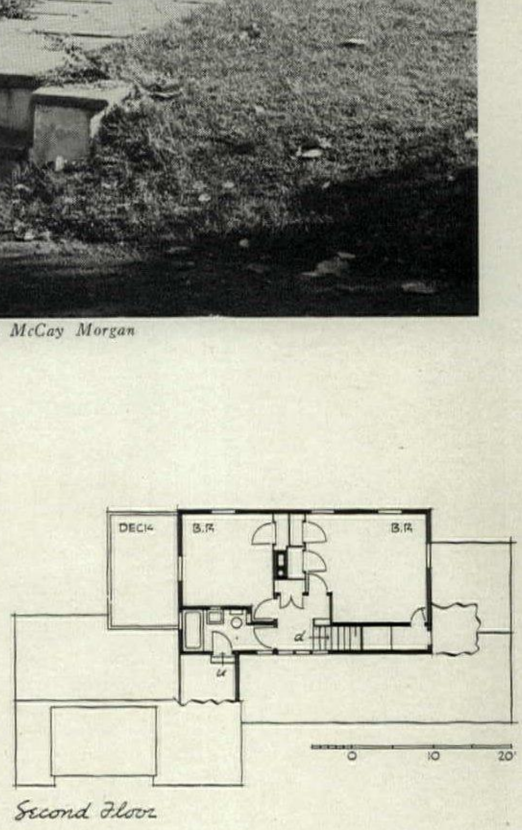
RUDOLF MOCK, Architect

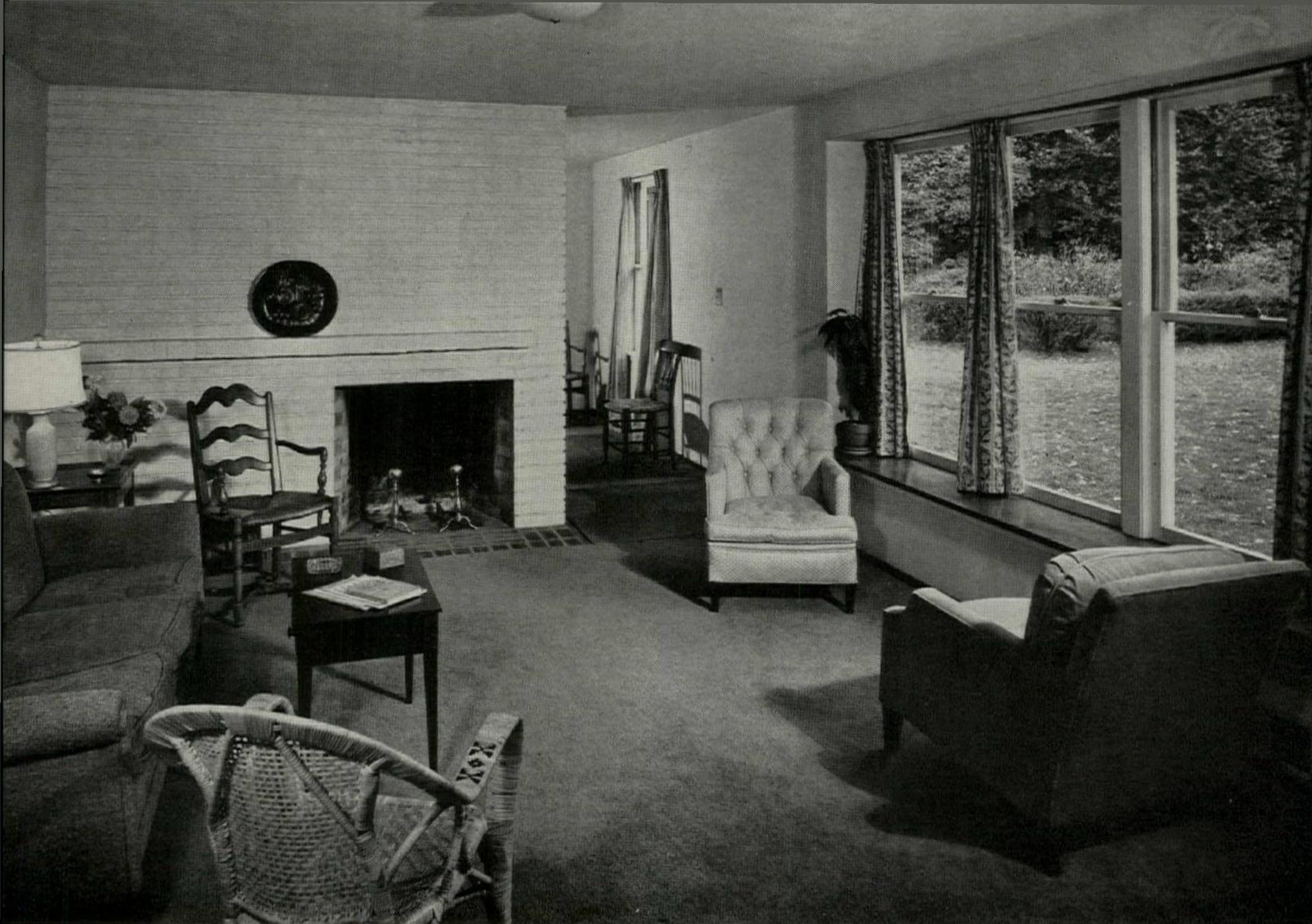
Illustrative of the type of residential work usually referred to as "transitional," we feel that this is an instructive example. Blending as it does two design philosophies, it is nonetheless thoroughly contemporary in planning and amenity, and it helps prove that good architecture is good architecture, whatever its surface treatment. In this case, it seems to us, the required details have been employed simply, without serious compromise.

Photos by Rodney McCay Morgan

Arranged along the south wall of the house, the living and dining spaces flow into one another with only the projecting fireplace wall as a partial separation. The north-lighted studio was provided for the artistic interests of the owner's wife. The arrangement of the garage and the fence connecting with the house provides a desirably shielded kitchen yard.







LIVING ROOM, looking toward dining room.

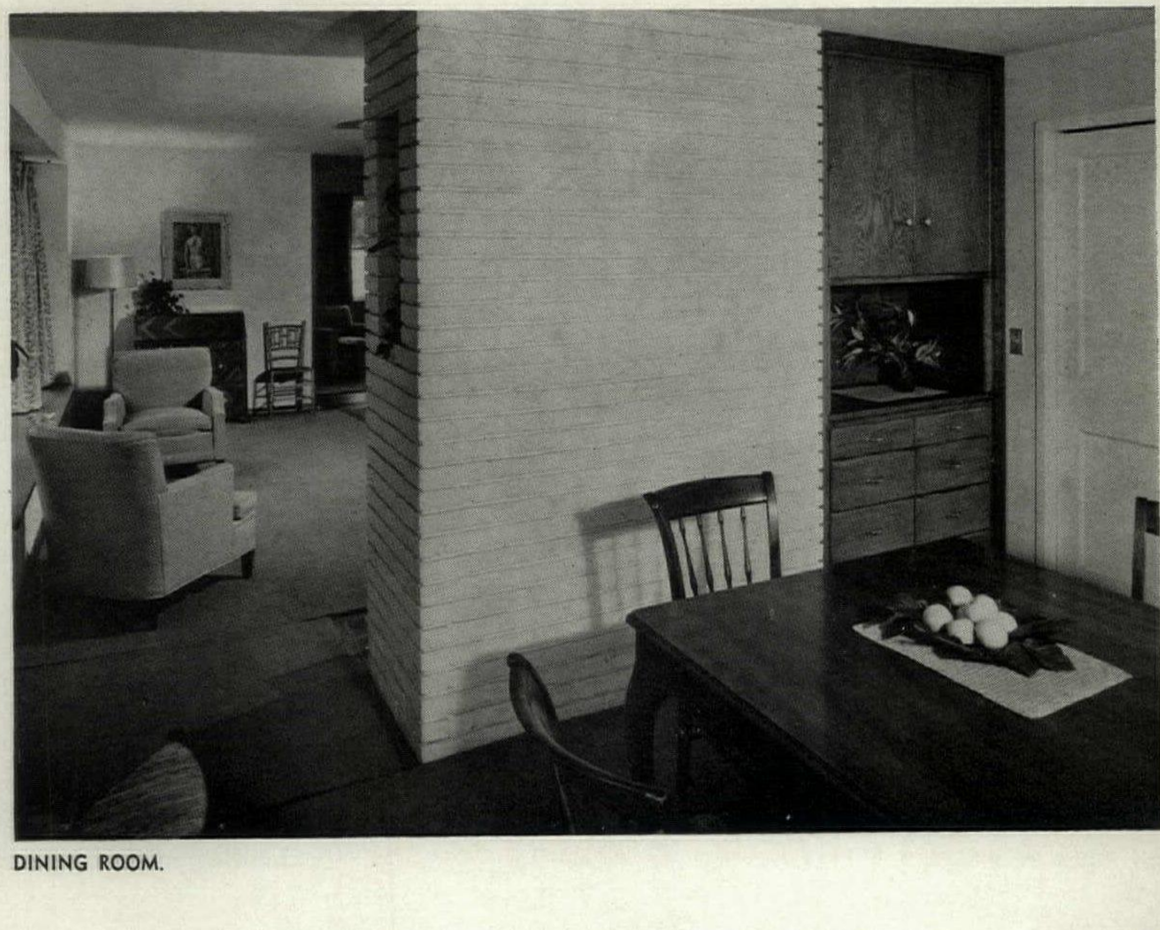
HOUSE IN PRINCETON, NEW JERSEY

RUDOLF MOCK, Architect

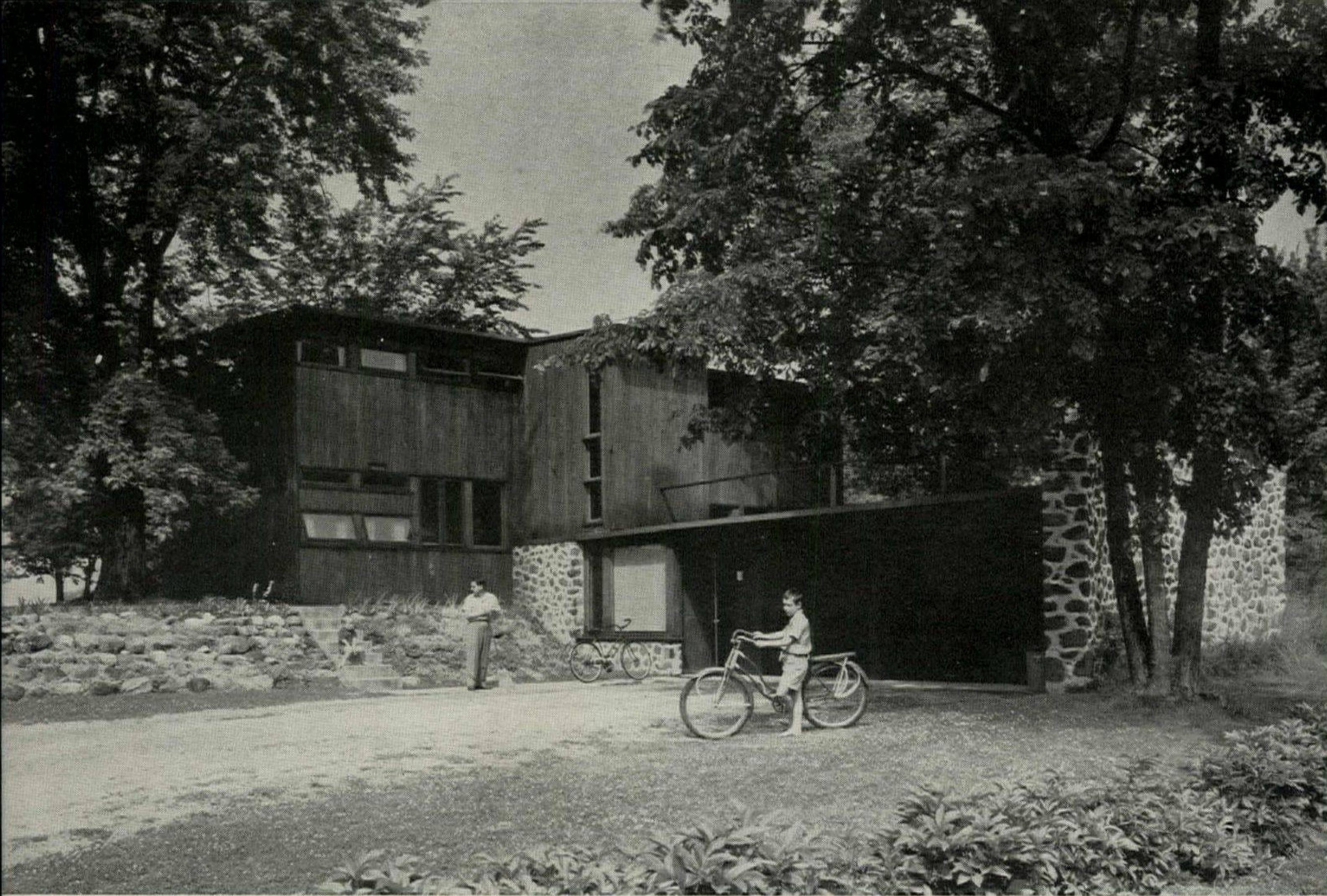
KITCHEN. Front door, at left; drying yard, through door at right

Though the exterior of the house, painted gray, with white trim and dark-green shutters, has a slightly reminiscent look, the interior takes advantage of some of the principles of open planning, utilizes daylighting in line with contemporary principles, and is entirely free from dictates of the purely picturesque. That the continuous fenestration used on the living-room side of the fireplace wall is not repeated in the dining room comes under the heading of client preference. Interior walls are sand-finished plaster, painted; the fireplace wall is painted brick. The house is of frame construction, with insulating board sheathing and bevel siding. A gas-fired hot-air system heats the house.

LOOKING FROM STUDY into living room.



DINING ROOM.

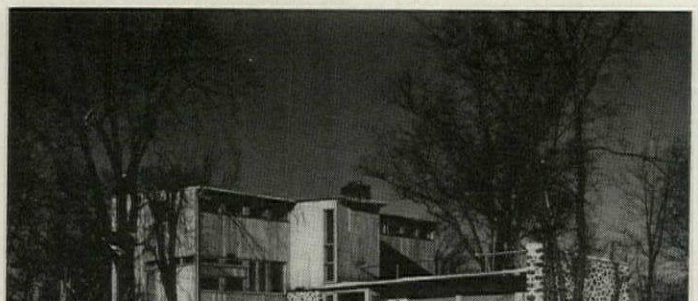


APPROACH SIDE of the house.

Photos by Hedrich-Blessing

HOUSE IN OCONOMOWOC, WISCONSIN

A rational, economical, easy-to-maintain scheme for a family with four vigorous young children. The owner is the architects' younger brother.



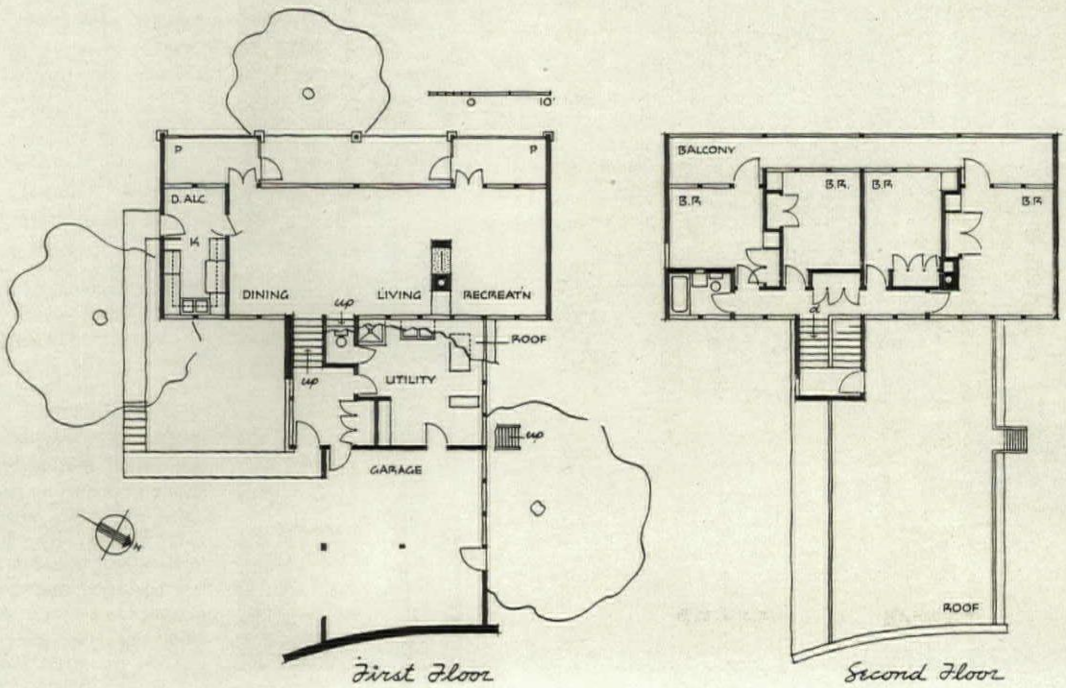
THE HOUSE IN WINTER.

The problem, quite simply, was to provide indoor and outdoor living, sleeping, and recreation for a man and his wife, their three boys and a girl. Design of the servantless house was consciously worked out to take the heavy wear with a minimum of drudgery and upkeep cost.

As the architects say, "It is easy to read the plan from the lake elevation—four bedrooms upstairs, recreation living-dining and kitchen downstairs. Most of the lake side of the house is screened; you can sleep inside or outside from each of the bedrooms; there is a screened porch off the recreation room and another off the kitchen."

LAKE FRONT.

GEORGE FRED KECK; WILLIAM KECK, Architects



THE LIVING ROOM WINDOW commands a view of the sloping lawn and the lake beyond.

FIREPLACE. The fireback is of sheet steel that is top hinged from a channel-iron lintel in the center of the flue opening. The sheet may be swung from front to back and locked in either of two positions, thus serving two fireplaces—one, on the living-room side; the other, opening into the recreation room.

HOUSE IN OCONOMOWOC, WISCONSIN

GEORGE FRED KECK; WILLIAM KECK,
Architects

The lovely site slopes down to the waters of Lake La Belle, where all of the family indulges its delight in sports—swimming, boating, fishing, skating, ice-boating, etc. Only one tree had to be removed to make way for the house.

"I see the house frequently," George F. Keck writes, "and after five years, with often dozens of children playing in the house at once, it has weathered well. I have seen a dozen people walk across the living-room floor with their ice skates on (the floor is stained concrete with wrought-iron pipes in it). In winter, when the children come home from school, in addition to taking off their coats and hats, they remove their shoes and stockings (radiant heat)."

To make the most of the orientation and the lake view (toward the southwest), all of the rooms look out on this front, and the treatment is extremely open; the projecting porches on both floor levels take care of sun control in summer.

The house is mainly standard wood construction insulated with mineral wool. Exterior walls are finished with clear fir boarding; interior finishes are of fir plywood. The stone portions of the construction are a glacial deposit rock indigenous to the neighborhood. The roof is surfaced with asphalt-type built-up roofing. The heating system is a combination of the wrought-iron pipes buried in the concrete floors and copper pipe where wood stripping occurs. While there is considerable glass area in the house (both standard plate and double-thick glass are used), and temperatures in this region fall to 20 degrees below, the architects tell us "the over-all fuel bills are standard." Oil is the heating fuel.

DINING AREA, at the kitchen end of the great main room.

KITCHEN ventilation is assisted by windows at different levels.

ANNOUNCING TO ALL ARCHITECTS IN THE UNITED STATES

The

ANNUAL PROGRESSIVE ARCHITECTURE AWARDS

For each year beginning with 1946 the publishers of PROGRESSIVE ARCHITECTURE will make two national awards.

1 **To the architect of the building or group of buildings (not a private residence), constructed during the year in the United States, which best exemplifies sound progress in design.**

2 **To the architect of the private residence, constructed during the year in the United States, which best exemplifies sound progress in design.**

Every architect in the United States is invited to present his best work or make nominations for review by a distinguished professional jury. The awards are intended to foster sincere, reasoned progress in architectural design in the United States by citation and recognition of those architects whose efforts to improve contemporary standards are judged the most successful.

The awards will consist of suitable plaques to be given to the winners at a presentation dinner attended by nationally prominent speakers and leaders of the profession. It is proposed to give the dinner in or near the home town of one of the award winners.

JURY

The buildings to be cited as the best constructed during 1946 will be selected by a jury qualified to consider all aspects of the building. Those invited to serve are George Howe, until recently Deputy Commissioner for Design and Construction, PBA, noted architect of country residences and large commercial structures, author and critic; William Wilson Wurster, Dean of Department of Architecture, M.I.T., pioneer in design of houses meeting the most advanced standards of contemporary design; Eliel Saarinen, internationally famed architect and long associated with the Cranbrook Schools; Dr. C.-E. A. Winslow, distinguished sanitarian and Chairman of the New Haven Housing Authority, lecturer, author of books and pamphlets on public health problems, emeritus Professor of Public Health in Yale Medical School; Fred N. Severud, noted engineer and authority on construction methods and use of materials; Kenneth Reid, Editorial Adviser of PROGRESSIVE ARCHITECTURE; Thomas H. Creighton, Editor of PROGRESSIVE ARCHITECTURE.

PROGRAM

The only basis for selection of the buildings winning awards in the two classifications above described will be demonstrable progress in fitness, strength, beauty, and purpose. The jury will be asked to give consideration to the appearance, plans, structure, use of materials, site arrangement, and relation to community plan and community needs.

ENTRIES

Every architect in the United States is invited to present before February 1, 1947, the best of his own work constructed during 1946—also to nominate buildings by other architects that he believes worthy of consideration by the jury.

From a preliminary judgment the jury will select a limited group of finalists. Preliminary submissions should include at least three photographs, preferably 8" x 10", showing both the interior and the exterior of the building, as well as plot plan, floor plans, and a brief description of the function of the building and its outstanding features. When the finalists are chosen, more detailed information will be requested about these.

INQUIRIES

Entries or inquiries about the PROGRESSIVE ARCHITECTURE annual awards should be addressed to Thomas H. Creighton, Editor, PROGRESSIVE ARCHITECTURE, 330 West 42nd Street, New York 18, N. Y.

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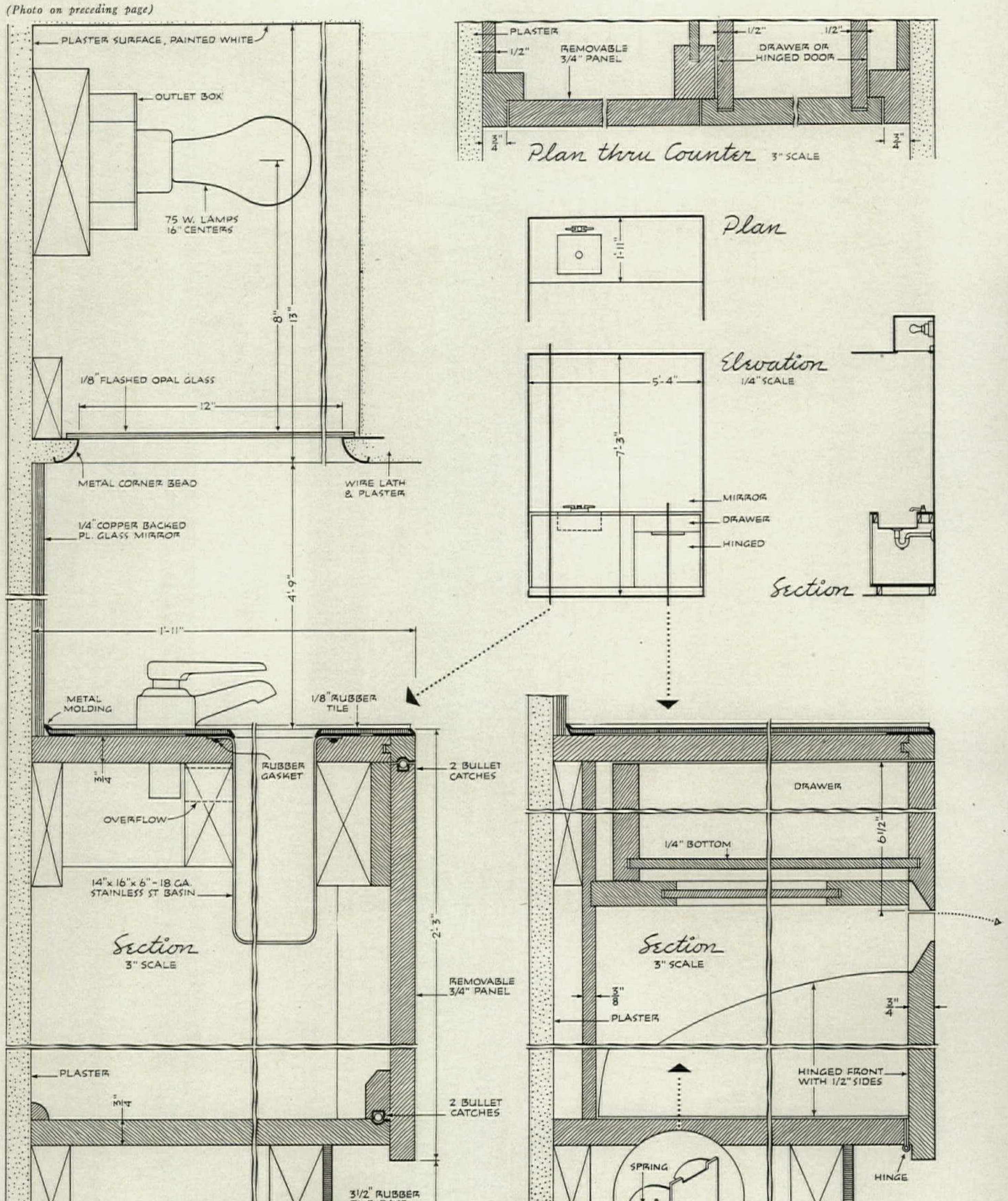
BUILT-IN LAVATORY, MIRROR AND LIGHTING FIXTURE

(Photo on preceding page)



BUILT-IN LAVATORY, MIRROR, AND LIGHTING FIXTURE

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PLANTING WINDOW, HEATING, LIGHTING

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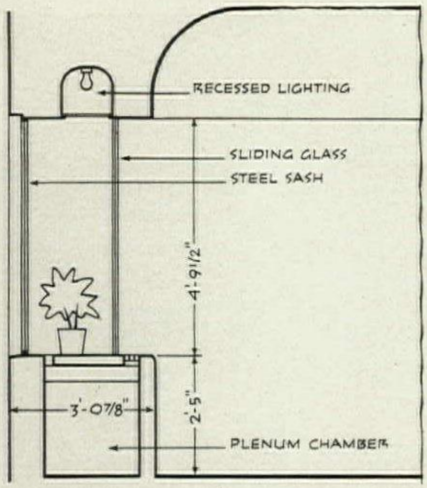
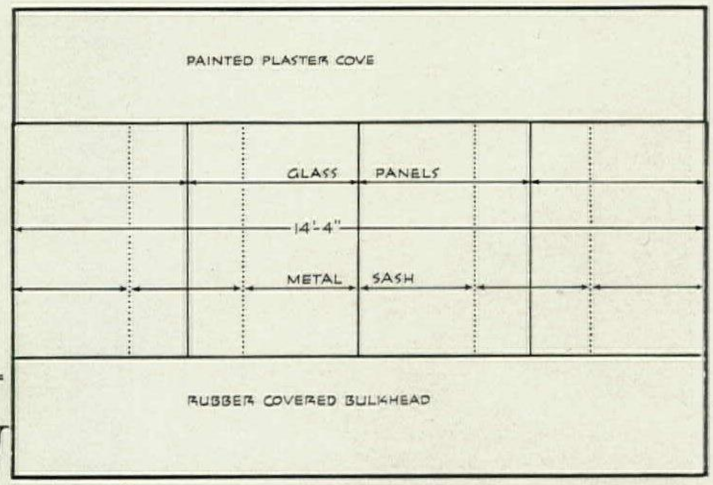
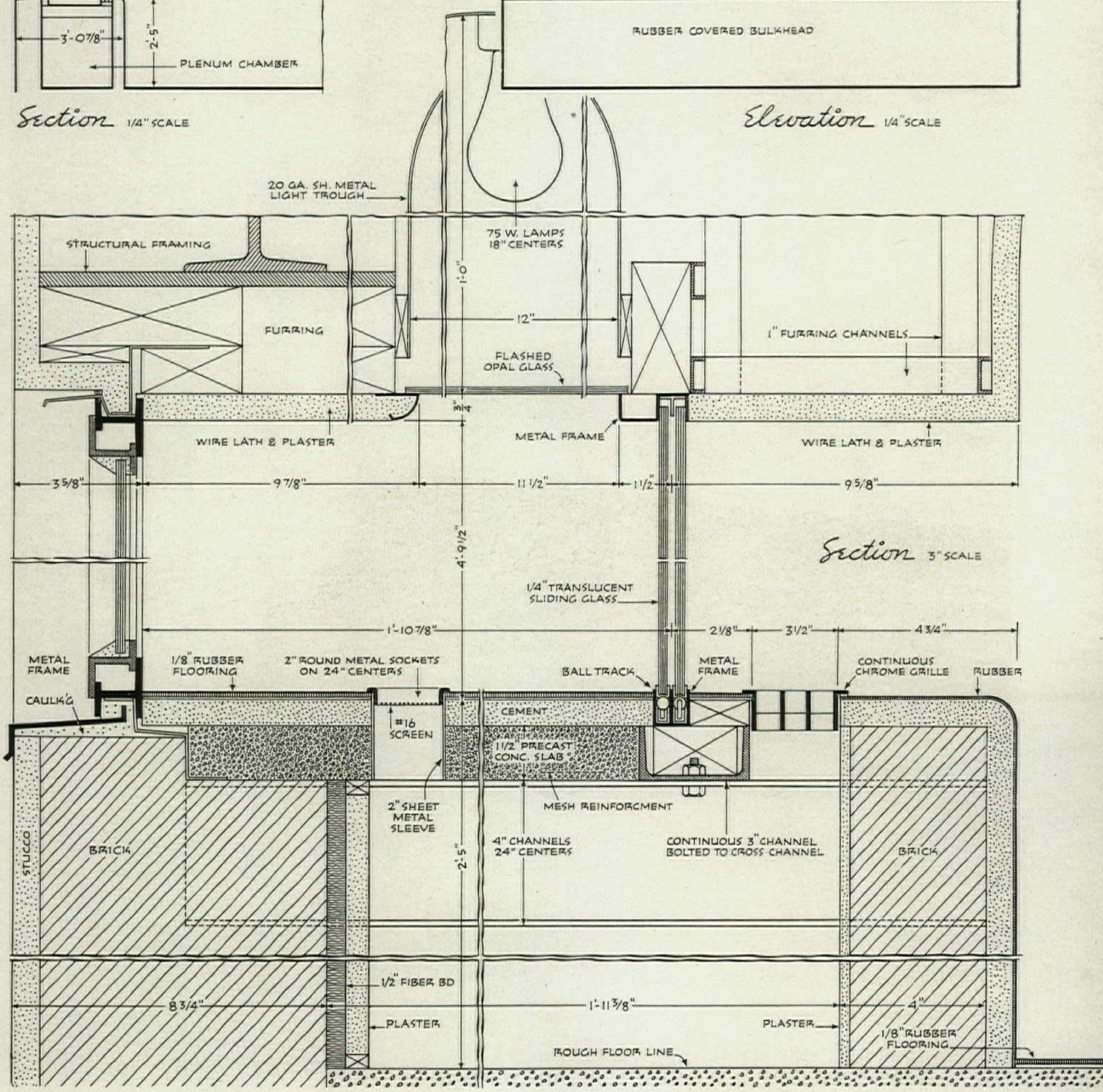


Section 1/4" SCALE



Elevation 1/4" SCALE



Section 3" SCALE

PLANTING WINDOW, HEATING, LIGHTING

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SPECIFICATION SURGERY

By BEN JOHN SMALL

The desirability of reducing an architectural specification to a true contract document, as graphic and free from extraneous material as an architect's working drawing, has been pretty well established. Largely through the efforts of Horace W. Peaslee, who advanced the principle in the pages of PENCIL POINTS as far back as August 1939, many specification writers are now producing "streamlined" documents, useful and legally straightforward.

Writing such specifications is not difficult; once the principles have been established in one's mind, there can be real pleasure in producing a working tool, without having to worry about literary standards. Actually, a specification writer need no more be an accomplished author than a competent draftsman need be a top-flight artist. Each must know construction, materials, and architectural design in the broad sense, and each must be able to translate certain parts of that knowledge into a simple, readable expression which cannot be misinterpreted.

PROCEDURE

The specification writer who wants to approach his task in this way must follow a few simple rules of procedure. First of all, there should be at the head of each subdivision of the specification a general clause which by its wording will make unnecessary the repetition, over and over again, of certain routine warnings. This "mandatory provision concentrated in a single governing clause" has been revised from Mr. Peaslee's original suggestion by the National Bureau of Standards, to read as follows: *Mention herein or indication on the drawings of articles, materials, operations, or methods requires that the Contractor provide each item mentioned or indicated (of quality or subject to qualifications noted); perform (according to conditions stated) each operation prescribed; and provide therefor all necessary labor, equipment, and incidentals.* In such a clause you've said the necessary things once and for all; you don't have to keep repeating them through the body of the specifications.

The next step in specification surgery is the total elimination of the "Scope of the Work" or "Work Included" paragraph. This legally dangerous statement of what you intend to describe later on serves no useful purpose. The specifications themselves list and describe materials and methods of construction and make statements, supplementing the working drawings, about the places where these materials and methods are to be used. In the general conditions should appear all the blanket clauses which define the completeness of all work to be done.

Another means of eliminating words which sound impressive but are really worthless is to take full advantage of standard descriptions of materials. There is no danger in referring to ASTM, Federal Specifications, American Standards Association, or similar accepted standard specifications, provided material grades and types have been checked before the reference is made.

NAME NAMES!

The next step in this simplification through reference is to refer to proprietary names. The prejudice against doing this is hard to understand when one considers the number of times specification writers have simply copied the manufacturer's description of a given product. Why not come right out and name it, save time and space, and set up a definite standard, in the "General Conditions," which, together with the inclusion of proprietary names in the body of the specification, will provide a basis against which "equals" can be evaluated?

Once this step has been accepted, further excess words can be eliminated by saying, simply and frankly: *Execute work in accord with manufacturer's printed directions.* If the ABC company's asphalt tile has been specified, by name, as the standard of acceptable material, and the ABC company prints and distributes standard installation directions, there certainly is no need to copy them into the specifications. If the XYZ company's product is proven equal and is finally accepted, then the specifications do not have to be changed; by the few words you have used you have made the XYZ company's installation directions mandatory.

For full protection under this system you should require copies of such directions to accompany any samples submitted, and you can state in the specification performance objectives that you desire—not detailed instructions. By using such a method you give the manufacturer no excuse to void his guarantee provisions if performance bogs down after his own instructions have been faithfully followed. Contradictions between various manufacturer's directions do not concern you, and there is no clearer or surer way to keep specifications *au courant,* abreast of technological developments.

ABBREVIATE

An obvious way to save words is to use the American Standards Association abbreviations. Instead of writing out "National Board of Fire Underwriters" half a dozen times through the body of the specifications, why not say NBFU? The most commonly used abbreviations are:

AAR—Association of American Railroads
AIEE—American Institute of Electrical Engineers
API—American Petroleum Institute
ASRE—American Society of Refrigerating Engineers
ASTM—American Society for Testing Materials
BMTP—U. S. Bureau of Mines Technical Paper
NBS—National Bureau of Standards
CS—Commercial Standard
FS—Federal Specification
ITE—Institute of Traffic Engineers
BLS—U. S. Bureau of Labor Statistics Bulletin
NBFU—National Board of Fire Underwriters
SPR—Simplified Practice Recommendation

DO NOT USE SENTENCES

Finally we come to the step which seems to be hardest for many specification writers who pride themselves on their ability to write English: the elimination of sentence structure. Throw away the constant references to "the contractor;" eliminate the unnecessary "shall perform," "shall provide," "as noted on the drawings," "according to the plans," "in conformity therewith," and many other hackneyed expressions; drop the articles; save yourself and your builder-readers the nuisance of meaningless weasel words and weasel clauses.

To be specific, do *not* say, "Portland cement shall be in accord with the Standard Specifications of the ASTM C150, Type I, latest edition." Say, instead: *Portland cement—ASTM, C150, Type I.* You don't even have to require that this be the latest edition; your "general conditions" will cover that.

FOR EXAMPLE:

Here is a normally short section made even briefer and more to the point:

Section No. 12—Fabric Covering

The "General Conditions" apply to all work of this section. Mention herein or indication on the drawings of articles, materials, operations, or methods requires that the Contractor provide each item mentioned as indicated (of quality or subject to qualifications noted); perform (according to conditions stated) each operation prescribed; and provide therefor all necessary labor, equipment, and incidentals.

1. Materials

[1] **(a)** Fabric—John Jones Co's "Wallskin."

(b) Paste: Size—Standard brand flour paste; best quality glue size, as recommended by fabric manufacturer.

[2] **(c)** Required samples:
1. 12" by 12" pieces of each required pattern.
2. Paste, glue—one-quart containers.
3. Manufacturer's printed hanging directions—4 copies.

[3] **2. Workmanship**

(a) Condition of plaster surfaces: smooth, true, free from dampness. Cut out and spackle cracks, blisters, and the like.

(b) Apply one coat of glue size.

(c) Hang fabric in accord with manufacturer's printed hanging directions.

(d) Where directed, hang sample installation in one room using required pattern. When approved, such work shall represent standard of workmanship throughout.

3. Salvage

Turn over to Owner all sizeable excess fabric for future patching purposes.

If you have the desire to produce a practical working specification, and you proceed on the basis of the suggestions outlined herein, you will in time find many other ways to reduce wordage, unnecessary work, and possible confusion. You will avoid repetition. You will find yourself developing easy-to-read tables instead of long paragraphs. And finally, you will feel that you are in step with contemporary methods of office practice, a necessary adjunct of progressive design.

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[1] The color or pattern number would be indicated on drawings under "Color Schedule" which also indicates affected locations.

[2] "General Conditions" states that samples, where required, shall be submitted in triplicate, describes methods of identification, grade names, seals, and the like.

[3] General workmanship standards, protection, damage to adjacent work are clearly stated in "General Conditions," therefore require no repetition here.

EDITOR'S NOTE: Both the preceding brief explanation and the following example of the contemporary trend toward streamlined specifications owe much to the initial discussion of the subject by Horace W. Peaslee, which appeared in Pencil Points **for August 1939. Mr. Small, in his duties with the New York City Department of Public Works, and more recently as specification writer for the office of Alfred Hopkins & Associates, has put into practice the principles which Mr. Peaslee then enunciated; and Mr. Beacham, whose office is in Greenville, South Carolina, has been, since publication of Mr. Peaslee's article (to quote him) . . . "inspired to undertake the job of completely revising the basic specifications then in use in our office." To judge by our own correspondence and conversations, and by reports in various architectural journals, professional interest in this subject is intense throughout the country.**

We are happy to present the Masonry Specification. If there is sufficient interest in the subject we will publish additional examples from time to time. Mr. Peaslee has had the opportunity to review some of Mr. Beacham's work of this kind, and approves, even though Mr. Beacham has found in practice that the extreme brevity which was at first advocated had in some instances to be modified in order to avoid misunderstandings. Mr. Peaslee and Mr. Beacham join in requesting that we announce that the system and its development may be used at will, without charge. Mr. Beacham further suggests the two following books as containing sound recommendations for specification writers: Engineering Contracts and Specifications, **by Robert W. Abbett ($2.25) and** A Handbook of English in Engineering Usage, **by A. C. Howell ($2.50), both published by John Wiley and Sons, 440 Fourth Ave., New York City, and available directly from them.**

A SIMPLIFIED SPECIFICATION FOR UNIT MASONRY

Prepared by JAMES D. BEACHAM, Architect

D-01. INDEX

D-02. GENERAL REQUIREMENTS

a) **SCOPE OF WORK:** Unit masonry of the several kinds specified or indicated necessary to complete the construction shown on the drawings, together with masonry flashings and other specified items of masonry incidental thereto.

Intent: Mention herein or indication on the drawings of articles, materials, operations, or methods requires that the Contractor provide each item mentioned or indicated, of quality or subject to qualification noted; perform according to conditions stated each operation prescribed; and provide therefor all necessary labor, equipment, and incidentals.

b) **GENERAL CONDITIONS:** See Division A.

Standard specifications; codes: References made herein to standard specifications, and codes, refer to editions in effect at the dates of proposals; such references include current addenda and errata, if any.

Abbreviations: "ASTM" refers to The American Society for Testing Materials; "Fed. Spec." refers to Federal Specifications.

c) **SAMPLES REQUIRED:** Face bricks; facing tiles; glass block; cast stone; mortar aggregates.

d) **CATALOG DATA REQUIRED:** Hollow tile; wall coping; flashing block; flashing material; firebrick.

e) **SHOP DRAWINGS REQUIRED:** Cast stone trim.

D-03. BRICKS

a) **COMMON BRICK:** American standard-size clay or shale brick in accord with ASTM specification C 62, having true faces and sharp, straight edges; free from an objectionable amount of cracks and spalls.

Classes of common brick: Class SW brick used for work in contact with earth; Class MW brick used generally.

Where required: For all construction indicated as "brick" except where face brick is required.

b) **FACE BRICK:** Selected common brick conforming to specified requirements for structural common brick; furnished in medium-to-dark red and brown shades, with salmon-colored and black bricks excluded; free from an objectionable amount of distortion, warpage, cracks, and other unsightly defects.

Where required: On all exposed exterior surfaces including penthouse walls and chimneys; also for exposed interior surfaces indicated as "face brick."

Brick for window sills: Solid, all-hard, dark colored face brick.

Special face brick: Bricks formed and burned to the special shapes indicated; otherwise conforming to requirements for the standard-shape face bricks.

Shipping and handling: Face brick shipped and delivered well packed in straw; handled only with tongs or by hand in manner to avoid chipping and other damage.

c) **FIRE BRICK:** Moderate-heat-duty grade conforming to Fed. Spec. HH-B-671.

Where used: Boiler stack.

D-04. FLUE LINING, ETC.

a) **FLUE LINING AND THIMBLES:** Hard-burned fireclay products, free from large or deep cracks, blisters, or other objectionable structural defects.

Size: As indicated or necessary for the mechanical equipment to be installed.

Where required: Where indicated; located at heights shown or directed.

D-05. HOLLOW TILE

a) **STRUCTURAL HOLLOW TILE:** Horizontal-cell clay or shale units of size and design indicated, conforming to ASTM specification C 34; necessary vertical-cell pieces furnished for jambs and corners.

Where required: For back-up in exterior walls below roof level; for interior walls and partitions to extent indicated.

Grade of tile: Grade LBX used for work in contact with earth; grade LB used generally.

Surface finish: Scored where mortar or plaster will be applied; smooth and unglazed where surface will be exposed or painted.

Accessory pieces required: Closures, fitters, and special shapes necessary to preserve the bond and avoid extensive cutting of standard units.

D-06. GYPSUM TILE

a) **GYPSUM PARTITION TILE:** Cored tile conforming to ASTM specification C 52.

Where used: For interior, non-load-bearing partitions and furring at locations indicated.

Prohibited usage: As first course above floor in partitions and furring; for parts of partitions and furring specified to receive mortar finish of Portland cement or lime.

Size of units: 30" long; 12" high; thickness as indicated.

Furring units: Split tile of the thickness indicated.

D-07. TILE WALL-COPING

a) **TILE COPING:** Standard salt-glazed coping with socket joints; sound; free from fractures, cracks, blisters, and warpage.

Size: Of proper width for walls indicated.

Accessory pieces required: Starting pieces; corner pieces; closed-end pieces; special shapes as required.

Where used: Generally, except where coping of other material is specified.

D-08. FLASHING BLOCKS

a) **FLASHING-BLOCK UNITS:** Hard-burned terra cotta material, having a diagonal groove not less than 1½" deep, measured horizontally, designed to receive roofing flashing.

Where used: At intersections of roofs with walls and similar vertical masonry surfaces.

Size of units: Designed to replace and course with two courses of brick.

Accessory pieces required: Units and shapes necessary to provide a continuous flashing groove at all masonry walls.

D-09. GLASS BLOCK UNITS

a) **GLASS BLOCKS:** Partially evacuated structural masonry units of pressed glass similar to those made by the Owens-Illinois Glass Company, complete with standard corner pieces, curved, and other pieces necessary to make a complete installation.

Where used: See drawings.

Accessories required: Continuous, corrosion-resisting, wire mesh strips or other approved metal wall ties, every 4th course in height; expansion joint material used where shown or required; all as specified or recommended by the manufacturer of the glass block.

D-10. FACING TILE—(INTERIOR)

a) **GLAZED CERAMIC UNITS:** Clay or shale tile facing units conforming to ASTM specification C 126, having all exposed surfaces uniformly finished with an impervious, durable, burned-on glaze of the designated color and texture.

Where required: For partitions and interior walls. See "finish schedule" and detail drawings.

Quality, color, and texture: Grade S, standard multi-cored units; absorption test waived; manufacturer's "ivory;" "matt-finish;" corresponding to approved samples.

Types of units: Types I and II, as required; standard stretchers and starters; molded shapes as indicated for caps, corners, jambs etc.

Face sizes: Stretchers 12" x 5" except as otherwise shown; tolerance in face size (all units) not to exceed .15%, plus or minus, of nominal size.

Thickness of units: 4" (nominal) generally; 4" and 2" units, and two 4" units, used together to form double-faced walls of 6" and 8" thickness, respectively.

D-11. CAST STONE TRIM

a) **MATERIAL:** Surfaced stone manufactured in accordance with the standard specification of the Cast Stone Institute; the product of an established manufacturer whose material has been previously used on similar work with satisfactory results.

Where required: Exterior ornamental trim and finish consisting of facing, sills, coping, lintels, etc., to extent indicated on drawings.

Surface color and texture: Similar to Indiana "buff" limestone; exposed surfaces "hand rubbed."

Requirements for shop drawings: Sizes, sections, dimensions, jointing, anchorage, flashing, and setting.

D-12. MORTAR MATERIALS

a) **PORTLAND CEMENT:** A well known American brand conforming to ASTM specification C 150.

b) **MASONRY CEMENT:** Type II in accord with Fed. Spec. SS-C-181.

c) **LIME PASTE:** Made with pulverized quicklime or with hydrated lime conforming to ASTM specifications C 5 or C 141, respectively.

d) **GYPSUM:** Calcined material conforming to ASTM specification C 22.

e) **SAND FOR MORTARS:** Hard, durable, natural sand free from injurious amounts of saline, alkaline, organic, or other deleterious substances.

Grading: From "fine" to "coarse" within the following limits:

Sieve size	Percentage passing each sieve
No. 8	95-100
16	60-100
30	35-70
50	15-35
100	0-15

f) **FIRE CLAY:** Grade C in accord with ASTM specification C 105.

g) **WATER:** Clean and free from deleterious amounts of acids, alkalies, or organic materials; of approved drinkable quality.

D-13. MORTARS

a) **DESIGN OF MIXES:** As determined by the Architect, following approval of the materials proposed for use; volume of aggregate in all mortars at least two times, but not more than three times, the volume of the cementitious materials; bids based on use of the mortar mixes following.

b) **FOR HOLLOW UNITS IN CONTACT WITH EARTH:** 1 part Portland cement; 1/4 part lime paste; not more than 3 parts sand.

c) **FOR BRICK AND STRUCTURAL TILE UNITS, GENERALLY:** 1 part Portland cement; 1 part lime paste; not more than 6 parts sand; **or,** 1 part masonry cement and not more than 3 parts sand.

d) **FACING-TILE MORTAR:** Same as the mortar used for setting brick and structural tile, but using non-staining quality cement; this mortar colored by addition of non-fading mineral pigment.

e) **STONE-SETTING MORTAR:** Same as mortar for setting brick and structural tile, but using non-staining quality cement.

f) **STONE-POINTING MORTAR:** 1 part non-staining Portland cement to not more than 2½ parts sand; sufficient lime paste added to make a very stiff mixture.

g) **GLASS-BLOCK MORTAR:** 1 part Portland cement; 1 part lime paste; not more than 4½ parts sand.

h) **METHOD OF MIXING MORTARS:** Materials proportioned by volume; Portland cement mortars made by mixing the cement and sand, adding the lime paste, then adding sufficient water to obtain proper working consistency. Masonry cement mortar mixed in accordance with manufacturer's directions.

D-14. FIELD WORKMANSHIP

a) **GENERAL REQUIREMENTS** (applying to all types of units): Watertight construction provided in all exterior masonry. Throughout the work, joints completely filled with the specified mortar.

Condition of beds and units: Clean; all beds and units properly wetted.

Protection of uncompleted work: Top thoroughly covered with watertight material while work thereon is not in progress.

Samples of masonry: Panel of brick and hollow-tile wall work, 12" thick and not less than 4'0" in width and height, laid up in advance of masonry work, for inspection and approval; approved sample panel retained as a standard of the work to follow.

Scaffolds: All face work laid up from scaffolds located on the facing side.

Mason's iron work and masonry flashing: Properly set as the masonry work progresses.

Workmanship (general): All work built true to line; level, square, and plumb. Exposed joints practically uniform in size. Masonry walls and adjoining masonry partitions properly bonded, to each other by toothing courses. Brick and hollow block units thoroughly bonded together.

Bed joints: Mortar spread thick. Deep "furrowing" avoided. Finished joints uniformly (approximately) 1/2" wide.

Head joints: Made with liberal application of mortar on surfaces of the unit to be placed and shoving the unit against the unit previously placed, causing mortar to ooze out at the top and sides of the joint. Contact surfaces of "closure" units and units previously placed given liberal application of mortar; closures "rocked" into place without disturbing the bond of adjacent units. Width of head joints same as required for bed joints.

Wall joints: Made with liberal, continuous application of mortar on the contact surfaces of units in place and units to be placed, and shoving the unit against the work previously placed, causing mortar to ooze out the top and sides of the joint. Wall joints 1/2" (minimum); 3/4" (maximum).

Finish of exposed joints: On exterior, exposed joints tooled in manner providing a compacted, concave surface, the mortar being pressed tightly against adjacent masonry units on both sides of the joint. On interior, exposed joints tooled as indicated or directed.

Prohibited practices in workmanship: "Buttering" corners of units; throwing mortar scrapings into joints; "slushing;" deep or excessive "furrowing" of bed joints; shifting position of units placed by tapping or hammering.

b) **BRICKWORK:** "Common" or "running" bond used (except where pattern work is indicated), with a full-length header course at every 6th course.

c) **FIRE CLAY UNITS:** Substantially bedded and laid up; full, close joints.

d) **HOLLOW TILE WORK:** Material accurately laid out so as to necessitate the minimum amount of cutting of standard units.

Bond of tile work: "One-half" bond.

Head joints: Made by liberal application of mortar on both edges of the unit to be placed.

Reinforcement of bearing points: In bearing joints and where anchors, bolts, etc., project within the cells of hollow tile, such cells filled with 1:2:4 concrete.

e) **HOLLOW TILE LINTELS:** Provided where indicated and where no other type of support is called for.

Reinforcement: Steel bars as indicated, set in well-rodded 1:2:4 concrete or 1:3 Portland cement mortar.

Forming: Lintels pre-cast; where exposed, 1/2" wide false joints cast between the ends of pieces of tile.

Curing: Lintels water-cured for not less than 7 days before use in wall work.

f) **TILE WALL-COPING:** Units set in full beds of the mortar used for laying up masonry in parapet walls.

End joints: Well filled with the setting mortar.

g) **FLASHING-BLOCKS:** Units set in the same manner required for brick setting.

h) **GLASS BLOCK WORK:** Before laying, sills coated with a heavy layer of asphalt emulsion, the coating being allowed to dry before the first mortar bed is placed.

Expansion strips: Required at jambs and heads, below shelf angles, at mullions, and where indicated; continuous; strips so installed that contacts of the edges of the glass block panels with the building structure are avoided.

Setting: Blocks set in the specified mortar, with all joints (except expansion joints) completely filled; mortar kept out of expansion joints; wall ties located as indicated or required and completely embedded in the mortar; ends of ties lapped not less than 6".

Joints: Uniform; width as indicated on detail drawings; exposed surfaces smoothly tooled to a slightly concave, non-porous surface after the mortar reaches its initial set.

Caulking: Oakum rammed between the sides of the blocks and the side of the chase or frame, after the mortar has set, to within not less than 3/8" of the finished surface; recesses thus formed at jambs and heads filled with mastic caulking compound.

i) **FACING-TILE WORK:** Generally, units laid up in accord with requirements for face brickwork; work accurately laid out in each room or space in manner requiring the minimum amount of cutting of standard units.

Bond: End joints located over the center of the underlying full-length tile; all courses bonded at corners and intersections.

Anchoring: All courses properly anchored to masonry and concrete backing.

Joints: Not more than 3/8" wide; surfaces tooled to a smooth, slightly concave finish.

Closures: Cut at job, with a carborundum saw to straight, clean-cut ends; minimum length of any closure, 1/4 the length of the standard stretcher.

Cutting and fitting: Neatly done around pipes, boxes, etc.

j) **SETTING CAST STONE:** Material accurately set by competent stone masons; true to line; level and plumb; with full joints of the specified mortar; all sides of stones cleaned and wetted prior to setting; exposed faces kept free of mortar at all times.

Anchors and dowels: Soft steel of sizes and shapes indicated on setting drawings; all zinc-coated or dipped in asphaltum or red lead after fabrication.

Projecting courses and members: Propped up until the anchoring has been built in and sufficient work above is in place to securely hold the projecting work in position.

Heavy blocks: Set only after the mortar in joints below has thoroughly set; 1/4" thick lead setting-pellets used in joints where approved or directed.

Bedding: Each piece of stone rested on a full bed of mortar insufficient amount to fill out to the edges of the piece on all sides; stones adjusted to their beds by striking with a wooden mallet or ram.

Parging: Backs of all stones and exposed sides of all bond stones plastered with not less than 1/2" thickness of setting mortar; mortar allowed to attain initial set before the masonry backing is built.

Jointing: Face joints uniformly 1/4" in width; setting mortar routed out 3/4" in depth from face.

Pointing: Stone surfaces at joints thoroughly cleaned and wetted; joints in vertical surfaces completely filled with the specified pointing mortar, packed tight, and rubbed smooth to a concave finish; top and wash joints thoroughly caulked with approved elastic caulking compound of color to match mortar joints.

D-15. MASONRY FLASHING

a) **FLASHING MATERIAL:** Sheet copper weighing not less than 2 oz. per square foot bonded to and between two layers of coarsely woven, asphalt-saturated cotton fabric by means of a ductile mastic; the entire assemblage corrugated on exposed surfaces in the manner providing a series of grooves running the entire length of each sheet. The material supplied in rolls of the maximum width and length suitable for the usage locations specified.

Acceptable material: Material equal to the flashing described as made by WASCO Flashing Company.

Where required: At window sills, exterior lintels, spandrels, and parapet walls; in positions shown on drawings.

Application: (general): Flashing material installed in manner to protect structural members from moisture and to effectively divert seepage toward the exterior of the construction. On horizontal masonry surfaces, flashing laid in a fresh bed of mortar; other surfaces receiving flashing thoroughly dry, free from loose materials, and be spotted with plastic cement to hold it in place until the masonry is laid.

Waterproof connections between pieces made by splicing (splitting the two top plies, lapping the metal 4", and coating the contacting surfaces with plastic cement).

Heads and sills: Flashing at lintels carried not less than 6" beyond ends. Material carried under and behind sills, and turned up at the ends, forming a pan.

D-16. CLEANING MASONRY

a) **TREATMENT OF SURFACES:** Masonry joints pointed or repointed where necessary; surfaces thoroughly brushed or scraped free of dirt, excess mortar or plaster, and other foreign materials; all discolorations and other objectionable surface defects thoroughly removed.

Acid treatment: Where necessary to restore original color, surfaces of exterior masonry, and exposed interior masonry not required to be painted, washed with a suitable muriatic acid solution.

Protection: Materials adjacent to masonry properly protected against staining and other injury during cleaning operations.

LOOKING AHEAD ON BUILDING CODES

By GEORGE N. THOMPSON

Mr. Thompson is Chief of the Division of Codes and Specifications of the National Bureau of Standards, U. S. Department of Commerce; his knowledge of his subject is unquestioned. **Other developments in this field are reported on page 80.**

This discussion of building codes will begin where many such discussions leave off: It will concede that, like much other legislation, codes are susceptible of considerable improvement, depending on their age and the degree of competence with which they have been put together. Its main interest, however, will be in the consideration of constructive measures through which refinements can be brought about. The old truism that it is much easier to criticize than to suggest a remedy seems to apply peculiarly to the code situation. In fact, criticism has been carried so far that there is very little left to add or to present in a different way. So attention will be focused here on specific problems and how they might be handled both now and in the future.

Before entering into this phase of the matter, however, it may not be inappropriate to say that building codes perform a useful function which, on the whole, has been fairly well done. Instances of failure to keep up with progress in the building art, of requirements based on selfish motives, and of rigidity in dealing with various possible methods of construction undoubtedly exist. Nevertheless, in any over-all estimate of the usefulness of codes the protection afforded to people who unavoidably must work, live, and play in buildings—and that means all of us—should be kept in mind.

Practically all discussions of the subject agree that codes tend to fall behind the times—"antiquated and outmoded" is a favorite expression. There are, in fact, many local codes that have not had a major overhauling for fifteen or twenty years. Inertia, expense of revision, and reluctance to open up controversial questions all play a part in this. Early attention on the part of local authorities is desirable but, recognizing the tendency to put off the job, it is also desirable to make the code, in a sense, self-revising in future years. Fortunately, it is possible to indicate ways in which this can be accomplished to some extent.

RELATION BETWEEN CODES AND STANDARDS

Few codes stand alone. Their requirements include references to other documents—standards for quality of materials, standards of performance, standards of good practice in construction produced by technical and professional societies, standardizing agencies, and other bodies. These standards represent the best thought that it has been possible to get together in their respective fields and their high quality is universally recognized. There are, however, legal problems connected with their use that are familiar to code authorities. The particular edition whose contents are to be followed frequently must be positively identified in order to avoid charges of delegation of legislative authority. When one comes to think of it, this seems a reasonable requirement, since nobody likes to be punished for a violation of something that was adopted by some agency over which, as a citizen, he has no control and which may change its requirements overnight without his knowledge.

The net effect of positive identification of a standard to which reference is made is, however, to freeze adherence to that standard until such time as the municipal council gets around to changing the requirement. Experience has shown that this changing is done infrequently. The result is that many codes are strewn with references to dead standards. If literally followed, the code provisions thus fall behind the times. If the provisions are quietly ignored, as sometimes happens, and the latest standards are used, there is due recognition of new developments but on an extremely dubious legal basis.

There are several ways of dealing with this problem. Some municipalities have dealt with it by employing a phraseology in their codes which in effect requires that good practice shall be followed and that various named standards as revised from time to time shall be deemed acceptable good practice. This is held to avoid the pitfall of delegation of legislative authority. Other municipalities permit their building officials to make rulings, naming the standards which will be recognized as fulfilling the general purposes of the code. Another method, that could be used in those places where the reference standards must be definitely identified as to edition, would be to place a provision in the administrative chapter of the code requiring the building official to review all references to standards annually and bring a revised list before the municipal council for adoption. This would not be too great a task and should accomplish the purpose.

The particular method chosen will vary with the jurisdiction in which the code is developed. This emphasizes a point seldom brought out in discussions of code improvement, namely, that greater uniformity in requirements is dependent not only on technical but also on legal considerations. The latter often go back to some fundamental principle that has developed over the years and is so embedded in local practice that the chances of changing it are not promising. However, the desired prompt acceptance of latest standards can generally be achieved through use of some one of the alternate methods that have been mentioned.

CODES, NEW MATERIALS, AND NEW TECHNIQUES

A frequent cause of complaint about building codes is that they fail to deal adequately with the many new materials, and new methods of putting these materials together, that are expected to come along in the near future. This business of setting up requirements for something that is as yet unknown, or at best whose characteristics are only imperfectly known, in many instances presents another set of problems. It is not sufficient to charge code writers with lack of vision. Some means must be found to deal justly not only with the manufacturers of these materials but also with the people whom the code is trying to protect. The fact that a material is new warrants neither discrimination against it nor unquestioning acceptance of claims made for it.

Obviously, some mechanism needs to be set up which will provide for an impartial investigation of claims and prompt acceptance for use if safety is assured. A start can be made with a provision now existing in many codes in various forms, to the effect that new materials and methods may be used on submittal of evidence, in the form of tests, structural analysis, or otherwise, that the proposed construction is safe. Sometimes the building official is empowered to pass upon the matter, sometimes a local board, and sometimes a combination of the two.

This is a necessary step, but only the first one. Unless it is implemented with other measures, it is likely to be used sparingly and to provide a convenient method of rejection.

TESTS AND THEIR INTERPRETATION

Many of the novel constructions that are being proposed are not susceptible of engineering analysis and so the only basis for judgment is that of testing. Here a fundamental weakness appears in that standard methods of testing to determine structural qualities have not been fully agreed upon. So it is entirely possible that a new method of construction may be subjected to one series of tests in one municipality and to another set elsewhere. It follows that uniformity of treatment requires agreement on standard methods of testing for use everywhere. Work is going on in connection with this problem.

There is still another step to be taken. Results of testing must be interpreted in terms of what are safe values for particular materials and constructions. A uniform method of approach to this problem would provide a useful guide to local officials and boards in the exercise of their duties. Its general acceptance would assure uniform treatment, thus removing the possibility of capricious and arbitrary rulings.

It is well to note that the perfection of the process by which new materials and new constructions are admitted to use may involve little change in many codes. It does require, however, some constructive work in the development of a sound procedure for putting the terms of the code into effect.

THE "PERFORMANCE BASIS"

Closely linked to the problem of dealing with new materials is that of applying the so-called "performance basis" to materials and constructions, both new and old. In essence, this is a type of requirement which calls for some definite result that may be reached in a variety of ways, the means being immaterial so long as the result is obtained. The flexibility of this arrangement has appealed to a great many critics of present code provisions but in most instances they have contented themselves with advocating the method without exploring the difficulties involved and the steps to be taken in order to make it fully effective.

In the matter of requirements for fire resistance much progress has been made in the direction of code requirements. Roughly, it works as follows: Definite periods of fire resistance are set for walls, columns, floors, and so on in various types of building construction. No specific materials or thicknesses of protection are given in the code but the statement is made that any material may be used that will provide the specified fire resistance under the Standard Fire Test of the American Society for Testing Materials.

Codes employing this treatment frequently supplement the code requirement by appendix information in which are listed familiar materials in the thicknesses necessary to meet the requirement. This treatment has proved very successful and is being quite generally accepted in new codes.

It will be apparent to the reader that, once the standard methods for structural testing are available as discussed in connection with new materials and methods, an extension of the same principle could be attempted with respect to structural requirements. Such a development is undoubtedly coming but, as already explained, standard methods of testing and of interpreting results of testing must first be worked out.

The same general principle can also be applied in other parts of a code as the basis for it becomes firmly established, for instance with respect to some of the new types of metal chimneys and other devices. It may still be found convenient, however, to retain certain specified clearances from combustible construction and other specific requirements. The extent to which the principle can actually be applied is dependent upon research and adoption of sound procedures through which performance can be definitely established.

RESPONSIBILITY OF THE BUILDING OFFICIAL

Mention has been made of issuance of rulings by the building official. Where such action is permitted, a measure of flexibility is introduced into building code requirements; but some municipalities frown on the practice. The general idea is for the code to lay down general principles for the guidance of the official and authorize him to deal with situations not specifically covered by the code so long as it comes within the scope of his general authority. This presupposes a high degree of competence and integrity on the part of the building official but when safeguarded, as it usually is, by provisions for adequate notice and public hearings, it provides a very useful means of meeting situations that inevitably develop as time goes on.

FUNCTIONS OF THE BOARD OF APPEALS

If the building code provides for a strong Board of Appeals to which grievances may be taken and through which differences with the building official may be adjusted, the way is provided for ironing out many situations which are a source of irritation today. Unless specifically authorized to do so by state law, such a board cannot grant variations outside of the terms of the code itself, but, within the scope of its authority and acting in a liberal spirit which recognizes the problems of the times, it can do much to loosen up the rigidity of interpretations about which so many comments are made. The questions of whether approvals of new materials and methods of construction should come before it originally or on an appeal through the building official is a matter largely for local determination, the point being that a definite, recognized system fully buttressed by a workable procedure is necessary.

ELIMINATING UNSOUND PROVISIONS

The rooting out of individual passages in codes that have their origin in selfish motives or obsolete practices is another factor in the general approach to code improvement. It involves much laborious work. Steps along the way include identification of questionable provisions, determination of how they are construed in actual application, comparison with accepted standards to determine extent of departure from the normal, investigation of any special conditions that may justify such departures, and educational measures designed to convince local authorities that a change should be made. Current emphasis on the need for reducing costs of construction and on permitting the widest possible selection of materials makes it probable that this process of critical inspection of doubtful provisions will be strongly emphasized from now on.

GOOD ADMINISTRATION IS ESSENTIAL

No mere perfection in wording of the building code can compensate for lack of intelligent administration, alertness in following developments in the building field on the part of both building official and board, and systematic attention to needed amendments to the code itself where that becomes necessary. The volume of sound technical material that can be utilized to advantage in the enforcement of building code provisions is constantly growing. The appearance and continued development of this material in recent years has been one of the significant features of building code improvement. It comes from professional societies, standardizing bodies, governmental agencies, and other sources and represents much careful thought. To fail to utilize it promptly is to deprive the public of the benefit of efficiencies and economies that should mean much in the difficult days ahead.

Once the structure of code provisions is strengthened along the lines that have been described, the way will be open for recommendations developed on a national basis to flow naturally into channels of local application through acceptance in local codes and as guides for local officials and boards in the exercise of their discretionary powers. There will always be controversial points to be settled through technical research and composite judgment of experts but progress will have been made toward reaching the desirable goal of reasonably uniform requirements throughout the country.