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THE VINYLITE HOUSE . . .

an experimental research project to show the versatility of Vinylite, a plastic material developed by Carbide and Carbon Chemicals Corporation. A three-room apartment has been built with factory-fabricated sectional wall panels of molded Vinylite. (These panels are experimental only and have not yet been put into commercial production.) Floor tiles, the doors and door knobs, the extruded ceiling molding and baseboard, and incidental items like vases and cigarette boxes are of the same material. The illumination is transmitted through translucent sheets of Vinylite about 0.0625 inches thick, which have a light transmission value of more than 90 per cent.

Vinyl resins are colorless, odorless, tasteless, noninflammable, and may be colored any shade with dyes or pigments. The pure resins are transparent but any degree of opacity can be attained by incorporation of fillers. Since the resins are permanently thermoplastic, molding is a comparatively simple operation. Because of low shrinkage, very large objects such as doors or wall panels can be molded easily. Metal, wood, composition board and similar products may be completely surfaced with a tough, stable and chemically resistant protective coating.

THE VINYLITE HOUSE...
(Description on over-page)

THE ARCHITECTURAL RECORD
JANUARY, 1934 VOLUME 75—NUMBER 1

NEW HOUSING DESIGNS and CONSTRUCTION SYSTEMS

Compiled by C. THEODORE LARSON

The housing problem has become one of offering more services and utilities—a progressively higher standard of living—while at the same time reducing the original construction cost as well as the expenses of maintenance through a more efficient building technique. Designers and manufacturers have approached the problem in different ways—some by seeking economies through factory fabrication of the entire structure; others through a better selection of materials or through prefabrication of certain parts, like standardized wall panels or combined kitchen and bathroom units; still others through a better utilization of space inside the house or through the inclusion of an increasingly greater number of household conveniences. Numerous such designs have already appeared as actual demonstrations, and many more are being developed on the drafting boards. In the belief that a comparison of these proposals may point the way to further experimentation, THE ARCHITECTURAL RECORD presents in the following pages, in addition to reports of various research activities, an illustrated review of some recently developed designs and structural systems. The descriptions are from information supplied by the designers and manufacturers.

RESEARCH FINDINGS OF BEMIS INDUSTRIES, INC.

By JOHN BURCHARD II, Vice-President

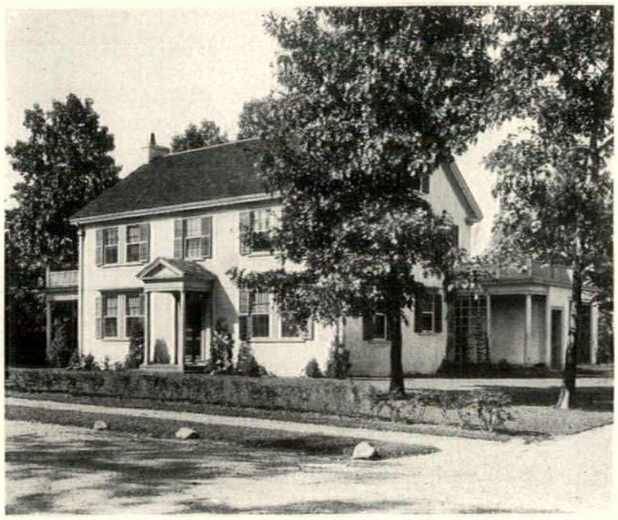
For upwards of a decade Bemis Industries, Inc., Boston, has been engaged in housing research with a view to producing individual houses more cheaply. During that period we have operated laboratories and through our subsidiary, Housing Company,* have yearly (until the last two years) built houses to test the methods which we have developed. During that period we have built houses embracing 22 different types of construction. We feel confident that over this period we have spent more time and money and effort on the problem than any other single organization in the United States. Our various constructions have reproduced to a surprising degree the basic principles now being urged by our more vociferous contemporaries, and for one reason or another we have given up most of these principles.

In spite of all this research we are unable to present today the plan, elevation and structural drawings of a house which we can offer and of which we can confidently predict that it will be a good buy for the customer and a profitable undertaking for us. Perhaps our long and not always happy experience has made us a little cautious. Perhaps we feel that some of the newcomers are in for disillusioning experience with their early leap into commercialization.

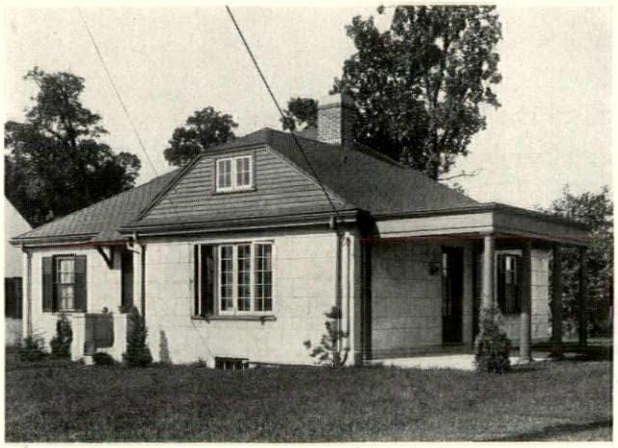
Our houses (see accompanying illustrations) may appear unduly large and not fitted to the income

*Housing Company is the outlet for the direct commercial exploitation of the ideas originated by Bemis Industries, Inc., which is primarily a management and operating company paying for all research and owning the patents.

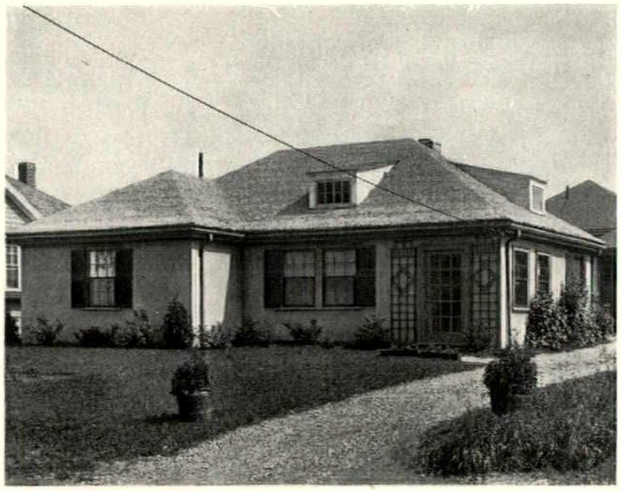
EXPERIMENTAL HOUSES



1925 HOUSE—WALTER PHILLIPS ESTATE
WELLESLEY, MASSACHUSETTS
GUNTHER AND BEMIS, ARCHITECTS



1926 HOUSE OF HARVEY L. DONALD
WALTHAM, MASSACHUSETTS
HOUSING COMPANY, ARCHITECTS



1927 HOUSE OF MRS. MARY HALLORAN
WALTHAM, MASSACHUSETTS
HOUSING COMPANY, ARCHITECTS

group for whom I presume we are all working. The reason for this lies in our method of research.

Our program for some time has been as follows: A scheme has been developed to a considerable extent on paper; we have then taken it into the laboratory and built full-sized sections on which we have made exposure, strength, fire, sound and insulation tests. If the intimations of these were favorable, we have then built a house with our own money. Since we hoped afterwards to sell this house we have tried to build houses of a type and in localities where they would find a ready market. It would scarcely be expected that we could build houses designed on a mass production principle very cheaply at the outset when the desired mass production was not available. Consequently we have sold our completed houses at the current market and the loss, if any, was the cost of research.

In our opinion there is no other way of testing a proposed house construction satisfactorily. A bona fide house must be built. And moreover we feel that a serious investigator will build the house with his own money and not with a customer's. Our customers have had a chance to see what they were getting before they bought, to buy at a favorable price, and the houses have been serviced after construction to a point which I think excessive, in order not to destroy the least vestige of good will.

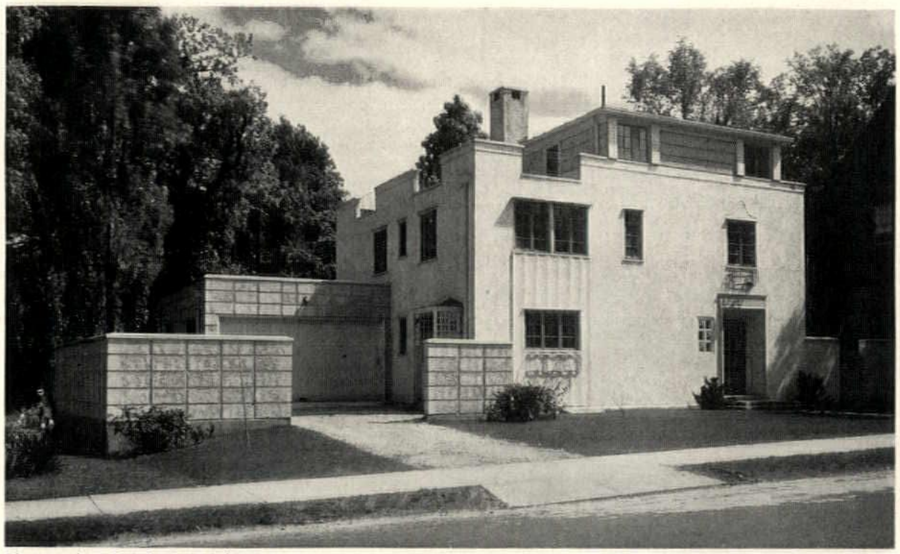
Our research program still follows the same general lines. To it we have added the step of model building, between the drawing stage and the laboratory stage. These models are carefully made in the laboratory with precision machinery and they often show up a defect in planning of the construction which otherwise would not be detected before the actual building was built. Typical wall sections are the easiest things in the world to draw and build. Any fertile-minded person could evolve ten or twenty a day. In laboratory tests of properties one usually deals with typical sections. But the most astonishing thing about typical wall sections is that they are not typical. The big problems of prefabricated housing come in joints, corners, wall intersections and openings, and these often come to light in the course of model making much more clearly than they do on paper.

I think I can honestly say that it is the ambition of this group to produce a house or houses (by that I mean constructions and not a single plan) which can be sold for less money than houses built in the conventional manner, with a view primarily not to profit for us but to ameliorating the housing conditions of the lower-income groups. But we are firmly convinced that under our present economic system no pro bono publico venture of this sort is worth anything unless it can demonstrate its ability to make a profit, however small. If our scheme or any other is such that no private initiative would be interested in it we cannot feel it to be a sound thing for public initiative.

BUILT BY BEMIS INDUSTRIES, INC.

1928

HOUSE OF FRANK G. AKERS
DEDHAM, MASSACHUSETTS
GUNTHER AND BEMIS, ASSOCIATES — ARCHITECTS



Photos by Paul J. Weber

1929

HOUSE OF MRS. B. C. ELLERY
BROOKLINE, MASSACHUSETTS
GUNTHER AND BEMIS, ASSOCIATES — ARCHITECTS

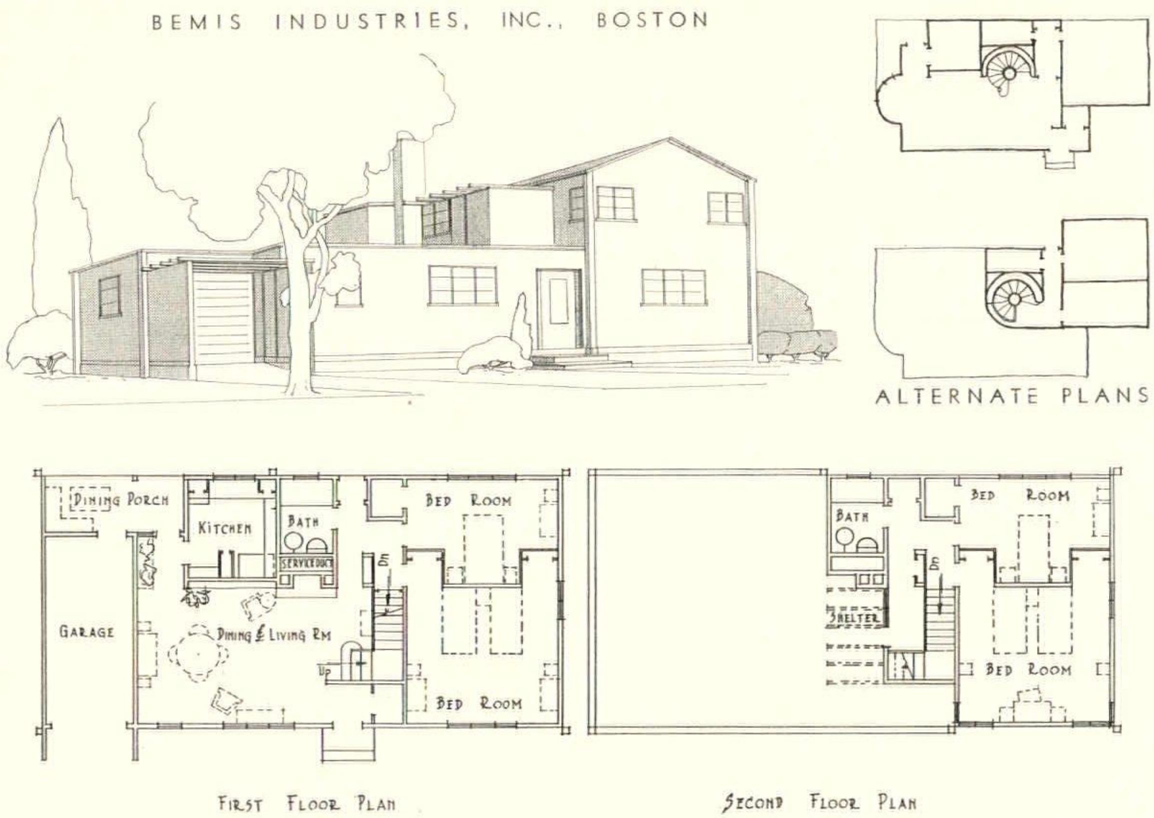
Historical Development

With this background I shall briefly sketch the work we have done over the past ten years:

1923-24. We built houses in Wellesley, Massachusetts, and South Tamworth, New Hampshire, as well as a dormitory for the Massachusetts Institute of Technology, with a scheme of which the basic principle was the premanufacture of built-up panels of wood extending story height with certain joints poured with concrete. This was a sort of self-forming scheme. It is still our conviction that where concrete or other cementitious materials are to be used structurally in a building the structure should be self-forming, that is, there should be no necessity for reclamation of valuable materials.

1925. We built three houses in Wellesley, Massachusetts, each slightly different. The broad idea, however, involved a light self-aligning steel frame for positioning only. Certain horizontal members of this frame served later for reinforcing for poured concrete floor beams. Precast gypsum blocks were used for walls and precast gypsum slabs 2 inches thick (see Fig. 1) spanned precast gypsum panels which were later filled with concrete to form the structural joists and also to bond the slabs together. Again here is the idea of self-forming of the structure together with the new conception of a positioning frame.

1926. The thin steel frame of a size which we could afford to use appeared perhaps not rigid enough properly to position members, so we developed in this year a gypsum tube 4½ inches in diameter and positioned our wall slabs on these tubes (see Fig. 2). Moreover we worked in the direction of lightening the slabs and produced an excelsior-magnesite material earlier than the Stockade block. This material has developed into our commercial material Acoustex. Some of the spaces between the tubes were poured. So again we had the aligning type of structure with self-containing



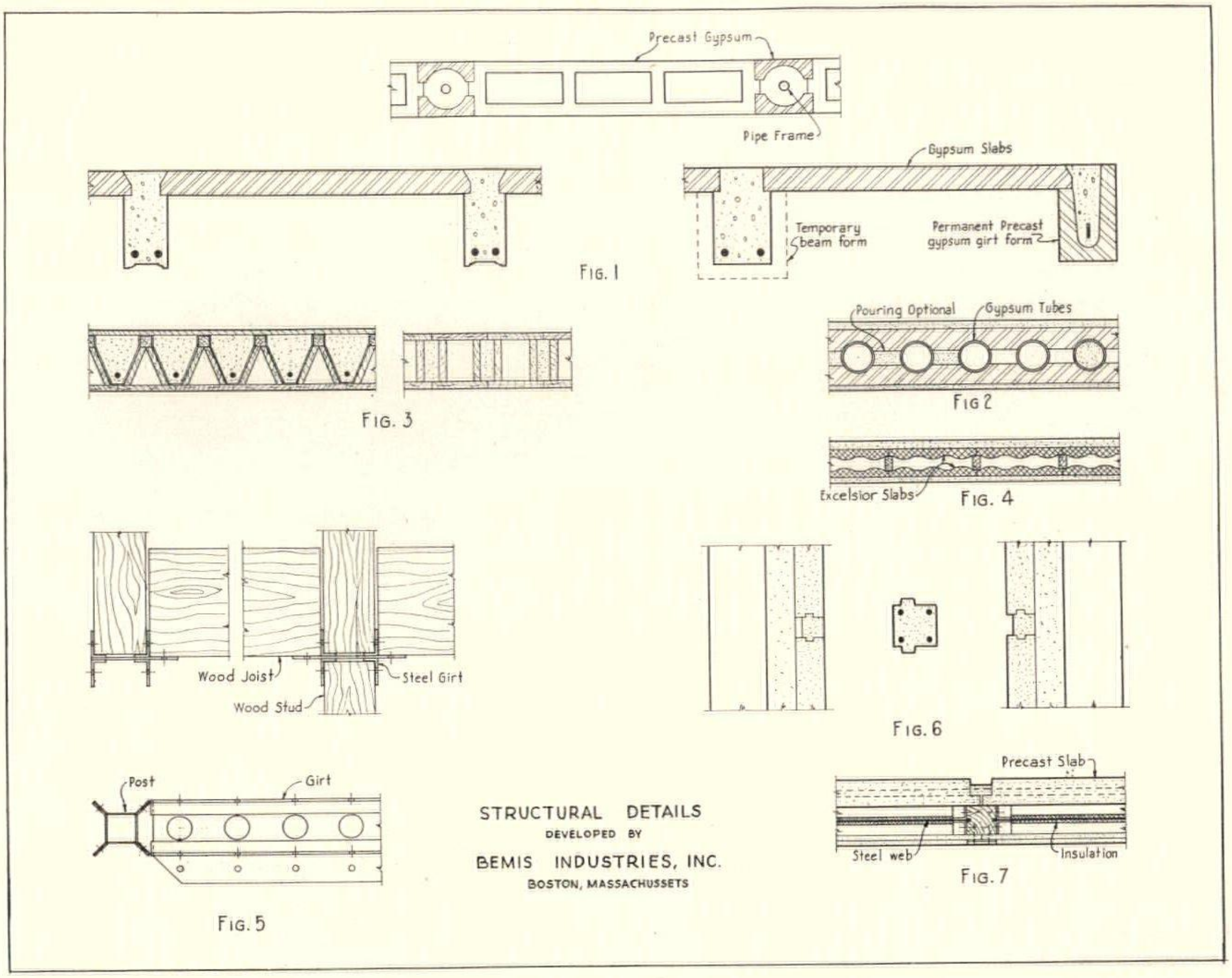
A RECENTLY DEVELOPED PLAN OF A HOUSE USING CENTRAL SERVICE DUCT

concrete forms. Here for the first time we achieved a small degree of prefinish with results that were not wholly satisfactory. Horizontality was the feature of the slab treatments of 1925 in Wellesley and of the six houses built in 1926 in Waltham, Massachusetts.

At the same time, however, in Hampton, Virginia, we embarked on a different approach, the beginning of what we call our Beamy-style system. In Hampton the wall units were of wood or of wood and Celotex of the cross section shown in Fig. 3. These were of wall thickness and of story height. Registering with the openings between them were openings between floor members of this cross section. These spaces were poured. The faces of the units were in some cases prefinished. Again this is the idea of self-forming members, but the story height principle is now added. There was no metal in these buildings other than the reinforcing necessary in certain floor joists. These houses were completed in—

1927, when we also built at Waltham two small houses of a Beamy-style type. Here we abandoned the gypsum tubes, built up story-height panels of considerable width (2 feet) with a slab of Acoustex on each side attached to two wooden vertical strips (see Fig. 3). The floor of these houses was conventional. The roof was slabs of Acoustex overlapped and covered with asphalt and slate chips to produce a roof looking marvelously like thatch, very inexpensive, and apparently very durable. Joints of the walls were poured with concrete. These houses were inexpensive but embraced too much conventional construction in floor and roof framing to seem attractive to us for a long pull.

1928. In this year we began the use of a steel frame which we have since marketed with more or less success under the name of the "A" frame. The frame was intended to serve as an aligning frame for our ultimate Beamy-style units. (We knew that in the long run we could not afford to build up Beamy-style units synthetically as we had done in the previous years, but in 1928 we had not yet developed a truly preformed and homogeneous Beamy-style unit. We were experimenting extensively in this field, however, largely with casting. The casting processes did not ultimately prove successful. At the same time we were trying to extrude wood pulp, but this also failed. Consequently the year found our frames but not our units ready.) We tried out the frames in four houses, two in Dedham and two in Wellesley, and later had orders for some others in the same towns. The frames were characterized by a girt of the



cross section shown in Fig. 5, the protruding plate being used to support floor joists. The frames in these houses were used with precut wood studs and joists and due to the repetitive punching of the holes in our steel members no rulers were needed and the framing was accomplished very readily. Sufficient steel studs and corner posts were used so that the steel could be erected first. This frame was not expensive as frames go. It was a marvelous method of aligning members. It produced a first-class wood frame house. But again it showed no ultimate process and we never regarded it as more than transitional device.

1929. Meanwhile we were working with other steel frames and had cheapened our process of making Acoustex to the point where when appearance was not necessary we could use it as an insulating slab. Accordingly, in 1929 we built an elaborate and somewhat modern house in Brookline, using a different type of frame with premade insulating panels. At the same time we returned to the always appealing idea of precast cementitious units with a new self-keying slab scheme which used 2-inch grooved slabs and long precast reinforced aligners with tongues on them (see Fig. 6). These slabs were keyed to the steel frame and formed a prefinished exterior and in one or two cases a prefinished interior as well, gypsum being used inside. The posts were poured. Here we had combined the idea of the steel frame with the vertical story-height Beamy-style units (in the form of insulating panels) with the horizontal earlier cementitious treatment and the bonding by pouring. The house cost too much and we think it always would.

1930. In this year we arrived at what we call a plate girder type of construction. Our Beamy-style units became panels of steel with a central web and angles around the edges, all quite small. These were fastened to girts and posts of similar cross section. Adjacent panels were jointed by a wooden asphalted strip with a saw kerf longitudinally into which the webs of the panels fitted, these webs projecting slightly beyond the back of the angles as shown in Fig. 7. We used our 1929 slab treatment on the outside and various self-keying panels on ceiling and walls inside. We allowed joints to show and attained a considerable degree of prefinish. If we had not covered the panels on the outside but had merely covered the joint with a U-shaped member we would have been pretty close to General Houses' Elmhurst scheme except that our panels were much more completely automatic.

This house showed a great deal of promise, but then came the depression and like most other organizations we had to draw in our horns somewhat.

Recent Developments

During the past three years we have consolidated this information and made a number of new developments:

(1) We have developed the manufacture of story-height wall units in pulp to a cheap and successful conclusion. The method is new and is patented. By it we can cast blocks of pulp up to 20 feet high, up to 4 feet wide, up to 9½ inches thick. A standard panel for our purposes would be 2 feet wide, 4 inches thick, and story height. We have worked with considerable success on prefinish of this panel which has a very high insulating coefficient (about 0.09 B.t.u.). We have succeeded in bonding metal to it and have also achieved interesting results with paints and synthetic resins.

(2) We have developed a self-keying partition using gypsum or transite wall boards in combination with a very simple steel stud which shows great promise not only for partitions but also for a simple exterior structure.

(3) We have developed a self-forming structure of burlap or of thin-gauge metals which is used for foundations and in which considerable economies can be effected where concrete walls are necessary.

(4) We are working on a new type of wood structure, not to replace our prefabricated structures but to occupy an entirely different field.

(5) In the field of materials we are most interested in applications of synthetic resins, in plywoods, and particularly resin-bonded plywoods, and in the new developments in Robertson Bonded Metal.

(6) During the past two years we have been supervising the publication of a three-volume work, "The Evolving House." The first volume dealt with *The History of the Home** and was by A. F. Bemis and the writer. The second volume, now on the press, deals with the economics of present-day housing and is by Mr. Bemis and Luther Conant. The third volume, on a method of rationalization of the industry, is in preparation by Mr. Bemis and should appear in 1934.

Immediate Program

We offer no house for sale today. We shall continue to push our research, confident that we are near a solution. In the spring we shall probably build houses embracing the new principles and adhering to those old ones which are tried and tested. It is quite likely that we shall supplement this with a series of model demonstrations perhaps under the auspices of a new corporation, Evolving House, Inc.

*Ed. Note: This volume is published by The Technology Press, Massachusetts Institute of Technology, Cambridge, Mass.; 534 pages, illustrated; price $4.

Our fundamental objective is better and cheaper housing on a self-supporting basis. We are committed to the exploitation of no individual material whatsoever. We have large numbers of patents in the housing field, many of them basic, and we will license these under proper safeguards to responsible parties. Whether or not we shall ever manufacture parts for ourselves cannot be stated now. Our inclination is that the house producer should not himself make the parts and certainly should not do the financing. We might even go farther and license others to do the house producing, reserving for ourselves the joys of experiment, development and education.

The backbone of all our planning, and basically patented, is the cubical modular system of design. This method is applicable even to conventional structures but applies with particular force to all forms of prefabrication. We are ready to license under this patent and believe that by such licenses the current factors in the housing field will profit both in improvement of their own product and in the cooperation they will obtain from other licensees. This system is really extraordinarily simple and beneficial. It will be explained in detail in Volume III of "The Evolving House."

Experience indicates that one of our principal structures over the next few years will be along the lines of Beamy-style—i.e., a prefabricated wall or floor unit containing its own finish, insulation, and structural strength.

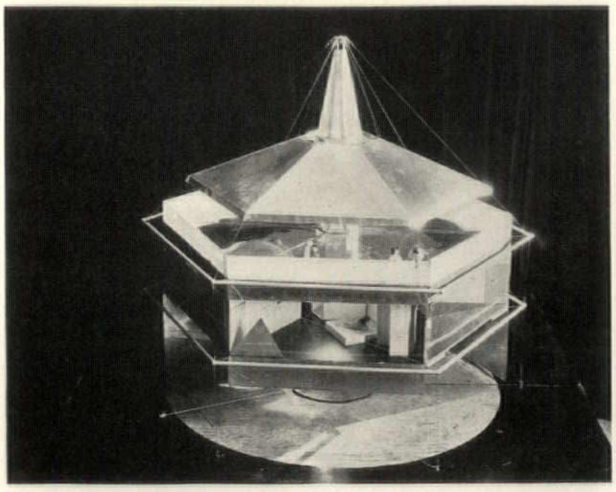
We believe in the elimination of water on the job if possible, but have a convenient forming scheme when poured materials are really necessary.

We shall continue to aim for the highest degree of factory manufacture as opposed to site manufacture and believe this necessitates integral finishes.

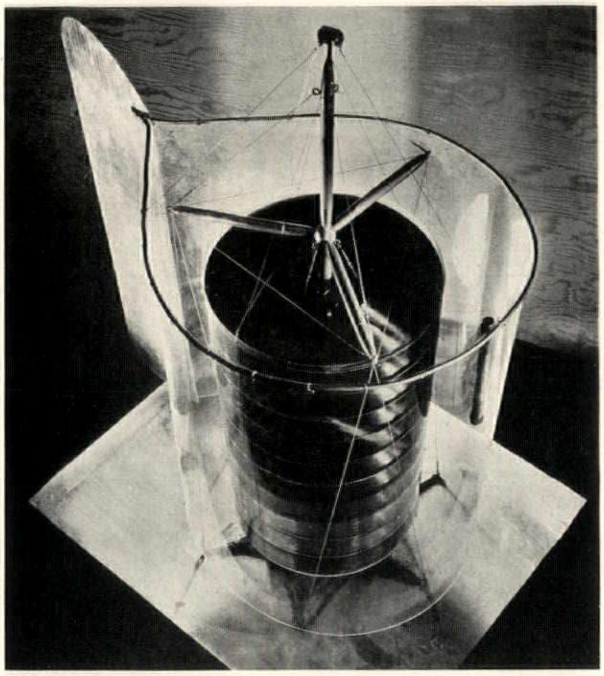
We shall continue to try alternative schemes until one proves clearly best. We are not in the business of trying immediately to commercialize one scheme before we know its faults and merits completely and to the exclusion of alternative schemes.

We think there is a good deal of merit in the central duct system, i.e., a modification of the Fuller and Bowman idea for handling services in a house. This is incorporated in a recently developed plan of a rather large modern house, which is illustrated on page 6, together with an alternate plan which we consider more attractive but probably not quite so suitable for mass production.

We believe housing in the United States will best be fostered not by the presentation of three or four or even twenty models of houses but by a system of planning and design which permits each and every buyer to have his own plan and design while using premade parts similar to those used by others. Our cubical modular system starts from this and our structures must conform to the criterion. We recognize that in commercial practice certain plans may be so good that they will merit repetition.

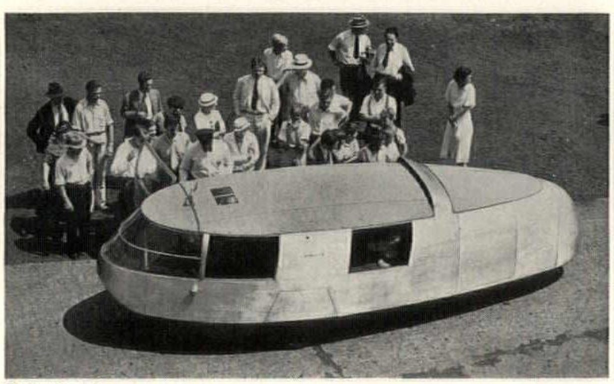


1929 MODEL OF DYMAXION HOUSE, SHOWING CENTRAL UTILITY MAST AND SUSPENDED FLOORS. (FIRST DESIGN: 1927)



© F. S. Lincoln

1932 MODEL OF 10-STORY HOTEL WITH REVOLVING STREAMLINED SHIELD FOR AIR CONDITIONING CONTROL



© F. S. Lincoln

1933 STREAMLINED DYMAXION SHELTER-MOBILE FOR LAND CRUISING—BUILT AT BRIDGEPORT, CONN.

DYMAXION HOUSES

AN ATTITUDE

By BUCKMINSTER FULLER

Reasonable persons have conceded the realization of the Dymaxion House within periods ranging from 10 to 100 years while the ultra-Tory dealing lavishly in thousand year units has tossed it lightly ages ahead or even into never-never land.

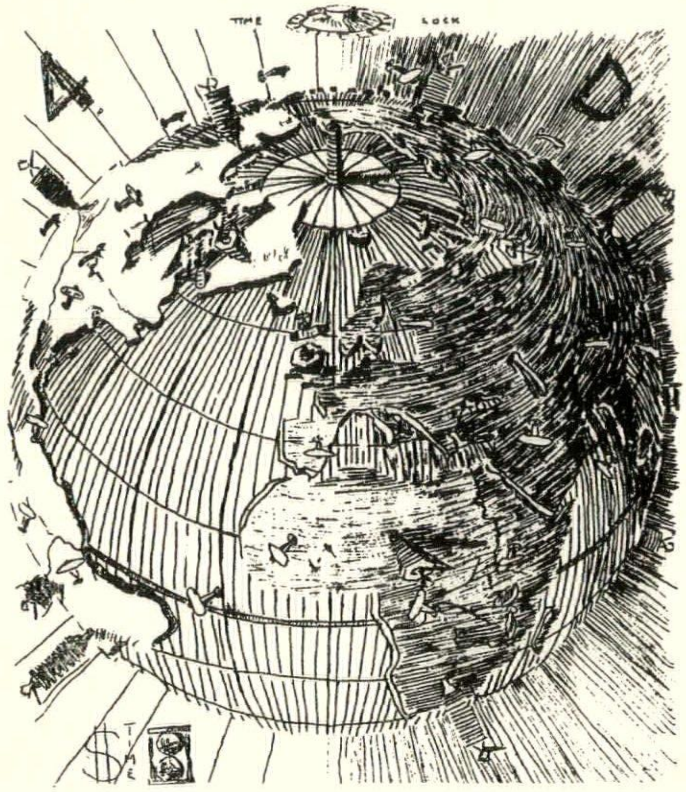
In July 1932 FORTUNE Magazine published a comprehensive stock-taking of the industrially-to-be-reproduced house. In the article there was considerable discussion of the principle involved in the designing of the Dymaxion House. A specially illustrated two-page spread in color was included in the article designed to show Dymaxion Houses in natural settings that the readers might visualize these otherwise theoretical structures. FORTUNE's editors were eager to have their readers envision the Dymaxion House or its progeny as a plausible article to be reproduced within a reasonable number of years.

The above event is recited to provide a characteristic example of popular or even specialized ability to forecast for there was involved an interesting anecdote. When FORTUNE had determined to illustrate the Dymaxion House in attractive color setting as above related they employed an artist skilled in the presentation of mechanical objects such as automobiles and boats. The artist held lengthy and detailed discussions with the designer of the Dymaxion House and acquired an excellent knowledge of its many details. He prepared and submitted his illustrations to FORTUNE. FORTUNE was pleased with the illustrations, but with one exception. Automotive vehicles were shown in the drawing like none they had ever seen. They were purely streamlined fishlike forms. The editors instructed the artist to remove these "incredible vehicles" from the picture and substitute everyday automobiles, fearing that the display of the former would tend to discredit the Dymaxion Houses, deemed indigestible enough. The designer of the Dymaxion House on hearing of this conferred with FORTUNE and explained that the automotive vehicles first in question were part and parcel of the original Dymaxion design, as every Dymaxion House was to have its transport unit just as yachts have their small boats, and that these truly scientific vehicles were quite as timely for popular usage as the Dymaxion House. "No," said FORTUNE, "while architecture, we will concede, is 2,000 years behind general industry, the automotive world is far advanced and we will not concede that your revolutionary design is as valid in the automotive world as your houses in architecture." That was July 1932. By July 1933 the second Dymaxion car had been finished and at the present writing industry is hastening its quantity reproduction. It is a proven and popular unit

DYMAXION TRAFFIC CHART

This illustration is a reproduction of a drawing from "Time Lock," a book written and illustrated by Buckminster Fuller in 1927. It illustrates the town plan for which Dymaxion shelters were designed. The Dymaxion shelters shown thereon indicated the author's notion of the areas of high future importance, for with the production of highly transportable scientific shelters the Arctic Circle and the Tropics may be readily developed as regular air courses. As the author writes: "When the illustration was made in 1927 the routes involved were deemed fantastic as was also the colonization of the Arctic Circle by Russia, indicated by the Dymaxion Towers. Today the subject matter is so much a matter of fact as almost to preclude its publication except as a vivid reminder that the portion of the human family which has believed in and striven for the 'new deal' in its comprehensive form is not long to be kept waiting."

Chart statistics: 26% of earth's surface is dry land; 85% of all earth's dry land is here shown; 86% of all dry land shown in above equator. "The whole of the human family could stand on Bermuda; all crowded into England they would have 750 square feet each."



with almost twice the efficiency of the traditional automobile. FORTUNE, an acknowledged modern, could not see one year ahead, even though declared friends of Dymaxion.

Theoretically the two world air routes most recently coursed by the Lindberghs, i.e., to the Orient and Russia via Alaska, and to Europe and Africa via Greenland and Iceland, were evident to the world-considerate architect years ago and academic to the scientifically minded for some time past, yet until Lindbergh had actually landed at the New York Airport on December 19, 1933, having jauntily traced and retraced his routes, was a notion of popular transportation by air over the pioneered track conceivable? It takes material demonstration to win popular credence of scientifically-arrived-at theory. This factual accomplishment derides Nationalism.

The Dymaxion House is still as it has been for years—a theory only. Despite pragmatic criticism it has conscientiously been kept so. While theoretical it is immediately improvable by every scientific advance. Its monthly improvements and inclusions are vaster than the yearly refinements and inclusions in the autmotive world, as it has never been burdened with "overhead" nor with heavy industrial-investment earning-requirement.

The Dymaxion House rather than being a fixed solution has been naught but a statement of the problem, progressively satisfiable in the latest manner.

It might even be more broadly stated that the Dymaxion House has been merely an attitude. An attitude of willingness to think truthfully. To think truthfully of the general problem of life's survival and its potential solutions in the terms of the latest achievements of the intellect, quite unfettered by history's relatively temporary national, political and aesthetic bonds. Such bonds are not habits of thinking but habits of not thinking. Dymaxion Houses may be conceived of as progressive composites of the best means of living as determined by universal survey.

Dymaxion shelters are germane to the emergent scientific (as opposed to political) socialism. The first full-sized research and demonstration of Dymaxion Houses requires probably an expenditure of millions of dollars. Millions of dollars have never been accreditable to the large army of designers and craftsmen now qualified to make the demonstration. The social implications of Dymaxion Houses have eventually rendered them nonsupportable to profit-minded private capital in each instance of past consideration. It has long been evident that demonstration sufficiently uncompromised to be successful could only be accredited by government subsidy. The central object of this article is the reasonable prediction that out of the fourteen billion dollar sum now contemplated for building (in its many departments) through government credit, there will soon be apportioned an adequate amount to underwrite the scientific development of shelter. The sore want of such underwriting must be evident in the answers to the questionnaire which THE ARCHITECTURAL RECORD has put out covering this subject.

It is worth remarking that at present the chief obstacle to such Federal underwriting of scientific shelter is the current espousement of the Public Works program by the organized revivalists of the multitudinous obsolete activities inherent in the tailored building of past land exploitation dominance, abandoned to death in its sleep by decentralizing scientific industry.

The items of the questionnaire sent out by THE ARCHITECTURAL RECORD to provide an able survey of the advance into the everyday industrial world of a Dymaxion attitude constitute an approximate list of the questions employed by Dymaxion designers since the conception of the idea. They were known as "universal conditions of reproducible shelter."

How much do houses weigh?

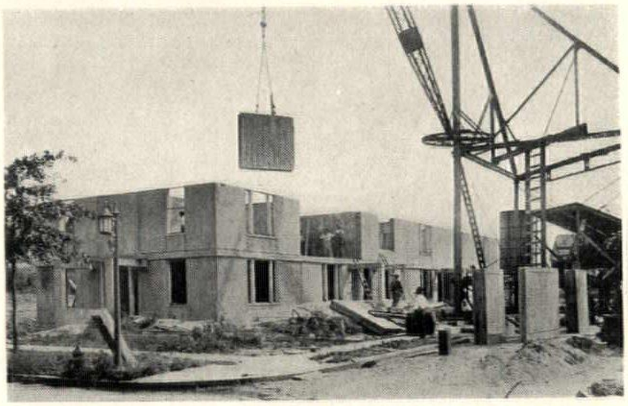
What is the specific longevity of the structure? of the entire shelter composition and its mechanical constituents?

What is the specific longevity of the structure?

Is the design to be sold or to be an incidental instrument of a service to be rendered such as a universal hotel and travel service might provide?

To THE ARCHITECTURAL RECORD'S questionnaire might be added a question: "Does your design emphasize life or death?" This question should not be interpreted in the aesthetic manner: "Is your architecture living or dead?" When in time ideas materialize sufficiently to be called architecture they are inevitably dead. Architecture is finite—life infinite. Maybe life is an idea—an idea that truth is progressively delightful.

1918 DEMONSTRATION GROUP 48
FOREST HILLS GARDENS, LONG ISLAND



Among the earliest examples of standardized unit construction are a series of group houses built by Grosvenor Atterbury in New Jersey and Long Island, beginning in 1907. Precast wall, floor and roof sections, composed of different materials, were assembled on the site. In this case concrete was used and the units were hoisted in place by means of a crane.

STANDARDIZED UNIT CONSTRUCTION

GROSVENOR ATTERBURY, ARCHITECT

COMMUNITY PLANNING WITH TRANSPORTABLE HOUSES

By TEMPLE HOYNE BUELL, Architect

Land is available in almost unlimited quantities along our main highways and within a radius of 20 miles of our cities that can be purchased for $200 an acre or $40 a site. At this figure an owner could rent a site for $8 a year and return the farmer 20 per cent gross on his land which is more than could be got by raising crops.

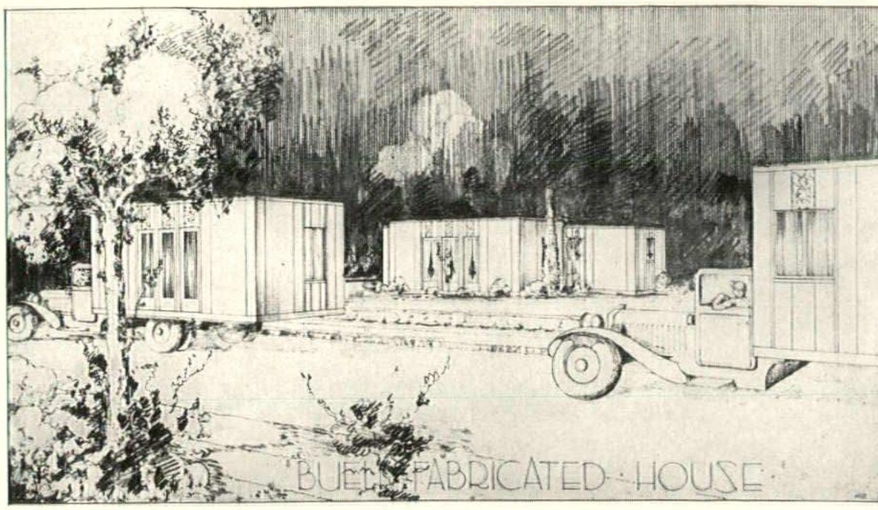
The rental of the site would have an advantage in that if the owner did not like his neighbors or should work become scarce in the neighborhood, he could have his house easily moved to another site. An owner of a standard house could thus become practically independent of the landlord. He could have his own garden in which to raise vegetables and flowers about his home. He would be able to purchase, direct from the farmer from whom he was renting a site, such farm or dairy products as he himself is incapable of producing, at a figure greatly reduced below what he must pay for them in the city. The produce would be fresher and, because no middle man would be involved, would return the farmer more than he is now accustomed to receive.

Every one would, by being less congested and the population as a whole less centralized, be able to live freer, cleaner and healthier lives, and the nation would benefit in that there would be developed a much stronger and sturdier race.

BUELL FABRICATED HOUSE SYSTEM

DENVER, COLORADO

T. H. BUELL & CO.
ARCHITECTS



Actual production has not yet begun, although small-scale working models have been prepared.

Occupancy: parents and either a child or an elderly person. Additional units can be added to provide for more occupants.

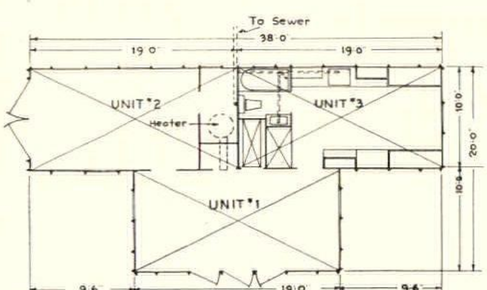
Cost: $1,200, delivered to the site, "when manufacture and distribution shall have approximated one-half the efficiency in production evidenced in the automotive field." Maintenance would depend on location, but would be far below usual expenses. Present plans call for methods of manufacture, distribution, sales, delivery and finance similar to those employed by General Motors Corporation.

House designs are intended to have every available labor-saving device. New products and equipment to be incorporated in succeeding yearly models.

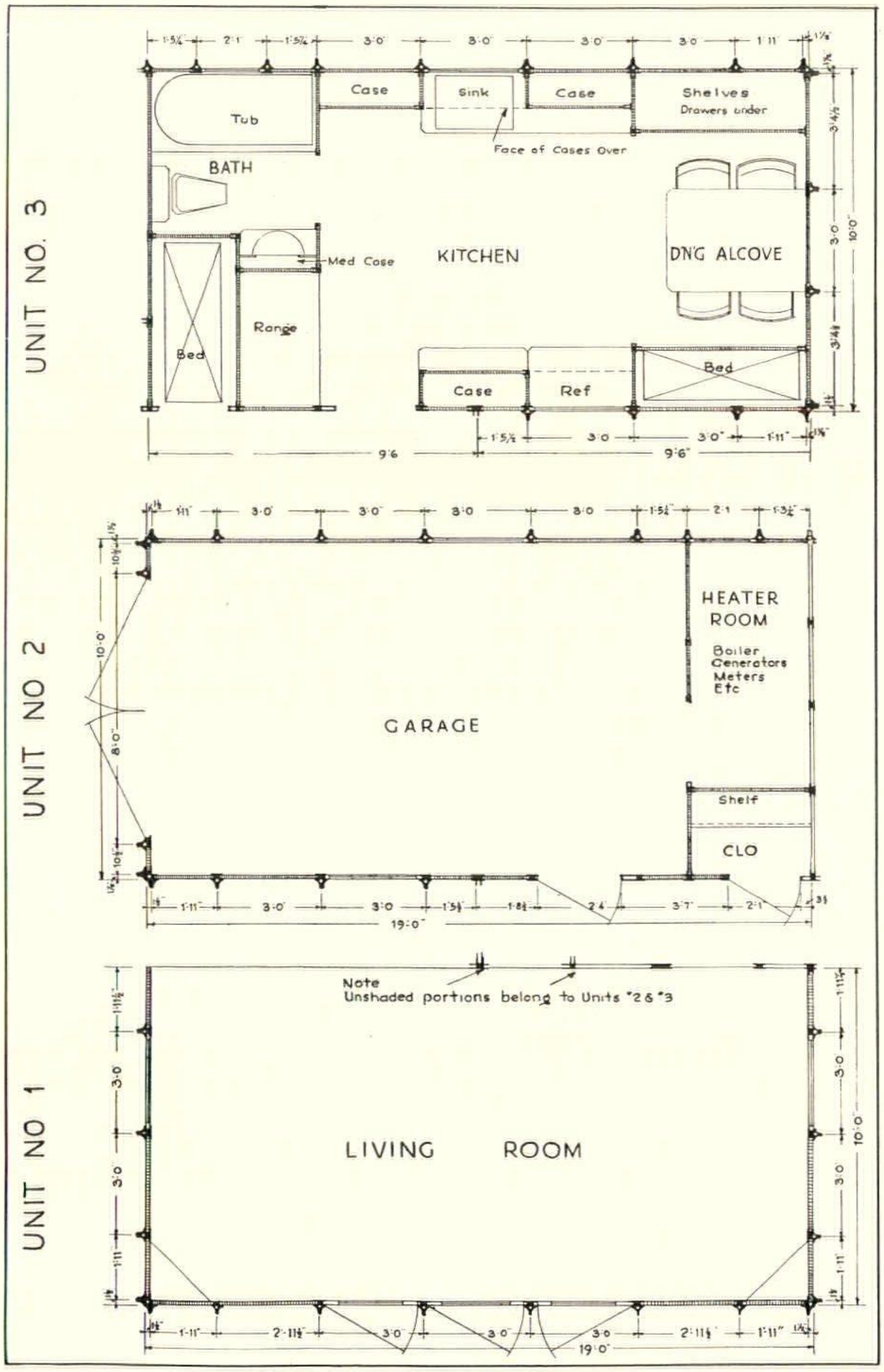
Air conditioning equipment to provide heated or cooled, humidified, filtered air. Atmospheric circulation by a fan system driven by the motor which generates the required heat through resistance coils.

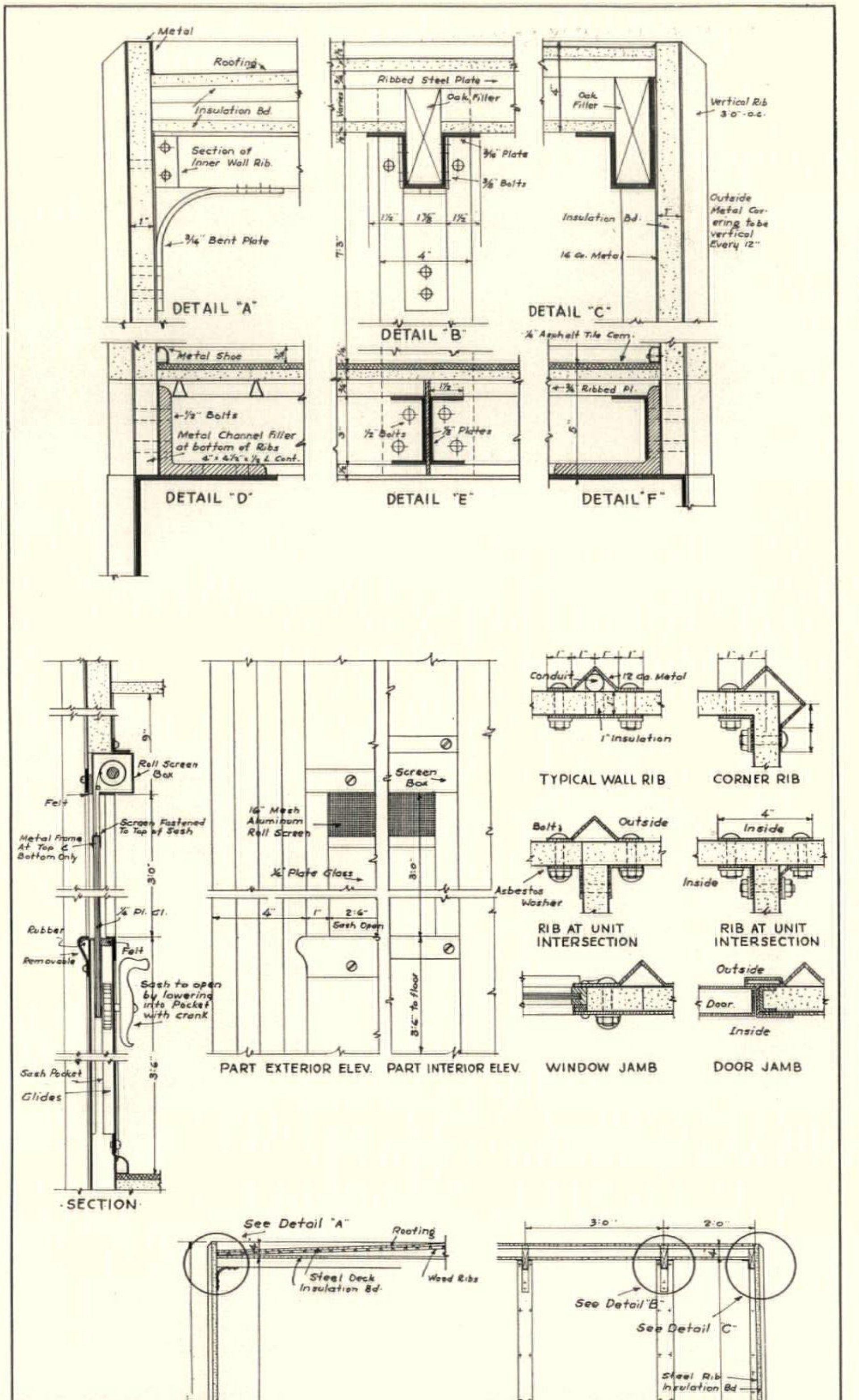
Illumination: both direct and indirect. Current from a generator in the dwelling itself.

As much furniture as possible is built into the interior design. All furnishings, bedding, dishes and utensils of every variety needed for immediate housekeeping included in purchase price and delivered with the house.



FLOOR PLAN





BUELL FABRICATED HOUSE SYSTEM

DENVER, COLORADO

T. H. BUELL & CO.
ARCHITECTS

All services and utilities to be provided, except water connection and sewage disposal. Where facilities are not provided by the municipality, accessories can be purchased so as to make the unit self-sufficient. Small garbage disposal plants available for country use.

Structural system: metal frame throughout. Exterior metal wall surface designed to care for expansion and contraction. Interior wall surfaces of metal with provision in design for ducts, conduits and pipes. Metal floors with manufactured covering. Metal roof similar in construction to automobile top.

Structural values: being practically fire-resistive, house should carry more favorable insurance rating. Being a structural entity in itself and requiring no prepared foundation aside from a level piece of ground, house would be unaffected by earthquake. Materials immune to attack by insects. Moisture filtration negligible. Thermal insulation by means of a crushed non-corrosive metal filler between exterior and interior wall surfaces.

Weight: approximately 3 pounds per cubic foot.

Construction entirely shop-fabricated. Approximately 24 man-hours required for assembly on site. Trucks carrying individual sections to the location will be supplied with cranes capable of lifting each section and setting it in its proper place, after which the units will be bolted together. As soon as furniture and dishes are unwrapped and fuel put in motor, the house can be occupied.

Outmoded or damaged units can be replaced, or others added, with no greater expense or inconvenience than required in setting up original structure. Expected life span of house: 5 to 10 years, depending on financial independence of owner. Demolition in less than 20 man-hours.

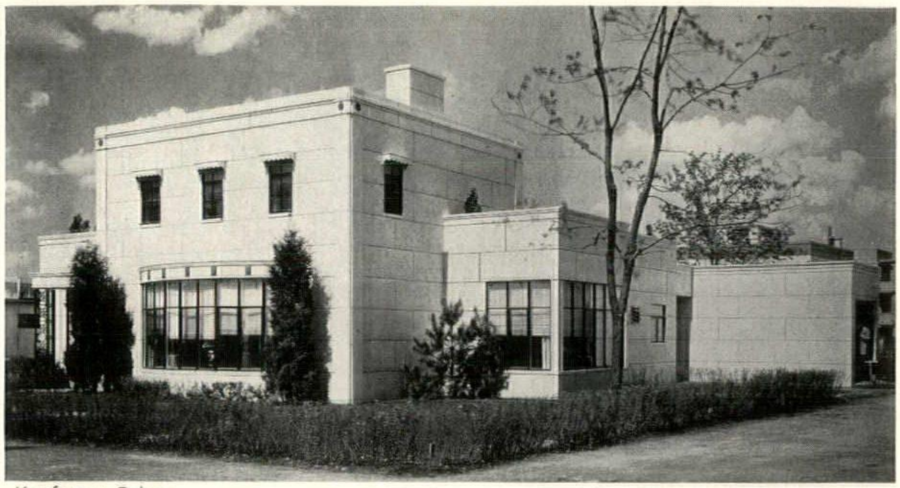
Potential salvage value would be approximately that of worn-out automobile which is taken in trade on a new model.

STRAN-STEEL HOUSE

CHICAGO WORLD'S FAIR — 1933

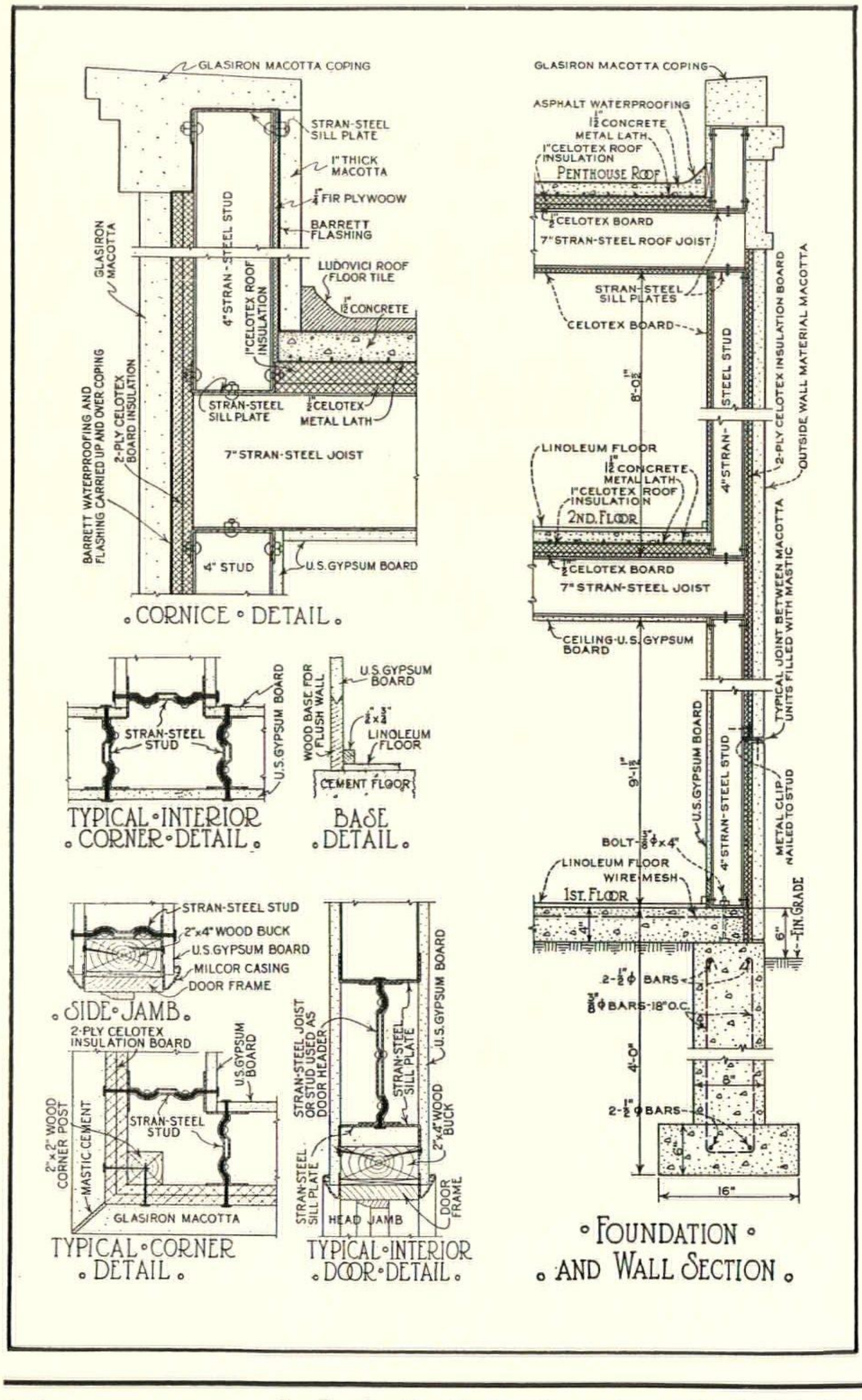
STRAN-STEEL CORPORATION
AND GOOD HOUSEKEEPING

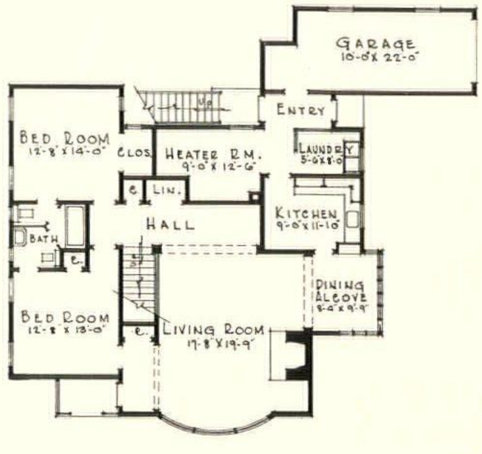
O'DELL AND ROWLAND, ARCHITECTS
DWIGHT JAMES BAUM, ASSOCIATE



Kaufmann-Fabry

COST OF DUPLICATION: $9,000, CHICAGO PRICES





FIRST-FLOOR-PLAN

According to manufacturer: "Not a prefabricated steel house, but a system of steel members which replaces wood joists and 2" x 4"s. All the well-known collateral building materials are nailed to Stran-Steel just as they are nailed to wood lumber."

Stran-Steel consists of 2" x 4" studs and rafter, 2" x 2" joists, and connections of 16- and 13-gauge steel, formed and riveted so that a nailing groove runs lengthwise on two sides of each stud and joist. When building materials are nailed to these members, the nails follow the sinuous shape of the groove and clinch themselves firmly into place.

The exterior of the Century of Progress house is covered with Glasiron Macotta slabs, 1¾" thick, 2 feet wide and from 2 to 8 feet long. This material consists of a layer of lightweight Haydite covered with thin-gauge steel which has a weather-resisting coat of porcelain enamel. After 1" Celotex insulation has been nailed to outside of steel framework, the Macotta is nailed on by means of right-angle metal clips and the joints are sealed with mastic tape. No plastering and no water used in construction except in laying concrete floor slabs.

COLUMBIAN HOMES

COLUMBIAN STEEL TANK CO. KANSAS CITY, MISSOURI

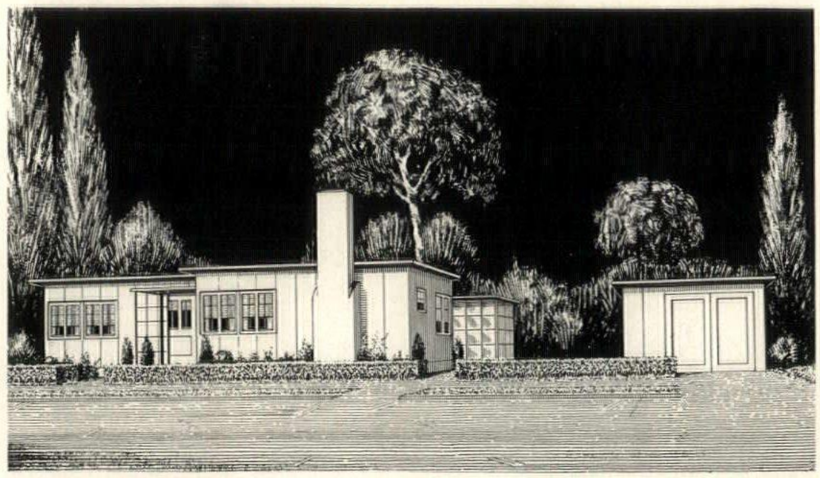
This company manufactures two types of steel buildings:

(1) Standard Framework Type, developed more than 20 years ago and now in use for pump houses, warehouses and general commercial utility. Construction: angle framework supports bolted wall sheets and unit-welded steel trusses with purlins support roof sheets; all standardized sections.

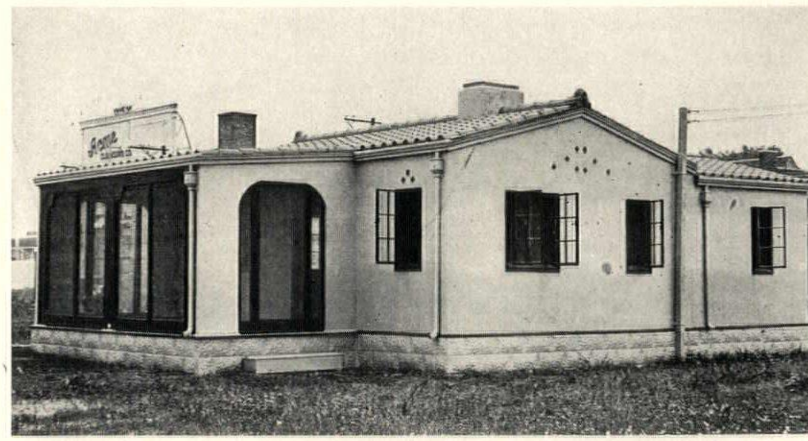
(2) Panel or Frameless Type, a recent innovation. Four sizes of simple panels made of flat sheet formed to a flanged channel, measuring 6", 12", 18" and 24" in width and 8', 9' and 10' in length. When bolted together with sealing compound in joints these panels form a flat-surfaced exterior wall. Where openings are required, panels are omitted and a window or door frame substituted. Insulation material, interior trim, roofing materials and exterior finish are optional with each purchaser. Electric wiring, fixtures and plumbing are not furnished.

This system of wall and roof construction is stated to be flexible enough to be used for practically any given building. Floor plans are not standardized, although sketches of typical residences are used to promote the use of the standardized building parts.

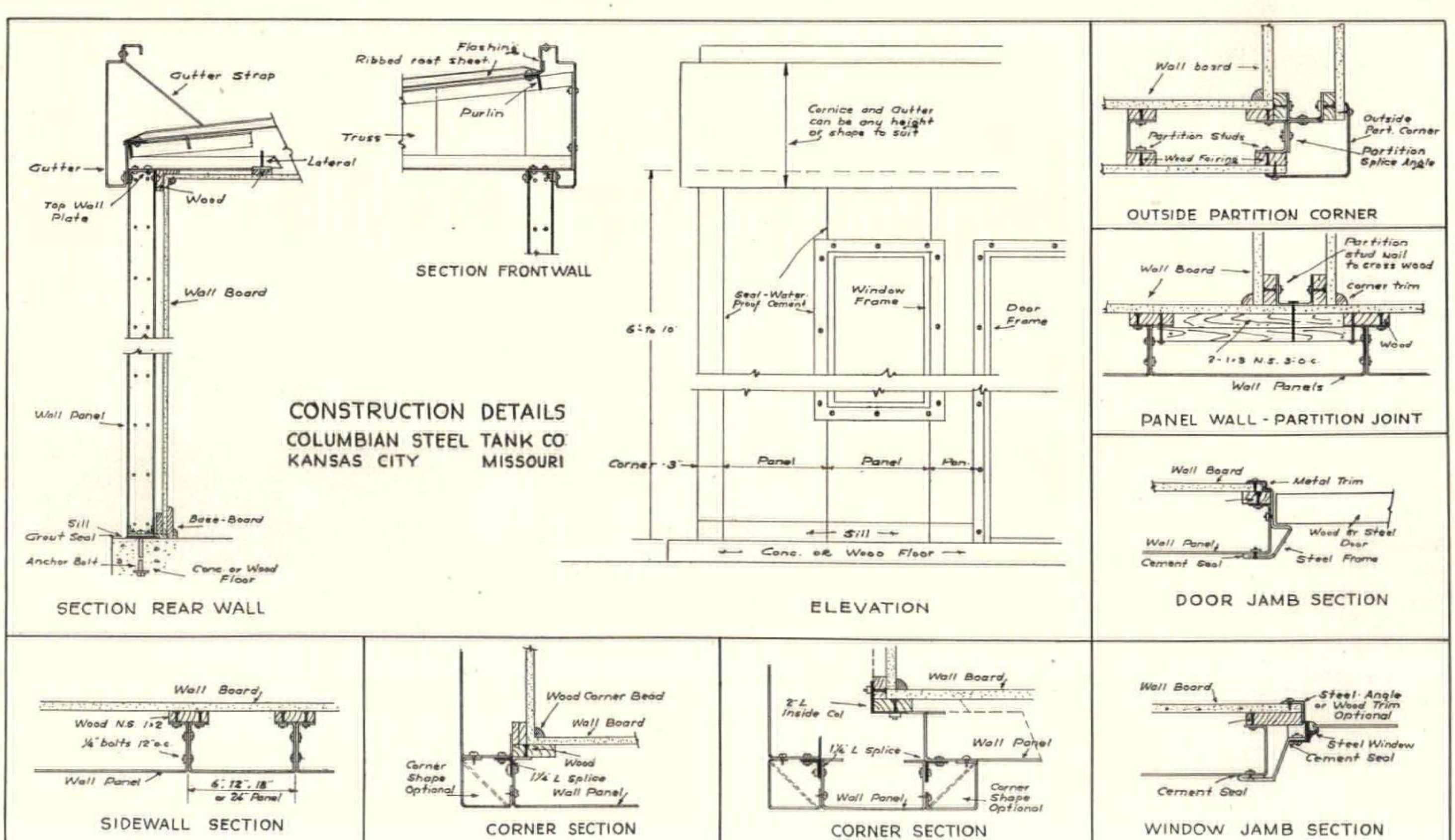
Prices are quoted on any custom-style house utilizing the standard construction. According to manufacturer's prospectus: "A perfectly plain building with a minimum of ornaments is of course the most reasonable in price."

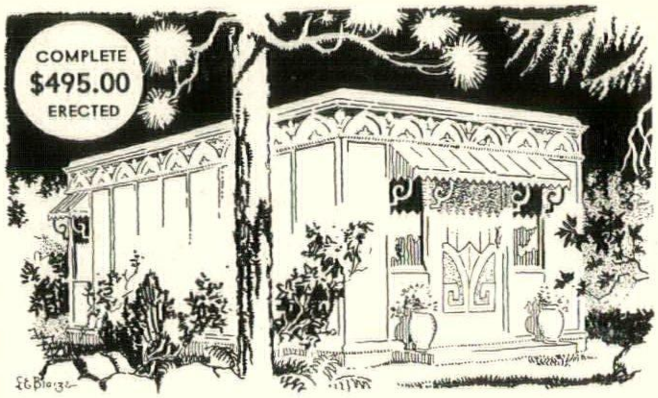


$1,000 CLASS—"ORNAMENTAL IN ITS SIMPLICITY"

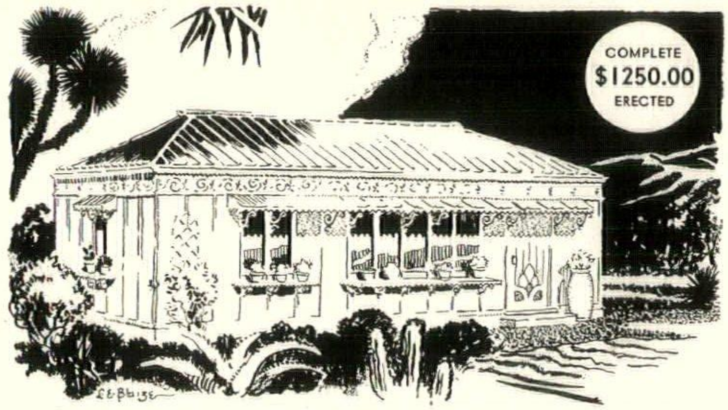


"HONEYMOON HOME"—BUILT OF 14 LARGE SECTIONS ASSEMBLED IN A SINGLE DAY





"WAYSIDE" MODEL
Complete with wall bed, lavatory and other conveniences, including electrical heating equipment.



"CONTENTMENT" MODEL
Price includes electric refrigerator and stove, heater, bathroom, fixtures, etc., as well as household furnishings.

These houses, completely shop-fabricated, are designed for bun galow courts, auto camps, and vacation resorts.

Prices quoted are F.O.B. Los Angeles and subject to change without notice.

All equipment necessary for household operation included in price of each model. The "Contentment" Model, according to manufacturer's announcement, offers electric refrigerator, electric stove, electric or gas water heater, solar water heater, Crane enameled sink with chromium fittings, wall bed, electric wiring, lighting fixtures, electric lighted house numbers, electric door buzzer, electric clock, Yaxley radio outlet, all plugs and switches. Metal cabinets are provided in kitchen and bathroom. Metal letter box and milk box also included. Bathroom is complete with Crane toilet, lavatory, overhead shower, and other accessories.

Air conditioning equipment provides heated or cooled, humidified air. Solar water-heating system has insulated storage tank.

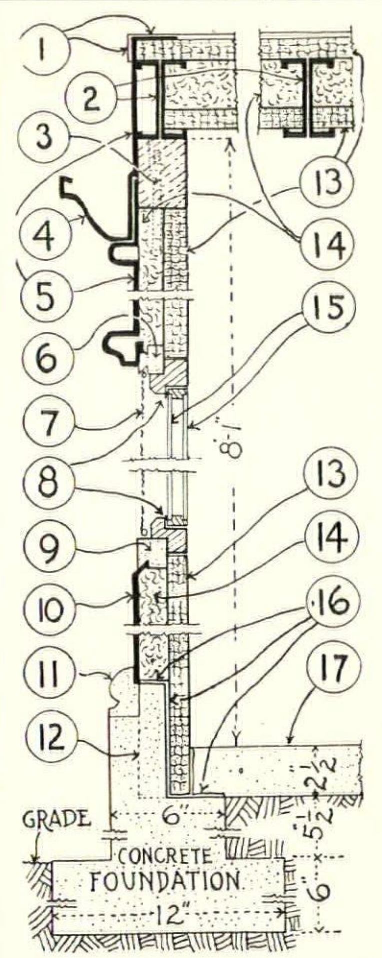
NATIONAL STEEL HOMES

HOLLYWOOD, CALIFORNIA

Patented by HARLEY S. BRADLEY

Structural features: both house types are insulated steel construction throughout. The structural system is proof against earthquake, fire, lightning, dust, weather and dampness, vermin, pollen and noise. All joints permanently sealed. Windows consist of two sheets of glass with air space between. Gasket-lined windows and doors provide maximum protection against drafts and dampness. Copper-bearing galvanized steel is rust-resisting and unaffected by dry rot or termites. Welded or bolted construction provides maximum resistance to stresses and strains.

Entire house can be transported by truck and erected by any mechanic or carpenter.



1. Composition, water-proof roof.
2. Ceiling and roof beams of 16 gauge steel.
3. Stud bolts secures ceiling plate.
4. Conventional gutter and flashing.
5. Ornamental frieze with over-lapping connection.
6. Head jam—cross section.
7. Wire-framed screen snapped into recess.
8. Dust-proof and leak-proof window gaskets.
9. Sill plate.
10. Interlocked steel wall plates.
11. Cement water table.
12. Concrete foundations, formed with pockets to receive studding at 16" intervals, make the studding an integral part of foundations, and produce the strongest possible construction.
13. "Canec" insulation wall board, 1" thick, which covers interior surfaces, may be used as the base of any interior decoration, such as plaster, wall paper.
14. Fire-proof rock wool fills space between steel plates and insulation board.
15. Two sheets of crystal glass, set 1" apart in mastic and metal sash.
16. Waterproof membrane on inside of foundation wall plates and insulation board.
17. Reinforced concrete flooring, 2½" thick, secures insulation board on all sides.

AMERICAN HOUSES, INC.

NEW YORK CITY

HOLDEN, McLAUGHLIN AND ASSOCIATES ARCHITECTS

This company, now entering its second year of building production, offers some 30 standard houses of prefabricated construction. Prices range from $1,975 to $15,000.

Standard equipment includes cooking, water and house heating equipment, air humidity control and circulation, electric fixtures and interior wiring, interior plumbing and complete interior and exterior decoration.

Heating: combination kitchen range, house heater, and hot-water heater, completely insulated; equipped with built-in humidifier, employing the forced air method of household heating electrically controlled.

Air conditioning: by utilizing the metal ducts to rooms installed with the standard combination house heater, for a comparatively nominal additional charge there can be added equipment for complete air conditioning which furnishes clean, cool, dehumidified air thermostatically controlled.

Foundation: concrete block, 8" wide by 4 feet deep around entire plan; 3-foot air space below first floor for additional insulation and dryness; includes pit containing ash receptacle, which rolls from position directly under range to space external to the building, making ashes readily accessible for removal.

Frame: fabricated steel on 4-foot centers; no part exposed to weather; the frame rigidly secures exterior walls and supports roof structure with a large factor of safety.

Floors: open-truss steel joists on foundation with fire-resistant composition planks, having high heat and sound resistance; finish floor of laminated cushion blocks; heat insulation equivalent to 1½ inches of cork.

Exterior walls: heat and sound insulation faced both inside and out with durable asbestos cement sheets; outside painted, inside finished with washable colored material of numerous patterns; heat insulation equivalent to a wall consisting of 16 inches of brick, with ½ inch of rigid insulation and ½ inch of plaster.

Roof: steel joists with fire-resistant composition planks covered with bonded built-up roof; 16-inch air space between roof and ceiling sections, having high heat-resistant characteristics; heat insulation through combined roof structure equivalent to 3 inches of insulating composition—in comparison, average refrigerator has 2 inches of similar heat-resistant insulation.

Windows: tested steel sash with inside screens; cranks which permit opening windows without removing screens.

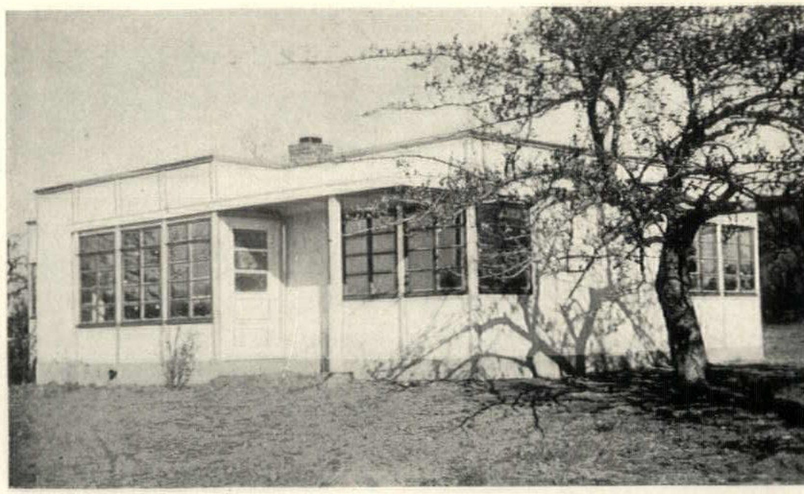
Doors: white pine painted with three coats of lead and oil; hung in steel jambs.

Plumbing: copper tubing with fixtures compactly centralized with other mechanical equipment.

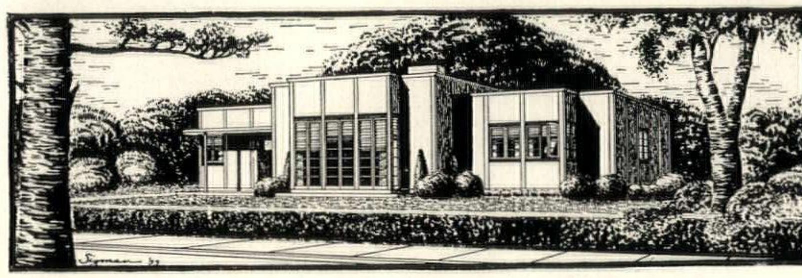
Electrical work: ceiling and base outlets in all rooms.

Interiors: ceilings painted with washable paint; ceiling height 8 feet above floor level; ceiling heights of 10 feet or higher can be furnished.

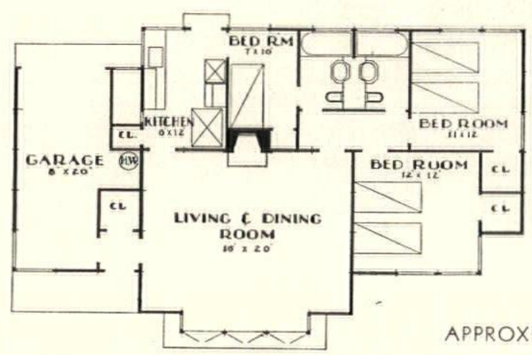
The houses can be assembled within 6 to 8 weeks, ready for immediate occupancy.



HOUSE BUILT AT CHESHIRE, CONNECTICUT
COST—$4,725, WITHOUT HEATING, COOKING, REFRIGERATION

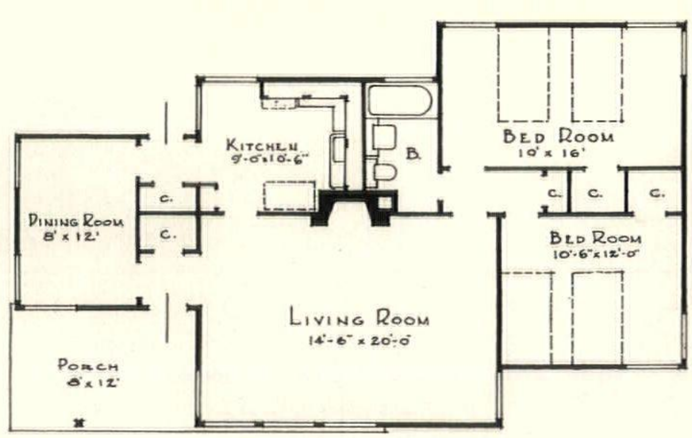


MODEL L—5 ROOMS, 2 BATHS, PORCH, GARAGE



PLAN OF MODEL L

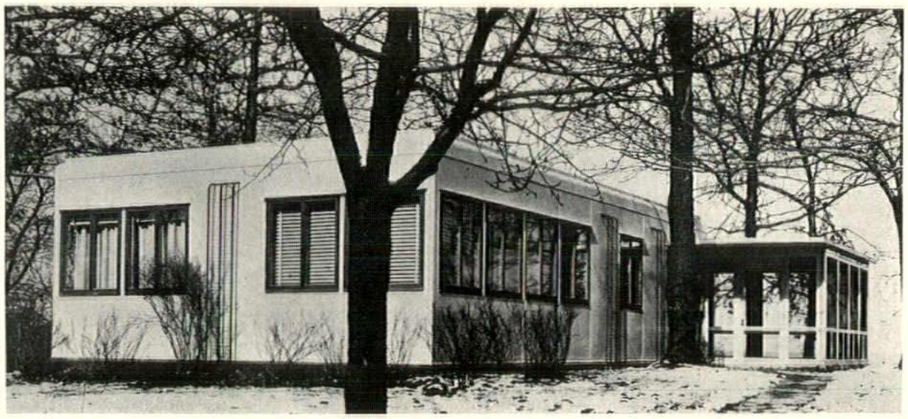
APPROXIMATELY $7,000



PLAN OF HOUSE BUILT AT CHESHIRE, CONNECTICUT

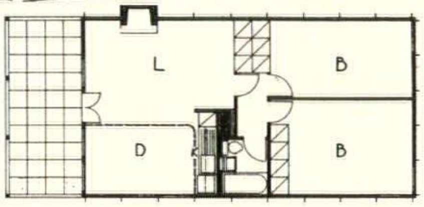
GENERAL HOUSES, INC.
CHICAGO

HOWARD T. FISHER
ARCHITECT



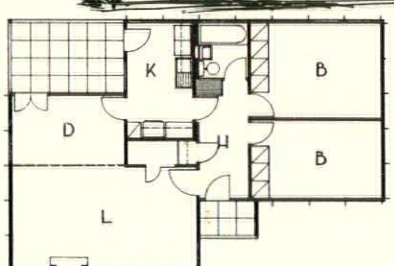
RUTH PAGE HOUSE IN WINNETKA, ILLINOIS

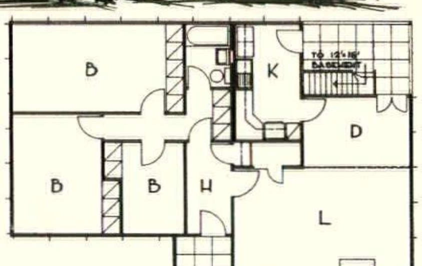
$4500 UP
MOHEGAN
R5P



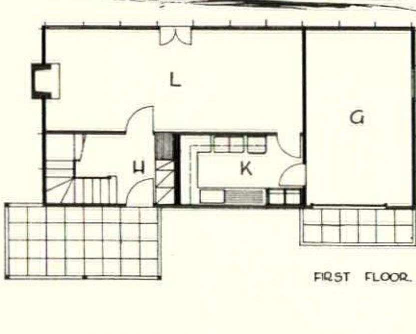
$5450 UP
ELMHURST
K3H4DP

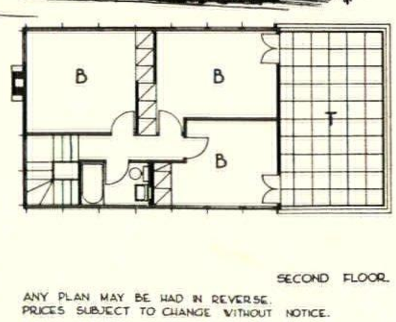
$6900 UP
STANDISH
K3H5DQ





BARRINGTON
T4H5G
$8550 UP





FIRST FLOOR

SECOND FLOOR

ANY PLAN MAY BE HAD IN REVERSE.
PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

This organization designs, builds and sells individual houses constructed of standardized parts. First house erected at Winnetka, Illinois, in winter of 1933 for Ruth Page.

Prices quoted on accompanying sketches are for houses completely erected on typical lot, exclusive of freight. Estimated yearly maintenance: $50 to $60 for average small house. At present units are sold direct; installment purchasing contemplated.

Standard equipment, foundations, plumbing fixtures, automatic heating, electric wiring and fixtures, screens, linoleum or wood finished floors, built-in wardrobe cases, kitchen cabinets, and porches or terraces are included in sales prices. For reasons of economy few automatic devices except thermostats are included.

Air conditioning: forced circulation of warm air, filtered and humidified. Cooling system available as extra.

Sewage disposal: connection to city sewer system or to septic tank.

Structural system: see outline specifications on opposite page.

Structural values: high degree of resistance to corrosion and physical deterioration, to moisture and atmospheric filtration, and to thermal transmission, determined by field tests. Construction largely noncombustible. Exterior painted a light shade to reflect radiant heat. Considerable sound insulation, but results inconclusive as yet.

Structural weight: approximately 3.5 pounds per cubic foot.

Houses assembled from factory-made steel panels. Approximately 600 man-hours required for house now being erected in New London, Conn. No special equipment involved in assembly. House can be occupied as soon as paint is dry.

Structural changes and alterations can be made very easily. Expected life span of houses: if properly maintained, forever. Time required for demolition: very short. Potential salvage value: very high.

OUTLINE SPECIFICATIONS

These specifications represent the current practice of GENERAL HOUSES, Inc., and are subject to change without notice.

Foundations and Basements: Concrete, reinforced as required.

Floors: Linoleum on felt on insulated steel panels (except floors on earth to be linoleum on insulated concrete slab on cinder fill).

Walls: Prefabricated panels of rust-resisting copper bearing steel alloy insulated for a heat loss of not more than 0.1 B.t.u. per hour per square foot per degree difference in temperature. Interior surface is steel, joints being covered with small panel strips.

Partitions: Faced both sides with steel and panel strips on steel studs. Partitions are insulated for sound deadening.

Roofs: Prefabricated panels similar in design, insulation, and finished surfaces to the exterior wall panel. Roof is waterproofed with built-up composition roofing.

Doors and Windows: Wood. Brass hardware. Complete weatherstripping. Windows are double hung.

Interior Trim: Wood base and picture moldings.

Fireplaces: Specially designed wood-burning unit, heating both by radiation and by convection through air passages surrounding the combustion chamber.

Terraces: Concrete on cinder fill.

Porches: Concrete floor on cinder fill. Steel posts. Steel panel roof construction as for main roof.

Trellis Entries: Steel construction with built-up composition roofing.

Roof Decks: Metal handrail and wire mesh guards. Wood slat flooring. Nautical ladder of steel provided for one-story houses.

Cases: Specially designed cases of wood for the efficient use of space, providing storage for clothing, linen, china, food, kitchen utensils, cleaning equipment, etc.

Electric Equipment: Complete wiring up to the electric meter, including fixtures and numerous outlets conveniently located.

Plumbing: Rough plumbing—all gas and water lines up to the meter location; all drainage lines to a point five feet from the building line. Finished plumbing installation is complete with chromium plated fittings, and vitreous china and enameled steel fixtures. Water heater may be either gas or oil-fired.

Air Conditioning Equipment: Gas or oil-burning automatic air conditioning system, providing heating, humidifying, and filtering of air with positive fan operated circulation. (Summer cooling may be easily added.) Oil storage tank is included with the oil-fired unit.

Screens: (for doors, windows, and porch)—Wood and bronze wire cloth.

Storm Sash: (for windows and doors)—Wood.

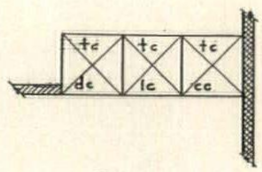
Flowerboxes: Painted metal.

Trellises: Simple design in wood.

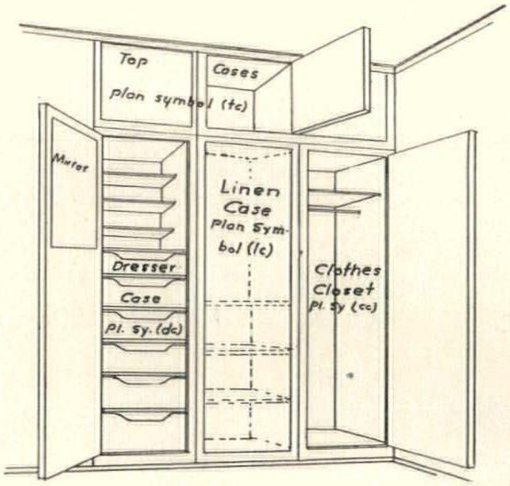
Painting: All exterior metal and wood surfaces receive three coats of paint. All interior wood and metal surfaces receive two coats of paint. Color of final coats selected by buyer from samples submitted by General Houses, Inc.

STANDARD BUILT-IN CASES

NEAT SPACE SAVING "A PLACE FOR EVERYTHING"

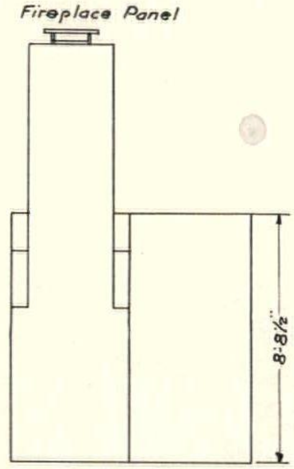


PLAN

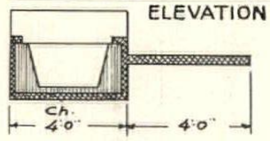


PERSPECTIVE

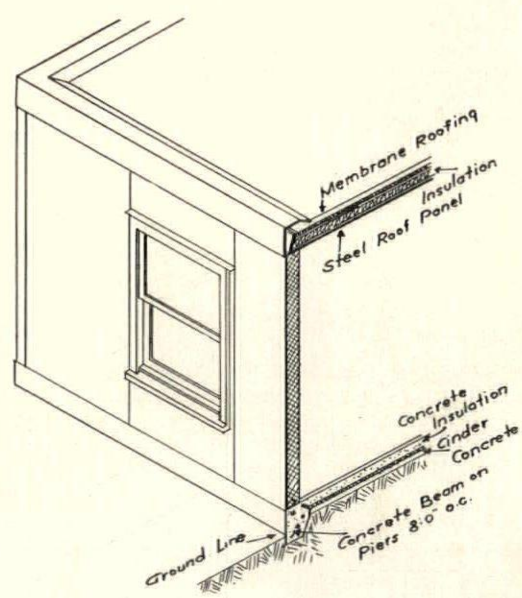
Fireplace Panel

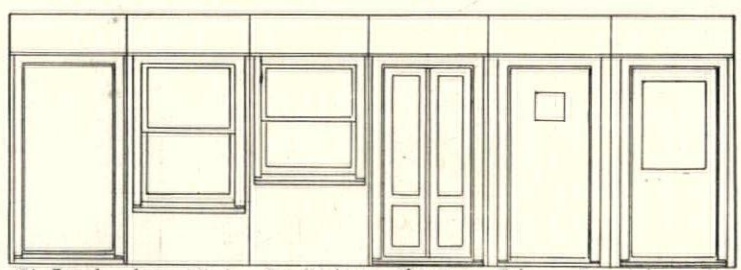


ELEVATION



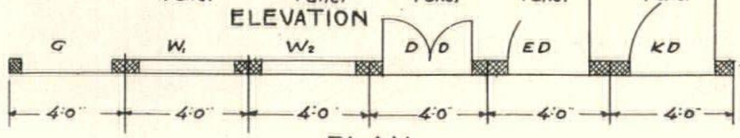
PLAN





Gl. Panel | Large Window Panel | Small Window Panel | Dble Door Panel | Entrance Dr. Panel | kitchen Dr. Panel

ELEVATION

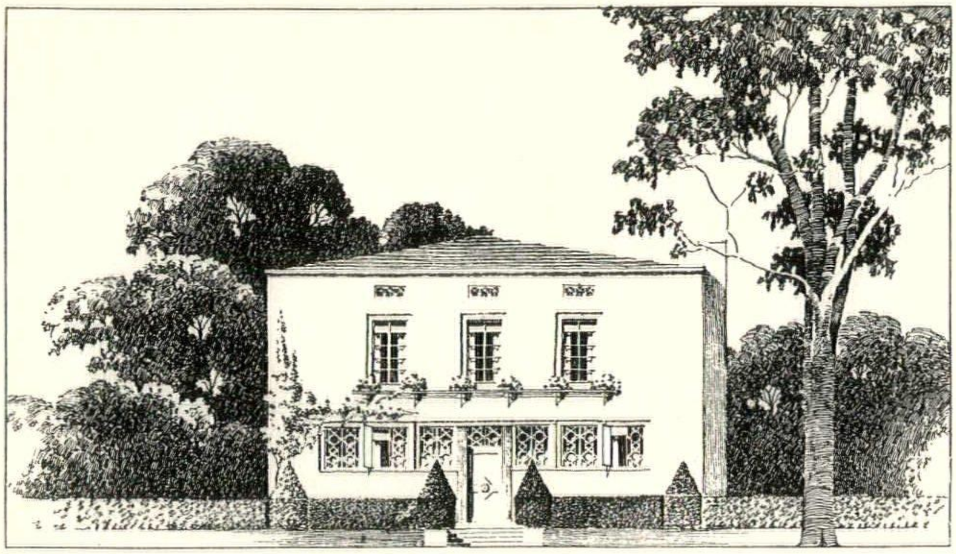


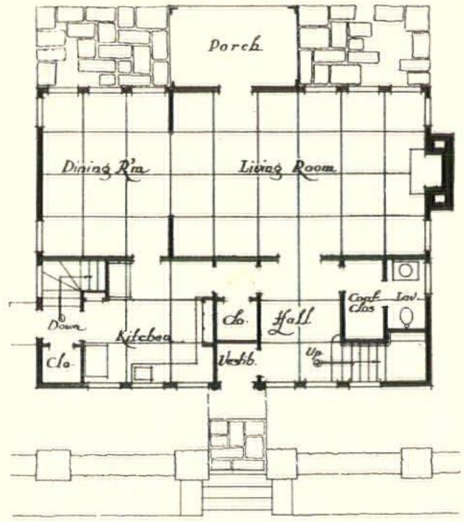
PLAN

STANDARD INTERCHANGEABLE WALL UNITS

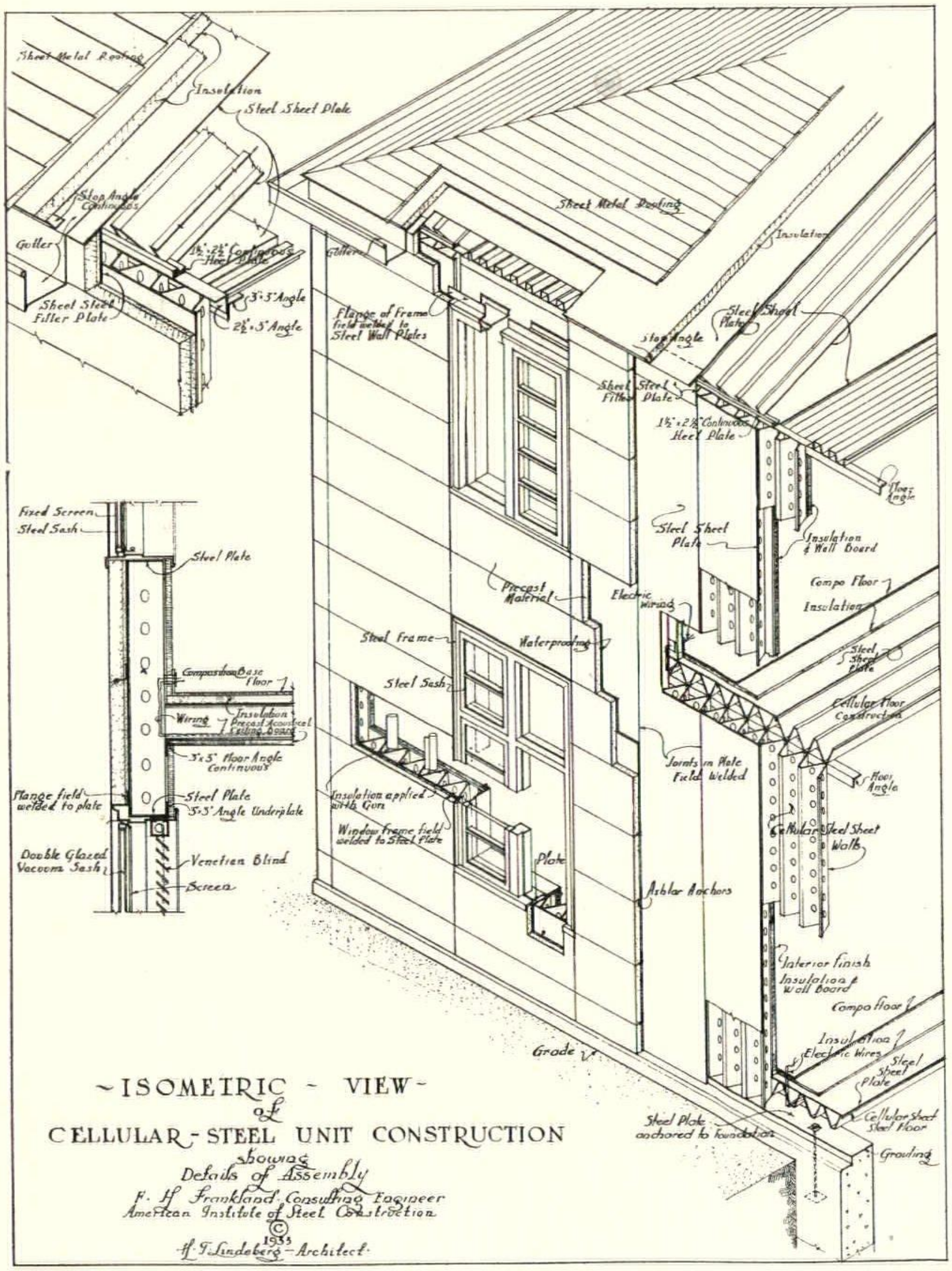
GENERAL HOUSES INC.

220 SOUTH STATE ST. - CHICAGO, ILL.





FIRST FLOOR PLAN



CELLULAR STEEL UNIT CONSTRUCTION

HOUSE DESIGN BY H. T. LINDEBERG ARCHITECT

F. H. FRANKLAND CONSULTING ENGINEER

Principles of this housing design: (1) Economy of construction by means of mass production of units, simple construction and coordination of labor. (2) Economy and efficiency in terms of living comfort. (3) A module scheme of design deriving from the construction units; for the variety of plan and elevation possible with this scheme, see the Portfolio of House Designs by H. T. Lindeberg, published in the October 1933 issue of The Architectural Record. (4) Elimination of ornament, even the cornice.

Structural system: There is no frame; the same cellular steel unit (Robertson Keystone Beam Steel floor system) is used for walls, floor and roof. The unit is small enough to allow ample flexibility, and its lightness makes it easy to handle. Assembly is rapid, consisting solely of welding. Metal window and door frames are welded into wall structure, making permanently tight joints. Entire construction is dry above foundation walls which are of poured concrete in standard forms. Floor construction runs from wall to wall, with 2" curtain walls made of a composition of gypsum and acoustolithic plaster.

Cellular form of outer wall units permits any form of heating and acts as conduit for air conditioning, humidifying, telephone and electric wiring, and plumbing.

WHEELING STEEL HOUSE

WHEELING CORRUGATING CO.—WHEELING, W. VA.

CHARLES BACON ROWLEY and ASSOCIATES, ARCHITECTS

Built as a demonstration house in outlying residential section of Wheeling, West Virginia, to illustrate use of construction system. Completed in December, and soon to be open for inspection. Costs have not yet been determined, nor have future marketing plans been considered.

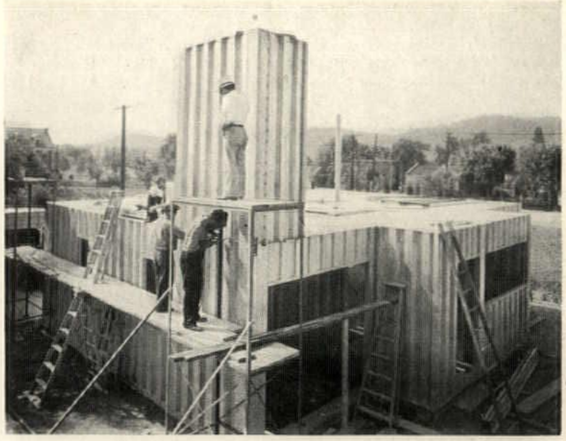
Heating system: hot water, down feed type.

Structural system: frame consists of sheet steel wall sections fabricated at factory, welded together on site and anchored to masonry foundations. Exterior walls: porcelain enamel panels, varying from 4' x 2'6" to 2' x 6" in size. Interior wall surfaces: plaster on metal lath. Floors: steel deck covered with hardwood. Roof: penthouse, composition roofing; porch, quarry tile.

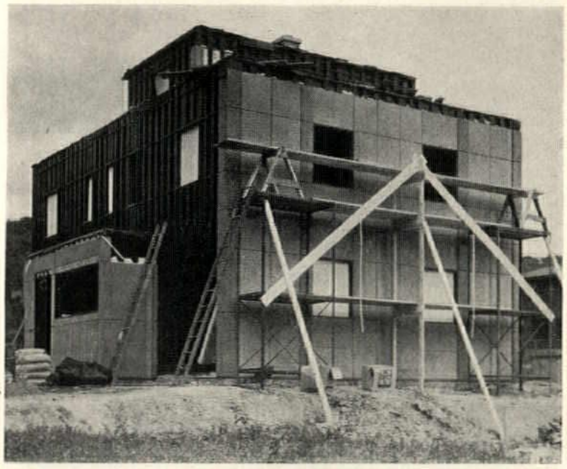
Structural values: Rock wool and insulating board give protection against heat loss equivalent to 18" brick wall. Fireproof construction. Doors are weather-stripped; filtration of atmosphere only around steel casement windows. Sound is reflected by steel and absorbed by mineral wool. Wall panels are a dark blue gray sprayed over a light gray background.

Weight: approximately one ton per 1,000 cubic feet.

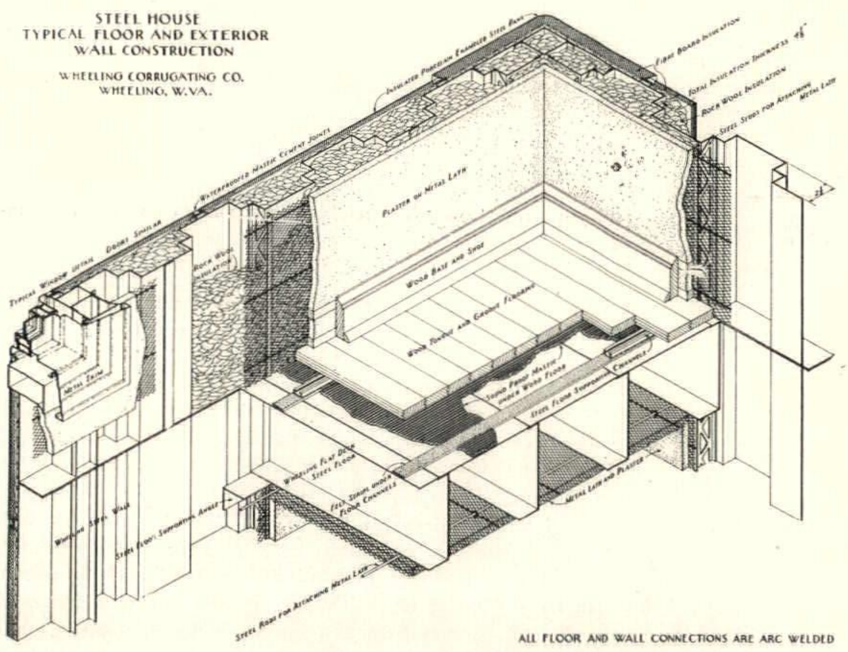
Structural system is approximately 60 per cent shop-fabricated. For erection and welding of all steel parts, including solid steel framework, 1,500 man-hours are required. House ready for occupancy about 4 weeks after assembly. Additions can made easily, but alterations are difficult. Structural longevity: same as masonry.

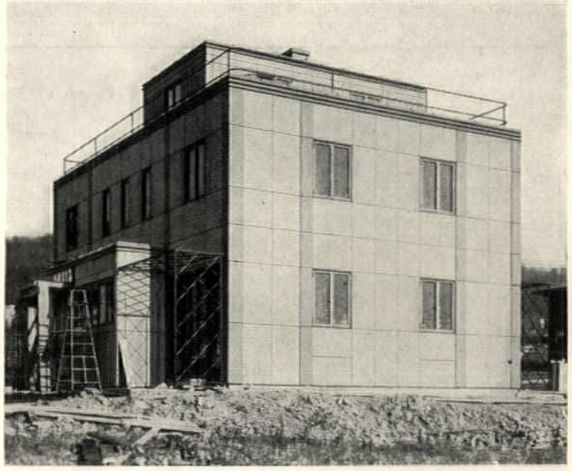


WELDING A SECOND-STORY SECTION

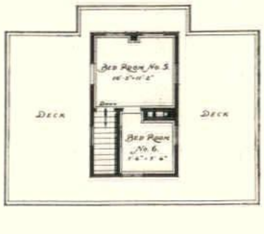


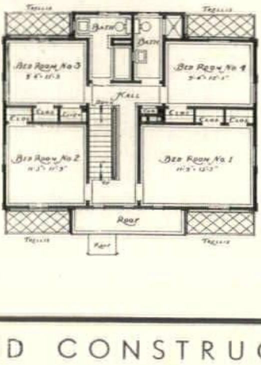
APPLYING PORCELAIN ENAMEL PANELS

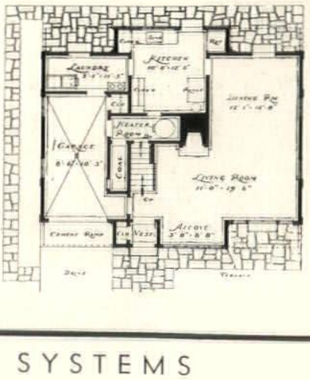




RECENT CONSTRUCTION VIEW



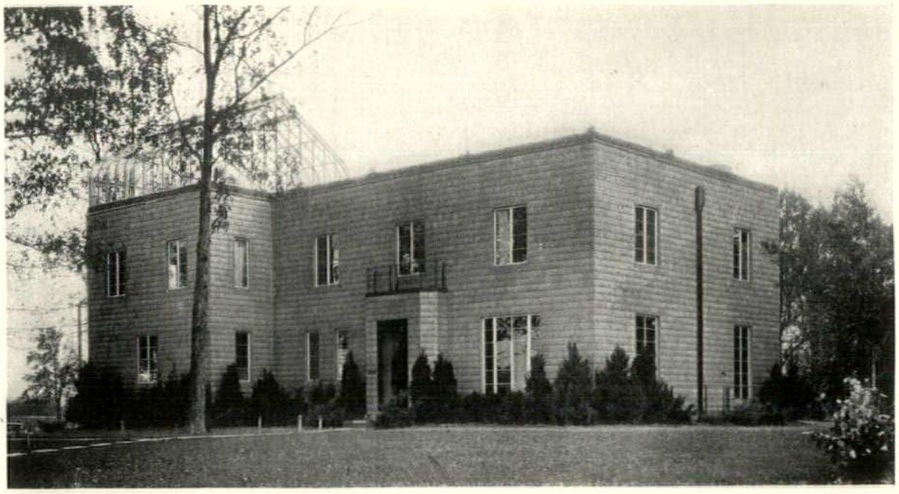


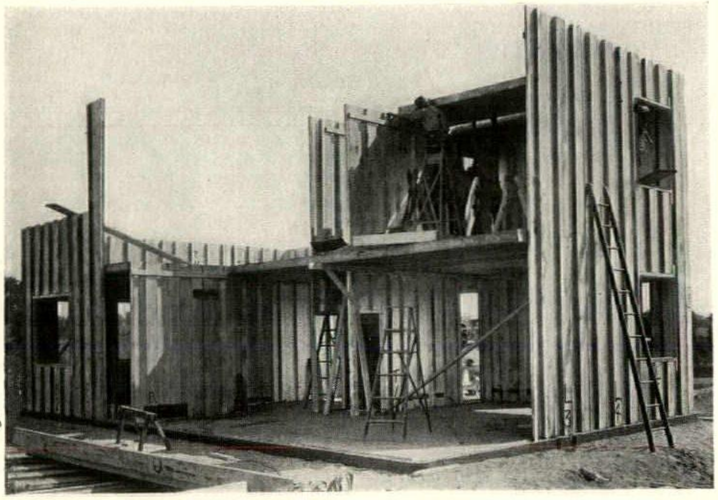


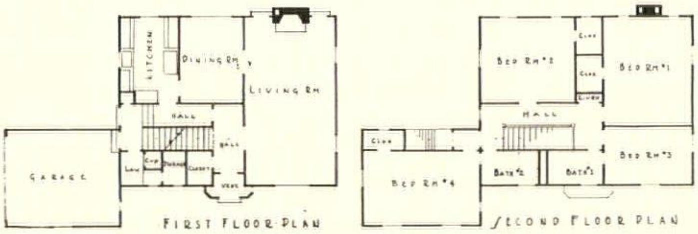
FRAMELESS-STEEL CONSTRUCTION SYSTEM

DEVELOPED BY
INSULATED STEEL CONSTRUCTION COMPANY
CLEVELAND, OHIO

This company produces a completely-inclosed metal structural shell or "chassis" for buildings such as residences and service stations, and furnishes lightweight curtain walls, floor members and roof decking for larger structures.

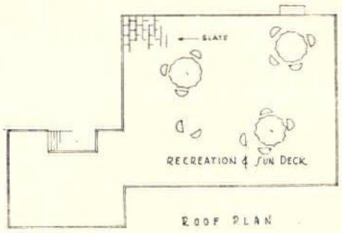


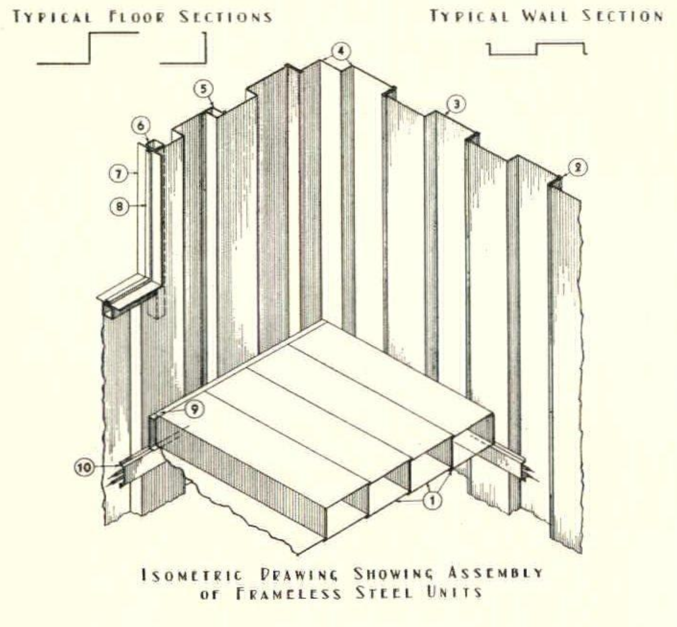




DEMONSTRATION HOUSE BUILT AT SOLON, OHIO (NEAR CLEVELAND) IN 1932

ROBERT SMITH, JR.
ARCHITECT





ISOMETRIC DRAWING SHOWING ASSEMBLY OF FRAMELESS STEEL UNITS

1. FLOOR SECTIONS
2. SHOP CONNECTION
3. WALL SECTION
4. WALL SECTION BENT FOR CORNER
5. FIELD CONNECTION SHOWING ADJUSTMENT
6. STEEL BUCK
7. STEEL TRIM
8. STEEL STOP
9. FLOOR END CHANNEL
10. FLOOR BEARING CHANNEL & ELECTRICAL CONDUIT

· INSULATED STEEL CONSTRUCTION COMPANY
· 3000 WOODHILL ROAD ·
· CLEVELAND OHIO ·

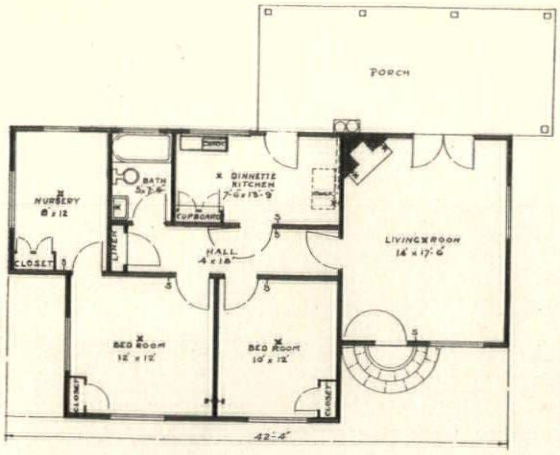
This product is called "Frameless-Steel" because no framing members are required in residences and other small structures.

Strength and rigidity are attained in the forming of light steel sheets. When sections are assembled into the "chassis," a continuous nailing surface is provided. The "chassis" replaces, in conventional frame construction, the joists, studs, rafters, bracing, sheathing, window and door frames, and interior and exterior trim. Window frames, door frames and electrical conduit are installed in the wall units complete before delivery to the job.

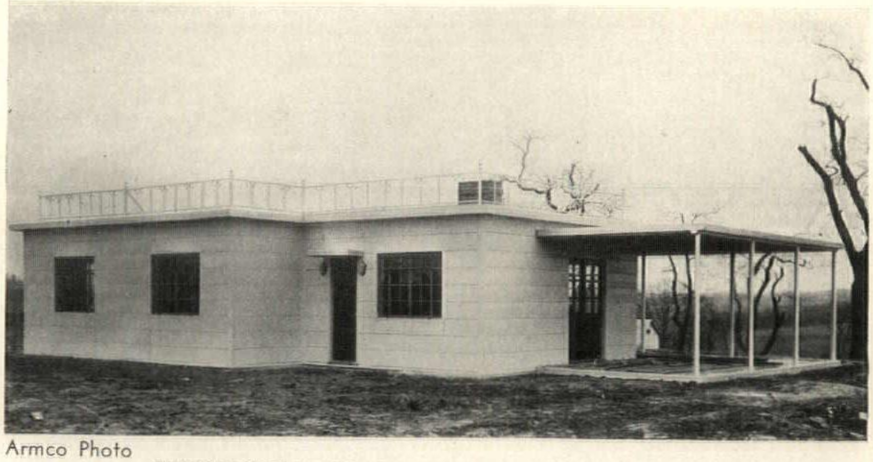
Z-shaped floor sections are lapped and boxed in at ends with an L-shaped member, providing both subfloor and subceiling. Depth of floor web: 5½". Web spacing ordinarily 8" on centers but can be varied for unusual loads. Dimensional adjustments of both wall and floor sections can be made by telescoping, thus eliminating field cutting.

In shop assembly, an electric spot welder puts weld in top and bottom of sections simultaneously to form large erection units. Welds in floor sections are 5½" apart. Field fastening of erection units is simply made with sheet metal screws. All standard building materials may be attached directly to the steel with screw-threaded nails.

Structural values: strong and rigid, yet light in weight. Storm and lightning safe. Vermin-proof, not subject to attack of termites. High insulation values (both heat and sound). Time of field erection materially reduced. Complete salvage value for "chassis."



COST: $2,770



Armco Photo

EXPERIMENTAL HOUSE—COMPLETED IN DECEMBER

UNIVERSAL HOUSE CORPORATION

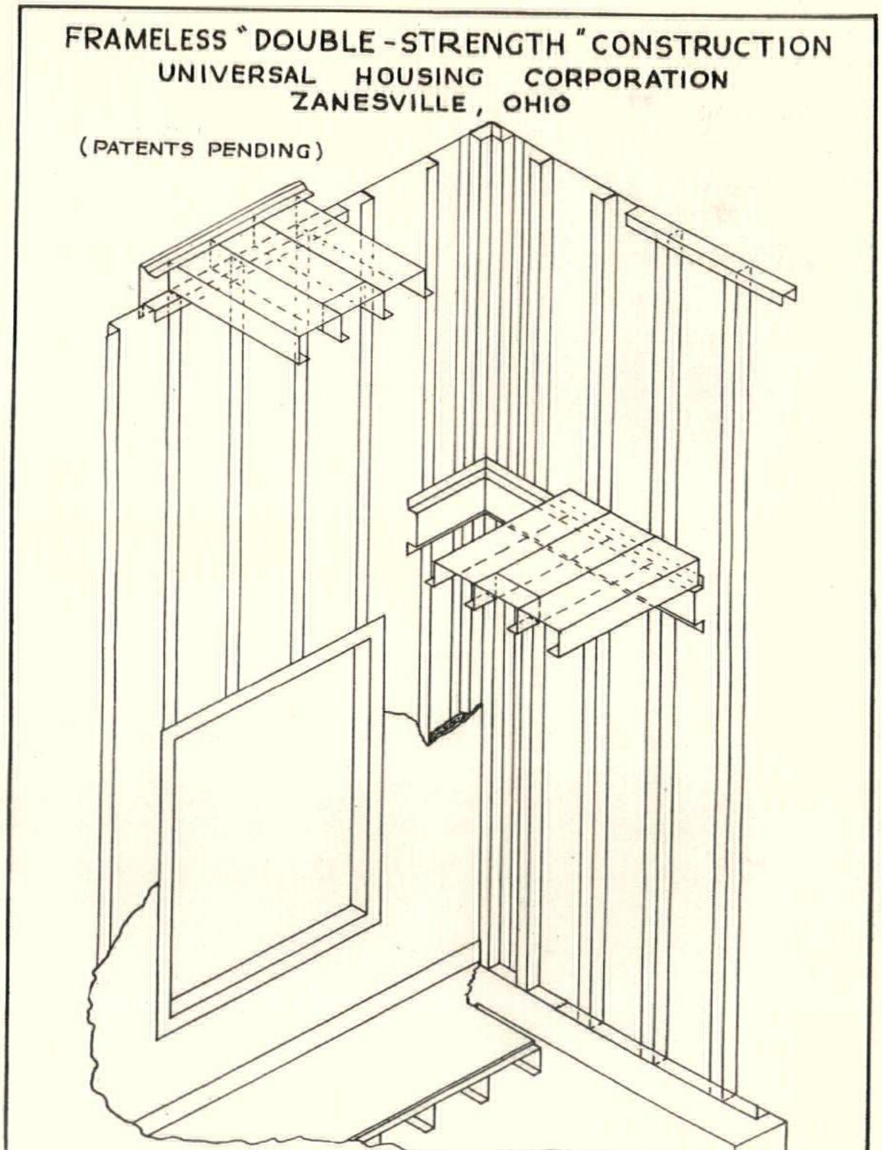
ZANESVILLE, OHIO

This company has announced its intention to produce houses for low-income families. An experimental house containing living room, three bedrooms, bath, dinette-kitchenette and a large porch has been recently completed.

The house plan can be duplicated for $2,770 in central Ohio, but the company's policy is to erect individually-planned custom-built homes in a higher price range. Edward L. Garrett, president, reasons that rural and suburban development will be the volume market for factory-made field-assembled houses. Work is under way on development of smaller low-priced units suitable for suburban locations and designed in several floor plans.

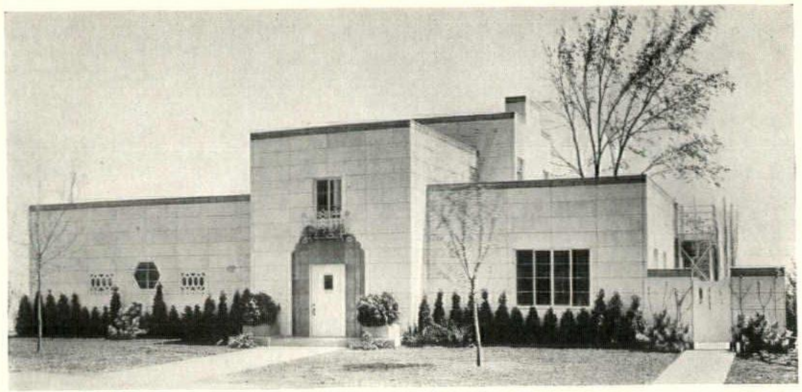
Structural system: Exterior siding is 16-gauge ingot iron formed in trough-shaped sections to give rigidity and load-carrying ability. (Although first house was built with tubular frame, a frameless system has now been developed.) Wall units were bolted to frame and then bolted together through flanges. Exterior sprayed with enamel paint. Floors and roof also of Armco sheet steel wide-flanged units; assembled on job but hereafter to be factory-assembled in large convenient sections. Steel window sash, frames and bucks. Pine doors and trim. Gypsum board used as subfloor with hardwood finish for all floors except bath where mosaic tile is installed. Roof: built-up asphaltic type put down over 1/2" insulating board.

Structural values: Insulated with 1/2" Insulite wall board decorated with Walltex as interior wall finish; space between wall board and metal wall filled with spun glass insulation. House is fire-resistant, lightning-safe, will not shrink and is vermin-proof. Field erection simple and easy. Maintenance cost should be low.



ROSTONE HOUSES

WALTER SCHOLER, ARCHITECT

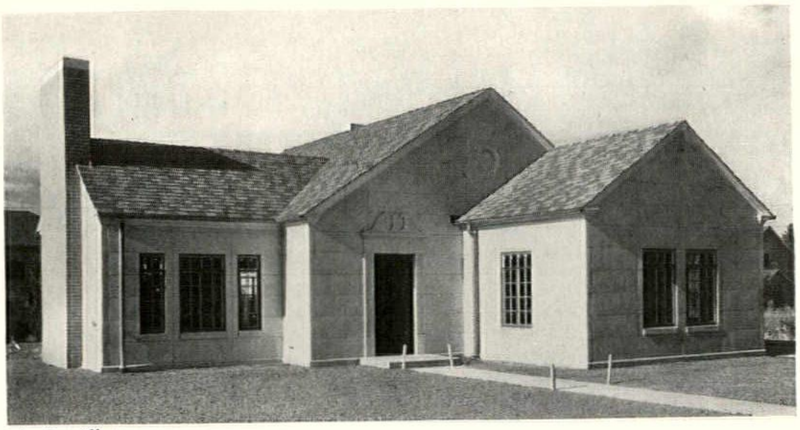


C. & C. Photo
DEMONSTRATION HOUSE—CENTURY OF PROGRESS

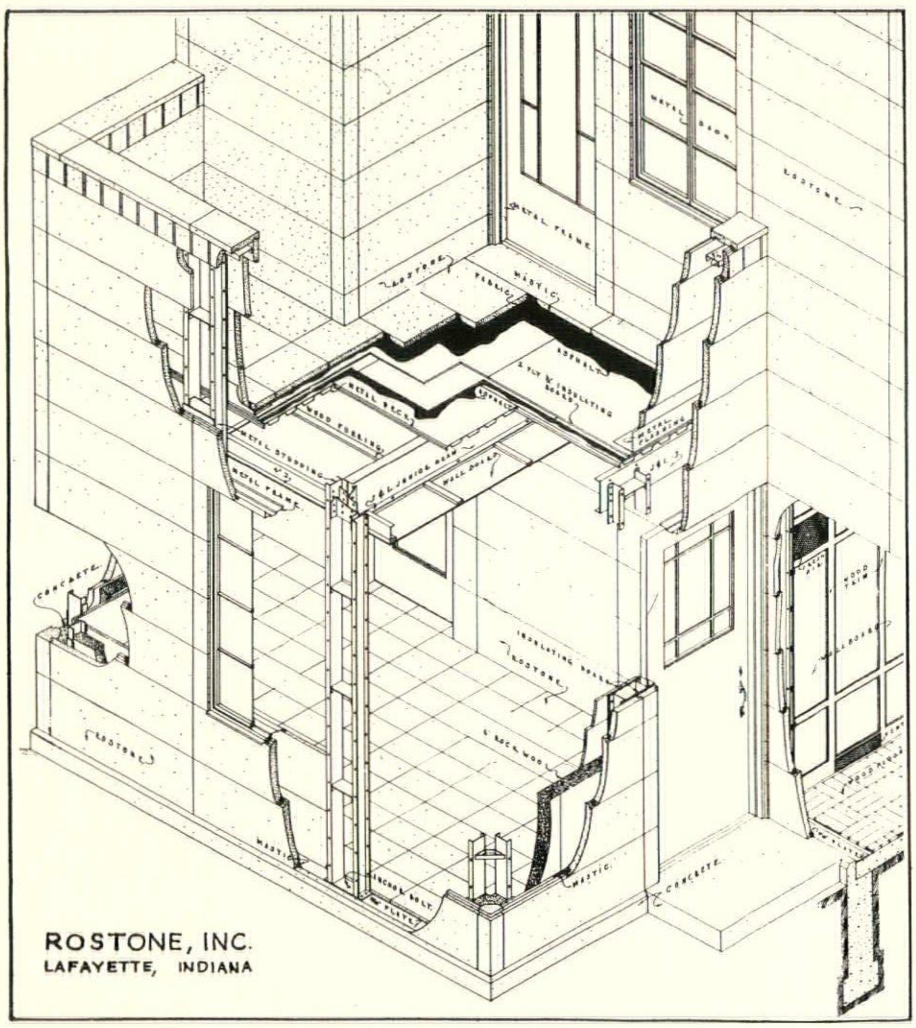
These are not factory-fabricated houses but a demonstration of a new structural system making use of materials which are very largely shop-fabricated, requiring a smaller proportionate field erection cost.

Primary material: A new stone-like substance called "Rostone," a synthetic product composed of shale, alkaline earths and limestone quarry waste. The material has a wide range of colors and color treatment. It is produced in slabs, panels and other forms to precise dimensions.

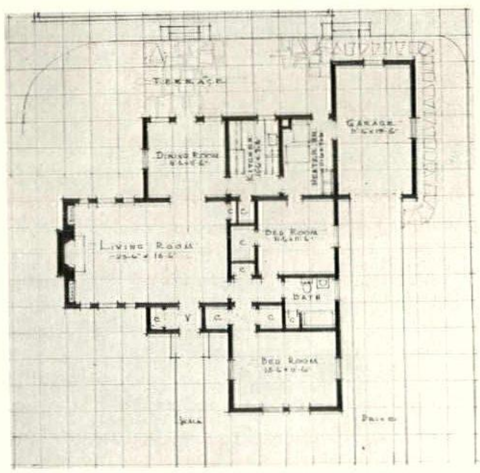
Structural system: Structural steel framework on concrete foundation. Vertical steel members are spaced uniformly 4 feet apart, a module which corresponds with length of Rostone slabs. These slabs are 18" in height and 2" thick, with ship-lap joints in mastic, and are bolted to the steel studs with a cushioning layer of insulating board. Bolts engage in threaded metal thimbles cast with Rostone slabs. Application of interior finish to steel framework depends on material used. Flat roofs are steel decks supported on steel beams over which is a thick layer of light-density Cornell insulating board on which are placed Rostone roof slabs.



J. G. Allen



ROSTONE, INC.
LAFAYETTE, INDIANA



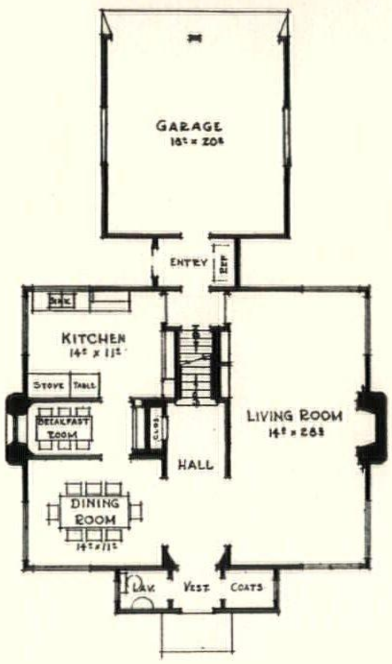
COLONIAL COTTAGE
WEST LAFAYETTE, IND.

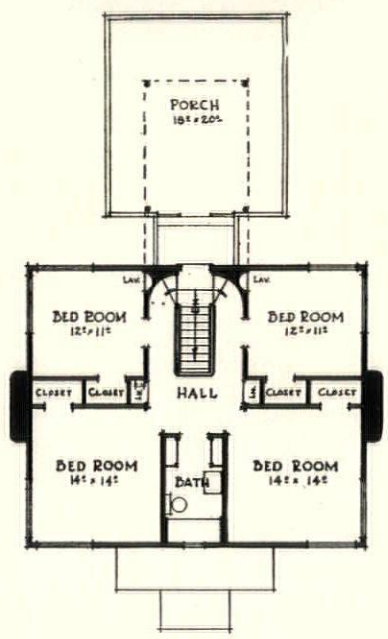
The strength, permanence, weathering quality, moisture-resistance and other physical properties are exceptional, and have been demonstrated through 5 to 8 years of severe exposure as well as through laboratory tests, according to report.

In the Century of Progress house Rostone is the only facing material. It is also used for (1) roof slabs, (2) interior flooring, (3) interior wall treatment, (4) fireplace as well as various other minor details.

FERRO-ENAMEL HOUSE

CHARLES BACON ROWLEY & ASSOCIATES — ARCHITECTS





House constructed July 1932 in Cleveland. Occupancy: one family, 4 persons.

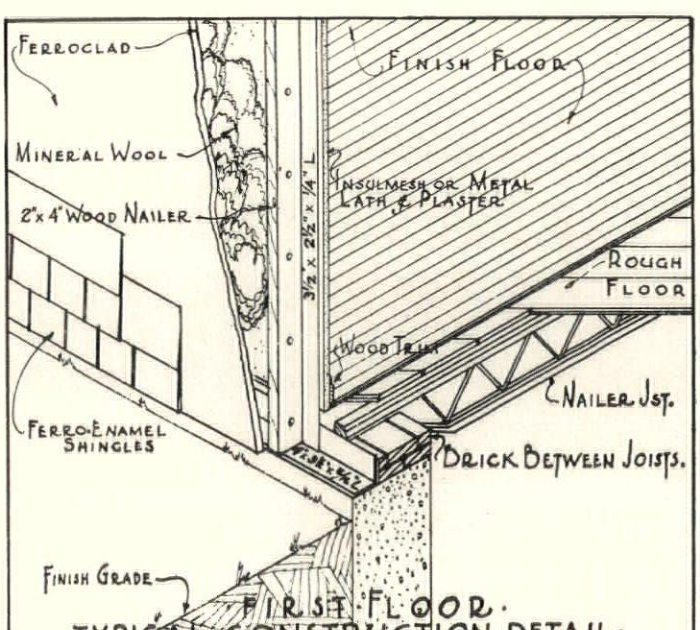
Approximate cost: $14,000 without land. Maintenance: $40 annually for painting metal windows, frames and doors.

Heating system: forced warm air, filtered, automatically humidified. Electric illumination. Dish-washer sink.

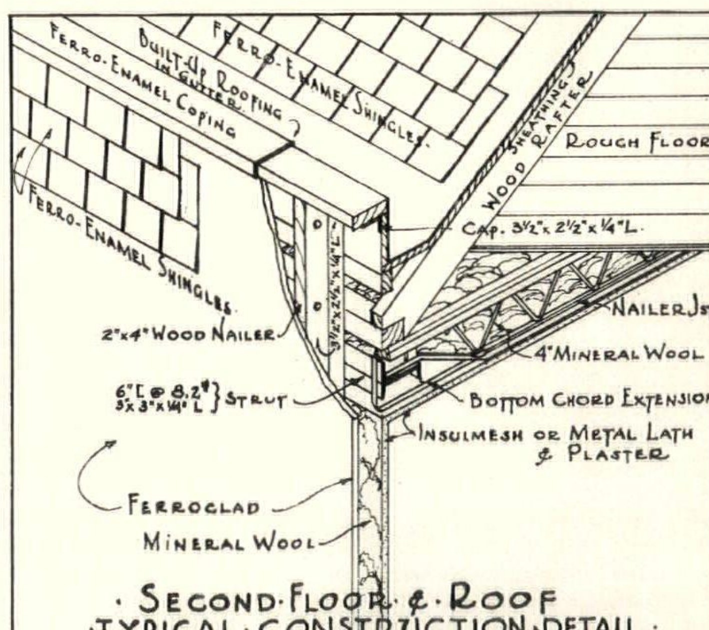
Construction: Thermal transmission same as 24-inch brick wall. Light reflected by porcelain enamel finish. Sound absorbed by mineral wool. Weight: approximately 1 ton per 1,600 cubic feet.

Structural system entirely shop-fabricated except for assembly. Electrically welded at site. House ready for occupancy 2 to 3 months after frame assembly. Structural changes not easily made, but repairs are not likely to be necessary. Expected life span: same as masonry.

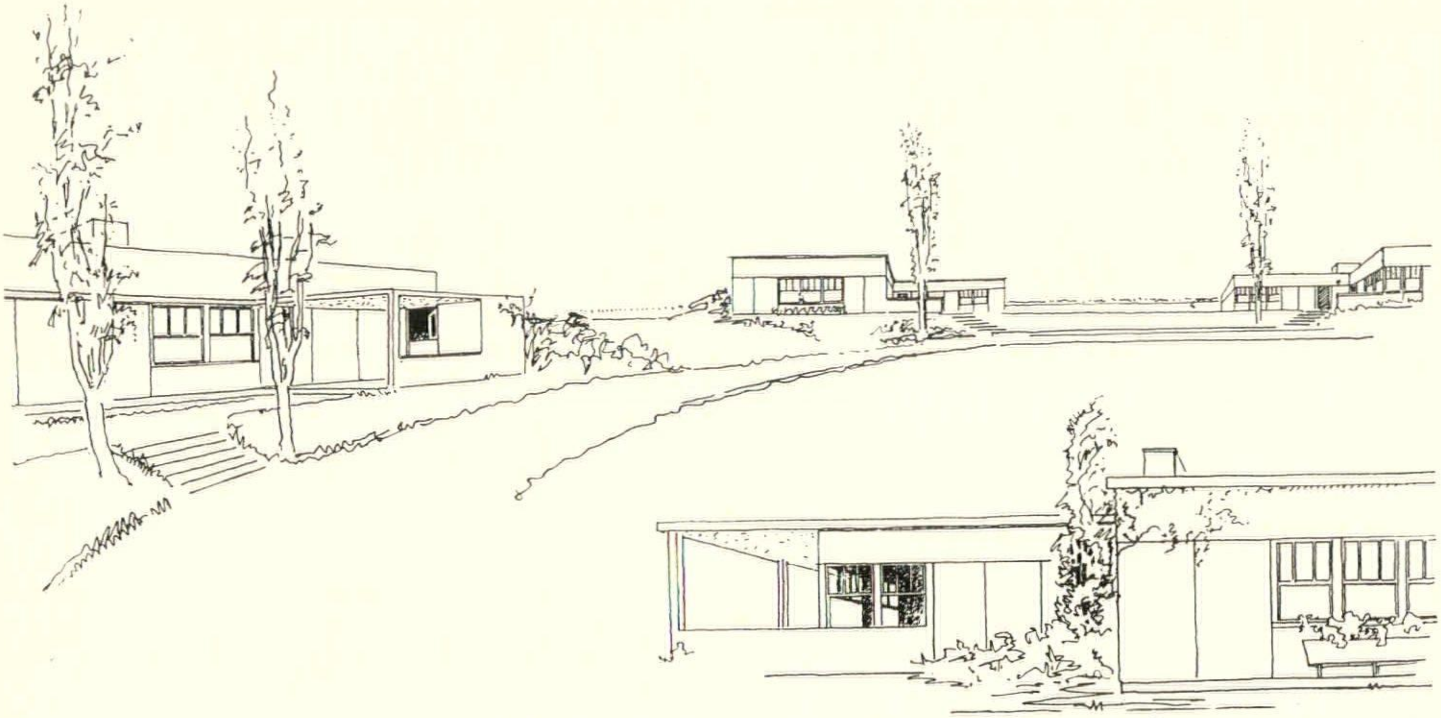
This house was built to demonstrate use of porcelain enamel shingles as exterior building material. Since then the shingles have been used as roofing for several buildings.



· FIRST · FLOOR ·
· TYPICAL · CONSTRUCTION · DETAIL ·
FERRO-ENAMEL · RESIDENCE · CLEVELAND · O ·



· SECOND · FLOOR · & · ROOF
· TYPICAL · CONSTRUCTION · DETAIL ·
FERRO-ENAMEL · RESIDENCE · CLEVELAND · O ·



NEGRO HOUSING

PROPOSED FOR RICHMOND, VIRGINIA

ALFRED KASTNER ARCHITECT

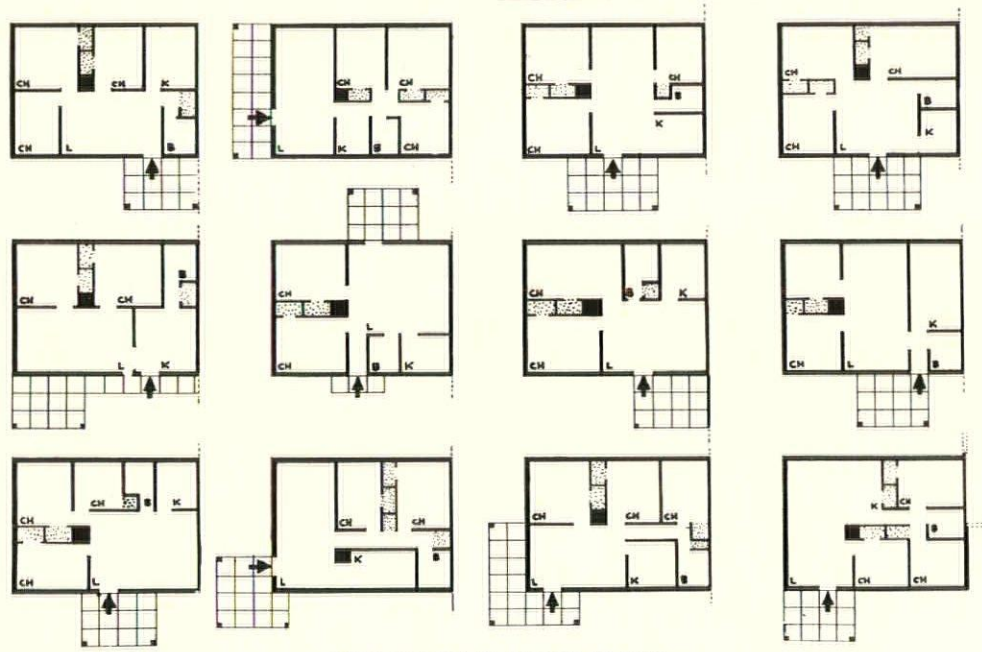
Proposed housing is combined with subsistence farming for Negro workers.

Financing is to be done through a cooperative organization of 500 prospective owners who contribute one-third equity, chiefly in the labor. On the basis of this equity a loan sufficient to cover the remainder of the investment is contemplated from a Government loan institution.

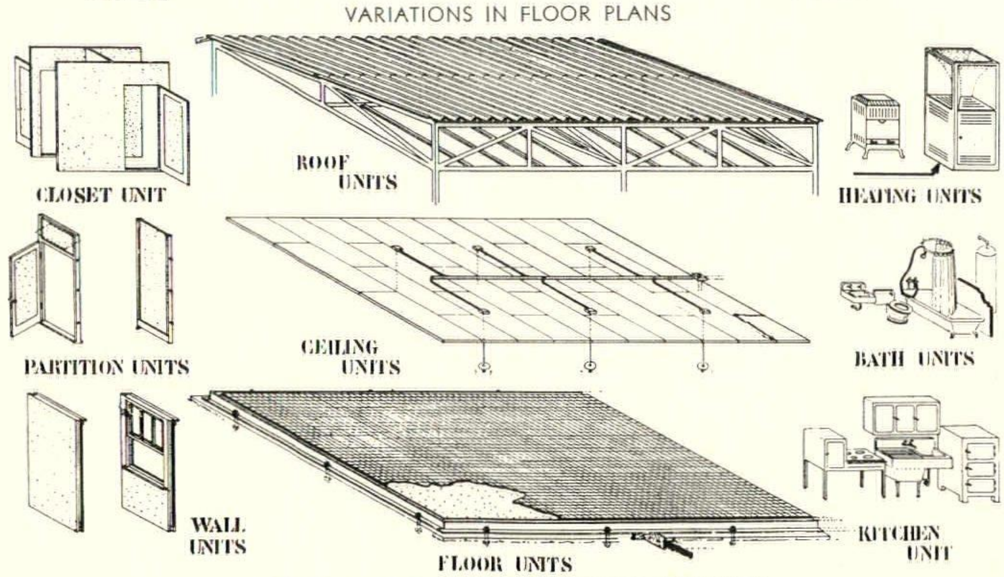
Estimated cost of each housing unit: $1,000. Each unit will occupy a half acre, costing $150 on a large-scale cooperative purchase. An additional $150 for each unit is estimated as cost of improvements such as streets and utilities. (Further details as to this method of financing and organization are to be found on pages 165 to 168 in the March 1933 issue of The Architectural Record.)

Utilities: oil heater, bath unit, kitchen unit. Illumination by electricity.

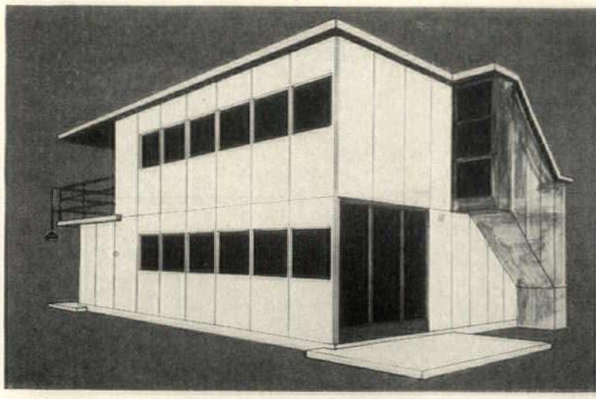
Structural system: prefabricated units of reinforced concrete to be erected by unskilled labor of the house occupants. Interior partitions permit various arrangements.



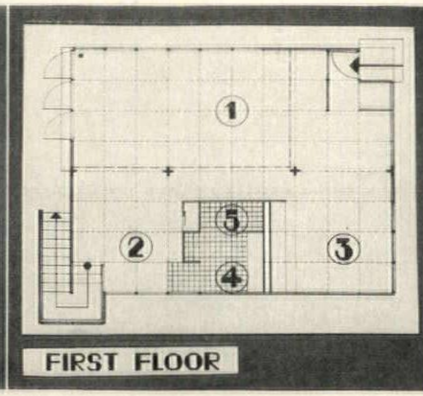
VARIATIONS IN FLOOR PLANS



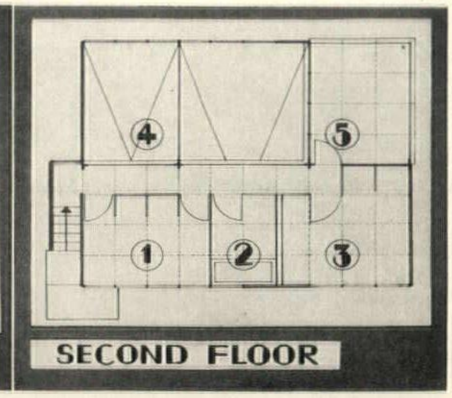
STANDARDIZED UNITS FOR HOUSE ASSEMBLY



TYPE "A"—$4,000



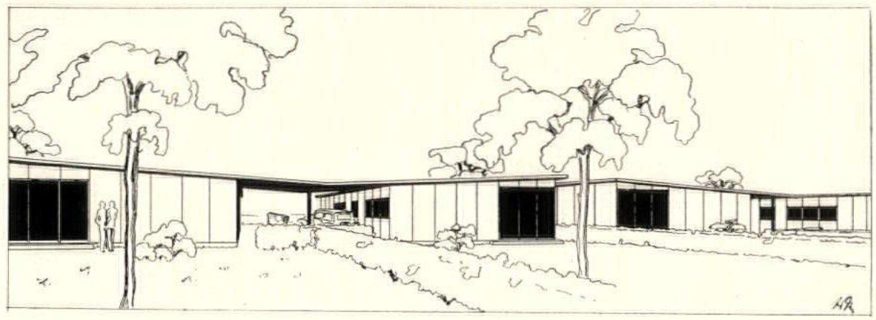
(1) Living room, (2) dining room, (3) library, (4) kitchen, (5) heater.



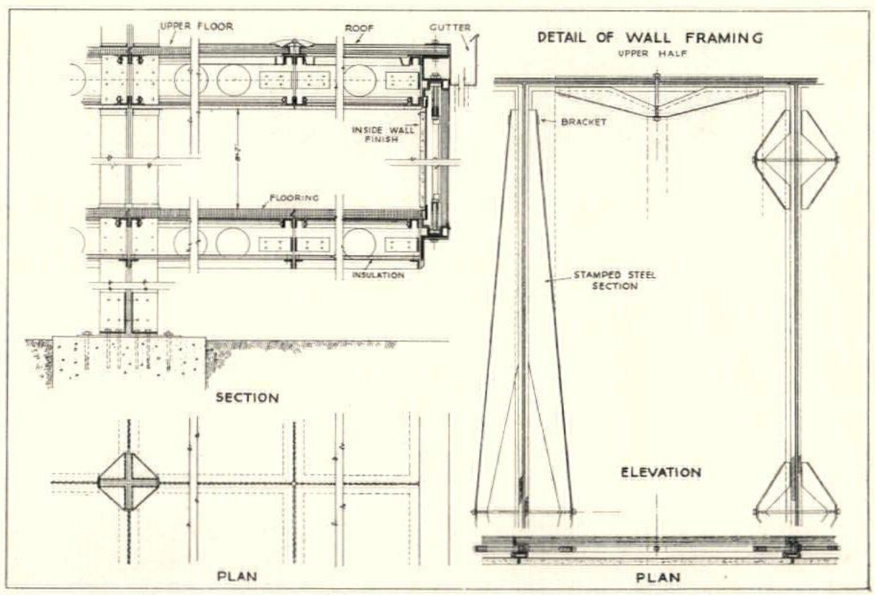
(1) Children's bedrooms, (2) bathroom, (3) bedroom, (4) upper part of living room, (5) roof terrace.

TWO HOUSES FOR QUANTITY PRODUCTION

WALTER BAERMANN, DESIGNER
HOLYOKE, MASSACHUSETTS



TYPE "B"—$1,200



Intended for low-income families: (A) 5 to 8 occupants, (B) 6 occupants.

Estimated cost of single houses: (A) $4,000, (B) $1,200, including financing but not land. Cost per 100 units: (A) $3,000 or less, (B) $850 to $900. Units to be sold direct. Annual heating expense: (A) $90, (B) $60.

Utilities: oil burner, hot-water heating. Septic tank for sewage disposal. Electric lighting.

Interior equipment: simplified kitchen layout. Plumbing closet. Murphy beds. Folding partitions.

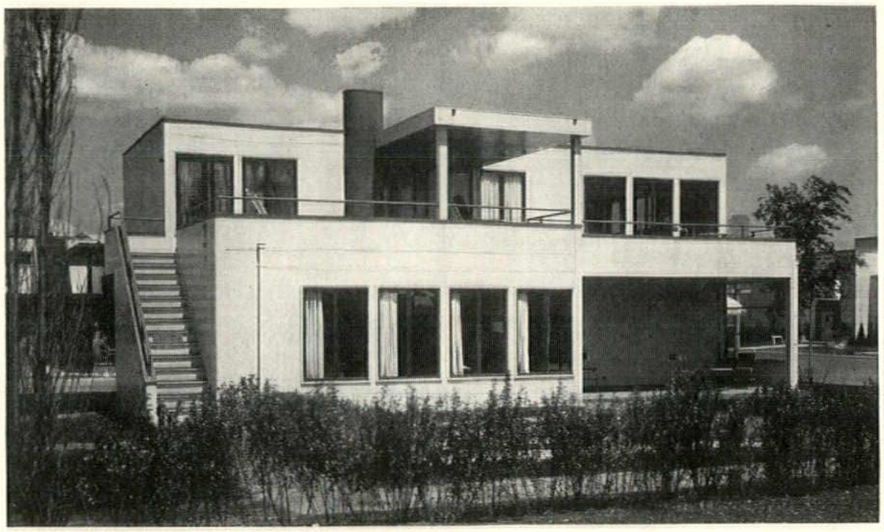
Materials for exterior and interior surfaces selected as desired, painted in colors according to direction of sunlight.

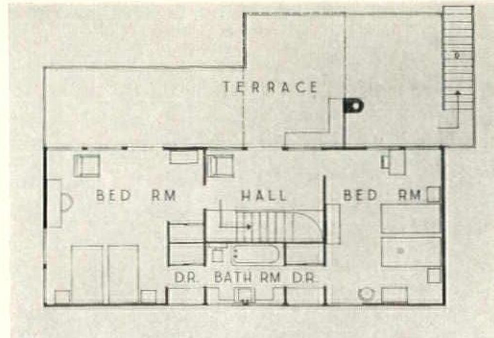
Structural system: fireproof, insulated. Completely shop-fabricated. All parts light enough to be handled by one or two men with ordinary tools; no part heavier than 150 pounds. Time required for assembly on site: (A) 48 hours; (B) 36 hours. For demolition: 7 hours. Materials salvageable.

Complete dry construction with exception of point foundations. Four or more center columns, each composed of 4 L-shaped sections. Stamped steel-beams, 1/4-inch thick and about 12 inches high, interlock with clips to fasten floor and ceiling units.

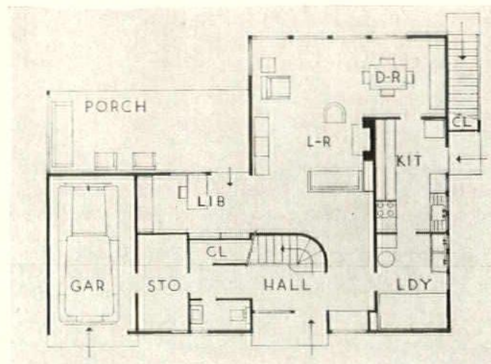
Walls in 3-foot sections. Frames are tension members counterbalancing floor and ceiling construction. Windows integral with these sections. Connections by means of tie rods and springs with rubber cushions like Frigidaire wall sections.

Provisions made for electric panel heating. All wiring may be in the panels.





SECOND FLOOR PLAN



FIRST FLOOR PLAN

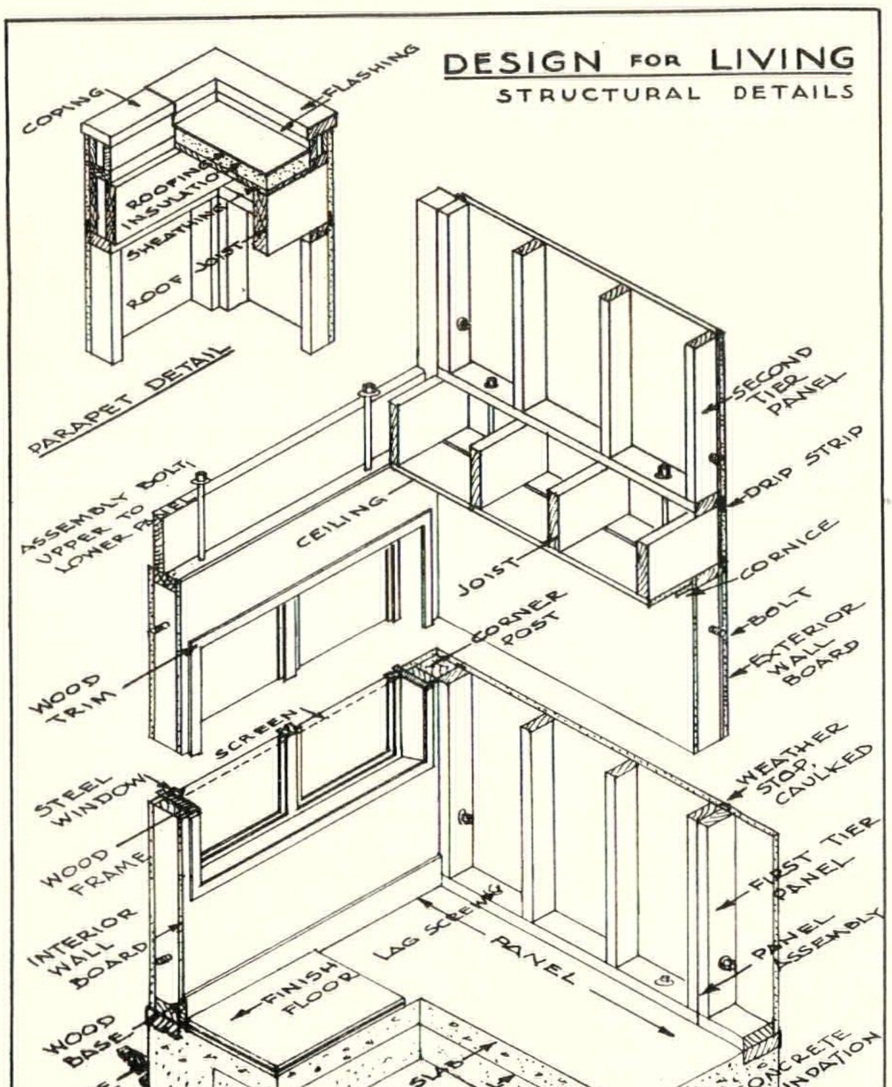
DESIGN FOR LIVING

JOHN C. B. MOORE, ARCHITECT

C. CLEMENTS HORSLEY
AND RICHARD C. WOOD
ASSOCIATE ARCHITECTS
INTERIORS BY GILBERT ROHDE

CONSTRUCTED FOR
A CENTURY OF PROGRESS
CHICAGO EXPOSITION
1933

Designed for maximum space with minimum area



Frame construction put together in panels selected as cheapest, easiest to erect and simplest to adjust.

Cost: approximately $8,000 in a metropolitan area, fully equipped as described, but exclusive of financing and land costs.

Air conditioning: Holland hot air furnace; water spray humidification, filter; electric fan circulation.

Electric light, direct illumination.

Built-in Kitchen Maid cabinets, and cases of drawers in dressing rooms and bathroom. Other built-in furniture proves inflexible and expensive. Overhead garage door.

Exterior wall surface: Thermasote. Interior wall surface: Gypsolite wall board. Linoleum for ground floor; asphalt tile on kitchen and baths. Carpet over rough plywood flooring on second floor. Roofing: built-in tar and felt.

Structural value: same as normal frame construction. Roof surfaced with aluminum paint to reflect and reduce penetration of heat rays of the sun. All interior ceilings have ¾" Insulite for sound absorption and insulation.

Weight: approximately 3.19 pounds per cubic foot.

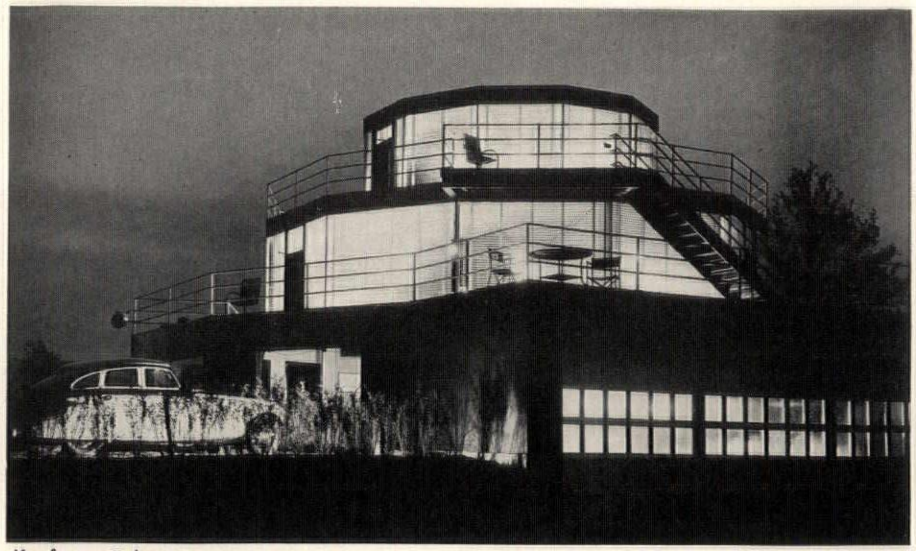
All exterior wall panels shop-fabricated and fastened with simple bolts and lag-screws. Approximately 64 hours required for assembly of structural frame; 3 weeks additional before house is ready for occupancy. One week required for structural demolition, including foundations. Expected life span: indefinite, as in case of a well-built frame house.

Potential salvage value: all exterior wall panels, built-in doors and window frames, floor and roof timbers, stairs, equipment and accessories.

HOUSE OF TOMORROW

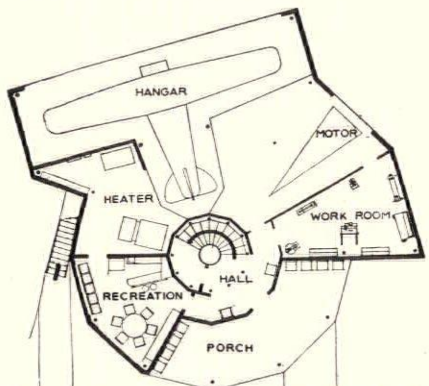
CENTURY HOMES, INC.
CHICAGO

GEORGE FRED KECK
ARCHITECT

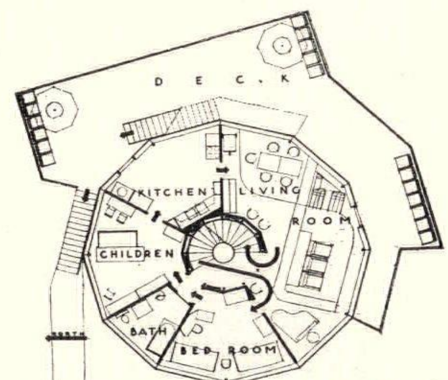


Kaufmann-Fabry

EXHIBITION HOUSE—CENTURY OF PROGRESS EXPOSITION



PLAN · GROUND - FL.



PLAN · LIVING - F L.

Designed to demonstrate mechanical equipment and new materials now on the market. Not intended for quantity production as designed, but possible to do so if slightly altered. At present no estimated cost. Cost of demonstration house: between $20,000 and $25,000. Estimated yearly maintenance: $500.

Air conditioning: heating, cooling, humidification with humidistat control; air washer; fan and blower. No movable windows in house.

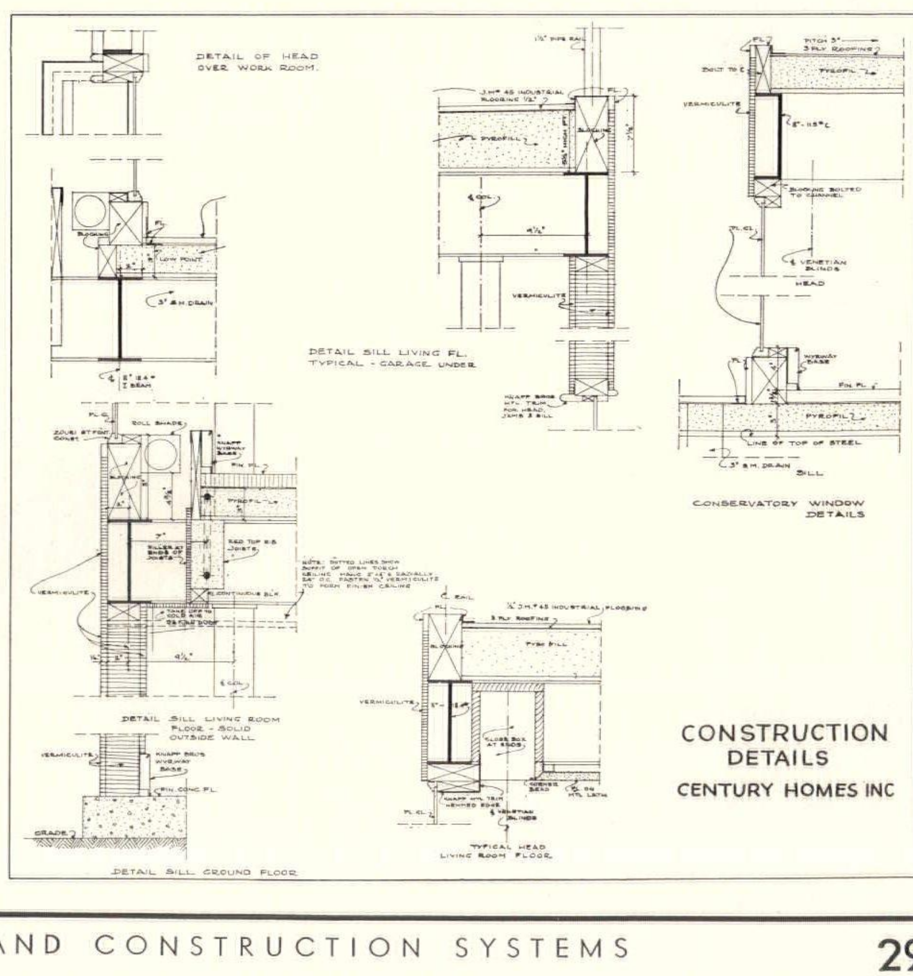
Structural system: concrete foundation and floor slabs. All other construction is "dry"; no plaster. Structural steel frame, entirely shop-fabricated and bolted together on site. No bearing walls. Phenoloid board for exterior and plaster board for interior on first floor. Store front plate glass exterior; glass sizes determined duodecagonal floor plan. Floors: U. S. Gypsum "Red Top" Steel, joist construction. Interior partitions: synthetic wall boards covered with glass, wood and lacquers. Interior partitions between garage and workroom: insulation board covered with bright aluminum foil to reflect heat. Roof: waterproof compressed asphalt board.

Structural values: earthquake resistant because of cantilever frame construction. Questionable whether glass walls will withstand tornados. Vermin-proof since all construction is above ground.

Thermal transmission: while house was being heated during November, it was found that large glass surfaces did not increase heating load although outside temperatures dropped as low as 20°. Infiltration is reduced because windows are fixed. A recirculation duct, ¾" wide, along inside perimeter of house collects cool air at bottom of windows.

Illumination: outside daylight obtained through large glass areas and intensity controlled by means of opaque roller screen, venetian blinds and drapes. Electric lighting in living room and conservatory also controllable to desired intensities by means of dimmers.

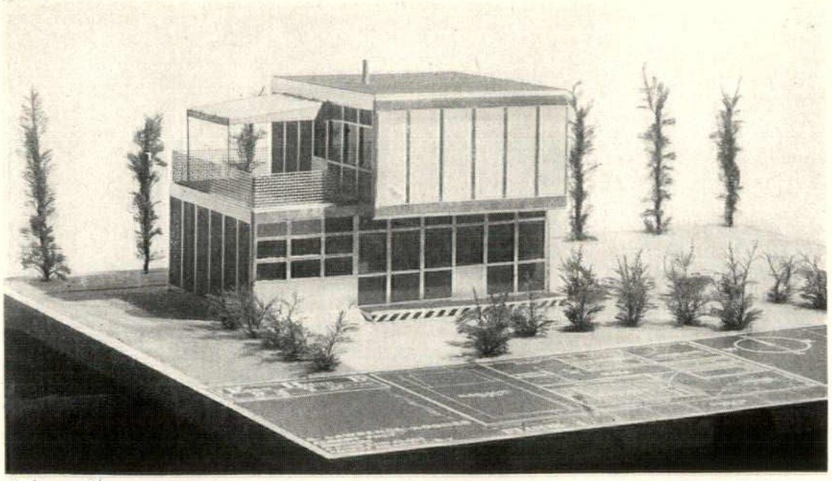
Assembly: 48 man-hours required on site for frame assembly. Entire house can be built in 30-60 days. Time required for demolition: one week. Expected life span: 50 years.



CONSTRUCTION DETAILS
CENTURY HOMES INC

LOW-COST FARMHOUSE

A. LAWRENCE KOCHER
and ALBERT FREY



Palmer Shannon

MODEL OF FARMHOUSE "B"

The rooms of this house have been planned in a use-relationship to farm life and work, based on a listing of requirements supplied by a committee of sociologists specializing in farm activity. Occupancy: 2 adults, 3 children.

Cost: $1,750, not including land and financing. If produced in quantity, $1,200 to $1,500. Small upkeep because no deterioration from dry rot.

Built-in furniture and equipment: china cupboards, kitchen table, cabinets, bed closets, clothes and linen closets, storage racks.

Heating: hot-air furnace, with filter. Ample ventilation through windows; roof terrace provides space for outdoor sleeping.

Utilities: electric lighting. Septic tank sewage disposal.

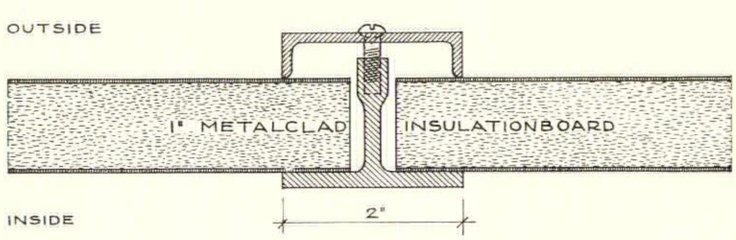
Structural system: Rolled steel frame. Painted sheet-steel surfaces, interior and exterior. Steel deck floors with insulation board and linoleum finish. Steel deck roof with insulation board and built-up roofing. All building parts now obtainable from industries in the open market.

Structural values: completely fireproof; earthquake and tornado proof; not affected by termites or vermin; protected against corrosion. Windows are tight-fitting and can be double-glazed. Superior to average masonry wall in insulation value. Ample sound absorption at ceiling.

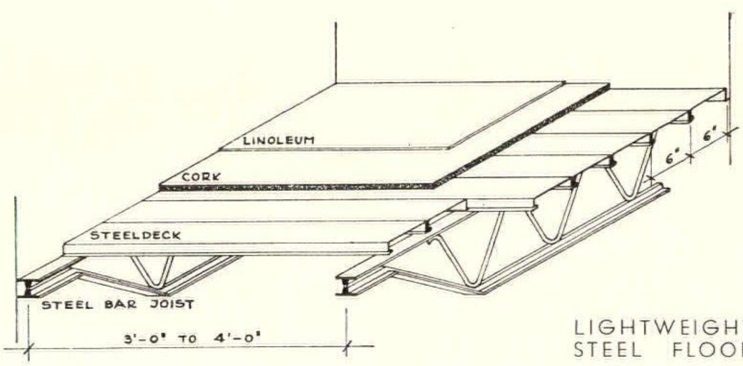
Weight: approximately 1/10 of masonry house.

Construction shop-fabricated; no cutting on job; only assembly of parts. Time required for erection—200 man-hours. House immediately ready for occupancy. Structural system suited to enlargement or replacement of parts.

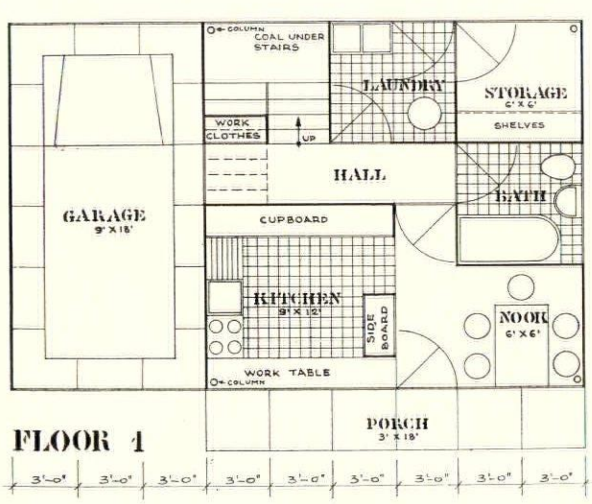
Expected life span of structure: house can be used a full generation. Demolition: 12 hours. Full salvage value.



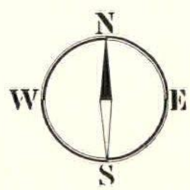
TYPICAL WALL SECTION

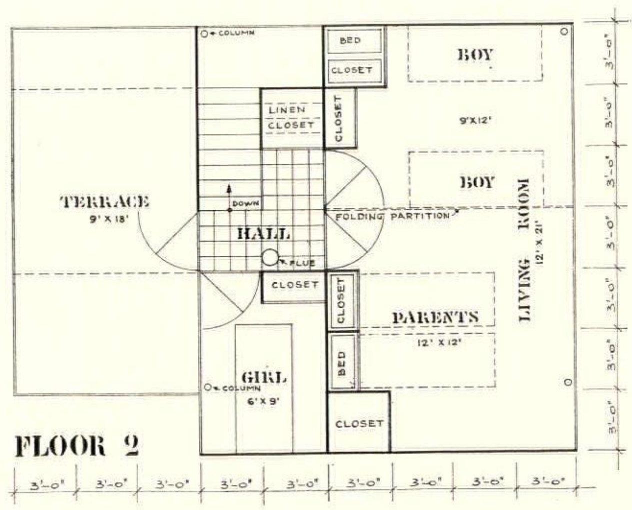


LIGHTWEIGHT STEEL FLOOR

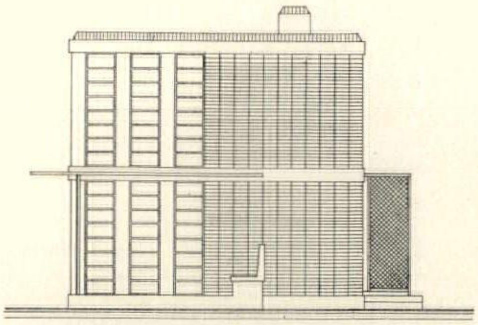


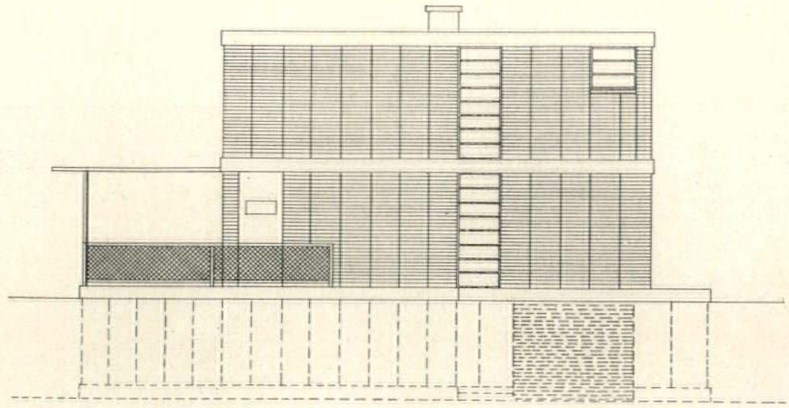
FLOOR 1



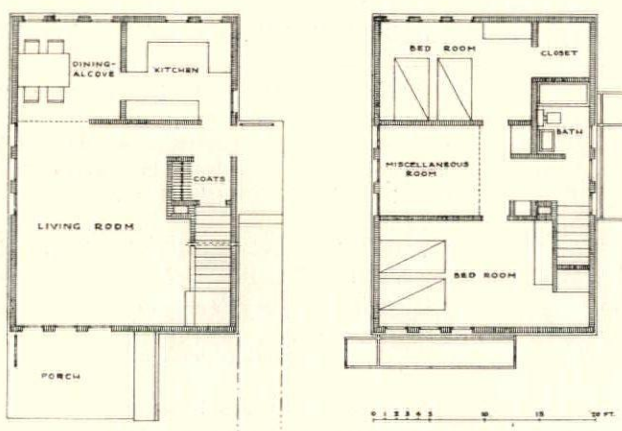


FLOOR 2





(Above): Elevation of plans shown below.
(Right): Side elevation of another house type which could be 3 stories high.



CONCRETE UNIT SYSTEM

BARRY BYRNE, ARCHITECT

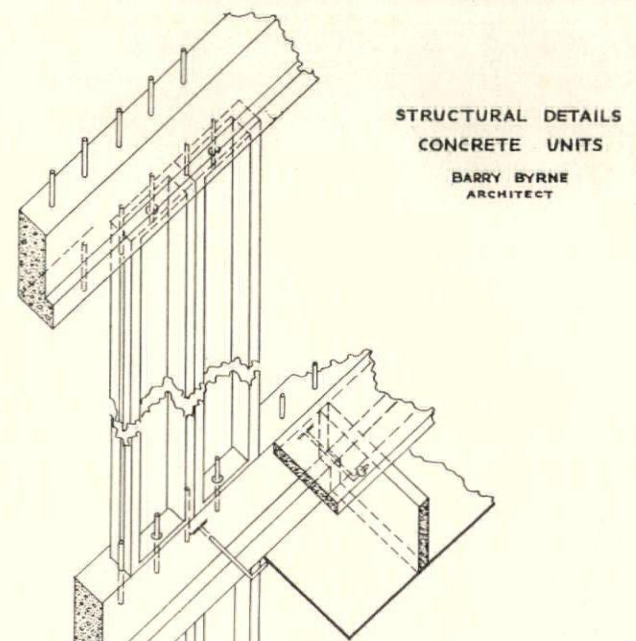
This scheme was devised to provide a relatively dry construction, with units adaptable to varied plans, exterior masses and proportions of parts. Aside from foundations, it is shop-fabricated and field-assembled.

House design planned for 2 adults, 3 children.

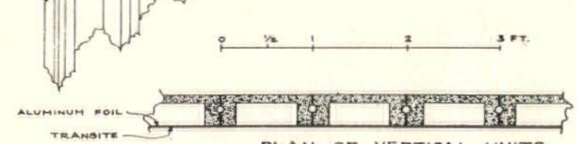
Air conditioning furnace; air circulation by means of blower in hot weather. Connection to municipal sewage system assumed. Illumination: concealed lights at junction of walls and ceiling with rays directed downward on wall at points to accent wall surfaces as related to plan. Kitchen equipment and garbage incinerator built in.

Structural system: pre-cast concrete units for structural frame and exterior walls. Interior wall surfaces finished in duPont wall fabrics. Floors of cork over cement. Prepared roof, cork insulation. Construction fireproof, resistant to vermin, physical deterioration, thermal and atmospheric transmission.

STRUCTURAL DETAILS
CONCRETE UNITS
BARRY BYRNE
ARCHITECT



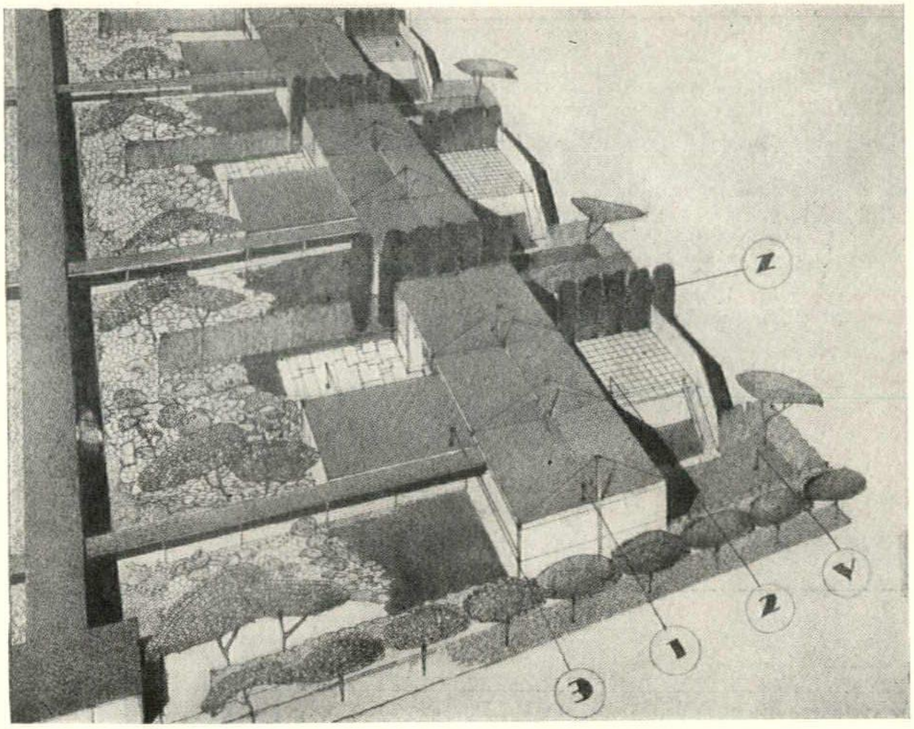
ISOMETRIC OF WALL & FLOOR SYSTEM



PLAN OF VERTICAL UNITS

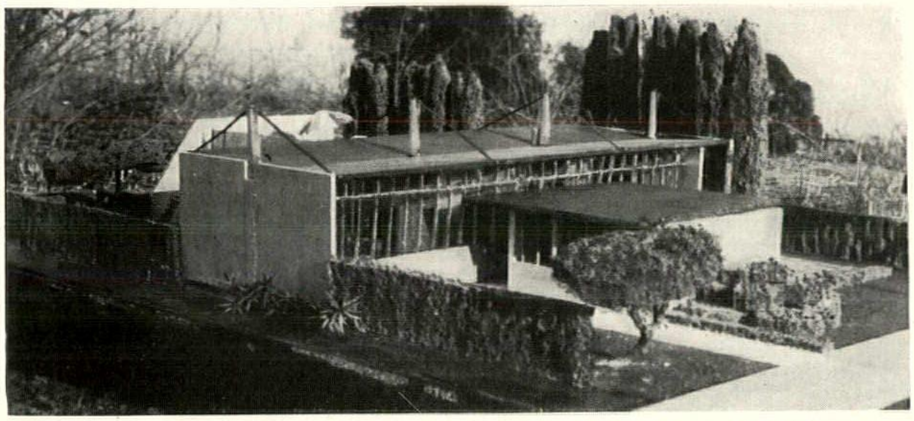
"ONE-PLUS-TWO" DIATOM HOUSE

RICHARD J. NEUTRA, ARCHITECT
PETER PFISTERER, ASSOCIATE
LOS ANGELES

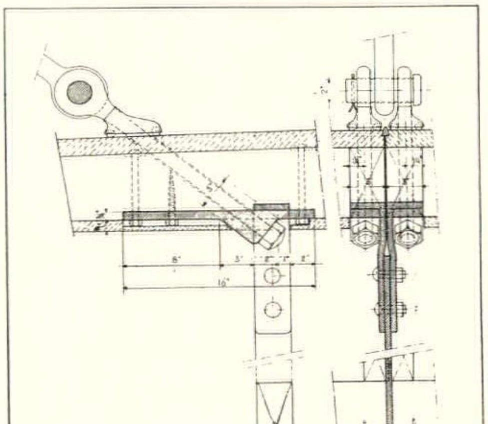


(1) Central House (2) Garage—2 cars (3) Children's Wing

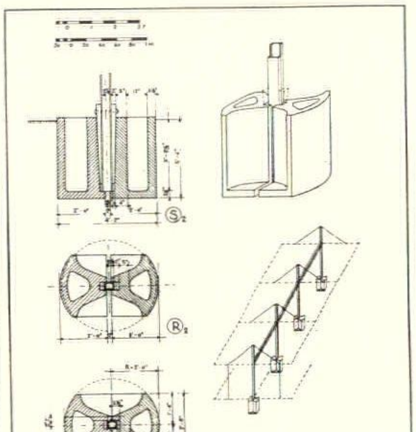
PROPOSED MULHALL COOPERATIVE FARMING COMMUNITY IN SAN DIEGO COUNTY, CALIFORNIA



VIEW OF MODEL SHOWING SUSPENDED ROOF CONSTRUCTION



DETAIL OF ADJUSTABLE AND SUPPORTING TENSION LINE



PREFABRICATED FOUNDATION 4-POST SUSPENSION SYSTEM

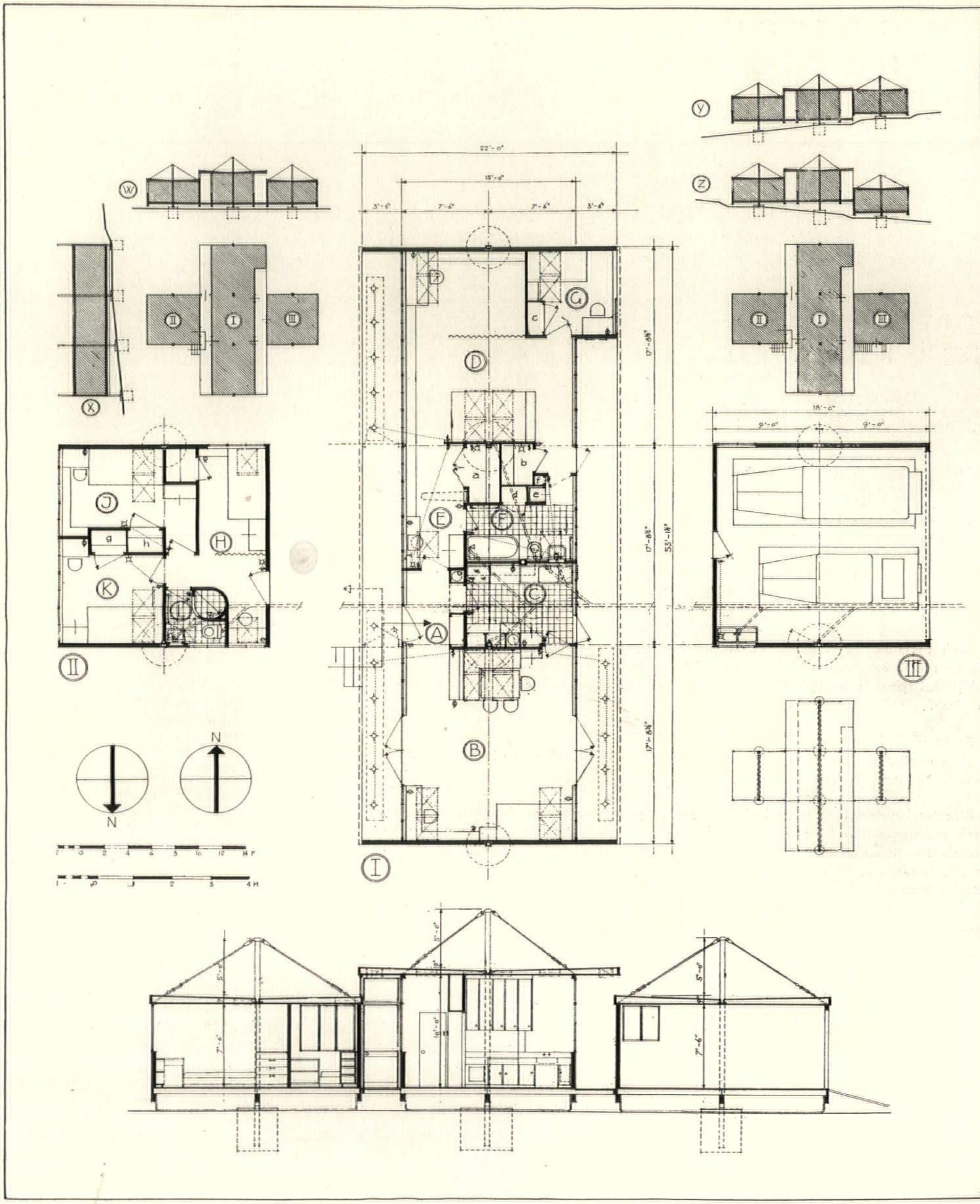
A shop-fabricated structure designed to permit three separate successive purchases. The central unit serves the smallest family group. Secondary elements for an expanding family are the children's unit and the garage unit. Houses can be arranged individually or in rows; a special type is used for hillside locations.

Estimated cost of central unit with sleeping porch and double garage: $1,750. Dependence unit for increased family group: $425. Prices include complete furnishings and would be decreased with increasing production.

Utilities: ceilings are low-temperature radiating metal panels. Indirect illumination provided by reflectors in ceiling which receive the light from vacuum tubes under outside roof projections.

Construction system: walls and roof of house units are suspended from four compression posts.

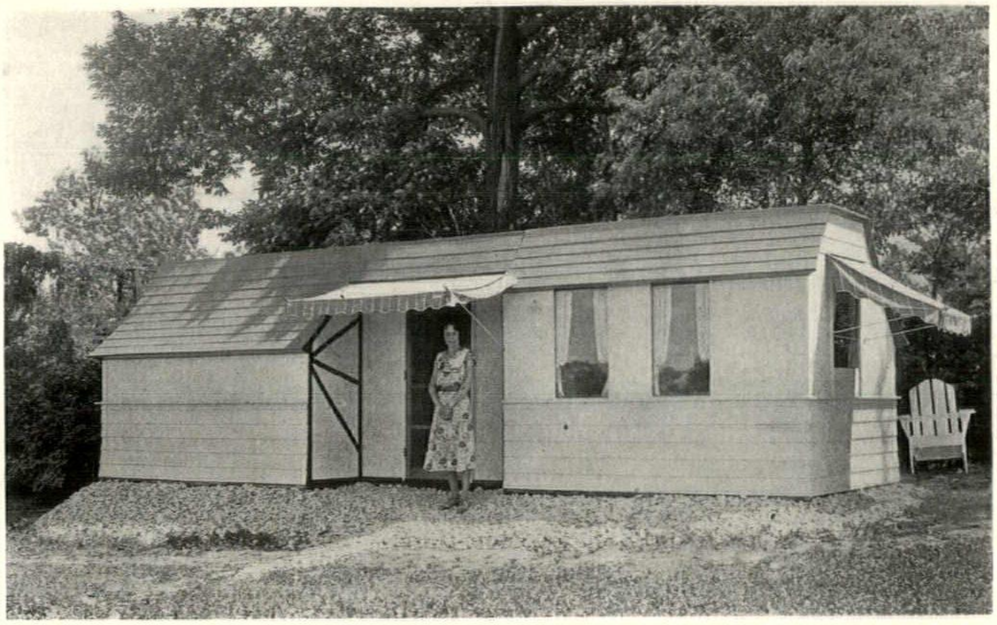
Synthetic structural material: a mineralized composition using infusorial earth as main ingredient and hardened under 8 atmospheres of steam pressure. This diatom composition is designed in various combinations for various requirements. In principle, the combination includes hydraulic binder, calcium hydrate, a fibrous material and resin as well as diatomaceous earth. Its minimum weight of 40 pounds per cubic foot can be further decreased for certain purposes by admixture of naphtalin as an evaporating agent that gives porousness. For moisture imperviousness the slabs before hardening are sprayed in the shop with a compound of hydraulic binder, water-repelling Ceresit or Colophonium, filler pigment and diatom powder to increase the interaction of the binder agent of upper and lower layers, and then the steam hardening of base and surface is accomplished in one process. No subsequent mechanical action can separate the surface layer from its base, and plaster surfacing is eliminated as a matter of course.



(I) CENTRAL UNIT (II) CHILDREN'S UNIT (III) GARAGE UNIT

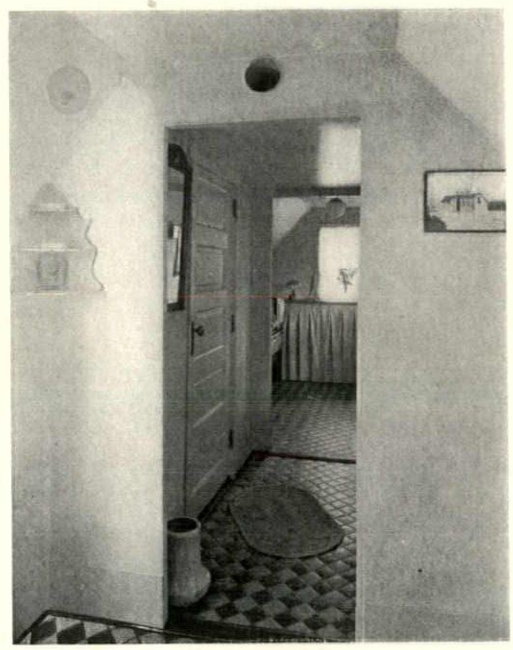
Structural values: The Diatom composition has crushing strength of 1,100 pounds per square inch, elasticity modulus 130,000, low specific gravity, low thermal conductivity, fire resistance, simple workability and precision without shrinkage. Steel reinforcing used for structural members like beams and roof slabs. A double shell wall (1¼" slabs with 3" air space) equals insulating value of an 18" brick wall with only one-twentieth of its weight.

COTTON HOUSES



PORTABLE HOUSE NEAR MILWAUKEE

DESIGNED BY
STANLEY W. NICHOLSON

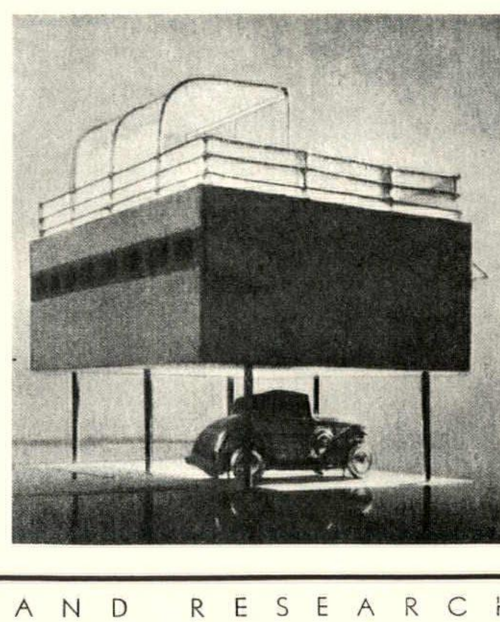


This demonstration house, built and occupied by the designer, consists of two room-units weighing only 370 pounds and costing $220. It is expected that this house type will be soon ready to market in room-unit form throughout Wisconsin, Minnesota and other vacation sections in the middle west. The houses will be sold to campers through sporting goods merchandising channels at a price of less than $100 for each room-unit.

Each room-unit is standardized in size and shape, and can be fitted for kitchen, dining room, bedroom or living room. Smaller units are provided for bathrooms. As additional space is needed, other units can be easily aligned and joined to those already in place.

Features of demonstration house: hot and cold running water; air conditioning system; kitchen equipped with refrigerator, gasoline range and sink. Concealed fixtures make it possible to convert living room into a bedroom, combining essential bathroom facilities.

Structural system has been adapted from airplane construction by designer, an aviator. Each room-unit is a light but rigid wood structure, with exterior covered by an unbleached cotton sheeting. The cotton is given a coating of cellulose "dope" as applied to airplane wings. This paint waterproofs and shrinks the fabric tightly in place. The interior is completely lined with the same material and the wall cell is filled with a loose-pack insulating material. The floor, integral with the room-unit, is of double thickness with an intervening air space.



WEEK-END HOUSE—Designed by A. LAWRENCE KOCHER and ALBERT FREY

The use of canvas for the covering of outside wall and roof surfaces in place of stucco, clapboards or shingles in the fabrication of small low-cost houses was first demonstrated in this model of a week-end house developed with the sponsorship of the New Uses Section of the Cotton-Textile Institute.

EXPERIMENTAL BUILDINGS U. S. DEPT. OF AGRICULTURE

BELTSVILLE EXPERIMENTAL FARM, MARYLAND

Under the supervision of Wallace Ashby, Chief of Division of Structures, U. S. Department of Agriculture, two canvas-covered sheds have been erected at the Beltsville Farm in order to study the life and utility of canvas as an outside covering for buildings, the effectiveness of different preservative and waterproofing treatments, and the ease of application with different kinds of sheathing and paints. Another new building using canvas is to be erected at the Delta Experiment Station in Mississippi in the near future.

The method of construction, as reported by J. R. McCalmont, Jr., agricultural engineer:

The wagon shed is ordinary shed construction with some variations in the sheathing requiring three men approximately 3 days to prepare it for the base treatments and canvas. The roof was sheathed with tongue-and-groove boards excepting two panels near the center of the roof which were covered with plywood flush with the sheathing.

The roof was divided into three sections for base treatment. A 6-foot strip along the south end was covered with hot asphalt, the center was untreated and an 8-foot strip along the north end was covered with white lead. The canvas strips were laid in the same manner explained for all canvas, the seams running with the pitch of the roof.

One end wall was covered with tongue-and-groove sheathing laid vertically, the other with plywood, and the back with tongue-and-groove sheathing laid part vertical and part horizontal. Plywood costs more per square foot than sheathing but there is less labor cost involved in laying it; the cost per square foot laid is about equal. It was thought desirable to have a canvas covering bonded to the sheathing and to accomplish this, three different base treatments were tried, hot asphalt, cold asphalt emulsion and white lead. The hot asphalt was easily applied but set up so quickly that the canvas could not be laid while it was still very soft, but had to be pressed into it. When the canvas was pressed into the asphalt it adhered very well. White lead had little or no holding power. Asphalt emulsion was the best preparation for a base treatment insofar as it was easily applied and held the canvas smoothly to the sheathing. Time is required to show how this treatment will set when it has dried thoroughly.

Four days were required to apply the base treatments, stretch and tack the canvas in place. Canvas is most easily applied by first fastening one end, stretching longitudinally, tacking the opposite end and finally tacking along the edges. Canvas must be stretched tight and smooth and tacked closely along all edges or it will separate from the base coat and become loose. Care must be taken not to stretch the canvas too much laterally when fastening the ends if its edges are to be kept straight. Canvas will stretch better the long way of the material, and after being stretched in one direction will stretch very little in the opposite direction. The change in moisture content will cause shrinking and stretching of canvas and if tacked too close to the edge of the strip the tacks will tear out of the fabric.

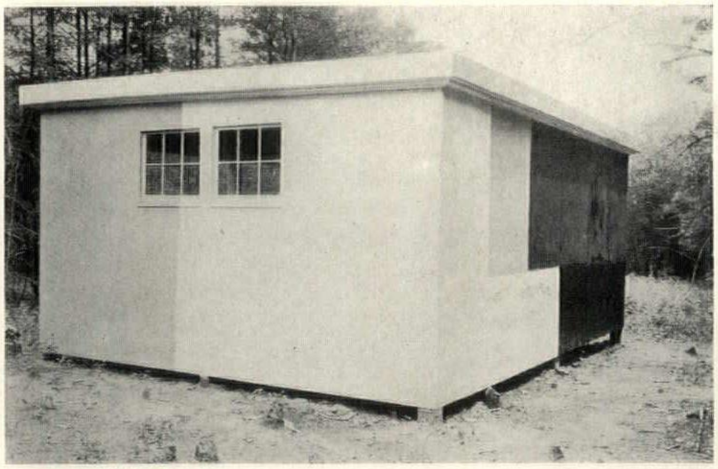
The value of the different paint treatments will develop as they have time to weather. Different paints and different colors in the same paint show a great difference in the amount of heat reflected and absorbed, which is expected to have an effect on the life of the canvas. The total time required for all the paint treatments was 2½ days.

The small shed, parabolic in cross-section, was built in 3 days. The ribs for the main part of the framing were made up of 3½" x 4" pieces of fir lumber. These pieces would break very easily at knots or points where the grain ran to the surface, and were not flexible enough to bend into shape without first soaking in water. Without clear uniform lumber it was also hard to bend the ribs to the same smooth curve, but with all having the same length the bracing and plywood sheathing on one half the roof and side kept them in line.

It was found that canvas can be laid better on a slightly convex surface than a plane surface, and it is easier to bond the canvas to the sheathing. This type of building would probably be less expensive than one using tongue-and-groove sheathing and canvas, and probably slightly more than one covered with drop siding alone, depending on the life of the canvas and the cost of the paint treatments used. Comparative cost between these methods of construction would depend on the locality in which the materials were bought.

When canvas is used there is no need for window or corner trim. The canvas can be carried around the edges of the window and under the window stops and drip cap. Trim boards would trap water and rot the canvas. Absence of trim cuts the cost of both labor and material.

Most of the paints cover the canvas well and appear to have furnished a waterproof surface. The canvas when painted was in good condition free from dirt and mildew.



Large canvas-covered wagon shed. Note absence of window trim.

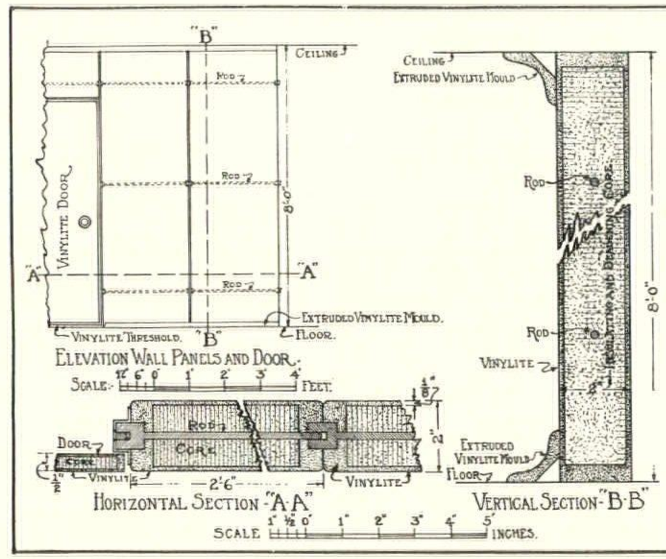
Small shed. Plywood is coated with asphalt before canvas is applied.

Canvas covering in place. No plywood used under canvas on south wall.

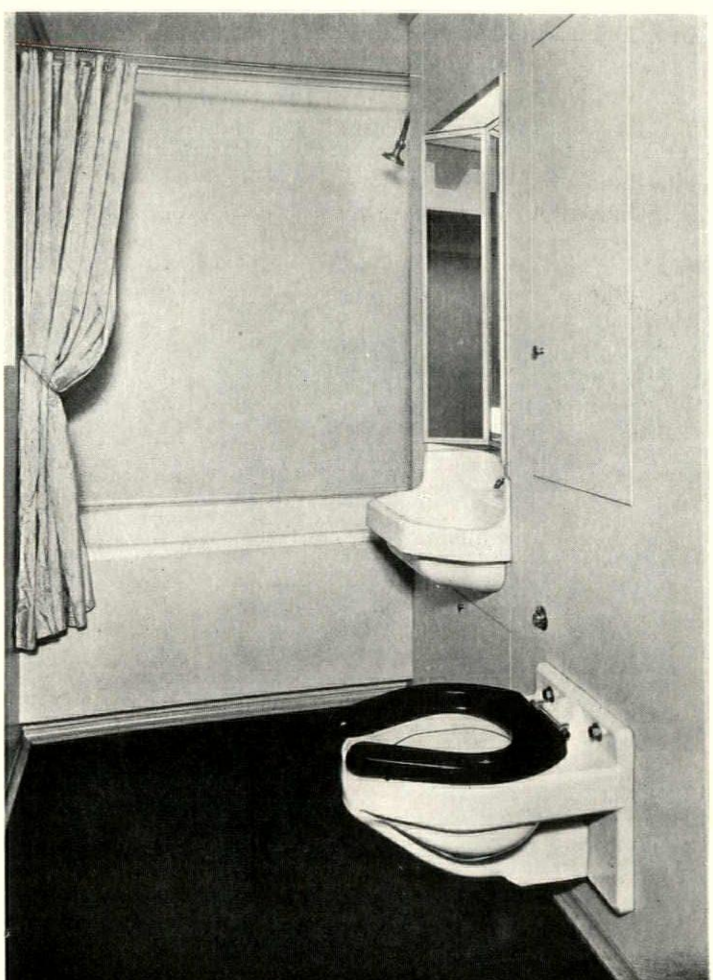
VINYLITE CUPBOARD DOORS, WALL PANELS, FLOOR TILE

THE VINYLITE HOUSE

A 3-room apartment—kitchen, bath and living room—built as a demonstration of the use of Vinylite for standardized building parts. (See description on frontispiece plate of this issue.) Wall panels are bolted together by rods inserted through core.



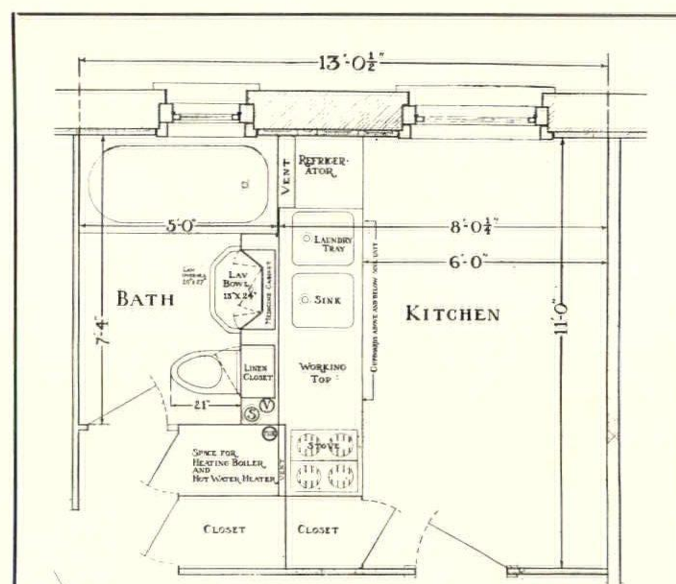
WALL PANEL CONSTRUCTION DETAILS



Eddowes Co., Inc.

KITCHEN-BATHROOM UNIT

A prefabricated combination unit developed as part of the housing studies of John B. Pierce Foundation, New York City. (Reported by R. L. Davison at the National Conference on Low-Cost Housing, October, 1933, sponsored by Cleveland Engineering Society.)



Backing up of kitchen and bathroom equipment eliminates need of partition wall. Combination delivered to building site as a single unit.

THE CONSTRUCTION OUTLOOK

By THOMAS S. HOLDEN, Vice-President in Charge of Statistics and Research
F. W. DODGE CORPORATION

The construction industry, sickest of all sick industries a year ago, is very decidedly convalescent; it has many reasons for viewing the year 1934 with renewed hope and vigor. It has already seen substantial increases in volume of public and private work, it has the early prospect of the signing of a master code satisfactory to all elements of the industry, and a practical certainty of increased volume of activity in the coming year.

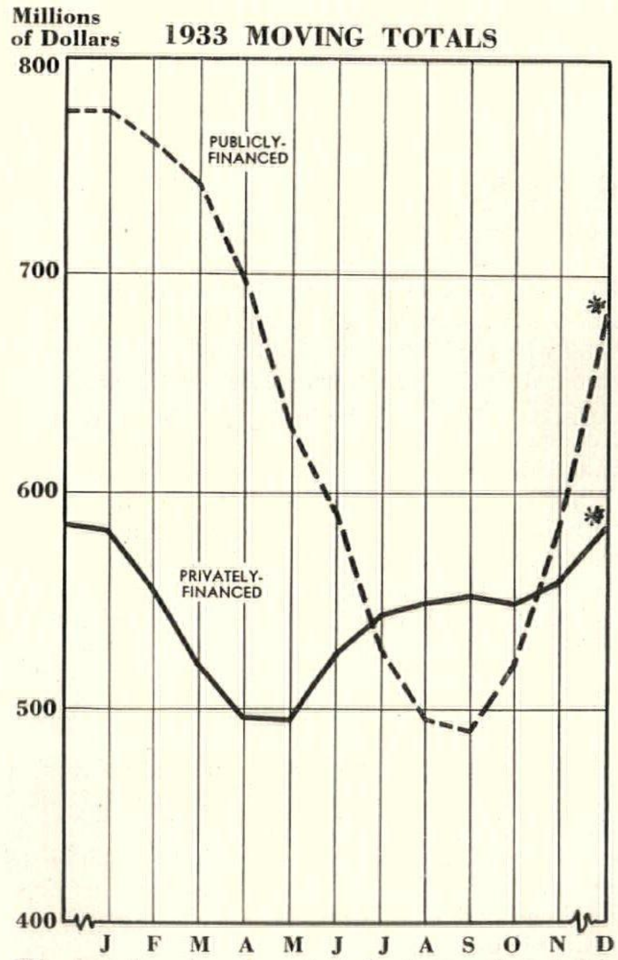
Public Works Program

Although the Federal public works program got under way several months after the upturn in private building activity, it was in magnitude the chief factor in recent increases of construction volume and is likely to continue as the largest factor through 1934. Practically all of the $3,300,000,000 fund had been allotted to specific projects by January 1, to projects in every state and territory. While some of the money is allotted to survey projects, reforestation, naval construction and the like, the bulk is for building and engineering construction. Most of the allotments will take effect as contracts and employment and material purchases in 1934. While engineering works predominate, hundreds of building projects have been approved, such as schools, hospitals, institutions, army housing, post offices, limited-dividend housing projects, new public buildings of all kinds, and repairs and alterations of existing public buildings. Inclusion of building projects in the program improves the outlook for architects, building craftsmen and other groups not employed in heavy engineering construction. Many of the engineering projects will be of indirect benefit to architects, through stimulating private building projects in the vicinity of new public improvements. The spread of purchasing power through public construction expenditures will have some effect on business confidence, real estate conditions and willingness to invest in new projects.

Planning Stimulated

The Federal public works program has not only provided money to carry through many hundreds of millions of dollars of construction work, it has also stimulated planning of many additional projects. At the opening of the year 1933 the creeping paralysis of deflation had practically strangled the will to plan new projects. F. W. Dodge Corporation used to record in single months of the boom years as much as a billion dollars in contemplated new projects reported in the early plan stage. By January 1933 the volume of contemplated new work had dwindled to $101,843,300, the lowest monthly total for many years. From January on there was a steady increase in contemplated work reported, up to $939,131,100 in November, the largest volume of new plans that had been reported in any month since April 1930. This remarkable upturn in the volume of new plans is shown in the accompanying tables and charts. The total volume of contemplated new work reported for the 37 eastern states in the year 1932 was only $1,838,340,000; in the year 1933 it reached the sum of $5,486,223,900 plus the figure for the final week of the year, unrecorded as this is being written. The total volume of new plans recorded in the year 1933 was three times as much as in the preceding year.

While this enormous volume of new planning was stimulated by expectation of Federal loans and



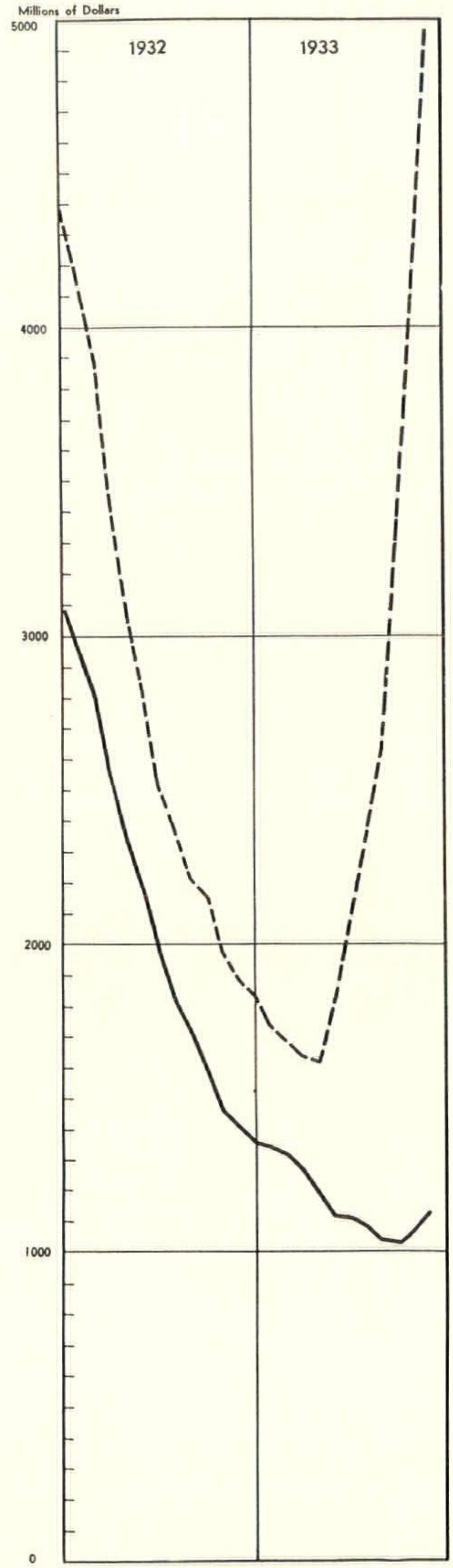
This chart shows how the revival of private work started in June, 1933, whereas the upturn in publicly-financed work did not come until October. Private work appears to have reached an irreducible minimum in 1933, having fallen only 2 per cent behind the previous year. As the year opens conditions seem favorable to continued moderate improvements in privately-financed work, along with very big increases in public work.

grants, it has not been confined to public projects. As shown in the charts and tables, every major classification of building and engineering work has participated in these increases; even the two classifications which do not show increases in the table for the first eleven months of the year (commercial buildings and religious and memorial buildings), show in the charts upturns for recent months.

Unfortunately, we can not take these figures on new plans as any exact measure of the volume of contracts to be expected in 1934. The projects practically certain to go ahead are those for which definite allotments of Federal funds have been made. When Secretary Ickes announced recently that the $3,000,000,000 mark had been passed in Federal allotments, he also stated that applications had been received by the Public Works Administration for loans to other projects amounting to $3,000,000,000 more. The incoming Congress will have before it the question of increasing the public works fund. It has been reported that an additional $2,000,000,000 will be asked for. If Congress accedes to this demand, wholly or in part, it will be possible to advance the money very quickly to many additional projects. It is entirely possible that some communities, still solvent and awakened to a new interest in improvements, will carry projects through with their own financing.

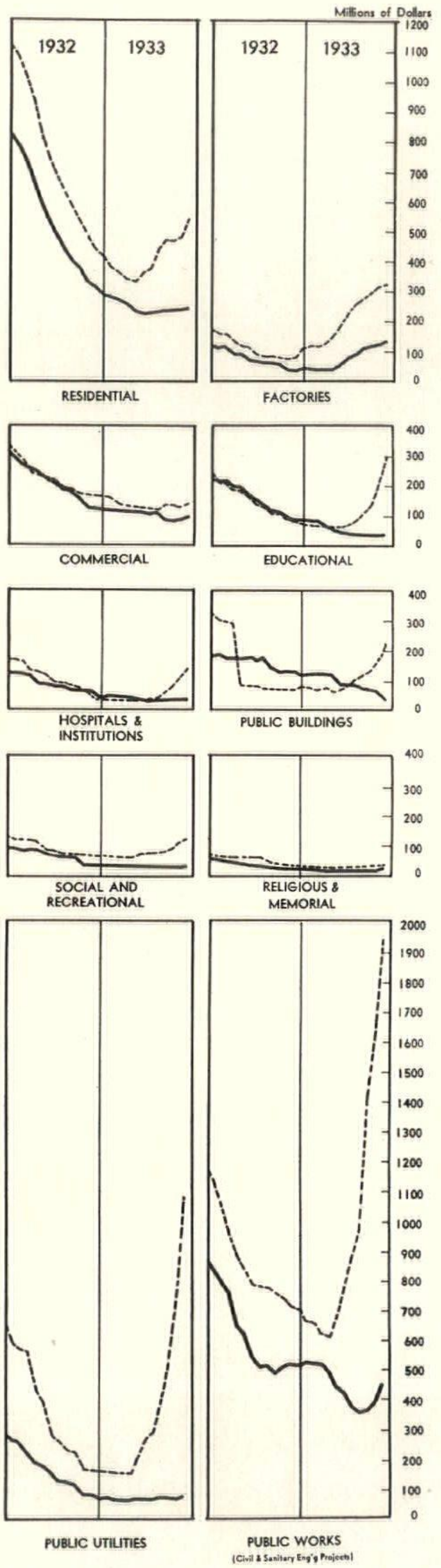
Private Building Revived

As previously stated, privately-financed building and engineering work started upward well ahead of the public works program (see chart on page 37). As early as June contracts for private work exceeded the figure for the corresponding month of 1932, whereas it was not until October that publicly-financed work began to run ahead of the preceding year. During the six months from June 1 through November 30, 1933, privately-financed contracts awarded in the 37 eastern states amounted to $325,745,700 and exceeded the figure for the corresponding period of 1932 by 20 per cent. While residential building participated in this increase, the most spectacular increase was in factory projects, which had in 1933 three times the contract volume of the preceding year. Breweries played a large part, as distilleries will in 1934. New industrial construction is less dependent on the mortgage-money market than other private construction, and this has undoubtedly been an influence favoring this class of construction. The fact that obsolete plants and equipment have been written down in value is a stimulus to manufacturing companies to seek new locations, new branches, modernized buildings and equipment. Architects participated in the planning of new factory projects to a greater extent than ever before; except for small houses, factories accounted for a larger volume of architect-planned work that went ahead in 1933 than any other class of work. The outlook for continued increases in factory construction and modernization in 1934 seems very good.



TOTAL CONSTRUCTION

In these charts the solid black curves represent 12-month moving totals of contracts awarded in the 37 eastern states; the broken curves represent 12-month moving totals of contemplated new work as recorded month by month. The increase in planning volume in 1933 was spectacular; while it was greatest in the engineering classifications (public utilities and



public works), it affected every other major classification of public and private work. The contract curves for five out of the ten major classifications have moved upward in recent months; factories, residential buildings, commercial buildings, public utilities and public works.

Other Signs of Progress

In the field of mortgage financing, progress has been slow. Government aid has thus far been extended principally to the small-house field. Liquidation of small-house mortgage difficulties by the Home Owners' Loan Corporation has made a good start. Aid to building and loan associations has assisted those institutions to prepare themselves for making new loans. Organization of new Federal building and loan associations has provided a number of communities with new institutions ready to lend on new mortgages. On November 19, 1933, John H. Fahey, Chairman of the Federal Home Loan Bank Board, announced that twenty charters had been granted to Federal savings and loan associations in seven states, and that preliminary approval had been given to 86 more in 26 states. Outside of the small-house field, progress has been made to the extent of more foreclosures out of the way, more distress property off the market, and signs of moderate improvement in real estate. Reopening of closed banks should be of some indirect aid to small-house building and modernization work.

Efforts will be made to persuade the incoming Congress to broaden the scope of the Home Loan Bank System, to finance individual owners and small-house developers, and even to create a national mortgage banking system for lending on all classes of property. How far the Government may go along these lines is a matter of conjecture at present; some liberalization of lending policies seems likely. Should the scope of Government financing be considerably expanded, the moderate increase in private work now expected for 1934 may be quite considerably accelerated.

The current civil works program is apt to provide a further stimulus to both private and public building activities. Immediate civil works projects will not include much contract work or much work requiring large bills of materials. They will include many local surveys and real property inventories which are apt to disclose building requirements in numbers of communities. The Government's housing and slum-clearance efforts will focus attention on the need for liquidation and rehabilitation of those bankrupt urban neighborhoods called blighted areas and slums and should lead to a well-defined slum-rehabilitation policy and program.

Signing of the master code for the construction industry presented by the Construction League of the United States, expected momentarily as this is being written, will mark a milestone of progress. Except for temporary emergency organizations, the numerous groups in the big general field of construction activity have had heretofore no strong national association representing all the diverse interests, acting to correct abuses nationally and locally, and integrating the several elements into a coordinated whole. Public discussion has also achieved for the construction industry a far more widespread recognition of its key function as producer of capital goods and distributor of general purchasing power than it has ever enjoyed before.

Notable Turn of Trend

While 1933 was the lowest point of depression for the construction industry, and a quite extreme low point, the progress that has been made since the turn of the year has been notable. Contracts awarded in the 37 eastern states during the first half of 1933 were 35% less in volume than in the first half of 1932; the second half year ran approximately 20% ahead of the second half of 1932. Consequently, the outlook for 1934 is vastly improved; naturally, this improvement is to be measured in terms of upturn from depression levels, not in terms of approximating the volumes of previous big boom years.

Publicly-financed work should at least double in volume over 1933. Private work should continue on the upgrade, with a moderate but substantial increase. Since architects will participate very largely in the public building projects as well as in any increases in private work, they will most likely have a considerably larger volume of business than in either of the past two years.

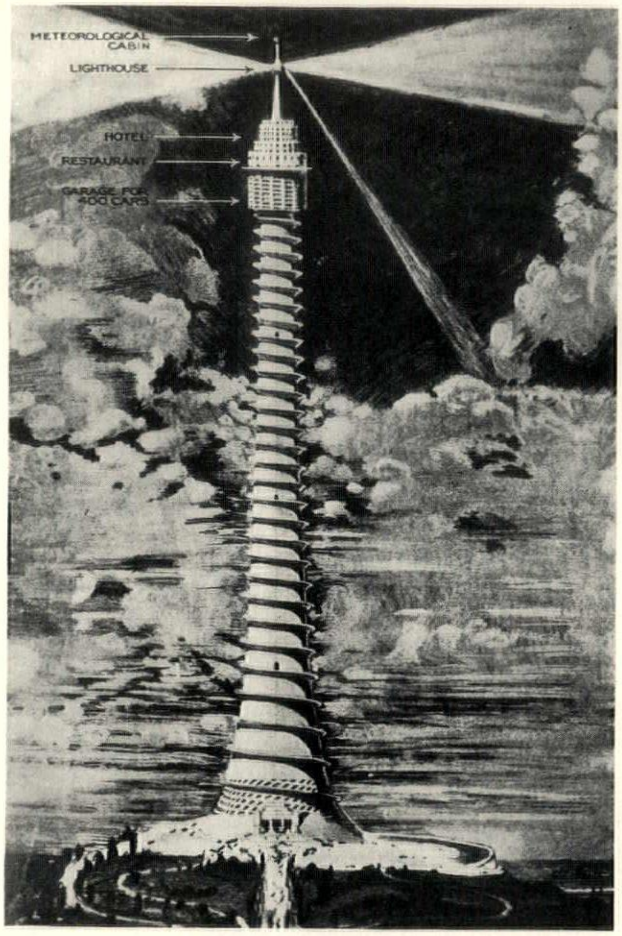
CONSTRUCTION STATISTICS—Thirty-seven Eastern States:

	Contemplated New Projects		Contracts Awarded	
	Entire Year 1932	11¾ Months 1933	Entire Year 1932	11¾ Months 1933
Commercial Buildings	$156,953,700	$151,255,000	$122,718,200	$97,766,300
Factories	102,720,700	314,073,800	43,490,900	126,734,000
Educational Buildings	75,822,900	393,837,100	82,307,500	36,803,800
Hospitals and Institutions	47,174,100	188,050,600	48,353,000	36,924,400
Public Buildings	73,295,100	243,114,700	117,982,500	48,994,300
Religious and Memorial	39,113,900	36,237,500	27,255,000	17,528,100
Social and Recreational	65,052,000	134,745,800	38,682,500	29,349,500
Residential Building	410,835,300	642,117,100	280,067,900	247,019,700
Public Works	708,058,900	2,136,364,500	514,699,700	482,006,800
Public Utilities	159,313,400	1,246,427,800	75,601,500	99,486,500
TOTAL CONSTRUCTION	$1,838,340,000	$5,486,223,900	$1,351,158,700	$1,222,613,400

These figures indicate the distribution of new plans among the major classifications of work. While biggest increases have taken place in plans for public works and public utilities, all other classes have had increased plan volume. In two classes (commercial buildings and religious and memorial buildings) increased plan volume came late in 1933 (see chart on page 39) but in insufficient amount to put the year's total for those classes ahead of 1932. In the contract tables the outstanding feature is the big increase in factory projects. Four other classes had contract increases in late months of 1933: residential buildings, commercial buildings, public utilities, and public works (see charts on page 39). The total for the full year 1933 was only about 7 per cent under that of 1932.

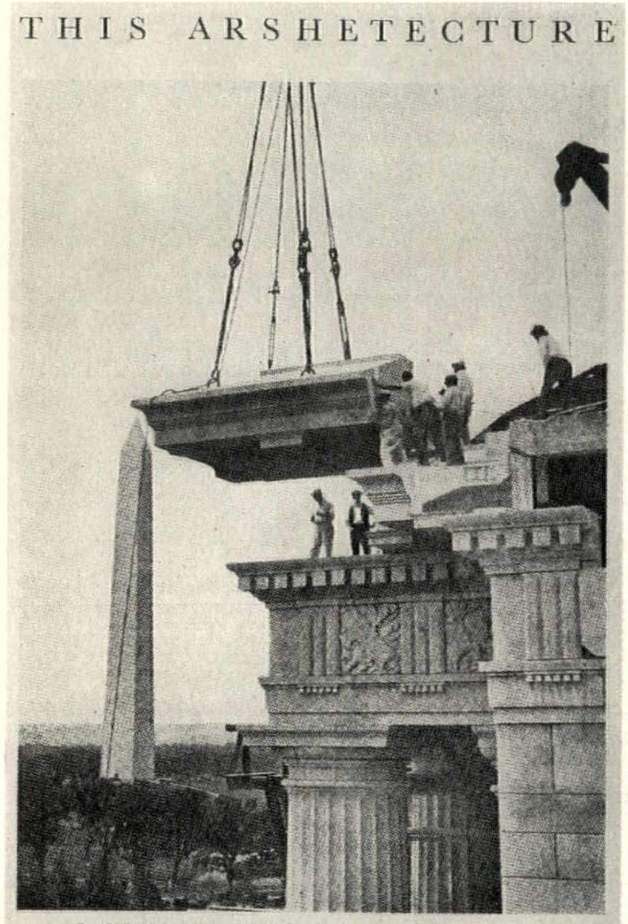
PRIVATE AND PUBLIC WORK REVIVED IN 1933 Contracts Awarded—37 Eastern States

	Privately Financed		Publicly Financed	
	1932	1933	1932	1933
January	$45,454,200	$43,876,300	$39,344,200	$39,479,700
February	55,373,200	26,075,800	33,672,600	26,636,500
March	67,422,100	34,752,300	44,812,400	25,206,200
April	61,175,000	38,933,800	60,529,800	17,639,200
May	53,673,000	53,487,500	92,548,200	23,684,200
June	48,806,800	73,520,900	64,268,200	28,821,000
July	43,504,700	62,469,700	85,264,000	20,084,700
August	52,885,700	58,741,300	81,102,400	47,247,600
September	47,426,000	46,744,800	80,100,700	73,389,600
October	46,348,100	44,805,900	60,925,800	100,561,300
November	32,215,200	35,797,300	73,087,100	126,543,300
December	29,207,300	51,346,700	52,012,000	155,862,800
TOTALS	$583,491,300	$570,552,300	$767,667,400	$685,156,100



Keystone

This proposed French structure will dwarf the Empire State building. In connection with plans for the Paris Exhibition of 1937, the construction of a huge tower of reinforced concrete, about 2,300 feet high, to be known as the Phare du Monde (Lighthouse of the World), has been suggested. It would be more than double the height of the Eiffel Tower (984 feet), and nearly twice that of the world's tallest skyscraper (1,248 feet). Besides interior elevators there would be a spiral outside motor-track leading to the first platform some 1,600 feet above the ground, with a garage for about 400 cars. A small track for light cars would ascend to another platform about 300 feet higher with a restaurant to accommodate about 2,000 people. Higher still would be a solarium for sun bathing and, above the lighthouse, a meteorological cabin. The engineer is M. Freyssinet.



In Washington, U.S.A. (reproduced from STONE).

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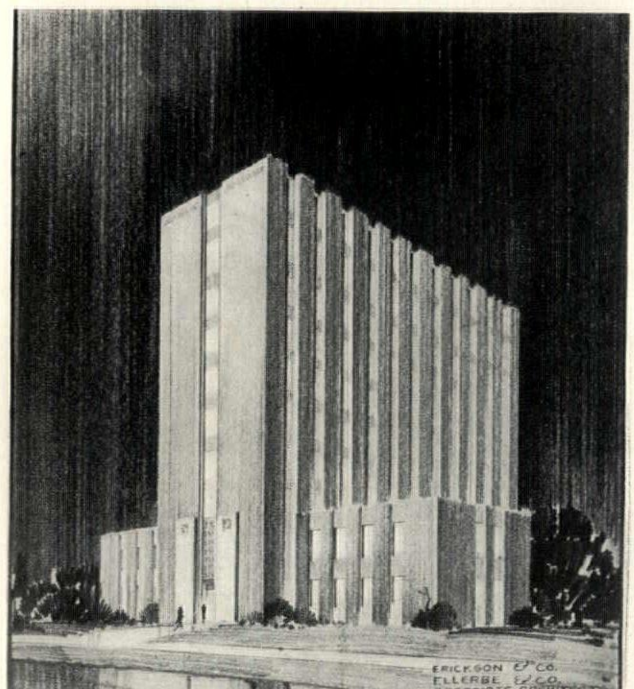
An English view of American architecture.

The Miller Hospital is now under construction in Duluth, Minnesota. The present structure is being erected at a cost of $200,000 and will have a capacity of 50 beds; when finally completed the hospital will accommodate 150 beds. Erickson & Co. and Ellerbe & Co. are the associated architects.



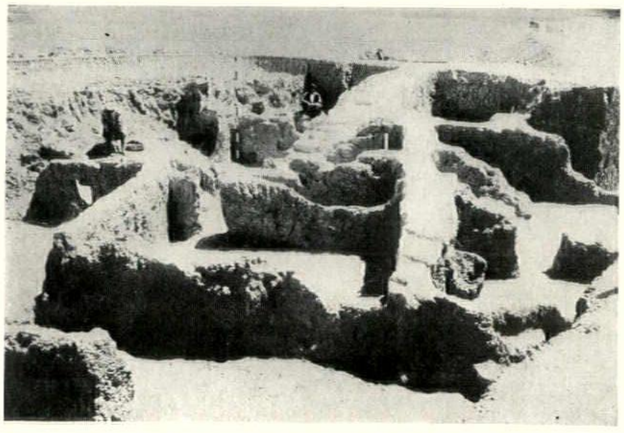
ANCIENT PERSIAN PALACE SCULPTURES AND A STONE AGE VILLAGE UNEARTHED BY AMERICAN EXPEDITION

Recently discovered sculptures in the ancient buildings of Persepolis are described in a report to Dr. James H. Breasted, Director of the Oriental Institute of the University of Chicago by Dr. Ernst Herzfeld, field director of the Institute's Persian Expedition at Persepolis, twenty-five hundred years old capital of the ancient Persian Empire, about forty miles from Shiraz. Two miles from Persepolis the expedition has found a 6,000-year old Stone Age village, with houses containing the earliest known windows ever found. Here lived the forebears of the Persian emperors, and in some of the rooms have been found the dishes and utensils from which they last ate some six thousand years ago.

Dr. Herzfeld has uncovered a series of wall sculptures which if set together would form a vast panel of reliefs five or six feet in height and almost a thousand feet in length. "The discovery is one of the greatest and most important in the history of archeological research anywhere," said Dr. Breasted. "It not only far surpasses any archeological disclosure ever made in the history of such research in Persia, but there has never been any discovery like it anywhere in Western Asia since archeological excavations began there almost a century ago."

The walls of the splendid palaces which stood on the gigantic terrace of Persepolis overlooking a mighty plain encircled by mountains, were of sun-dried brick, but the colonnaded halls, the windows, and the great doors were done in black stone which was polished like ebony.

The friezes and sculptured scenes were embellished with colors now all lost except in one relief just discovered by Herzfeld. It had been sheltered from the weather under rubbish for centuries.



First glimpse of the Stone Age village near Persepolis at the beginning of the clearance. The adobe walls of these houses were built six thousand years ago.

Now uncovered, it reveals the Persian Emperor wearing a robe bordered with scarlet and purple, shoes of scarlet, and other finery in royal hues.

It was due to the disintegration and final fall of the great mud-brick walls that the newly discovered sculptures were preserved, and protected from the ravages of weather and vandalism through the nearly 2,500 years since they were created. The carvings, which include a series of historical inscriptions of the greatest importance, are as fresh as the day when the sculptors' chisels touched them for the last time.

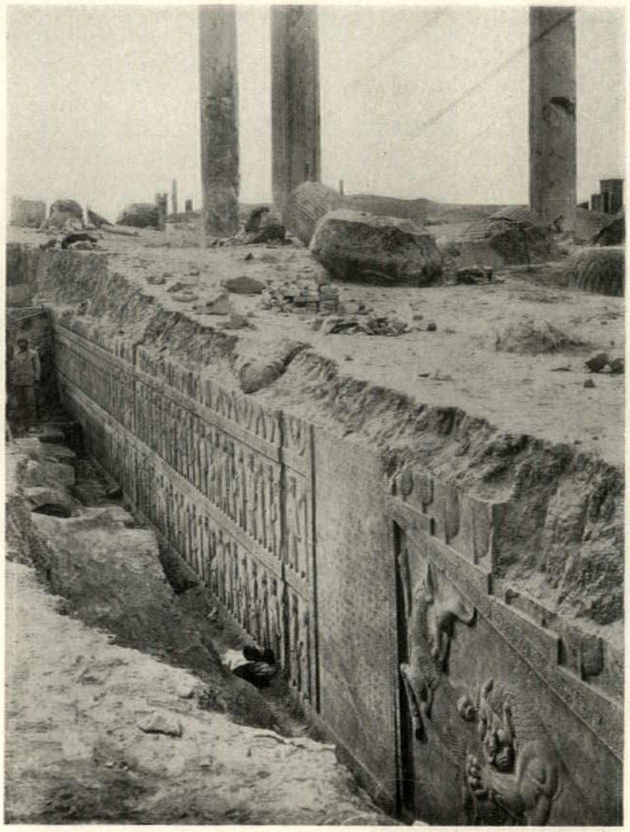
"One tradition has it," said Dr. Breasted, "that Alexander the Great in 330 B.C., sotted with wine and urged on by his lady-love of the moment, set fire to the roof of one of these palaces, and thus sent up in flame and smoke a supreme expression of ancient Oriental genius.

"It was a disaster which marked the end of the evolution of Oriental civilization in Western Asia, and the destruction wrought by that conflagration devastated and wrecked forever most of the works of art which made the palaces of Persepolis the great world center of culture and civilization under the Persian Empire.

"When the Moslems overflowed into this region in the seventh and eighth centuries of the Christian Era, they battered to pieces the heads and faces of the sculptured figures they found still visible above the ground at Persepolis. But the sculptures which the Oriental Institute has now discovered escaped their notice."

The subject matter of the reliefs is a magnificent *durbar* representing a great group of Persian and Median officials standing with the gorgeous uniformed palace guards of the Persian Emperor drawn up at one side to receive the ambassadors of twenty-two subject nations who approach from the other side bearing their tribute to Persia. The execution of the scenes displays unparalleled beauty and refinement of detail. The palace guards, consisting of footmen, horsemen, and charioteers, form a superb ensemble. In the sculptor's representation of each chariot wheel, the bronze nail which was dropped through a hole in the end of the axle outside the hub to prevent the wheel from coming off is depicted in every detail; and the upper half of each nail consists of a beautifully sculptured female figure, carved with the delicacy of a cameo in an area not as large as a postage stamp, the legs of the figure forming the stem of the nail which is inserted in the hole in the axle.

Within two miles of Persepolis, Dr. Herzfeld has found a small mound some 300 by 600 feet in area and only ten or twelve feet in height, which when excavated has been found to cover a Stone Age village in a state of preservation surpassing any such discovery ever made heretofore. It dates from about 4,000 B.C.



(Left) Relief from small stairway at Persepolis showing two tribute bearers. (Right) Monumental stairway at front of palace. The uppermost reliefs on top course of blocks were knocked off by fall of sun-dried brick wall above; the blocks have been discovered lying uninjured at base of wall and will be replaced by expedition.

The walls of the *adobé* houses are preserved in places to a height of six or seven feet. There is a narrow street or alley extending the length of the little settlement, and a modern visitor walking along it can look over into the houses. Through the doors, and the earliest known windows ever found, one can see mural decorations of red ochre water color still discernible on the walls. Still standing about on the floors are household utensils of pottery, fireplaces with burned clay fire-dogs still in position, and pottery vessels still containing the remains of food, especially the bones of probably domesticated animals. In some of the dishes lay the flint knives with which these ancient people had last eaten about 6,000 years ago.

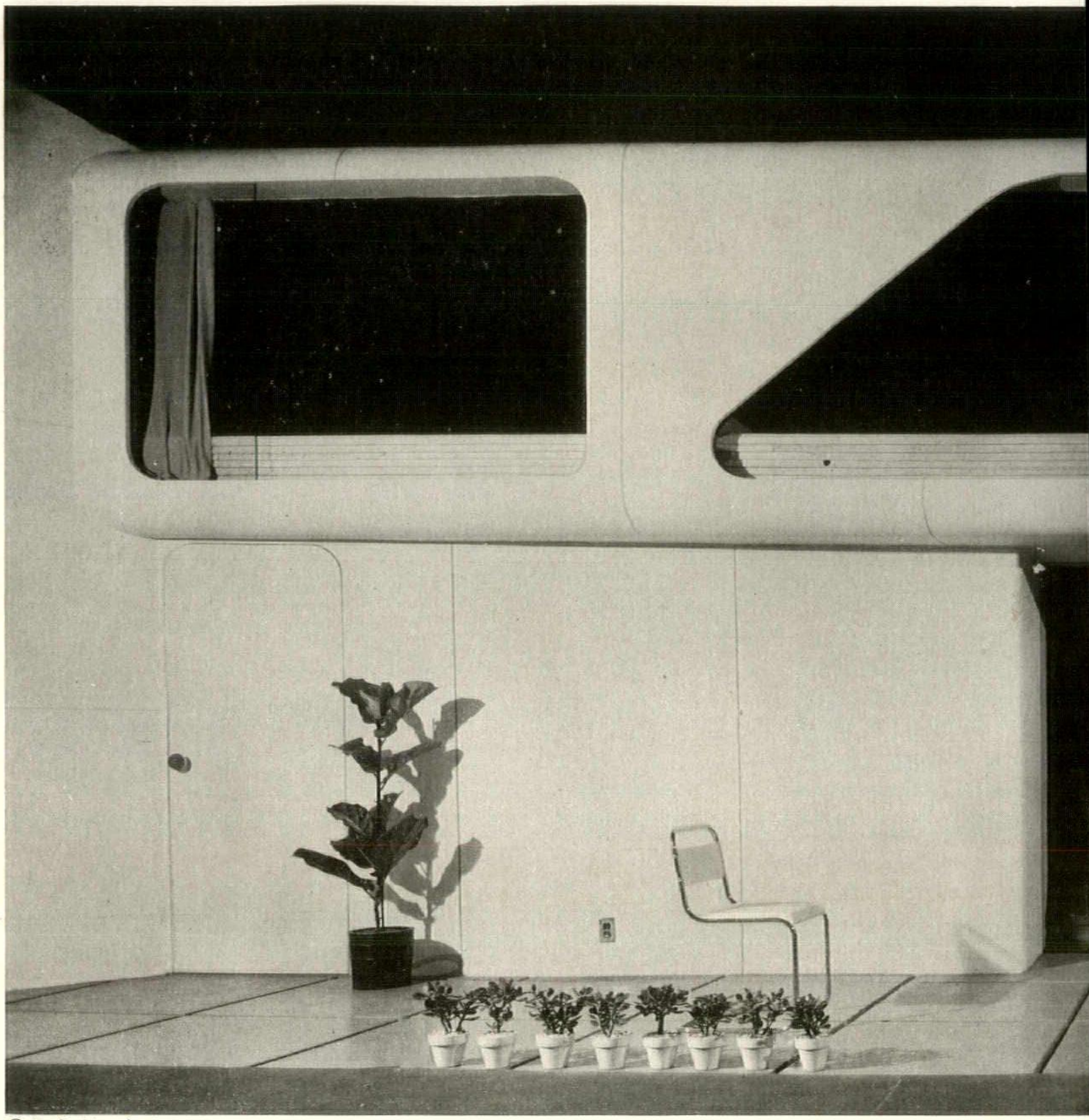
The Oriental Institute holds a concession to all the surrounding ancient sites within a radius of ten kilometers, or a circle of thirteen miles with Persepolis at its center. The Oriental Institute's Persian Expedition, headed by Professor Ernst Herzfeld, is engaged in recovering the long cultural development which went on for ages among the Persians and their predecessors in this region, as they advanced from the remote Stone Age to the magnificence of Cyrus the Great and the Persian emperors at Persepolis.

HISTORIC ARCHITECTURE TO BE SAVED FROM OBLIVION

To save from "unrecorded oblivion" the nation's historic buildings, the American Institute of Architects announces the appointment of four members of a National Advisory Committee: Dr. Leicester B. Holland, chief of the Division of Fine Arts of the Library of Congress; William Graves Perry of Williamsburg, Va.; Albert Simons of Charleston, S. C.; John Gaw Meem of Sante Fe, N. M. Three other members will be named by the Director of the Office of National Parks, Buildings, and Reservations.

The purpose of the program, framed as a civil works measure to provide immediate employment for 1,000 or more architects, is to record "interesting and significant specimens of American architecture." The advantages, it was stated, are that men could go to work at once, and that a very minimum of equipment, supplies, and overhead is necessary.

The plan embraces every type of antique structure in America from the Colonial architecture of the Atlantic Seaboard and the traces of Spanish culture in the South and Southwest to the prehistoric remains in New Mexico and the Russian remains in Alaska. Excavations of aboriginal ruins, and the making of complete records of the "decomposing cities" of the old mining settlements are contemplated. Residential buildings ranging from the birthplaces of Presidents to the hewn log cabins of the early pioneers are included.



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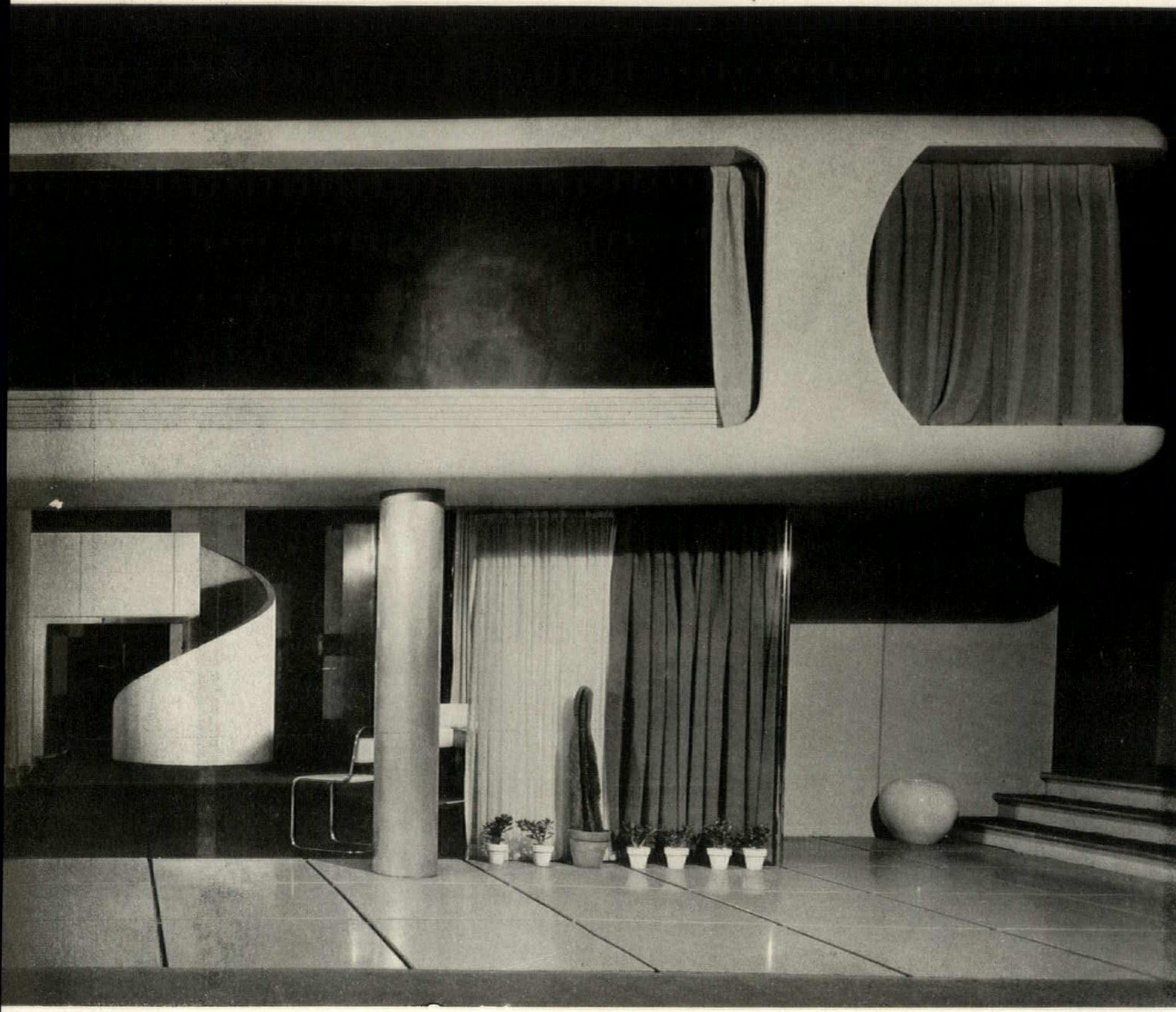
SPACE HOUSE

By FREDERICK J. KIESLER, ARCHITECT



Floor view of the Space House. Designed as one living space convertible into several rooms. The shell of the house is continuous tension, a construction principle developed to reduce deadload and to eliminate column support. (The column seen in the illustration could not be removed from exhibition floor.) The shell of the house is intended for die-cast unit construction. The view of the interior through the movable plate glass, on the main floor, is toward the living-sector of the house with the winding staircase leading over a small bridge into the segments for sleeping, on the mezzanine.

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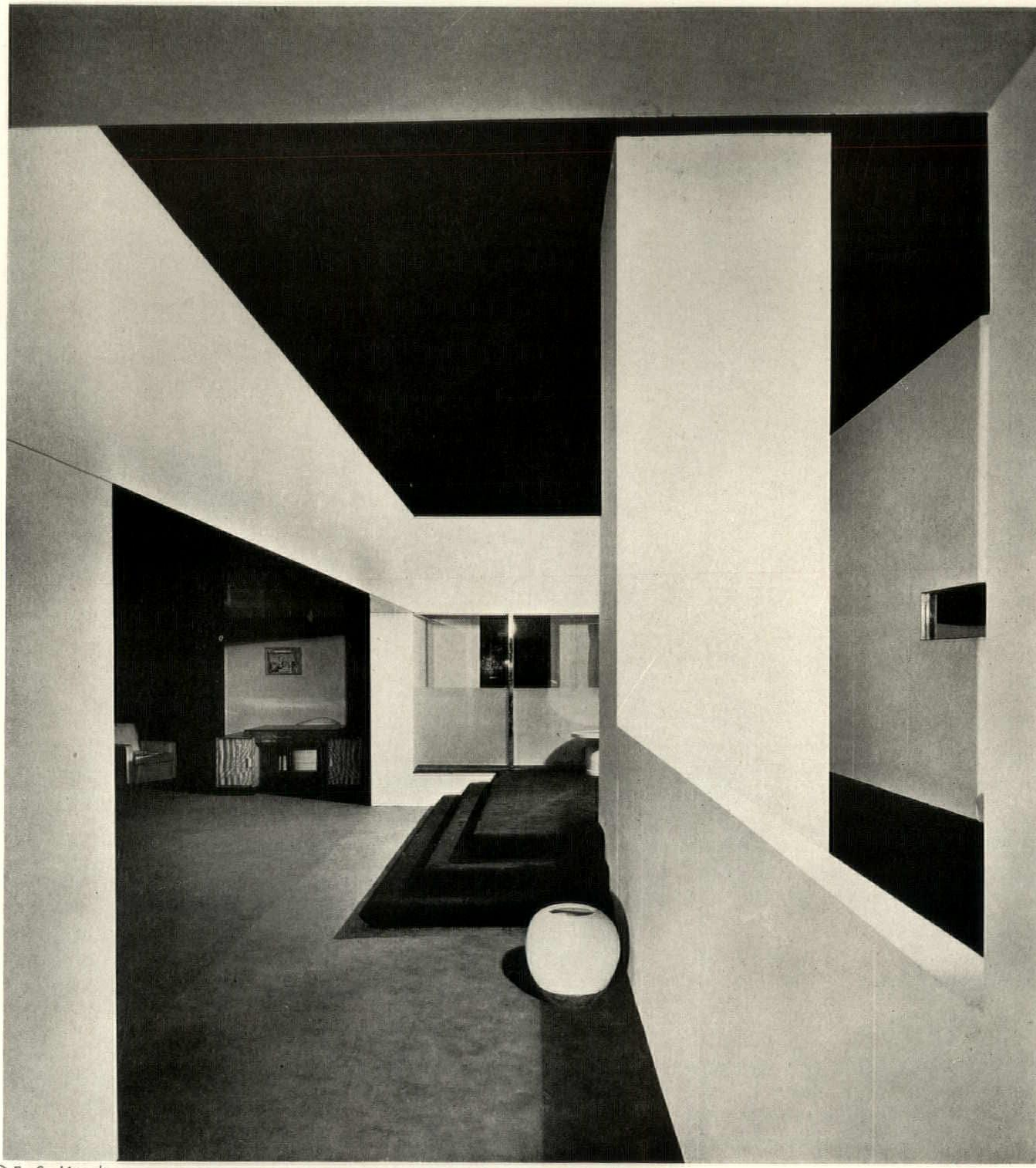
Stairway of exhibition hall adjoining Space House.

SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT



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Interior of space house: Dining space (to the left), living segment (behind staircase), library (under the mezzanine), study (in front) may all be thrown open into one large unified space-unit. These elements vary in height, depth and length; they are planned on four different levels. The design is an interpretation of the architect's theory of Time-Space-Architecture.

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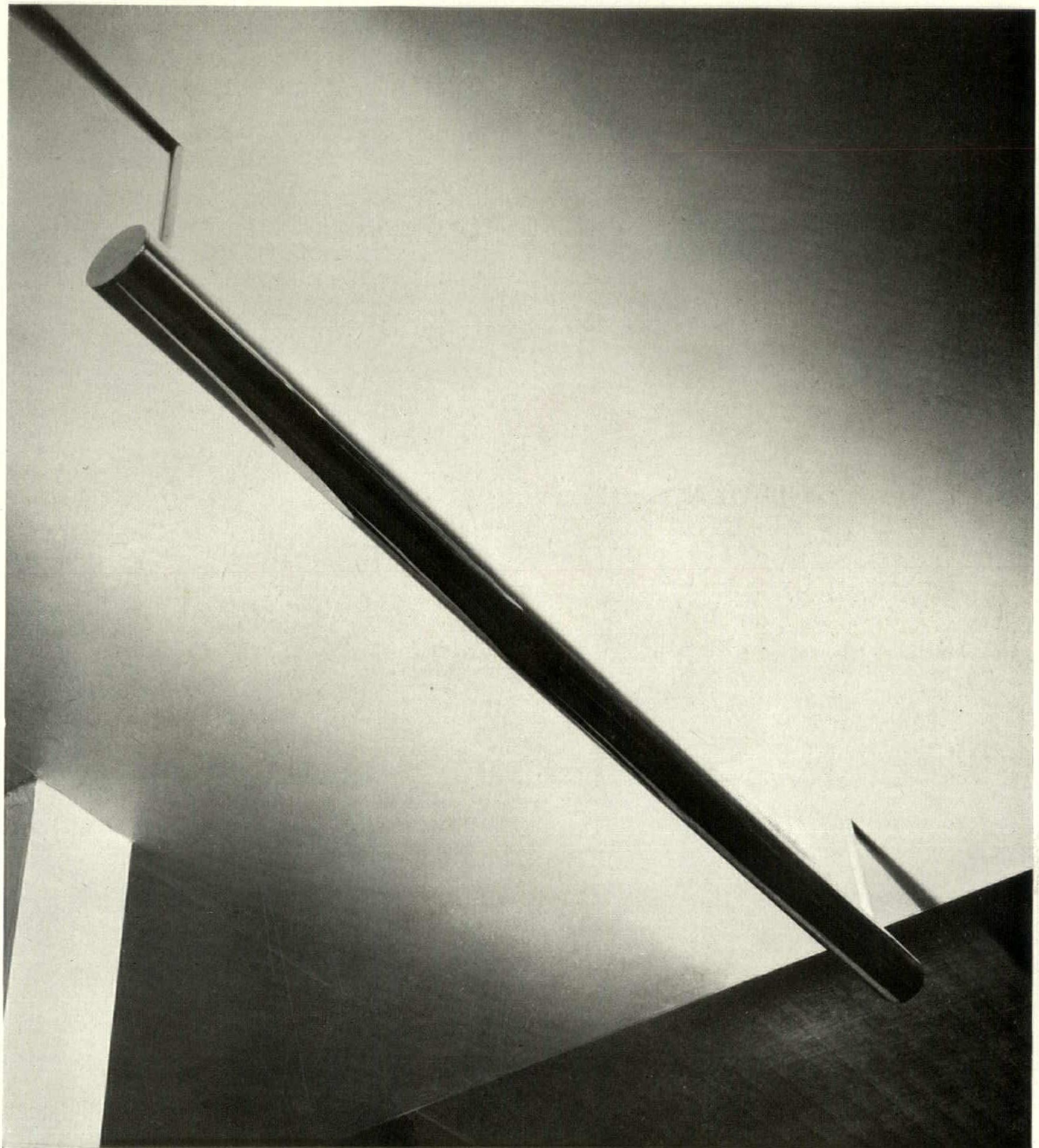
SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT

Photo mural by Frederick Kiesler: "Determination" (Labor and Play).



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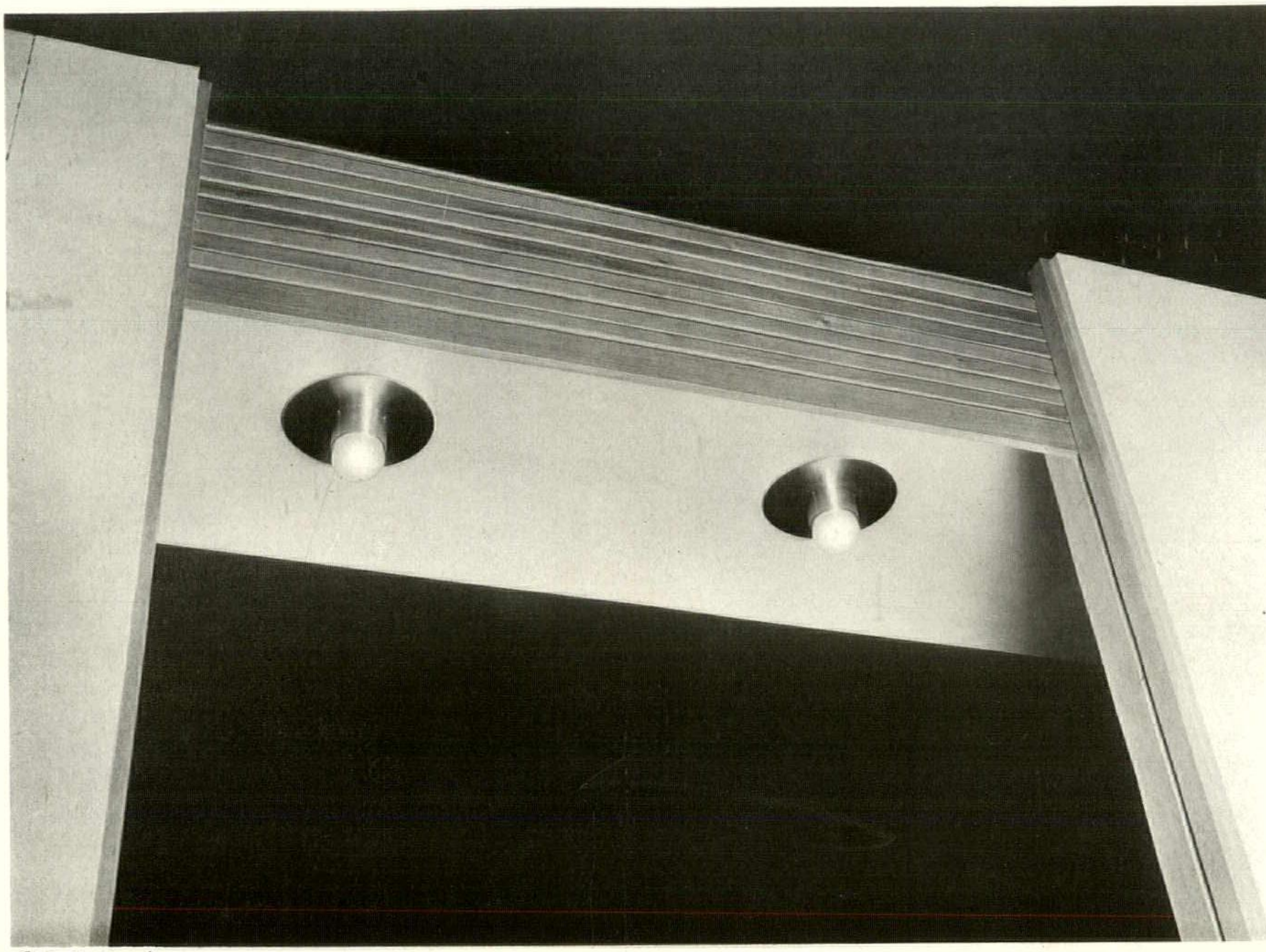
Tubular lighting fixture on mezzanine floor of showroom.



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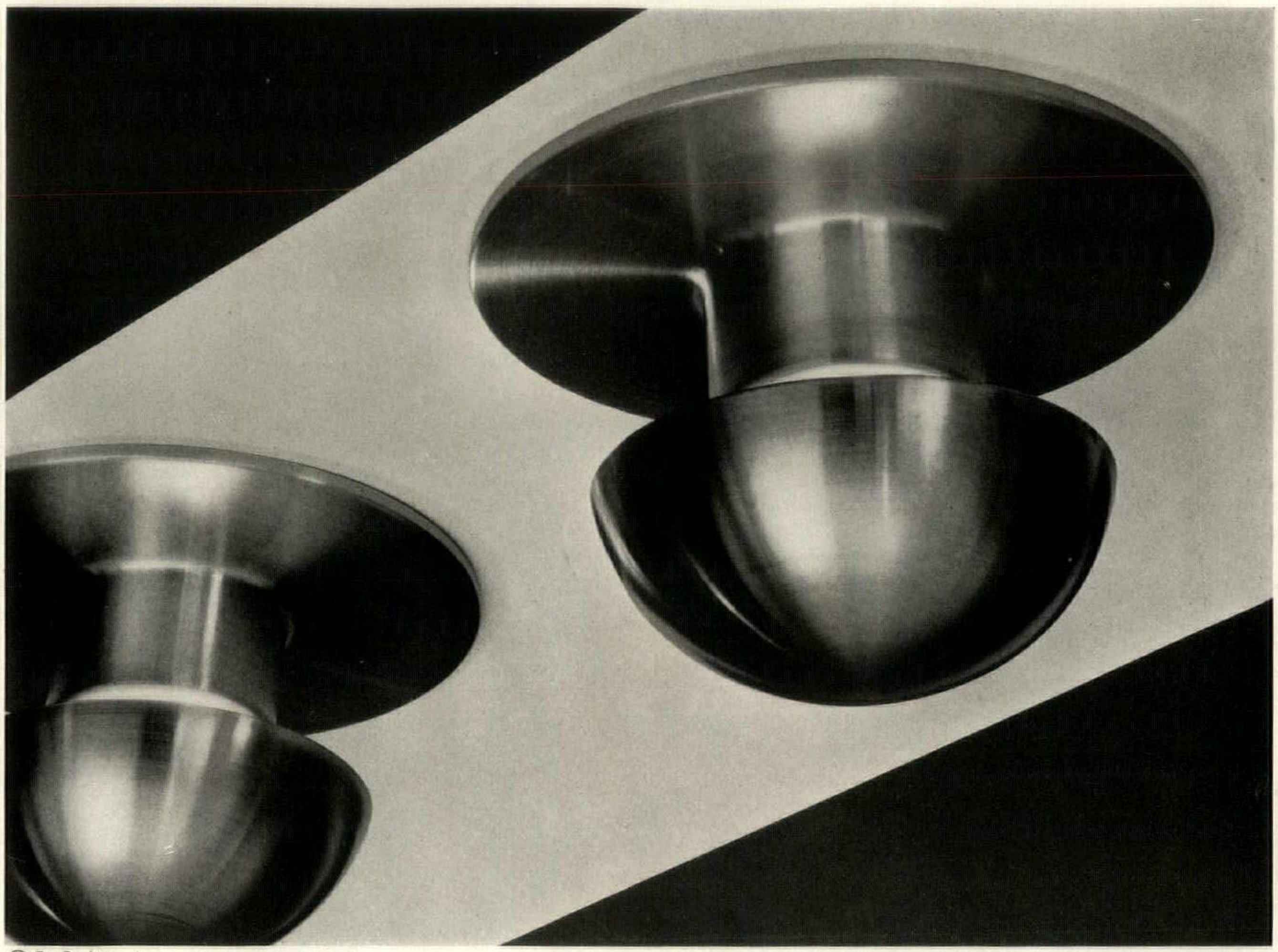
Lighting fixtures of spun aluminum over roll-down door.

MATERIALS OF SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT



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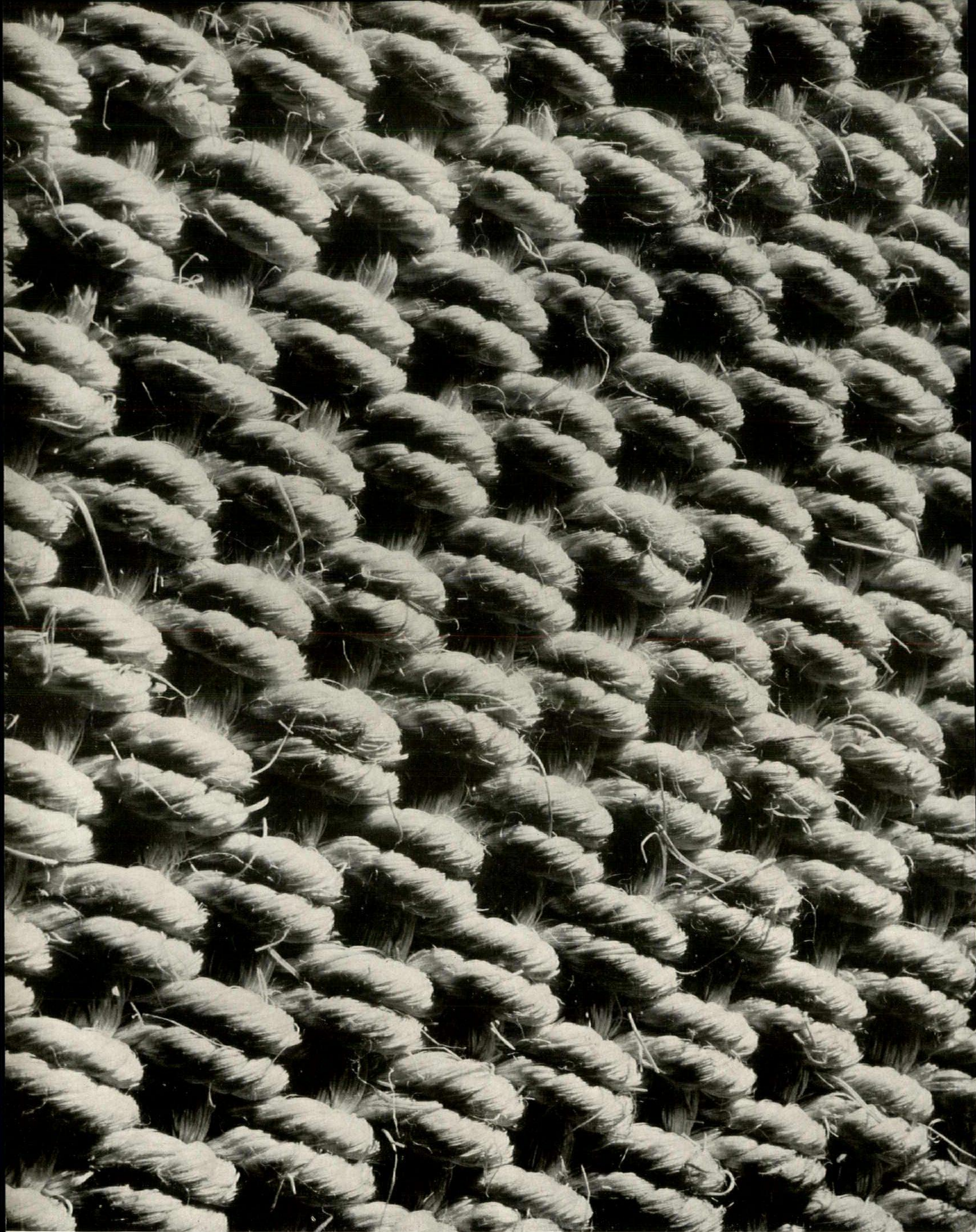
Lighting fixtures used throughout the house, in some cases with bulb exposed; in other cases, as in this illustration, with cup covering bulb. These fixtures are of aluminum, about 8 inches in diameter.



MATERIALS OF SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT

Jute matting used as floor covering.

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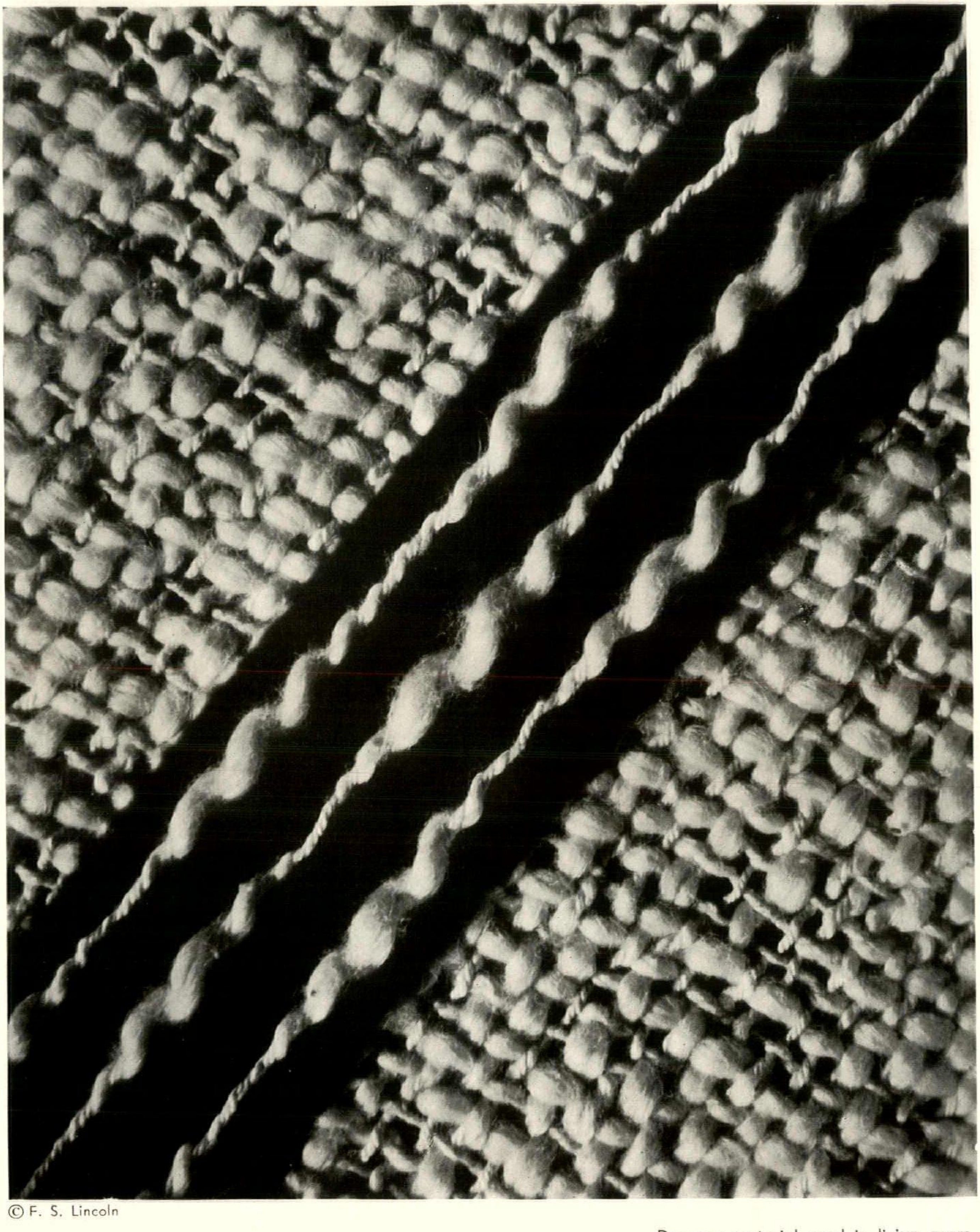
Straw floor matting in carpet width and continuous roll.



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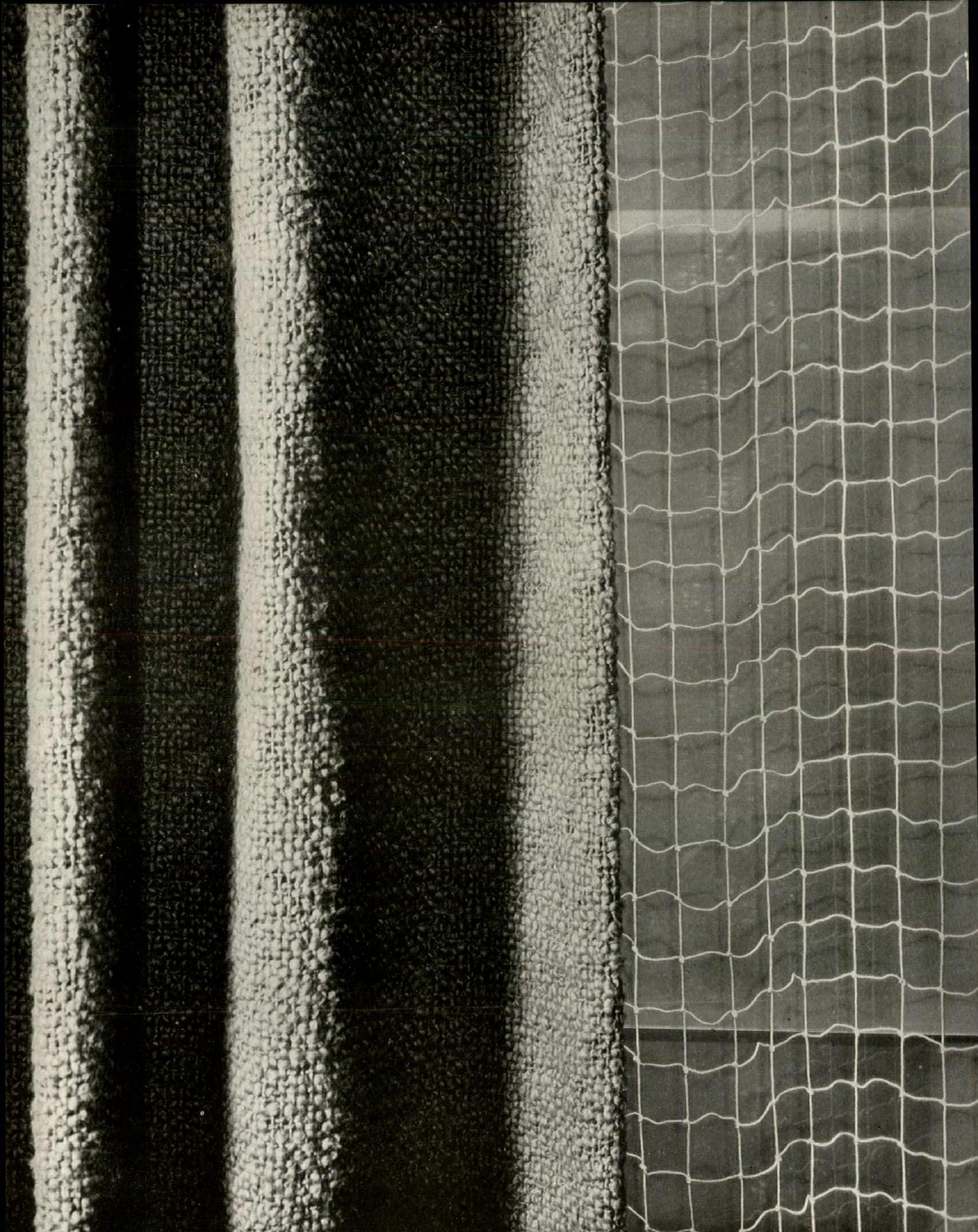
Drapery material used in living room.

MATERIALS OF SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT

Curtain in dining room, that can be opened or closed as desired.



MATERIALS OF SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT

Coarse brown drapery obscures vision; fishnet admits air and light.

F. S. Lincoln

Net fabric used for ceiling. This material is reinforced with hemp twine to permit drawing material taut.

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MATERIALS OF SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT

Sponge rubber curtain approximately 3/16″ thick.

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Sponge rubber used as floor covering.

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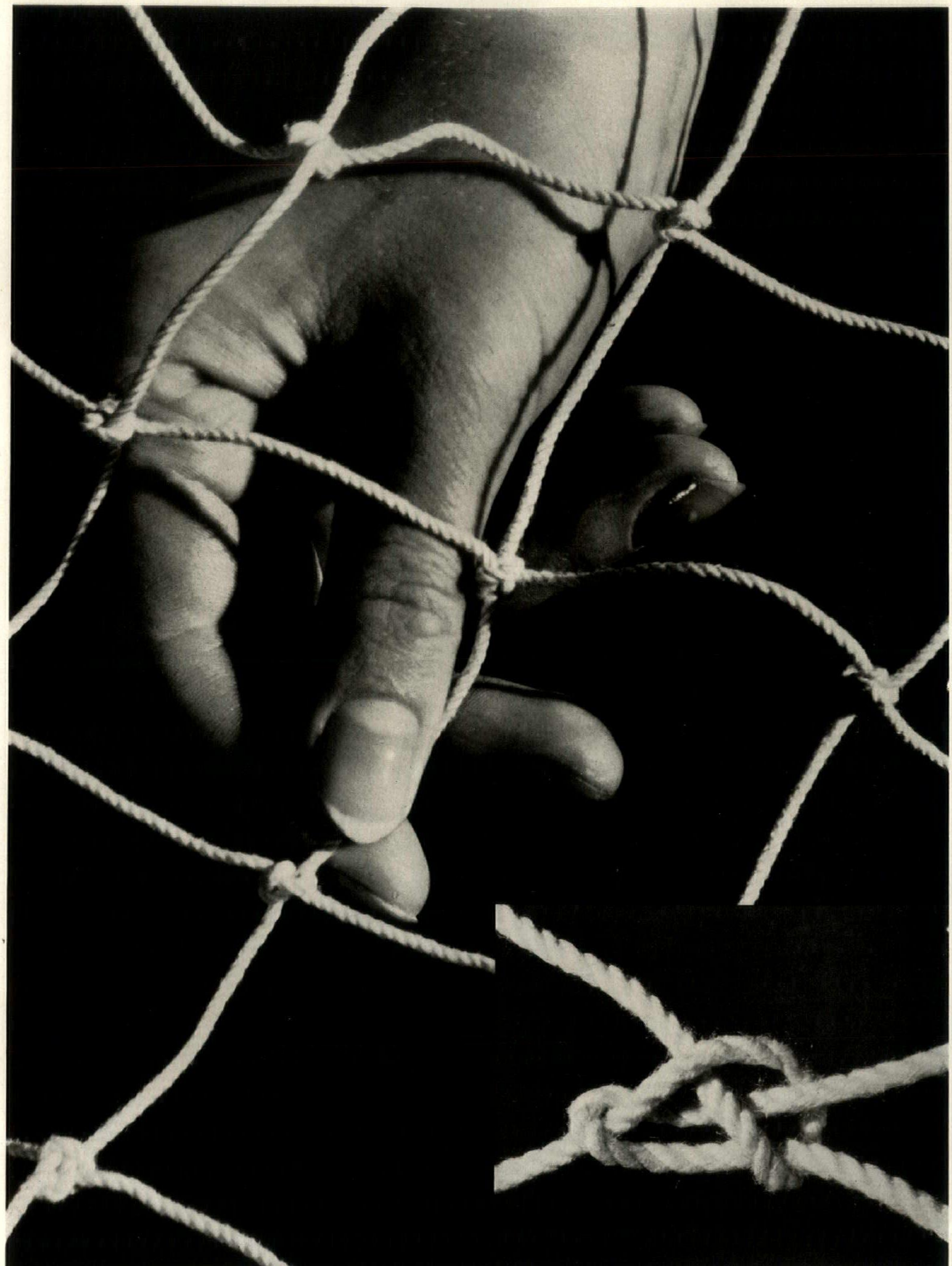
The fishnet may be drawn to cover the window entirely or translucent fabric at left can be used to give privacy.

MATERIALS OF SPACE HOUSE
FREDERICK J. KIESLER, ARCHITECT



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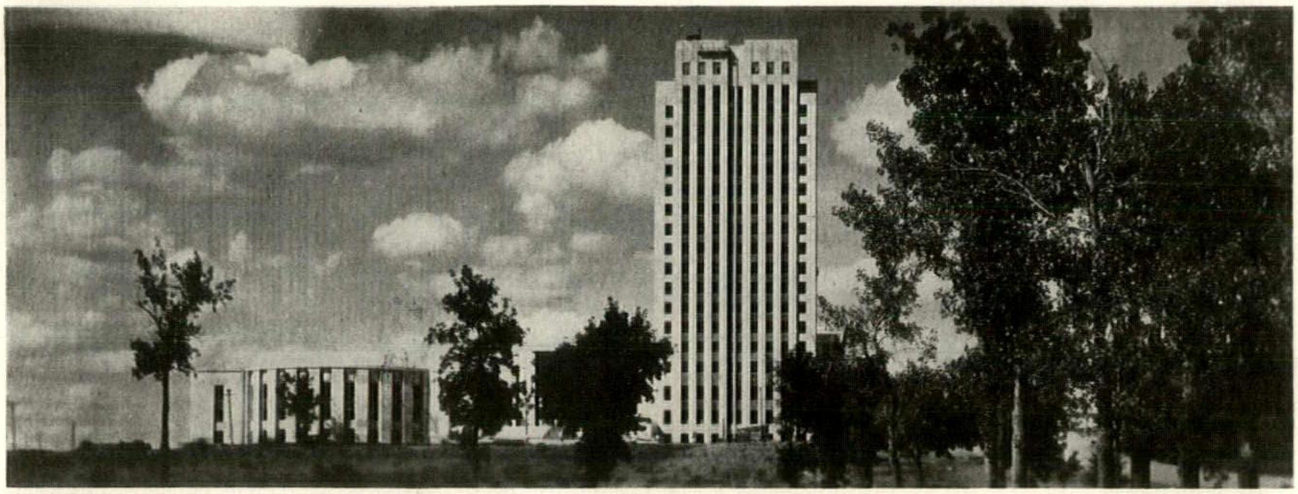
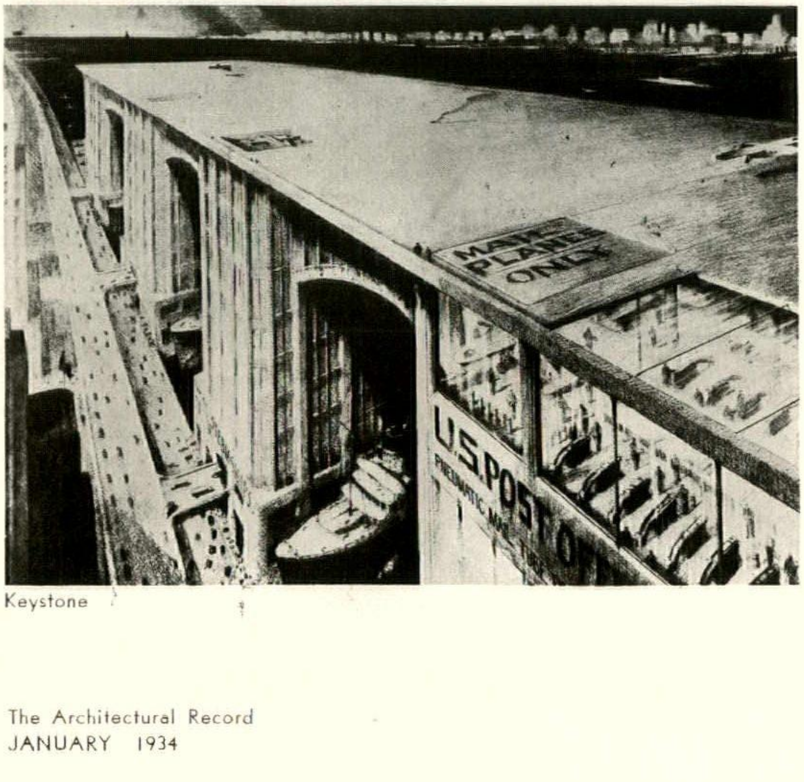
Detail of twine curtain shown on opposite page.



Keystone

H. G. Eisenhand



Keystone

The new Capitol Building at Bismarck, North Dakota, which replaces the old capitol building destroyed by fire in 1930. It has been built at a cost of two million dollars. Holabird and Root are the architects.

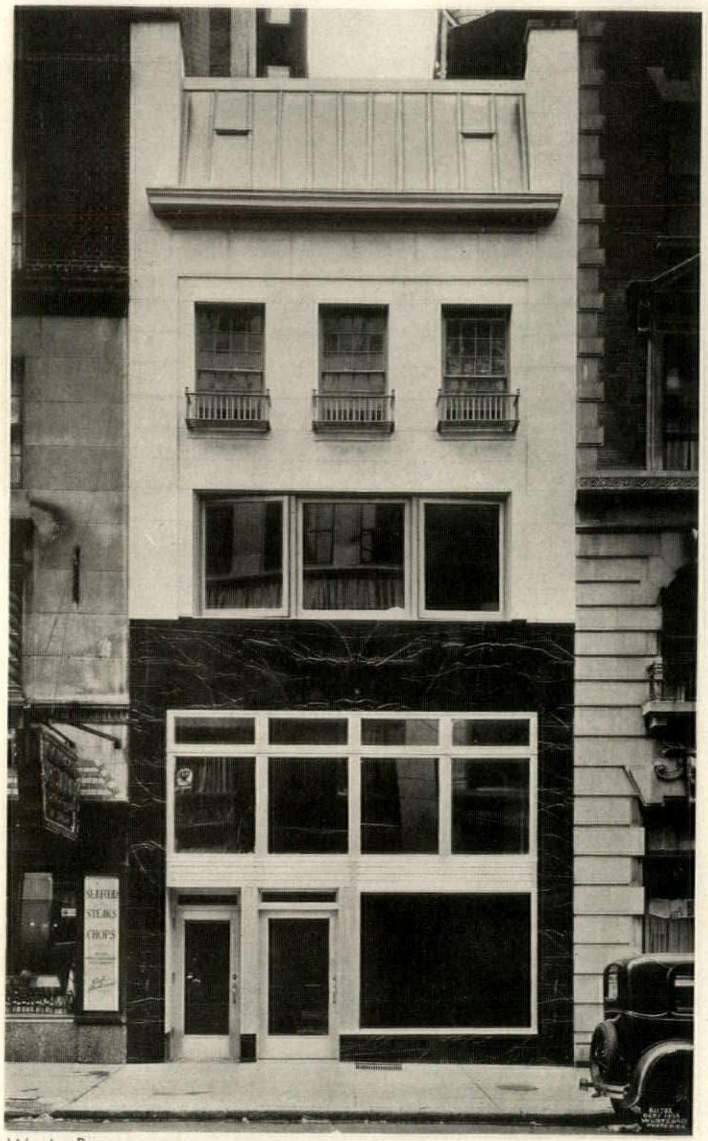
The new Denver City and County Building is shown in this air view of the Civic Center. The building was originally planned by the Allied Architects Association of Denver. George S. Koyl did the greater part of the designing for the building; the active architect in charge is Roland L. Linder.

Combination air and marine terminal. Two New York architects, L. A. Reinhard and Henry Hofmeister, collaborated with Commander Frank M. Hawks to develop this plan for a super-landing field above New York's steamship docks. The field would be 3,000 feet long and 800 feet wide, and high enough to permit ships to dock below. The scheme has been proposed for study as a self-liquidating project under the NRA program. The drawing is by Hugh Ferriss.

MODERNIZATION

ALTERATION TO 130 WEST 45th STREET, NEW YORK CITY

FRANK A. ROOKE, ARCHITECT



Wurts Bros.
BUILDING FRONT AFTER ALTERATION

FIRST FLOOR: two-thirds of first floor raised to sidewalk level; two-thirds of second floor removed, the remainder, with new stairs from first floor, to serve as a mezzanine; new toilets on first floor and mezzanine; old stairs removed, new stairs from first to third floors.

SECOND FLOOR (formerly the third floor): replastered, new flooring, and new fire-retarding doors to stairs; new stairway and railing; new front window, painted and decorated.

THIRD FLOOR (studio apartment): entire floor replastered; new skylight; new fire-retarding doors to stairway, painted and decorated; new roofing over all.

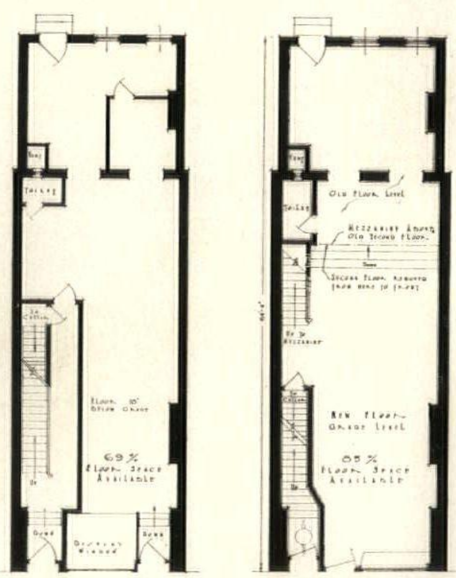
EXTERIOR: front of building chipped and stuccoed with stone joint marking; store front design carried out in black Belgian marble; new show windows are framed with Kalamein moldings.

Rear yard was leveled off and concreted for a garden type restaurant.

Wurts Bros.
BEFORE ALTERATION

130 WEST 45TH STREET, NEW YORK CITY

FRANK A. ROOKE
ARCHITECT



BEFORE AND AFTER ALTERATION—AVAILABLE FLOOR SPACE INCREASED FROM 69% TO 85%

Lincoln
SHOWROOM OF ETA, INC., FOR DISPLAY OF WOMEN'S DRESSES TO BUYERS.

SHOWROOM OF ETA, INC.
ELEANOR LE MAIRE, INTERIOR ARCHITECT

MATERIALS USED:

FLOORING: black and white designed rubber tile. Shaped gray rug with white goat hair fringe used on top of rubber tile floor.

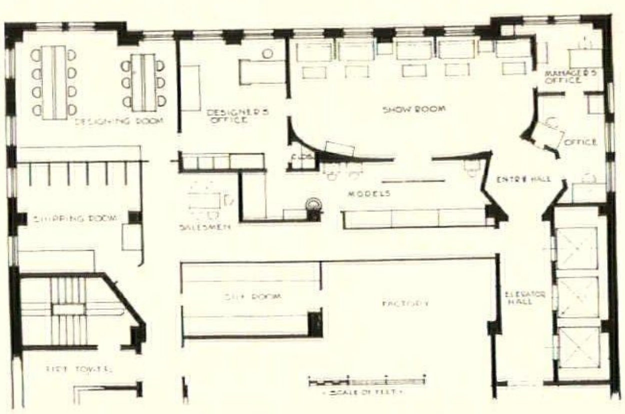
WALLS: plaster, painted. Half of room is white; other half is graphite color (the half of room used by buyers, etc., is in graphite or dark coloring; the half of room where models display gowns, etc., is in white.)

CEILING: part of the ceiling is done in silverleaf; other part is in white.

LIGHTING: cove trough light with glass rods.

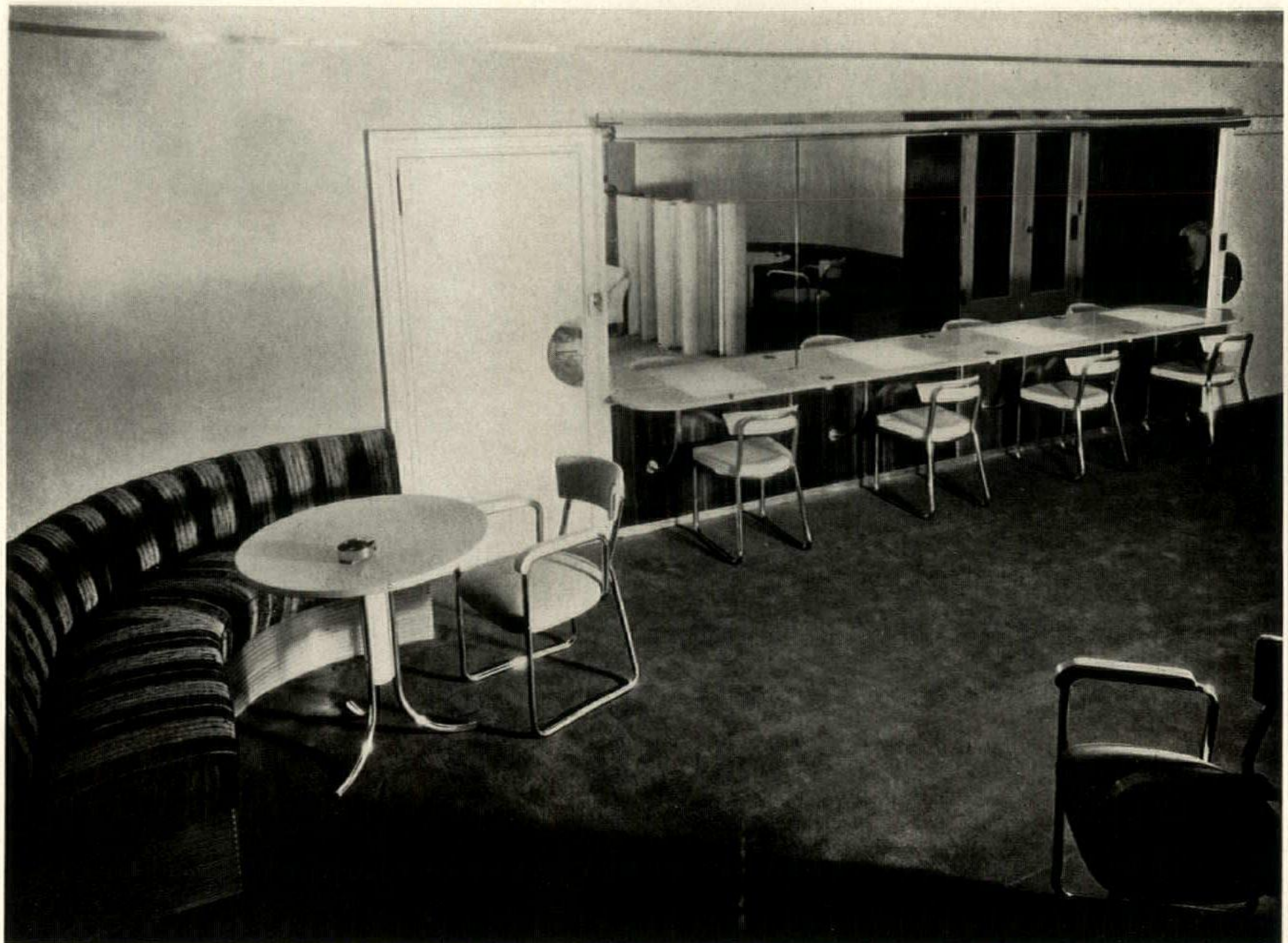
FURNITURE: upholstered seat in vivid blue rep, white lacquer frames; tables, white and black lacquer; chairs, black lacquer frame with vivid blue webbing used for upholstery; folding screens, white leatherette; white cabinet with vermilion lining used to hold samples of material, etc.

Double slab door with glass rod and chrome handles leads to foyer. Opening with mirrored panel screen is used by models.



PLAN OF SHOWROOM, RELATED OFFICES AND FACTORY: ETA, INC., NEW YORK CITY

Lincoln
OFFICE OF DESIGNER, ETA, INC.
ELEANOR LE MAIRE, INTERIOR ARCHITECT



Richard Garrison

SHOWROOM FOR LILLY DACHE, NEW YORK CITY
M. B. SANDERS, JR., ARCHITECT

Walls, pale yellow; tables with white leather tops, legs of aluminum; chairs of aluminum frame with beige upholstery or with white lacquer; ash gray rug; indirect lighting.

BEFORE AND AFTER VIEWS OF ENTRANCE LOBBY TO INSULITE COMPANY, MINNEAPOLIS, MINN.
CLARENCE B. NELSON, ARCHITECT

Van Anda

REMODELED HOUSE AT SHELTER ISLAND, NEW YORK

RODGERS AND POOR ARCHITECTS

THE STRUCTURAL FRAME OF THIS HOUSE WAS RETAINED. PORCHES WERE REMOVED AND A NEW TWO-STORY PORCH ADDED. THE OUTLINE OF THE HOUSE WAS SIMPLIFIED BY REMOVING TOWER AND PROJECTING BAY WINDOWS

HOUSE BEFORE ALTERATION

Van Anda

HOUSE AT SHELTER ISLAND, NEW YORK, AFTER ALTERATION. RODGERS AND POOR, ARCHITECTS

AETNA LIFE INSURANCE COMPANY BUILDING AT HARTFORD, CONN.

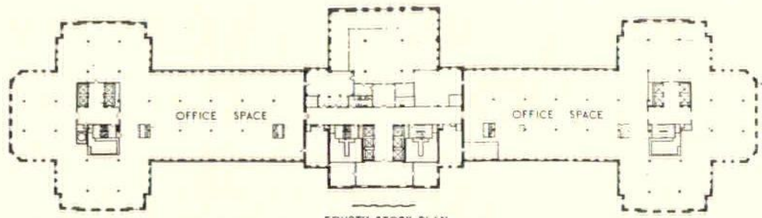
JAMES GAMBLE ROGERS, INC., ARCHITECTS

F. S. Lincoln

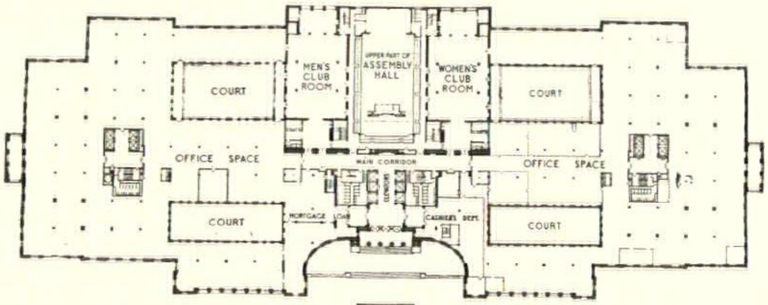
Entrance Façade

AETNA LIFE INSURANCE COMPANY BUILDING HARTFORD, CONN.

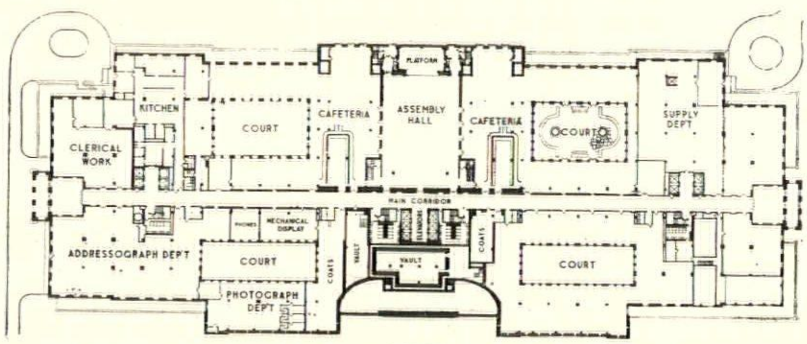
JAMES GAMBLE ROGERS, INC.
ARCHITECTS



FOURTH STORY PLAN



FIRST STORY PLAN



A STORY PLAN

The Colonial inspiration for the design of this particular building was the old State House still existing in Hartford. It is true that the problem could be handled more easily if the columns and trimmings were of wood instead of stone, but existing fire laws in our cities do not permit the use of wood for such purposes and so stone had to be used. A brick made in the vicinity in the same way that artisans have been making brick for the last one hundred years was selected—a real old Colonial brick. The stone is in harmony; the cold gray stone so often used has been avoided.

The plan is based on the principle that the building should have a main entrance on the first floor for visitors and the general conduct of business during the day, and also two ground-story entrances, one on each side, with elevators close to the door for the quick distribution of the workers. These two basement entrances are connected by a grand hallway, almost one-fifth of a mile in length, which permits easy distribution to all parts of the building. The elevators at the side doors may be closed except in the early mornings on entering and in the evenings on leaving and at the noon hour when the workers go to the lunchrooms and clubrooms.

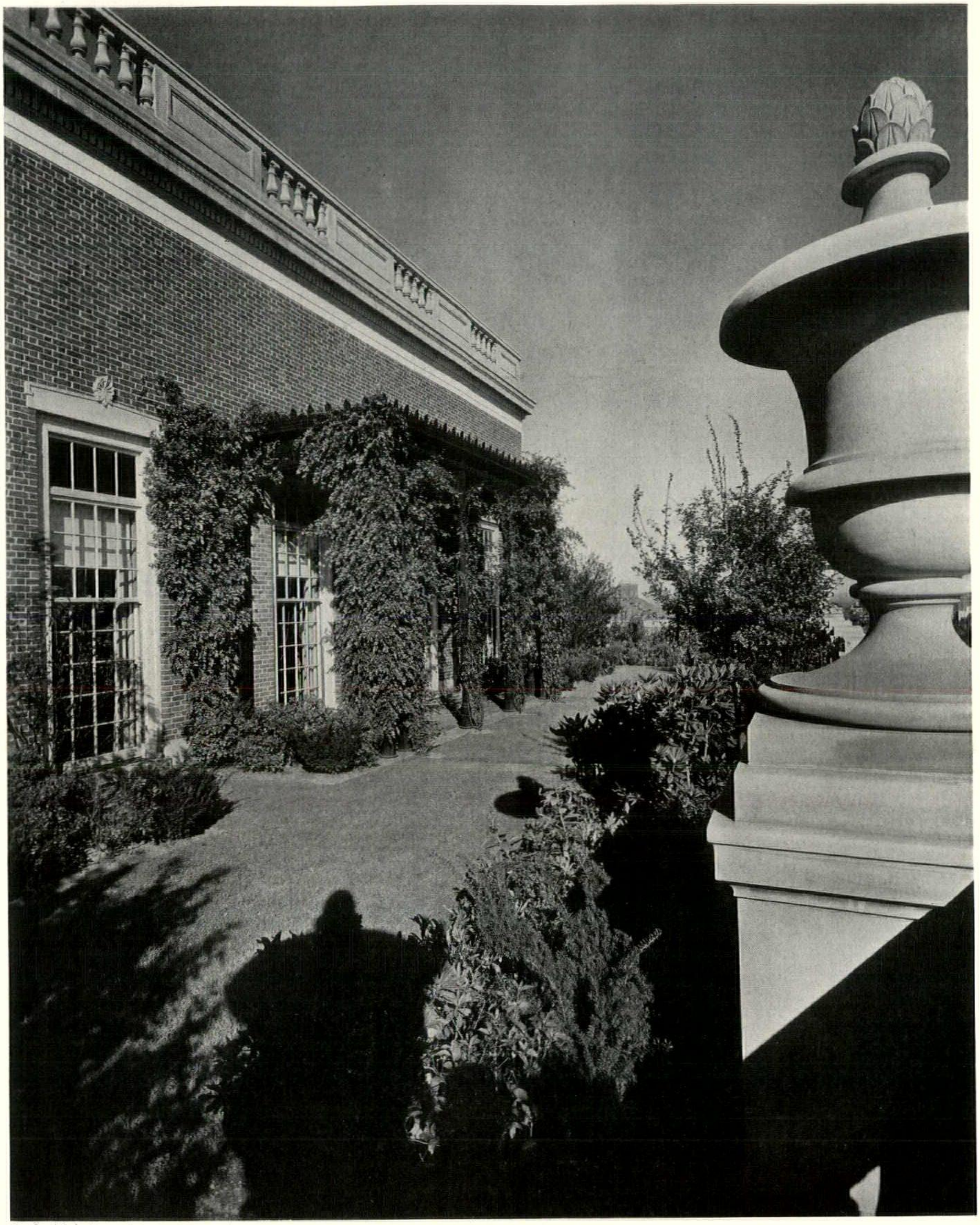
The lunchrooms and lounges on the basement floor and on the first floor are furnished not in the institutional manner but as attractive dining rooms and clubrooms. There is also a grand auditorium between the clubrooms and the dining rooms, where meetings can be held and where games can be played. Off each dining room is a court in which there are well arranged walks and plants.

The officers are grouped together on the top floor with a large trustees' room where meetings can be held. This arrangement gives the best views and the best light to the rooms which are designed in simple and dignified Colonial style.

F. S. Lincoln

Recreation Room

AETNA LIFE INSURANCE COMPANY BUILDING AT HARTFORD, CONNECTICUT
JAMES GAMBLE ROGERS, INC., ARCHITECTS



F. S. Lincoln

Roof Terrace

AETNA LIFE INSURANCE COMPANY BUILDING AT HARTFORD, CONNECTICUT
JAMES GAMBLE ROGERS, INC., ARCHITECTS

F. S. Lincoln

Gymnasium and Auditorium

F. S. Lincoln

A Private Dining Room

AETNA LIFE INSURANCE COMPANY BUILDING AT HARTFORD, CONNECTICUT
JAMES GAMBLE ROGERS, INC., ARCHITECTS

F. S. Lincoln

AETNA LIFE INSURANCE COMPANY BUILDING AT HARTFORD, CONNECTICUT
JAMES GAMBLE ROGERS, INC., ARCHITECTS

THE RADIO CITY BROADCASTING STUDIOS OF THE NATIONAL BROADCASTING COMPANY

ROCKEFELLER CENTER, NEW YORK CITY

REINHARD AND HOFMEISTER; CORBETT, HARRISON AND MACMURRAY; HOOD AND FOUILHOUX, ARCHITECTS

Sigurd Fischer

Second-Floor Foyer for Program Personnel.

Sigurd Fischer

Eighth-Floor Foyer Serving Large Broadcasting Studio.

NATIONAL BROADCASTING STUDIOS, ROCKEFELLER CENTER, NEW YORK CITY
REINHARD AND HOFMEISTER; CORBETT, HARRISON AND MACMURRAY;
HOOD AND FOUILHOUX, ARCHITECTS

Sigurd Fischer

Public Foyer Displaying Glass-Inclosed Main Control Room.

NATIONAL BROADCASTING STUDIOS, ROCKEFELLER CENTER, NEW YORK CITY
REINHARD AND HOFMEISTER; CORBETT, HARRISON AND MACMURRAY;
HOOD AND FOUILHOUX, ARCHITECTS

Frederick Bradley

R.C.A. Building Façade. The N.B.C. Studios Are Housed in Windowless Section.

NATIONAL BROADCASTING STUDIOS, ROCKEFELLER CENTER, NEW YORK CITY
REINHARD AND HOFMEISTER; CORBETT, HARRISON AND MACMURRAY;
HOOD AND FOUILHOUX, ARCHITECTS

SOUND CONTROL AND AIR CONDITIONING

IN THE N.B.C. RADIO CITY BROADCASTING STUDIOS

By A. WARREN CANNEY, of the staff of Clyde R. Place,
Consulting Engineers for Rockefeller Center

Sound engineering is a newly developed science. Within the past decade it has grown into an extremely intricate subject because of the applications from the field of the electric circuit and, more recently, vacuum-tube electronics.

The electrical reproduction, transmission and measurement of sound has made necessary a large, highly specialized staff within the National Broadcasting Company, under the direction of O. B. Hanson, national radio authority, who was responsible for the design of the N.B.C. Radio City broadcasting studios. Mr. Hanson was required to not only incorporate the sum total of the experience of N.B.C. in the past but to anticipate future requirements in the face of the rapid growth of N.B.C. No detail known to present-day science has been overlooked toward a closer approach to perfection in the art of broadcasting.

The author of this article was in charge of the soundproofing of the air conditioning system and its design, as well as certain special soundproofing and thermal engineering problems.

SOUND CONTROL

Sound, in technical work, is objective, and is the disturbance or phenomenon in material media which becomes subjective only when it is perceived as a sensation of hearing. In engineering we speak of and control objective sound so that the subjective reaction of the hearers will be satisfactory.

Sound is caused by vibration. (The only possible condition of complete absence of sound would be the complete cessation of motion of everything in the world, from automobiles to atoms. There is no such thing as an absolutely soundproof room unless it be pumped to a complete vacuum.) As energy released from a vibrating source, the propagation of sound depends on the communication of these vibrations through any medium possessing inertia and elasticity, whether it be a loud speaker diaphragm, a tuning fork, a building partition, a steel column or merely atoms. A sound wave moves air particles and other media similarly. Unless obstructed, it radiates from the source, in air for example, in the form of a series of uniformly expanding spherical waves. This explains why the loudness-intensity is inversely proportional to the square of the distance from the source. The speed is given by the formula

$$V = \sqrt{\frac{KP}{p}}$$

where K—a thermodynamic constant: 1.4 for air.
P—pressure: 76 centimeters of mercury for air at sea level.
p—density: .0612 gram per cubic centimeter for air.
V—velocity: 1,125 feet per second for air.

This fundamental equation has been proved experimentally, and shows the velocity to be much greater in liquids and solids than in gases such as air.

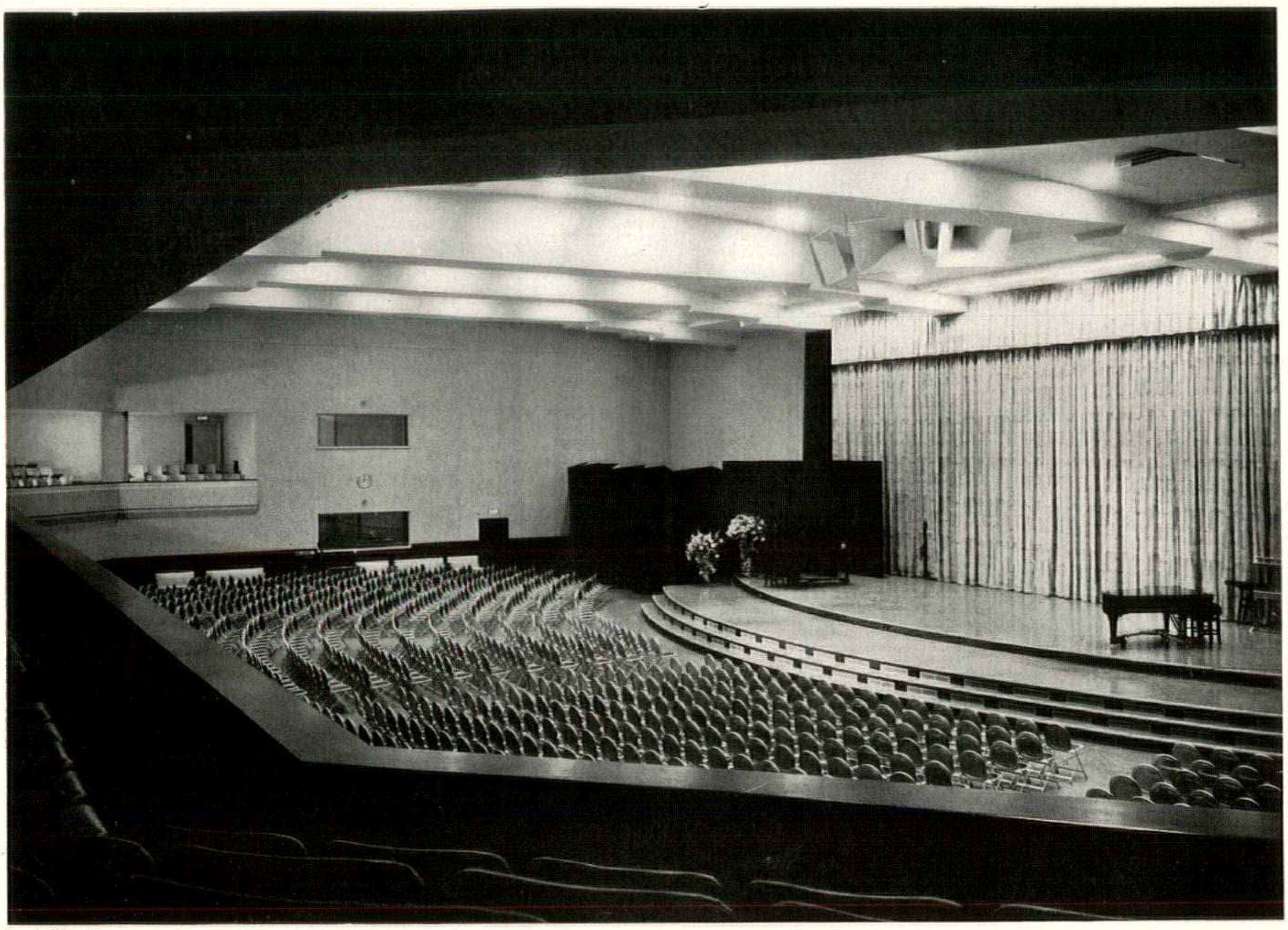
The velocity is an all-important factor as it determines, in part, how long sounds will take to "die out," that is, to diminish to inaudibility. Note, too, that the meteorological properties of air influence velocity according to barometric pressure and temperature. In psychrometry, relative humidity exerts influence on both speed and air absorption.

When something vibrates, say, at 512 complete back-and-forth cycles per second, what happens? Within one second 512 pushes are exerted against the air, as for example by a loud speaker diaphragm. The air is actually compressed 512 times, the first compression having traveled away radially 1,125 feet during the first second. An imaginary section through a photographic "still" would show

512 annular rings, each $\frac{1125}{512} = 2.2$ feet apart,

that is, with a wave length of 2.2 feet. Between these rings of compression (called condensations) there would be 512 midway regions of greatest rarefaction, where the air pressure would be below the barometric pressure of the air by an amount equal to the pressure of the condensations above it. The number of cycles determines what is musically called pitch, and we subjectively identify the pitch of 512 cycles with the musical scale tone "middle C." The regions of minimum pressure are situated exactly halfway between the regions of maximum pressure, or one wavelength apart.

This conception of the transfer of alternating pressures and rarefactions is vital to the comprehension of sound wave disturbance in any media.



Sigurd Fischer

The Largest Studio in the World — Three Stories High.

NATIONAL BROADCASTING STUDIOS, ROCKEFELLER CENTER, NEW YORK CITY
REINHARD AND HOFMEISTER; CORBETT, HARRISON AND MACMURRAY;
HOOD AND FOUILHOUX, ARCHITECTS

The particles sway as each vibrational push transfers its impulse from particle to particle. Frequency mostly, and velocity somewhat, determine wave length and consequently the pitch. The amplitude, together with frequency, is an index of the intensity or subjective loudness. The total energy E of a vibrating mass M, generating a pure tone with amplitude A and frequency N is given by $E = 2M\pi^2(AN)^2$. Note particularly that the total energy (power) is proportional to the square of the amplitude (pressure or, in electrical work, voltage). In a receiver, only a small part is converted and radiated into effective objective sound. The inefficiency represents dissipated energy, usually in the form of lost heat. A vibrating string may vibrate through a large amplitude, but its reinforcement is obtainable by a sounding board, usually in musical instruments, which have more mass than the string but vibrate through much smaller amplitudes than the string.

People can hear amplitudes, on the average, between sound pressure changes in the air above the usual barometric pressure, of from .00000000855 to .029 pounds per square inch. At less pressure change than the first figure, people cannot hear sound; above the upper limit the sound is sensed as a pain productive of anger. The frequency limits of hearing are within about 20 to 15,000 cycles per second. This sensible hearing range includes about 10 octaves and the amplitude or air particle displacement in the region of inaudibility is only .000000001 inch!

Complexity of Sound Investigation

The all-important elemental consideration of quality is doubtless the greatest complication. Quality is created by superimposed, regularly-recurring wave-forms due to overtones which, in accordance with the laws of physical resonance, are variations in the main pressure wave. This main pressure wave is the fundamental frequency, and is the lowest tone in the sound. The number and prominence of these overtones constitute the basic complexity of a musical sound.

The manner of reinforcement, as by a piano sounding-board, produces further modifications ef-

Sigurd Fischer

Ed Wynn Broadcasting in the Large Studio

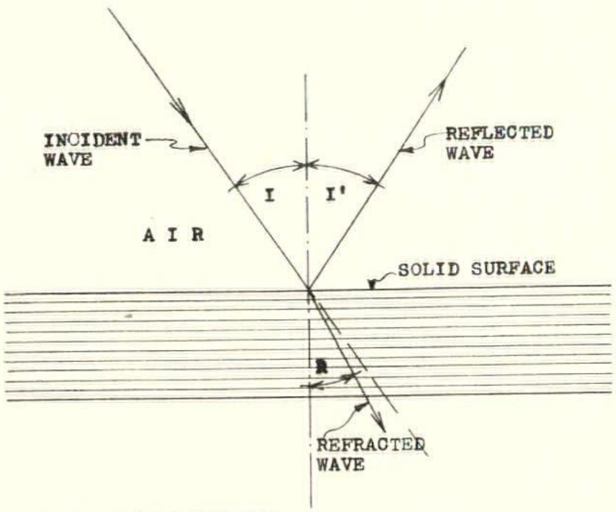
NATIONAL BROADCASTING STUDIOS, ROCKEFELLER CENTER, NEW YORK CITY
REINHARD AND HOFMEISTER; CORBETT, HARRISON AND MACMURRAY;
HOOD AND FOUILHOUX, ARCHITECTS

fecting timbre. If the superimposed waves are not of regular recurrence with respect to the fundamental, the sound is sensed as a noise. The Radio City Studios have been designed to preserve with fidelity *all* of the frequency components which are used in speech and music. All must be of sufficient intensity to enable the ear to analyze these complex vibrations into their simple harmonic components in perfect identity with the vibrating source. To illustrate: put your foot on the loud pedal of a piano, and sing a note into the strings for a few seconds; the string whose normal fundamental vibration is the counterpart of the note you sang will sound loudest. But sounds arise from many other strings too! Each of these strings produces its overtone of that frequency. This crudely illustrates one process of the mechanism of hearing. The response of the ear to a symphony at any instant is obviously much more multifarious than this.

If extraneous sounds are rather loud, the sounds one wishes to hear must be louder, unless their pitch be very different. In a studio in Radio City, for example, one can easily discern a distant whisper, or hear one's heart beat. Some one else talking normally would prevent you from hearing the whisper. This is called masking. Extraneous sounds must be reduced to a certain maximum intensity level to permit good hearing indoors. In broadcasting this level must be very, very quiet. The shape and composition of interior surfaces of the room establish, together with usage, the upper limit of permissible sound level.

If two sound waves of nearly the same pitch are sounded within a room, there will be regions of nearly complete annulment and easily discernible reinforcement. Throbs occur, noticeable sometimes in organ music. Normally these factors are to be avoided or controlled within well defined limits.

Owing to its wave length, sound "bends" and expands after passing through an opening such as a crack under a door. In this respect sound doesn't behave like light, which has very minute wave lengths. The thinnest razor-like slit is required to diffract light. Not so for sound, which has wave lengths from 60 down to .065 feet. Auditorium



I = ANGLE OF INCIDENCE
I' = ANGLE OF REFLECTION
R = ANGLE OF REFRACTION

Figure 1—This diagram illustrates the reflection and refraction of sound.

designers have sometimes assumed that sound is diffracted after reflection much as light, which is usually not the case. Sound follows the simple laws of reflection and refraction as indicated in Figure 1, but diffracts with the spreading effect of the spherical wave forms.

Most diffraction occurs where the boundary surface is flat and very large. In any case it is dependent on the size and shape of the hole, edge, or surface and the frequency-band involved. With complex interiors sound engineers make models and by light or by water waves analyze the "wave-front" distribution, so that modifications of the interior profiles may be made, if necessary. By following the geometrical progression of the wave front interiors may be modified to control diffraction.

This brings us to one of the most important considerations in acoustics—the reverberation time-period of the room under consideration. This depends, broadly, on the number of reflections combined with the amount of energy absorbed, and may be described as the length of time a sound of given initial intensity, frequency distribution and location in the room "decays" to a level of inaudibility.

Energy Content and Sound Level

Note that in the energy formula, the intensity E, which is the technical term for loudness or energy content in the sound wave, is proportional to the square of either the velocity or displacement amplitude. This means that if a vibrating object vibrates through greater distance, or faster through the same displacement distance (amplitude), or both, the sound will be subjectively louder and objectively greater in intensity.

A microphone is an instrument which varies the voltage of an impressed electric current in a wire proportional to the rate of change of sound energy in the air at each instant. The condenser microphone operates on a displacement principle. The Radio City studios of N.B.C. use a new type of microphone which effects this with greater fidelity, but is based on the rate of change of velocity of the sound waves.

Based on pressure changes, the intensity of sound

$$I = \frac{P}{10xLxD} = \text{microwatts per square centimeter,}$$

where P = dynes per square centimeter of pressure.
L = centimeters per second (velocity).
D = density of the material in which the sound is being propagated, such as air, in grams per cubic centimeter.

If everybody in the United States talked normally at once, the total resulting speech energy output in the air would only be some 8 horsepower! From this an idea of the extremely minute amount of energy involved in sound can be obtained. To change the voice of only one person to a variable electric current, to amplify these minute energy quantities and propagate them without interruption as an aerial radio wave with sufficient energy for every "listener-in" in the territory served by the radio transmitting station—with perfect fidelity—is the amazing business of the broadcasting company.

The relation between the intensity-pressure of a sound wave and the loudness heard is logarithmic. Most sensory stimuli of the body follow this law closely. In an effort to obtain a mathematical relation between the loudness of sounds as we hear them, a unit of intensity-level called the decibel is widely used, which defines the number of sensation units between the energy of two sounds which are to be compared. In other words, a decibel is equal to a change in hearing loudness which the average ear can reasonably well distinguish. The original comparison was written by telephone engineers as follows:

$$\text{Sound Level Difference} = \text{S.L.D.} = \text{Bels} = \log_{10} \frac{P^2}{P^1}$$

where P^2 is the sound having a greater pressure than P^1. P is conveniently computed in units of dynes per square centimeter. Ten times this numerical ratio resulted in the pressure differences which could be reasonably well distinguished by the average listener. The numerical result was therefore assigned the name of decibels, wherein unity equals one decibel.

This is written $DB_p = 10 \log_{10} \frac{P^2}{P^1}$ when P is measured in pressure units. Let 10,000 and 100 be the pressures of two sounds then $10 \log_{10} \frac{10{,}000}{100} =$

$$10 \times \frac{4}{2} = 10 \times 2 = 20 \text{ DB.}$$ One hundred times as

much energy as 100 dynes per square centimeter seems only twice as loud. But intensity (power) is proportional to the square of the pressure.

$$\text{Hence } DB_I = 10 \log \left(\frac{P^2}{P^1}\right)^2 = 20 \log_{10}\left(\frac{I^2}{I^1}\right)$$

when I is measured in power units such as microwatts, or ergs per square centimeter, per second DBs are merely convenient measuring units associated with the logarithmic characteristic of hearing.

Inasmuch as most modern measurements are made electrically and in power, DBs are DBs whether the sound energy is measured in the air, or equivalent electrical energy in an electric circuit, or whether it is what you hear, or energy in a steel column picked up by a passing truck, because DBs are quantitative *under specified conditions.* Unless the condition of arbitrary zero be specified or understood DBs are meaningless. A sound which is louder than another is said to be of higher energy level. Thus DBs are a numerical expression of difference of loudness. Above the level of the threshold of inaudibility DBs are commonly used as an index of sound level.

The amount of sound energy removed by something such as a partition is called attenuation. This varies, for a given inclosed object, with both frequency and intensity of the original sound. The attenuation is, then, merely the sound level reduction under certain stated conditions and may be numerically stated by the difference of the DB levels on the two sides of the object above threshold as zero level.

Figure 2 shows the DB level above the threshold of audibility as zero DB for places having various sound intensities.

With the improvement of electrical broadcast facilities, it was essential for N.B.C. to control the sounds in regard to their true undistorted qualities before their impingement on the microphone diaphragm, which means "handling" the sound in the studio proper. In Radio City the whole design has been based on a frequency band encompassing frequencies practically throughout the audible range which means from 40 to 15,000 cycles. This has meant the examination and control of the whole phenomenon in a radio broadcasting studio, throughout this extended range, an attainment of results not hitherto attempted in broadcasting work.

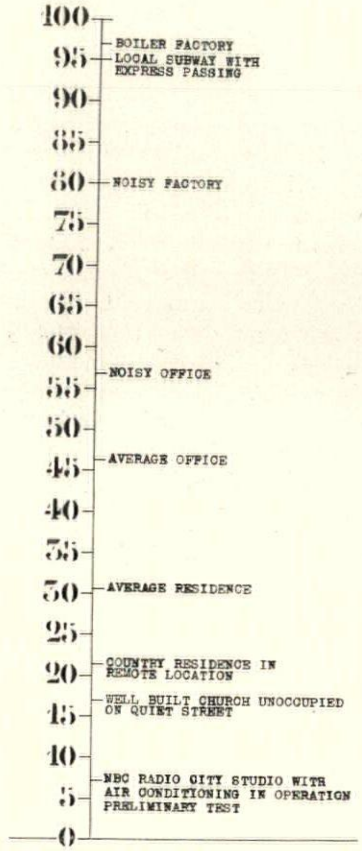


Figure 2—Range of sound intensities in terms of decibels.

Reverberation and Sound Absorption

In general, hard dense surfaces, such as metals, reflect sound much more than the surfaces of materials which are microscopically porous, these latter usually being light in weight and sometimes flimsy. It is an inherent property of most materials to absorb different amounts of sound at different frequencies. The more totally absorptive a given room is, the sooner will a sound of given initial intensity decay to inaudibility. Under specific conditions this time period of decay is termed the reverberation period of the room, and is based on the mean total distance of all reflections of a sound having a specific initial intensity.

Reverberation is one of the most important characteristics of a room in studio sound engineering. Reverberation formulas are not rigidly applicable and are empirical. To provide studios of proper and sufficiently variable reverberation periods for any type of program production was one of the problems which confronted the Radio City engineers.

An opening in an outside wall one foot on a side gives a sound absorption coefficient of unity—the maximum—for none of the sound in the form of a plane wave is reflected by such an opening. Unfortunately the absorption of a material has been a rather elusive figure to measure, but sufficient agreement for commercial work is usually obtained. Moreover, the frequency range tested is usually only within 128 to 4,096 cycles, and frequently the absorption at 512 cycles is the only test point, all of which was inadequate for the requirements of the Radio City studios. In addition, the maximum absorption of most materials lies within this range. In Radio City a practically flat absorption curve from 40 to 15,000 cycles was the necessary requirement.

When a sound wave impinges on any material its total energy is distributed by reflection (R), absorption (A), and transmission (T) in the instance where R and A is less than the total. The mechanism of absorption converts the energy to heat. The less reverberant a room, the more absorption there must be, and total wall, floor and ceiling absorption equals the summation of the product of the square feet of each kind of surface times its absorption coefficient. Thus, where the area is limited, sufficient absorption must be obtained in the material. The more the absorption the less the transmission, so that while the amount of absorption is the prime consideration establishing acoustical treatment, the absorptive material also helps cut down the amount of energy transmitted, that is, increases the attenuation of the total construction.

The importance of reverberation can be appreciated by considering that if the reverberation time is excessive, sounds will overlap due to prolongation, and the result will be muddled by masking and superimposition. Slight overlap in organ and symphony work is not altogether objectionable in the concert hall, however, where the listener is where the program originates. On the other hand, in radio work any type of program may originate in a studio, and to whatever reverberation period occurs in the studio, there must be added the reverberation time of the room in which the listener's radio loud speaker is located.

The old and universally used scheme of meeting these problems was to vary the reverberation period with the amount of sound-absorbing drapes exposed, the amount and kind of carpeting, the size of the audience in the studio and perhaps hinged panels containing absorptive materials on one side, or by any combination of these.

Studio Requirements

The exacting standards set by N.B.C. for the new studios ruled out these uncertain methods in large measure. The combined location of the absorbing and relatively nonabsorbing surfaces effect the reverberation period and, of tantamount importance, the uniformity pattern of sound distribution in the studio. Multiple reflection and partially dead spots are inherent without highly scientific design, it was recognized.

Absorption in many of the Radio City studios is therefore variable by means of remotely controlled panels which slide in and out of pockets along the wall. By the touch and release of a button by the control engineer, the reverberation may be varied. Different reverberation periods in the same studio are demanded by a band and a string quartet for example.

Program technique demands adjustment of reverberation, location of microphones and distribution of artists to provide the uniform blending so that the microphone receives all the sounds in their desired relative proportions for the reproduction desired. Program technique is a science in itself, but demands uniformity of sound distribution. This resolves itself largely in what to do in studio design to eliminate conditions which should not occur in the space pattern of sound distribution. There are, of course, studios of varying sizes suited to both number of performers and total sound intensities.

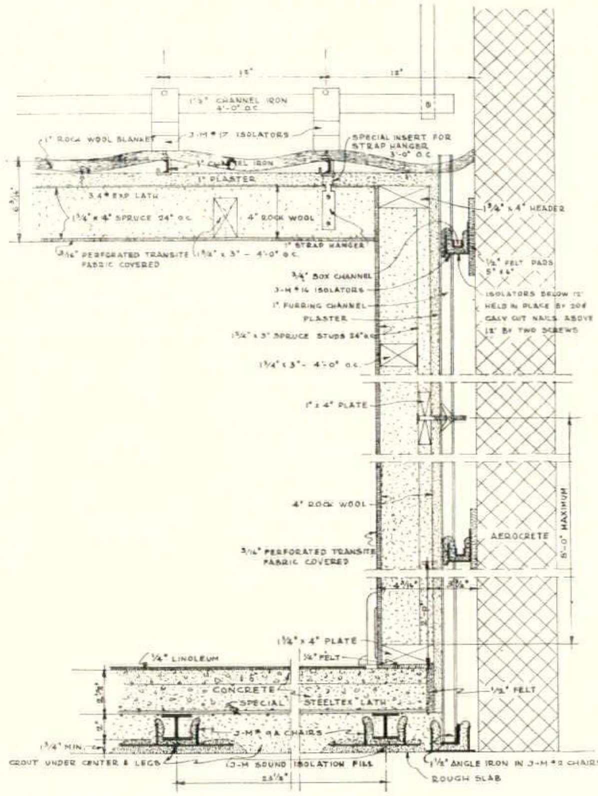


Figure 3—Construction detail of studio soundproofing systems.

Microphones may be located anywhere in studios which are individually of fixed size. Microphones, of course, respond as would a person with one ear in use in place of two. Furthermore, in normal usage, microphone electric circuits are much more sensitive than the ear, because they pick up sounds which are of inaudible intensity in direct listening. For this reason the studios must have a residual sound level which is extremely low, of the order of only a few DBs above minimum threshhold, and which must be maintained even with the air conditioning system in operation, with elevated train rumbles in the ground around footings of the building, elevators, plumbing pipes connected to noise-generating fixtures, with electrical conduits which are apt to be set in vibration or pick up sound due to any one of a hundred potential disturbances, and in spite of sounds originating in the rooms surrounding each studio. These matters resolve themselves into a problem of sound isolation and involve considerations in addition to the acoustical requirements within each studio.

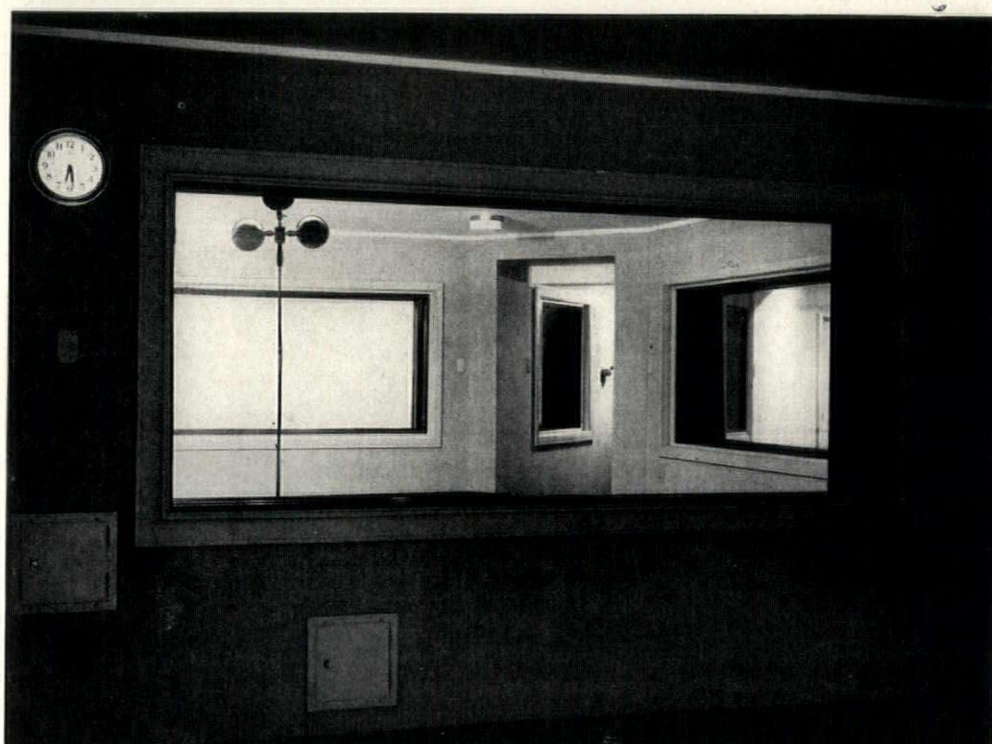
Acoustical Features of the N.B.C. Radio City Studios

Before examining the question of isolation, a few points regarding the acoustics in the Radio City studios will be explained.

Many ceilings and walls have a V-surface profile as an important influence in obtaining distribution uniformity. Considerable study and calculation underlies the design of these ceilings.

The multiple-glass partitions are sloped to avoid multiple reflection and localized reinforcement. The lights are flush with the ceiling to avoid interference patterns. These light fixtures are resonance-proofed and sound-transmission-proofed. The proportions of the studios follow ratios of length, width and height first developed and experimentally verified by Mr. O. B. Hanson as the best proportions for broadcast work. The observation windows of double and triple glass range from 5/8" to 3/8" thick and are set to provide maximum necessary attenuation with the prevention of resonance. Floors are quietized with a linoleum surface material.

Many other details which are duplicated in each studio revolve around the technical requirements as the prime consideration. The logical basis for this is that the broadcasting studio is fundamentally a technical workshop in the production of sound. *Fabric, the interior surface variable medium for the architect plus the construction developed as indicated in Figure 3, conformed to both primary objectives—varied interiors which would be an architectural medium to enhance the poise and complacency of those who broadcast, yet fulfill the technical requirements.*



Sigurd Fischer

Figure 4—View of television control room (see plan below).

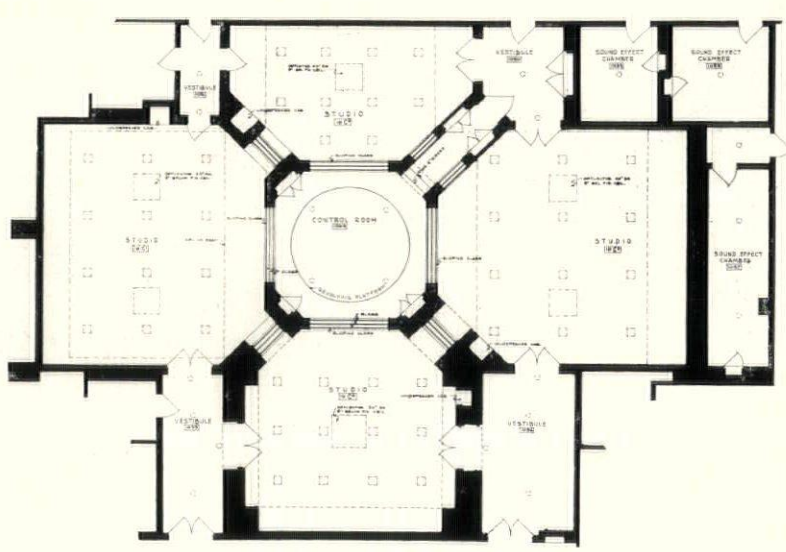


Figure 5—Plan of future television studios on ninth floor of R.C.A. Building.

SOUND CONTROL REQUIREMENTS

We may now clearly subdivide the basic requirements:

1. Acoustical treatment for the control of sound originating in the studio (interior treatment).
2. Provision for a maximum residual sound level by control of sound transmission of sounds originating outside the studio.

These two classifications of control apply to practically every problem affecting architecture.

Construction Details

The Acoustical Construction Corporation, a subsidiary of Johns-Manville, were contractors for the soundproofing. The labeling of this construction in Figure 3 is self-explanatory. The perforated transite was selected because it is a thin, space-saving, strong, nonwarping material for receiving the fabric. The perforations, of course, enable the sound energy to be absorbed by the mineral fiber.

The transite does not reduce the absorption efficiency of the rock wool at all appreciably. The special clips employ hair felt, and their use is to keep diaphragm action out of the special acoustical T.C. wall. The T.C. wall may be a structural wall or a partition; in any case its use is an integral part of the construction.

Figure 5 shows the future television studios on the ninth floor of the N.B.C. quarters of the R.C.A. Building. Figure 4 is an unusual photograph of the 4-sided television control room shown in the center of the plan of Fig. 5. Guides explain this to guests as a part of the tour through the studios arranged for the public.

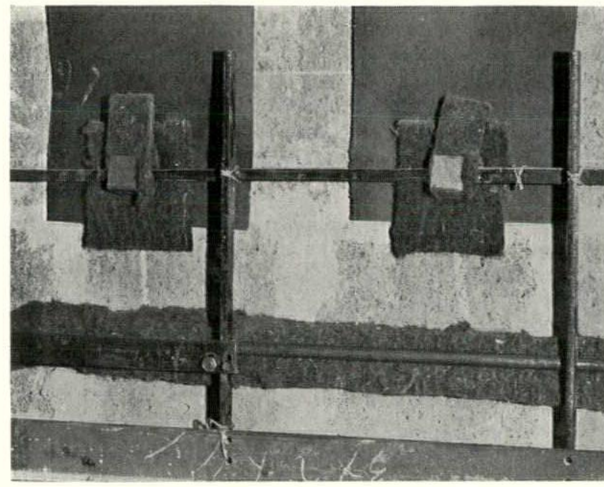


Figure 6—Detail view of clips with hair felt as soundproofed point contact construction.

Prevention of Sound Transmission

It should be emphasized that this composite construction prevents transmission by a combination of the following principles in obtaining two-way attenuation:

1. Absorption necessarily provided for item (1) above.

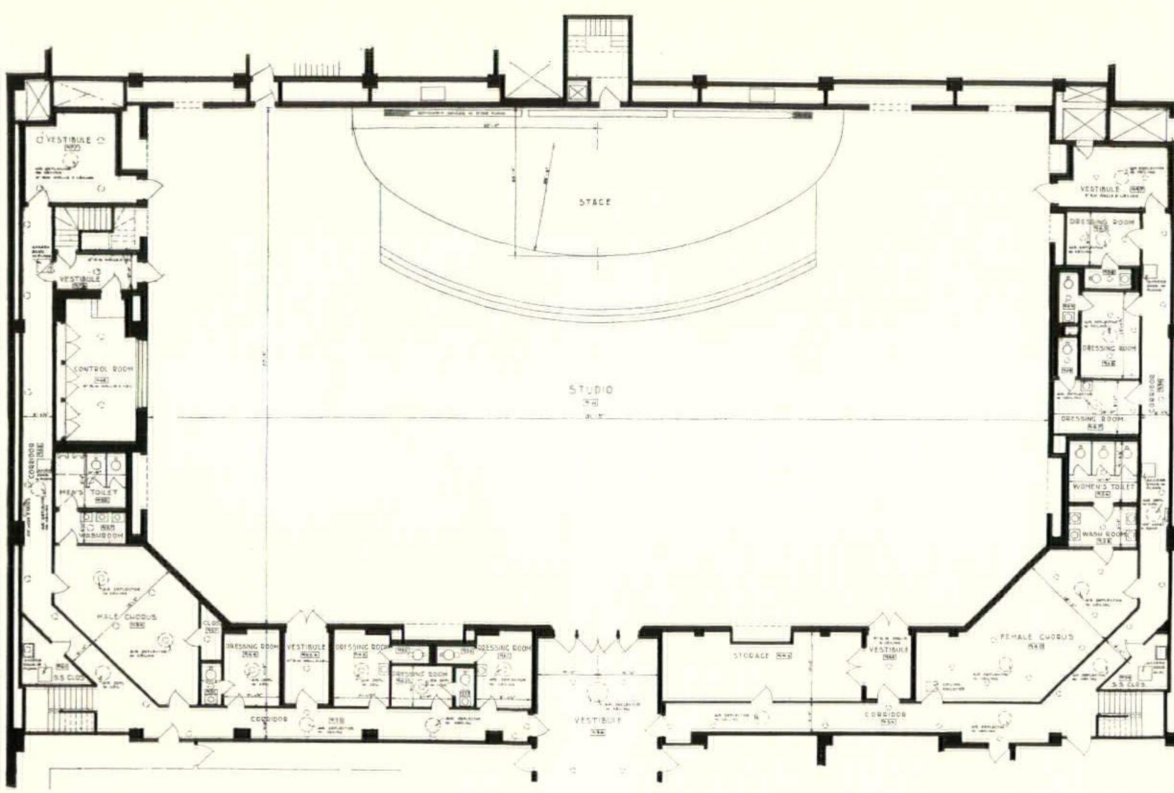


Figure 7—Plan of three-story studio illustrated on pages 78 and 79.

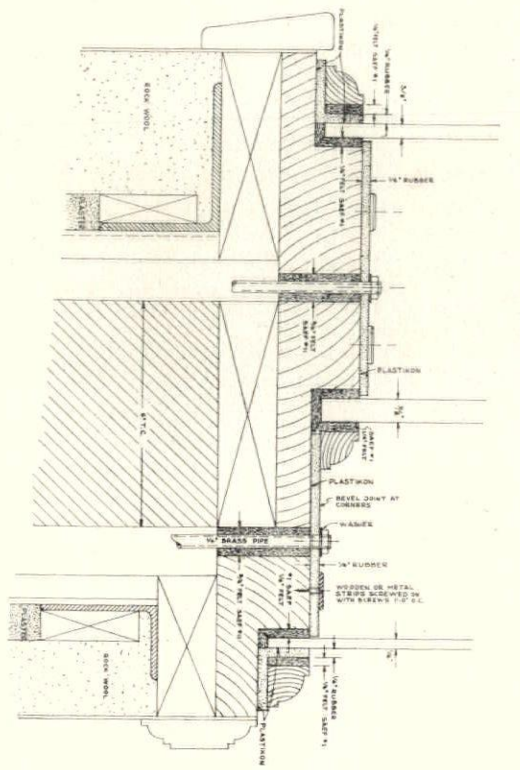


Figure 8—Detail of system of window isolation developed by author in collaboration with N.B.C.

2. Attenuation provided by reduction of passage of sound energy through materials of different density.
3. Prevention of diaphragm action.
4. Prevention of sound energy in the building from reaching floating construction.
5. Attenuation by provision of mass damping.

This construction, in the instance of two adjacent studios is good for about 100 DB, that is, a sound of subway train intensity in one would be inaudible in the other.

The use of the construction indicated in Figure 3 employs, therefore, a system of "point contact" in the form of wall isolators, floor pads supporting wood sleepers, and ceiling clips, each utilizing hair felt for point contact as an aid to damping out sound. Fig. 6 illustrates the clips and also shows an isolated pipe. Their spacing is related to both the isolating efficiency, as related to sound energy levels involved on both sides, and the total weight loading, both static minimum and local maximum. This involves light fixtures in the ceiling, and people and pianos on the floor, for examples. The net effect of this point isolation is to create a room within a structural room, referred to as "floating" construction.

Figure 7 shows a plan of the three-story studio illustrated on pages 78 and 79. All spaces shown on this plan with walls of heavy poché show where floating construction is used.

Sound Control Details

The attention of the reader is called to the typical vestibules in Fig. 7 using double doors creating sound-locks surrounding studios. The doors have heavy checks and are of extremely rigid mounting. A change in section plus a special double rubber line-contact provides isolation.

Figure 8 shows a detail of the method of window isolation developed by the author in collaboration with N.B.C. Out of this construction method an original means of keeping the interior surfaces clean was developed while equalizing barometric pressure on both sides of the panes.

Soundproofed Air Conditioning System

The most potentially dangerous continuous generator of sound above the maximum acceptable residual level is the air conditioning system. Extensive air conditioning researches were conducted at the Times Square studio of N.B.C. in order to obtain data extending over the full frequency range which the Radio City Studios were designed to meet. The following problems were due to air conditioning and their acceptable attenuation or elimination was essential:

1. Any sound originating from any source anywhere in the studio section and getting into ducts or taking any detrimental path whatsoever through ductwork.
2. Mechanical equipment sounds through ducts.
3. The flow of air from either friction or turbulence.
4. The flow of water and pump sounds in pipes.
5. Refrigeration compressors, both air borne and structural transmission.
6. Structural transmission from air handling apparatus.
7. Steam air heaters.

The Carrier Engineering Corporation's tubular system for sound absorption within air ducts was

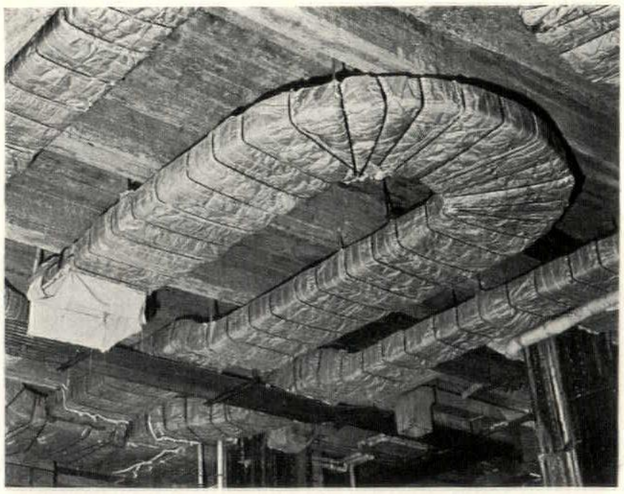


Figure 9 typically illustrates the air conditioning supply ductwork at a studio ceiling. The straightaway sections receive the internal sound absorbers in the duct.

Figure 10 shows the canvas connection indicated in the air conditioning outlet of Figure 9 which provides isolation between the hung ceiling and the sheet metal duct. The wood ground will support the plaque which distributes air from the outlet.

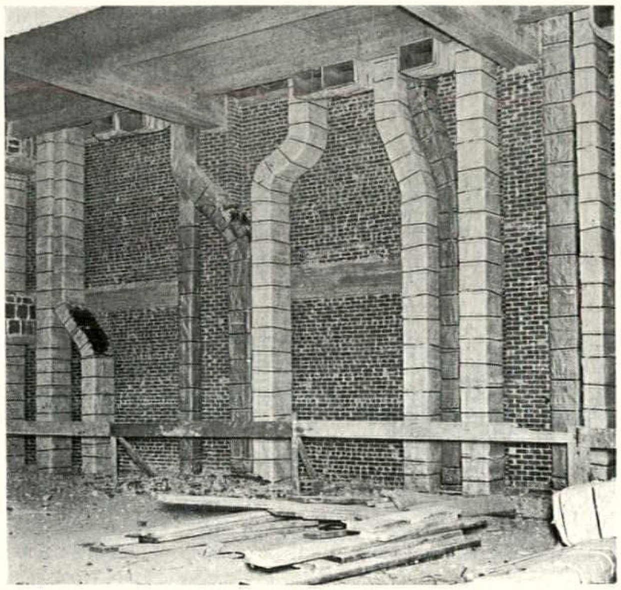


Figure 11 illustrates some of the vertical air conditioning ducts wrapped with soundproofing material on the outside. Similar ducts completely fill the duct shaft which runs along the entire west wall of the three-story studio, which may be observed by reference to Figure 7.

employed. It has been successfully adequate.

At no time does the air at any point within any acoustically treated room such as a studio vary more than .004 pound per cubic foot. Moreover, there are no air stratifications which would disturb the uniform distribution of sound waves in the studios.

Acceptable velocities, stream-lining, channeling and absorption are a few of the elemental considerations in quietizing the air conditioning system. The handling of the air to meet specific sound level requirements is an intricate study in itself.

Isolation of Mechanical Work

All electric conduits have been sound-isolated where they penetrate studio structural walls, being discontinuous in terms of sound isolation, and are also supported so as to be resonance-proof. This applies to all plumbing. Elevators and steam risers have likewise received due attention from a sound isolation standpoint.

Isolation of Extraneous Sounds

The studio section is also isolated from street, airplane, ground and other outside extraneous noise. There are windows only on the two office levels in the studio section of the R.C.A. Building for this reason. Control rooms and observation rooms, both public and those especially provided for the clients of N.B.C. are soundproofed against two-way disturbance and are acoustically treated, mostly from a reverberation standpoint in consideration of program loud speakers.

THE N.B.C. RADIO CITY AIR CONDITIONING SYSTEM

In the development of broadcasting studio design, the N.B.C. requirements for lower sound levels and for air conditioning have interacted in such a way that both have demanded more refined practice as new studios were built, until now the nature of the construction makes air conditioning an absolute necessity. This is because the construction is thermally equivalent to about 10 inches of cork so that whatever heat is emitted to the air can not possibly escape by natural means. The heat emission is so great from the occupants and the lights that straight ventilation would create a veritable gale to keep the studio temperatures down to 100 degrees when it is hot out-of-doors in summer. Moreover, the duct sizes for such extraordinary air volumes would be prohibitively large.

The experiences of N.B.C. have demonstrated that performers are not at their best unless they are perfectly comfortable. Thus a "thermos bottle" construction plus provision of complete human comfort demanded air conditioning.

The importance of the air conditioning system led to an expenditure of over a million dollars for this one mechanical service. This extraordinary expense was partly caused by the following special requirements:

1. Individual studio automatic remote control.
2. Subdivision of the 9 occupied floors into over 300 air conditioned rooms.
3. Sound control.
4. Heavy duty service of 18 hours every day in the year, and breakdown protection.
5. Nearly 100 automatically individually controlled spaces in addition to studio controls.
6. Narrow control-limit requirements.
7. Centralization of equipment for quick repair.

Inasmuch as the only windows are on the second and fifth floors, the N.B.C. space probably represents the most efficient cold storage construction in the world. The inability of heat to escape from the studio section demands cooling even in the dead of winter. The outdoor atmospheric conditions affect only the refrigeration load and the heating of the offices.

Let us examine how this air conditioning system functions.

The human body dissipates in all of the following ways the heat it generates:

1. Convection of cooler air layer adjacent to skin.
2. Evaporation of skin surface moisture, whether visible or invisible.
3. Radiation to surrounding boundaries at a temperature lower than the body, such as clothes and walls.
4. Exhaled breath.
5. Heat in moisture of exhaled breath.

The body's automatic temperature control is contained mostly in the variation in the amount of surface skin moisture to be evaporated. This normally varies in an adult between .0017 to .005 pound per minute. On evaporation this moisture tends to increase the water vapor content and hence the relative humidity of the air, and the rate of evaporation is dependent on the existing atmospheric relative humidity and air circulation. Thus relative humidity control is as vital in air conditioning work as temperature control. As a matter of fact, in summer and most places where we feel oppressively hot, the relative humidity is excessive-

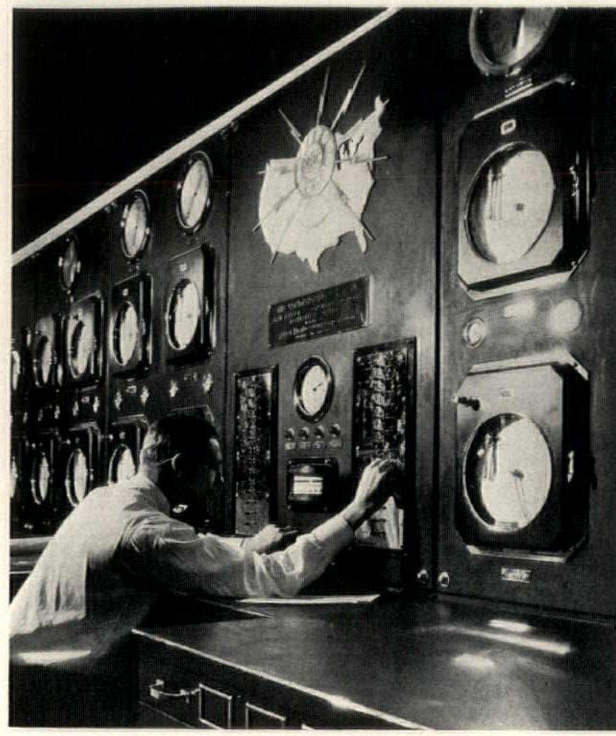
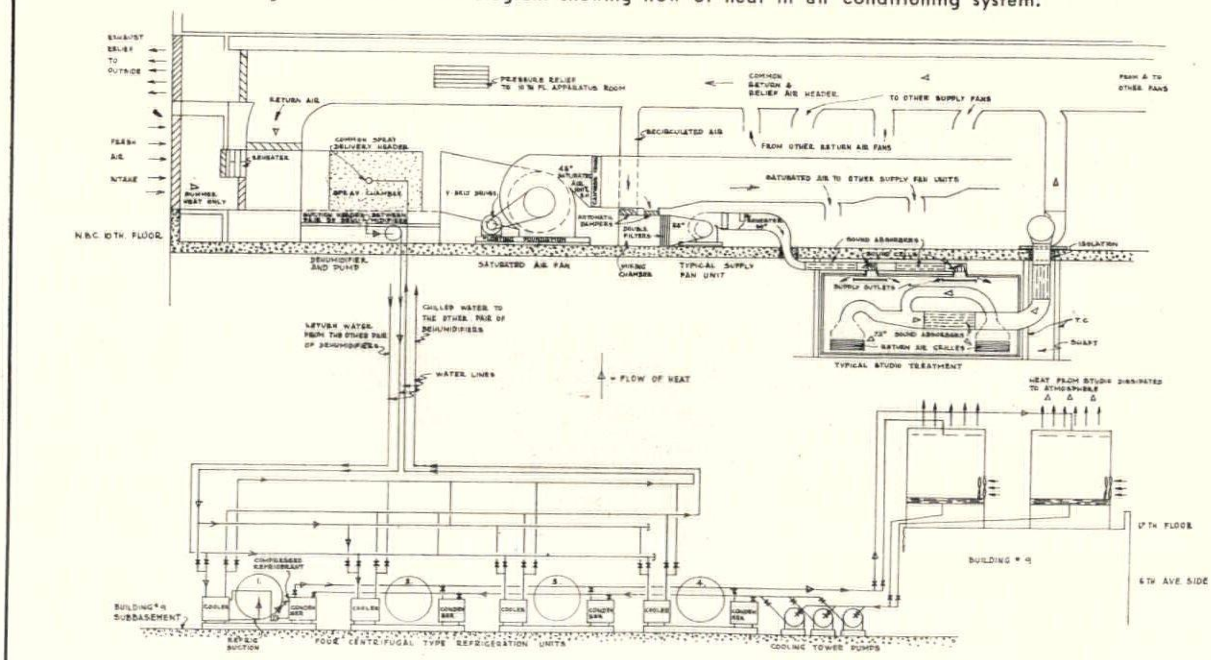


Figure 12—Close-up of remote central control board. View shows author operating the system for remotely obtaining temperatures in 60 important rooms.

Figure 13—Schematic diagram showing flow of heat in air conditioning system.



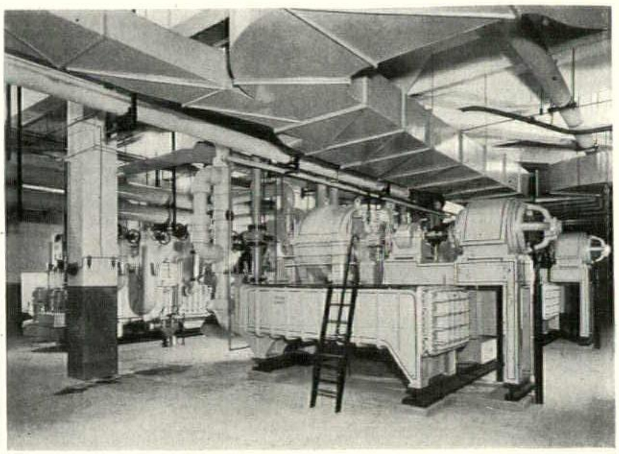


Figure 14—Refrigeration room.

ly high, and causes greater discomfort than the high temperatures of the air normally encountered. Relative humidity control, then, maintains the most desirable rate of evaporation of skin-surface moisture, the prime regulator of body temperature. No system for human comfort can, therefore, properly be labeled air conditioning without relative humidity as well as temperature control all year round, regardless of weather. In the studios, temperature is controlled automatically within plus or minus ½ of one degree of the control point, regardless of the number of occupants or their respective rates of emitting heat.

Figure 12 is a close-up of the remote central control board. Any condition desired in any studio may be attained quickly from this point. This illustration shows the author operating an electrical system for remotely obtaining the temperatures in sixty important miscellaneous rooms other than studios.

Figure 13 is a schematic diagram indicating the flow of heat in the system. There are a total of 54 fans which function similarly to those indicated in the sketch.

Four refrigeration compressors of the centrifugal type, using Carrene under partial vacuum, total 900 tons of refrigeration capacity. This is equivalent to about 20,000 domestic refrigerators. These refrigeration machines cool the spray water which conditions the air to a fixed constant temperature and moisture content per pound. Heat is removed from the air by the spray water in summer, and the incoming air has its water vapor content lowered by condensation, called dehumidifying. When this happens the droplets of atomized water become larger. When humidifying they reduce in size by a volume equal to the total evaporation. The refrigeration machines act as a pump to reject heat to the cooling tower water which is at a higher temperature level than the spray water which is chilled to 38 degrees. The cooling towers reject this heat (which originally came from the people and electric lights) into the atmosphere by partial evaporation of the 162,000 total gallons per hour recirculated. These towers with their huge fans, handling twenty million cubic feet of air per hour, can be seen from Sixth Avenue atop the 17th floor of another building in the Rockefeller Center project. Figure 14 shows the refrigeration room.

The minimum amount of air introduced from outside to every space conditioned is 50 times the amount which would be breathed by the maximum occupancy. The amount of air circulated through each studio is 4 times this amount.

The supply fans deliver 15,000,000 cubic feet of air per hour total, but all the fans handle very nearly twice this amount. The total plant connected horsepower is 1,941. Air is handled at an average velocity of 1,000 feet per minute. This varies considerably with the duct work design and sound requirements. The air travels .2 of a mile in the longest round trip run of duct.

Comfort is established by the combined temperature, relative humidity, velocity and direction of air movement. Distribution is from overhead, the supply air leaving plaques in the studios which are horizontal with the ceiling. This air is cooler and therefore more dense than the air below it. It therefore gradually settles toward the floor in a blanket method of diffusion, which takes an av-

(Continued on page 27, advertising section)

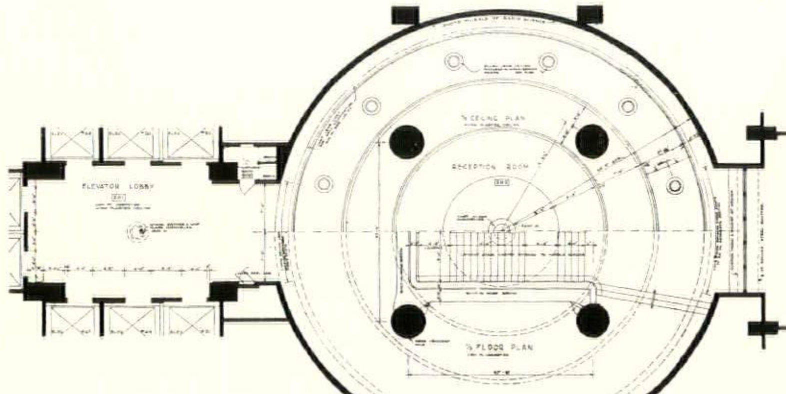


Figure 15 is a plan of the mezzanine reception foyer. This circular room represents a difficult conditioning problem not only because of shape, but because of the open staircase to the ground floor.

LIGHTING NATIONAL BROADCASTING STUDIOS

By HENRY L. LOGAN, ENGINEERING CONSULTANT, HOLOPHANE COMPANY

O. B. HANSON, OPERATING MANAGER, NATIONAL BROADCASTING STUDIOS

The lighting problem, complicated as it was by the sonic problem, and further complicated, as it turned out later, by an intricate thermal difficulty, demanded extensive research and experimentation. Each studio had to be so built that no sound could enter from another, nor from any part of the building, and that no sound could leave, except at the will of the control operator. The technical difficulties begin to appear when it is realized that the studios had not only to be grouped in the same building; placed *next* to each other and on *top* of one another, with entrances from the same corridors; with the same ducts, pipes, tubes and other mechanical connections tying them together for heat, ventilation, air conditioning, light and similar services, but had to be located in a building next to the Sixth Avenue Elevated Railway Station, so that the train vibrations would be transmitted through the steel framework of the building containing the studios.

The architectural and artistic handicaps can be understood by considering the limitations imposed by sonic requirements. Every material, every surface treatment, every shape, had to stand the test of sound transmission, sound absorption, sound reflection, sound distortion and so on. Even the glue with which the textile fabrics are fastened to the walls had be be specially sound insulating.

The function of the studios being the production and control of sound, little explanation is required to show why windows and natural light were ruled out at the beginning. Areas that would admit natural light would also admit sound from the outside world. The glass would introduce an interruption into the sound-controlling surfaces of the studios. Adequate natural illumination could have been secured only by windows in two walls, in many studios, thus requiring such studios to have two outside walls, which considerations of planning and economy would not permit. Other reasons will occur to the reader.

Artificial light was therefore dictated by the nature of the requirements so that every studio is entirely isolated from the outside world although the building in which they are housed pushes its way far up into the sunlight.

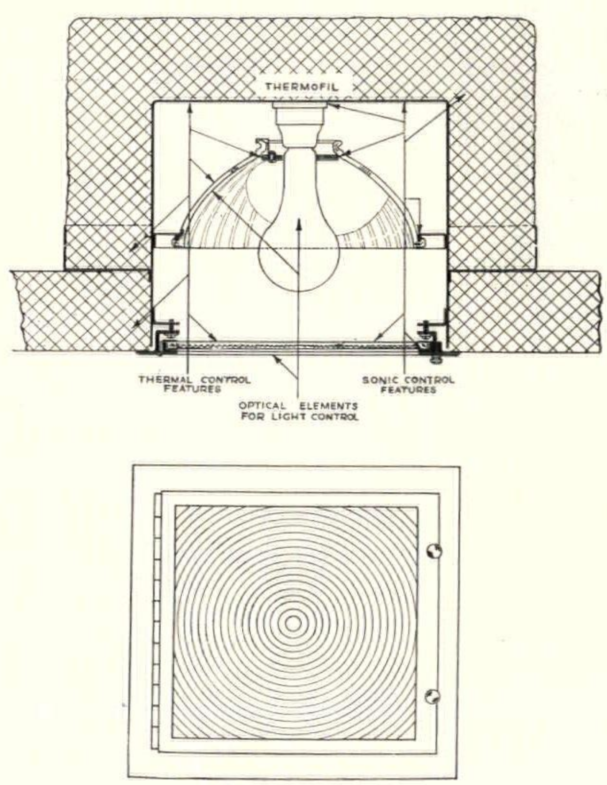
Experience with the lighting of previous studios led to the choice of twenty foot-candles as the desirable level of average intensity. Lower intensities had proved unsatisfactory.

Experience also ruled out hanging fixtures. They introduced distortions into the broadcasts, in the Chicago Studios, by sympathetic vibrations and sound reflections. In the Fifth Avenue Studios, New York, their size, which was necessary to accommodate the wattage required, also interfered with the air conditioning.

Several conferences were held to determine how to secure this intensity with visual comfort, without hanging fixtures, with reasonable wattage economy and architectural satisfaction.

The following criteria were developed from these talks:

1. The equipment should be flush in the ceiling with no projection below.
2. The light should be sharply controlled so that bright glaring rays would not strike the eyes of the performers or spectators while at the same time the scores of the musicians



SECTION AND PLAN OF TYPICAL HOLOPHANE CONTROLENS UNIT FOR N.B.C. STUDIOS and the scripts of the actors were generously illuminated.

3. Enough light should reach the walls to reveal their decoration and avoid "spotting" or "tunnel" effects.
4. Sufficient light should be returned to the ceiling by reflection from the floor and walls to overcome the contrast between the light-producing areas and the rest of the ceiling.
5. The efficiency of the equipment should be of the highest possible order to keep the power input within reasonable limits and to generate the least amount of heat so that interference with the air conditioning controls would be within a controllable range.
6. The equipment should be designed so that it would not "sing" with the broadcast by parts vibrating in sympathy with particular notes, or by the whole acting as a diaphragm; and it should produce the same acoustical results as the "floating" ceiling in order that the sonic characteristics of this specially-constructed costly ceiling would not be defeated by the holes punctured in it to receive the lighting units.

The first criterion led to the study of "built-in" lighting. Flush, luminous rectangles were decided upon as being in harmony with the rectangular shapes of the studios. Experiments were made

Suspended light fixtures used in the old N.B.C. quarters were ruled out from the new studios because of sound-distorting characteristics.

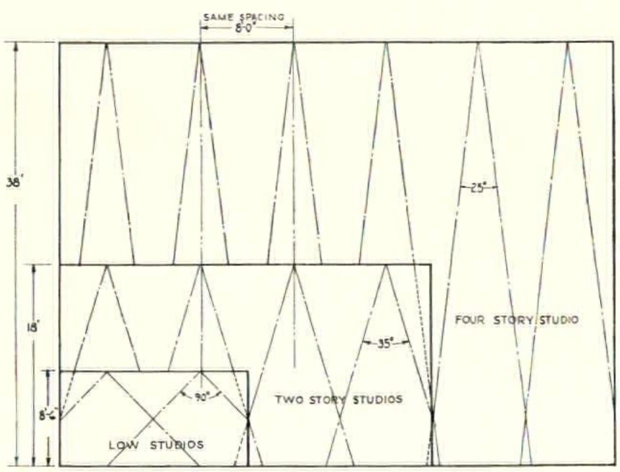


Diagram showing illumination spread in various studios.

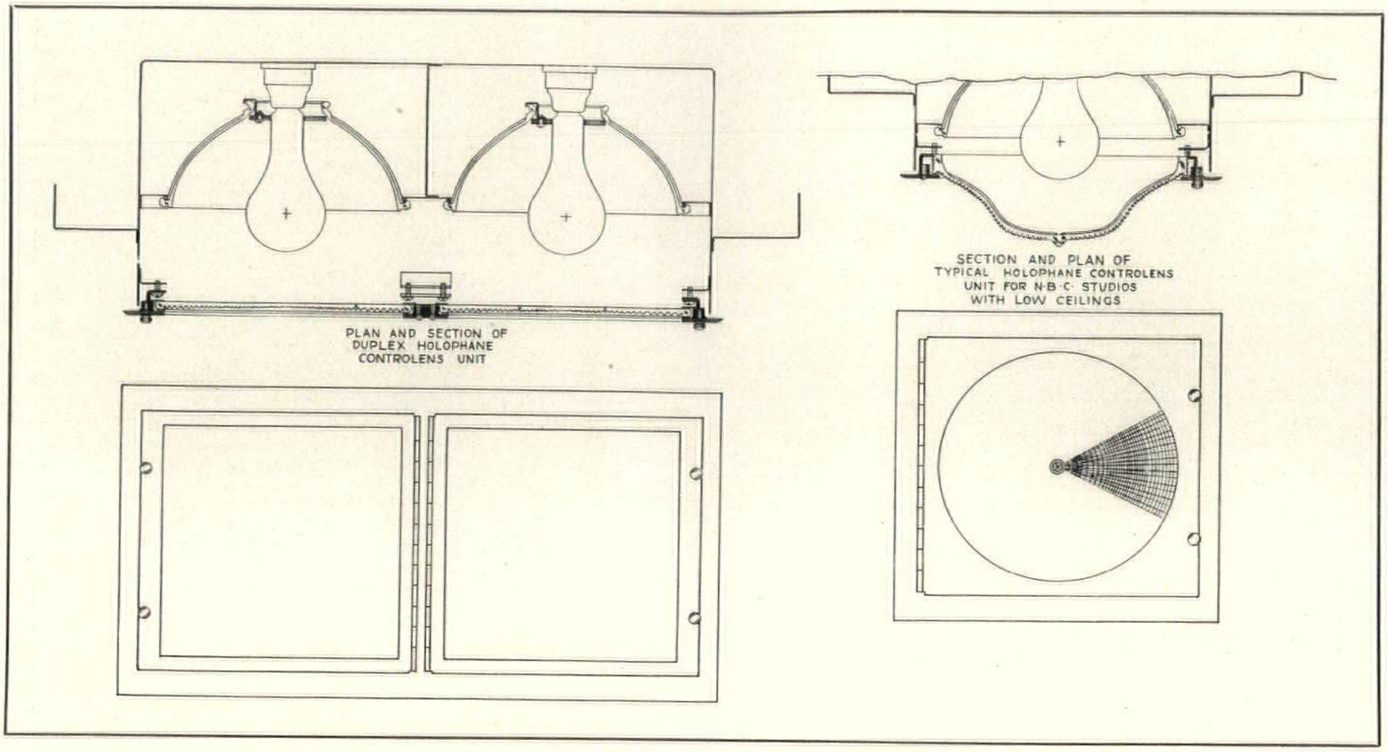
with louvers, etched glass, opal glass, controlenses, mirrored, metal and prismatic reflectors. The combination of Holophane controlens and prismatic reflector was adopted because it gave the greatest output of light; controlled it more sharply, permitting the principal beam to be confined to the work plane with a secondary blanket of softer illumination for the walls and figures of the performers, and the prismatic reflector "filled" out the lens best so that its lighted appearance was satisfactory. That is, the lens and prismatic reflector satisfied criteria Nos. 1, 2 and 3 directly.

Criterion No. 4 was met by giving the floors and walls finishes that would reflect sufficient light back onto the ceiling.

The fifth criterion proved a real stumbling block. The use of lenses solved the efficiency difficulty but the question of what to do with the heat that would be generated in the metal housings above the lenses was a poser. Experiments quickly limited the practical lamp size to 200 watts. Larger lamps raised the operating temperature of the equipment too much. That also settled the spacing of the units, as with 200 watt lamps on the sending end and twenty foot-candles on the receiving end simple arithmetic gave the answer to how many lamps were needed for each studio, and what their spacing should be.

However, that merely brought the investigation to the point where we were satisfied the equipment would operate without failure or deterioration under the temperatures developed in its interior: but that wasn't enough. Each studio was a "box" within a "box," the inside chamber being separated from the outer by a cradle of felt-covered "springs." The space between, above the ceiling of the inner "box," was filled with ducts carrying the air conditioning currents. Heat released from the light hoods that penetrated into this space would affect these currents and play havoc with the control of the air conditioning system. So there was further experimentation.

The aim was not only to drive as much of the light generated by the lamp out through the lens as possible, but also to *send the heat out the same way*. The degree of success that ended the experiments is measured by the figures of the

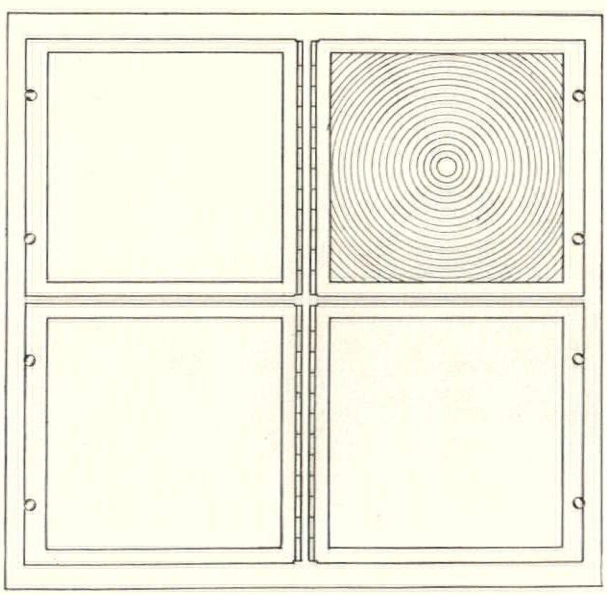


PLAN AND SECTION OF DUPLEX HOLOPHANE CONTROLENS UNIT

SECTION AND PLAN OF TYPICAL HOLOPHANE CONTROLENS UNIT FOR N·B·C· STUDIOS WITH LOW CEILINGS

final test showing that only ten per cent of the heat generated leaked out through the housing into the space around it, the rest going out by way of the bottom of the unit. Curiously enough, the equipment in its final form controls thermal energy even better than it does light.

A cross section through a typical unit is shown above with the optical elements, the thermal control elements and the sonic control features indicated. An examination of this illustration shows that the same parts sometimes control two and even three kinds of energy. That is particularly true of the lens which is a nearly perfect transmitter of luminous energy, a fair insulator for sonic energy (particularly when damped with felt around the edges), and a good transmitter for the short-wave length thermal energy, usually referred to as "radiant heat."



PLAN OF QUADRUPLEX HOLOPHANE CONTROLENS UNIT

Sonic control was achieved by damping all parts with a tendency to diaphragm action, such as the lens and the reflector, with felt, and by tying all metal parts and the entire assembly rigidly together to prevent rattles, then by covering it all over the outside where it projected into the space above the ceiling with the same sound-absorbing material used in the "floating" ceiling, so that the ceiling merely "bent" around it and continued on unbroken, sonically speaking, although optically the ceiling stopped at the edges of the units.

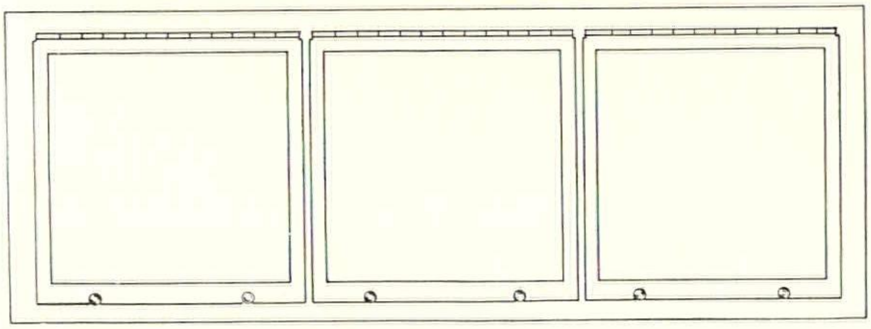
The various ceiling heights complicated matters. The large auditorium studio goes through nearly four stories. The clear height from finished floor to ceiling is thirty-eight feet. Some of the one-story studios are at the other extreme being only 8½ feet high. Normally these great differences would be reflected in proportionate wattage changes. The higher the ceiling the more the wattage. The use of the lenses made it possible to reconcile this wide range of heights *without proportionate changes in wattage.*

A convex lens, bulging slightly downward into the room, was selected for the lowest studios with a light spread for the principal "beam" of 90°.

A flat lens was used in the two-story studios that compressed the same quantity of light into about a 50° spread so that the greater height was compensated for by "squeezing" the light into a narrower cone and putting as much onto the work-

Sigurd Fischer

NATIONAL BROADCASTING STUDIOS, ROCKEFELLER CENTER, NEW YORK CITY
REINHARD AND HOFMEISTER; CORBETT, HARRISON AND MACMURRAY;
HOOD AND FOUILHOUX, ARCHITECTS



PLAN OF TRIPLEX HOLOPHANE CONTROLENS UNIT

ing plane with the same average wattage per square foot of area, as for the lower ceilings.

The same lens was used in the four-story studio but the lamp and reflector settings were changed to "squeeze" the light still more, this time into about a 30° beam so that again the same average wattage could be used to secure the desired intensity.

The diagram on page 90 will make this clear. Measurements taken since the installation has been completed show that the average wattage per square foot for all the studios is a little under four, and the average intensity is a little better than twenty foot-candles.

The engineering requirements of the lighting system were so rigid that architectural considerations were subordinated, but all comments that have reached the writers dealing with the architectural features of the lighting have praised them. Perhaps this is evidence in favor of the viewpoint that holds the surest way to beauty is to satisfy the "function" of a "creation."

PANEL HEATING

By ALFRED ROTH, Architect*

Panel heating, initiated by Richard Crittall & Co., Ltd., London, is a warm-water heating system, with water circulation by pump or gravity. Heat is transmitted to rooms, not by radiators or exposed pipes, but is literally radiated into the rooms by means of warm surfaces of plaster or other suitable material (generally with the aid of concealed coils in walls, floors, and especially in ceilings).

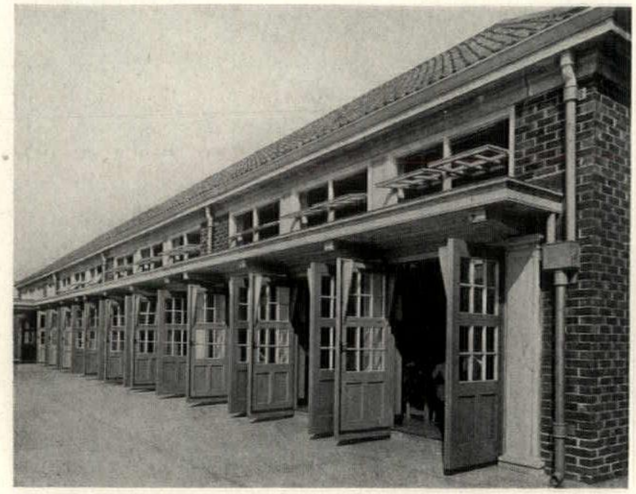
The heating effect of this system is fundamentally different from the one attained by radiators. We know that heat can be emitted either by convection or by radiation. In ordinary heating units (radiators, pipes), both kinds of heat emission are in effect, one more, the other less, depending upon construction and position of the unit. In heat distribution by convection the air surrounding the unit has first to be brought to the desired temperature and then carried into the room. This results in a constant air circulation. Contrary to this, in heat distribution by radiation alone, no practical rise in temperature affects the air between the heat-emitting and the heat-receiving bodies.

Panel heating is based on this principle of heat dispersion almost entirely by radiation. As a result, a characteristic of the system is that the effect of warmth is perceived before a thermometer, protected against radiation of heat, registers the desired room temperature.

We have all been so accustomed to surrounding ourselves with an indoor atmosphere of hot air in winter that at first it will be difficult for many to realize that they can be kept comfortably warm by radiant heat, even in air considerably cooler than 70°; but experience has shown conclusively that this is the case.

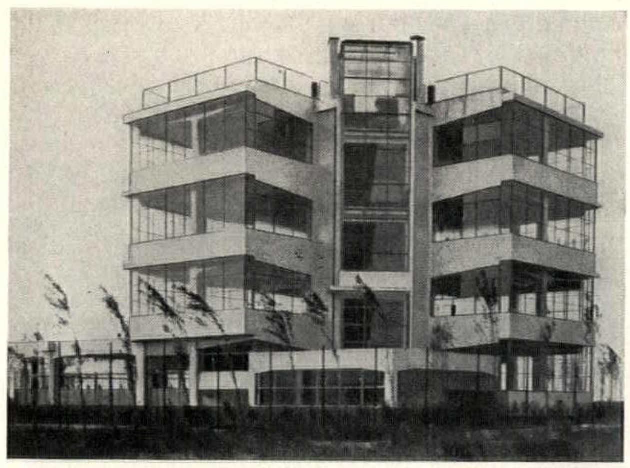
In the panel-heating system, in the ordinary case, a portion of the ceiling radiates heat downward into the room; this radiant heat is reflected at various angles by the walls of the room, the furniture, and so on, and impinges on the occupants from above and from all sides. The radiant heat is absorbed directly by the surface upon which it strikes (in proportions which depend upon the nature and color of the surface), and thus warms the occupants, the furniture, the floors and, to a lesser extent, the walls of the room. So far the air of the room has played no part in the process, but the warmed walls, furniture, and even the occupants, of course, give out heat slowly to the air, so that it is warmed somewhat by a "secondary convection" (although at a much lower rate than with ordinary heating systems). The result is that the occupants can be kept as comfortable by mild radiant heat as in the ordinary 70° room temperature, although the air itself

*Application in U.S.A. by Wolff & Munier, Inc., Engineers, N.Y.C. Article translated by A. Frey, extracted from *Schweizerische Bauzeitung*, Zurich.

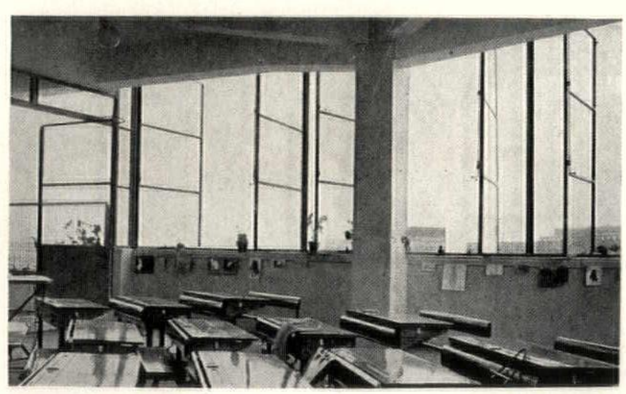


Stewart Bale

Norris Green Pavilion School, Liverpool, England. A feature of this school is the close relation of classrooms and out-of-doors. Panel heating makes this opening of the rooms possible for the entire year.



Open-Air School in Amsterdam, Holland. J. Duiker, architect. Every classroom in this vertical arrangement has a connected terrace for out-of-door teaching.



Classroom interior, Open-Air School in Amsterdam. With panel heating in ceiling, heat is radiated downward (not circulated), permitting open windows during cold weather out of doors. Window areas may be large without much heat loss.

is several degrees lower in temperature than is usual with any other form of heating.

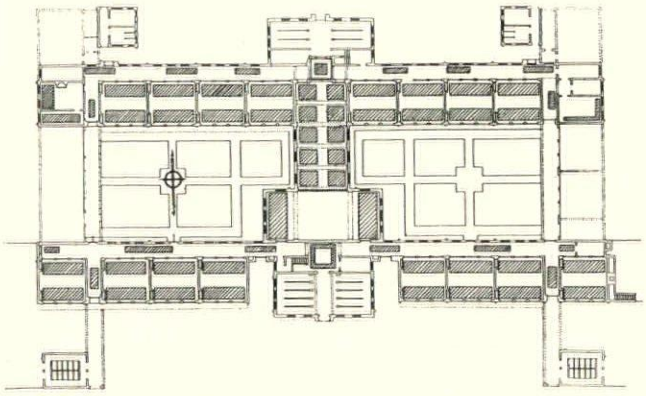
In the first experiments, coils were embedded in walls, floors, and ceilings. It has been found, however, that heat from ceilings alone is sufficient in most cases. This might seem paradoxical at first because with ordinary steam or hot-water heating we endeavor to place heating surfaces as near as possible to the floor level (under windows, for example). In regard to heat transmission by convection this conclusion is right, since heated air tends to rise. For panel heating, however, operating almost exclusively by radiation, this conclusion is out of consideration. The radiation from the surface of the temperately-heated ceiling is mild and even.

The water used for heating is never heated to a temperature greater than 135°, and the radiating surface reaches a temperature of about 120°. The warmth is the more agreeable when it is mild. Lowest surface temperatures and largest heat-radiating areas, evenly distributed over the entire room, give best results. The heating effect coming from above is not only agreeable but is perceived as natural, because we are used to it from the sun. It would seem that with a surface radiating heat from the ceiling, the floor would be cold, but actually the floor is the warmest space apart from the ceiling. This is due to the fact that the radiant heat not only strikes the human bodies, but every object in the room and especially the floor directly under the ceiling, which absorbs the heat and becomes a radiating surface.

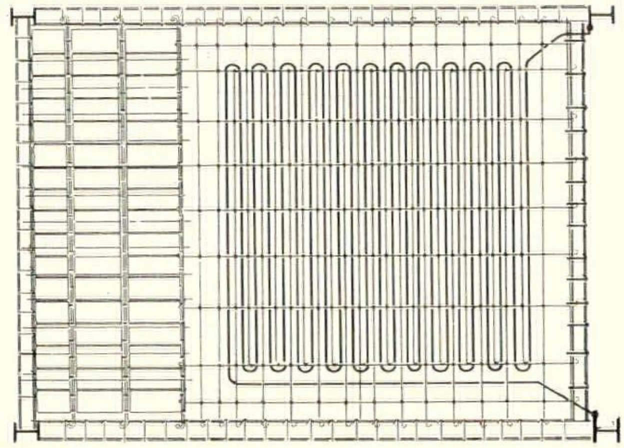
Panel heating requires the burying of coils of steel pipe in the building construction, immediately behind the surface which is to radiate the heat. Water is circulated through these coils at a temperature which is made to vary according to the weather. Heat from the water is conducted through the metal of the pipe and through the construction materials to the plaster surface which is kept warm, the pipes being so spaced as to maintain an approximate uniform temperature for the whole area of the panel.

To obtain the desired results it is necessary to have intimate contact between the pipe coils and the building construction which forms the panel. This has been achieved both by casting the coils in the bottom of a stone concrete arch and, in this country, by hanging the coils at the suspended ceiling level and applying the wire lath and plaster directly to the coil pipes. The advantage of the latter method (which better fits the usual American construction) is that there is a smaller mass to heat and cool, with the result that the system responds more quickly to the rapid changes in temperatures encountered here.

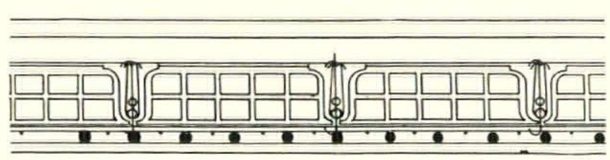
Heating panels may be located behind any type of building material which has a fairly good coefficient of heat conduction. In England it is quite common to place panels which, for various reasons, are not in the ceilings, behind marble bases, or under terrazzo floors. There have been a number of cases where heating panels have even been



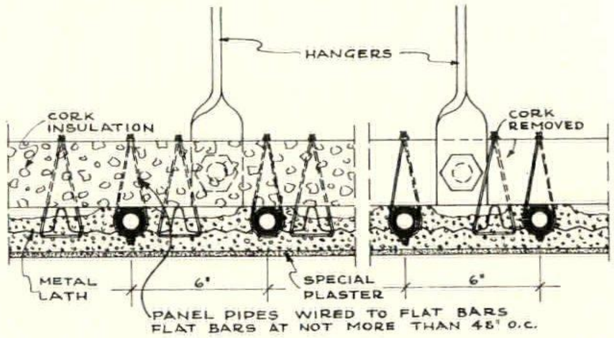
Norris Green Pavilion School, Liverpool, England. Heating panels at ceilings of classrooms and corridors are indicated by dark areas.



A typical ceiling panel, showing pipe coils, and risers and returns at columns.



Section of floor with coils suspended at ceiling. The coils with frame are suspended to the steel floor framework.



Detail of ceiling, showing suspension of pipes. Metal lath is attached to these pipes. The pipes are then embedded in a special plaster suited to heat radiation. The space above the pipes and plaster is filled with cork insulation.

located behind large mirrors, and the mirror surface actually radiates heat, as well as reflects light. Wood and similar porous materials do not make very satisfactory heating panels, because of the resistance they offer to the conduction of heat from the coil to the surface of the panel.

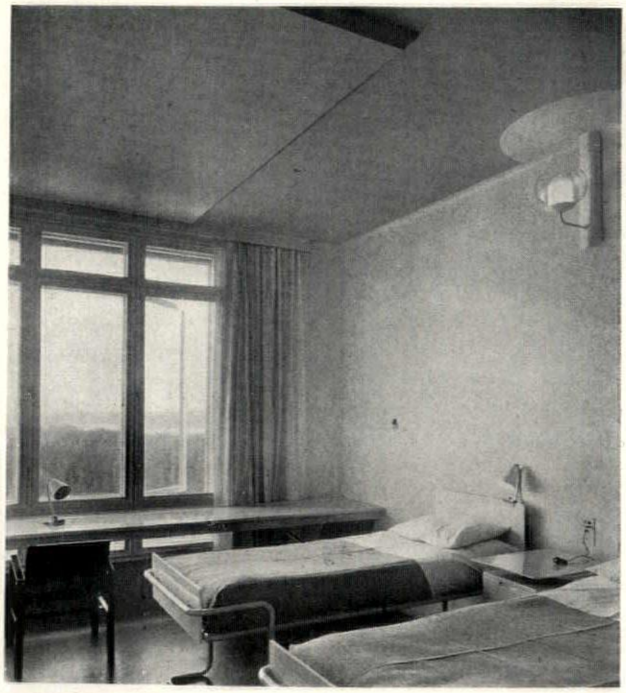
The usual panel surface, of course, is plaster, and this is practically the invariable surface in the case of a conventional coil location in the ceiling. Through the use of a special grade of plaster, reinforced by the application of "scrim" troweled into the freshly-applied white plaster, any danger of cracks is overcome. The scrim becomes embedded in the plaster in such a manner as to be practically invisible (except that it gives a "textured" surface).

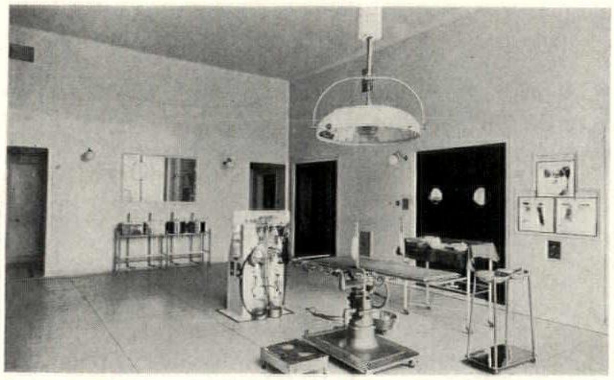
The method of heating hot water for the panel heating system depends entirely on the requirements of the building and the desires of the owner. Coal, oil or gas may be used as a fuel; or steam from a central distributing system can be used with a hot-water converter for panel heating. The hot water for the system can be circulated either by gravity or by pump; pump circulation is preferable as it results in smaller pipe sizes and more rapid heating and cooling. With circulation by cooled water the system can aid in keeping rooms comfortable in summer.

Panel heating, due to the fact that it is entirely concealed and an integral part of the construction, gives the architect a wide range of treatment in the design and finish of the rooms. This is of special importance from hygienic and aesthetic standpoints.

It is of course necessary, owing to the construction, that the architect and builder, as well as the heating contractor, work in conjunction both as to the design and installation of the system. The coils and branches must be installed before pouring the arches (if embedded therein), or before applying

Sanatorium Paimoni in Finland. Alvar Aalto, architect. Heat radiating units are here visibly applied at ceiling, affording unobstructed floor area and flexibility in lighting and ventilating.





Sydney Newberry

Interior of Sanatorium Paimoni, Finland. Alvar Aalto, architect. The requirements of rooms for tubercular patients do not demand evenly distributed heat but concentration upon the foot-ends of beds. Pure air is also essential. Panel heating makes possible the opening of windows without exposing the patient to the danger of catching cold. The advantage of this method of heating for the operating room is obvious.

wire lath and plaster (if hung ceiling panels are used). All pipe work is welded and tested in order to prevent any danger of leaks. The small loss of time due to the installation of panel heating at this stage of the construction is more than offset by the saving in time effected in the finish of the building owing to the omission of radiators and grilles.

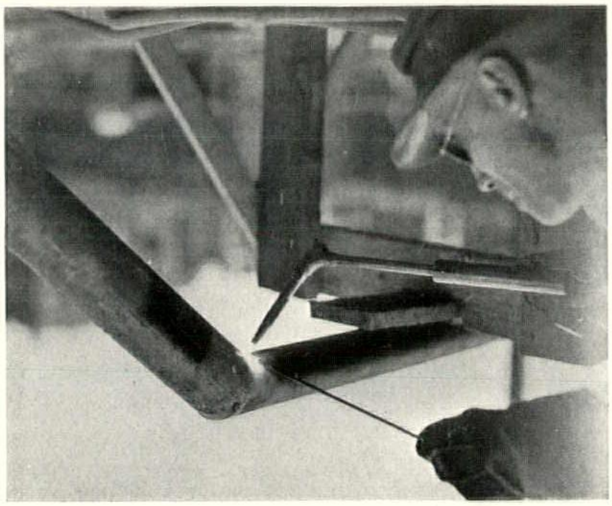
Panel heating has been installed for some years in many types of buildings, such as hospitals, residences, office buildings, and public buildings, and it has also found special uses, in open-air schools (where, because of the radiant heat, the occupants feel warm while the windows are open), and the heating of tile floors around swimming pools.

From the standpoint of comfort, and of the preservation of perishable materials, the advantages of panel heating are as great as from the aesthetic standpoint. In common with all hot-water heating systems, the amount of heat liberated can be regulated easily and conveniently, at the central boiler plant, to suit the requirements of the weather, so as to avoid the overheating (in average mild weather) which is so characteristic of most steam heating systems. However, panel heating enjoys further advantages which are *not* present in other hot-water heating systems; these are derived from the essential feature, that *radiant* and not convected heat, is used. This radiant heat will maintain complete comfort with an air temperature several degrees lower than is necessary with other methods of heating. The result of this cooler air is a delightful sense of freshness, without any chill. At the risk of repetition, the point should here be stressed that the radiant heat from the panels is picked up directly by the skin and clothes (as well as by the furniture and floors), which are thus kept comfortably warm in air considerably cooler than when the only source of heat is the air itself.

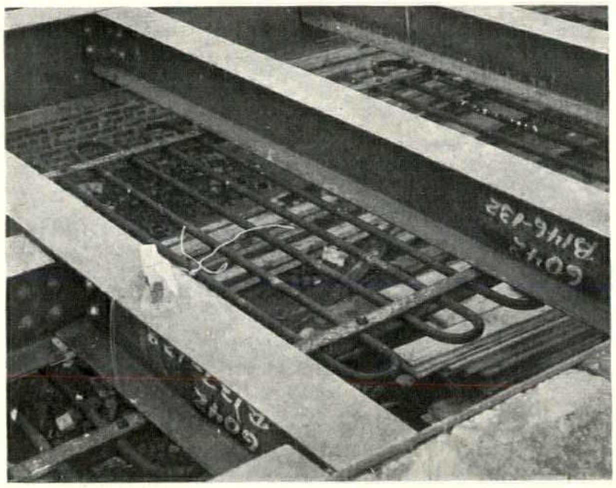
Panel heating thus offers a comfort which is somewhat analogous to out-of-door living. As a result we become accustomed to panel-heated rooms immediately. In addition, this method of heating creates living conditions which eliminate the hazards occurring through change from outside to inside temperatures, such as catching cold.

From an operating point the installation of panel heating shows considerable economy. The average outdoor temperature, throughout the heating season, is in the neighborhood of 42° (New York City); with 70° room temperature, the temperature difference from indoor to outdoor averages 28°, while with panel heating it will only average about 20°. In the British Embassy Building, Washington, D. C., which was the first installation of panel heating in this country, it has been found that there was a saving of at least 40 per cent in fuel.

Panel heating forming an integral part of the structure has theoretically or practically no influence upon floor layouts. It even underlines the free disposition of partitions which skeleton construction has made possible. A further advantage of the complete disappearance of heating units is in the space gained for furniture.

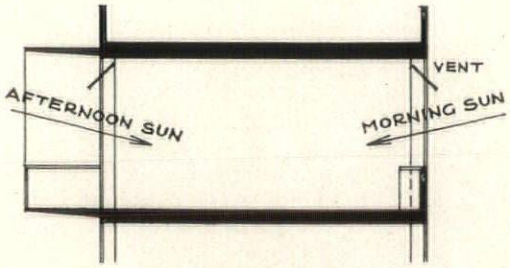


Pipes for panel heating as installed in the United States are welded.

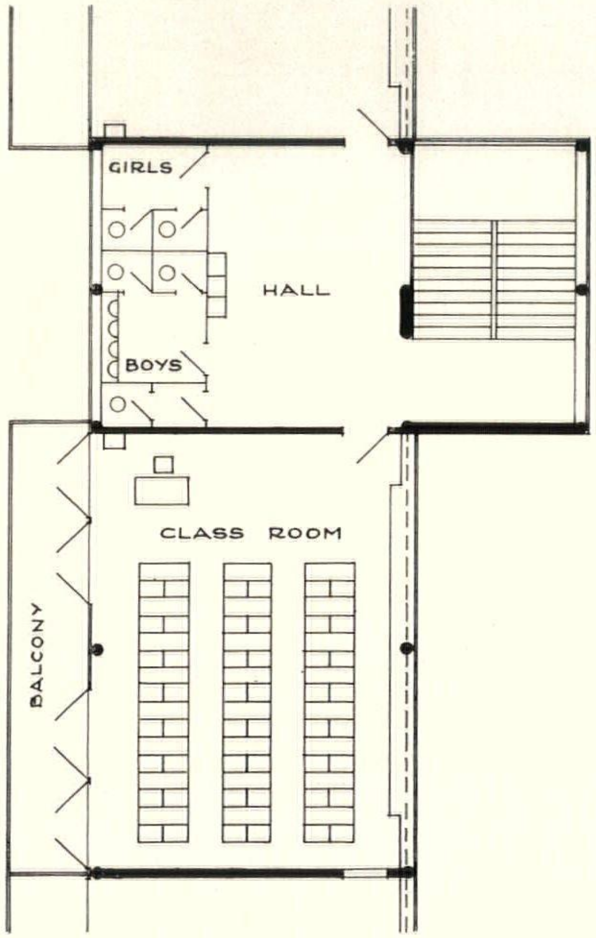


Hot water pipes placed under the beams before applying metal lath and plaster. British Embassy Building, Washington, D. C.

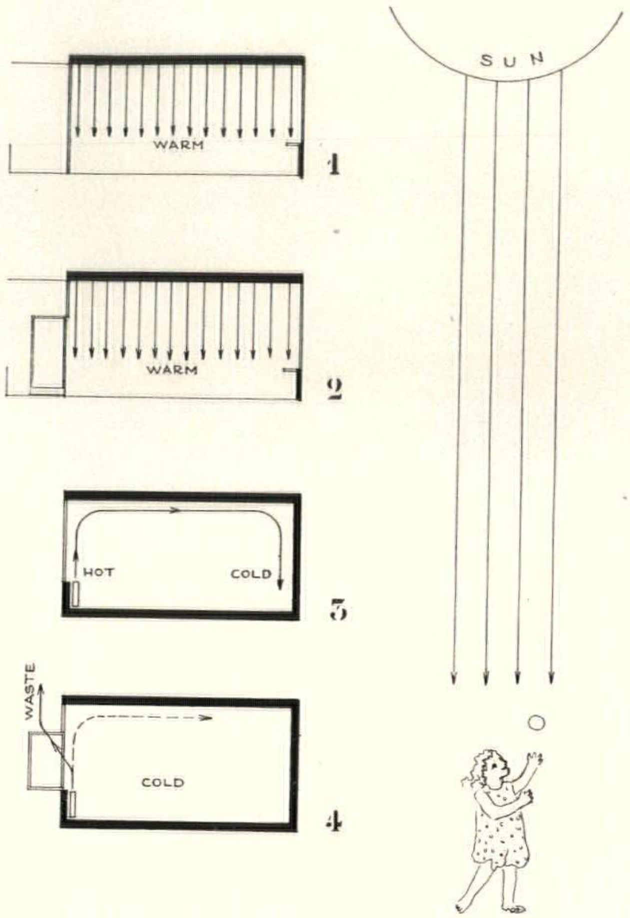
Heating coils are embedded in plaster at ceiling—with minimum mass to be kept at even temperature.



Section of typical classroom.

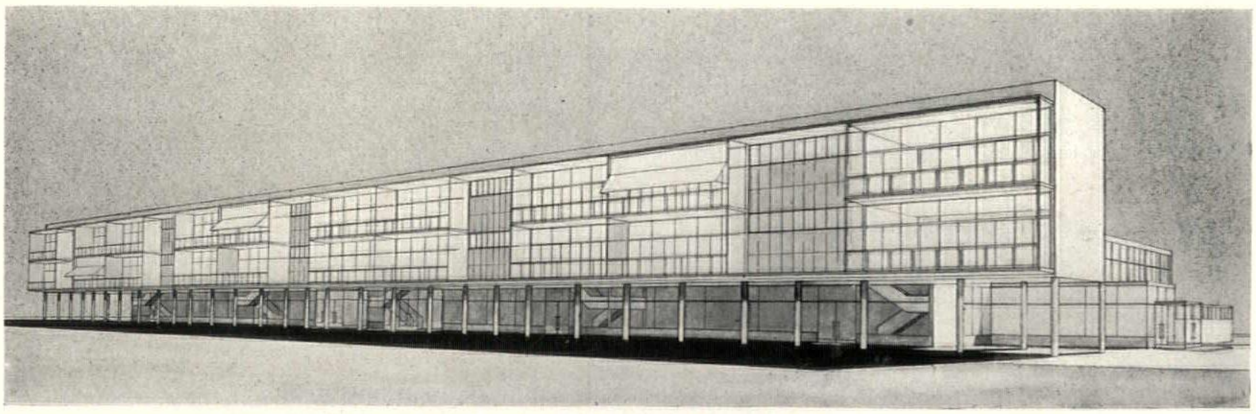


Plan of typical classroom and central stair hall. Stairways serve two classrooms at each floor level.

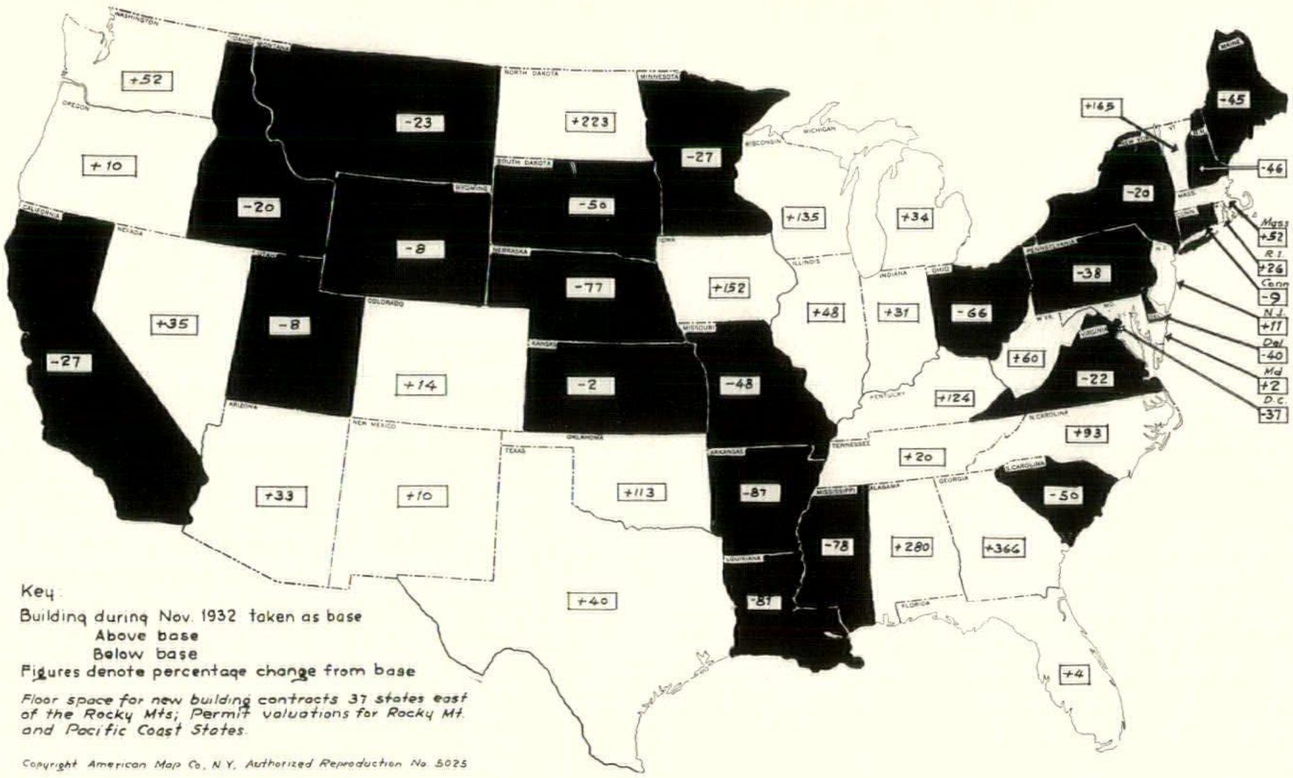


Diagrammatic indication of heat from ceiling panels of proposed Open-Air School in Zurich, Switzerland. (1) Vertical direction of heat radiated from ceiling. The air within classroom is not heated. (2) The opening of doors or windows does not upset heat radiation. (3) Circulation of air by ordinary wall radiator methods. (4) When radiators are placed beneath open windows, heat escapes and cold air takes the place of the lost heat.

It is well known that the heating of air reduces its relative humidity. In severe winter weather the air that has been heated from a very low temperature to about 70° is actually *drier* than the summer air of deserts.



Proposed open-air school in Zurich, Switzerland. A. Roth, architect. In recognition of the effects of panel heating, the classrooms are disposed for admittance of light and sun from two sides and for cross ventilation. Each classroom, to the southwest, has a balcony upon which glazed doors open for the entire width of the room. By this arrangement the classrooms may be converted to out of doors without having pupils leave their seats.



BUILDING TRENDS AND OUTLOOK

By L. SETH SCHNITMAN, Chief Statistician, F. W. Dodge Corporation

Construction contracts awarded in the 37 eastern states during the full year 1933 amounted to $1,256,000,000 as contrasted with the total of $1,351,000,000 for 1932; this, it is seen, is a decline of about 7 per cent between the two years. For the first half of 1933, contracts were running 35 per cent behind the corresponding period of 1932; thus it is clear that during the final half of the year a considerable speeding up in contracts took place even though such improvement was not quite sufficient to offset completely the loss recorded during the initial half.

For December alone the contract total amounted to $207,209,500; this was a gain of almost 28 per cent over the November total of $162,330,600 which itself was almost 12 per cent larger than in October. In fact, the December contract volume was more than 2½ times as large as the total recorded in December, 1932. Increases over December, 1932, were fairly general both as to geographical location and as to major construction types. Thus, for residential building the gain approximated 85 per cent; for nonresidential building, December awards were twice as large as those reported a year earlier; while for public works and utilities combined, December contracts were more than three times as great as the total shown for December, 1932.

It is of interest, too, to indicate that out of the December total of $207,209,500 for all awards east of the Rockies, publicly-financed contracts accounted for $155,862,800; this represented about 75 per cent of all contracts for the month.

MATERIAL PRICE MEASURING ROD*

The prices in this tabulation enable one to visualize at a glance the main trend of the material market. Their significance does not extend beyond that point, and the explanation below should be read carefully.

F. W. Dodge Corporation Composite Prices as Indicated in Explanation—

Material	This Month	Month Ago	Year Ago
Portland Cement	$2.20	$2.20	$2.05
Common Brick	12.34	12.34	11.75
Structural Steel	1.65	1.65	1.60
Lumber	16.44	16.37	15.50

Prices given in this comparison are composite and do not in all cases refer to one item. For instance, the price of structural steel is the composite of prices of shapes and plates f.o.b. Pittsburgh; the price of lumber is a composite of five items of Southern pine and five items of Douglas fir f.o.b. mill; the price of cement is a composite of prices in fourteen different cities per barrel, carload lots, to contractors; price of brick is composite in fourteen cities per M, delivered on the job.

*As previously published in *General Building Contractor.*

COSTS NOT INCLUDING GARAGES	TYPE A	TYPE B	TYPE C	TYPES D E
HOUSE @ 20¢ CU. FT.	$2721.00	$2623.00	$3135.00	$4514.00
LAND @ $2.00 SQ. FT.	2788.00	1650.00	1260.00	2932.00
FINANCING, PROFIT, ETC. 15% OF ABOVE	826.00	641.00	659.00	1117.00
TOTAL COST	6335.00	4914.00	5054.00	8563.00
MONTHLY COST @ 10% YEARLY	52.79	40.95	42.12	71.38
ONE GARAGE BLDG., LAND FINANCING & PROFIT	TOTAL COST $1058.00	MONTHLY COST @ 10% YEARLY $8.82		

DATA

TOTAL AREA OF BUILDINGS: 50.182 SQ. FT. COVERAGE: 46%
AREA OF BLOCK: 108.976 SQ. FT. AVERAGE AREA OF GROUND PER PROPERTY 1330 SQ.FT.
TOTAL NUMBER OF HOUSES: 82 OF GARAGES: 60
TOTAL COST OF LAND $217,952. AVERAGE COST OF LAND PER PROPERTY $2658
TOTAL COST OF BUILDINGS $303,236 AVERAGE COST PER BUILDING $3698
TOTAL COST OF DEVELOPED PROPERTY $521,188 AVERAGE COST PER PROPERTY $6356

PRELIMINARY STUDY FOR

A BLOCK OF SINGLE FAMILY HOUSES AND GARAGES

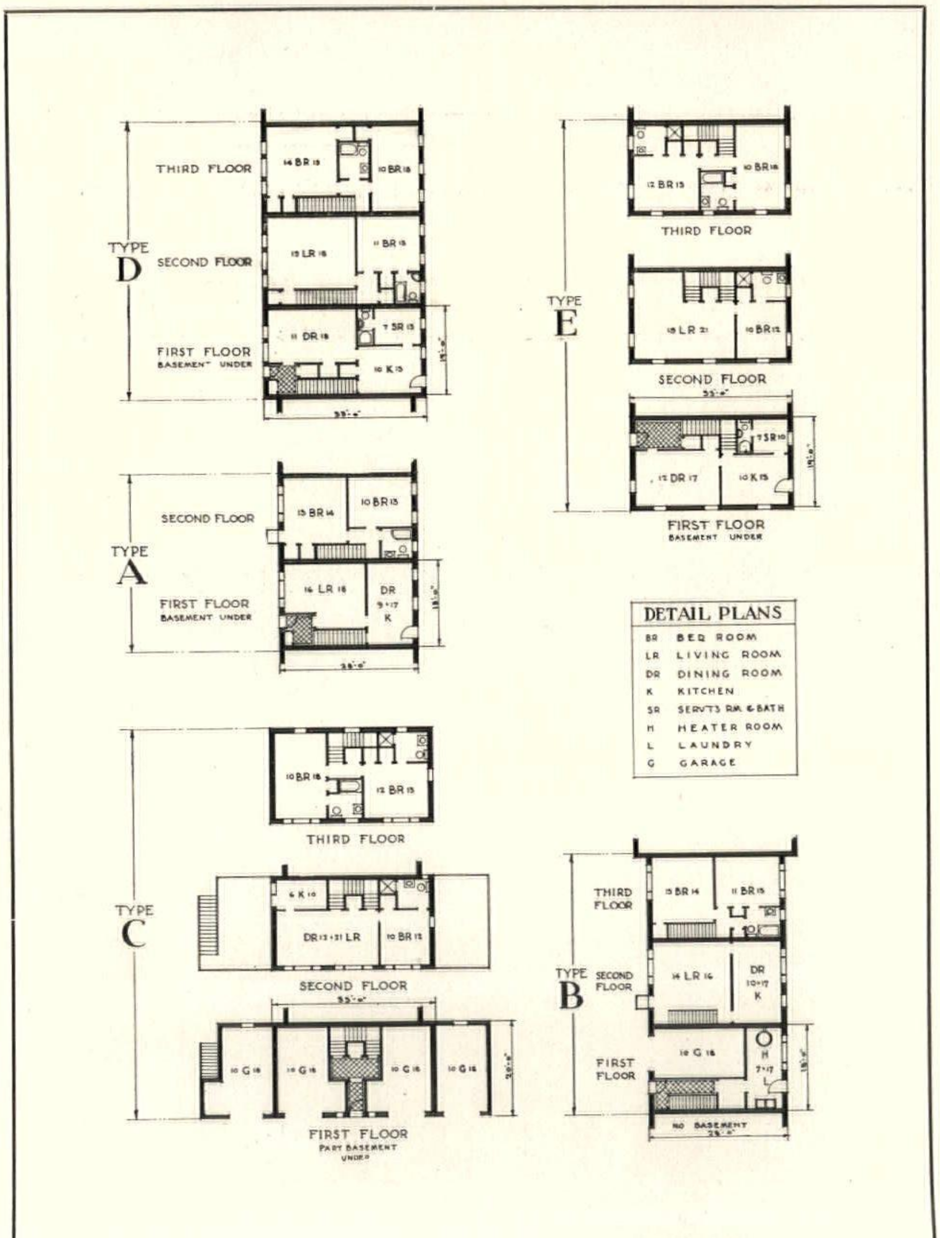
PREPARED FOR

THE ARCHITECTS MUNICIPAL COUNCIL OF THE PHILADELPHIA CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS

BY

EDMUND B. GILCHRIST
OF THE PLANS COMMITTEE
ARCHITECT

1-12-33



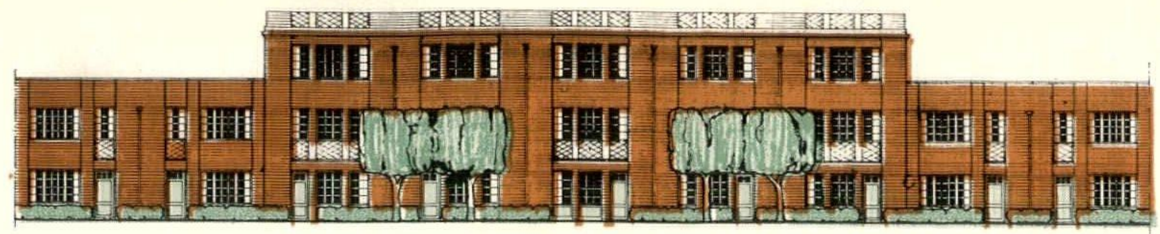
OBJECTIVES OF HOUSING PROJECT:

(1) To provide individual houses and garages (60 garages, 82 houses) for those affording rents as indicated, on land in the central section of Philadelphia (or elsewhere of similar value), now slum areas.

(2) To give maximum privacy from the street by placing all garages directly on surrounding streets, and fronting majority of houses on courts with pedestrian access only.

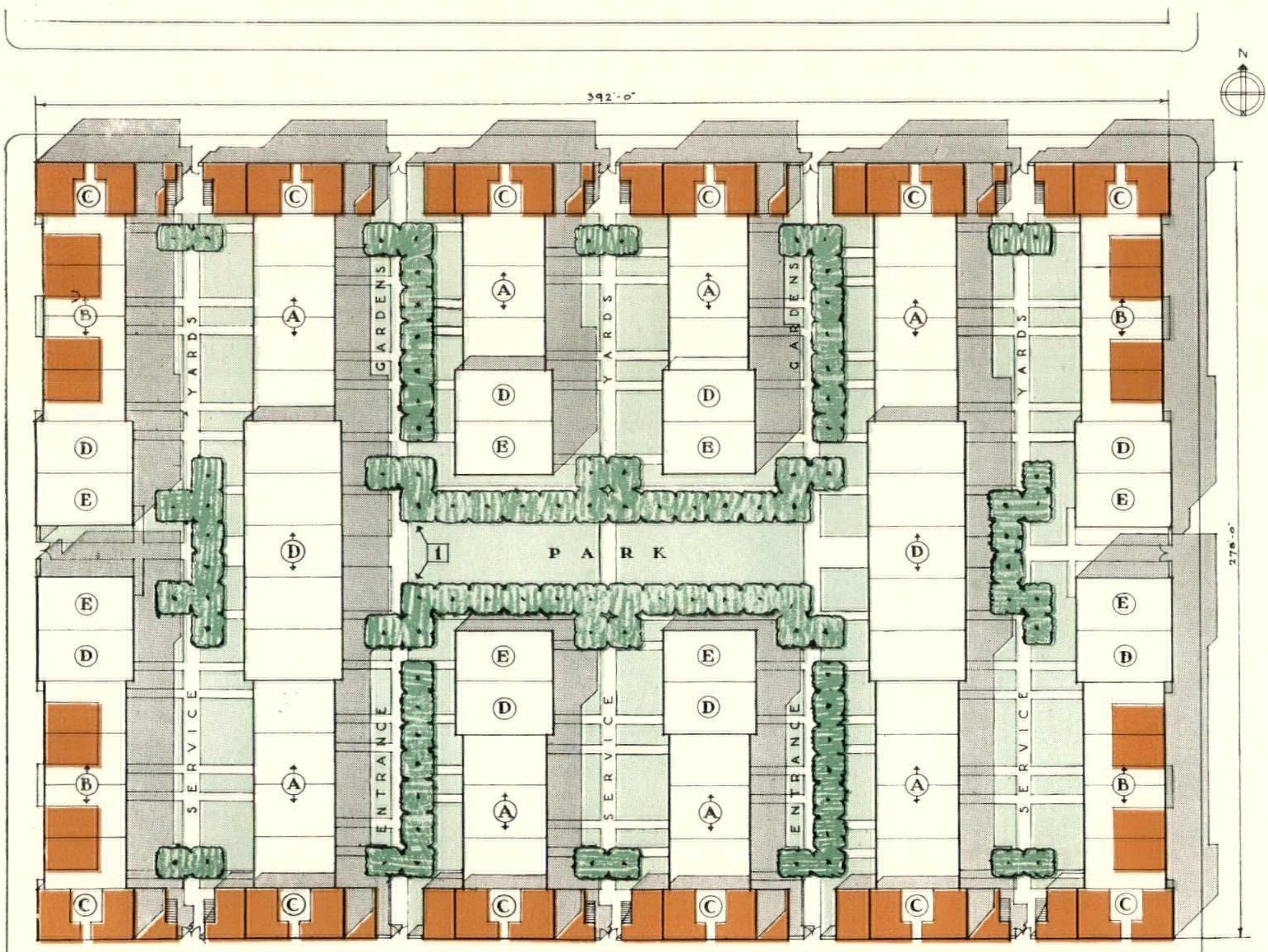
(3) To eliminate all lesser and wasteful subdivisioning of main blocks, such as alleys and minor streets to reach rear yards and garages; to restrict vehicular traffic to the periphery of the block.

The average room rent is $8.65, counting baths as half rooms, and living room and dining rooms, and kitchen and dining rooms, as room and a half.



·ELEVATION·1·

·ELEVATION·2·



PLOT PLAN

0 10 20 30 40 50 60

HOUSING DESIGN DEVELOPED FOR ARCHITECTS MUNICIPAL COUNCIL OF THE PHILADELPHIA CHAPTER AMERICAN INSTITUTE OF ARCHITECTS—EDMUND B. GILCHRIST, PLANS COMMITTEE, ARCHITECT

VOL · 75 NUMBER 2

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FEBRUARY

THE ARCHITECTURAL RECORD

CONSTRUCTION CODE APPROVED, MONEY FOR PRIVATE BUILDING CONSIDERED

The Code of Fair Competition for the Construction Industry was approved by President Roosevelt on January 31 and goes into effect on the thirtieth day thereafter. It covers the designing and the constructing of buildings and other "fixed structures . . . intended for use in industry, commerce, sanitation, transportation, communication, flood control, power development, reclamation and other similar projects or services."

The Construction Code permits branches of the industry to organize themselves as divisions, each of which may submit a specialized code which when approved becomes a chapter of the Construction Code. Thus, the term "division" means "a branch of the industry which has been or may hereafter be defined in a particular chapter of this code."

The Construction Code as approved consists of an opening chapter of general provisions and such division codes or chapters as were ready for submission along with the general provisions. Chapter I governs the industry in so far as it has not yet organized itself under approved division codes. The architects' code, when signed by the President, becomes a chapter of the Construction Code.

Administrative functions are exercised mainly by a Construction Code Authority and Divisional Code Authorities, which include non-voting members appointed by the Administrator of Title I of the National Industrial Recovery Act. The primary object of the code was understood to be regulation of competition between employers. The sponsors of the code, assuming that the general interests of labor would be sufficiently protected by the non-voting members, made no provision for labor representation on the various code authorities; division boards, each containing two representatives of labor and two of employers, under an impartial chairman, were empowered to hear local complaints with reference to hours, wages and conditions of employment.

The principal delay in formulating an acceptable code arose over the question of labor representation. The solution finally reached is a National Construction Planning and Adjustment Board of twenty members, one-half labor, under leadership of a Presidential appointee, together with supplementary regional boards. This arrangement leaves intact the power of employers to administer those parts of the code which deal with competition among themselves, but provides for joint administration by labor and employers of many important and troublesome labor problems.

A minimum of 40 cents an hour for unskilled labor is established, together with a forty-hour week, rising to forty-eight hours under certain conditions. Wages and hours may be reconsidered by the Planning and Adjustment Board, which is also to handle jurisdictional disputes between labor unions.

The approval of the Construction Code in its present form does not complete the projected organization of the construction industry, but it clarifies objectives and sets up machinery which should facilitate further progress. Organization of the construction industry in accordance with the principles embodied in the code is a first step toward rehabilitation. The next logical step is organization of credit facilities for private construction projects. (A reprint of Chapter 1 of the Construction Code will be found in this issue.)

POSSIBILITIES FOR RESIDENTIAL BUILDING

A residential building revival could do much to provide the basis for a sustained recovery in business. But is there any real economic demand for housing? If there is a demand, shall government provide the senior financing or shall the conventional sources of mortgage money produce the funds? What of the disparity between building material prices as a group and the general price level? What of the distressed residential properties that now can be purchased from mortgagees in possession at prices far below present replacement costs? These are a few of the questions which must be answered before private credit can be expected to flow effectively into residential building projects.

Fortunately these conditions are recognized both in and out of government circles. The Real Property Inventory which is now in process in 63 cities has as its basic function the determination of existing housing facilities in those centers. The announced purpose of John H. Fahey, Chairman of Home Loan Bank Board, to seek additional enabling legislation from Congress to permit a broader program of home financing is another piece of evidence that some of the factors are being isolated. The study of modernization possibilities both by the Home Owners' Loan Corporation and the Housing Division of the PWA is still another avenue of investigation.

The extension of Federal Savings and Loan Associations is being actively furthered, especially in those sections of the country where existing financing facilities are unable to supply needed funds for home-building. At the same time Congressional Committees are investigating numerous plans to supplement the existing governmental financing machinery, not the least important of which involves the establishment of a Central Mortgage Banking System. Already a bill has been introduced in Congress to guarantee the principal of the bonds of the Home Owners' Loan Corporation where hitherto they were guaranteed by government only as to interest payments; in addition this same bill provides for a $3,000,000,000 increase in the issuing power of bonds of the Home Owners' Loan Corporation and that about 50 per cent of this amount be made available for the erection of new homes.

In some quarters in Washington a plan has been advanced which proposes that the government accept part of the risks customarily taken by equity-holders and those supplying junior financing. Under this proposal the government would advance perhaps up to 40 per cent. of the value of a housing project at a nominal rate of interest and with a long period of amortization, selling the first mortgage bonds secured by the project to investors, both private and institutional.

These plans all have active sponsorship in important quarters. What is needed now is a coordinating agency of government to investigate their merits individually and in relation to the whole. The focal point of the problem inheres in the restoration of residential building activity.

There appears some reason to believe that in the near future a broad review of all new governmental units directly and indirectly interested in the revival of residential building will be undertaken in order to appraise the effectiveness of existing instruments of government and to provide the basis for such supplementary aids as appear indicated. This would materially clarify the present outlook for residential building mortgage money, since such a coordinating analysis should tend to disclose, first, the need for building; secondly, the ability to supply the demand, if any is found to exist; and, finally, whether the money should be supplied by government alone, by private capital alone, or by both in a soundly conceived cooperative effort.

Wide World

Boulder City, Nevada — a housing development for workers employed in the town and on the dam. At left center is shown the new public school; to the right of the school is the post office.

REPLANNING OLD AREAS FOR NEW HOUSING

By JOSEPH PLATZKER, Secretary, East Side Chamber of Commerce, New York City

It is now timely that we should try to settle the issues behind the clashing viewpoints of the architects and city planners who insist that low-cost housing should be planned in the outskirts of our cities in order to depopulate our slums as opposed to those who ask for re-housing and re-planning the blighted and slum areas in a well-balaned clearance plan.

The cheap land cry is indeed a fallacy in more ways than one. Cheap land is idle land where no expenses have been made for improvements and where the city itself has furnished no services. Clarence Stein, architect, is a champion of cheap land development; the recent Federal loan he received for his Hillside Housing Development in a sparsely settled part of the Bronx apparently supports his views although future costs of municipal services for his new settlement will tell another story. I do not wish to indulge in criticism of this or other specific housing projects, and am more desirous of pointing out that proposed outskirt developments will never settle or solve our slum problem when at the same time they add to the financial burdens of the cities. In the first place, efforts to ignore our large slum areas even for another decade will not cause them to die a natural or unnatural death. They will simply keep on changing, mostly for the worse.

Those who attack land values in the slums as outrageously high in comparison to those on vacant lots have not stopped to inquire the reason for such values. Even the Lower East Side of Manhattan has land values varying from $4 to $20 a square foot, depending on location, wihch are not on the whole high. The values in this community have been dropping for four years, but they will soon be finding a resistance level. More than 60,000 families still live on the Lower East Side and at least 12,000 retailers, jobbers, wholesalers and manufaturers still do an extensive business. In this section, for example, New York City spent more than $55,000,000 in a variety of public improvements since 1929.

Improvements of municipal services will be found in many old tenement areas in other cities. Are we to shut our eyes to these facts? Should we allow the existing widespread municipal services in the slums to be abandoned? Would slums in the big cities stop growing worse if we tried to abandon them? Wouldn't new hideouts in abandoned and semi-abandoned buildings promote more crime and delinquency? Would any one believe that either lending institutions or private investors in first mortgages in the slums would be scared by the cheap land cry in the outskirts and fail to safeguard their investments? How could the municipality be expected to economize reasonably in its budget and to cut costs of government if it would be continually called upon to extend transit lines further from the center and to build more municipal services for newer communities?

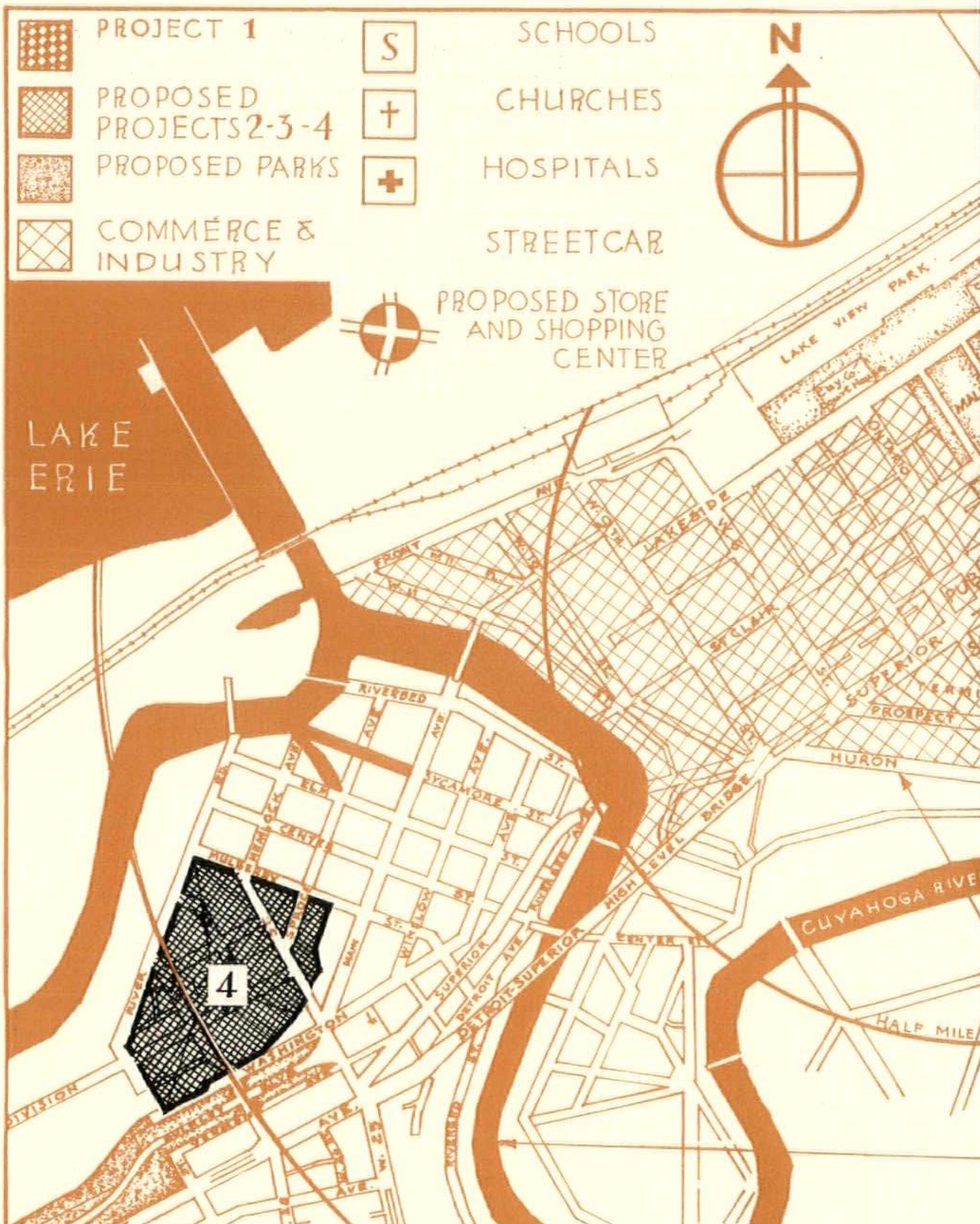
(Continued on page 32, advertising section)

CLEVELAND HOUSING

LOW-COST APARTMENTS

PLANS SHOWING HOUSING TYPES A, B, C, D, E AND F.

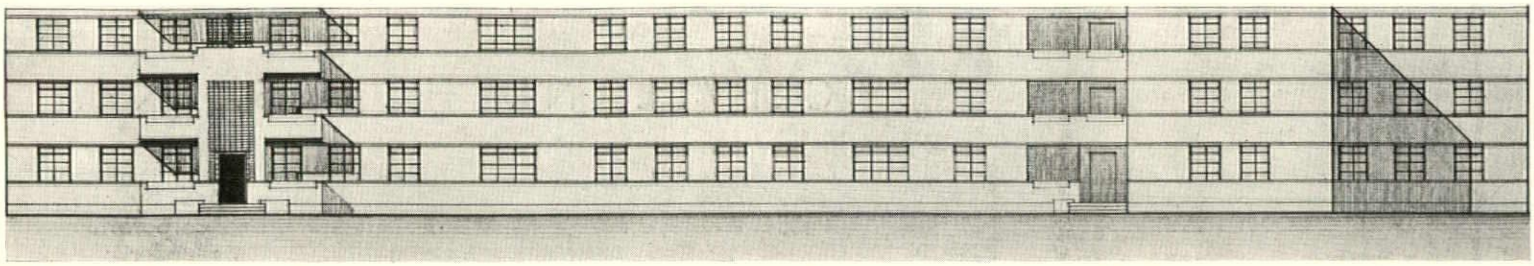
WALTER R. McCORNACK
JOSEPH L. WEINBERG and
CONRAD AND TEARE
Associated Architects
FREDERICK BIGGER
Consulting Architect



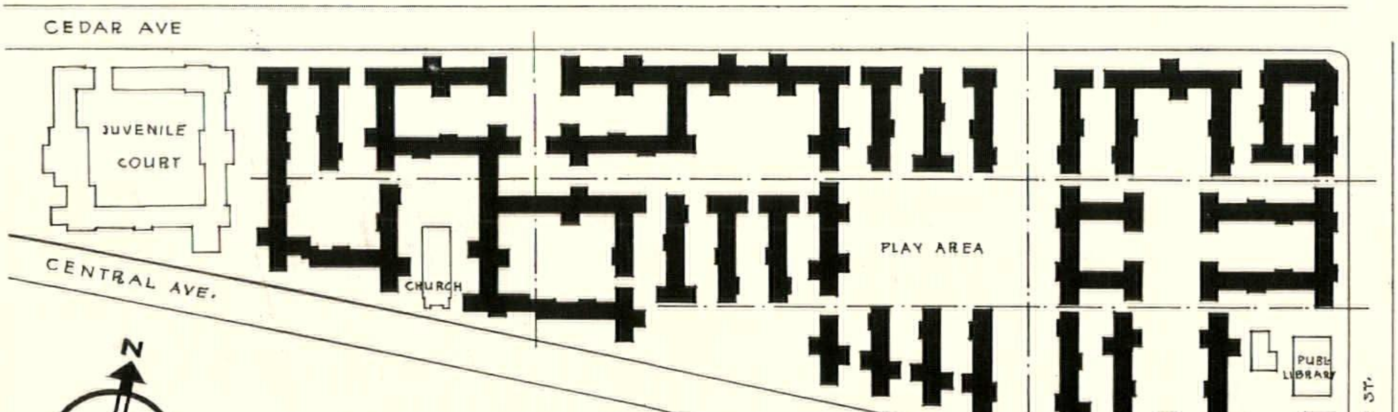
CLEVELAND HOMES, INC.

A tentative loan of $12,000,000 has been granted by the Public Works Administration to a limited dividend corporation for undertaking a series of housing developments under the auspices of the Mayor's Business Recovery Commission. The projects are to cost not more than $14,000,000. The proposed housing is to yield an average monthly rental of between $8 and $8.50 a room.

CLEVELAND HOUSING



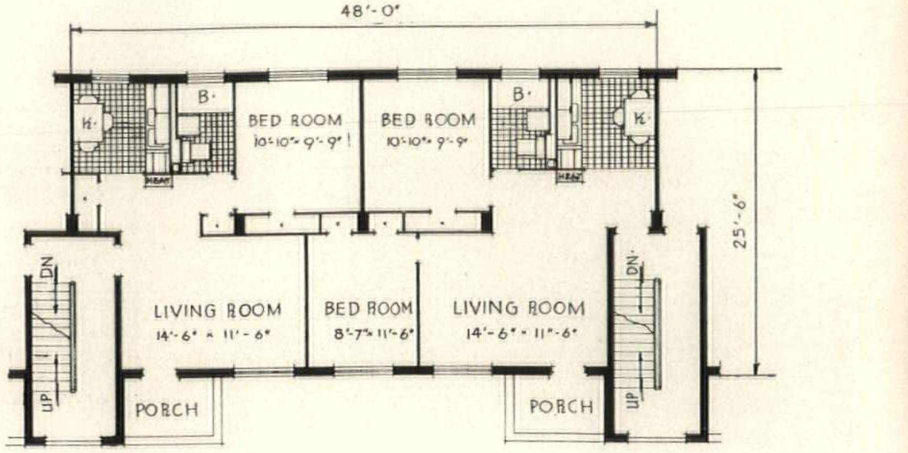
PROJECT No. 1
(See map on page 105)



CLEVELAND HOUSING

LOW-COST APARTMENTS

THIS CONDITION OCCURS WHERE A THREE-ROOM APARTMENT INTERLOCKS WITH A FOUR-ROOM, AND WHERE EACH IS SERVED BY A DIFFERENT STAIR.



TYPE 'D' 3 & 4 ROOM COMBINATION

FACTS ABOUT PROJECT No. 1:

32 per cent coverage; three-story walk-ups.

Approximately 900 apartments.

Approximately 3,400 rooms.

Average monthly rental—$6 a room.

Land cost—approximately 85 cents a square foot.

Construction (cost, approximately 30 cents a cubic foot)—
- Masonry exterior walls.
- Floors, beams and columns of reinforced concrete.
- Interior finish in plaster.
- Wood floors laid in mastic.

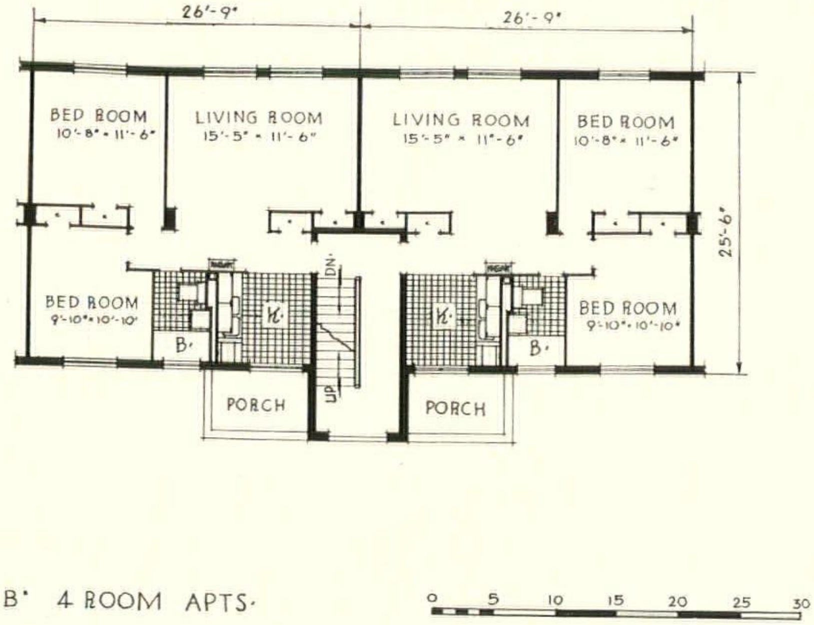
Unit apartment heaters—gas-fired or fed by central steam plant.

Equipment—range, mechanical refrigerator, built-in cabinets.

CLEVELAND HOUSING

LOW-COST APARTMENTS

THIS PLAN OCCURS WHERE TWO TYPE B FOUR-ROOM APARTMENTS ADJOIN AND MAY BE SERVED BY THE SAME STAIR.



The quotations on this and the following seven pages are from an address given by Walter R. McCornack before the National Conference on Low-Cost Housing, held in Cleveland, October 25-27, 1933:

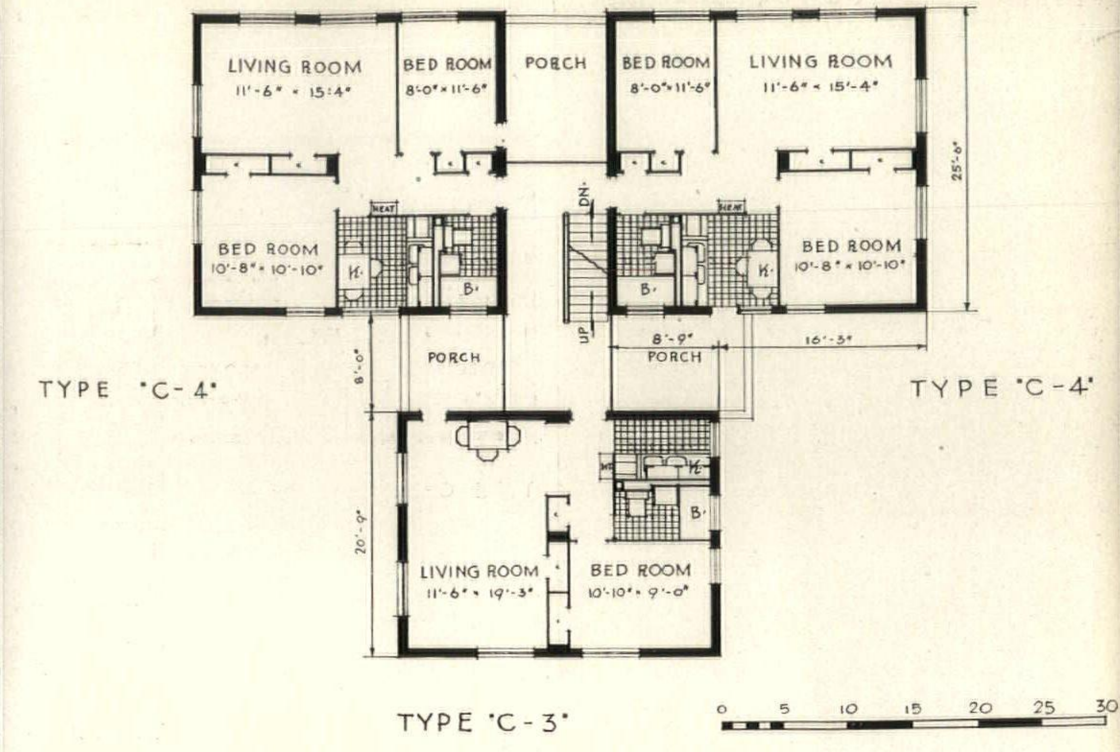
"On the basis of the data we have in Cleveland, low-cost housing must range from $1,200 to $3,000, which is high; preferably $2,500 should be the total cost to meet the incomes of the people who must live in these homes."

Views at bottom of pages 108–113 show existing structures on site of proposed housing.

CLEVELAND HOUSING

LOW-COST APARTMENTS

THIS CROSS PLAN OCCURS AT INTERSECTIONS OF STRAIGHT-RUN APARTMENTS, AND MAKES POSSIBLE LARGE COURT AREAS. THE STAIRWAY SERVES FOUR UNITS, EACH FLEXIBLE AS TO NUMBER OF ROOMS AND EACH CAPABLE OF CONNECTION TO A STRAIGHT-RUN APARTMENT.

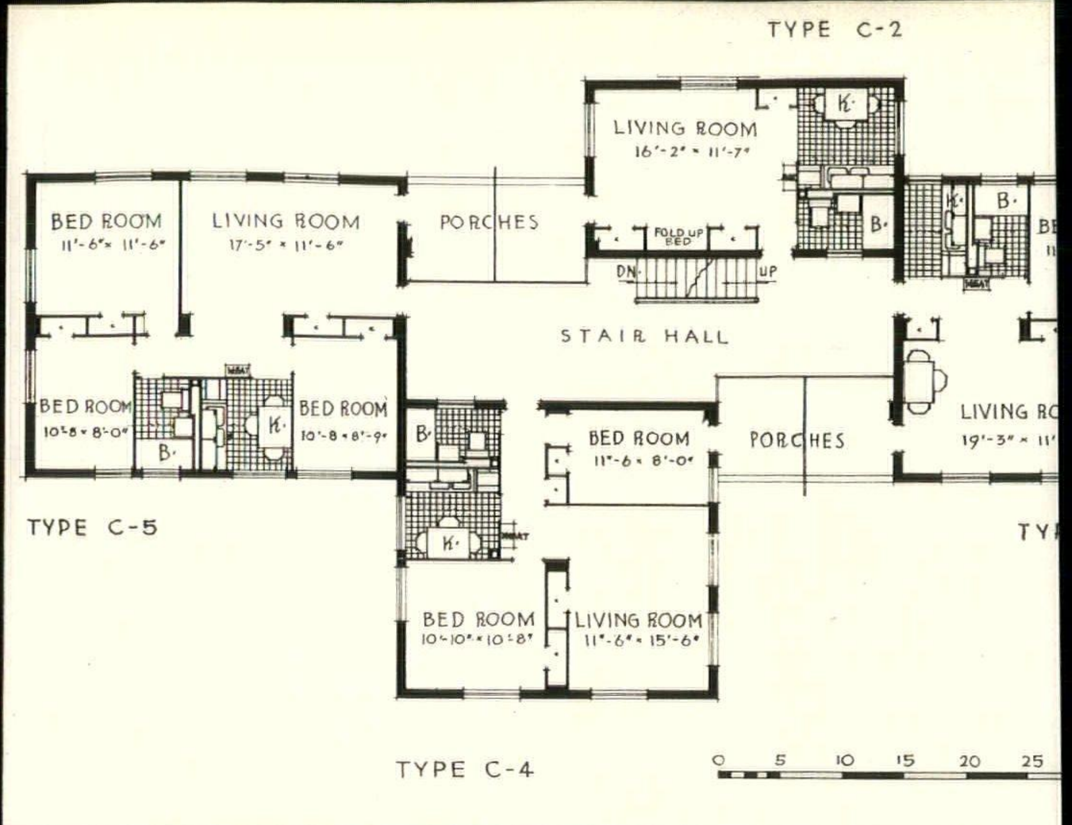


"These figures are derived from allowing 20 per cent of the total income to go for shelter. The financing is based on a 10 per cent gross in the case of the higher brackets and an 8 per cent gross for the lower brackets, because in the lower brackets we believe the new Housing Authority will be able to take advantage of the 30 per cent grant and possibly tax exemption."

CLEVELAND HOUSING

LOW-COST APARTMENTS

THIS CONDITION OCCURS WHERE ONLY THREE PARTS OF A TYPICAL FOUR-PART CROSS PLAN ARE USED.

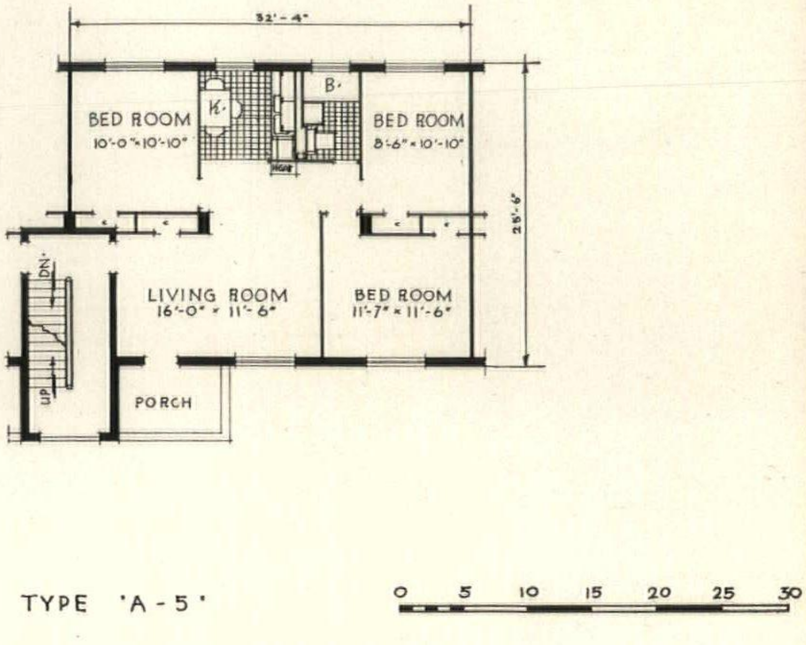


"With the survey of the City of Cleveland, which shows twenty-two square miles of blighted area in the city, there is a potential market for low-cost housing of about $300,000,000. It can't be touched under the present conditions—conditions of financing, conditions of land purchase, conditions of actual construction, and whatnot that have made up the old order of construction of homes."

CLEVELAND HOUSING

LOW-COST-APARTMENTS

THIS PLAN IS USED WHERE A FIVE-ROOM APARTMENT IS DESIRED. IT MAY BE USED WITH TYPES A, B, D, F AND G, ON THE SAME STAIR, AND ADJACENT TO TYPES A. B. C. F OR G.

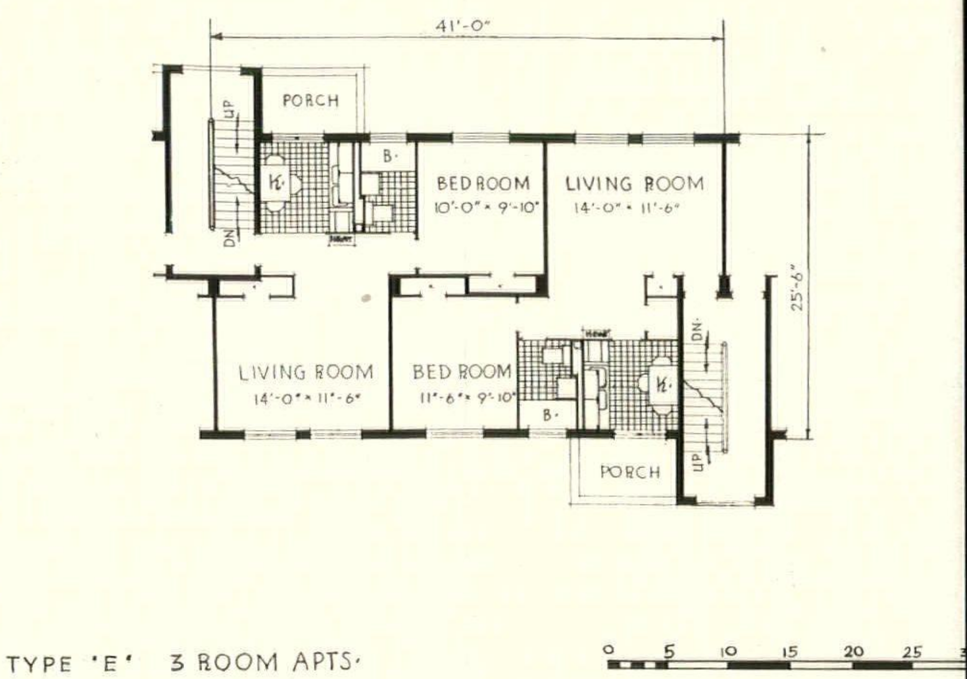


"I think the financing is well on the way to be solved. I think the over-supply of land, the necessity for finding a market for those who are hardridden by taxes will eventually solve that problem, but when we figure that the building cost itself is 70 per cent of the total cost of the project, here is a field which we must enter to try to solve the problems."

CLEVELAND HOUSING

LOW-COST APARTMENTS

THIS CONDITION OCCURS WHERE TWO TYPE E THREE-ROOM APARTMENTS ADJOIN, BUT ARE NOT SERVED BY THE SAME STAIR.

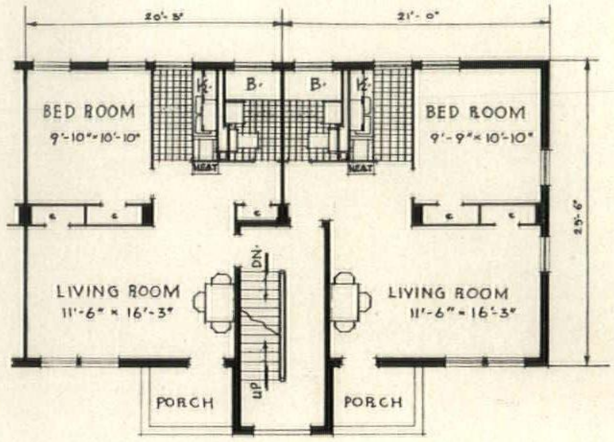


"Cleveland Homes, Inc., consists of a group of architects, contractors and others who are all interested in solving this problem. There will be in one of the sections of that development two experimental buildings, one in the city and one outside the city."

CLEVELAND HOUSING

LOW-COST APARTMENTS

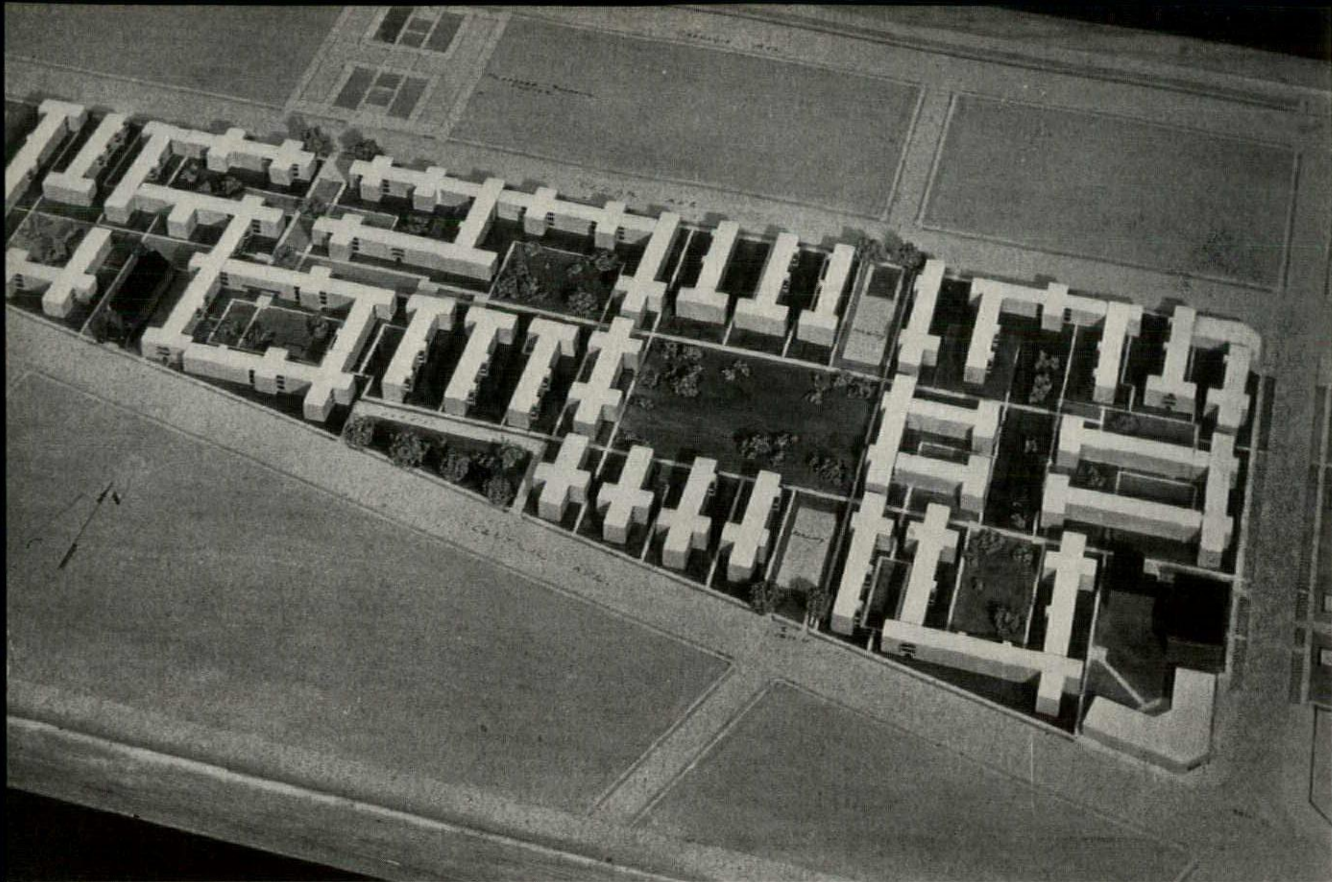
THIS PLAN IS USED WHERE A THREE-ROOM APARTMENT IS DESIRED TO COMPLETE AN END OF THE BUILDING, OR TO BE ADJACENT TO TYPES A, B, C AND F.

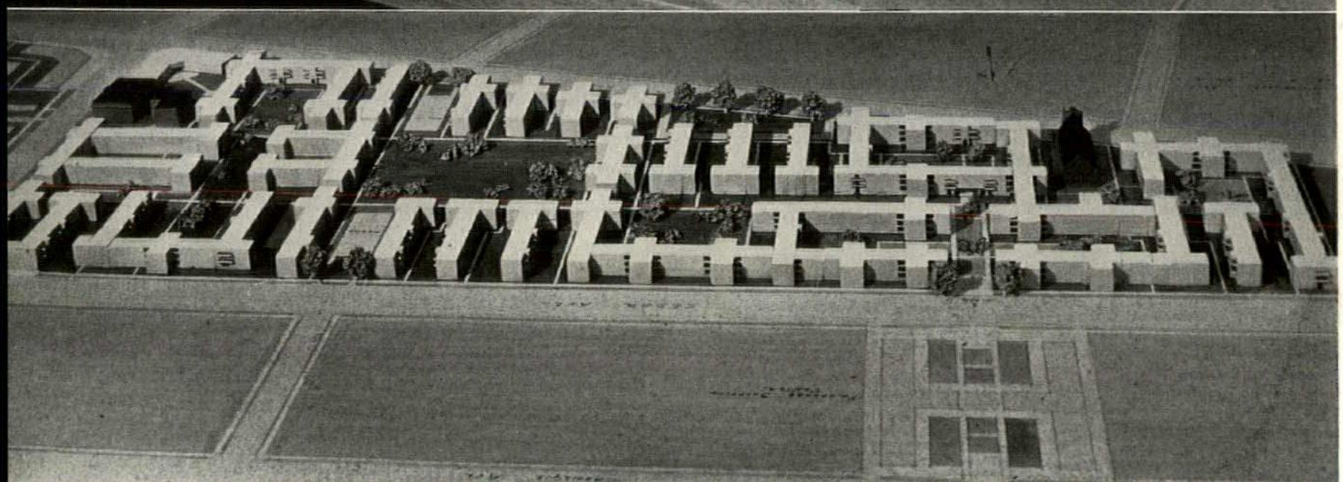


TYPE 'F' 3 ROOM APARTMENTS

0 5 10 15 20 25 30

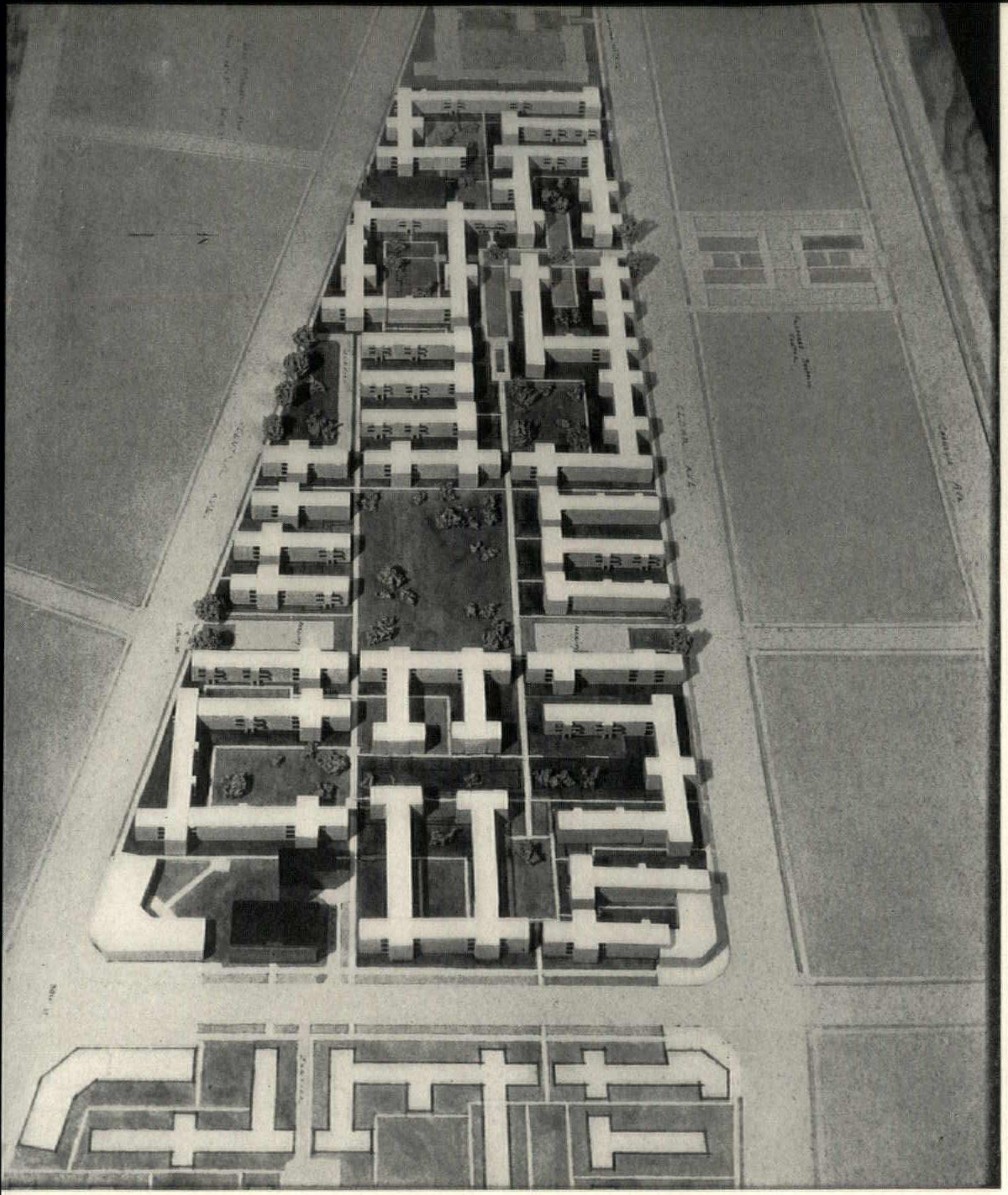
"The experimental building in the city will be a definite attempt to bring the cost of that building, including the land and all other charges, to $2,500 per unit, which at a 10 per cent gross for a five-room apartment will produce $4 per month rental per room."





Parade Studios, Inc.

"The other development is the problem that we must solve in taking care of those who, we must admit, will be eliminated from the downtown area. In other words, houses for people who should live in the country. The proposal for the removal of these people from the center of the city is that we shall findin the surrounding territory such land and such location as will not be injurious to the residents now living there; that we will provide part of the labor by the people themselves; that the land cost will be only about one and one-half cents a square foot as against seventy cents in Cleveland; that instead of building individual houses on individual lots, 20 or 30 or 40 by 110 feet long, we will put two or three lots together for a family and produce from one-fifth to one-quarter of an acre with a chicken run and vegetable garden. With occasional work we believe the family can be self-supporting or pretty close to it."



Photographs of Models of CLEVELAND HOMES, INC.

WALTER R. McCORNACK
Architect

"We have set a definite area for that group and are working on different types of construction. We have fixed the price of the land and building and other charges at $1,200. I think we will reach some of these ideals for which we are struggling.

"In the case of the town apartment house, it is a question of providing minimum area for bedrooms and a maximum area for living rooms. In other words, why should the harassed woman of the house, who has to work, find it necessary to take care of huge bedroom areas? Instead of having 170 square feet per room we will reduce that to 100 and yet provide ample, well-ventilated rooms. We are planning the bedrooms with the idea of a tip-up bed so the areas in these rooms will be available for sewing or play of small children during the daytime.

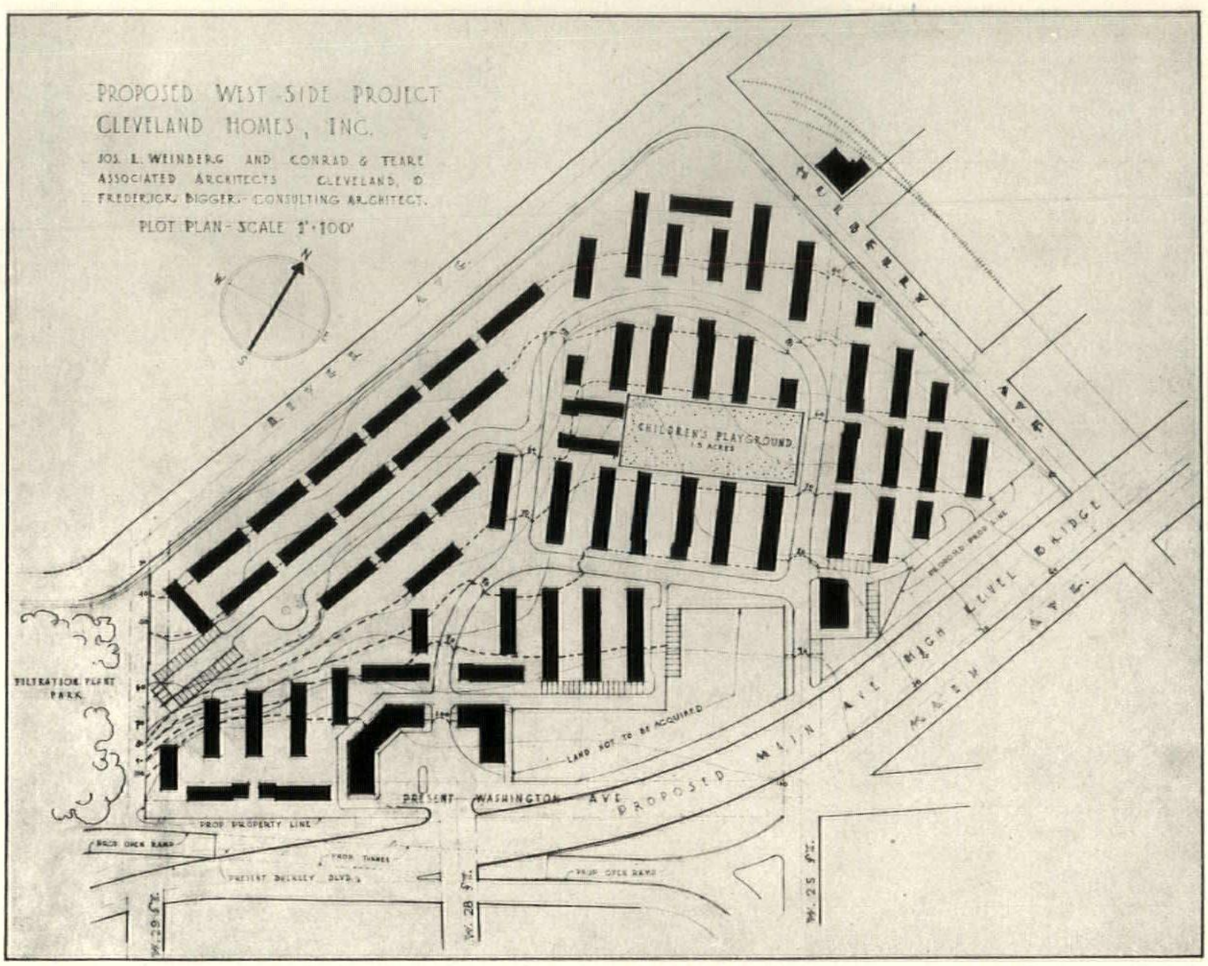
"Summarizing the problem, there is necessary: first, to reduce the total area and total cubage; second, to find all the new types of building materials which seem to point to the solution of a $2,500 five-room house that can be rented for $4 a room; then to carry the same idea to the edge of the city and attempt an experiment there along the same lines."

Hunter Aerial Surveys Co.

AIR VIEW OF SITE OF PROPOSED WEST SIDE DEVELOPMENT

The West Side project will occupy 22 acres, options on 95 per cent of which have been obtained. The site is bounded by Washington and Main Avenues on the south, River Avenue on the north, Mulberry Avenue on the east and West 29th Street on the west.

The project has been designed by the architects, Joseph L. Weinberg and Conrad and Teare, for 675 families housed in 2,600 rooms. There will be two types of housing—row housing and apartments. The row housing will be two stories high, with suites of four to six rooms. Living rooms will be on the first floor and bedrooms on the second. The apartments will be two to three stories high, with three to five rooms in the suite. In some instances there will be a dinette in addition.

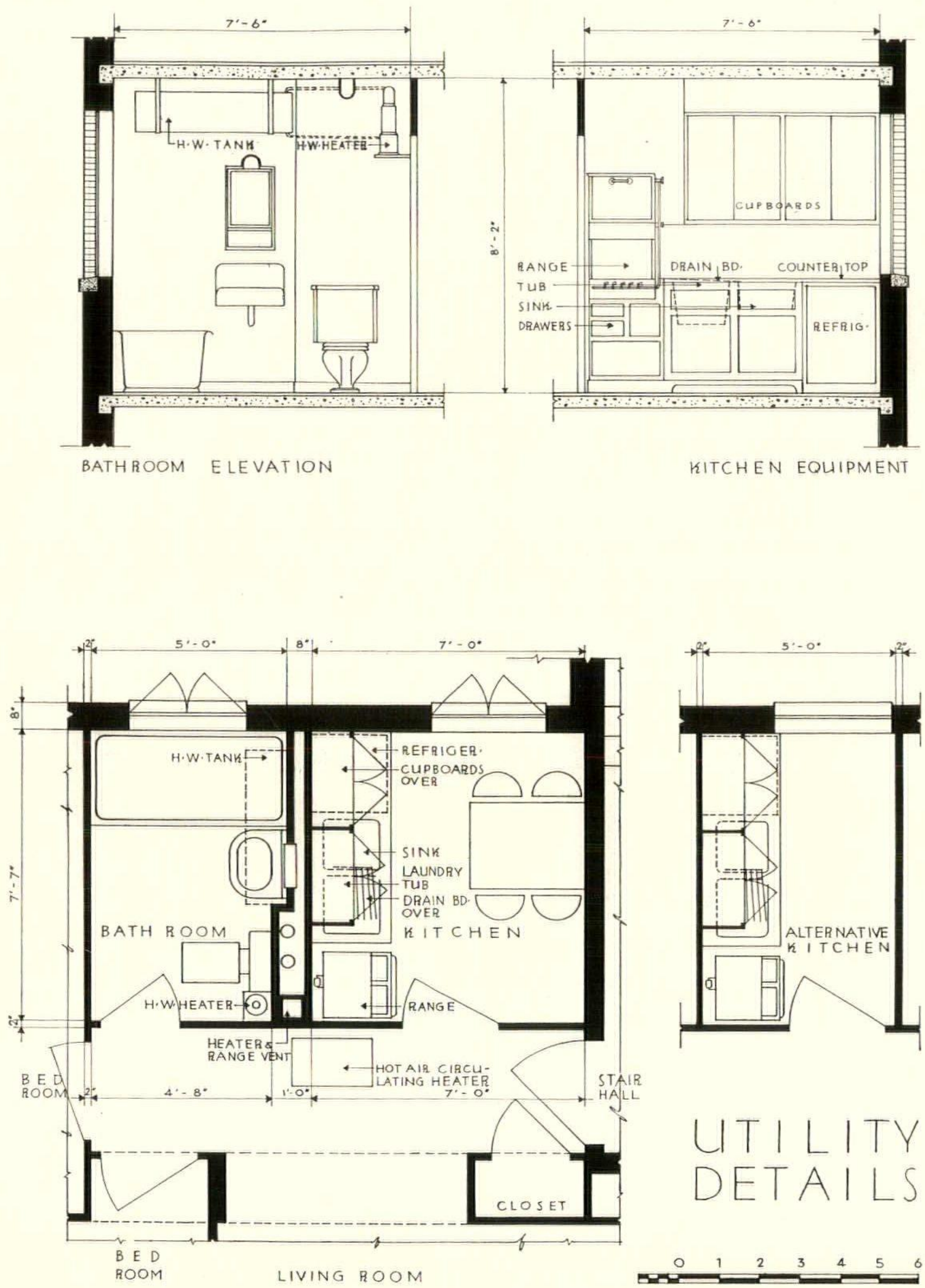


HOUSING PROJECT No. 4 — CLEVELAND HOMES, INC.

(See map on page 104)

All units will have basements for the individual families. In the row housing each family will have an individual garden, with at least 50 feet between each house.

Gardening by the occupants will be emphasized. Only 26½ per cent of the entire area will be built up. The remainder will be open space. Included in the open space will be a 1½-acre playground for small children and a site for a future community center. The houses will be orientated to the best advantage with respect to sunlight and the grading of the land. Buildings will all be fireproof, with brick exterior, wood-covered concrete floors and concrete roof construction.



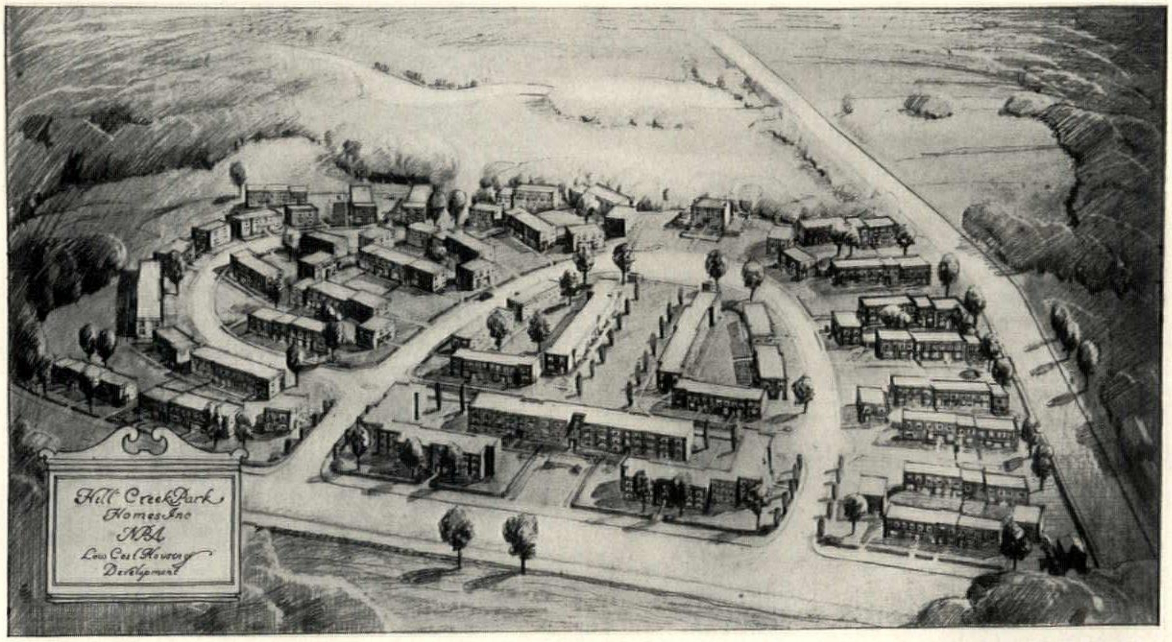
UTILITY DETAILS

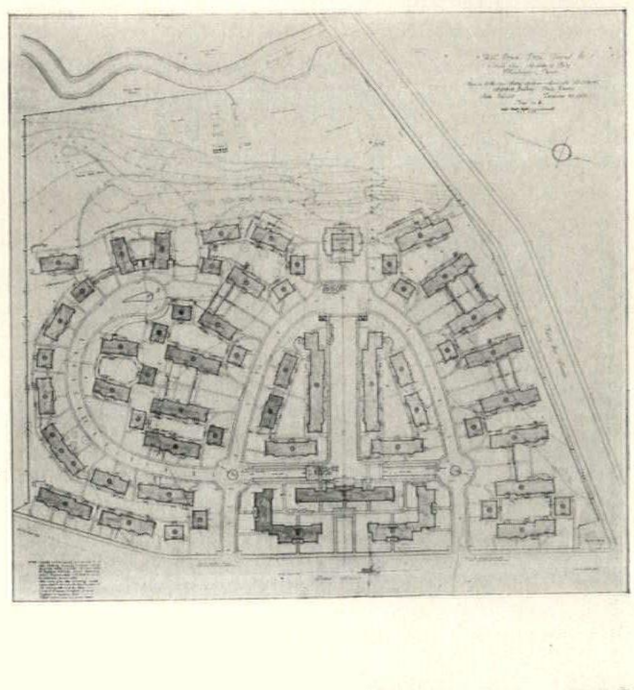
CLEVELAND HOMES, INC.

WALTER R. McCORNACK, ARCHITECT

HOUSING PROJECT UNDER WAY

The Public Works Administration has loaned $1,000,000 to a limited dividend corporation for the construction of a low-cost housing project at Euclid, Ohio. The house illustrated at left is one of a group nearing completion. The houses contain five and six rooms, and are built on lots 50 feet wide.

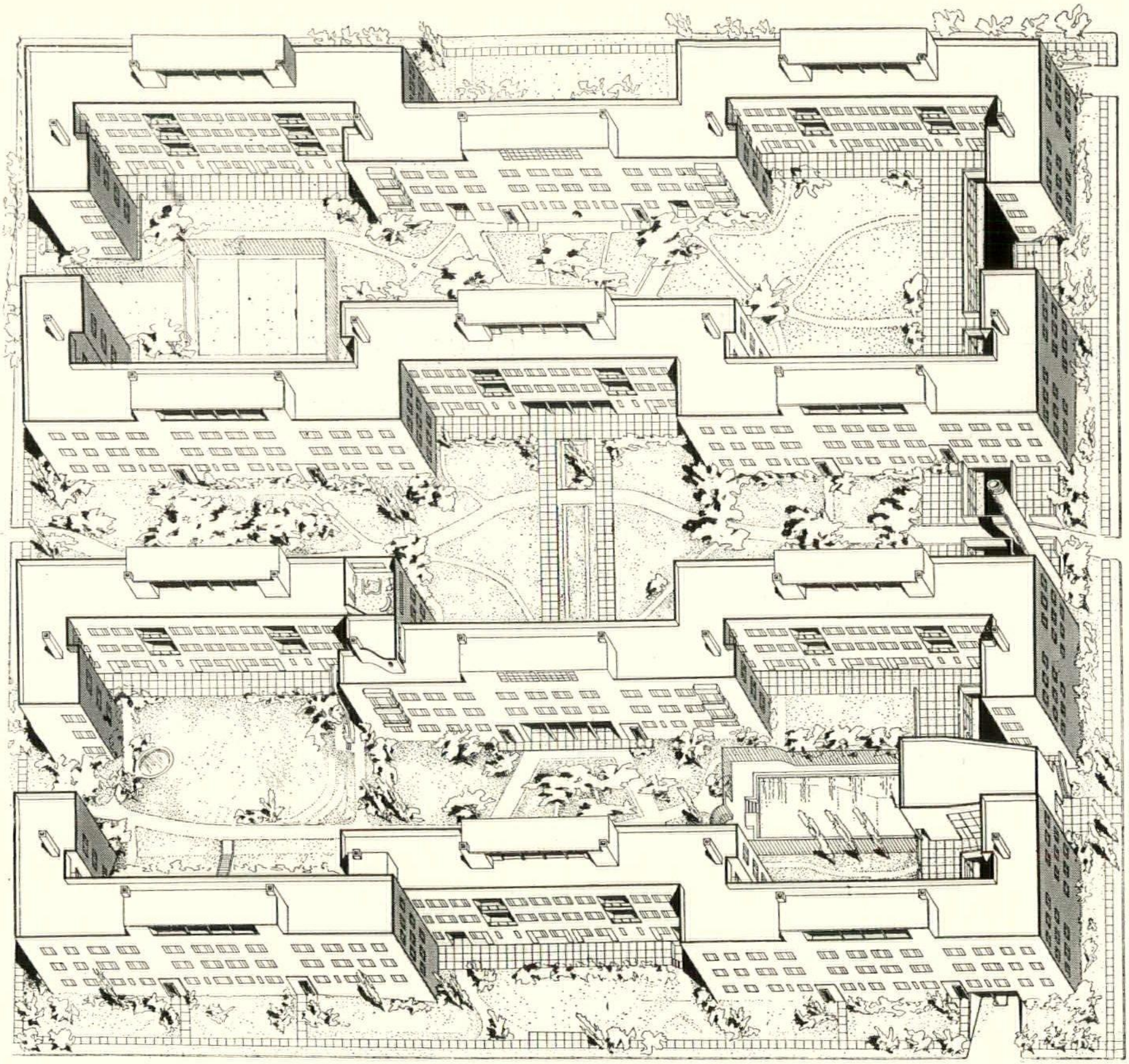




HILL CREEK HOMES—PHILADELPHIA

THOMAS AND MARTIN, ARCHITECTS

The buildings will consist of six-room residences and three-story apartments providing 1,620 rooms and it is hoped that the low rental of $7.50 per room may be attained. The site is adjacent to the Tacony Creek Park, within walking distance of an extensive industrial area, and approximately six miles from the City Hall.



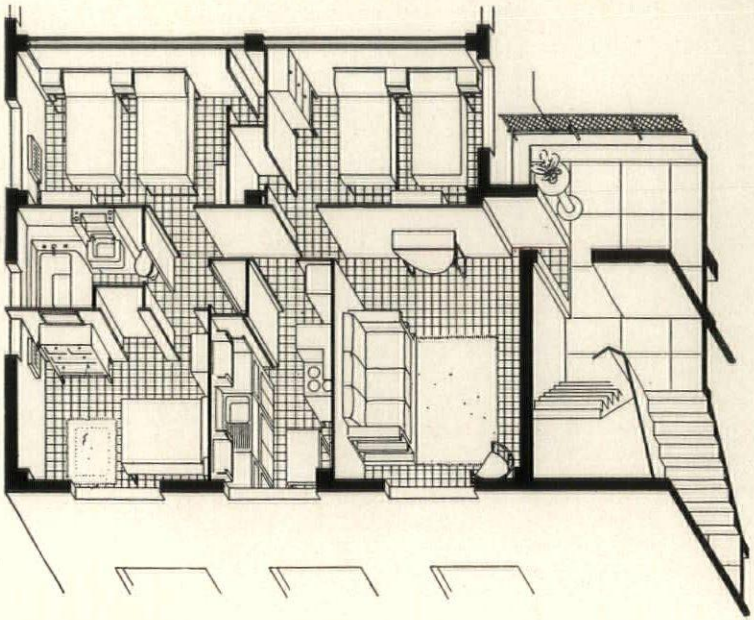
CARL MACKLEY HOUSES—PHILADELPHIA

KASTNER AND STONOROV; W. POPE BARNEY, ARCHITECTS

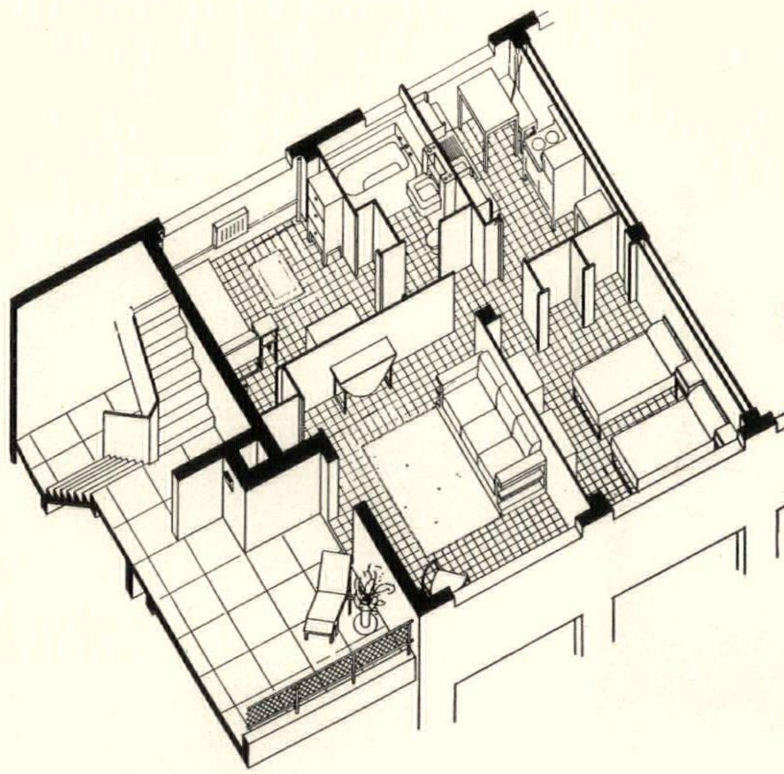
The community is to be at Cayuga and M Streets, opposite the Juniata Park Golf Course. Ample shrubbery and trees will make the garden a continuation of the adjacent park. The four main buildings take up the entire block, 480 by 490 feet. Each unit is three stories high and is separated from the next by a park area varying from 72 to 131 feet in width. Each building is 30 feet wide and extends 480 feet, the full length of the block. Each apartment has cross-ventilation; each contains a porch. In all, there are 272 apartments. There will be a community buying league or club, in effect a store without profits, selling only to persons within the apartments. This store will also handle milk and bread concessions within the community, enabling those who wish to buy necessities at less than possible otherwise. There will be a swimming pool 30 by 75 feet with a diving board and a sand beach, in connection with an auditorium where meetings, movies or dances may be held.

CARL MACKLEY HOUSES

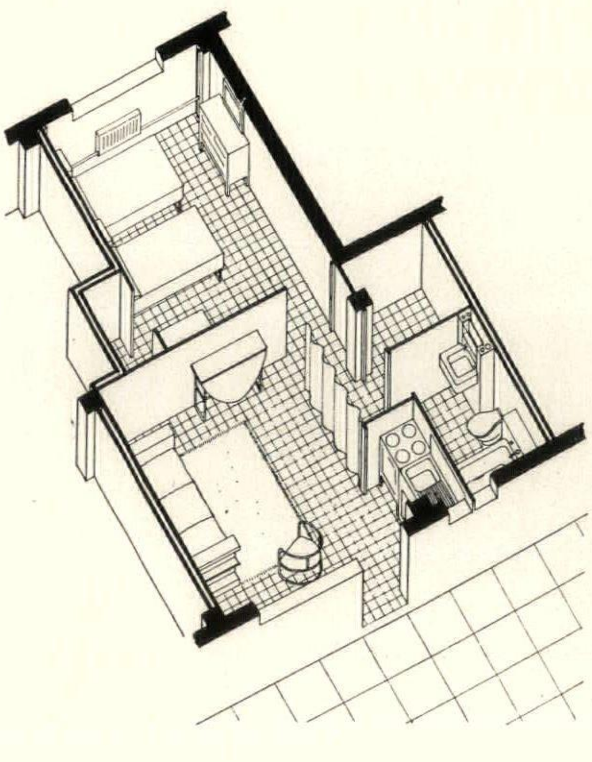
A COMMUNITY DEVELOPMENT
FOR HOSIERY WORKERS
IN PHILADELPHIA
KASTNER AND STONOROV
W. POPE BARNEY, ARCHITECTS



26% OF TOTAL APARTMENTS ARE LIKE THIS TYPICAL FIVE-ROOM SUITE.



45% OF APARTMENTS ARE LIKE THIS TYPICAL FOUR-ROOM SUITE



29% OF TOTAL APARTMENTS ARE LIKE THIS TYPICAL 2½-ROOM SUITE.

KNICKERBOCKER VILLAGE HOUSING PROJECT

SLUM CLEARANCE UNDER WAY ON LOWER EAST SIDE OF NEW YORK CITY

FRED F. FRENCH COMPANIES, BUILDERS

WHAT HAPPENED TO 386 FAMILIES WHO VACATED A SLUM TO MAKE WAY FOR A HOUSING PROJECT

A Study Conducted by Fred L. Lavanburg Foundation and Hamilton House

The study was undertaken to provide factual information bearing on the following questions: Do people unhoused by slum-clearance projects move to better or worse sections of the city or do they move into adjoining blocks where the same kind of housing facilities are found? Is it a matter of choice or does the income determine this move? Where do the heads of these families work—near their homes or at a distance?

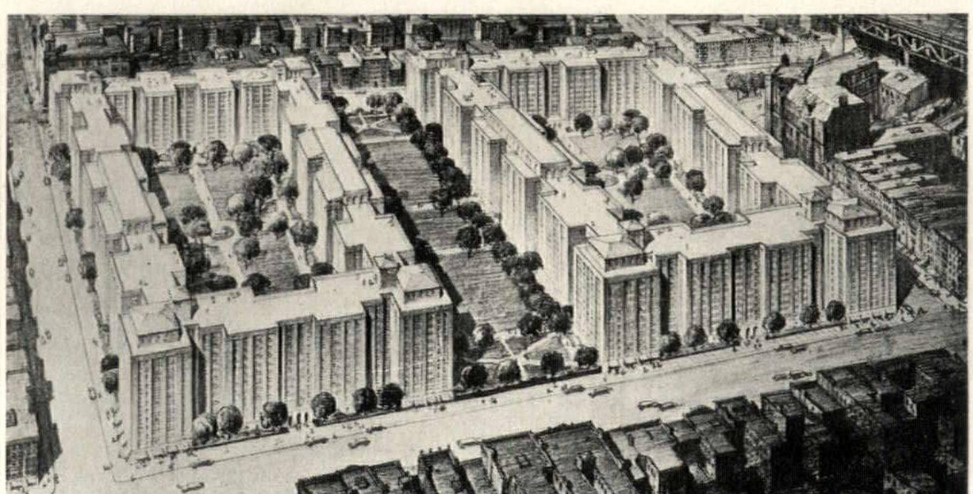
Opportunity for investigating these and related questions arose in March, 1933, when Fred F. French announced plans to build a model housing development, to be known as Knickerbocker Village, on the lower East Side of Manhattan with funds obtained from the Reconstruction Finance Corporation. The area involved comprised the two blocks bounded by Catharine, Market, Cherry and Monroe Streets, one of which had been characterized in 1903 by Robert W. de Forrest, then Tenement House Commissioner, as so bad that "every consideration of public health, morals and decency requires that the buildings on this block be destroyed at an early date."

The buildings on the two blocks contained in March, 1933, a total of 1,085 apartments—652 vacant and 433 occupied. The occupants of 47 apartments refused to be interviewed or for other reasons were not included in the study, which embraced 386 families, the term "family" being used in the sense of household, conforming with the definition employed by the Federal Census.

Progress photograph showing site cleared of slum dwellings.

Albert Rothschild

KNICKERBOCKER VILLAGE HOUSING PROJECT



Proposed new apartments.

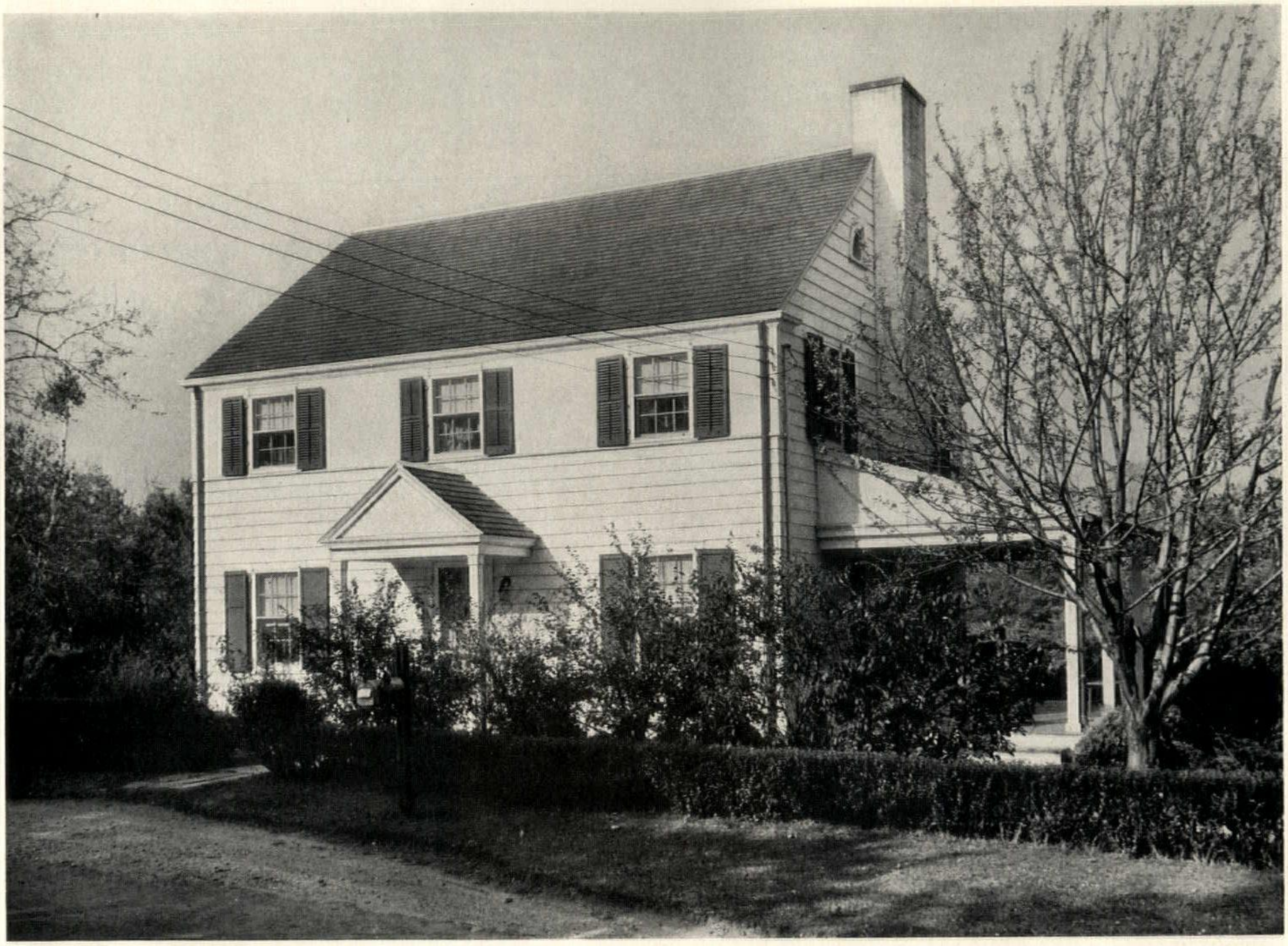
About 10 per cent of the families had their apartments rent free in return for janitor service and about 88 per cent paid $2 to $7 a room a month. The findings of the investigation are summarized as follows by Abraham Goldfeld, executive director, Fred L. Lavanburg Foundation, and Lillian D. Robbins, headworker, Hamilton House:

1. The great majority of tenants expressed a desire to remain in the immediate neighborhood and when forced to vacate only fourteen per cent left the district, eighty-six per cent settling in the adjoining blocks.
2. Most of the families have been residing in the neighborhood for a long period of time and many of the wage earners work within walking distance.
3. Only 97 out of 386 families had hot water in their flats before moving.
4. 119 families had private toilets in their flats.
5. Only 25 out of 386 had bathing facilities.
6. Not one single family enjoyed the luxury of steam heat.
7. In the new flats there has been some improvement as to physical facilities, notably an increase in the number of bath tubs and private toilets.
8. Though almost all the families desire to move into Knickerbocker Village only a small number will be able to pay the higher rental under present conditions.
9. 319 families (83 per cent) continue to live in Old Law Tenements, declared to be unfit for human habitation by the Tenement House Commission as early as 1900. Of this number 35 families live in remodeled Old Law Tenements.

The report consists almost entirely of statistical tables, dealing with such topics as composition of families, length of residence in same apartment, length of residence in neighborhood, religion, nationality, citizenship, number of children, school attendance, unemployment, occupation, rentals before and after moving, number of rooms before and after moving, types of flats, toilets, heating, lighting, hot water, bath tubs and so on. Not the least valuable feature of the report is a complete reproduction of the questionnaire employed.

One of the most controversial questions pertaining to slum clearance is this: Are the low-income groups to be rehoused on the same land regardless of its value or in districts where land is less expensive? On this fundamental problem definite conclusions have been impossible, in the absence of factual information. This investigation supplies such information with respect to a particular area, group and period in an economic depression. Other investigations of a similar nature are needed and seem likely to be made in connection with rehousing projects under way in many cities. In order that the information obtained may be comparable on as many items as possible, it is hoped that the present initial study will become widely known.

The Hillside Housing Corporation project in the Bronx, New York City. The Public Works Administration has entered into a contract with the Hillside Housing Corporation for a loan of $5,060,000 to assist in financing the erection of 108 four-story walk-up units and 4 six-story elevator apartments, providing 4,934 rooms in all.



Van Anda

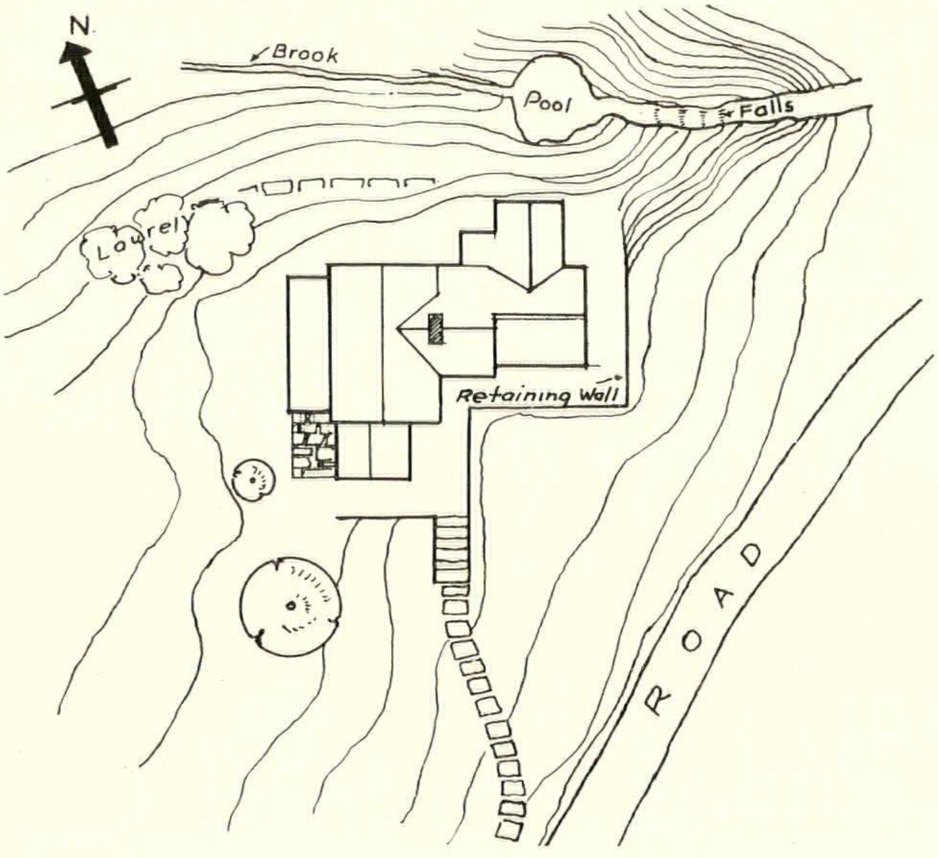
HOUSE OF MRS. HAROLD LLOYD
WESTPORT, CONNECTICUT

HARRY KOERNER, ARCHITECT

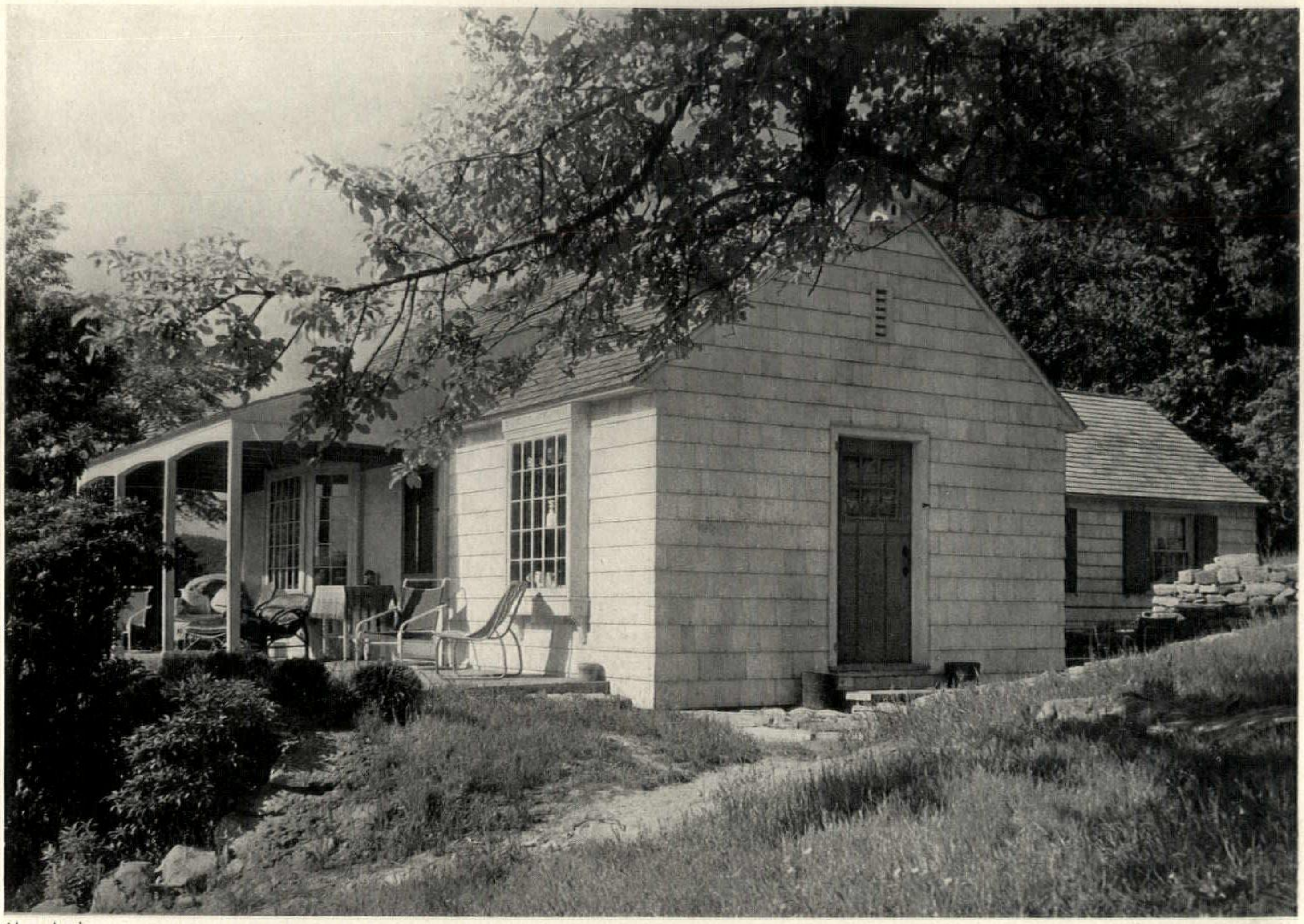
PORTFOLIO of SMALL HOUSES

Van Anda

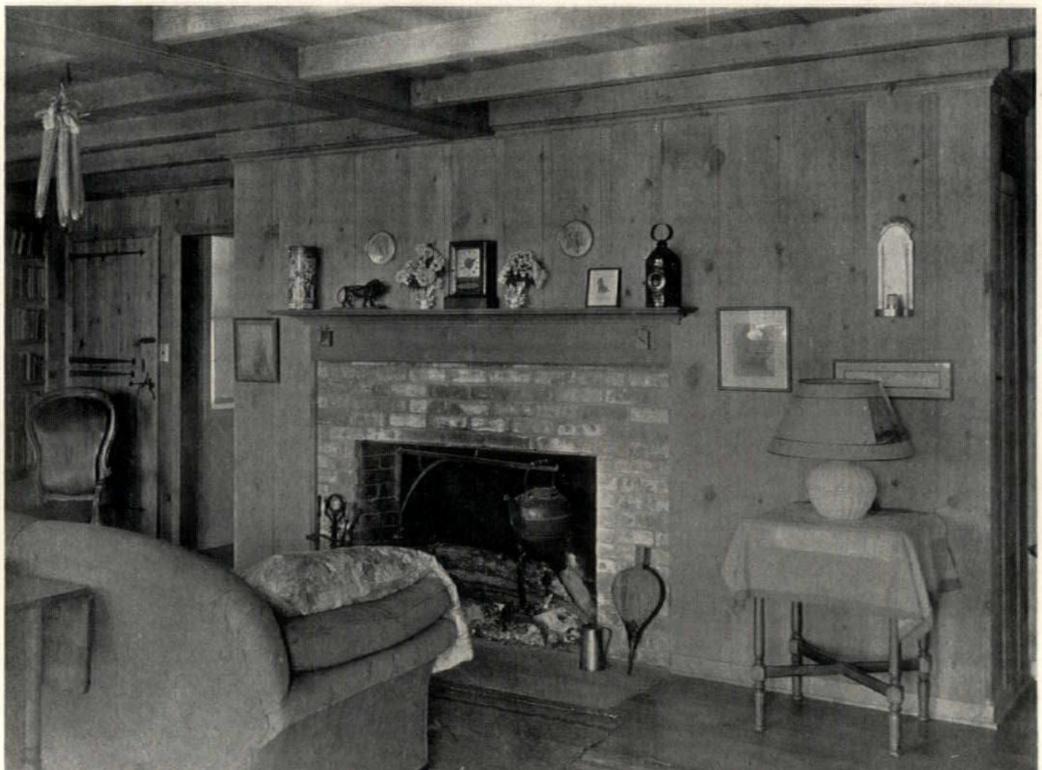
The home was planned to take advantage of the views from the living room; the most desirable bedroom overlooks a falls in the brook about 50 feet away. There were some exceptionally fine clumps of laurel that had to be preserved. Another controlling factor was an old apple tree with "a silhouette like a Japanese print." As the house is arranged the most has been made of tree, laurel, brook and landscape.



HOUSE OF
DR. PHILIP COOK THOMAS
ALLAN McDOWELL
DESIGNER
PETER GAWEL, BUILDER



Van Anda



The side walls are white shingles with weathered shingled roof. Blinds are jade green. The living room has a reproduction of an old Colonial kitchen fireplace; the walls are vertical boards with molded edges stained to resemble old pine. Broad random width boards on living room floor are painted. Hardware by local blacksmith. All inside doors are made of one thickness vertical molded edge boards with ledgers on back. The bedroom doors are halved so that bottoms can be shut while tops are open.

HOUSE OF
DR. PHILIP COOK THOMAS
ALLAN McDOWELL
DESIGNER
PETER GAWEL, BUILDER

Van Anda

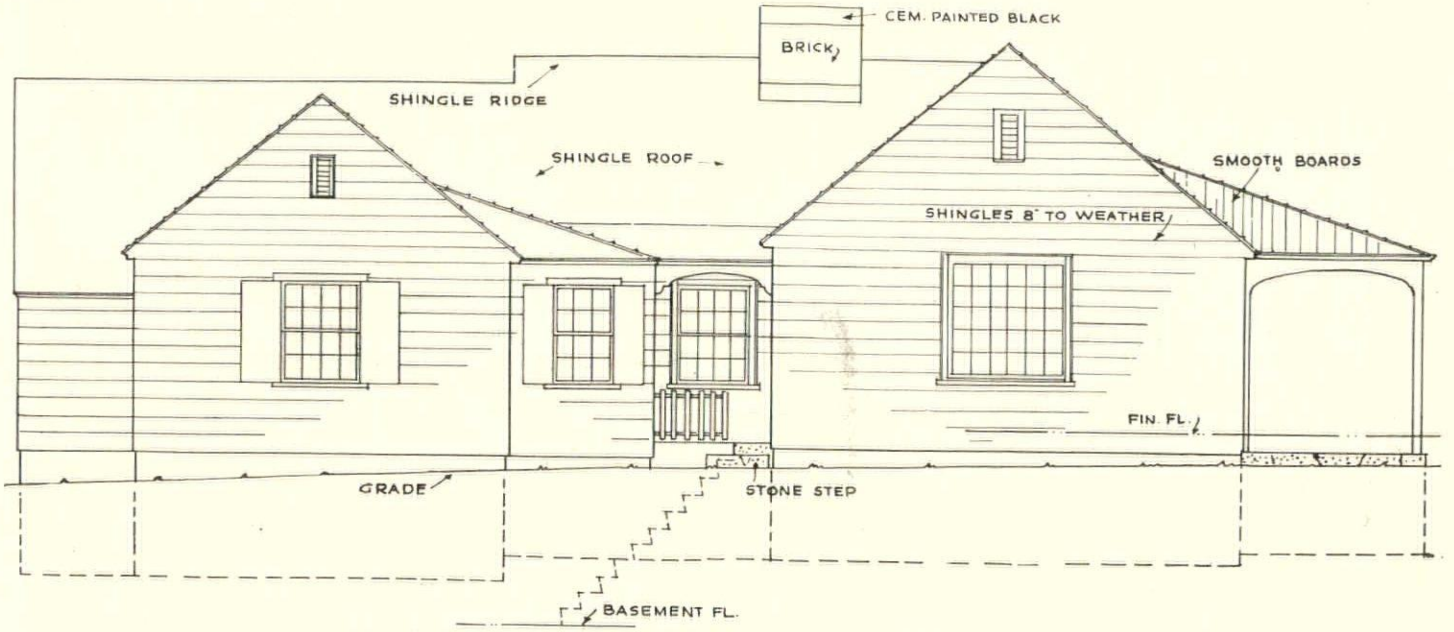
DESIGNED BY ALLAN McDOWELL

HOUSE OF DR. PHILIP COOK THOMAS
KENT, CONNECTICUT

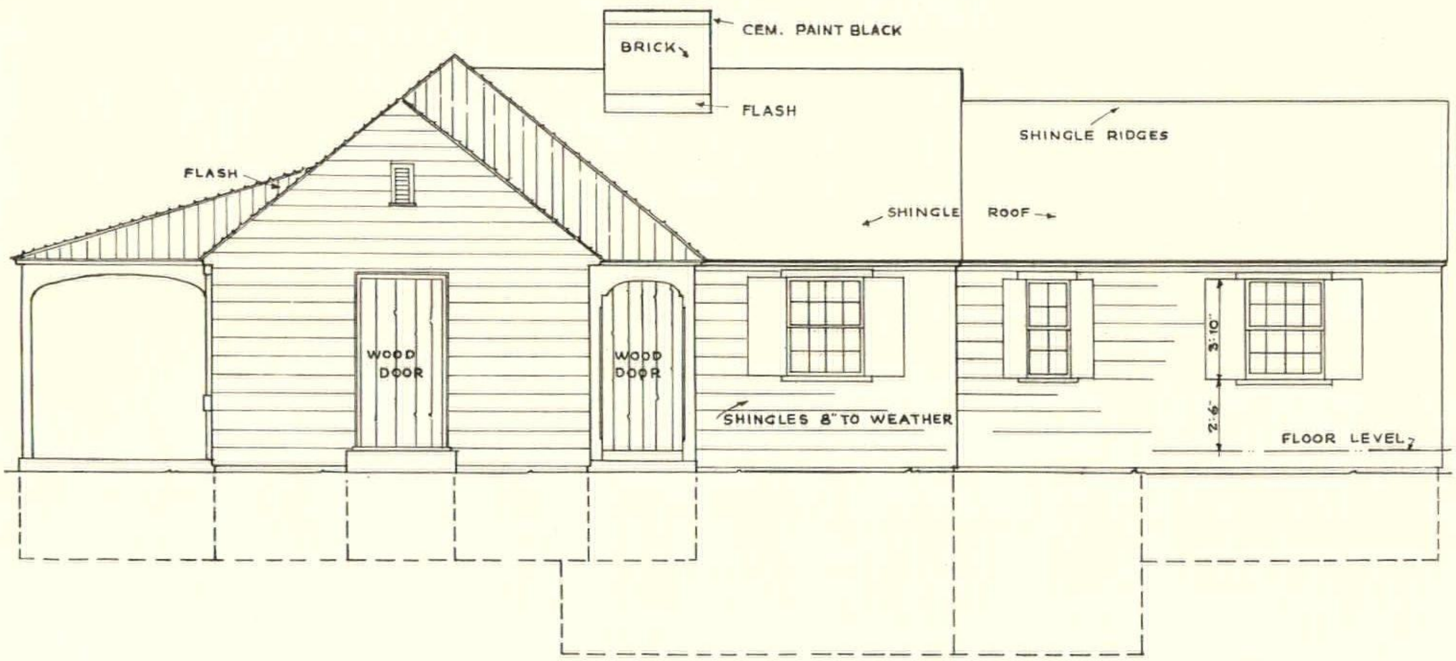
Van Anda

HOUSE OF DR. PHILIP COOK THOMAS
KENT, CONNECTICUT

DESIGNED BY ALLAN McDOWELL



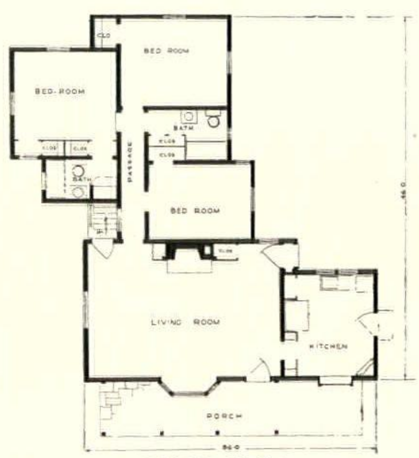
NORTH ELEVATION



ELEVATION

HOUSE OF DR. PHILIP COOK THOMAS
KENT, CONNECTICUT

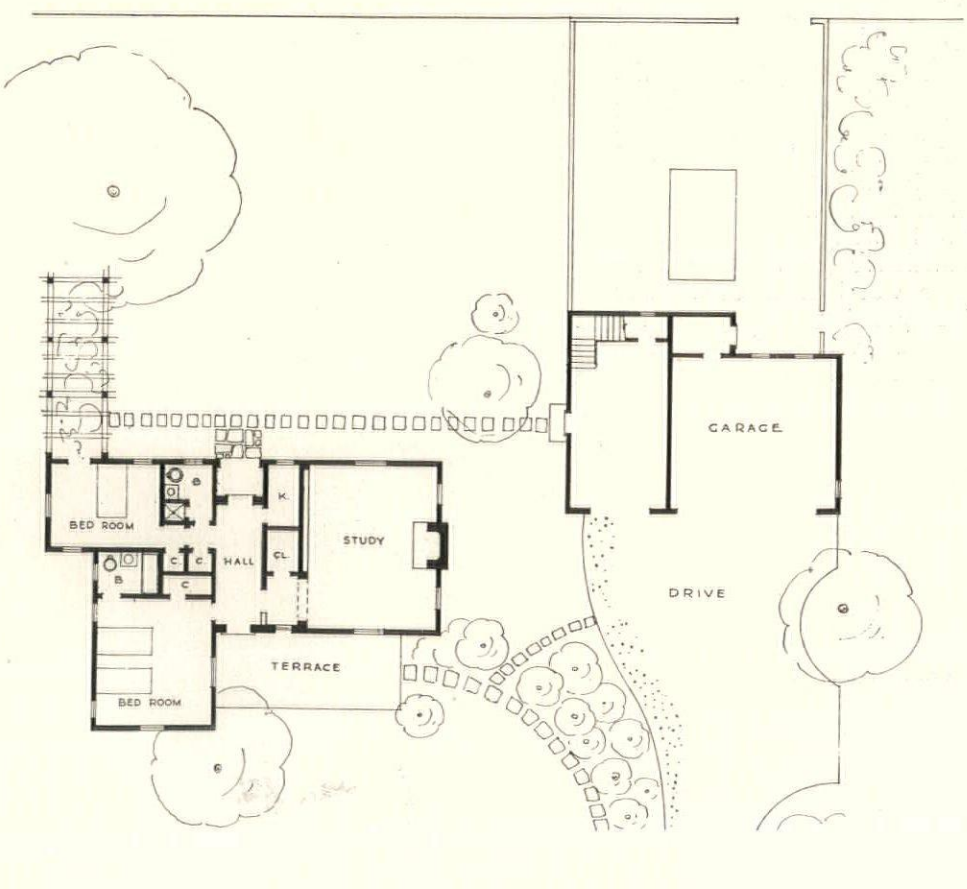
DESIGNED BY ALLAN McDOWELL
PETER GAWEL, BUILDER



FLOOR PLAN

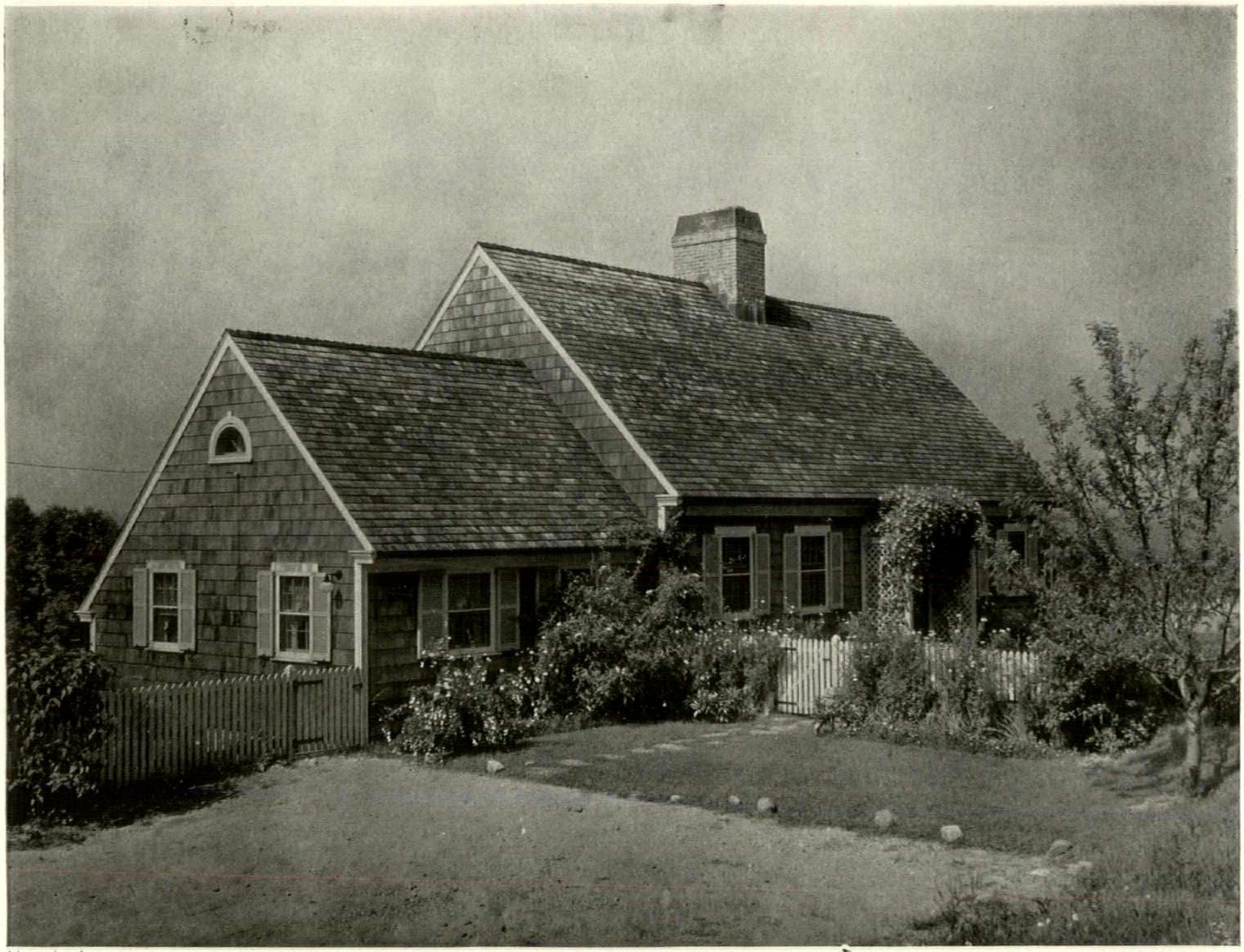
Mott Studios

The house is situated in the rear of garden, facing the street. The entire exterior, including chimney, is painted white, with green blinds. Shingle roof is weathered gray.



GUEST HOUSE
OF DR. WILLIAM B. MUNRO
PASADENA, CALIFORNIA

JOHN D. ATCHISON
ARCHITECT



Van Anda

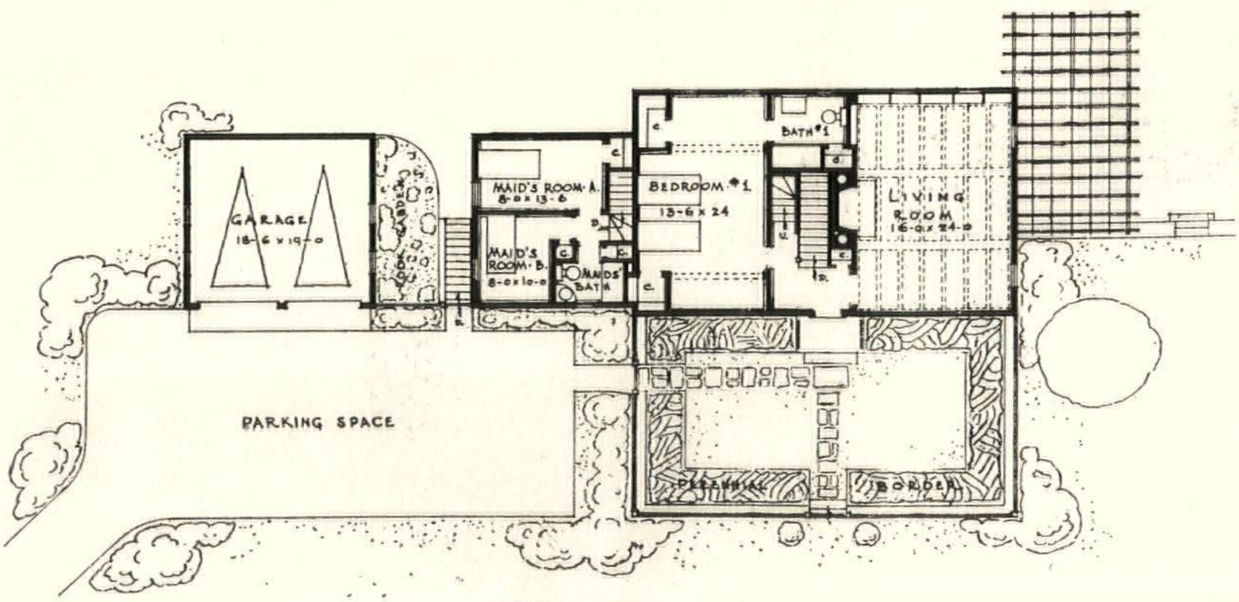
The house was placed on the brow and slope of a hill, enabling the dining room and kitchen to be below the first floor in the space usually designated to cellar. The construction is frame on a concrete foundation. The living room has a wood beam ceiling and pine panel boarding on the fireplace wall and a random width oak floor.

Van Anda

HAMILTON RESIDENCE
NEW CANAAN, CONNECTICUT

WALTER BRADNEE KIRBY
ARCHITECT

Van Anda



FIRST FLOOR PLAN

HAMILTON RESIDENCE
NEW CANAAN, CONNECTICUT

WALTER BRADNEE KIRBY, ARCHITECT

Van Anda

WALTER BRADNEE KIRBY, ARCHITECT

HAMILTON RESIDENCE
NEW CANAAN, CONNECTICUT

Van Anda

HOUSE OF LAWRENCE MOORE
WILTON, CONNECTICUT

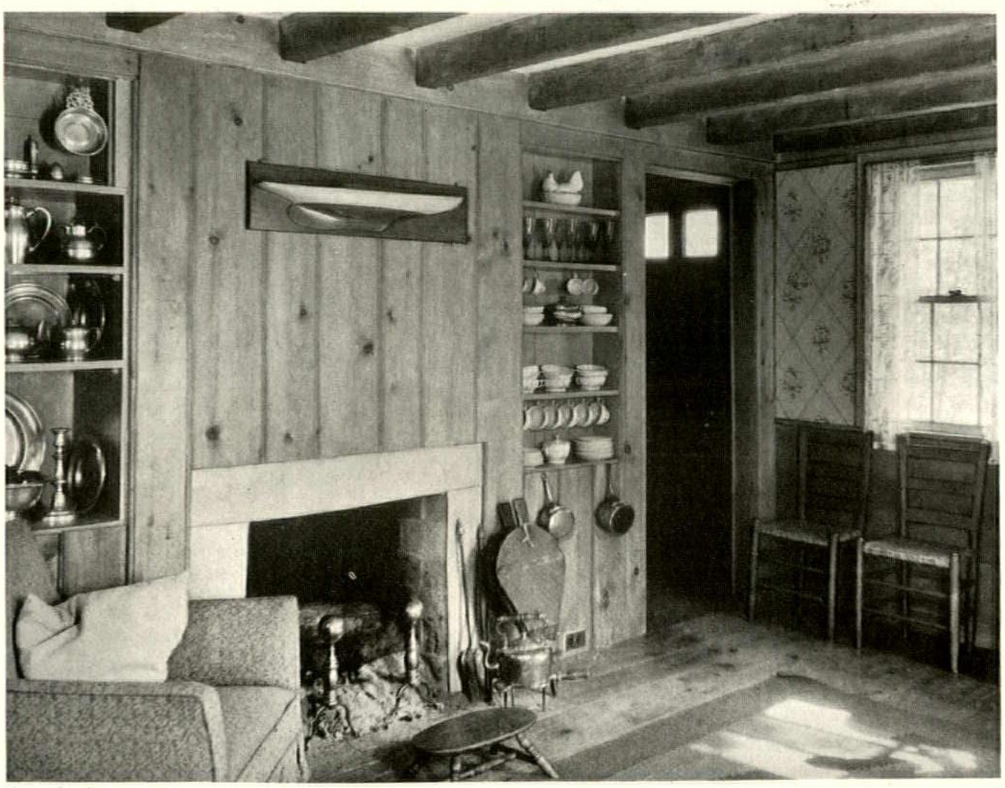
EVANS, MOORE AND WOODBRIDGE, ARCHITECTS

Van Anda

This house was built at various times, beginning in 1927. The guest house was added in 1931 and the kitchen wing was enlarged in 1933. The original house cost about $6,000, and the guest house about $1,000, not including landscape work. The house is frame with clapboard exterior painted white. The walls are insulated with Celotex and the roof with Cabot's Quilt. The house is heated with hot air. It was designed for week-end use.

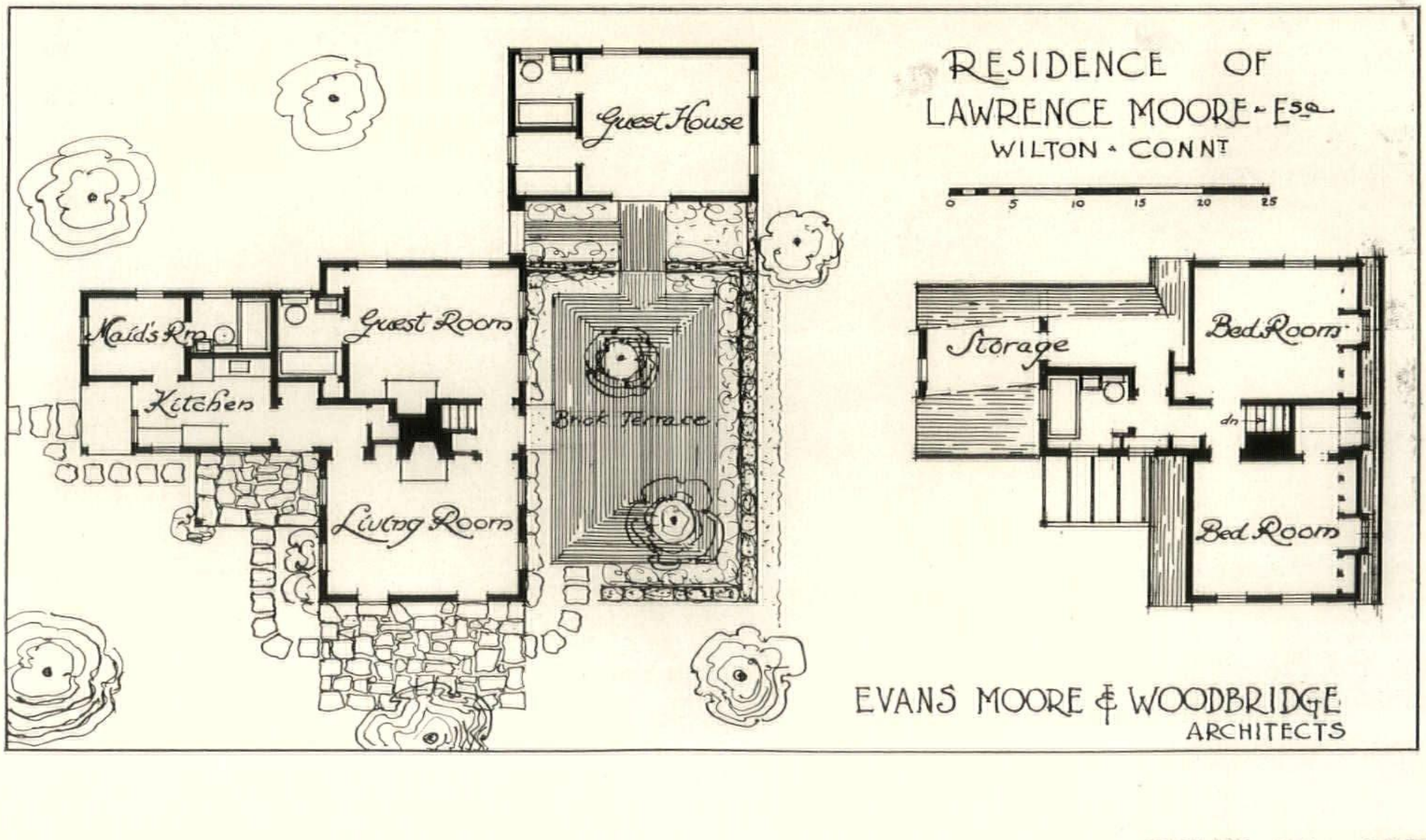
HOUSE OF LAWRENCE MOORE
WILTON, CONNECTICUT

EVANS, MOORE
AND WOODBRIDGE
ARCHITECTS



Van Anda

Van Anda

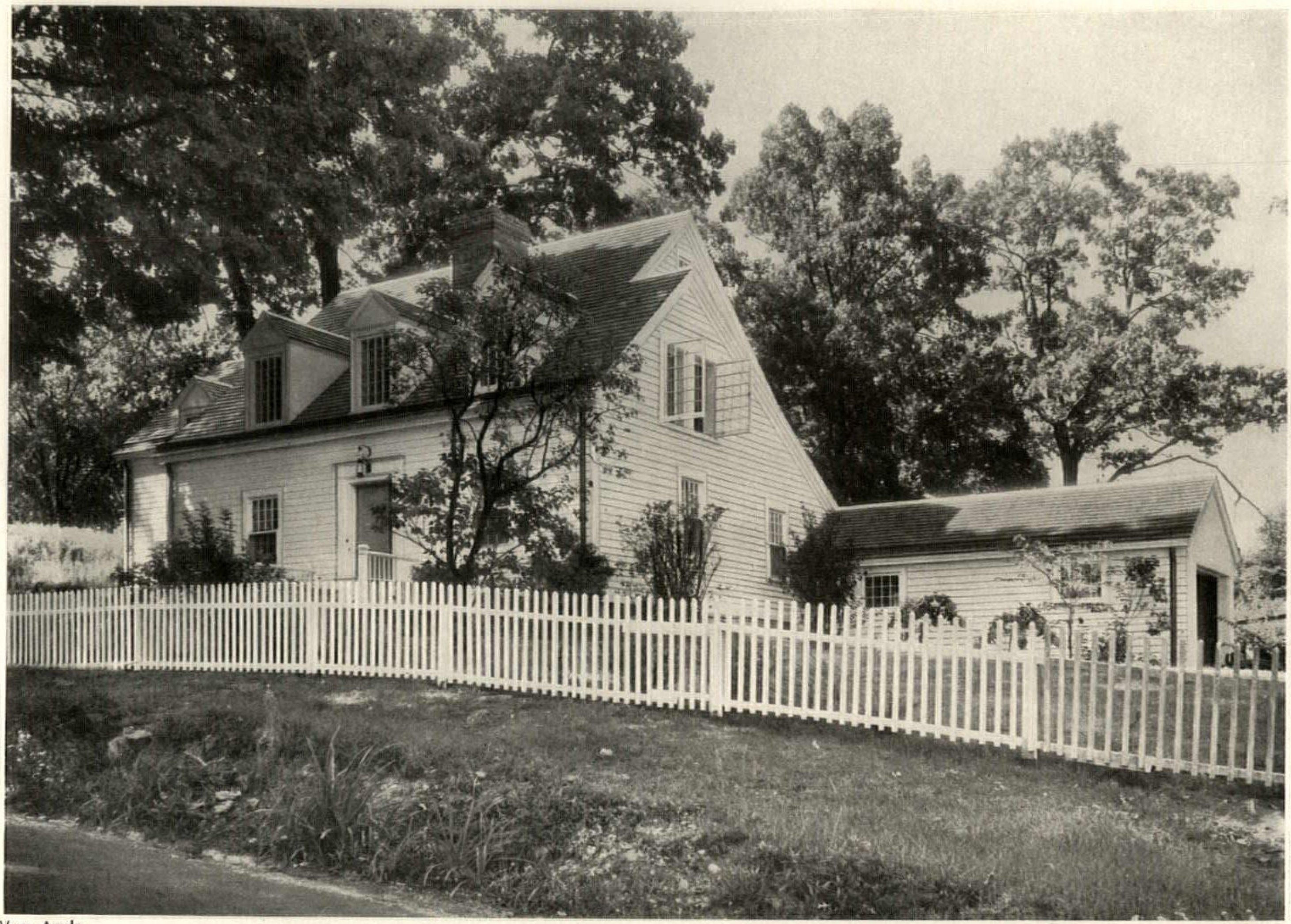


RESIDENCE OF
LAWRENCE MOORE - Esq
WILTON - CONNT
0 5 10 15 20 25
Guest House
Maid's Rm
Guest Room
Kitchen
Brick Terrace
Living Room
Storage
Bed Room
dn
Bed Room
EVANS MOORE & WOODBRIDGE
ARCHITECTS

Van Anda

THEODORE VISSCHER AND JAMES BURLEY, ARCHITECTS

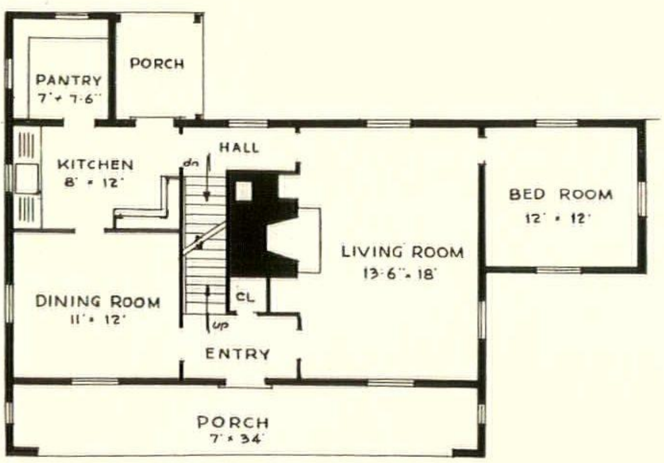
STURGES RESIDENCE
SOUTHPORT, CONNECTICUT



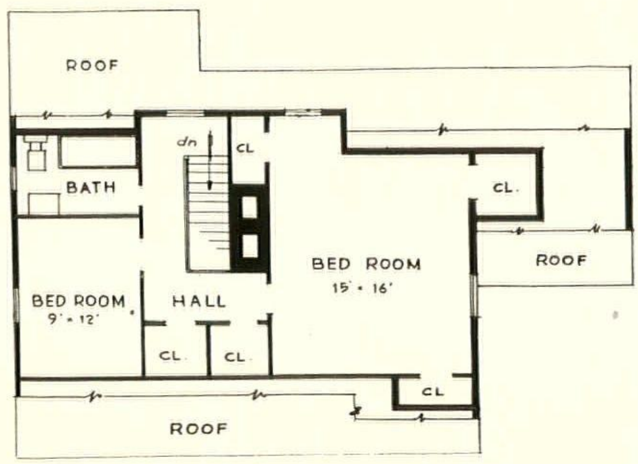
Van Anda

BEFORE AND AFTER VIEWS
REMODELED HOUSE
OF EDWARD B. STURGES
SOUTHPORT, CONNECTICUT

THEODORE VISSCHER AND
JAMES BURLEY, ARCHITECTS



FIRST FLOOR



SECOND FLOOR

DESIGNED BY CHARLES M. RASQUE

HOUSE OF MRS. ALICE NISBET
KENT, CONNECTICUT

R. Tebbs

HOUSE OF M. L. HOUGH
RYE, NEW YORK

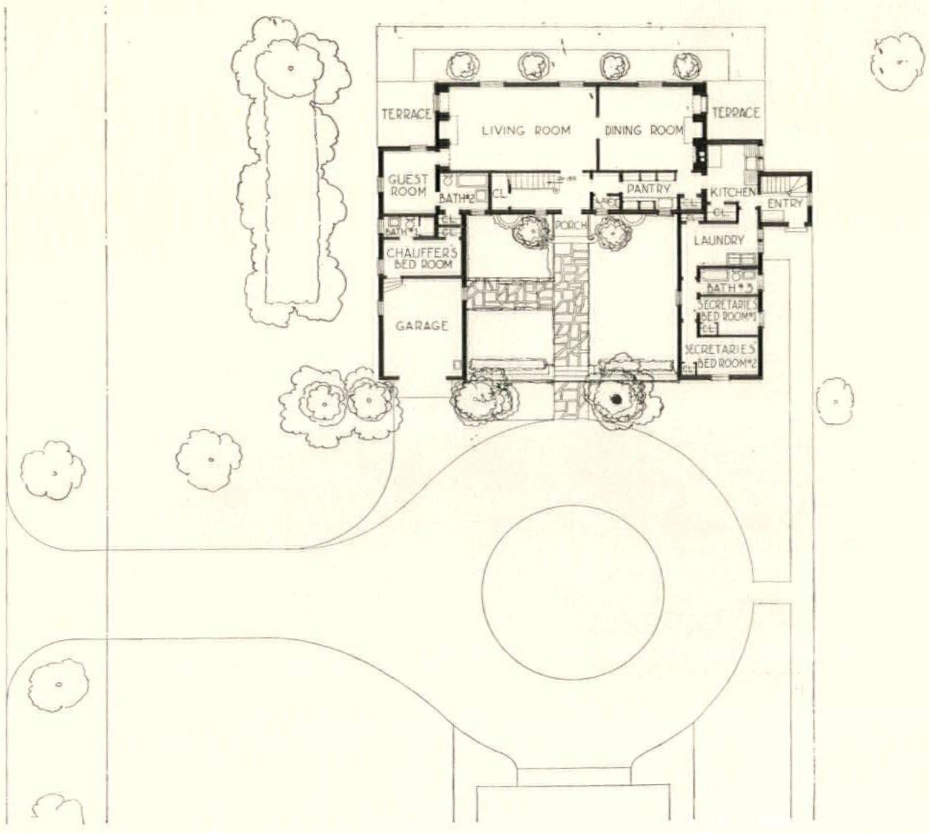
DELANO AND ALDRICH, ARCHITECTS

R. Tebbs

DELANO AND ALDRICH, ARCHITECTS

HOUSE OF M. L. HOUGH
RYE, NEW YORK

Van Anda



(Above)

HOUSE OF W. S. WATERBURY
CHAPPAQUA, N. Y.
J. BLAIR MULLER, ARCHITECT

(Left)

PLAN OF HOUGH RESIDENCE
RYE, NEW YORK
DELANO AND ALDRICH
ARCHITECTS

Van Anda

J. BLAIR MULLER, ARCHITECT

HOUSE OF WALTER S. WATERBURY
CHAPPAQUA, NEW YORK

R. Tebbs

HOUSE OF MARTIN BAKER
KNOXVILLE, TENNESSEE

BARBER AND McMURRY, ARCHITECTS

R. Tebbs

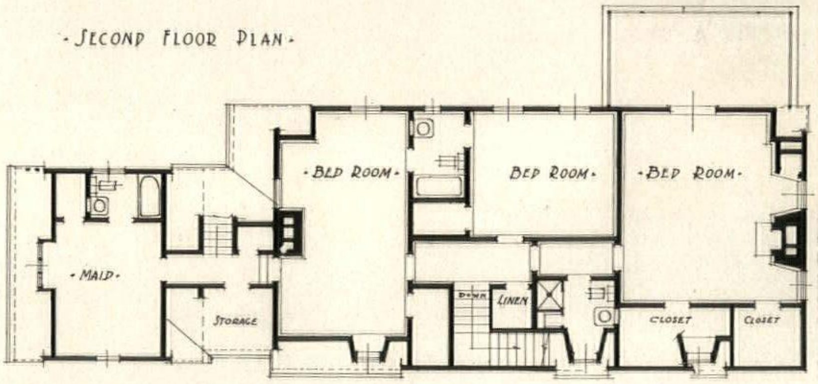
BARBER AND McMURRY, ARCHITECTS

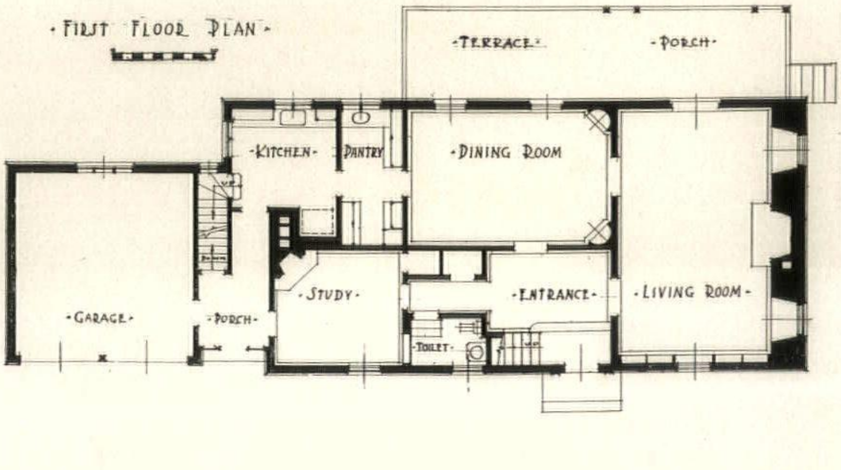
HOUSE OF MARTIN BAKER
KNOXVILLE, TENNESSEE

R. Tebbs

Exterior walls are built of weathered field stone picked up from the surface of the ground, and roughly squared. The wide poplar siding is painted. The doorway, which was adapted from a number of early American examples, is framed by two apple trees. The rear of the house is on a bluff facing a bend in the Tennessee River and the magnificent panorama of the Great Smoky Mountains.

The house cost $17,800 and contains 48,200 cubic feet, costing 37¢ per cubic foot.





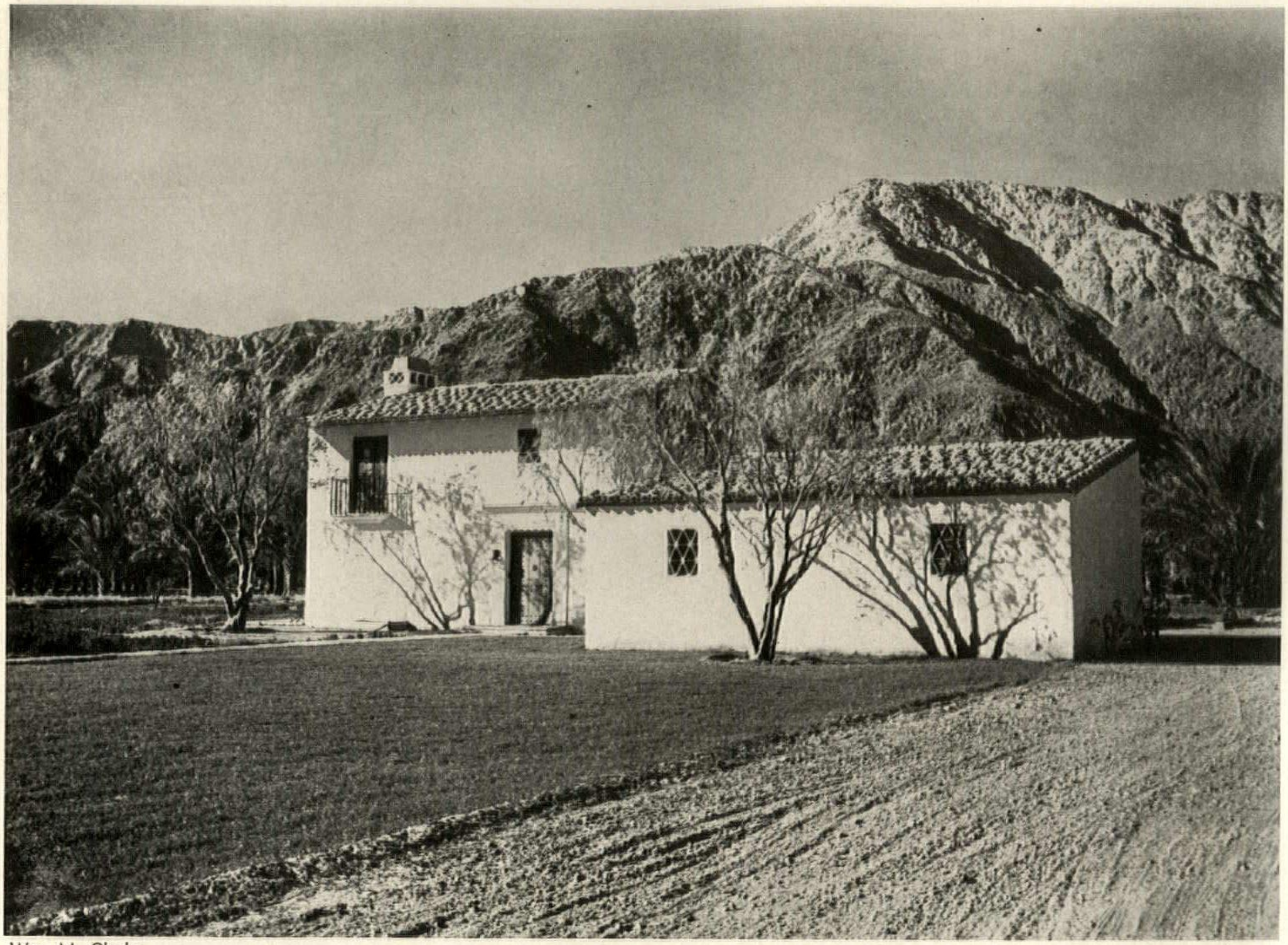
HOUSE OF MARTIN BAKER
KNOXVILLE, TENNESSEE

BARBER AND McMURRY
ARCHITECTS

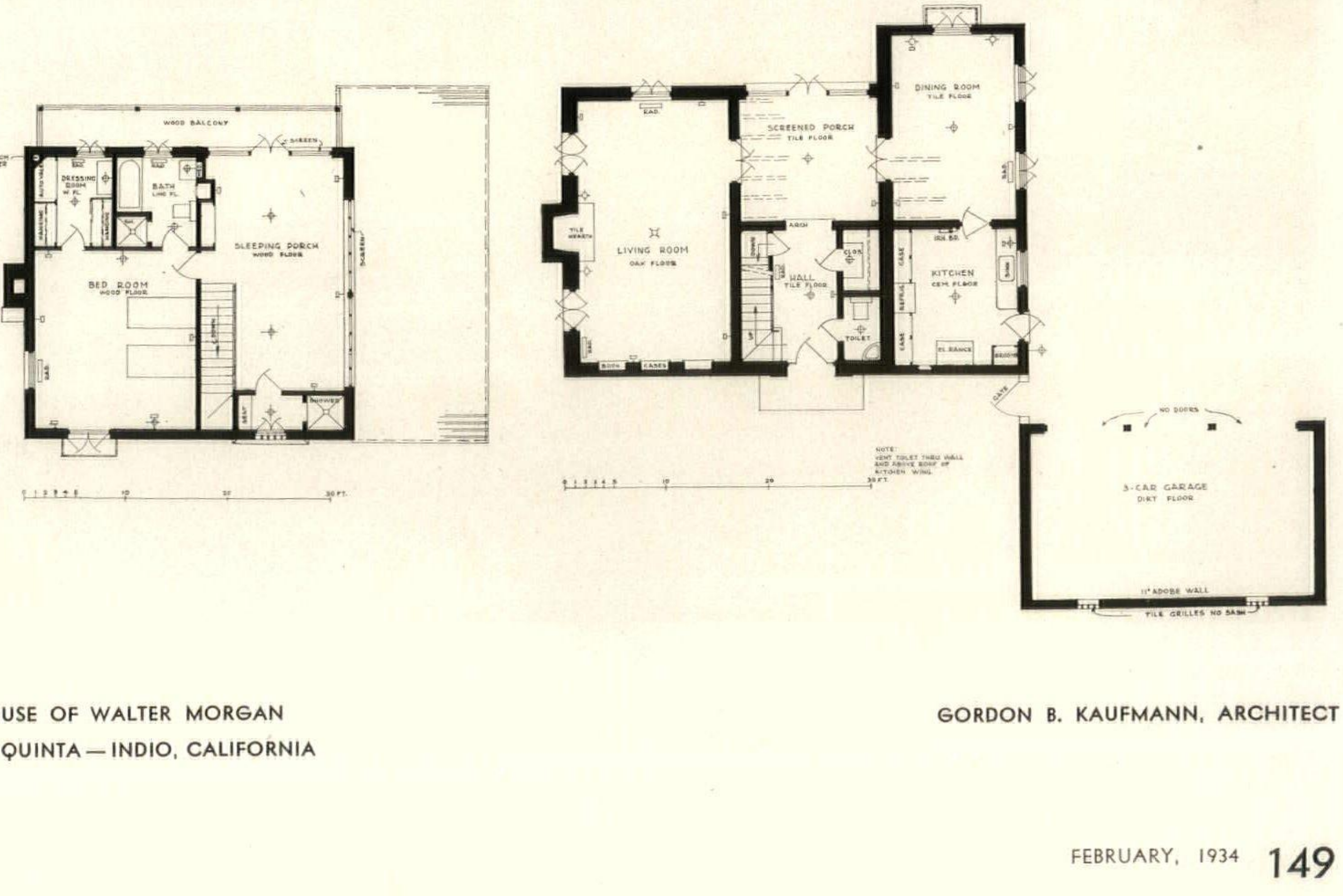
Wm. M. Clarke

GORDON B. KAUFMANN, ARCHITECT

HOUSE OF WALTER MORGAN
LA QUINTA — INDIO, CALIFORNIA



Wm. M. Clarke



HOUSE OF WALTER MORGAN
LA QUINTA — INDIO, CALIFORNIA

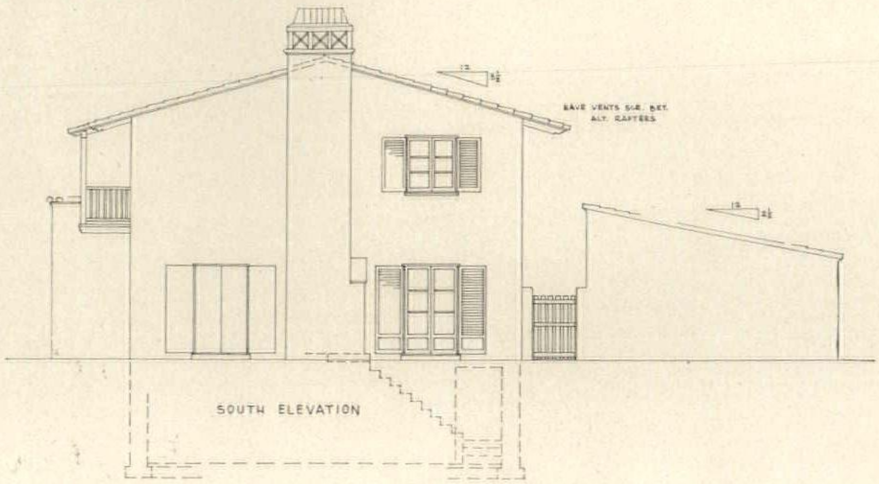
GORDON B. KAUFMANN, ARCHITECT

Wm. M. Clarke

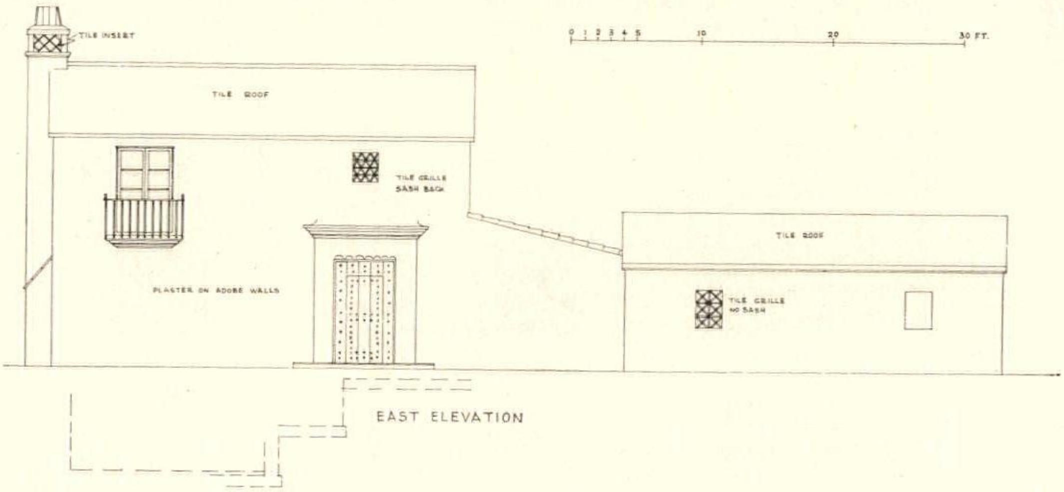
GORDON B. KAUFMANN, ARCHITECT

HOUSE OF WALTER MORGAN
LA QUINTA — INDIO, CALIFORNIA

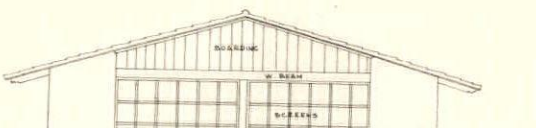
The house has concrete foundations, adobe walls plastered on both sides, tile roof, oak plank or tile floors, and wood windows and doors. It is located in the desert near Indio and is part of the La Quinta Hotel group. All materials, including adobe brick, tile roof, floor tile and casework, were made on the site. The simple Mexican style fits in with the general design of the hotel group, and is particularly adaptable to the dry, hot weather and picturesque scenery.



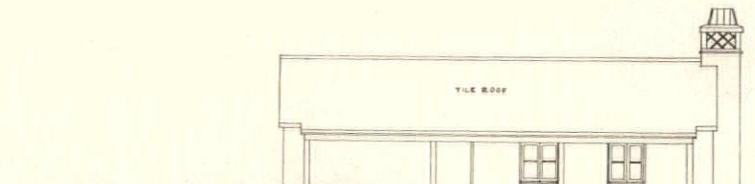
SOUTH ELEVATION



EAST ELEVATION



NORTH ELEVATION

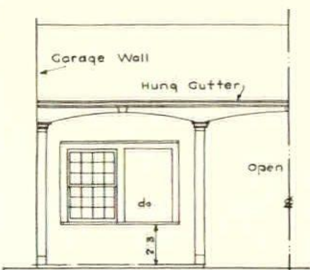


WEST ELEVATION

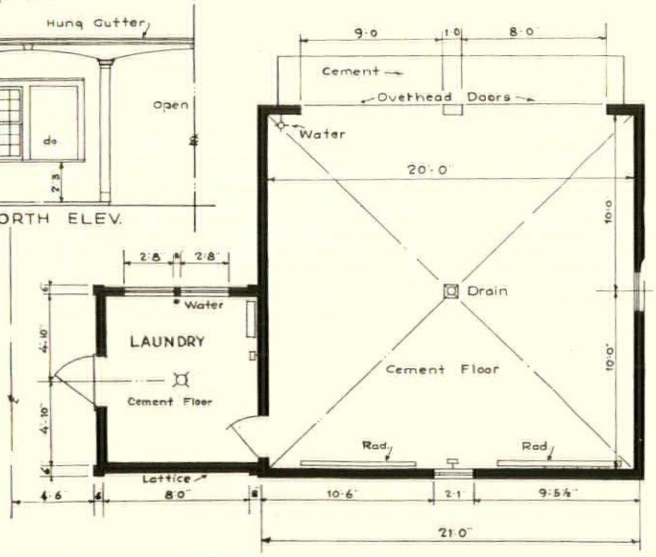
HOUSE OF WALTER MORGAN
LA QUINTA — INDIO, CALIFORNIA

GORDON B. KAUFMANN, ARCHITECT

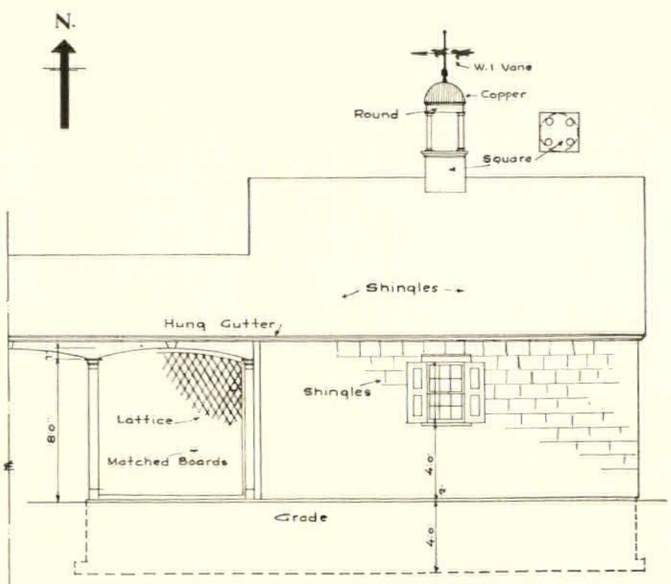
Van Anda



NORTH ELEV.



FLOOR PLAN



SOUTH ELEVATION

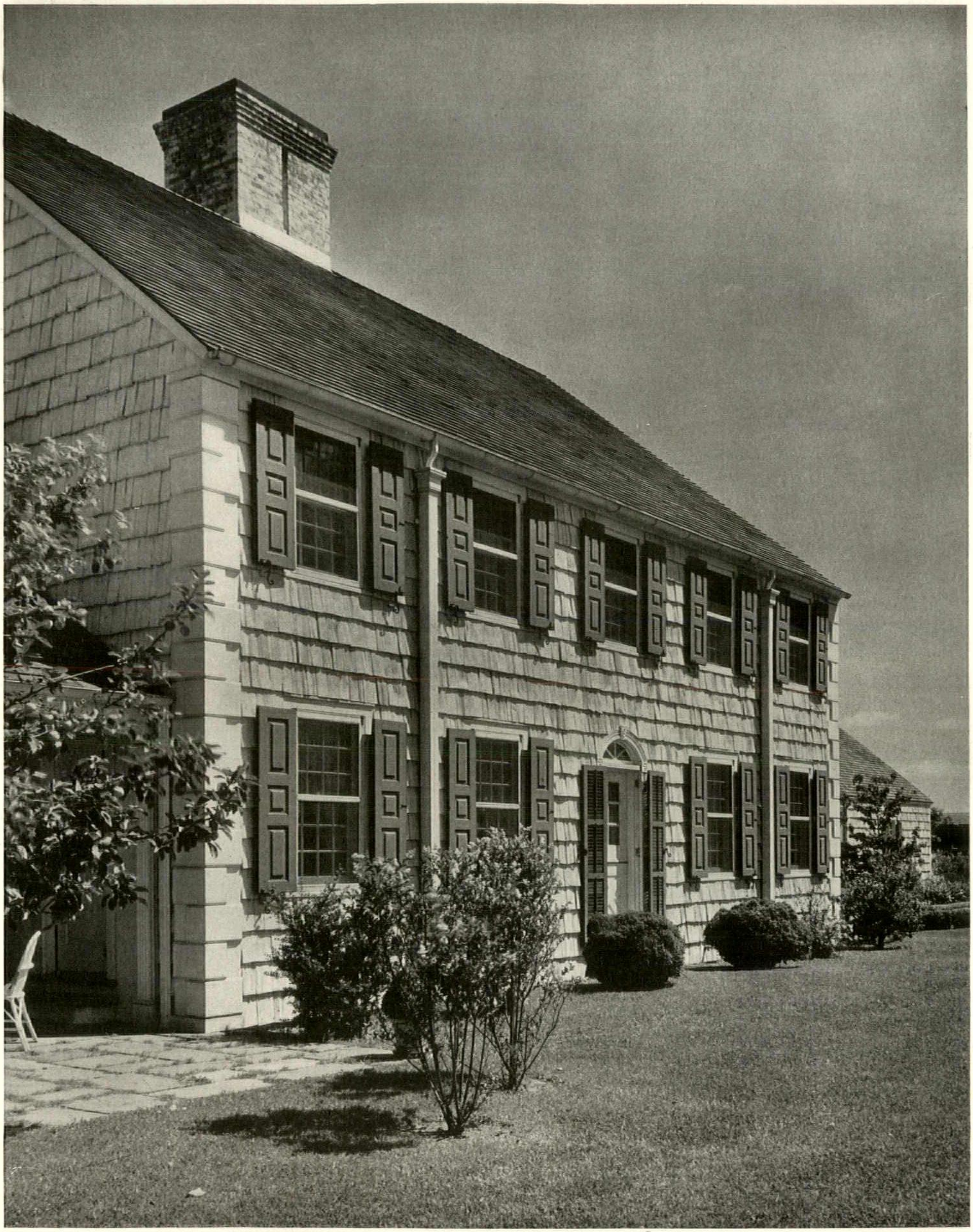
POLHEMUS AND COFFIN, ARCHITECTS

HOUSE OF ALLAN C. BAKEWELL
SOUTHAMPTON, NEW YORK

Van Anda

HOUSE OF ALLAN C. BAKEWELL
SOUTHAMPTON, NEW YORK

POLHEMUS AND COFFIN, ARCHITECTS



Van Anda

POLHEMUS AND COFFIN, ARCHITECTS

HOUSE OF ALLAN C. BAKEWELL
SOUTHAMPTON, NEW YORK

Van Anda

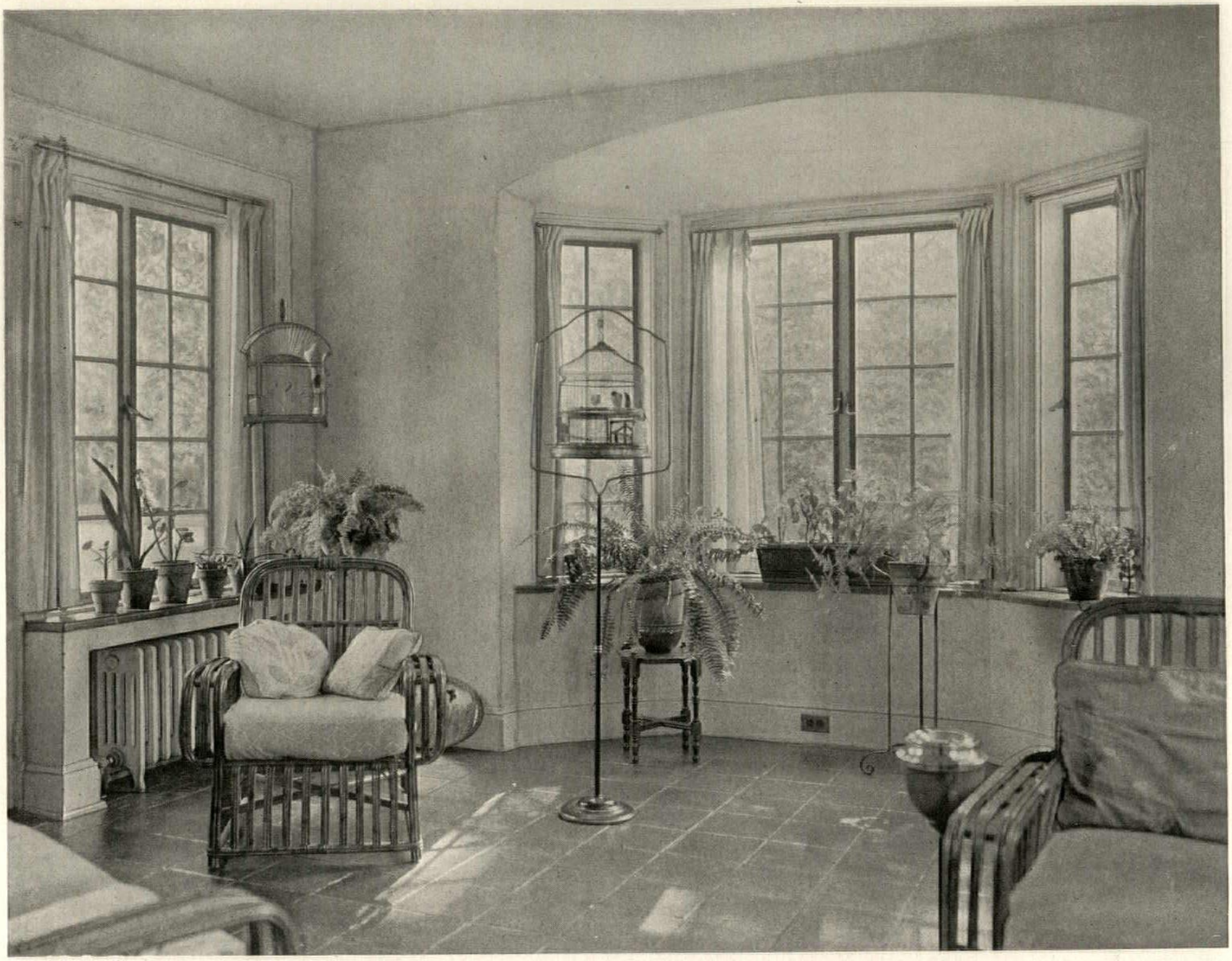
HOUSE OF ALLAN C. BAKEWELL
SOUTHAMPTON, NEW YORK

POLHEMUS AND COFFIN, ARCHITECTS

Adolph Studly, Jr.

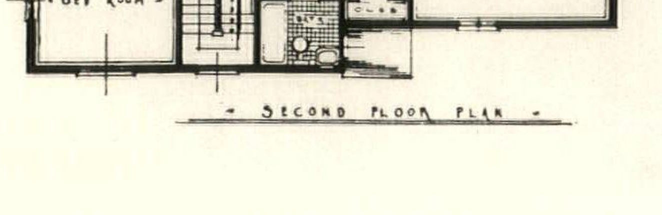
JULIUS GREGORY, ARCHITECT

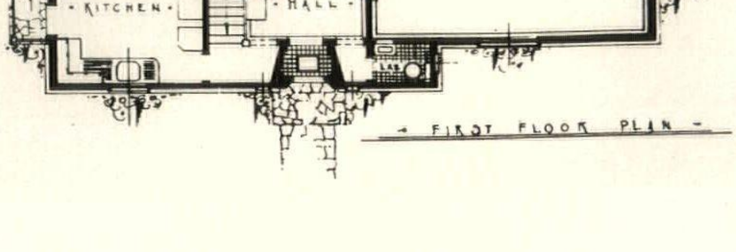
HOUSE OF ROBERT E. HILL
FIELDSTON, NEW YORK



Adolph Studly, Jr.

This house was designed for a family of three and one maid. It is built of frame and stucco on metal lath. The site is a sloping triangular lot. A playroom is under the living room; the garage is in the basement with entrance at rear.



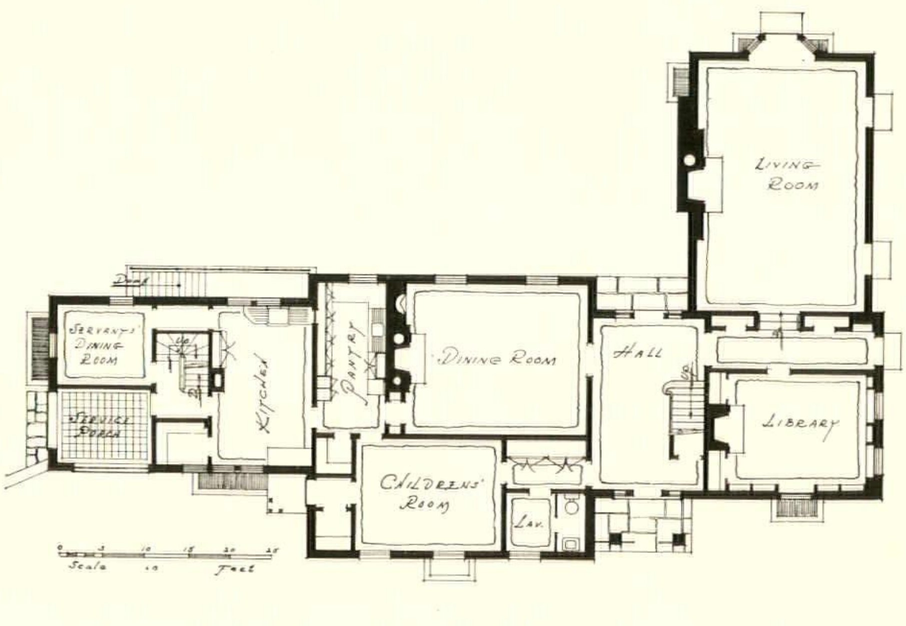


HOUSE OF ROBERT E. HILL
FIELDSTON, NEW YORK

JULIUS GREGORY, ARCHITECT

Van Anda

The house is of English design with gables, two of which are very large. For this reason the shutters were treated with diagonal boards and painted in two colors, thus giving the building a somewhat Swiss appearance. The site is in very hilly country, about three or four miles from Hartford, and rather isolated; it was selected partly because of a peach and apple orchard which makes the place very beautiful during a week or so in the spring. From the back of the house there is a view of twenty-five miles over the Connecticut valley.



HOUSE OF RALPH D. CUTLER
WEST HARTFORD, CONNECTICUT

PHILIP L. GOODWIN, ARCHITECT

Van Anda

Van Anda

In the interior, certain old mantels and carved door and window trim, coming from a demolished house belonging to Mr. Cutler's family, were used in the dining room and living room. The study has special cupboards for fishing tackle and guns.

A special feature of the house is the playroom, taking up all the space under the living room. It has a large stone fireplace and is decorated with trophies of various kinds. All sorts of games, from ping pong to others requiring less pace, are provided. Adjoining is a workshop equipped for carpentry work, with a shower bath and lavatory.

HOUSE OF RALPH D. CUTLER
WEST HARTFORD, CONNECTICUT

PHILIP L. GOODWIN, ARCHITECT

Van Anda

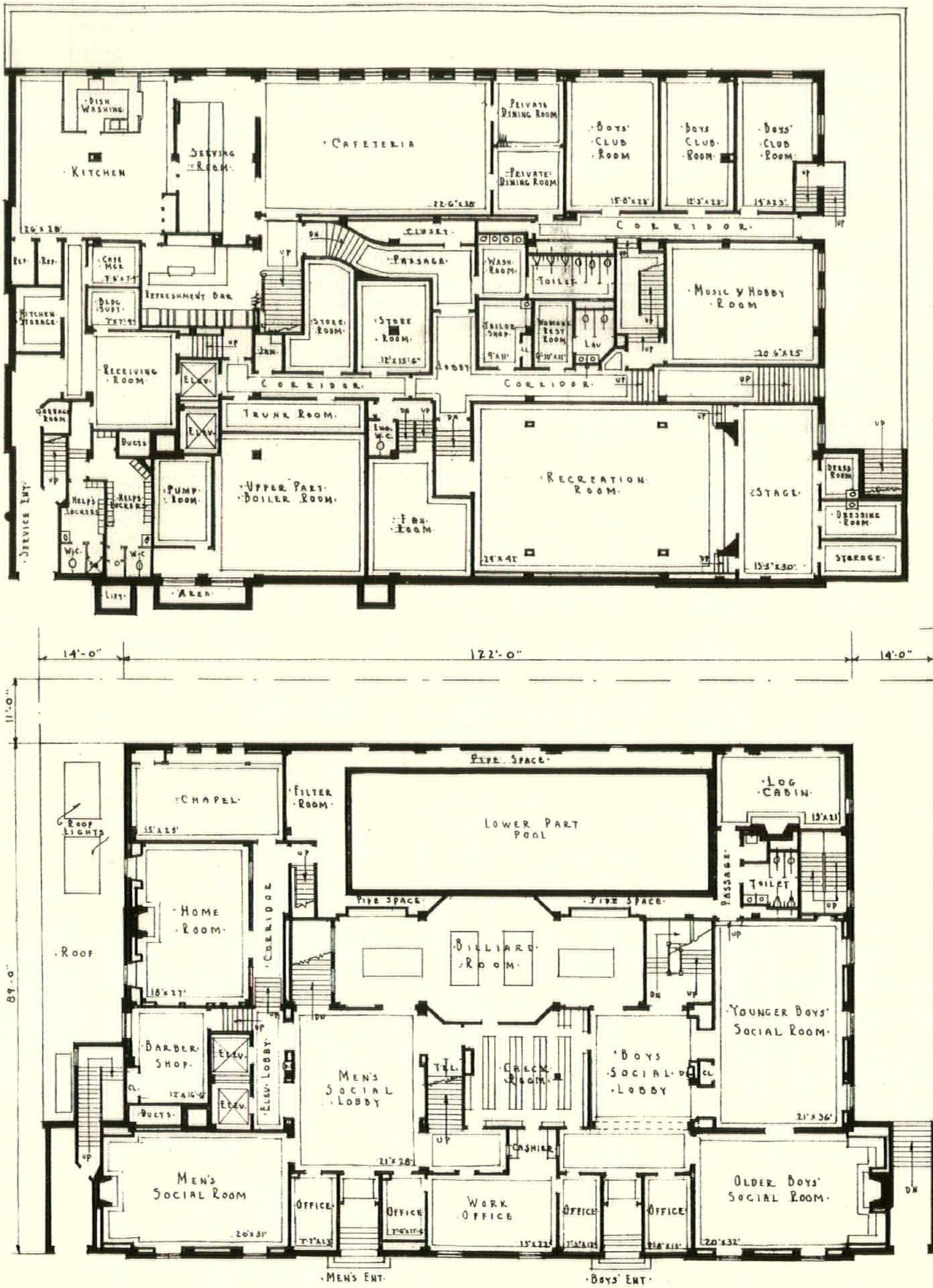
PHILIP L. GOODWIN, ARCHITECT

HOUSE OF RALPH D. CUTLER
WEST HARTFORD, CONNECTICUT

Glasgow

Y.M.C.A. BUILDING, NEW YORK CITY
WEST 135TH STREET BRANCH

JAMES CLINTON MACKENZIE, JR., ARCHITECT



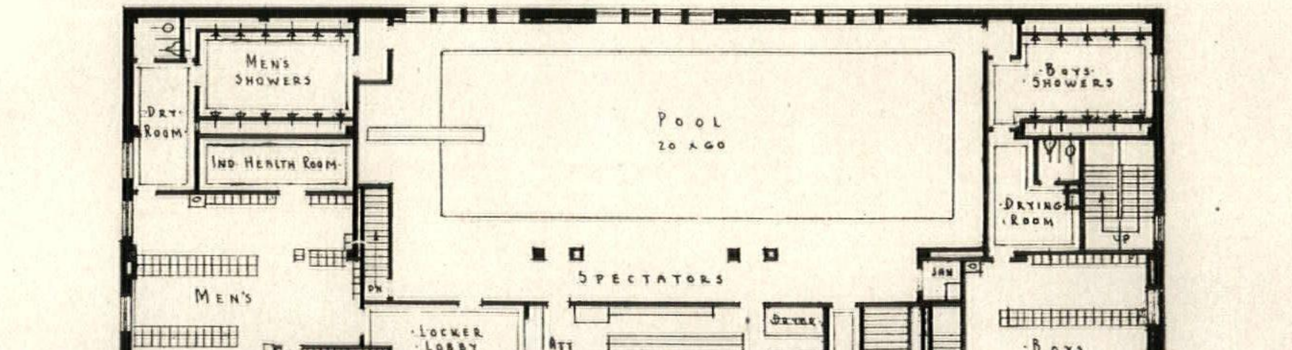
Basement and First Floor Plans.

JAMES CLINTON MACKENZIE, JR., ARCHITECT

Y.M.C.A. BUILDING, NEW YORK CITY
WEST 135TH STREET BRANCH

Glasgow
Street Elevation.

Second Floor Plan.



Y.M.C.A. BUILDING, NEW YORK CITY
WEST 135TH STREET BRANCH

JAMES CLINTON MACKENZIE, JR., ARCHITECT

Glasgow

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Y.M.C.A. BUILDING, NEW YORK CITY
WEST 135TH STREET BRANCH

Glasgow

Y.M.C.A. BUILDING, NEW YORK CITY
WEST 135TH STREET BRANCH

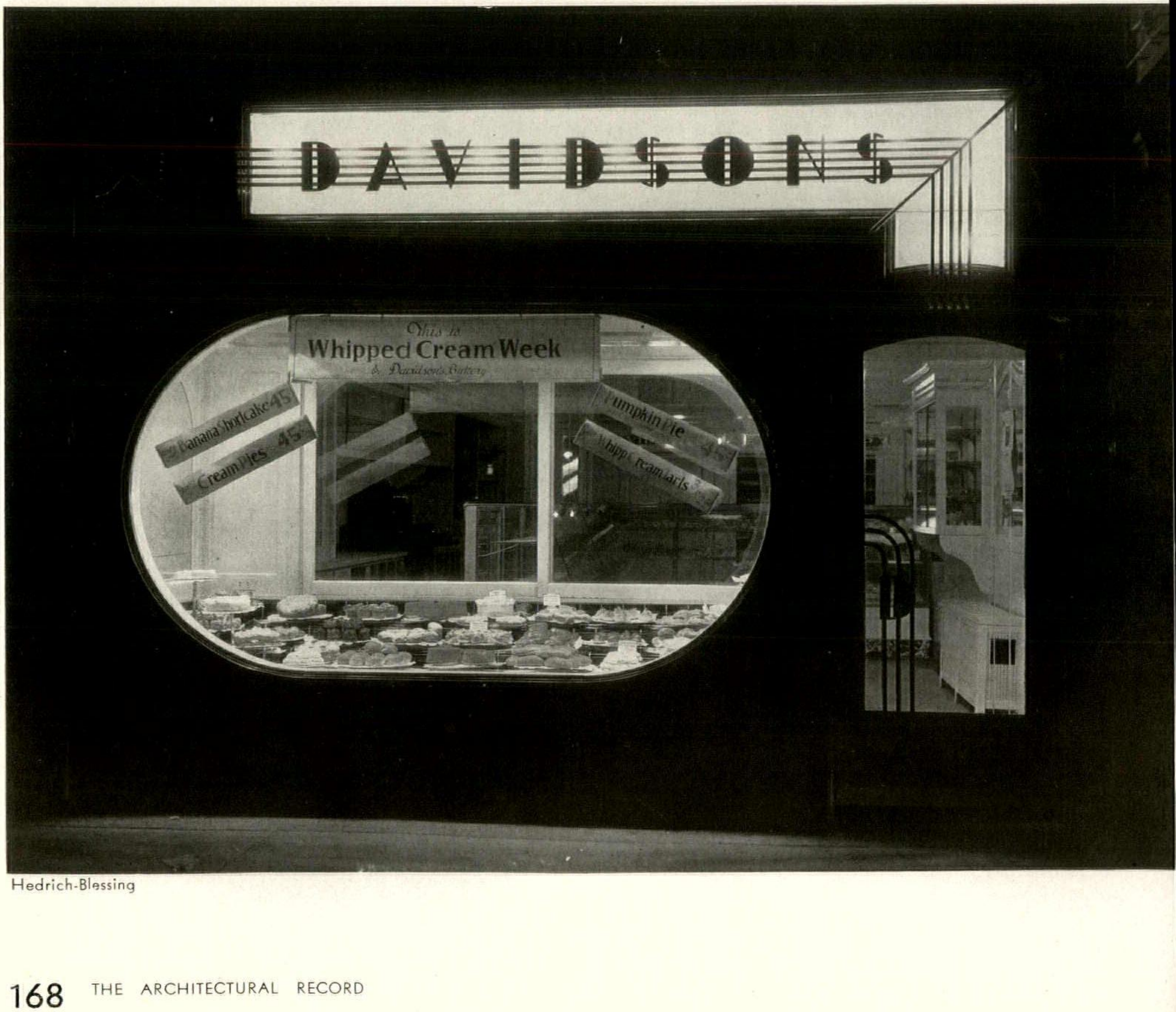
JAMES CLINTON MACKENZIE, JR., ARCHITECT

ALTERATION OF SMALL SHOPS

MODERATE IN COST

A BAKERY IN CHICAGO BY GORDON S. GRUNDLIN

This store front is surfaced with black structural glass. The windo is intended to stress merchandise display, with window backgroun kept subordinate. The interior of the window is in peach colo enamel. The window floor is 4" x 4" black glazed tile with whit joints. Window lighting is accomplished with concealed reflector The entrance door is birch with black enamel finish and Rixso floor hinge. Push bars have an overlay initial plated in gun-meta



Hedrich-Blessing

Hedrich-Blessing

A PIANO SHOP, CHICAGO **HOLABIRD AND ROOT, ARCHITECTS**

Display window serves for display within window and to give view of store interior. This window is also an important source of daylight. The surface of the shop front is pink Georgia marble. Lettering is bronze. Door and door frame are bronze. Interior walls and ceiling are turquoise blue. Floor is covered with a black carpet.

Most shops illustrated on these pages have modernized store fronts and with only slight changes to interior arrangement or treatment of fixtures. They represent improvements of moderate cost.

Hedrich-Blessing

AIMEE DRESS SHOP, CHICAGO; HOLABIRD AND ROOT, ARCHITECTS
EXTERIOR WITH BRUSHED ALUMINUM AND STRUCTURAL GLASS

INTERIOR OF AIMEE DRESS SHOP, CHICAGO

Hedrich-Blessing

HOLABIRD AND ROOT, ARCHITECTS

The interior of this small shop combines display of dresses and dress accessories at salient points, and concealed storage of women's dresses. There is a segregation of sales spaces on the ground floor and on mezzanine. The chief source of daylight is at show window. Interior walls are of gray Salubra wall paper.

Hedrich-Blessing

Hedrich-Blessing

WILLIAM J. QUIGLEY, INC., SHOP, LAKE FOREST, ILLINOI

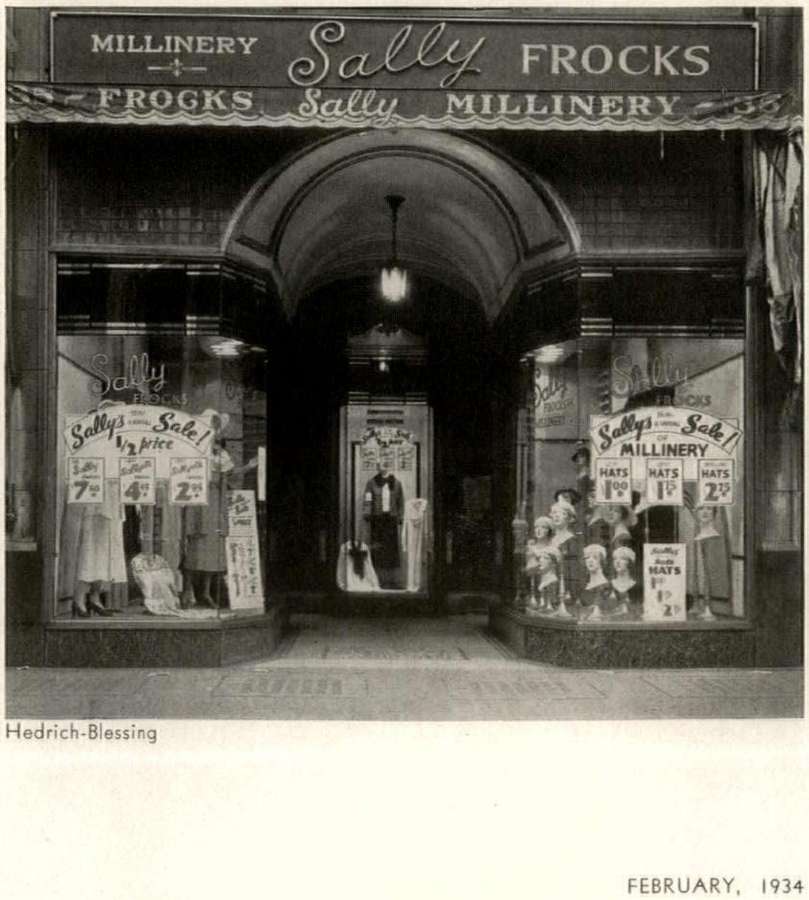
INTERIOR WALLS OF KNOTTY PINE FLEXWOOD, CEILING CHALK WHI

SALLY SHOP, CHICAGO
HERBERT SOBEL AND
J. ARTHUR DRIELSMA
ARCHITECTS

AFTER ALTERATION

Hedrich-Blessing

Shop faced with black Carrara glass; trim of polished aluminum. Opal glass behind trade name is illuminated at night. No changes were made in plan for this alteration. Existing glass was not disturbed. The changing of glass is, in general, a most costly single item on such an alteration. All work was done without barricade and during the height of the business season.



BEFORE ALTERATION

Hedrich-Blessing

BASIS FOR PLANNING RETAIL FACILITIES FOR NORTH SECTION OF RADBURN, NEW JERSEY, WITH 10,000 POPULATION

Kind of Store	Average annual per capita sales, 11 towns	Estimated annual sales, Radburn, at 10,000 population	Average Sales Volume Chain Store Units, 1929: U. S. A., local, sectional and national chains	New Jersey Towns 10,000 to 30,000: Sectional and national chains	New Jersey Towns 10,000 to 30,000: All chains, plus multi-unit independents	Estimated number of stores	Estimated rent per cent of sales	Estimated possible rental income	Modifying Factors
Food Group	$151.04	$1,510,400	$57,200			26	(4.0%)	$60,700	
Grocery	48.41	484,100	44,600	$44,000	$38,700		3.5%	16,900	Maximum of 26 stores: There is a tendency within the trade toward larger stores, combination stores, and complete markets.
Meat	19.74	197,400	50,800				3.5%	6,900	
Combination (Meat and Grocery)	55.24	552,400	72,900	91,300	72,500		3.0%	16,600	
Candy and Confectionery	9.32	93,200	36,900				10.0%	9,300	
Other	18.33	183,300					(6.0%)	11,000	
Automotive	107.95	1,079,500				10	(4.0%)	43,200	
Automobiles	* 80.55	805,500	478,000			2	2.5%	20,100	Present retail automotive facilities in towns near Radburn will affect the Radburn market.
Filling Stations	17.70	177,000	21,200	29,800	28,800	6	8.0%	14,200	
Garages, Repairs	4.11	41,100	44,500			1	13.0%	5,300	
Accessories, etc.	5.59	55,900	59,500			1	5.5%	3,600	
Lumber, Building	68.60	686,000				11	(3.0%)	19,400	
Building Supplies	* 50.24	502,400	60,300			8	2.0%	10,000	Radburn requirements in this category are a special case, due to construction being under a single management..
Hardware, Paint, Glass	13.05	130,500	50,700			2	6.0%	7,800	
Heating, Plumbing, etc.	5.31	53,100	42,800			1	3.0%	1,600	
Clothing (Specialty)	19.08	190,800	69,600			4	8.5%	16,200	
General Merchandise	18.73	187,300	180,000				6.0%	11,800	
Department Stores	* 4.99	49,900	367,600				4.5%	2,200	
Dry Goods	8.31	83,100	49,700				7.0%	5,800	
Variety (5c and 10c, etc.)	* 5.43	54,300	151,400	125,000			7.0%	3,800	
Furnishing and Household	* 12.45	124,500	82,400			1	5.5%	6,800	
Restaurants	* 12.12	121,200	114,200			1	8.0%	9,700	Might be more. Chain store volume not a final index here.
Coal, Wood, Ice	* 22.26	222,600	132,600	134,800	114,100	2	2.0%	4,500	Depends on kind and amount of service supplied.
Drug Stores	13.38	133,800	88,500	116,800	66,300	2	7.5%	10,000	Would probably tend to include goods otherwise classified here.
News, Stationery	5.78	57,800	30,800			2	8.5%	4,900	
Cigars, Tobacco	3.30	33,000	47,600				8.0%	2,600	
Radio, Music	4.27	42,700	135,100				5.0%	2,100	Probably included in General Merchandise or Drug Stores
Florist	3.79	37,900	46,700			1	9.0%	3,400	
Jeweler	3.22	32,200	92,600				9.0%	2,900	See item just above.
Not Otherwise Classified	17.66	176,600	General Average 65,300	61,300	52,400	3	(8.0%)	14,100	
TOTALS	$463.53	$4,635,300				63		$212,300	

The Census of Distribution figures do not include service businesses. No very reliable sources of information in this field have as yet been found, but the following estimate is offered. Such services include barber and beauty parlors, cleaners, tailors, laundries, shoe repair, plumber, electrician, etc. It is estimated that about $15 per capita per year might be spent in this category, which would mean total sales of $150,000 for the community. This might support about 7 stores and, at 8% of sales for rent, would increase rental return by $12,000. Total sales would therefore be around $4,785,300, total number of stores about 70, and total rent income $224,300.

* Highly variable under differing conditions of wealth and location. (Other per capita sales are fairly stable).

lloway

A store organized for effective display. Whitestone Landing, Long Island, New York.

STORE BUILDINGS AND NEIGHBORHOOD SHOPPING CENTERS

By CLARENCE S. STEIN and CATHERINE BAUER

I. THE PROBLEM

The neighborhood community is the basic unit of city building. The economic success of a neighborhood community and the well-being of its inhabitants depend to a great extent on the planning of the neighborhood shopping center. Such a center supplies the daily and staple needs of the homes within a limited radius. It differs from the regional or metropolitan market in that it depends on purely local trade. It gets little if any patronage from outside. If it is to be successful, it must be convenient in location and attractive in arrangement. Its prices must be reasonable and, above all, it must be profitable—profitable to the storekeeper, to the landlord, to the neighborhood community, and in taxes, it must be profitable to the city.

All the details in the problem of planning shopping centers for a new community resolve themselves into four general categories: quantity, location, form, and control. How many and what kinds of stores will be required? What form shall they take, where should they be located? And how can long-time success be guaranteed, in planning and in operation?

Quantity, number and kinds of stores, must be analyzed first. Form must follow function. So far experiments have been made only in the matter of form, and a large number of these experiments, although valuable as suggestions, have been invalidated through lack of any scientific basis in the matter of quantity.

To plan a successful neighborhood shopping center, we must first know what to plan for, how many stores and what kind. Numerous painstaking surveys of existing conditions have been made for the purpose of setting up a basis for future planning. These have attempted to find the number and kinds of stores that would be needed by counting the number of existing stores or measuring the number of front feet occupied by existing stores and comparing that with the neighboring population. All these studies serve but one purpose: they show us what not to do, for any one who looks around his own neighborhood knows that there are too many stores. And so we can only use most of these analyses of existing conditions as a warning. They show why the great majority of shopkeepers make something less than the barest living and die off like flies before they even get started. They explain the long rows of empty stores in every neighborhood. They explain the enormous and expensive turnover in store property. They explain decreased values, empty lots, blighted streets and uncollected taxes.

The picture they paint is not one of emergency depression conditions. Most of these studies were made in the good old days of prosperity or so-called "normalcy."

In 1929, according to the U. S. Census of Distribution, there were a million and a half stores in the United States. *One-half of these stores had annual sales of less than $12,000 per year and were responsible for only 8.6% of the total business.* The average sales for these 750,000 stores was only $5,500. Except in very special cases a store doing $12,000 worth of business, even if it pays only $500 rent, even if the proprietor and his family are the only sales force, cannot make the proprietor a living wage, let alone a return on his investment. *Almost every one of these 750,000 stores was an uneconomic marginal store.* Where were they? Some of them were doubtless in the country. But the vast majority were not. And an enormous percentage were certainly in new or developing residential districts: "tax-payers," strung out in miserable rows, unrelated to the needs or the form of the community which they pretend to serve.

The Trial Census of Distribution, made in 1927 by the U. S. Chamber of Commerce, covering eleven cities which together have one-twentieth of the total population and do one-tenth of the nation's business, brings to light similar figures. One quarter of the independent food stores did a business of less than $5,000. The report figures that such a store could not possibly net its proprietor more than $.32 return per day. It continues: "The average store with an annual volume of $5,000 has little chance of surviving, and while the possibility of profitable operation increases with annual volume, it is not until we reach a volume of more than $50,000 that more than mere existence appears possible. Of all independent grocery stores, 5.66% reported a volume in excess of $50,000 and accounted for 32.32% of the independent business."

These figures, it must be borne in mind, are "Prosperity" figures. What conditions are at present may be left to the imagination.

There are certainly too many stores, and particularly in just that category of store which makes up most of the business of a neighborhood shopping center; stores dealing in food and other staples. The result of such conditions is obvious, and not far to seek for statistical proof. The rate of mortality among new independent businesses is about the same as that among mosquitoes with winter coming on.

A survey made in Buffalo in 1929 showed that somewhere between 30% and 60% of all independent retail stores (depending on the type, but with grocery stores invariably the highest in mortality rate) go out of business during the first year of their existence.

In Louisville it was found that 45% of all the groceries started between 1921 and 1928 failed in the first year of their life. (It is interesting that this was not due merely, if at all, to chain store competition for almost exactly the same proportion of new grocery stores failed during a comparable period back in the '90's, and this not only in Louisville but in several other cities surveyed.)

A survey by Mr. Paul D. Converse of 255 Illinois towns shows that a new dealer entering business has two chances out of three of lasting until the end of the following year, an even chance of lasting to the end of the second year, and two chances out of five of lasting until the end of the third year. Groceries, restaurants and garages, all staple neighborhood enterprises, are throughout the highest in rate of turnover.

In Kansas City in 1928 around 50% of the restaurants quit within one year of opening. Half a dozen other reports, including every serious survey that we have come on in the field, supply similar figures.

What happens when a store fails? First of all, the retailer loses his savings, perhaps has to go into bankruptcy. The wholesaler and other distributing agencies distribute their loss over the general price-level, thus raising prices to the consumer. The landlord probably loses back rent, and certainly must look forward to a period of vacancy and the cost of renovation for a new tenant. The community loses by unsightly vacancies, and eventually possibly by a devaluation of surrounding areas. And the city loses a source of tax-income.

All of which goes to prove that in determining the size of shopping centers logic, not precedent, must be our guide. A healthy shopping center must fulfill five different requirements:

1. It must satisfy the *consumer*, by giving him a reasonable selection of goods at a fair price in a convenient location.

2. It must satisfy the *landlord*, by providing adequate rentals, a minimum of vacancies and reasonably low turnover in tenants. In short, a maximum return on a minimum investment.

Galloway

Public Market in Richmond, Virginia. A hold-over from method of selling by farmer to customer. Very few localities provide suitable parking space for trucks and for needed display.

3. It must satisfy the *storekeeper*, by providing an adequate return for intelligent operation, and reasonable assurance of permanent demand.

4. It must satisfy the *community* as a whole (whether the property is in single or multiple ownership), by being attractive and harmonious when built, and by presenting no danger of blight or decay, which might eventually affect the entire neighborhood.

5. It must satisfy the *city* or other governmental body, by paying adequate and regular taxes.

There is hardly a shopping center in the country which fulfills these conditions, even in times of prosperity. And the principal reason was then as it is now: there were too many stores, too many from the point of view of all interests.

1. The *consumer* sometimes appears to profit momentarily from cutthroat competition, but in the long run the burden of wasteful distribution and store-mortality falls on his neck. And the consumer as home owner, as neighborhood resident, loses out from the start.

2. The *landlord* receives rent irregularly from tenants who go out of business regularly.

3. The *storekeeper*, if he is independent, and most of the marginal stores are independent, invests all his savings and has about a fifty-fifty chance of pulling through the first year, not to mention the almost hopeless possibility of making a decent living.

4. *Communities*, healthy and well kept up before the mushroom growth of tax-payers within their limits, are everywhere being infected with progressive blight and decay from conditions engendered by a planless surfeit ot stores made unavailable for other use because zoned for business.

5. *Cities* are going bankrupt because they are unable to collect adequate taxes in blighted areas.

There is nothing in our present methods of *laissez faire* that will help us out of this mad condition of a surfeit of stores that harms all interests. All methods of estimating store requirements for new neighborhoods, which are based on quantitative uncritical surveys of existing conditions, are worthless for this purpose.*

Chaotic waste in construction of stores, in store operation and in cost of distribution, is not a necessary and unavoidable condition. It is possible by scientific analysis of the problem and by planned large-scale construction and control to set up shopping centers that will fulfill the requirements of the five interests concerned.

Any approach to scientific store planning must be based on one simple fact, namely, that any given community has a fairly definite and ascertainable

**See note on page* 187.

Galloway

Main Street, Huntington, Long Island. Principal shops border this street which is a main arterial highway. Parking is permitted in center of street and along curbs. This has resulted in excessive congestion.

purchasing power, and the modifying factors—income, general character, buying habits, location in relation to larger centers, etc.—are quite capable of analysis and forecast.

There are four principal questions for which the planner must find answers before laying out a new local shopping center. They are:

1. How much local business in dollars may we reasonably expect? (How much lost to and how much attracted from other centers?)
2. How will the local retail dollar be divided by kinds of business?
3. What is the approximate sales volume and size of a successful store in each classification?
4. How much rent can these different types of stores afford to pay?

Obviously, none of these questions can be answered with complete accuracy. And none of them can ever be answered once and for all. Every community has certain conditions which differentiate it from every other community. Some of these conditions will only be discovered by trial and error.

But there is sufficient scientific data available with which to make a very close approximation to the correct answer to the four basic questions. This should be tested and developed through actual experience and realistic reasoning on the part of active planners and city builders.

The scientific as well as the common sense method of planning retail facilities must begin with an analysis of the number and kind of stores that will be required in a given community. To illustrate this approach to a scientific method of community store planning we have selected as a demonstration problem the northern section of Radburn, New Jersey, which will ultimately have a population of about 10,000.

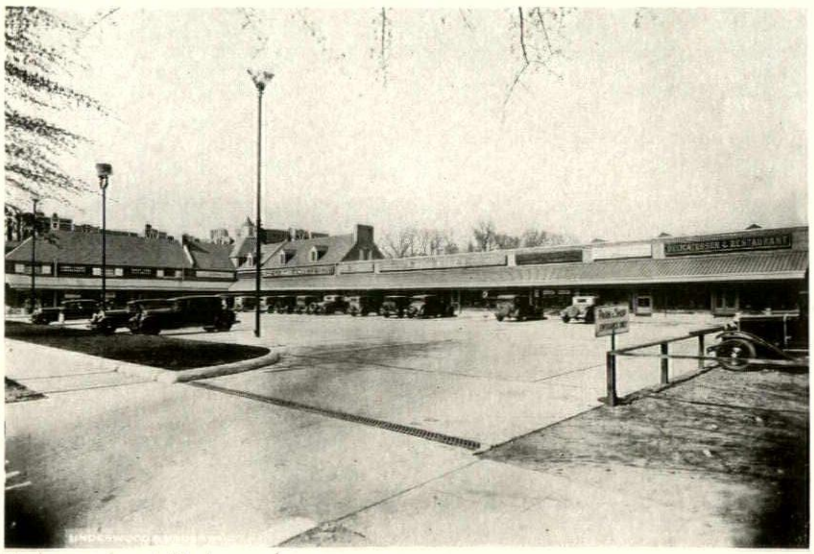
II. NUMBER AND KIND OF STORES

Planning Retail Facilities for the Northern Section of Radburn, N. J., 10,000 Population: An Example of Method

Elements of the Problem

Not front footage, *not* existing ratios between number of stores and population, but:

1. Total sum likely to be spent within the community for different kinds of goods.
2. Most efficient volume of business needed for success in each category.



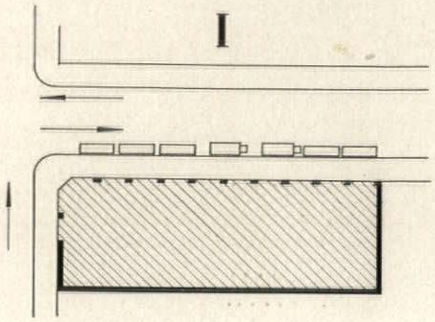
Underwood and Underwood

Drive-In Market, Washington, D. C. There is convenient and well-lighted parking space for customers.

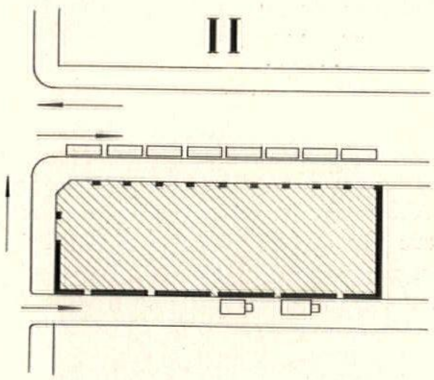
Method of Approach

There are roughly two different methods of getting at the total sales volume, two methods which provide a good common sense check on conclusions. One is based on an analysis of retail expenditures in existing towns of comparable size, location and general character, with due allowance for special features of the case in hand. The other is based on an estimate of the purchasing power of the community, the incomes and probable budgets of the residents. As available material for the first method happens to be much more scientific and complete than that for the second, due largely to the exhaustive Census of Distribution made in connection with the last Federal Census, our estimate of expenditure is based on a comparative survey of sales in eleven comparable small towns.

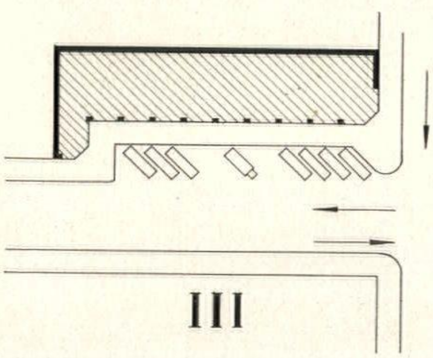
THE PLANNING OF NEIGHBORHOOD SHOPPING CENTERS AS AFFECTED BY THE USE OF THE AUTOMOBILE



(I) Normal type of parking obstructs roads and makes approach to stores difficult.

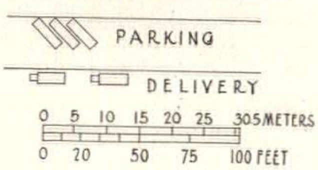


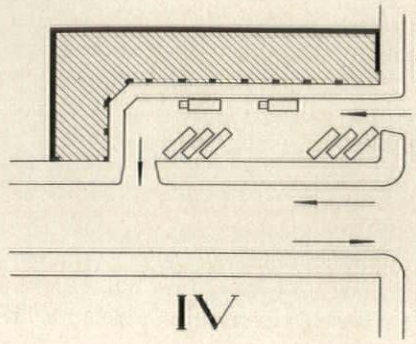
(II) Deliveries in rear of store on alley somewhat decrease street congestion.



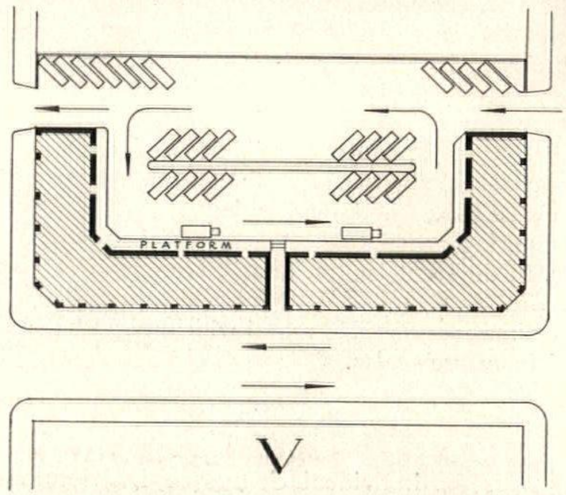
(III) Building set back so as to secure diagonal parking.

SYMBOLS:

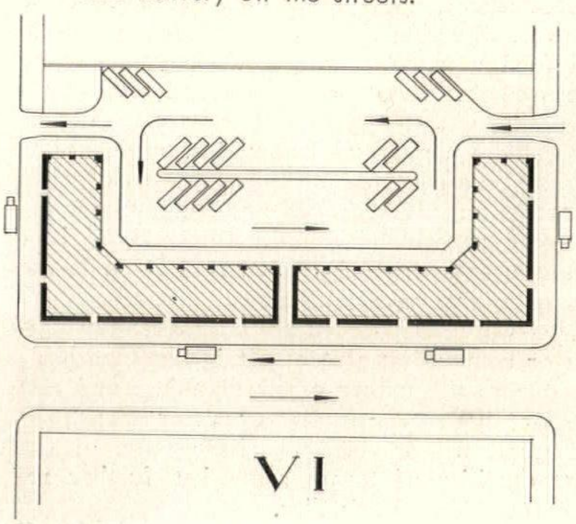




(IV) The California Drive-In Market. Parking and delivery on private property instead of public streets.



(V) Another way of taking parking and delivery off the streets.



(VI) The stores face toward the court where the customers arrive in automobiles. Delivery at rear of stores on street.

The figures thus resulting have, however, been roughly checked by the second method.

Use of the Census of Distribution in This Study

What it covers: So far, the published material includes summary reports for the entire country and for each State, and also individual reports for every town of 10,000 population and over. Retail trade is divided into some forty different classifications, and analyzed statistically to show such items as net sales, number of stores, number of employees, operating expenses, etc. Types of management, i.e., independent or local, sectional or national chain, are indicated in all the classifications. State and national summaries also provide figures on all the above items classified according to different sizes of community, and further break down operating expenses to show rent in per cent of net sales in all of the classifications. (Also available for the five boroughs of New York City.) It is possible, therefore, to find exact per capita expenditures in 1929 in any given type of store (excluding service business, such as laundries, etc.) in any town of over 10,000 population in the United States. It is also possible to uncover average annual volume of sales in all categories for both chain stores and independents. And finally, by comparing rental percentages in different businesses, in different States, and in sections of New York City if desirable, it is possible to arrive at some estimate of possible rental which might be expected from such sales.

Selecting Towns for Comparative Analysis

Going over the individual Census of Distribution reports, we picked out some 24 towns in northern New Jersey, southern New York State and western Connecticut, with populations of 10,000 or a little over. Ranging these towns according to per capita food expenditure and total per capita sales, it appeared that eleven of them constituted a real norm, and that the remaining thirteen, ranging about equally above and below this norm, might safely be omitted from the analysis, usually for obvious reasons. (Englewood and Summit, for instance, are abnormally wealthy towns, Lodi is a community entity only in name, Red Bank is the center of a large and rich rural area, etc.)

The eleven towns chosen are not all strictly suburban or commuting centers. It is felt that Radburn, due to the nature of its planning, and due to the fact that there is no larger center immediately adjacent, will be likely to have some of the market qualities of towns somewhat further removed from New York City.

Per Capita Sales: 11 Towns

The eleven towns chosen for comparative study, together with their respective populations and per capita sales in 1929 are as follows:

Town	Population	Per Capita Sales	Per Cap. Food Sales
Naugatuck, Conn.	14,315	$337	$145
Ridgefield Park, N. J.	10,764	380	137
Pleasantville, N. J.	11,580	394	154
Beacon, N. Y.	11,933	431	151
Valley Stream, N. Y.	11,790	437	144
Burlington, N. J.	10,844	456	137
Wallingford, Conn.	11,170	462	157
Westfield, N. J.	15,801	481	159
Rutherford, N. J.	14,915	550	154
South Orange, N. J.	13,630	568	147
Mamaroneck, N. Y.	11,766	579	158

It is worth noting that the figures for New York State, New Jersey, Connecticut and Queens Borough also fall within this range:

New York State	$574	$148
New Jersey	458	140
Connecticut	478	127
Borough of Queens	383	153

In each store classification, the combined sales in the 11 towns were divided by the total population (138,508) to give the per capita expenditure. These are the figures in the left-hand column of the chart reproduced herewith. An asterisk marks those items which are most highly variable.

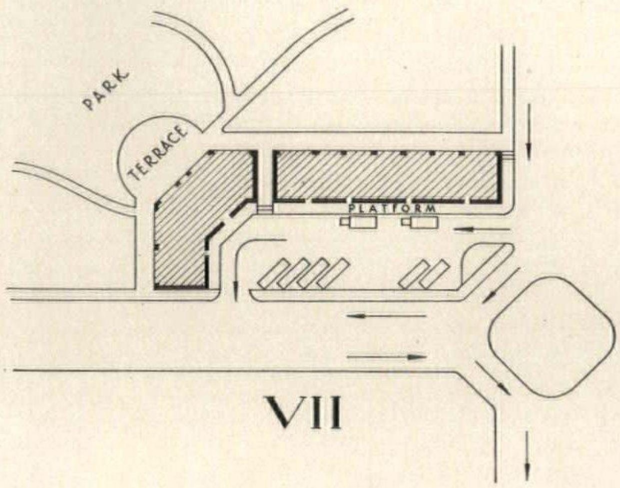
Total Estimated Sales, Radburn, at 10,000 Population

This column is obviously achieved by the simple process of multiplying the per capita expenditures by 10,000, with a resulting total estimated annual expenditure on goods other than services of over four and a half million dollars.

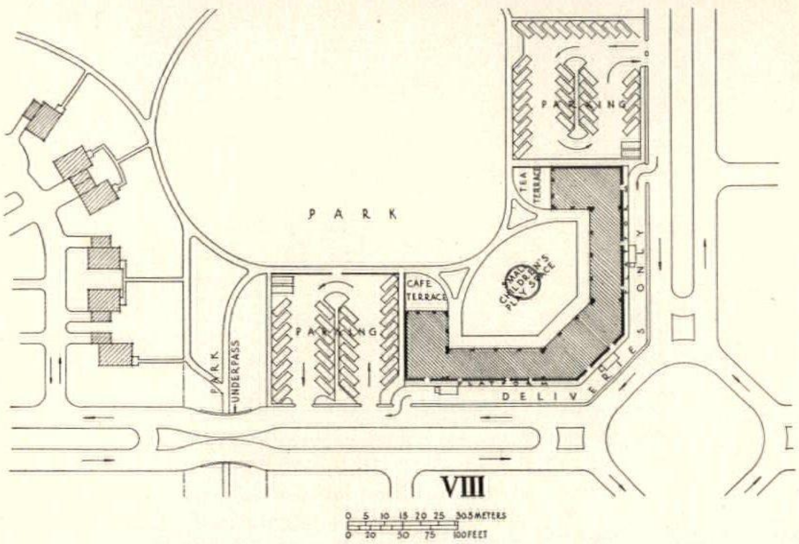
Check: Radburn with 10,000 population will consist of about 3,000 dwellings and families. The average rent (or its equivalent) will be about $75 per month per dwelling, or $900 per year. Average income, then, according to most sources of information, is likely to be something just under $4,000. It is agreed by several responsible authorities that between 35% and 40% of income is likely to be spent within a residential suburban community, provided the store facilities are adequate and conveniently located. Most of this will be spent on food and automobile supplies. If the combined income of the residents of Radburn is, therefore, about $12,000,000 their local expenditures by this method of calculation would be somewhere around four and a half million dollars. Which figure checks in general with our previous calculations. (Additional expenditures for services and for amusements not listed here would probably be more than balanced by judicious cutting in some of the categories, necessitated by the special conditions at Radburn. The most obvious of these is the Lumber and Building Material Item.)

Size of Efficient Stores, Use of Data on Chain Stores

Here there are also two methods of approach, which, at least when they are better documented, may be used to check each other. One of these rests on the simple and obvious fact that the average chain store is infinitely more likely to be efficient and economic than the average independent. For one thing, the big chains have means of analyzing markets and desirable locations which no independent can hope to achieve. For another thing, they have cumulative experience concerning the volume of business necessary to show a profit in different lines of trade. And finally, they are very unlikely to keep a store in operation very long which proves itself unprofitable. In most cases, and particularly in the field of staple and more or less standardized goods which form by far the greater share of the small town market, it seems fair to consider the average chain store volume as a good indication of the size of business which an efficient store must produce.



(VII) The store group in a town of the Motor Age such as Radburn, N. J., should face toward the park as most customers will walk to it.



(VIII) The Neighborhood Shopping Center fully developed to meet modern requirements will care for those who come on foot or machine. It will face toward green open spaces and turn its back to the road. Safe parking of children will be even more important than parking of automobiles.

The third, fourth and fifth columns on the chart show the average volume of business of chain store units in the different categories in 1929, as derived from Census of Distribution figures. On the left are the figures for all the local, sectional and national chains in the United States. The general average is $65,000. The other two columns show such figures as were available for New Jersey towns of 10,000 to 30,000 population, the middle dealing with sectional and natural chains and the right-hand column with all chains plus multi-unit independents.

It will be seen that the variations, particularly in the food group, are not very wide. The general average for the larger chains in the New Jersey small towns was $61,000 and for all forms of chain $52,400. (It may be well to point out in this connection that the average sales in single-store independents were $25,000 for the United States and $27,000 for the New Jersey small towns. Moreover, the *median*—the business volume below which fall more than half of these stores—was less than $12,000.)

Check: The other method of uncovering the size of a healthy store would, of course, consist of a scientific analysis of all the factors which go into retailing, with particular attention to the progressive tendencies already visible within the business itself. Such a work was of course impossible within the limits of this study. Considerable authoritative trade literature has been consulted, however, and the conclusions tend to uphold the tabulated figures. For instance, all authorities agree that a food store must do $50,000 worth of business in order to be a permanent paying proposition. (The average annual volume of independent grocery and meat stores was $17,000 in the United States as a whole and $14,000 in the New Jersey small towns; the median being of course much lower.)

In general also the tendency of efficient modern practice is toward larger stores handling a wide variety of goods and away from the specialty shop. This tendency is so marked in the food business in particular, where large markets (sometimes run on a concession basis) are growing up in various sections of the country, that we have not itemized the number of food outlets according to kinds of stores. Food store facilities must provide an *equivalent* of the 26 units estimated on the chart, but the actual form must be determined later after careful study and conference with authorities in the field.

ESTIMATED SPACE REQUIREMENTS FOR STORES OF VARIOUS TYPES

Type of Store	Dimensions	Area (Sq ft.)	Authority
Grocery	40' x 60'	2,400	Safeway Stores, California.
	35' x 60'	2,100	Average chain store doing $3,000 weekly business.
	30' x 40'	1,200	Lönberg-Holm, architect.
	20' x 45'	900	Carl Dipman, editor of *The Progressive Grocer.*
	20' x 35'	700	Average chain store doing $1,200 weekly business.
	28' frontage		W. F. Williamson for store doing $100,00 business annually.
	16'-18' front		W. J. Baxter, Chain Store Research Bureau.
Grocery and Meat	100' x 100'	10,000	Ralph Morgan, President of Chain Store Research Bureau.
	60' x 100'	6,000	Average store.
	35'-50' front		W. J. Baxter.
Drug store	20' x 80'	1,600	Ralph Morgan.
Variety (5 and 10c)	40' x 150'	6,000	Kresge and Woolworth.
Specialty—hardware, etc.	20' x 80'	1,600	Ralph Morgan.
	20' x 36'	720	Ideal electrical contractor's, National Lamps Works.
Chain Department	50' x 120'	6,000	J. C. Penney average.
Shoes	20' x 100'	2,000	Wise Shoe ideal.
	20' x 80'	1,600	Walkover ideal.
	15' x 75'	1,125	Beck Hazzard ideal.
	18' frontage		W. J. Baxter.
Candy	7' x 40'	280	Mary Lee shops.
	or 9' x 30'	270	
	18' frontage		W. J. Baxter.

All store examples and estimates from Baxter, William J., *Chain Store Distribution and Management,* 1932; Williamson, W. F., *The Retail Grocer's Problems;* U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce.

STORE SPACE REQUIREMENTS

In trying to determine the amount of space desirable for stores of various types doing a profitable business, one is faced with a shortage of scientific material on the subject. Chain stores and chain store organizations seem to be the only ones who have thought at all in terms of the model, ideal, or average store, and the few figures available vary so much that they are of little use. Grocery store estimates vary from 20 to 40 feet in width and from 35 to 60 feet in depth, while the addition of a meat department increases the width to 60 or 100 feet, the depth to 100 feet.* For the ordinary shop (shoes, specialty, hardware, drugs, etc.), the 20'x80' recommendation of Mr. Ralph Morgan, President of the Chain Store Research Bureau is typical. On the other hand, in actual practice, high rents in desirable locations enforce the use of smaller areas. Mr. William J. Baxter of the Chain Store Research Bureau points out the present-day trend among chain stores toward the use of smaller stores because of

1. High rents;
2. Consolidation of stock by introduction of new and more compact lines of goods and less bulk goods;
3. Economy and efficiency in the use of space.

* Baxter, William J. *Chain Store Distribution and Management.*

Estimated Number of Stores of Each Kind

The figures in this column on the chart have obviously been secured by roughly dividing the total estimated sales in each category by the estimated size of a healthy store. Where the sales were too small to warrant allowing a separate unit, they have been combined with other suitable categories. The total number of store-units, excluding services, is estimated at 63.

The fact that analytical and critical use of available facts leads to something very different from present conditions may be attested by the following table:

Number of Stores per 100 Population	
U. S. A.	1.26
New Jersey	1.49
Eleven small towns	1.43
Borough of Queens, N. Y. C.	1.16
Radburn as planned	.63

Possible Rental Income

We have occasionally, for matters of convenience, distinguished between the interests of the landlord and those of the community as a whole. However, it is one of our major premises in attributing importance to scientific and economic store planning that, in the construction of large-scale housing and communities, the interests of the store owner and the community will be identical. For they will be the same thing. This part of our premise has already been accepted in the financial set-up of most recent housing projects. It is taken for granted that the profits arising from store properties shall go to the community as a whole.

These profits come from rent. It is apparent from a comparison of Census of Distribution figures for the country as a whole, New Jersey, New York, Connecticut and the Borough of Queens, that the average rent is a fairly regular percentage of the sales volume of a store. The composite percentages resulting from this survey have been listed in the next to last column of our chart, and the resulting estimated rentals in the last column. The total possible rental income, excluding service businesses, comes to $212,300.

There is one axiom to be mentioned in this connection, an axiom which sums up the whole point of this section of our study. Namely, that it is more profitable to get a certain amount of rent *regularly* from ten healthy stores than it is to get the same amount of rent irregularly from twenty-five marginal stores doing the same total volume of business.

Modifying Factors

The estimate of 63 stores selling goods at retail is by no means the final figure. It is merely the basic figure achieved by multiplying the average per capita sales in the eleven selected towns by 10,000 and then dividing the product by the average volume of a chain store unit. Obviously, there must be certain modifications.

In the first place, the Census of Distribution does not include stores which may be classified as services: laundries, shoe repair shops, barbers, etc. We have made a rough estimate of the sales and number of stores and possible rentals of shops in the category, at the bottom of the chart. The number of stores is thereby increased to 70. This is a field in which accurate statistical survey and research are needed.

Then also, it must clearly be taken into consideration that the Census of Distribution was made in 1929, a "prosperity" year. In so far as *prices* may have been permanently lowered since that time, it will affect the total volume of sales, but by lowering the whole scale of costs, wages and rents, it will probably not have materially changed the number of stores required. On the other hand, it is probable that the permanent purchasing power of such a community, in terms of *goods,* will remain for a long time below the 1929 level. The effect of this probably will not be very great on stores dealing in staples, particularly those in the food group. The luxury goods outlets will, of course, be the first to be affected, but the extent of this effect cannot as yet be gauged with any accuracy, as we may still hopefully assume that present levels of purchasing power are as far below the norm as 1929 was above.

Radburn, however, has certain special characteristics which will further influence the basic index figures on our chart. For one thing, its population is not likely to include any very wealthy or any very poor people. This fact will tend to decrease to a certain extent the amount of strictly luxury goods consumed, but it may also tend to increase the per capita consumption of staples: food, drugs, dry goods, services, etc., even possibly automobiles. Special requirements due to particular characteristics of the population must be considered. Educators, skilled workers and clerks have all about the same income but with very different buying and living habits.

The consumption of coal, wood and ice depends obviously on the arrangements for heating, refrigeration, etc. The possible existence of local industry and of wage-earners employed at Radburn although living outside, will have considerable influence on restaurants, and also on amusements. The fact that both Ridgewood and Paterson are large centers for the sale of automobiles may further modify the possibility of such sales at Radburn.

Another modifying factor is the fact that, particularly outside the field of staple goods, the size of a chain store unit cannot be used too rigidly. This is probably more true of restaurants than of any other single item. It is quite possible that smaller restaurants and cafés of a different character from the usual chain establishment might well be conducted on a profitable basis, but the income and the ground area required will remain approximately the same.

How Generally May Our Ratio of Stores to Population Be Applied

This is a very important question and must be answered very emphatically. There is no rule-of-thumb method for determining either the amount of sales or the number of stores in a new community. Every case requires special study and analysis. Our ratio of .7 of a store for every 100 people applies to Radburn itself *only* when it has reached 10,000 population. A survey of smaller communities in this region shows that there is almost invariably an enormous jump between the character of a local market for 5,000 people and one for 10,000; even between one for 8,000 and one for 10,000. Per capita sales in suburban towns of 5,000 and under are not much more than half those found in our eleven towns of over 10,000.

Moreover, this ratio will not hold even for a community of 10,000, if that community is a more dependent suburban type (i.e., closer to a large center), and it will most certainly not hold for such a community planned for an urban district. In short, all that can be useful to other planners in this study is a suggestion of *method.*

But this method is one that can be applied to similar problems for any community. It is based on ascertainable facts as to consumers' buying habits and available data on successful stores instead of on quantitative uncritical surveys of existing conditions. It shows how many stores can pay their way, not how many are needed to repeat the tragic conditions of past failures.

III. LOCATION

Neighborhood shopping centers serve purely local functions. They can depend on little or no trade from the outside. They should be placed and planned to serve and hold as much as possible of the local trade.

They should be located so that any resident may be able to either walk safely and easily to them (at least for daily convenience goods), or ride comfortably and find a parking space. If walking is made safe and attractive as it is in Radburn by completely separating pedestrian from vehicular traffic, and by paths passing through parks, there will be much less use of automobiles in local shopping. The wasteful use of the machine is likely to be more limited in the future, for even after the depression is over we will have to face reality and live on earnings rather than debt. If residents are to walk to their stores, no home should be more than half a mile from a neighborhood shopping center.

In more sparsely populated sections the shopping centers must be more widely separated. If the automobile is to be used for shopping, it is essential that stores be located where there is adequate and convenient space for parking. Many retail centers have lost their patronage through inadequate facilities for nearby parking. It is natural that it is in California, where the proportion of automobiles to population is greatest, that the effect on market planning is most apparent. There it is being recognized that parking is not a public but a private function. The Bureau of Foreign and Domestic Commerce estimates that throughout the country about a million cars are taken off the streets annually by merchants' parking provisions.

Each neighborhood shopping center should be in a carefully planned concentrated area, with all the possibilities for necessary growth considered in the original plan, leaving no leeway for shoestring development. Related stores should be planned together, and as far as possible, the whole group should be on one side of a street or in one block. If this is not possible, they should be connected by over- and under-pass.

For a long time there has been a more or less spontaneous recognition in store policy of the fact that the modern highway is a dividing line and not a means toward concentration. In most large cities, one side of a main thoroughfare is devoted principally to women's shops, while the other may be quite different in character, perhaps catering principally to men buyers. And often, even in quite small towns, food and related shops will string out down one side of a street rather than cross it.

The local shopping centers should be on or contiguous to a main neighborhood street but *not* on a regional highway. A neighborhood center's function is local. It gets little if any patronage from through traffic and such a location would be a nuisance and a danger to resident shoppers. The land is too expensive. Parking facilities are difficult to provide.

Last year the Los Angeles County Regional Planning Commission made a series of careful studies of the effectiveness of various shopping centers in picking up passing trade throughout the suburban areas of the county. A careful count was made of the number of automobiles that entered each shopping district, as compared with the number of those that stopped for purpose of shopping. As walking is practically a lost art in Southern California, it was presumed that all consumers come in automobiles. The count in each case was made during twelve hours for three days and the figures given were based on an average. It was found in every case that a far larger percentage of those passing through the retail center stopped when it was off a main traffic road.

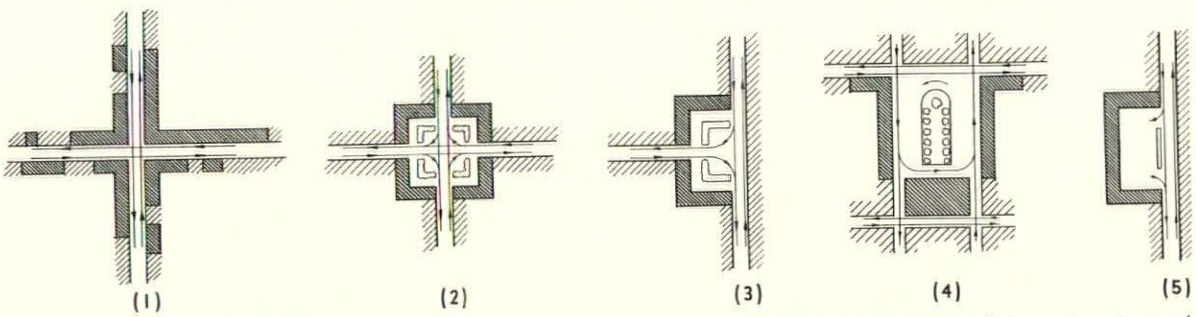
In a large community a number of shopping centers will be needed to give easy access to all. All consumers should have variety of choice of all products. But it is not strictly necessary to provide competition in every type of business in each single subcenter. In all but the more sparsely settled neighborhoods it is possible to have two centers within walking distance (one-half mile) of all homes. Where there are a large number of automobiles, the owners can easily prevent local shops from taking advantage of them by monopoly.

In a community of 10,000 such as the northern part of Radburn, there will be probably at least three centers. Only one of them will carry any large amount of specialty or shopping goods. Offices and the greater part of service enterprise will also be grouped in the main center. The smaller nuclei will be mainly for food markets, and possibly with such services as cleaner, laundry and shoe repair.

Shopping centers should be located on the interior of a development where the property is in single original ownership. If placed at the corners, competitive groups could be set up nearby which would invalidate all the constructive planning activity of the original neighborhood.

IV. THE FORM

The form of the American store, like that of the urban house, has been molded to fit the requirements of narrow rectangular lots rather than functional requirements of human needs. Stores have been measured by the foot, not by use, because they have been turned out like sausages, long strips of them all alike, no matter how different might be the requirements of site, of special use, or of grouping. It is astounding how obstinately the stereotyped standardized form of store has persisted in spite of its inconvenience and the fact that modern practice and custom has made it obsolete in form and wasteful in use. Only gradually and in a few places have new forms begun to take



(1) Originally neighborhood shopping centers grew up around the intersection of two streets and gradually spread. (2) Architectural symmetrical plaza does not lessen dangers of crossing streets. (3) and (4) Shopping center developed at one side of main traffic road; danger still exists from secondary roads. (5) A drive-in market such as has been built in Washington, D. C., in which all through traffic of automobiles is eliminated.

shape to meet the real needs of the storekeeper, customers and the community.

The automobile has been one of the dominating features of American life for more than twenty years and yet most stores are still planned without any recognition of the needs of parking. The customer is inconvenienced and the shopkeeper loses trade because this prime need is not yet recognized in any but a few places.

The danger of the automobile is gradually forcing new groupings of shopping centers. Originally they grew up around the intersection of two streets and gradually spread in a disorderly way in four directions. The difficulty of crossing traffic is leading to the concentration at one side of a road. But there are still hang-overs from the past. Architects actually plan symmetrical plazas for shopping with attractive looking store buildings at four corners of intersecting roads just as though there were no automobiles and the functions of the buildings could be made like the exterior treatment for an age long past.

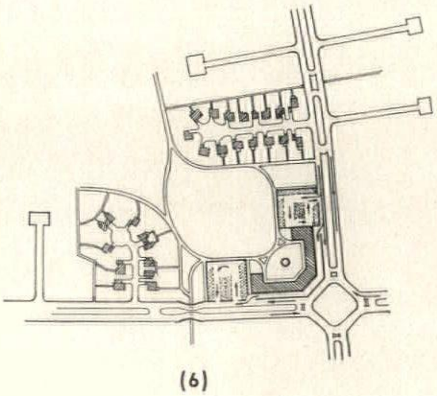
The California drive-in market has come closest to a recognition of the functional requirements of a modern shopping center. The rapid development of such regions as Los Angeles has led to the building of local shopping centers as a unified group planned for a special use and under a single management. The need of parking space has been recognized as a dominant requirement.

"Open Display" is the term most frequently applied to the modernization of store plans and interior arrangement. Everything that is for sale must be not only easily visible to the purchaser, but if possible must be within reach. Low, open shelves and complete circulation facilitate self-service, or at least reduce the cost of clerks. The store itself is likely to provide the best window display, instead of a dusty clutter of objects against an "art" background. In general, the modern food store needs a greater proportionate width to depth than the old unit.

Open display in shallow shops facilitates buying and increases the rate of turnover. The California storekeeper has apparently discovered that the need of keeping a large stock of all kinds of goods in storage like an old country store has disappeared as a result of the facility of delivery by auto truck. It is much better to keep supplies in a central warehouse where they have better care at less cost and thus save about half the depth of the store. The space saved is much more valuable for parking of automobiles.

When the neighborhood shopping center is designed as a group instead of a series of separate stores it can be made an attractive feature instead of a monotonous eyesore. Much of the beauty of the Southern California store groups comes from their colorful display of fruit and vegetables in the open. We can see no reason why the store fronts should not be open through the greater part of the spring, summer and autumn, even in cities as far north as Chicago and New York.

The final step in making the shopping center completely functional in relation to modern living is still to be realized. In the community of the future, the purely local store will follow the example of the Radburn house. It will face toward the life of the community which will center around the park. Most people will walk to the store because it will be convenient, safe and enjoyable. There will be facilities for parking automobiles, but in most built-up communities this will be of much less importance than a safe place to park the baby where the mother can watch it while she shops. The store in some cases may have two entrances and show windows, one the principal one, toward the park, the second toward the highway. But the street side of the store will in most cases be used only for delivery. Where there is only the traffic of fast-moving automobiles, the pedestrian ways will pass through the parks as they do at Radburn. Show windows are of little use to people driving by in automobiles. Well-designed lettering as a part of the group design will do much more to draw passing trade. But the neighborhood store should be designed to meet the comfort and convenience of the local customers on which it must depend. When the neighborhood store group has turned its face toward the life of the park rather than the haste and danger of the traffic road it will become a real center of the community. Its whole



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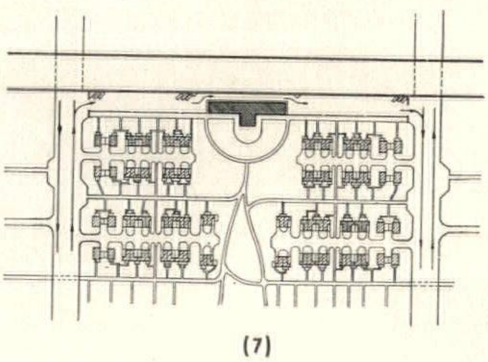


(7)

(6) and (7) The Neighborhood Shopping Center in the modern town planned so as to care for and separate pedestrians, parking and delivery.

Albert Frey

Drive-In Market, Los Angeles, California.

character may change with the development of such features as the open-air restaurant and the out-of-doors café.

V. CONTROL

What is the use of developing a scientific method of store planning? None whatever, if present methods of subdivision and chaotic development are allowed to continue. None whatever, unless the complete, planned neighborhood is accepted as the minimum unit of development. No scientific store-planning method can be applied to speculative methods of development. But, on the other hand, one of the basic reasons for the acceptance of the neighborhood unit is the *necessity* for economic planning, for the preservation for the benefit of the community of the value increment which the community itself brings to its property. And this real increment (as opposed to inflated speculative expectation-value) which must be planned for, guarded and permanently preserved, occurs in store properties.

Many of the proposed limited dividend housing companies working under the New York State Housing Laws count on making a success of their enterprises on the basis of a goodly profit from stores. Their expectation of rental values is generally far beyond what can be realized because their figures generally have not been based on any scientific relation to the buying power of the future population.

Increment value that comes to property through the presence of population affects store values much more than residential property. The retention of the maximum of the spending power of the community within the neighborhood is greatly affected by the manner in which the shopping center is planned and its development is controlled.

To maintain a healthy retail shopping center and guard the interest of all concerned, all property that can be used for store purposes must be in single ownership. Where the community is being developed by a limited dividend company in the interest of the residents, it is possible to preserve for the inhabitants the extra profits that can be derived therefrom.

The best method of serving all the interests permanently, however, is the community ownership of land and buildings for stores from the beginning.

In addition to enhancing the possibility of success in all the factors mentioned above, such an arrangement is the only one whereby the increment in value created by the community may be preserved completely and assuredly for its own advantage.

Only in these ways can property be controlled so as to preserve the wealth of the community, be an advantage to the community, or enrich the developer of the property. What this means in practice is:

1. Limiting amount of property to be used for stores in the development so as to secure maximum possible return without injury to consumer.

2. Keeping possession of all such land.

3. Preventing use of other property of development for business use by:

(a) Continued ownership of all land by community or developing company.

(b) Sale of residential land only with restriction permanently preventing its use for business. Zoning may help, but it is not a permanent guarantee against change as is private agreement. It is safer to have both.

4. Preventing value from flowing over the edge of property. If shopping center is too near edge of the development, part of it will flow over through competing stores in neighborhood properties taking advantage of attraction of parking facilities.

Restrictive legislation has been of no assistance in restricting the number of stores. Zoning at its best has not met the situation. At worst it has caused large areas to be assessed as business property far in advance or beyond the final limits of any possible need, and has thus directly encouraged the erection of wasteful tax-payers.*

The planner for the community organization must not only provide convenient and attractive shopping centers; he must limit the area, limit the number of shops, and scientifically apportion the kinds of retail enterprise. He must provide for competition and varied choice of each commodity, but not over-competition. He must see that every sort of shop which a given community will support is given a place, and he must keep out over-specialized types which the character of the community does not warrant. He must plan for rentals which will give the landlord a good return, leave the shopkeeper with a decent living, and leave the municipality with an adequate and assured tax income. He must plan and build the center as a pleasant whole, and as a nucleus for a future center commensurate with the planned probable growth of the community as a whole. The planner must achieve a practical balance between all these factors. Such coordination is achieved by thorough understanding of each element plus a clear conception of the whole pattern.

NOTE ON EXISTING FORMULAS

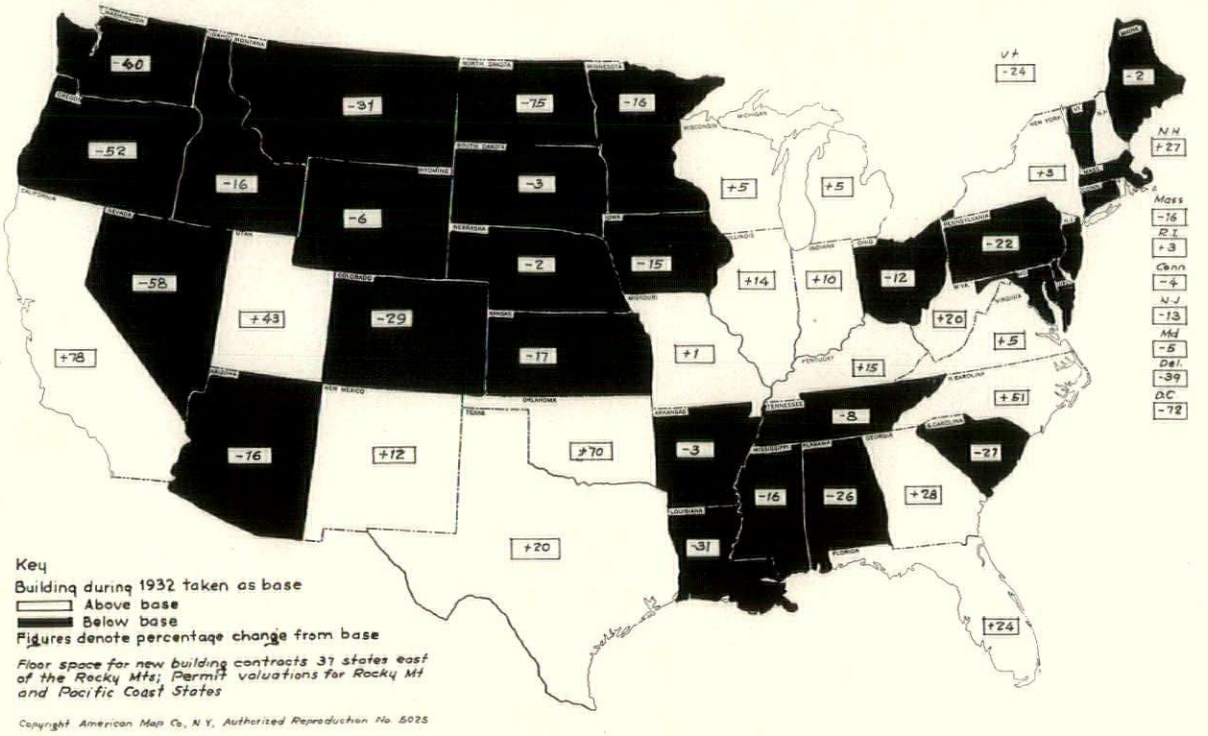
**The Regional Plan of New York and Environs* made a tabulation of retail stores as listed in the classified telephone directories of seven large cities (100,000 to 3,000,000) and used the averages obtained in this way without any sort of modification, to determine the number and kinds of stores for a community of 6,000 population. The *Chicago Regional Planning Association* went out and measured the store frontage in 17 cities and villages in the Chicago region: and the resulting average, likewise unmodified, of some 50 feet per 100 inhabitants has been widely used as a "planning" gauge. The *Milwaukee County Regional Planning Department* made a somewhat more critical survey, to show over-zoning for business. Various city planners have their own rule-of-thumb formulas, and Gardner S. Rogers of the U. S. Chamber of Commerce evolved a system of coefficients between population and stores, based on the Trial Census of Distribution, which would be admirable if that census had not already proved beyond controversy that existing conditions ought by no means to be duplicated.

NOTE ON BUSINESS ZONING

*Harland Bartholomew says: "The over-zoning of business frontage is detrimental in many respects. It has created a great surplus of business property. It has stimulated speculation in such property beyond reasonable limits, the reaction from which has resulted in depressed values. It has produced involved problems of taxation. It has invited and produced blighting of large stretches of property along our main thoroughfares."

In many cities all property fronting on main roads has been automatically zoned for business. Dr. Aronovici points out that "on this theory it was found that if every boulevard frontage in Los Angeles County were to be zoned for business there would be more business frontage than could be reasonably expected from all the population of the United States." A survey made in six districts in Milwaukee County brought to light the fact that, as a result of "shoe-string zoning," only 39.88 per cent of all the area zoned for business was actually in business use—most of the districts having already achieved their maximum density.

Dr. Richard T. Ely, land economist, said in the *New York Times* that "places can be found where, whatever standards one may take, there is twenty times the amount of property plotted for business frontage needed to satisfy any economic demand."



BUILDING TRENDS AND OUTLOOK

By L. SETH SCHNITMAN, Chief Statistician, F. W. Dodge Corporation

During the initial three weeks of January contracts awarded for all classes of construction in the 37 eastern states aggregated $146,466,500. This total compares with $207,209,500 for all of December and only $83,356,000 for January, 1933.

Of the contract total for the three-week period $128,000,000 or about 88 per cent was for publicly-financed undertakings; this proportion is by far the largest ratio of publicly-financed construction in any similar period of record. The back-log of PWA allotments for construction yet to reach the contract stage is still very large, exceeding a billion dollars; thus it should be clear that considerable sustaining influence on the contract record can be counted upon from this source over the next few months.

On indicaitons from the three-week record of January, privately-financed undertakings for the full month fell substantially below this class of work as reported during January, 1933. Unless our economy is undergoing a most fundamental change we must still rely upon private construction to produce the needed stimulus to business. It is hoped that publicly-financed construction activity will provide a sufficient rise in mass purchasing power to warrant increased private construction. But to insure this desired end effective co-ordination of all governmental agencies interested in the problem appears as the first order of business.

MATERIAL PRICE MEASURING ROD*

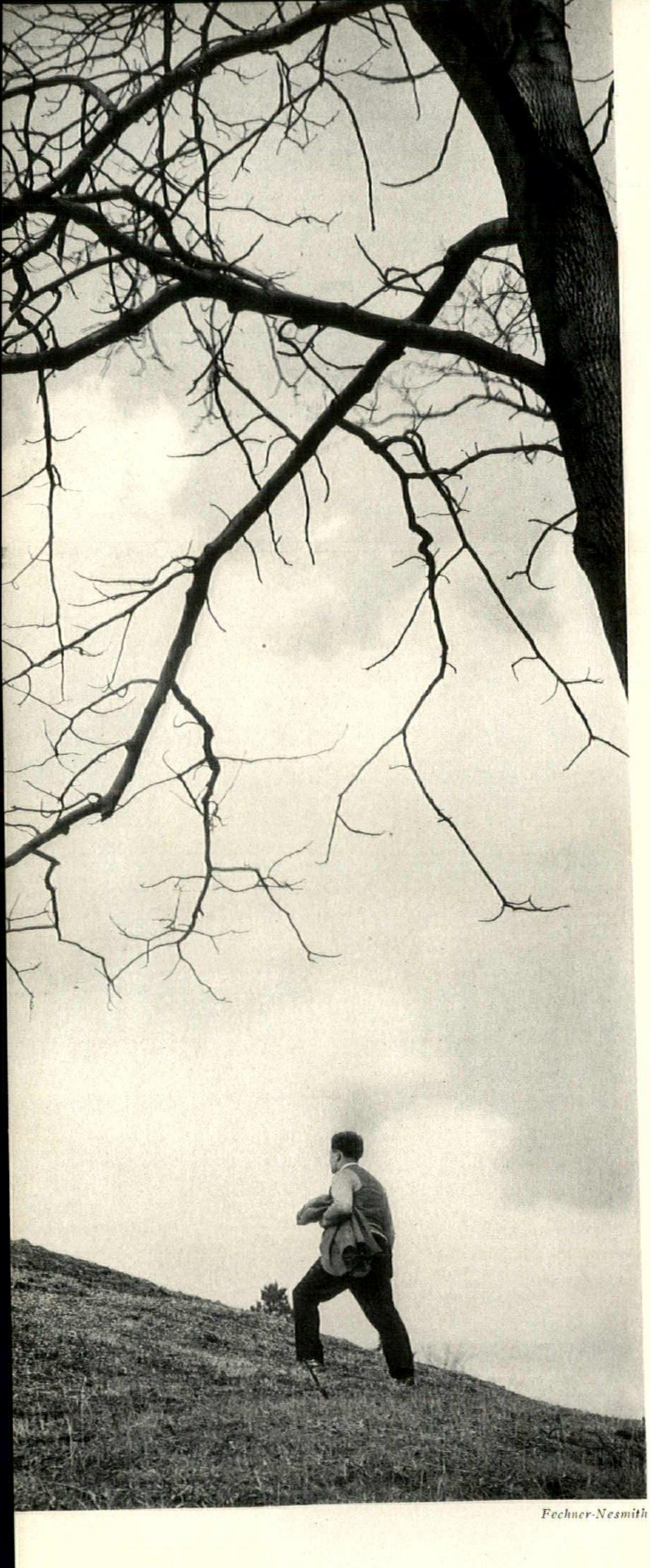
The prices in this tabulation enable one to visualize at a glance the main trend of the material market. Their significance does not extend beyond that point, and the explanation below should be read carefully.

F. W. Dodge Corporation Composite Prices as Indicated in Explanation

Material	This Month	Month Ago	Year Ago
Portland Cement..	$2.20	$2.20	$2.05
Common Brick....	12.35	12.34	11.73
Structural Steel...	1.65	1.65	1.60
Lumber	16.46	16.44	15.50

Prices given in this comparison are composite and do not in all cases refer to one item. For instance, the price of structural steel is the composite of prices of shapes and plates f.o.b. Pittsburgh; the price of lumber is a composite of five items of Southern pine and five items of Douglas fir f.o.b. mill; the price of cement is a composite of prices in fourteen different cities per barrel, carload lots, to contractors; price of brick is composite in fourteen cities per M, delivered on the job.

*As previously published in *General Building Contractor.*



Fechner-Nesmith

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M A R C H

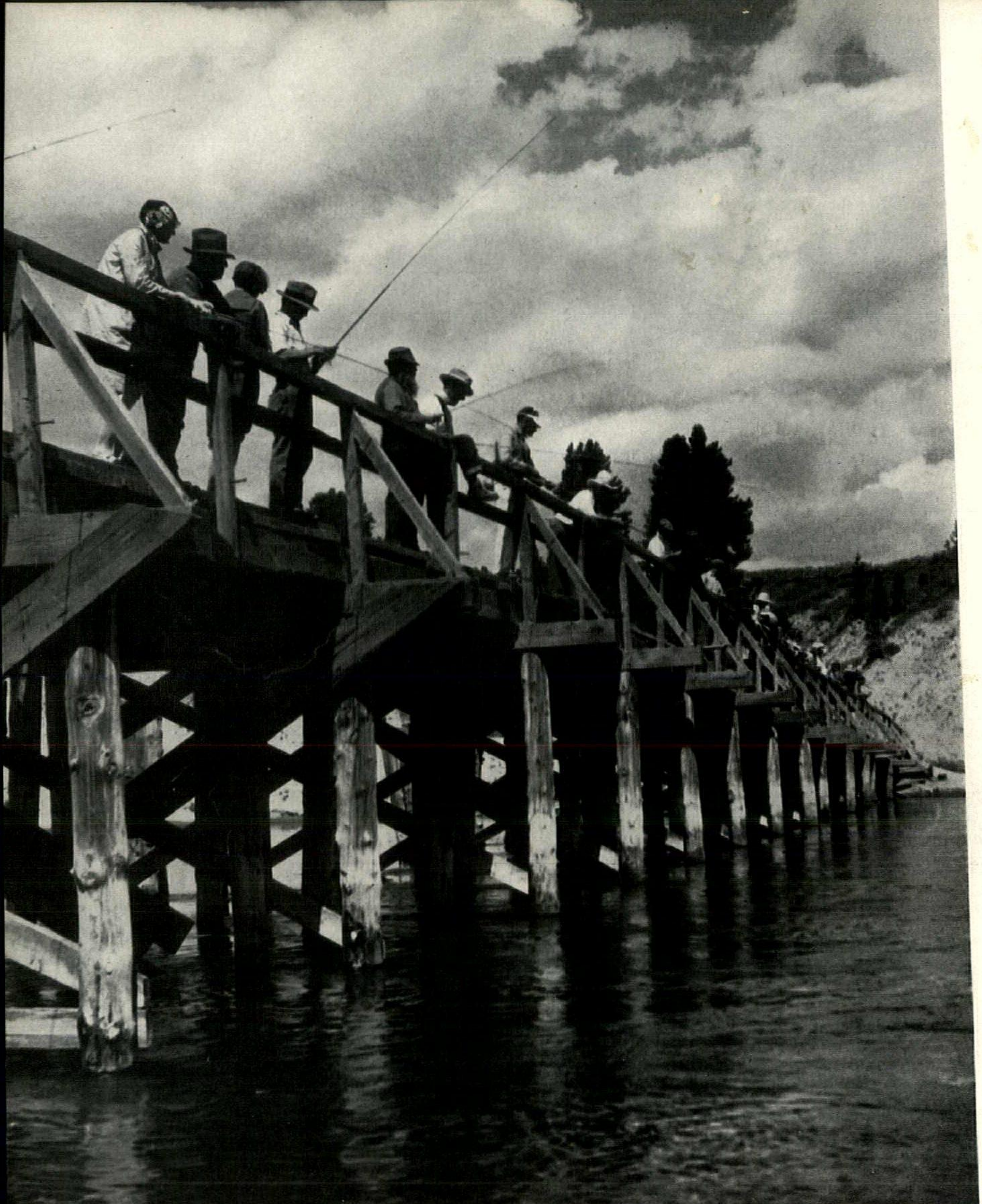
THE ARCHITECTURAL RECORD

LEISURE AS A FACTOR IN ARCHITECTURE

WILLIAM ORR LUDLOW, CHAIRMAN OF THE A.I.A. COMMITTEE ON INDUSTRIAL RELATIONS, HAD A SUGGESTIVE ARTICLE IN THE MAY, 1933, ISSUE OF THIS MAGAZINE ON LONGER HOURS OF LEISURE AS A PROSPECTIVE MAJOR INFLUENCE IN ARCHITECTURE. ARCHITECTS, HE CONCLUDED, "WILL DO WELL TO THINK A LITTLE IN ADVANCE OF THE INEVITABLE TREND." TO FACILITATE SUCH THINKING THE EDITORS HAVE BROUGHT TOGETHER IN THE PRESENT ISSUE THE FACTUAL INFORMATION AVAILABLE. THIS CONSISTS PARTLY OF THE RESULTS OF A QUESTIONNAIRE CONDUCTED BY THE NATIONAL RECREATION ASSOCIATION TO LEARN WHAT RECREATIONAL ACTIVITIES HAVE THE BROADEST PUBLIC APPEAL AND PARTLY OF A SELECTED ANNOTATED BIBLIOGRAPHY.

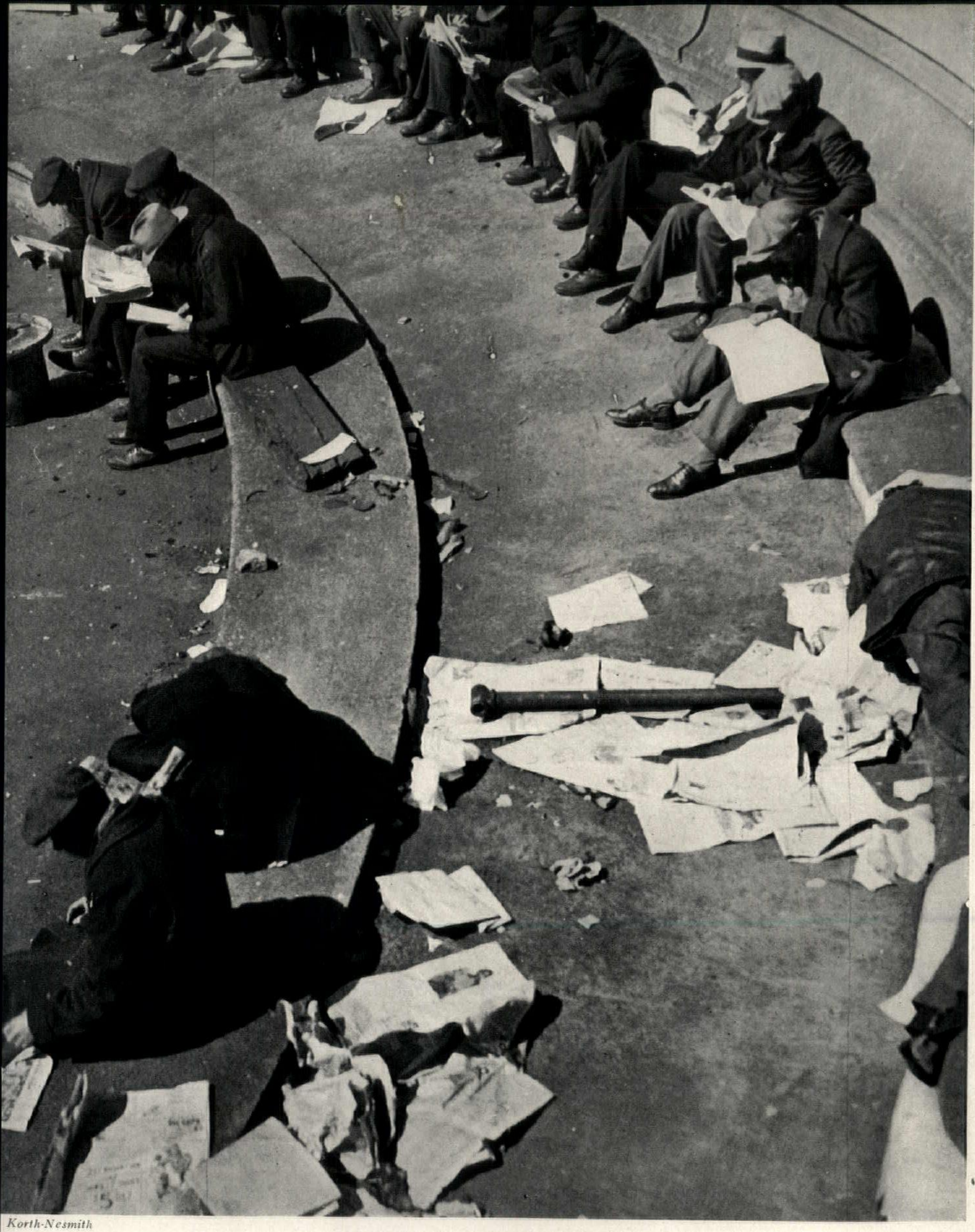
THE BIBLIOGRAPHY IS INTENDED PARTICULARLY TO CLARIFY THE QUESTION: WHAT IS MEANT BY LEISURE? IF THE WORD HAS NEW IMPLICATIONS FOR ARCHITECTURE, IT IS NECESSARY TO IDENTIFY THEM AND INCORPORATE THEM IN A REVISED DEFINITION. THE INEVITABILITY OF A PLANNED NATIONAL ECONOMY, WITH SHORTER WORKING HOURS AS AN ESSENTIAL ELEMENT, HAD INDEED BEEN FORECAST BY ADVANCING TECHNOLOGY, BUT HAD RECEIVED NO POPULAR RECOGNITION UNTIL THE PLAN FOR INDUSTRIAL CODES WAS ADOPTED A YEAR AGO. IT IS NOT SURPRISING, THEREFORE, TO FIND THAT MODERN CONCEPTIONS OF LEISURE ARE AS YET EXPRESSED WHOLLY IN TERMS OF SOCIOLOGY. THE DEFINITIONS CONTAINED IN THE BIBLIOGRAPHY ARE HELPFUL MAINLY AS A STARTING POINT FOR ARCHITECTURAL THINKING.

THE NEXT LOGICAL QUESTION IS: WHAT WILL PEOPLE DO WITH THEIR LEISURE? THERE IS NO LARGE OR VARIED BODY OF EXPERIENCE IN AMERICA TO DRAW UPON FOR AN ANSWER, NOR DOES THERE SEEM TO BE MUCH HELPFUL INFORMATION ABROAD. THE INVESTIGATION BY THE NATIONAL RECREATION ASSOCIATION IS THEREFORE OF FIRST-RATE NEWS VALUE AND WE APPRECIATE THE COURTESY WHICH ENABLES US TO PUBLISH ITS FINDINGS.



Korth-Nesmith

SECURITY AND LEISURE TIME



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INSECURITY AND SPARE TIME

What is LEISURE?

Fechner-Nesmith

LEISURE, as a social concept, is defined and its historical development traced in a brief but compact essay by Ida Craven which appears in the Encyclopaedia of Social Sciences. Broadly speaking, leisure is time at the disposal of the complete man, not the man who is exhausted by 14 hours of labor or 8 hours under a speed-up system and worried by insecurity; there must be more than just time for enough recreation to freshen the worker so that he can continue his toil.

For purposes of social analysis the concept of leisure is taken to mean simply freedom from activities centering around the making of a livelihood. "The artist, the scientist, the scholar, work at their art or science or research for their living; in another sense, theirs is the privilege of constant leisure to devote themselves to what are for them the highest pursuits. . . . One might say that the more nearly ideal the organization of society, the more perfectly would every individual's work be adapted to his abilities and the greater would be the number of people who enjoyed similar qualitative leisure through rather than outside of their work."

The ancient civilizations cultivated leisure as among the chief goods of life. The force of this concept, as it developed in antiquity, is indicated by the fact that the English word school is derived from the Greek word for leisure (schole). "Whatever complaints might be made against the luxury of the rich, however, the desirability of leisure itself was never really brought into question throughout antiquity or the Middle Ages. With the growth of capitalism there appeared a new and condemnatory attitude. The Puritan emphasis on the moral duty of continuous industry reflected the needs of a mercantilistic and later of an industrial economy. The further disparagement of arts and amusements represented the reaction of the vigorous rising bourgeois class to the luxury and display of the older aristocracy. . . .

"Certain changes of attitude are already apparent. When the eight-hour laws were under discussion in 1916 and 1917, the prospect of such accretions of free time led governments and social reformers to talk fearfully of the leisure 'problem.' Temperance societies prepared for increased drunkenness and attention was centered on the real evils of commercialized recreation as it prevailed in most large cities. . . . In 1924 the International Labor Office devoted part of its sixth conference to a discussion of the problem; in 1930

Nesmith

the First International Congress on Workers' Spare Time met at Liége with 300 members from 18 countries, the governments of 14 of which were officially represented. In the discussions of this congress and previously in those of the International Labor Office the emphasis had completely shifted from repression of commercial recreation to provision of facilities for other ways of utilizing leisure, and the conception of leisure as a problem had given way to its recognition as an opportunity and a cultural necessity. . . . "

European groups interested in workers' leisure have stressed the importance of proper housing and community planning as essential to a social and individual utilization of leisure. Urban congestion and bad transportation facilities prevent the enjoyment of leisure, and lack of space in the home throws the worker upon the streets and into commercialized amusements.

In the United States recreation has been largely limited to adolescents. Adult education does not exist except for a few notable exceptions. "The limited traditions of community living and the greater emphasis on the achievement of wealth as a goal have retarded the development of the idea of creative enjoyment of leisure. Nevertheless, here as in Europe, the automobile, the moving picture and the radio have provided the means for new forms of recreation which taste and economic change might transform into the basis of real leisure. . . . "

SOCIOLOGICAL ASPECTS OF NEW LEISURE. By George A. Lundberg, Columbia University. Sociology and Social Research, May-June, 1933.

Leisure is treated as a problem in this essay for two reasons: (1) Leisure time has increased, and the production of material necessities is now carried on by a small percentage of the population. (2) Urban civilization and mechanical devices have disrupted traditional leisure pursuits, thus compelling community recognition. The problems of leisure will not disappear as a result of any currently proposed reforms of our economic order; details may vary but the fundamental fact is that, under any system of control, masses of men would be relieved or prevented from occupying working hours in conventional manner.

The ultimate objective, the author states, is adjustment of the individual to the social order. This can be achieved by a process which may be looked at from two points of view: (1) manipulation of environment, (2) conditioning of the individual. "A certain purchasing power with a corresponding education in wants, standards, and tastes would appear to achieve the most economical and efficient adjustment."

THE THREAT OF LEISURE. By George Barton Cutten. Yale University Press. 1926.

The notion of leisure as a problem finds expression in this book. To the author the concept of leisure as an opportunity brings up the question of "Opportunity for What?" in relation to workers whose minds have become standardized by industrial routine. People have been told what they must do during working hours; as for leisure they have been told what they must not do. A more positive action must be taken, he believes.

LEISURE IN THE MODERN WORLD. By C. Delisle Burns. The Century Company. 1932.

This book, based on a series of radio talks given in London in 1932, covers a variety of contemporary factors—the social effects of motor cars, motion pictures and radio; ways of escape, like gambling and hiking; changing conventions and manners; the women's movement and children's leisure utilization; and so on. Leisure, according to the author, is the most valuable product of modern mechanisms and modern social organizations, but since it is generally regarded as a negligible by-product, it is largely wasted.

The new mechanisms, like movies and the radio, have speeded up the *rate* of social change. They are the most valuable and the most dangerous instruments of education, for they involve a much greater centralization of power in the hands of a few in every country. "They are forms of education very suitable to dictatorship; and every man knows how excellent a dictatorship would be—if he were the dictator."

RESPONSIBILITY AND CULTURE. By L. P. Jacks. Yale University Press.

In a series of lectures delivered at Yale University Professor Jacks of England contrasts the concepts of labor and leisure, and defines leisure as not inaction but a higher kind of activity: "The time when we are making the greatest demands on the services of our fellow men." That is to say, the utilization of leisure is possible only when means are provided for enjoying ourselves.

Education Professor Jacks views as the first means toward a full utilization of leisure and the fulfillment of every individual's right to self-development. The alternate objective is reciprocal education, for "unless the right to self-development immediately expands into the duty of promoting the self-development of others, the man (or the community) which possesses that right is worse off with it than he would be without it." The idea of *education,* he emphasizes, is fundamentally related to the idea of *government,* and this implies a responsibility for the educated citizen "to create values that are worth voting for."

UTILIZATION OF WORKERS' LEISURE. International Labor Conference (Geneva Labor Office, 1923), Sixth Session, Geneva, June, 1924. See also International Labor Office Annual Report, 1930, pp. 455-459.

Viewing leisure as an important study, the International Labor Office has emphasized, in its conference discussions, a twofold approach: (1) The preservation of leisure through paid work during leisure hours, improvement of transport facilities, workers' dwellings and an ordered arrangement of the working day. (2) The development of facilities for the utilization of leisure, including legislation and social hygiene.

Institutions which have been set up in recent years to facilitate workers' leisure are considered as divided into the following four classes:

1 *Improvement of economic situation of the worker.*

The object of such institutions is to give opportunity to the worker for gardening, poultry-raising and working in his home. Garden cities and workers' gardens are described as the most valuable.

2 *Promotion of physical development of worker.*

Various types of institutions are comprised, ranging from old-fashioned gymnastic clubs to modern football, athletic, alpine and similar clubs, the object of which is to encourage games and sports among workers.

Galloway

THE INFLUENCE OF THE CITY ON RURAL RECREATION HAS BEEN LARGELY NEGATIVE, BUT NOW THAT THE GROUND IS CLEARED, IT IS EXPECTED THAT ACTUAL ADOPTION OF URBAN AMUSEMENTS BY RURAL POPULATIONS WILL BE RATHER RAPID.

3 *Development of intellectual life of worker.*

for the general and technical education of workers such institutions as libraries, courses for adults, foreign language schools, technical courses, including musical and dramatic societies, are suggested.

4 *Development of participation in public life.*

Such institutions include workers' clubs, study circles for political, economic and social questions, public lectures, and the like.

LEISURE AND ITS USE: SOME INTERNATIONAL OBSERVATIONS. By Herbert L. May and Dorothy Petgen. A. S. Bowes & Co., New York. 1928.

In this book leisure is classified broadly as (1) nonorganized, comprising (a) types found in home, outdoor life, games, sports, and the like, and (b) commercial recreation; (2) organized, subdivided as (a) voluntary, e.g., clubs, and (b) provided, i.e., such activities as are furnished on the initiative of the few. The trend of recreation depends on the economic standard of the country; the greater the average man's surplus, the stronger his tendency to buy his pleasures.

Extensive quotations are made from the International Labor Conference report in 1924. Children's playgrounds are discussed. The main section of the book, however, is devoted to phases of recreation in France, Germany, and England.

In *France* there is a notable indifference to recreation as a problem. Workers' gardens are important. Adult education, as we understand the term, is practically nonexistent. Sports are a recent development but growing. Music and theater do not have a strong hold on people. The French government voted 100,000 francs annually (1) to encourage the development of sporting associations; (2) to encourage work of societies managing workers' gardens; and (3) to develop education. This work was very successful.

In *Germany* the people have a very strong social conscience. Since the war there has been a tremendous increase in voluntary organized recreation, especially in the field of sports. Workers' education is undertaken by the national government, the state governments and, in particular, the municipalities. Encouragement of gardens is considered one of the most important activities of social welfare work. The Youth Welfare Law of 1922, called the "Magna Charta of Youth," has served in certain ways to develop leisure time activities. A subsidy system provides for state theaters, operas, and orchestras; people's stage societies also are active.

In *England* there is a great emphasis on sport with attendant playing fields and services. Industrial welfare organizations spend large sums in this direction. Adult education provides studies including politics, history, philosophy, psychology, art, architecture, music, drama, and folk and rhythmic dancing. An important development of leisure in rural areas has occurred through community centers.

Notes on Belgium, Denmark, Czechoslovakia, Austria and Italy follow in more condensed

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form, and the book concludes with a short account of recreational activities in the United States.

AMERICANS AT PLAY. By J. F. Steiner. Report of President's Committee on Social Trends in the United States. Two volumes. (See Vol. 2, pp. 912-957.) McGraw-Hill, 1933.

In the cities churches, schools and various municipal associations have surrendered their recreational functions, which have been taken over by parks and playgrounds, libraries and museums, theaters, motion picture houses, professional athletic associations, cabarets and night clubs, and social and recreational clubs. Little progress has been accomplished in urbanization of rural recreation, although a beginning has been made.

The rural community appears to have developed a public recreational facility indigenous to itself. The influence of the city on rural recreation has been largely negative, but now that the ground is cleared, it is expected that actual adoption of urban amusements by rural populations will be rather rapid.

Facilities designed especially for recreational uses fall naturally into three classes: (1) commercial amusements, (2) public recreational facilities, and (3) facilities provided by closed groups for their own use.

The influence of city planning and model communities is necessary to make recreational areas available. At present public recreation as a proper function of government, the report continues, is only in the early stages of its development.

The annual cost of various kinds of recreation for the 1928-1930 period is given in the following table:

Travel	$6,492,151,000
Commercial Amusement	2,214,725,000
Leisure Time Association	382,500,000
Games, Sports, Outdoor Life	883,071,000

Popularity of expensive forms of recreation must not, however, be regarded as a sole cause of the nation's expanding recreational budget. Wider participation is of equal if not greater importance: 40,000,000 persons annually enjoy motor tours and a 100,000,000 weekly movie attendance explains enormous bills. These figures were reached in a period of prosperity, of course. Perhaps during a period of slower development there may be greater success in building up a recreational program that is better balanced and more carefully planned in the interests of general welfare.

PUBLIC OPPORTUNITIES AND FACILITIES FOR LEISURE TIME RECREATION, AMUSEMENT AND INSTRUCTION IN AMERICAN CITIES. Municipal Reference Library, City of Chicago, 1926.

This volume contains the results of a survey for the purpose of disclosing facilities for leisure time in various communities, especially in relation to—

1. Music, bands, orchestras.
2. Symphony and other concerts, choral classes and community singing.
3. Drama, opera, indoor and outdoor theaters.
4. Art galleries and museums.
5. Moving picture shows and lectures.

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6. Folk dancing, social dancing.
7. Indoor and outdoor games.
8. Swimming pools, baths, bathing beaches.
9. Athletics, gymnasiums, skating rinks.
10. Forest and park camping.
11. Pool and billiard tables and bowling alleys.
12. Baseball fields, boxing and wrestling contests.
13. Civic and social entertainments and meetings.
14. Other public neighborhood and community recreations.

In addition, the problem of leisure time and the value of community recreation are discussed.

The 1925 expenditures for recreation, in toto and per capita, are given for the following cities: Boston, Milwaukee, Buffalo, Washington, Rochester, Chicago, Minneapolis, Detroit, San Francisco, St. Louis, Philadelphia, Indianapolis, Baltimore, New York City, Pittsburgh, New Orleans, Cleveland. All data are presented concisely, and should be valuable to anyone interested in knowing the status of representative leisure activities in this country in the period before the depression years.

THE NEW LEISURE CHALLENGES THE SCHOOLS. By Eugene T. Lies. National Recreation Association. 1933.

This study was made by Mr. Lies for the National Recreation Association, because of a conviction that education must play a larger part in the problem of utilization of free time and that character values are inherent in play and recreation; and because of the active part played by the Association in community recreation. Emphasis is placed on the recreational aspects of leisure. Only public schools in cities of 5,000 and upward were covered in the study; rural and parochial schools were not touched.

The text is principally a report of findings as to content of school programs and prevailing teaching practice for (1) physical education, (2) reading and literature, (3) dramatics,

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(4) music, (5) arts and handicrafts, (6) nature study, (7) social training and opportunities, (8) extra-curricular activities. There are also chapters on after-school hours, vacation time for school children, evening schools, recreational opportunities for nonschool youth and adults, and the place of the school in relation to other factors in solution of the problem of leisure.

THE NEW LEISURE, ITS SIGNIFICANCE AND USE: A Selected Bibliography. Compiled by Grace P. Thornton. Bulletin of the Russell Sage Foundation Library, Number 117, February, 1933.

Probably the best and most up-to-date checklist of (1) bibliographies, (2) books and (3) periodical references on the general subject of leisure is to be found in this bulletin published by Russell Sage Foundation, 130 East 22nd Street, New York City, and obtainable at a cost of 10 cents a copy. It is recommended to those who may wish to investigate the subject in greater detail. A listing of publications on hobbies is also included.

THE LEISURE HOURS OF 5,000 PEOPLE

A REPORT OF A STUDY OF LEISURE TIME ACTIVITIES AND DESIRES CONDUCTED BY THE NATIONAL RECREATION ASSOCIATION

This investigation was made last year (May 15-August 31) by the National Recreation Association, with three major objectives: to determine (1) what people are doing in their free time, either occasionally or often, (2) what changes have occurred in the use of this free time during the past year or so, and (3) what they would really enjoy doing if the opportunity were afforded.

The individual questionnaire method, in spite of its limitations, was adopted as the only practicable means of securing from a large number of persons in a brief period data as to their free time activities and interests. The questionnaire consisted chiefly of a checklist of 94 activities covering a wide and varied range of interests. Spaces were provided beside each activity for the individual to place a check mark in case he took part in the activity (1) once in a while, (2) often, (3) more than before, (4) less than before, and (5) if he would enjoy taking part in the activity. In addition, questions were asked as to the individual's age, sex, occupation and employment status, recent changes in his recreational activities, his interest in serious study, and a few others. Persons were asked not to sign their names.

Because of limited time and the need for economy the investigation was confined to a few communities sufficiently different in size and type, however, to give a fairly representative picture. A total of 29 cities in 10 States were studied, particularly Boston; Newark; Worcester, Mass.; Irvington, N. J.; Ossining, N. Y.; Millburn, N. J.; and Durham, N. C. In order to include as typical a cross-section of the communities as possible the cooperation of a wide range of agencies was enlisted. In most instances the cooperating agencies assumed responsibility for the distribution of the questionnaires among the groups with whom they were in contact. Factors kept in mind in the placement of the blanks were a fair balance between various occupational, social, nationality and age groups, the two sexes, and between the various degrees of employment. Industrial and commercial concerns placed the questionnaires so as to secure returns from executives, foremen, the sales force, skilled and unskilled laborers. Five thousand and two questionnaires, in addition to a few which were either incomplete or arrived too late for tabulation, were turned in. Among the occupations listed with more or less frequency were hatters, bellhops, housewives, embalmers, truckmen, sausage makers, freight handlers, barbers, meat cutters, weavers, teachers, social workers, librarians, authors, janitors, actresses, brokers, dancers, models, playground directors, musicians, clerks, nurses, housemaids, chauffeurs, salesfolk, telephone operators, machine operators, mill workers of all sorts and kinds, executives of many types, mechanical and construction engineers and architects. No tabulation has yet been made by occupations, but the lists indicate that the effort to reach a diversified group was successful.

Of the 4,447 people who reported their sex, nearly three out of five were women, or 2,606 women as compared with 1,841 men. The considerable number of teachers, store clerks and office workerss participating in the study doubtless explains these figures. Approximately three out of five, or 2,520 out of 4,217, reported they were single. Slightly more than one-half of the men were married—920 as compared with 829 single—whereas among the women only 777 were married and 1,691 were single. Considerably more than one-half of the participants were between 21 and 35 years of age. Only a few persons over 60 filled out the questionnaire. It is of interest that the average age of women in the study is lower than that of the men. The replies also indicated that nearly 30% of the people had little or no regular employment during the preceding year. A larger proportion of the women were employed on a full-time basis than is the case of the men.

The 5,002 persons reported a total participation of 126,442. In other words, the average number of activities taken part in by each individual was 25. Participation in home activities totaled 59,613, somewhat less than the outside activities which numbered 66,829. The average number of home activities engaged in was 12 as compared with 13 outside the home.

The field work in gathering the data was carried on by Miss Beatrice Stearns of the Association's staff. George D. Butler was largely responsible for the tabulation and interpretation of the returns and the preparation of the report, which has just been published as 83 pages of tables and text in mimeograph form. The report is obtainable from the National Recreation Association, 315 Fourth Avenue, New York City, at a cost of $1 a copy.

OUTSTANDING FACTS DISCLOSED BY THE NATIONAL RECREATION ASSOCIATION STUDY

1. The home is the center for a large and increasing percentage of leisure time activity for large numbers of people.

2. The average number of activities taken part in outside the home, especially often, is relatively small and did not increase during the past year.

3. To a considerable degree leisure time activity at the present time is largely determined by low cost and availability, rather than by the real desires of people.

4. The expressed desires of large numbers of individuals can be realized only as opportunities are made available through community provision for them.

5. The limited evidence available indicates that people working comparatively short hours but with reasonable security are utilizing their leisure increasingly in a wider range of varied activities than are people of any other employment status.

6. Age, sex and marital status are factors which have a considerable and varying influence upon people's leisure time activities and desires.

WHAT ARE PEOPLE DOING WITH THEIR FREE TIME?

ACTIVITIES PARTICIPATED IN	OCCASIONALLY	OFTEN
1. Reading newspapers and magazines	3,977	(1) 3,244
2. Listening to the radio	3,955	(2) 2,842
3. Attending the movies	3,670	(8) 1,642
4. Visiting or entertaining others	3,445	(7) 1,672
5. Reading books—fiction	3,408	(3) 2,155
6. Auto riding for pleasure	3,246	(6) 1,765
7. Swimming	2,976	(9) 1,603
8. Writing letters	2,899	(10) 1,158
9. Reading books—nonfiction	2,847	(5) 1,776
10. Conversation	2,735	(4) 2,141
11. Playing bridge (home)	2,505	(11) 1,078
12. Picnicking	2,389	(23) 740
13. Attending theaters	2,228	(18) 801
14. Parties or socials	2,193	(17) 816
15. Hiking	2,152	(19) 768
16. Card parties (home)	2,126	(24) 734
17. Family parties	1,994	(28) 617
18. Dancing parties (home)	1,972	(21) 766
19. Playing tennis	1,841	(20) 767
20. Serious study	1,837	(12) 987
21. Caring for flower garden	1,817	(14) 947
22. Attending card parties	1,813	(29) 573
23. Backyard games, etc.	1,775	(49) 382
24. Taking part in political, church or civic activities	1,747	(15) 915
25. Visiting art or other museums	1,732	(55) 352
26. Day outings	1,709	(31) 532
27. Informal play hours with children	1,702	(16) 893
28. Sewing and millinery	1,694	(22) 750
29. Reading at library	1,648	(26) 656
30. Caring for home grounds	1,625	(13) 967
31. Concerts (admission fee)	1,595	(46) 402
32. Attending lectures, debates, forums	1,592	(34) 500
33. Attending amusement parks	1,570	(40) 444
34. Attending concerts (free)	1,515	(39) 457
35. Boating	1,480	(36) 496
36. Ice skating	1,378	(38) 460
37. Playing musical instruments	1,367	(27) 655
38. Playing indoor games other than cards	1,357	(45) 471
39. Indoor game parties (home)	1,344	(37) 410
40. Carpentry, painting, repair jobs	1,342	(33) 507
41. Attending community or club dances	1,316	(35) 497
42. Baseball (playing)	1,282	(30) 542
43. Playing horseshoes	1,175	(51) 370
44. Listening to the victrola	1,173	(47) 402
45. Fishing	1,167	(60) 312
46. Reading aloud	1,115	(59) 312
47. Loafing	1,114	(48) 382

This table indicates the relative importance of various activities, based on the reports of 5,002 persons who indicated whether they had participated (1) once in a while or (2) often. The rank order is according to the first classification, but the figures in parentheses indicate the relative sequence for the second. This second column is important because frequency of participation may be a greater factor in measuring free time activity than mere range of interests or activities.

ACTIVITIES PARTICIPATED IN	OCCASIONALLY		OFTEN
48. Playing basket ball	1,104	(32)	514
49. Caring for pets	1,066	(25)	661
50. Family singing	1,037	(43)	416
51. Indoor bowling	1,030	(58)	324
52. Attending dance halls	1,005	(56)	334
53. Playing golf	977	(63)	301
54. Organized group picnics	962	(64)	293
55. Roller skating	931	(62)	306
56. Lodge meetings and activities	908	(44)	414
57. Weaving and fancy needlework	905	(52)	368
58. Taking part in amateur dramatics	904	(73)	216
59. Gymnasium classes	904	(42)	440
60. Caring for vegetable garden	899	(41)	443
61. Art—modeling, painting, drawing	846	(54)	362
62. Playing handball	842	(61)	308
63. Pool and billiards	839	(74)	211
64. Coasting	817	(75)	208
65. Camping	814	(68)	274
66. Playing volley ball	805	(65)	292
67. Home singing or concerts	804	(57)	329
68. Playing playground baseball	765	(50)	372
69. Nature study	758	(67)	276
70. Attending meetings and productions of dramatic groups	754	(71)	243
71. Singing in a choral group	716	(53)	364
72. Writing poems, stories, etc.	696	(79)	205
73. Taking part in debates, discussion groups, etc.	688	(69)	264
74. Playing croquet	675	(87)	159
75. Other lecture and study courses	633	(66)	289
76. Motor camping	624	(84)	170
77. Plays and dramatic stunts (home)	620	(78)	205
78. Bicycling	554	(81)	186
79. Taking part in Parent-Teacher activities	547	(72)	233
80. Attending meetings of musical organizations	534	(76)	207
81. Community singing	505	(83)	179
82. Hunting	484	(85)	165
83. Attending evening school	472	(70)	260
84. Play reading and study groups	428	(86)	165
85. Chess or checker clubs	392	(89)	140
86. Miscellaneous collections	392	(77)	206
87. Stamp collections	363	(88)	148
88. Playing in instrumental groups	348	(82)	181
89. Playing soccer	333	(92)	106
90. Hobbies (in and around the home)	286	(80)	201
91. Archery	280	(94)	81
92. Playing in bands, orchestras and other groups	272	(90)	136
93. Poultry raising	226	(91)	107
94. Hobbies (outside the home)	159	(93)	95

GENERAL OBSERVATIONS

1. Seven out of the ten most popular activities are carried on in or around the home; only three are outside activities.

2. All seven of the most popular home activities involve little or no expense to the individual.

3. The cost of the three outside activities is not great. In other words, the economic factor seems to be of considerable importance.

The ten activities carried on by the largest number of people are also the ten which are carried on often by most people, although the ranking of several varies between the two lists. Reading newspapers and magazines and listening to the radio are first and second respectively on both lists.

4. Two of the three outside activities on the most popular list, namely, attending the movies and swimming, drop in rank on the list of activities taken part in often. This suggests that their cost affects frequency of participation.

5. The ten most popular activities are predominantly indoor, individual, quiet or passive. The factors of group participation, social intercourse and physical activity are almost entirely lacking although they are more in evidence in the next ten.

ON THE 94 ACTIVITIES

6. The number of people reached by programs of recreational and educational agencies is small compared to those who participate in activities carried on by the individual, either at home or in informal outside activities.

7. There are only eleven activities in which as many as one-half of the people reporting take part even once in a while.

8. Few people take part in music, drama and crafts as compared with other types of activities, and the frequency with which they are carried on is correspondingly low.

9. The activities which have a much higher rank in the list of things done often—in other words in which the people taking part spend considerable time—are inexpensive and, for the most part, home activities.

10. With very few exceptions the activities which are reported by comparatively few people have a correspondingly low place in the list of activities taken part in often.

11. With a few exceptions, games, sports and outing activities are reported by relatively few people and the number who take part in them often is proportionately small.

HOW USE OF LEISURE IS INFLUENCED

ACTIVITIES RANKED IN ORDER OF TOTAL PARTICIPATION

MEN

Activities	MARRIED 21–26	27–35	36–45	46–60	60–	SINGLE 16–20	21–26	27–35	36–45	46–60	No. Times Listed
Radio	1	2	1½	2	2	2	4½	2½	2	1½	10
Reading magazines and newspapers	2	1	1½	1	1	1	1	1	1	1½	10
Movies	3	3	4	3	8	3	2	2½	3	3	10
Swimming	4½	4	5			5	4½	5			6
Visiting and entertaining	4½	5	3	5	8		8	7	7	4	9
Reading books—fiction	6	6	6	9½	8	4	3	4	4		9
Auto riding	7	7		8	6	7	6	8	5	6	9
Playing baseball	8					8					2
Playing bridge	9	10						10			3
Playing horseshoes	10										1
Reading books—nonfiction		8	8	9½	5	6	7	6	6	9	9
Carpentry, painting and repairing		9	7	4	10					9	5
Informal play hours with children			9								1
Caring for home grounds			10	6	3						3
Caring for flower gardens				7	4						2
Conversation						9	9		9½	6	4
Backyard games						10					1
Writing letters							10		8	6	3
Attending theater								9			1
Hiking									9½		1
Fishing									9½		1
Reading at library										9	1
Total											22

WOMEN

Activities	MARRIED 21–26	27–35	36–45	46–60	SINGLE 16–20	21–26	27–35	36–45	46–60	No. Times Listed
Visiting and entertaining	1	2	3	3	5	3	4	4½	3	9
Reading magazines and newspapers	2	1	1	2	2½	2	2	1	1	9
Listening to radio	3	3	2	1	1	6	1	2	2	9
Attending movies	4	4	5	5½	2½	1	3	4½	5½	9
Auto riding	5	5	9	8	7	5	6	6½	7	9
Reading books—fiction	6	6	7	10½	4	4	5	3	4	9
Swimming	7	10½			6	8				4
Picnicking	8½	8		10½				10		4
Writing letters	8½	7	6	7	8	7	7	6½	5½	9
Sewing and millinery	10½	9	4	4					10	5
Playing bridge	10½					10	8			3
Family parties		10½								1
Caring for flower garden			8	5½						2
Reading books—nonfiction			10		10		9	9	8½	5
Caring for home grounds				9						1
Attending parties and socials					9					1
Conversation						9		8	8½	3
Attending theater							10			1
Total										18

BY AGE, SEX AND MARITAL STATUS

GENERAL OBSERVATIONS:

1. Single persons, both men and women, take part in a much greater number of activities than do married people.
2. Men in both groups participate in a slightly larger number of activities than women of the same marital status.
3. Activities outside the home are taken part in to a much greater extent by single men and women than by married persons.
4. Married men take part about equally in both outside and home activities whereas married women engage in more home than outside activities.
5. Participation varies inversely with age.
6. The decrease in range of activities as age increases is not constant for all four groups, varying from 53% for single men between ages 21–26 and 46–60 to 27% for married women. Furthermore, the decrease in outside activities is twice as great as that in home activities.
7. Single men and women 21-26 have a much more varied leisure than married persons. This advantage disappears with age, however, especially in the case of men.
8. In general, young men enjoy more leisure activities than young women, but in later life women take part in an even greater number of activities than men.
9. At 21–26 and also at 46–60 all four groups take part in approximately the same number of home activities.
10. Home activities become relatively more important than outside activities in all groups as persons become older.
11. Beyond 26 years of age, single women take part in more activities than any other group, although men, both married and single, take part in more outside activities up to 35.
12. Maximum participation among the women in the single group is at 16–20 years of age; among the men in the single group 21–26 years of age. The total number of activities of those two groups is almost identical, more of the men's activities, however, are outside the home.
13. There is a striking similarity in the ranking activities of both men and women, married and single, of various ages.

VARIATIONS IN SPECIFIC ACTIVITIES:

1. Participation in drama is unusually high among single men 21–26.
2. In educational, music and commercial recreation activities, single men participate more than married men at all ages except 36–45. There is a big drop in social activities among single men after 35.
3. Single women maintain an active interest in outing, music, educational and social activities to a much greater extent than do men beyond the age of 35.
4. In games and sports, participation is sustained to a much greater degree by married than single men. Relatively few married women take part in games and sports; active interest of both single and married women drops earlier than it does with men.
5. It is surprising that conversation which appears several times in the lists of single men and women is entirely missing in the married people's lists.
6. Reading books, especially fiction, ranks higher in the list for single persons, men and women, than for married people. Attending the movies ranks higher among single than married women; the opposite is true of visiting and entertaining.

WHAT CHANGES HAVE OCCURRED

RANK ORDER OF ACTIVITIES AS TO NET INCREASE IN PARTICIPATION

Reading magazines and newspapers	962
Listening to the radio	738
Reading books—nonfiction	610
Conversation	583
Caring for home grounds	391
Caring for flower garden	334
Reading books—fiction	322
Swimming	319
Visiting and entertaining	316
Serious study	272
Informal play with children	253
Carpentry	232
Auto riding for pleasure	232
Taking part in political, church, and civic activities	219
Sewing and millinery	188
Caring for pets	167
Caring for vegetable garden	143
Playing tennis	135
Playing bridge	122
Reading at library	102

RANK ORDER OF ACTIVITIES AS TO NET DECREASE IN PARTICIPATION

Listening to the victrola	188
Ice skating	185
Attending movies	184
Attending legitimate theater	148
Coasting	137
Pool and billiards	136
Indoor bowling	109
Motor camping	101
Attending amusement parks	99
Backyard games	96
Bicycling	91
Playing croquet	76
Roller skating	75
Playing golf	74
Playing musical instruments	46
Stamp collecting	43
Attending concerts (admission fee)	43
Archery	38
Weaving	37
Attending dance halls	36

IN THE USE OF LEISURE TIME?

This table indicates in rank order the 20 activities which the largest number of people reported taking part in *more* than before as compared with the number doing them *less*. It represents, in other words, those showing the greatest net increase in participation, which is perhaps the truest picture of the trends in leisure time activity during the year preceding the study.

CONCLUSIONS:

1. Increased leisure time activity has been centered primarily in and around the house. Nine out of the first 10 and 15 of the first 20 showing a net increase are home activities.
2. Passive forms of recreation head the list and 14 of the 20 activities are quiet in nature.
3. With two or three exceptions, their cost is negligible and several activities involve actual or potential economic returns.
4. Social and large group activities are few. Types involving team play, such as organized games, bands and orchestras, are entirely missing. In this respect, and also in its lack of outing activities, the list indicates a somewhat unbalanced development.

A study of the activities taken part in *less* is also needed in judging the changes during the past year. This table indicates the 20 activities which the largest number of people reported taking part in *less* than before as compared with the number doing them *more*. In other words, it lists in rank order those showing a net decrease in general participation.

CONCLUSIONS:

1. The activities showing decreased participation are in rather striking contrast to the list showing increased participation. Fifteen of the 20 activities done less are outside the home.
2. Fourteen are characterized by physical and, in several cases, strenuous activity. Only 4 are passive in nature.
3. More than one-half of the twenty involve considerable expense.
4. Most of the activities are essentially individual rather than group or social in type. The effect of mild winters is reflected in the decrease in winter sports. Dance halls suffered less than the other commercial activities, confirming reports that many young people go there for lack of other opportunities.

COMPARISONS

A STUDY HAS BEEN MADE OF THE CHANGES REPORTED BY FOUR EMPLOYMENT GROUPS FOR THE PUR

POSE OF DETERMINING THE PARTICULAR ACTIVITIES IN WHICH THE CHANGES HAVE BEEN MOST MARKED

ACTIVITIES WHICH TWICE AS MANY PEOPLE REPORT DOING **MORE**: BY EMPLOYMENT GROUPS

FULL TIME	PART TIME	OCCASIONALLY	NOT AT ALL
Carpentry and repair jobs	Caring for home gardens	Attending meetings and productions of drama groups	Caring for vegetable garden
Caring for pets	Sewing and millinery	Caring for home grounds	Caring for home grounds
	Art	Sewing and millinery	Sewing and millinery
	Carpentry and repair jobs	Carpentry and repair jobs	Loafing
	Loafing	Loafing	Family singing
	Family singing	Home sings	Listening to radio
	Home sings or concerts	Listening to radio	Reading books—fiction
	Listening to radio	Reading books—fiction	Reading books—nonfiction
	Reading books—fiction	Reading books—nonfiction	Serious study
	Reading books—nonfiction	Playing bridge	Caring for pets
	Informal play hours	Visiting and entertaining others	Playing playground baseball
	Caring for pets	Informal play hours	Hiking
	Hobbies (home)	Miscellaneous collections	Camping
	Playing basketball	Hobbies (home)	Nature study
	Attending concerts (free)	Swimming	Fishing
	Play reading and study groups	Taking part in church, political or civic activities	Playing in band or orchestra
	Reading at library		Attending evening school
	Attending evening school		Lecture or study courses
	Taking part in Parent-Teacher activities		Visiting art and other museums
	Visiting art and other museums		Taking part in church, civic or political activities
	Attending parties and socials		
	Hobbies (outside)		

In addition, the following three activities belong in each group's list:

Caring for flower garden
Reading magazines and newspapers
Conversation

1. People employed full time have a diminishing variety and frequency of leisure time activity. This group has not only the fewest activities in the list showing the greatest net increase, but also the largest number of activities in the list indicating lessened participation. It is obvious that people employed full time do not have as much free time as the other groups.

2. The part-time group enjoys the most favorable position as to range and increasing richness of activity. It may be fairly assumed that a majority of this group have more leisure time than those employed full time, that they have a degree of security in their jobs even though incomes are rather limited. The activities done less than before are few and relatively unimportant as compared with those done more. The reports seem to indicate that the added leisure resulting from part-time employment makes possible, and is already being used for, a richer recreational life.

3. The situation with respect to people occasionally employed or entirely without employment is less clearly defined. In every comparison the unemployed are in a much less favorable position, with respect to the range, frequency and changes in their leisure time activities than are the people employed part time. Obviously, they are handicapped by enjoying freely their free time, which for the most part is not due to their choice. The activities they are doing *more* include a varied and highly desirable list but many types of activity are entirely closed to them. It is evident that these two groups, even more than the people employed full time and part time, are largely dependent upon either their own limited resources or those provided by public and private agencies for opportunities to enjoy and benefit by their abundant free time.

CTIVITIES WHICH TWICE AS MANY PEOPLE REPORT DOING **LESS**: BY EMPLOYMENT GROUPS

FULL TIME	PART TIME	OCCASIONALLY	NOT AT ALL
ackyard games	Weaving and fancy needlework	Playing in instrumental groups	Backyard games
rt	Listening to victrola	Writing poems, stories, etc.	Listening to victrola
oafing	Stamp collecting	Playing baseball	Hobbies (home)
istening to victrola	Playing golf	Playing volley ball	Playing volley ball
Vriting poems, stories, etc.	Indoor bowling	Playing golf	Pool and billiards
ancing parties	Fishing	Playing horseshoes	Roller skating
laying baseball	Coasting	Indoor bowling	Attending concerts (with fee)
laying volley ball	Community singing	Pool and billiards	Attending legitimate theater
laying basketball		Organizing group picnics	Attending movies
laying croquet		Day outings	Taking part in amateur dramatics
laying horseshoes		Motor camping	Lodge meetings and activities
rchery		Camping	
ool and billiards		Fishing	
ymnasium classes		Bicycling	
amping		Roller skating	
unting		Chess and checker clubs	
oasting		Attending amusement parks	
icycling		Attending dance halls	
aking part in amateur dramatics		Attending legitimate theater	
ttending parties and socials			
hess and checker clubs			
ttending amusement parks			

n addition, the following two activities belong in each group's list:

Playing soccer
Ice skating

WHAT DO PEOPLE REALLY WANT?

One purpose of the study was to learn the things which people really desire to do during their leisure hours. Each person was asked to indicate what he or she would enjoy doing and which there is now little or no opportunity to take part in. It was felt that this type of information would more truly indicate needs than a recording merely of people's interests. Many persons failed to fill out this part of the blank, either due to indifference or to lack of appreciation or understanding of leisure time interests. Doubtless the desires expressed by many people were based upon or limited by their experience which in many cases has been meager. The desires which were expressed, however, give an interesting picture as to the unmet recreational wants of a large number of individuals.

Since taking part in an activity, especially if infrequently, naturally influences the desire for more opportunity, the accompanying table of most desired activities also lists the total number of people taking part as well as those reporting frequent participation. The activities are listed according to rank of expressed desires. It should be kept in mind that if all the 5,002 persons had reported what they would enjoy doing, the numbers indicating desires in this table would be approximately 50% greater.

RECREATIONAL ACTIVITIES DESIRED BY MOST PEOPLE

ACTIVITY	No. REPORTING DESIRE FOR	TOTAL No. TAKING PART	No. PARTICIPATING OFTEN
Playing tennis	837	1,841	767
Swimming	793	2,976	1,603
Boating	773	1,480	496
Playing golf	732	977	301
Camping	676	814	274
Caring for flower garden	666	1,817	947
Playing musical instrument	660	1,367	655
Auto riding for pleasure	639	3,246	1,765
Attending legitimate theater	617	2,228	801
Ice Skating	597	1,378	460
Hiking	576	2,152	768
Taking part in amateur dramatics	575	904	216
Fishing	564	1,167	312
Listening to the radio	546	3,955	2,842
Attending movies	538	3,670	1,642
Picnicking	535	2,389	740
Motor camping	525	624	170
Attending concerts (free)	511	1,515	457
Gymnasium classes	493	904	440
Reading books—fiction	486	3,408	2,155

CONCLUSIONS:

1. Games, sports and outing activities head the desired list. The 5 activities desired by the greatest number of people are of this type; so are 12 out of the first 20 on the list.

2. Outside activities predominate. Only 4 of the first 20 are home activities.

3. Physical activity is greatly desired. Only 6 quiet or passive activities are found in the first 20 on the preferred list.

4. Social and organized group activities are conspicuously absent; of the first twenty only two—taking part in amateur dramatics and gymnasium classes—necessarily involve cooperation, although several may be conducted on a group basis.

5. The things most desired are obtainable as a rule only at cost to the individual. With the possible exception of caring for the flower garden, the entire list of 10 most desired activities involve some individual expenditure, either for equipment, instruction or admission fees. Several involve costs of two or more types.

6. More than one-half of the activities—and the ones which are desired by the largest number—cannot be provided by the individual himself. They involve facilities, organization, leadership or some other special provision by public or private agencies.

7. There is no consistent ratio between the number of people desiring to take part in the various activities and the number already taking part. Where the majority of people already take part, a relatively less unmet desire is recorded. On the other hand, many people would enjoy participation in some activities in which large numbers already take part, such as auto riding and swimming.

8. Activities which train people for jobs or which have a direct economic value are absent from the list. No adult education activities such as serious study, lecture courses or evening school are represented in the list.

CONCLUSIONS:

1. The widespread appeal of the activities which were found to be desired by the largest number of individuals, for the whole study, is apparent from the fact that 9 of them appear at the head of the list of activities desired most by the various age groups, men and women. Ice skating alone is missing from the list and its place is taken by listening to the radio.

2. Ice skating is listed as one of the 10 most desired activities by 5 of the 9 women's groups, most of them single women. This group comprised more individuals than any other in the study, so the high ranking of ice skating is accounted for.

ACTIVITIES MOST DESIRED BY **MEN**

ACTIVITY	MARRIED					SINGLE				
	21—26	27—35	36—45	46—60	60—	16—20	21—26	27—35	36—45	No. times listed
Tennis	1½	8	10			3	1	1	5½	7
Swimming	1½	1	7			2	3½	2½	5½	7
Fishing	3½	2	1	1	4½		9½		1	7
Baseball	3½					4				2
Pool and billiards	6								5½	2
Boating	6	7	5½	2		1	3½	8	5½	8
Hunting	6		5½	10		6		9½		5
Camping	8½	5½		8½			9½	4½		5
Auto riding	8½	9½	2	3	4½	7		4½		7
Playing musical instrument	11					8½	5	6½		4
Playing basketball	11					8½				2
Listening to radio	11		8½	4½	9	10				5
Attending the movies		3	4	6½						3
Golf		4	10		9	5	2			5
Attending the theater		5½	3				6	2½		4
Bowling		9½							5½	2
Picnicking			8½							1
Caring for flower garden			10	4½	9					3
Backyard games			10		1½					2
Caring for vegetable garden				6½						1
Poultry raising				8½	1½					2
Reading books—nonfiction					4½					1
Caring for pets					4½					1
Reading magazines and newspapers				9						1
Playing horseshoes				9						1
Motor camping							7			1
Taking part in amateur dramatics							8			1
Attending concerts (free)								6½	5½	2
Attending evening school								9½		1
Gymnasium classes									5½	1
Attending card parties									5½	1

Note: Figures indicate rank order of activity according to number of persons desiring it.

3. The extent to which outside rather than home activities are most desired is indicated by the fact that the former appears 73 times in the women's lists as compared with 24 desires for home activities. The difference in the men's lists is even more marked: 75 outside as compared to 20 inside activities.

4. A much wider range of activities is represented in the ranking lists indicating desires than in the corresponding lists representing activities engaged in. This suggests that opportunities for taking part in many of the desired activities are limited.

5. Except for the activities appearing frequently in the lists of both married and single people, home activities predominate in the list of desires of both married men and women. On the other hand all but one of the leading desires of single men and women alone are outside activities. Single women desire strenuous, outdoor activities for a larger period than do married women.

ACTIVITIES MOST DESIRED BY WOMEN

ACTIVITY	MARRIED 21–26	MARRIED 27–35	MARRIED 36–45	MARRIED 46–60	SINGLE 16–20	SINGLE 21–26	SINGLE 27–35	SINGLE 36–45	SINGLE 46–60	No. times listed
Tennis	1½	7½			2	2	1			5
Caring for flower garden	1½	1	1	1		5	5	2	2½	8
Playing musical instrument	3½	7½			4½		6			4
Boating	3½				1	3½			8½	4
Camping	5				3	10		10½		4
Swimming	7	2	11		4½	3½	3	6		7
Picnicking	7	9½						6	8½	4
Roller skating	7				10	7				3
Ice skating	9				7	8	9½	10½		5
Playing golf	10½				6	1	2	3		5
Bicycling	10½				9					2
Auto riding		5	5	8				7½	8½	5
Attending concerts (free)		3½	5	6½					8½	4
Taking part in amateur dramatics		9½	11		8	6	4			5
Attending theater		6	5					1	4	4
Attending movies		3½	2½	9						3
Listening to radio			2½	2						2
Caring for vegetable garden			7	3						2
Reading magazines and newspapers			8½	4½						2
Attending concerts (fee)			8½				9½	4	2½	4
Reading books—fiction			11							1
Visiting and entertaining				4½						1
Sewing and millinery				6½						1
Caring for home grounds				9						1
Listening to victrola				9						1
Hiking						9	8	7½		3
Gymnasium classes							7			1
Nature study									1	1
Archery								6		1
Visiting museums									5	1
Reading books—nonfiction									8½	1
Day outings									8½	1

Note: Figures indicate rank order of activity according to number of persons desiring it.

THE ECONOMIC SIGNIFICANCE OF VOLUNTARY LEISURE

BY HAROLD S. BUTTENHEIM
EDITOR, THE AMERICAN CITY

The remarkable development in recent years of the automotive and motion picture and radio industries is bringing to many former thrift-worshippers a new point of view. Doubtless more than half of the immense sums spent annually on the purchase and operation of automobiles can be attributed to the urge of pleasure or luxury, rather than to business needs. But no one believes that if the American people were to refrain from these expenditures on leisure-time enjoyment the nation would become richer. No, what we need is a bolder approach to the more abundant life—more abundant both for those who spend wisely and for those who profit economically thereby.

For the architect or landscape architect who is looking to the future with hope, rather than to the past with regret, the coming age of voluntary leisure offers a challenge. The structure and facilities to be designed will be manifold: libraries, museums, educational buildings, community houses, theaters, auditoriums, parks, playgrounds, swimming pools, bath houses, golf courses, country club buildings, stadiums, baseball and football fields, tennis courts, gymnasiums, bowling alleys, dance pavilions, summer resort hotels, tourist camps, parkways, bridle paths, skating rinks, toboggan slides, and the rest of the list which might range alphabetically from airports to yacht basins.

More than one man of wisdom, from Aristotle to John H. Finley, has pointed out that a true end of education is to make possible the best use of leisure. May it not be that the best use of the architect's present leisure will be to advance this true end of education?

Photos by F. S. Lincoln

TRANS-LUX THEATER, NEW YORK CITY

THOMAS W. LAMB, ARCHITECT

Projection is from the back of the screen. It was developed from the daylight screen used in stock exchanges and brokerage offices. The reversal of film required by this method is accomplished in the lens system. This projection method was described in The Architectural Record, June, 1932, page 38.

This theater has 450 seats, spaced 42" apart, back to back, allowing clearance and without disturbing persons seated. The theater can accommodate 25,000 persons per week. The theater is intended for a short program consisting of ½ hour news and ½ hour short reels (animated cartoons, comedy, etc.).

The plan includes a spacious lounge and toilets for men and for women. The women's toilet is furnished with dressing tables.

The air-conditioned air is changed every three minutes, and is adjusted to 72°, winter temperature, and 70-78° summer temperature.

PORTFOLIO

TRANS-LUX THEATER, NEW YORK CITY. THOMAS W. LAMB, ARCHITECT.

VIKING APARTMENTS, MILWAUKEE, WISCONSIN. MARTIN TULLGREN AND SONS, ARCHITECTS.

AN EXHIBITION ROOM, HAMBURG, GERMANY. KARL SCHNEIDER, ARCHITECT.

A PROPOSED INTERNATIONAL STUDENT CENTER, GENEVA, SWITZERLAND. ALFRED ROTH, ARCHITECT.

PROPOSED PARKING GARAGE, BUS STATION AND HOTEL, RICHMOND, VIRGINIA. LEE, BALLOU AND VAN DEVOORT, ARCHITECTS.

A NEWS REEL MOVIE IN A RAILROAD STATION. CINCINNATI UNION TERMINAL, CINCINNATI, OHIO. FELLHEIMER AND WAGNER, ARCHITECTS.

DRIVE-IN THEATER, CAMDEN, NEW JERSEY. DESIGNED BY R. M. HOLLINGSHEAD, JR.

SHOWROOM FOR REUSS STUDIOS, INC., NEW YORK CITY. ERNST AUERBACH, DESIGNER.

U. S. POST OFFICE AT GLEN COVE, LONG ISLAND DELANO AND ALDRICH, ARCHITECTS.

SHOPPING CENTER, GLENDALE, CALIFORNIA. GORDON B. KAUFMANN, ARCHITECT.

JEWELRY STORE FOR FINLAY STRAUS, NEW YORK CITY. PERCIVAL GOODMAN, INC., ARCHITECTS.

APPLE STORAGE WAREHOUSE, CROZET, VIRGINIA. VAN RENSSELAER H. GREENE, ENGINEER.

FACTORY BUILDING FOR THE OTIS ELEVATOR COMPANY, TOKYO, JAPAN. ANTONIN RAYMOND, ARCHITECT.

FRENCH EMBASSY, TOKYO, JAPAN. ANTONIN RAYMOND, ARCHITECT.

TWO SERVICE STATIONS, TOKYO, JAPAN. BY ANTONIN RAYMOND, ARCHITECT.

A SERVICE STATION, YOKOHAMA, JAPAN. ANTONIN RAYMOND, ARCHITECT.

POLICE AND FIRE STATION, NEEDHAM, MASSACHUSETTS, GEORGE ERNEST ROBINSON, ARCHITECT.

MERCHANDISE MART, ST. LOUIS, MISSOURI. PRESTON J. BRADSHAW, ARCHITECT.

A BUS TERMINAL, NEW YORK CITY. THOMAS W LAMB, ARCHITECT.

THE RESPESS AIRSHIP DOCK. ROBINSON AND STEINMAN, CONSULTING ENGINEERS.

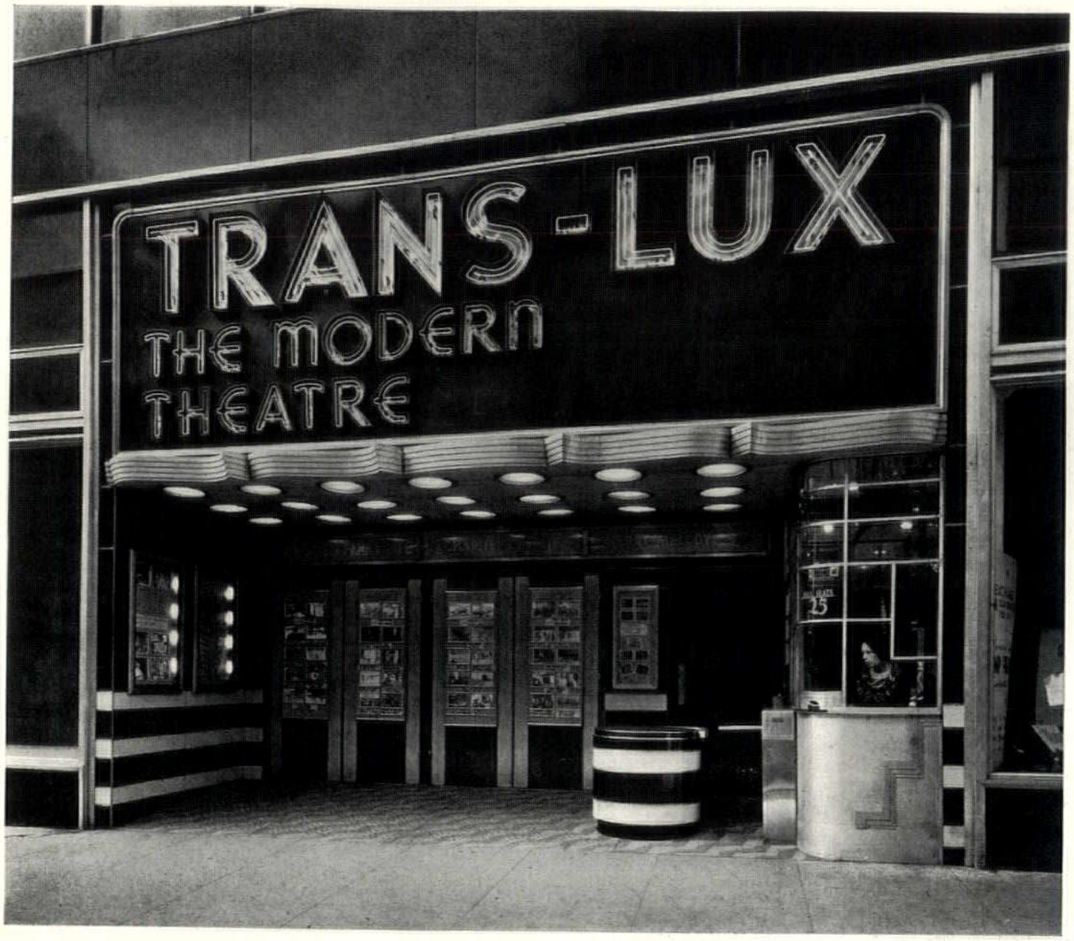
A SUBWAY GROCERY STORE FOR THE "A. & P.," PHILADELPHIA, PENNSYLVANIA.

SPORT AND COMMUNITY CENTER, BRESLAU, GERMANY. RICHARD KONWIARZ, ARCHITECT.

MUNICIPAL AIRPORT AND RECREATION CENTER, ENTERPRISE, ALABAMA. H. L. HOLMAN, JR., ARCHITECT.

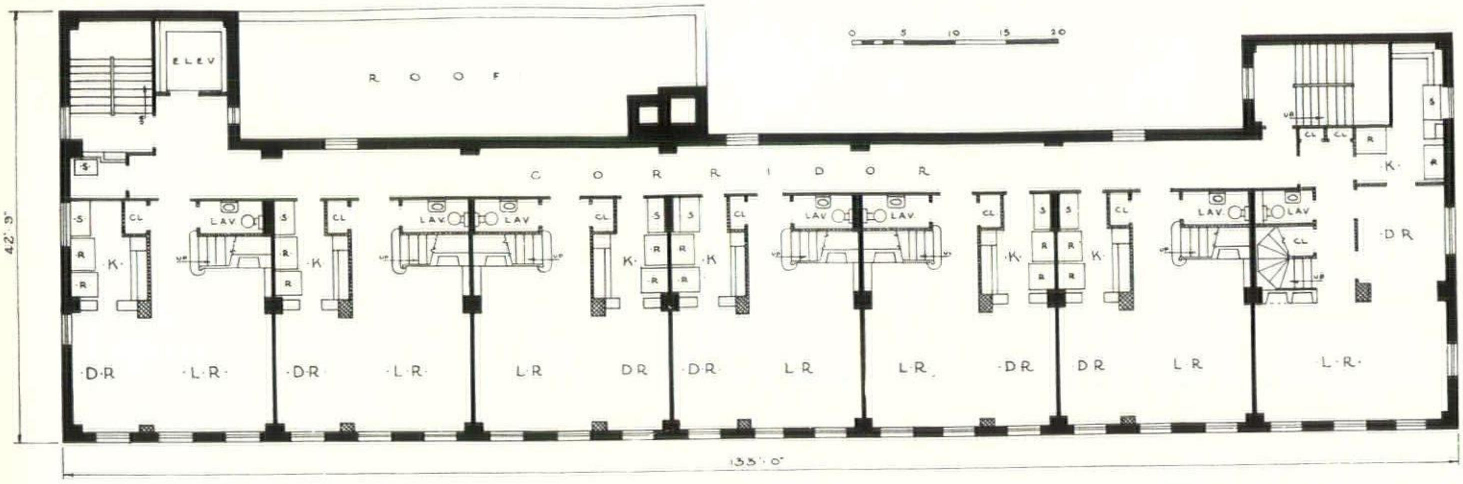
A CAFE AT CANVEY ISLAND, ENGLAND. CHRISTIANI & NEILSEN, LTD., ENGINEERS.

COMBINED FOOTBRIDGE AND PIPE LINE. CHRISTIANI & NEILSEN, LTD., ENGINEERS.

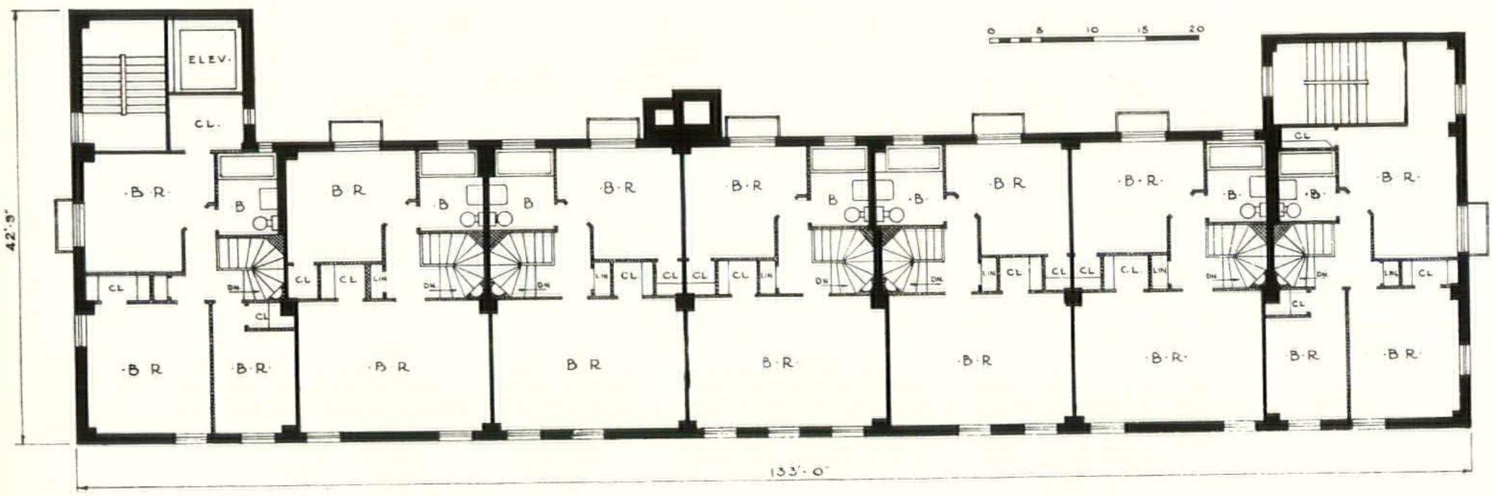


ENTRANCE

GENERAL VIEW OF
THEATER BUILDING

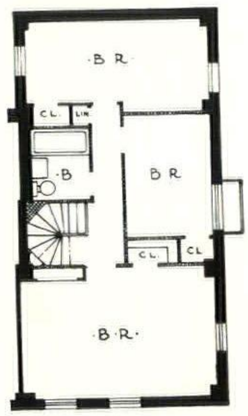


PLAN AT CORRIDOR LEVEL



PLAN AT BEDROOM LEVEL

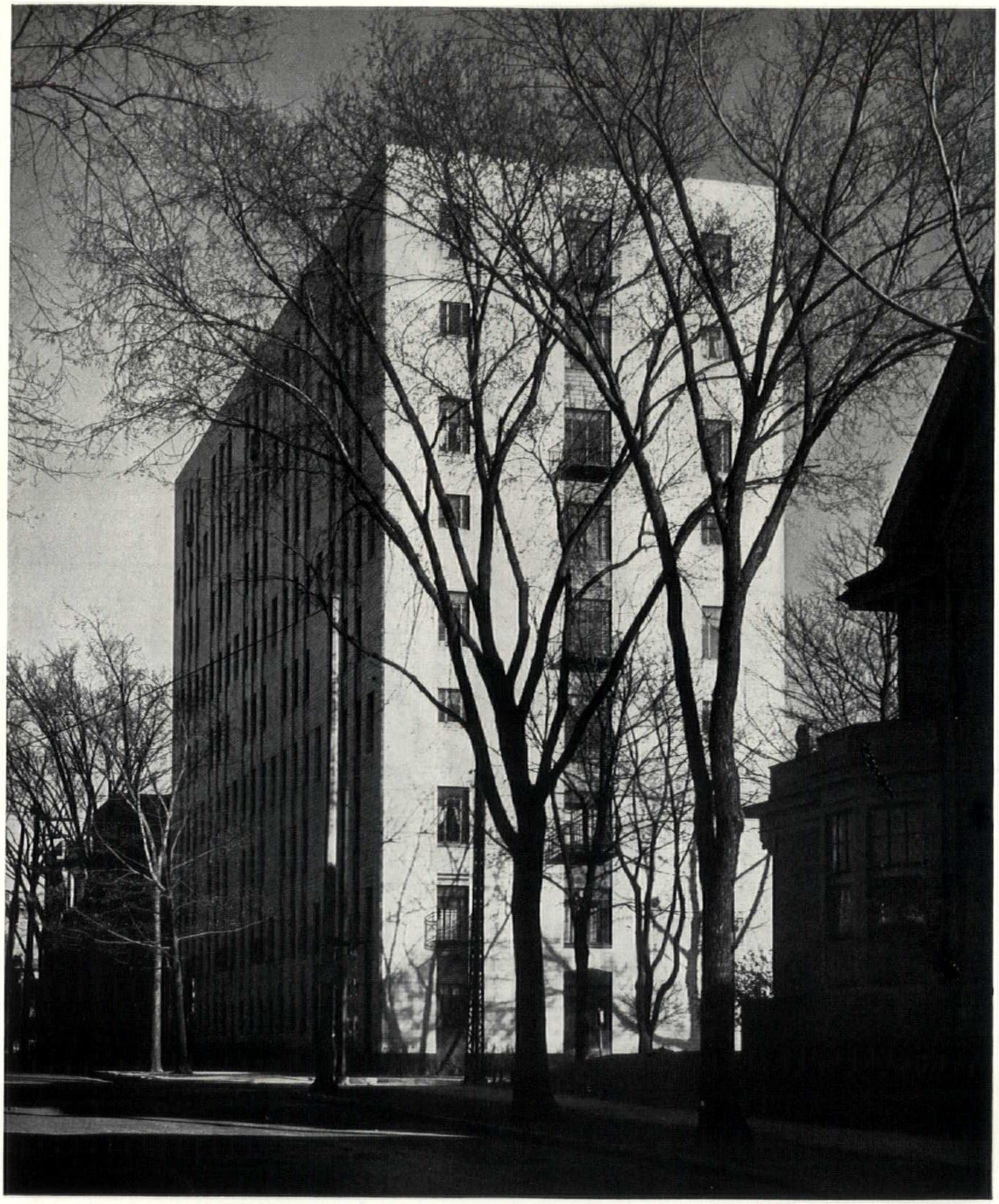
This apartment house, developed by Milwaukee architects, is the forerunner of a newly developed plan for residence apartments. The new Tullgren Plan places corridors on alternate floors. The separate apartments occupy two floors accessible from the corridors. By reducing corridor space there is an increase in space utilized for rooms of the apartment. Under the Tullgren Plan, the units that account for 80 per cent of total building cost are standardized and may be purchased and prefabricated locally. Prefabrication of this type is essentially an assembly operation and may be conducted advantageously by local labor.



VIKING APARTMENTS, MILWAUKEE, WISCONSIN

MARTIN TULLGREN AND SONS, ARCHITECTS

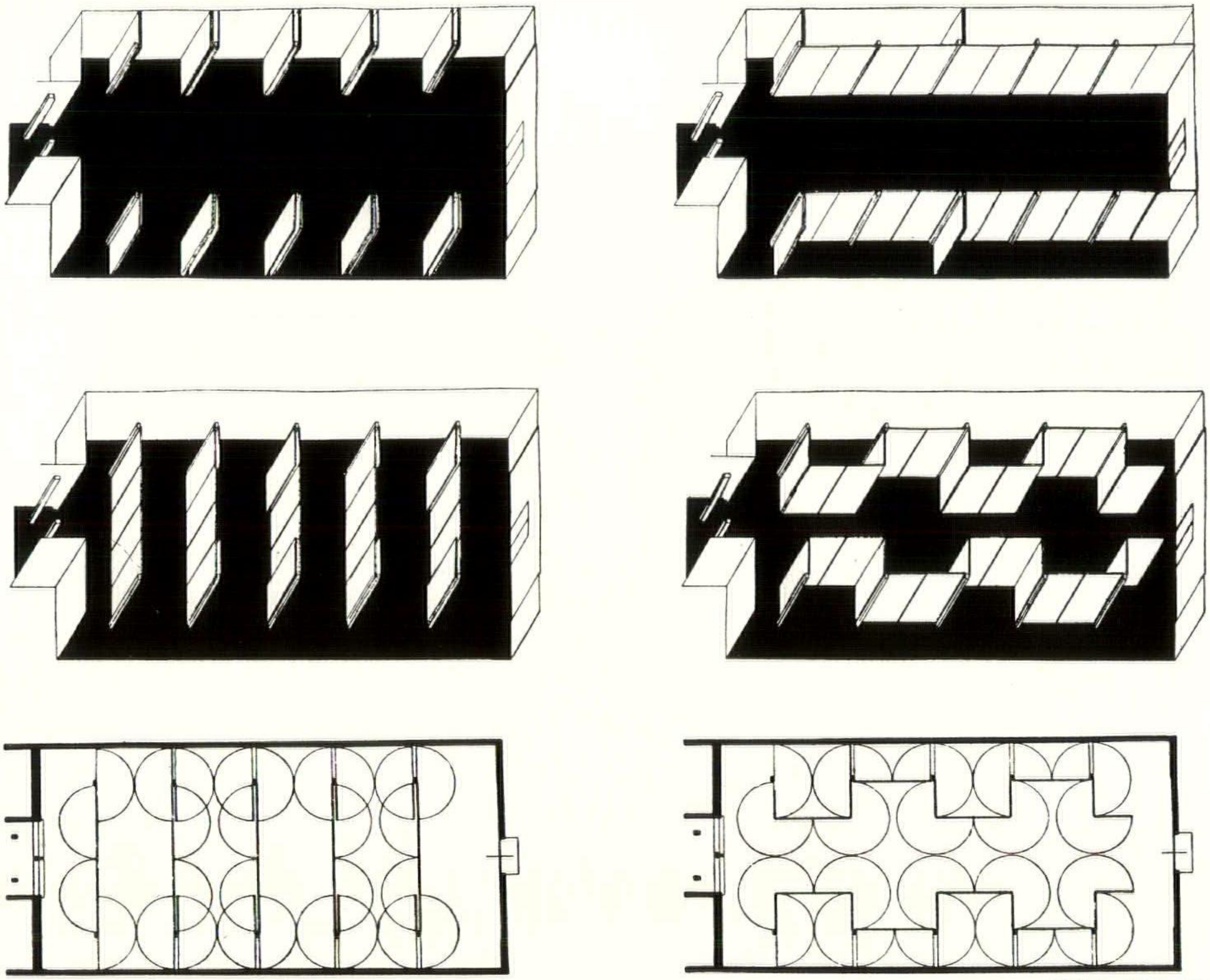
BEDROOM PLAN FOR TOP FLOOR



EXTERIOR

VIKING APARTMENTS, MILWAUKEE, WISCONSIN

MARTIN TULLGREN AND SONS, ARCHITECTS



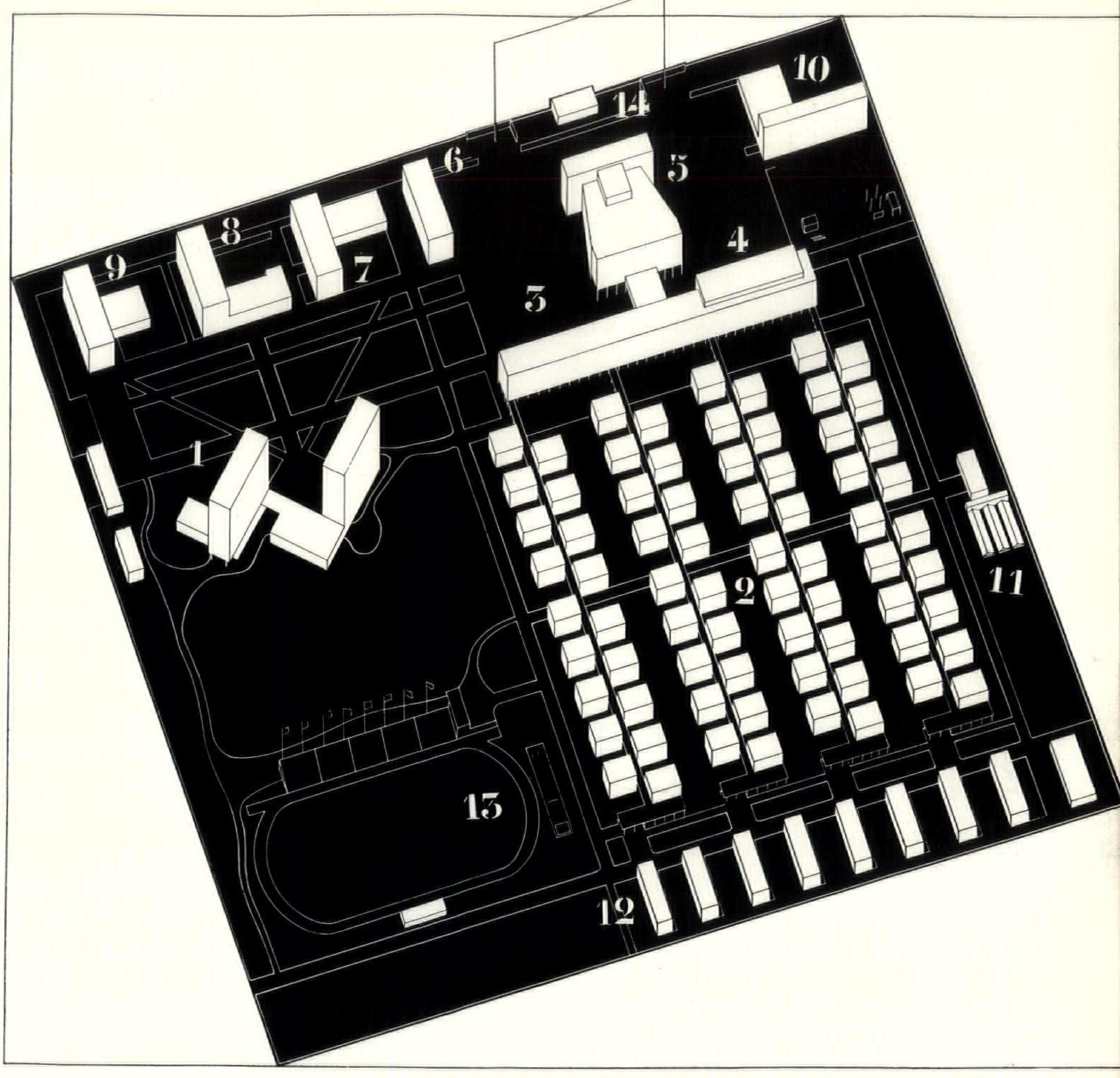
Moderne Bauformen

AN EXHIBITION ROOM, HAMBURG, GERMANY

KARL SCHNEIDER, ARCHITECT

Most art exhibition rooms are not designed exclusively for display of pictures. They are also used for sculpture, prints, photography, architecture, etc. Each of these arts has certain conditions. There also exists the problem of exhibiting various arts at the same time. The ideal exhibition room must at any time be able to fit these different conditions. We should be able to isolate and to divide; to reduce and extend space. The best solution, therefore, is a flexible room such as the architect Karl Schneider, professor at the State Art School in Hamburg, has designed in his remodeling of the Hamburg Art Association Building. The remodeling was done at minimum cost.

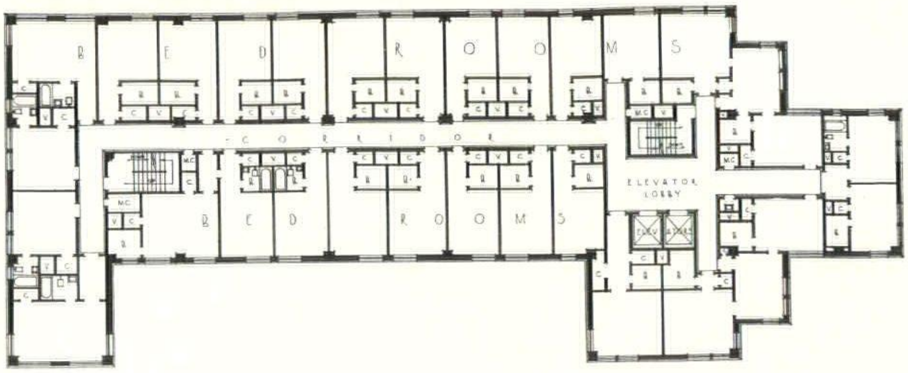
Partitions are of flexible wood veneer panels. The illustrations show some of the combinations which can be made with these panels. The amount of wall space can be multiplied about three times inside a given space. The room has a complete skylight in order to insure lighting under all conditions.



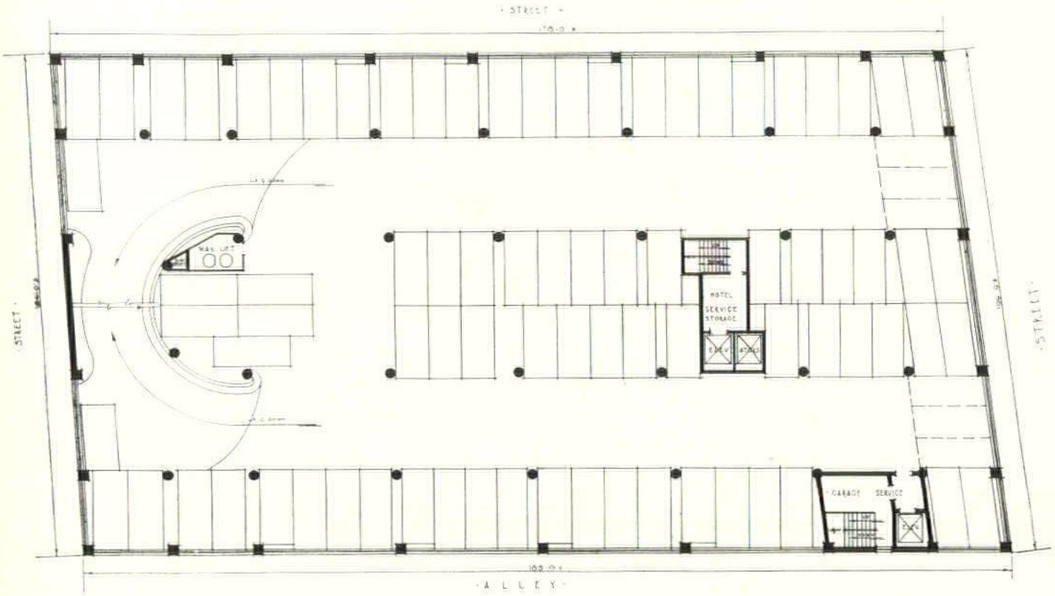
1 Dormitory 2 Studios (one pavilion for every nation or region) 3, 4, 5 Classrooms, library, auditorium 6 Hygienical (dwelling, working, recreation, transportation) 7 Institute of production and absorption (statistical, pictorial material) 8 Anti-war museum 9 Ethnographic institute (present state of countries and people and their production ability—pictures, maps, films, etc.) 10 Architectural and engineering school. The school accepts modern architecture as an essential factor in modern social life. Young architects and craftsmen are given the opportunity of developing their profession in close contact with the other activities of the school. 11 Agricultural experimental farm (to contribute to the food supply of the institution) 12 Housing for permanent collaborators, teachers, visitors 13 Sporting grounds, stadium, play areas 14 Radio station

Since the spring of 1931 there has existed in Geneva a college for working peopl composed of about 40 students from the following countries of northern Europe Denmark, Finland, Norway and Sweden. The aim of this school is to study and co ordinate the economical, political and social problems which these smaller nation have in common. Some of the initiators are permanent or temporary collaborators i the International Department of Labor of the League of Nations. This school, how ever, is entirely independent from other international institutions in Geneva and ha no political character. Geneva has been chosen for its seat, because the work o such an organization is only fruitful when it is done outside the states interested in i and also because of the existing institutions in Geneva. At the present time the three months courses are held on a country estate near Geneva. Much interest in this typ of school exists not only in the northern states of Europe but also in international circle because of the excellent results obtained. There has come to light the thought o making it accessible also for students of other nations than those which were th founders. The reproduced drawing may be called a proposal for a fully expande international school.

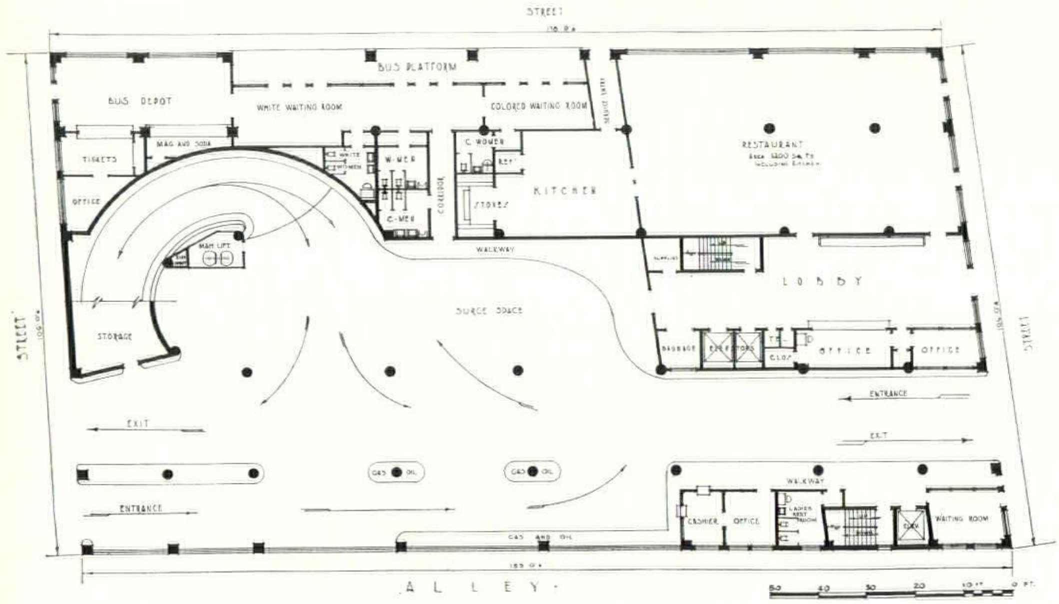
A PROPOSED INTERNATIONAL STUDENT CENTER, GENEVA SWITZERLAND. ALFRED ROTH, ARCHITECT



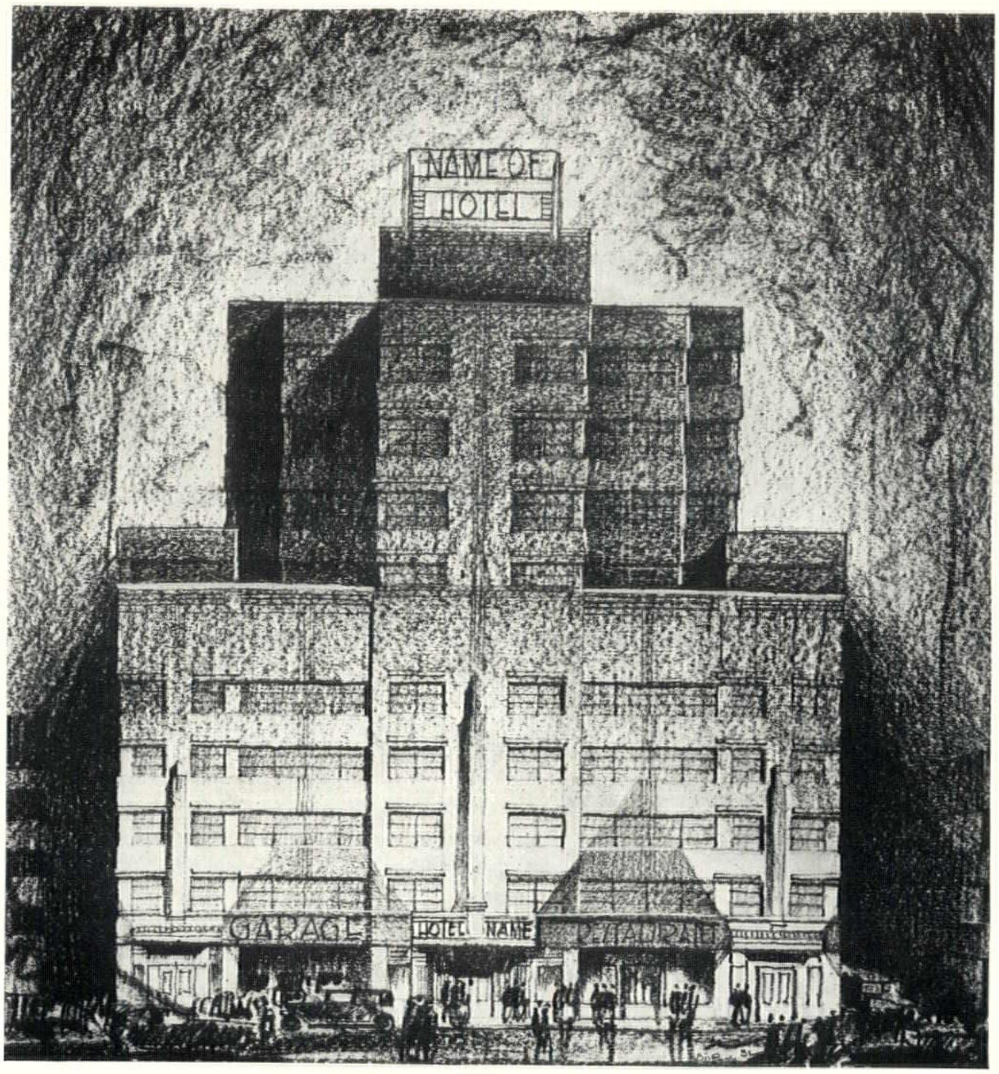
TYPICAL HOTEL PLAN



TYPICAL GARAGE PLAN



STREET LEVEL PLAN



STREET ELEVATION

PROPOSED PARKING GARAGE, BUS STATION AND HOTEL, RICHMOND, VIRGINIA

LEE, BALLOU AND VAN DEVOORT, ARCHITECTS

This building offers convenience of a storage or parking garage, hotel accommodation and is also intended as an auto bus station. Persons who stop at the hotel drive into the building where they place their car in the care of an attendant. They then go by elevators to the hotel lobby on an upper floor. On checking out of the hotel, an attendant is given the storage ticket and the car is delivered at the waiting room on the first floor. The hotel is not restricted to persons with cars but is intended also for general patronage.

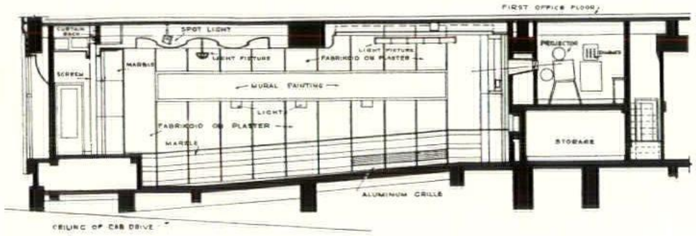
The first floor is arranged so as to offer usual garage accommodations. The bus terminal on this floor has a platform to allow three buses to pull alongside and load at the same time. The restaurant on the ground floor is for hotel patrons and for the public. The parking garage is equipped with a spiral ramp to deliver cars at different floors. The hotel, the garage, the bus terminal and the restaurant may be leased by individuals.

INTERIOR

A NEWS REEL MOVIE IN A RAILROAD STATION

CINCINNATI UNION TERMINAL, CINCINNATI, OHIO

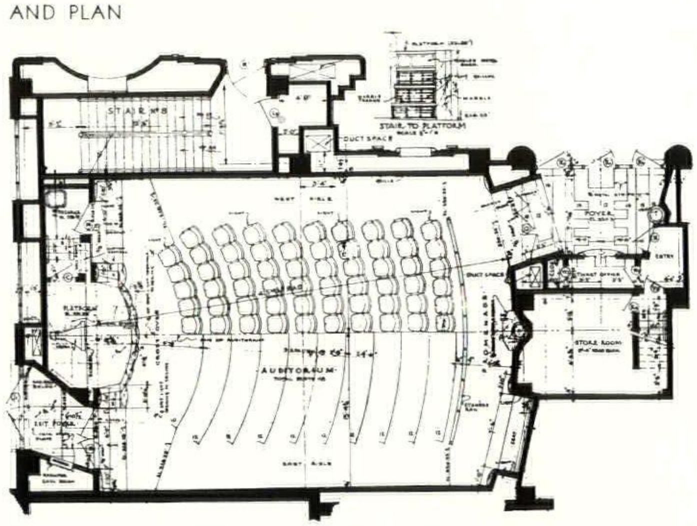
FELLHEIMER AND WAGNER, ARCHITECTS

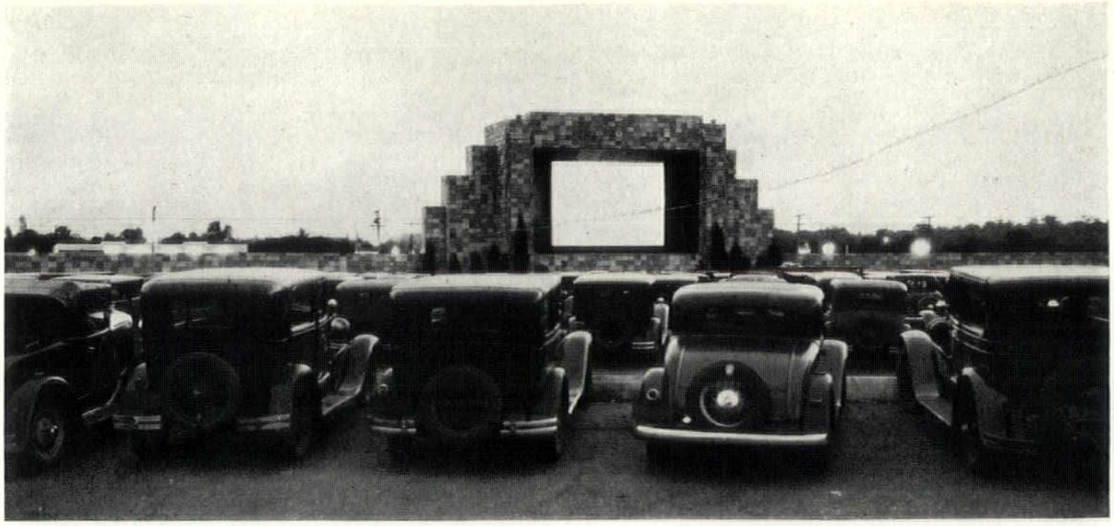


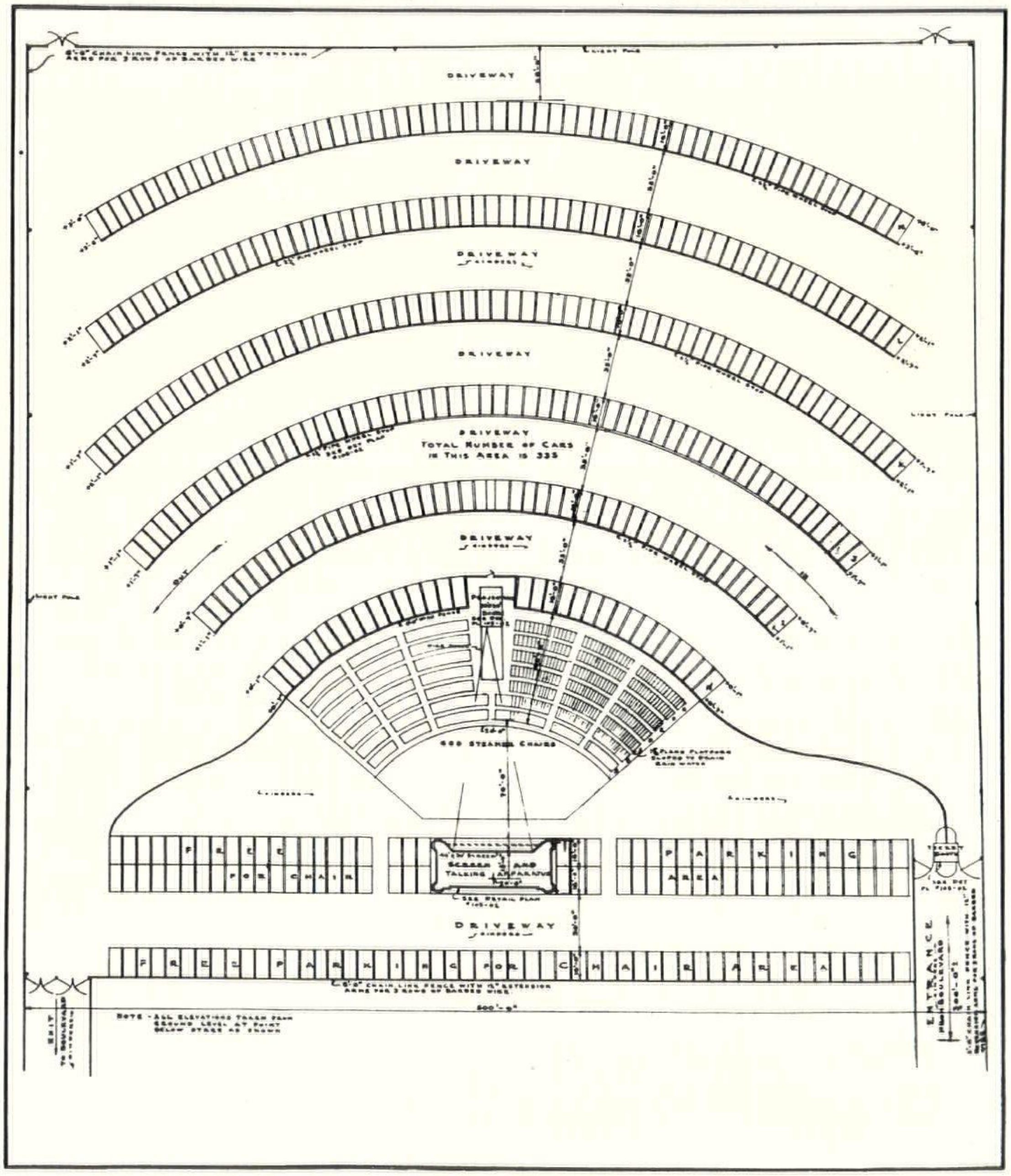
LONGITUDINAL SECTION

THEATER SECTION
AND PLAN

LOBBY



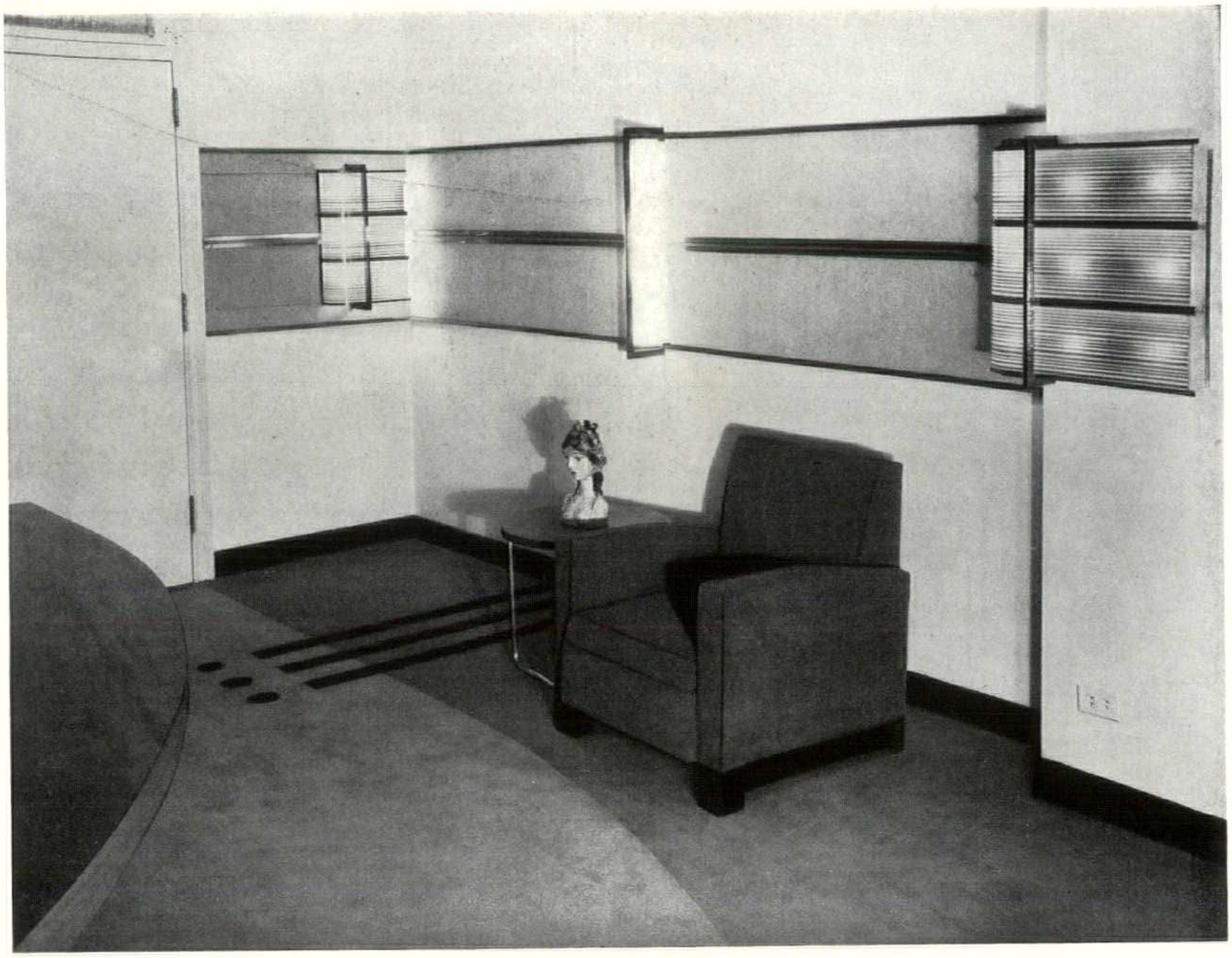


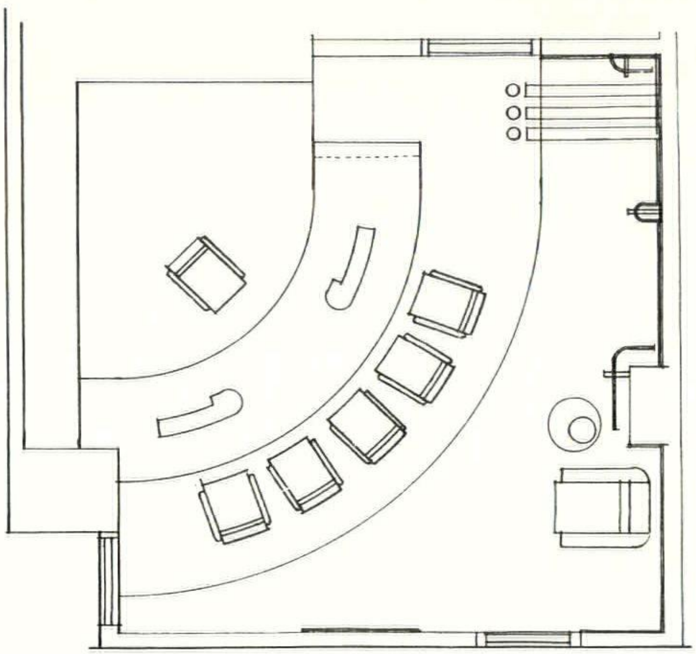


An outdoor theater to which motorists may drive and sit in their parked cars. There is also an area close to screen, with space for 600 steamer chairs, for motorists who park their cars at rear of screen. Cars are parked facing the screen on parking planes that are sloped up toward the screen so as to permit a clear vision of the moving picture.

DRIVE-IN THEATER, CAMDEN, NEW JERSEY

DESIGNED BY R. M. HOLLINGSHEAD, JR.





WALLS—Yellow plaster

RUG—Brick red and gold with some black

LOUNGE CHAIR—Bluish green chenille

CHAIRS AROUND TABLE—Satin brushed chromium covered with vermilion chenille

CABINETS AND SEMI-CIRCULAR DESK—Very light mahogany

SMALL TABLE—Tubular with mahogany top

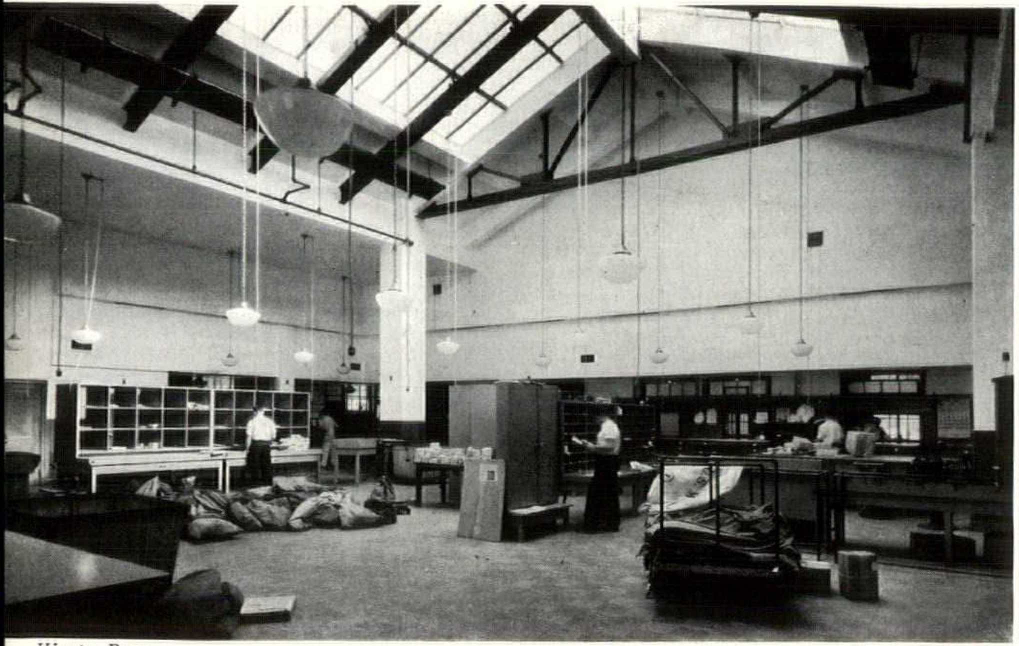
DESK LIGHT—Polished black nickel and glass (sand blast white with black lines)

INDIRECT LIGHTING

SHOWROOM FOR REUSS STUDIOS, INC. NEW YORK CITY

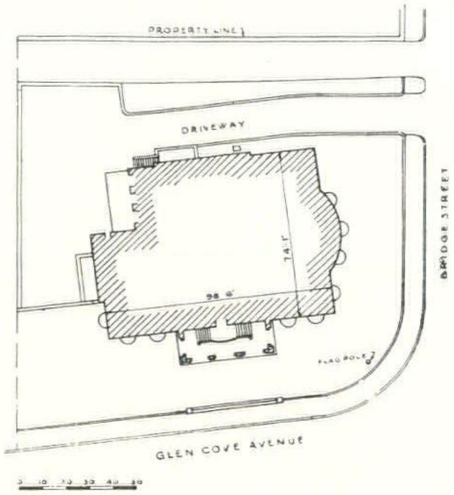
ERNST AUERBACH, DESIGNER

COUNTER AND STORAGE CASES



Wurts Bros.

VIEW OF WORK SPACE

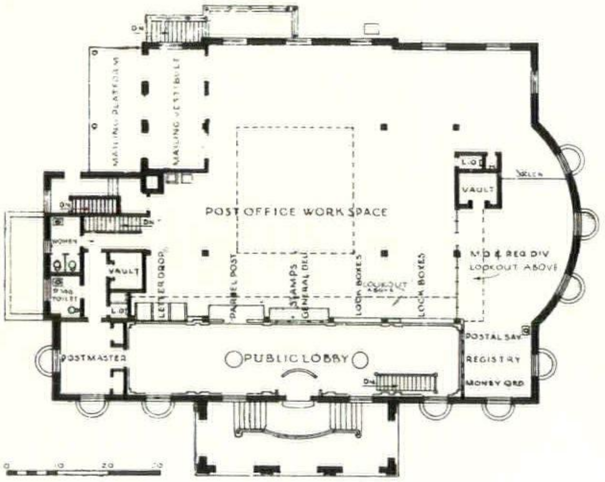


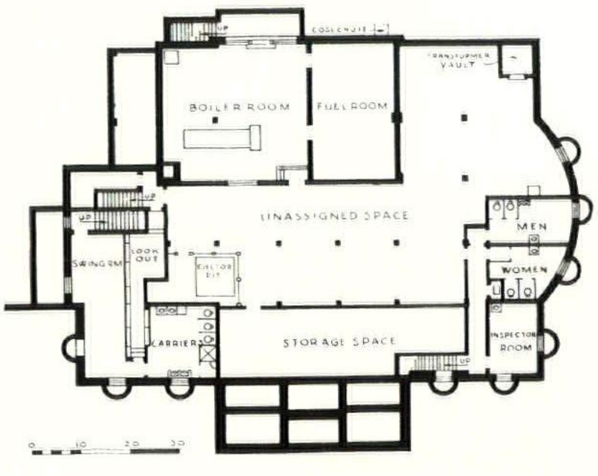
U. S. POST OFFICE AT GLEN COVE, LONG ISLAND

DELANO AND ALDRICH, ARCHITECTS

This building, whose architecture is along the lines of that of the Early Republic, has an arcaded porch with the main floor raised several steps due to existing culverts. The exterior is of red brick and Vermont marble. The paneled public lobby, of a type unusual in post office design, is of American oak. Notable details are the motive of the Caduceus, symbol of Mercury and of commerce, in the capitals, and the form and ornamentation of the window lintels. The planting designed around the building has not yet been done.

This building forms a part of a proposed group of three buildings making a civic center for Glen Cove. Balancing the Post Office is to be a City Hall, and between the two a circular library, set back behind a garden and connected with the two other buildings by semi-circular walls. This is one of the few instances in which a post office building has been definitely planned as a part of an extensive community development.

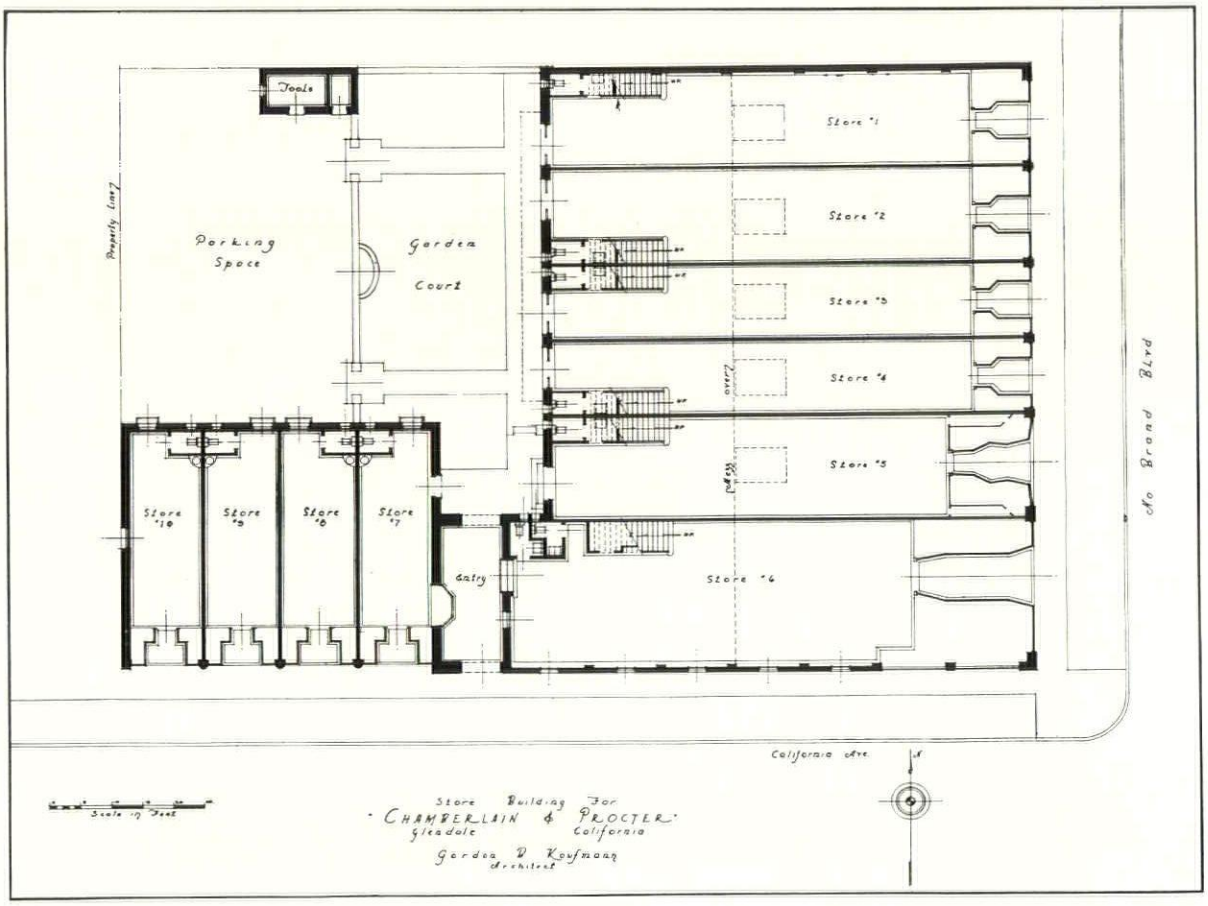




ENTRANCE PORCH

GENERAL VIEW

Wurtz Bros.



SHOPPING CENTER, GLENDALE, CALIFORNIA

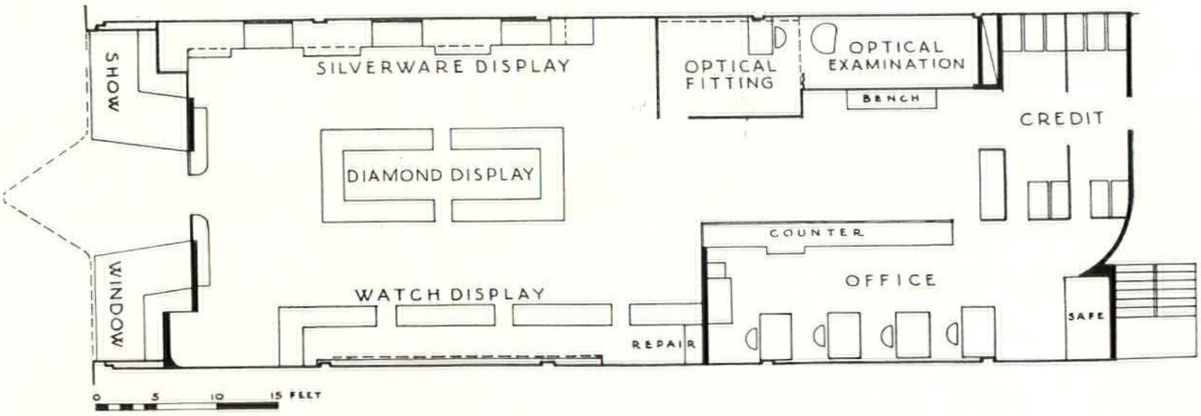
GORDON B. KAUFMANN, ARCHITECT

SHOPPING COURT

William Lyman

JEWELRY STORE
FOR FINLAY STRAUS
NEW YORK CITY

PERCIVAL GOODMAN, INC.
ARCHITECTS



A JEWELRY STORE FOR CREDIT TRADE

WATCH DEPARTMENT

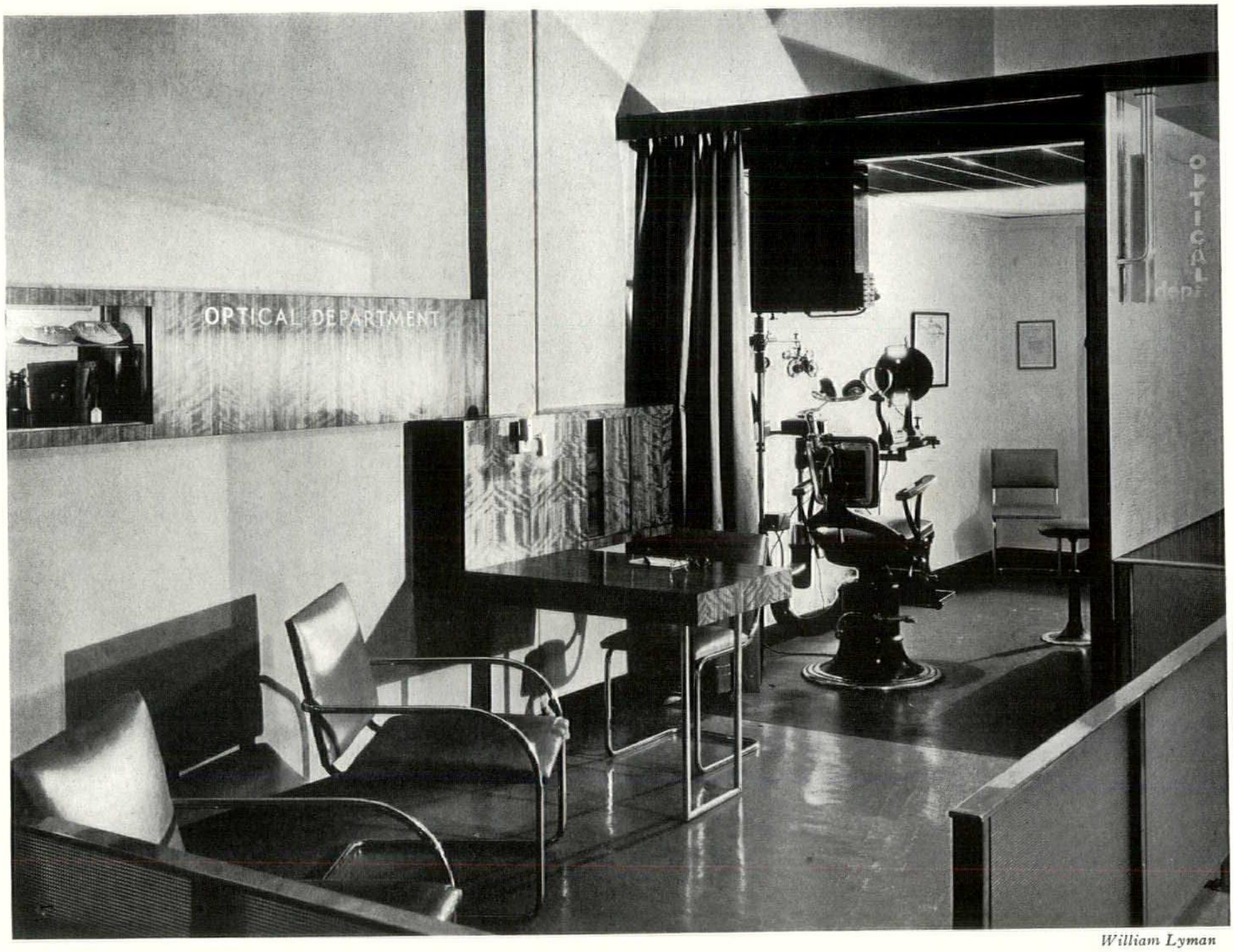
GIFT DEPARTMENT

William Lyman

This company sells jewelry, watches and in addition a variety of household accessories, which are as diverse in type as clocks and electric egg-beaters.

Their plan of merchandising demands not a display of a few carefully selected objects but rather a form of display that will show with some effectiveness a maximum of quantity.

The services necessary for their method of selling are, in addition to the aforementioned display: a series of booths equipped with tables and chairs where the salesmen may take the customer and secure a report on his ability to pay for the object bought. An office provided with a large counter where customers make their weekly payments, take objects to be repaired, make complaints, etc. This office is also pro-



William Lyman

OPTICAL DEPARTMENT

vided with a vault, posting machine, files and several desks for the manager. An optical department, consisting of waiting space, fitting desk, and a dark room equipped for examinations.

The display and selling space divides into three categories; jewelry department, watch department (including repair desk), and household accessory department. The first requires showcases for selling and display, the second showcases and wall cases and the third large wall cases with storage space beneath.

The lighting of such a store as this is very important, especially for the selling of diamonds. To present diamonds effectively it is necessary to have a brilliant glaring light on the merchandise and yet protect the customer's eyes from this glare; at the same time the store as a whole must be pleasantly illuminated and maximum economy in power consumption maintained. This was accomplished by the use of hanging reflectors, the height of the fixture from the floor and

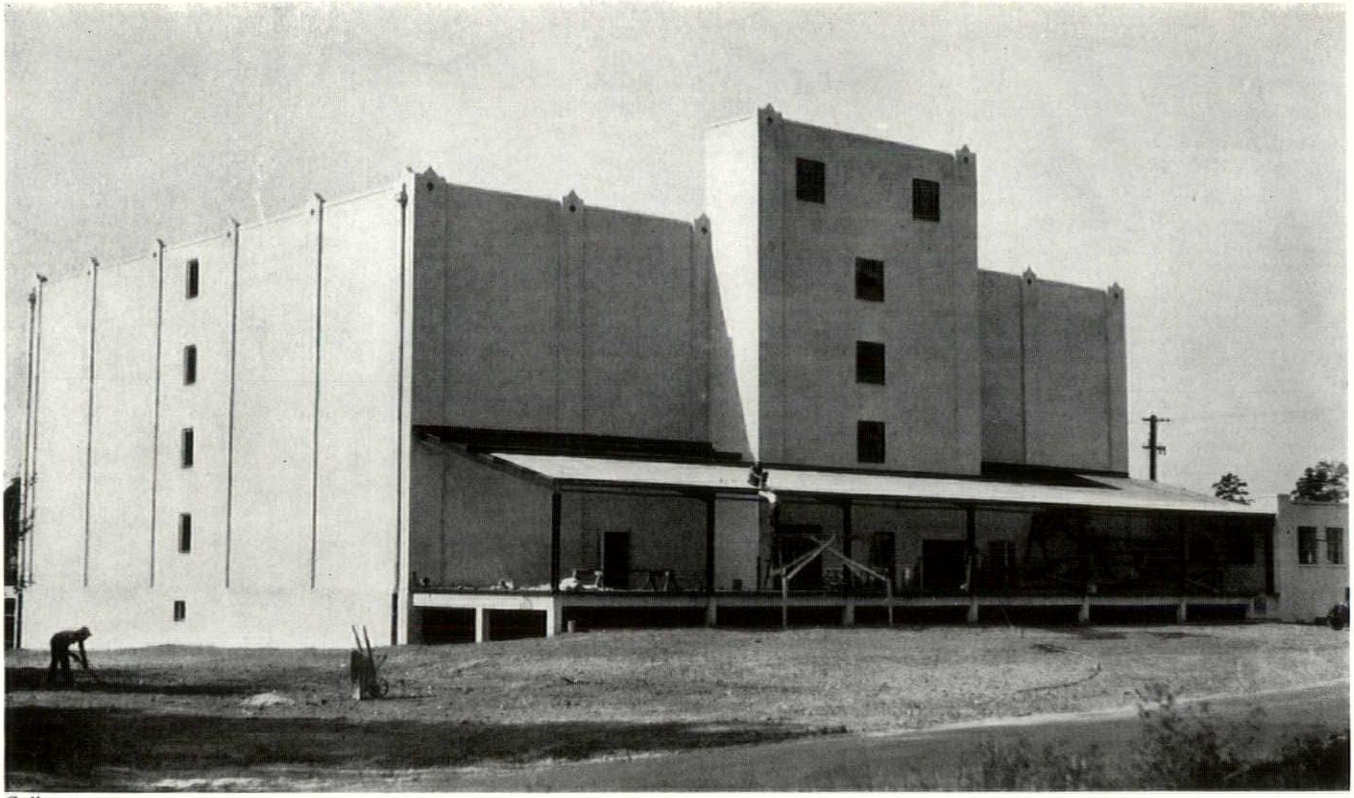
SECTION OF JEWELRY COUNTER

the center of the bulb filament adjusted to provide maximum foot candles on the object displayed. The reflector is of white baked enamel with an exterior shield of aluminum. The bottom of the reflector is covered by a sheet of prismatic glass, which is cut in the center, allowing half of the bulb filament to be entirely exposed. A 300-watt reflector bulb is provided.

The upper part of the fixture is equipped with a series of exposed, frosted 25-watt bulbs which provide a general ceiling illumination.

The store is ventilated by an intake fan at the rear of the store and two exhausts at the front.

A burglar alarm system is provided.



Galloway

APPLE STORAGE WAREHOUSE
CROZET, VIRGINIA

VAN RENSSELAER H. GREENE, Engineer

LOCATION

*A few years ago, the fruit growers near Crozet, Va., organized the Fruit Growers Association, an organization which assisted in the marketing of their product. The region surrounding Crozet is particularly well situated for the raising of peaches and Albemarle Pippins. Other apples are also grown in this territory, but the Albemarle Pippins predominate. The fruit raising industry has proved so successful in this territory, that each year sees many new orchards planted, and many orchards come into bearing. The apple crop had reached such size in 1928, that it became apparent to the members of the Crozet Fruit Growers Association that a local cold storage warehouse would be necessary in order to secure maximum prices for their products, and to properly preserve their apples until needed in the markets.

THE BUILDING

Accordingly, in the spring of 1929, the Crozet Cold Storage Corporation was organized and plans were gotten under way for a modern cold-storage warehouse capable of holding 60,000 barrels.

The location of the plant is approximately one mile north of Crozet on the Jefferson Highway. Railroad facilities are provided by the Chesapeake & Ohio Railroad.

The main building is a five-story structure with inside measurements 100 feet by 120 feet long, and with ceiling heights 10 feet. This building is of reinforced concrete construction having flat slab floors and reinforced concrete walls.

The plan shows the arrangement of the first floor, and this first-floor arrangement of the main building is the same for all floors. On the front of the railroad side there is a covered platform 15 feet wide with an elevator serving all floors. On the front of the building there is a covered platform 25 feet wide with an elevator stairway and a barrel hoist. A chute is also provided from the platform to the basement which is used for chuting baskets of apples into the basement.

The engine room and office occupy a structure approximately 21 feet by 67 feet long at one corner of the building. The arrangement is indicated on plan.

WALL CONSTRUCTION

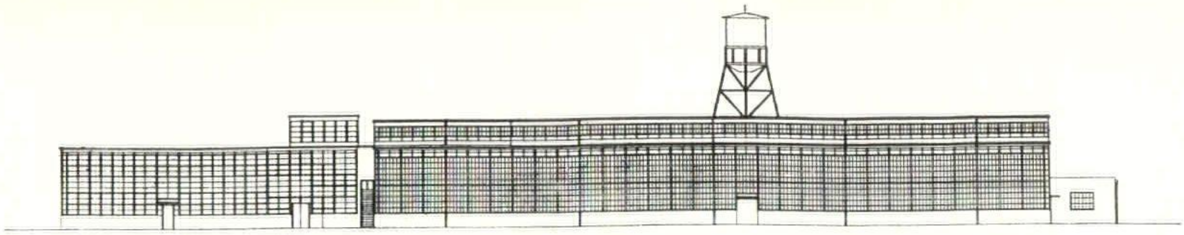
The walls are of reinforced concrete construction. The method of constructing these walls is of particular interest to the cold-storage industry. The walls are only 6 inches in thickness but are thoroughly reinforced to withstand any wind pressure. The pilasters are securely anchored to the building columns at each floor level with heavy galvanized iron rods.

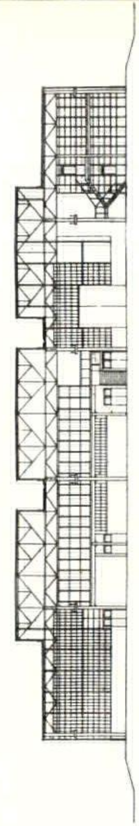
The walls were constructed by the use of a patented sliding form of the MacDonald Spencer Engineering Company, Inc., of New York City. By the use of these patented forms, it was possible to pour over 8 feet of wall work per day, and the resulting wall was a smooth even surface inside and out, with true corners and pilasters. The wall is waterproof and windproof, a construction much desired in the cold-storage industry. One advantage of this type of construction for cold-storage work is the fact that no plastering of the walls is necessary before insulation is applied, nor is any outside finish needed other than a cold water paint.

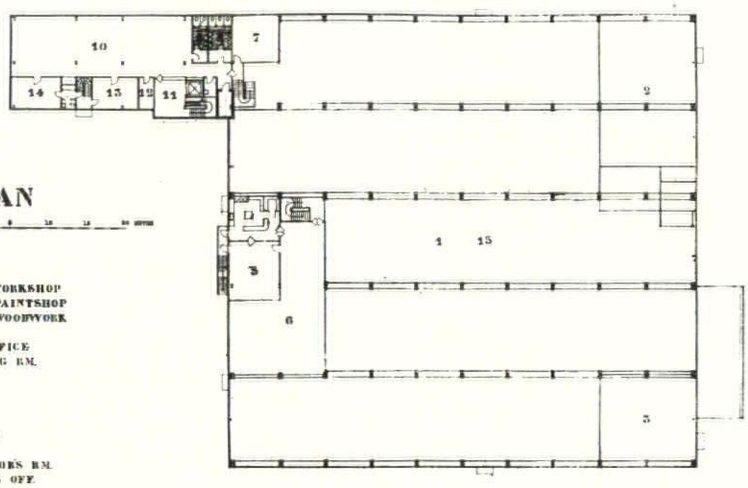
INSULATION

The insulation consisted of one layer of 3-inch corkboard on the basement floor and all walls, and two layers of 2-inch corkboard on the roof of the building. All insulation was set up in hot asphalt. The finish over the insulation on the walls is of particular interest. It is a mastic finish which is different, and which is said to be an improvement over most of the mastic finishes now in use. The finish is ¼ inch in thickness, is very hard, does not crack. and is moisture-proof. The color is much more pleasing than the old-style mastic finishes.

*From *Ice and Refrigeration*

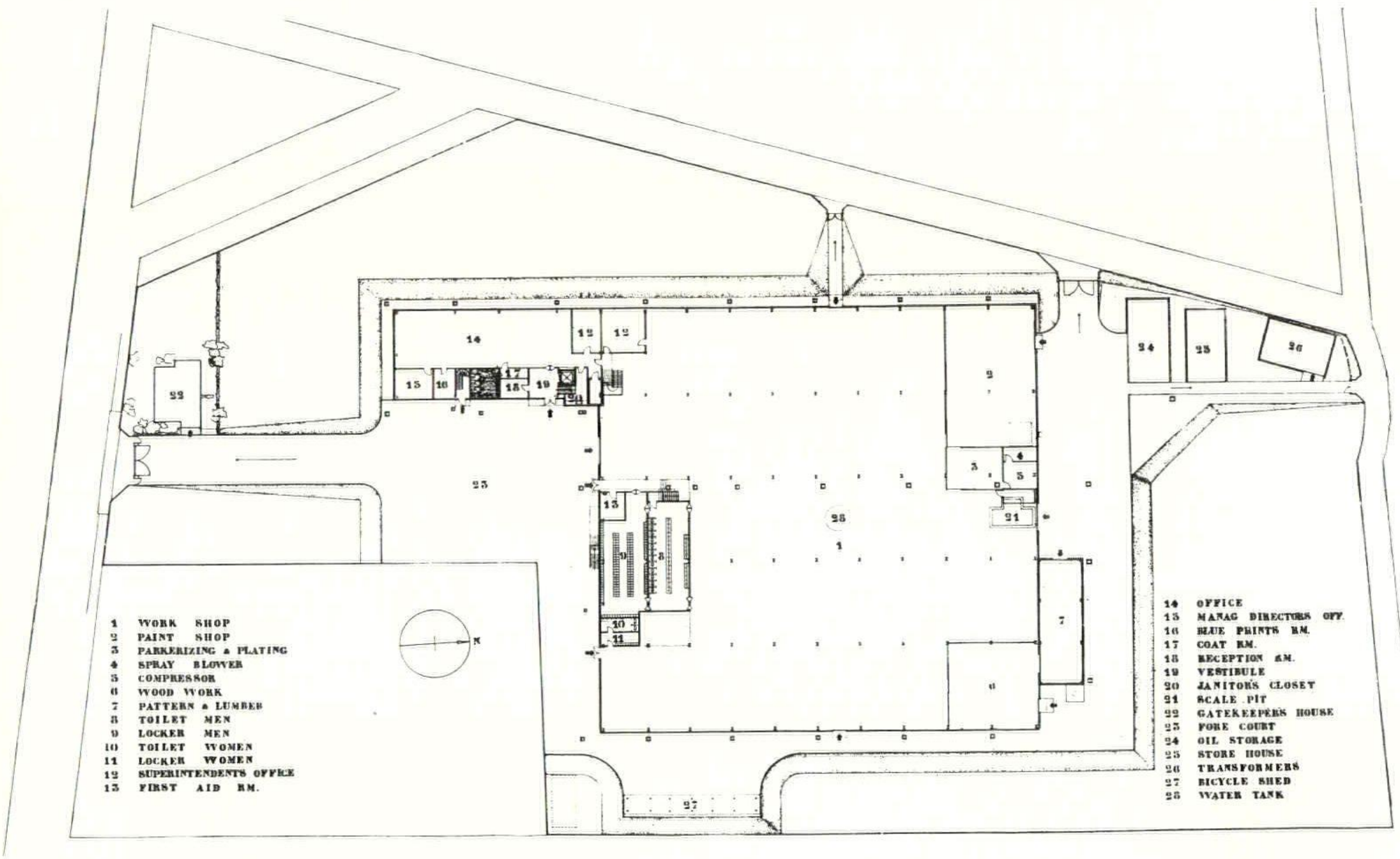






2ND FL. PLAN

1 UPPER PART OF WORKSHOP
2 UPPER PART OF PAINTSHOP
3 UPPER PART OF WOODWORK
4 KITCHEN
5 DINING RM FOR OFFICE
6 WORKMENS' DINING RM.
7 EXHIBIT RM.
8 TOILET MEN
9 TOILET WOMEN
10 GENERAL OFFICE
11 RECEPTION SPACE
12 STATIONERY
13 BOARD OF DIRECTOR'S RM.
14 MANAG. DIRECTOR'S OFF.
15 WATER TANK



1ST FL. PLAN

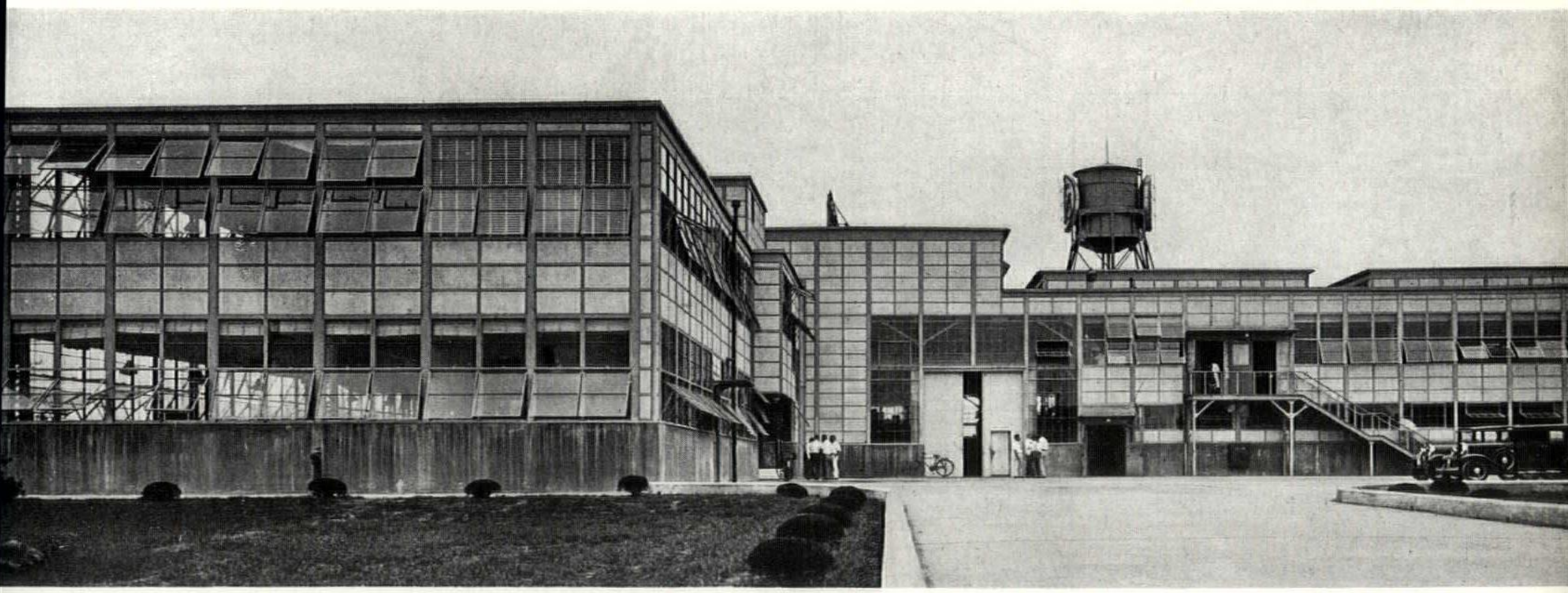
FACTORY BUILDING FOR THE OTIS ELEVATOR COMPANY, TOKYO, JAPAN

ANTONIN RAYMOND, ARCHITECT

WEST ELEVATION

FACTORY BUILDING FOR THE OTIS ELEVATOR COMPANY, TOKYO, JAPAN

ANTONIN RAYMOND, ARCHITECT

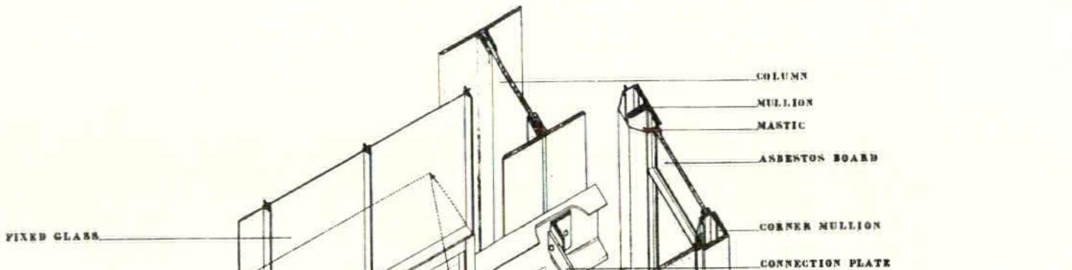


SOUTH ELEVATION AND MAIN ENTRANCE

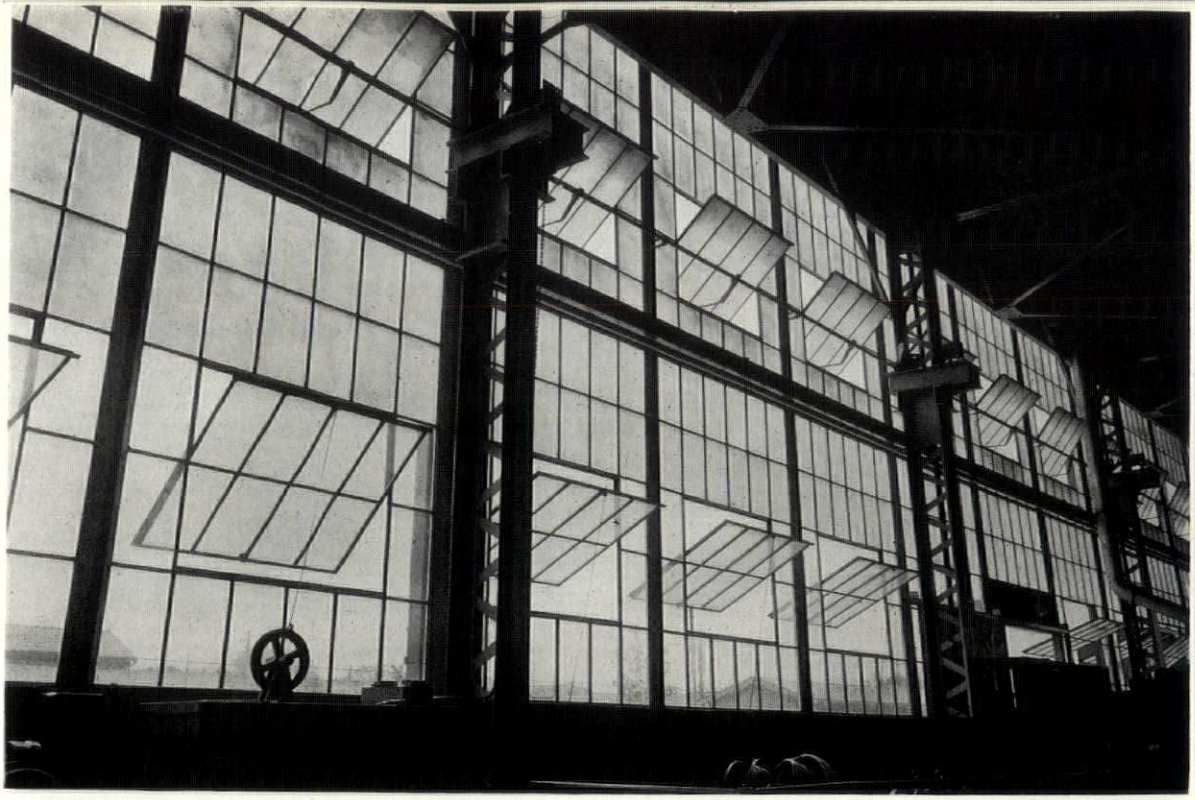
WEST WALL

OTIS ELEVATOR FACTORY, TOKYO, JAPAN

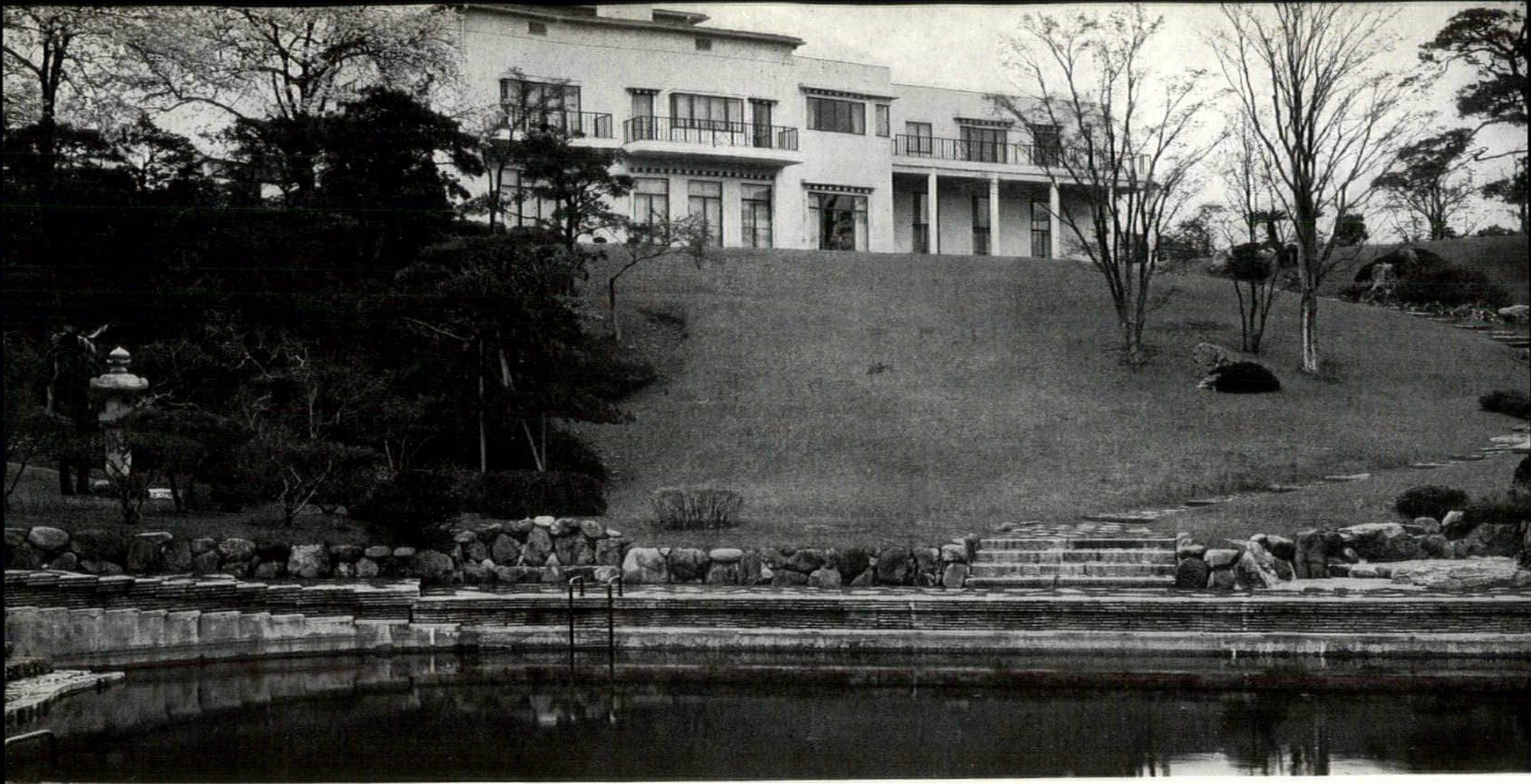
ANTONIN RAYMOND, ARCHITECT



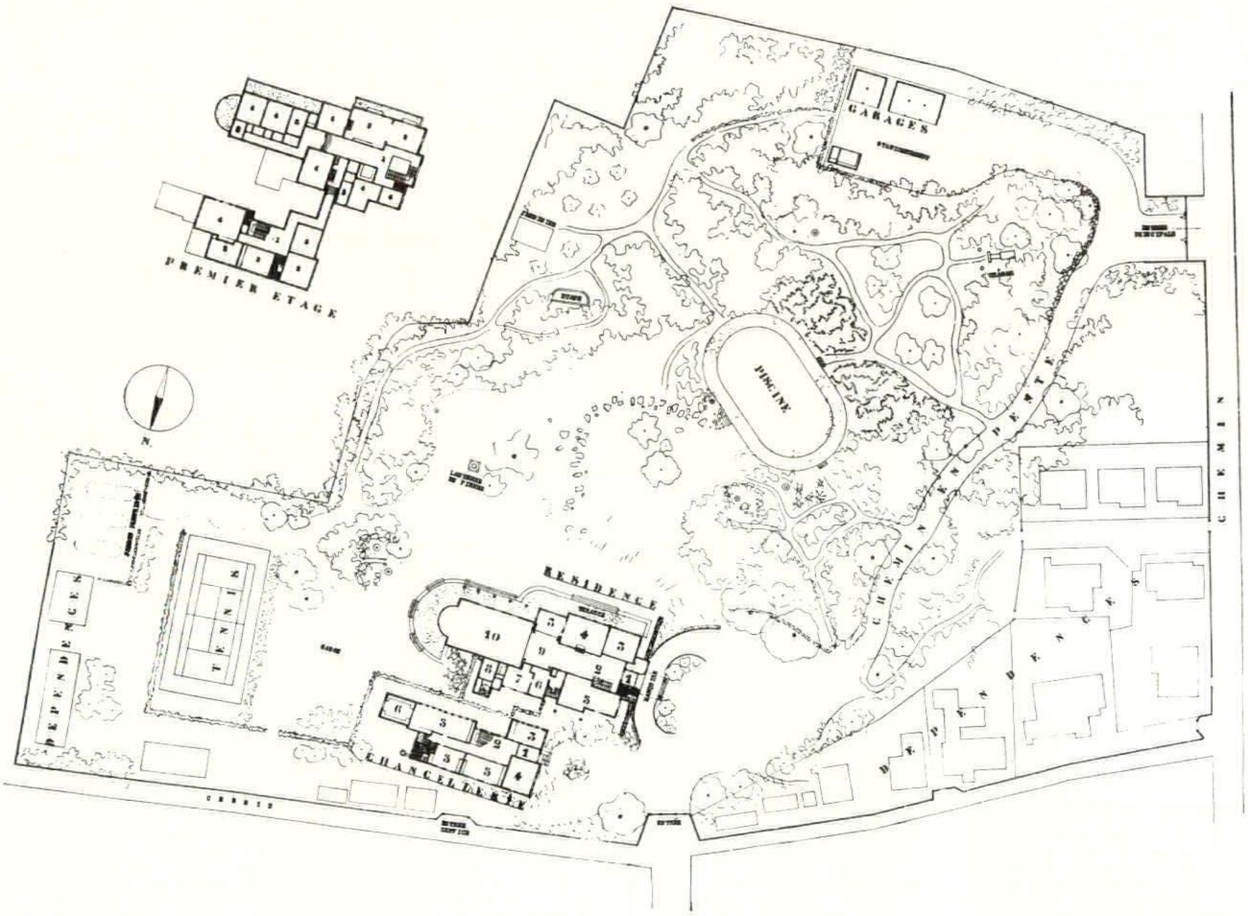
TYPICAL DETAILS OF EXTERIOR WALL



INTERIOR
PLANT VIEWS



VIEW FROM POOL



EMBASSY BUILDING

GROUND FLOOR

1. Vestibule
2. Hall
3. Attendant
4. Waiting Room
5. Office
6. Files

FIRST FLOOR

1. Hall
2. Secretary
3. Office
4. Office of the Ambassador
5. Attendant

RESIDENCE

GROUND FLOOR

1. Vestibule
2. Hall
3. Salon
4. Grand Salon
5. Dining Room
6. Office
7. Kitchen
8. Servants
9. Foyer
10. Great Room

FIRST FLOOR

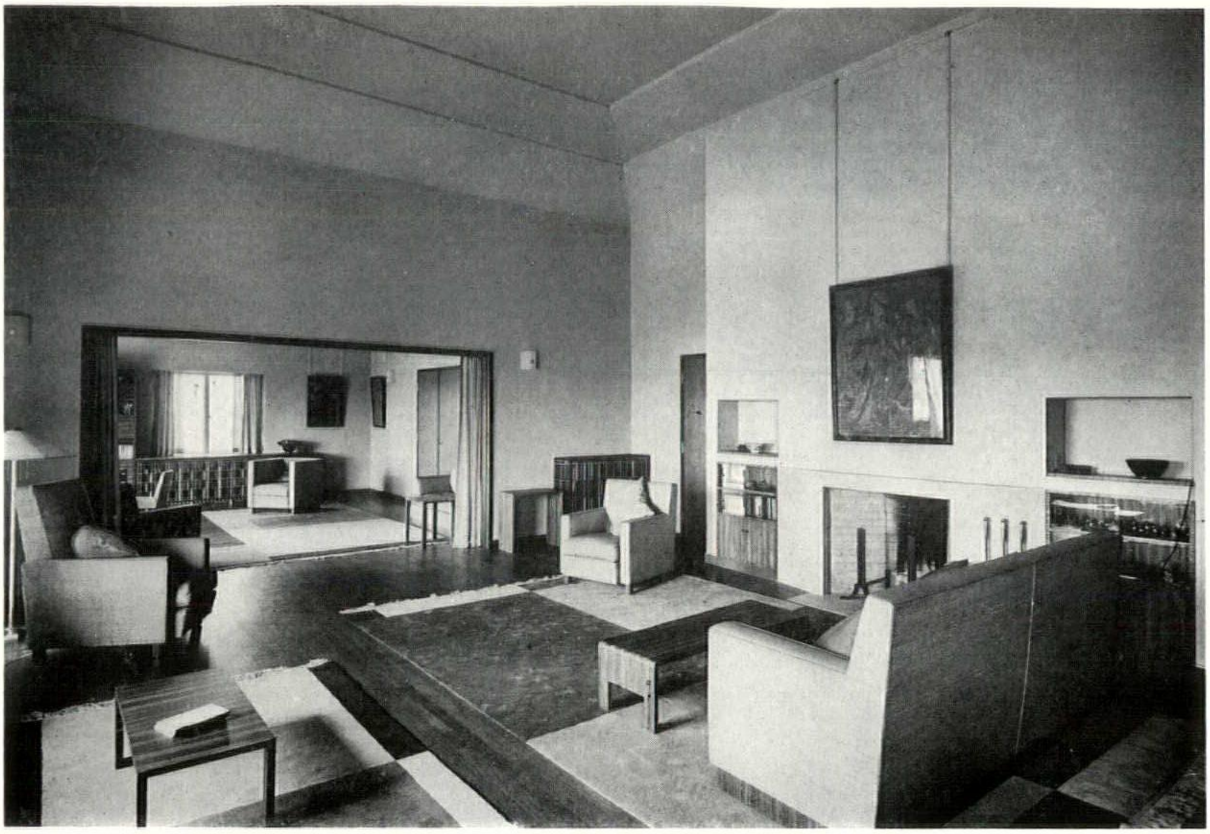
1. Hall
2. Smoking Room
3. Salon
4. Bedroom
5. Bathroom
6. Linen

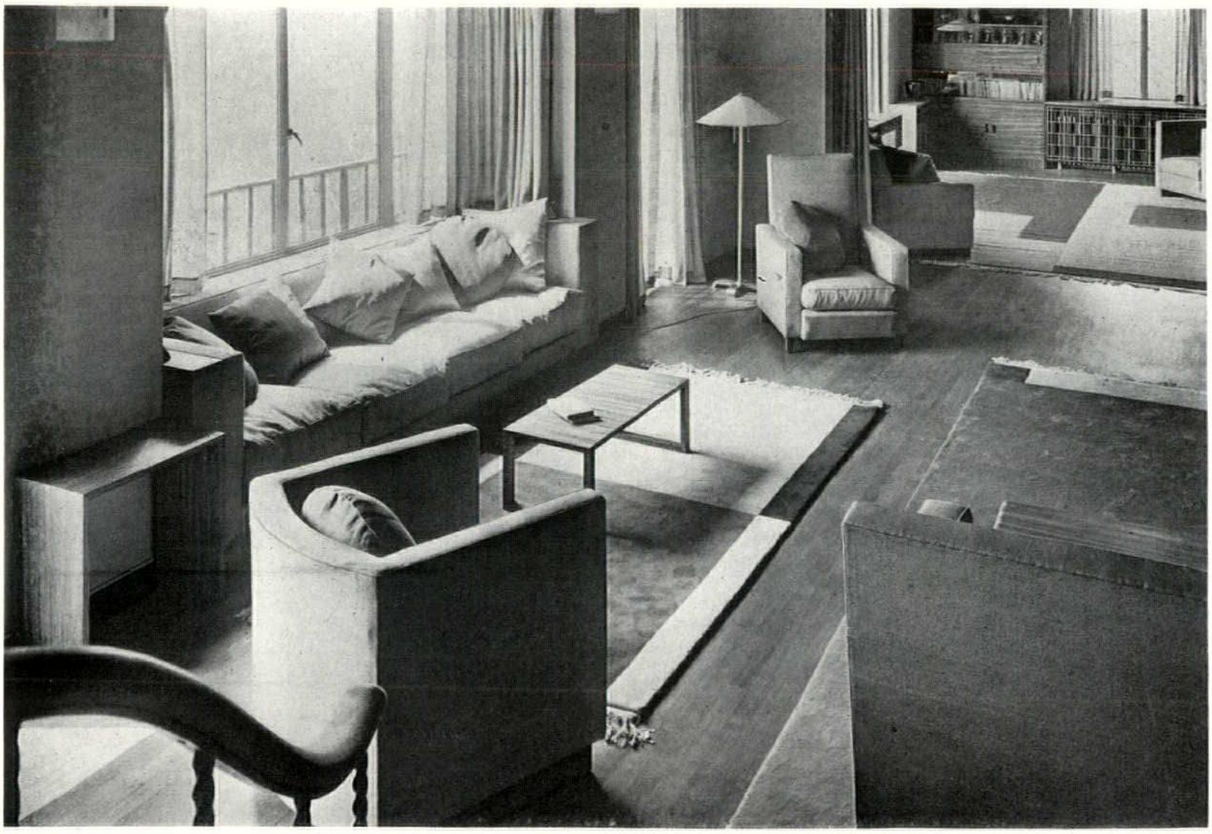
FRENCH EMBASSY, TOKYO, JAPAN

ANTONIN RAYMOND, ARCHITECT

THE TERRACE

FRENCH EMBASSY, TOKYO, JAPAN

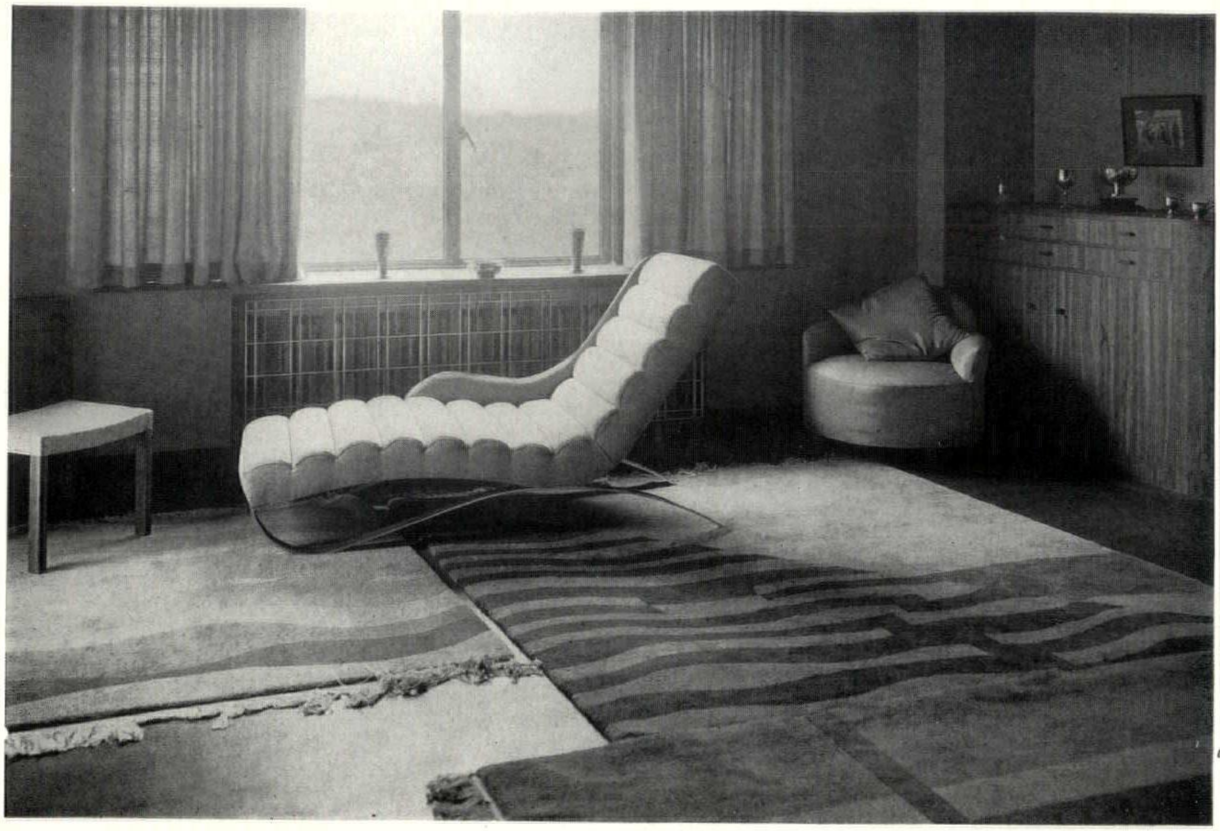




SECOND FLOOR LIVING ROOM VIEWS

WALLS, CEILING, FURNITURE, CURTAINS, SAND COLOR,
CUSHIONS AND RUGS SAND, VIOLET, COPPER, BLACK AND TOBACCO.

ANTONIN RAYMOND, ARCHITECT



BEDROOM

BREAKFAST ROOM ON SECOND FLOOR

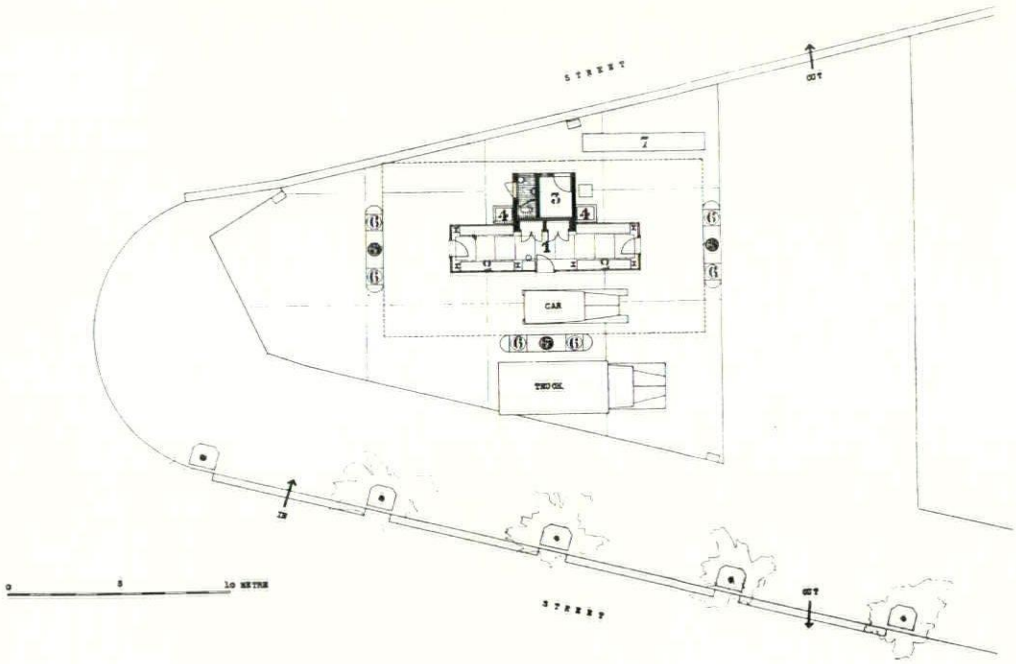
GREEN, WHITE AND ULTRAMARINE.

A SERVICE STATION, YOKOHAMA, JAPAN

ANTONIN RAYMOND, ARCHITECT

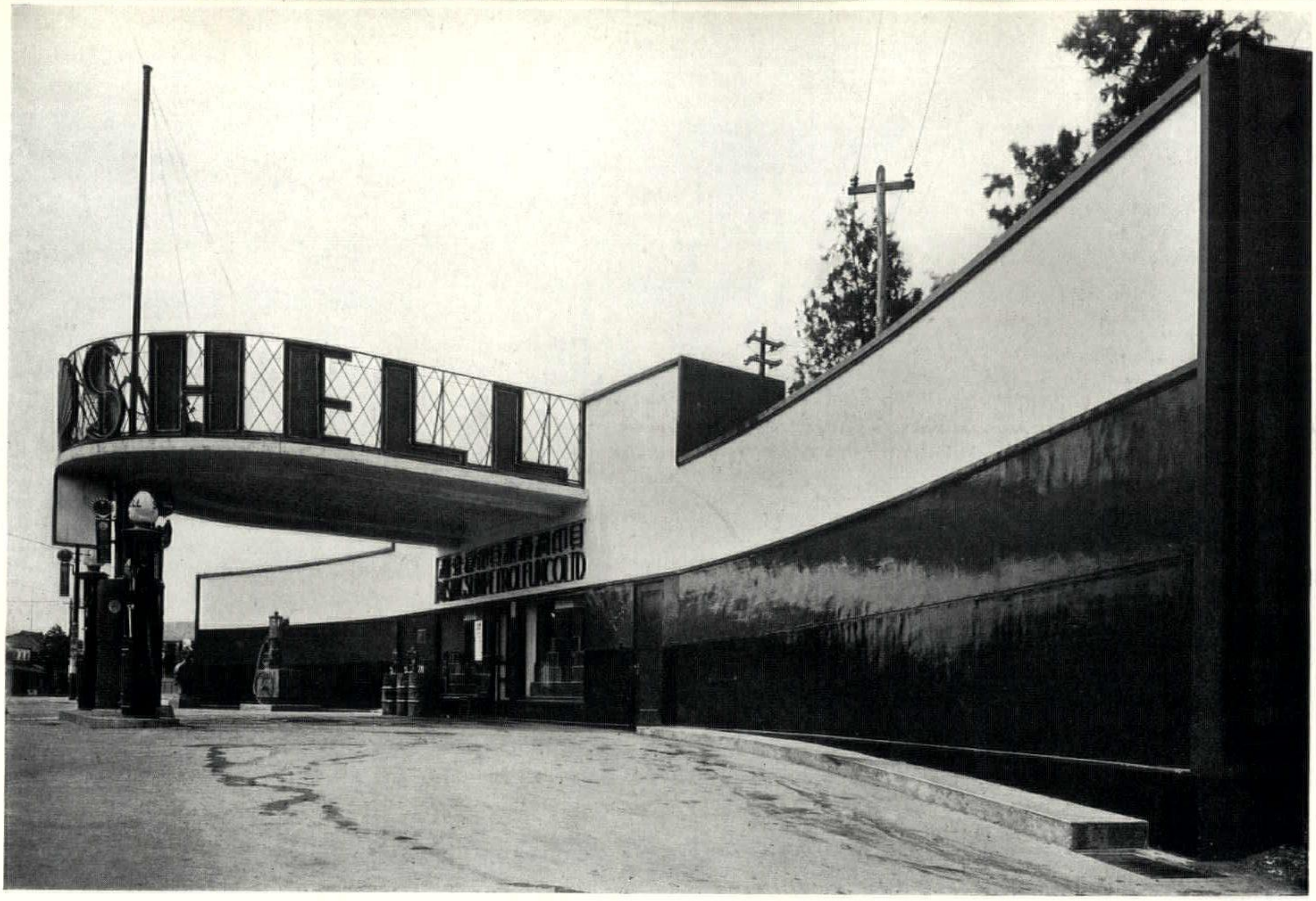
COLORS:

BLACK
RED
YELLOW
WHITE



PLAN:

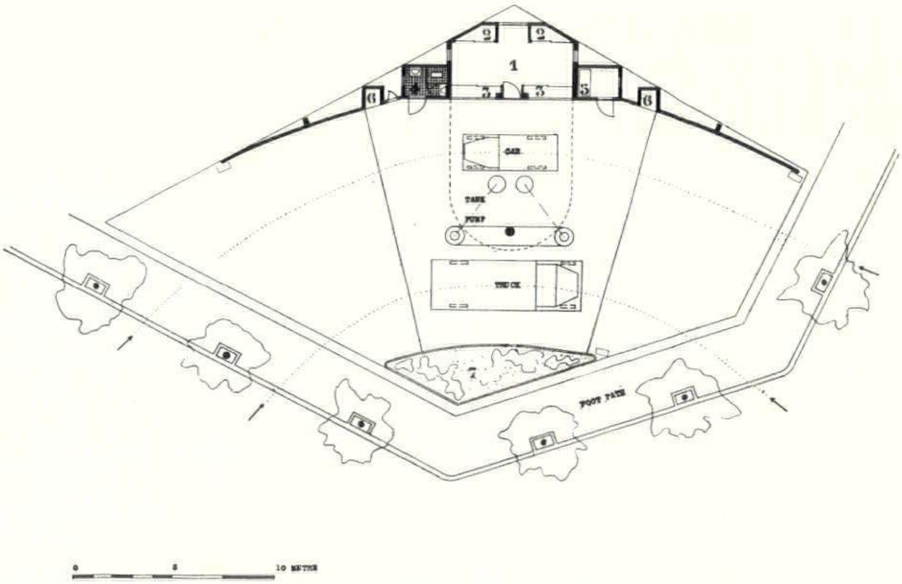
OFFICE 1
SHOW WINDOW 2
STORAGE 3
SAND-BOX 4
PUMP 5
OIL 6
HOIST 7



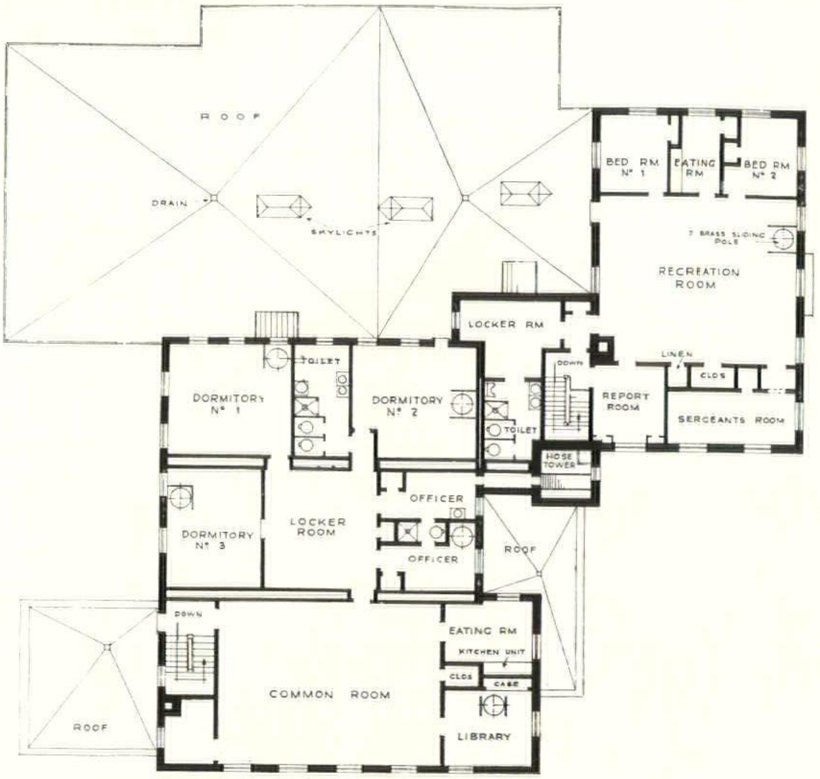
A SERVICE STATION, TOKYO, JAPAN

ANTONIN RAYMOND, ARCHITECT

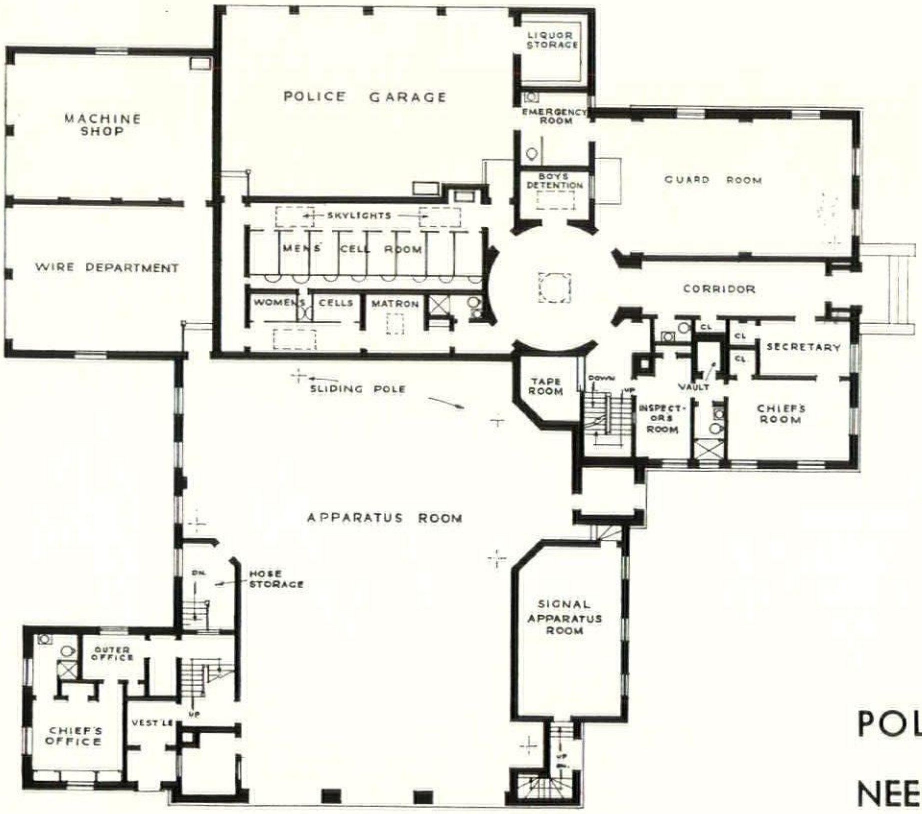
COLORS:
BLACK
RED
YELLOW
WHITE



PLAN:
OFFICE 1
CLOSET 2
SHOW WINDOW 3
TOILET 4
AIR COMPRESSOR 5
SAND-BOX 6
TURF 7



SECOND FLOOR PLAN



FIRST FLOOR PLAN

POLICE AND FIRE STATION, NEEDHAM, MASSACHUSETTS

GEORGE ERNEST ROBINSON, ARCHITECT

ul J. Weber

GENERAL EXTERIOR VIEW TOWARD ENTRANCE

In general it is desirable to have the fire station, police station and the fire-alarm system building in different locations as they all function differently. The smallest towns have these housed usually in their town building.

In towns with population ranging from six thousand up to thirty-five thousand, we have a problem such as is shown for the Town of Needham, Massachusetts. This town has assembled the three units on one lot of land, each building adjoining the other but having practically no connection. This insures to the firemen and policemen buildings which are on different streets.

The fire alarm requires an equipment separate from any telephone system, with boxes located on streets of the city. Ten boxes serve the average circuit but an overloaded circuit, in an emergency, can take twenty boxes per circuit. Separate batteries, placed in a different room from the high-priced fire-alarm system, take care of the system. If all the local electric light companies should be out of order, the fire alarm still operates satisfactorily.

One of the best known call-systems of whistles is the Lebaron which is comprised of air tanks, one to three in number, about ten feet long and four feet in diameter.

DETAIL, MAIN ENTRANCE

Whistle-machinery which looks like a lathe is placed at a point near the whistle and must be kept free from frost. Battery racks, usually five to seven feet long, are made up in units which go into the battery room. The repeater should be in the middle of the alarm room and the instrument itself from two to three and a half feet long and incased in glass. The relay board varies as to use and is usually made of slate.

The fire-alarm building, which is marked "signal apparatus room" on the accompanying plan, shows the approximate size for a town of about twenty-five thousand people. This allows for growth which is necessary in laying out a building of this nature.

THE FIRE STATION

The Town of Needham has a permanent fire-fighting force. Its building is laid out for approximately twenty-five men, as a maximum, and there are at present twelve to fifteen men on duty. The average apparatus room will house a one-thousand gallon pumper which is about twenty-six feet long; one hose wagon which is approximately twenty-two feet long; one chemical apparatus about twenty-four feet long; one ladder which is nearly forty-five feet long. Some of

Paul J. Weber

FIRE DEPARTMENT BUILDING

the other apparatus used in a fully-equipped fire department are: an emergency wagon, boat facilities for use on ponds, lakes and rivers, and brushwagon to be used in fighting brush fires.

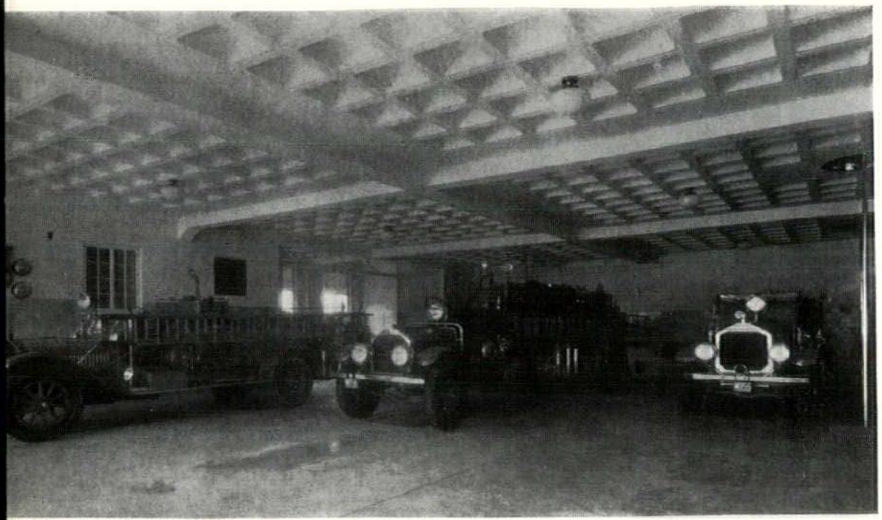
It is not uncommon to lay three to five thousand feet of hose at a fire and this must later be dried. Some firemen believe the hose should be hung in a tower and allowed to drip. Others believe it should be hung over a large roller while some believe a pitched rack should be used for drying the hose. As hose comes in multiples of fifty feet, the architect can arrange for drying in planning his building.

Fire extinguishers have come into use in many buildings and homes and many departments use vitriol for the recharging of the extinguishers. It is imperative that the acid be kept in a separate place as it is the enemy of the hose.

In entering a fire station one must first approach a watchroom.

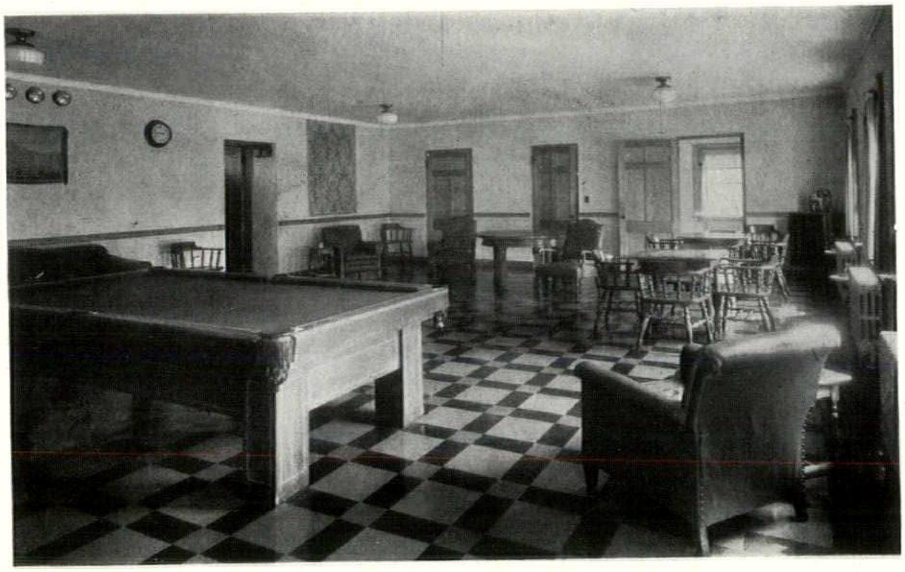
The office for the Chief includes shower bath, toilets, closets and vaults and should be on a different floor from his sleeping accommodations, if such are provided for him.

Regarding sleeping accommodations, officers should have their own rooms and bath accommodations. The men should have what is known as "bunk" rooms, each accommodating from four to ten men. If the two platoon system



Photos by Paul J. Weber

INTERIOR APPARATUS ROOM



RECREATION ROOM

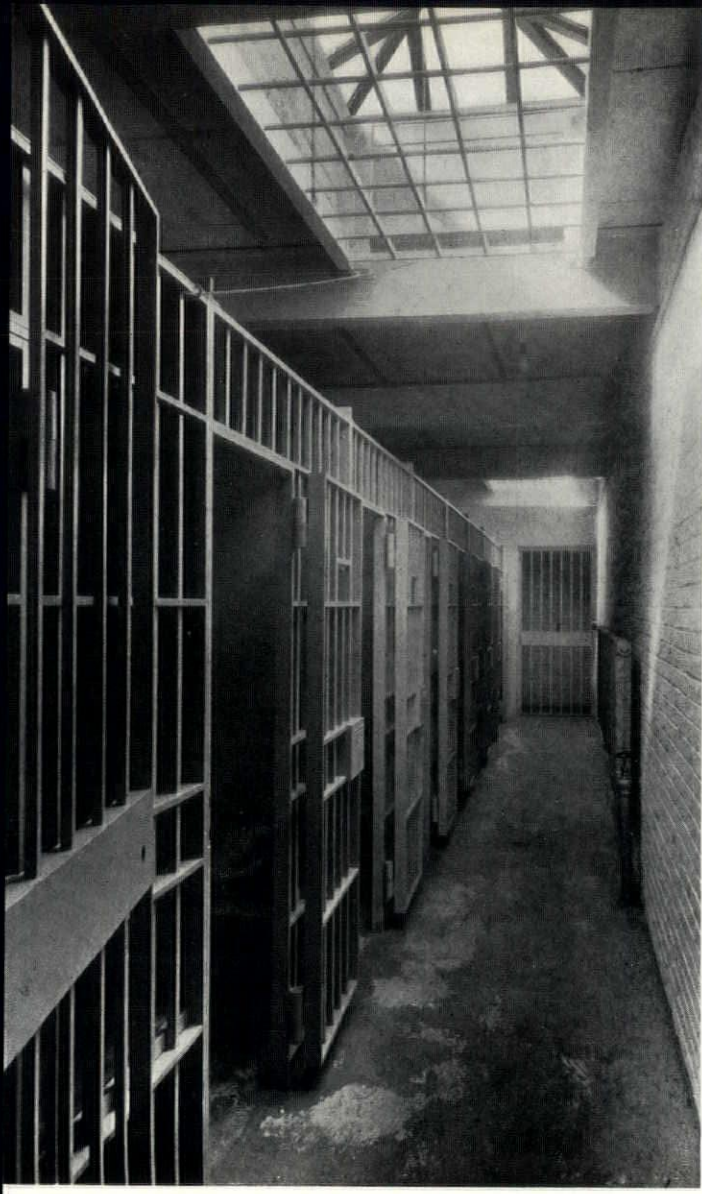
is used, every man should have his own bed. The locker rooms should be adjacent to the bunk rooms; and also the boot room which is for the night quick-hitch. The firemen should also have ample recreation rooms.

The sliding poles should never be in the middle of the floor where the apparatus is kept but should run as near as possible to the sides or front of the apparatus. Poles are apt to be knocked over when apparatus is backed in. It might be added that a fire station with posts between the apparatus is antiquated and unsatisfactory. Often men have been injured by posts while running to get to their apparatus in minimum time.

The water supply of a city or town is so closely allied with the fire department that an architect must give it serious consideration in making his plans.

THE POLICE STATION

The police station at Needham, as shown on the plan, is laid out according to the number of cells required by the town. In other words, the number of cells determines almost entirely many of the requirements of the police department. This station functions from the center. The rotunda gives the man in control a full view of the station. The



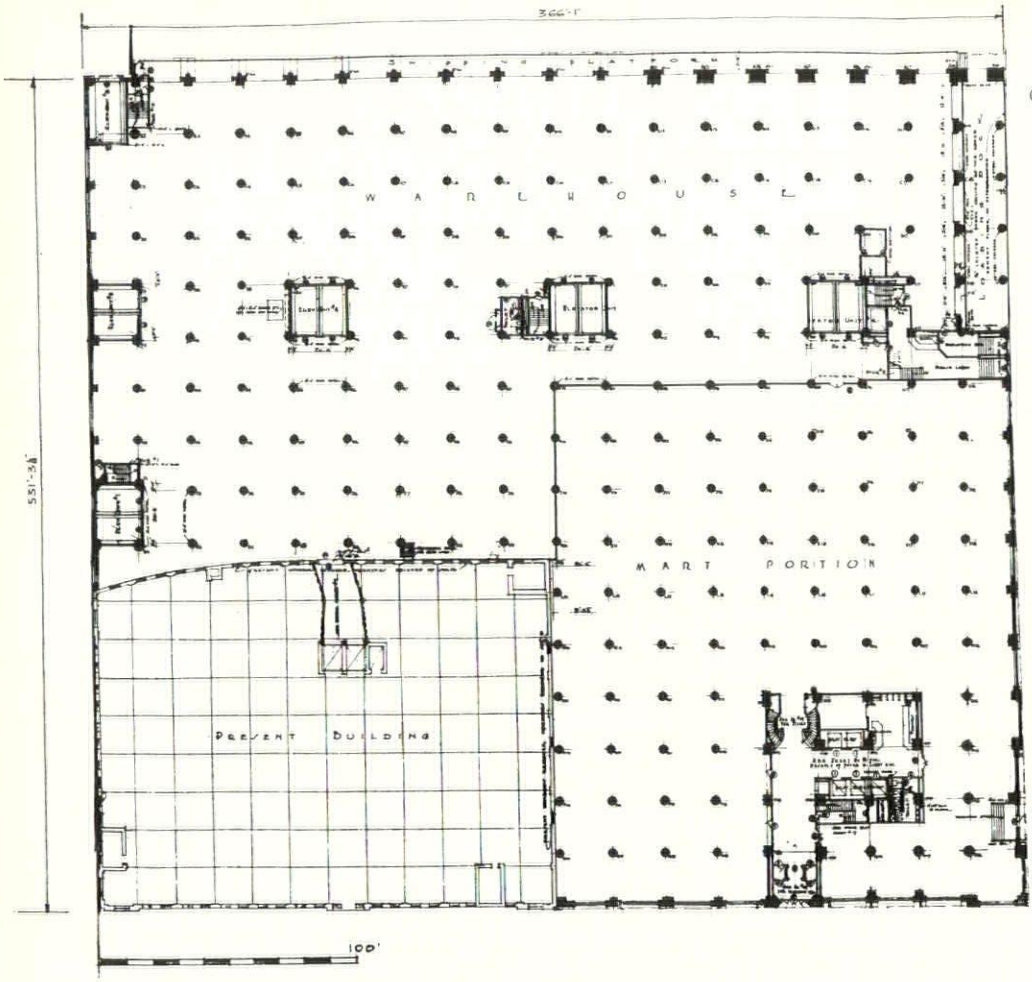
CELL ROOM AND
HEARING AND CONTROL ROOM

booking-desk gives him opportunity to read his teletape on duty, to book his customers, and to note when his men come in and go out. He has control over the boys' detention room, the laws of Massachusetts stating boys cannot be held in a cell.

There must be an inspector's room for fingerprinting and examinations. An emergency room is necessary (and in this case the emergency room is especially well equipped); likewise, a guard room where the officers hold their activities and receive instructions.

In the basement it is desirable to have a rifle range and also place for lost and stolen articles. In a station of this size a matron is not always on hand, but it is required by law that a matron be in a station where there is a woman prisoner. She must have a separate room and toilet accommodations.

On the second floor of the police station there is an officers' room where daily reports can be made out, also bedrooms where the men can stay in cases of emergency; a kitchen where they can eat their meals and a common room. A sliding pole goes through the second floor common room to the guard room on the first floor, an innovation in police station design.



GROUND FLOOR

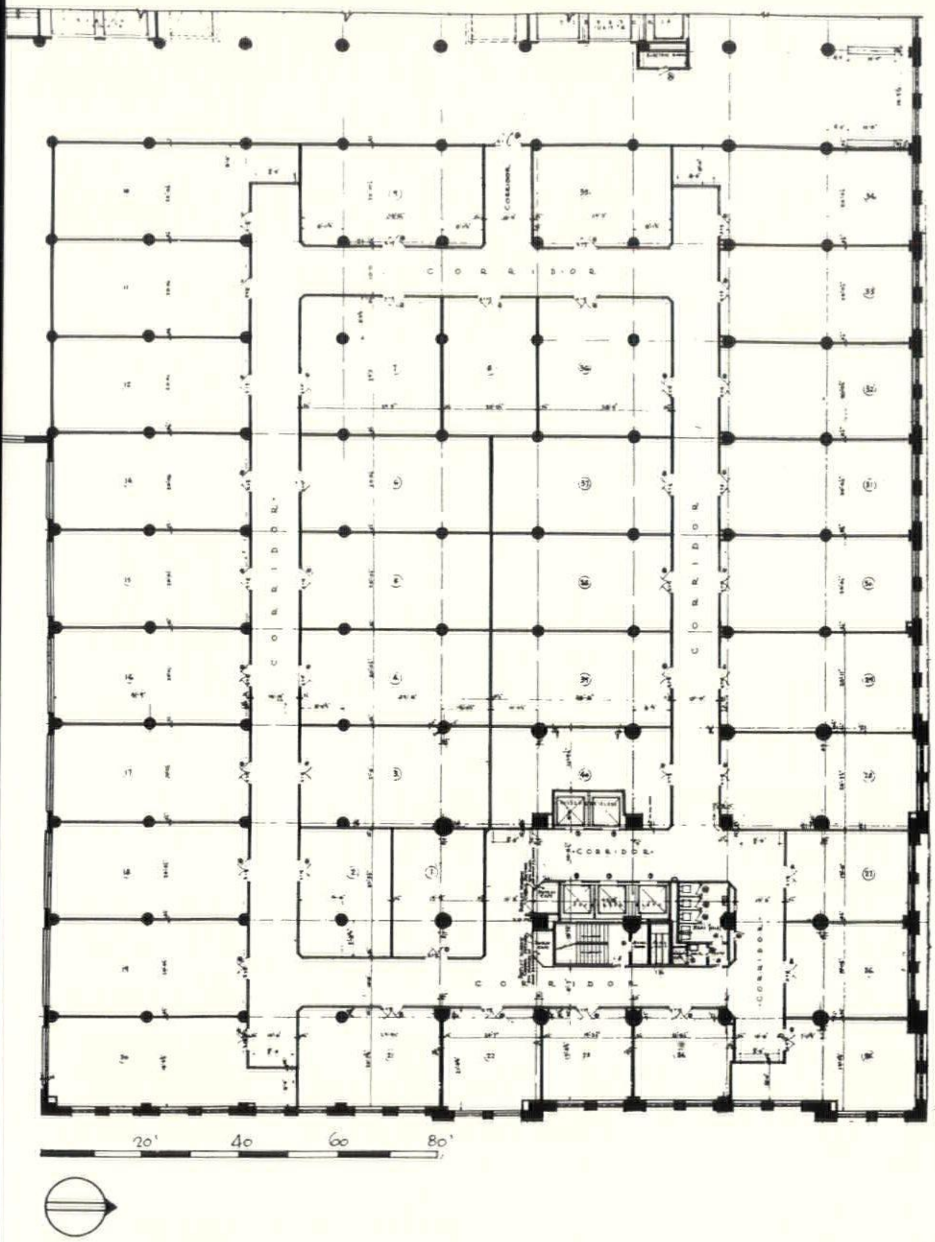
MERCHANDISE MART, ST. LOUIS, MISSOURI

PRESTON J. BRADSHAW, ARCHITECT

An office building for merchandise display and sales. The Mart Building covers an entire city block. This building, new in type, provides under one roof the following accommodations:

—Complete modern sales offices
—Permanent exhibitions of merchandise
—Warehousing facilities
—Every form of distributing service
—Sales marts
—Club rooms occupying two floors with every convenience that the business men's club affords
—Auditoriums
—Meeting rooms for sales conferences
—Studios of KMOX—one of the broadcasting stations of the Columbia chain

The Mart sections (see plans) are divided into large salesrooms with plate glass display windows facing wide corridors. This assumes the character of an arcade of merchandise displays.



TYPICAL MART PLAN

Offices in the tower of the building have latest-type equipment. The corridor partitions are of tapestry obscure glass. The floors are of tile with a terra cotta wainscot. Five high-speed, self-leveling passenger elevators afford lift service from the first to the top floors in twenty-one seconds without stop, while nine well-distributed freight elevators serve the Mart and Industrial sections.

The main *auditorium*, having a seating capacity of 500 people, immediately adjoins the radio broadcasting station. In connection is a special kitchen which is employed when the auditorium seating is cleared and the room used as a banquet hall.

WAREHOUSE FEATURES:

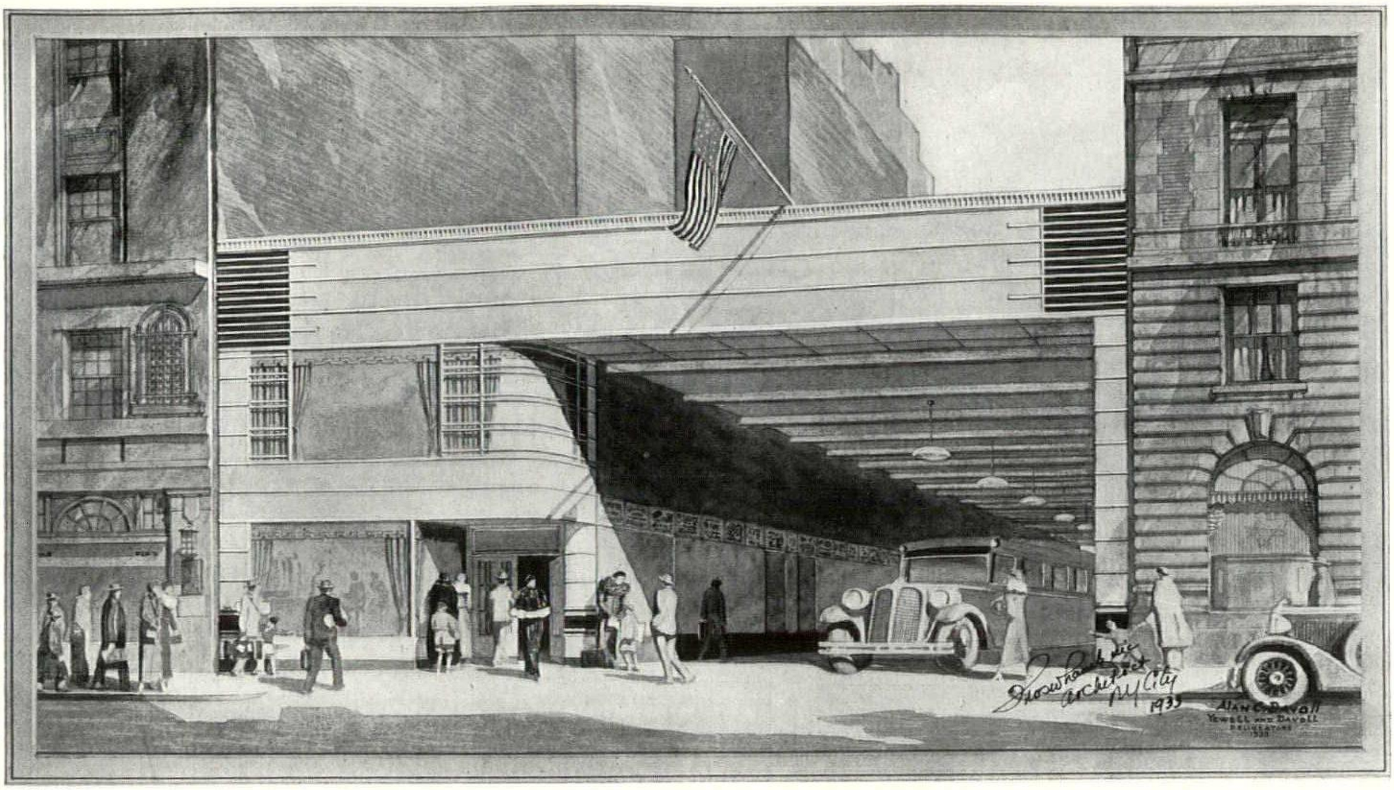
FLOORS—AREA AND LIVE LOAD: Each floor affords approximately 100,000 square feet of area—sufficient to handle almost any amount of storage on one floor is desired. The heavy construction of the building permits live floor loads of 250 pounds per square foot.

CEILING HEIGHTS: Ceiling heights are ample, being 11'6" on the ground floor, 12'3" on the first floor, and 10'9" on the other floors, measurements being taken from floor line to ceiling. The warehouse is protected with sprinkler systems.

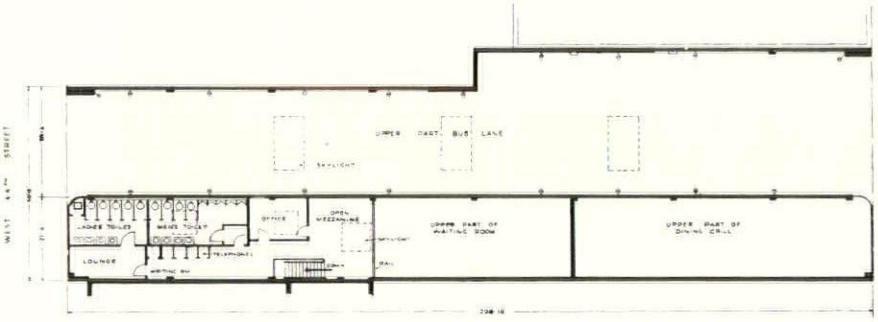
ELEVATORS: Eight heavy-duty elevators with 9 x 17-foot platforms, having a capacity of 10,000 pounds each, serve the warehouse. An additional elevator with a 10 x 24-foot platform and a capacity of 18,000 pounds is so located that a large truck may be driven on to it and carried to any industrial floor for loading or unloading.

TRUCK DOCKS: Covered truck docks on Spruce Street and the full length of Thirteenth Street have a capacity of fifty trucks at one time.

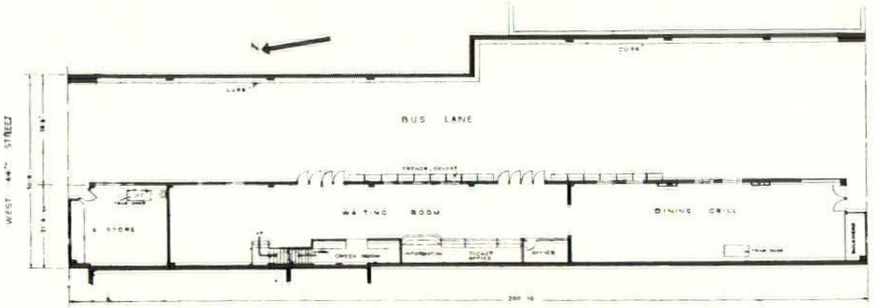
RAILROAD DOCKS: Private railroad sidings adjoin covered freight docks the entire length of the south side of the building, at which 30 cars can be spotted. This provides ample capacity for 100 cars inbound and 100 cars outbound daily.



Dreper



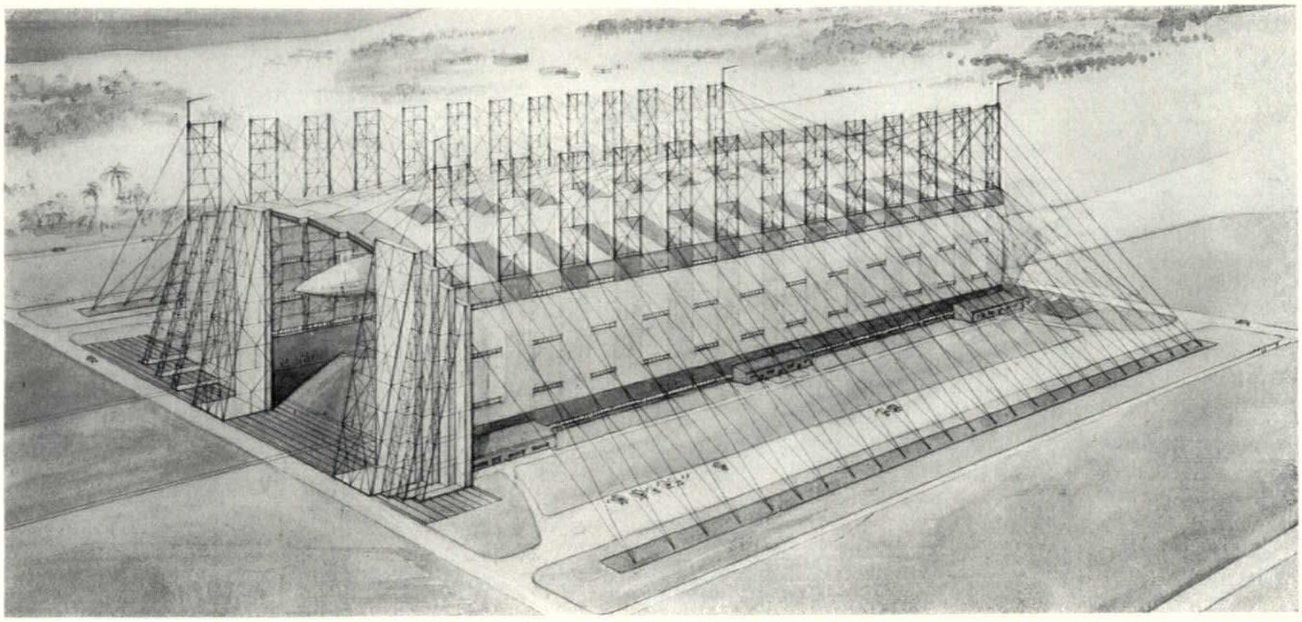
MEZZANINE LEVEL



STREET LEVEL

A BUS TERMINAL, NEW YORK CITY

THOMAS W. LAMB, ARCHITECT



THE RESPESS AIRSHIP DOCK

A NEW TYPE OF DIRIGIBLE HANGAR USING A SUSPENDED ROOF

ROBINSON AND STEINMAN, CONSULTING ARCHITECTS

The construction of the Respess Dock represents a radical departure from all types of dirigible hangars now in use. Instead of arch construction, which is generally in use, the Respess Airship Dock uses a suspension system as shown in the typical cross-section. The inside dimensions of this hangar are 1,000 feet long by 500 feet wide by 225 feet high along the center line. The height of the hangar at the wall is 175 feet.

This hangar was designed to permit the simultaneous construction of two ships 150 feet in diameter. The wind loads were distributed according to data obtained from wind tunnel experiments on model hangars of similar shape. No snow load was considered in the design, as the contemplated construction site is in the South.

LOW COST

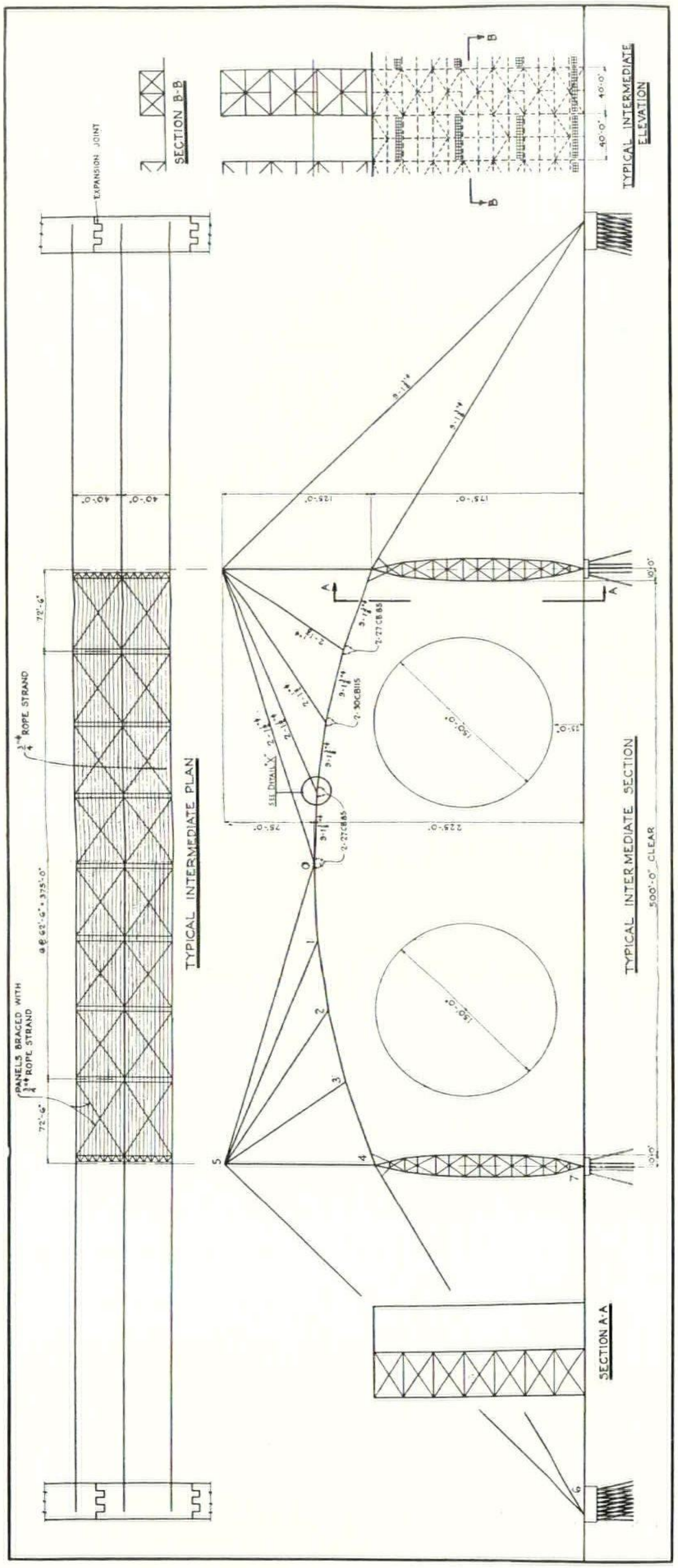
The use of the suspension system in the Respess Airship Dock indicates a substantial saving in cost over the arch type. The estimates indicate that a hangar 1,000 feet in length, open at both ends, and wide enough to permit simultaneous construction of two dirigibles 150 feet in diameter, may be built for $3,050,000. One end may permanently be closed for $225,500 additional.

Doors for the Respess Airship Dock have not been developed at this time. If one door is assumed to cost $375,000, the hangar, with a door at each end, may be built for $3,800,000. A minimum estimate of cost for an equivalent hangar using arch type construction would be $5,000,000, as the Akron Airship Dock, with half the volume of the Respess Airship Dock under consideration, cost about $2,000,000.

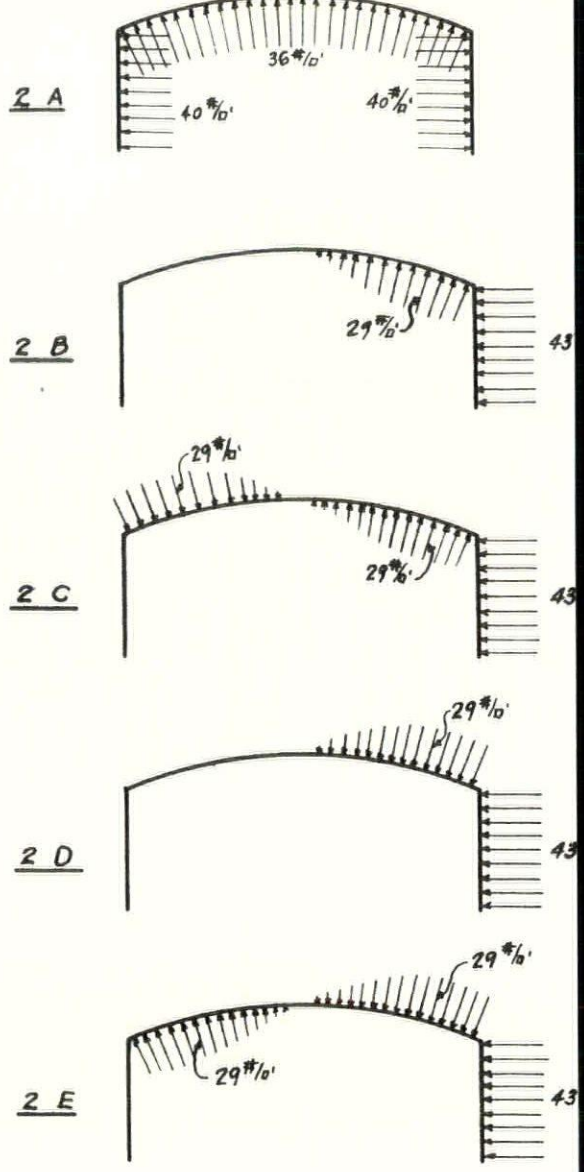
Allowance for snow load increases the above costs for the Respess Airship Dock by $375,000.

SAFETY

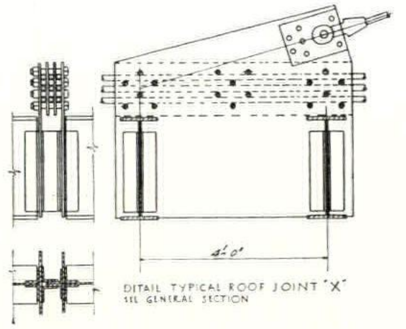
The main carrying members of the Respess Airship Dock consist principally of steel bridge strands which represent the ultimate in inherent strength. This generous use of bridge strands results in a structure which

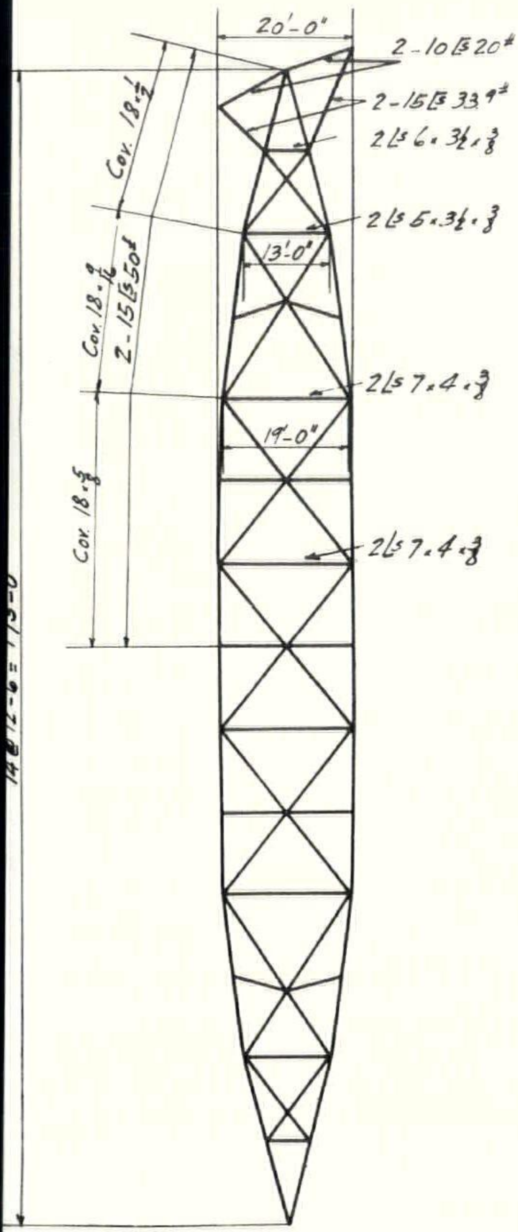


CROSS SECTION SHOWING FRAMING COLUMNS AND CABLES THAT SUPPORT ROOFING MATERIAL OF WIRE MESH AND INTERWOVEN FABRIC



WIND PRESSURE DIAGRAM





COLUMN FRAMING

ALL DIAGONALS AND SUB-HORIZONTALS ARE TWO ANGLES 3½" x 3½" x ⅜"

RESPESS AIRSHIP DOCK
ROBINSON AND STEINMAN
CONSULTING ENGINEERS

has great resilience, a property which permits the hangar to absorb the impacts coming from sudden gusts of wind.

PERMANENCE

The design for the Respess Airship Dock, as described in this report, is comparable to that of a modern suspension bridge in materials and details of construction. A conservative estimate of the useful life of structures of this type is 100 years ***minimum***.

GENERAL DESCRIPTION

The hangar is intended to be a plant for the simultaneous construction of two dirigibles, 150 feet in diameter, thus necessitating a clear width of 500 feet. (A hangar, which is built solely for the storage of two dirigibles, may be made narrower.)

The general plan of construction may be seen on drawings. The hangar space is covered by a suspended roof. The main carrying systems are spaced 40 feet apart. Each system consists of a group of ropes, anchored at 6, strutted to the proper elevation by the side walls 4-7, and following the path 6-4-3-2-1-0. The portion of the ropes forming the roof is held to arched form by stay cables 0-5, 1-5, 2-5, and 3-5. These stay cables are suspended from the top of post 4-5 which is guyed by a group of ropes, 5-6, fastened to the anchorage at 6.

The roof between the main carrying systems is divided by longitudinal girders at points 0, 1, 2, 3, and 4. These girders consist of two beams, laced together into a box section to give vertical and lateral stiffness. They provide support for catwalks, hoists, and other construction conveniences. They also support rope strands which run transversely across the hangar between the side walls.

These transverse ropes support the roofing material which consists of a combined layer of wire mesh and a special fabric interwoven among the transverse ropes. On top of this layer is placed an additional and heavier layer of fabric laid smoothly. The fabric is fireproofed and weatherproofed.

Other types of roofing may also be used. For example, the roof panels may be subdivided by steel beams, instead of ropes, and covered with sheeting or fabric.

The anchorages to which ropes 4-6 and 5-6 are attached are two continuous blocks of concrete, extending the length of the hangar, with expansion joints every 80 feet.

The side walls, 4-7, are designed to act as compression members to support the vertical components of stress in the suspension system. The side walls, being covered with sheeting, must also take a lateral wind load. The roof posts, 4-6, are designed to take the vertical components of stress in the stay ropes and guys 5-6. The side wall columns and roof posts are braced in pairs.

DESIGN OF HANGAR

In the design of a hangar, the principal consideration is that of wind load. The exact wind loads on a structure of this type are a matter of speculation and can only be ascertained with any degree of accuracy by wind tunnel tests of models.

In lieu of wind tunnel tests, which were not warranted by the scope of this preliminary investigation, recourse was had to records of tests already made. Since no tests had been made on a model of the exact shape of the proposed Respess Airship Dock, the wind loads used for this design had to be assumed after a study of existing data.

The wind loads are of two general types: (1) A bursting pressure caused by wind blowing into the open end of the hangar and creating a great negative or outward pressure as in drawing No. 2A; (2) Pressure from wind blowing approximately at right angles to the axis of the hangar. The pressure on the windward wall is positive. The pressure on the leeward wall may have a small positive value or may have a negative value as great numerically as the positive pressure on the windward side.

The wind pressure on the roof, as shown by test data on model hangars, may have great negative value on the windward half and smaller negative value on the leeward half. Accordingly, two wind loadings were assumed as on drawings Nos. 2B and 2C.

Two additional loadings, though improbable in character, were also tested. They are shown on drawings Nos. 2D and 2E.

The maximum positive and negative stresses in each member for the above loadings were noted.

Live load, consisting of the weight of a deflated dirigible, was hung from point w in one half of the roof and then from both halves of the roof. The maximum positive and negative stresses for the live loadings were noted.

Dead load stresses were then computed based upon an initial value of tension in the ropes 4-6 which would preclude .all possibility of reversal in stress from any combination of dead, live, and wind loads. The maximum direct stresses are given on drawing No. 3. Rope sizes are also given on this drawing.

Member 4-7, the side wall column, was designed for stresses due to bending from a lateral wind load, in addition to the direct stress given above. Material for the side wall bent is given on drawing No. 4.

Gall

A SUBWAY GROCERY STORE FOR THE "A. & P."

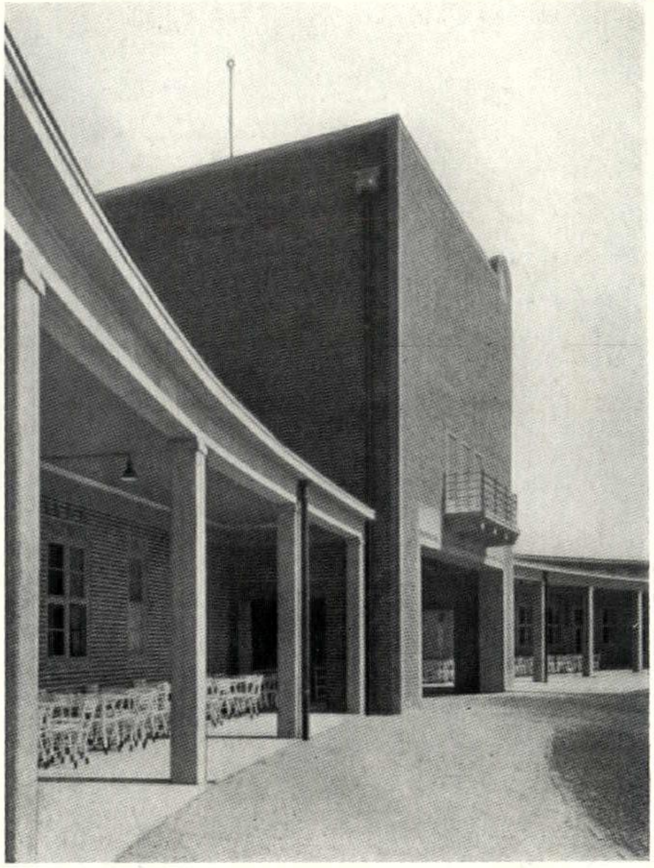
A SUBWAY GROCERY STORE FOR THE "A. & P."

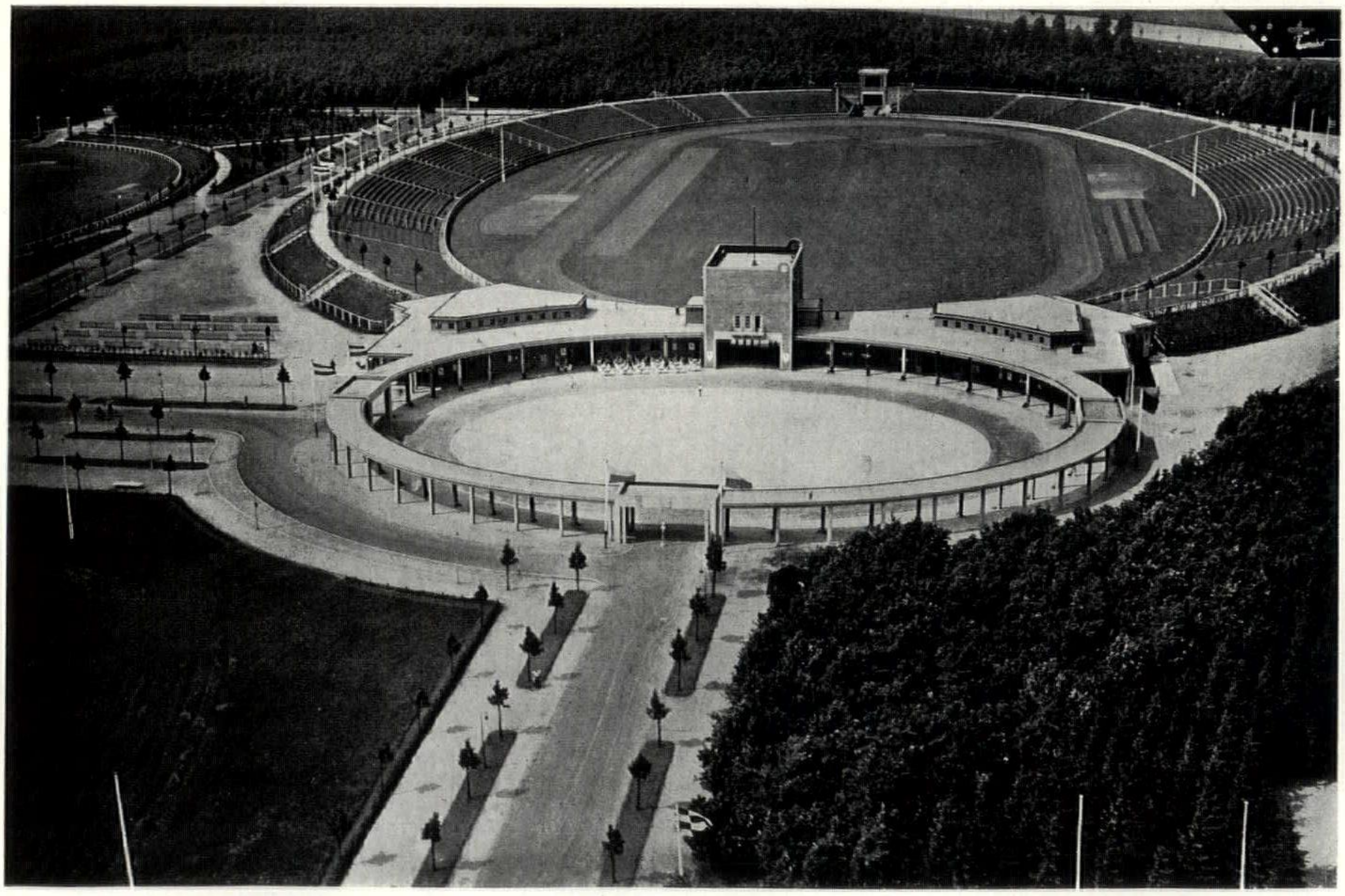
The new Broad Street Railway Station, Philadelphia, has a subway grocery store for the "A. & P." as an accommodation to suburban residents who use the railroad and connecting subway transportation.

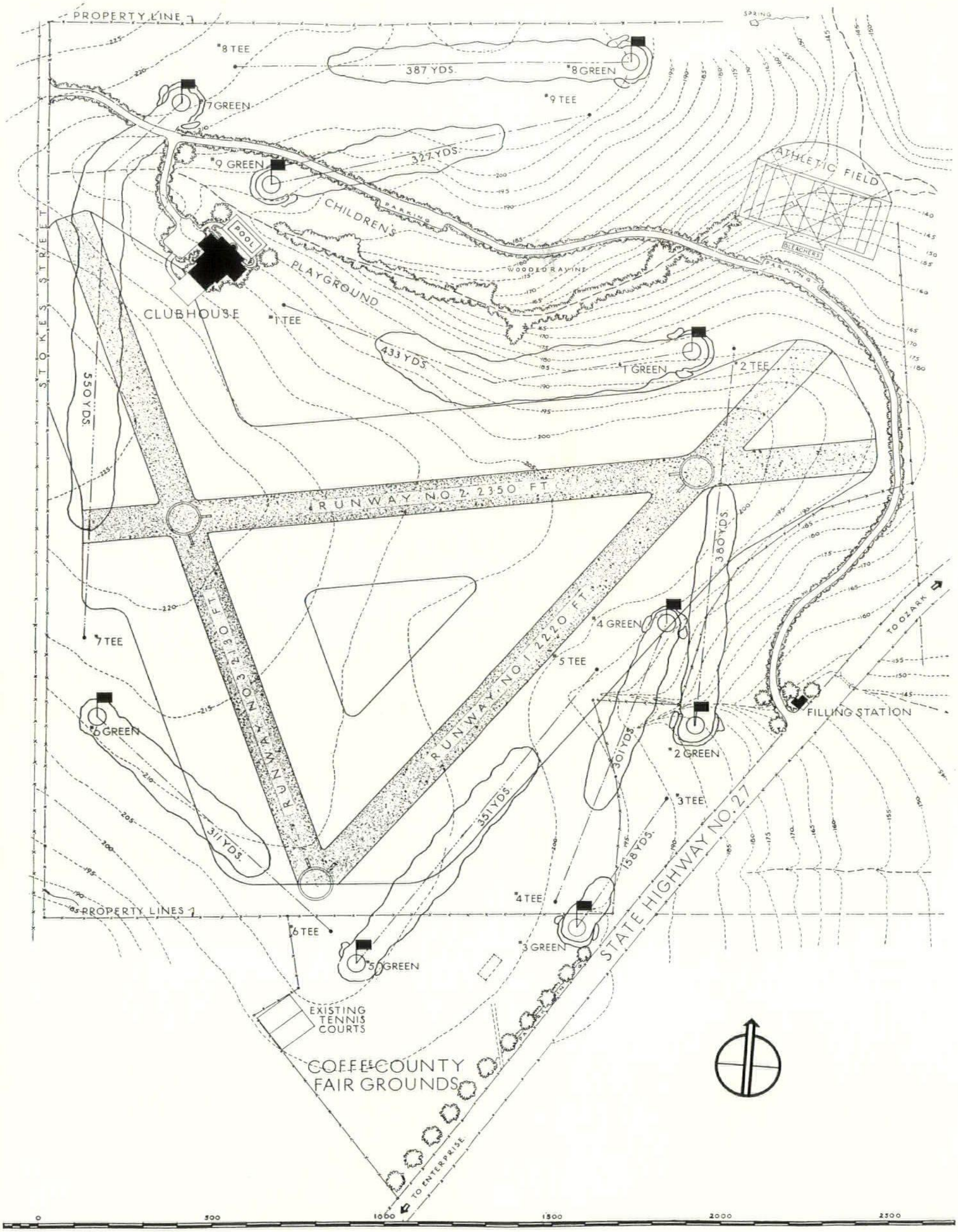
SPORT AND COMMUNITY CENTER, BRESLAU, GERMANY

RICHARD KONWIARZ, ARCHITECT

This building was awarded first prize in the Olympic Games Competition for architecture devoted to sports. Second prize was awarded to John Russell Pope for the Payne Whitney Gymnasium at Yale University.

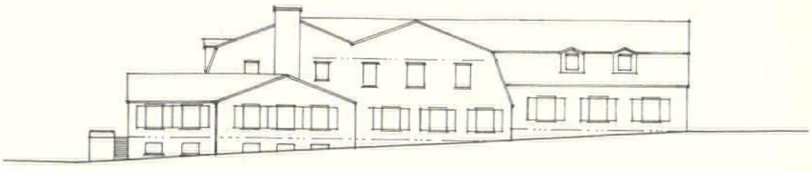




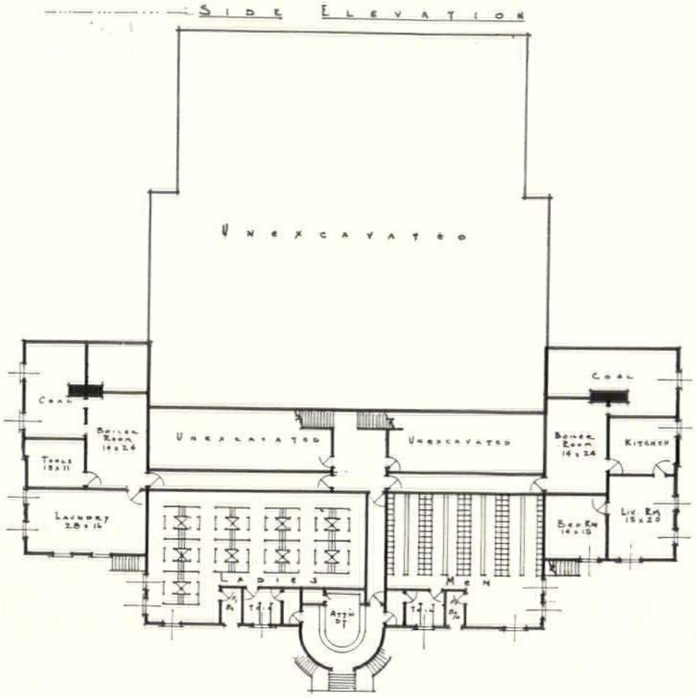


 AN AIRPORT AND RECREATION CENTER COMBINED

MUNICIPAL AIRPORT AND RECREATION CENTER AT ENTERPRISE, ALABAMA . . . Now Under Construction . . . Financed by CWA Funds and CWA Labor . . . H. L. Holman, Jr., Architect



Side Elevation



Ground Floor Plan

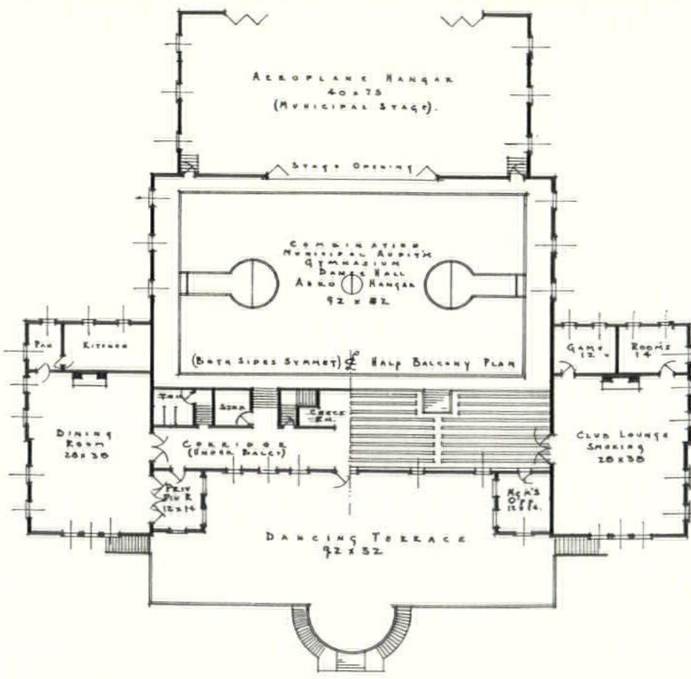
Swimming Pool

The Enterprise, Alabama, Airport and Recreation Center consists of the following:

1. U. S. Government Regulation airplane landing strips (13 airplane runways)
2. Country clubhouse
3. Nine-hole golf course
4. Swimming pool (40 x 100)
5. Athletic field for football and baseball (bleachers)
6. Tennis courts
7. Children's park and playground
8. County fair ground
9. Municipal auditorium (seat 1,200)
10. Gymnasium and indoor basketball court
11. Dancing, indoors and out
12. Public and private dining rooms
13. Caretaker's cottage
14. Filling station
15. Public comfort station
16. Picnic grounds

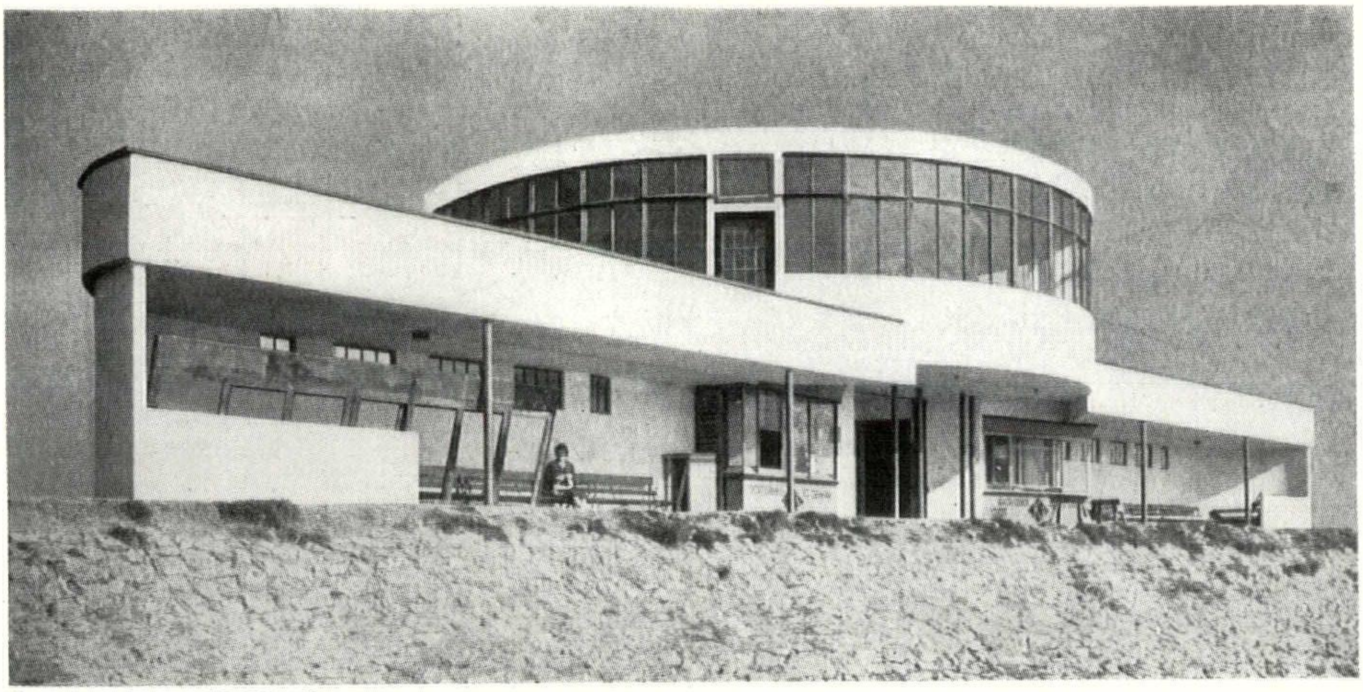
By including the above recreational items in the Airport and by charging a small fee for participation in any of the events, the town will derive an income from the property sufficient to solve the ever-present problem of upkeep, as well as to attract the genearl public to the Airport, consequently stimulating public interest in aviation. In this way it becomes a self-liquidating community asset.

The various activities are selected as an attraction at practically all seasons of the year.



Main Floor Plan

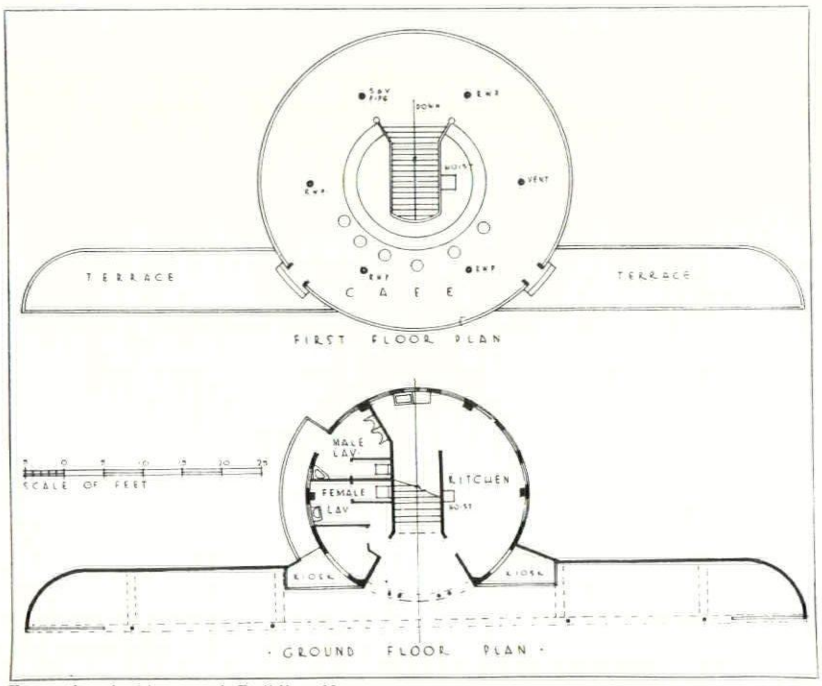
Swimming Pool

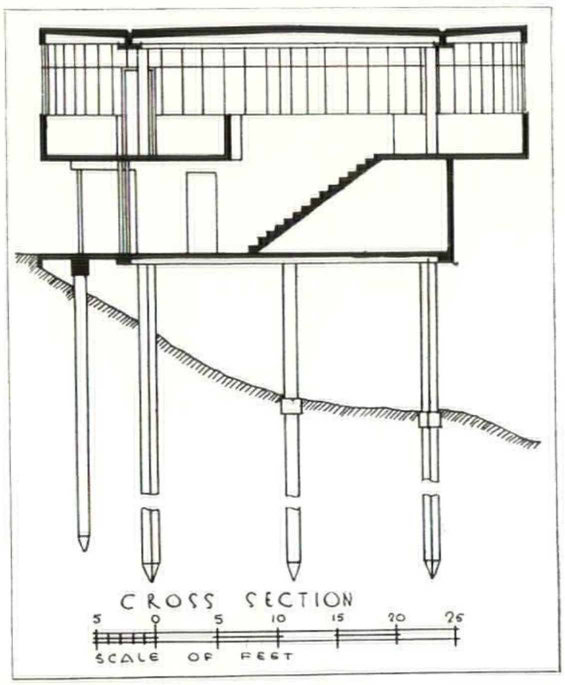


From the Architect and Building News

A CAFE AT CANVEY ISLAND, ENGLAND

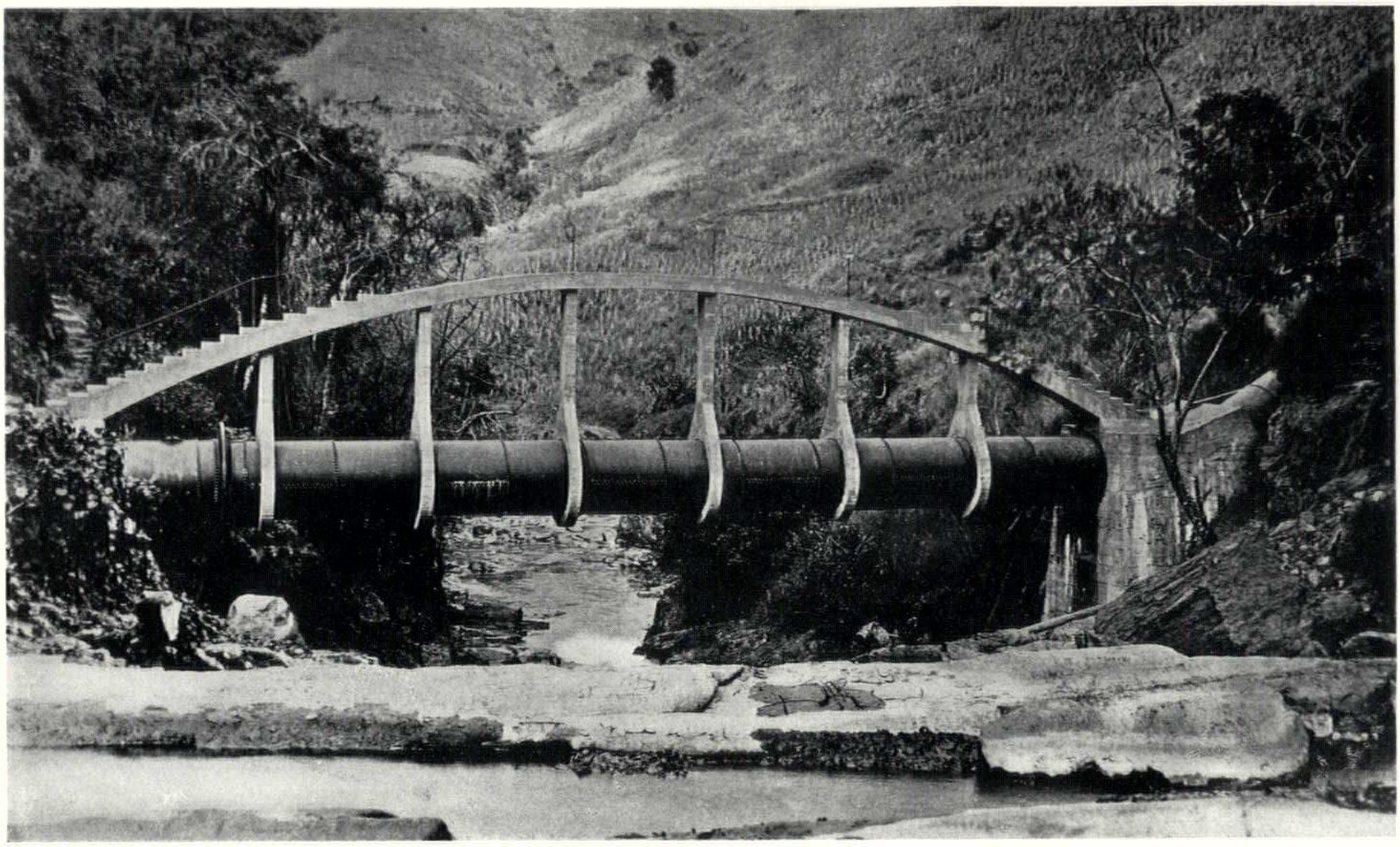
CHRISTIANI & NEILSEN, LTD., ENGINEERS RESPONSIBLE FOR THE PLANNING AND REINFORCED CONCRETE DESIGN AND CALCULATIONS





From the Architect and Building News

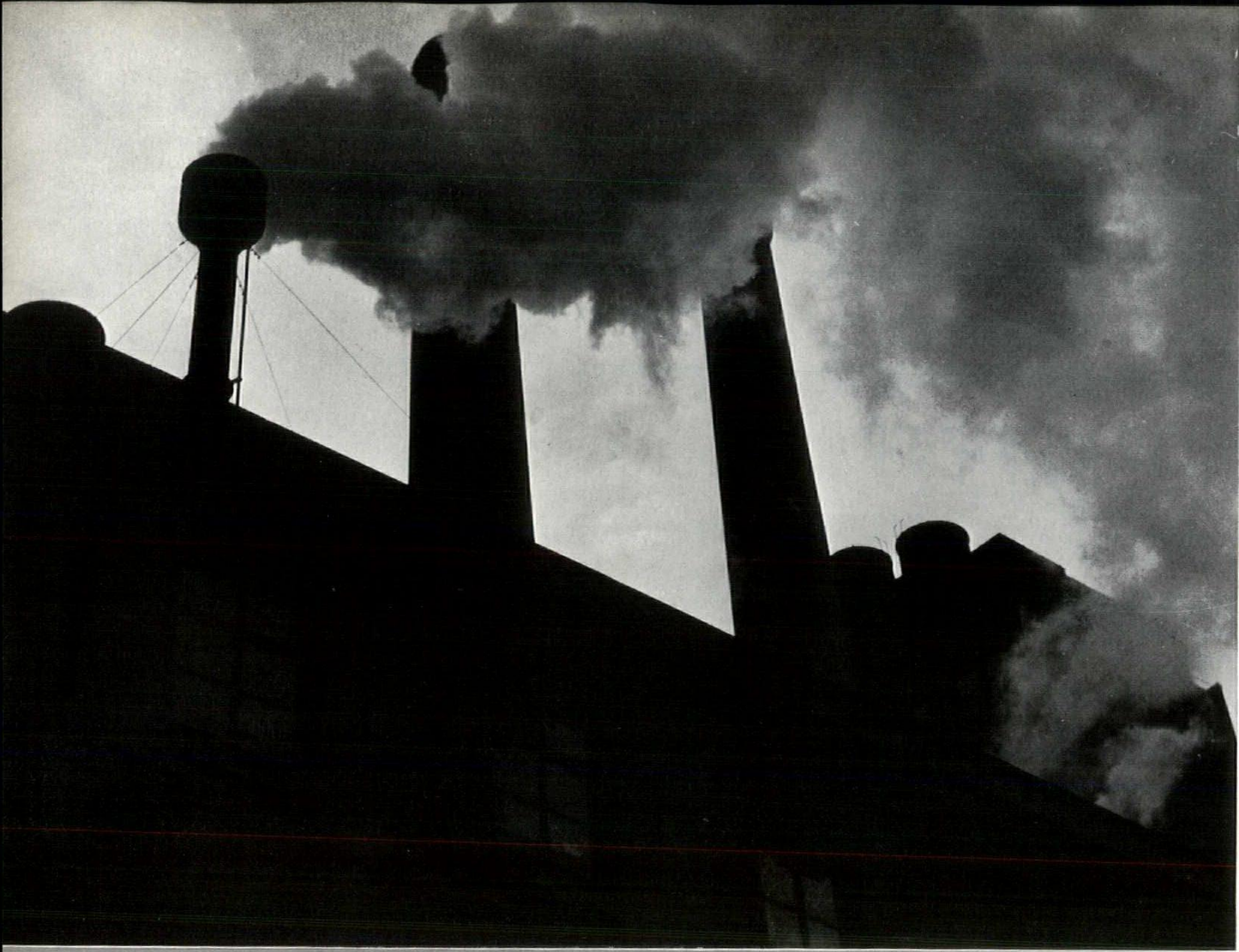
A café housed in a circular building along the river bank at Labworth Park. Kitchen and lavatories are below in the circular part. The two wings are adapted for shelters. The structure is of reinforced concrete. The café floor, over 40 feet in diameter, is cantilevered 6 feet 3 inches beyond the kitchen wall. The circular roof is also supported by a cantilever construction supported by internal hollow columns. Rainwater is drained down the hollow columns. Arrangement and reinforced concrete designed by Christiani & Neilsen, Ltd., Engineers.

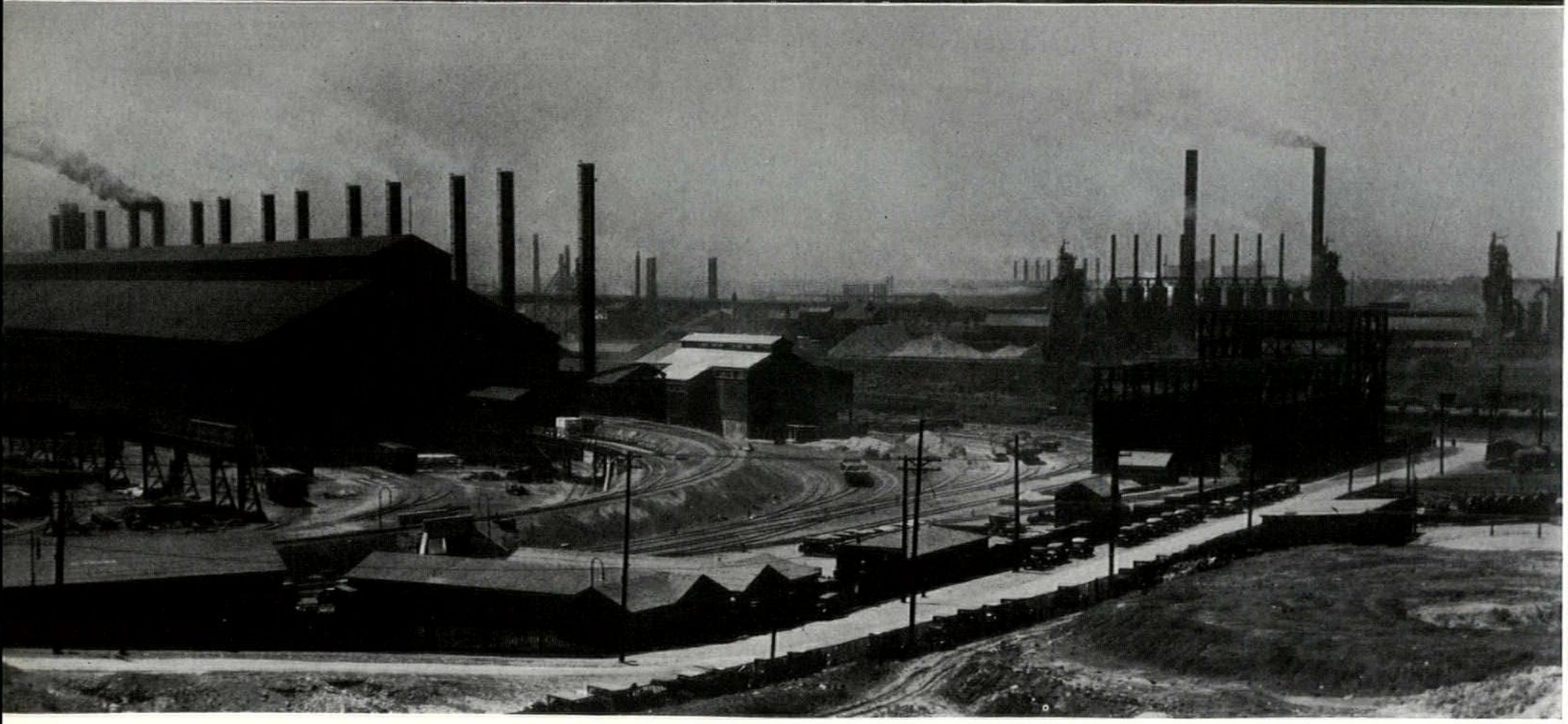


COMBINED FOOTBRIDGE AND PIPE LINE

CHRISTIANI & NEILSEN, LTD., ENGINEERS

This pipe bridge spans the Rio Fagundes, Estado do Rio de Janeiro. It is 75 feet in length. As the pipe line required two large anchoring bolts on each side of the river, the reinforced concrete arch of the bridge rests naturally on these. The bridge was built over and around the pipe line which was first completed on a temporary wooden scaffolding. To the left, on the view above, between the last suspender and the abutment, is seen the expansion joint in the pipe. Steps are formed on the concrete arch for the use of foot passengers.





Nesmith

THE CHIEF CONTAMINANTS OF URBAN AIR ARE PRODUCTS OF FUEL COMBUSTION. ADDED TO THESE ARE DUSTS AND GASES FROM INDUSTRIAL PLANTS, DUST FROM ABRADED STONE, METALLIC PARTICLES, LINT FROM FABRICS AND OTHER SUBSTANCES THAT ARE NOT NATURAL CONSTITUENTS OF THE ATMOSPHERE.

TECHNICAL NEWS AND RESEARCH

AIR POLLUTION

By H. B. MELLER and L. B. SISSON

AIR POLLUTION

By

H. B. MELLER
Head, Air Pollution Investigation, Mellon Institute of Industrial Research, and Chief of the Bureau of Smoke Regulation, Department of Public Health, Pittsburgh, Pa.

L. B. SISSON
Industrial Fellow in Smoke Abatement, Mellon Institute of Industrial Research, Pittsburgh, Pa.

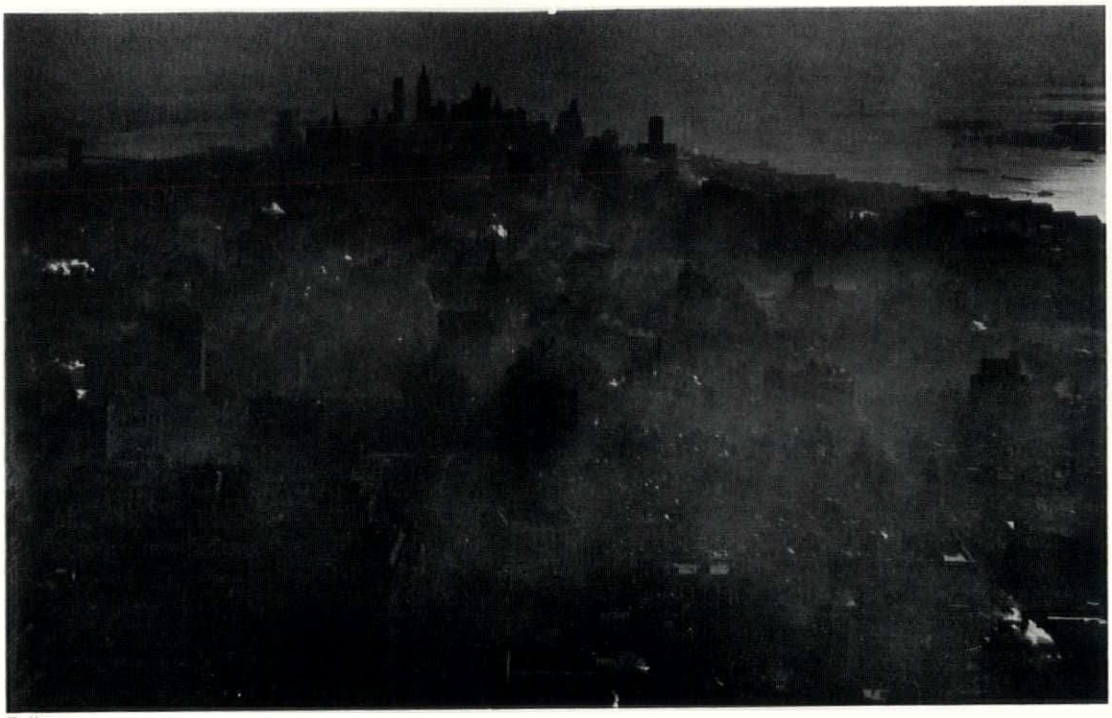
THE PROBLEM

In the last few years science has evolved improved fuel-combustion devices and control methods which the architect can employ to protect his clients and their property. The application of these has lagged because of the low volume of repairs, alterations and replacements of old heating and ventilating plants, and the shortage of new work of this kind. Meantime, the smoke nuisance is reliably reported to have appeared in additional cities and to have been aggravated in some large communities where regulatory efforts were relaxed under severe economic pressure. Within recent months the extension of Administration influence in the construction field has been accompanied by the placing of greater emphasis on the social aspects of housing and urban rehabilitation.

The considerable changes that have come in urban and suburban air control must be taken into account by the architect, engineer and builder. The designer must also give consideration to the fact that preventable smoke and dust are worthless by-products of incomplete combustion and uncontrolled emission, and as such they not only have no sound economic justification, but are permitted to be discharged into city air only because of the good-natured tolerance of the people. How long this tolerance will last is questionable. City people may demand a "new deal" in air as in other matters; they may include smokelessness as being one of the attributes of a "good neighbor."

AIR POLLUTANTS

The chief contaminants of urban air are the products of fuel combustion. Added to these are dusts and gases from industrial plants, dust from abraded natural or artificial stone, metallic particles, lint from fabrics, and other substances that are not natural constituents of the atmosphere. The designer is interested in the combined effects of all these upon structural materials; he also has a second interest in the products of combustion, because he may, through his building design and specifications for the power or heating equipment, be responsible for an increase or a decrease of smoke and dust in the immediate locality.



Galloway

Fuels are gaseous, liquid or solid. In the first group are natural and manufactured gases which, when cleaned and burned with proper appliances, make no visible smoke or dust. Gas is an ideal fuel, within price limitations. The liquid fuel, oil, can be burned smokelessly, but in practice often is not; when it does smoke, due to improper burning, it is highly objectionable. The solid fuels include the inherently smokeless anthracite and coke; semi-bituminous and bituminous coals, with smoke-producing potentialities in direct proportion to the amount of contained volatile matter.

FUELS AND COMBUSTION

For this analysis, fuels may be considered to be composed of volatile matter, fixed carbon and ash. Where the fuel is all volatile, as in gas, or where there is very little volatile matter and nearly all the combustible is in the form of fixed carbon, as in anthracite and coke, it is easy to choose fuel-burning equipment that, with normal operation, will provide complete combustion. As the percentage of volatile matter in the fuel increases, the combustion problem is less simple, and more care is required in the selection of equipment and fuel and in operation to secure comparative freedom from visible smoke.

With solid fuels there is ash, more or less of which is carried out with the stack gases, in the aggregate a large percentage of the solid pollution found in the atmosphere of an industrial city. All of the fuels, except some of the natural gas, contain sulfur in small percentage.

COMBUSTION AND ITS PRODUCTS

Theoretically, combustion is a simple process, being a chemical union of combustible in the fuel with oxygen from the air, the combination producing heat. However, owing to the conditions under which combustion is carried on in a furnace, complications are introduced which may require care to overcome. The number and nature of the difficulties vary considerably with the chemical and physical characteristics of the fuel, the type of furnace and the method of firing.

COMBUSTION AND ITS PRODUCTS

When fresh fuel is fired, its temperature must first be raised to the point where the volatile matter distills off. This volatile matter must be mixed with air, most of which is introduced over the fire. If sufficient air is not supplied, or if the air is not thoroughly mixed with the gases, incomplete combustion will result; there will be carbon monoxide in the gases, and visible smoke will be produced. It is obvious that the smoke-making potentialities of a fuel are in direct proportion to the amount of volatile matter, and are also dependent upon whether the fuel is fired regularly in small quantities (as with a stoker) or intermittently in comparatively large charges. An all-volatile fuel, like gas, can be satisfactorily fed through a properly designed burner which provides for mixing of the gas and air.

After the volatiles are freed from the (solid) fuel, the remainder is coke and ash. Air required to oxidize the carbon is supplied mainly through the fuel bed. The fixed carbon in a soft coal, after distillation of the hydrocarbons, is inherently smokeless and burns similarly to that in anthracite or coke.

Ash produces no heat; much of it is carried out the stack, in fine particles, along with the gases.

The volume of sulfur gases depends upon the amount of fuel burned and its sulfur content—varying from none in much of the natural gas to several per cent in some of the other fuels. Most of the sulfur goes out the stack, partly as a gas and partly occluded in soot. Sulfur trioxide (SO_3) unites with water to form sulfuric acid (H_2SO_4); sulfur dioxide (SO_2) in similar manner forms sulfurous acid (H_2SO_3), which later tends to oxidize further to sulfuric acid.

If combustion is complete, the products will be carbon dioxide and water vapor, plus some compounds of sulfur, and plus such solid particles of carbon and ash as may be forced out by reason of the draft. Only a haze will be visible as coming from the stack. On the other hand, incomplete combustion will result in some carbon monoxide (CO) and the production of more or less visible smoke.

Domestic smoke usually is characterized by the large percentage of combustible material (carbon, hydrogen and tar) and the small percentage of ash. Because usually there is low draft and poor firing, and because the temperature in a hand-fired domestic furnace usually is low, the volatile products are distilled without complete combustion and carried off with the flue gases in various stages of decomposition. The low draft and low velocity in the chimney are responsible for the small percentage of ash.

In larger plants, the fuel is fired more regularly, the furnace temperature is higher, and usually there is better draft. The percentage of combustible in the stack emission is lower, but the amount of ash carried off by the higher draft is much greater.

There are, therefore, as direct air contaminants resulting from the burning of fuel: (1) visible smoke, in volume proportional to the type and amount of fuel burned and the efficiency of combustion; (2) coke and ash, carried off through the stack by the intensity of the draft; and (3) sulfur gases resulting from the burning of sulfur contained in the fuel.

In a consideration of effects, it should be borne in mind that in the broader sense smoke includes all of the products of combustion, whether solid, liquid or gaseous, visible or invisible—not only visible smoke, and especially not merely that visible smoke which is of a density sufficient to bring it within the limit of restriction indicated in the typical anti-smoke ordinance.

METEOROLOGICAL ASPECTS OF AIR POLLUTION

While in thinly inhabited districts the gases generated in the process of combustion may be a negligible factor, in the atmosphere of large cities, they must be taken into account. Along with the gases are the solids from various sources, which are caught up by the turbulent surface wind and carried away or distributed throughout the atmosphere. Naturally, the densest dust or smoke layer is found in congested communities. The effects of this pollution upon meteorological conditions will vary from city to city, depending not only upon the size of the municipality and its rate of production of impurities, but also upon the rate at which the wind and convection currents can carry away the atmospheric sewage. They vary, therefore, with geographical position, season, average wind velocity, and topography.

Fogs may form more quickly, reach a greater density and be prolonged in the presence of a sustained volume of smoke. The free surfaces of suspended particles are nuclei upon which atmospheric moisture can condense when the saturation temperature is reached. As the smoke blanket builds up, in the absence of sufficient wind to carry it away, until it becomes a veritable giant mushroom, the heat rays from the sun are less able to penetrate to any considerable depth and so to break up the fog by evaporation. In the presence of sulfuric acid, evaporation of fog particles is retarded. Also, a further retardation is caused by oily or tarry substances in the smoke which coat the fog particles. Either a smoke pall or a fog mixed with smoke (smog) can persist for days over a community while the surrounding country area may be enjoying sunshine.

There is less natural sunlight in cities than in the country. On an average, yearly, about a sixth of the visible light is calculated to be screened out in New York City and Baltimore, where studies have been made by the U. S. Public Health Service. The ultraviolet loss is larger, it is thought. Mellon Institute found that, in Pittsburgh during the period from October, 1931, to March, 1932, there was a total of 73 days on which the visibility was less than 8 miles, as a result of smoke and dust as distinguished from other obstructions to vision. The average amount of solar ultraviolet radiation (shorter than 3350 A.) received during these days of "light smoke" was 40 per cent less than that recorded for a similar number of days on which this blanket of light smoke was absent. The "ultraviolet winter" sets in earlier in the fall and lasts longer into the spring than does the "visible light winter" in smoky cities.

EFFECTS OF SMOKE ON STONE

From the aesthetic viewpoint, a building that is coated with grime is a building deteriorated, even though the coating of dirt may, in fact, be protective to a degree. That is the case when noncorrosive products of combustion settle upon stonework. If these contaminants are carbon and ash, not accompanied by tar, they can be removed by the simple process of brushing. When tar is present, especially in the case of soot, the condition is aggravated. The tar causes the soot to adhere firmly to the stone, with the result that the surface is

Sandblaster while cleaning outside wall of building wears protective suit, but pedestrians are not guarded against abraded dust which becomes an active air pollutant.

Galloway

Grimy part of prison wall, in contrast with cleaned portion, shows accumulated soot and tar transmitted through atmosphere. (See opposite page).

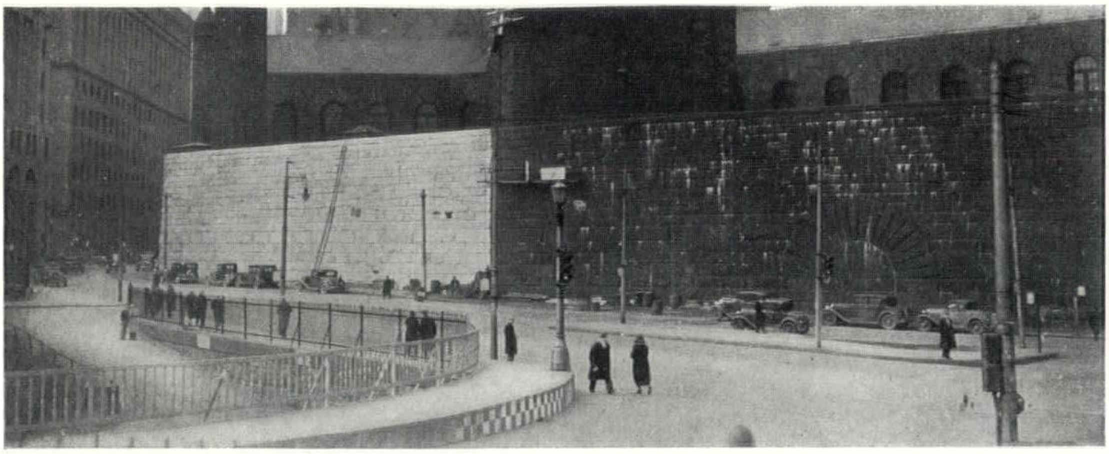
EFFECTS OF SMOKE ON STONE

covered with a coat of black paint which penetrates into the porous structure. This coat is not readily removed, because it has adhesive properties and also because it is insoluble in water. Steam cleaning, the use of solvents or special detergents, such as sodium metaphosphate, or scouring must be resorted to. And of course, the stone soon becomes as dirty as before, unless conditions with respect to atmospheric pollution are changed in the meantime.

Rock *in situ* contains water in amount proportional to the percentage of porosity. Additional water may be absorbed soon after quarrying; this contained and absorbed water, saturated with various substances in the rock composition, gradually comes to the surface and is evaporated, depositing the dissolved minerals in the form of a hard, compact crust which is a protection to the stone beneath. It is obvious that the removal of this crust in the process of cleaning will leave the stone open to weathering until another crust or a coating of noncorrosive dirt is formed as a defense against erosion.

When corroding agents are present even in the small amounts found normally in city air, there may be definite action on certain types of stones if they are brought into contact. Of these agents, sulfuric acid is the most important. Sulfurous acid is not particularly active, but becomes so when changed to sulfuric acid. Hydrochloric acid is of less importance; ammonia and hydrogen sulfide have practically no corrosive effect on stone, but do act upon some exposed metals.

It was stated that part of the sulfur acids leaving the chimney is occluded in soot and part goes out in the form of gas. That which escapes with the flue gas is dissolved by rain and will corrode material with which it comes in con-



tact, but it is soon washed off. That occluded in soot is more injurious, because of its propensity to adhere firmly to the stone. It is not readily washed away by rain and in all probability, if the stone is corrodible, the action is complete.

The corrodible stones are those that contain larger or smaller amounts of the carbonates of calcium and magnesium—limestone, dolomite, and sandstones with a calcareous cementing material. Granites, gneisses, and sandstones in which the grains of sand are cemented by substances other than the carbonates are but little affected by the corroding agents derived from combustion.

The action of sulfuric acid upon stones containing carbonates of calcium and magnesium is to change the carbonates to sulfates. This chemical action involves a change in volume. Still more important than the volume change is the pressure developed by the sulfate crystals growing in definite oriented directions. The stone becomes more porous, loses its cohesion, and disintegrates more readily under the action of the weather.

Action upon concrete is similar, gypsum being formed from the lime in the cement. In addition, the acid reacts upon the aluminate of the cement, forming a complex substance the volume of which is three times that of the original aluminate. The pressure developed in the aggregate is tremendous.

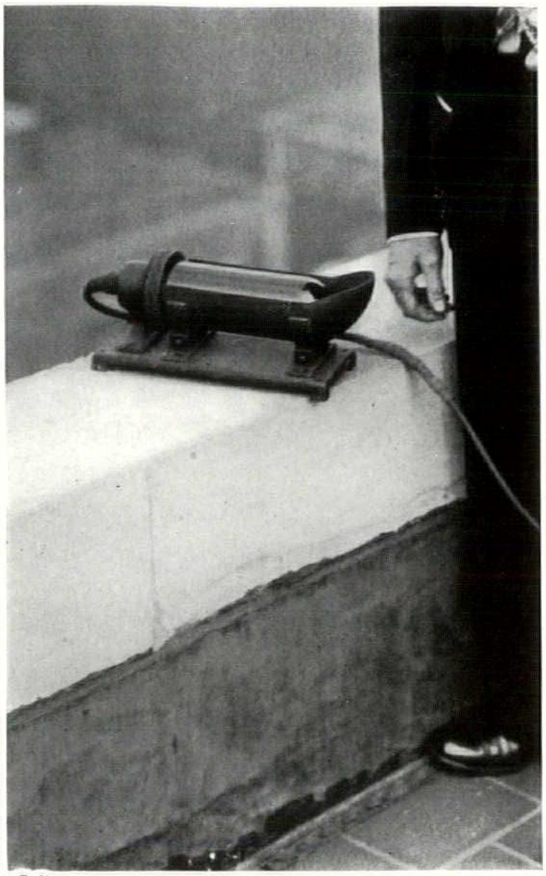
Mortar has a rather porous structure, and besides, it is in process of chemical change for some time after it is placed. It is particularly subject, therefore, to the action of atmospheric acids.

EFFECTS OF SMOKE ON METALS

What has been said about the effects upon stone of a coating of tar, carbon and ash, without accompanying acid, applies also to metals. The covering is protective to a degree, but any intended decorative effect is spoiled, if not entirely destroyed. Scouring may be necessary to rid the surface of soot and tar, but injury to the metal results through abrasion.

When acid is present there is action upon corrodible material. This action is accentuated when the acid is occluded in soot—not only because the accompanying tar causes the soot to adhere firmly to the metallic surface, but because any free carbon that the soot may contain is electro-negative, while the metals are electro-positive; thus galvanic action takes place readily under these conditions and when water is present.

The action of acids, even in small amounts in the atmosphere, upon the common metals used in constructional work is well known. Iron is readily cor-



Galloway

LEFT: Dust counter.

RIGHT: An "electric eye" which automatically records amount of smoke in the atmosphere.

EFFECTS OF SMOKE ON METALS

roded in moist air containing acids; this action is much more rapid in the city with its large volume of products o fcombustion than in the country. Corrosion is made much more rapid by any arrangment of substances making possible electrolytic action. When coated with zinc, iron corrodes more rapidly, once the coating is broken, than either metal alone, because of electrolytic action. On zinc itself there is formed a thin coating of white basic carbonate, soluble in sulfuric acid, which is destroyed readily in air carrying acid vapors. Tin is greatly affected only when it is used as a protective coating for iron, especially when part of the coating is worn away, exposing both metals. Where tin is imperfectly soldered, electrolytic action hastens corrosion. Copper becomes coated with verdigris in moist acid-carrying air. While but slightly affected by dilute hydrochloric and sulfuric acids, copper is particularly sensitive to the action of hydrogen sulfide (as is brass), and is attacked readily by both ammonia and nitric acid, which always are present in small quantities in the air. Lead surfaces dull on exposure, but there is no appreciable corrosion.

Metallurgical research offers to the architect chromium, aluminum and corrosion-resisting alloys of other metals. The exposed metal surfaces on the Empire State and Chrysler buildings are examples of recent practice in this type of ornamentation. No deterioration is evident after about four winters of New York air, although the griming is as great as with other metals. Cleaning with "pure" soap and water removes the dirt and, so far as is evident, leaves the original properties of the metals unchanged.

Often paint films are found to have dried with tacky surfaces that readily collect soot and dirt. Sulfur dioxide will cause such a condition when high percentages of carbon dioxide are present and the humidity is high. While the appearance is marred, soot and dirt are protective, in that they obstruct ultra-violet light and so tend to increase the life of the paint coating. This is of course aside from any action the atmospheric acids may have upon ingredients in the paint.

Increasing use in all types of structures of metals and alloys that are not particularly resistant to atmospheric corrosion has kept paint chemists busy at their problem—to maintain a sufficient concentration of hydroxyl ions next to the surface of an underlying metal.

EFFECTS OF SMOKE ON INTERIORS

Wherever there is air there is dirt—more or less as the outside air is dirty or clean, or the inside air has been filtered. This dirt is carried everywhere by air currents, and increases in griming qualities in proportion to the amount of accompanying tarry matter.

The market does not afford the designer a paint or wall covering the life of which is not shortened by soot. Nor can he make free use of white and light colors in a smoky community. The possibilities of making fullest use of natural lighting are curtailed by the fact that not only is much light absorbed in the atmosphere, but skylights and windows quickly become coated with soot. Interior decorations such as curtains, hangings and rugs pick up the dirt, so that delicate colors cannot be used with any degree of satisfaction.

EFFECTS OF SMOKE ON TREES AND SHRUBBERY

The smoke, dust and gases from the combustion of fuel have the power to check growth or fruition in vegetation. This is evidenced not only by the external appearance of many of the plants, but also by their internal appearance as shown by the size of annual rings and by lesions in leaves. Leaves acquire a tarry "overcoat," especially marked in the case of evergreen plants. Sunlight cannot penetrate the film and the plant is unable to feed properly. Sulfur dioxide, when present, is absorbed by the leaves and forms sulfuric or sulfurous acid, both of which are toxic in the tissues of the leaves. This injury of plants by sulfur is especially marked in time of fogs.

In some cities, evergreen plants are washed or sponged several times a year, to insure that they shall live and grow. A sodium metaphosphate-soap solution is especially useful for such cleaning. The use of plants for ornamental purposes has been severely curtailed by smoke palls, nurserymen report.

HYGIENIC ASPECTS OF THE SMOKE PROBLEM

The psychological and hygienic aspects of air pollution are so closely related that for practical purposes neither can be considered separately. Mental and bodily states react on each other. A smoggy day irritates the mind as well as the respiratory tract, although by different processes. The performance of even routine tasks is affected unfavorably, according to surveys of clerical forces. Common observation is that the feeling of depression often is translated into a nervousness that does not depart until the smoke pall is blown away.

The effects of air contaminants on the body range all the way from those that appears to be transiently and mildly irritation to those that may be serious, or even fatal. None of the solid or gaseous products of the combustion of fuel is held wholly harmless in relation to human health.

HYGIENIC ASPECTS OF THE SMOKE PROBLEM

Air-borne impurities coming in contact with the sensitive membranes of the eyes, nose and throat may aggravate or cause diseases of these organs. Sinus trouble and severe coughing often accompany inhalation of excessive smoke. Atomized (unburned) oil is irritating to the upper respiratory tract. Poisonous compounds which are swallowed may cause nausea or systemic disturbances.

It is in the respiratory tract that the direct effects of the breathing of atmospheric pollutants have been most explored by medical research. Pulmonary anthracosis (not in coal miners) resulting from the retention in the lungs of carbon particles from air breathed is distinctly a disease of the city dweller and is proportionate to the smokiness of the air. With the quantity of carbon particles accumulated by a person in a large city there is an accompanying fibrosis which impairs the elasticity and alters the functional capacity of the organ.

In England, some medical men who are also public health authorities have made surveys and reported a direct relationship between the prevalence of bronchitis and the volume of air pollutants arising from chimneys.

In America, a relationship between pneumonia and smoke has been suspected but no complete investigation, coupling field data with mortality records and laboratory findings, has been reported. In making studies along this line in Pittsburgh, it was found that the districts which reported the most pneumonia were the smokiest and also about the poorest in housing and some other respects. These factors made the studies very complicated and did not permit of conclusions one way or another. Among the physicians who have continued to think there is a direct relationship between smoke and pneumonia is Dr. Samuel R. Haythorn, director of the Singer Memorial Laboratory. He has been collecting autopsy material from Pittsburgh lungs for a quarter of a century, and has recently organized a medical staff to study the material. The Pittsburgh Department of Health also has assigned a physician to gather ample field data on current pneumonia cases.

One of the facts connected with acute inflammatory conditions of the lungs is the value of having unobstructed lymph spaces. Where air pollutants have obliterated these lymph spaces, however, the gravity of the condition is increased. Solid contaminants which have been breathed in, and which of themselves may not directly act on lung tissue, can by their mass clogging be indirectly very serious.

The refusal of the acute respiratory disease death rate to decrease in near the proportion that most other disease death rates have dropped in the cold months in cities is responsible for the ceaseless quest being conducted for predispositionary and contributory causes. Air pollution is one of these, but its rank still is debatable.

Medical research along a related line is reporting upon the direct effects of the inhalation of one certain air pollutant, silicon, which exists in nature chiefly in the form of the oxide, SiO_2, and as silicates of various kinds. Ash containing silica is among the products of the combustion of solid fuel and is carried out of the stack mostly according to the velocity of the draft. Abraded constructional materials and highway surfacings also are sources of silica particles in city air. In industrial and some other operations silica is frequently described as "rock dust" and investigations into it have been authoritatively reported on by the U. S. Public Health Service, the U. S. Bureau of Mines, and others. Other studies now being pursued are taking cognizance of the effects of combinations of dusts. This latter type of study is deemed necessary for an eventual relation of the findings to city air.

These investigations appear to be headed toward an authoritative determination of the "safe load" of the sizes, the kind or kinds, or combinations of kinds, of air-borne solids that may be breathed.

Among the indirect hygienic effects of smoke is the interception of some, and in cases all of the shorter ultraviolet rays of the sun. These rays are the natural source of vitamin D; in addition, they restrict bacterial growth. Rickets, and other disturbances of the metabolism of lime salts very important to health, result when this short ultraviolet radiation is excluded from the body. When the nutrition of the body is thus vitiated, it becomes more susceptible to bacterial infection.

Galloway

AIR POLLUTION

PREVENTIVE MEASURES →

Measures adopted to protect structures from the effects of atmospheric pollution may be discussed under five general heads:

1 CHOICE OF SITE AND ORIENTATION OF BUILDING;

2 DESIGN;

3 SELECTION OF MATERIALS, INCLUDING PROTECTIVE COATINGS;

4 POSSIBILITY AND EASE OF CLEANING, AND

5 SMOKE AND DUST CONTROL.

SELECTION OF A SITE If there is possibility of selection from a number of available locations, it is of primary importance to know something about relative dirtiness. There may be available data from sootfall studies such as have been conducted in various cities, or it may be feasible to have the air sampled over a period of time at each of the possible sites. Failing these, some indications of the condition of the atmosphere can be obtained by making a visibility study or by observing the luxuriance and vitality of trees, flowers, shrubbery and grass. There also are records, which may be secured upon request, of various tests which reveal the corrosive properties of the air in some localities. These will give cues relative to the rate and seasonal intensity of attack against which provision must be made.

In orienting a building, the utilization of sunlight for illumination is not the only objective. The beneficial hygienic effects of direct sunlight, especially of that in the ultraviolet region, are to be considered. Likewise, the use of sun-heat to counteract dampness is of importance.

DESIGN In the presence of very good air conditions, there may be a wide latitude in design. Such circumstances specially favor the flat-roof, sun-deck type of building. Not nearly as much care need be taken to guard against exterior irregularities of line which would serve as shelves or pockets to catch and hold the black and corrosive contaminants from the air.

The problem is complicated when the air carries considerable concentration of the products of combustion. Under such conditions it is likely that the architect will simplify his design and will eliminate irregularities or dirt-catchers as far as possible. This may involve setting the windows practically flush with the exterior wall and excluding projections that might trap sooty or acid water which later would trickle down the face of the building in a jagged pattern. The solution retained along shelves becomes more acidic as the water evaporates. This favors severer destructive action on mortar, stone and metal. If there are cracks in constructional material, such as sometimes are seen at window ledges, any projecting surface which interrupts the flow of polluted water will divert it into the fissures and assist disintegration deeper in the wall.

DESIGN

SELECTION OF MATERIALS, INCLUDING PROTECTIVE COATINGS

Scientific research in building materials, paints and lacquers has been so extensive and has produced so many new combinations that an architect well may be excused if he honestly confesses that he does not know the "last word." As a matter of fact, this "last word" still lies somewhere ahead. The task of the designer is to choose the best of that which is available.

From the standpoint of evading damage by air pollution, choice of outside wall materials will be toward the resistant stones and glazed ceramic products, because they are not affected by atmospheric acids, are easily and cheaply cleaned, and do not discolor under sunlight. Special attention will be given to the composition of mortar, in order to check disintegration by acid compounds.

The development by metallurgical research of acid-resisting alloys, especially for exposed trim, has been mentioned. Likewise, paint chemists have been searching for the best combinations of materials for protective coatings for metals that are not resistant to atmospheric corrosion. One of these, recently reported, is composed of 1 part linseed oil, 2½ parts bakelite and 8 parts chinawood oil for the vehicle; blue lead and zinc chromate as pigments.

A Navy specification for exterior metal protection prescribes 2 pounds of aluminum powder to 1 gallon of the foregoing proportions of linseed oil, bakelite and chinawood oil. The same specification has been adopted by some, at least, of the electric light companies for painting iron poles.

For covering exterior stone, aluminum stearate and aluminum palmitate, available in any tint, are being used extensively as resistants to city air contaminants.

Some recent research directs the use of a coat of aluminum wood priming for protection of either exterior or interior wood surfaces; to be followed, on inside woodwork, with two coats of a pain which has a phthalic-anhydride-glycerol type resin (30 per cent nonvolatile) for vehicle, and either lithopone or titanium-reduced pigment. For outdoor application, the nonvolatile element in the vehicle is increased to 50 per cent, with zinc, lead or titanium for pigment.

These examples of the fruits of research are not to be considered as either all-inclusive or necessarily the best, but as illustrating the trend of paint technology away from simple and familiar formulas and toward more complex and decidedly more expensive mixtures. The goal being striven for is not merely the delay of corrosion in structures, but the securing of practically complete protection of the structural materials, with a protective coating which itself shall be highly resistant to deterioration by atmospheric contaminants and the abrasive action which accompanies cleaning.

In connection with the protection of corrodible metals or metallic pigments, attention should be accorded a series of studies on the causes of corrosion of metals, made in England in connection with monthly sootfall collections. It was reported that the rate of attack on metals exposed to city air was found to be directly proportional to the concentration of air pollutants, regardless of the season. Where dust settles on commercial metallic surfaces (save in the instances of chrome-steel alloys or pure aluminum and perhaps some other cases) the difference in electrical potential between the dust particle and the metal makes possible electro-chemical action, leading to pitting and crystalline deformation which can be detected only by testing for loss of electrical conductivity or by a study of photomicrographs. Moisture, which is present always in air, has a part in the action.

In cities where there has been a considerable increase in air pollution in recent years, it is a question if some of the older structures carry as high a safety factor as that with which they were originally credited.

CLEANING

In communities where the uncontrolled smoke and dust content of the air amounts to a continuous nuisance and where there is a sufficient concentration of air-borne sulfur-compounds to damage buildings and contents, the owners and managers of business establishments are just as ready as are housewives to listen attentively to suggestions that promise permanent reductions in cleaning, maintenance and replacement costs and that at the same time will result in cleaner exteriors and interiors. These will attract customers, clients and lessees.

The place to start to plan for a paring of operating and replacement expenditures is in the original design of the construction or in the remodeling of a building. In carrying out this idea, the architect chooses materials that are resistant to the disintegrating effects of smoke deposits and then arranges them to facilitate removal of the grime. Sharply broken surfaces are replaced by mass flatness; angles tend to become exceedingly scarce; variation in line is supplanted by large areal depressions and by variations in color. The underlying idea is to secure surfaces inside and outside that lend themselves to rapid and cheap mechanical scrubbing and drying, and will not abrade under such treatment.

The plan of rapid and frequent cheap cleaning may call for door frames and window casements, and the surfaces of the doors and windows, to be flush with the flat wall, so that the scrubbing movement can be continuous.

SMOKE AND DUST CONTROL IN A BUILDING

The architect does not need to be reminded of the importance of proper loca-

SMOKE AND DUST CONTROL IN A BUILDING

tion and arrangement of the boiler room. A wrong location with reference to the fuel-storage space, to the stack which is to carry off the products of combustion, or to the distribution of the steam, hot water or warm air, easily can increase the cost of heat production.

In the selection of fuels and fuel-burning equipment there is wide latitude. The choice will depend, in most cases, largely upon what is the logical fuel in the particular district. If it should be gas or anthracite, the choice of equipment to provide for smokeless operation is simple. If it should be bituminous coal, however, the first decision to be made is whether the coal shall be burned in its raw state, or coke shall be used. In the latter event, no extra precautions will be necessary. Should the decision be in favor of raw coal, the demand for steam or heat will determine whether the fuel shall be fired by hand, or fed automatically. Automatic feed is best in all cases, but for small installations (heating boilers under, say, 2,500 sq. ft. rated capacity) the general practice is to fire by hand. For all cases in which the coal is not fed automatically, the boiler should be of the approved "smokeless" type or the fuel used should have volatile matter not to exceed 20 per cent.

The stack should be of a cross-section and height sufficient to furnish the necessary draft and to carry off the gases at a reasonable (not excessive) velocity. City bureaus of smoke regulation have tables of stack sizes that conform to good practice. It scarcely seems necessary to say that a stack must be higher than any nearby building, but many cases where this simple imperative rule has been violated can be seen in any city.

These are matters that have to do directly with the making or prevention of visible smoke. For the comfort and convenience of persons in the building, it is possible to purchase fuel that has little or no dust, or that has been treated to prevent dustiness in the boiler room. This is of distinct advantage where the basement or cellar is to be used for other purposes, as well as to prevent contamination of the air in the building by dirt from the fuel.

As protection from excessive air pollution in outside air, recourse may be had to filtration of air brought in for indoor uses. Architects will learn with interest that during the current heating season, in some rather well-rated residential districts, manufacturers engaged in installation of air conditioning equipment have encountered difficulties by reason of the periodic appearance (generally in connection with smogs) of unexpectedly large volumes of excessively tarry or oily soot, frequently acidic, and in very large proportion coming from the chimneys of the private dwellings or small business places in the immediate neighborhood. All such difficulties have to be met by expenditures for more extensive filter area or replacement of the filter devices, or both. The condition is not promotive of lower prices or easier operation of the air conditioning systems.

In congested areas the use of roofs for recreational purposes is increasing. In designing for this, the architect must consider not only the contaminants in the air of the district, but those that may come from the chimney of the building in question. Obviously, the matter of general pollution must be handled in a community way, but no roof will be usable with any satisfaction if the chimney on the building is permitted to smoke or to emit quantities of dust.

The prevention of visible smoke has been touched upon; other solids must be separated from the gas stream. This is feasible to a very satisfactory degree by use of one of the various types of dust separators now on the market. Space will not permit a discussion of the methods, but it is believed designers are familiar with their operation in many large plants, and will see the advantage of extending their application.

AIR POLLUTION CONTROL ESSENTIALS

In connection with the several foregoing considerations of methods of protecting against the effects of air pollution, it may be asked why it would not be cheaper and really easier to control the output of smoke and dust in the first instance. It would, but the difficulty is that those responsible for this air pollution are neither the only nor perhaps the worst sufferers from it. If they were obliged to retain it in the atmosphere immediately surrounding their own structures, the story would be different. So far, apparently, one of the conceptions of being a good neighbor is to stand, more or less uncomplainingly, for damage caused by someone else's smoke.

With negligible exceptions, city ordinances attempt to regulate only smoke so dense that it is impossible to see through it as it leaves the stack. Even the densest smoke is permitted for a matter of minutes at varying periods. Contaminants that do not color the smoke stream are wholly unregulated. Ordinances are not flexible, they do not provide for progressively stricter standards. The forces of inspectors are everywhere inadequate. Almost all cities exempt private dwellings, which are known to be heavy contributors to the nuisance.

For communities that do feel that something constructive in the matter of general control can and should be done, the way is open.

It is easy to indicate the limits to which existing (or new) ordinances could be raised:

(1) no dense smoke in normal operation, light smoke only according to character of logically available fuel;

(2) alterations and repairs to meet the new standard of smokeless operation;

(3) time limit for compliance by all fuel-users;

(4) dust separators in cases of excessive emission;

(5) progressive ordinance revision as improvements in fuels, appliances and practices are made.

Complete elimination of air pollution being impracticable, a community movement toward purer air needs first to learn the reasonably attainable limits and be satisfied therewith. The scientific manner of securing this knowledge is by survey which will determine:

(1) the sources and extent of the actual polluation, and its effects;

(2) the logical combinations of fuels and appliances for a particular com-

...mong leaders of commmunity thought to make a sus-
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...r can, if he will, assume a leading rôle by authori-
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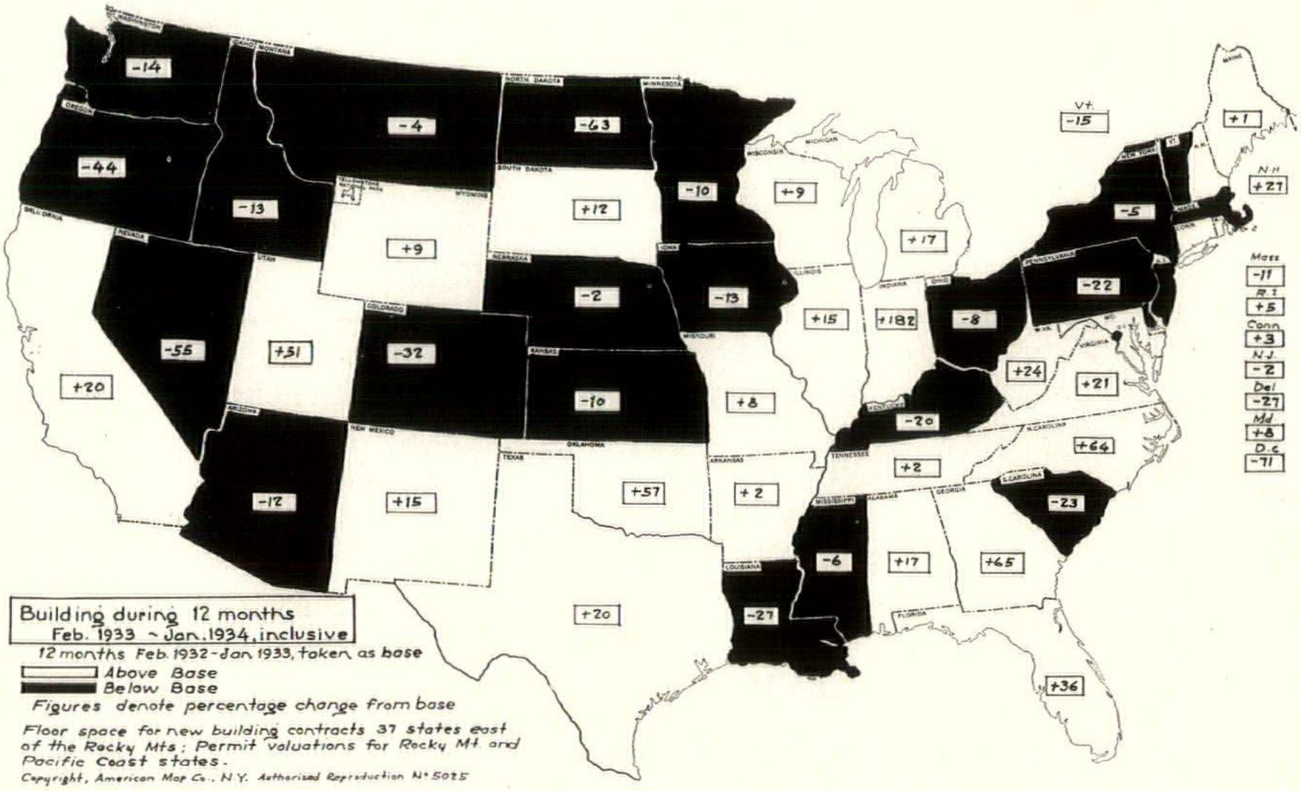

BUILDING TRENDS AND OUTLOOK

By L. SETH SCHNITMAN, Chief Statistician, F. W. Dodge Corporation

Contracts let during January in the 37 Eastern states showed a gain of over 100 per cent over January, 1933; but the total of $187,463,700 was almost 10 per cent smaller than the contract volume for December which totaled $207,209,500. The current January total was only 5 per cent behind the volume for the entire first quarter of 1933; this discloses how great has been the relative improvement over the lethargic conditions of last year.

January contracts for residential building totaled $15,110,400 as against $23,899,600 for December and only $11,950,900 for January, 1933. Awards for nonresidential building amounted to $58,616,100 in January as compared with $50,040,000 for December and only $28,731,600 for January of last year. Public works contracts (of engineering types) awarded in January not only exceeded the totals for both comparative periods but were more than 60 per cent larger than those reported for the entire first quarter of 1933. Public utilities awards fell sharply from December but were maintained above the level of January, 1933.

Based on figures for the first three weeks of February, the contract total for the 37 Eastern states for the entire month fell sharply from the record for January, but the contract volume was almost twice as great as was recorded in February of last year. The sharp decline from January was occasioned by a slackening in the PWA program; privately-financed construction appears to have run ahead of both the January volume and that for February of a year ago.

MATERIAL PRICE MEASURING ROD*

The prices in this tabulation enable one to visualize at a glance the main trend of the material market. Their significance does not extend beyond that point, and the explanation below should be read carefully.

F. W. Dodge Corporation Composite Prices as Indicated in Explanation

Material	This Month	Month Ago	Year Ago
Portland Cement	$2.26	†$2.26	$2.05
Common Brick	12.36	†12.35	11.70
Structural Steel	1.65	1.65	1.60
Lumber	16.50	†16.46	15.47

Prices given in this comparison are composite and do not in all cases refer to one item. For instance, the price of structural steel is the composite of prices of shapes and plates f.o.b. Pittsburgh; the price of lumber is a composite of five items of Southern pi... items of Dou... cement i... differ... tra...

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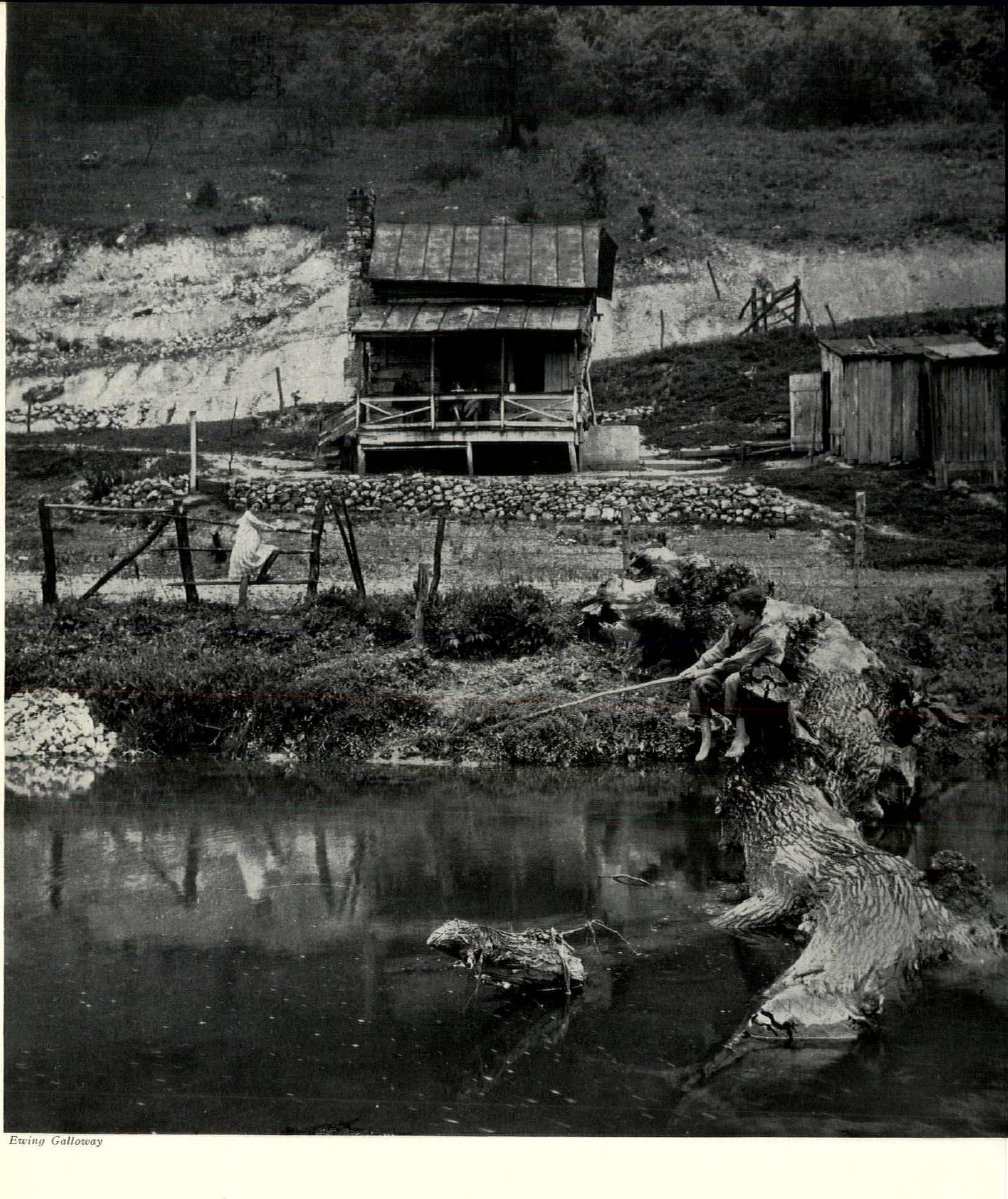

Ewing Galloway

VOL · 75 NUMBER 4

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A P R I L

THE ARCHITECTURAL RECORD

BETTER HOMES AS AN AID TO RECOVERY

THE RECOVERY PROGRAM HAS AMONG ITS GENERAL AIMS THE FOLLOWING OBJECTIVES: (1) TO PLACE AGRICULTURE AND INDUSTRY ON A FOOTING OF EQUALITY AS REGARDS THE EXCHANGE VALUE OF THE COMMODITIES WHICH THEY PRODUCE AND (2) TO RAISE THE STANDARDS OF LIVING BOTH IN THE AGRICULTURAL AND IN THE INDUSTRIAL POPULATION. IN FURTHERANCE OF THE SECOND OF THESE OBJECTIVES, A PROGRAM OF URBAN HOUSING IMPROVEMENT IS TO BE PARALLELED BY A PROGRAM FOR IMPROVEMENT OF FARM AND VILLAGE HOUSING.

TO PROVIDE BASIC INFORMATION FOR THE LATTER PROGRAM, A FIELD SURVEY HAS BEEN MADE OF ALL FARMHOUSES IN ABOUT 300 RURAL COUNTIES IN 46 STATES. THE SURVEY IS A CIVIL WORKS PROJECT, CARRIED OUT BY THE U. S. DEPARTMENT OF AGRICULTURE AND THE STATE AGRICULTURAL EXTENSION SERVICES.

THE SURVEY DEALT NOT ONLY WITH STRUCTURAL CONDITIONS BUT ALSO WITH CONDITIONS RELATED TO SANITARY AND LABOR-SAVING DEVICES, PROGRESS IN THE PROVISION OF WHICH HAS BEEN RETARDED IN RESPECT OF FARM HOMES COMPARED WITH URBAN DWELLINGS—WATER SUPPLY AND SEWAGE DISPOSAL; LIGHT AND HEAT; REFRIGERATION, LAUNDRY AND COOKING FACILITIES; LANDSCAPING OF HOMESTEADS.

TO GAUGE THE IMPLICATIONS OF THE QUESTIONS ASKED WITH REGARD TO SANITARY AND LABOR-SAVING DEVICES, ONE MUST BEAR IN MIND THE DECLARED PURPOSE OF THE ADMINISTRATION TO MAKE ELECTRIC CURRENT AVAILABLE FOR THE AVERAGE HOME. THAT AN ERA OF GENERALLY DISTRIBUTED INEXPENSIVE CURRENT IS AT HAND IS EVIDENT FROM THE HYDRO-ELECTRIC PROJECTS UNDER CONSTRUCTION OR AUTHORIZED. AMONG THESE MAY BE MENTIONED THE TENNESSEE RIVER PROJECT FOR THE SOUTHEAST, BOULDER DAM FOR THE SOUTHWEST, THE BONNEVILLE AND GRAND COULEE PROJECTS FOR THE NORTHWEST, AND OTHER PROJECTS FOR THE GREAT INTERIOR TRIBUTARY TO THE MISSISSIPPI RIVER.

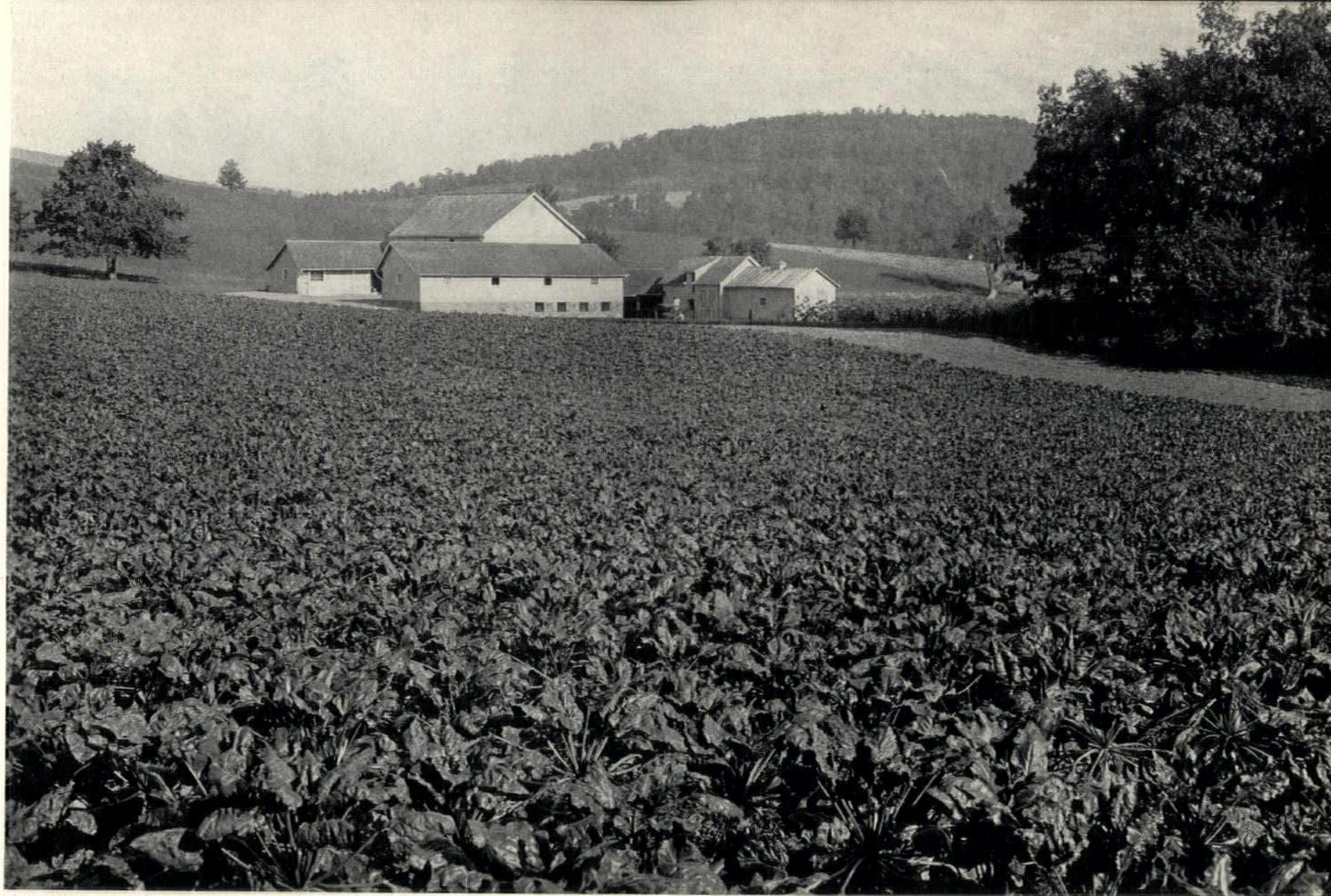
Each state group was asked to submit plans for new farmhouses in the following price ranges, based on NRA prices and wage rates.

REGION	FIRST PRICE RANGE	SECOND PRICE RANGE	THIRD PRICE RANGE
EASTERN STATES	UNDER $1,500	$1,500 – $3,500	$3,500 – $7,000
CENTRAL STATES	UNDER 1,500	1,500 – 3,500	3,500 – 7,000
SOUTHERN STATES	UNDER 750	750 – 2,500	2,500 – 5,000
WESTERN STATES	UNDER 1,200	1,200 – 3,000	3,000 – 6,000

IN ANTICIPATION OF A FEDERAL PROGRAM FOR MODERNIZING OLD FARMHOUSES AND CONSTRUCTING NEW ONES, THE CIVIL WORKS ADMINISTRATION HAS ALSO SPONSORED AN INVESTIGATION BY THE BUREAU OF HOME ECONOMICS IN COOPERATION WITH THE BUREAU OF AGRICULTURAL ENGINEERING AND OTHER AGENCIES OF THE U. S. DEPARTMENT OF AGRICULTURE TO PREPARE A SERIES OF DESIGNS FOR NEW FARMHOUSES, OF SUGGESTIONS FOR REMODELING AND OF SPECIFICATIONS FOR EQUIPMENT. THE INFORMATION GATHERED BY THE INVESTIGATION REPRESENTS THE COOPERATIVE EFFORT FOR EACH STATE OF HOME ECONOMISTS, AGRICULTURAL ENGINEERS, RURAL ARCHITECTS, AND EXTENSION WORKERS OF COLLEGES AND OTHER PUBLIC INSTITUTIONS.

EACH STATE GROUP WAS ASKED TO SUBMIT AMONG OTHER ITEMS PLANS FOR NEW FARMHOUSES IN THREE PRICE RANGES, BASED ON NRA PRICES AND WAGE RATES. THESE PRICE RANGES, IN CONNECTION WITH COOPERATIVE EXPERT PLANNING, ARE CALCULATED TO BRING OUT INFORMATION NOT OBTAINABLE ELSEWHERE ON SOUND LOW-COST EQUIPMENT AND CONSTRUCTION BY USE OF PRODUCTS ACTUALLY ON THE MARKET.

THE PROBLEMS OF PLAN, DESIGN, CONSTRUCTION AND EQUIPMENT OF FARMHOUSES DIFFER ONLY IN DETAIL, AND NOT IN PRINCIPLE, FROM THOSE OF SUBURBAN DWELLINGS. NEVER WITHIN OUR KNOWLEDGE HAVE SO MANY KINDS OF SPECIALISTS OVER SO WIDE A GEOGRAPHICAL AREA CONTRIBUTED PERSONAL EXPERIENCE TOWARDS THE SOLUTION OF AN ARCHITECTURAL PROJECT. THE COMPILATION OF THE RESULTS IS IN THE HANDS OF DR. S. H. McCRORY AND MR. WALLACE ASHBY OF THE BUREAU OF AGRICULTURAL ENGINEERING, U. S. DEPARTMENT OF AGRICULTURE, THROUGH WHOSE COURTESY THIS MAGAZINE IS PRIVILEGED TO PUBLISH WHAT IS IN EFFECT AN ILLUSTRATED REPORT ON THOSE FEATURES WHICH HAVE PARTICULAR VALUE FOR ARCHITECTS.



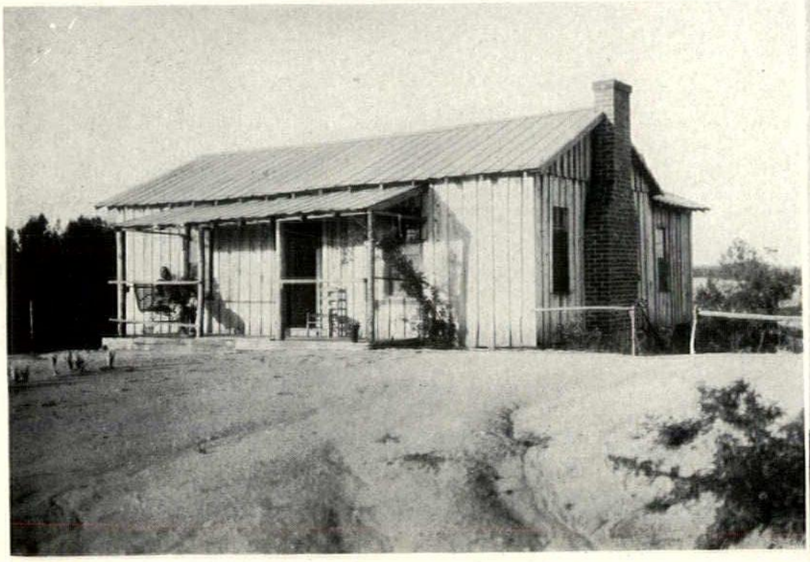
Nesmith

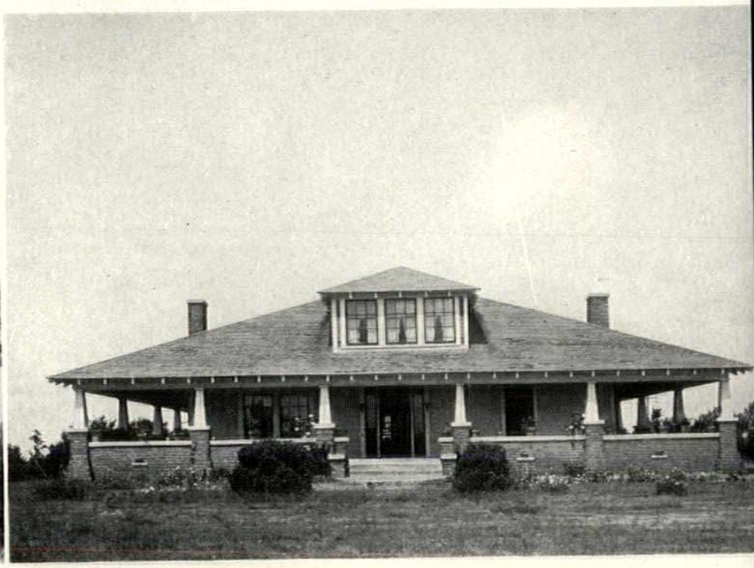
ASSUMING THAT THE FACTS UNCOVERED BY THE FARMHOUSE SURVEY ARE APPLICABLE TO THE SIX MILLION FARM DWELLINGS IN THE UNITED STATES, AND ASSUMING FURTHER THAT THE ADMINISTRATION SUCCEEDS IN RAISING THE EXCHANGE VALUE OF AGRICULTURAL COMMODITIES, ONE IS LED TO CONCLUDE THAT THE FARM AND VILLAGE HOUSING IMPROVEMENT PROGRAM MAY BECOME AN IMPORTANT FACTOR IN THE BUILDING INDUSTRY AND THAT ITS INFLUENCE MAY EXTEND OVER A LONG PERIOD IN RESPONSE TO THE TREND TOWARDS HYDRO-ELECTRIC DEVELOPMENT.

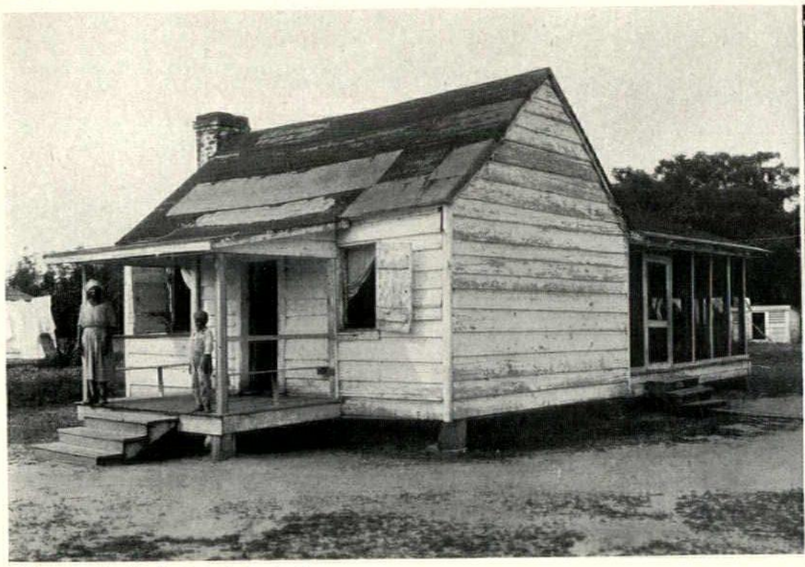
THE FARM AND VILLAGE HOUSING PROGRAM IS INTERLOCKED WITH A PROGRAM FOR IMPROVEMENT OF MODERATE-COST URBAN HOUSING. BOTH PROGRAMS ARE BASED ON FIELD SURVEYS TO COMPUTE (1) THE EXTENT OF THE NEED FOR REPAIRS, MODERNIZATION AND NEW CONSTRUCTION AND (2) THE AMOUNT OF LOW-COST FINANCING REQUIRED. AT THIS WRITING THE RESULTS OF THE URBAN OCCUPANCY-VACANCY SURVEY HAVE NOT YET BEEN RELEASED, BUT THEIR TREND IS A MATTER OF GENERAL KNOWLEDGE.

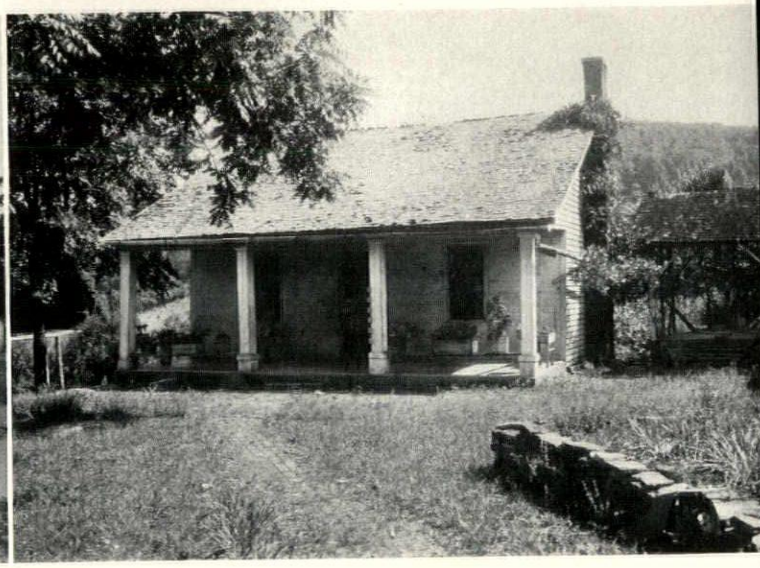
EACH OF THESE PROGRAMS DEPENDS FOR SUCCESS UPON LOW-COST FINANCING. A PLAN FOR REORGANIZATION OF MORTGAGE FACILITIES AND FOR OTHERWISE LOWERING THE COST TO HOME OWNERS PARTICIPATING IN THE BETTER HOUSING CAMPAIGN WILL PROBABLY BE ADOPTED.

THIS FORM OF BETTER HOUSING CAMPAIGN WILL ENCOUNTER NO SUCH HINDRANCES OF DIVIDED OWNERSHIP AND ARTIFICIAL LAND VALUES AS HAVE SLOWED UP THE PLAN FOR SLUM CLEARANCE AND LOW-RENT HOUSING. IT IS SIMPLE OF EXECUTION, IF INEXPENSIVE FINANCING IS SUPPLIED; AND ITS POSSIBILITIES AS AN AGENCY OF RECOVERY IN THE CAPITAL GOODS INDUSTRIES ARE OBVIOUS.









Photos, U. S. Dept. of Agriculture

1 Negro quarters, South Carolina—meeting house at end of group.

2 Negro house, Gaffney, South Carolina.

3 Negro cabin on plantation in South Carolina.

4 Typical mid-western farmhouse. The original 2-room house was expanded with increase of family by the addition of a wing and porch.

5 A typical farmhouse in Mississippi.

6 Farm home, Jasper, Tennessee. Cistern at right. Kitchen at rear.

SURVEY OF FARM CONDITIONS

The Farm Housing Survey is a Civil Works Administration project under the direction of the U. S. Department of Agriculture and the State Agricultural Extension Services. The objective is the provision of basic information necessary for a program of improvement for farm homes.

About 300 counties throughout the United States have been covered by the investigation. Approximately one-tenth of the counties, representing ten different states and comprising a total of roughly 57,600 farmhouses, have already been reported and the findings issued in preliminary form, subject to later revision, by the Department of Agriculture. The accompanying tables have been prepared by The Record from data contained in the county reports; they conform to the major divisions of the questionnaire used by the CWA enumerators. Although the reports issued to date (March 28) represent too small a sample to justify very definite conclusions, except for the particular localities, it is likely that subsequent reports will not materially change the relative statistical importance of those factors which appear predominant in the tabulations.

In view of the plans of the Administration in Washington to extend credit to finance needed renovation and modernization of dwellings, the tables should be useful in indicating the general scope of such a construction program for the rural districts as well as showing the relative significance of individual items of repair or addition most desired by the farm populations. The Housing Survey reveals clearly and emphatically a number of insufficiencies in the construction and equipment of American farmhouses.

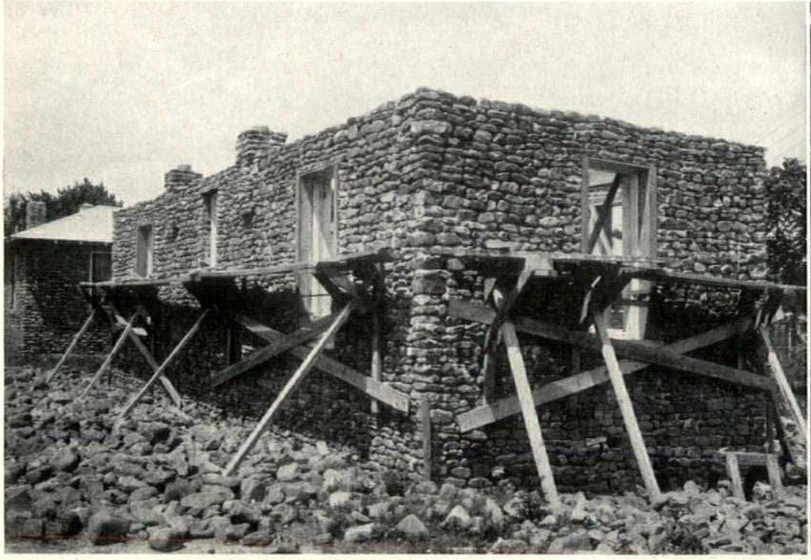
1

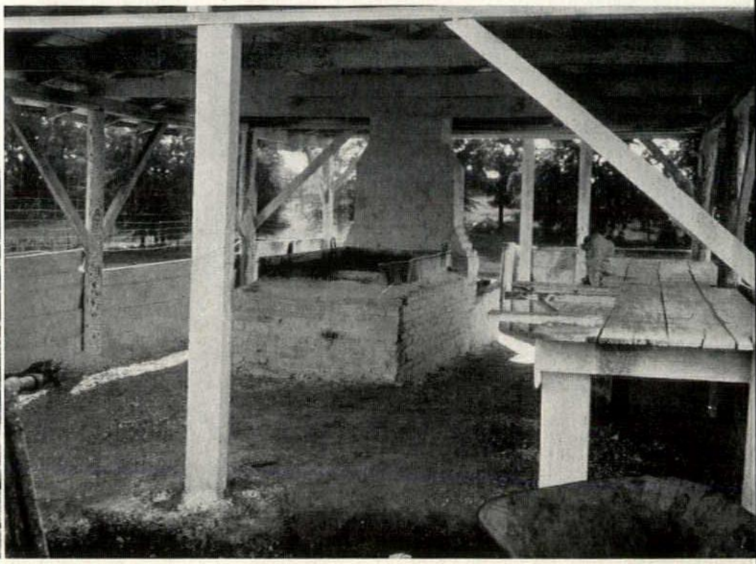
TYPES OF FARM HOUSES

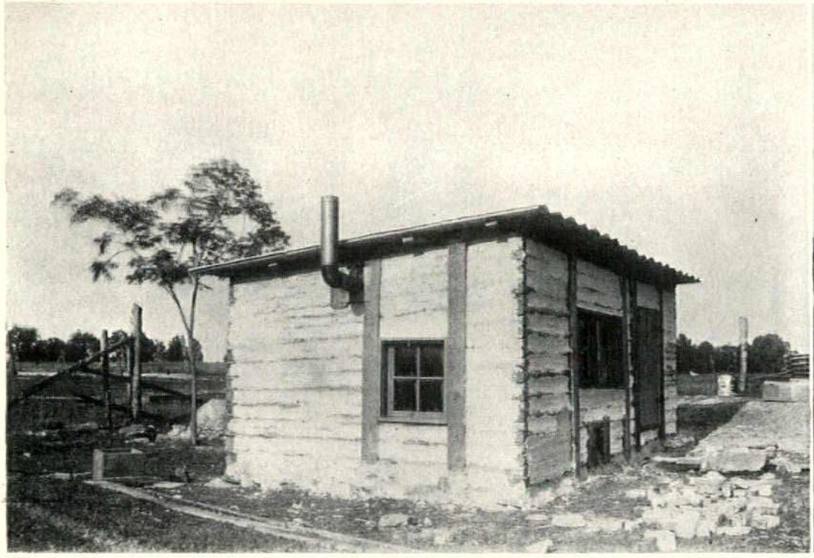
STATE	COUNTY	TABULATED FARMHOUSES	LOG HOUSES	EARTH HOUSES	FRAME HOUSES—UNPAINTED	FRAME HOUSES—PAINTED	STUCCO HOUSES	BRICK HOUSES	STONE HOUSES	CONCRETE HOUSES	AVERAGE NUMBER OF ROOMS PER HOUSE	NUMBER OF FARMS IN 1929	FARM POPULATION
ARKANSAS	Arkansas	2631	118		1583	927	2	1			4	2301	12973
	Faulkner	3370	153		2211	979	5	7	14	1		4204	21467
FLORIDA	Orange	1492	10		306	1094	55	13	1	13	5	1608	5127
INDIANA	Benton	1392			100	1241	18	24	2	5	10	1195	6225
KENTUCKY	Bourbon	1461	30			1165		173	23			1896	8394
	Boyle	973										1251	5760
	Calloway	2792	78		715	1983						2990	12883
	Fleming	1907	261		380	1217		49				2642	9329
	Hardin	2642	307	3	560	1705	2	61	2	2	5	2752	3058
	Hickman	1426	37		671	706	1	1		1	3	1434	6424
	Knott	2114	568		957	597		2	9	9	3	1951	15510
	Ohio	2610	220	1	958	1425						3191	14277
	Shelby	2015	66	1	156	1625	10	146	4	7	7	2337	11220
	Simpson	1749	108		575	1028					5	1797	8144
LOUISIANA	Acadia Parish	3575		10	2755	808	1	1			4	3228	19813
	Beauregard	1371	117		839	411	2	2			4	1374	7056
MAINE	Knox	1000			55	933	12		1		8	1845	5794
MINNESOTA	Stevens	1250										1292	6355
NEBRASKA	Cuming	1770		1	11	1719	24	21	1	1	7	1943	9562
	Otoe	2093									7	2280	9617
NEVADA	Washoe, Churchill	1056	4	23	388	535	29	37	9	31	4	1088	4997
N. CAROLINA	Cleveland	2871	78		1899	843	3	40	2	6	5	5181	30030
	Duplin	2311	22		1600	685		3		1	5	4970	26210
OKLAHOMA	Beaver	1825										2047	8636
RHODE ISLAND	Providence	1139			41	1082	3	5	8		10	1390	6281
TENNESSEE	Knox	3357										4039	12689
VIRGINIA	Rockingham	3346										3434	17849
WASHINGTON	Snohomish	2041	18		475	1542	4	4	2	1	5	4262	18482

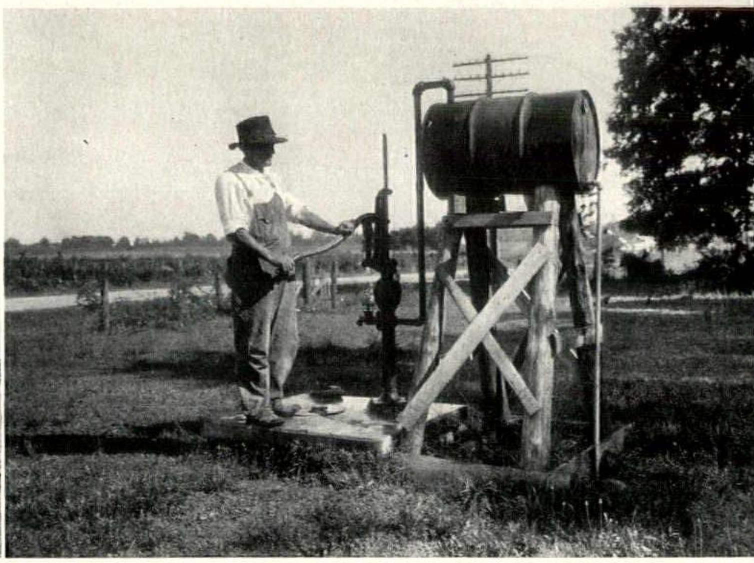
In general, restricted space goes along with inferior construction. Counties, particularly those in the South, which have a large proportion of log houses and unpainted frame houses also show a small average number of rooms per house. In the northern states, like Indiana, Maine, Nebraska and Rhode Island, the houses are larger and better constructed.

Considerable variation, however, is shown between the various counties within a single state, such as Kentucky. Knott County, with a large proportion of log houses and unpainted frame houses, has a population that averages 8 individuals to a farm, all of whom are sheltered, by statistical averages, in houses of only 3 rooms. Shelby County, on the other hand, has a large proportion of brick houses and painted frame houses, and an average occupancy of less than 5 persons for farmhouses that average 7 rooms.









Photos, U. S. Bureau of Agricultural Engineering

1 **Barn wrecked by tornado near Columbus, Mississippi, indicating need for tornado-proof construction.**

2 **House with field stone walls, Jasper, Tennessee.**

3 **Sweet potato storage house, Franklinton, North Carolina.**

4 **An improved water wheel for pump. Wheel made from parts of old Ford car—Billingsley, Alabama.**

5 **Canning shed, Shorter, Alabama.**

6 **Water supply with oil barrel for tank—Athens, Mississippi.**

2

CONDITION OF HOUSES

COMPLETE REPLACEMENT NEEDED (Approximate Percentages)

The highest percentages appear generally in the exterior paint column, although in a few counties screens are indicated as the most imperative need. The percentages range surprisingly high for both replacement items, particularly in the southern states.

Interior walls and ceilings, roofs, doors and windows, foundations, and floors are other items which are generally needed throughout the country. In the South new exterior walls are required.

In Orange County, Florida, 86 per cent of the houses need insulation, a condition which has been emphasized perhaps by the unusually cold weather just preceding the farm census. Similarly, insulation appears as the major need in Knox County, Maine, which lists 32 per cent of the farmhouses in this category.

The preliminary government reports do not give complete information as to the number of houses needing replacement entirely. From the percentages for the three states listed in this column—Kentucky, Nebraska and Nevada—it is clear, however, that not all slum dwellings are confined to urban areas.

STATE	COUNTY	TABULATED FARMHOUSES	FOUNDATIONS	EXTERIOR WALLS	ROOFS	CHIMNEYS	DOORS AND WINDOWS	SCREENS	EXTERIOR PAINT	INTERIOR WALLS AND CEILING	FLOORS	INSULATION	ENTIRE HOUSE
ARKANSAS	Arkansas	2631	25	15	24	22	19		54	30	14		
	Faulkner	3370	20	11	21	15	16	41	62	43	13		
FLORIDA	Orange	1492	15		19	24	13	28	44	33	11	86	
INDIANA	Benton	1392	11		10		8	24	40	10	7	8	
KENTUCKY	Bourbon	1461	8	4	7		6	15	19	6	5	16	6
	Boyle	973	11	9	12		11	36	50	12			
	Calloway	2792	24	18	39	14	23	53	75	36	23		11
	Fleming	1907			11	5	6	20	26	6	6	14	
	Hardin	2642	6		14		6	28	43	7			3
	Hickman	1426	22	18	31	8	18	35	61	17	15	28	
	Knott	2114	21	17	30	14	31	75	57	25	21	44	22
	Ohio	2610	17	17	33	11	25	54	67	21	19		6
	Shelby	2015	6	2	12		5	22	49	6	4	12	
	Simpson	1749			19		11	30	52		7	52	8
LOUISIANA	Acadia Parish	3575	22	20	27	24	25	30	12	17	12		
	Beauregard	1371	33	24	38	30	46			27	30		
MAINE	Knox	1000	1		1	2	2	12	7			32	
MINNESOTA	Stevens	1250	16				14	33	30		15		
NEBRASKA	Cuming	1770	8		8			12	39	6			3
	Otoe	2093	5		6			8	17	6	5		6
NEVADA	Washoe, Churchill	1056	28		15			25	44	18	19	22	23
N. CAROLINA	Cleveland	2871	8		14		12	57	76	19	12		
	Duplin	2311	4	2	4	3		72	71	15	4		
OKLAHOMA	Beaver	1825		12	26	45	19	33	53	18	19		
RHODE ISLAND	Providence	1139			3		2	3	3	2	2		
TENNESSEE	Knox	3357	13		22			33	44	17	10		
VIRGINIA	Rockingham	3346		10	8	6	8	22	35	15	9		
WASHINGTON	Snohomish	2041		11	19			18	34	13	11	10	

3

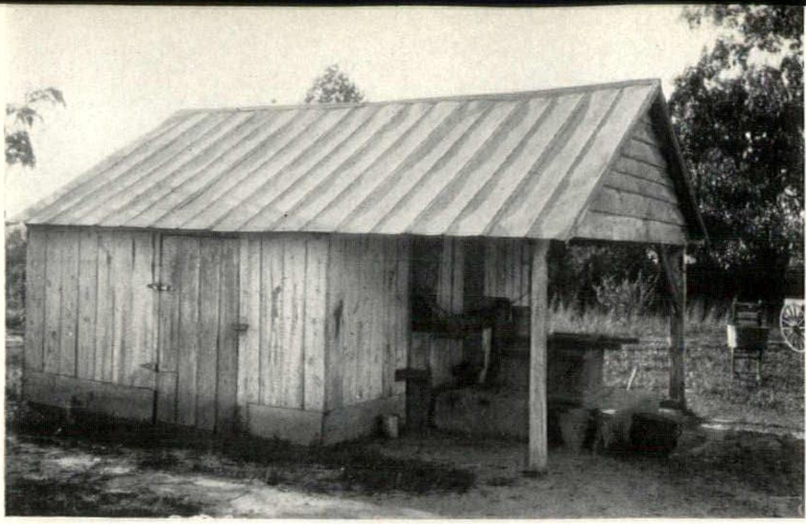
NEED FOR ADDITIONAL SPACE

ROOMS NEEDED (Approximate Percentages)

Every county reports that relatively large percentages of the farmhouses require additional bedrooms. In some instances, particularly in Kentucky, the percentages are exceeded in magnitude by the entries in the columns for bathrooms and for storage space for fruits and vegetables, although these items apparently are not so widely needed throughout the nation.

Basements stand out as a need in Kentucky. Porches likewise are indicated for this state and for North Carolina, Arkansas and Nevada. In North Carolina, Louisiana and Arkansas living rooms are noticeably lacking. In only a few counties are washrooms for farm help listed as a space requirement.

STATE	COUNTY	TABULATED FARMHOUSES	BEDROOM	LIVING ROOM	DINING ROOM	WORKROOM	WASHROOM For Farm Help	BATHROOM	BASEMENT	FRONT OR SIDE PORCH	BACK PORCH	STORAGE SPACE For Fresh Fruits and Vegetables
ARKANSAS	Arkansas	2631	11	6			4			5	7	7
	Faulkner	3370	30	12	16	12					18	43
FLORIDA	Orange	1492	36		18			21		11	15	31
INDIANA	Benton	1392	5				5	8				6
KENTUCKY	Bourbon	1461	11		3			9	3		7	11
	Boyle	973	8	6						7	10	25
	Calloway	2792	37		20	17		30	37		19	
	Fleming	1907	7		4	9				11	12	24
	Hardin	2642	16	1	1					12	15	21
	Hickman	1426	39		18	20		39	32		17	
	Knott	2114	62	31		16		27	33			63
	Ohio	2610	23	41	39	29	27	67	50	27	36	57
	Shelby	2015	13		12	28	21	41	27		19	36
	Simpson	1749	15		10			27	10	11	17	59
LOUISIANA	Acadia Parish	3575	51	8	6					18	13	
	Beauregard	1371	46	25	28	26		49				49
MAINE	Knox	1000	13					16				1
MINNESOTA	Stevens	1250	8		2				5			
NEBRASKA	Cuming	1770	6		2			20	4			
	Otoe	2093	8		3		3	5				3
NEVADA	Washoe, Churchill	1056	47		13	17	15	32		19	19	18
N. CAROLINA	Cleveland	2871	41	38	34	25					25	33
	Duplin	2311	19	23	16	11				11	19	
OKLAHOMA	Beaver	1825	26			6		30		4		
RHODE ISLAND	Providence	1139	4		1			6		1		
TENNESSEE	Knox	3357	29	5	5			8			9	
VIRGINIA	Rockingham	3346	7		5	2		17		2		4
WASHINGTON	Snohomish	2041	29		4			20	7	5	4	6



WASH-HOUSE IN YARD OF HOUSE NEAR GAFFNEY, S. C.

BARREL FOR WATER SUPPLY, HOUSE NEAR GAFFNEY, S. C.

4

WATER SUPPLY AND SEWAGE DISPOSAL

EXISTING FACILITIES (Approximate Percentages)

The insufficient living standards of the rural districts, especially in the South, are revealed by the contrasting percentages for improved and unimproved sanitary facilities. Even in Providence County, Rhode Island, which shows the highest percentage of farmhouses with improved indoor toilets, 34 per cent of the houses still have outdoor privies. Furthermore, if the percentages for both improved and unimproved facilities are added together, it may be observed that surprisingly many farmhouses in Arkansas, Kentucky, Louisiana, North Carolina, Oklahoma, Tennessee and Virginia seem to be lacking in even minimum sanitary requirements.

The counties in Rhode Island, Washington, Nevada, Florida, Maine and Indiana have the largest number of houses with both hot and cold running water, but the percentages show that even in these localities the majority of farmhouses do not have such conveniences. In the South, as the high percentages indicate, water is carried by hand in most farmhouses. Only in Rhode Island is there a county wherein more than half of the houses have tubs or shower baths.

STATE	COUNTY	TABULATED FARMHOUSES	WATER CARRIED BY HAND	HAND PUMP IN DWELLING	RUNNING WATER COLD	RUNNING WATER HOT	OUTDOOR TOILETS UNIMPROVED	OUTDOOR TOILETS IMPROVED	INDOOR TOILETS IMPROVED	TUB OR SHOWER BATHS	KITCHEN SINKS WITH DRAIN
ARKANSAS	Arkansas	2631	95	1	7	2	74	4	2	5	7
	Faulkner	3370	97	3	1		70	4	2	1	4
FLORIDA	Orange	1492	43	17	43	19	50	12	36	46	48
INDIANA	Benton	1392	70	27	30	15	52	32	16	27	64
KENTUCKY	Bourbon	1461	83	3	17	15	71	22		16	19
	Boyle	973	80	8	9	8		13		10	13
	Calloway	2792	99	1	1		71	1	1	1	
	Fleming	1907	94	5	3		87	1	2	2	7
	Hardin	2642	92	5	3	1	84	5	2	3	7
	Hickman	1426	74	1	4	1	69	7	1	3	7
	Knott	2114	98		1		86	3			1
	Ohio	2610	96	4	1		87	1		1	9
	Shelby	2015	91	5	8	7	84	15		8	12
	Simpson	1749	92	6	5	2	75		3	4	9
LOUISIANA	Acadia Parish	3575	85	6	8	1	76	5	2	6	5
	Beauregard	1371	94	2	6	2	61	13	3		
MAINE	Knox	1000	34	37	33	14	66	17	18	15	98
MINNESOTA	Stevens	1250	91	54	7	3	76	20	6	7	30
NEBRASKA	Cuming	1770	48	20	31	16	84	1	20	28	61
	Otoe	2093	66	19	12	15	86	1	16	22	45
NEVADA	Washoe, Churchill	1056	1	1	47	35	69	6	29	41	63
N. CAROLINA	Cleveland	2871	82	6	5	2	56	12	2	3	8
	Duplin	2311	72	29	1		64	6	2	1	8
OKLAHOMA	Beaver	1825	73	2	21	4	86			11	25
RHODE ISLAND	Providence	1139	26	14	64	33	34	24	46	54	97
TENNESSEE	Knox	3357	83	6	11	7	62	25	6	9	19
VIRGINIA	Rockingham	3345	70	13	19	9	81	13		12	27
WASHINGTON	Snohomish	2041	38	4	57	42	63	6	32	42	62

5

Kerosene or gasoline lamps constitute the most general type of illumination for the American farmhouse, except in the localities listed for Washington, Rhode Island, Nevada and Maine, where electricity is largely available. Counties in Indiana, Minnesota and Nebraska report a larger number of farms producing electricity from home plants than those utilizing power lines, but the percentages are relatively low. (The preliminary government reports do not distinguish between the two types of electric power production in all cases, and in such instances the percentages have been recorded within parentheses in the power line column.)

Stoves appear to be the chief method of heating the American farmhouse. Considerable variation, however, exists between localities in the same state, Kentucky for example, where 3 per cent is shown for one county and 91 per cent for another. In the northern states fairly large percentages of the houses have central heating systems, whereas in the South the fireplace is a more important source of heat.

LIGHT AND HEAT

EXISTING FACILITIES (Approximate Percentages)

STATE	COUNTY	TABULATED FARMHOUSES	KEROSENE OR GASOLINE LAMPS	GAS LIGHTING	ELECTRICITY, HOME PLANT	ELECTRICITY, POWER LINE	FIREPLACES	STOVES	CENTRAL HEATING SYSTEMS
ARKANSAS	Arkansas	2631	92	1	3	6	9	93	1
	Faulkner	3370	96			(5)	51	52	
FLORIDA	Orange	1492	57	2	6	42	50	46	5
INDIANA	Benton	1392	79	5	13	6	2	63	42
KENTUCKY	Bourbon	1461	76	6		(19)	50	43	24
	Boyle	973	87		2	11	51	75	10
	Calloway	2792	98		1	2	84	36	1
	Fleming	1907	94	1	4	2	52	73	8
	Hardin	2642	91	1		(9)	24	91	4
	Hickman	1426	98	1			41	71	1
	Knott	2114	92	2		(4)	88	3	
	Ohio	2610	97	2		(1)	76	36	3
	Shelby	2015	84	3		(15)			5
	Simpson	1749	94	3	1	3	70	61	2
LOUISIANA	Acadia Parish	3575	96	1		(4)	50	38	1
	Beauregard	1371	94	2		(5)	66	26	
MAINE	Knox	1000	48		2	50	4	90	25
MINNESOTA	Stevens	1250	90	1	7	3		64	36
NEBRASKA	Cuming	1770	69	2	25	6		64	41
	Otoe	2093	74	2	14	12	1	67	34
NEVADA	Washoe } Churchill }	1056	30	1		(70)		84	22
N. CAROLINA	Cleveland	2871	84	1	1	14	94	9	2
	Duplin	2311	95	2	1	3	89	16	
OKLAHOMA	Beaver	1825	89	8		(6)		77	18
RHODE ISLAND	Providence	1139	16	1	1	82		72	50
TENNESSEE	Knox	3357	81	4	3	14	71	45	13
VIRGINIA	Rockingham	3346	70	2		(30)		91	11
WASHINGTON	Snohomish	2041	16			85	8	73	18

6

Ice boxes are much more common than mechanical refrigeration, but the low percentages indicate that the great majority of American farmhouses do not have any refrigeration. An exception is Providence County in Rhode Island.

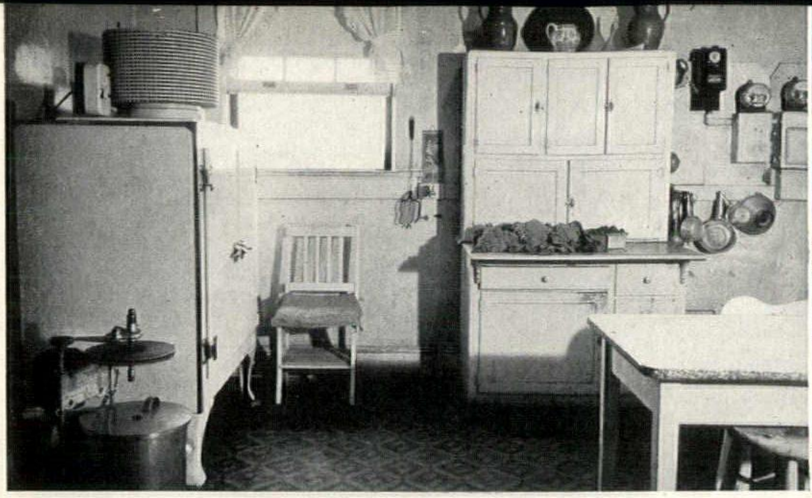
The figures for laundry facilities show such wide variations that again it is impossible to draw any general conclusions except for individual localities.

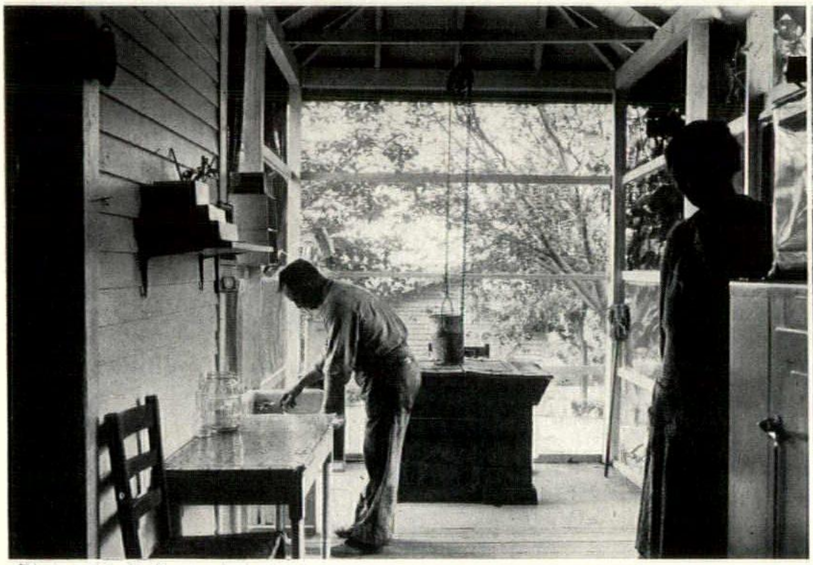
The preliminary reports on cooking facilities likewise are not complete enough to provide an adequate basis of judgment. The high percentages in the wood or coal stoves column indicate, however, that this is probably the most general method of cooking, with Knox County in Maine as an exception. Approximately one-tenth of the houses in Providence County, Rhode Island, and Snohomish County, Washington, have electric stoves.

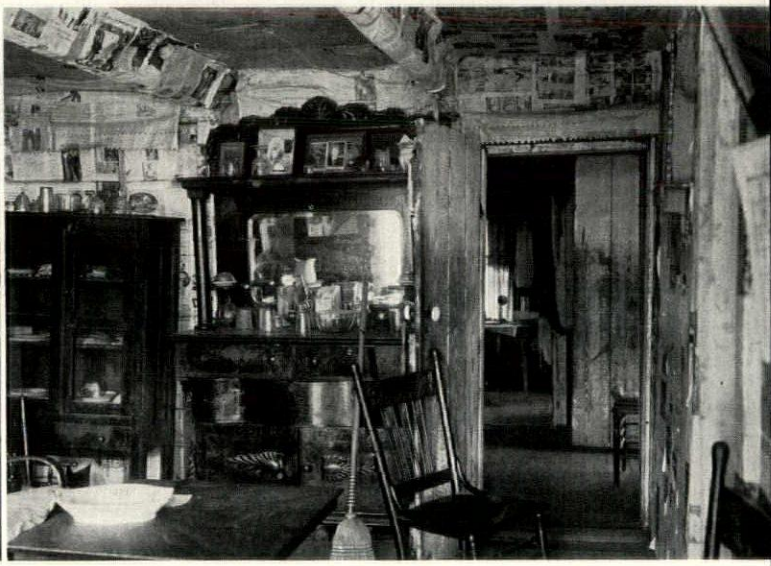
REFRIGERATION, LAUNDRY AND COOKING FACILITIES

EXISTING FACILITIES (Approximate Percentages)

STATE	COUNTY	TABULATED FARMHOUSES	ICE BOXES	MECHANICAL REFRIGERATION	WASHING MACHINES, HAND	WASHING MACHINES, POWER	WOOD OR COAL COOKING STOVES	KEROSENE OR GASOLENE STOVES	GAS STOVES	ELECTRIC STOVES
ARKANSAS	Arkansas	2631	23	2	4	11	95	18		
	Faulkner	3370	10	4		1				
FLORIDA	Orange	1492	50	16	1	9				
INDIANA	Benton	1392	19	2	30	45	96	29		
KENTUCKY	Bourbon	1461	52	9	52	15	91	12	3	
	Boyle	973	29	42	64	36				
	Calloway	2792	12		97	1	97	7		
	Fleming	1907	26		91	5				
	Hardin	2642	12	12	93	4	98	15		
	Hickman	1426	31		87	3	93			
	Knott	2114	3		1	4	91			
	Ohio	2610	10		96	3				
	Shelby	2015	49	4	66	21				
	Simpson	1749	40		2	3	98	8	1	
LOUISIANA	Acadia Parish	3575	7	1			92	19		
	Beauregard	1371	15	2	2		99	7	1	
MAINE	Knox	1000	43	4	7	24	10	8		2
MINNESOTA	Stevens	1250	4	1	21	49	95	43		
NEBRASKA	Cuming	1770	9	2	16	78	99	26	1	
	Otoe	2093	25	5	26	63	98	37	1	1
NEVADA	Washoe } Churchill }	1056	31	8	2	30	75	8	3	7
N. CAROLINA	Cleveland	2871	25	1	1	2	97	2		1
	Duplin	2311	6		1		92	7		
OKLAHOMA	Beaver	1825	17	2	25	30				
RHODE ISLAND	Providence	1139	69	22	19	27	78	31	7	10
TENNESSEE	Knox	3357	34	2	1	6				
VIRGINIA	Rockingham	3346	41	5	23	23				
WASHINGTON	Snohomish	2041	3	2	6	48	96	1		11







Photos, U. S. Dept. of Agriculture

1 Kitchen in home at Clarkston, Georgia.

2 Kitchen in home at Gaffney, South Carolina.

3 An outdoor kitchen at Anderson, South Carolina. Lavatory for washing by farm hands.

4 Living room in home at Clarkston, Georgia.

5 Dining room in home at Clarkston, Georgia.

6 Interior of negro cabin, Lavington Plantation, South Carolina. Walls covered with newspapers for insulation and decoration.

7

REPAIRS and IMPROVEMENTS DESIRED

Structural repairs apparently are more urgently desired than additional space or additional equipment. Interior walls, ceilings and floors, exterior walls, and roofs, are the most desired items of repair, as indicated by the generally prevailing high percentages in these columns. In the southern localities, particularly Louisiana and North Carolina, doors, windows and screens, and porches, are also important wants.

In most counties additional space is asked by the farmers, vying in importance with their desires for water systems and bathroom equipment.

Considering the need for improved sanitary facilities expressed in a preceding table, this item shows a comparatively small demand except in the counties in Louisiana and North Carolina.

Relatively little desire, on the basis of a limited spending sum, is manifested for lighting and heating systems, laundry and cooking facilities, and landscaping. Furnishings, on the other hand, are a potentially important item of expenditure.

REPAIRS AND IMPROVEMENTS DESIRED IF $500 WERE AVAILABLE

(Approximate Percentage of Total Farms)

STATE	COUNTY	TABULATED FARMHOUSES	FOUNDATION	EXTERIOR WALLS	ROOFS	CHIMNEYS	DOORS, WINDOWS, SCREENS	PORCHES	INTERIOR WALLS, CEILINGS, FLOORS	ADDITIONAL ROOMS	WATER SYSTEM	SANITARY FACILITIES	LIGHTING SYSTEM	HEATING SYSTEM	BATHROOM EQUIPMENT	LAUNDRY FACILITIES	COOKING FACILITIES	LANDSCAPING	ELECTRICITY: HOME PLANT	ELECTRICITY: POWER PLANT	BUILT-IN EQUIPMENT	FURNISHINGS
ARKANSAS	Arkansas	2631	18	22	21	10	24	21	26	15	14				11							10
	Faulkner	3370	16	31	31		26	16	42	26	9	6			8	7						28
FLORIDA	Orange	1492		39	33	17	29	25	51	26	35	20	14		32					(15)	21	18
INDIANA	Benton	1392		13					14		17			11	20				5	13		14
KENTUCKY	Bourbon	1461	3	8	6	3	6	8	16	10	11		4		4					(6)		17
	Boyle	973		34	21		23	21	35	25	15							14				
	Calloway	2792	8	24	19		17	10	22	17	14				7					(14)		11
	Fleming	1907		4	3		3	4	3	5	4	2			2					(3)		
	Hardin	2642		14	11			9	11	9	12								8			9
	Hickman	1426	27	55	44	8	33	39	56	28	29					9					12	
	Knott	2114	25	38	45		48	26	56	46	36	18	15		10	14		30			16	56
	Ohio	2610		36	29		29	26	32	20	18				13							
	Shelby	2015		49	26		22	19	46	21	29				16			18		(17)		13
	Simpson	1749	8	41	28	8	28	27	42	27	44		11		28					(26)		16
LOUISIANA	Acadia Parish	3575	38	52	48		68	35	49	43	28	45										28
	Beauregard	1371	42	49	48	43	70	46	58	45	35	25			31							34
MAINE	Knox	1000	13	33	21				27	7	19		8		18							
MINNESOTA	Stevens	1250	13	13					24	16	23					16						19
NEBRASKA	Cuming	1770	13	23	12		13	8	24	19	26	11		7	27					(8)		
	Otoe	2093		17	10		10	10	22	14	27	23		9	22					(16)		11
NEVADA	Washoe, Churchill	1056	14	21	19		13	18	31	29	34	18			37							18
N. CAROLINA	Cleveland	2871	19	50	33		53	34	58	34	32	72										22
	Duplin	2311	38	55	45	21	63	36	72	26	26	34										18
OKLAHOMA	Beaver	1825		11	10		7		13	11	10				9							
RHODE ISLAND	Providence	1139		29	13				27		18	11			18							10
TENNESSEE	Knox	3357		43	31		27	24	41	26	33	20			19			13		(18)		14
VIRGINIA	Rockingham	3346		18	7			10	20	13	22		13		20			13		(15)		12
WASHINGTON	Snohomish	2041	26	39	25		12	11	44	29	27				36							13

RESEARCH IN FARM STRUCTURES

BY HENRY GIESE
Senior Agricultural Engineer, Bureau of Agricultural Engineering, United States Department of Agriculture.
Miscellaneous Publication No. 133. April, 1932. Pamphlet for sale by Superintendent of Documents, Washington, D. C. Price 15 cents.

According to the 1925 census, the total investment in farm buildings in the United States is $11,746,629,000. The investment in each of eight States exceeds $500,000,000. Land is the only larger item of investment on the farm. While accurate figures are not available, it is conservatively estimated that American farmers spend several millions of dollars daily upon the construction and repair of buildings. The annual farm fire loss is more than $100,000,000 and to this economic loss must be added a yearly loss of 3,500 lives. Fire losses are truly economic losses and in the majority of cases are preventable. Repairs become necessary to take care of wear or the ravages of destructive agencies such as temperature, moisture, wind, and insects. Good farm management frequently involves remodeling of buildings. Farm buildings definitely influence agricultural welfare.

According to the 1925 census there are in the United States more than 6,250,000 farm units, but the average investment is relatively small. The individual farmer's interest in farm structures research is lessened by the long period of service generally obtained from his buildings. Not every generation builds a barn. In many cases, especially where materials have been readily available, buildings have been so substantially built as to last several generations and consequently remodeling to meet service requirements is a more acute problem than new construction.

Under present methods of merchandising the farmer does not buy buildings complete and ready for operation as he buys other equipment. He buys partially fabricated materials or builds from materials produced on his own farm. In either case skillful handling on the part of the purchaser is required. As construction specialists are not usually available, the buildings frequently are unsuited for their intended use and are not constructed in a way that will tend to reduce depreciation and repair costs to a minimum. The situation is altogether different from that in cities, where buildings generally are planned by trained architects, built by experienced contractors, and checked by building inspectors.

Proper construction of buildings necessitates a careful study of building methods. The requirements as to space and sanitation, and the conditions of air temperature, relative humidity, and rate of air movement, must be known before buildings can be well designed, and in meeting these requirements materials and labor must be used economically. New materials should be adapted to farm uses. Development of standard practices and simplification of construction methods would aid materially in securing better buildings. Much of the data now available for the design of farm buildings are based on tradition and probably are inaccurate.

The architectural profession in general has not as yet shown interest in developing farm structures. The small, scattered units have not proved profitable from a professional standpoint, and the architect has not seen the necessity for specific training in the design of farm buildings. The farmer usually does not employ professional service, because he does not appreciate the importance of scientific design and is not convinced of the value of the assistance for which a professional charge is made. On the other hand he may be reluctant to accept recommendations from organizations that give free assistance in planning but that expect eventually to sell enough merchandise to cover their service costs. There is, then, a real need for constructive effort in research.

PLANNING THE FARMSTEAD

BY M. C. BETTS AND W. R. HUMPHRIES

M. C. Betts, Chief, Division of Plans and Services, and W. R. Humphries, Chief Engineering Aid, Bureau of Agricultural Engineering, U. S. Department of Agriculture, Bulletin 1132.

The main considerations influencing the determination of the farmstead site are its location with respect to the rest of the farm and to public utilities, the elevation and drainage of the proposed site, the available water supply, the nature of the soil, the relation to the points of the compass, the prevailing breezes and protection from heat and cold.

The planning of a farmstead involves arrangement of lots, yards, various buildings, driveways, with relation to each other, to the fields and to the highway. The arrangement should aid in executing the routine work of the farm with a minimum of time covered and with no retracing of steps.

DETERMINING THE FARM PLAN

It is not possible to develop a plan having general application, because the conditions to be met in each case vary.

The following factors influence the plan arrangement of the farmstead:

TOPOGRAPHY OF LAND.
CLIMATIC AND SOIL CONDITIONS.
TYPE OF FARMING TO BE UNDERTAKEN.
DIRECTION OF WINDS.
RELATION TO HIGHWAYS AND TOWNS.

Important conditions in selection of a farm site may be mentioned:

LOCATION OF FARMHOUSE IN RELATION TO PUBLIC UTILITIES.
ELEVATION AND DRAINAGE.
WATER SUPPLY.
NATURE OF SOIL.
ORIENTATION.
PREVAILING BREEZES.
PROTECTION FROM HEAT AND COLD.

Ease of access to the fields from the buildings is highly desirable, as otherwise loss of time due to inconvenience will be incurred.

Traffic is a source of considerable interest to the average farm family. The ability to observe at close range or to hail those passing on the road tends to promote social intercourse and participation in community affairs.

It is of great importance that the farmstead site have a slope, in one or more directions, sufficient to carry off surface water from about the buildings and yards. Good drainage about the farmstead insures dry floors and comparatively dry paths and driveways, making it easier to get around in bad weather. FOR THIS REASON A KNOLL or HILLSIDE with MODERATE SLOPE SHOULD BE SOUGHT.

The garden, lawn, orchard and windbreak, constituting a considerable part of the farmstead, require a good and preferably light soil, while the ground occupied by the farm buildings may be the poorest land on the farm.

ORIENTATION

The points of the compass have an important bearing on the proper arrangement of the buildings in the farmstead.

Sunlight is one of the most potent enemies of dirt and disease. Germs do not thrive in sunlight, and dirt is more readily detected in a bright, cheery room than in one that is dark and dreary. It is very desirable, therefore, that all shelters of human and animal life receive the utmost benefit of the sun's rays during the winter and of the cooling breezes in the summer time. The principle of orientation is the arranging of the various parts of a building so that this end may be attained.

If a farmhouse is situated near the road, it is generally best to place it four square to the highway, but if it is placed fairly well back, there is no reason why it should not be set at almost any angle in order to secure the best results.

BREEZES AND PROTECTION FROM HEAT AND COLD

As a rule, throughout the Middle West, the prevailing summer breezes are from the south, southwest, and west, although in certain localities topographic conditions may cause a variation from this generality. Cold winds and snow sweeping over the farm, unchecked by hills or trees, cause general discomfort.

It requires a great deal more fuel to warm a house that is exposed than one that has a measure of protection. For this reason, it is desirable to select a site having a south and southeast slope, or one in which existing trees form a natural windbreak, as it requires many years to grow an effective protection.

If the locality is without hills or other natural windbreak, a shelter belt of trees should be planted to the north and west of the farmstead. The trees should be selected with reference to nativity, height, denseness and rapidity of growth, ability to resist wind, and commercial value. It is a good plan to plant rapid-growth trees of the less desirable varieties along with permanent planting. In this way, protection is secured quickly, and when the hardier trees have acquired growth, the others may be cut out. The permanent planting should include a goodly proportion of evergreen trees. Evergreens, however, should not be planted so near the house as to cast a shadow upon the window area during the winter months.

Shrubs planted so near the house as to hinder the entrance of the sun's rays into the basement rooms, also should be avoided.

During the summer months barnyard odors are an annoyance. If the outbuildings are placed to the north or east of the dwelling, the prevailing breezes will carry the odors away from the house. Relief from summer heat is best provided for by permitting the cooling breezes from the south and southwest to sweep unchecked through the farmstead. The dwelling should be so planned that principal rooms will receive the benefit of these breezes.

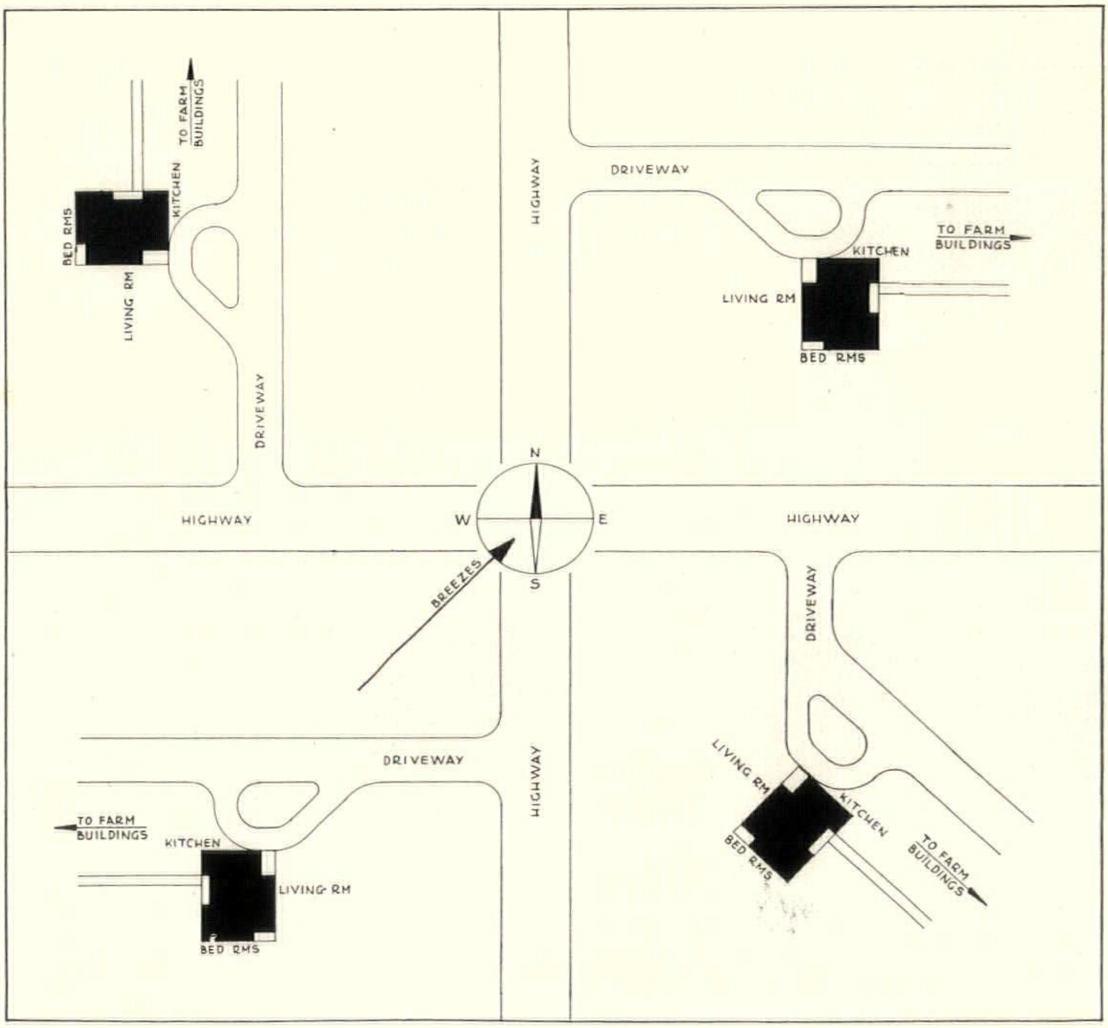
A moderate amount of shade should be provided, especially near the house, since it prevents radiation of heat from the ground, which is perhaps a greater source of discomfort in the house than the direct rays of sun on roof and walls.

DIAGRAM SHOWING LOCATION OF FARMHOUSE either north, east, west or south of the highway. In every case the house is situated in relation to the driveway and the other farm buildings so as to avoid the carrying of dust or barnyard odors towards the house by the prevailing breezes.

Living room and main entrance face the highway.

Bedrooms are arranged to get most benefit of the summer breezes from the southwest.

The kitchen overlooks the driveway and barnyard to give the housewife control over the approach to the farmstead and the other farm buildings.



PLANNING THE FARMHOUSE

PLANNING THE WILLAMETTE VALLEY FARMHOUSE FOR FAMILY NEEDS, BY MAUD WILSON, AGRICULTURAL

A ONE ROOM FARMHOUSE INTERIOR IN THE OZARK MOUNTAINS, MISSOURI; USED FOR DINING, SLEEPING, COOKING AND SITTING. A COMMON FORM OF FARM DWELLING IN LOCALITIES THAT AFFORD MEAGER INCOME.

Galloway

FOR FAMILY NEEDS

EXPERIMENT STATION, OREGON STATE AGRICULTURAL COLLEGE, CORVALLIS, OREGON, BULLETIN 320

The farm family must usually make the best of its housing situation, for rarely is it possible to move to another farm for the sake of a more suitable dwelling. In planning the farmhouse, therefore, it is necessary to keep in mind that it must serve the needs of the family over a long period of time, and that it will probably shelter families of varying sizes during its period of use.*

Reading, listening to radio programs, and informal social life are the major home leisure activities of the farm family for which provision should be made in planning the house or its furnishings. The customary procedure is for homemakers to relieve the tedium of the routine tasks of sewing, mending, and ironing by listening to daytime programs, a fact to be considered in planning the location of the radio, the ironing board, and the sewing machine.

GENERAL REQUIREMENTS FOR THE FARMHOUSE:

A terrace or uncovered porch protected from winter winds but reached by the sun's rays at midday, to encourage children, elderly people and sick people to get out of doors on sunny days in winter.

An open porch or uncovered deck on the second floor, as a place to air bedding and to place beds in warm weather.

Steps between ground level and first floor. These should be avoided where possible by grading the back yard and by using gently sloping nonslippery walks.

Over-protection of windows. Outside protection of windows is seldom necessary. If considered desirable in a particular situation, use awnings which can easily be raised or lowered or easily reinstalled or removed for the season.

Opaque window shades. Many windows require no shades at all. Venetian blinds are desirable for windows in some situations, translucent shades in others.

DESIRABLE ARRANGEMENTS:

Four well-defined play areas for small children:

1. In the house.
2. Out of the house but under cover.
3. In the sunshine but on a surfaced space.
4. Out on the ground.

Kitchen windows located so as to overlook the children's outdoor play center.

Floors that are warm and easily kept clean.

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*This article developed from "Planning the Willamette Valley Farmhouse for Family Needs," by Maud Wilson, Agricultural Experiment Station, Oregon State Agricultural College, Corvallis, Oregon, Bulletin 320.

A well equipped — but poorly planned — kitchen.
Laundry in kitchen is undesirable.

Galloway

Downstairs bathroom adequately planned for the care of children.

Toilet facilities readily accessible from the back door and the kitchen.

A bed for each child.

A clothes closet for each child.

Low hooks, shelves, drawers, and racks for clothes.

Adequate and readily accessible storage for play supplies and equipment in current use.

Storage of unused or reserve toys in places not readily accessible to children.

Dining chairs suited to the child's needs as to height; foot rests provided where feet do not rest on floor.

Chairs, tables, desks, and other articles used exclusively by children suited to the heights of the users.

Stepping stools near lavatory, toilet, and high window sills.

Shelves for drinking glasses in kitchen and bathroom.

Space units for the two-story house. Following is a list of the space units suggested for the "whole-family" farmhouse.

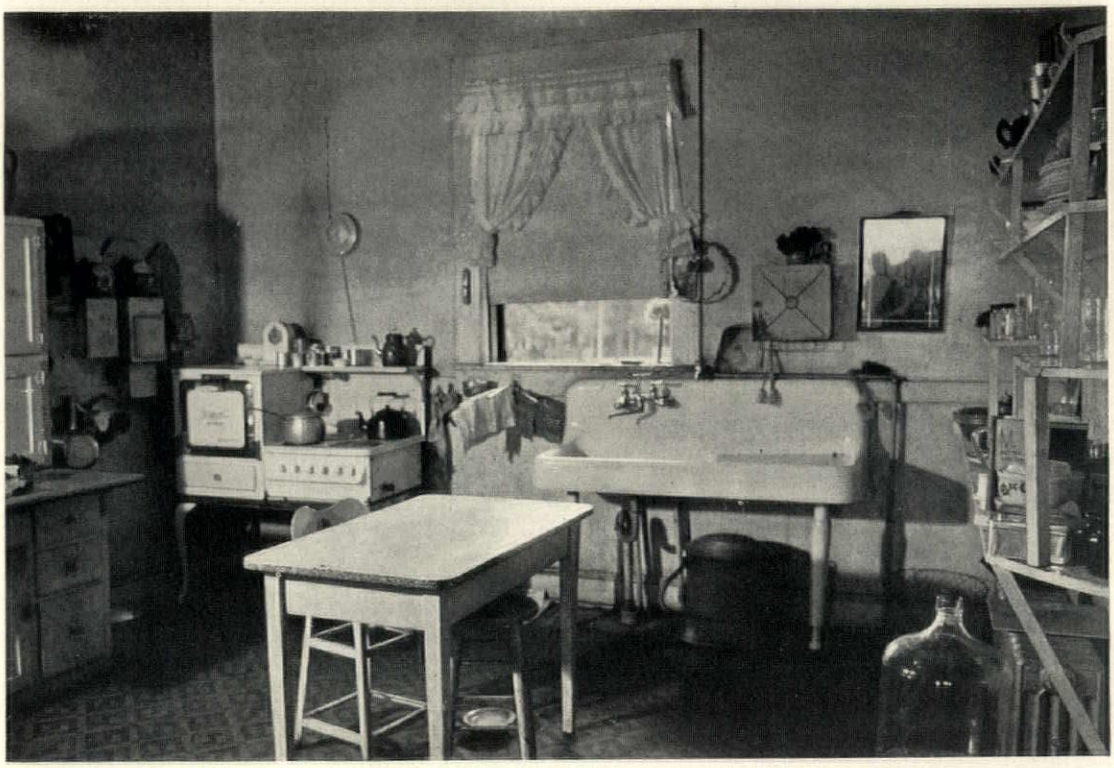
FIRST FLOOR, BASEMENT, OR ADJACENT BUILDING:

Auxiliary work areas and storage rooms for equipment, supplies, and products.

Men's wash room.

Storage space for work clothes.

Good equipment with unsatisfactory disposition. Walls are cluttered with utensils that should be in closed cabinets. Open shelving at right undesirable. Wall counter space near stove and sink needed. Radiator should be placed under window.



FIRST FLOOR OR BASEMENT PLAN:

Area required for heating plant.

Storage for fuel for heating plant, stoves, fireplace.

Winter storage for screens, outdoor play and living equipment, and in some cases for yard and garden tools.

FIRST FLOOR PLAN:

Kitchen, used for work with foods and service of everyday meals, and in some cases for ironing.

Bedroom, with one or two closets.

At least two other rooms, serving purposes of second bedroom, living room, dining room, office, child's playroom, sewing room, and in some cases for ironing; closets to supply the storage space needed in connection with these functions.

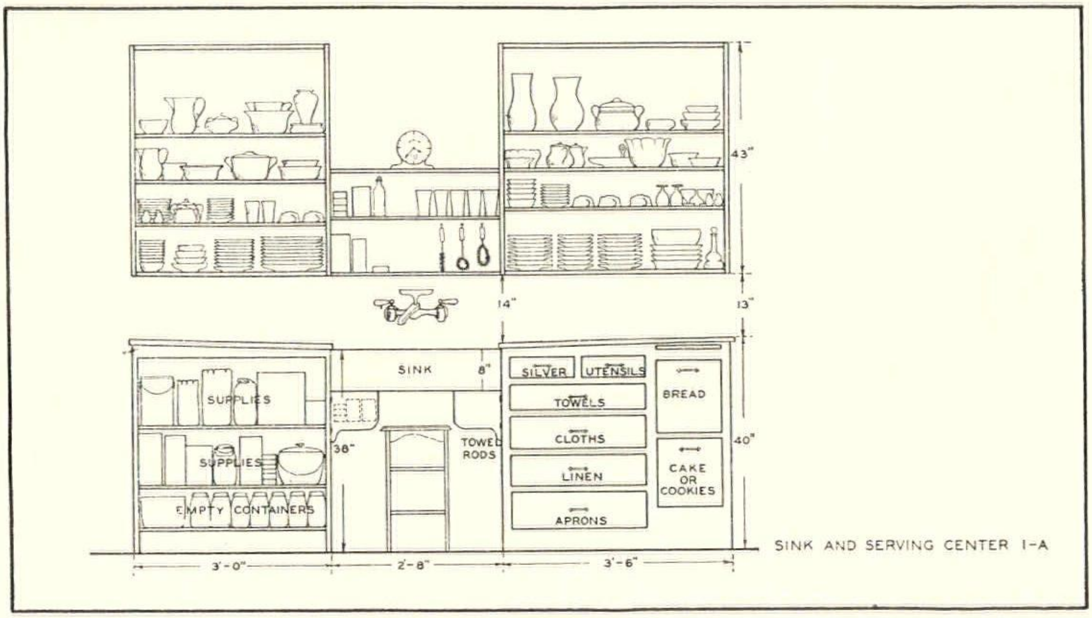
Toilet facilities.

Vestibule for front entrance.

Central hall, connecting bedrooms, bath or toilet, stairways, outside entrance leading to drive or farm buildings, kitchen, and either the living room or the dining room.

Closet for cleaning equipment and supplies, opening preferably from the central hall.

Sink and serving center for farm kitchen. See discussion on this page.



Closet or open space for outer garments in frequent use.

SECOND FLOOR PLAN:

Two or more bedrooms, each with clothes closets, preferably one for each person occupying the room.
Bathroom.
Hall, connecting bedrooms, bathroom, and stairway to the first floor.
Bedding closet opening into the hall.
Storeroom for unused furniture, trunks, and other bulky articles.
Storage for cleaning equipment used on the second floor.
One or more deck or open porch.

GRADE LEVEL AND HOUSE SURROUNDINGS:

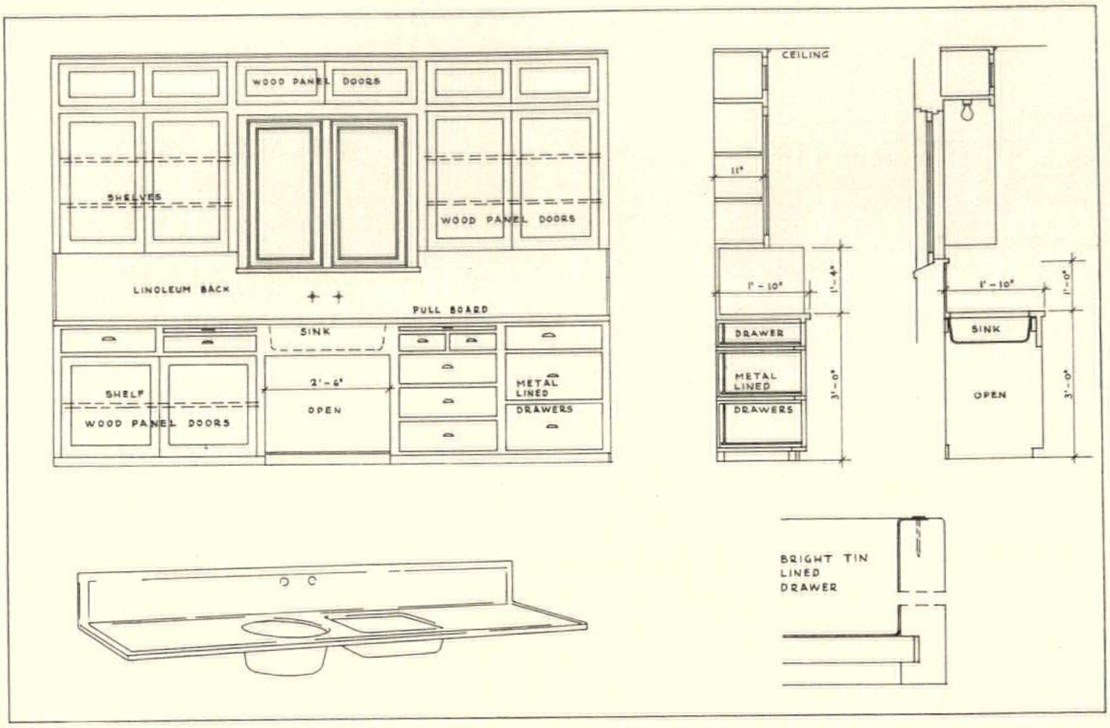
Storage for equipment used about yard and garden during the growing season.
Drying lines.
Children's play center.

ARRANGEMENTS DESIRABLE FOR KITCHENS:

Kitchen dining table on the same side of the work area as the door to the dining room or the living room.
Work centers not separated by doors.
"Cooler" close to worktable and to sink-and-serving area.
Refrigerator close to worktable and serving area.
Stove between sink and worktable units.
Sink and worktable units opposite each other.

Built-in kitchen cabinet suited to farmhouse proposed by Division of Agricultural Engineering, University of California.

A two-compartment sink is shown at lower left of illustration. It is of stamped steel, enameled and simplifies washing and drainage of dishes and cleaning of vegetables.



Sink and serving units combined so that the serving counter may also be a drain board.

Sink and serving unit adjacent to dining area of kitchen.

Serving unit on partition between kitchen and dining area so that a pass cupboard may connect the two.

Articles of equipment stored near the place where they are used.

Supplies that do not deteriorate unduly in room temperature, stored near point of use.

"Cooler" space large enough to provide for the storage of all supplies requiring a temperature lower than that of the room.

Wall space for a small mechanical refrigerator in addition to the cooler.

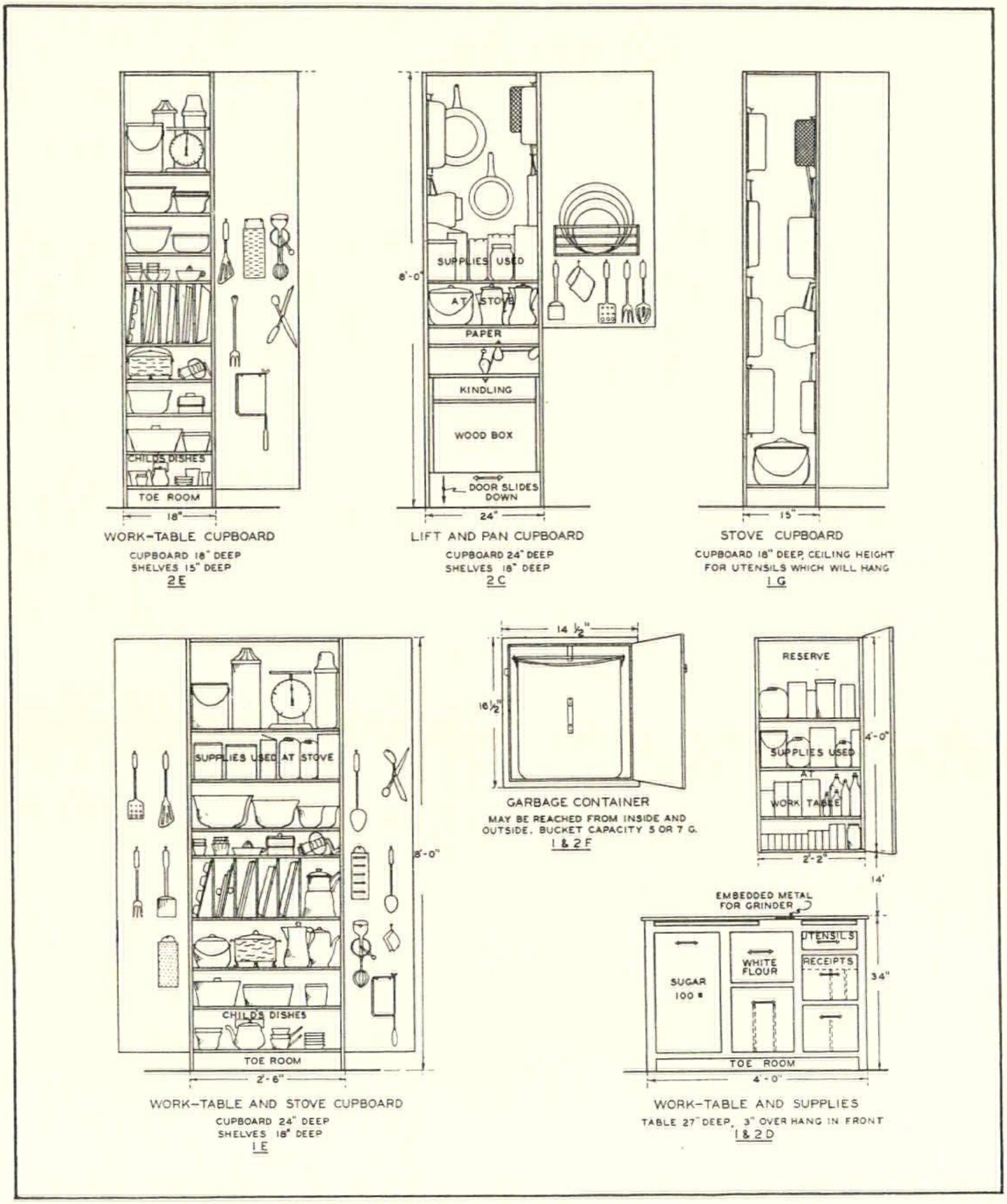
"Cooler" made so that it can be easily removed to permit installing a large refrigerator.

A narrow cupboard reaching from floor to ceiling and with hooks on the sides, for large articles which will hang.

Space in the utensil cupboard which is divided vertically to form slots for holding lids, pie tins, and shallow pans.

Drawers coated on the inside with paraffin, and sectioned to provide bin space for cereals purchased in five-pound or ten-pound lots.

Work-table and cupboards for kitchen showing location for supplies. See discussion on page 316.



Wall space large enough for a combination wood and electric or gas stove, together with space to stand at sides of the stove.

Depth of stove area sufficient to permit setting the stove away from the wall for ease in cleaning.

Where the combination stove is not used, a cabinet adjacent to the stove having its top on a level with the stove and covered with a material not harmed by hot kettles.

A place near the stove large enough to hold a day's supply of fuel; this may

An orderly and convenient kitchen. Equipment is well arranged. House for J. Victor East, Longmeadow, Mass.

Van Anda

be a woodbox with cleanout below, or it may be a wood lift with a door which drops down to make the contents readily accessible.

Compartments in sink which permit washing and draining dishes without use of pans.

Shallow cupboard above sink for drinking glasses, cleaning powders, hand lotion, etc.

Built-in garbage container accessible from both inside and outside the house.

Provision for a stool to be used at the sink.

Stepping stool just high enough to make the upper shelves accessible.

All storage spaces closed.

Roller-shades used on cupboards instead of doors.

Results of the study to date indicate that more storage space is needed for equipment and supplies in the kitchen than is possible to arrange above and below drain boards and worktable surfaces, without increasing their length beyond that needed for their respective functions. The best way to accommodate this overflow is to provide storage cupboards reaching from floor to ceiling. Where the stove is placed between sink and worktable, one of these can be a worktable-stove cupboard while the other can be a sink-stove cupboard.

It is a common practice among farm families to feed edible garbage to animals. Both kitchen plans appearing on Plate I show a built-in garbage container that can be reached from the outside as well as the inside. This container is designated as I and 2F on page 318.

A cooler large enough to care for all the supplies it is desired to store at a temperature lower than that of the room will need to be 2 feet wide if it is 18 inches deep.

AUXILIARY WORK AREA:

The term "auxiliary work area" is used to designate an area devoted to work it is desirable to do under the house roof but outside kitchen and living rooms. The purposes which this area will serve vary in different households, but they may include washing; ironing; preparing fruits, vegetables, meats, and fish for cooking, canning, or curing; processing canned foods; packing eggs; making soap; dressing poultry for the market; cleaning, oiling, and repairing shoes; mixing paint and caring for paint brushes; working with guns and other sports equipment; working at a carpenter's bench or metal lathe; transplanting house plants and starting bulbs and seeds; separating milk; washing milk utensils; setting incubators. Storage room will need to be provided for canned fruits, vegetables, and other preserved foods and for those produced for market, and for supplies and equipment used in doing the various kinds of work assigned to the area. It is well also to provide toilet facilities nearby.

The first floor is probably the most satisfactory location for this work area, but use of the basement has the advantage, besides possible economy in building costs, of having a necessarily unattractive section of the house out of sight of the drive and of the living rooms. In situations where the new house is built near the old one, the latter may be converted into an auxiliary work area, and connected with the new house by a covered passage having a wall on the side from which storms come.

Since the operations performed in the auxiliary work area will vary from time to time, it is well that arrangements be highly flexible. Only such partitions should be planned as are required for privacy or for desirable differences in temperature and the area should be so planned that each part of it is suited to the greatest possible number of uses.

FEATURES OF AUXILIARY WORK AREA:

An insulated and ventilated room for canned products and other preserved foods.

Flue for use of stove when desired.

Windows sufficient for light required for work in daytime.

Floor impervious to water and easily cleaned.

Entrances conveniently located with reference to kitchen and farm buildings.

Drive planned to make it possible to bring heavy articles to entrance of auxiliary area in wheelbarrow or truck.

Room allowed for use of a table as large as 3 feet by 8 feet near sink and stove.

A cabinet provided with some means of forcing the circulation of warmed air, for use during the rainy season in drying the wash.

Basement walls waterproofed and kept whitewashed.

Stairs that are easy to climb.

An outside as well as an inside stairway if both are needed for ready access to kitchen and farm buildings.

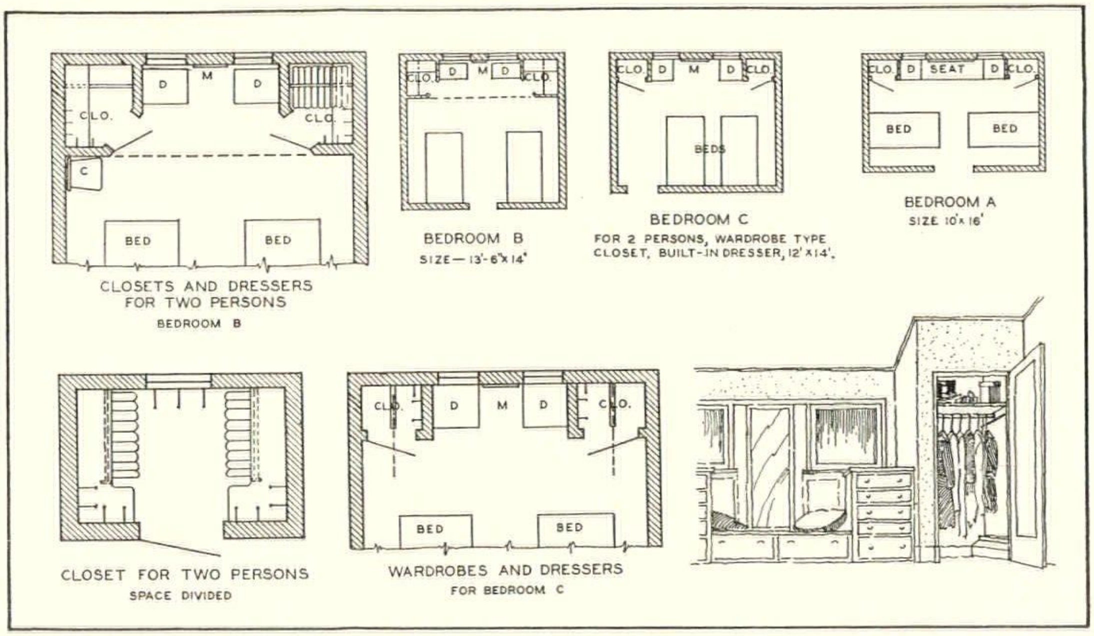
Chutes and lifts provided where possible, to eliminate carrying equipment and supplies. It is sometimes possible to arrange a lift opening on the outside of the house on a level with a truck bed, for convenience in handling egg cases, hog carcasses, etc.

A stairway that is broad and straight and is entered from the end, where equipment and supplies must be carried to the basement rather than transported by means of a lift.

DINING AREAS:

It is desirable that arrangements for the location of dining areas be made flexible because preferences of farm families in this regard vary from time to time. Elderly people and homemakers whose children are small commonly prefer the kitchen as the place for serving family meals. Where there are children old enough to set the table and wash the dishes, a dining area outside

Clothes closets and dressing centers. See discussion on page 323.



the kitchen may be preferred.

The outside location is always desired for company meals. This area may be a separate dining room or it may be combined with the living room. It is a more usable area if separate.

A porch where meals may be served in warm weather is popular. Crews of men may be served here.

The requirement of flexibility makes it necessary to plan for the storage of dishes, silver, and linen with reference to the various locations of the dining table. A good plan is to store all articles in the kitchen except the silver and linen used only in connection with company meals.

A buffet is a desirable article of furniture for use in serving company meals. Drawers below provide adequately for the silver and linen not used every day.

DESIRABLE ARRANGEMENTS FOR SERVING MEALS:

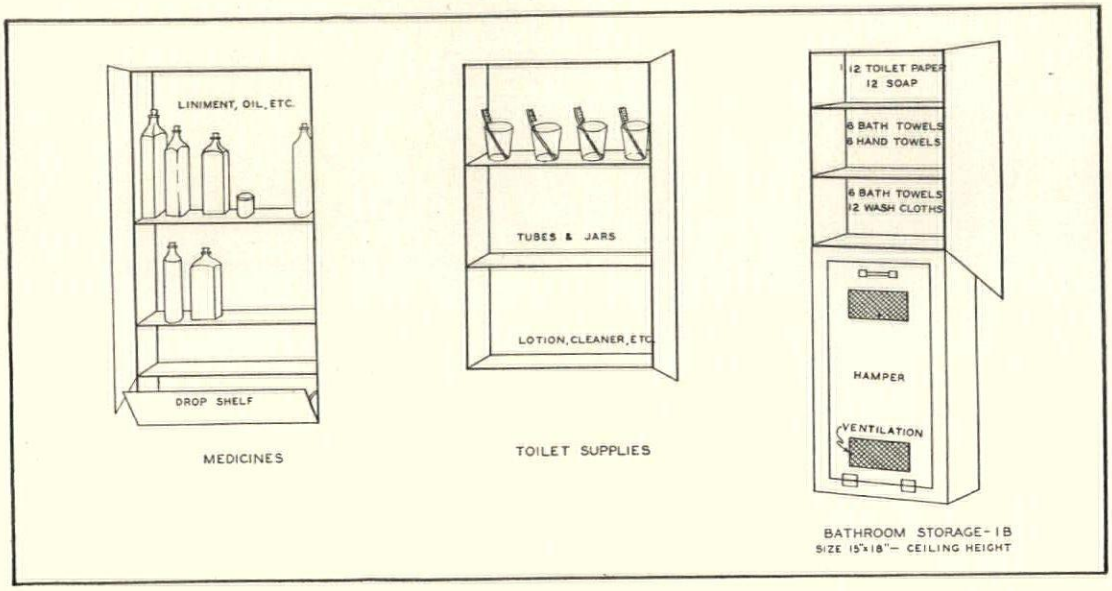
If the company meal is served in the living room, an area so situated as to make it possible to screen the table while it is being prepared for a meal.

Where everyday meals are served in the dining room, distance between dining table and serving area of kitchen as short as possible.

The table used for everyday meals so placed that it does not require moving, in setting it for a meal.

The kitchen dining table so placed that it can be reached from the living room

Diagram showing bathroom cabinets and location of needed supplies.



without crossing the work area of the kitchen.

A special low table for the child of less than three years of age.

Where benches are used, lightweight movable single benches with handholds are preferable to fixed benches seating more than one person.

SLEEPING AND DRESSING AREAS:

The problem of heat conservation is of very great importance in connection with provisions for sleeping and dressing. The rooms are not used a great deal during the day except as places in which to dress, and most farm dwellers prefer sleeping in cool rooms. Hence, in most cases only enough heat needs to be furnished to keep beds dried out and to make the rooms comfortable for use while dressing.

It would seem, therefore, that an economical arrangement for a second-floor room would be to plan a clothes closet large enough for use as a dressing room and equipped with an electric heater. If this were done, the bedroom would need to be only large enough for beds and a small table.

PLANNING FOR CONVENIENCE:

Space in each bedroom large enough for two beds each 40 inches wide.

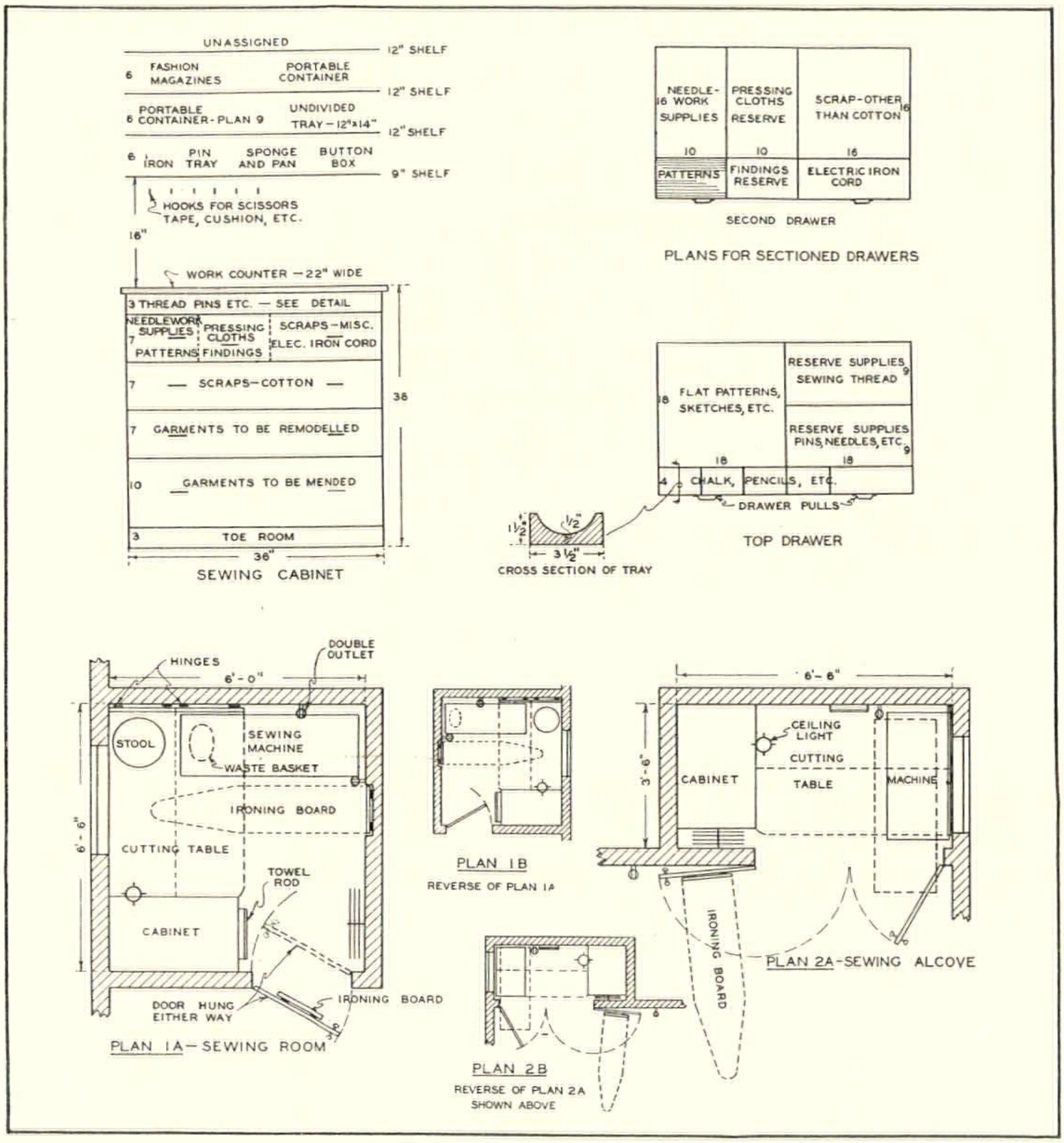
Decks or open porches, as places where older boys and girls may sleep out in summer.

Space at both sides of the bed, and passage at the foot.

A double closet, or preferably two single closets, for each bedroom.

A full-vision mirror with nothing in front of it.

Floor plans for small sewing room and alcove. Storage cabinet for supplies and minor equipment. See discussion on page 325.



Rod space sufficient to care for dresses, coats, dress shirts, and heavy sweaters.

Hooks, rod, and shelf capable of being set at three heights, for use by children at various ages.

Ventilation of windowless closets accomplished by means of ventilators in door.

Clothes of children not old enough to dress themselves, kept on first floor.

A bathroom on the first floor, located near the back entrance; toilet in a separate compartment; bathroom equipped for care of small children and for use as a dressing room; fixtures including tub and shower and lavatory with separate section for care of teeth; storage provided for toilet supplies and equipment, towels, and articles used in the care of small children; mirrors located for convenience in shaving and for use by children.

MINOR CONVENIENCE ARRANGEMENTS:

A table surface at least 14 inches by 18 inches near the lavatory.

Drawers or shelves for toilet articles and shaving equipment.

Storage in or near the bathroom for towels and supplies of soap and paper.

A built-in cabinet which provides a foot rest and a place for storage of shoe-cleaning equipment; this may be a section of the main cabinet, or it may be fitted in between studs.

A ventilated cabinet containing rods for towels in use and a place for wet brushes and cloths.

A cabinet top at least 18 inches by 36 inches for use in the care of an infant, or a wall surface permitting the use of a table for this purpose.

A place near the bathroom for the storage of supplies and equipment used in cleaning the bathroom.

A dental fixture; this may be purchased as a separate fixture or as a part of the lavatory.

A place for a mirror in front of a window or between two windows, with no obstruction in front of it.

Recess in wall for installation of electric heater when desired.

A shelf near the lavatory large enough for drinking glasses for all persons using the bathroom.

Hand-holds at back and left end of tub. It should be possible to reach a hand-hold from a sitting position in the tub and also from a position outside the tub.

A bathroom stool with a revolving seat.

Outlet for use of electric hair clipper.

SEWING, MENDING, AND IRONING:

Plans for locating sewing and ironing:

Plan 1. Sewing done in living room or dining room. A closet or alcove in connection which contains storage cabinet; work surface for basting, pinning, and cutting small pieces; place to store machine when not in use; dress form; folding clothes rack; portable cutting table.

Plan 2. Minimum-size sewing room, with machine in position for use at all times. Ironing done outside room.

Plan 3. Suitable for use in a home where guests are infrequent. Combination sewing room and spare bedroom; two closets—one for sewing, the other for a roll-away bed.

Plan 4. Suitable for a family which includes boys and girls of high school age or older. Valet room in which all sewing, pressing, and ironing are done.

ARRANGEMENTS FOR SEWING, MENDING, AND IRONING:

Room readily converted to other uses.

Storage room in one place for all supplies and minor equipment used in sewing. This may be a chest of drawers with open shelves above it for boxes, baskets, trays, etc.

Machine stored when not in use in a place where it is possible to get at it readily for emergency mending.

Work surface, available at all times, which is convenient for basting, pinning, and cutting small pieces, preferably located in a place where work can be left undisturbed between periods of sewing.

Work surface for use in laying out commercial patterns on lengths of goods. Use of such a surface would be infrequent, hence it can be a folding table or one used for other purposes.

Ironing board located near sewing area and in a position where it is in readiness for use while sewing is in progress.

A mirror conveniently located and of such dimensions and location as to provide a full vision for the person who is being fitted.

Sewing machine provided with an attached electric light.

Machine placed so that light from the window will come from back and left side of worker.

Portable containers for equipment and supplies used in hand sewing and darning.

ARRANGEMENTS FOR CARE OF FARM BUSINESS:

Satisfactory arrangements fall into three groups:

Scheme 1. No provision for interviews.

Writing done at dining table or library table.

Storage provided by means of portable cabinets or wall closets.

Scheme 2. Office desk provided for use of farm operator.

Desk located in living room or dining room.

Supplementary storage provided in portable cabinet or wall closets.

Scheme 3. Separate office room, including office desk and built-in cabinets for supplies and for the use of employees. It may be desirable to make this room somewhat larger than required for office purposes alone, in order that it may be possible to use it as a "man's room" or second living room.

The office room, or the office area of the living room or dining room, should be located so as to be readily accessible from the farm drive and farm buildings. It should be possible to enter it without crossing any of the living area of the house.

If an office room is provided, it should have an entrance which is readily accessible from the kitchen, for the convenience of the home-maker who is expected to answer the telephone and take care of part of the farm business. In certain locations two entrances are necessary.

The telephone. Although the wall type is in general use in farmhouses at the present time, it is likely that it will be supplanted eventually by the desk type. Arrangements for the telephone should be made with this possibility in mind. The telephone should be located away from the center of family life but near the kitchen, and in a place convenient for a person coming in from outside. The bell box should be placed where the bell can be heard from all parts of the house. (Extra wiring may be needed.) Suggested locations are in an alcove off the back hall; in the wall between the back hall and the kitchen and accessible from both sides; or in the wall of the office at the point most accessible from the kitchen. A good size for the alcove is 28 inches wide and 18 inches deep.

Convenience in the use of a telephone installed at standing height is enhanced by the provision of a writing shelf with light above it, and by a platform or low stool for the use of the shorter persons in the family. If the telephone is installed at sitting height, a desk or shelf should be provided in connection. A good size for a rectangular shelf or desk is 16 inches by 28 inches. A corner one will need to extend 28 inches on each wall.

Halls and entrances. There are four essentials in the planning of the front entrance of a house; adequate protection for the door, a vestibule of adequate size, a coat closet, and a seat to be used in removing overshoes. A roof or porch should extend over the door far enough to afford adequate protection from the rain. On the stormy side this roof will need to be at least 3 feet 6 inches wide if there is no side wall. If the seat is outside the house, it should be so located as to be protected from rain.

The vestibule should be of such proportions as to permit a guest to pass her hostess while the latter closed the door; a convenient plan is one which provides a minimum of 30 inches between one side of the door and the wall, and a minimum depth for the vestibule of 24 inches more than the width of the door, making a room 5 feet by 6 feet 3 inches. The vestibule should be at least

4 feet wide, and a room of this width will need to be 9 feet 6 inches long.

A study of the manner in which halls are used by the family shows the desirability of planning a house so that traffic areas ramify from a central stem. The base of this stem is the entrance leading to the farm drive and the farm buildings; the stem itself is a hall connecting this entrance with the portions of the house that are in constant use. These include the kitchen, living room or dining room, downstairs bedroom, entrance to the basement, and entrance to the second floor. It is desirable to locate in or adjacent to this hall a coat rack or closet for the use of the family, a telephone niche, alcove, or booth, a cleaning closet, and a cabinet for the storage of sports equipment. The telephone and the sports-equipment cabinet may be located in the office, if such a room is included in the floor plan.

BASIC DIMENSIONS:

Certain dimensions are used in determining areas in many different parts of the house. Some of the more important general dimensions are listed below, while those used chiefly in the planning of specific areas are listed in the following sections.

ENTRANCES:

Quarter or half circle, as determined by width and location of door.

PASSAGES:

Between pieces of furniture of less than elbow height—

To permit a person to "edge" through, 15 inches.

To permit a person to walk through naturally, 18 inches.

Between wall or high furniture and piece of less than elbow height, 21 inches.

Between wall and high furniture, 24 inches.

SEATING:

Depth of space needed for knee and foot room in front of straight chair, 20 inches.

Minimum width of space occupied by seated person (as between legs of table), 15 inches.

STANDING ROOM:

No action, 18 inches.

Working at drawer, depth of area 24 inches to 27 inches.

REACH:

Maximum height of shelf from floor, 72 inches.

Distance between centers of drawer pulls, 20 inches to 24 inches.

STOOP, BEND OR CROUCH:

Depth of area, 36 inches.

ARM MOVEMENT:

Width of area varies from 24 inches to 34 inches, depending upon extent to which entire arm is used.

KITCHEN DIMENSIONS: In planning the kitchen, the size of certain structural units to be accommodated must be considered as well as the floor area itself.

STRUCTURAL UNITS:
Depth of mixing table, 27 inches.
Width of part of mixing area unobstructed by cupboard above, 24 inches.
Distance between counter and first shelf of upper cupboard, 14 inches.
Depth of stack-and-drain surface, 24 inches.
Length of counter for draining and drying dishes, 32 inches.
Length of counter for stacking dishes, 36 inches.
Minimum distance between left of sink and wall or counter, 24 inches. (Place for person wiping dishes.)
Maximum height from floor to shelf intended for articles frequently used, 72 inches.

MARGINS ABOUT ARTICLES STORED (FOR FREEDOM IN ACTION OF HAND):
In front of article stored on shelf, 2 inches.
Between article and shelf above, 3 inches.
Between a hook and the lower edge of an article hung above it, 3 inches.
Between the backs of utensils hung on the side walls of a cabinet, 4 inches.
Minimum width of pass-cupboard opening, 14 inches.

FLOOR AREAS: Minimum width of space between two centers, 48 inches.
Space in front or at side of open oven door of wood stove, 30 inches. (Measure taken from edge of door when open.)
Space in front of wood lift (if below counter), 36 inches.
Space before drawers—
For pulling out the drawer, 6 inches less than depth of counter or table (if drawer occupies its entire depth).
For standing in front or at the side of drawer, 21 inches.

DINING AREAS: Space required for occupied seat or nonmovable seat: Since the front edge is on a line with the edge of the table, this measure depends on the floor area required by the seat itself. 18 inches by 18 inches is a common measure.

WIDTH OF PASSAGES:
Between front of seat and edge of table when seat is drawn back—
To permit person to take own seat, 9 inches.
To permit person to pass to seat beyond, 12 inches.
Between corner of table and corner of adjacent article of less than elbow height, 15 inches.
Back of occupied seat and article of furniture of less than elbow height—
For person passing to seat beyond, 15 inches.
For person serving table, 21 inches.
Back of occupied seat and wall or article of furniture of more than elbow height—
For person passing to seat beyond, 18 inches.
For person serving table, 24 inches.

BEDROOMS—	Width of space at side of bed, for convenience of person making it, 20 inches. Width of passage at foot of bed, 20 inches.
CLOTHES CLOSETS—	Length of rod space per garment— Street and house dresses, $1\frac{1}{2}$ inches. Dinner and evening dresses, 2 inches. Coats, fur-trimmed, 6 inches. Coats, other, 4 inches. Distance between hooks, 9 inches.
TOILET FACILITIES—	Area in front of tub required for persons stooping or kneeling while helping child with bath: Depth of area in center, 30 inches. Distance from end of tub to adjacent fixture or piece of furniture 18 inches in depth, not less than 8 inches. Area about toilet required for person, child or feeble person (measured from center of front edge of back of seat): Depth, 30 inches. Distance to adjacent fixture or other obstruction at right of toilet, 30 inches. Area about lavatory (measured from the center of the bowl, laterally, and on a line with the fronts of the faucets): Distance to adjacent fixtures or other obstructions more than 12 inches in depth, at left, 20 inches (required by adult washing own hair); at right, 38 inches (required by person helping another to wash hair).
SEWING ARRANGEMENTS—	CUTTING TABLE: Space between ends and adjacent wall or furniture, 2 inches. Space in front for worker: Length same as that of table. Depth, 24 inches. Size of table: For all purposes, 42 inches by 108 inches. For households where outer garments for adults are habitually bought ready-made, 38 inches by 72 inches. Work surface for basting, pinning, and cutting small pieces, 22 inches by 60 inches. Sewing machine—distances to walls or adjacent articles of furniture: At left of machine, 6 inches. At back of machine, 2 inches. At right of machine, 1 inch.
IRONING—	Space at open end of board, 6 inches. Space at back of board, 6 inches. Space for worker: Length—that of board plus 12 inches. Depth, 27 inches.

DESIRABLE REQUIREMENTS FOR THE FARMHOUSE

RECOMMENDATIONS OF COMMITTEE ON FARM AND VILLAGE HOUSING, PRESIDENT'S CONFERENCE ON HOME BUILDING AND HOME OWNERSHIP.

EXTERIOR OF THE FARMHOUSE

1

A. General appearance—simple in line and detail rather than ostentatious.

B. Shape, height, and architectural style of the house should be adapted to the site and general surroundings and to climatic conditions.

C. Number, size, and location of doors and windows should afford pleasing appearance.

D. Materials should be selected and used in accordance with purpose, economy, and local supply.

E. The color scheme should be harmonious.

INTERIOR OF THE FARMHOUSE

2

A. General arrangement.

1. ***Kitchen, food storage space and dining area*** should be located with easy access to each other. The kitchen should have ***view toward both farm buildings and highway.***
2. Places for special work and for men to wash and to hang wraps should, if possible, be located near both the kitchen and a rear or side entrance.
3. Living room should be located on sheltered side of house or where there is best view.
4. It is desirable to have a bathroom with a toilet convenient to sleeping quarters.
5. Main approach entrance for family and visitors alike should be easily reached from kitchen, but also should lead into living quarters.
6. A passageway should lead from the main rear entrance to the living or dining room ***without passing through kitchen work area.***
7. Stairs should be located in the hall if there is one. Stairs to cellar should be convenient to kitchen and to rear entrance.
8. The arrangement of doors and passages should accommodate social groupings.
9. Doors, windows and passages should be arranged to provide ventilation.
10. Covered porches should not be placed so as to reduce unduly the natural lighting of rooms.

B. Facilities the farmhouse should provide.

1. Living quarters.

(a) Space for comfort, rest, and reasonable privacy for all members of the family.
(b) Space for the placing of furniture to avoid interference with doors, windows and closets.
(c) Study equipment and play space for children.
(d) Facilities for correspondence, reading, keeping of farm records, and business transactions.
(e) Rooms arranged conveniently for visiting with friends and entertaining neighborhood gatherings.
(f) Provision for the young people to entertain their friends.

2. Convenient working arrangements.

(a) Kitchen work centers grouped to save steps (stove, sink and work surfaces each not more than 12 feet from all others). Work space should be between 90 and 150 square feet in area, and should not be broken by doors and passages.
(b) Working heights that allow worker to stand or sit normally.
(c) Space for doing the laundry (see section A-2), and where washing machine, tubs, and other equipment may be left when not in use; should be protected from weather, close to drying space, and not less than 50 square feet in size.
(d) Space near rear entrance (general service room or porch—see section A-2) for preparing or canning products coming into the house. May be combined with laundry space.

3. Adequate storage facilities.

(a) For food.
- (1) Ample kitchen cupboards planned and located with reference to the material to be stored.
- (2) Refrigerator that maintains temperature below 50° for perishable foods in warm weather; size adapted to needs.
- (3) Ventilated cupboard or closet for cool weather and for year-around storage of the less perishable vegetables and fruits.
- (4) Storage for large quantities outside of kitchen work areas.
- (5) Cupboard and bins in dry basement near stairs or in other dry cool place for canned products and vegetables.

(b) For fuel.
- (1) Coal or wood storage convenient to heating plant.
- (2) Coal or wood box near range, the wood preferably put in from outside.
- (3) Kerosene or gasoline; small supply kept in convenient place, main supply kept outside of house.

(c) For operating equipment.
- (1) Work cabinet with satisfactory storage space for small and large utensils, kitchen tools and linens.
- (2) Separate closet space for cleaning equipment, off rear hall; minimum size 16 by 20 inches or equivalent.
- (3) Storage for ironing board near kitchen, or a built-in board.

(d) For wraps.
- (1) Front or side entrance wrap closet equipped with high and low hooks for adults and children; minimum size 36 inches wide by 20 inches deep.
- (2) Rear closet for rough wraps and work clothes, or hooks near rear entrance.

(e) For bedding and linen; minimum closet space 36 inches wide, 18 inches deep, height of room.

(f) For children's playthings; storage space under window seats, in closets or drawers, upon shelves or in boxes with lids.

4. Sleeping facilities.

(a) At least one bedroom for every two adults.
(b) Bedroom area, not less than 100 square feet for two persons.
(c) A bedroom downstairs is desirable in houses of more than one story.
(d) All bedrooms provided with cross ventilation and wall space for beds.
(e) Closet or wardrobe space in addition to bedroom space, not less than 20 by 36 inches, height of room; should be equipped with shelf, rod for hangers, and shoe racks.

3 UTILITIES OF THE FARMHOUSE

A. Lighting.

1. Each room should have at least one unobstructed window; kitchen, living and bedrooms preferably should have windows on two or more sides.
2. *Direct sunlight* should enter at least three-fourths of the rooms.
3. There should be both daylight and artificial light on all work surfaces such as stove, sink, work and study tables, and at reading centers.

B. Heating.

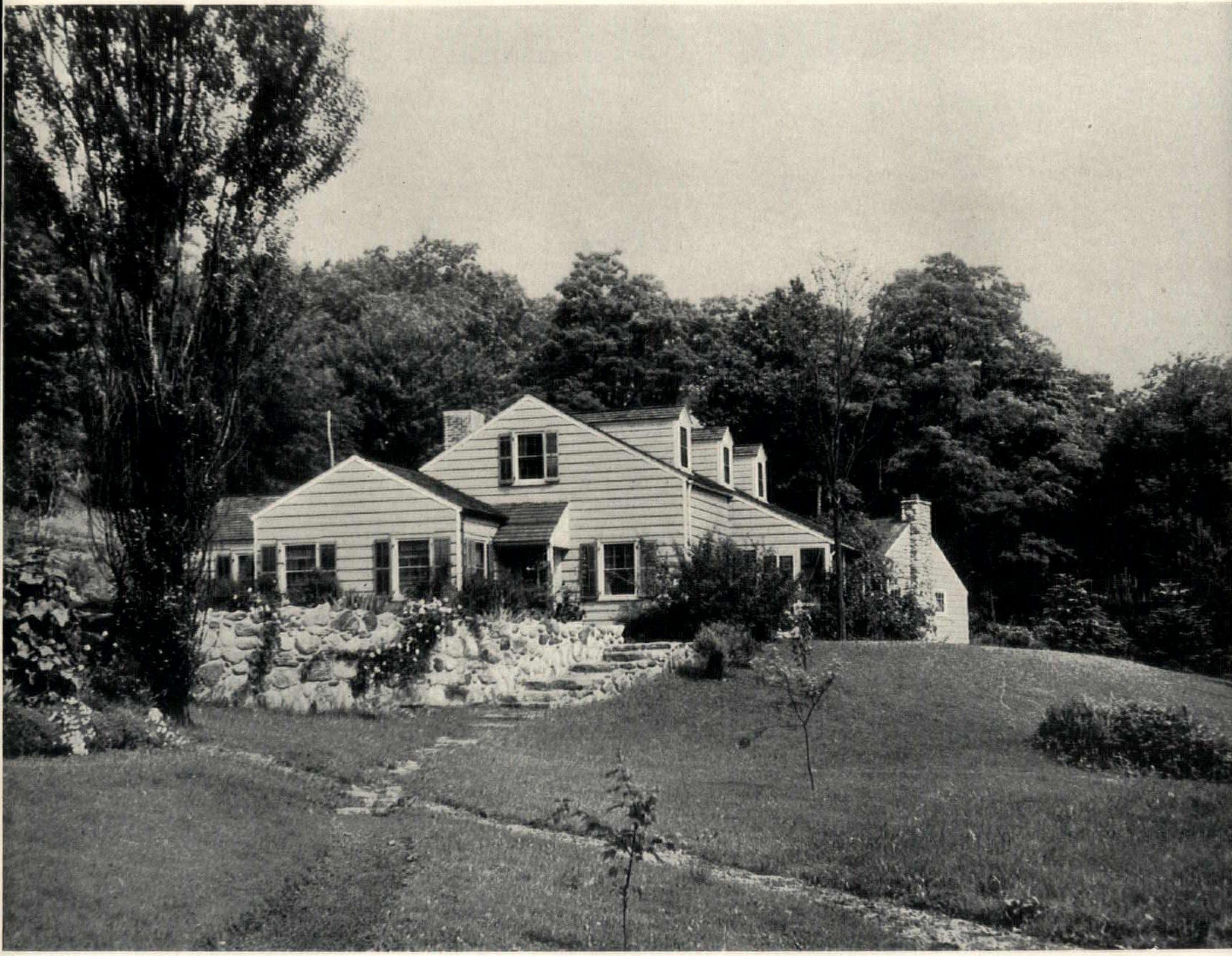
1. Equipment should be capable of maintaining comfortable temperature, and of utilizing locally available fuels.
2. A properly designed and installed central plant is desirable in the colder regions.

C. Water supply and plumbing.

1. House should be provided first with piped water supply, sink, and drain. If piped water supply is not possible, a walk to well should be provided.
2. Hot water supply, bathroom (and septic tank), laundry, and washroom should be added as means permit.

PORTFOLIO

FARM AND VILLAGE HOUSING



Van Anda

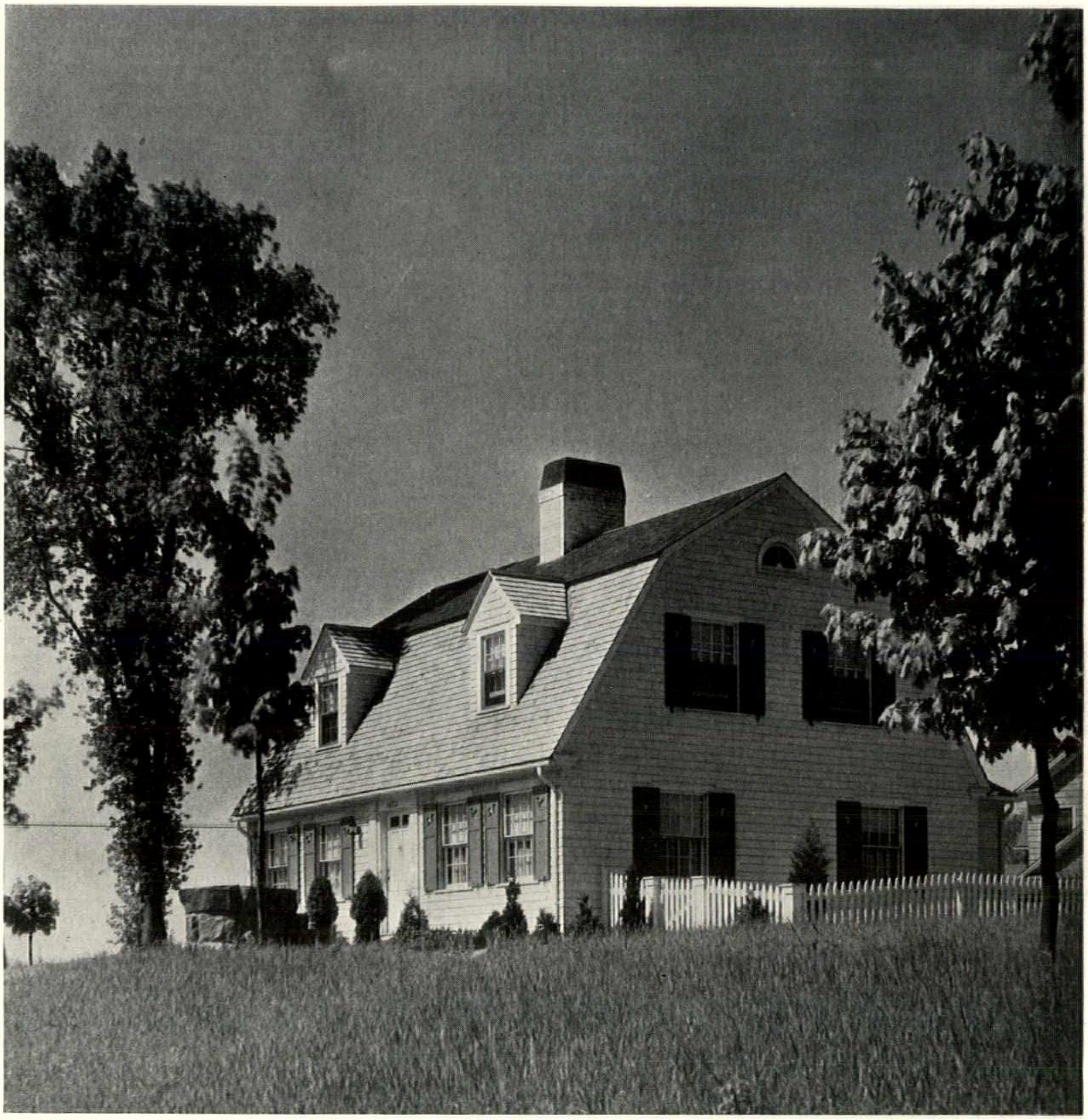
HOUSE FOR A. U. HICKS, ROSLYN, LONG ISLAND

GODWIN, THOMPSON AND PATTERSON, ARCHITECTS

Van Anda

HOUSE FOR A. U. HICKS, ROSLYN, LONG ISLAND

GODWIN, THOMPSON AND PATTERSON, ARCHITECTS



Van Anda

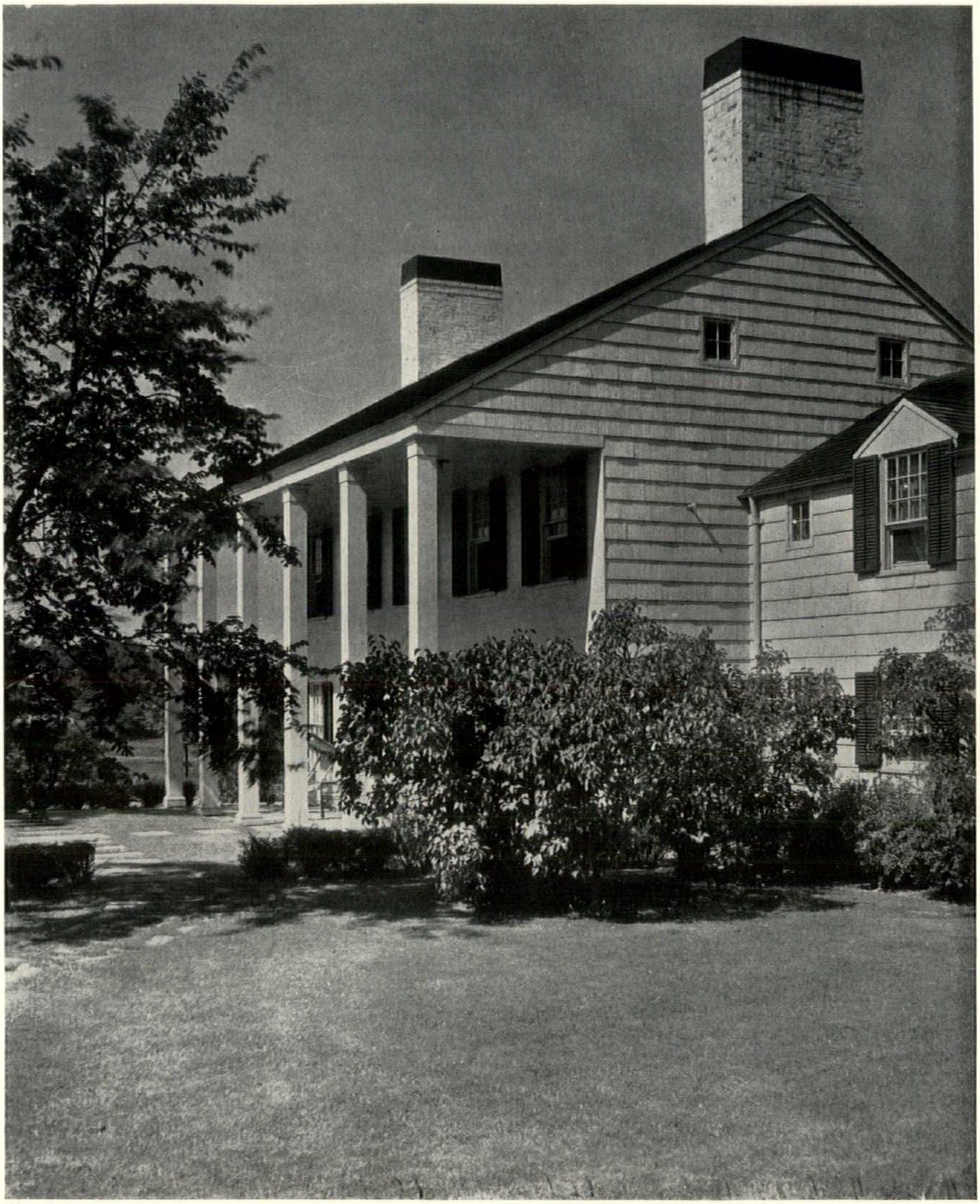
HOUSE FOR J. VICTOR EAST, LONGMEADOW, MASS.

ARCHITECT UNKNOWN

Van Anda

HOUSE FOR J. VICTOR EAST
LONGMEADOW, MASS.

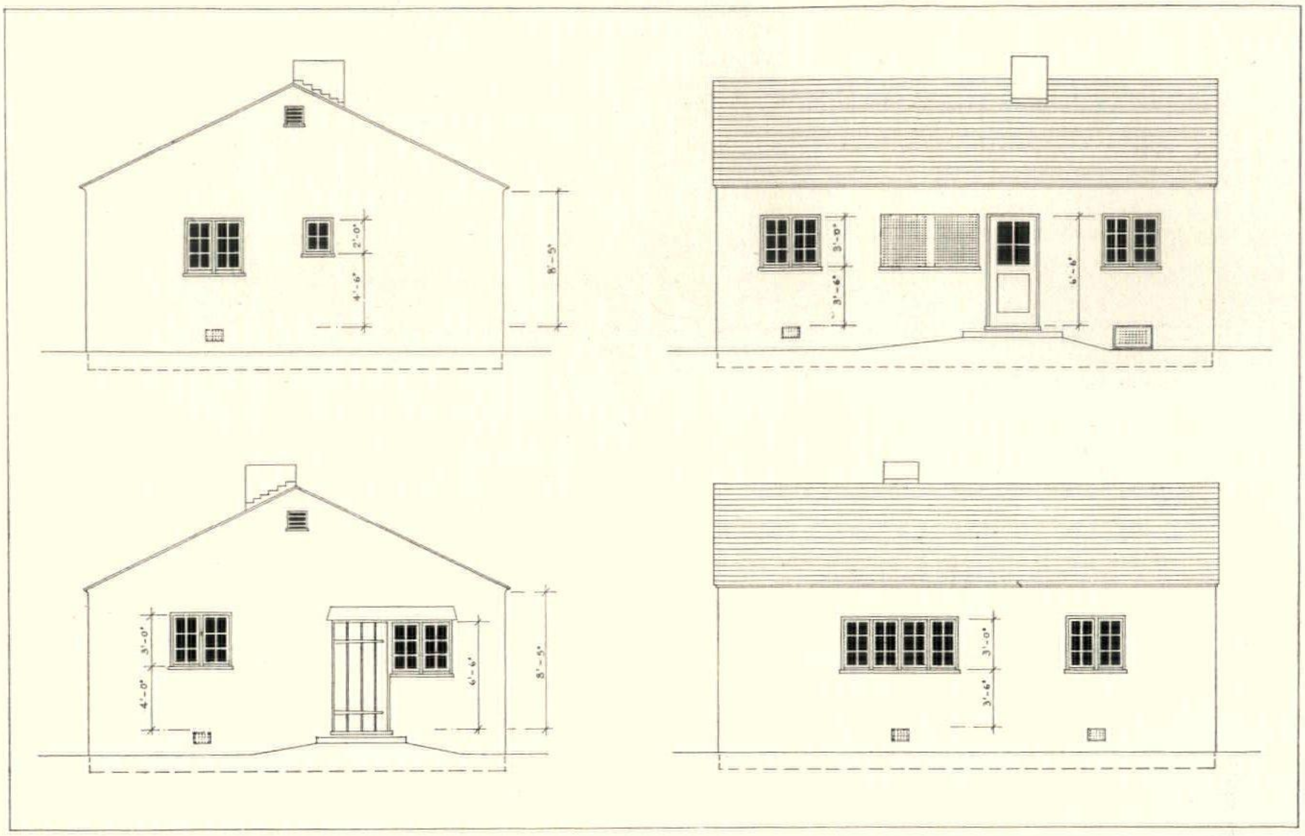
ARCHITECT UNKNOWN



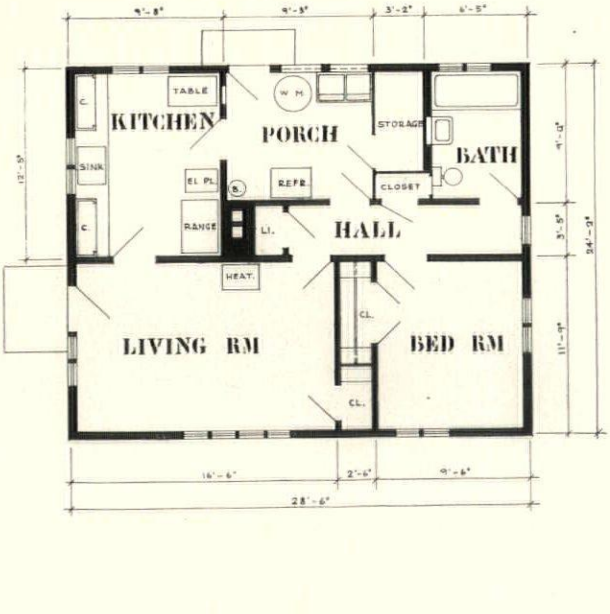
Van Anda

HOUSE FOR S. K. BECKER, FAIRFIELD, CONN.

CAMERON CLARK, ARCHITECT



ELEVATIONS



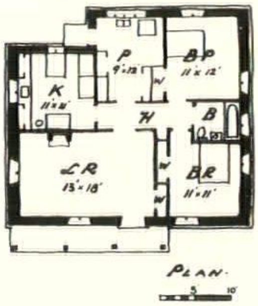
PLANS

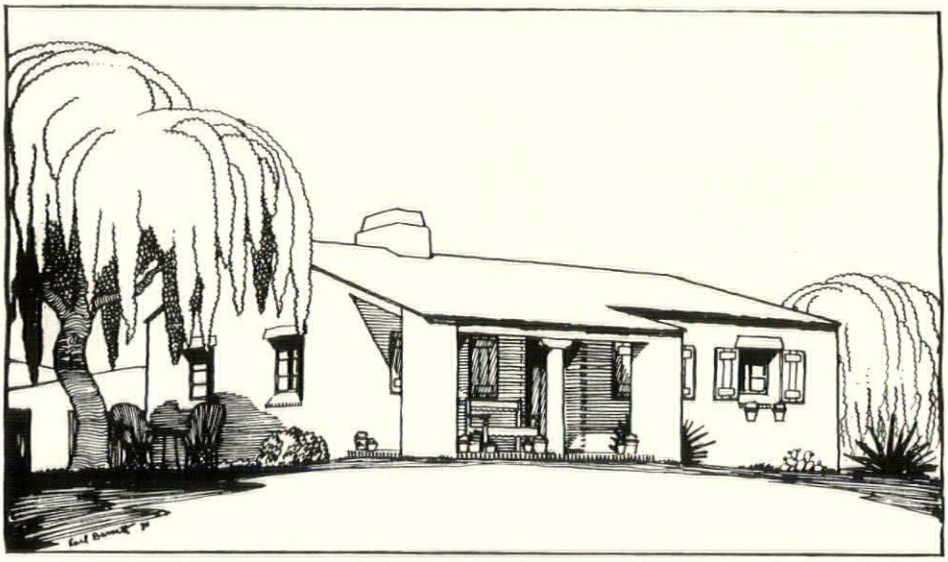
FARMHOUSE

DEVELOPED BY DIVISION OF AGRICULTURAL ENGINEERING, UNIVERSITY OF CALIFORNIA, FOR U. S. DEPARTMENT OF AGRICULTURE.

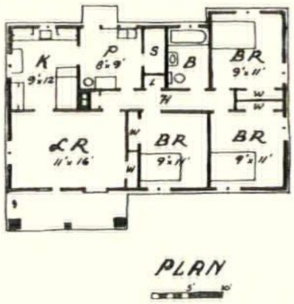
FOUR FARMHOUSES

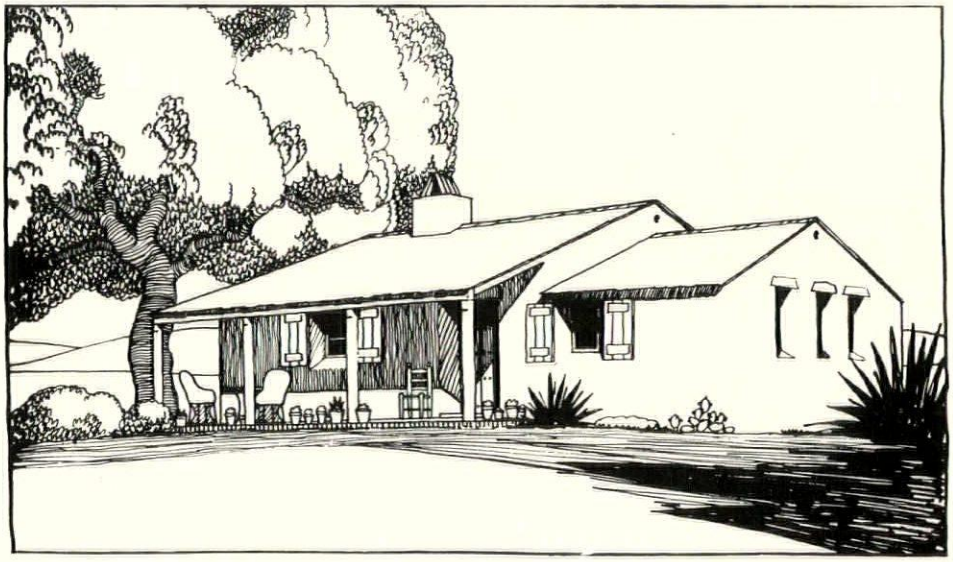
The one-story bungalow types permit light construction. These farmhouses suggest adobe or concrete but in reality most farmhouses in California are built of frame with stucco on lath. Cost for adobe would be somewhat higher than if stucco wall construction were used. All rooms have cross ventilation, particularly necessary in California. Living room, kitchen and two bedrooms.





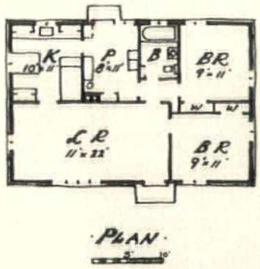
A California type farmhouse with screened porch that also serves as laundry and workroom. The porch at center of side for coolness fulfills functions of hallway. There are three bedrooms, living room and kitchen.





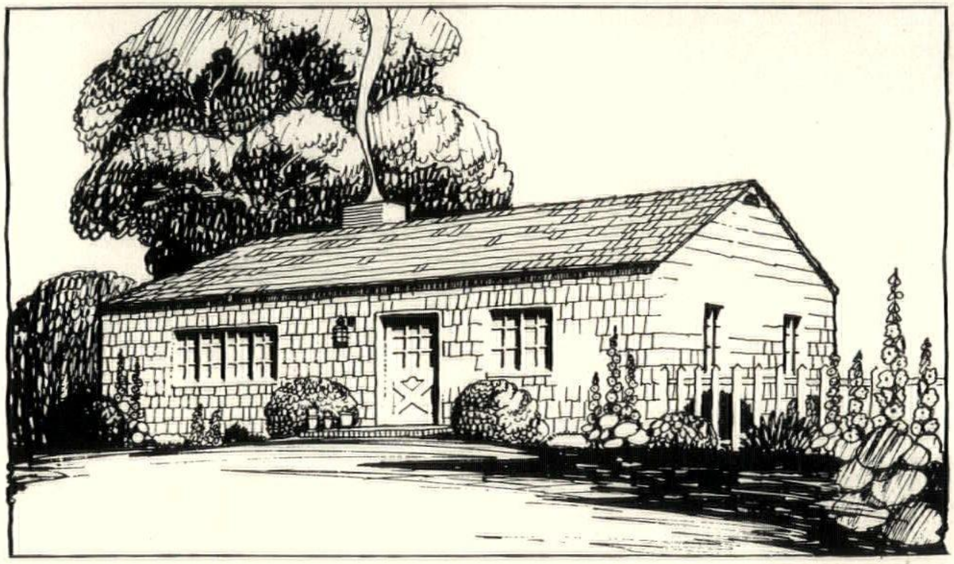
ESTIMATED COST OF THESE HOUSES IS $2,250 AND $2,900.

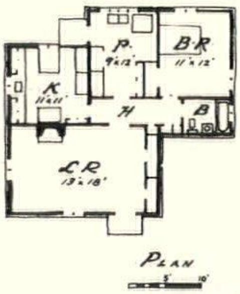
DEVELOPED BY DIVISION OF AGRICULTURAL ENGINEERING, UNIVERSITY OF CALIFORNIA FOR U. S. DEPARTMENT OF AGRICULTURE, C.W.A. PROJECT.



A two-bedroom farmhouse that could have three bedrooms by reducing size of living room. See plan on opposite page.

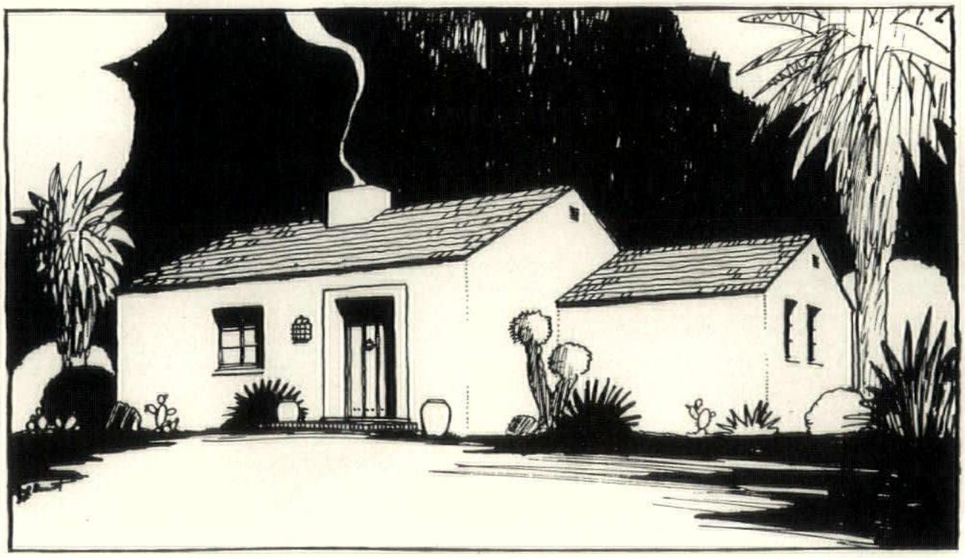
Farmhouse faced with split redwood shingles or "shakes" intended for location in Northern California.



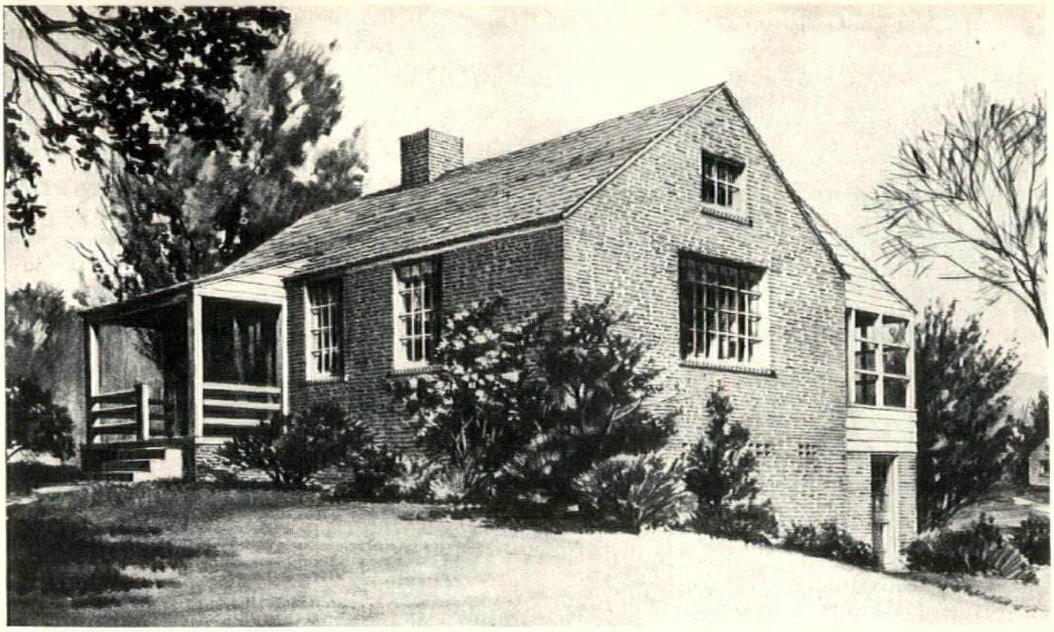


Farmhouse intended for location in Southern California. The one-story house is well suited to informal additions.

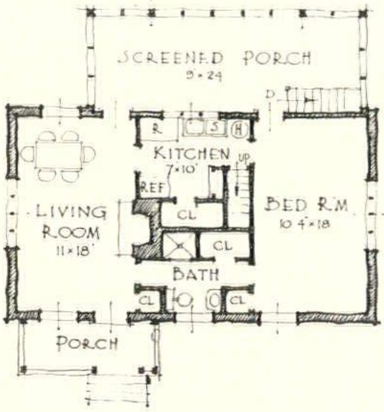
A one-bedroom farmhouse that could be expanded to a two-bedroom type as with plan on opposite page.



ESTIMATED COST
OF THESE HOUSES
IS $2,700 TO $3,000.

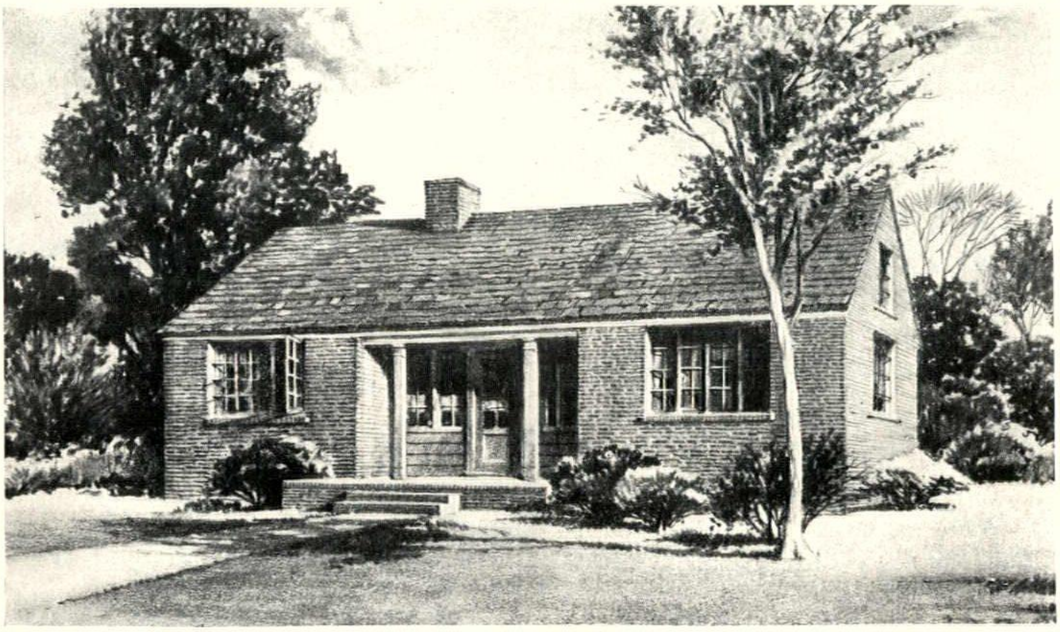


T. V. A. HOUSE
N - 2

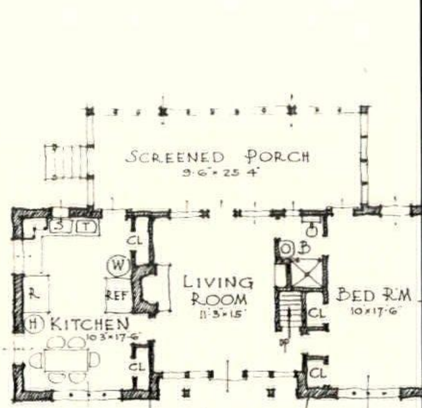


Contains 12,900 cubic feet of space.
Extension to living room used for dining purposes. Dining table may be on screened porch.
The square-shaped kitchen is provided with a built-in cabinet, a refrigerator and storage space.
The range and sink are placed beside a window, which insures a well lighted work space, as well as an outdoor view across the porch.
A narrow staircase leads to the attic, lighted and ventilated by gable windows.
Bedrooms are of large size with ample space for furniture.
There is space under the rear porch for use as a laundry and storage room.
Kitchen range, refrigerator and water heater are electrified.

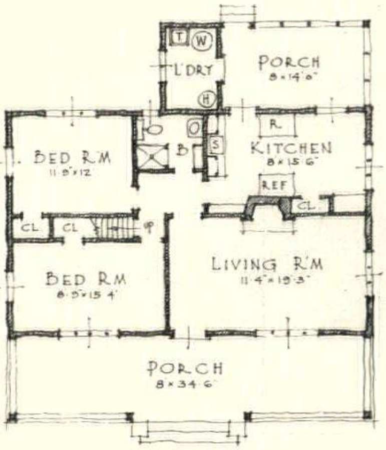
Separation of house into two wings with an open space between, but all covered under same sweep of roof, insuring ventilation for homes built in warm climate. The open gallery area is convertible into a living room that can be inclosed when required.
There is thorough ventilation for every room. The bedroom and kitchen receive light and air from three sides. There is no basement, as storage space in attic and electric heating system make such space unnecessary.
Dining space is provided in kitchen.
Equipment includes electrified cooking range, hot-water heater and refrigerator.
The screened porch is accessible to all rooms of house.
Walls are of brick.

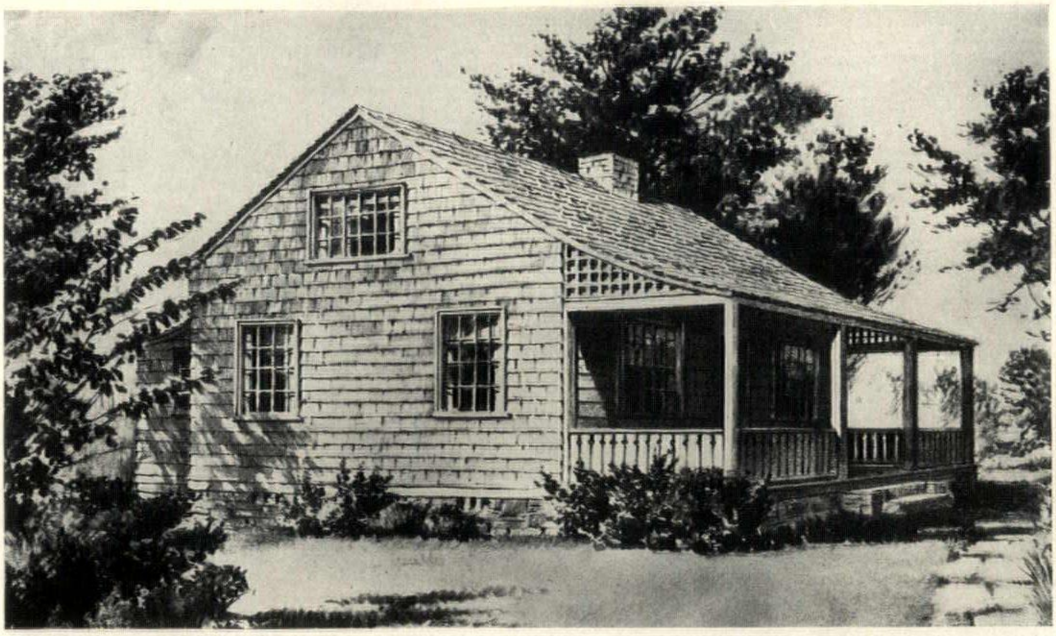


T. V. A. "BREEZE-WAY" HOUSE D - 1



T. V. A. HOUSE
NORRIS, TENNESSEE



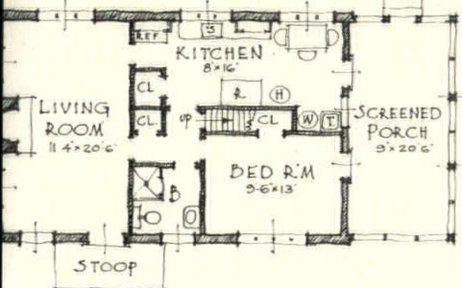


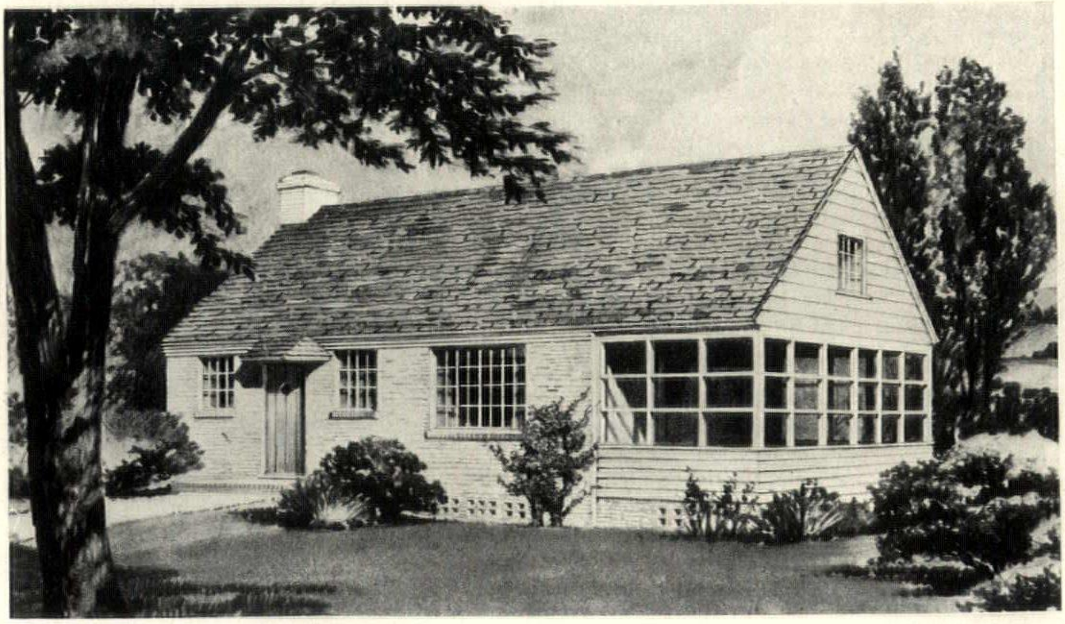
Four-room house with screened porch. Rooms are of ample size and well lighted.
Undesirable arrangement of kitchen sink along line of traffic and without light, other than from distant window. Refrigerator at chimney and range at outer wall adjoining entrance door is impractical. It would be an advantage to enlarge bathroom.
Walls of house are of wood, faced with shingles.

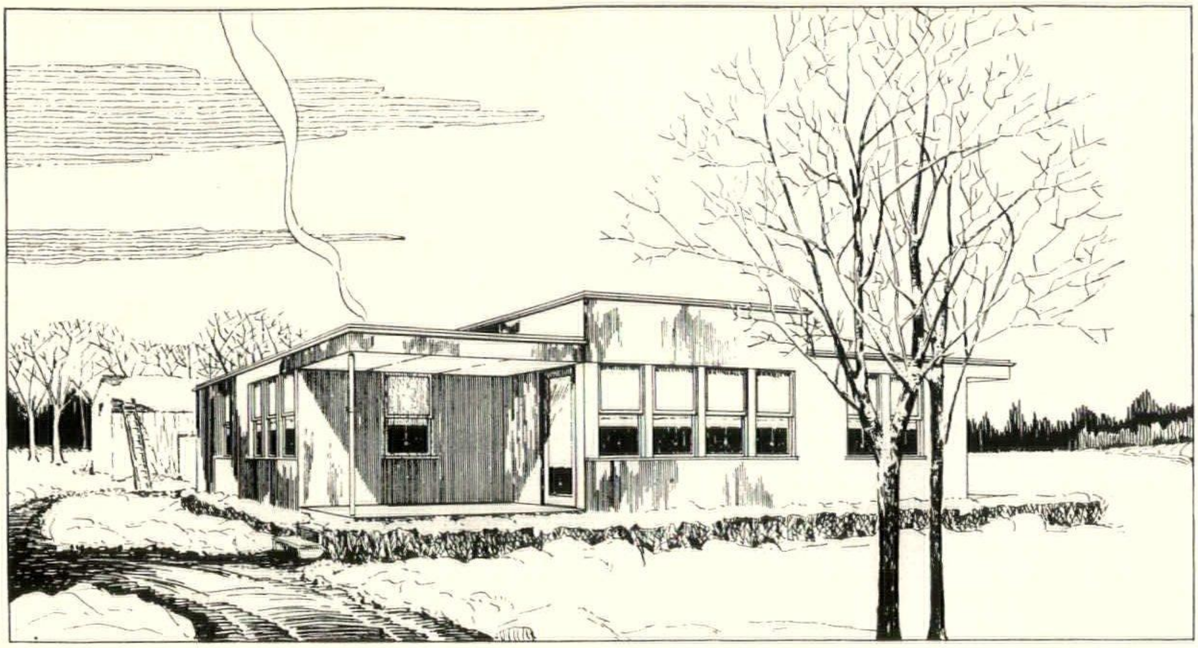
FOUR FARMHOUSES FROM THE TENNESSEE VALLEY AUTHORITY AT NORRIS, TENNESSEE

Three rooms of ample size. Kitchen arranged to care for dining purposes. Electric heaters in each room. There is no basement.
Living room has windows on three sides insuring ample ventilation. Fireplace supplements electrical heating system. Central hall provides intercommunication between rooms including bathroom. Walls are of brickwork, stained white to match the woodwork or left natural in color.

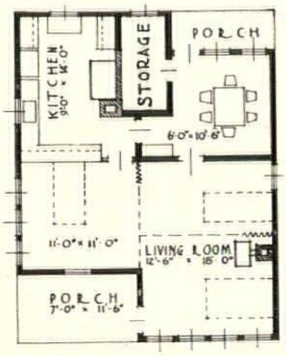
T. V. A. HOUSE
NO. 32



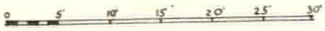


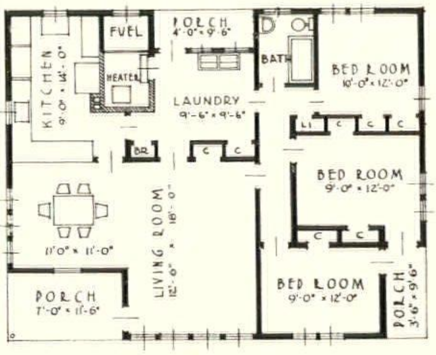


GENERAL VIEW, COMPLETE



PLAN, FIRST STAGE





PLAN, SECOND STAGE

ONE-STORY EXPANSIBLE FARMHOUSE

DEVELOPED BY U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF HOME ECONOMICS AND BUREAU OF AGRICULTURAL ENGINEERING, CWA PROJECT.

FIRST STAGE

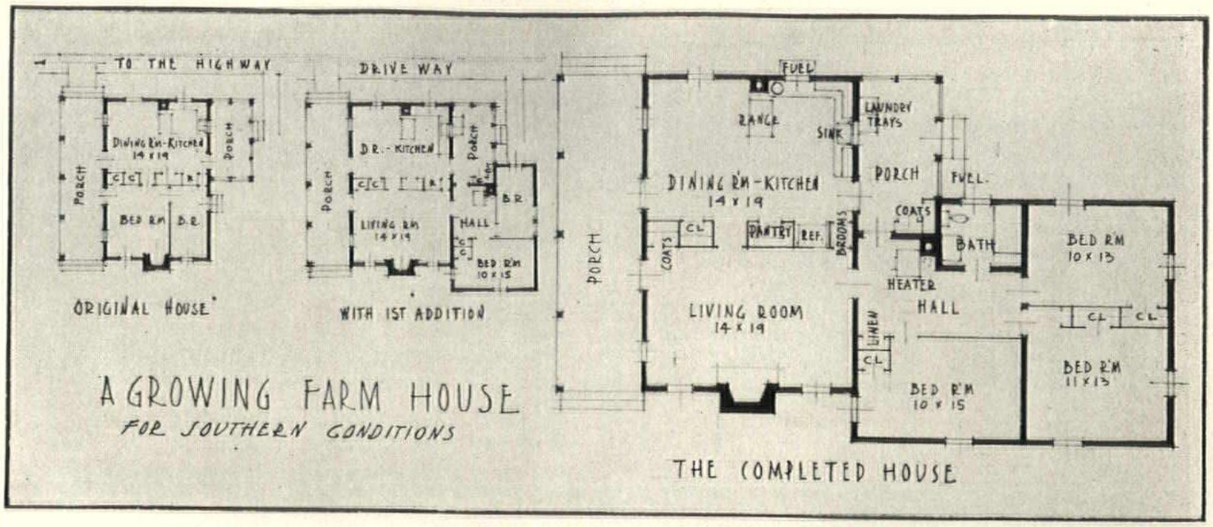
First stage, 8,500 cu. feet. Front porch and living room face highway. Three bedrooms obtained by dividing living areas with curtains or folding partitions. Rear porch is entrance from barnyard. Wash or dining room giving access to kitchen, living room, heater or storage and fuel. Built-in closets for coats, wraps and brooms. Kitchen for cooking only, equipment arranged so as to eliminate unnecessary steps and avoid traffic through the working area. Views from kitchen to approach of house and to barnyard. All rooms have cross ventilation. Living room has a ceiling height of 9 feet 4 inches. All other rooms 7 feet 4 inches high for economy. Heating by circulator heater in living room or by central hot-water boiler with radiators. Simple rectangular shape of plan makes most economical construction possible and represents an architecturally finished appearance in this stage of development.

SECOND STAGE

Second stage, 14,000 cu. ft. Addition of 3 bedrooms, bath, and porch. Ceiling height 7 feet 4 inches. Built-in closets for clothes and linen provided in each room. Cross ventilation assured. Ample-sized living and dining rooms can be combined for gathering. All rooms are permanent and have direct access from either front or rear entrance. Bed and living rooms heated by hot-water system. Fireplace in living room obtainable. Erection of addition does not involve major changes in structure of first stage and expanded house shows the complete dwelling as an integral whole.

CONSTRUCTION METHODS

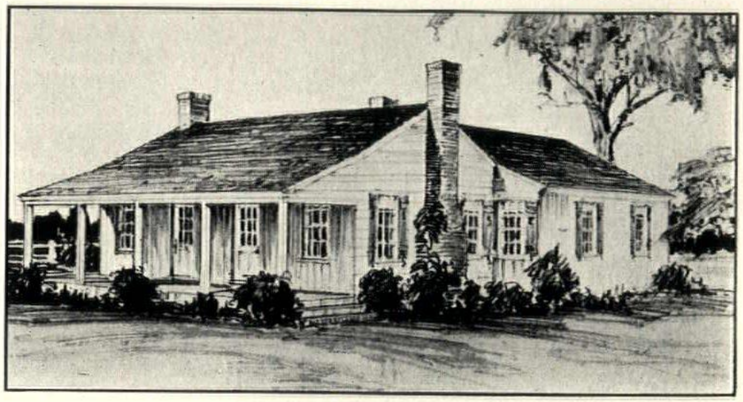
Construction methods. The plan and design can be adapted to brick, concrete, or other masonry construction, to wood frame and to systems using fabricated wall, window and door units 3 feet 6 inches wide. Frame construction with suitable coverings is one low-cost method easily erected and adaptable to most parts of the country. Dry materials which can be readily placed and are not subject to cracking are preferable. Exterior wall coverings may be boards and battens, sheet metal or sheathing covered with painted canvas. Interior wall coverings may be of narrow boards with v-joints, plywood or fiber board. Insulation against heat or cold should be provided in walls and ceiling. Flat roofs covered with built-up roofing are used because they eliminate special roof framing.

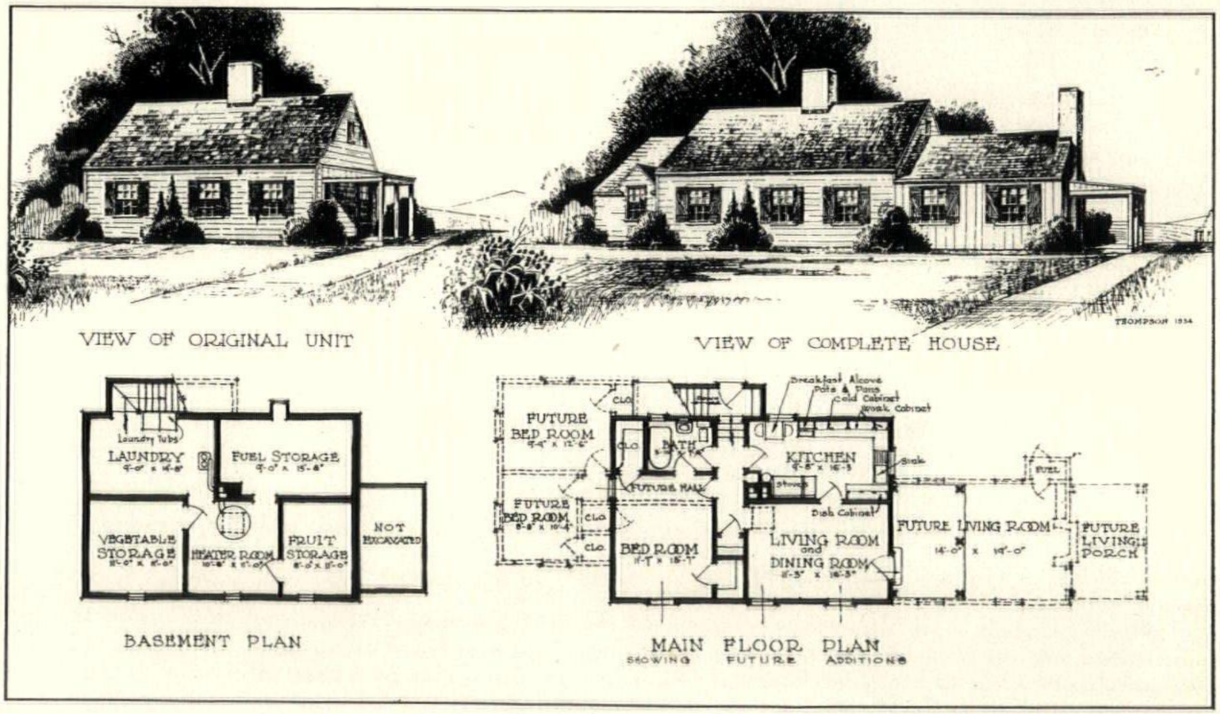


SOUTHERN FARMHOUSE

DEVELOPED BY U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF HOME ECONOMICS AND BUREAU OF AGRICULTURAL ENGINEERING, CWA PROJECT.

The original unit provides two temporary bedrooms.
Entrances are located to give convenient access to kitchen and living room from front or rear. Kitchen is so arranged that persons going from one part of house to another, or passing in or out of house will not interfere with the kitchen work. Work area provides for convenient arrangement of equipment. Plenty of storage space is provided for foods, clothing and the current supply of fuel. Men coming from barns or fields can leave outdoor clothing on back porch before entering house.
Entire house, in mild climate, can be heated by circulator heater in central hall.
All rooms have cross ventilation.



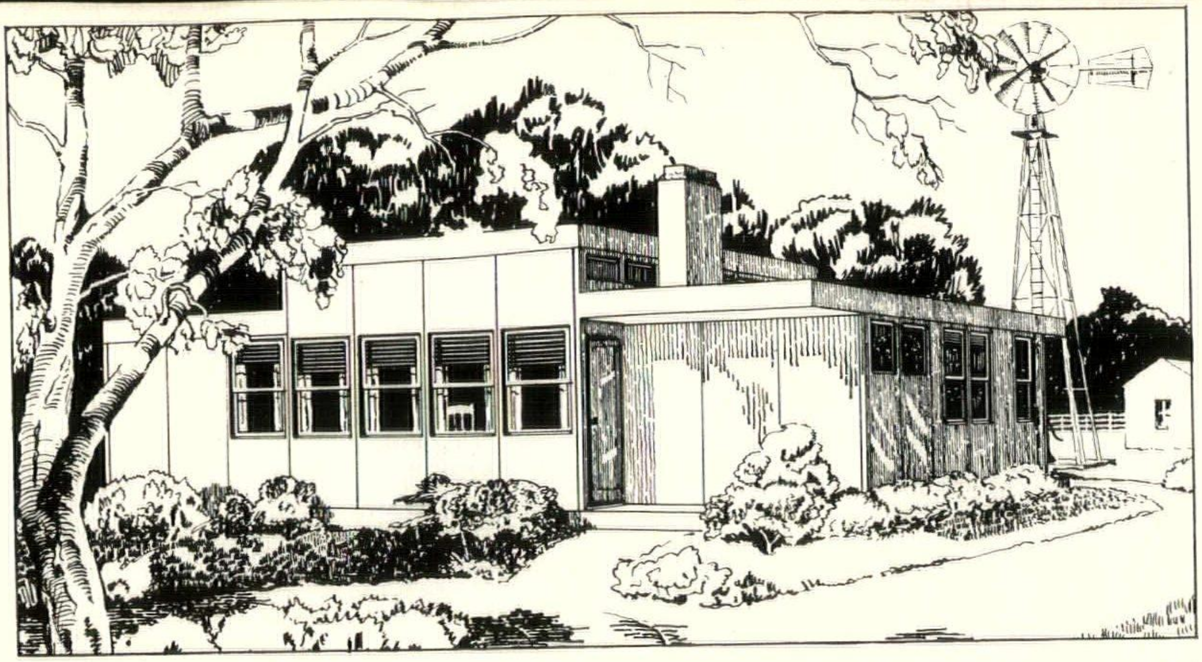


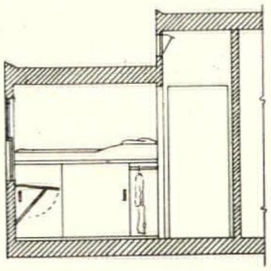
ONE STORY EXPANSIBLE FARMHOUSE.

DESIGNED BY VIRGINIA POLYTECHNIC INSTITUTE, BLACKSBURG, VIRGINIA, IN COOPERATION WITH THE U. S. DEPARTMENT OF AGRICULTURE, CWA PROJECT.

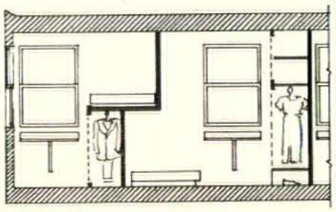
First unit consists of combined living-dining room, front porch, kitchen, bedroom and bath. Basement with laundry, heater room, fuel-, vegetable- and fruit-storage. All rooms can directly be reached by the central hall. The windows are arranged for cross ventilation and desirable outlooks. Heat by hot air furnace.
Addition of two bedrooms. Future hall provides convenient relation of bedrooms and bath. Plenty of closets for clothing and linen.
Addition of larger living room. Former living-dining room becomes dining room only.
Additions can be erected without inconvenience for housekeeping in original house and structural changes therein.

PERSPECTIVE

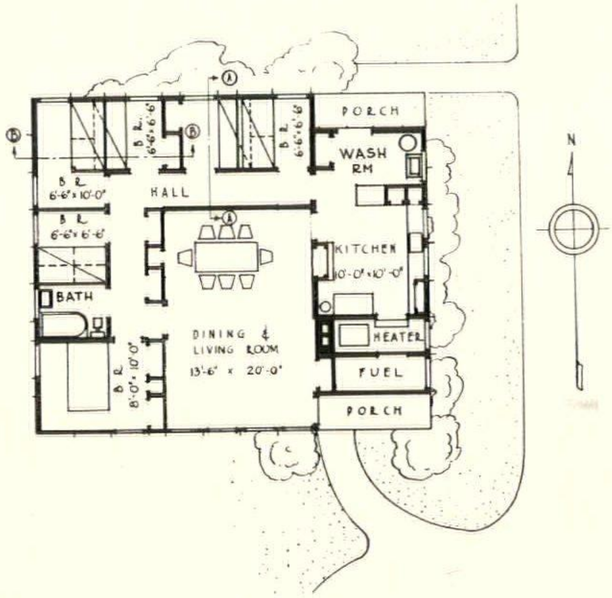




SECTION A-A



SECTION B-B



PLAN

FARMHOUSE PROPOSED FOR LOWER INCOME GROUP

DEVELOPED BY U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF HOME ECONOMICS AND BUREAU OF AGRICULTURAL ENGINEERING. C.W.A. PROJECT.

PURPOSE

This farmhouse with utmost economy in space is intended for the lower income group and for families up to 5 children.

REQUIREMENTS

The combined dining-and-living room being used by all members of the family and simultaneously for the largest amount of time has naturally the greatest floor area and ceiling height.

The bedrooms are limited in size to the space required for the bed and for dressing. Beds are arranged in the manner of double bunks but being accessible from different sides a separate bedroom is provided for every child with no more area needed than for rooms with 2 beds.

Built-in clothes closets and shelves eliminate the usual furniture. A drop-leaf desk under the window makes the room usable for undisturbed studying. The house is entered from the highway by a sheltered entrance to the living room and from the farmyard side by a rear porch leading into the washroom, kitchen and hall. Kitchen and washroom are combined for convenience of working and for economy of plumbing.

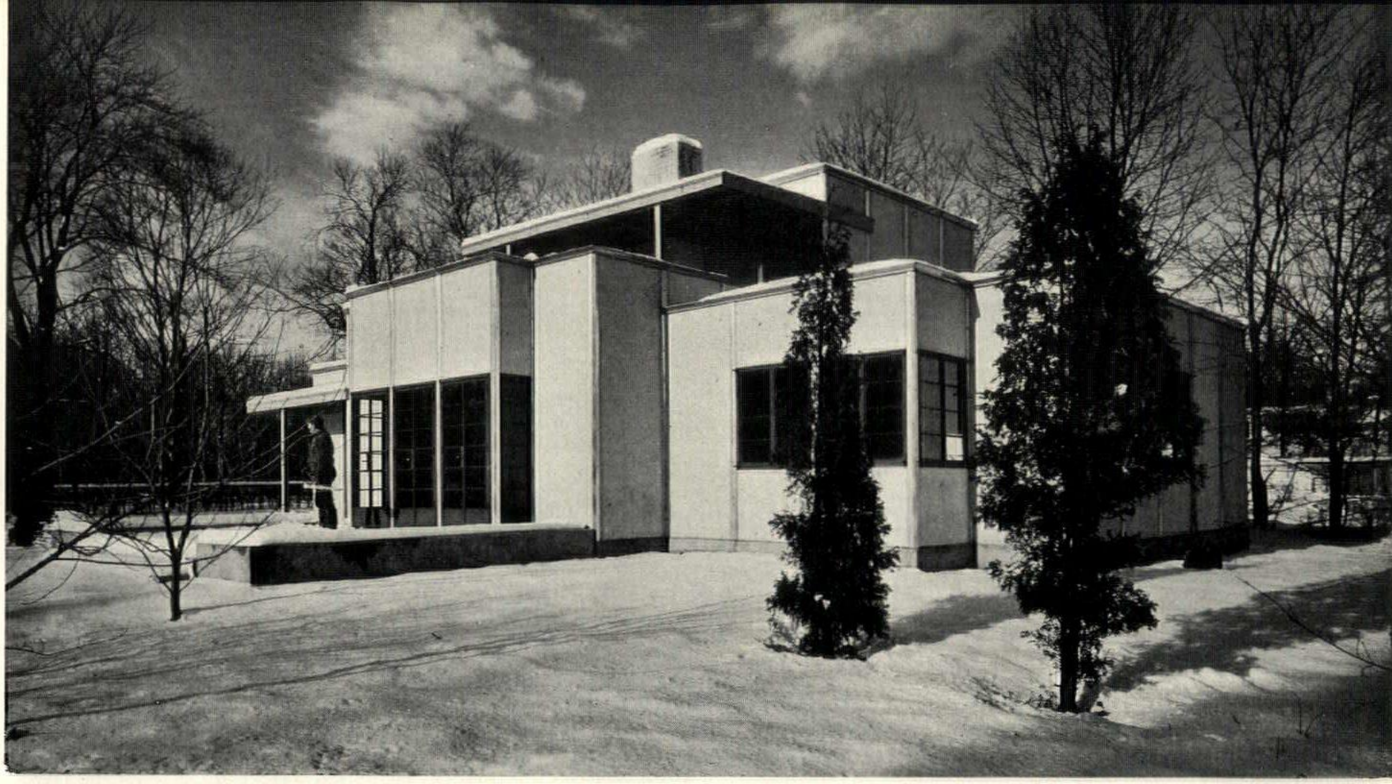
CONSTRUCTION

The house design is suitable for masonry, concrete, frame and prefabricated construction systems.

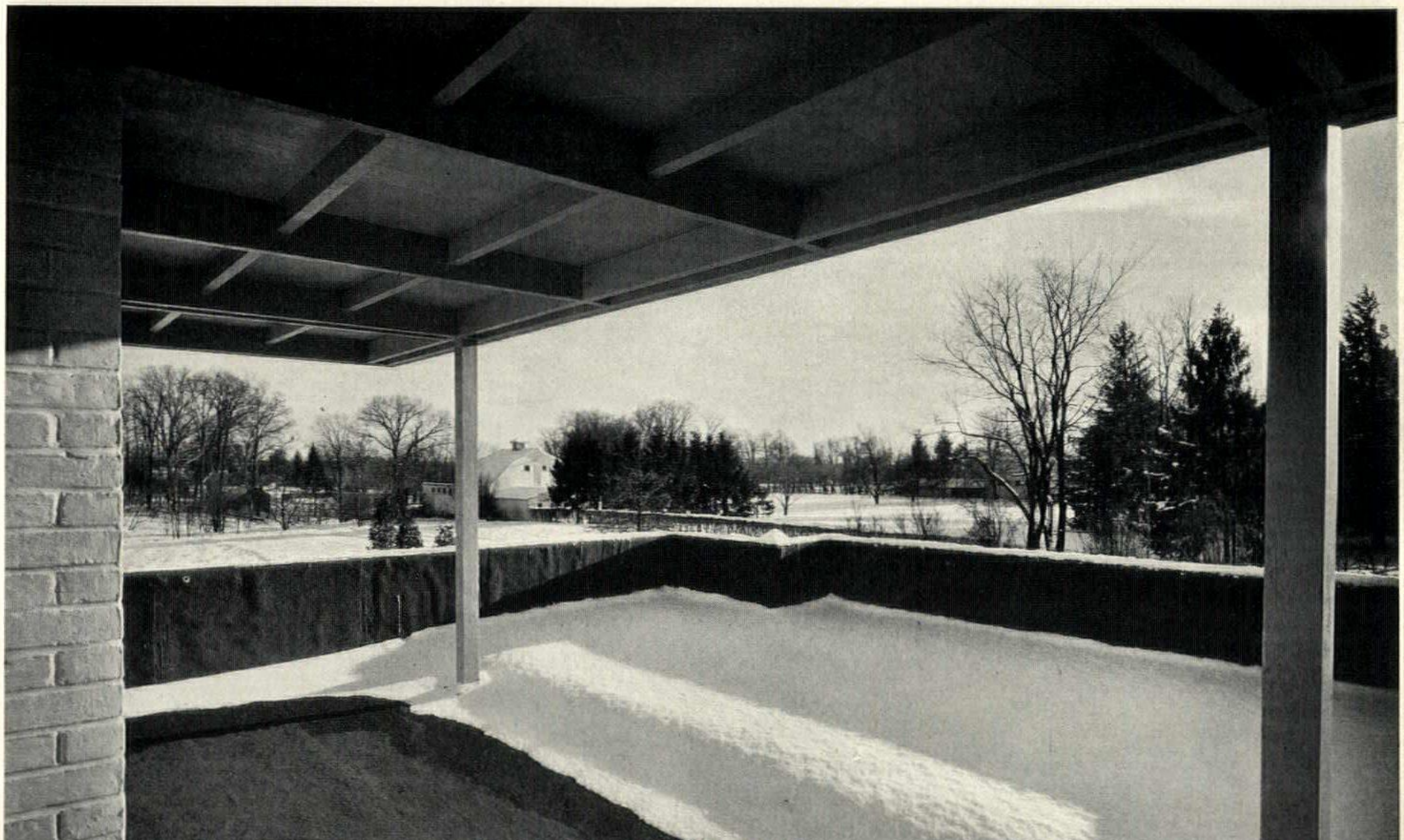
The plan is based on units of 3'-6" and half units. With ordinary materials this feature simplifies erection and makes possible the use of similar types of doors, windows, etc. With prefabricated methods panels of the width of one or one-half units and heights from floor to ceiling are produced.

Closets, cabinets and partitions are based on the same module and consist of completely finished sections built of wood, steel or other suitable material. Prefabricated lightweight systems are especially adaptable to regions without local building materials and skilled labor because of small transportation cost and ease of erection of ready-made parts.

GENERAL
VIEW



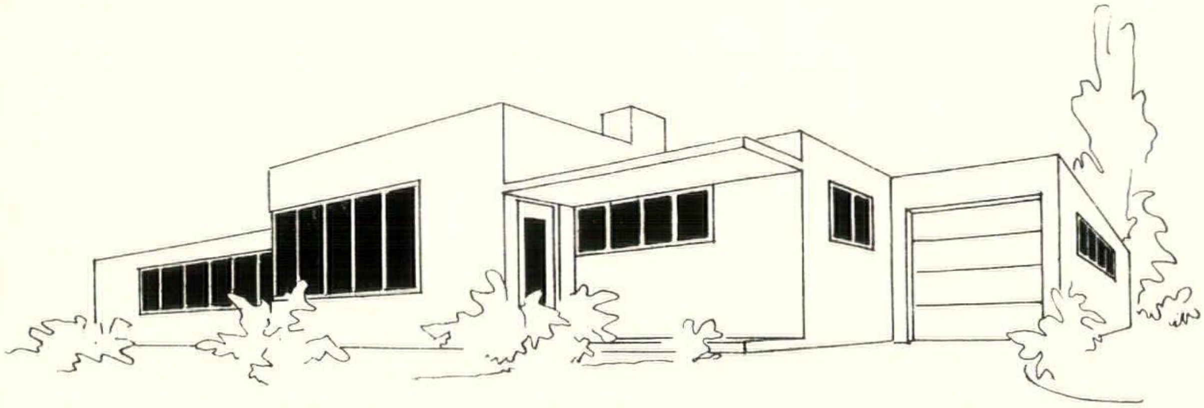
DETAIL OF
DECK
PORCH



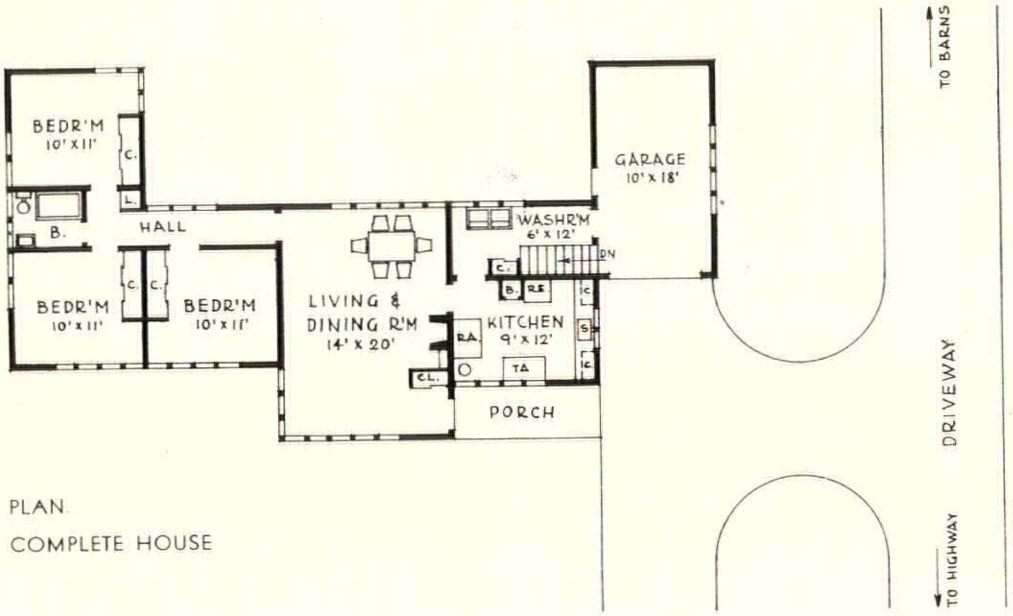
Photos, F. S. Lincoln

HOUSE ON LONG ISLAND. HOLDEN AND McLAUGHLIN, ARCHITECTS, (American Houses, Inc.)

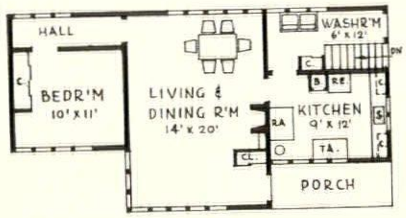
The informality of this type of house is suitable to country location. It is apparent that the unit system permits expansion, a common necessity of farmhouses. It provides good insulation, fireproofness, low maintenance cost, low insurance rate and eliminates waste space because of flat roof. The roof porch is used for sitting and sleeping.



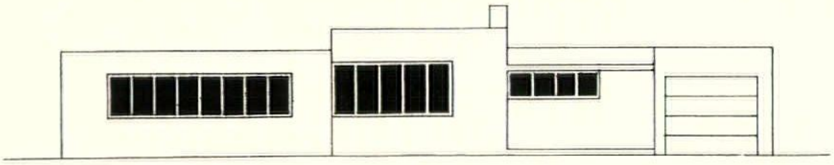
PERSPECTIVE



PLAN
COMPLETE HOUSE



PLAN,
FIRST STAGE



FRONT ELEVATION

FARMHOUSE

DEVELOPED BY DIVISION OF AGRICULTURAL ENGINEERING, MICHIGAN STATE COLLEGE, FOR UNITED STATES DEPARTMENT OF AGRICULTURE, CWA PROJECT

SUBSISTENCE FARMSTEADS

BY

A. LAWRENCE KOCHER AND

ALBERT FREY

The subsistence farmstead is intended primarily for city workers who have taken up land as a place to build a house and where some foodstuffs may be provided by the cultivation of a garden and the keeping of chickens. It is not intended to compete with the more productive purposes of a farm. It is not expected to provide complete subsistence. It can aid one who works in the city with a low wage.

The subsistence *farmhouse* must provide many of those comforts and conveniences to which the city dweller is accustomed. It can be as compact as an apartment but with an arrangement that will facilitate light farm work.

CHECKING LIST OF REQUIREMENTS

WITH AMPLE LAND, IT IS MOST ECONOMICAL TO HAVE ALL ROOMS ON ONE FLOOR (ELIMINATING STAIRWAY AND HALLS —ROOF LIGHTER IN CONSTRUCTION THAN FOR A SECOND STORY).

ROOMS DIMENSIONED TO EXACT NEEDS.

BEDROOMS, USED ONLY AT NIGHT, ARE OF SMALLEST SIZE.

LIVING - DINING ROOM OF MOST GENERAL USE IS OF AMPLE SIZE.

KITCHEN, FOOD STORGE ROOM AND LAUNDRY AS SUITE AND WITH CONSIDERATION OF FARMING REQUIREMENTS.

WINDOWS OF KITCHEN OVERLOOK FARMSTEAD.

CROSS VENTILATION.

COMBINATION OF KITCHEN - DINING AREAS.

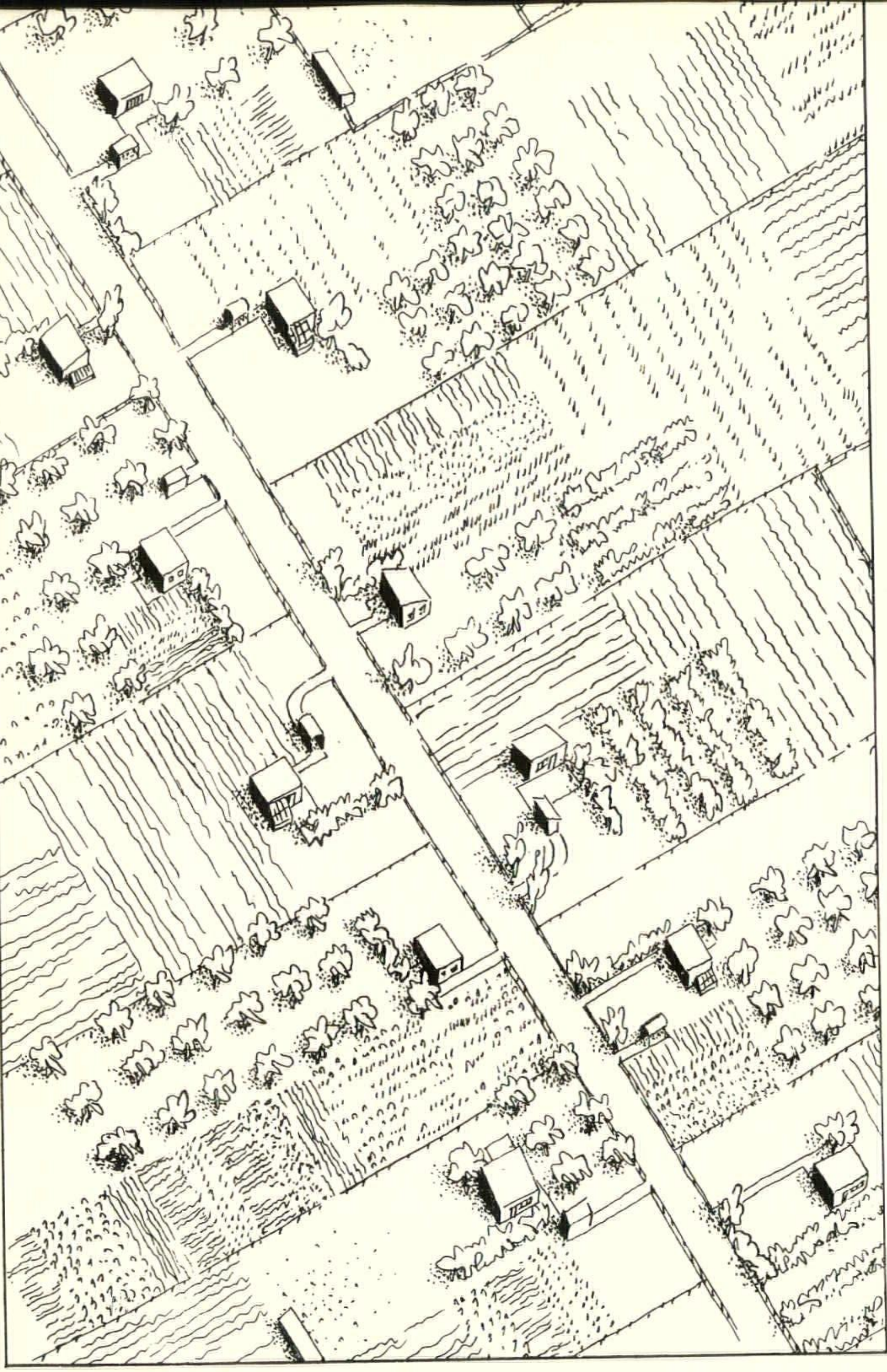
CONVENIENCES OF WASHROOM FOR FARMER ENTERING HOUSE.

PLUMBING GROUPED.

ENTIRE FLOOR AREA UTILIZED. NO HALLWAYS OR VESTIBULES.

BUILT-IN CLOSETS OF STANDARD SIZE.

FEWEST POSSIBLE DOORS.



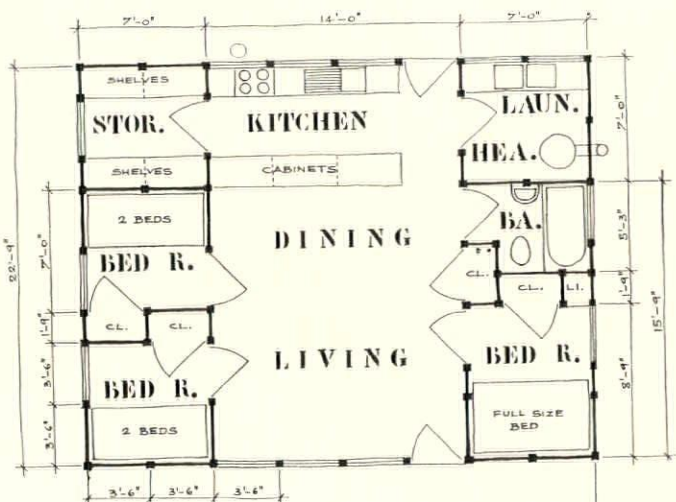
SUBSISTENCE FARMSTEAD PLAN

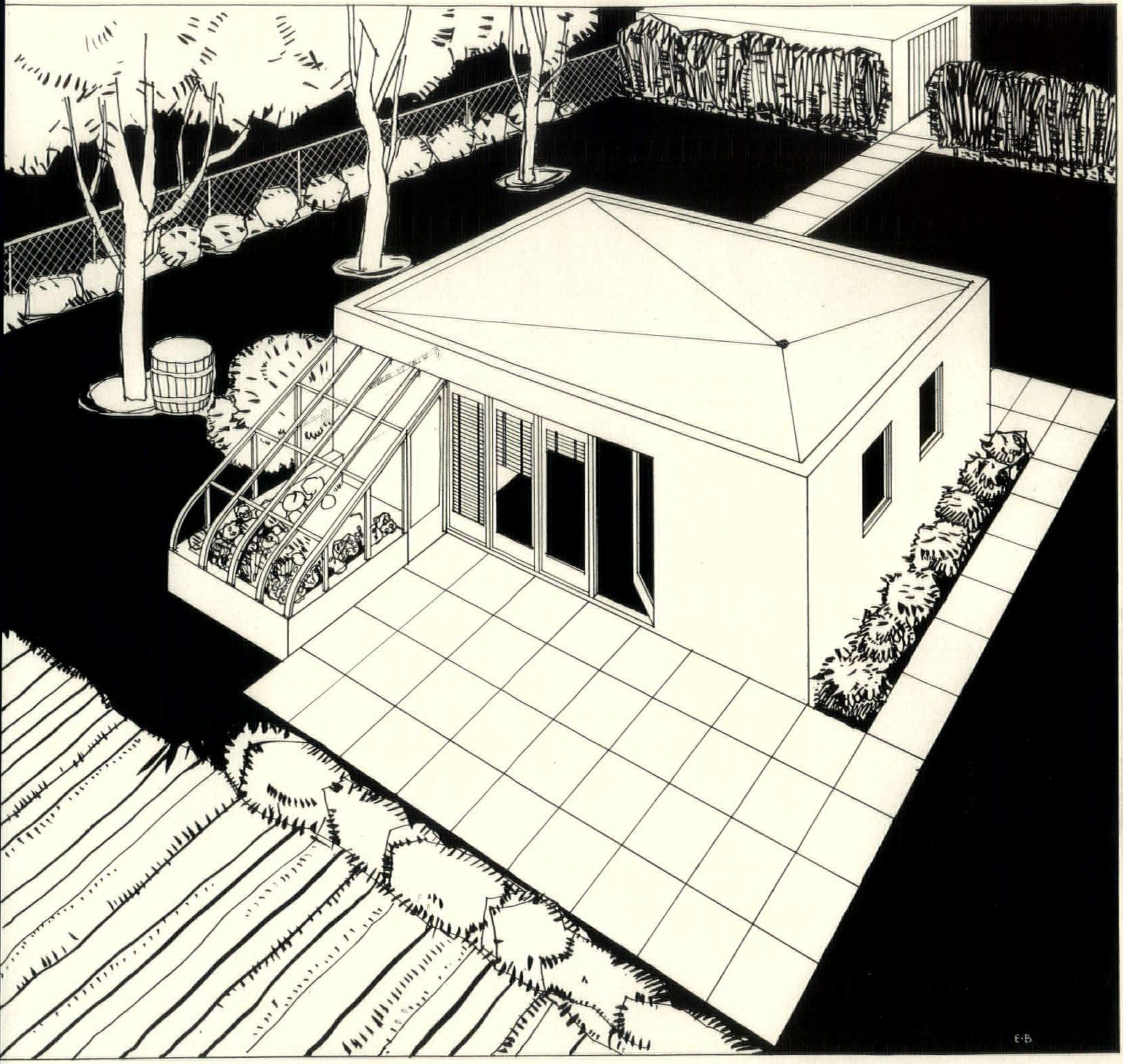
for location along existing highway. Houses are located near to road in order to reduce cost of driveways and water supply. Each plot is approximately one acre in size. Additional fields at rear of subdivision are available for cultivation as required.

The site selected has electricity ready for extension. Each house is provided with a septic tank for sewage disposal.

PROPOSED FARMHOUSE PLAN FOR SUBSISTENCE DWELLERS

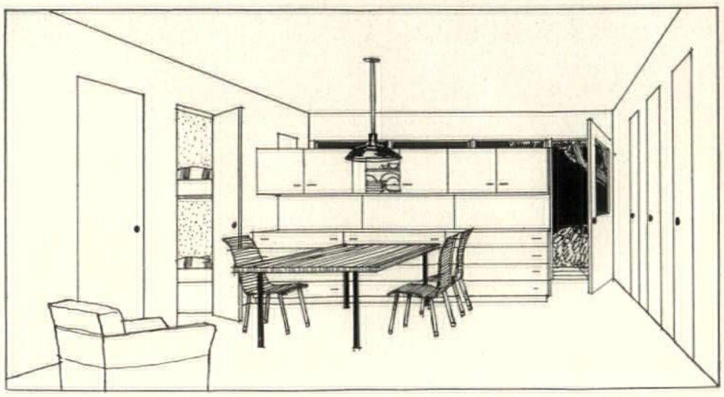
The house is small in size because intended for unemployed with very limited funds. At the same time maximum accommodation and convenience are required. The large living-dining room is combined with kitchen so as to obtain a spacious interior having cross ventilation and good lighting. The kitchen also relates to a storage room for storage of fruits, vegetables and canned goods. A laundry room is at right side of plan. A hot water heater is placed in the laundry. Bedrooms at left are of small size with double-decker beds. A larger bedroom for parents is at right of plan and with space for a double bed. Closets are steel and extend from floor to ceiling. Precast concrete panels are used for construction. These are 3′ 6″ units or half units. This precast system is suited to CWA labor with skilled supervision.





PERSPECTIVE VIEW OF
SUBSISTENCE FARMHOUSE

Walls constructed of cinder concrete blocks or poured concrete. Roof of precast concrete beams and panels. Suited to use of local materials and production of blocks or units by owner. Fireproof and low-cost.



Interior of living-dining room, showing cabinets separating kitchen from living-dining space. All other rooms are directly accessible.

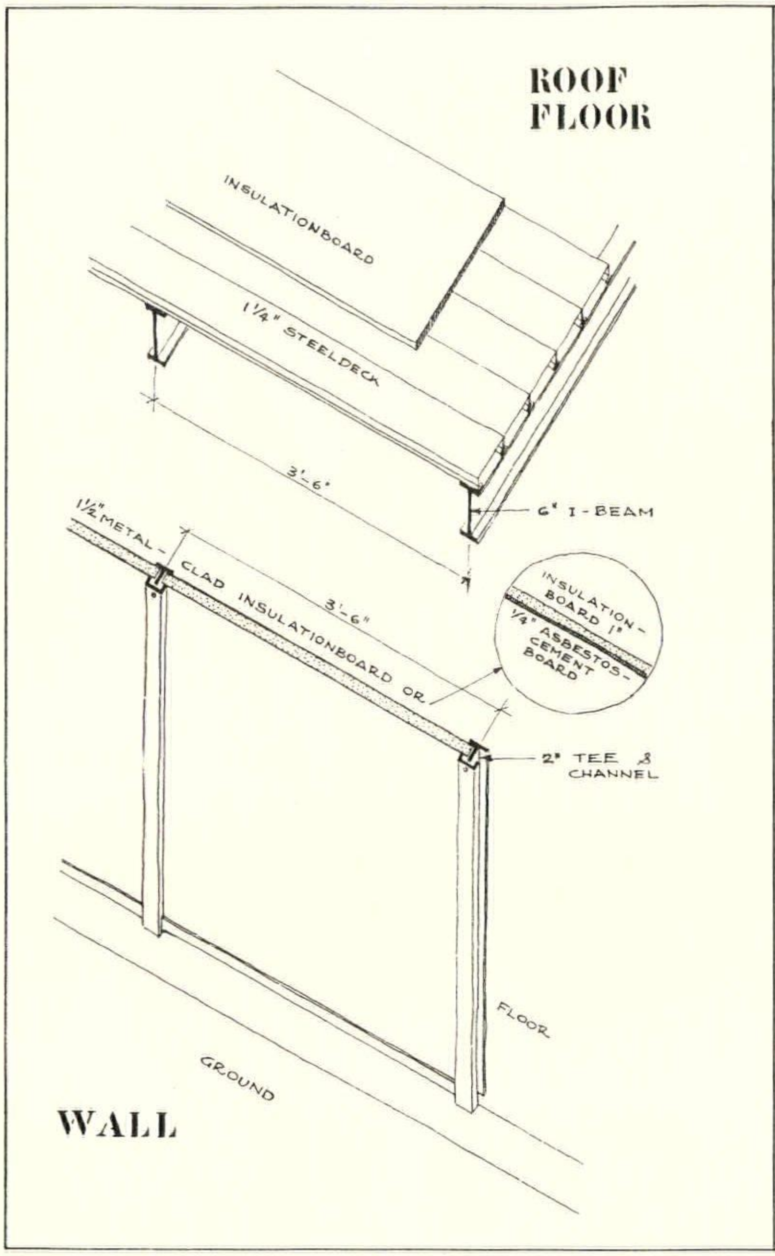
PREFABRICATED SYSTEM

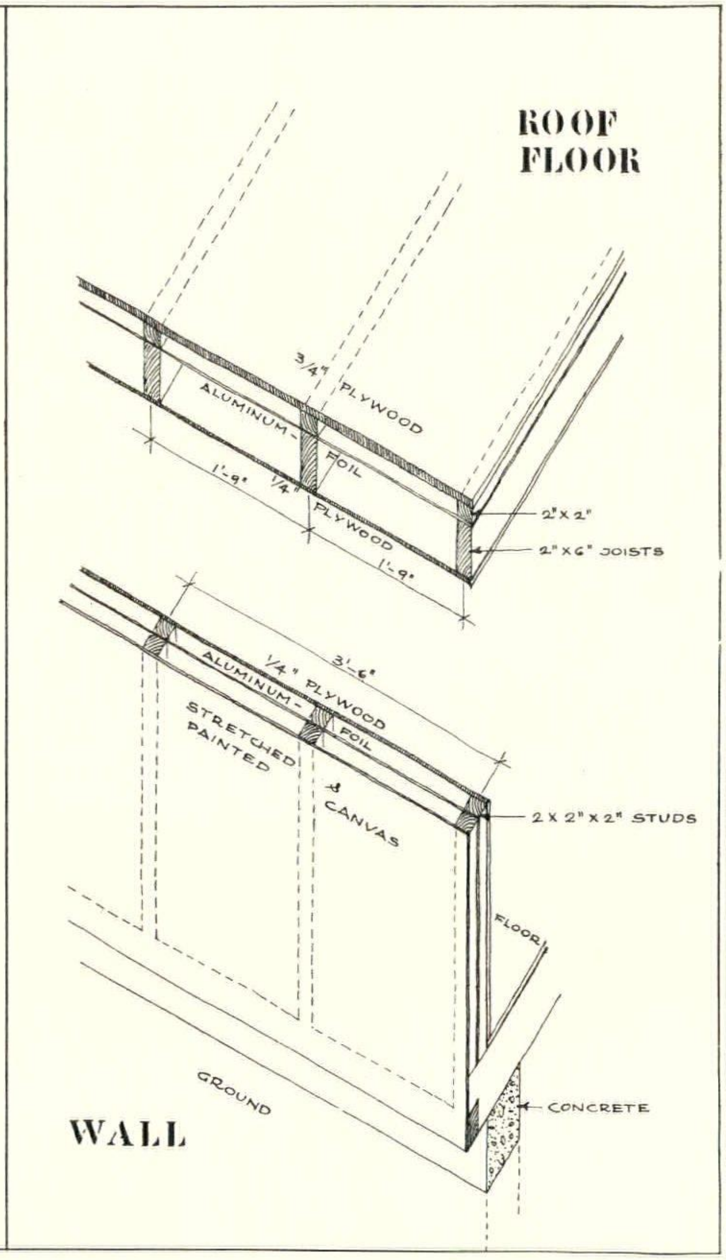
(Fireproof)

Use is made of standard and available steel parts such as steel angles, channels, girders, floor deck and steel faced insulation board. This construction is cheap with quantity production. It is moderate in cost for 25 houses.

WOOD AND CANVAS

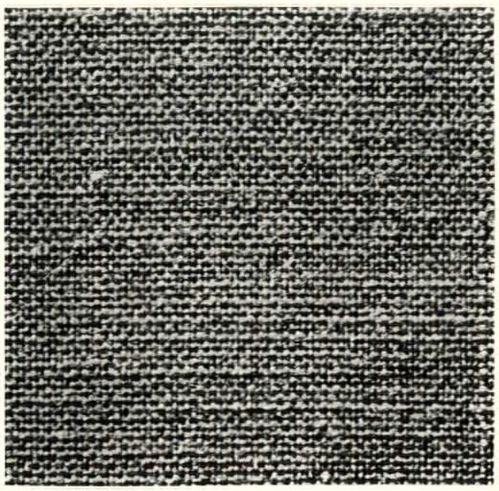
This construction method is cheapest of all. It has high insulation value and is very well suited to enlargement.





STRUCTURAL SYSTEMS ADAPTABLE FOR SUBSISTENCE FARMHOUSE CONSTRUCTION

KOCHER AND FREY
NEW YORK



CANVAS BEFORE PAINTING

CINDER OR OTHER CONCRETE BLOCKS

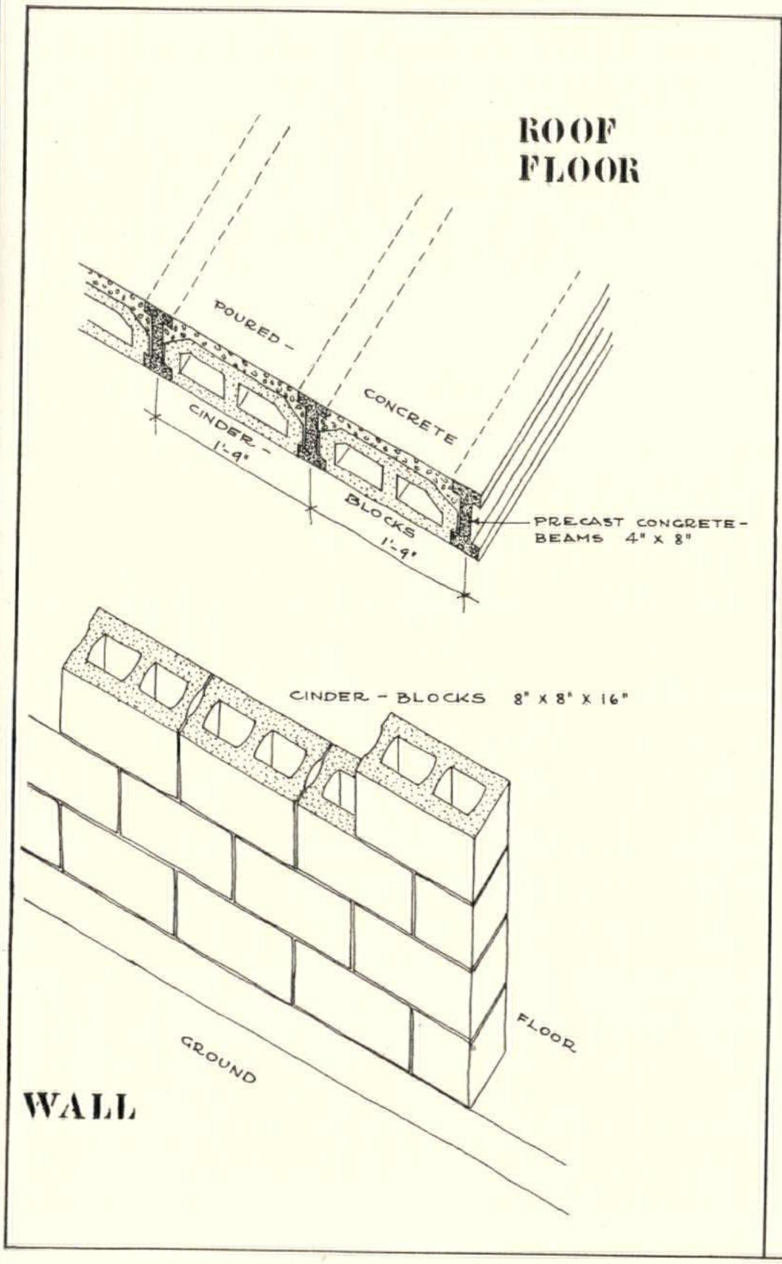
(Fireproof)

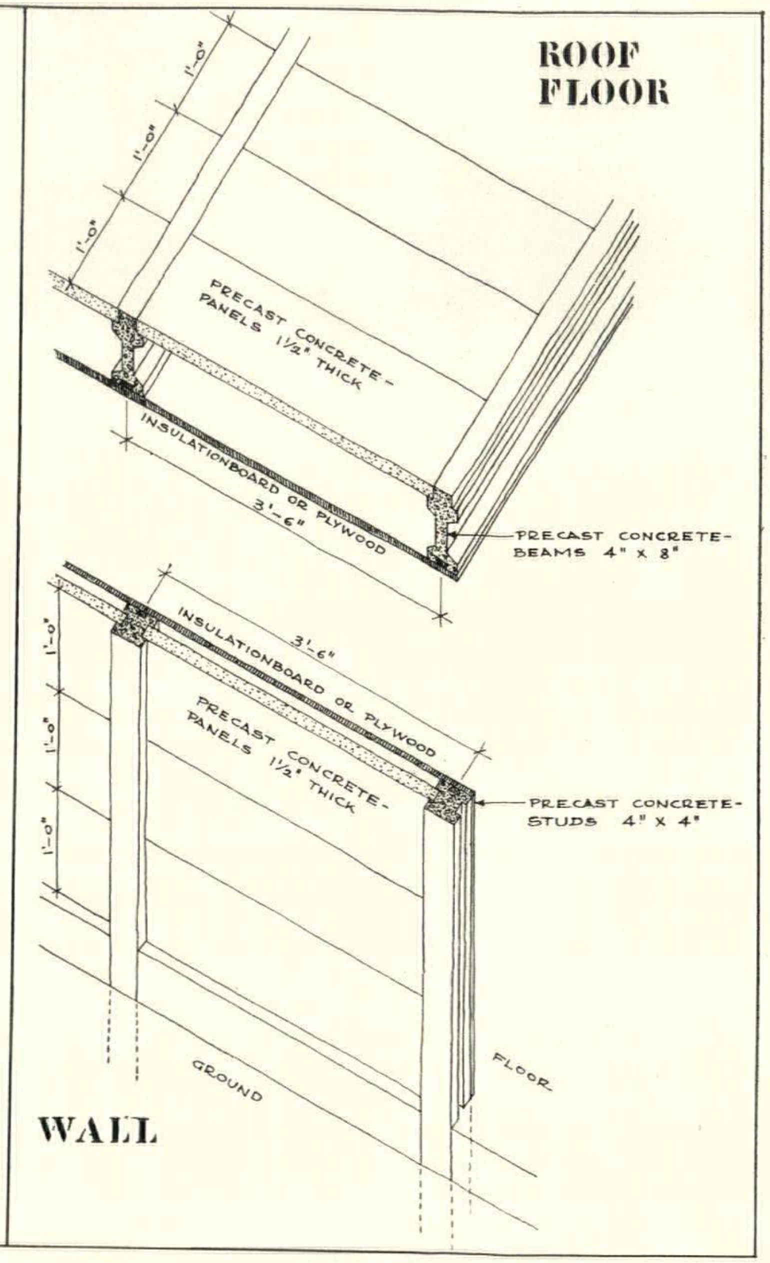
This method is economical if blocks are cast in the field where building operation is carried on. This is especially so when sand or cinders are obtained locally.

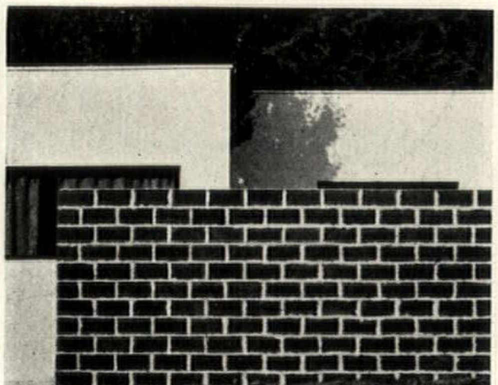
PRECAST CONCRETE (Post and Plank)

(Fireproof and termite-proof. Low maintenance)

It is not difficult for unskilled labor to erect the parts of this house. There would be supervision in the making of precast units of uniform size and in erection of posts and girders. A very economical system.





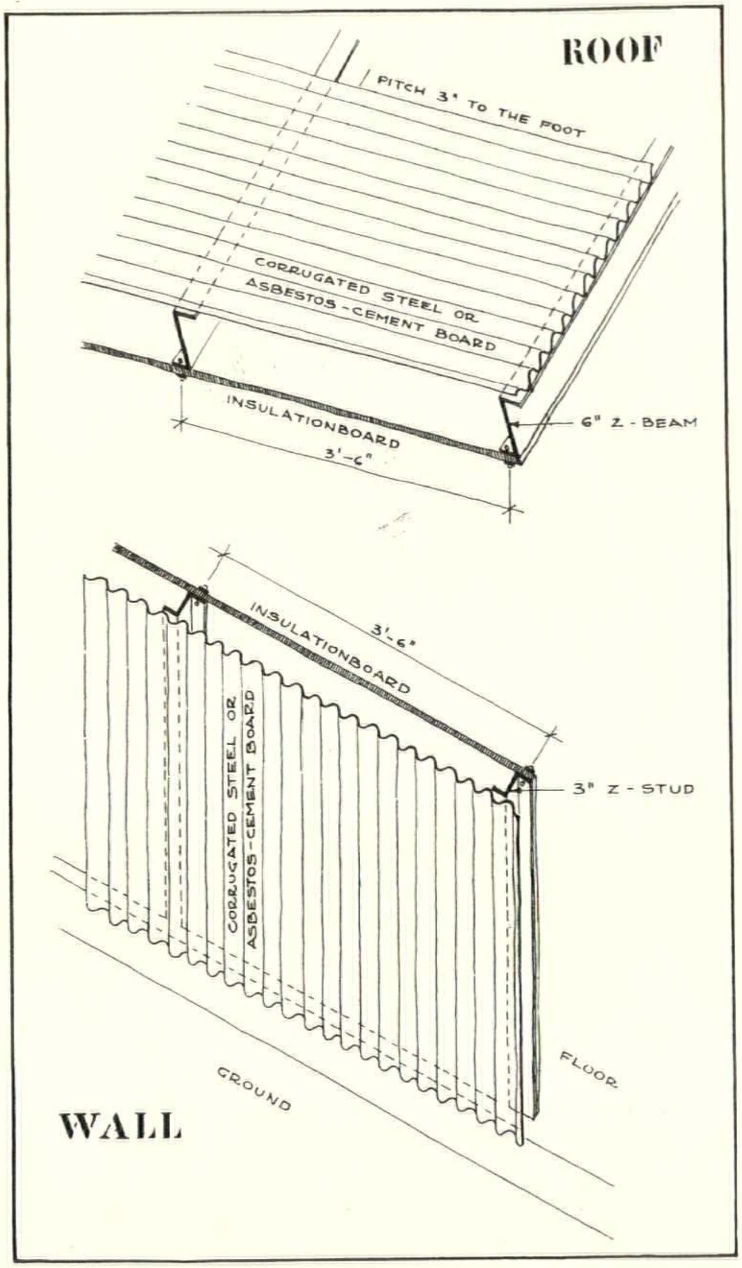


CINDER BLOCKS
WITH AND WITHOUT
STUCCO COAT

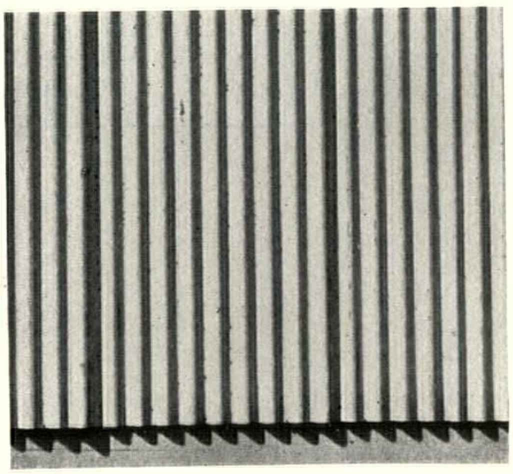
TYPICAL CAST
CONCRETE
SURFACE

LIGHT STEEL MEMBERS

Connections by bolting and clips. Facing with light sheet steel or corrugated asbestos board. Inside walls faced with asbestos board. Ease of construction and reerection. High salvage value. Fireproof. Lightweight.



ACTUAL APPEARANCE OF CORRUGATED STEEL OR ASBESTOS-CEMENT BOARD



STATUS OF SUBSISTENCE HOMESTEAD PROJECTS

(Figures in parentheses for each project show approximate cash allocation and number of homesteads. Published by courtesy of U. S. Government, Subsistence Homesteads Division.)

Birmingham, Ala. ($750,000; 300)—Land acquired; plans well advanced; land improvement under way.

North Georgia Project (Jones & Putnam Counties)—($1,000,000; 500)—Acquiring land and doing survey work.

Pender County, N. C. ($1,000,000; 500)—Land acquired; land improvement under way.

Decatur, Ind. ($145,000; 48)—Land acquired; land improvement under way; about to start construction.

Westmoreland County, Pa. (stranded coal miners)—$200,000; 100)—Land acquired; land improvement under way; house plans nearly completed.

Tygart Valley (near Elkins) W. Va. ($250,000; 125)—Land being acquired; land improvement starting.

Monmouth County, N. J. (decentralization of industry involving Jewish needle workers)—($500,000; 200)—Land being acquired; plans almost complete.

Youngstown, Ohio. ($500,000; 160)—Land being acquired; organization set up.

Dayton, Ohio. ($359,000; 200)—Some houses complete in one unit; project being extended to four new units.

Reedsville, W. Va. (experimental village)—($500,000; 125)—50 houses nearly finished and rest ready to begin.

Austin, Minn. ($125,000; 50)—Land acquired; land improvement under way.

Wilmington, Del. ($200,000; 70)—Land being acquired; improvement and plans under way.

Crossville, Tenn. ($471,500; 250)—Land acquired; improvement under way; plans nearly complete.

Arlington, Tex. ($125,000; 50)—Land acquired; land improvement under way; plans nearly complete.

Wichita Falls, Tex. ($125,000; 50)—Land acquired; land improvement under way; plans nearly complete.

Three Rivers, Tex. ($125,000; 50)—Land acquired; land improvement under way; plans nearly complete.

Arlington, Tex. ($250,000; 100)—Land acquired; land improvement under way; plans nearly complete.

Houston, Tex. ($250,000; 100)—Land acquired; land improvement under way; plans nearly complete.

Wisconsin Forest Farms (Northern Wis.)—($450,000; 400)—Land acquisition beginning; surveys under way.

McComb, Miss. ($62,500; 25)—Land acquired; improvement under way; planning nearly done.

Laurel, Miss. ($62,500; 25)—Land acquired; improvement under way; planning nearly done.

Tupelo, Miss. ($62,500; 25)—Land acquired; improvement under way; planning nearly done.

Meridian, Miss. (62,500; 25)—Land acquired; improvement under way; ¡lanning nearly done.

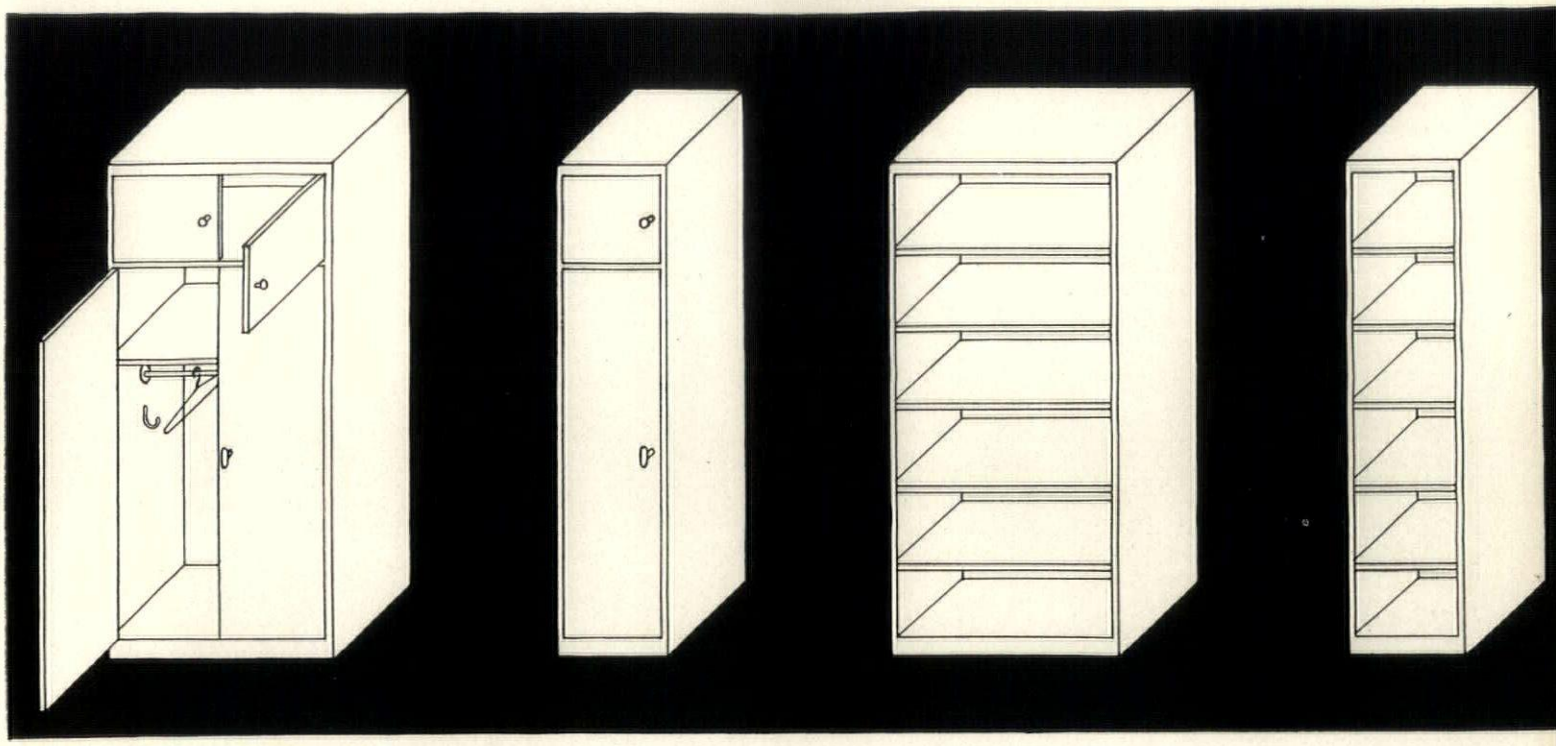
Hattiesburg, Miss. ($62,500; 25)—Land acquired; improvement under way; planning nearly done.

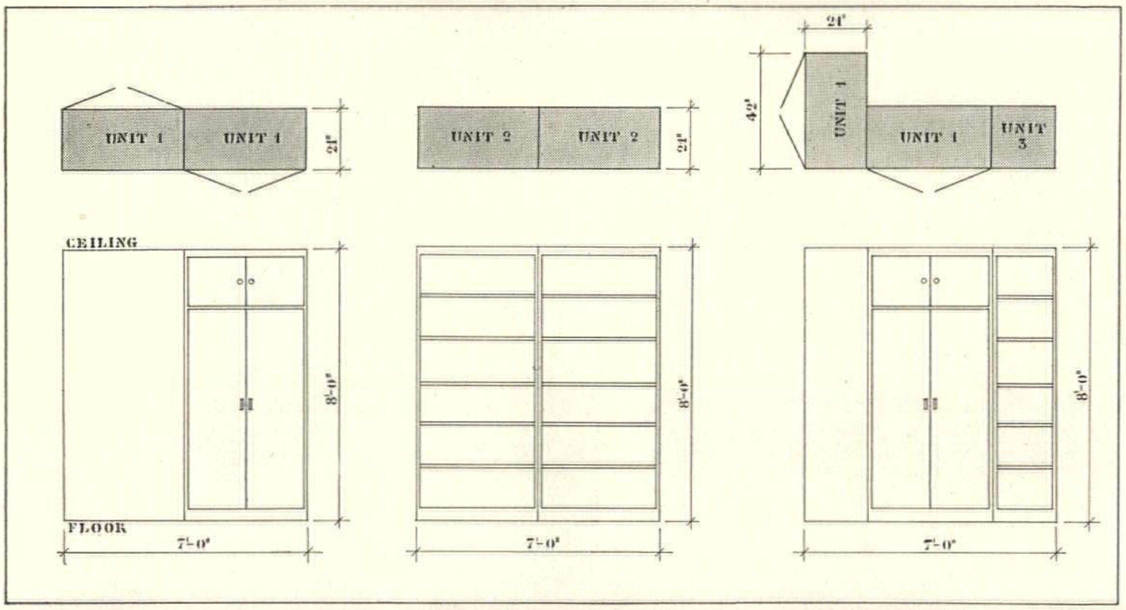
Rochester, N. Y. ($100,000; 33)—Land being acquired and other plans being prepared.

Jasper, Ala. ($244,000; 100)—Land being acquired.

A two-unit project in Los Angeles, Calif., is to be announced.

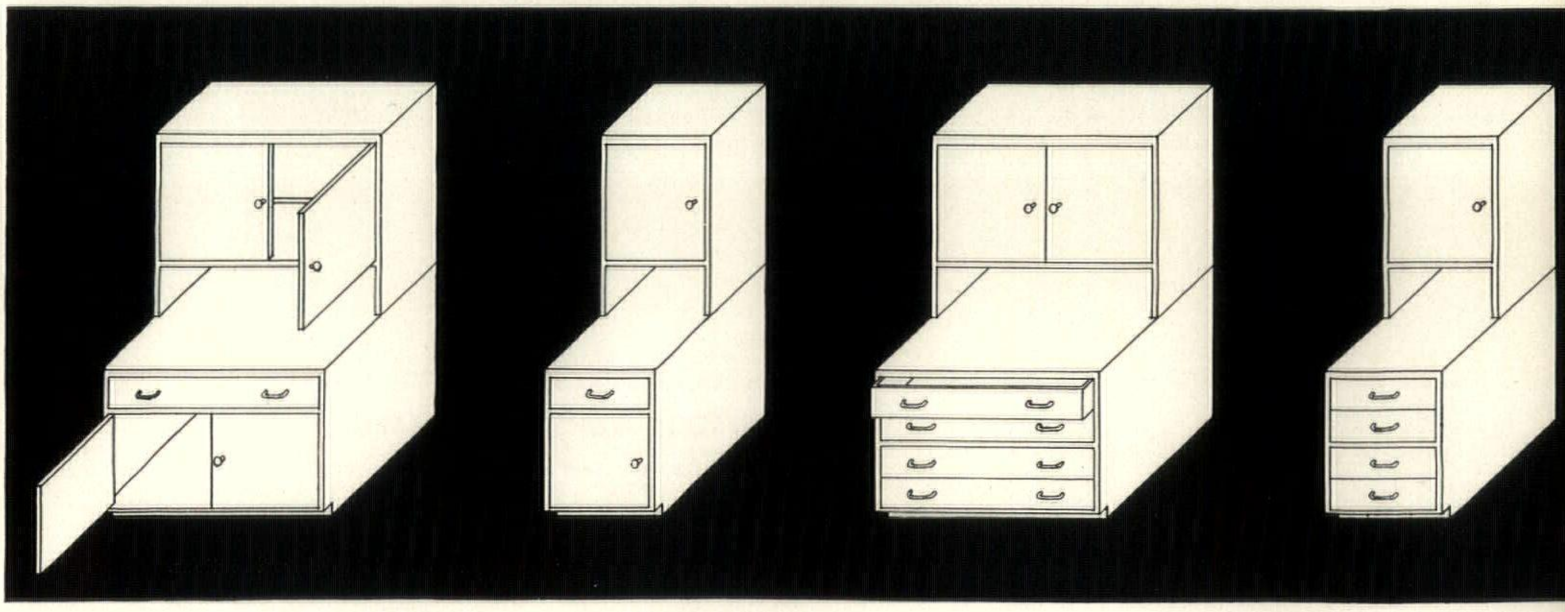
Usually the planning and acquisition stage is longer than the actual construction on the above projects.

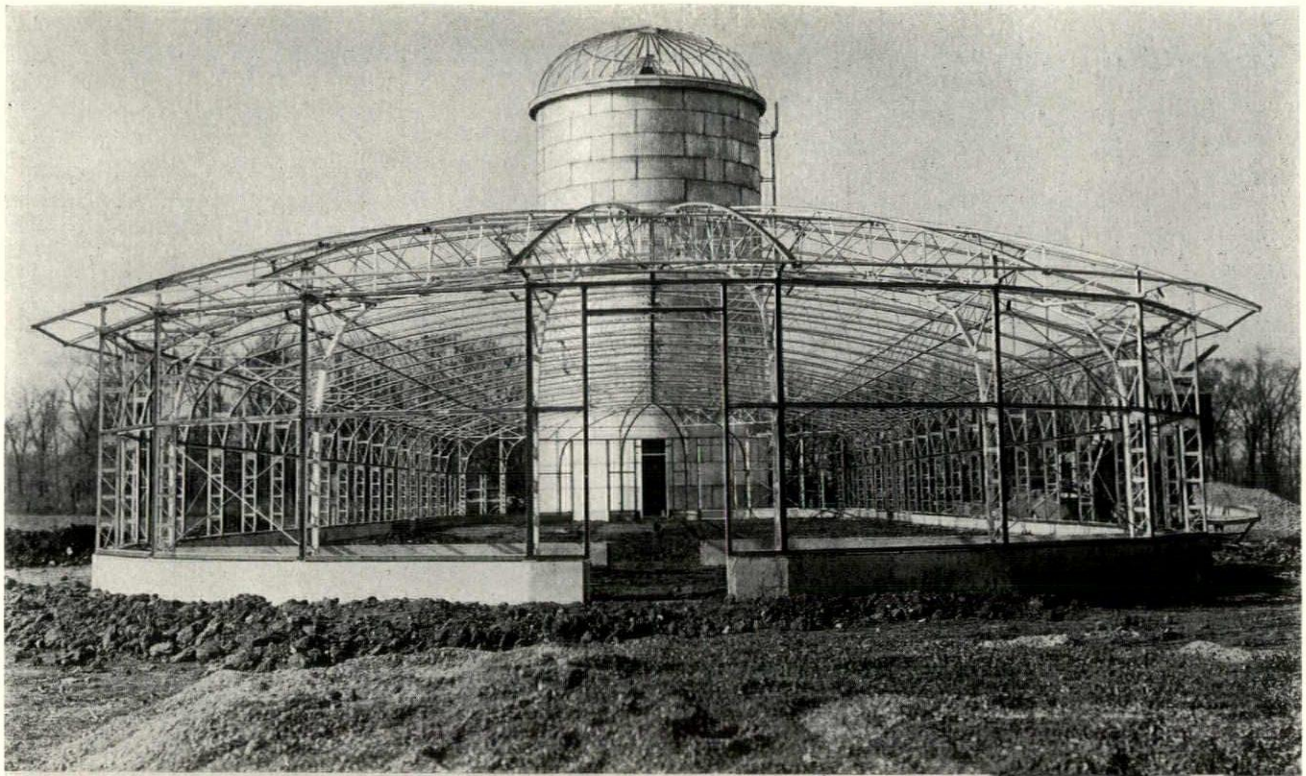


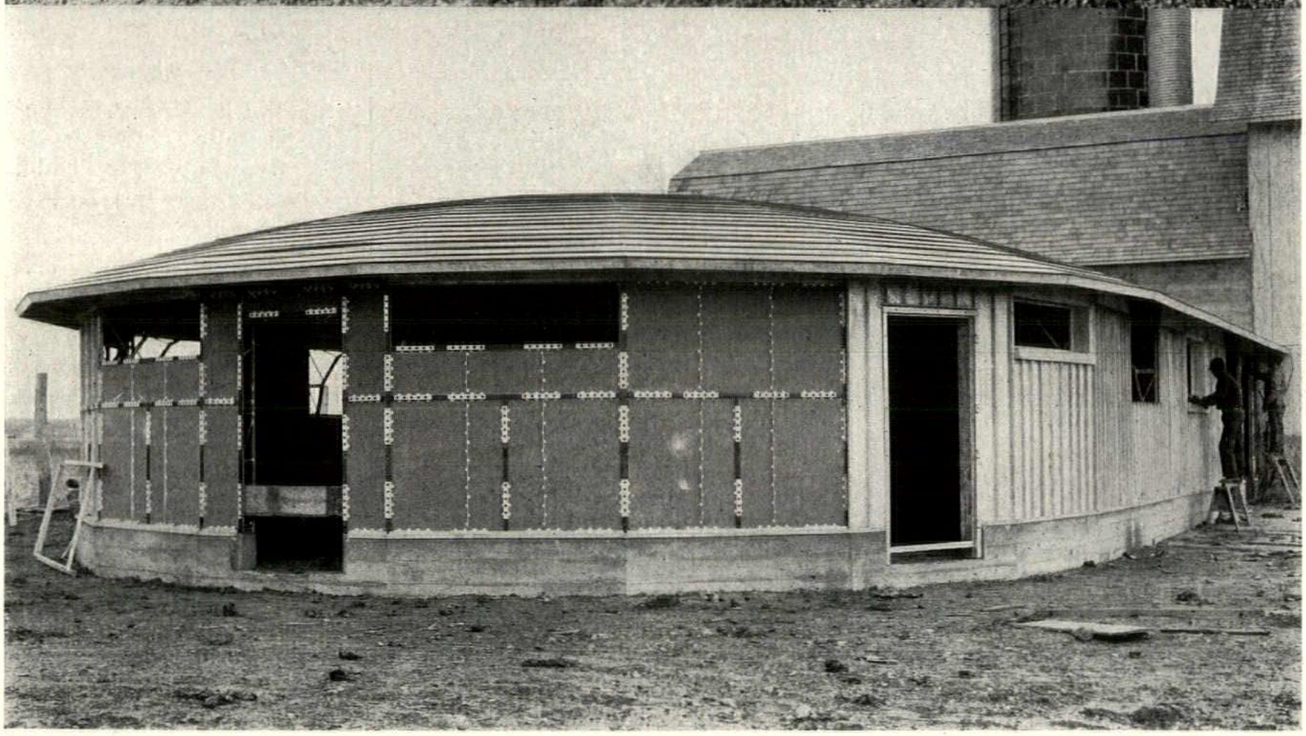


CLOSETS and CABINETS

for the subsistence farmhouse were designed so as to care for the usual storage for a farm. They are made of steel and in quantities of 200 are more economical than of wood construction. Closets extend from floor to ceiling. Cabinets are 56" high. See plan on page 350 for location of these steel units. These cabinets were detailed by Hamilton Manufacturing Company for A. Lawrence Kocher and Albert Frey; Arthur Barzaghi, consulting engineer.







Iron Age

A FIREPROOF AND SANITARY BARN

36 feet by 126 feet, and a

CROP KEEPER

24 feet 8 inches by 45 feet, framed with light stamped steel sections. Walls and roof are insulated and covered with metal sheathing.

TECHNICAL NEWS
AND
RESEARCH

BY

P. BURKE JACOBS

HEAT AND LIGHT ON THE FARM

Nesmi

CERTAIN FARM WASTES WHICH ARE TO BE FOUND PRACTICALLY EVERYWHERE WILL PRODUCE LIGHT, HEAT OR GAS UNDER VARIOUS CONDITIONS. THE GENERAL PROBLEM OF UTILIZING THESE FARM WASTES IS ONE OF GREAT NATIONAL ECONOMIC IMPORTANCE, INASMUCH AS A FINANCIAL RETURN FROM THESE WASTES EITHER DIRECTLY OR INDIRECTLY WOULD INCREASE THE FARM INCOME.

HEAT AND LIGHT ON THE FARM

THE UTILIZATION OF FARM WASTES

By P. BURKE JACOBS
CHIEF, AGRICULTURAL BY-PRODUCTS LABORATORY,
BUREAU OF CHEMISTRY AND SOILS, UNITED STATES
DEPARTMENT OF AGRICULTURE, AMES, IOWA

THE problem of power, heat and light for the farm home involves many factors. The construction of the house, its requirements, the number of occupants, the situation of the farm with respect to nearness to a large community or to commercial sources of supply of fuel or power, and the number and kind of farming operations normally carried on, all must be considered before specific decision can be made as to the type and size of service units to be installed. Any article on this subject must therefore be somewhat general in character.

POWER SOURCES

The selection of power generation equipment for the farm is primarily a question of geographical location and size of desired units. In the eastern states a large percentage of farm homes are located near thriving communities, and usually electric power lines are available, due to density of population, except in the more sparsely settled areas. Where such power lines are not available, adequate generating units, driven by gasoline engines and operating in connection with storage batteries, are commercially obtainable which are perfectly capable of meeting the usual demands of isolated properties. It is not believed at present that any better or more economical system of power generation, by the use of local wastes, can be evolved. Such units should be located with respect to convenience, noise of operation, protection from freezing or other weather conditions, and accessibility.

HEAT AND LIGHT SOURCES

When the question of available gas, suitable for heating and lighting, is considered, the problem becomes more difficult. Installation of a large gas distribution system involves a heavy expense. Obviously, the cost of gas, or electric power, to a consumer must be based on the cost of supply lines and the number of consumers on these lines. Therefore a gas distribution system to a farm region is usually impractical unless the farms are closely located to a municipal distribution system. In areas adjoining large cities, or in thickly settled districts where large towns are close together, as is the case in the eastern states, gas may be secured at reasonable cost. In other parts of the country farmers are fortunate in having supplies of natural gas available, as in West Virginia and western Pennsylvania, or Texas and Oklahoma, for example. At some points deposits of marsh gas are available. In certain areas some attempt has been made to commercialize the sale of compressed illuminating gas, whereby fresh cylinders of gas are delivered by the gas company and attached to the house distribution system. But generally speaking, gas is comparatively unobtainable on the farm, recourse being had to kerosene as a substitute, but the usual farm home depends on wood or cobs as a direct fuel.

In many areas farmers are located reasonably close to supplies of coal, in which case the farm heating equipment will likely be based on the use of such fuel. In many parts of the country, however, the sources of fuel other than wood are quite remote, and it is to these areas especially that the idea of generation of fuel gas from waste becomes attractive. Some districts in the south depend on stump pine wood or pine charcoal for fuel, coal being considerably more expensive. Other districts, like North Dakota, use peat or lignite deposits for fuel where available. In general, the fuel question becomes especially serious through the more thinly settled western states where coal is remote and where large cities do not exist, and it is these general districts that the government has chiefly in mind in the experimentation which is being conducted in the hope of finding some adequate design or process to meet the problem.

Hoit-Nesmith

SUCH MATERIALS AS CORNCOBS, CORNSTALKS, OAT HULLS, RICE HULLS, WHEAT STRAW, NUTSHELLS, TOBACCO STEMS, AND THE LIKE ARE ANNUALLY OBTAINABLE, AND WASTED IN ENORMOUS QUANTITIES. . . .

Considerable interest is being displayed by the public in the possibility of heating and lighting the farm by means of its own waste products, and there seems to be considerable misapprehension of the fundamental economics involved. Quite obviously such generation of heat or gas from wastes involves expense for installing the necessary equipment, and also involves a certain amount of labor, care and attention. The possibility that the raw materials required for generating gas might have value for other purposes is a factor of the problem, and in addition there are certain fundamental facts and hazards to be considered.

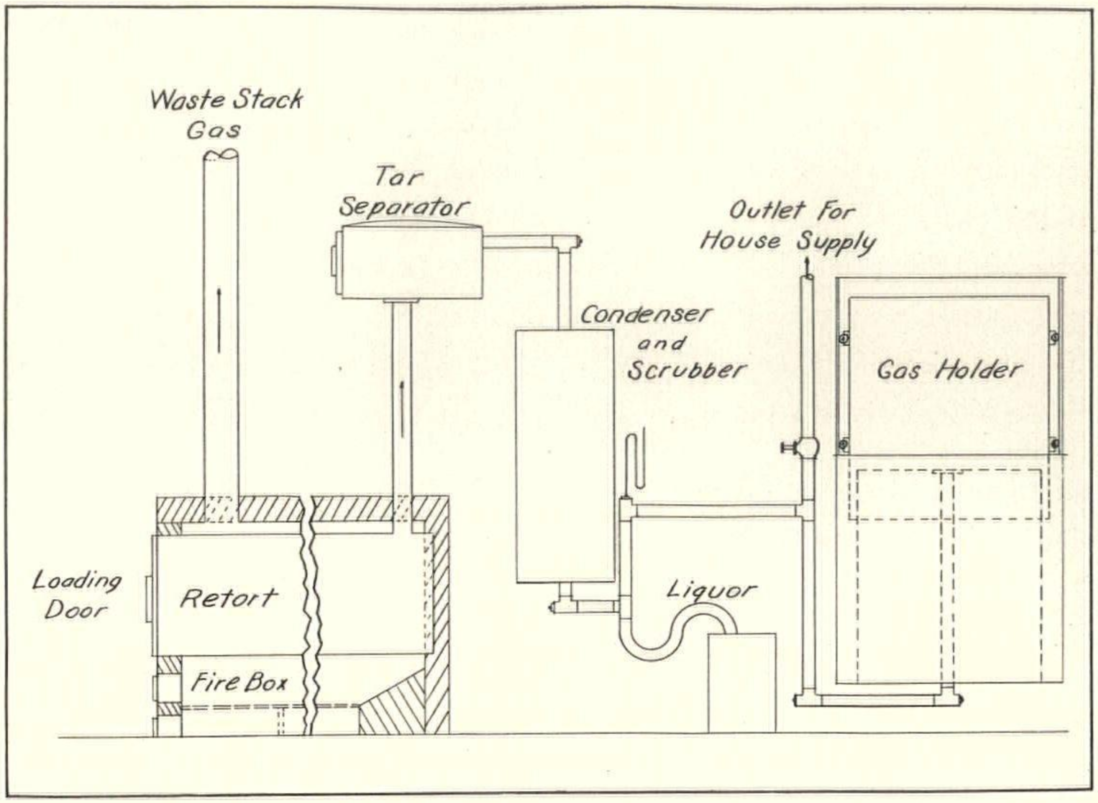
POWER FROM FARM WASTES

Certain farm wastes, which are to be found practically everywhere, will produce light, heat or gas under various conditions. The general problem of utilizing these farm wastes is one of great national economic importance, inasmuch as a financial return from these wastes, either directly or indirectly, would increase the farm income. Such materials as corn cobs, cornstalks, oat hulls, rice hulls, wheat straw, nut shells, tobacco stems, and the like, are annually obtainable, and wasted, in enormous quantities, although attempts are made to utilize them partly. Straw and cornstalks are now fed to live stock, tobacco stems are used for fertilizer, cobs find use as fuel, and so on. In the east, where small farms and diversified crops are the rule, it is probable that no large excess of these wastes exists, and it will be noted that this condition applies more particularly to thickly settled areas where other sources of light, heat and power are readily available. In the agricultural states west of the Mississippi River, however, where farms are larger, communities more widely scattered, sources of fuel and power and manufactured gas are less available and the size of crops relatively much larger, tremendous quantities of these wastes lack utilization at the same time that heating problems are usually more acute, because of the severer winters on the plains. Some means of generation of heat and power from these waste materials, in such areas, would therefore have tremendous significance.

There are at least four possible means of generating light or heat from such materials. They may be burned directly in suitable stoves, or converted to charcoal and burned; they may possibly be utilized in the form of charcoal to produce gas in certain forms of charcoal gas generators; they may be destructively distilled in suitable retorts to produce gas and charcoal; or they may be fermented to produce a burnable gas. All of these possible methods are being studied at the Agricultural By-Products Laboratory of the U. S. Department of Agriculture, Bureau of Chemistry and Soils, in cooperation with the Iowa State College, at Ames, Iowa.

1. DIRECT FUEL METHOD

Study of the first, or direct fuel method, has been limited to the possibility of producing briquets from wastes for use as direct fuel. It may be feasible to install briqueting machinery on a truck and go from farm to farm, producing compact fuel from such local wastes as might be available. Farm wastes are light and bulky, and the cost of collecting and transporting them is expensive. Furnaces for burning them require large fire areas and frequent replenishing because of the flimsy nature of the materials, so that generally only corn cobs are successfully used for fuel, especially as the average furnace or stove is usually designed for a compact fuel. However, by the compression of such materials into briquets, on the farm, the cost of transportation of wastes is largely avoided and a compact fuel material, comparable to wood, is secured for a minor cash outlay. Against this must be considered the cost and depreciation of compressing equipment, the cost and transportation of



SMALL ASSEMBLY FOR DESTRUCTIVE DISTILLATION

tar or other binding materials for the briqueting, and the time and labor involved. If the total cost of the operation exceeds the comparative value of other available fuel, the scheme becomes impractical.

2. GAS FROM CHARCOAL

The generation of gas from charcoal in special units has not been considered to any degree, in the experimental work, because this phase has received some commercial exploitation, and because of the general impracticability of the production of charcoal from light-structured wastes by individual farmers.

3. DESTRUCTIVE DISTILLATION

Considerable attention has been given to the problem of producing heat and gas by the destructive distillation of wastes in small, specially designed retorts. A number of commercial groups have designed and attempted commercially to exploit suitable apparatus for this purpose, with uncertain success. These gas-producing machines essentially consist of a closed iron retort in which a charge of material is placed; a fire box whereby the retort is heated, generally by use of additional quantities of the same waste material; a condenser for removing the water, acid, and tar, and a storage tank for the gas. The more compact or dense the raw material used, the more gas secured per charge. Wood or sawdust could be distilled, also.

DESTRUCTIVE DISTILLATION

Various designs have been evolved which frequently attempt to increase the efficiency of the process by securing more adequate gas production from a given weight of material by further decomposition of the residual tars, charcoal, and so on. There is little which is patentable on devices of this character, but the commercial exploitation usually is done under assembly patents which often may not prove to be valid under litigation, and sometimes unwarranted claims are made for the economic efficiency and operation of the unit.

Insufficient consideration has been given by the public to the many factors involved in an operation of this character. These include the collection and storage of a daily quantity of from 100 to 200 pounds of inflammable material, the labor and attention of collection, charging, distillation, cleaning and repair of apparatus, and disposal of by-products, besides the initial cost of installation, which probably will exceed $500. Furthermore, the operation is actually a chemical engineering one, and is subject to certain fire and explosion hazards. While gas can certainly be produced in quantities of from 8 to 14 thousand cubic feet per ton of cellulosic wastes, depending upon the temperatures used and the particular design of the equipment, it must be remembered that for a considerable period at the start of the distillation only carbon dioxide is evolved, which is without any fuel value, and for a further period at the end the evolved gas is mostly hydrogen, which has comparatively small fuel value. The analysis of the mixed gas from a complete run may approximate:

Carbon dioxide	45% - 32%
Methane	25% - 30%
Carbon monoxide	15% - 20%
Hydrogen	10% - 15%
Illuminants	3% - 3%

of which only the illuminants and methane have high calorific value. Various retort manufacturers have attempted to increase the fuel value of the gas by passing the carbon dioxide over heated charcoal, reducing the carbon dioxide to carbon monoxide, or even by enriching the gas by bubbling it through gasoline and the like, but no prediction can be made as to the actual day-by-day value of gas secured by an untrained operator from the usual apparatus. Considerable quantities of a water, tar, acid mixture of a pungent odor will result as a by-product which must be disposed of. It is our opinion that a distillation process of this character could be more logically applied in central distillation plants in isolated small communities, whereby sufficiently adequate amounts of materials could be distilled to justify the employment of a trained chemical engineer to supervise the operation, and where by-products would be accumulated in sufficient amounts to pay for reclaiming and selling them, the resulting noncondensible gas being possibly scrubbed, purified, stored and distributed to homes of the community. While the figures vary for different raw materials, it may be generally stated that a ton of farm wastes would yield 400 to 600 pounds of carbon, 800 pounds of acid water and tar, and 8,000 to 14,000 cubic feet of gas (including CO_2), depending on temperature and design, and the greater or lesser destruction of portions of the tar and charcoal.

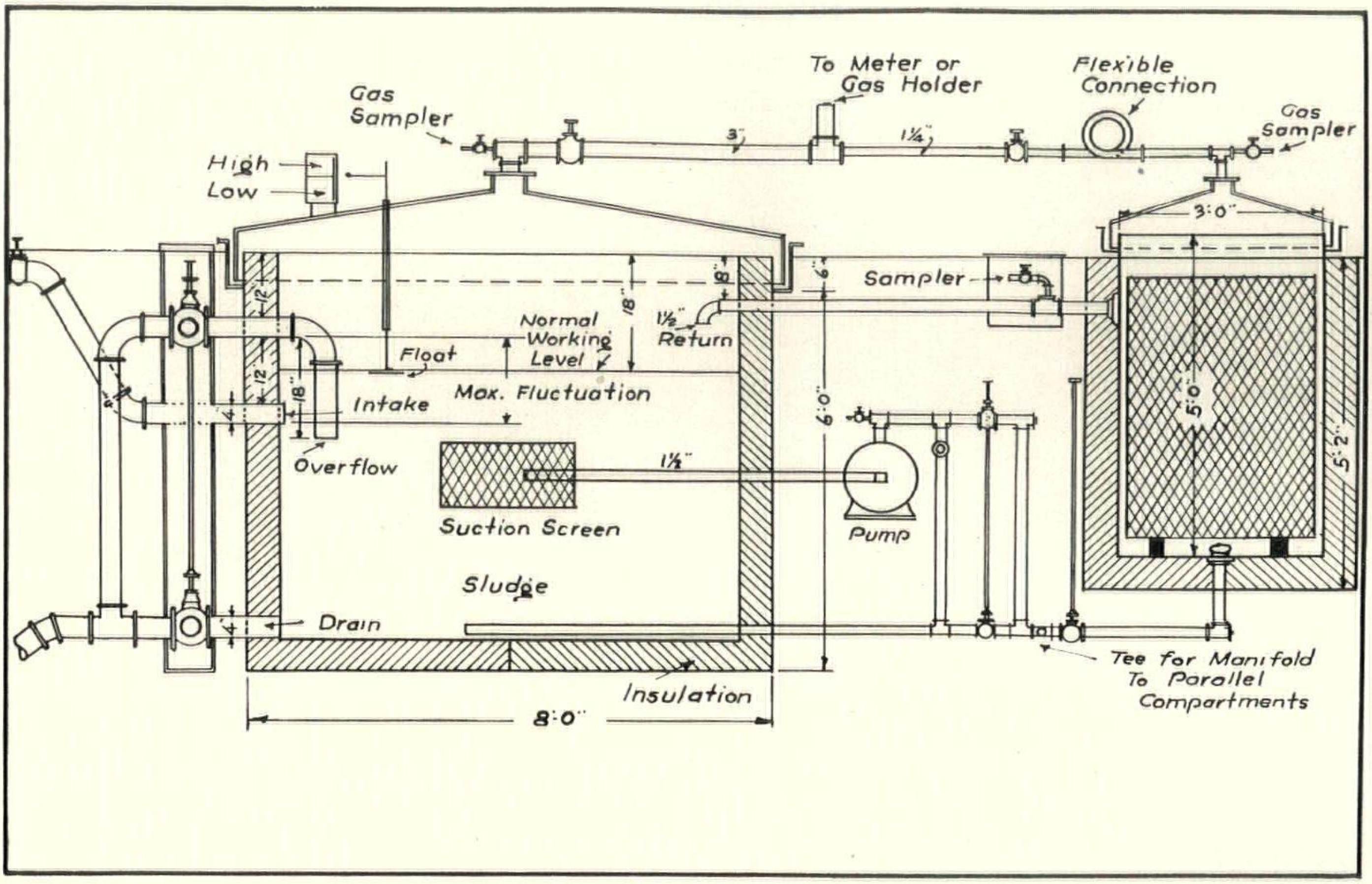
Installations of this character should be housed in a separate building, located some distance from other farm buildings. The building should have a metal roof and a dirt or concrete floor. A preferable form would be constructed entirely of metal siding on a frame of wood studding. The sides and roof of the building should be well away from the operation. The gas holder must be protected from freezing. Interior space should be adequate to allow for some storage of fuel materials indoors, but at a safe distance from the retort. The retort neck and pipe accessories must be kept free from tar and dust, otherwise explosions may occur. If straw or other fuel is used, the stack outlet outside the building should be covered with a spark screen.

4. FERMENTATION OF VEGETABLE WASTES

Especial interest has been shown by the public on a possible process of fermenting cellulosic farm wastes for the production of gas. Here again, as in the retort process, many involved problems are encountered. At least $500 to $750 must be invested in the equipment; the storage and collection of and handling of suitable quantities of wastes must be undertaken; and considerable daily attention must be paid to the functioning of the process. It may be estimated that 10,000 cubic feet of gas of 500 B.t.u. value are obtainable from a ton of wastes. At higher fermentation temperatures (55° C.) this gas consists approximately of 50% carbon dioxide, 25% methane, 25% hydrogen. At mesophilic temperatures (30° C.) the gas approximates 50% carbon dioxide, 50% methane. Such gases can be burned without difficulty in the usual equipment without removing the carbon dioxide (although such removal would increase the heat value), but the fermentation is slow and therefore a much larger space and equipment is necessary than with a retort process.
In attempted operation many technical difficulties will be encountered.

Farm wastes will not successfully ferment and generate gas without the presence of nitrogenous bodies to aid the bacterial growth. Absolute control of temperature is essential, development of acidity must be prevented, periodical fresh additions of new materials are required, proper dilution must be maintained, the design must function under varying evolution rates while delivering gas at definite pressure, and the hazards of gas leaks must be controlled. In the process of fermentation, the water soluble extract of the wastes is first broken down, followed by a gradual attack upon the vegetable structure, pentosans and cellulose being removed slowly, and lignin remaining mostly unattacked. A residue thus remains for disposal. The decomposing materials seem to form acids as an intermediate decomposition stage, and these acids must be continuously broken down and kept from forming pockets, otherwise the fermentation will be retarded. This may be accomplished either by stirring the mass or by circulating the fermentation liquid through the mass under pressure. In the apparatus evolved by Dr. A. M. Buswell of the University of Illinois, a charge of cornstalks is placed in a wooden generator containing the bacterial sludge, and the mass is frequently agitated by means of a hand-operated stirring mechanism, fresh additions of cornstalks and equivalent removals of semi-decomposed materials being made at intervals, either ammonia salts or sewage being used as a nitrogen source. In the system being experimented with at this laboratory, a more positive control was sought and the pumping system is used, the apparatus in use at present being shown in schematic design in the accompanying sketch. At least a ten-day fermentation period is required.

Essentially the apparatus consists of an air-tight, insulated cesspool about 8 feet in diameter and 6 feet deep, in which the main bulk of the sludge liquid is collected and stored. Chopped cornstalks are placed in convenient wire baskets holding about 90 pounds and inserted in various compartments of a separate digestion tank, about 10 by 5 by 3 feet in size, the compartments receiving fresh charges in turn periodically, so as to maintain a continuous evolution of gas by replacing part of the spent material with fresh stalks. Air is excluded from the entire apparatus and the escape of gas prevented by means of water seals. The nitrogenous liquid (chiefly barn drainings) in the cesspool is periodically pumped through the cornstalk baskets to wash out the soluble breakdown compounds from the cornstalks, the liquid returning to the cesspool where further decomposition occurs. Gas is stored in an appropriate gas holder (100 cubic feet capacity). Experimentation on the



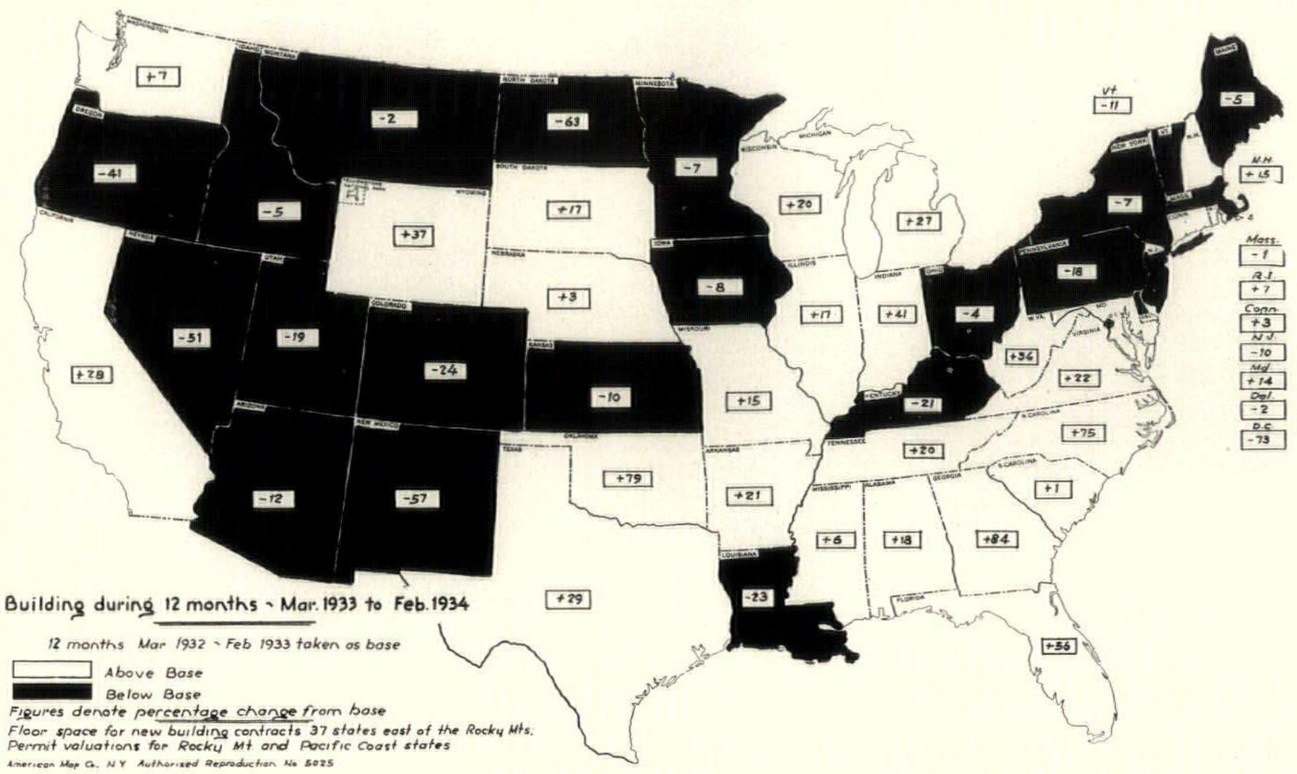
GAS GENERATING PLANT FOR FERMENTATION OF VEGETABLE WASTES

use of house sewage as a source of nitrogen was abandoned because of sanitary reasons, and because of the fact that house sewage contains large amounts of wash water which merely dilute the cesspool contents without adding much nitrogen value. The use of ammonia salts instead of sewage is possible. The experimentation is far from complete and the design shown is largely tentative, and the process cannot be said to be of proved economic value as yet.

A fermentation plant should be housed in a barn or reasonably well-protected building. Cesspools and digestion tanks may preferably be sunk below ground level, but should be surrounded by insulation. The gas holder may be located elsewhere, if protected from freezing. It is advisable to place the units as close together as possible, and a small chain hoist, for lifting the baskets of spent cornstalks, will be a great convenience. Either hand or electric driven pumps may be used. Great care must be taken to locate the plant at an exact level, in respect to the sewer lines, as shown. If the depth shown in figure is not obtainable, the cesspool may be made larger in diameter and smaller in depth.

COSTS

It will be seen from the above that the general problem of heating farm homes by the use of farm waste products involves so many economic factors that no definite prediction can be made, at this time, as to the probable economic success of the various proposed methods in the hands of nontechnically trained operators. It was shown by Roethe in 1923 (U. S. Department of Agriculture Bulletin No. 1203) that the gas produced from straw by destructive distillation in a commercial unit (designed to break down most of the residual carbon and tar so as to secure a large yield of gas while at the same time utilizing these unwanted by-products) cost approximately $2.36 per thousand cubic feet. By the fermentation method, using purely arbitrary charges for materials, labor, and interest and depreciation on a plant costing $750 (estimated to produce 200 cubic feet per day) a cost of $1.75 per thousand cubic feet might be tentatively arrived at. However, dependence of such a unit for supplying the home entails a reasonably continuous day-by-day operation, and on maintaining sufficient quantities of gas of the correct constitution, at definite pressure. Since the average farmer operates under both slack and rush seasons, conditions might arise where the necessary labor and attention could not be given to the producer unit. True, the slack season comes partly in winter, when gas requirements may be highest, but winter conditions might also slow up a fermentation operation, unless the equipment is adequately housed. In view of all these contingencies, therefore, no investment should be made in generating devices of this character without a careful study and analysis of all the factors involved.



CONSTRUCTION PUSHES AHEAD

By L. SETH SCHNITMAN, Chief Statistician, F. W. Dodge Corporation

MATERIAL PRICE MEASURING ROD

The prices in this tabulation enable one to visualize at a glance the main trend of the material market. Their significance does not extend beyond that point, and the explanation below should be read carefully.

F. W. Dodge Corporation Composite Prices as Indicated in Explanation

Material	This Month	Month Ago	Year Ago
Portland Cement. .	$2.26	$2.26	$2.05
Common Brick. . . .	12.36	12.36	11.70
Structural Steel. . .	1.65	1.65	1.60
Lumber.	16.50	16.50	15.48

Prices given in this comparison are composite and do not in all cases refer to one item. For instance, the price of structural steel is the composite of prices of shapes and plates f.o.b. Pittsburgh; the price of lumber is a composite of five items of Southern pine and five items of Douglas fir f.o.b. mill; the price of cement is a composite of prices in fourteen different cities per barrel, carload lots, to contractors; price of brick is composite in fourteen cities per M, delivered on the job.

March contracts for construction of all descriptions amounted to $179,161,500; this was almost twice the total reported for February and about three times the volume of March, 1933. Increases over both the previous month and March of last year were scored in each of the four principal classes of construction.

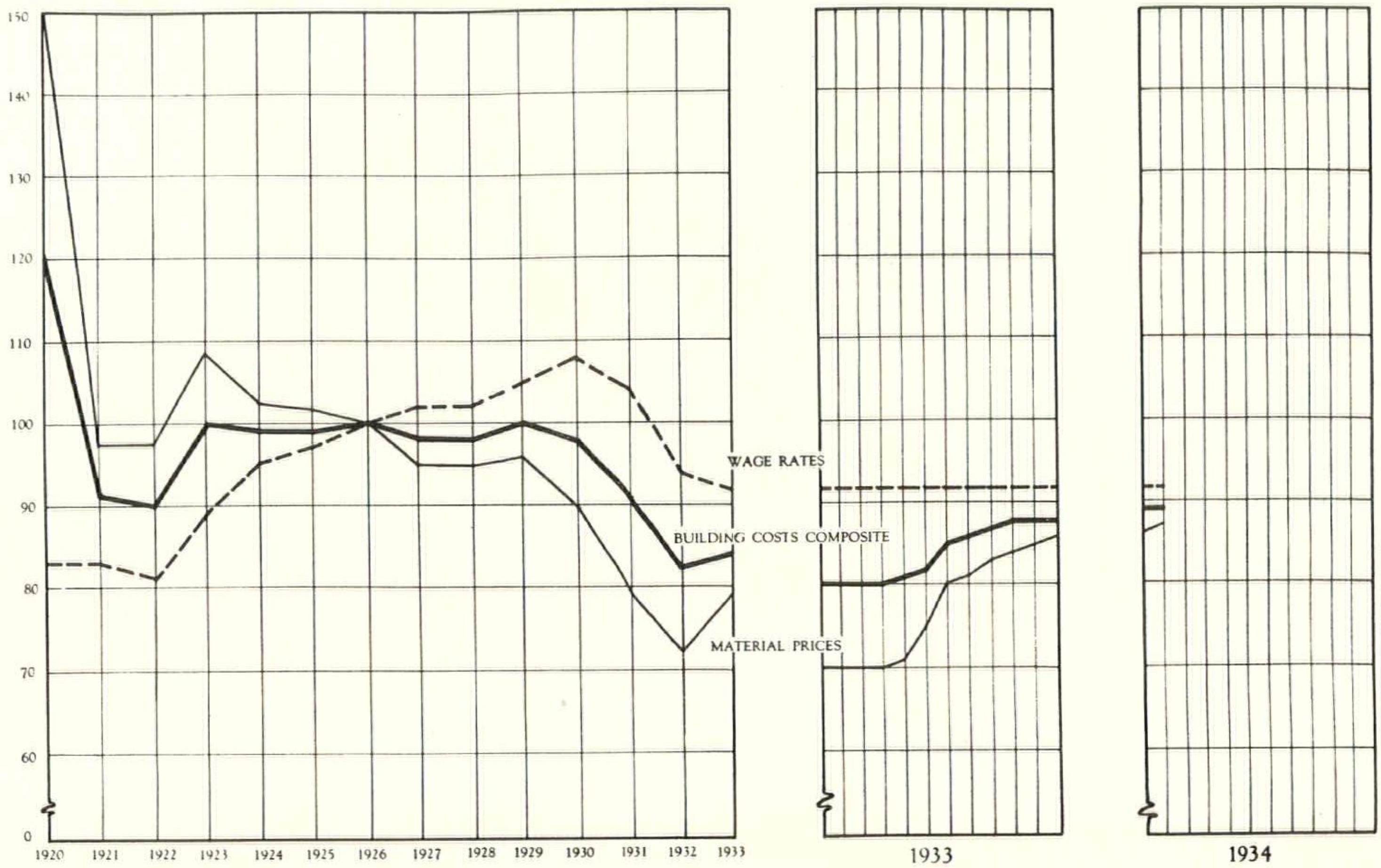
For the first quarter of 1934 contracts totaled $462,-341,500, as contrasted with only $196,026,800 in the corresponding quarter of 1933. For residential building the gain over 1933 to date amounted to about 46 per cent; for nonresidential building the increase was almost 85 per cent; for public works the 1934 volume was more than three and one-half times the size of the 1933 total; while for public utilities the first quarter's total was about two and one-half times as great as in the corresponding period of 1933.

Contracts awarded in March showed gains over February in each of the thirteen Dodge districts except southern Michigan, where a relatively unimportant decline was reported. Gains over March, 1933, were universal throughout the 13 districts. Likewise, for the initial quarter of 1934 contracts showed gains over the corresponding quarter of 1933 in each of the 13 districts without exception.

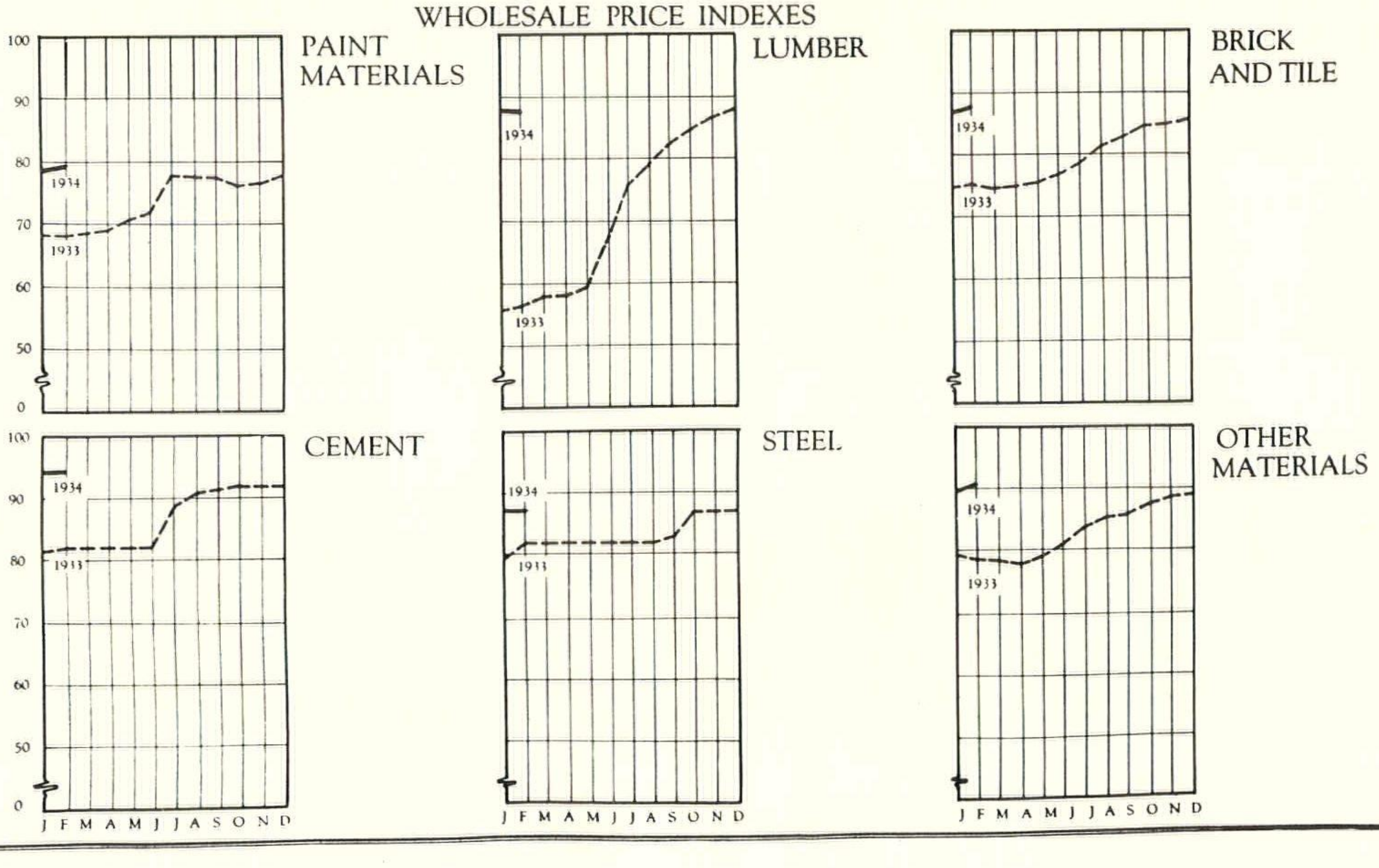
During the second quarter of 1933 contracts for all classes of construction in the 37 states as a whole totaled $236,086,600. For the second quarter of 1934 contracts in the same territory should exceed $325,000,000 by a fair margin. Of the contract volume for the second quarter of the current year it is probable that at least 70 per cent of the total will represent publicly-financed undertakings. During the initial quarter of the year this class of work, totaling almost 350 millions, represented 75 per cent of the contract total.

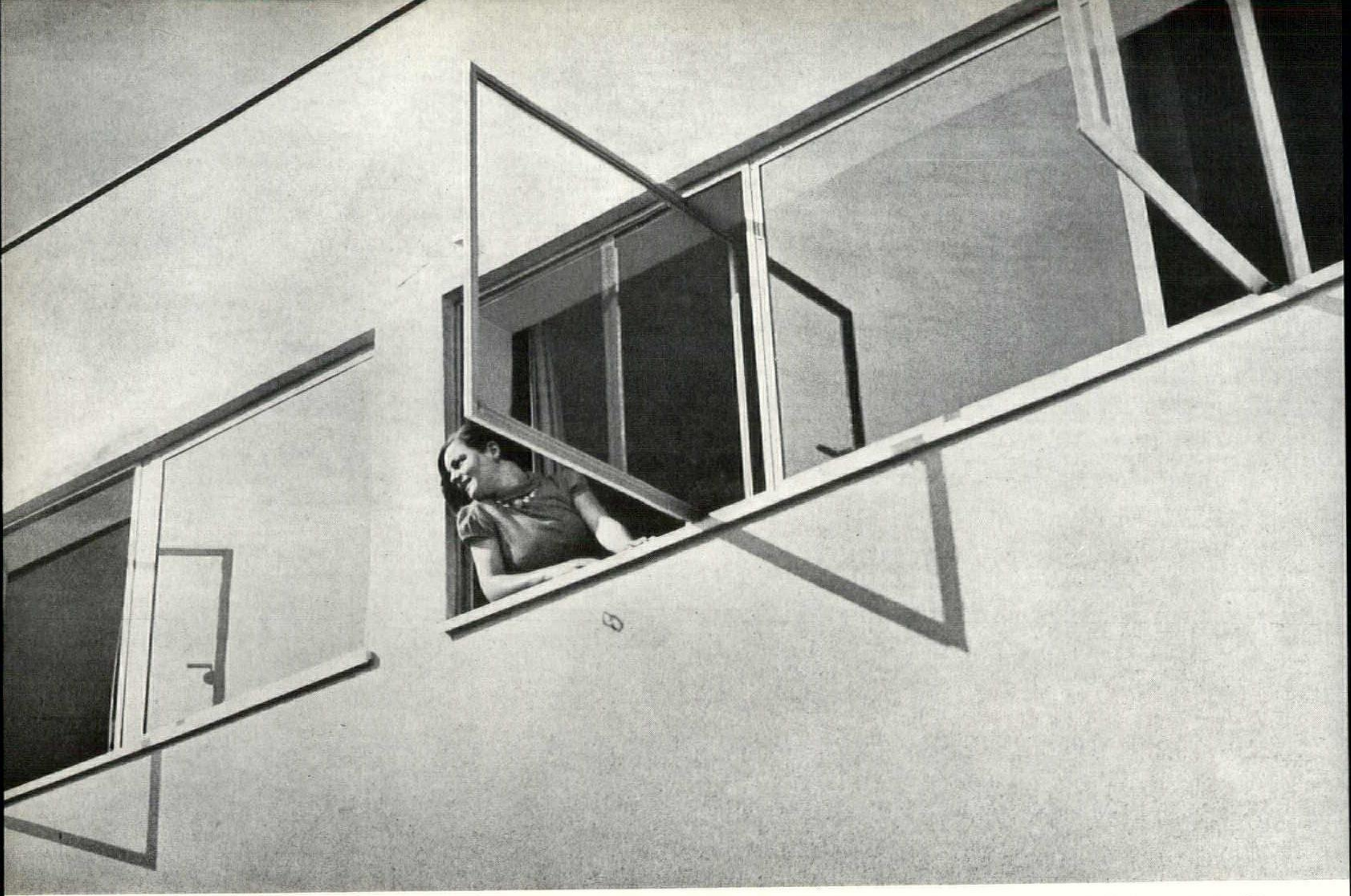
MATERIAL PRICES, BUILDING WAGE RATES AND BUILDING COSTS COMPARED

1926 Monthly Average = 100



WHOLESALE PRICE INDEXES





WINDOW DETAIL, HOUSE AT WEISBADEN, GERMANY — Marcel Breuer, Architect

ALL WINDOWS FACE SOUTH AND WEST BECAUSE IN THIS DIRECTION ONE ENJOYS FULLY THE GARDEN, THE SUN AND VIEWS OF THE RHINE VALLEY. IN THE AUTUMN, WINTER AND SPRING THE SUN, SHINING THROUGH LARGE GLASS AREAS, HELPS TO HEAT THE ROOMS. IN SUMMER THE WINDOWS ARE PROTECTED BY REMOVABLE AWNINGS. THESE ARE PLACED 8 INCHES FROM THE WALL TO PERMIT ESCAPE OF HEATED AIR REFLECTED FROM WALL SURFACES.

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M A Y

THE ARCHITECTURAL RECORD

WHAT SHOULD BE DONE TO IMPROVE ARCHITECTURAL EDUCATION?

BY DR. S. GIEDION
GENERAL SECRETARY OF THE INTERNATIONAL CONGRESSES FOR NEW ARCHITECTURE

There are increasing complaints by architects and others that the courses of study in the architectural schools do not satisfactorily prepare the practitioner for today's problems. As explanation we may say that the distance is becoming greater and greater between what is being taught and what the young architect is called upon to solve and to do in actual practice. Notable physicians, chemists, engineers, have been trained in technical schools and universities but their training has had the advantage of a close teaching contact with outstanding and experienced men in their fields.

The leaders of contemporary architecture in Europe, with very few exceptions, did not receive academic architectural training in universities. This is no reflection on schools as a suitable place for educating the architect. It indicates a lack of progress in existing training as compared with very definite scientific progress pertaining to methods of living and working and with respect to construction methods and materials. The real leaders in contemporary architecture are mostly outsiders who were obliged to develop independent thinking as a means of expanding their professional responsibilities. Certainly the university trained architect is able to get rid of unfruitful knowledge, but the great majority is hopelessly trained in the wrong way. *The most important aid to the continuous development of architecture is an approved and broadening education of the young student.*

We know that, in present day life, it is not the number of inventions nor production totals that are important to the proper functioning of a community and the well-being of all classes of citizens. It is rather the ability to absorb the inventions and productions sensibly, economically and politically. Our lack of historically formulating power is revealed by the fact that for a century, that is, since the conception of modern industry, we have not succeeded in creating a new form of living which is in step with advances in social science, medical science and building methods. The claim of contemporary architecture is to broaden the general interest in housing and community arrangement beyond professional circles. *The new architecture would take advantage of scientific progress so as to attain new possibilities for greater human comfort.* The new architecture is attempting to apply, in its own field, *a sensible use of technical invention and production for the creation of a more healthful, pleasant and homogeneous form of life.*

This use of technical invention and production for a new homogeneous life demands leaders of real creative ability because nothing is more difficult than to detour from the wrong track to the right one. The education of the young architect should obviously be placed in the hands of architects who have professional experience and leadership and not in the hands of men of secondary ability or individuals who have not kept up with a knowledge of new needs or who are merely clever imitators.

Contrary to common practice in medicine, chemistry, physics and engineering, Boards of Selection have not been inclined to appoint advanced practitioners for teaching architecture. For what reason? It is because architecture appeals strongly to sentiments; and these sentiments in favor of traditional architecture have swayed school authorities.

The following proposals are made with a conviction that their application would aid in attaining a correct transformation of architectural education and a useful training of the student-architect:

Appointment of architects of outstanding experience and technical ability as professors of the important schools of architecture. For example, would not an experienced educator and creative head such as Walter Gropius be very helpful for the reorganization of architectural schools of America? Those productive architects who are aware of general conditions and are able to judge the value of knowledge and training in special fields should be given supervision of separate departments of architecture.

Scientific education (mechanics, mathematics, construction methods, and so on) could in most cases be taken over from the existing teaching framework; with, perhaps, a more pronounced specialization in architectural requirements.

Special attention should be given to well defined and applied knowledge of *construction materials* because the architect should be accustomed to clearly transmit, very early, his problems to the industry which produces each building part. In the future the cooperation between architects and manufacturers must be closer, in order that the architect not only passively accepts what industry produces, but also influences from the very beginning the production through requirements which are in accordance with a favorable architectural development.

For the *general education* of the architect it is essential that he acquires knowledge of pertinent facts about economics, trade codes and financing. The architect should be informed of economic systems, the essentials of social orders, and the functioning of groups and classes within cities and states; but these subjects should be taught with consideration of their relation to architecture.

Architectural history need not be eliminated from the educational program. The usual teaching of *history of art*, however, by reviewing superficially all the periods, has not been proved satisfactory. It may be that one specific building problem should be studied through the various periods or a single period only could be treated exhaustively.

As important as the knowledge of early periods of architecture would be an acquaintance with the origin and evolution of building of our own time or since the end of the eighteenth century. This would inform the young architect of a real tradition, the tradition on which he stands. It would give him ample justification and courage for his own activity. One might add that the student should be kept informed of what is happening in architecture all over the world. The horizon for the student would thus be broadened to his advantage.

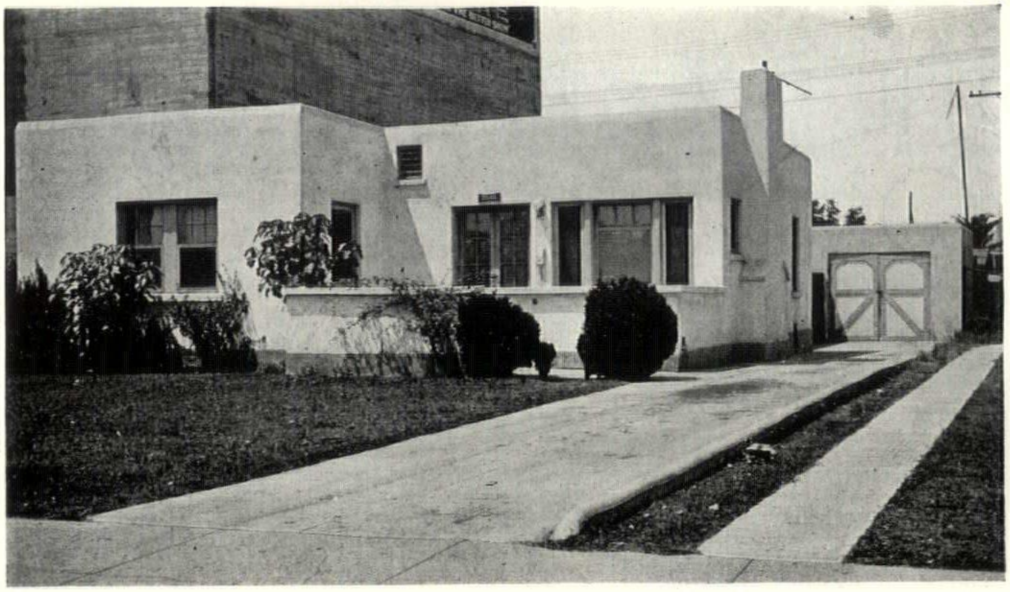
Progress lies in the future. The question therefore arises whether a world congress on architectural education could be called together in the United States. Such a gathering would be of value to all who would participate. The members of the "International Congresses for New Architecture," consisting of leaders and students, would take great pleasure to assist such a congress.

IN EUROPE some experiments have been tried in advanced architectural education. There is the notable instance of long activity by Professor Karl Moser at the Polytechnic Institute in Zurich. To him we are appreciative for the well trained architectural graduates that practice today in Switzerland. In Stockholm the experienced architect, E. Asplund, the planner of Stockholm's building exposition in 1930, was appointed as instructor in architecture two years ago. At the Institute of Technology in Charlottenburg, Germany, the housing architect, Bruno Taut, has been active until the coming of the National Socialists. In Russia there are Alexander Wesnin and Ladowski. An outstanding accomplishment has been the founding of the "Bauhaus," 1919 at Weimar, Germany, by Walter Gropius. Under its original constitution the "Bauhaus" was not classified with universities. It was an independent school which, for the first time, systematically developed a new building and housing culture by the correct training of the student for urgent contemporary problems. In France architectural education is proceeding in ateliers. Those of the brothers Perret and of Le Corbusier have done more for the education of the young architect than all the schools of France together.

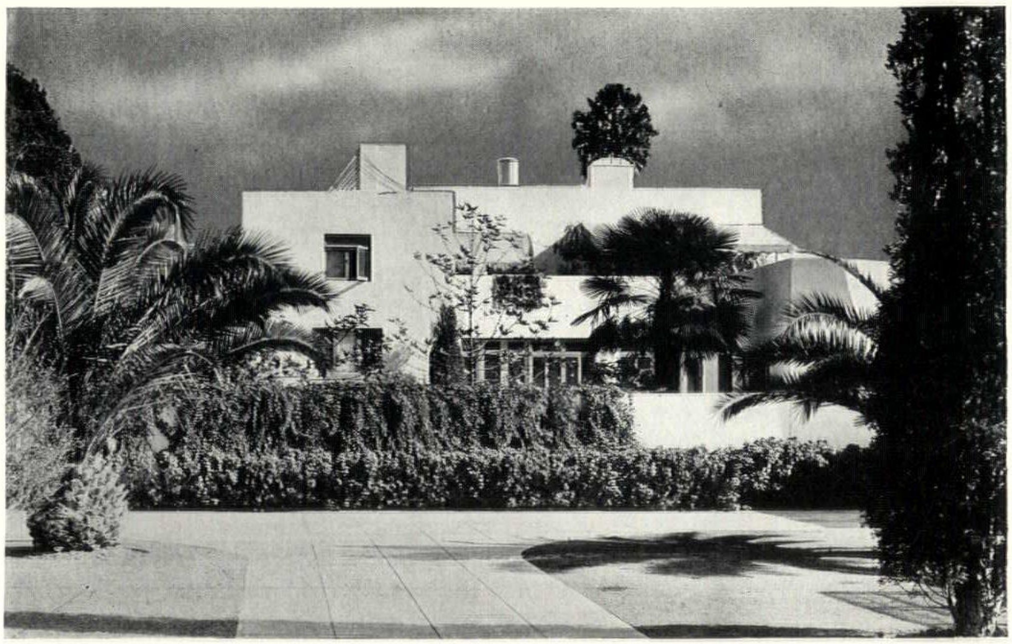
Albert Frey

INDIAN PUEBLO AT TAOS, NEW MEXICO

A native American architecture is found in the pueblos of Indians of the Southwest. These buildings for dwelling purposes exhibit an unusually well balanced harmony of living requirements, structural methods and formal expression. There are no parts that exist for purely sentimental or decorative purposes. At the same time essential needs are expressed with a refined knowledge of appearance. Such architecture is at once timeless and modern.



A CALIFORNIA BUNGALOW



HOUSE OF MARY BANNING, LOS ANGELES, BUILT IN 1911.
IRVING GILL, ARCHITECT

In certain contemporary American architecture we discover forms that are strikingly similar to the Indian pueblos of New Mexico. With a natural architecture the form is a consequence of planning requirements and structural methods. In the three cases illustrated there is a grouping of rooms for dwelling purposes. Since a cube represents the most compact and practical shape for a room, we can expect the economical grouping of such rooms to result in a rectangular composition.

THE STATUS OF CONTEMPORARY

OURS IS A PERIOD OF TRANSITION. THERE IS TODAY A MIXTURE OF THE PRACTICE OF THE PAST AND NEW TRENDS. THIS EPISODE OF CHANGE IS NOT NEW. IT HAS BEEN GOING ON FOR OVER A CENTURY. EVERY COUNTRY IS BEING AFFECTED, USUALLY AT THE RATE OF ITS INDUSTRIAL PROGRESS. INDUSTRIALIZATION HAS ALTERED OUR FORMER SOCIAL AND ECONOMIC EQUILIBRIUM. THERE EXISTS A MOVEMENT WHICH SEEKS A TRUE EXPRESSION OF THE NEW METHODS IN CONSTRUCTION AND PLANNING WITH THE AIM OF ACCOMPLISHING A NEW HARMONY OF OUR LIFE AND ACTIVITIES. LET US REVIEW BRIEFLY THE ACTUAL STATUS OF CONTEMPORARY ARCHITECTURE IN THE DIFFERENT COUNTRIES.

FRANCE In the 19th century engineers in France erected great structures, giving no evident consideration to aesthetic appearance. Through the example of anonymous engineering structures a new sentiment has unconsciously arisen. Modern painting was first to attain a new language in expressing the new sentiment. Great architects like Perret and Tony Garnier introduced the new methods to all kinds of building without enunciating, however, their complete formulation. Later on LeCorbusier developed further the new vocabulary. His preoccupation with painting accelerated his conception of new forms.

HOLLAND In 1917 the creative architects of this country combined ideas in a magazine, "De Stil," with contributions from foreign architects, including Frank Lloyd Wright and Sant Elia. The initiator was Theo van Doesburg with Oud, Rietveldt, van Eesteren and others. Holland was the first country to change its aspect by the building of garden cities with roof terraces, large windows and a garden setting. It also was the first country to set up the exact requirements for low-cost housing.

BELGIUM About 1920 Victor Bourgeois started the new movement for Belgium by the construction of a garden city for the working class.

SWITZERLAND The first examples of new architecture appeared in Switzerland in 1924. Its recognition and practical application have steadily grown, and today the new trend includes house furnishing and industrial design.

SCANDINAVIA Sweden, Norway, Denmark and Finland cultivated a neo-classic tradition during the opening years of the twentieth century. This influence spread abroad to England, Germany and the United States and hindered for a period the natural development of modern architecture. However, since the Stockholm exposition in 1930 and notable contributions for group housing, the building of a network of new cooperative stores and also factories, there has been much progress and an official acceptance of contemporary architecture.

GERMANY Walter Gropius, before 1914, did much to attain a clear expression for German architecture. Greatest progress was made from 1927 to 1930. Architecture in Germany since 1932 has been subjected to so much regulation as to threaten the progress made during the past twenty years.

POLAND Its architects have cooperated as a group to solve low-cost housing for Poland. Consideration is given to the special requirements of that country.

ARCHITECTURE BY DR. S. GIEDION

U. S. S. R.

After a number of premature experiments between 1927 and 1929, experiments mostly modernistic and executed with unsolved construction methods, there is a reaction in favor of classical styles. It is not possible to predict any issue at the present moment but there are results in modern city planning which the Russians are evolving and which are of international importance.

U. S. A.

This country has the most highly developed building technique, it erects the highest buildings, it possesses one of the greatest pioneers of modern architecture—Frank Lloyd Wright; but until recently, America has given little attention to the application of technical knowledge to an architecture suited to its advanced methods and new materials. With difficulties confronting the building industry during the depression there has been an awakening of interest in housing for the lowest income group. America has sent during the last few years a great number of architects and sociologists to Europe for the study of these new requirements. It seems now that a new architectural approach is developing.

ENGLAND

Some forty years ago England set an example for other countries in building houses for the nonprivileged classes. After a long period of delay, and with the stimulus of new architectural training, there is a new and widening circle of activity in producing a new and useful architecture.

SPAIN

ITALY

In the nineteenth century these countries employed results which had previously been verified by the Northern countries. In Barcelona, the beginning of unexpected developments is now noticeable. At the site of the 1929 Exposition garden cities are now planned for 30,000 inhabitants of the working class. The close cooperation between the government and the architects in charge is favorable to both of them. In its industrial buildings, stadiums, etc., Italy possesses all of the elements necessary for the development of a contemporary architecture. Like Sweden, in 1930, it has taken an official step towards new realizations by the "Triennale 1933" at Milan.

ALGERIA

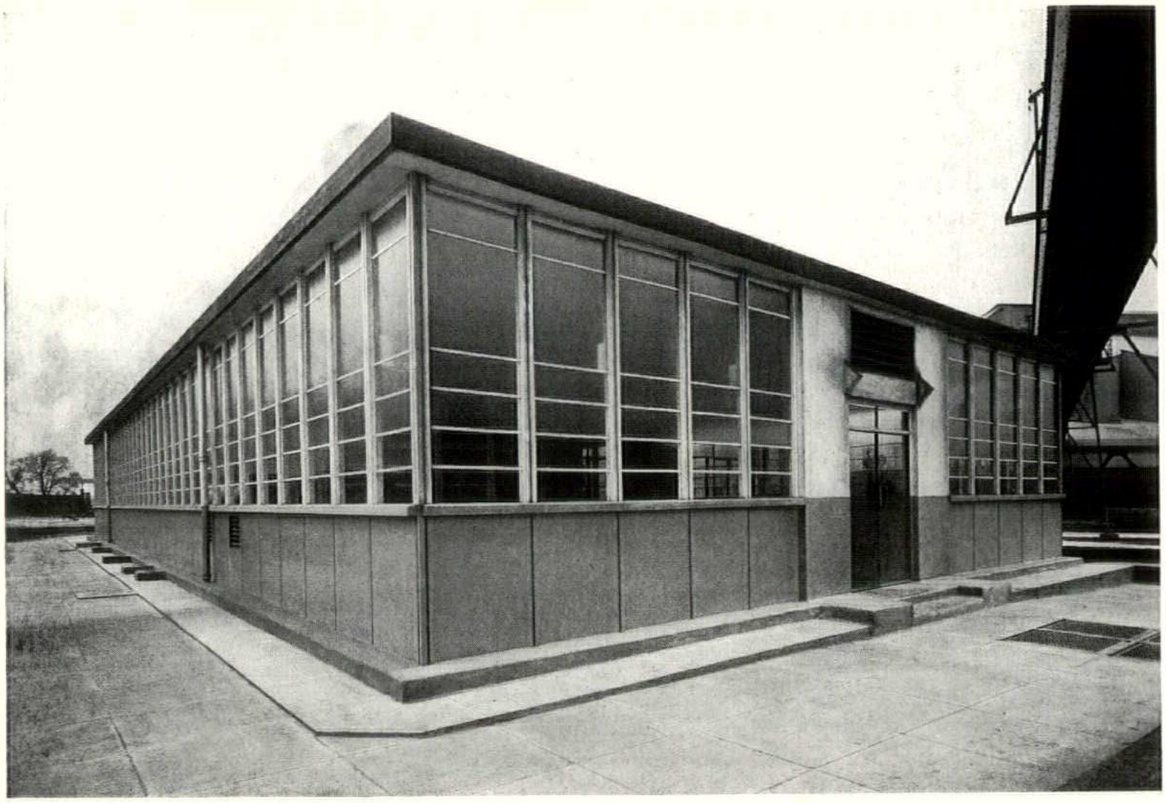
Algeria, which confronts urgent problems in city planning, is furthering new solutions.

GREECE

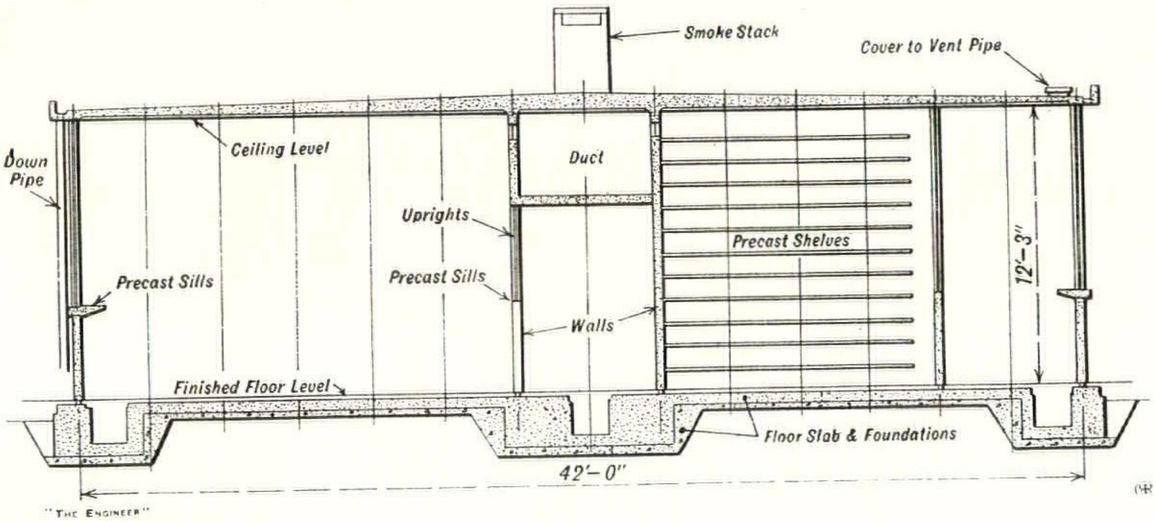
Greece shows much interest in the modern movement and there is no doubt that an evolution in such a magnificent setting can give best results by the continuation of tradition in a truly modern way.

IN THE FOLLOWING SECTION IS A REPRESENTATIVE SELECTION OF EXAMPLES OF CONTEMPORARY ARCHITECTURE FROM NINE COUNTRIES

PORTFOLIO

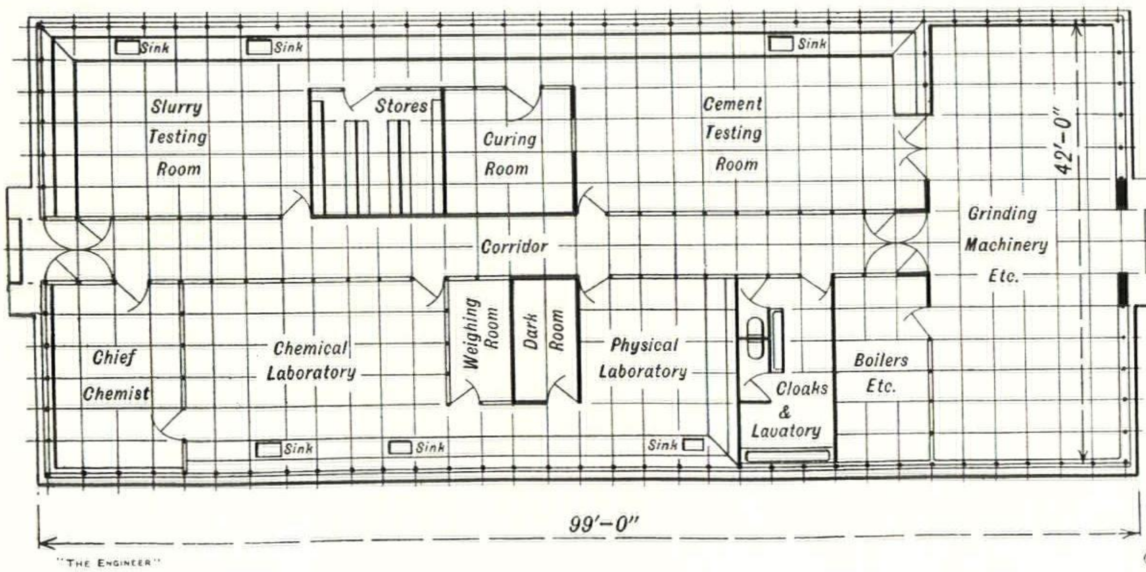


WEST END,
SHOWING ENTRANCE



CROSS SECTION
OF LABORATORY

Window frames, sills and wall units are of precast concrete sections. Shelves for storage are of precast and reinforced concrete one and one-quarter inches thick.



PLAN OF LABORATORY

The building is constructed to a unit dimension of three feet. Corridor width and room sizes are multiples of three feet. Window frames of concrete are three feet on centers.

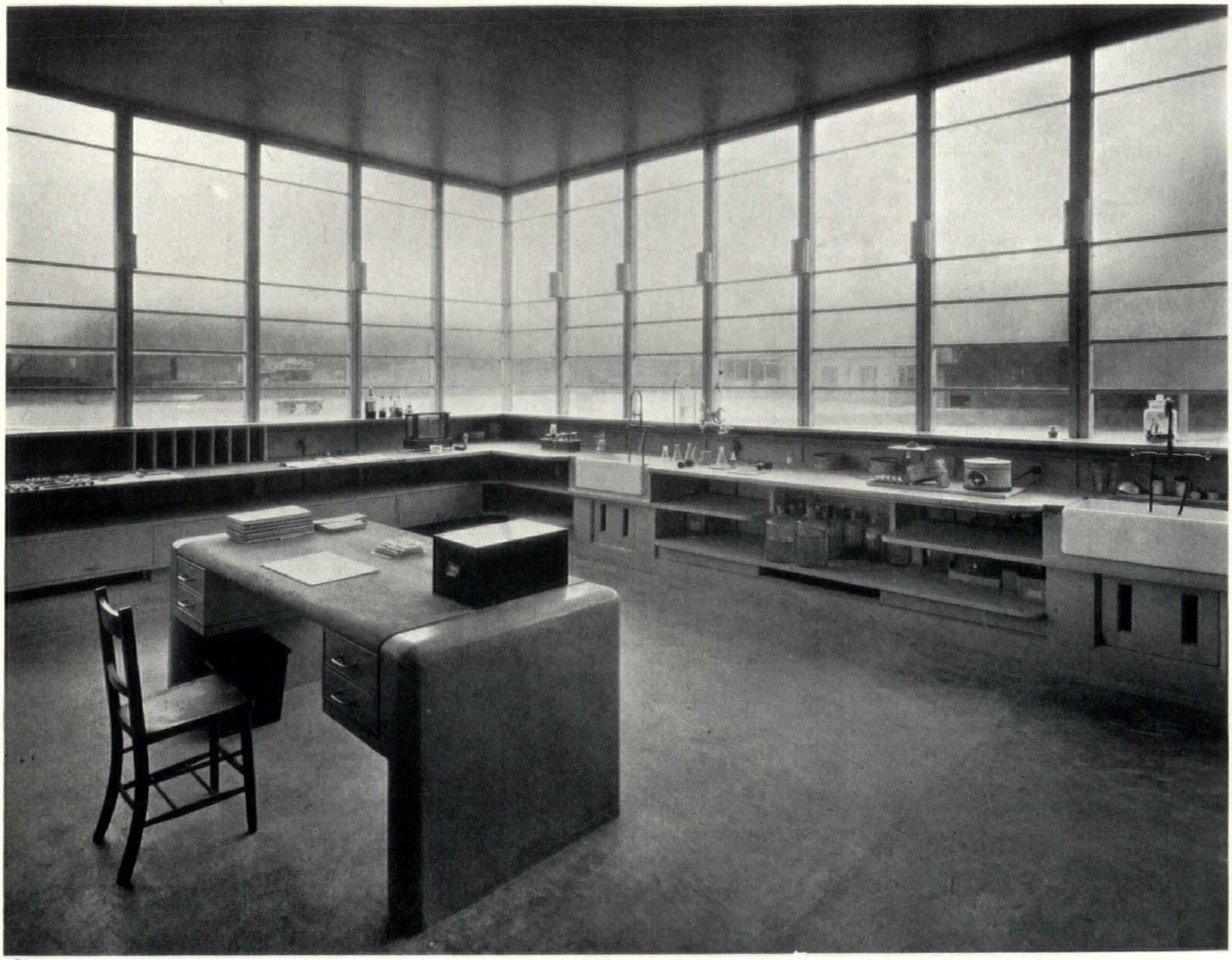
Sims

NIGHT VIEW WITH ILLUMINATION TO GIVE DAYLIGHTING CONDITIONS

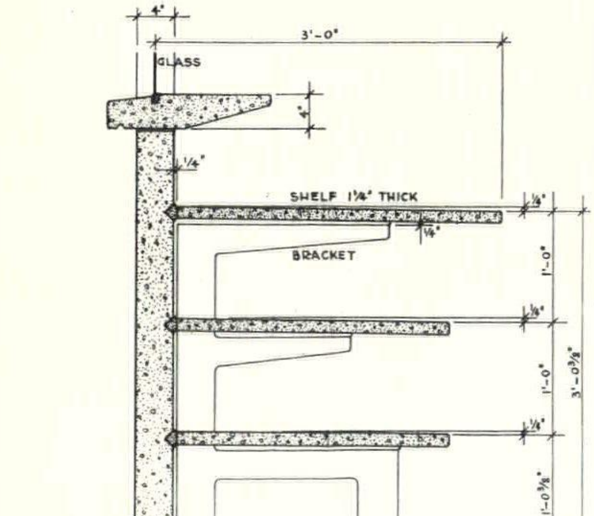
AN ALL-CONCRETE LABORATORY, ESSEX, ENGLAND

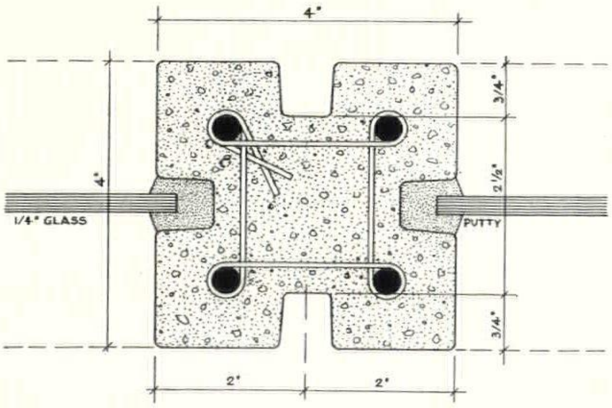
DESIGNED BY SIR E. OWEN WILLIAMS

This laboratory building was designed for the Tunnel Portland Cement Company, England. It is used as a chemical laboratory for testing cements produced by the firm. The construction is of interest because every possible part of the structure, even including shelves, cupboards and desks, is of reinforced concrete. The building is one story high, provided with a flat roof, supported by four-inch square posts. These posts are spaced three feet apart. The building length is ninety-nine feet and the width is forty-two feet. Window glass is mounted in three-quarter-inch slots in side of posts. Slots in face of posts are used to house supports for electrical fittings. Fresh air is delivered to every room by an air duct above corridor. Used air is delivered outside by ducts beneath corridor and at outer wall. The extensive shelving used for storage is partly precast and partly built in place. The roof is of slab construction with underside faced with cork for insulation.



Sims
INTERIOR OF ALL-CONCRETE LABORATORY





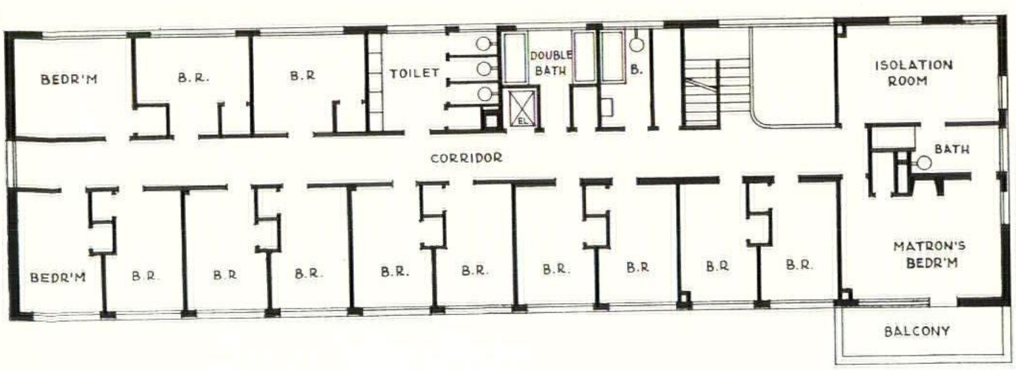
ABOVE: SECTION OF FOUR-INCH CONCRETE POSTS, SPACED THREE FEET ON CENTERS FOR WALLS. GLASS IS SET IN GROOVES WITH PUTTY.

LEFT: DETAIL OF SHELVING UNDER WINDOWS. SHELVES ARE ONE AND ONE-QUARTER INCHES THICK, PRECAST AND SUPPORTED BY CONCRETE BRACKETS. THE CAST WINDOW SILLS ALSO SERVE AS SHELVING.

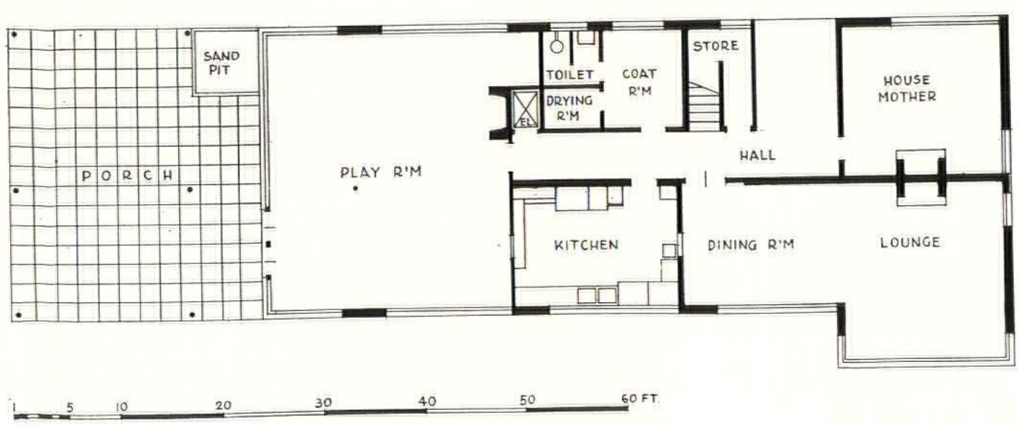
Sims
CONCRETE STORAGE SHELVES

Moss

INTERIOR OF COMBINED DINING ROOM AND LOUNGE



DORMITORY ROOMS ON SECOND FLOOR



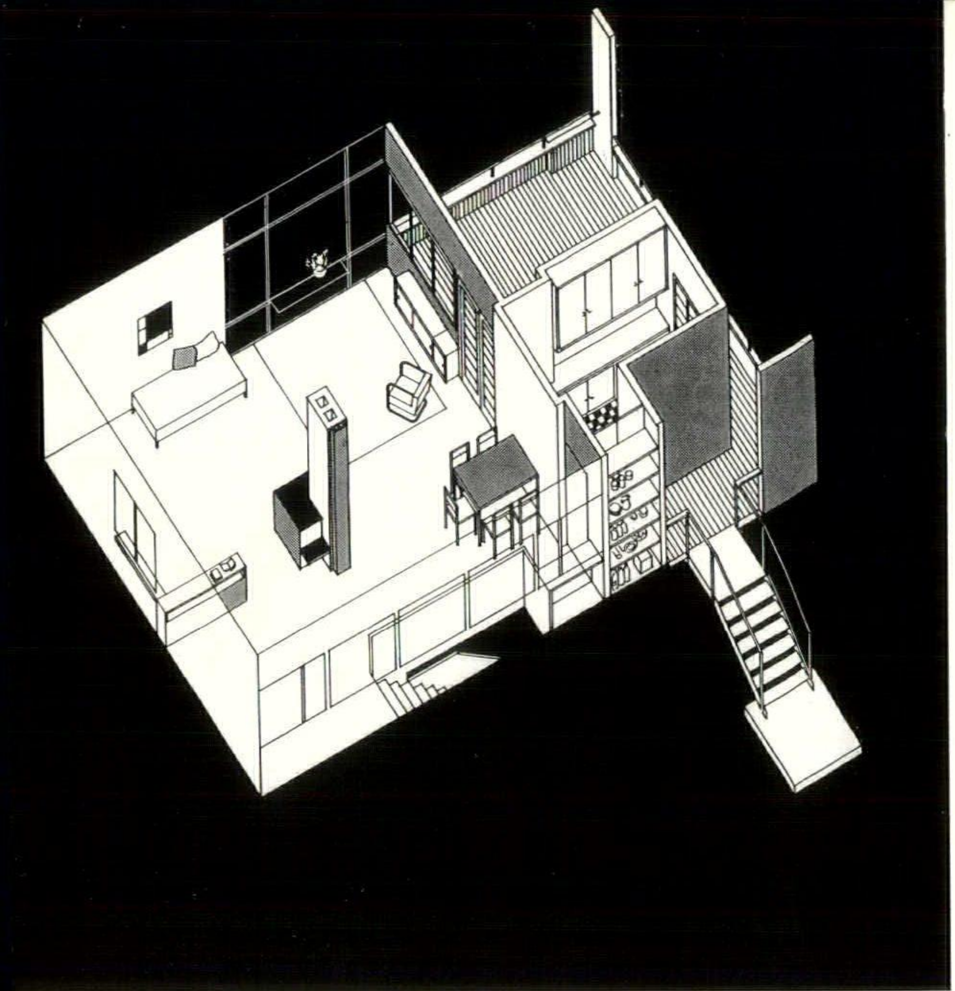
GROUND FLOOR PLAN

Moss

GENERAL VIEW OF EXTERIOR

THE DARTINGTON COUNTRY SCHOOL
SOUTH DEVON, ENGLAND
HOWE AND LESCAZE, ARCHITECTS

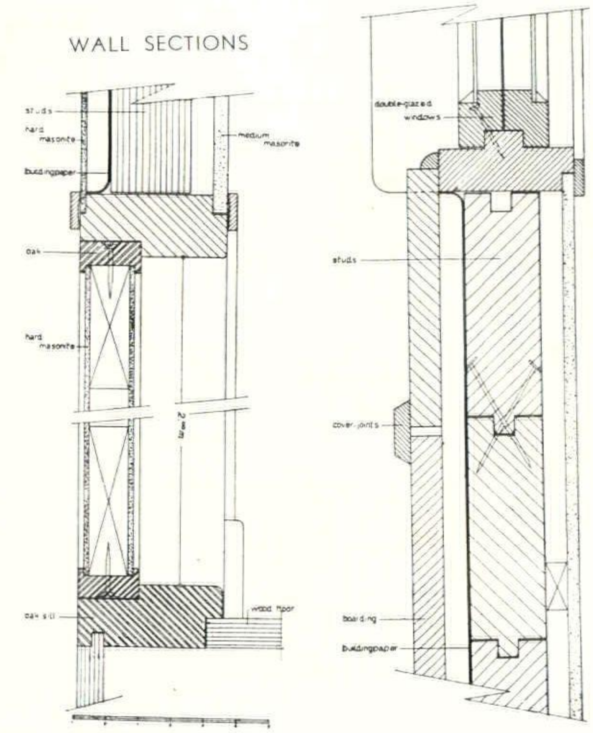
A boarding school for boys. The school was placed in a rural setting, surrounded by Devonshire farms and woodlands. Cultural education supplements training in countryside activities; gardening, forestry, weaving, building, clay potting and firing. Agriculture is conceived of as an industry and a life work. The London Architectural Review (article by Gerald Heard) summarizes the aims of Agriculture: "producing goods, paying its way and giving its constituents a sense that the organization is not only their means but their end; not only their livelihood, but their life's purpose." The new architectural form does not suffer from its naturalistic setting, in fact the orderly character of the architecture is suited to its inclosure of trees.

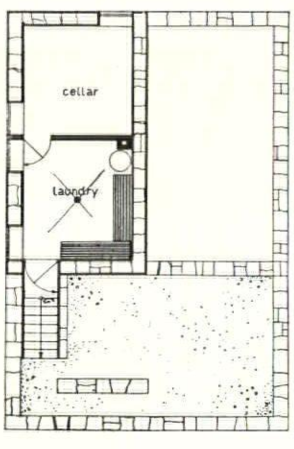


SUMMER HOUSE NEAR GOTEBORG, OF WOOD CONSTRUCTION

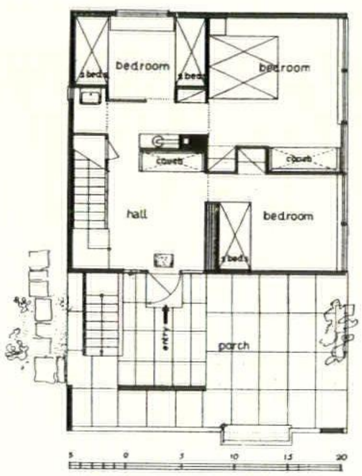
ALFRED ROTH AND INGRID WALLBERG, ARCHITECTS

WALL SECTIONS

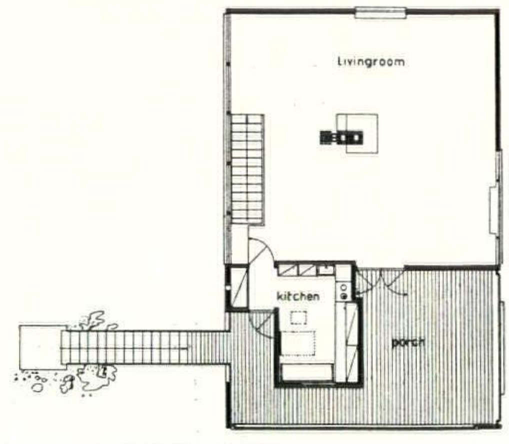




BASEMENT

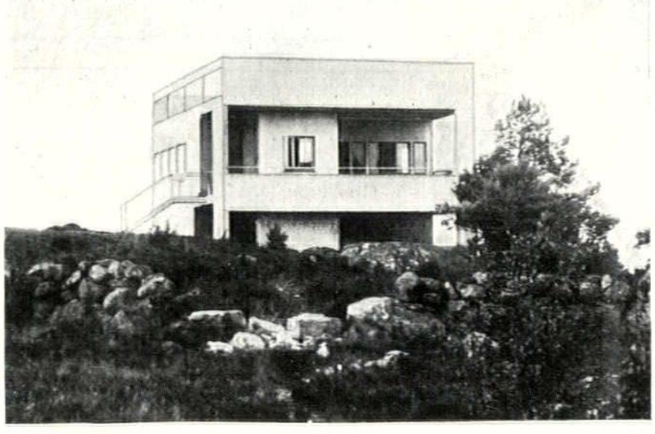


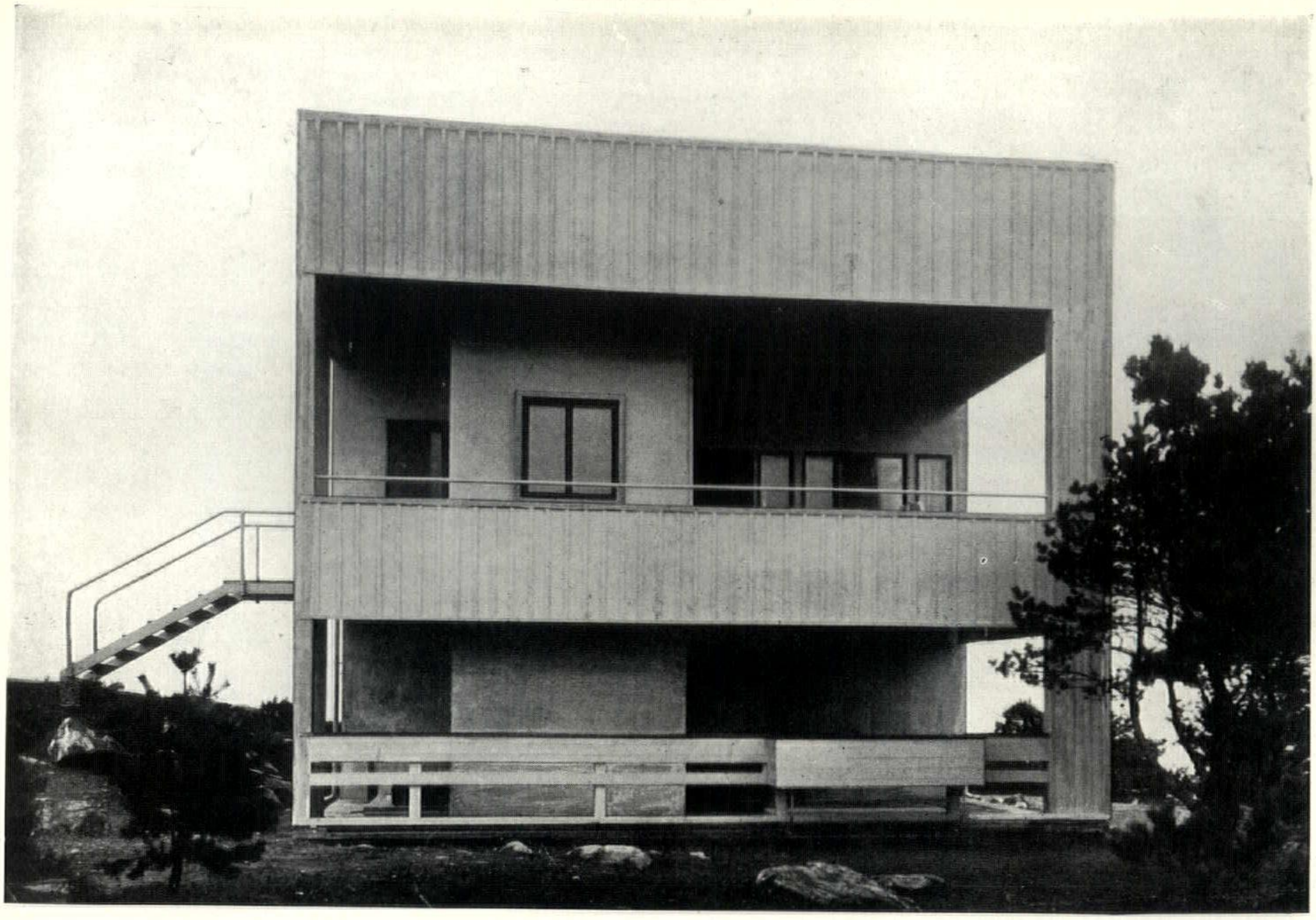
FIRST FLOOR



SECOND FLOOR

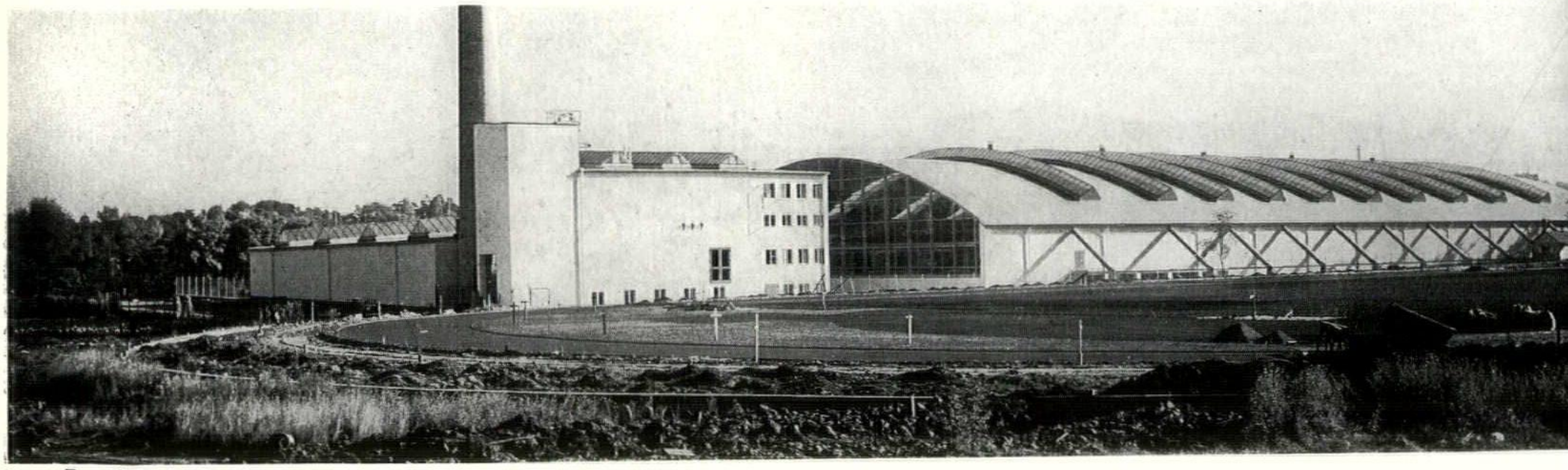
This house was built for a tradesman of moderate income. It is situated on a rocky promontory overlooking the water. A large living room is placed on an upper level for quietness and view. The bedrooms on the first floor are separated by closet units. There are no doors, excepting for exterior entrance. Curtains are used as a substitute for doors. Exterior structural walls are of heavy planks, tongue and grooved, and placed vertically. The outside facing is of light boards and battens. Interior walls are lined with Masonite insulation board.





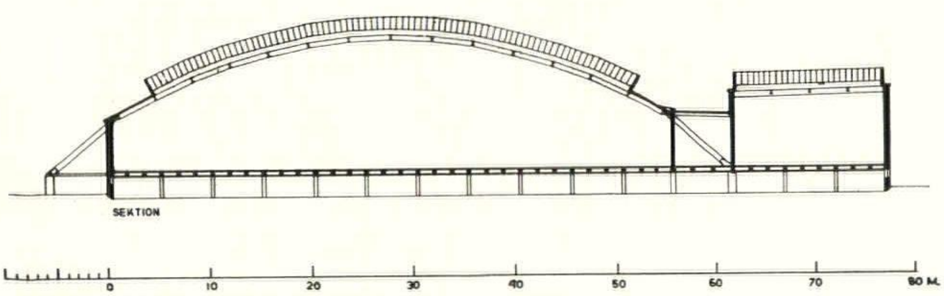
ABOVE, ELEVATION TOWARD VIEW

BELOW, INTERIOR OF LIVING ROOM



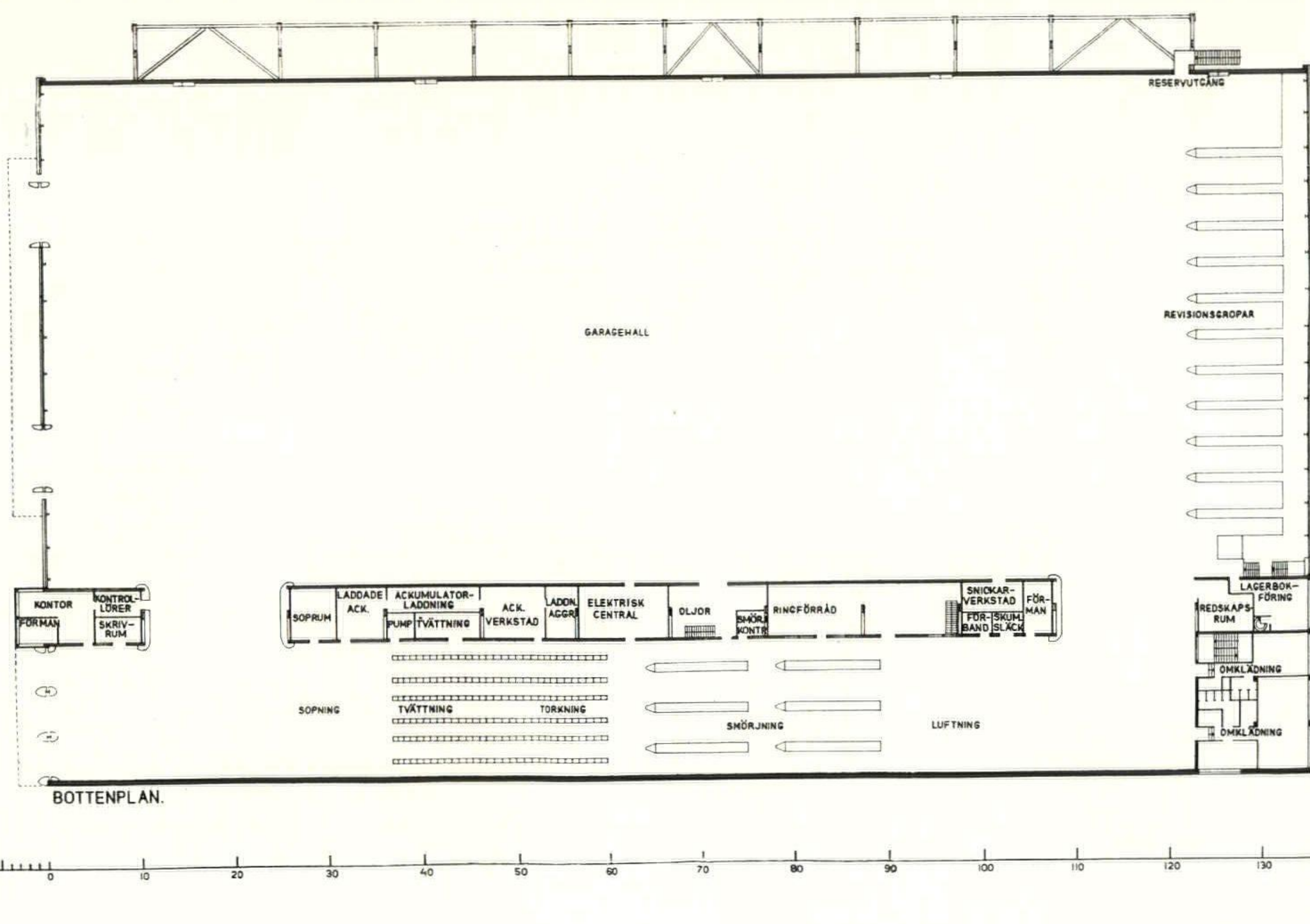
Rosenberg

GENERAL VIEW WITH WORKSHOP AND POWER PLANT IN FOREGROUND



SECTION OF GARAGE.

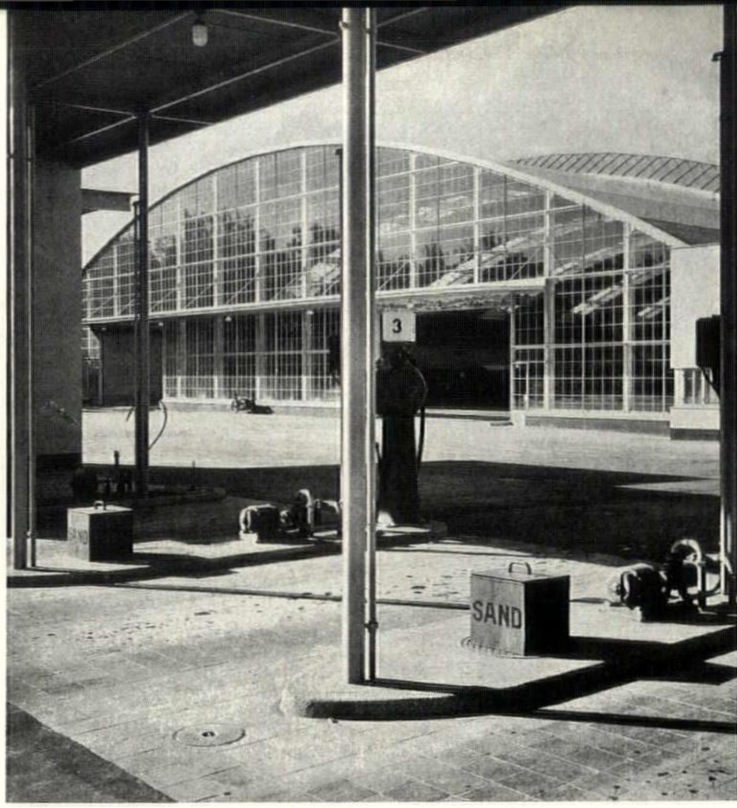
PLAN OF GARAGE BELOW.



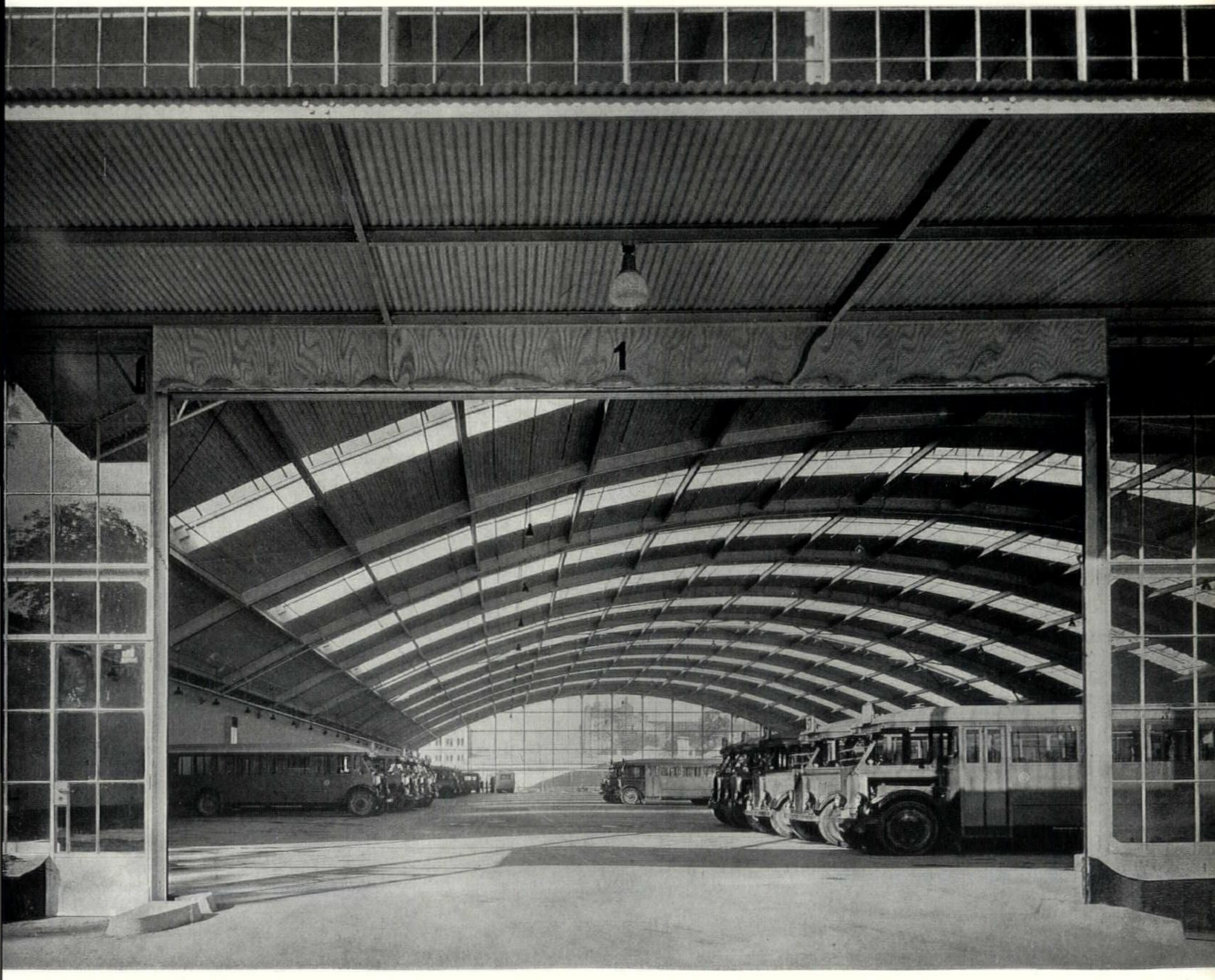
AUTOBUS TERMINAL AND GARAGE
STOCKHOLM, SWEDEN

ESKIL SUNDAHL, ARCHITECT

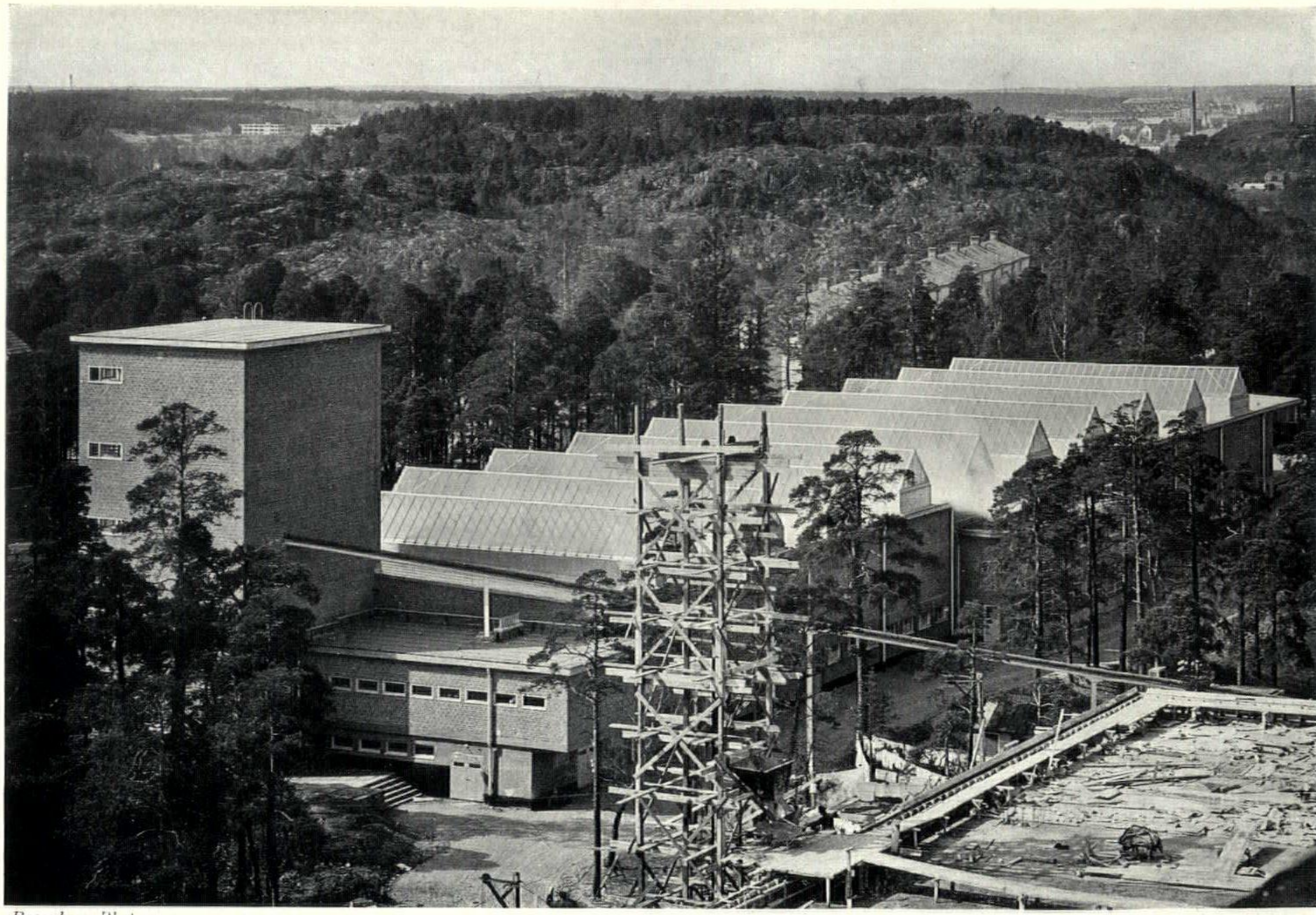
Space is provided for 250 autos, a repair shop and power plant, gasoline station and administration offices. Garage space and shops can be enlarged to double the existing capacity. There is an unobstructed parking area for buses lighted from overhead. Columns were omitted because they hinder a free movement of cars and it is impossible to anticipate exactly the sizes of buses of the future. To permit the free entrance of two-story buses, the doors were made sixteen feet high. The roof is framed with continuous steel girders forming an arch that extends beyond the side walls. The ends of the garage hall are entirely of glass with steel frame. The building was erected on a huge slab of concrete, which in turn is supported on piling, shown on the drawing of the section on the opposite page.



Rosenberg Photos




OSCARIA

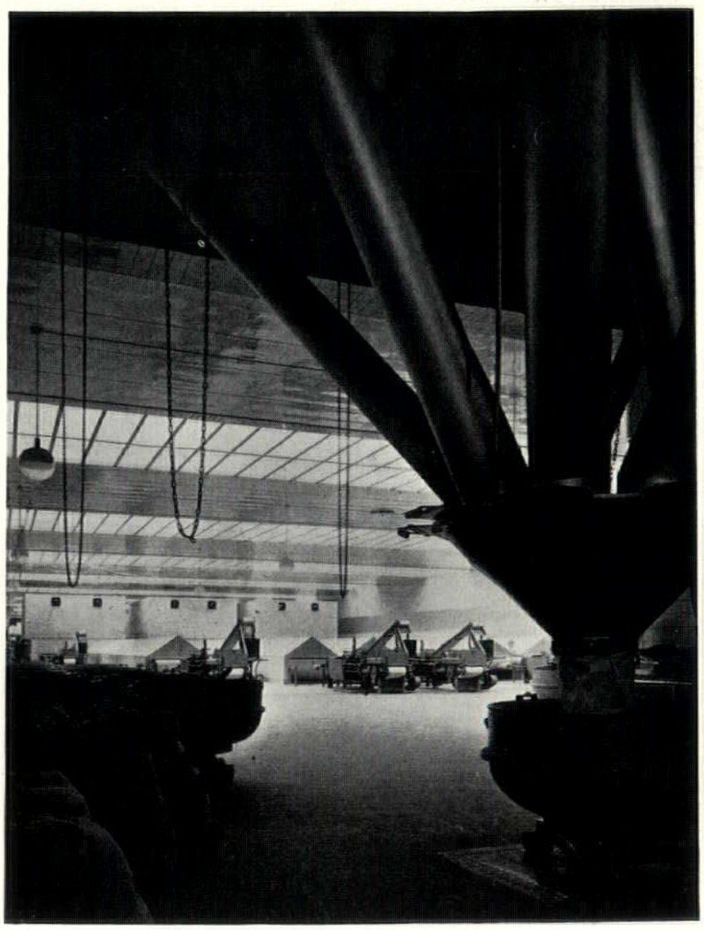


Rosenberg Photos

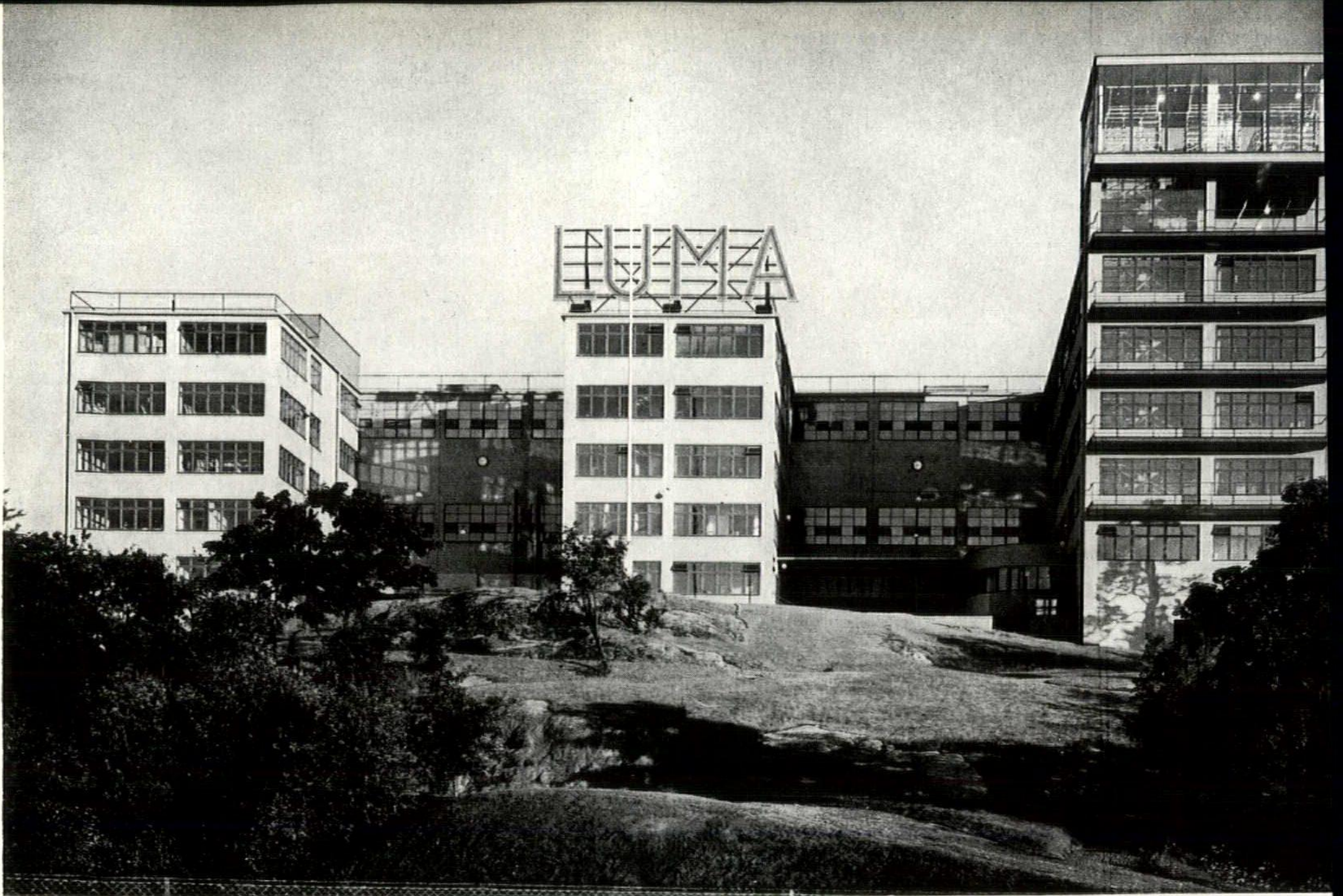
CRACKER FACTORY (COOPERATIVE), STOCKHOLM, SWEDEN

ESKIL SUNDAHL AND OLOF HULT, ARCHITECTS

This factory manufactures a Swedish hard bread and is situated near the grain elevators of the City of Stockholm. The site of the factory is a wooded island and the selection of location was influenced by a desire to obtain a natural beauty of setting to contrast with the well organized shape of the factory group. The general plan consists of a large factory floor daylighted by saw-tooth skylights, a tower for storage of ground meal, a power plant, a small dining room for workers, toilets and lockers. The entire plant is supplied with conditioned air. Because of this mechanical ventilation it was possible to use a skylight with fixed sash. This minimized the usual objection to overhead glazing, namely, its liability to leakage.



LEFT: Interior of Autobus Terminal near Stockholm, Sweden. Eskil Sundahl, architect. There is unobstructed space for free maneuvering of cars. Skylights and a wide expanse of glass at end walls give outdoor daylighting conditions.

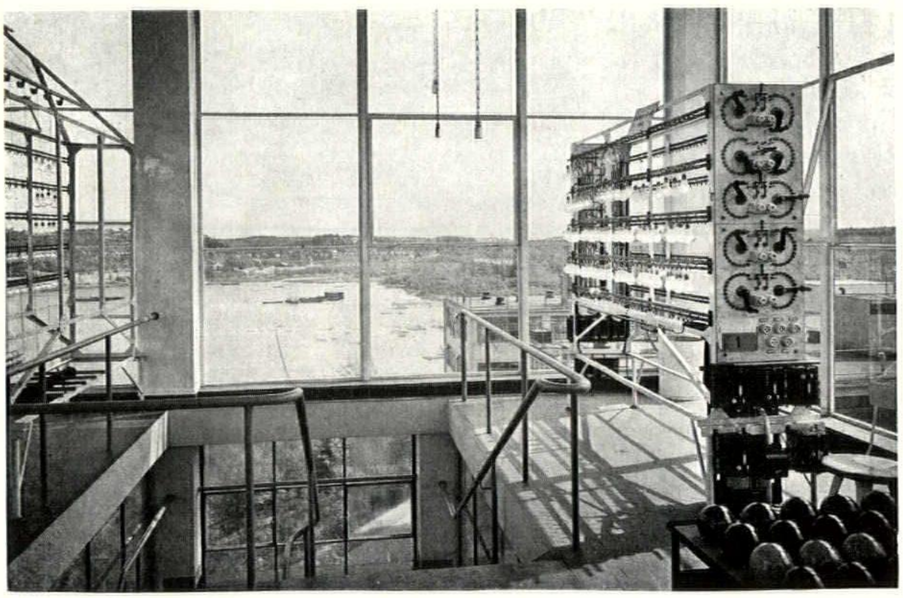


Rosenberg Photos

"LUMA," ELECTRICAL LAMP FACTORY (COOPERATIVE), STOCKHOLM

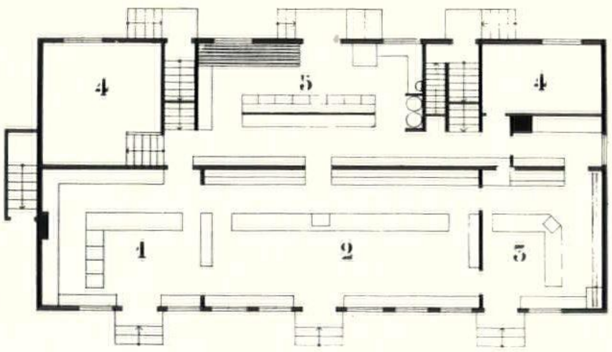
ESKIL SUNDAHL AND ARTUR VON SCHMALENSEE, ARCHITECTS

GENERAL VIEW OF FACTORY, SITUATED ON A WOODED ISLAND NEAR STOCKHOLM. THE GLAZED-IN ROOM AT ROOF LEVEL IS USED AS A TESTING ROOM AT NIGHT. THE ILLUMINATION OF THIS BUILDING IS ONE OF THE MOST FAMILIAR SIGHTS OF STOCKHOLM.



INTERIOR VIEW OF LAMP TESTING LABORATOR

INTERIOR VIEW OF GROCERY STORE, SHOWING BUTCHER SHOP THROUGH GLASS DOOR.



COOPERATIVE COMMUNITY STORES NEAR STOCKHOLM

ESKIL SUNDAHL AND OLOF THUNSTRÖM, ARCHITECTS

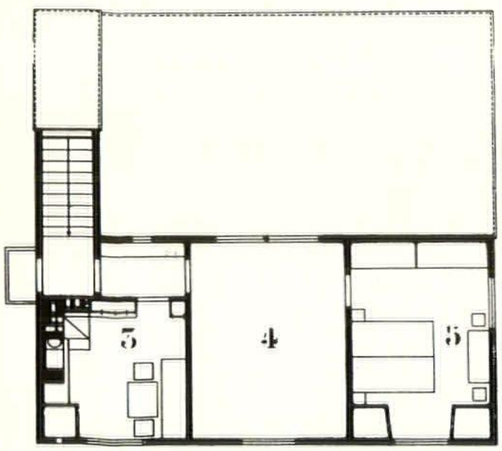
LEFT—FLOOR PLAN SHOWING GROUPING OF DEPARTMENTS: (1) BAKERY; (2) GROCERY; (3) BUTCHER SHOP; (4) MISCELLANEOUS; (5) STORAGE.

BELOW: EXTERIOR VIEW OF STORES FROM STREET WITH ENTRANCES TO EACH DEPARTMENT. APARTMENTS OF STOREKEEPERS ON SECOND FLOOR.

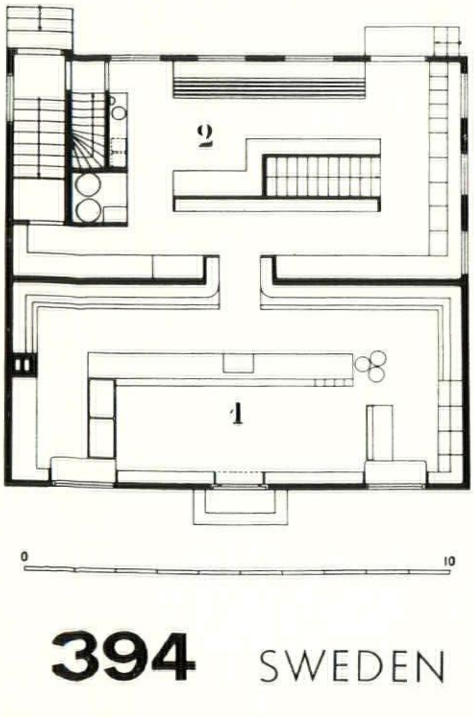
ERAL VIEW OF STORE

STANDARDIZED TYPE OF COOPERATIVE COUNTRY STORE

ESKIL SUNDAHL AND OLOF THUNSTRÖM, ARCHITECTS



SECOND FLOOR PLAN WITH APARTMENT OF MANAGER: (3) KITCHEN: (4) LIVING ROOM: (5) BEDROOM



FIRST FLOOR PLAN:
(1) STORE AND DISPLAY
(2) STORAGE ROOM

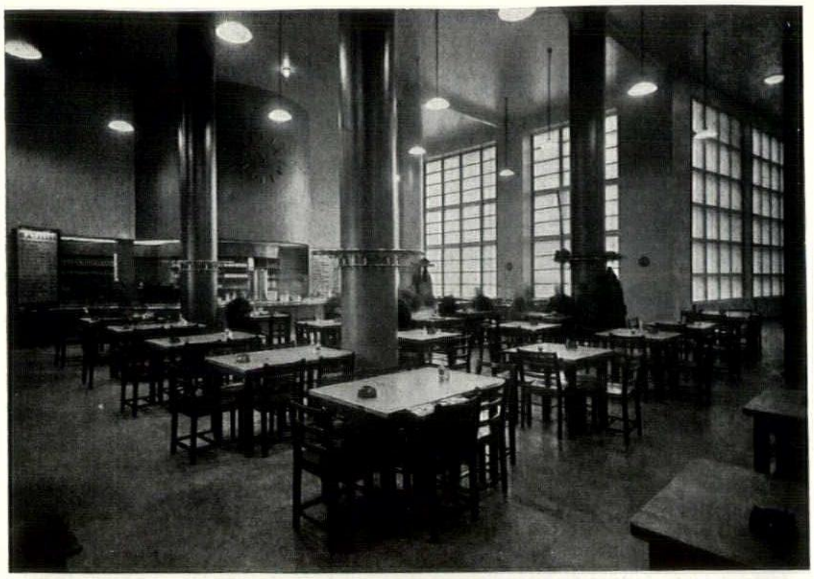
INTERIOR OF STORE

INTERIOR OF STORAGE ROOM

SWEDEN

A PUBLIC RESTAURANT HELSINKI, FINLAND

P. E. BLOMSTEDT, ARCHITECT

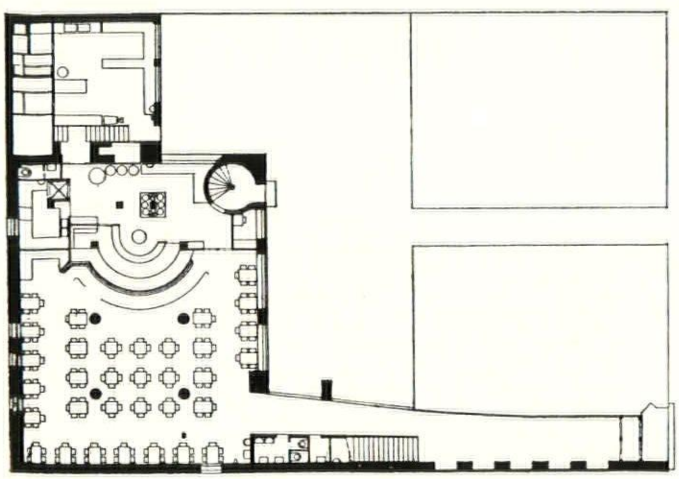


CAFETERIA DINING ROOM

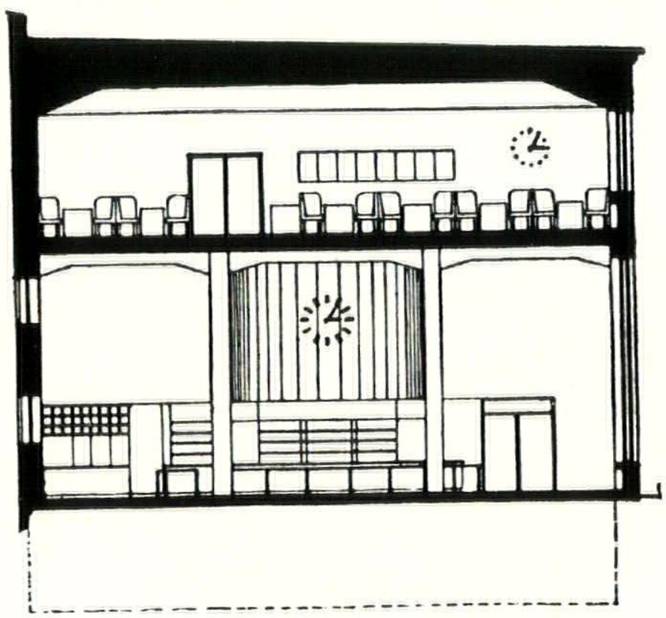
RESTAURANT SERVICE UPSTAIRS

Iffland Photos

PLAN



SECTION



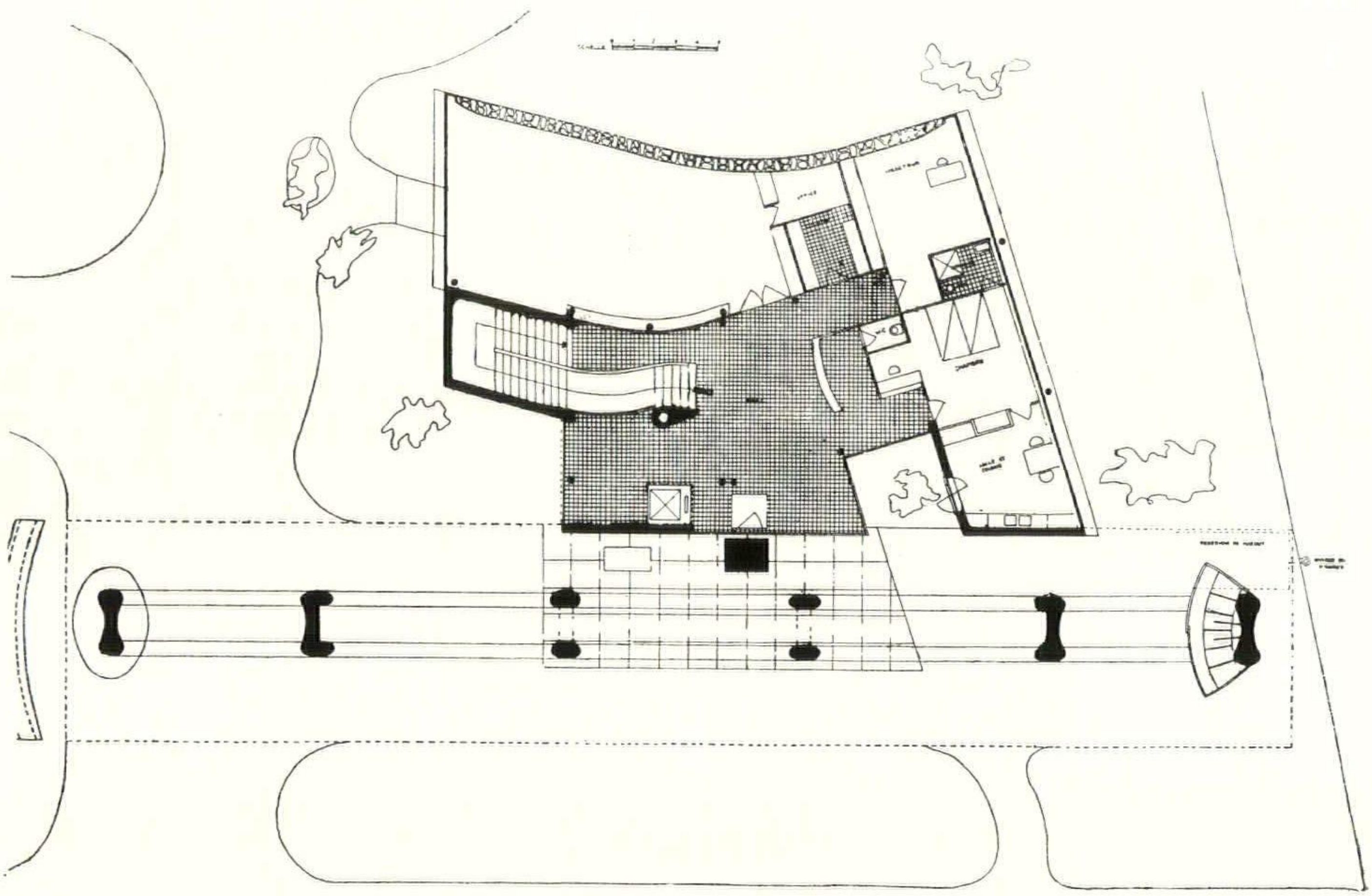
ffland Photos

COUNTER FOR CAFETERIA SERVICE
P. E. BLOMSTEDT, ARCHITECT

OPPOSITE PAGE—VIEW TOWARD CAFETERIA DINING ROOM

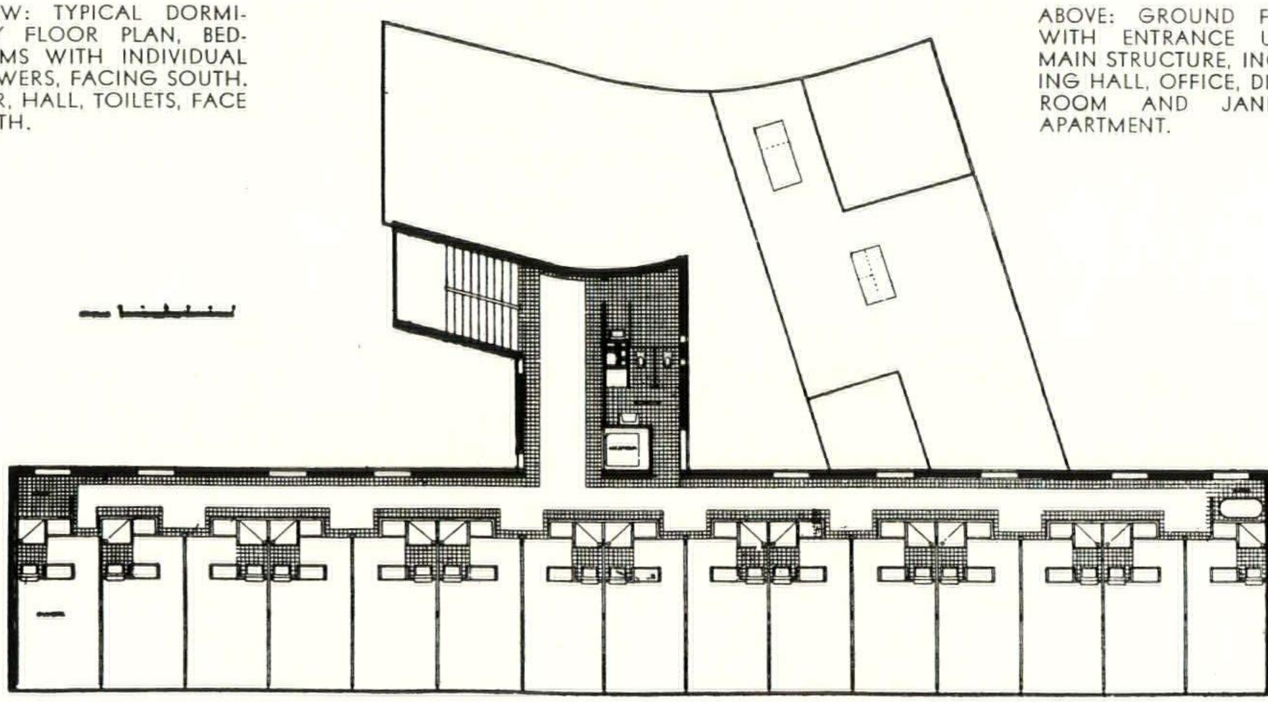
SWISS PAVILION, CITE UNIVERSITAIRE, PARIS

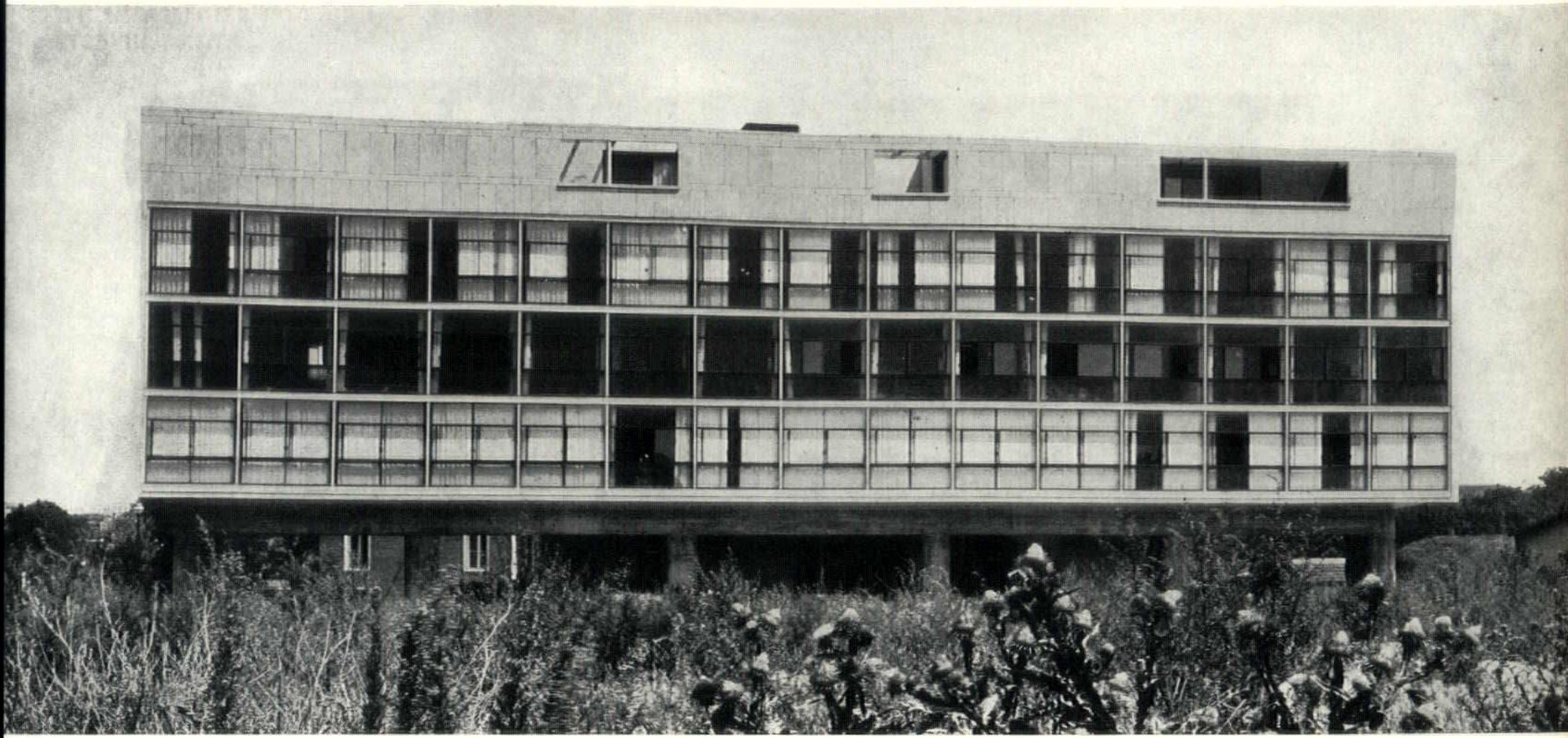
LE CORBUSIER AND P. JEANNERET, ARCHITECTS



BELOW: TYPICAL DORMITORY FLOOR PLAN, BEDROOMS WITH INDIVIDUAL SHOWERS, FACING SOUTH. STAIR, HALL, TOILETS, FACE NORTH.

ABOVE: GROUND FLOOR WITH ENTRANCE UNDER MAIN STRUCTURE, INCLUDING HALL, OFFICE, DINING ROOM AND JANITOR'S APARTMENT.





Gravot

SOUTH ELEVATION OVERLOOKING FUTURE ATHLETIC FIELD AND PARK. EACH GLASS-SQUARE REPRESENTS ONE BEDROOM WITH SUNLIGHT CONTROLLED BY BLINDS

SWISS PAVILION, CITE UNIVERSITAIRE, PARIS

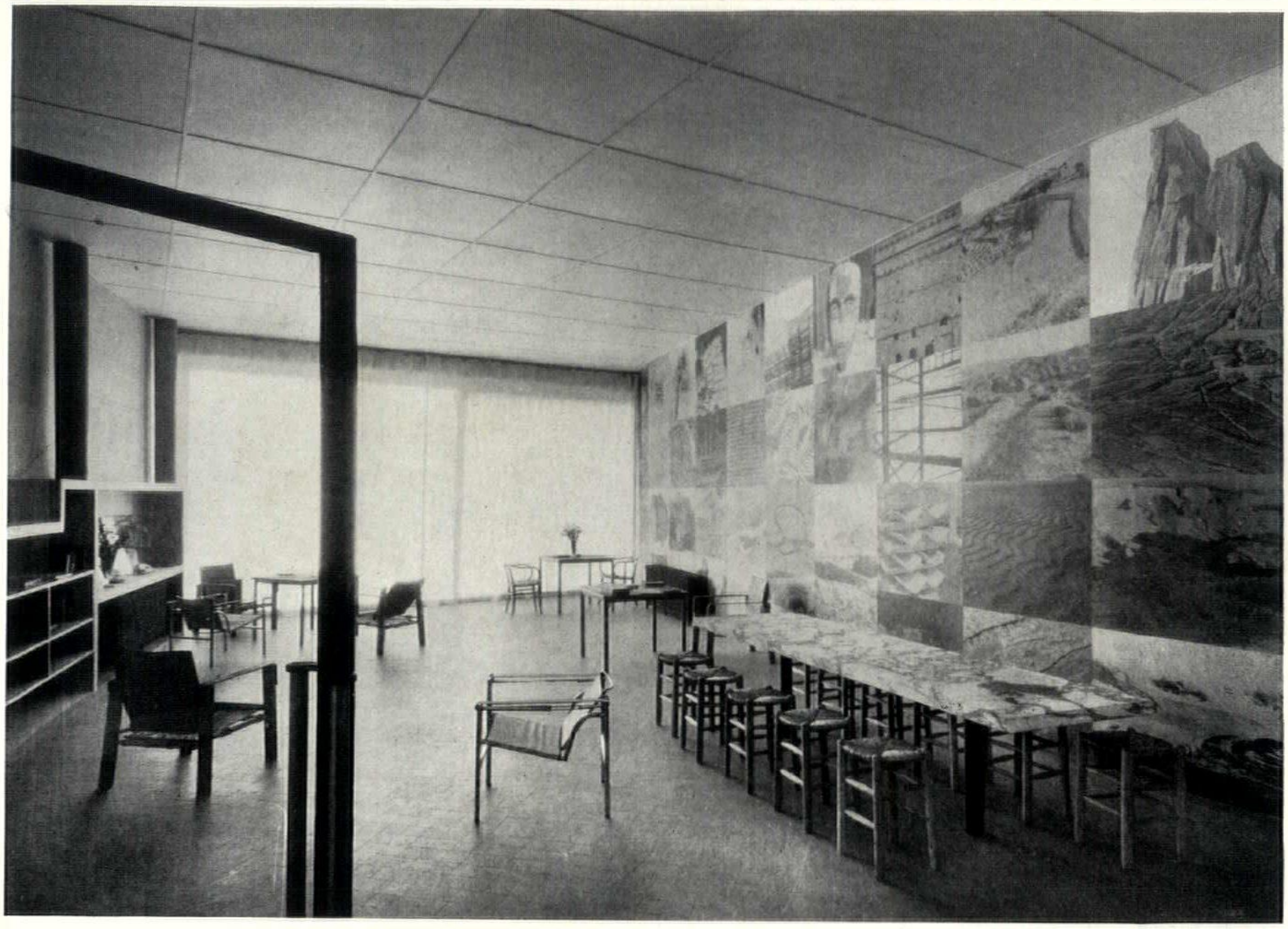
LE CORBUSIER AND P. JEANNERET, ARCHITECTS

The Cité Universitaire is a group of National Pavilions at the outer perimeter of Paris, providing shelter for students from all over the world who are studying in Paris. These pavilions were designed, with one exception, in national styles exhibiting architectural clichés of Greece, Germany, Holland, France, Cuba, United States, Argentine and Japan. Switzerland alone is represented by a thoughtfully designed structure with two clearly articulated units. The dormitory is four stories high, raised twelve feet above the ground on pairs of concrete columns. On the side facing the future athletic field of the Cité Universitaire, the lower three stories are faced entirely with glass. The remainder of the building is faced, excepting for minor fenestration, with precast concrete slabs. The columns support, by cantilevers, a concrete slab on which the superstructure rests. The footings for the columns extend down to a depth as great as the height of the building. This was a structural necessity because the building was erected on filled ground, over a stone quarry. The second unit contains commons' rooms, offices for the director, a library, and a caretaker's apartment. The stair-well provides vertical circulation by elevator and stairways with the outer wall entirely of structural glass. The building is of interest because it exemplifies an extensive use of dry construction with prefabricated materials, including cast concrete wall units, glass blocks and partition sections. Color was employed to differentiate the control and use of rooms by student groups from counties of Switzerland.

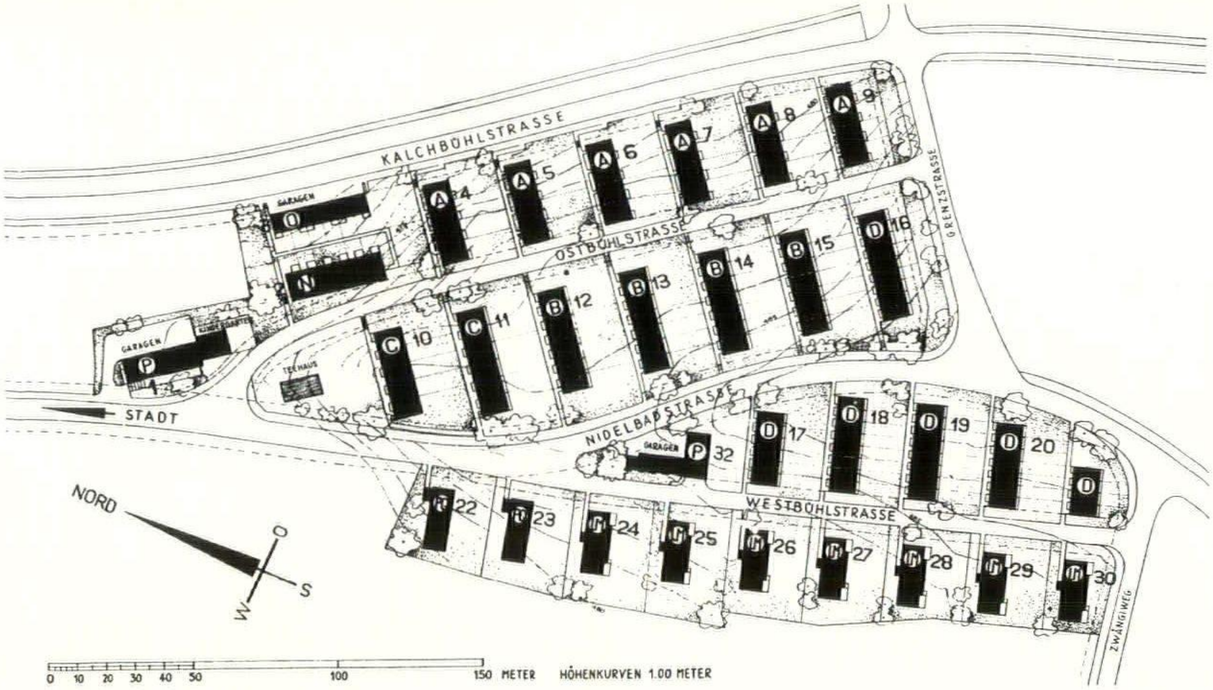
SWISS PAVILION — CITE UNIVERSITAIRE, PARIS. LE CORBUSIER AND P. JEANNERET, ARCHITECTS

VIEW OF CONCRETE COLUMNS SUPPORTING PAVILION. CARETAKER'S APARTMENT TO THE RIGHT.

SIDE VIEW, SHOWING GARDEN EXTENDING UNDER BUILDING. BLANK END WALL OF PAVILION AND AT LEFT, STAIR-TOWER FACED WITH STRUCTURAL GLASS BRICK.



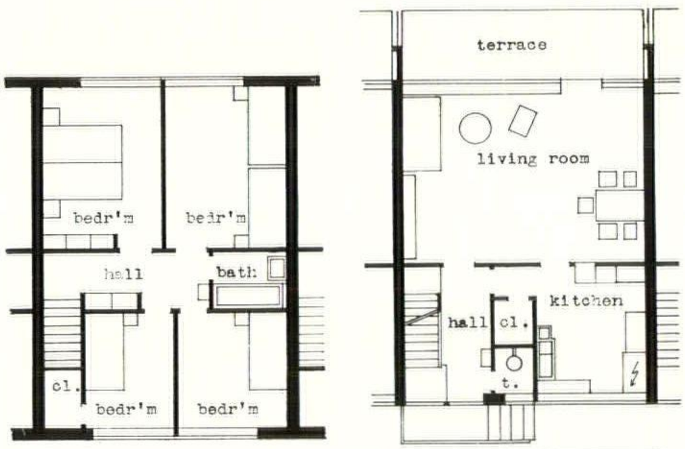
DINING AND READING ROOM. SLIDING GLASS DOORS AT END OPENING TO THE GARDEN. PHOTOMURAL ON WALL TO THE RIGHT. DINING TABLE OF MARBLE SLAB SUPPORTED BY TWO POSTS. CEILING OF ACOUSTICAL TILE. **BELOW:** SHELTERED TERRACE FOR SITTING AND READING. ENTRANCE TO HALL AT RIGHT.



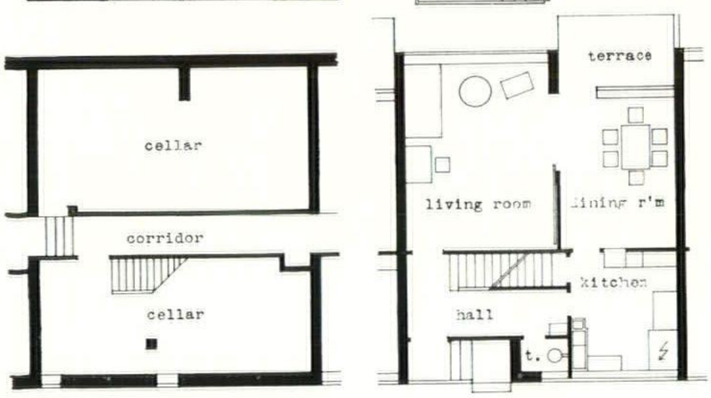
Bauwelt

PLOT PLAN OF "NEUBUEHL," ZURICH

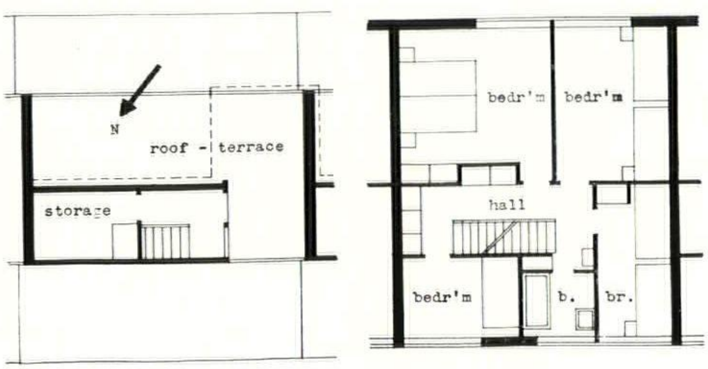
Buildings are oriented so as to receive sun on two or more sides.



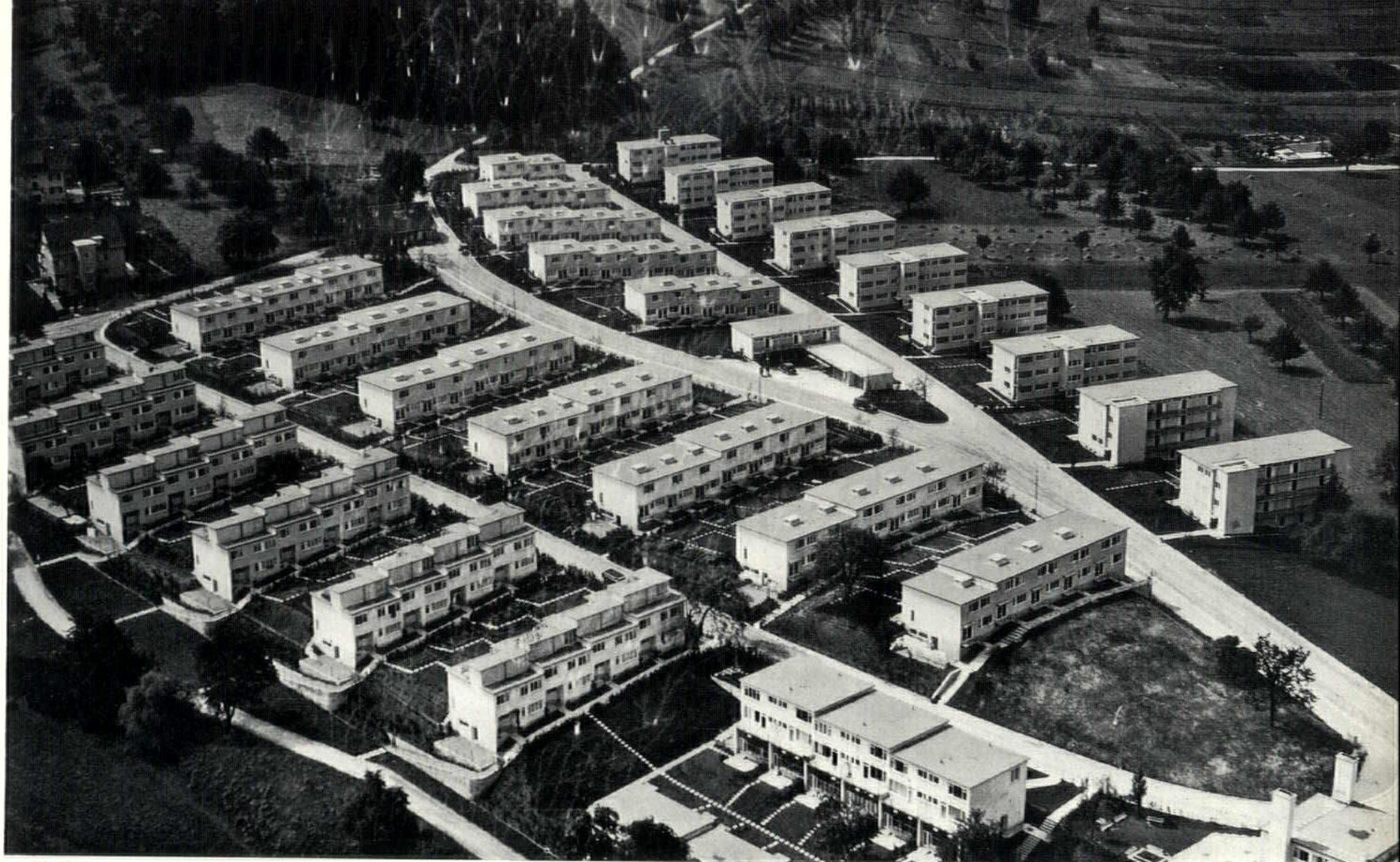
FIRST AND SECOND FLOOR PLANS OF TYPE C



BASEMENT AND FIRST FLOOR PLANS OF TYPE A



SECOND AND THIRD FLOOR PLANS OF TYPE A



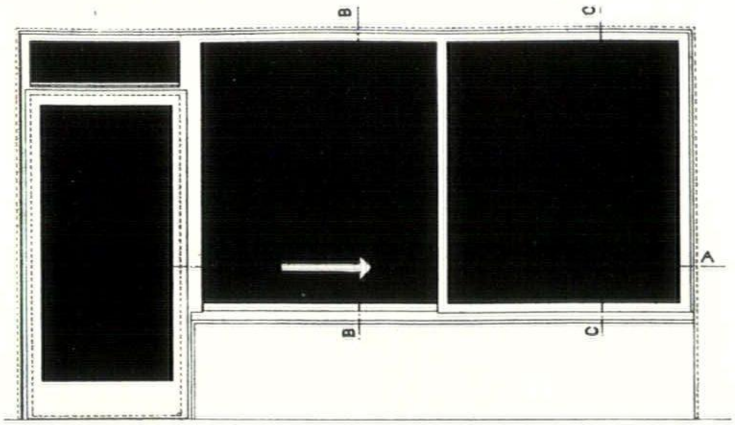
Ad Astra

HOUSING DEVELOPMENT, "NEUBUEHL," ZURICH

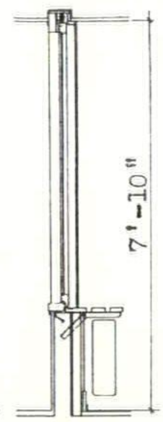
ARTARIA AND SCHMIDT, HUBACHER AND STEIGER, M. E. HAEFELI,
W. M. MOSER, AND ROTH, ARCHITECTS

This development applied the results of a survey on required living accommodations in the erection of about 200 apartments and dwellings. It is situated on a hill slope and the houses are arranged so as to give full advantage of the views towards the lake and the city. Seven architects of the younger generation cooperated in the planning and execution of the development. The houses are intended for employees of moderate income. The only luxury permitted was the use of large plate glass windows, which slide easily in horizontal direction and give an unobstructed view and admit a maximum of light, sun and air. To eliminate supports in these window openings, the reinforced concrete floors span the entire width of the row houses, from one party wall to another. The walls themselves are built of large-size hollow tile blocks. Where the row houses are built on sloping ground their flat roofs are stepped down and used as roof terraces. All flat roofs are drained towards the inside of the houses. This prevents down-spouts from freezing. Economical requirements of modern housekeeping and living were considered for size and arrangement of rooms. There are large living rooms that open on garden terraces or balconies. There are also service rooms of minimal size and straight stairways in single runs from floor to floor. The whole development is heated by a central hot-water heating plant. The supply conduits run through the basement of the houses and are accessible for repairs. The architects also supervised the decorating and furnishing of apartments.

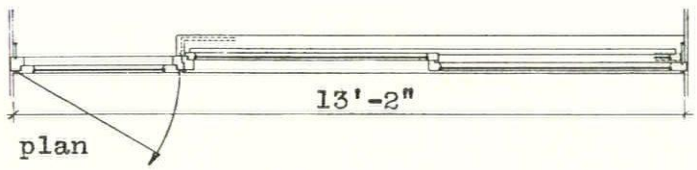
HORIZONTALLY SLIDING PLATE GLASS WINDOW FOR LIVING ROOMS OF "NEUBUEHL" HOUSING DEVELOPMENT. GLAZED DOOR USED AS ENTRANCE FROM TERRACE.



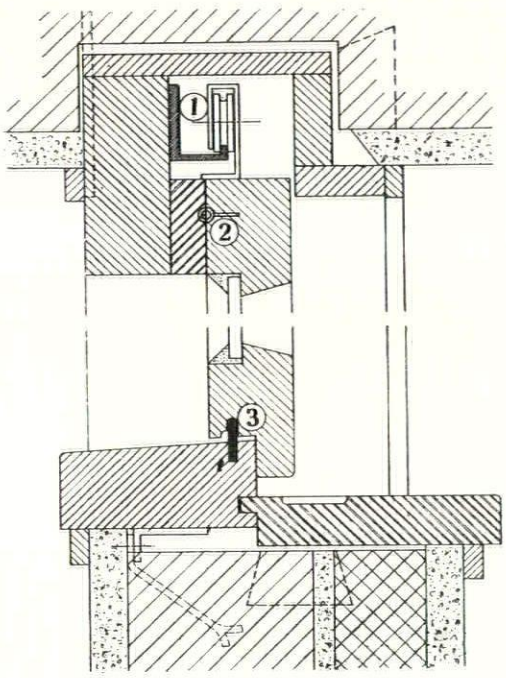
exterior elevation



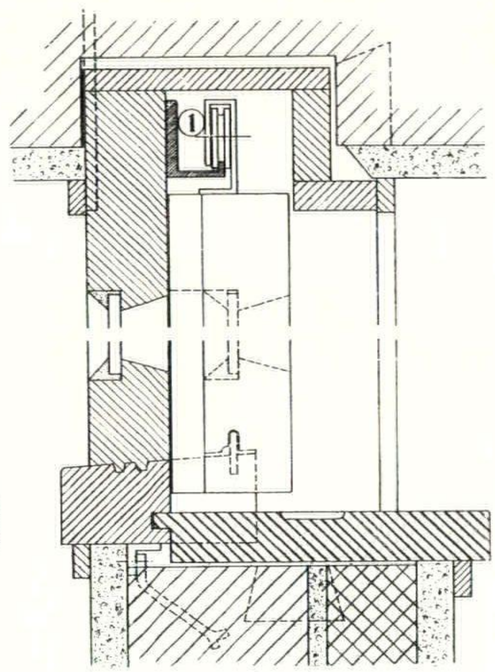
section



plan

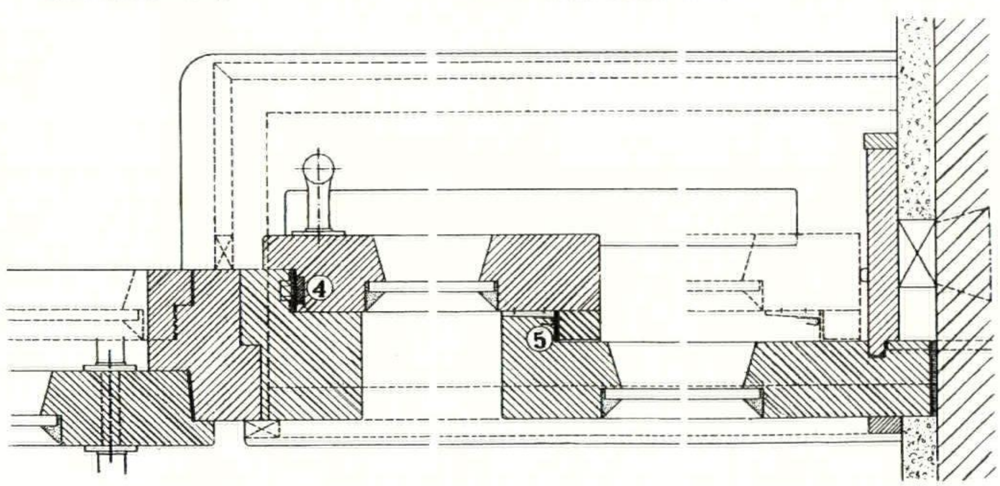


section B-B



section C-C

1 Track with overhead rollers.
2 Rubber gasket to insure watertight and airtight connection.
3 Guide rail at sill.



section A-A

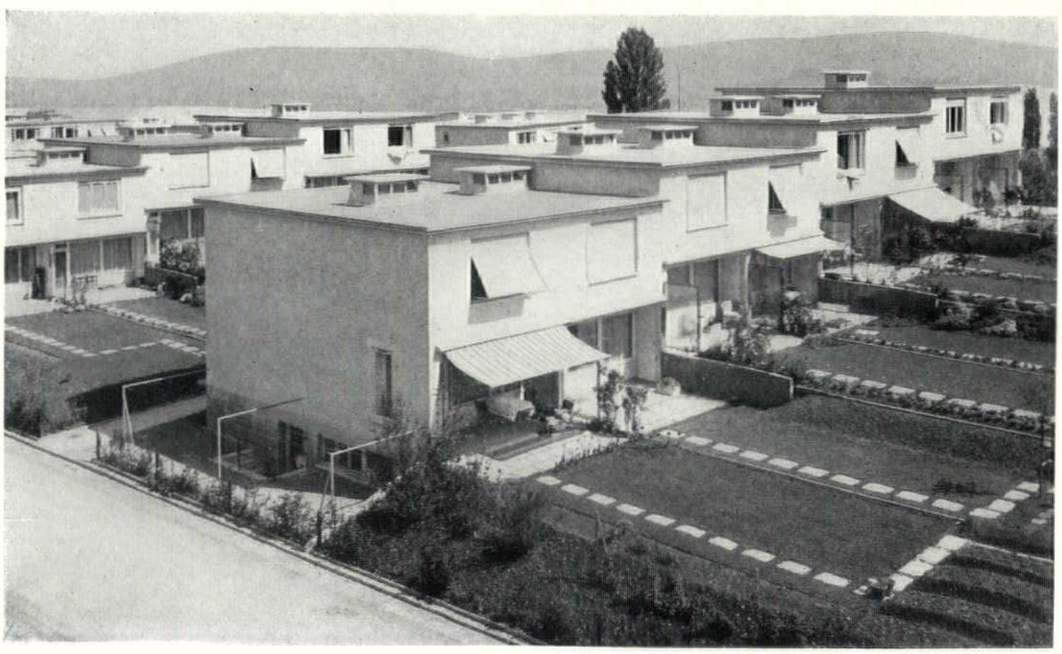
Bauwelt

4 Hardware of refrigerator type used for tight fastening.
5 Rubber gasket with spring.

VIEW OF GARDEN PORCHES ACCESSIBLE FROM LIVING ROOM

HOUSING DEVELOPMENT, "NEUBUEHL," ZURICH

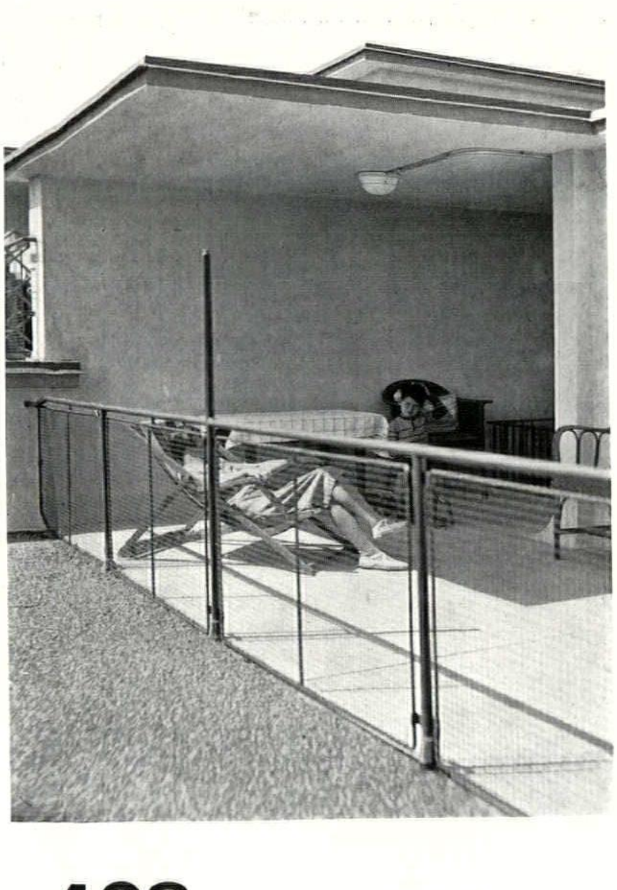
ARTARIA AND SCHMIDT, HUBACHER AND STEIGER, M. E. HAEFELI, W. M. MOSER, AND ROTH, ARCHITECTS



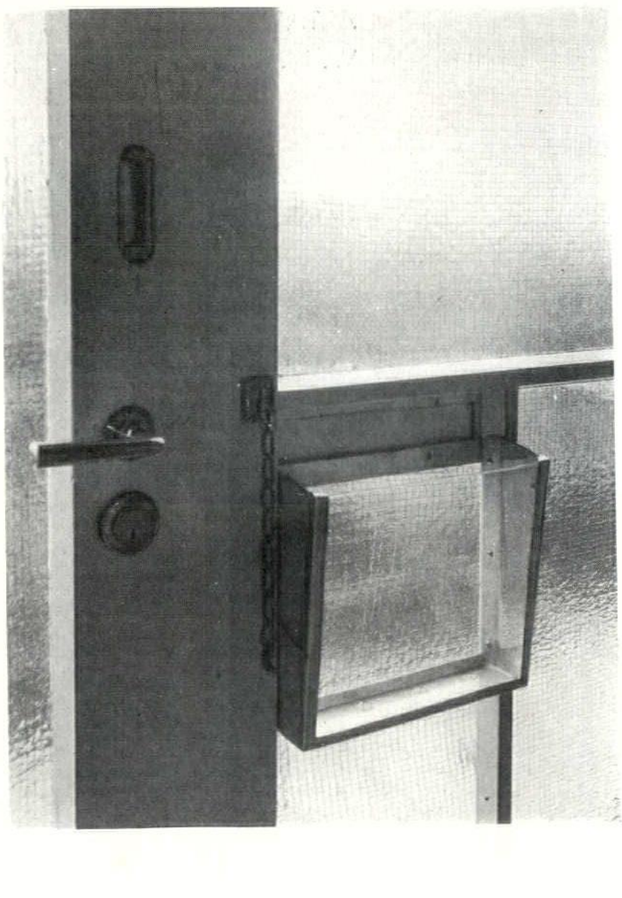
SOUTH VIEW OF HOUSING ROWS

FRONT ENTRANCES

ROOF TERRACE

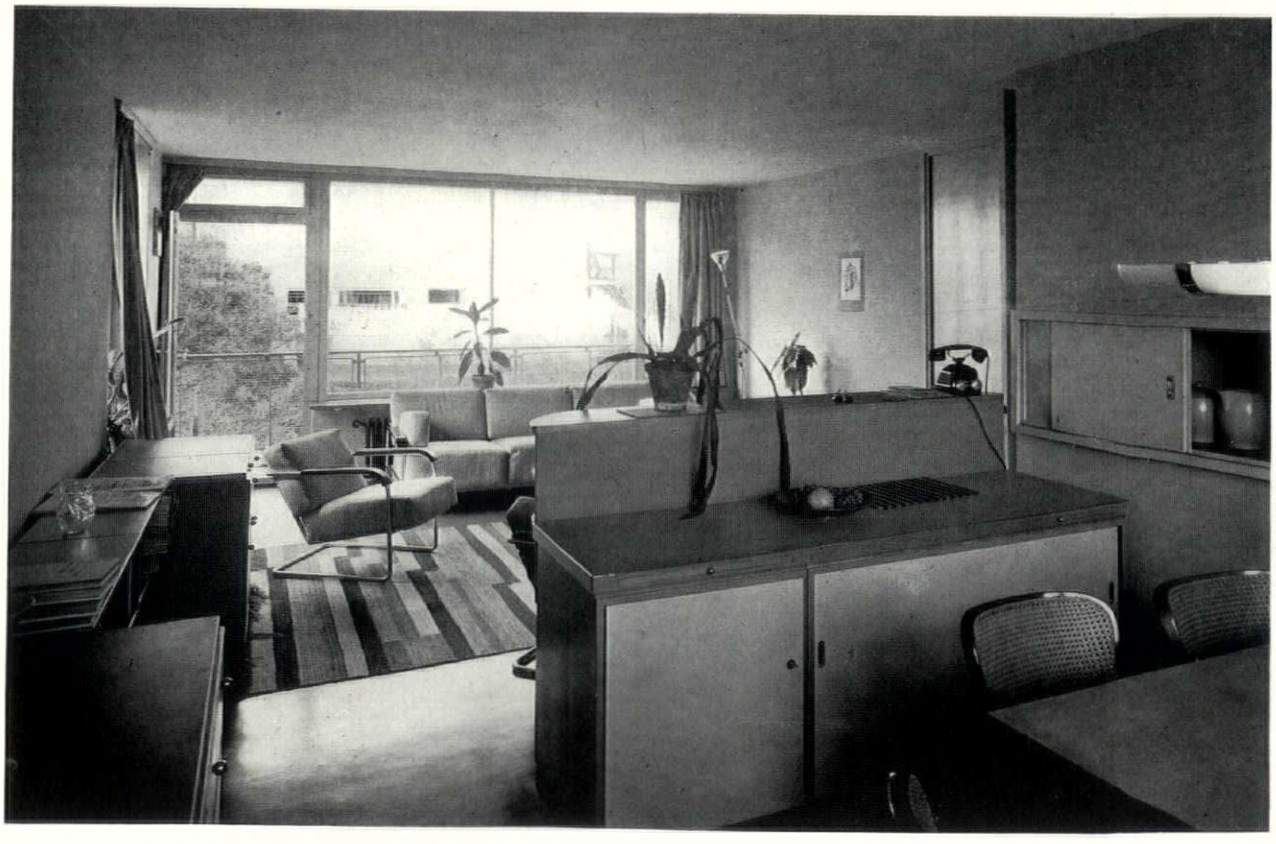


MAIL BOX AS PART OF ENTRANCE DOOR



LIVING ROOM

LIVING-DINING ROOM



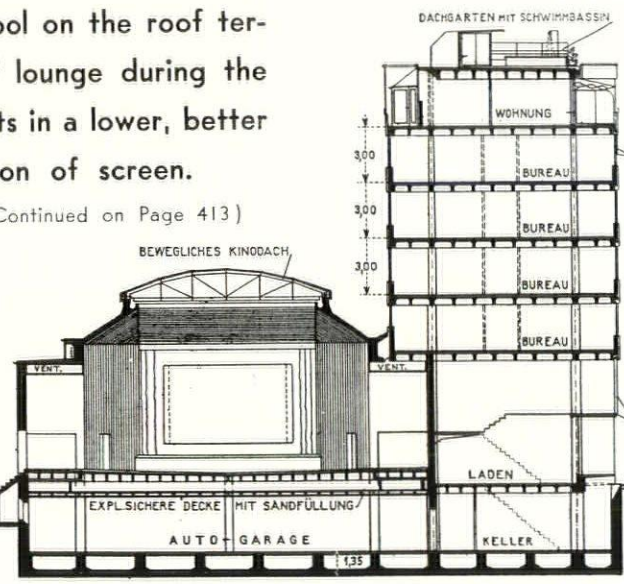
THE Z-BUILDING, ZURICH

CONTAINING OFFICES, STORES, MOVIE THEATER, RESTAURANT, APARTMENTS, GARAGE AND SWIMMING POOL

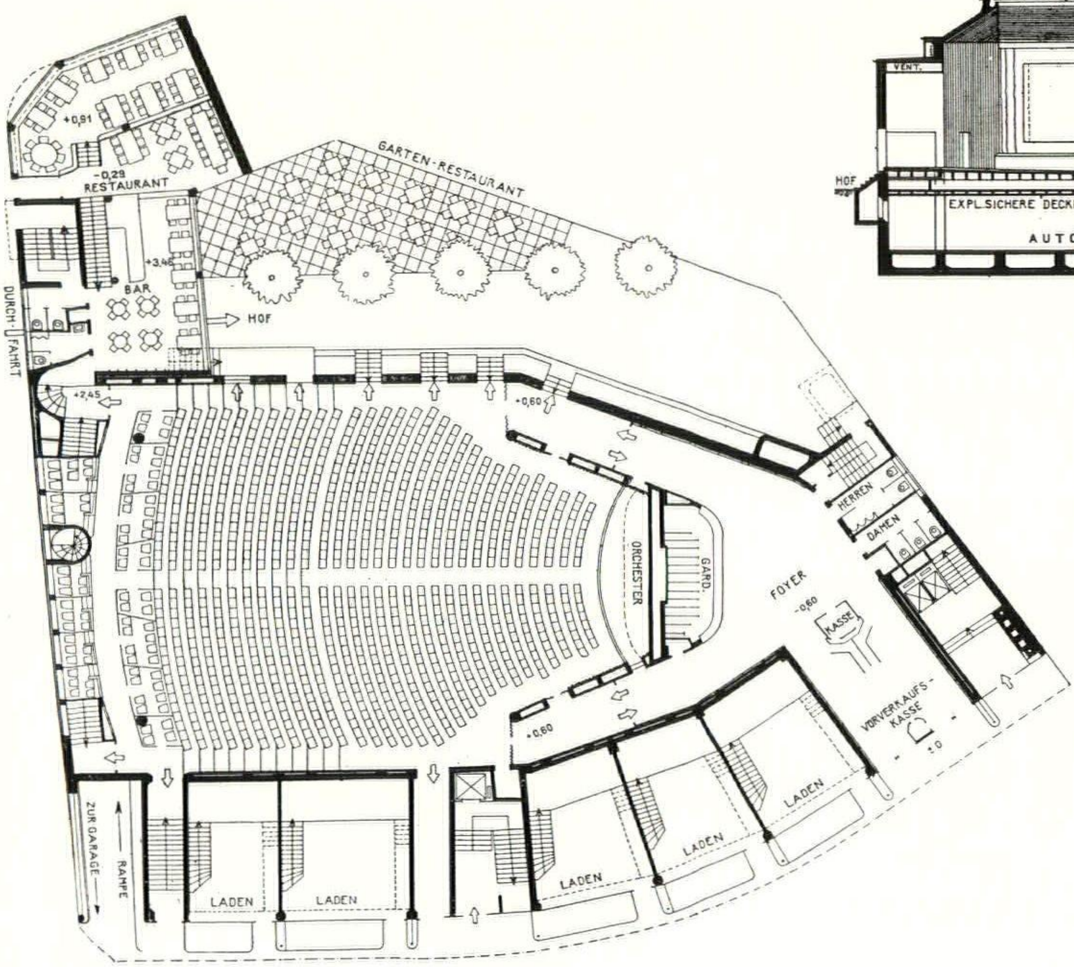
HUBACHER AND STEIGER, ARCHITECTS

The design of this building offered difficulties on account of the small and irregular shaped plot. It was necessary to obtain a good arrangement for building elements of diverse character. The supporting structure is of reinforced concrete. In the office and store building the floors are cantilevered over the columns, which permits continuous windows for display or working. This system also reduced the number of supports and made possible other economies through the balancing of the floor loads. The apartments at roof level are accessible from an open, but covered passage. This open gallery facilitates cross ventilation of the apartments. They are provided with balconies. Tenants of apartments are permitted use of a swimming pool on the roof terrace. The office employees make use of an open-air roof lounge during the lunch hours. The movie theater has no balcony. This results in a lower, better proportioned room, good acoustics and favorable position of screen.

(Continued on Page 413)



SECTION

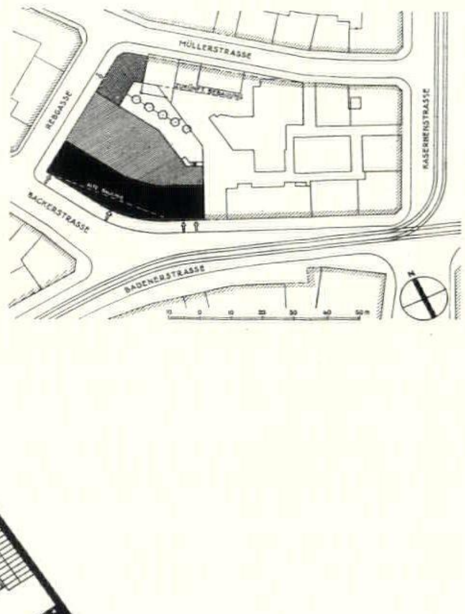


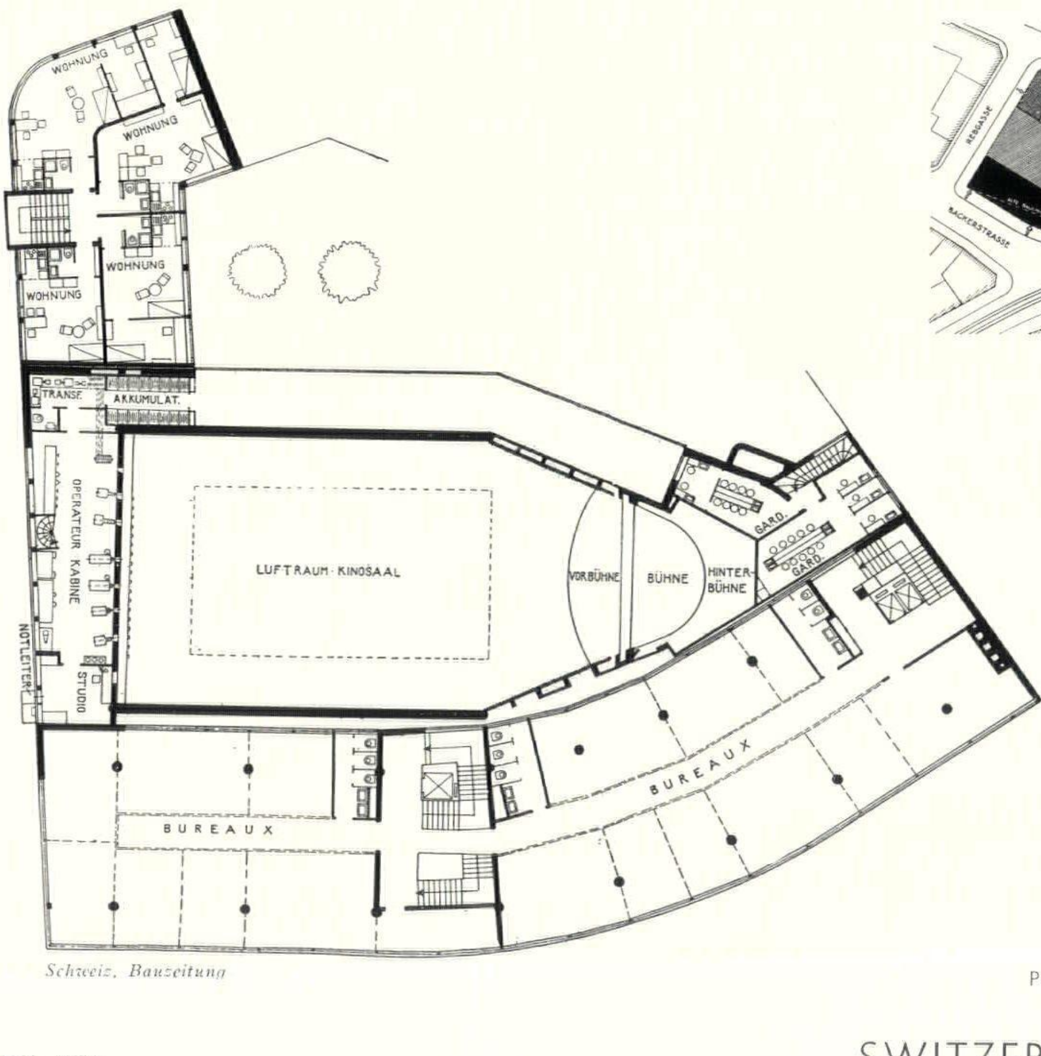
Schweiz. Bauzeitung

GROUND FLOOR PLAN

EXTERIOR VIEW

PLOT PLAN

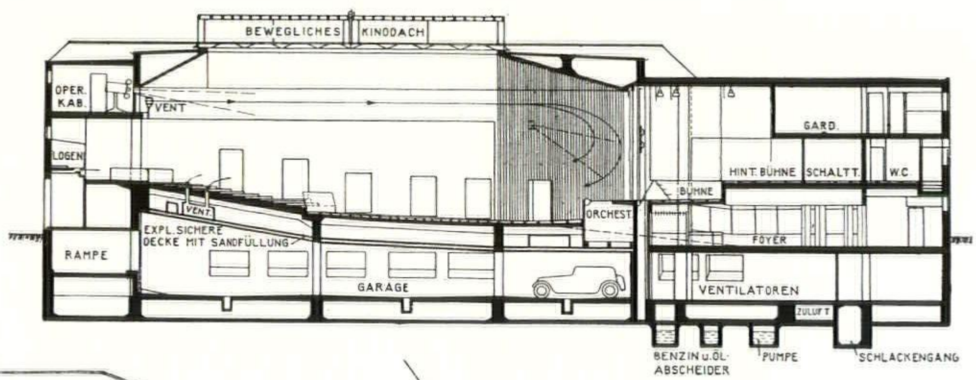




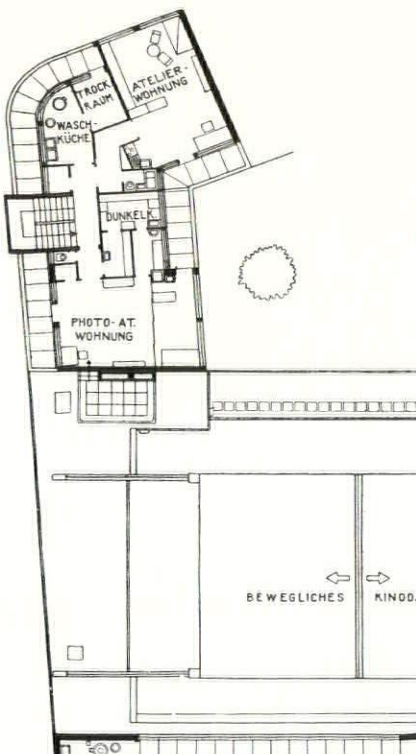
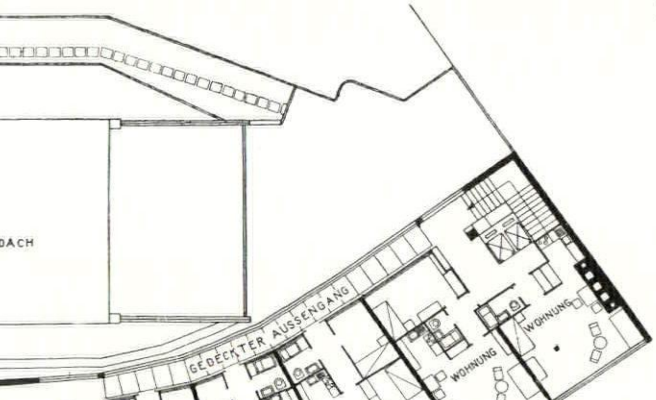
Schweiz. Bauzeitung

PLAN AT OFFICE FLOOR LEVEL

THE ROOF OVER THEATER IS MOVABLE AND TWO PARTS OF THIS ROOF CAN SLIDE BACK SO AS TO OPEN THE THEATER TO THE SKY.

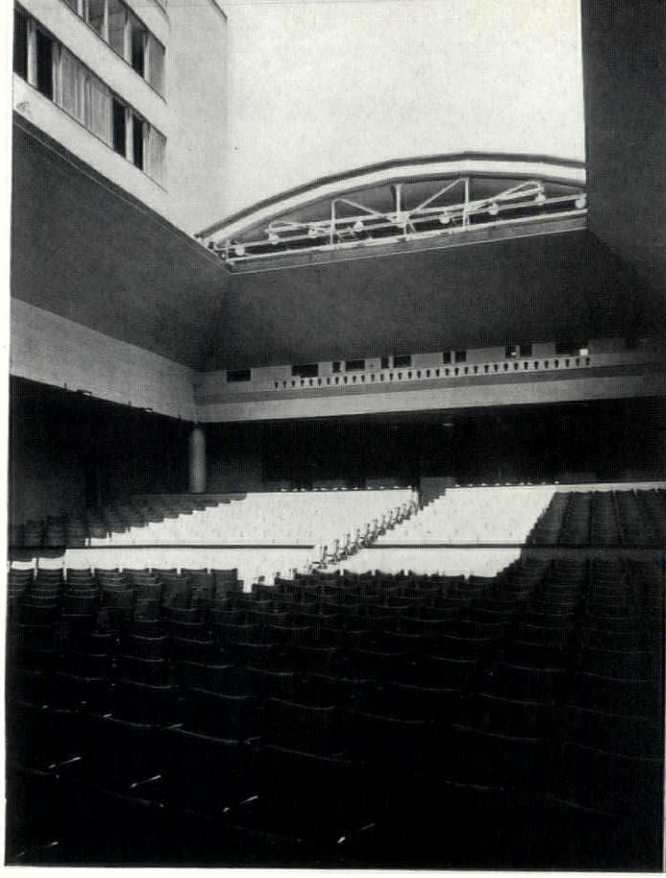


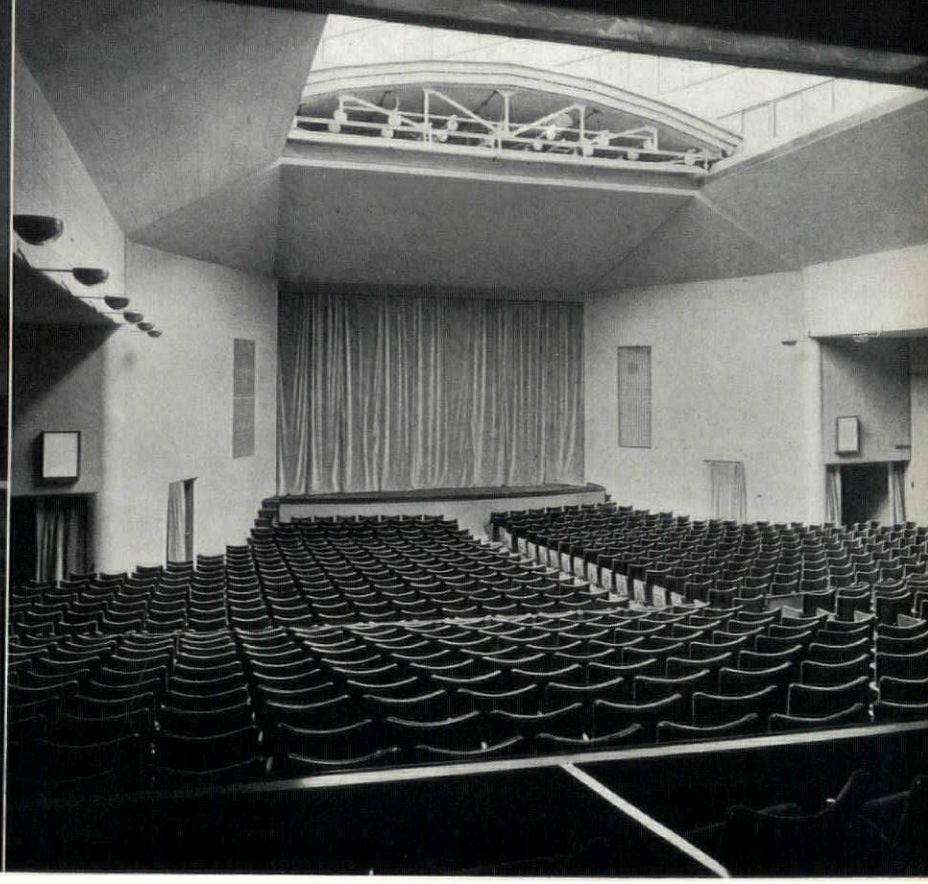
SECTION THROUGH THEATER

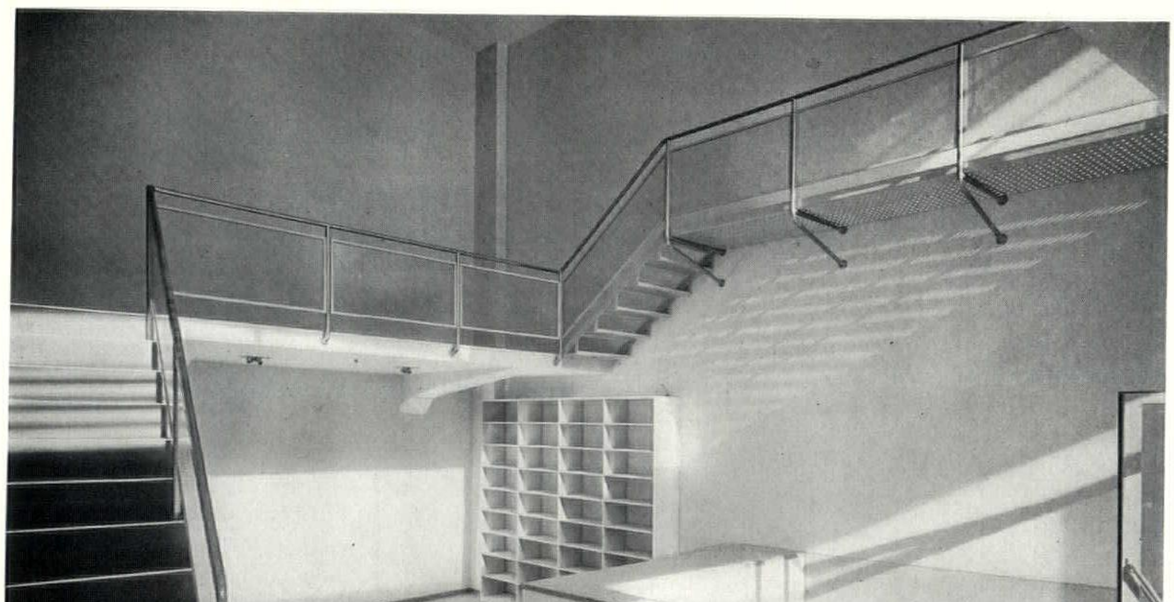
APARTMENT FLOOR PLAN

Schweiz. Bauzeitung





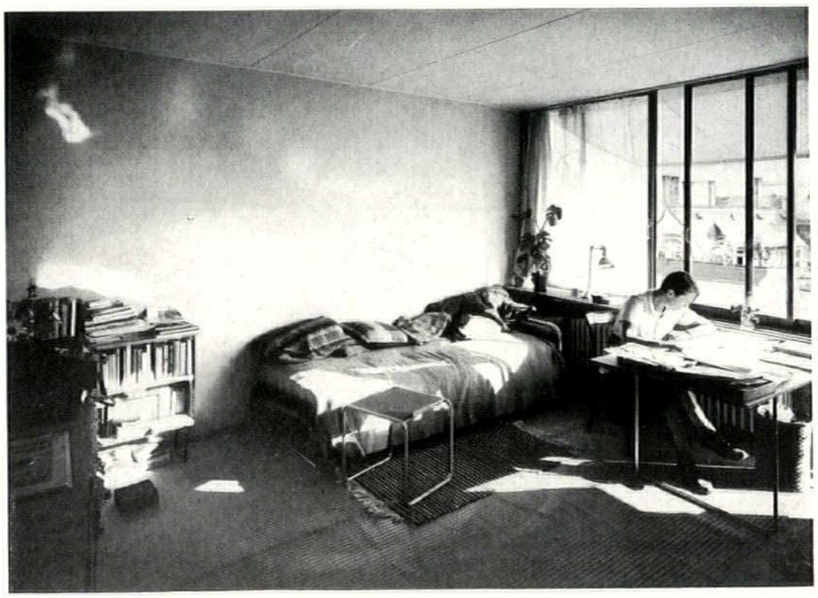
Ceilings are surfaced with Celotex acoustical tile. The roof over theater is movable and two parts of this roof can slide back so as to open the theater to the sky. This feature supplements the air conditioning when complete change of air is desired. The restaurant is built over a limited area and to gain space it has three successive levels. The highest part is directly connected with the theater. The restaurant



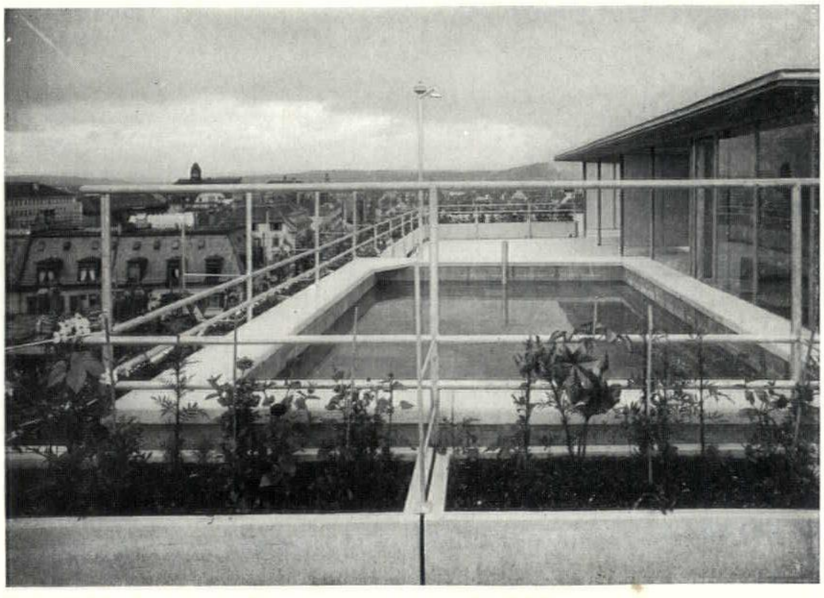
INTERIOR OF TYPICAL STORE

LEFT: Z-BUILDING, ZURICH, SHOWING THE RESTAURANT. BELOW: INTERIOR VIEW OF APARTMENT, SITUATED AT ROOF LEVEL. ENTRANCE TO THESE APARTMENTS IS BY AN OPEN GALLERY.

is supplied by a completely electrified kitchen. The garage is situated under the theater with an explosion-proof ceiling. Windows are horizontally sliding and of steel. Exterior walls are covered with synthetic stone slabs. Built-up roofing is graveled,



RIGHT: RESTAURANT INTERIOR WITH DINING TERRACE OUTSIDE.
BELOW: A SWIMMING POOL FOR EMPLOYEES IS SITUATED ON THE ROOF.



and protected by concrete tiles on terraces. Bright colored awnings built in the window lintels provide the large glass areas with shade in summer and add a cheerful note to the simplified architecture.

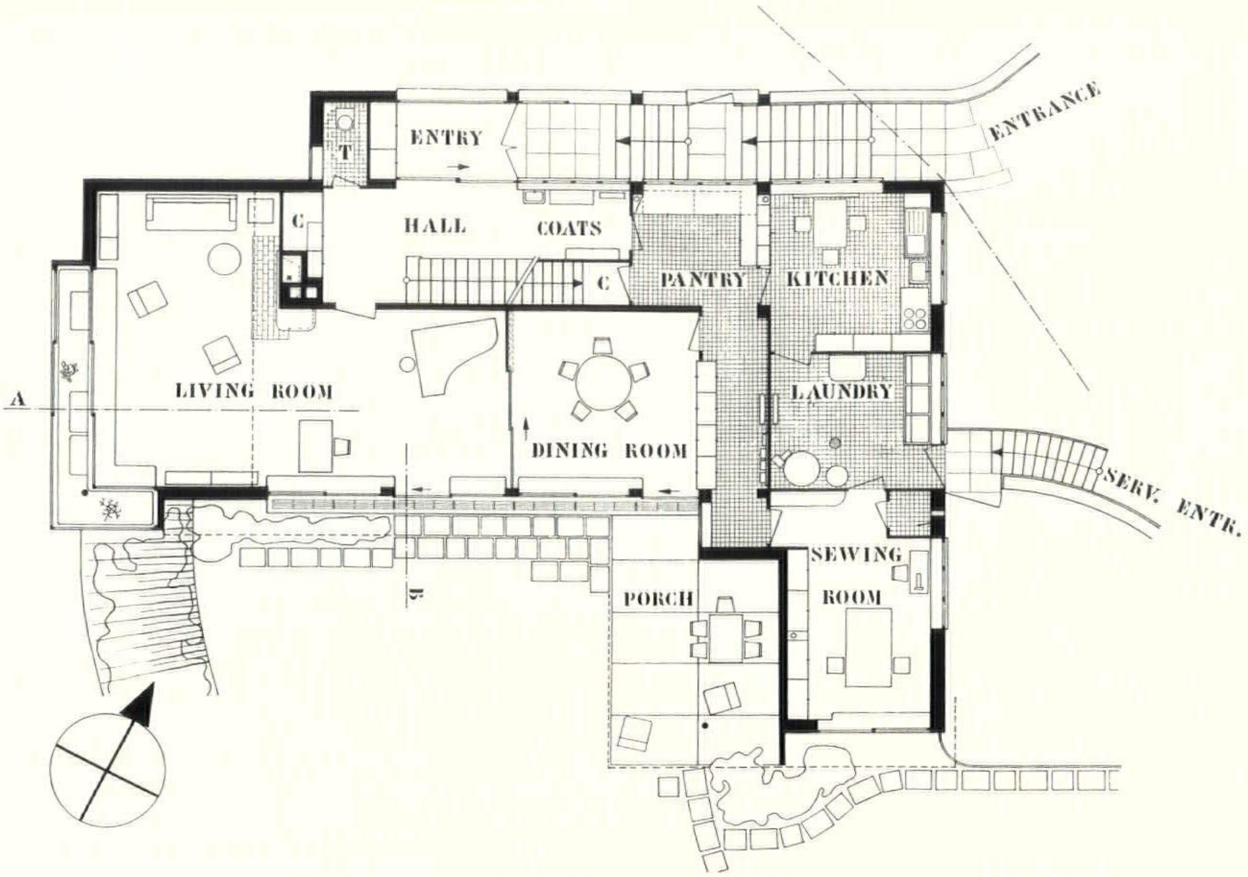
HOUSE NEAR ZURICH

M. E. HAEFELI, ARCHITECT

This house intended for a family with children is situated on a hillside overlooking the Lake of Zurich. Views from the living room and good exposure of the bedrooms were regarded essential in the plan layout. Large terraces for living and sleeping are accessible from all rooms, and connect the house with the natural surroundings. Horizontally sliding plate glass windows favor a perfect view of the outside and admit adequate air, light and sun. The large corner window of the living room commands a sweeping view. This window is formed of two sheets of glass a few feet apart to serve the double purpose of a conservatory and for better insulation. Accommodations and requirements for the favorable

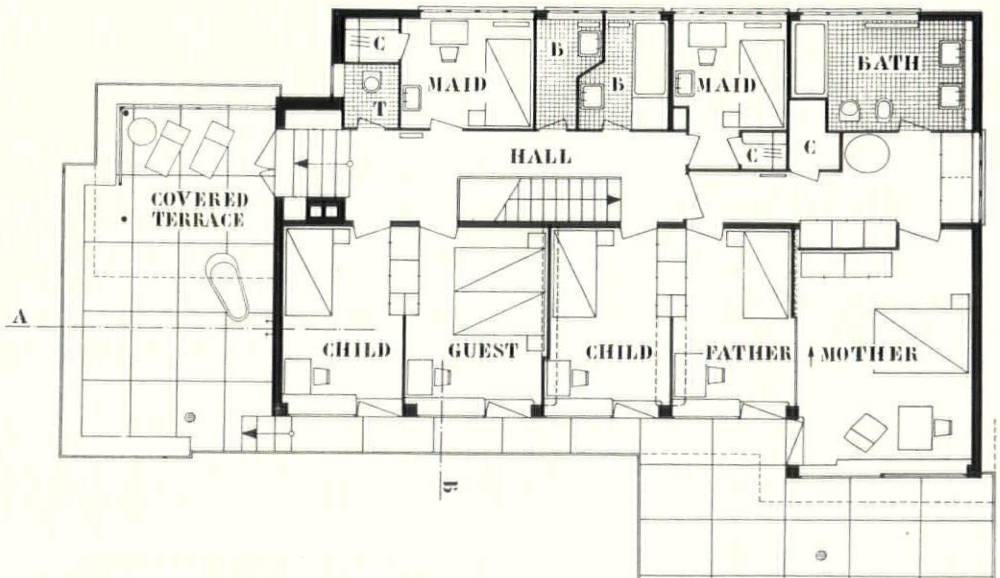
VIEW FROM SOUTH

Finsler



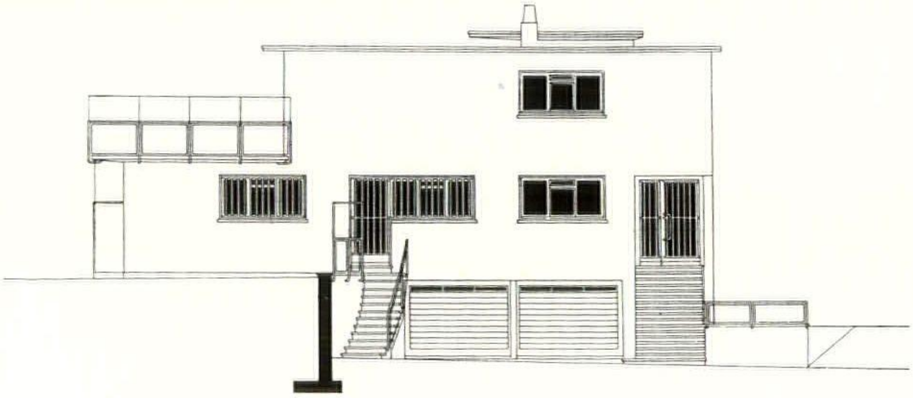
FIRST FLOOR PLAN

development of children have been considered in the provision of indoor and outdoor play spaces, safe balcony guards and so on. The house is completely fireproof, being built of reinforced concrete, steel and hollow tile blocks, stuccoed on the outside and plastered inside. Light buff, blue and green were chosen as colors known to be cheerful and restful to the eye. Interior walls have washable surfaces.

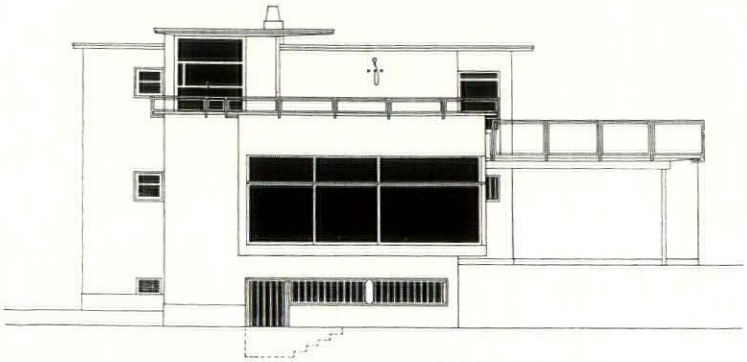


SECOND FLOOR PLAN

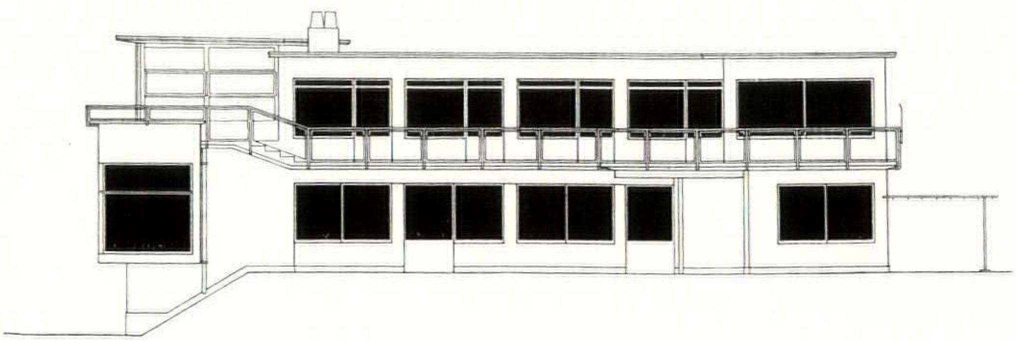
THE ENTRANCES ARE AT NORTHEAST SIDE OF HOUSE. THE MAIN ENTRY IS THROUGH GARDEN AND THERE IS DIRECT ACCESS FROM GARAGE, UNDER HOUSE, TO ENTRANCE STAIRWAY SHOWN AT RIGHT.



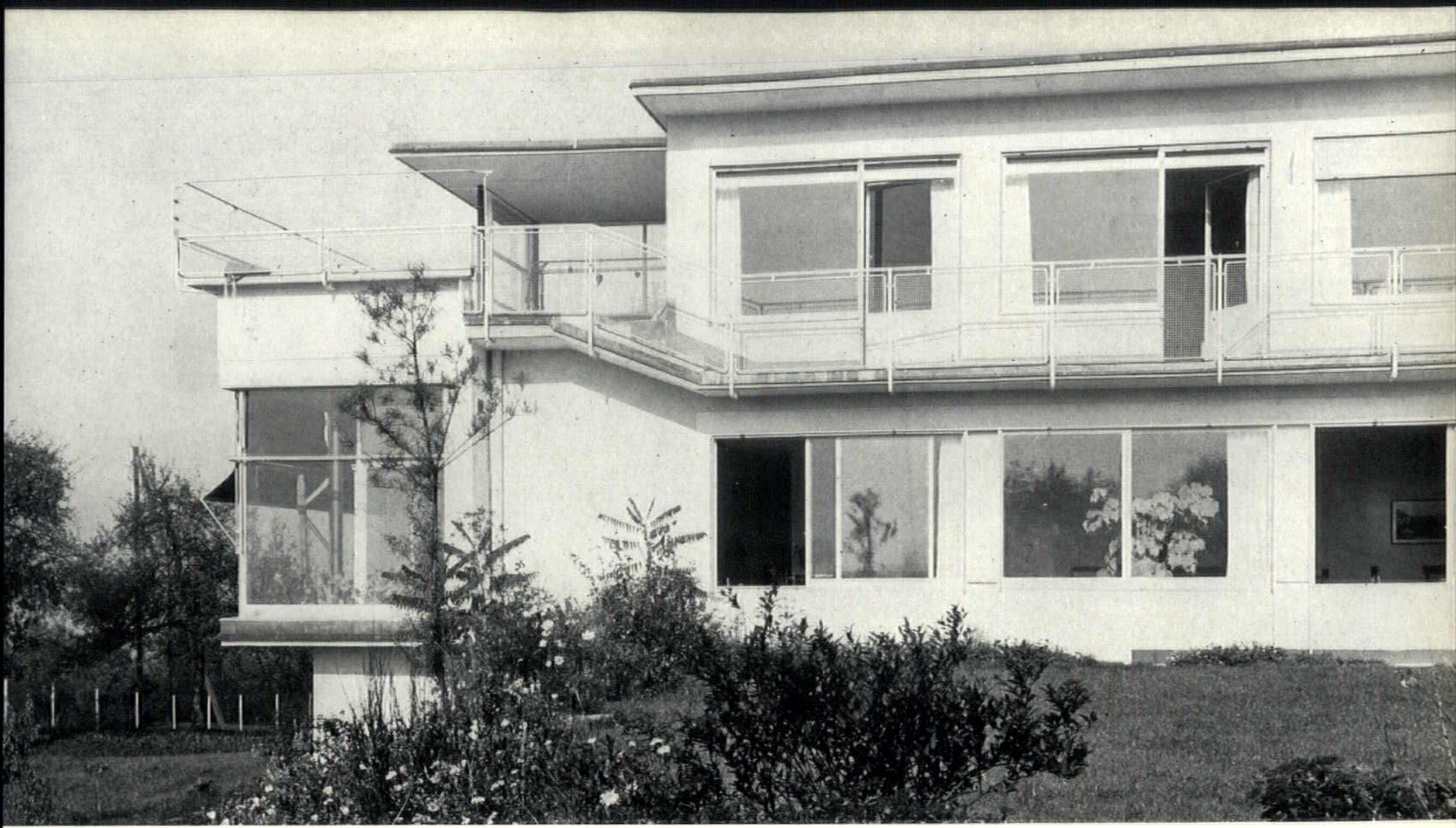
NORTHEAST ELEVATION



SOUTHWEST ELEVATION

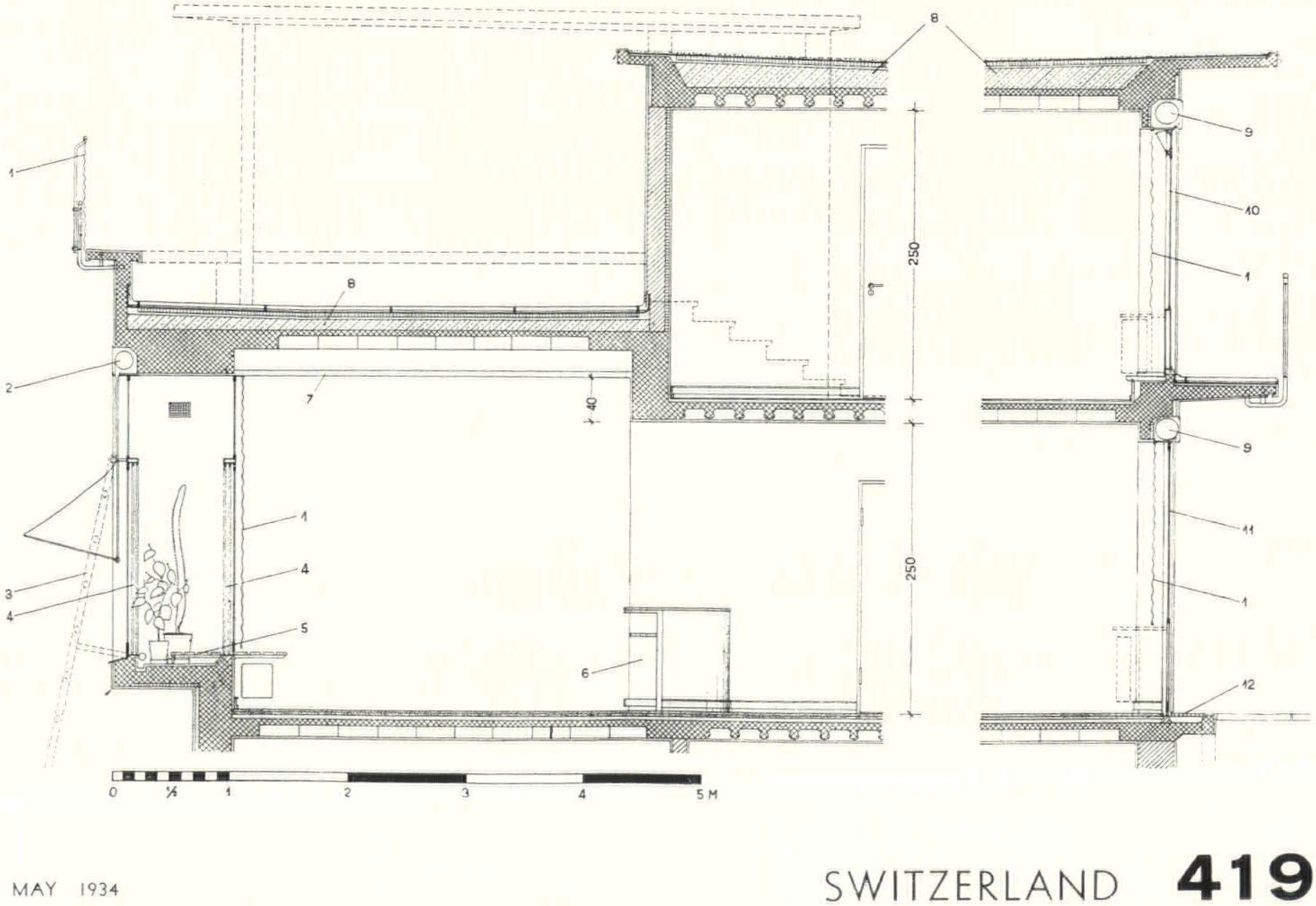


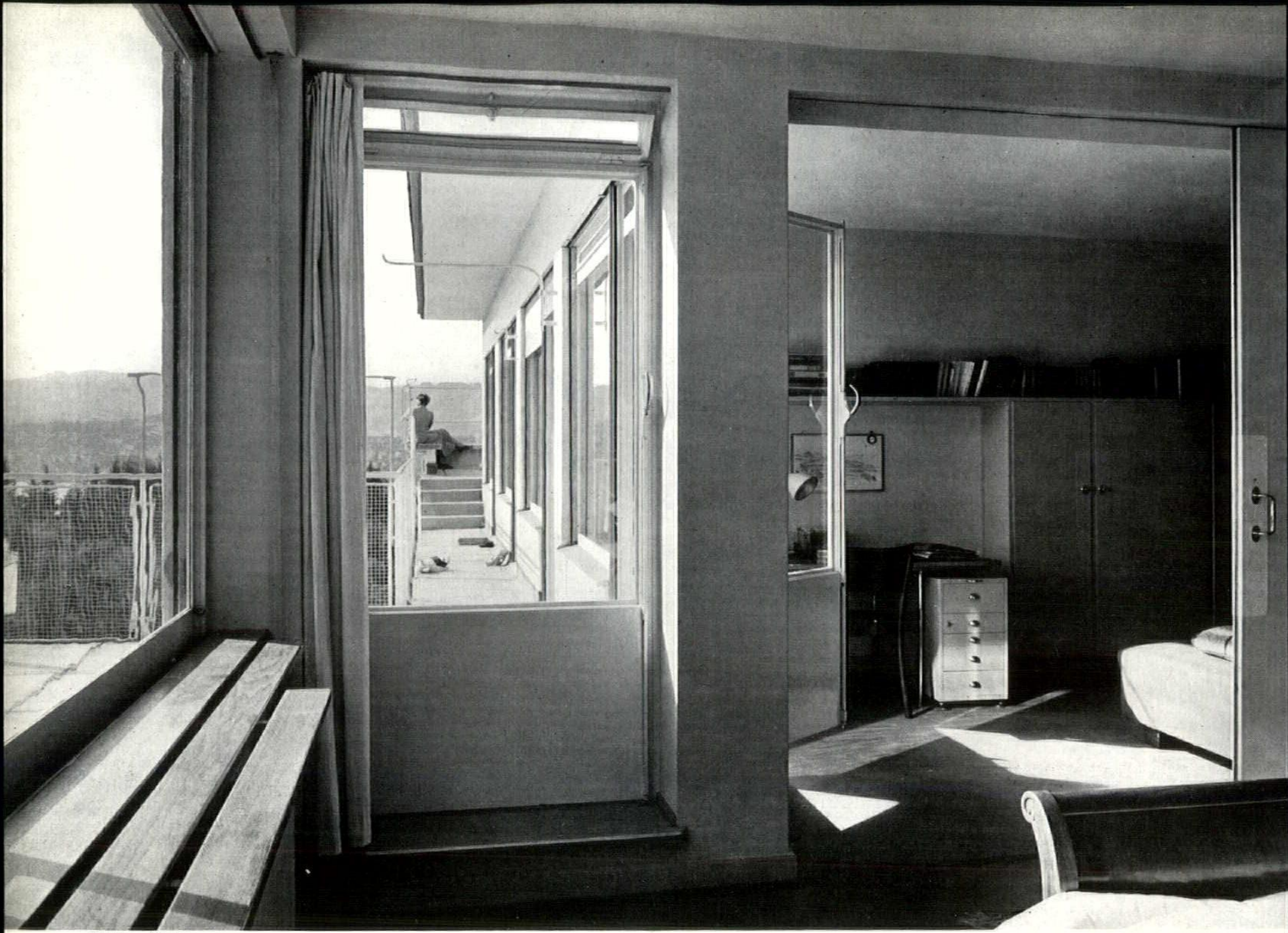
SOUTHEAST ELEVATION



Finsler Photos

GARDEN VIEW OF HOUSE FACING SOUTH AND EAST. AWNINGS TO SHELTER WINDOWS ARE INCORPORATED IN CONSTRUCTION OF WALLS. WINDOWS SLIDE HORIZONTALLY. SECTION BELOW SHOWS A DOUBLE GLASS WALL FOR CONSERVATORY. CONSTRUCTION IS FIREPROOF THROUGHOUT.



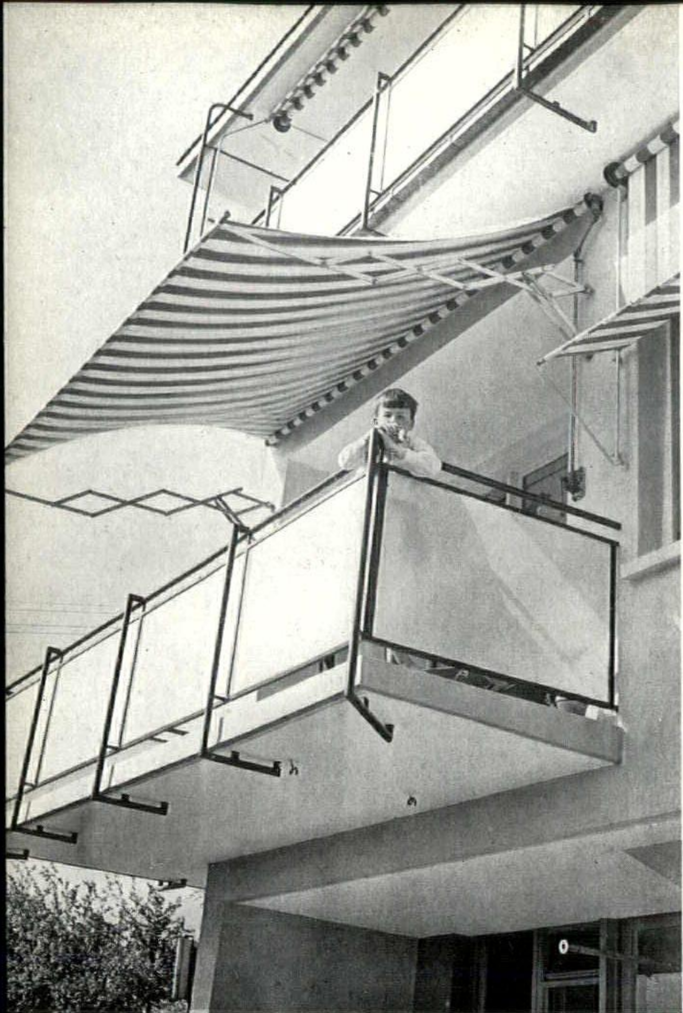


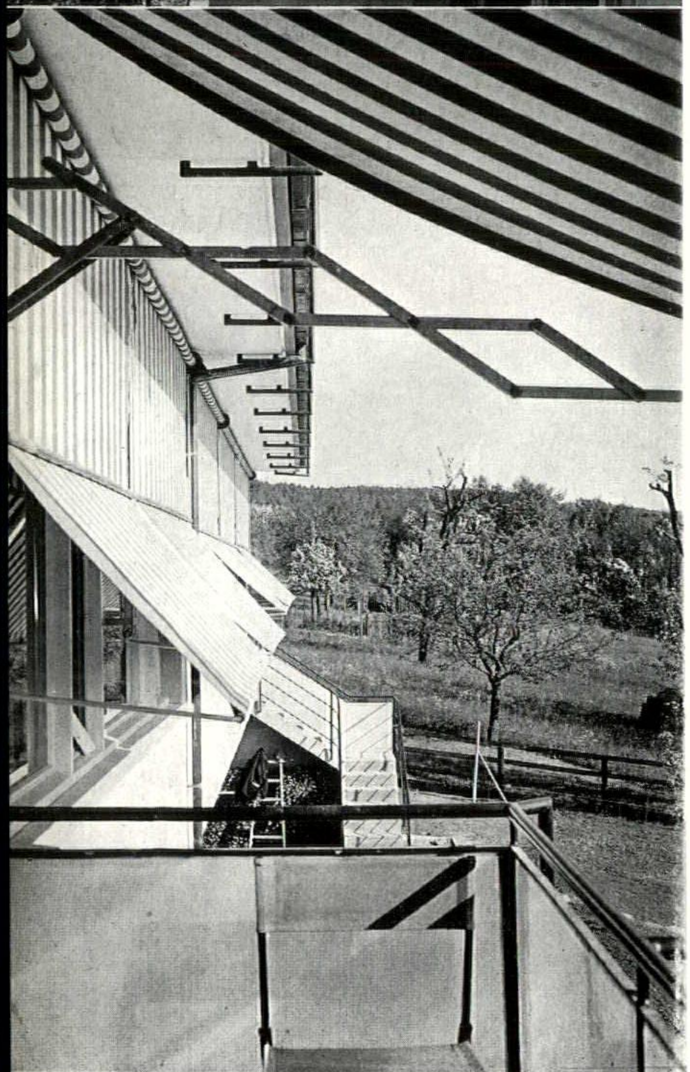
Finsler Photos

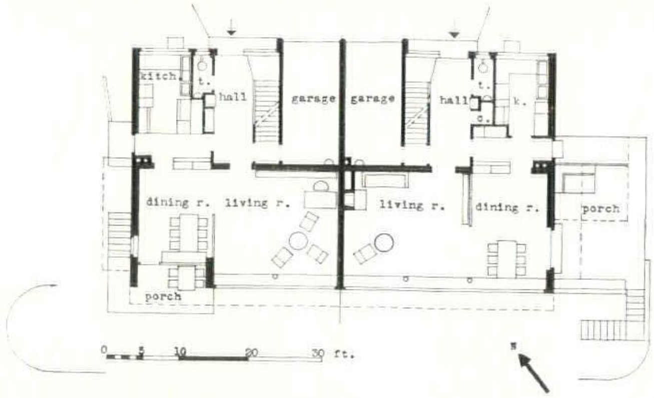
EXTERIOR GALLERY TO COVERED TERRACE FROM MASTER BEDROOM SUITE.

LIVING ROOM


LIVING ROOM INTERIOR TOWARD GARDEN AND LIVING TERRACE.







FIRST FLOOR PLAN

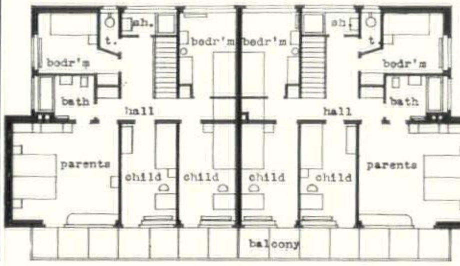
AT LEFT, BALCONY VIEWS

DOUBLE HOUSE NEAR ZURICH, SWITZERLAND

WERNER M. MOSER, ARCHITECT

A two-family house situated on a southwest slope overlooking a valley, lake and the city of Zurich. The large windows and balconies of the more important rooms face the view. Entrances are to the rear or street side. The dining and living rooms can be combined so as to serve as a single room. The architect conceived the house as a place that would be attractive to children. This was attained by provision of space for children to play and to store their playthings, and by the lightness of forms and the pleasant lemon-yellow color of the wall surfaces. The mechanical details of construction have been worked out with the utmost exactness.

LIVING ROOM

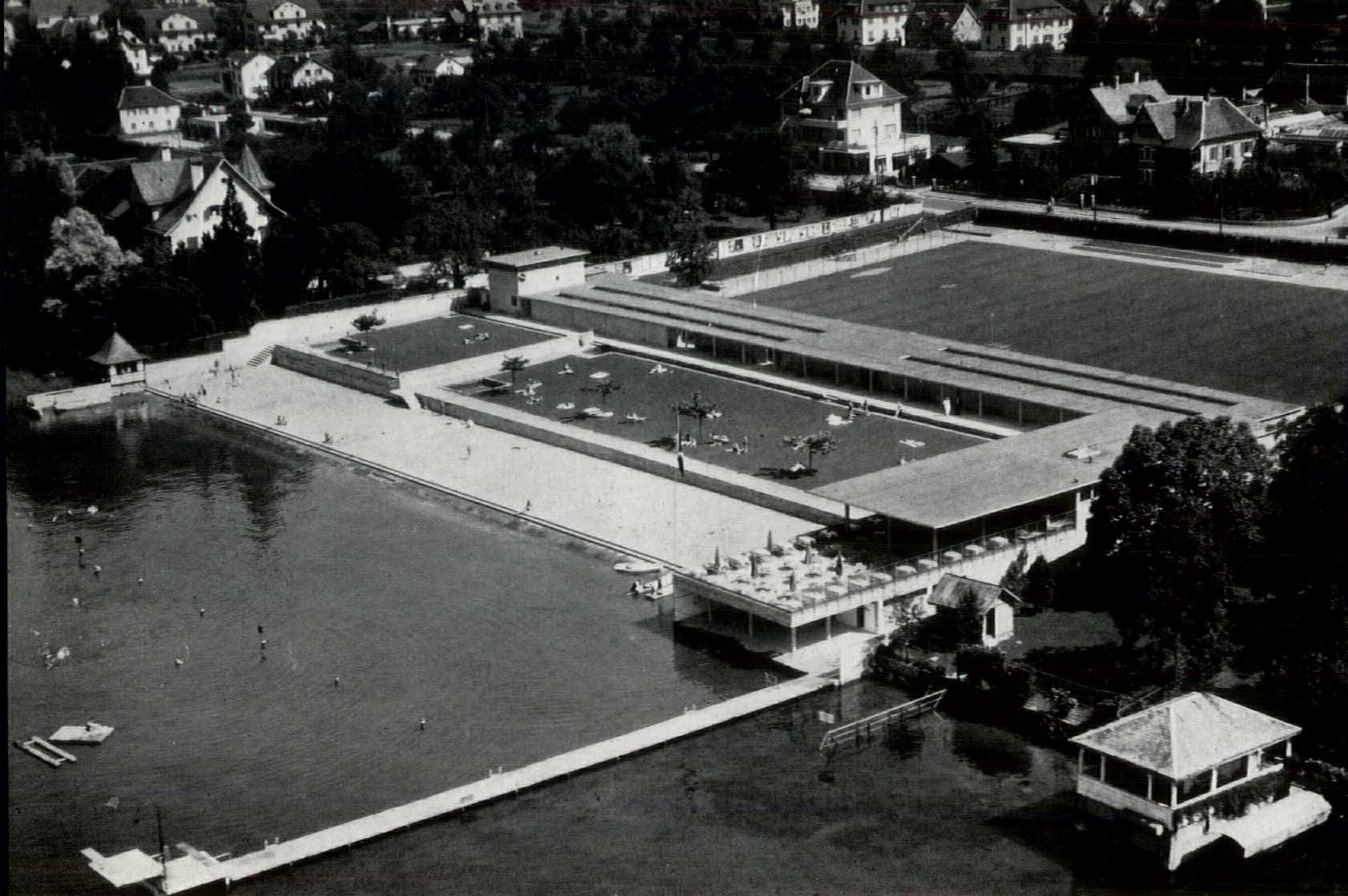


SECOND FLOOR PLAN

VIEW OF HOUSE FROM GARDEN

VING ROOM INTERIOR FROM DINING ROOM

ANGLE OF LIVING ROOM



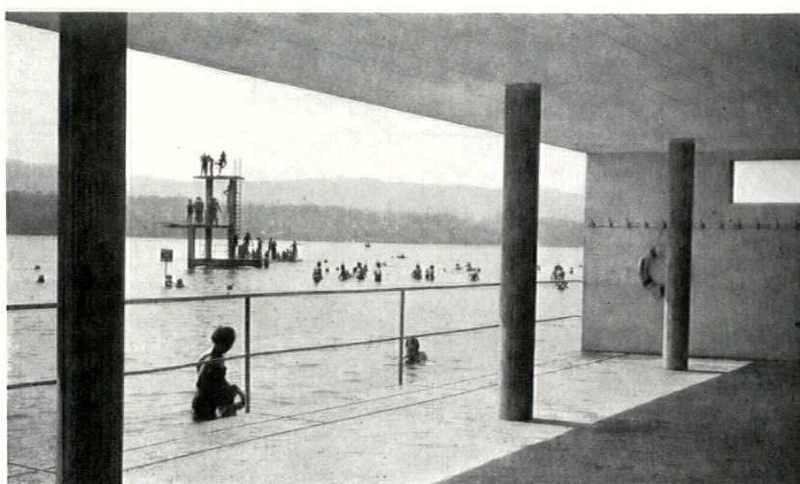
Astra

BATHING ESTABLISHMENT ON LAKE OF ZURIC

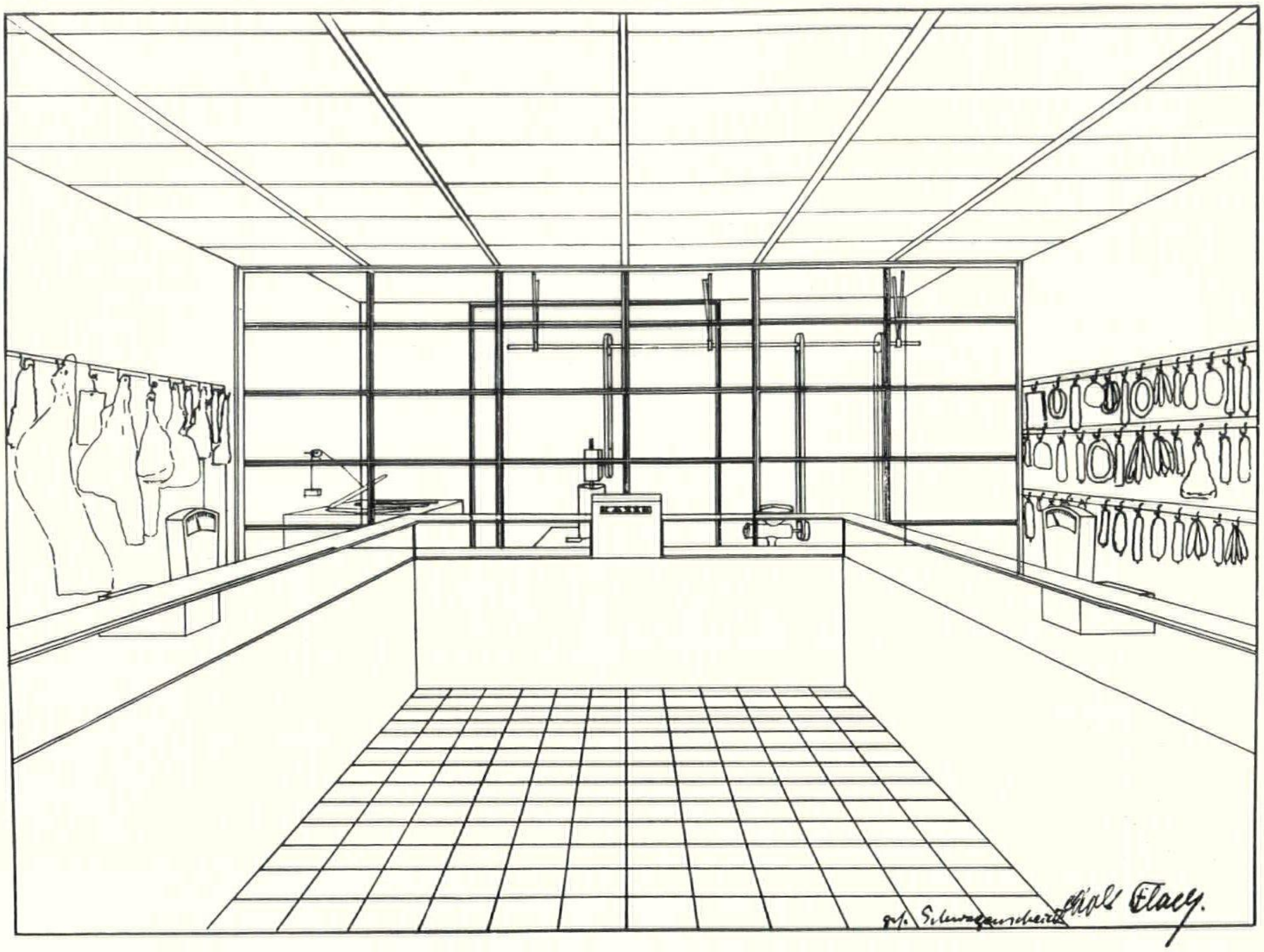
STEGER AND EGENDER, ARCHITECTS

THE CONSTRUCTION OF PAVILIONS AND BATHHOUSES IS OF CONCRETE AND FIREPROOF.

VIEW OF END PAVILION, SHOWING DINING TERRACE ABOVE AND DRESSING ROOMS BELOW.



SHELTER AT LOWER LEVEL, USED AS PASSAGE TO DRESSING ROOMS.



BUTCHER SHOP INTERIOR

A suggested scheme for the treatment of a butcher shop interior with use of sanitary material such as enameled steel or glass. The workroom at the far end of the shop is visible through a glazed partition between store and workroom.

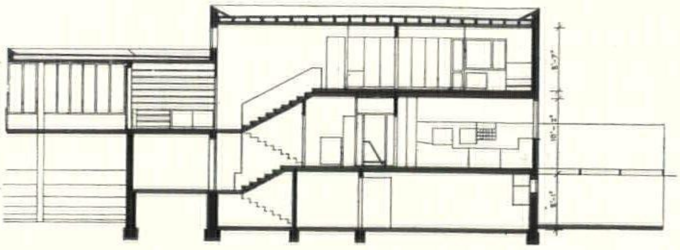
EXTERIOR STAIRWAY
FROM
GARDEN TO TERRACE

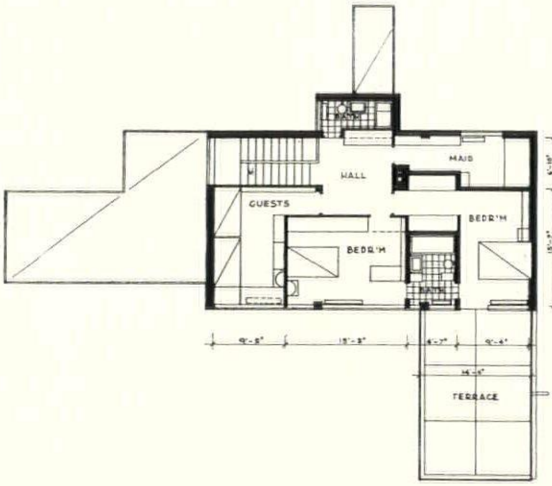
HOUSE IN WIESBADEN

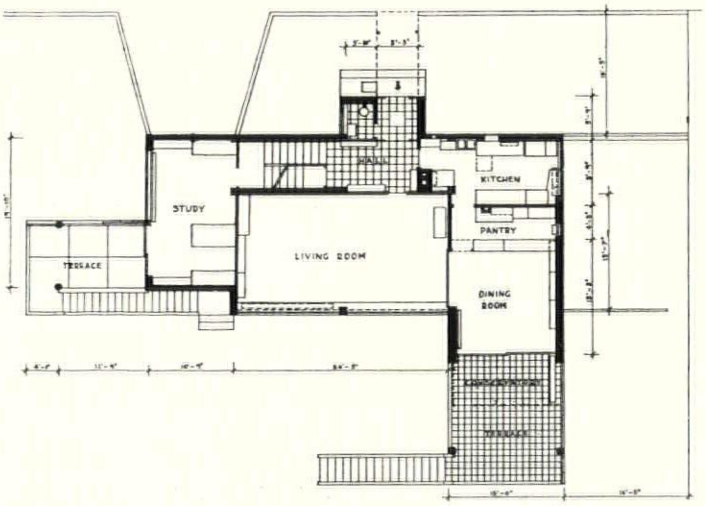
MARCEL BREUER, ARCHITECT

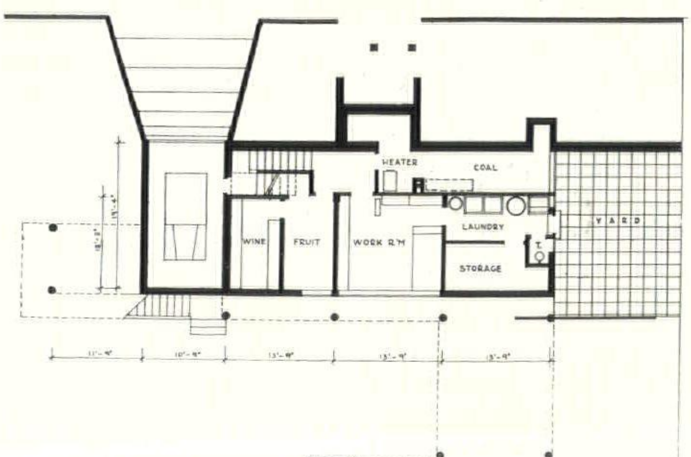
The plot is situated on a southerly slope with street at far side higher in level. All windows and terraces face to south and west in order to gain advantage of sun and view of garden and Rhine valley. Terraces are supported on concrete columns so that garden area continues under the house.
CONSTRUCTION with steel frame of standard sections; exterior walls of aerated concrete blocks 5 inches thick, backed with shredded wood and magnesite composition board. A two-inch air space separates the two wall elements; floors are concrete slabs and steel beams; the face of house is light gray stucco, interior walls and partitions are plastered. Floors are linoleum and carpet inside, tile for terraces. Cost of house, less than $10,000.

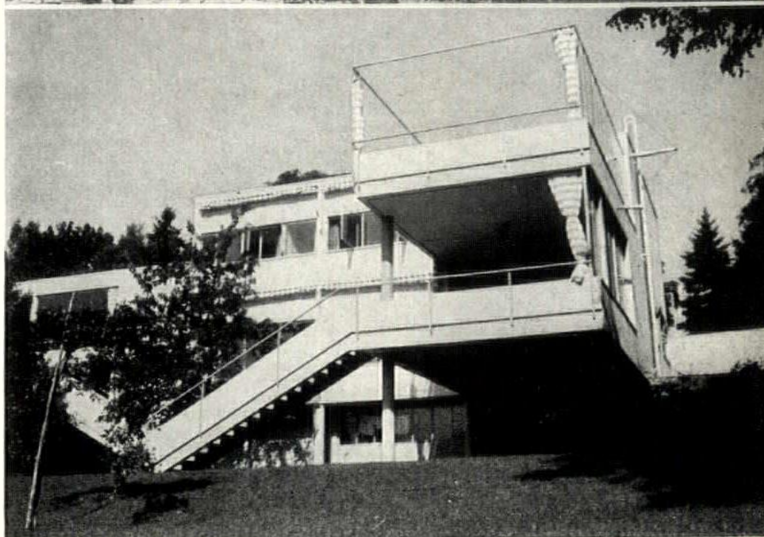
BELOW ARE SHOWN SECTION AND PLANS. AT RIGHT SOUTH ELEVATION, SOUTH TERRACES, AND GARDEN SHELTER.

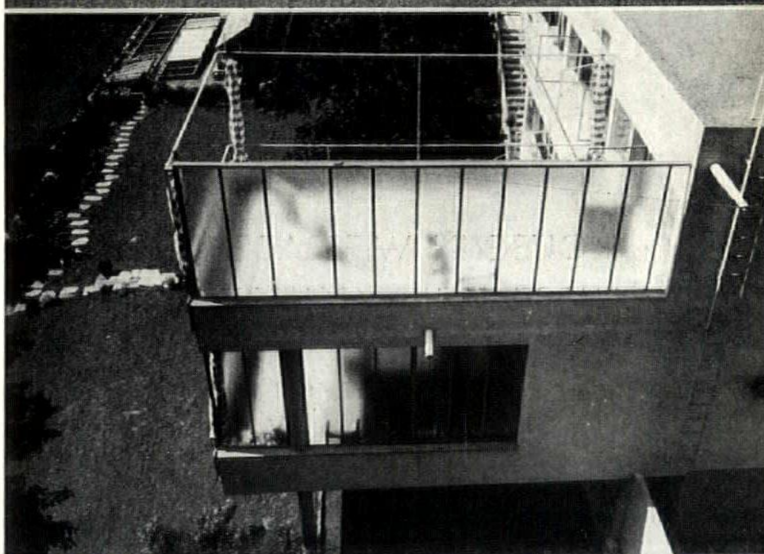


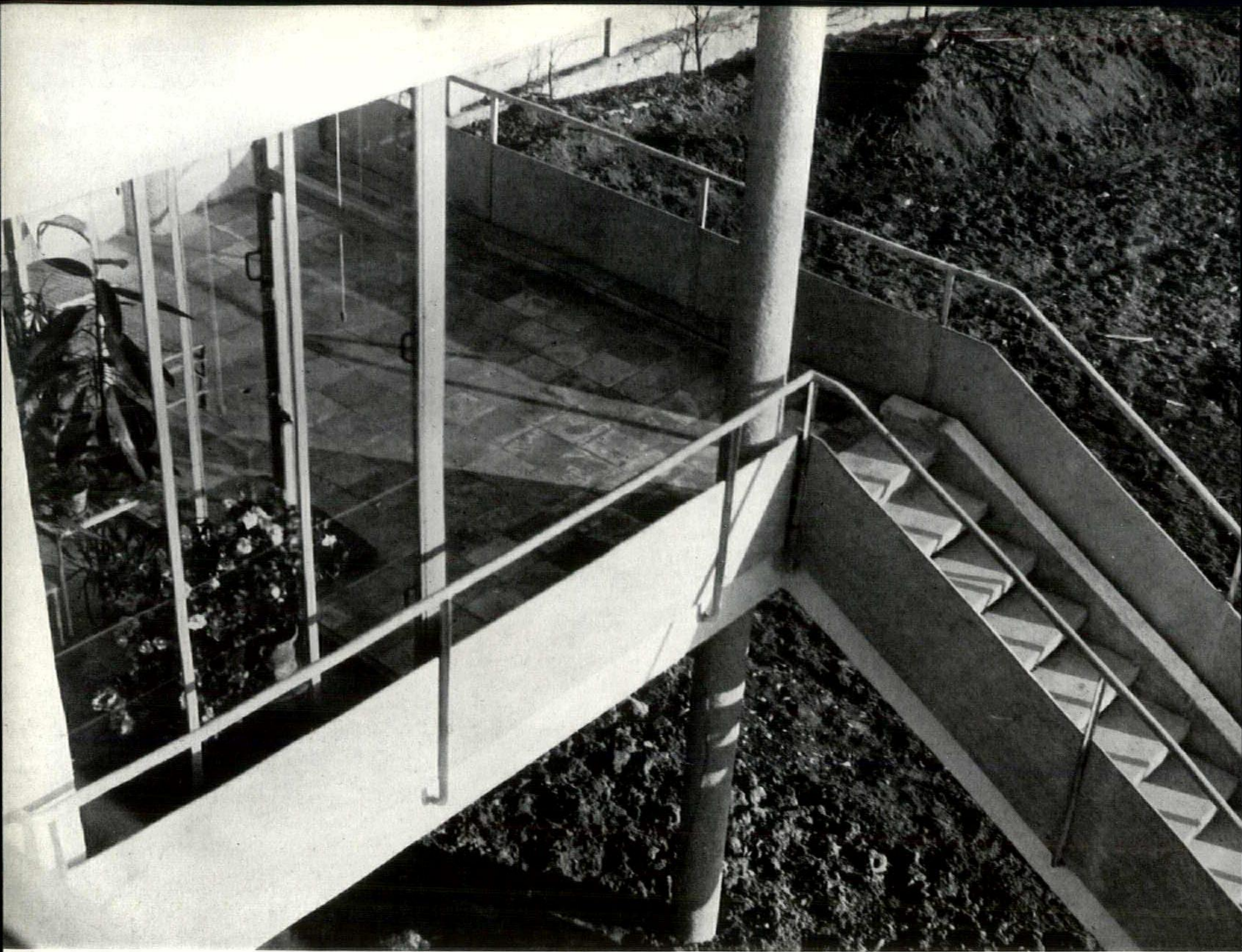












SOUTH TERRACE

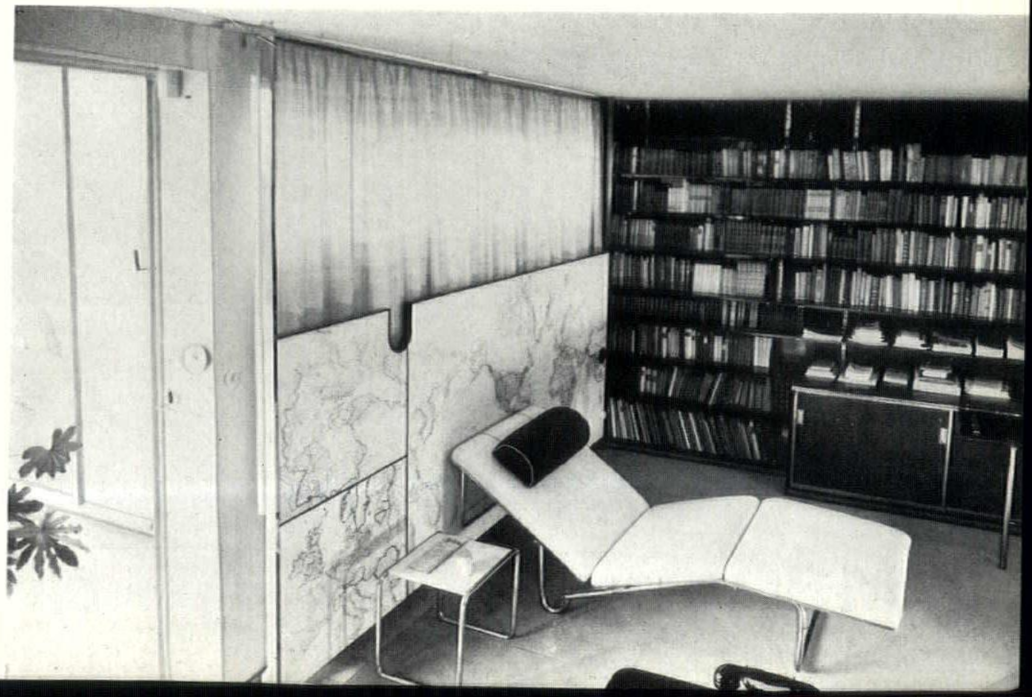
HOUSE IN WIESBADEN, GERMANY

MARCEL BREUER, ARCHITECT

LIVING ROOM

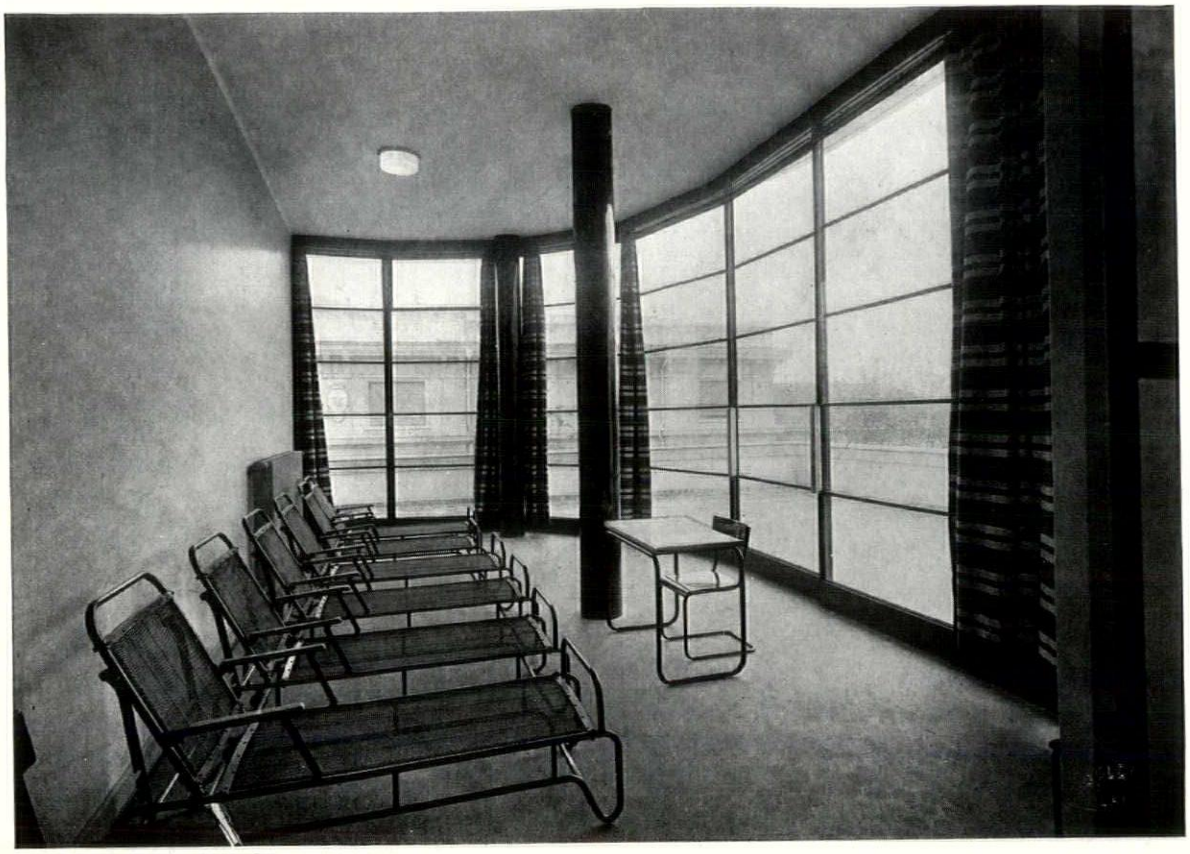
VIEW FROM LIVING ROOM TO SOUTH TERRACE.

STUDY AND WORKROOM



PATHOLOGICAL INSTITUTE, MILAN, ITALY

ENRICO A. GRIFFINI, ARCHITECT



THE SOLARIUM

LECTURE ROOM

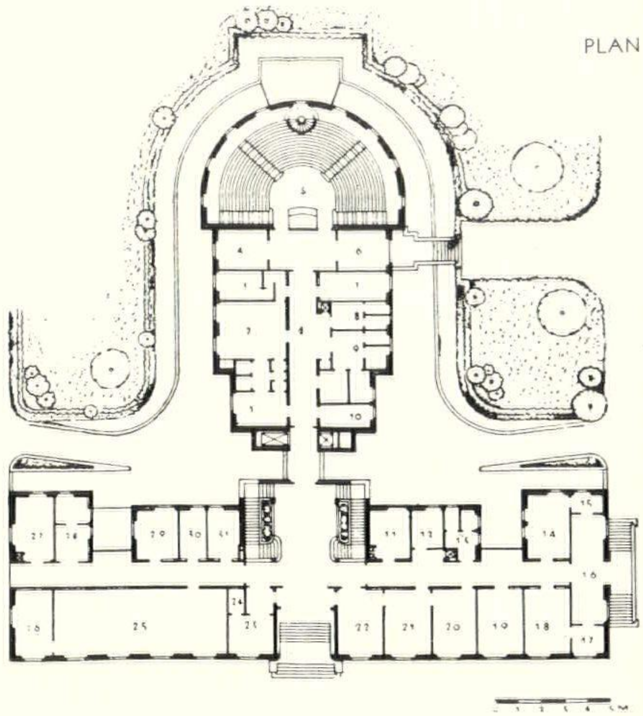
PLAN: (1) Radio therapy; (2) radio diagnosis; (3) dark room; (4) service; (5) lecture hall; (6) vestibule; (7) office of Director; (8) toilets; (9) electro-therapy; (10) waiting room; (11) registry; (12) archives; (13) toilets; (14) antechamber; (15) dressing room; (16) vestibule; (17) dressing room; (18) antechamber; (19) analysis; (20) visit control; (21) study; (22) waiting room.

SIDE VIEW: Low element is lecture room; next, the laboratories. The stair inclosure and the large mass is the ward section, crowned by the solarium. The large central window in the ward building lights the corridors.

THE SOLARIUM: The ceiling is rose colored; walls, light orange-vermilion; column and ironwork are in vivid reddish purple. Cots are vivid red; hangings are black and red bands of different shades; floor is of dull red tile.

LECTURE ROOM: Walls in light gray, border lines of silver; floor of bright blue linoleum in the seating space; risers and baseboard of black linoleum; floor of lecture platform of black linoleum; stair nosing is aluminum. The window shades to darken room for slides and moving pictures are electrically controlled from the lecture table.

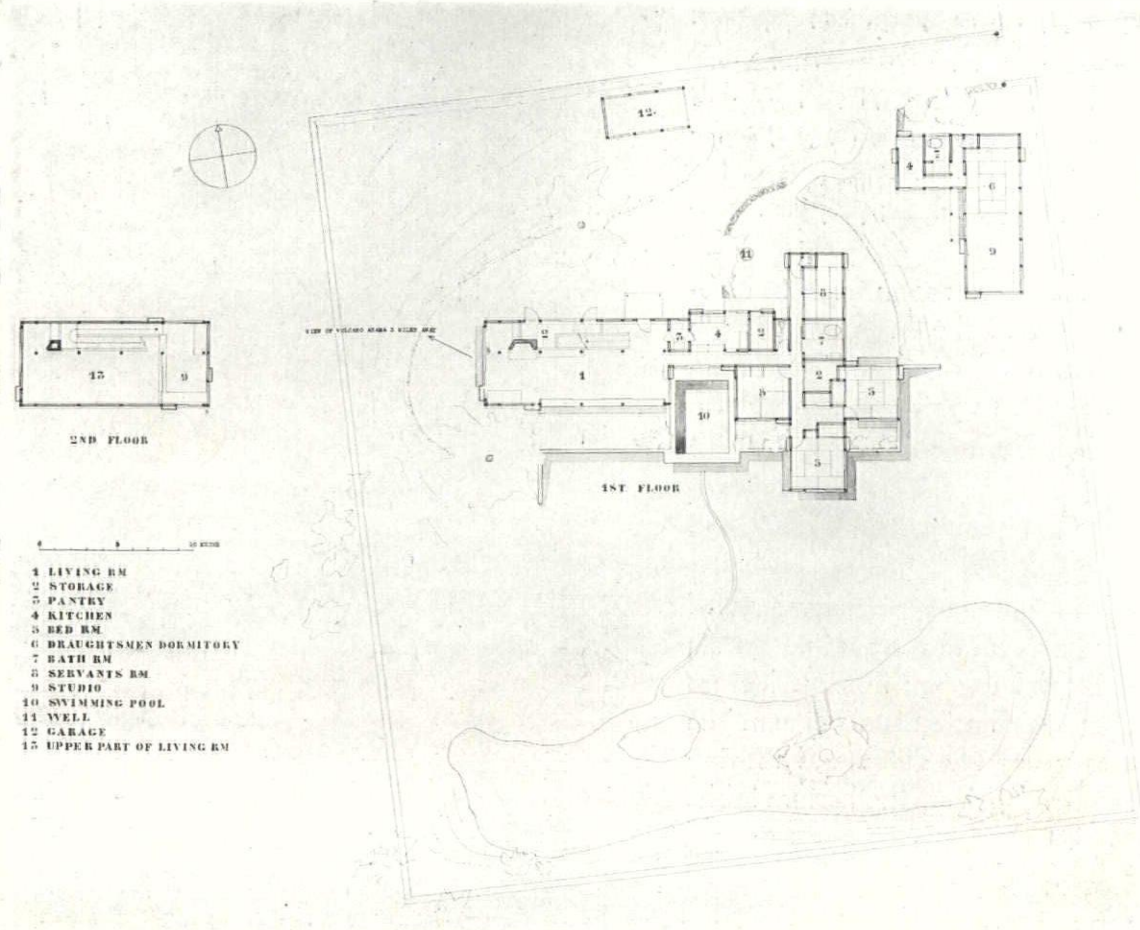
PLAN



EXTERIOR WITH LECTURE ROOM, STAIR INCLOSURE AND MAIN BLOCK.

ARCHITECT'S SUMMER QUARTERS, KARUIZAWA, JAPAN—1933

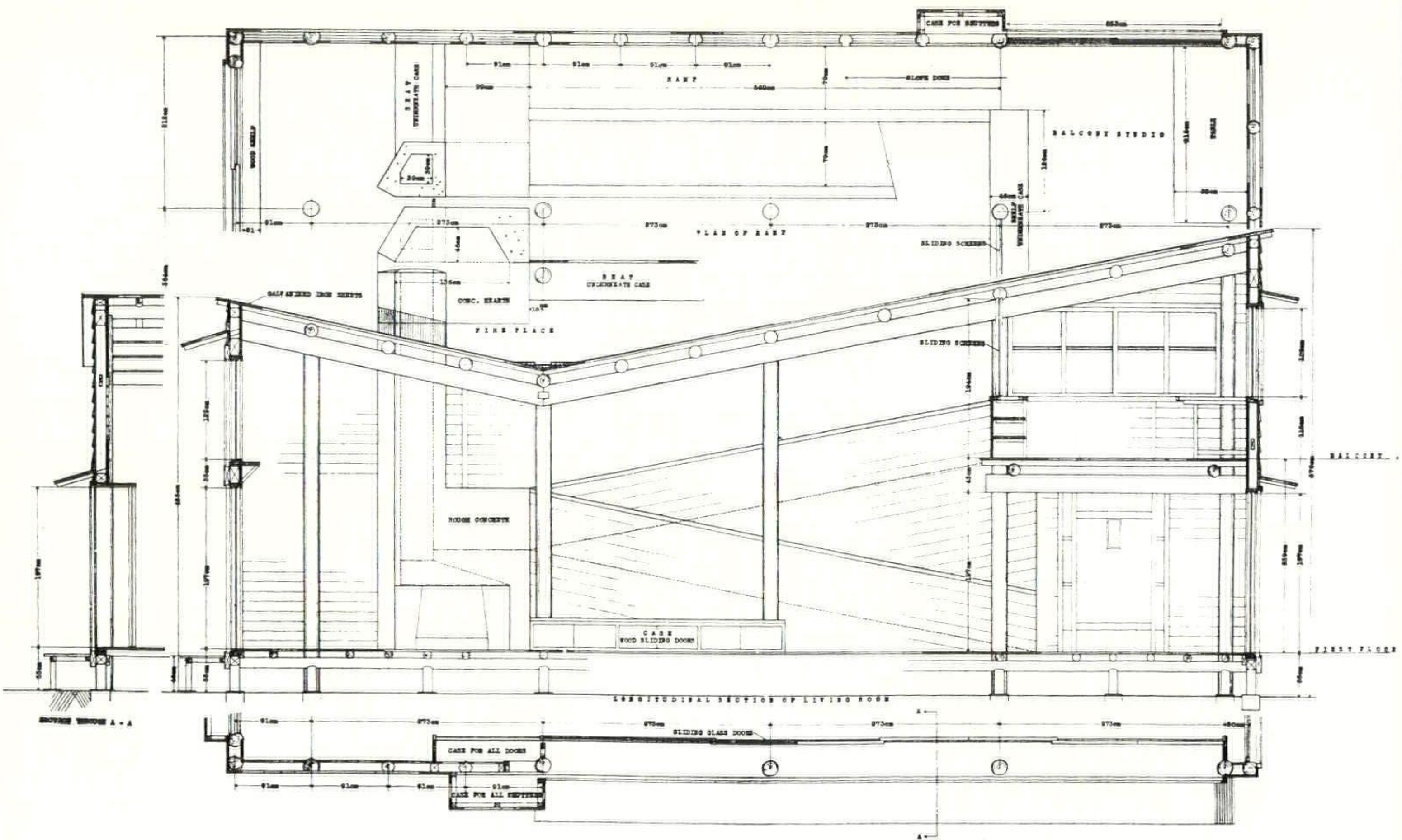
ANTONIN RAYMOND, ARCHITECT

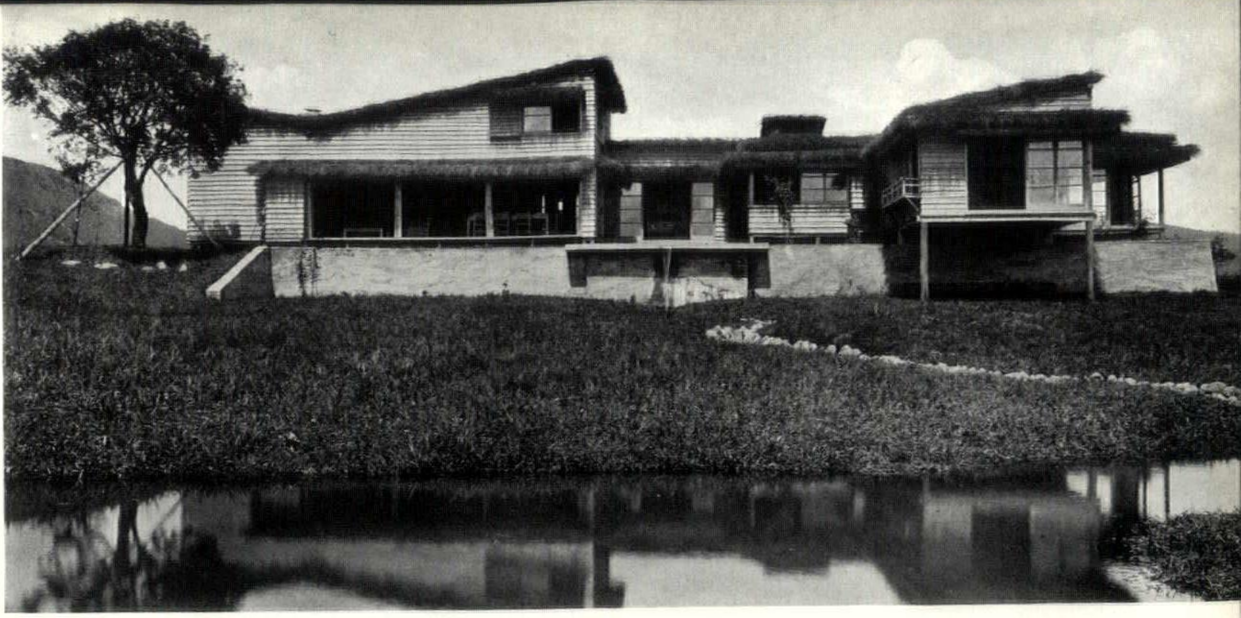


PLAN

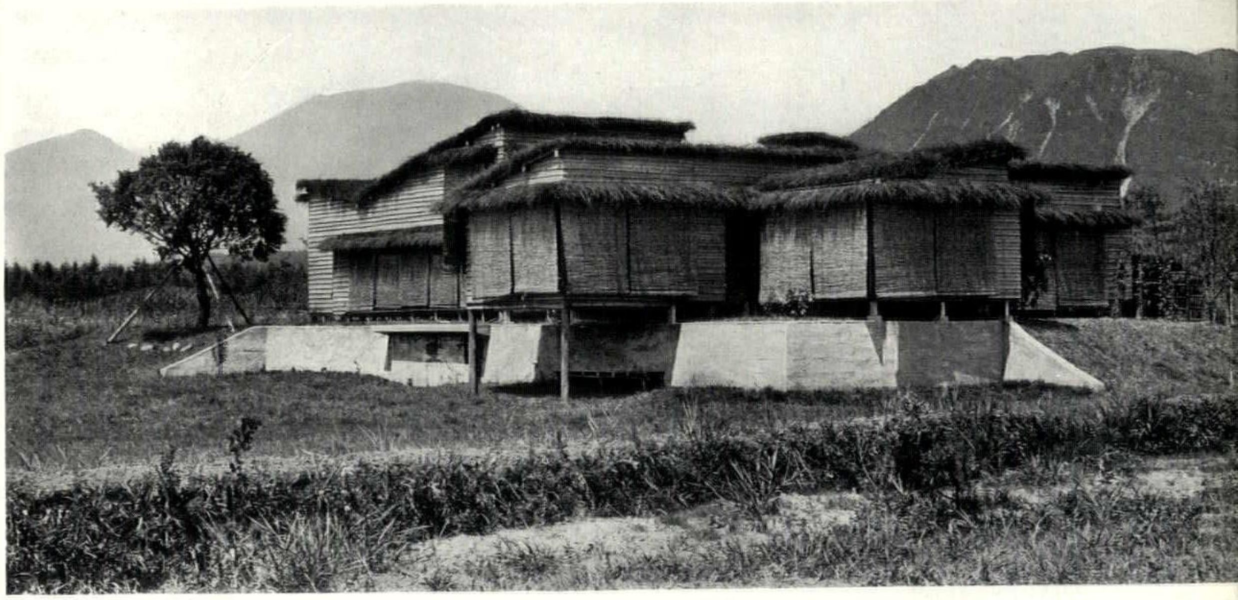
THE HOUSE IS ON A PLATEAU ENTIRELY SURROUNDED BY MOUNTAINS. THE JAPANESE EIGHT-MAT ROOMS ACCOMMODATE FROM THREE TO SIX SLEEPERS.

DETAILS OF LIVING ROOM



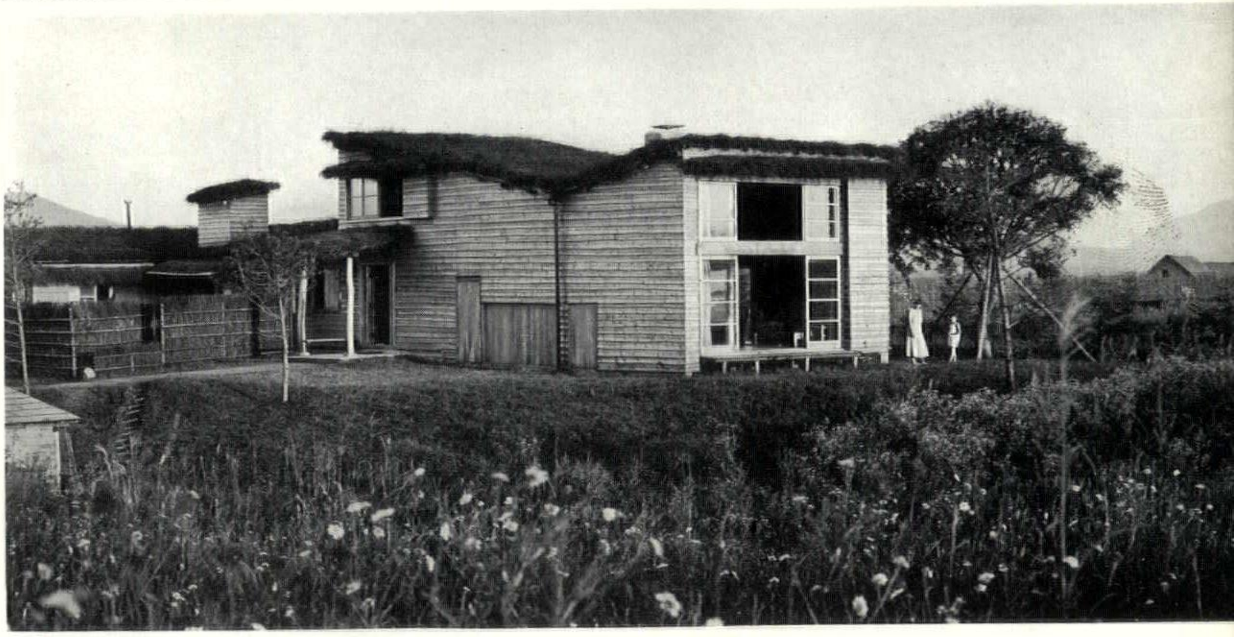


VIEW TO SOUTH



SOUTH AND EAST

REED SCREENS DOWN. VOLCANO ASAMA IN BACKGROUND.



NORTH AND WEST

Materials: LAVA CONCRETE, CEDAR SIDING, LARCH THATCH, CHESTNUT COLUMNS—ALL NATURAL COLOR OUTSIDE AND IN—REED SCREENS, YELLOWISH; CEDAR, ROSE; LARCH, PURPLISH; CHESTNUT, GRAY.

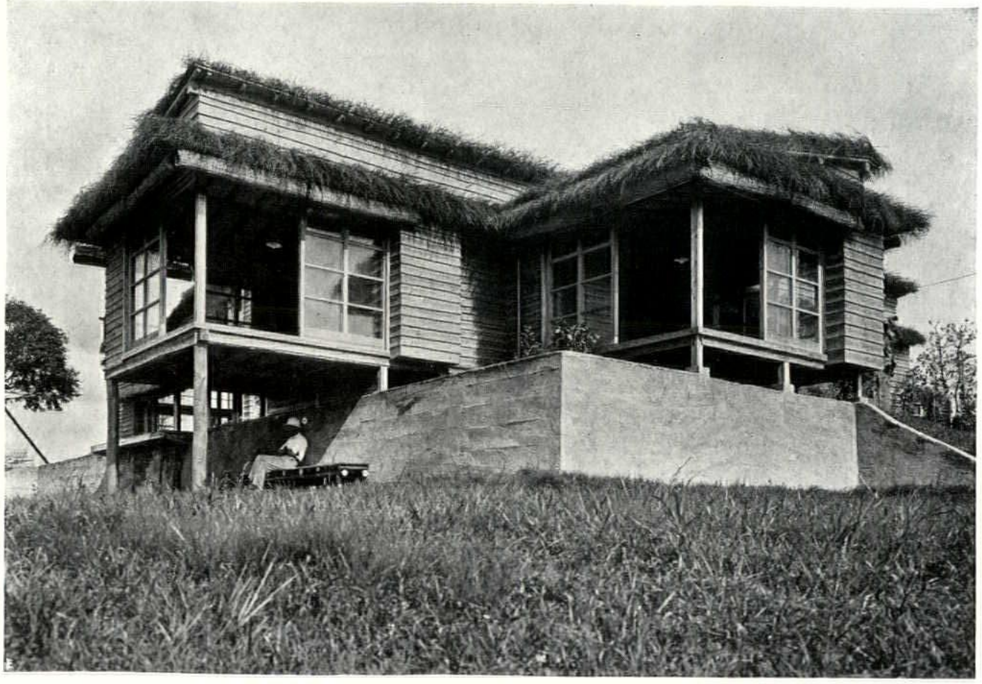
ARCHITECT'S SUMMER QUARTERS
KARUIZAWA, JAPAN—1933

ANTONIN RAYMOND, ARCHITECT

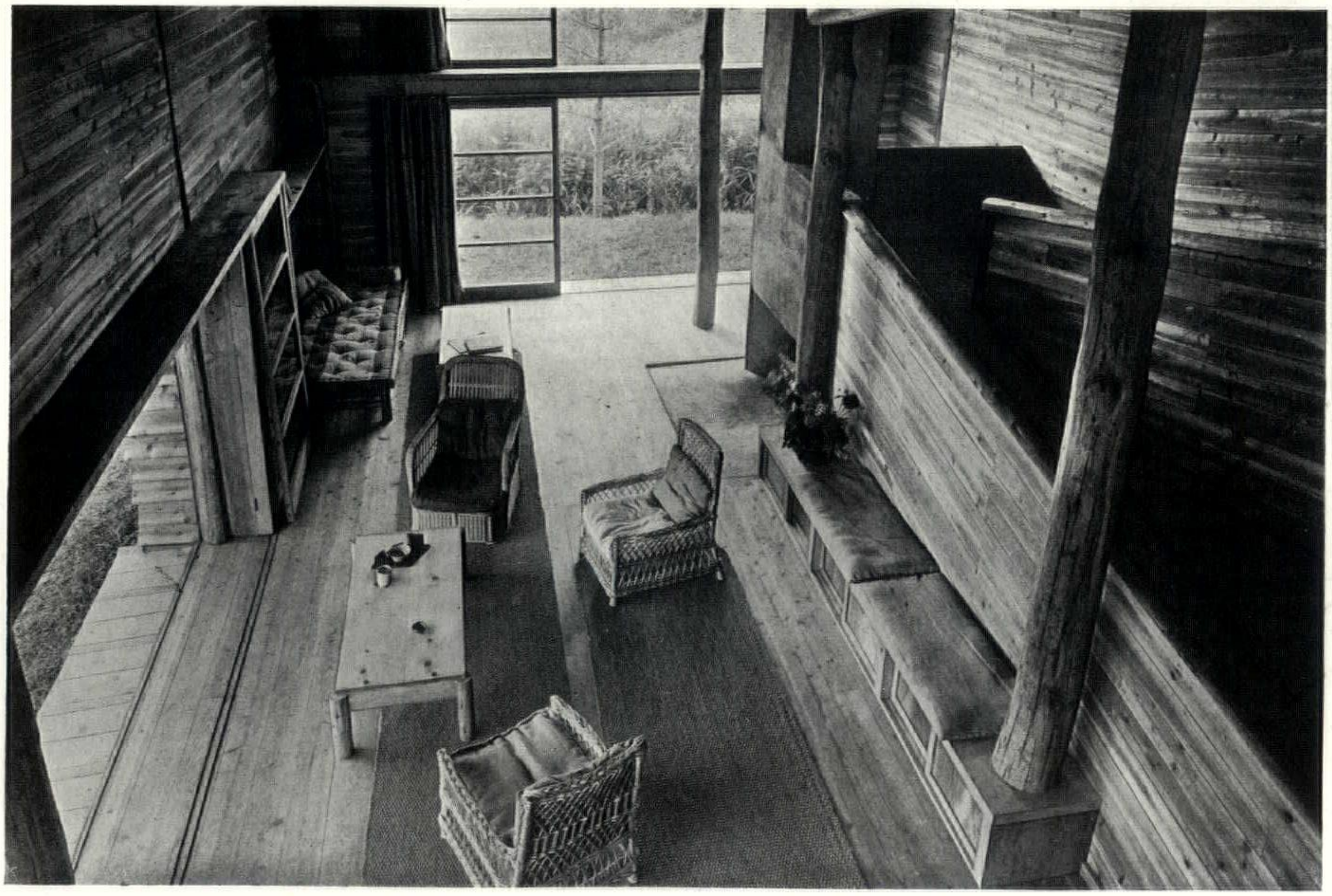
OPPOSITE PAGE:

VIEW OF LIVING ROOM ACROSS SWIMMING POOL FROM JAPANESE BEDROOM. FURNITURE WAS MADE BY CARPENTERS ON JOB, USING CEDAR, HINOK AND STRAW. LIVING ROOM: GLASS DOORS SLIDE LATERALLY. RAMP TO UPPER LEVEL WAS INSPIRED BY A PLAN OF LE CORBUSIER FOR A HOUSE IN SOUTH AMERICA.

OVERFLOW CASCADE FROM PLUNGE.



JAPANESE ROOMS.

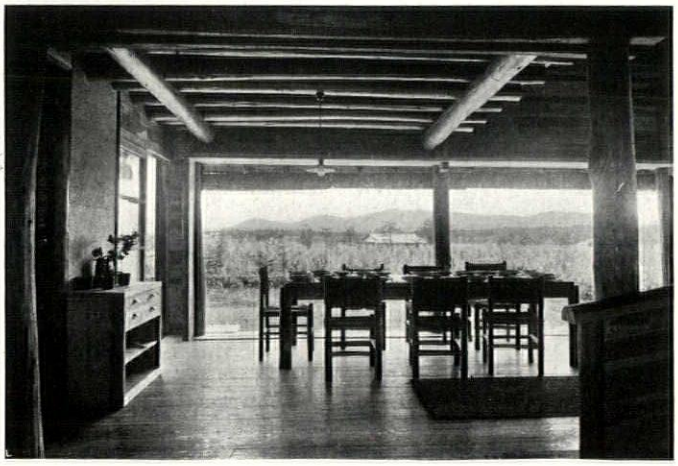


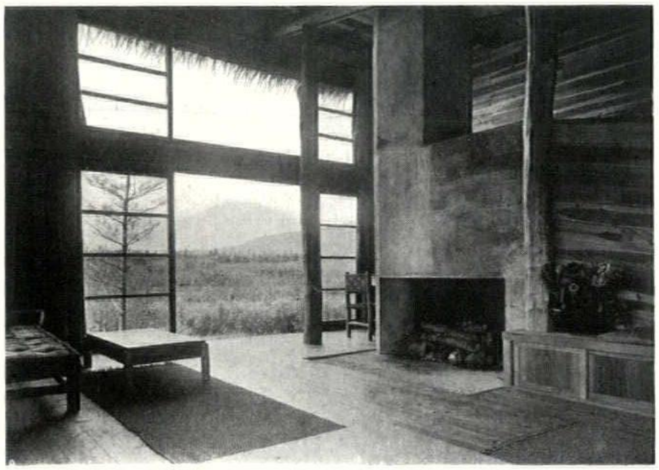
ARCHITECT'S SUMMER QUARTERS
KARUIZAWA, JAPAN—1933

ANTONIN RAYMOND, ARCHITECT

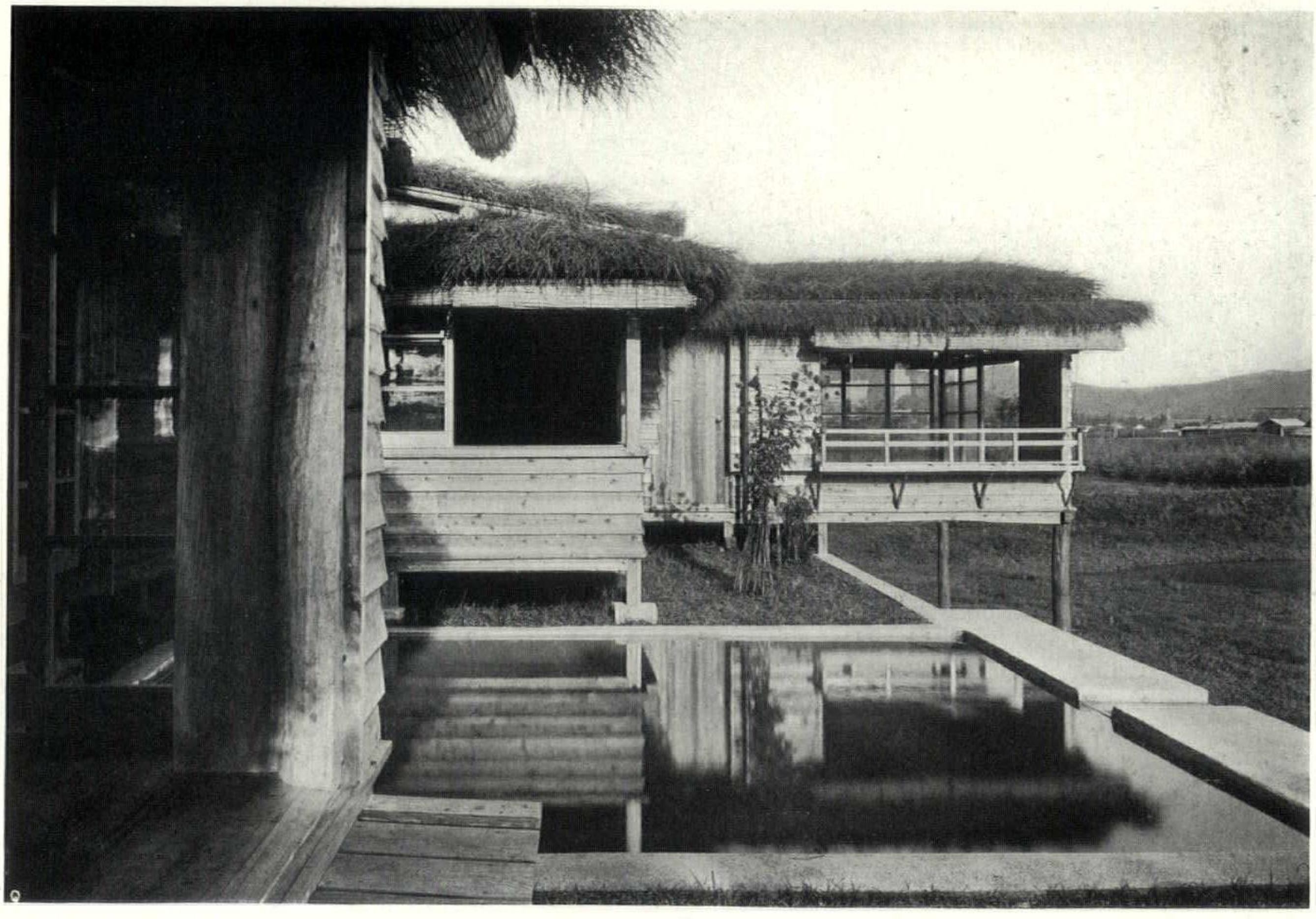
LEFT:
RAMP AND DRAFTING ROOM

BELOW:
TWO VIEWS OF LIVING-DINING ROOM



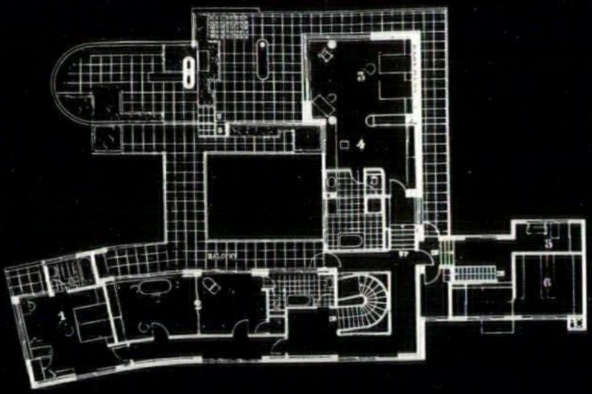


VIEWS OF JAPANESE AND FOREIGN BEDROOM AND FROM LIVING ROOM OVER SWIMMING-POOL.



RESIDENCE OF MORINOSUKE KAWASAKI, TOKYO, JAPAN—1933

ANTONIN RAYMOND, ARCHITECT

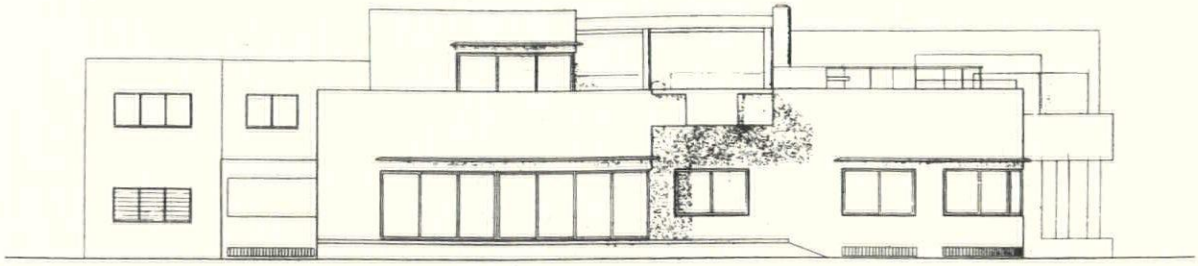


THIS PLAN WAS DESIGNED WITH A VIEW TO MAXIMUM AIR AND LIGHT.

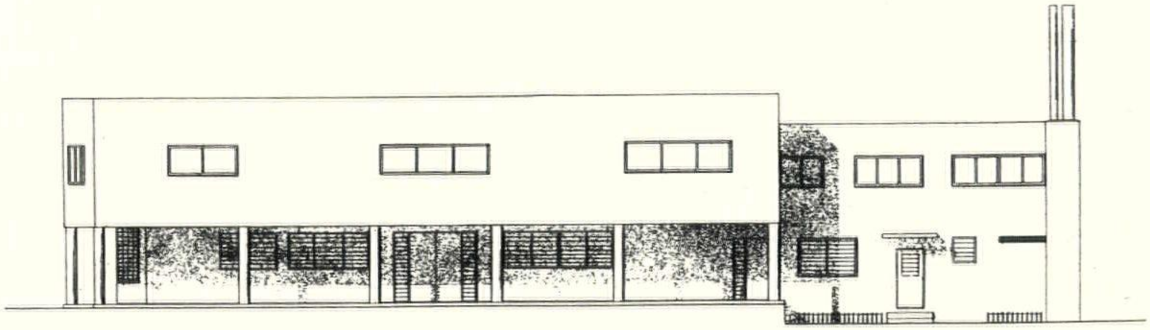
1 Vestibule
2 Hall
3 Reception Room
4 Study
5 Living Room
6 Dining Room
7 Kitchen
8 Family Vestibule
9 Boy's Room
10 Service Entrance
11 Maid's Room
12 Laundry
13 Japanese House
14 Kura
15 Gardener
16 Garage
17 Storage
18 Chauffeur
19 Cook
20 Pool
21 Patio
22 Kennel
25 Japanese Garden

ABOVE: SECOND FLOOR PLAN

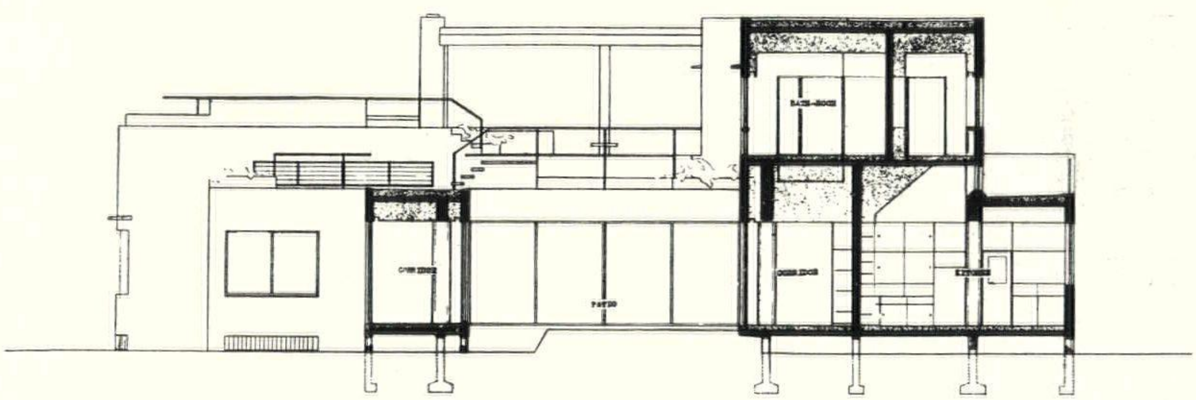
1 Guest's Room
2 Children's Room
3 Bedroom
4 Dressing Room
5 Service Pantry
6 Nando



SOUTH SIDE ELEVATION

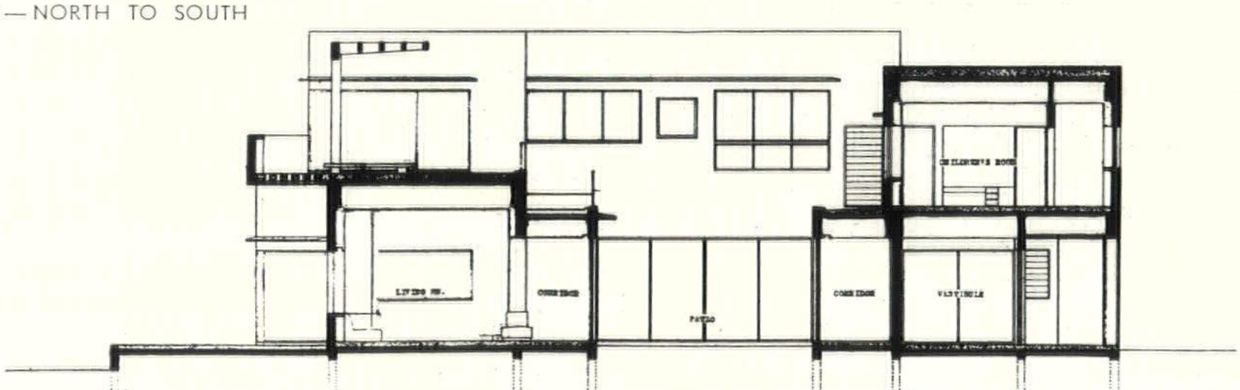


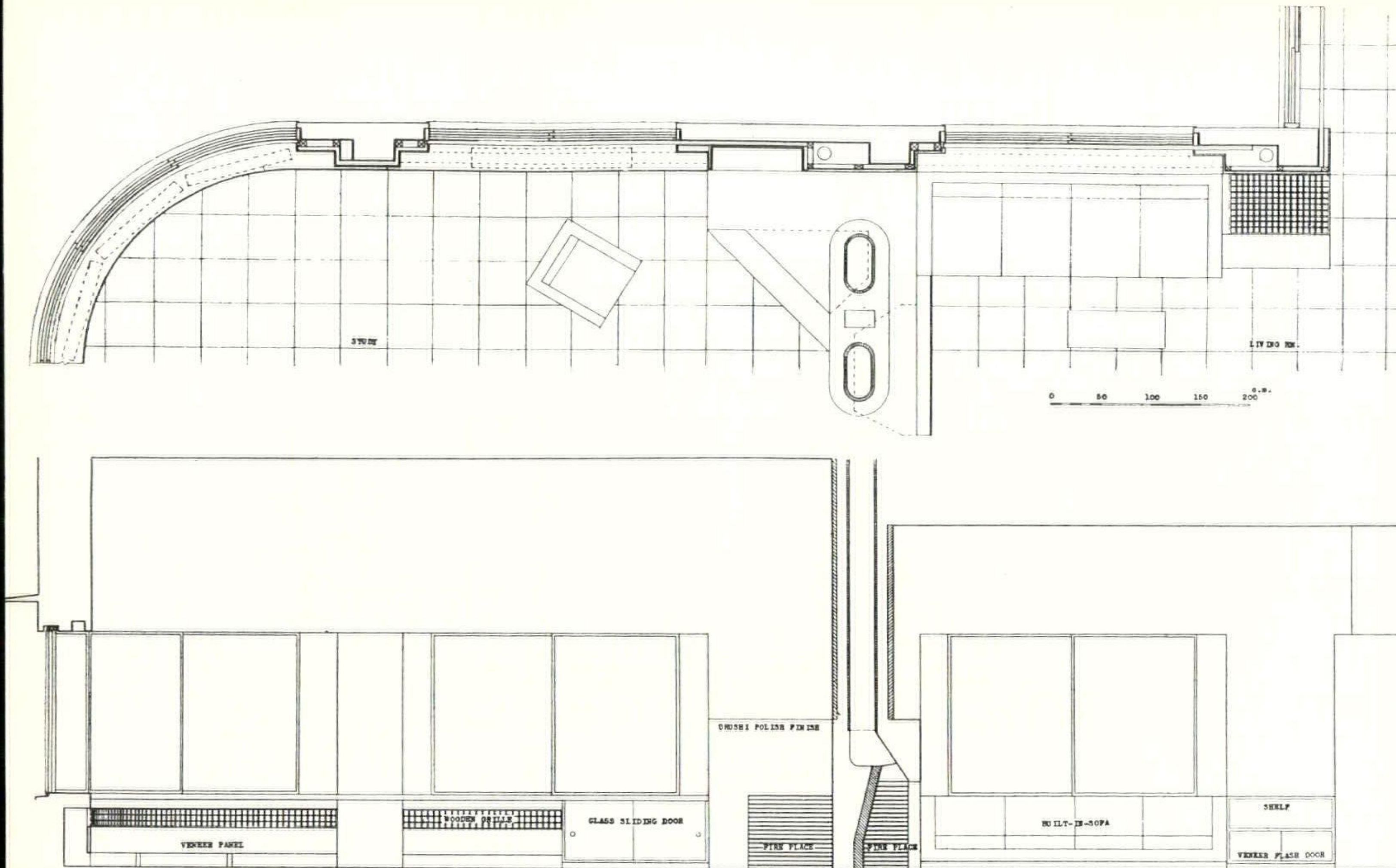
NORTH SIDE ELEVATION



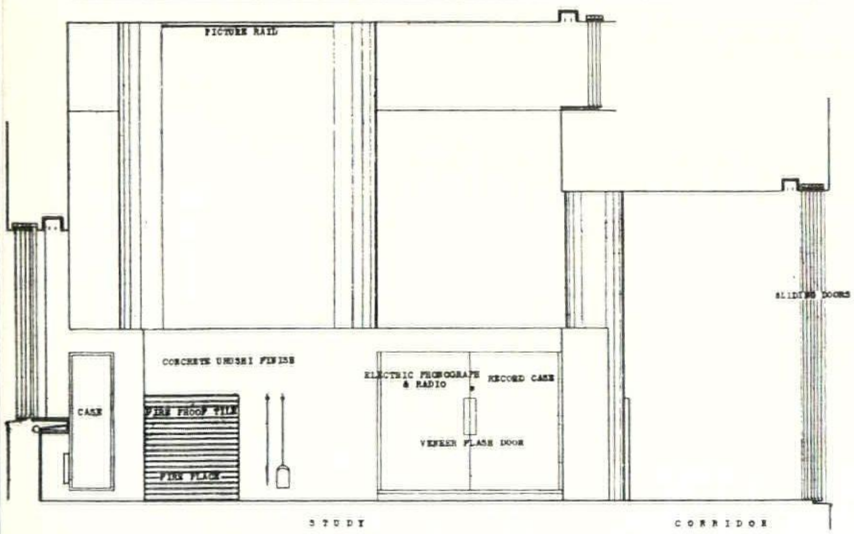
SECTION — EAST TO WEST

SECTION — NORTH TO SOUTH

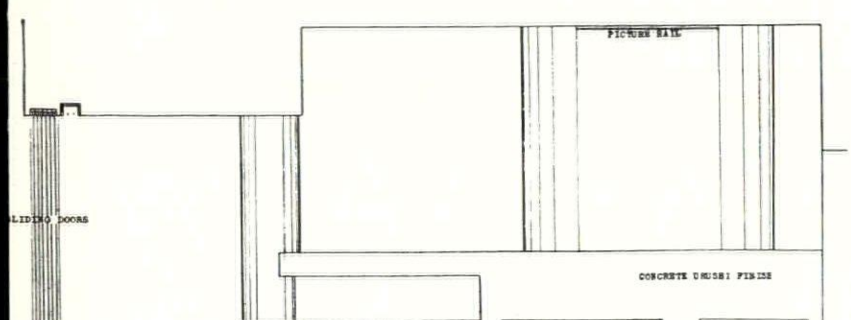




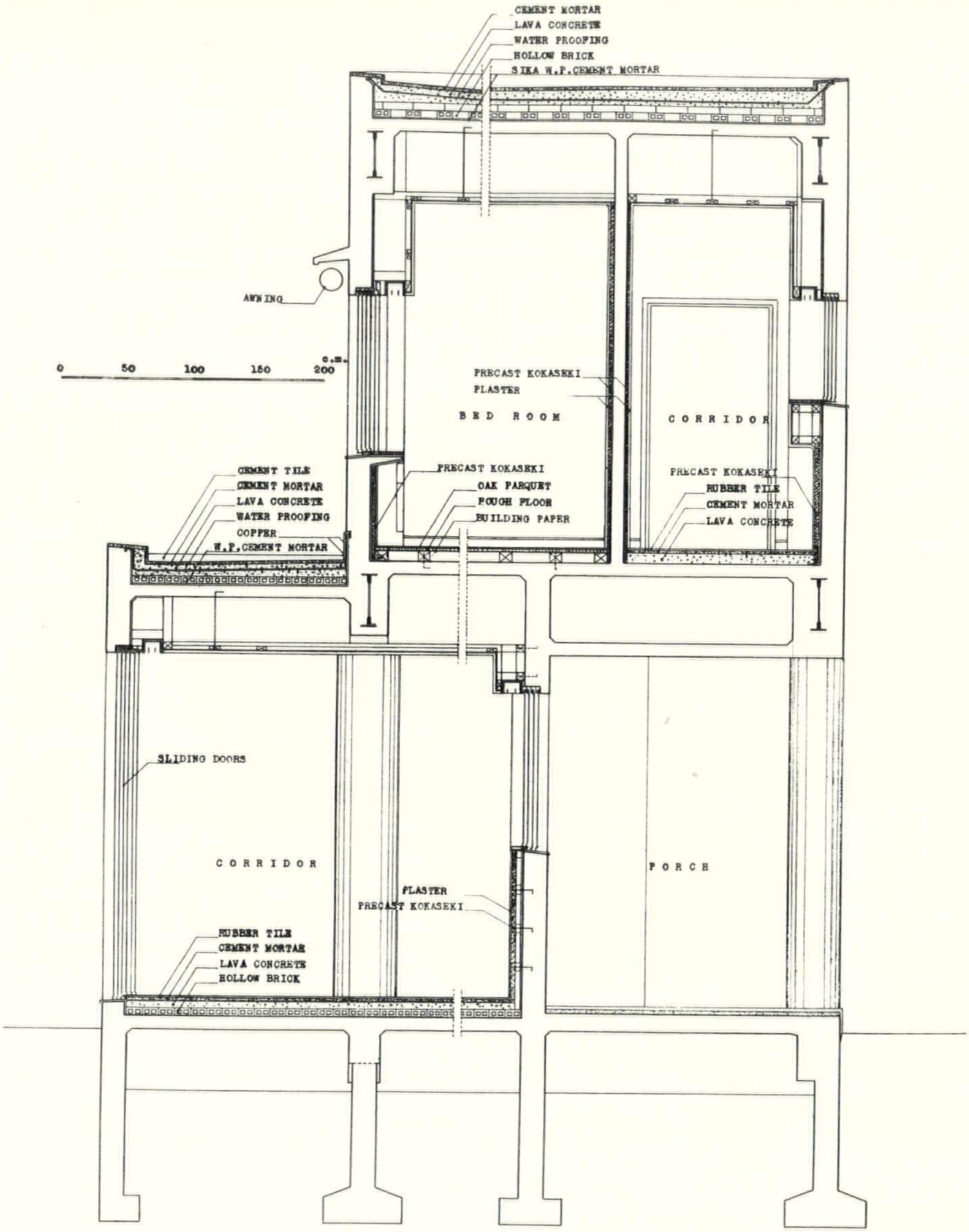
ABOVE: PLAN AND SECTION



SECTION THROUGH STUDY



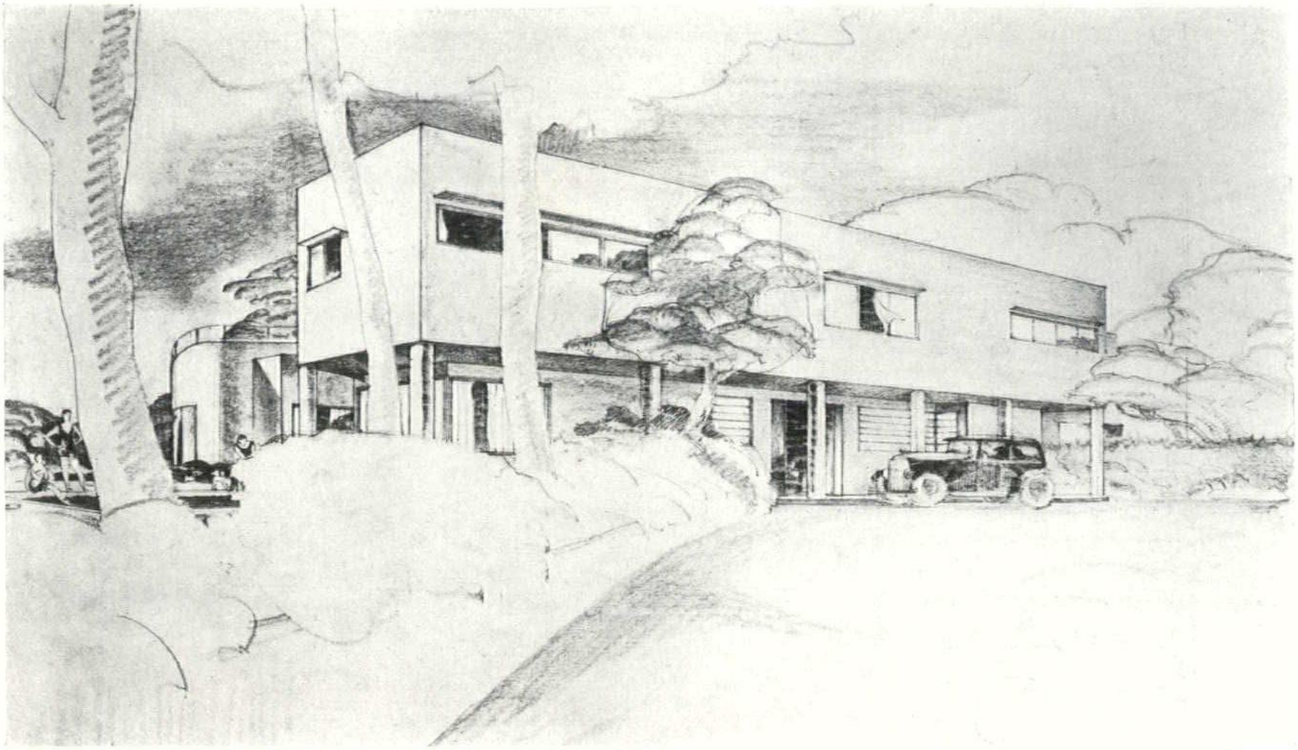
SECTION THROUGH LIVING ROOM



TYPICAL SECTION, SHOWING CONSTRUCTION

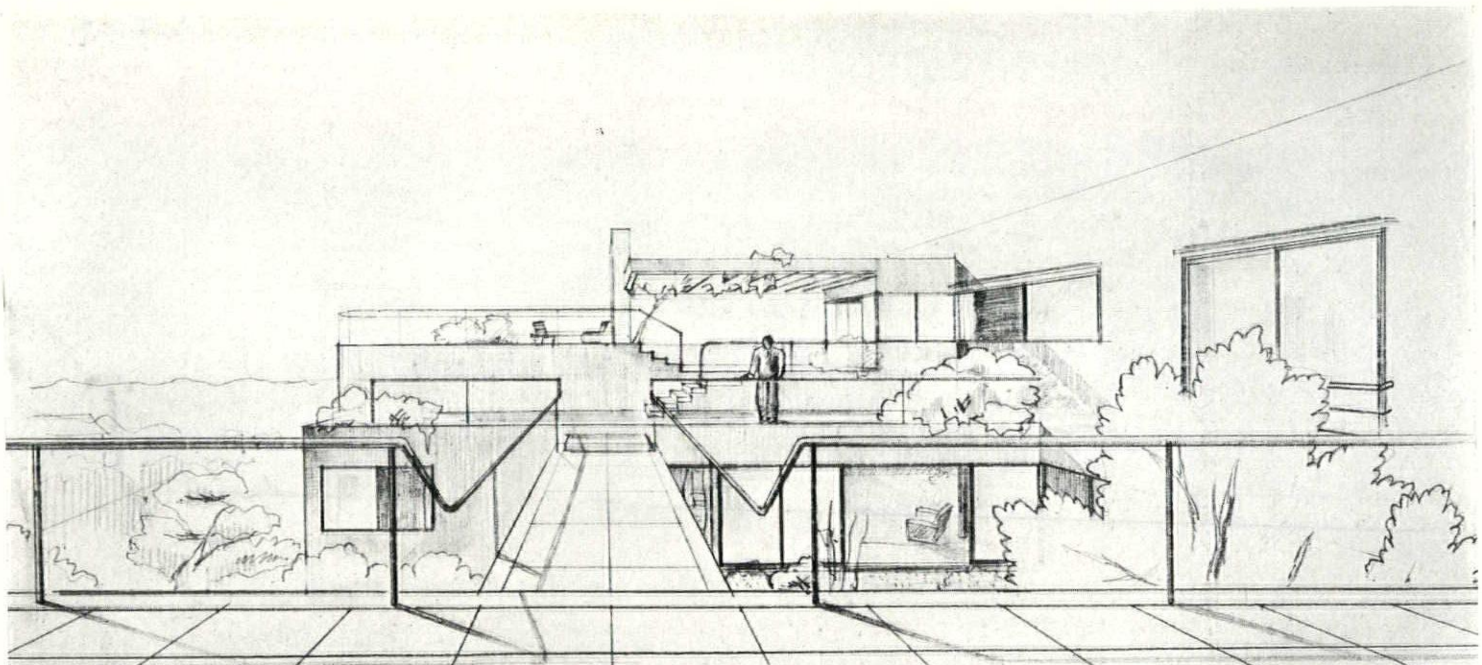
RESIDENCE OF MORINOSUKE KAWASAKI, TOKIO, JAPAN—1933

ANTONIN RAYMOND, ARCHITECT



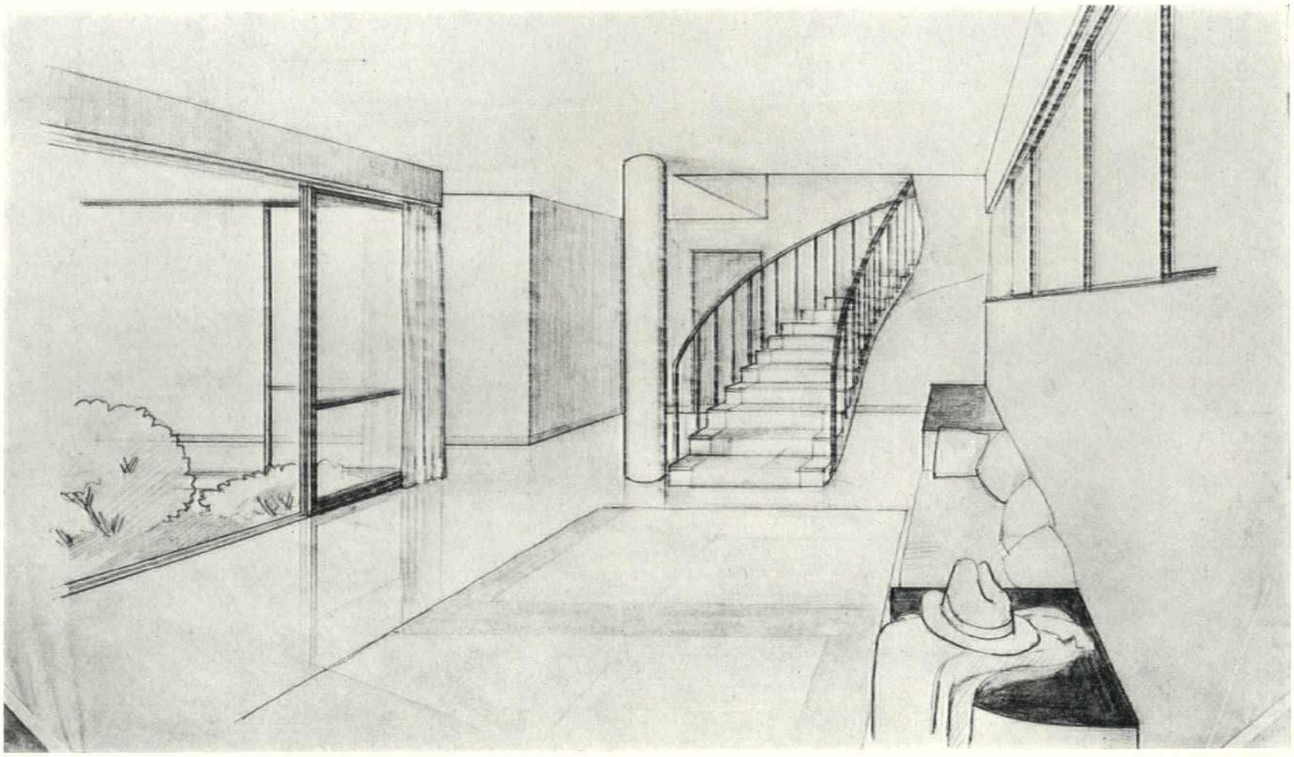
NORTH SIDE — ENTRANCE

VIEW FROM NORTH WING BALCONY, LOOKING SOUTH



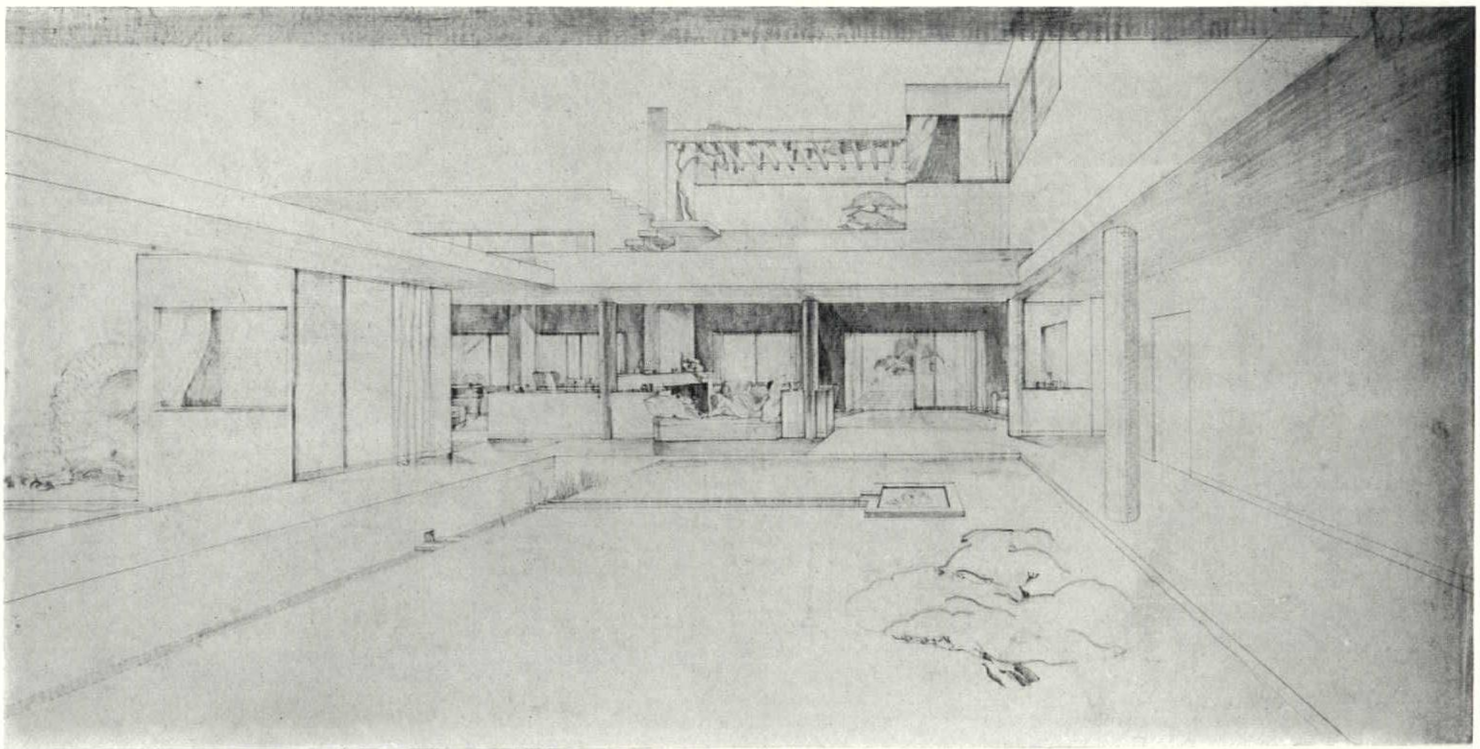
RESIDENCE OF MORINOSUKE KAWASAKI, TOKYO, JAPAN—1933

ANTONIN RAYMOND, ARCHITECT



STAIR HALL

INSIDE GARDEN WITH VIEW INTO LIVING ROOM

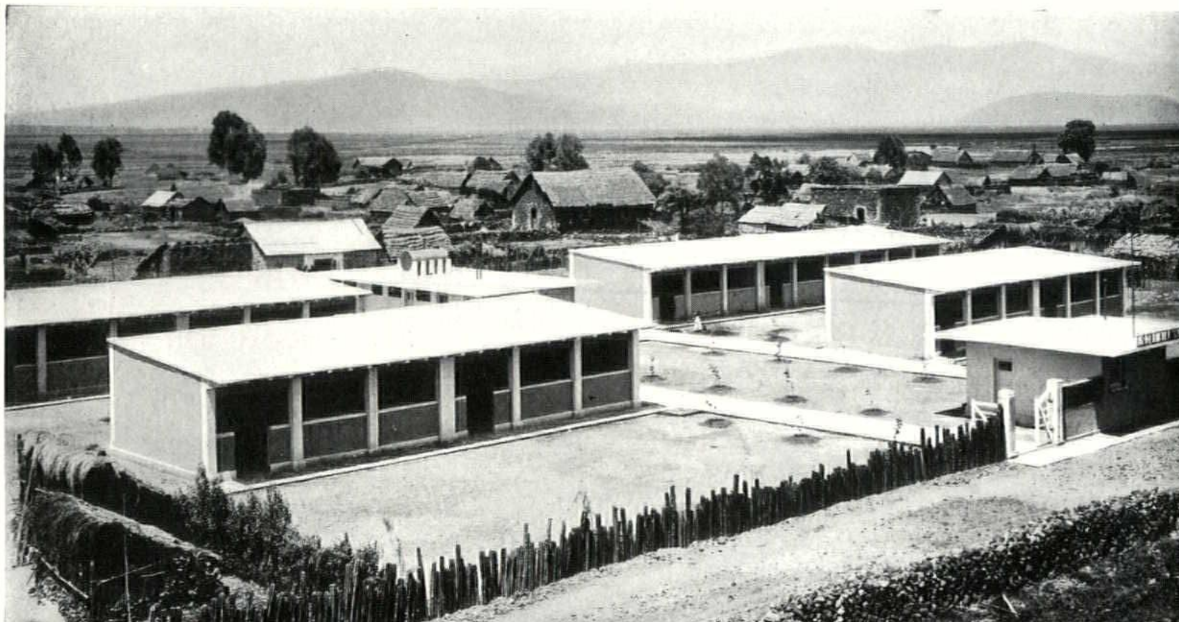


FEDERAL SCHOOLS OF MEXICO

JUAN O'GORMAN, SUPERVISING ARCHITECT

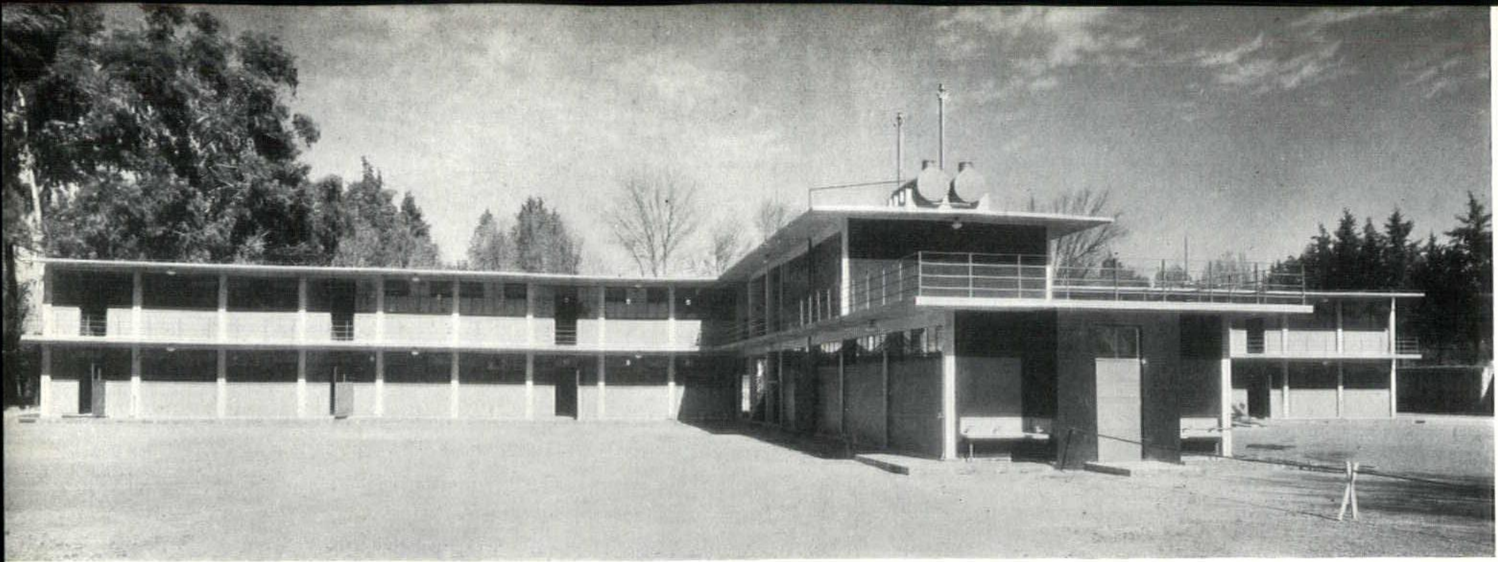
PLAYGROUND OF SCHOOL IN COLONIA PORTALES. WALLS ARE GREEN, GRAY AND BLUE. ALL STEEL OF WINDOWS AND RAILINGS ARE PAINTED A BRILLIANT RED VERMILION.

PRIMARY SCHOOL IN THE INDIAN VILLAGE OF ILAHUAC



SCHOOL IN INDIAN VILLAGE OF XOCHIMILCO

There has been a distinct shortage in school building in Mexico since 1929 resulting from an expanded educational program dating from that year. A school building program was launched which was intended to bring benefits of education to the popular mass. In some schools morning and afternoon classes were organized in order to remedy the great deficiency in schools and to accommodate the increased demand for primary school education. To rush construction of buildings the Secretary of Public Education in collaboration with the architect, Juan O'Gorman, prepared plans for places where there was most urgent need. Limited funds, only 1,000,000 pesos, less than $500,000, were made available in 1932 for construction and repair of school buildings. Inhabitants of zones where schools were built lent help by donations of land, materials, labor and money. Elements of construction and planning were made uniform wherever possible. Typical classroom sizes are 6 x 9 meters. Offices for the school principal were standardized at 3 x 3 meters; libraries, the same as for classrooms; clinics 3 x 6 meters; storerooms 3 x 3 or 3 x 6 meters, depending on importance of school. The school house plan was so devised that it could be enlarged without waste of space or crowding. New sections are to be added to ends. Windows face to East and Northeast in order that the sun may enter rooms in the morning. Walls toward corridors are provided with portholes to permit cross ventilation. Floors of classrooms are of asphalt, since this material can be readily kept clean and disinfected. In many schools there is a terrace over the shower room used for sitting and where a radio is installed to broadcast over the play spaces. The same terrace is, in some cases, provided with equipment for projection of "movie" films. The play space is then used to seat people of the village. The exteriors of all buildings are painted in vivid colors—red, orange, rose and green—dark enough to prevent strong heat reflections and glare. Interiors are tinted in light shades.



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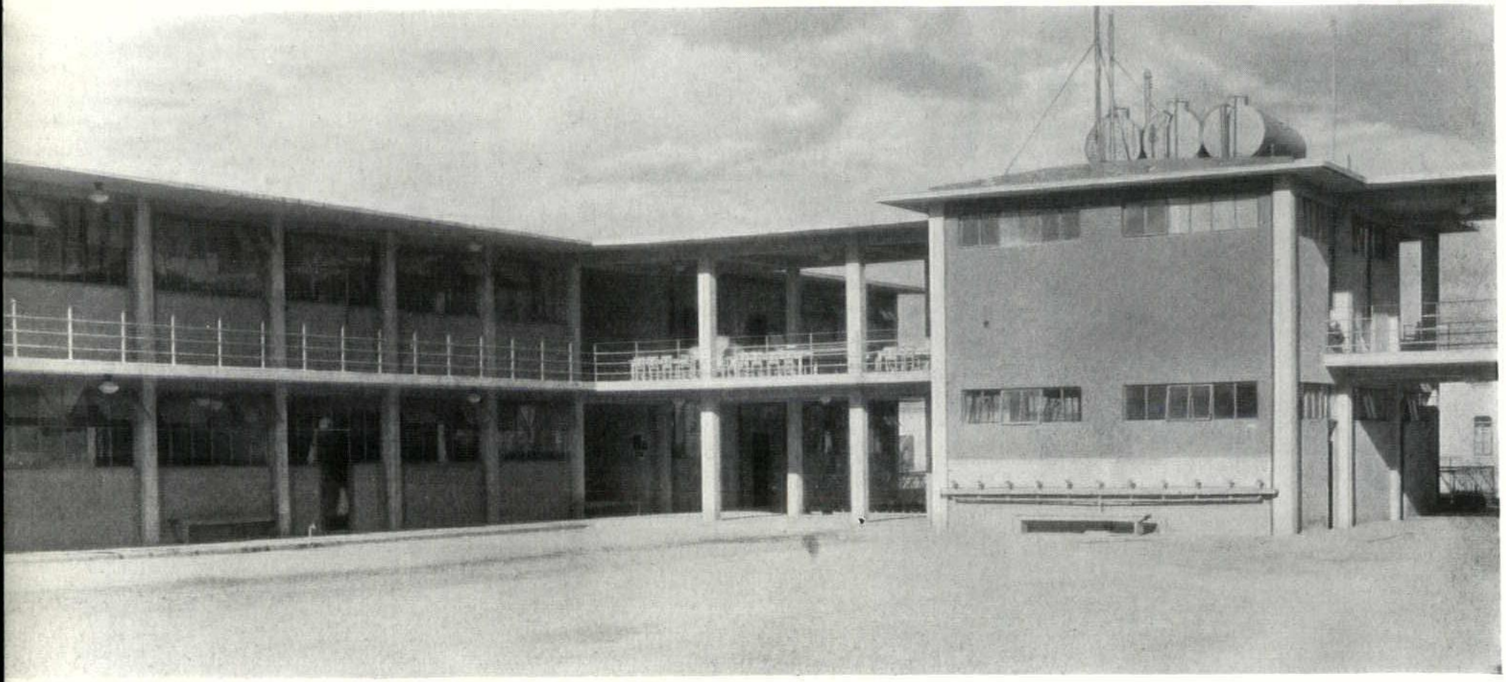


2

3

1 SCHOOL IN A SLUM DISTRICT OF PERALVILLO. WALLS ARE IN ROSE, GRAY AND ORANGE.
2 A TWELVE-CLASSROOM SCHOOL AT COGOACAN. WALLS ARE BLUE AND BROWN.
3 SCHOOLS NEAR MEXICO CITY IN SLUM DISTRICT AT PERALVILLO. WITH FUTURE ADDITIONS THIS SCHOOL WILL COMPRISE FORTY CLASSROOMS.

TECHNICAL NEWS AND RESEARCH

ELECTRICITY IN THE HOME

BY
HENRY L. LOGAN

ELECTRICITY IN THE HOME

BY HENRY L. LOGAN
CONSULTING ELECTRICAL ENGINEER

Electricity was originally introduced in the home to provide light. This is still its main function since almost three-quarters of the average residential load is consumed in illumination.

Power to operate time- and labor-reducing devices is being provided on an increasing scale, but the degree to which the public has failed to take advantage of the comfort, protection, health benefits and entertainment possibilities of electricity can be realized only by comparing an adequately electrified home with the "statistical average."

Three times the load that the latter uses for all purposes is devoted, in the case of the former, to comfort requirements alone. The total connected load of the first is nine times that of the second.

The coming decade will reveal great changes in the average home. Reduced current costs are already in effect in some localities and will be the rule, sooner or later, everywhere. Electrical loads that are now out of the question not only will be economically possible, but because efficient use will offset other charges, they will become economically desirable. All homes planned today should include provision for full electrification in order to avoid rapid obsolescence.

ITEMS FOR POWER PROVISION

The power system of the modern home should make provision for the following items: (See "Super-electrification," page 450.)

1 WORK (labor and time-saving equipment)

FOOD PREPARATION	Range	
	Mixing equipment	Toasters
	Percolators	Waffle iron
	Portable heaters	Chafing dish
	Plate warmers	Pancake griddle
	Dish washer	Electric heated service
	Refrigerators	Cart (portable steam table)
LAUNDERING	Washing machine	Flat irons
	Ironing machine	Clothes drier
CLEANING	Vacuum cleaners	
	Floor waxing machine	Spraying machine

WATER	Pump, in some districts	

2 COMFORT

AIR CONDITIONING	Oil burner Water pump motor	Air conditioning motors Air conditioning controls
VENTILATION	Exhaust fans	
MISCELLANEOUS	Hair driers Shower heater	Towel warmers Bathroom heaters

3 HEALTH

ULTRA-VIOLET RADIATION	Sun lamps	
INFRA-RED RADIATION	Heat lamps Warming pads	Mechanical exercisers

4 PROTECTION

ALARMS	Fire Burglar	
COMMUNICATION	Outside telephones Intercommunicating telephones	
TIME	Clocks	

5 ENTERTAINMENT and RECREATION

SOUND	Reproducing piano	Radios
VISION	Television Equipment	Motion picture equipment
HOBBIES	Special equipment, such as lawn mowers for gardening, electric hedge cutters, workshop motors, pumps and heaters for aquariums.	

6 ILLUMINATION

LIGHTING EQUIPMENT	(This will be treated at length in a later issue.)

The accompanying tabulated data will help the reader to understand the degree of electrification made possible by various connected loads.

TABLE 1

CONNECTED LOAD	DESIRABLE DIVISION OF CONNECTED LOAD						TOTAL CONNECTED LOAD FOR SIX-ROOM HOUSE OF AVERAGE 2700 SQ. FT. TOTAL FLOOR AREA	DEGREE OF ELECTRIFICATION
Expressed in watts per square foot of total floor area								
	Light	Work	Comfort	Health	Protection	Leisure		
1.1	0.63	0.33	0.04				2.9 kw	Statistical Average
2.0	1.00	0.60	0.13	0.20		0.07	5.4	Inadequate
4.0	1.75	1.35	0.50	0.25	0.07	0.08	10.8	Minimum
7.0	2.00	1.60	3.00	0.25	0.07	0.08	18.9	Minimum Adequacy
9.0	3.40	2.00	3.00	0.25	0.15	0.20	24.3	Adequate
14.0	4.40	4.90	3.00	0.60	0.20	0.90	37.8	Super
20.0	5.00	10.00	3.00	0.70	0.30	1.00	54.0*	"Home of Tomorrow"

** Prorated to total floor area of 2,700 square feet. The Westinghouse "Home of Tomorrow" has a floor area of approximately 4,000 square feet (total), and a total connected load of 80kw.*

The figures in Table I have been related to the total floor area of the home. There is direct justification for this use of an area guide in connection with the lighting load as illumination is generally calculated on a "wattage-per-square-foot" basis. There is not the same direct area relationship to power uses but the area figure is convenient and has worked out accurately for the writer in the examples to which it has been applied and it is hoped that more extended use will prove it reliable.

ELECTRIFICATION BY WATTS—SQ. FT.

MINIMUM ELECTRIFICATION
(4 watts per sq. ft.)

allows for minimum average lighting intensities, small portable kitchen apparatus, refrigerator, washing machine, flat irons, vacuum cleaner, floor waxer, oil burner, exhaust fan, portable fans, sun lamp, heat lamp, warming pad, protective lighting, electric bells, electric clocks, radio equipment and small miscellaneous portable apparatus.

MINIMUM ADEQUATE ELECTRIFICATION
(7 watts per sq. ft.)

permits all year 'round air conditioning in addition to the above, some improvement in the lighting and an increase in the heavier work devices.

ADEQUATE ELECTRIFICATION
(9 watts per sq. ft.)

makes generous illumination possible with increased electrification of the kitchen and laundry. (It does not allow for electric cooking or clothes drying.)

SUPER-ELECTRIFICATION
(14 watts per sq. ft.)

provides optimum visibility conditions, full electrification of the kitchen (including cooking), adequate electrification of the laundry and bathrooms, all year air conditioning, complete accessory ventilation, complete electrical health equipment, full electrical protection, and entertainment.

"HOME OF TOMORROW"
(20 watts per sq. ft.)

Electrification in this "model" home includes, in addition to the preceding, electrical water heater, clothes drier, sterilizer and hot plate in the laundry, automatic garage door equipment, kitchen range with almost double the average load, separate electrical broiling oven, electrical serving table, shower heater in the bathroom, built-in electrical radiation heaters on third floor, complete range of lighting effects inside and outside and fifty per cent additional provision for miscellaneous portable and semi-fixed electrical devices.

The writer is impressed with the possibility that within ten years a six-room home provided with a connected load of less than 19 to 20 kilowatts will be as unrentable and unsalable as an unwired home is today.

The connected load of the adequately electrified small home can only be determined accurately in any given case by a compilation of the wattage consumptions of the noncomplementary electrical equipment to be provided for, so a list is given in Table II. To the connected load so figured should be added, for the illumination, at least 2 and preferably 3 to 3.5 watts per square foot of the total floor area. Allow 17 convenience outlets for portable lamps, and sufficient additional outlets to take care of other portable equipment to be provided (usually a total of 75; see Table 3).

TABLE 2 WATTAGE OF HOME ELECTRICAL APPLIANCES

FOR USE ON ORDINARY BRANCH CIRCUITS	
Air conditioning controls	650 watts
Bottle warmer for nursery	40 "
Clocks	2 "
Cooker	475 "
Curling iron	20 "
Coffee maker	550 "
Dish washer	125 "
Electric blower for heating system	75 "
Electric refrigerator	75 "
Electric towel drier	1000 "
Egg cooker	420 "
Flat irons	660 to 1000 "
Floor waxer	50 "
Grill	475 "
Hair dryer	50 "
Heating pad	60 "
Humidifier	80 to 90 "
Mixer	70 "
Oil burner motor	125 "
Oil burner, including ignition and controls	500 "
Pressure pump	500 "
Radio	100 "
Reproducing piano	400 "
Sewing machine	65 "
Sump pump	200 "
Sun lamp	400 "
Toaster	500 "
Vacuum cleaner	40 to 50 "
Vent fan	50 "
Waffle iron	700 "
Washer	100 to 400 "
Water pump motor	200 "
Automatic garage doors	200 "
FOR USE ON MEDIUM BRANCH CIRCUITS	
Ironer	1350 "
Space heaters	1500 "
FOR USE ON HEAVY BRANCH CIRCUITS	
Air conditioning motors	3850 "
Clothes drier	4000 "
Electric range	9000 to 14000 "
Electric water heater	1500 to 3000 "

TABLE 3 GENERAL DISTRIBUTION OF ELECTRICAL OUTLETS IN A SIX-ROOM HOME

	STATISTICAL AVERAGE HOME	EXCEPTIONAL PRESENT PRACTICE	ADEQUATELY ELECTRIFIED HOME*	WESTINGHOUSE "HOME OF TOMORROW"
Connected load	3 kw	15 kw	25 kw	80 kw
Convenience outlets	7	36	75	87
Radio outlets	..	..	7	9
Electric clocks	..	1	6	7
Night and burglar lights	..	8	21	24
Pilot lights	..	.	4	4
Lighting outlets	22	70	70–80	113
Telephone outlets	..	..	6	8
Wall switches†	8	30	52	91†
Door switches	..	7	7	5
Key switches	..	..	2	2
Portable lamps	6	17	17	17
Light bulbs	23	78	90–100**	320**
Electric outlets of all kinds	65	160	240–250	369

** See first table.*
† Exclusive of master switches, switches on portable or fixed machinery and appliances, panel boxes, fuses or circuit breakers (except where latter are "Nofuze" or similar type, constructed as part of wall switches).
*** This figure will vary widely.*

A well-wired house has been described as "one in which there are outlets equal to the number required for all present and future needs—placed with respect to the uses they will serve—with proper controls properly located and good materials used throughout." The fundamental parts of the home electrical system are illustrated in Figure I.

A WELL-WIRED HOUSE

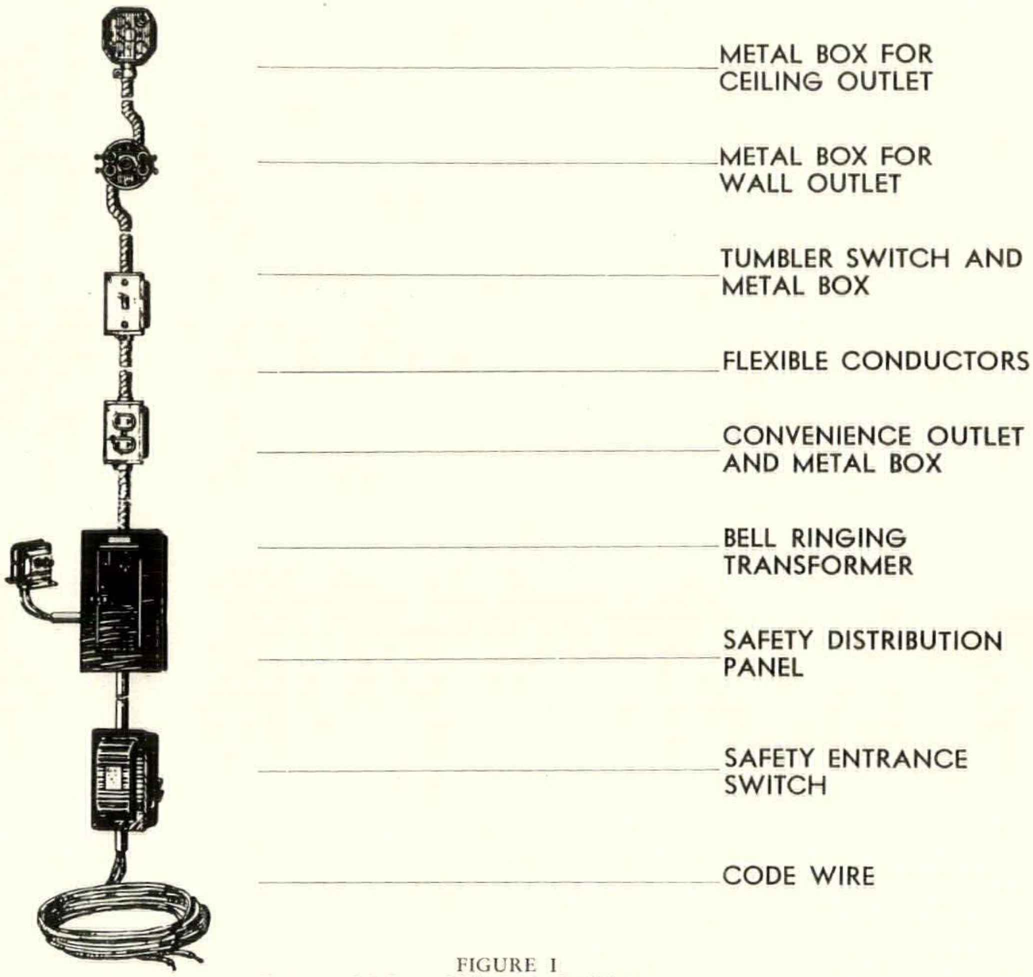


FIGURE I
Courtesy McGraw Hill Book Publishing Co., Inc.

ELECTRICAL SYSTEMS

The panel box should be located in an accessible place such as the rear hall closet, kitchen or pantry. Where the circuits are sufficiently numerous as to require several points of distribution (called "load centers"), these should be similarly located in accessible places. The circuits should be plainly marked at all such panels and load centers.

IDENTIFICATION OF CIRCUITS

Distinctive color braids are available and should be employed to identify feeders, lighting circuits, power circuits, burglar alarm systems, radio circuits, signal systems and other special installations. One manufacturer provides the following colors: black, blue, red, green, yellow, brown, orange, white.

In all cases where the load on a circuit can be definitely fixed G.E. Circuit

CIRCUIT BREAKERS Breakers, Westinghouse "Nofuze," or similar devices, instead of old style fuses, should be installed to protect the circuits. The circuit breakers are operated magnetically and open the circuit by releasing a switch mechanism. The circuit remains open until the trouble ceases or is removed. This obviates the necessity of removing blown out fuses but imposes a fixed limit upon the capacity of each circuit that cannot be changed as easily as in the case of a fuse. If, for example, a circuit originally carries 15 amperes and it is desired to increase the load to 20, the protecting fuse can be replaced by a heavier one, but the circuit breakers cannot be adjusted to the heavier load. This inflexibility of circuit breakers has the advantage of preventing unwise loading of circuits and forces a more accurate study of the probable circuit loads in the planning stage.

WIRING SYSTEMS KNOB and TUBE: This method employs braided, rubber-covered single wire. The wire is supported on porcelain knobs. Porcelain tubes are used when it is necessary to pass through wooden joists, beams or studding. The wires must be separated by at least 5 inches and kept at least 1 inch from the surface on which they are mounted. There are other restrictions that make this method the most expensive due to excessive labor requirements. It is also the poorest system.

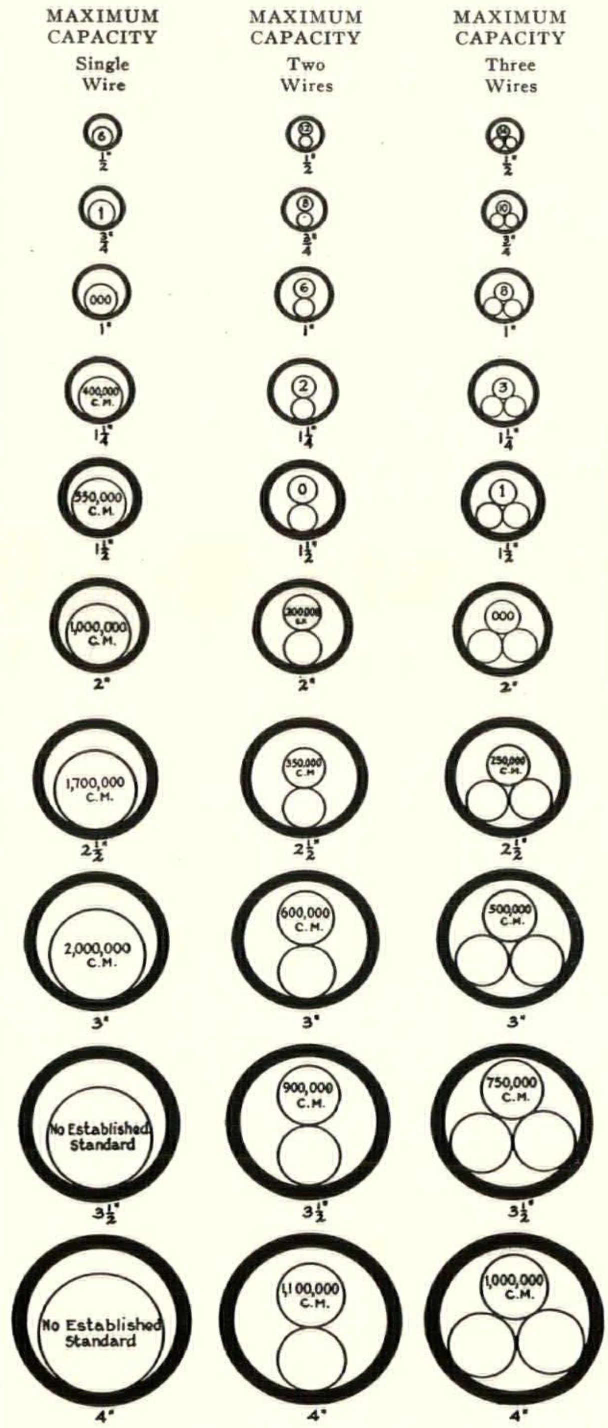
NONMETALLIC SHEATHED CABLE: This is the most widely used method in present day practice. It uses two conductors separately insulated, contained in an outer sheathing of braided, fibrous or other insulating and protecting material. The cable is run from outlet to outlet in continuous lengths without joints or spliced connections. The cable is fastened directly to the mounting surface by means of metal straps similar to those used for supporting water pipes. It is now available with a special fire-resisting, or flame-retarding, finish, which many local codes require, and which Fire Underwriters will probably require generally in the near future.

ARMORED CABLE: Also in wide use. It consists of a flexible metal cover wound over rubber or other insulated wires. It must be run from outlet to outlet in continuous lengths. It is fastened by water pipe straps. The armored covering is both mechanically and electrically connected to all outlet boxes and fittings.

CONDUIT: This consists of insulated wires in rigid metal pipe. The conduit is first put in place and the wires are drawn in afterwards. Conduit wiring is now standard practice in industrial and commercial work (armored cable being used for short extensions only, with an outlet box at every splice). It is the best system and considered the cheapest by many electrical contractors because of the lower labor requirements. It will probably be required eventually for all types of work.

SIZES OF CONDUIT

WITH NUMBER OF WIRES PERMITTED UNDER CODE



General Electric Co.

TYPES OF CONDUIT

WHITE RIGID CONDUIT

Galvanized under the "Hot - Dipped" process and Glyptal coated

BLACK RIGID CONDUIT

Finished in special heavy black enamel. Conduits are furnished in 10-foot lengths, threaded on both ends, with coupling on one end

SINGLE STRIP CONDUIT

This is a galvanized flexible steel conduit. Fittings are adapted to each size

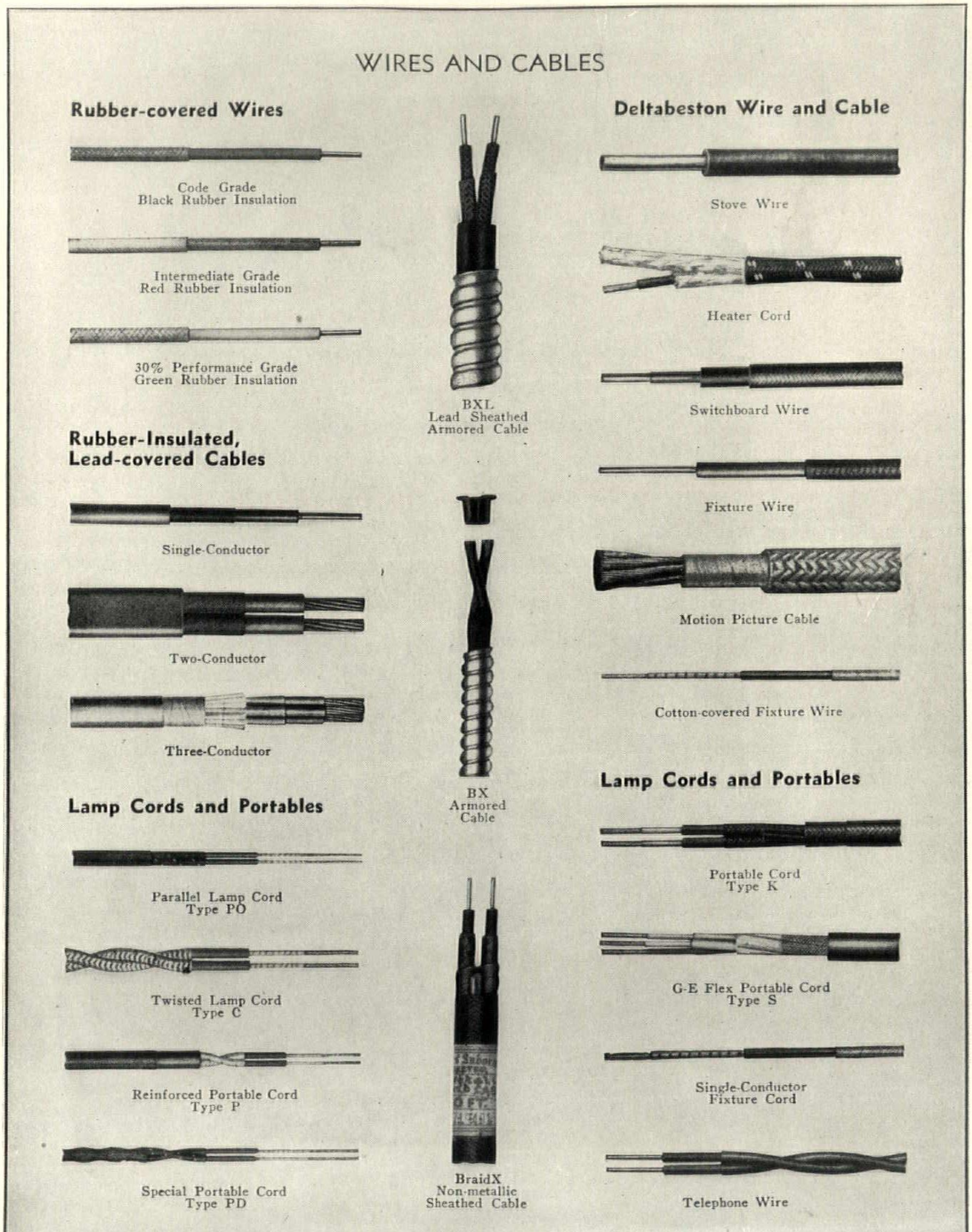
OVAL TUBING

Available in electro-galvanized finish only. The line of fittings is so designed that interchangeability of airing systems may be effected whenever desired

ELECTRICAL METALLIC TUBING

A thin wall rigid raceway made from open-hearth steel and ductile enough for easy installation. Electro-galvanized finish only

SOME DIFFERENT COMMON TYPES OF WIRES AND CABLES



General Electric Co.

CONDUIT SIZES ARE SHOWN ON THE ACCOMPANYING CHART, P. 454

Recommended wire sizes are given in Table IV.

CONDUIT

BRANCH CIRCUIT WIRE SIZES REQUIRED TO RESTRICT VOLTAGE LOSS TO 2 VOLTS (Two Wire, 115 Volt Circuits) TABLE **4**

LENGTH OF CIRCUIT IN FEET	WATTS PER CIRCUIT 750	1000	1500	1725	2000	3000
	AMPERES PER CIRCUIT 6.1	8.7	13.1	15.0*	17.4	26.1
20	14	14	14	14	14	12
30	14	14	14	12	12	10
50	14	12	10	10	10	8
100	10	10	8	8	6	4
150	10	8	6	6	4	4
200	8	6	4	4	4	2

** Fifteen amperes is the allowable current capacity as set forth in the National Electric Code.*

CIRCUITS

BRANCH CIRCUITS

Lighting and appliance branch circuits should be separate so that lights will not go out if an appliance overloads and blows a fuse. The latter should be fed through a power meter where a lower power rate is available.

ORDINARY APPLIANCE BRANCH CIRCUITS

Ordinary appliance branch circuits are limited to fixed or portable devices rated at not over 1320 watts or 12 amperes, 110 volts; e.g., 1200 watt, 15 pound laundry irons, hot plates, electric towel dryer.

MEDIUM DUTY APPLIANCE BRANCH CIRCUITS

Medium duty appliance branch circuits are for fixed or portable appliances rated at not over 1650 watts, or 15 amperes, usually run with No. 10 wire to laundry, kitchen or bathroom where heavier appliances are customary.

HEAVY DUTY APPLIANCE BRANCH CIRCUITS

Heavy duty appliance branch circuits are two wire, No. 10, fused at 25 amperes, limited to 250 volt circuits at 20 amperes (electric ranges, etc.).

Two different circuits should be provided for each room so that service to the room will still be available in case of the failure of one circuit.

SEPARATE POWER CIRCUITS

A separate power circuit should be provided for the oil burner, and another for the air conditioning apparatus.

FUTURE GROWTH

Extra circuits should be allowed on the panel board for future growth. Appliances not even known to us at present may be developed in the future.

It is well to keep in mind that at some future time the third floor may be furnished into separate rooms and the wiring should be treated in accordance with that consideration.

The size of all conduits should be chosen to permit the future accommodation of conductors having double the current carrying capacity of the initial installation.

SERVICE ENTRANCES

Each utility company supplying electrical service establishes rigid requirements governing the materials that must be employed from the utility company's service pole through the meter and service switch to the distribution panel. Owners and architects have little opportunity or need to select and specify these materials on their own account. They should consult the utility company and follow the requirements thus established.

OUTLETS

Special wall outlets should be provided for fans, ventilators and electric clocks; special radio outlet for aerial and ground connections, and tell-tale pilot lights for the iron, other silent appliances and cellar, entrance and porch lights.

One floor outlet is practically a necessity in the center of the dining room, to permit the use of table appliances and decorative illumination for dinner parties; and one floor outlet in the breakfast room to permit the use of toaster, percolator, and the like, except where the table is the type that stands against a wall when a wall outlet will serve.

Weatherproof convenience outlets should be provided for out of doors.

Duplex receptacles are recommended on all ordinary appliance branch circuits.

Mercury tube switches are desirable for bedrooms, bathrooms, intervening hallways, nursery and wherever noiseless operation is desired.

No more than three switches should be placed at any location, to avoid confusion.

The night light system can be controlled from a switch on a flexible cord in the master bedroom.

One locked cabinet should control burglar lights and the wiring for same should be especially concealed.

HOUSING CONDITIONS IN 7 SMALL CITIES

by **THOMAS S. HOLDEN**

VICE PRESIDENT IN CHARGE OF STATISTICS AND RESEARCH, F. W. DODGE CORPORATION

REAL PROPERTY INVENTORY RESULTS FROM 7 SMALL CITIES

(SUMMARIZED AND COMBINED WITH 1930 CENSUS DATA)

	BOISE, IDAHO	CASPER, WYOMING	BUTTE, MONTANA	ASHEVILLE, N. C.	COLUMBIA, S. C.	NASHUA, N. H.	BURLINGTON, VERMONT
POPULATION:							
1920	21,393	11,477	41,611	28,504	37,524	28,379	22,799
1930	21,544	16,619	39,532	50,193	51,581	31,463	24,789
Per cent increase	0.7%	44.8%	—5.0%	76.1%	37.5%	10.7%	8.7%
FAMILIES:							
1930	5,887	4,637	10,119	11,695	11,184	7,593	6,004
1934	6,523	5,045	9,523	12,524	12,380	8,177	6,648
Increase since 1930	636	408	—676	829	1,196	584	644
Extra (double up)	366	124	498	1,390	823	637	370
DWELLINGS:							
Total units	6,477	5,595	10,727	12,584	12,188	7,946	6,618
Crowded and overcrowded units	1,074	1,011	2,551	2,174	3,569	1,097	898
Occupied units	6,157	4,921	9,025	11,134	11,557	7,540	6,278
Vacant units	320	674	1,702	1,450	631	406	340
Vacant 1 year or more	72	238	985	474	61	104	53
Units unfit for use	148	262	358	421	170	90	49
AGE AND STRUCTURAL CONDITION:							
Median age	25 yrs.	19 yrs.	31 yrs.	15 yrs.	23 yrs.	40 yrs.	39 yrs.
Per cent 30 years or older	33%	3%	53%	22%	37%	64%	67%
Per cent needing minor repairs	43%	46%	41%	46%	46%	43%	47%
Per cent needing structural repairs	15%	20%	24%	23%	19%	11%	9%
Per cent unfit for use	2.9%	6.1%	4.9%	3.9%	1.7%	1.9%	1.2%
Per cent masonry construction	9%	9%	32%	12%	15%	3%	14%
LACK OF CONVENIENCES:							
Number without central heating	3,794	3,615	7,808	7,429	9,988	4,287	2,904
Number without running water	499	699	526	623	2,805	69	24
Number without gas or electricity	210	477	126	2,434	4,102	59	123
Number without indoor water closets	1,364	1,410	2,409	1,958	4,444	224	114
Number without bath tubs or showers	1,559	1,721	3,418	3,446	5,252	2,055	1,521
Number without mechanical refrigeration	5,170	4,782	9,726	10,571	10,293	8,813	5,550
Number without garages	1,678	1,872	3,231	5,233	5,611	2,470	1,758
GARAGES WITH DWELLINGS:							
Number	3,462	2,795	4,073	5,571	4,290	2,159	2,474
Car capacity	4,241	3,695	5,296	7,437	5,878	5,992	4,295
Cars owned	3,857	3,337	4,286	5,113	5,100	3,169	3,113
VEGETABLE GARDENS IN 1933:							
Number	970	850	1,177	3,312	1,316	1,358	1,322
OWNED HOMES:							
Number in 1930	2,891	1,844	3,995	4,428	3,496	2,912	2,469
Number in 1934	2,912	1,865	4,084	3,498	3,577	2,868	2,599
Median value 1930	$3,772	$3,197	$2,605	$5,838	$5,709	$5,419	$6,635
Median value 1934	$2,815	$2,214	$1,927	$2,485	$3,604	$3,692	$5,802
RENTED HOMES:							
Number in 1930	2,853	2,710	6,060	7,122	7,406	4,528	3,469
Number in 1934	3,565	3,730	6,629	9,086	8,611	5,101	4,319
Median rental 1930	$26.62	$25.48	$25.83	$23.06	$14.38	$22.09	$25.13
Median rental 1934	$20.33	$17.41	$16.37	$13.47	$11.40	$18.90	$22.33
ALL HOMES:							
Median rental, including estimated rental value of owned homes, 1930	$31.30	$26.80	$25.22	$30.00	$21.96	$29.20	$36.13
Same for 1934	$23.74	$18.50	$17.79	$15.34	$14.44	$22.87	$28.12

THE U. S. Department of Commerce has released preliminary statements on the results of seven real property inventories taken in the earlier months of this year. The seven cities thus far reported are all small cities, ranging from 16,000 to 51,000 in population in 1930. Three are in the Rocky Mountain States (Boise, Butte and Casper), two in the Carolinas (Asheville and Columbia), and two in New England (Nashua and Burlington). It is obvious that the data furnished by these seven cities are too limited for general conclusions, but it is worth while to summarize the figures that are at hand. Such a summary can indicate a method of study of later survey reports, and may point to some tentative observations of value in reaching conclusions on more complete data to be obtained when more cities have been reported on.

POPULATION AND FAMILIES: Five of the cities were growing cities from 1920 to 1930; Boise, Idaho, was stationary; Butte, Montana, lost population. All but Butte gained in population from 1930 to 1934, and Butte continued to lose. It is significant to note that the other six cities gained 4,277 families and that they have 3,710 extra families living doubled-up in family quarters. It raises a suspicion that the population gains consisted very largely of unemployed persons who left the larger cities to go back to the small towns and live with relatives.

DWELLINGS (Housing shortages and surpluses): The seven cities have 60,820 families and 62,135 dwelling units, of which 1,498 are rated as unfit for use. In five cities the number of families exceeds the number of dwelling units rated as fit for occupancy: Boise, Asheville, Columbia, Nashua, and Burlington. On this showing it may be concluded that these five cities have real housing shortages; just how effective the immediate demand would be is dependent on the permanency of the new population and the important question as to whether the overcrowded families are financially able to build or rent new quarters. In Casper the excess of habitable dwellings over families is 15 per cent; in Butte, 9 per cent. Even in these two cities the proportion of crowded dwelling units is practically the same as in the other five. It is to be noted that Butte is the only city in which dwelling units vacant 1 year or more greatly exceed the number rated as unfit for use.

AGE AND STRUCTURAL CONDITION (The market for repair work): All the cities have large numbers of buildings needing minor repairs, the percentages of such buildings ranging from 41 per cent to 47 per cent. Here is a potential market for small work, in so far as the properties and their owners can stand the expense.

There is a very striking variation in the percentage of buildings needing structural repairs; the lowest percentage being in Nashua and Burlington, which have many more old buildings than the other cities. The city with the fewest old buildings, Asheville, has the second highest percentage of buildings needing structural repairs. Obsolescence is thus much less a matter of age than of sound structure and proper maintenance. There does not seem to be any definite relationship between the need for structural repairs and the proportion of masonry structures.

MODERN CONVENIENCES: On the matter of central heating, variations of climate are an important factor, as between the seven cities. Nashua and Burlington have rather surprisingly large numbers of houses without central heating, and rather high standards in other respects, including relatively high rent and property value scales. On this indication there would appear to be a market for modern heating units in these two towns. With respect to other modern conveniences, it is impossible to state from the evidence shown whether their lack indicates any large potential market or merely a low living standard. Comparison of these figures with the prevailing rent scales inclines one toward the latter conclusion. Lack of garages does not indicate much demand for new garages if we compare the figures lower down in the table which show the car capacity of existing garages well above the number of cars owned.

VEGETABLE GARDENS: One family in every six had a vegetable garden in 1933. The largest proportion of families having gardens was found in Asheville, where rent drops were worst and other factors indicate depressed conditions and low living standards; the large number of gardens probably indicates a large proportion of subsistence gardening. Such figures as these will be extremely valuable if collected again at a later date to indicate whether there is a trend toward greater interest in gardens. It will be interesting to compare with these the figures for the larger cities.

HOME OWNERSHIP: The numbers of owned homes remained practically the same since 1930 in all the cities, whereas the numbers of rented homes (including vacant ones for rent) increased. Even reduced values and low construction costs have not tended to increase ownership.

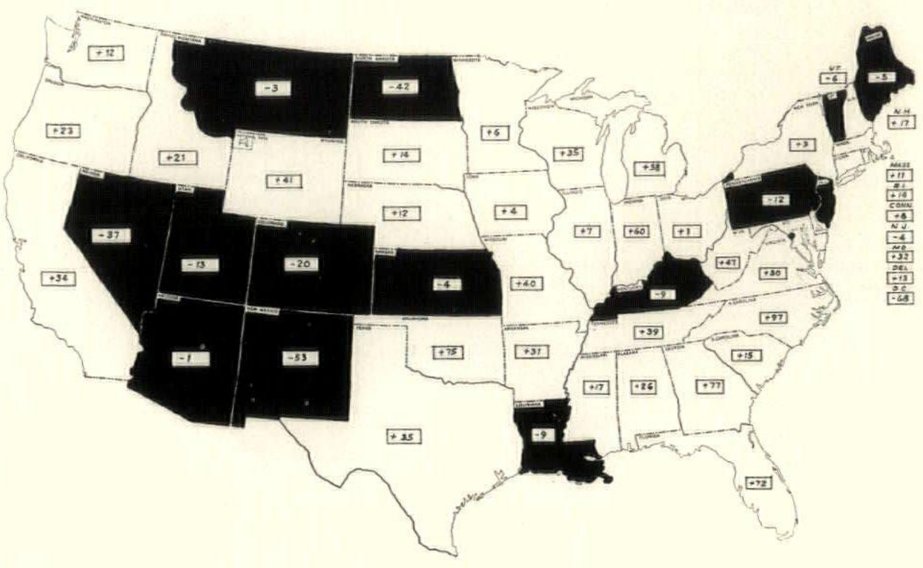
VALUES AND RENTALS: The median values shown are only rough indicators, but useful for comparative purposes. The greatest deflation in values and rentals took place in Asheville, the least in Burlington. In 1934, median values were under $3,000 in 4 out of the 7 cities; median rentals were less than $20 per month in 5 out of the seven. The figures here given on estimated rental equivalents of all homes are merely a device for setting up a single index for comparisons as between the cities. They are partial indices of incomes and living standards of the communities, and should be so considered in connection with the figures on lack of modern conveniences.

GENERAL CONCLUSION: These 7 reports indicate the existence within the 7 cities of potential demand for new houses, for minor repairs, for structural repairs and, possibly, for modernization. Immediate demand is limited by fairly low living standards in some of the places and by current conditions of employment and income of the people. Credit on easy terms would probably develop a reasonable amount of business.

The indications as to rentals and lack of modern facilities should be of interest to the sociologist as well as to the architect, the builder and the real estate man. They indicate a future potential demand that is dependent on considerable increases in the incomes of the people.

BUILDING TRENDS AND OUTLOOK

BY L. SETH SCHNITMAN
CHIEF STATISTICIAN
F. W. DODGE CORPORATION



BUILDING DURING 12 MONTHS—APRIL, 1933 - MARCH, 1934, INCLUSIVE. Corresponding twelve months ended March, 1933, taken as base. SHADED AREA: BELOW BASE. UNSHADED AREA: ABOVE BASE. Figures denote percentage change from base. Floor space for new building contracts, 37 states east of the Rocky Mountains. Permit valuations for Rocky Mountain and Pacific coast states. Map, copyright American Map Co., N. Y. Authorized reproduction No. 5025.

PRIVATE CONSTRUCTION SHOWS GAIN

Construction awards reported in the 37 Eastern States during April were more than twice as large as those recorded for April, 1933, but registered a decline of 26 per cent from the volume shown for March of this year. Gains over a year ago were shown in each of the thirteen major territories of the area east of the Rocky Mountains. Declines from the preceding month were recorded in all territories except New England, the Central Northwest and Southern Michigan.

Privately-financed construction awards in April totaled $56,-252,900. This was a higher volume for private construction projects than has been reported for any month since August, 1933, and compares with $52,405,600 for March of this year and only $38,933,800 for April, 1933. At the same time publicly-financed contracts totaled $75,158,900 in April; this was a decline of about 40 per cent from the volume registered in March, but was more than four times as great as the total reported in April of last year, before the advent of the PWA program.

Total contracts for construction in the 37 Eastern States, both public and private, let during the elapsed four months of 1934 amounted to $592,937,600. This contrasts with a total of only $252,599,800 for the corresponding four months of 1933.

Contemplated new work reported in April amounted to $319,-721,600, as compared with $409,073,100 for March and $132,566,200 for April, 1933.

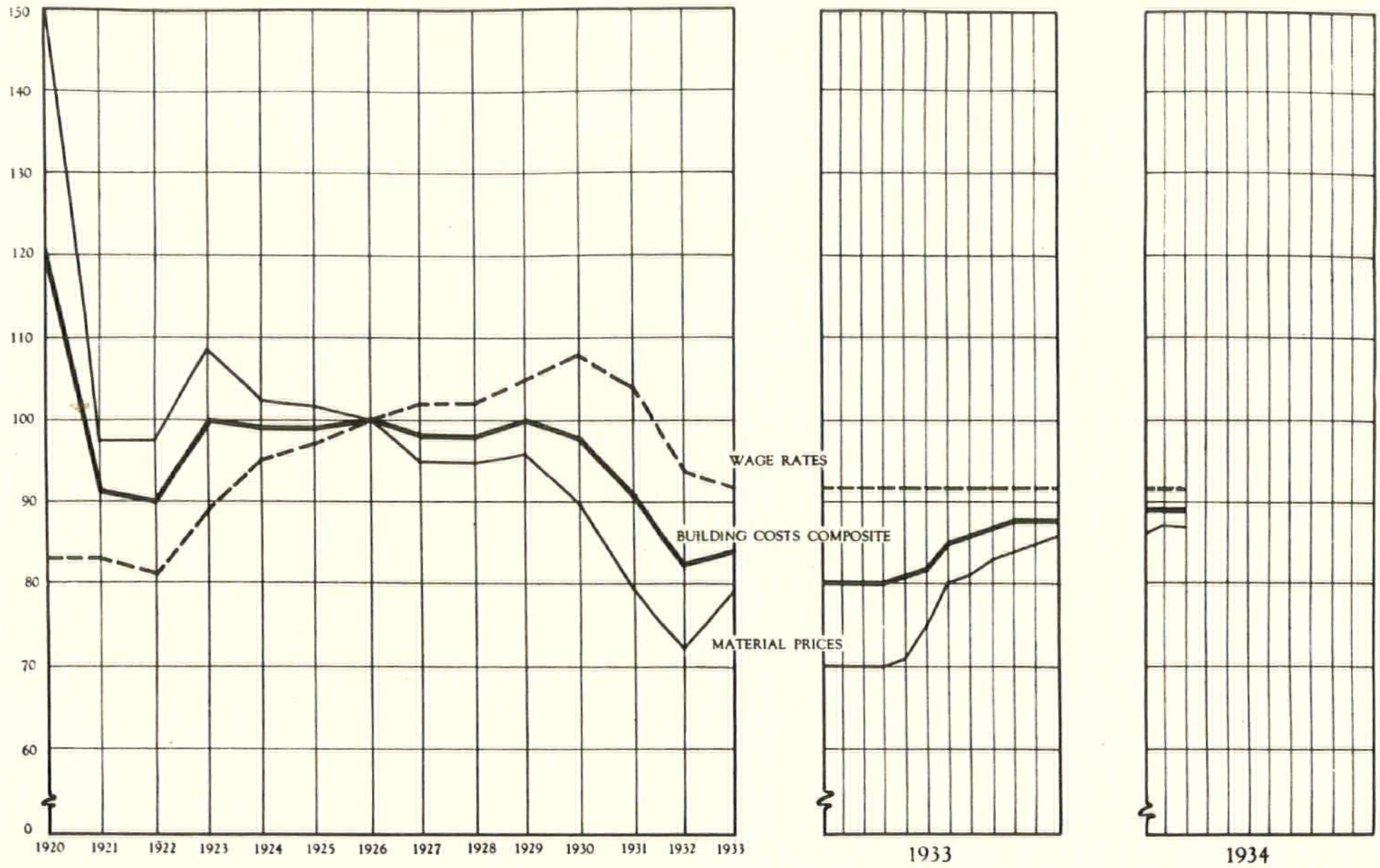
MATERIAL PRICE MEASURING ROD

F. W. DODGE CORPORATION
COMPOSITE PRICES

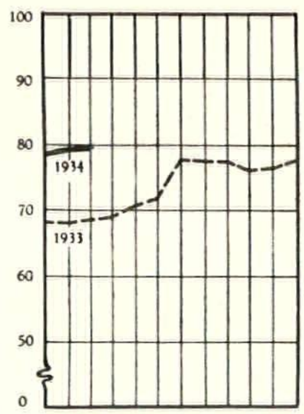
MATERIAL	This Month	Month Ago	Year Ago
Portland Cement . .	$2.30	$2.26	$2.05
Common Brick	12.36	12.36	11.70
Structural Steel . .	1.65	1.65	1.60
Lumber	16.48	16.50	15.48

The prices in this tabulation enable one to visualize at a glance the main trend of the material market. Their significance does not extend beyond that point, and the explanation should be read carefully.

Prices given in this comparison are composite and do not in all cases refer to one item. For instance, the price of structural steel is the composite of prices of shapes and plates f.o.b. Pittsburgh; the price of lumber is a composite of five items of Southern pine and five items of Douglas fir f.o.b. mill; the price of cement is a composite of prices in fourteen different cities per barrel, carload lots, to contractors; price of brick is composite in fourteen cities per M, delivered on the job.

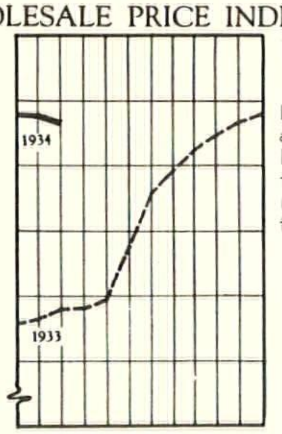


WHOLESALE PRICE INDEXES



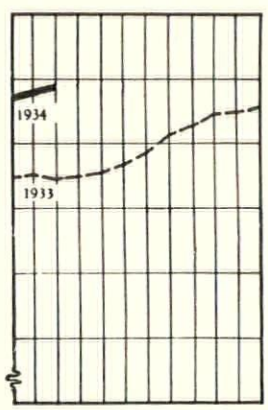
PAINT MATERIALS

There is little likelihood of further important price advances over nearby months.



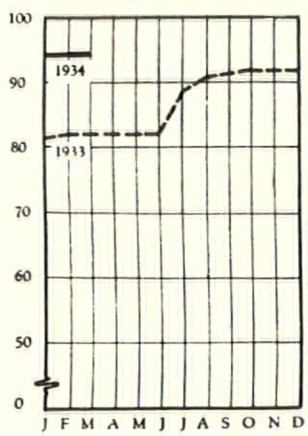
LUMBER

Lumber prices have about reached the level where important sales resistance must be encountered.



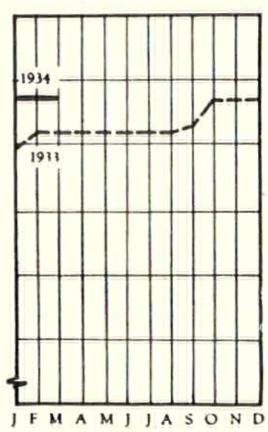
BRICK AND TILE

Prices for clay products appear to be nearing point where they will mark the beginning of a declining tendency.



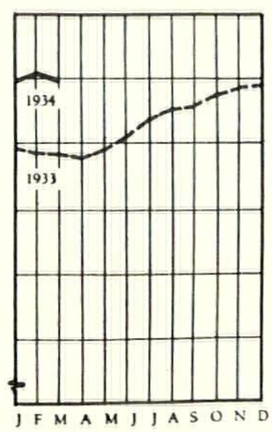
CEMENT

No important advances in cement from current levels appear likely in nearby future.



STEEL

Prices for structural shapes appear to have stabilized at current levels for the nearby months.



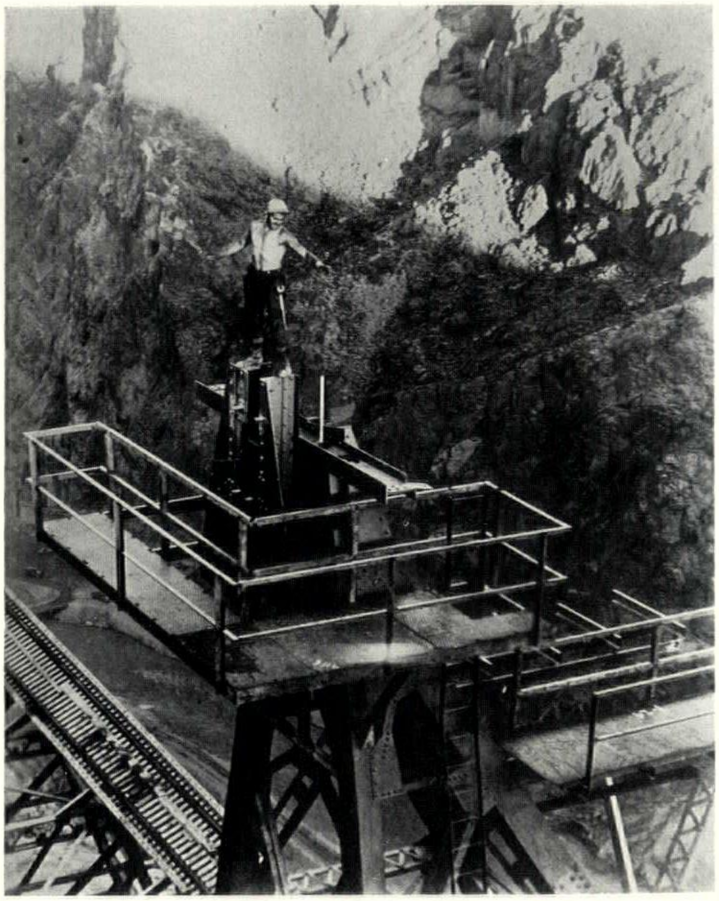
OTHER MATERIALS

The limit of the recent recovery in building material prices seems to have been reached for the time being.

1926 MONTHLY AVERAGE = 100

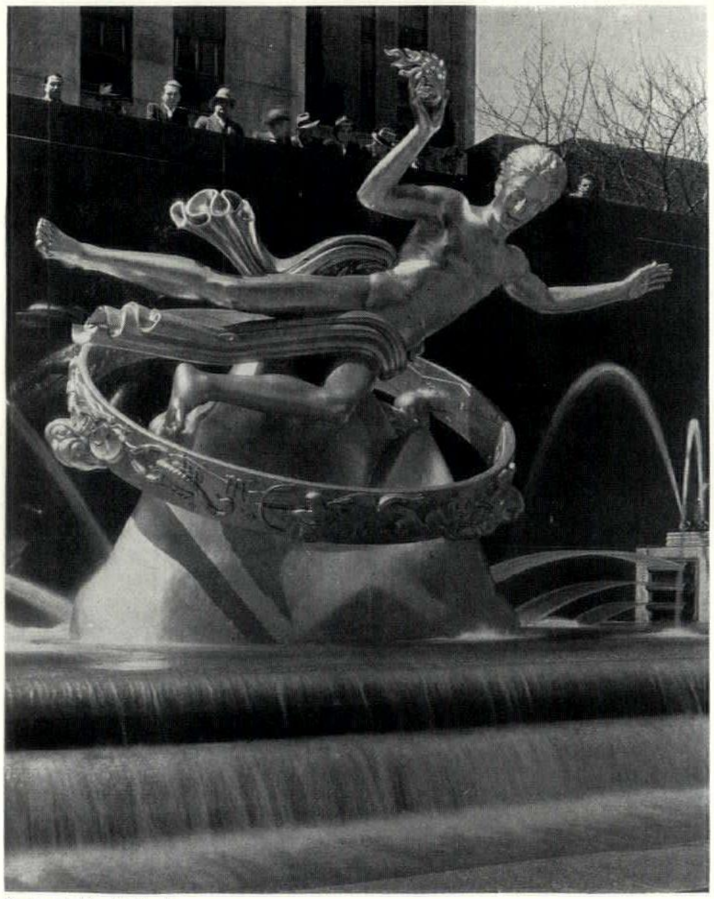
MATERIAL PRICES, BUILDING WAGE RATES AND BUILDING COSTS COMPARED

ILLUSTRATED NEWS



BOULDER DAM

A steel worker atop cableway tower on the Nevada rim of Black Canyon above Boulder dam site. The Public Works Administration allotted $38,000,000 to the Bureau of Reclamation to continue work on the Boulder Canyon project.



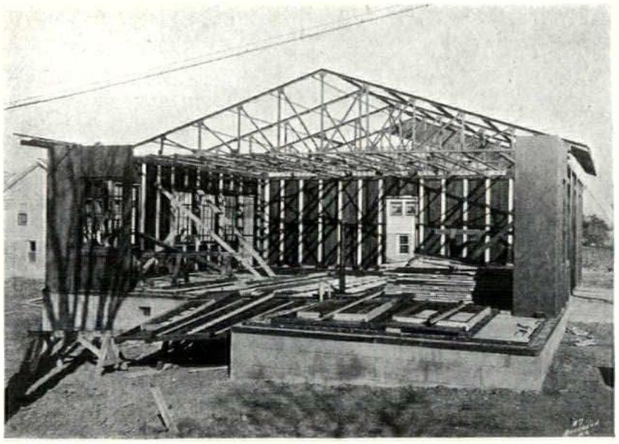
Samuel H. Gottscho

PROMETHEUS WITH ZODIAC

The Prometheus Fountain in the Sunken Plaza in Rockefeller Center, New York City, has just been completed. Designed by Paul Manship, American sculptor, the bronze fountain group depicts Prometheus, legendary contributor of fire, bearing the gift down to mankind. Prometheus, the central figure, is two and one-half times life size. The two basins of the fountain are of polished Deer Island granite and the back wall is of red Balmoral granite. Water spills over the lip of the upper basin into the lower basin which is sixty feet wide and sixteen feet across. The fountain is centered against the west wall of the Sunken Plaza in the middle block of the development between 49th and 50th streets. It will be illuminated with floodlights at night and visible at all times from Fifth Avenue.

AUTOMATIC DOORS IN PENNSYLVANIA STATION

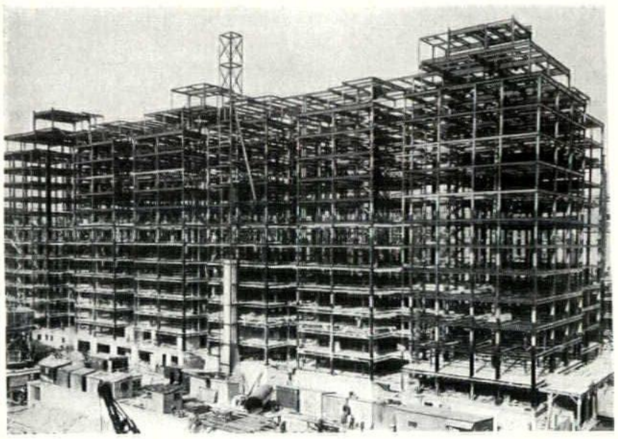
A photoelectric cell mechanism actuates the new doors in the Pennsylvania Station, New York City, installed by specification of McKim, Meade and White, architects. The doors have plywood centers covered with red Formica refinishing stock veneer, inlaid with black lines.



Anderson

A NEW STEEL HOUSE

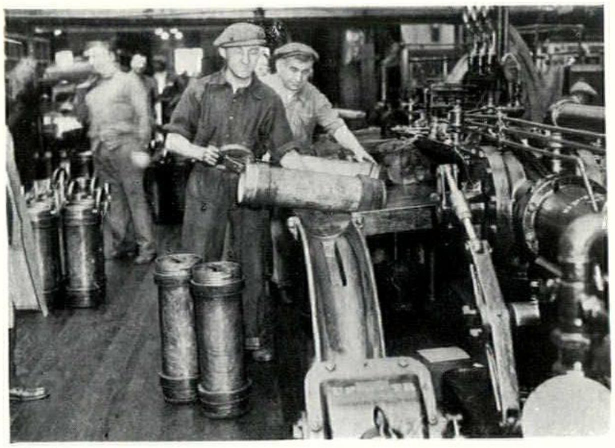
The first operating subsidiary of Universal Houses, Inc., has been organized recently in Kansas City, Missouri. This local company is now engaged in erecting Universal type non-standardized steel houses, following a method of construction evolved by John H. Miner, structural steel engineer. Standard parts consist of door, window, corner, and plain panels; roof trusses; floor beams; and all other items for the erection of completed houses, assembled on the foundation like an over-sized Erector toy, by trained erection crews of six men each.



Ewing Galloway

KNICKERBOCKER VILLAGE

The east unit of the first building of the Knickerbocker Village, New York City, nears completion. The $6,000,000 Fred F. French building project, which will house 1600 families in 6000 rooms, is scheduled to be ready November 1. The two 15-story units will have 13,200,000 cubic feet of building space and 1,300,000 square feet of floor space.

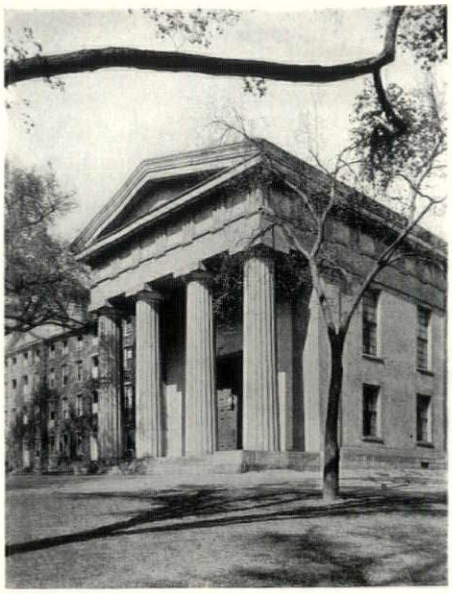


Wright

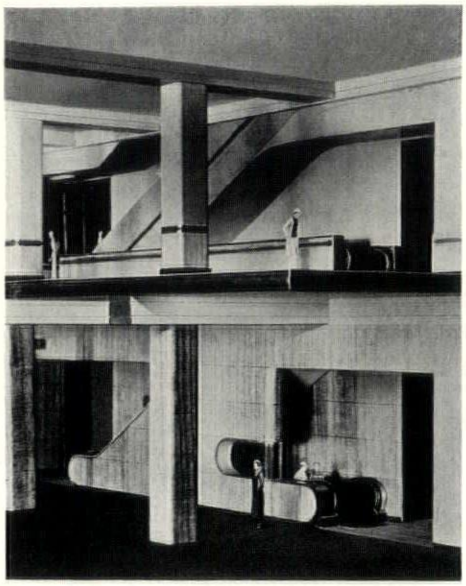
TUBES FOR AIR MAIL

In the New York General Post Office a high-speed underground mail tube system shoots some 6,000,000 letters daily to al! rts of the city. It is this type of service that will be a part of a new scheme enabling air mail planes to shoot their mail to the post office destination five minutes after a plane has landed.

The District of Columbia war memorial in Potomac Park has been chosen by the architectural committee of the Washington Board of Trade as the most outstanding memorial erected in the national capital in the last two years. The memorial, of white Vermont marble, is a Greek Doric temple large enough to accommodate an eighty-piece band. It was designed by F. H. Brooke, architect, with Horace W. Peaslee and Nathan Wyeth, consultants.



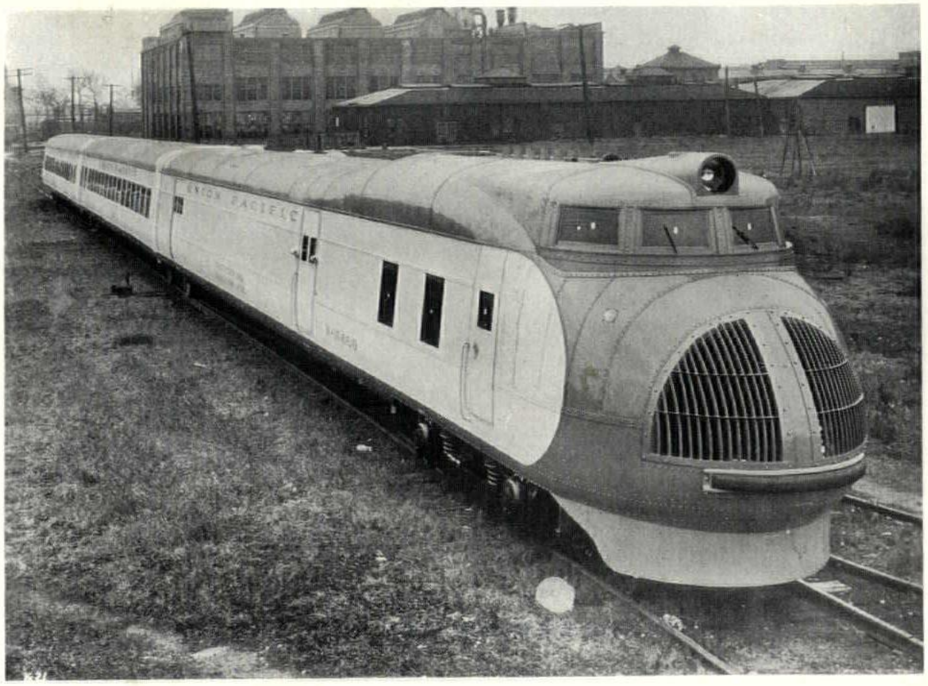
The 100th anniversary of the erection of Manning Hall was recognized at Brown University in appropriate exercises as a part of the Visiting Day Program. Manning Hall, named in honor of James Manning, the first President of Brown University, was the third building to be erected on the campus of the University. It is an example of the Greek revival which influenced American architecture during the first fifty years of the 19th century.

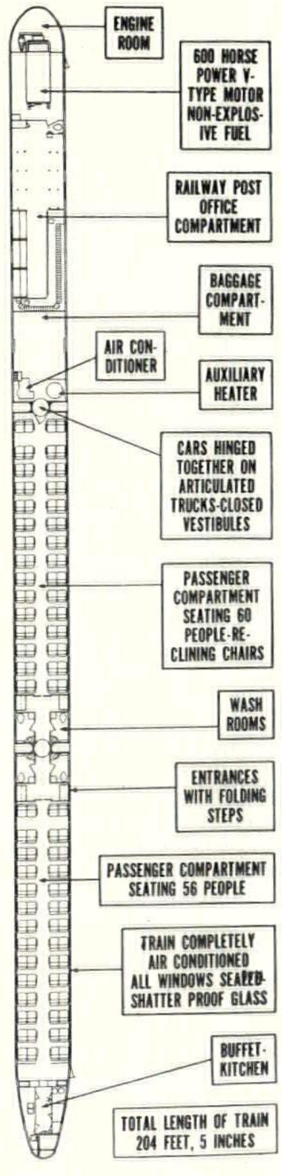


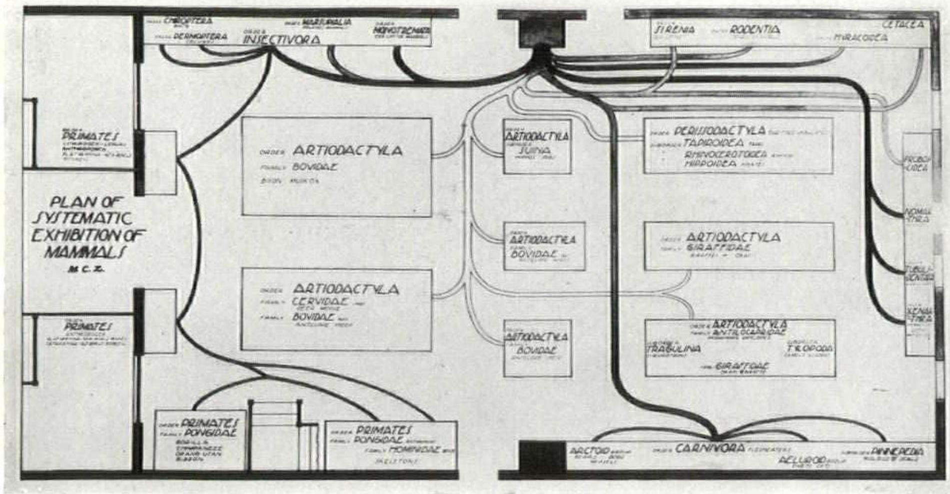
Model of the new Otis "streamline" escalators—an exhibit at the Industrial Arts Exposition, New York City.

STREAMLINED . . .

The three cars of the new streamlined Union Pacific passenger train, built of aluminum alloy, weigh only as much together as a single Pullman sleeping car. With its 600-horse power internal combustion engine directly connected to an electric generator, this super-speed train is capable of a maximum of 110 miles an hour.







FLOOR MOSAIC MAMMAL DIAGRAM

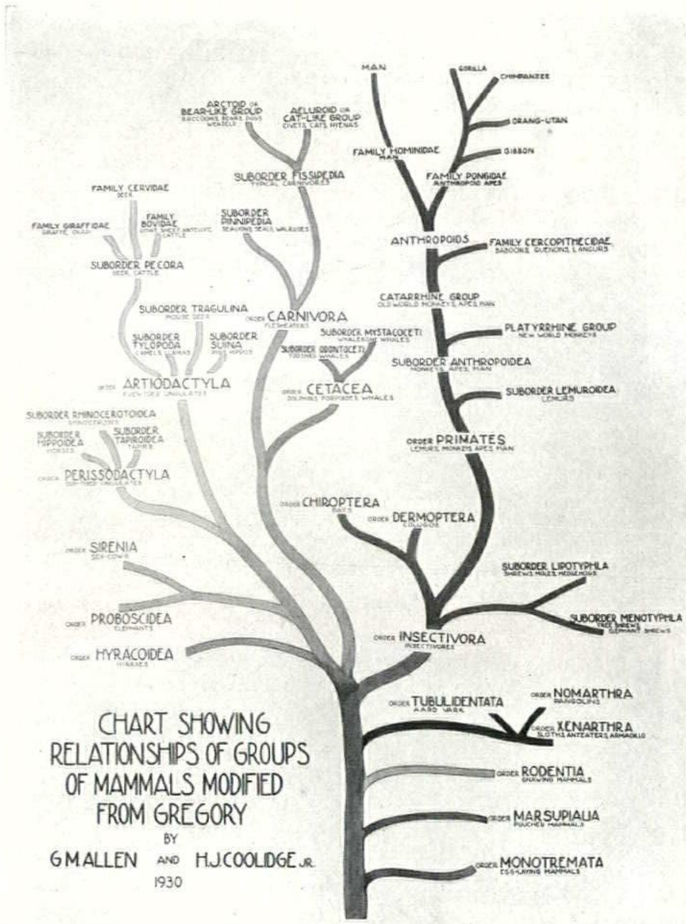
The exhibition hall floor mosaic, shown at left, is based on the classroom chart, shown below.

The Harvard Museum of Comparative Zoology has made an educational innovation in its systematized mammal exhibits by projecting on the floor of the hall colored lines showing the inter-relationship of all the important orders in the mammalian kingdom from Man down to the egg-laying Duck-bill Platypus. This relationship can best be illustrated for educational purposes by means of a diagrammatic tree. On the wall of the Museum hall is a chart showing a tree with varying colored branches. The trunk of the tree represents the Mammalian Phylum; the larger branches the zoological orders which may be divided into smaller branches or sub-orders, and these in turn into even smaller and more compact groups called families.

Because of the shape of the exhibition cases and the size of animals like the giraffe, it has proved impossible to arrange them so that each would occupy the correct position if the tree of mammalian relationship were projected without distortion on the floor of the room. The mammalian family tree most universally accepted by scientists at the present time, however, has been projected in colored lines on the floor. The colors are in every case the same as those in the tree chart on the wall and the main limbs spring from the same root or central stem. In this way it is a simple matter to follow the blue line on the floor to see who Man's closest cousins may be, or the yellow line that leads from the rodent case if one wishes to trace the relationship of the beaver found there with the other groups of mammals.

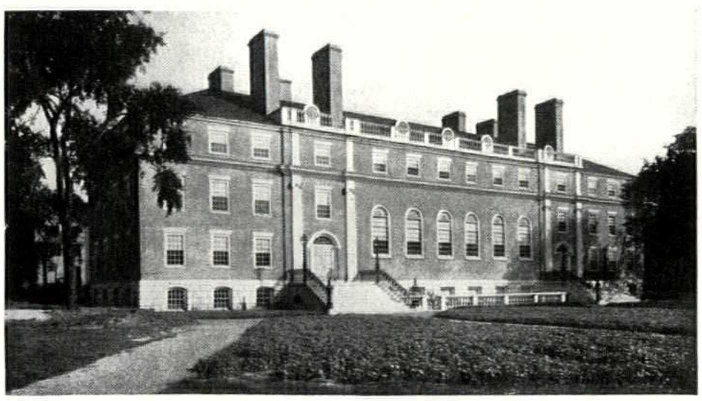
In many systematic museum exhibits, especially in Leningrad and Moscow, wall lines and charts are used but a reflection of such a wall chart with the same colors painted on the floor and leading to the mounted animals with their complete descriptive labels has probably not been used before in a mammalian exhibition.

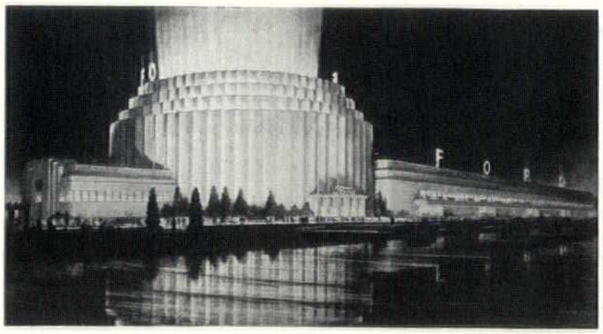
The distortion of the chart because of existing space conditions raises the question whether the museum hall should be designed to agree with the chart. According to H. J. Coolidge, Jr., of the Museum of Comparative Zoology, "This is a problem which would be difficult to solve because every few years scientists change their views about animal relationships. This does not, however, usually apply to the more important groups; but some revolutionary find among the fossils may cause such a change and then what would the architect do unless his cases were on little rollers and could be moved about?"



GOLD MEDAL AWARD

For the design of the Radcliffe College Lecture Hall in Cambridge, Massachusetts, the firm of Perry, Shaw and Hepburn has been awarded the Harleston Parker Gold Medal of the Boston Society of Architects. The building was first published in The Architectural Record in October 1931.




NIGHT VIEW — RENDERING BY HUGH FERRISS

WELDING IN THE FORD BUILDING AT THE 1934 CENTURY OF PROGRESS

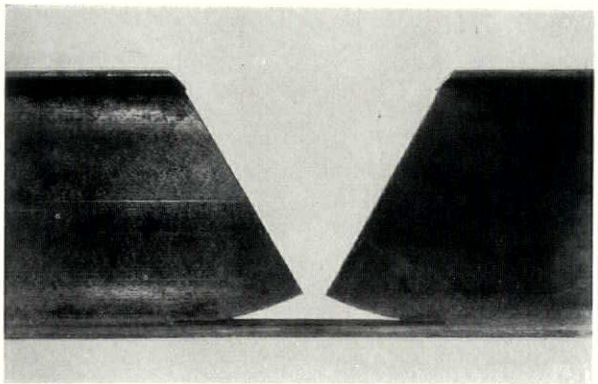


FIGURE 1

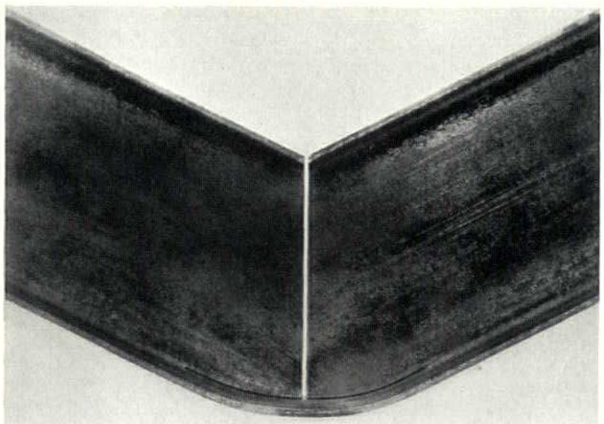


FIGURE 2

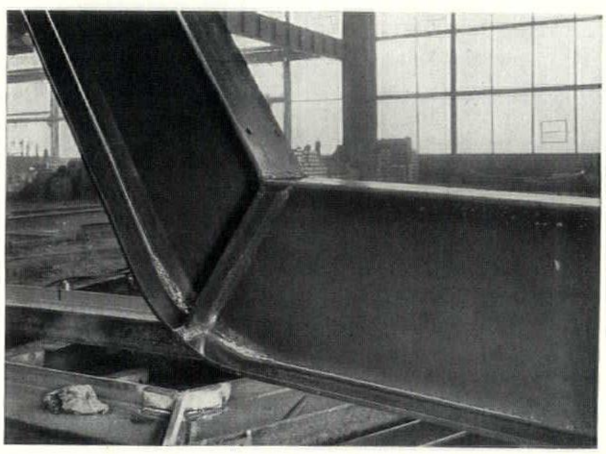
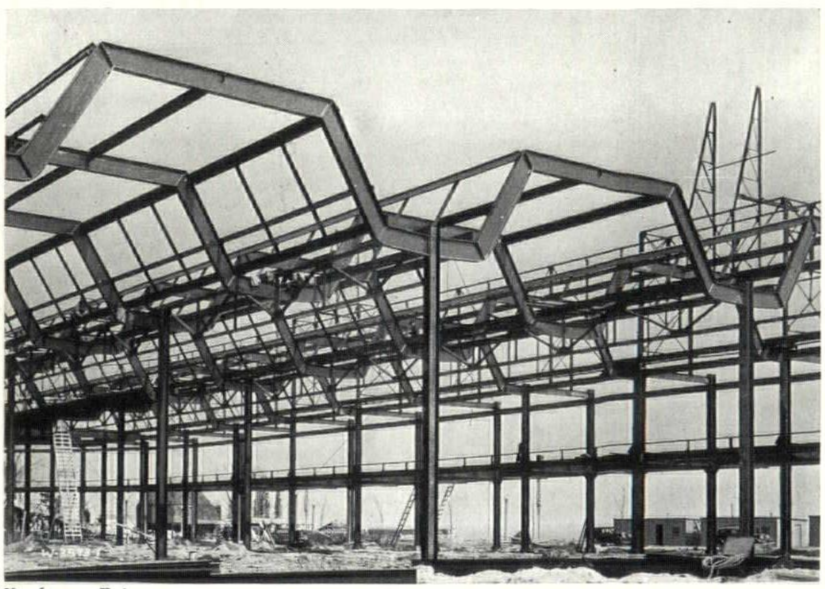


FIGURE 3

The Ford Exposition Building has been designed by Albert Kahn, Inc., for the World's Fair in Chicago. The building proper is nine hundred feet long with a central rotunda one hundred and ten feet high. The small wing of the building at left (south) will house Mr. Henry Ford's personal historical exhibit. The large rotunda will display the Drama of Transportation, an exhibit of vehicles ranging from the early Egyptian Chariot to the modern automobile. The long wing on the right (north) will house the industrial exhibits of the Ford Motor Company and a group of its principal supplies .

From a standpoint of structural design, the roof framing over the three monitor bays of the north wing of the building is of particular interest. In place of the usual monitor trusses, a continuous I-beam is cut, bent and welded in shape. Fig. 1 shows how the beams were cut with a triangular notch and the desired radius for the bottom flange; Fig. 2 shows the beam bent into position; Fig. 3 shows the bottom bend reinforced with a strut on each side of the web and the welding completed. Through the employment of these continuous beam monitor frames, fabricated by the R. C. Mahon Company, Detroit, the usual maze of steelwork is eliminated, giving the appearance of a much higher ceiling.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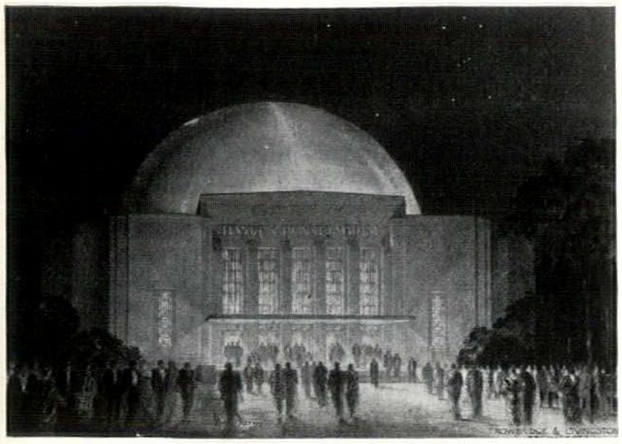
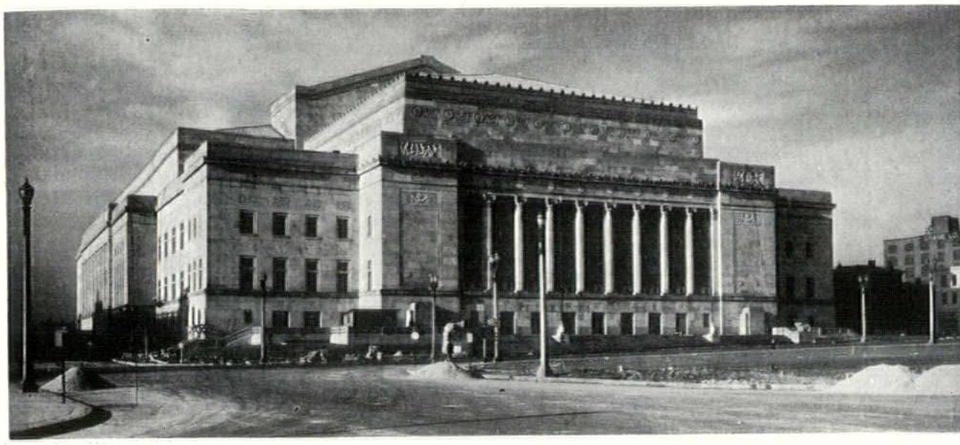


American Museum of Natural History

A Hugh Ferriss rendering of the proposed Hayden Planetarium in New York City. Trowbridge and Livingston are the architects.



Alexander Piaget

The new Municipal Auditorium in St. Louis was formally dedicated with a program o activities during April 14-28. The building faces north and commands a view of the entir Memorial Plaza. The Auditorium's overall dimensions are 320 feet from east to west an 500 feet from north to south. Its height is 168 feet from the street to the ridge line o the main arena. Exterior walls are faced with Bedford stone in harmony with the monu mental character of the design and in harmony with the present Municipal Courts Build ing, the new Civil Courthouse and other Memorial Plaza buildings. The architects ar La Beaume and Klein.

FAMOUS TEMPLE IN ATHENS TO BE REBUILT

The little temple of Nike on the Acropolis is in danger of caving in. Architects, investigating the foundations, reported the weakness of the structure. As a result of the report, arrangements are now being made to take down the temple and rebuild the base on which it stands. The temple will then be set up again on the new, firm foundation. The project is expected to require a year. Temporary removal of the building is welcomed by archaeologists, who see a chance to learn whether a still more ancient structure stood on the site of the Temple of Victory. The Nike temple was built about 410 B.C. and stood until 1687, when it was damaged in the bombardment of Athens by the Venetians. The Turks at that time took the temple materials to use in building a bastion. About a century ago, German and Greek architects attempted to restore the temple to its original delicate beauty, but lack of experience in this type of problem resulted in a reconstruction lacking in permanence. Storms or even slight earthquakes threaten the edifice.

SOCIETY OF CHEMICAL INDUSTRY

The system which supplies the islands of Bermuda with fresh water was the subject of discussion at a meeting of the American Section of the Society of Chemical Industry, held jointly with the American Chemical Society, the Electrochemical Society and the Societe de Chiminie Industrielle May 5 in New York City.

Dr. W. D. Turner, of Columbia University, who developed the system, presented a paper entitled "The Bermuda Water Works," in which he described the special installation made necessary by the soil conditions peculiar to the islands. On a visit to the islands he conceived the idea of applying horizontal wells or infiltration galleries for collecting the surface waters. The system produced water free from salt but very hard, due to percolation through the coral sandstone. This system was therefore supplemented by an extensive softening process, and the resultant soft, fresh, pure water is now being produced and distributed throughout the colony in a complete system of asbestos water mains designed to be resistant to the serious corrosion conditions existing in these subtropical sea islands.

ARCHITECTS PROTEST CHEAP BUILDINGS

Use of cheap materials in Federal buildings is opposed by the American Institute of Architects and the Producers' Council, a national organization of manufacturers. A resolution adopted by both organizations and sent to President Roosevelt protests against "a trend in the planning of building to cheapen construction below the requirements of wise economy in quality of construction and materials."

This policy would result in unnecessary increase in maintenance costs, thereby adding a correspondingly heavier burden upon the taxpayers and business, it is charged.

"It is desirable that the investment of public funds should be safeguarded by insisting upon adequate standards in construction methods and materials, which is recognized as a fundamental policy in the financing of non-Federal buildings," the resolution says.

"The American Institute of Architects and the Producers' Council urge the Federal Government to maintain a policy in the planning and erection of Federal buildings which will not require a reduction in unit cost so drastic that suitable standards cannot be maintained which are consistent with sound principles of investment and conducive to appreciation of good architecture and to community pride.

"The Institute and the Council do not advocate extravagance in building, but believe that Federal buildings should be planned with a view to combining utility, minimum maintenance expense, and good constructon, which will make them a sound investment, and worthy examples of good architecture, symbolizing the dignity and stability of the Federal Government wherever they may be erected and regardless of their size."

PRIX DE ROME AWARD

Robert A. Weppner, Jr., twenty-seven-year-old instructor in architecture at the Catholic University in Washington, has been awarded the Rome Prize for Architecture, at the conclusion of the annual competition sponsored by the American Academy in Rome.

A native of Lakewood, Ohio, Mr. Weppner began his college career at Notre Dame University, where he remained a year, and was graduated from the Catholic University, in Washington, with the degree of bachelor of science in architecture. In Washington he became later associated with the firm of Murphy & Olmstead. He also worked with the firm of Waddy B. Wood.

The competition problem was a memorial in Washington to the Founders of the Republic, specifying a location at the end of a main park vista near the Potomac River in conformity with the general plan for the future development of the capital.

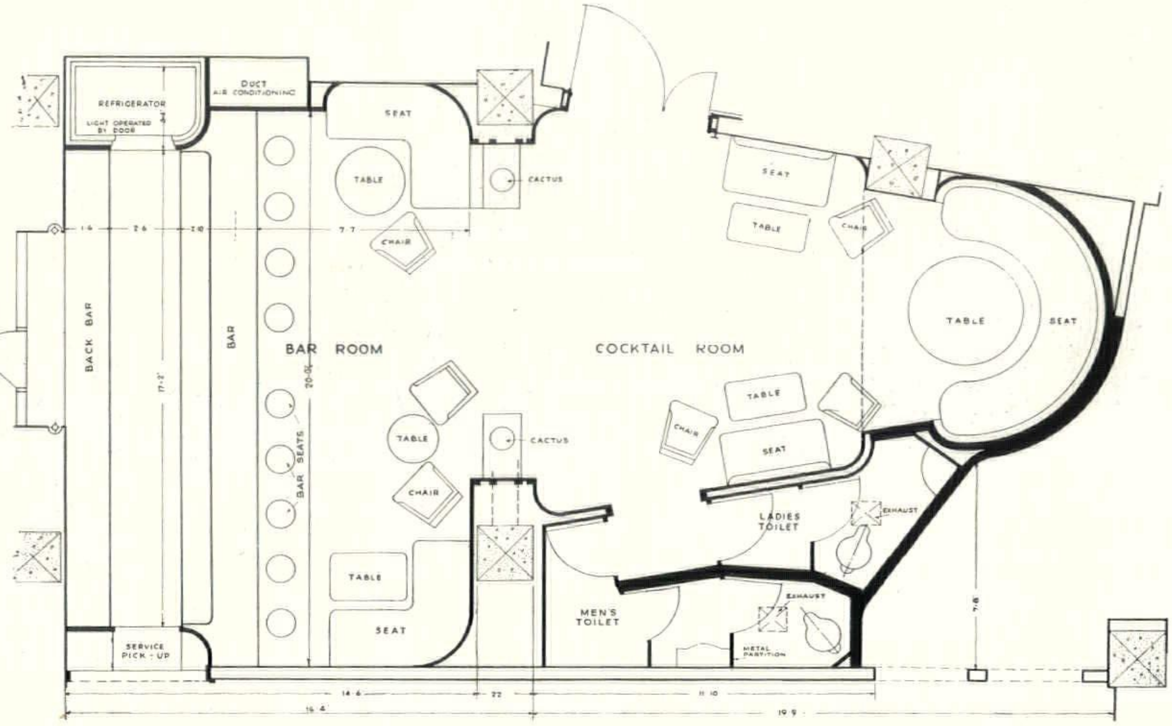
PRIVATE ARCHITECTS TO DESIGN FEDERAL BUILDINGS OVER $60,000

Private architects will design Federal buildings costing more than $60,000, according to an announcement by the American Institute of Architects following a conference of Institute representatives with officials of the Treasury Department. Structures in the smaller communities involving less than this amount will be planned by government architects.

Louis La Beaume of St. Louis, chairman of the Institute's Committee on Public Works, declared in a progress report that the long struggle of the Institute to win recognition for outside architects has resulted in the adoption of a new general policy favorable to the architectural profession. Appointments of architects for certain projects under the Federal building program are expected soon.

"The representatives of the Institute heartily endorsed the Government's policies with regard to simplification of design and economies of construction," the report said. "They reaffirmed, however, the obligation of the Government in the encouragement of good architecture, however simple or however practical the proposed projects might be."

Treasury offcials will submit an outline of proposals regarding fees, standards of architectural types, and other matters for the Institute to study, it was decided at a conference between Rear Admiral C. J. Peoples, Director of the new Federal Procurement Division, W. E. Reynolds, assistant director, L. A. Simon, supervising architect, and Frank C. Baldwin, secretary of the American Institute of Architects, E. C. Kemper, executive secretary of the Institute, and Mr. La Beaume.



PLAN OF BAR AND COCKTAIL ROOM IN HOTEL SHORELAND
CHICAGO - - - - J. R. DAVIDSON, DESIGNER

FOR ILLUSTRATIONS OF THIS MODERNIZATION PROJECT, SEE FRONTISPIECE (FOLLOWING PAGE) AND ALSO PORTFOLIO PAGES 517-519. PHOTOGRAPHS BY HEDRICH-BLESSING.

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J U N E

THE
ARCHITECTURAL RECORD

A FOUR POINT PLAN FOR BUILDING TRADES RECOVERY

A national housing program was started on May 14 when President Roosevelt sent a message to Congress, proposing four major interrelated activities:

(1) MODERNIZATION, REPAIR AND NEW CONSTRUCTION.

(2) MORTGAGE INSURANCE.

(3) MORTGAGE ASSOCIATIONS.

(4) INSURANCE OF BUILDING AND LOAN ASSOCIATIONS.

Following the reading of the message identical bills carrying out the proposed plan were introduced in the House and Senate.

At the same time Frank C. Walker, Executive Director of the National Emergency Council, made public supplemental information concerning the problem that is dealt with in the housing program which the Council recommended to the President and on which the legislation was asked.

THE PROBLEM OF MORTGAGE INDEBTEDNESS

After stating the extent of the decline in construction—from a former annual *aggregate* of $11,000 million to a present annual total of $3,000 million, and from a former annual *residential construction* of $3,000 million to a present annual total of $300 million—Mr. Walker's report continues:

Besides being accountable at the present time for our largest industrial problem and our largest unemployment relief problem, the construction industry is also accountable for our largest remaining financial problem. The real estate mortgage debt in the country as a whole is $43,000,000,000. *This is the largest single class of outstanding long-term indebtedness in the capital market. It is more than three times as large as the total railroad debt, four times as large as the total public utility long-term debt, and four times as large as the total industrial long-term debt. It is nearly as large as the combined totals of national, state, county, and municipal debt.*

Of this mortgage indebtedness, $21,000,000,000 *or approximately half the total, is represented by individual mortgages on homes. Much of this huge home-mortgage debt, furthermore, was created under the unsound financial practices that prevailed during the boom conditions of* 1922-29. *Those unsound practices are now universally recognized and discredited. The most detrimental of them were the following:*

The practice of financing new construction through the use of second mortgage financing at exorbitant costs.

The practice of charging excessive fees, in addition to high interest rates, for the renewal of maturing mortgages.

The practice of making long-term loans on a fictitious short-term basis. That is to say, mortgages were written on a three-year or five-year basis, but without any provision for their gradual repayment out of the income of the borrower; and they were expected as a matter of course, by borrower and lender alike, to be renewed or refinanced at maturity.

Owing largely to these unsound practices of the years 1922-29, *the mortgage market has been unable to stand the strain of the depression or to share in the general recovery. In many sections of the country, active mortgage financing has virtually disappeared. New residential construction, even where it is fully justified, has from almost the beginning of the depression been drastically curtailed because of the inability of borrowers to obtain second-mortgage financing. It has also been difficult for borrowers to obtain the customary renewal or refinancing of maturing mortgages; and they have in numerous instances been pressed for heavy repayments at the time when they were least able to make them.*

By 1933, *when the Home Owners' Loan Act was enacted, it was estimated that* 10% *of all mortgaged urban homes had been foreclosed. Foreclosures were going forward, furthermore, at the rate of nearly* 25,000 *homes per month. Since then the foreclosure rate has declined to about* 20,000 *homes per month. To date the Home Owners' Loan Corporation has received* 1,250,000 *applications aggregating more than* $4,000,000,000.

These facts make it plain that the reorganization and reopening of the mortgage market is as vital to the free functioning of our financial institutions as is the resumption of construction to the reemployment of the huge army of workers that is now being carried on the relief roll. We have here, in fact, a sort of vicious circle. Unemployment is maintained at a high figure because of the absence of facilities for financing new construction, while at the same time the financial burden of the existing mortgage debt becomes increasingly difficult to carry because of the continuing large volume of unemployment.

FOUR METHODS TO SOLVE THE PROBLEM

In the program recommended to the President by the National Emergency Council, the mortgage problem is attacked by four different methods, all essential parts of an integrated whole. Together they are intended to encourage, in areas where new construction is economically justified and where an economic demand is present, a resumption of building activity but under new and sound financial practices.
Quoting the NEC report the four component parts of the program are:

(1) MODERNIZATION. *After five years of neglect of the ordinary maintenance of our residential, commercial, and industrial properties, a widespread potential demand now exists for construction in the field of repair, renovation, and modernization. By providing definite incentives in the way of reasonable costs and advantageous credit terms, we can stimulate a renewal of activity and employment in the kind of construction, both urban and rural, in which substantial results can be most quickly obtained. A modernization campaign and a plan of home-improvement credit have been proposed as a means of inducing the prompt undertaking of this work. The modernization project would embrace commercial and industrial property as well as residential property. The special credits that have been proposed, however, would be limited to a maximum of $2,000 each, and hence would be availed of for the most part by homeowners.*

(2) MORTGAGE INSURANCE. *A plan of mutual mortgage insurance, under governmental direction, has been proposed as one of three principal means of reopening the mortgage market. By insuring mortgages on existing homes up to 60 per cent of their currently appraised value, we can induce private capital again to invest more freely in mortgages. By offering to insure mortgages on newly completed homes, but up to 80 per cent of the appraised value, we can enable new construction to go forward without any occasion for reviving the second-mortgage market. Mortgages would be insured, however, only where the insurance would be beneficial to the mortgage market. No construction of a speculative type would be eligible to mortgage insurance, nor would the insurance be granted in areas where there was an existing surplus of modern homes. New construction, therefore, would be limited to that which is economically justified in each community. In other words, new construction would for the immediate future be localized. Then as the modernization campaign got under way, and the general recovery program became further advanced, the justifiable demand for new construction would spread in an ever-widening circle.*

(3) MORTGAGE ASSOCIATIONS. *As another important means of reopening the mortgage market, the authorization of privately owned and operated mortgage associations, to be incorporated under Federal charter, has been proposed. By placing these associations under rigid Federal supervision, and restricting their dealings to the insured mortgages, we can provide an effective means of attracting funds from financial centers in which there is a surplus of capital for investment to areas in which local savings are insufficient to meet the requirements of home financing, and in which the local cost of such financing is therefore unduly high. In this manner the advantages of low-cost, long-term financing can be spread to communities throughout the country.*

(4) INSURANCE OF BUILDING AND LOAN ASSOCIATIONS. *The insurance of the shares and certificates of sound building and loan associations has been proposed as still another important means of reopening the mortgage market. These institutions have been placed at an inequitable disadvantage since the insurance of bank deposits was put into effect at the beginning of the present year. By insuring building and loan savings, we can remove this disadvantage and again enable the associations to attract small savings for mortgage lending.*

FIRST TWO MONTHS UNDER THE

THE CODE OF FAIR COMPETITION FOR THE CONSTRUCTION INDUSTRY WENT INTO EFFECT ON MARCH 2. THE CONTRACTS SO FAR LET UNDER IT ARE OF COURSE TOO FEW IN NUMBER AND TOO LIMITED IN VARIETY TO SUPPLY A BODY OF EXPERIENCE UPON WHICH TO FORM DEFINITE OPINIONS AS TO ADVANTAGES AND DISADVANTAGES OF THE CODE. HOWEVER, IT SHOULD BE OF INTEREST TO LEARN WHAT IMPRESSION HAS BEEN MADE UPON ONE OR TWO REPRESENTATIVES OF THE INDUSTRY IN EACH OF A DOZEN CITIES BY THE FIRST TWO MONTHS OF CODE ENFORCEMENT.

JOHN H. COWPERTHWAIT
J. Sims Wilson and Company
Contractors and builders, Philadelphia

So far the Code has had the effect of greatly increasing prices of work in our line and, as far as we can judge from our own experience, curtailed the progress of contemplated work.

The advantages in theory may be all right, but since the depression our old clients, who practically make all their improvements from the income derived from their investments, have been obliged to curtail because of the returns which they are now receiving and the uncertainty of the future.

Again, the Code has made the individual mechanic, who has been temporarily laid off, enter the market as a free lance, with the owner purchasing all required material, while he furnishes labor alone. With prices arranged as per Code the individual can purchase all his requirements at exactly the same price as we would have to pay our material men, so you can readily see that it would be a physical impossibility for us to compete along this line.

EDWARD P. FLANNERY
John N. Gill Construction Co.
Philadelphia

In our opinion the Code will affect building costs only in so far as they have been driven too low under the effect of unrestrained and irresponsible competition.

Prices will undoubtedly be increased, but it is probable that this increase will only be the amount that prices have fallen below actual cost of production. There does not seem to be any danger that the Code will afford any opportunity to increase prices beyond this point until the volume of work rises to somewhat near parity with the capacity of the construction industry.

We do not see any real disadvtange in the Code requirements, except the necessity of learning to operate under the Code; the advantage is very definite in that the Code, if enforced, will insure fair wages, which have always been paid by good construction firms with a competitive advantage to the firms that did not pay fair wages; the various devices that have been used in purchasing to drive prices below cost, or fair costs, are prohibited and with any reasonable degree of enforcement can be prevented.

One essential is the appointment of the proper persons to the various committees in authority, so that direct practical and forceful measures can be taken to prevent violation of Code requirements.

CONSTRUCTION CODE

UPON ONE POINT ALL THE LETTERS WHICH FOLLOW ARE AGREED; NAMELY, THAT THE CODE HAS INCREASED OR IS LIKELY TO INCREASE THE COST OF CONSTRUCTION. SOME EXPRESS FEAR THAT THE INCREASE WILL DETER BUILDING; OTHERS POINT OUT THAT SUBNORMAL PRICES AND WAGES DID NOTHING TO STIMULATE BUILDING BEFORE THE CODE WAS ADOPTED. THE LETTERS ARE INDIVIDUALLY INTERESTING AND THE MAJORITY CONTAIN SUGGESTIVE EXPERIENCES. HOWEVER, THE GROUP AS A WHOLE DOES NOT, AND WAS NOT EXPECTED TO, WARRANT CONCLUSIONS OF GENERAL APPLICATION.

RUDOLPH S. ADLER
Hentz, Adler and Shutze, Architects
Atlanta

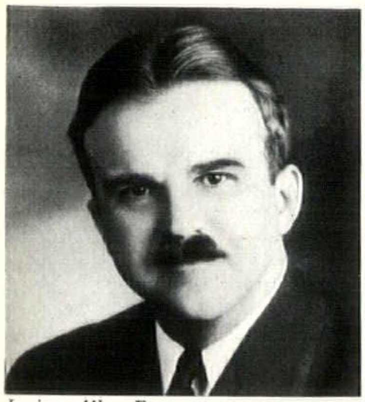
I think that the Code will increase, and already has materially increased, prices in the industry. I think that the costs in the South particularly, where labor has not been organized as it has in the northeast sections of the country, will be materially affected and at first will tend towards a certain amount of inefficiency. Although many large contractors disagree with this belief of mine, I still hold that labor conditions will be materially changed.

Heretofore reinforcing steel for concrete was tied together by men particularly fitted in this trade but was placed either by carpenters or common labor. Concrete was poured by common labor, whose maximum wage per hour in the very highest times was 25 cents. I have been told that in the organized sections of the country steel is matted together by specialized workers, as well as placed by specialized workers belonging to the trades unions.

In house construction where steel columns or beams were used to support a heavy weight in the floor above, carpenters on the job were employed to set this steel and carpenters, brick masons or common labor set steel angle lintels above window openings on brick or hollow tile veneer jobs. Now of course it will be necessary, if the trades unions enforce the letter of the law, to have a steelworker on a house job practically at all times during the erection of stud walls and floor joists as well as on brick veneer jobs if any steel occurs in the work.

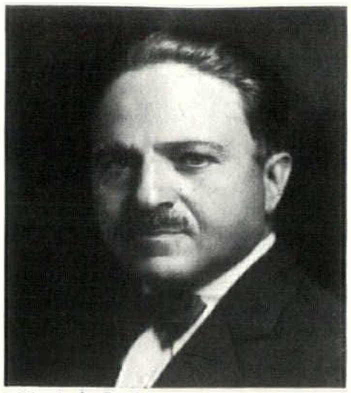
I am heartily in favor of the Code and believe that Article 7 of Chapter 1 will be beneficial, in that unscrupulous owners will not be permitted to beat down bid prices.

Article 3, Section 2, B-3 (a) would seem to void entirely the status of the draftsmen so far as a 40-hour week is concerned, and unless this particular sentence is clarified in the Architects' Code, would work to a great disadvantage for the draftsmen. It has been common practice by many architects in the South to work men with high pay for ten, sometimes twelve, hours a day on rush work without extra compensation, which of course is totally unfair to the draftsmen. In fact, on rush work where a job has been promised by our office, we have resorted to this practice possibly for a week before the job actually had to be finished; but we always gave the men a week or two of leisure after this rush work had been completed.



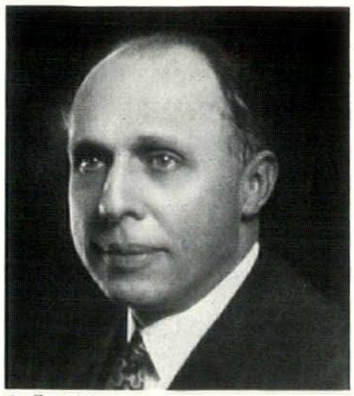
Irving Allen Fox

TEMPLE H. BUELL



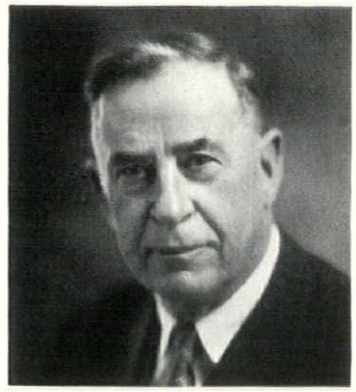
Blank & Stoller

ELY JACQUES KAHN



J. Zweifel

H. I. SCHENCK



Walton Studio

S. A. LAYTON

FRANK D. CHASE
Frank D. Chase, Inc.
Engineers and Architects
Chicago

Code prices for materials are generally higher throughout the country than they were prior to the establishment of the Code. In many instances manufacturers are taking unfair advantage of the Code to increase costs beyond any reasonable level. Some Codes have practically no control over the retail prices.

Building costs will be higher, too, under the Code because of labor regulations.

TEMPLE H. BUELL
T. H. Buell and Company, Architects
Denver

First, it is generally conceded that the Code will raise building prices to a plane substantially higher than they are at present; that the advantages in this would far outweigh the disadvantages inasmuch as, if building were dependent on price alone, there would have been more construction during the period such as we have experienced during the past few years when prices were on rock-bottom.

It will permit the production of materials and the employment of workmanship far in advance of the generally accepted standard of the past decade, resulting in buildings in which the factor of depreciation would be reduced to a minimum and bring us to the time when we could more nearly approximate the craftsmanship which has characterized the great eras in architectural development.

Second, the practical advantages or disadvantages in any particular Code requirements are much mooted questions and although all trades and divisions of the industry have given a great deal of time and thought in their preparation, the eventual solution can only be the result of the practical functionings of each, and the way in which each dovetails in with all others.

The construction industry is a tremendous one in America and one in which changes must necessarily come slowly because of its character.

The changes which have come into effect with the Code are in many instances momentous but are logical and will, I feel, redound to its great benefit.

ELY JACQUES KAHN
Architect
New York City

The Construction Code seems to aim in two directions: (1) the stabilization of costs for building which has already developed into rising prices, and (2) the very important matter of preventing unfair practice in the handling of estimates.

Cutthroat competition has been the curse of a good deal of our work, and if the Code strengthens the position of those who really desire to maintain a high standard of accomplishment, it will have done an important service. It is sufficiently difficult in normal times to avoid the thought that estimates are not always bona fide and that the bidders assume that an adjustment is bound to be discussed. Now that competition is so intense, the possibilities of bargain hunting become far more serious, with the result that, without the Code, every one concerned would be at a loss to feel certain of preliminary figures or final estimates.

Of course, one of the great problems is the owner who, not being a member of the industry, is hard to control when he takes it into his hands to put pressure on his architect or builder.

HARRY I. SCHENCK
Schenck and Williams, Architects
Dayton, Ohio

In our field the effect of the Code on building costs has been very promptly to bring the total cost of building to fully equal the peak prices. Since peak prices always were too high to justify any form of investment building, as well as home building, the effect is to discourage completely all construction that is not a positive necessity.

There are both advantages and disadvantages in the Code requirements too extensive to discuss in a brief paragraph. It is not to be denied that there have been many destructive practices in the construction industry which need correction. The Code presumes to remedy the custom of "bid peddling and chiseling" which will be as impossible as was the enforcement of prohibition.

The Code stipulates what architects must do to help enforce the contractor's code requirements, but, as we interpret it, contractors are not required to refrain from invading the field of the architect and may freely continue to furnish plans as well as construct projects of even major importance.

It is our puspose to cooperate to the fullest extent while the Code is in operation, but we have already observed certain methods of evading the code regulations, which seems to be the usual tendency following any measure of legislative reform.

S. A. LAYTON
Layton, Hicks and Forsyth, Architects
Oklahoma City

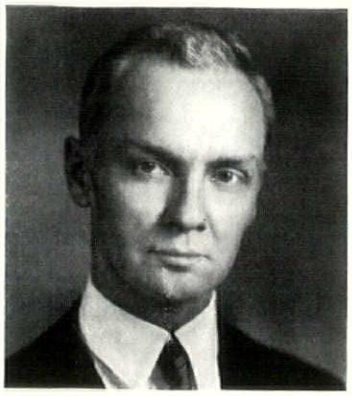
First, the effect of the Code on building costs will be materially to increase the cost of building. Second, as to the particular advantages or disadvantages of the Code as written, I cannot see that it will have any particular effect upon securing fair competition, because public sentiment seems to demand that contracts be let to the lowest bidder and public officials will not go against public sentiment and take due consideration of the character and financial responsibility of bidders and award contracts fairly on this consideration.

Yago

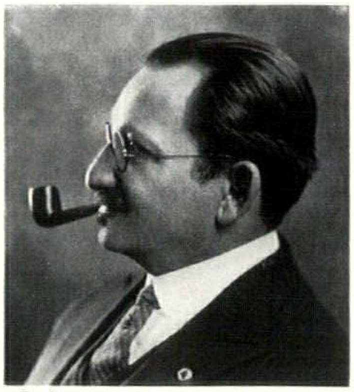
ALBERT KAHN

W. B. Poynter

H. E. HANNAFORD



BEN F. McMURRY



Irving

EMERY ROTH

ALBERT KAHN
Albert Kahn, Inc.
Architects and Engineers, Detroit

The Code is to becommended, particularly for its aid in preventing "bid peddling." As to its limitation on the permissible number of working hours, I am not so certain. Building costs will no doubt be increased under the new regulations, but experience has proved that ruinously low costs never stimulate building. Neither do excessively high costs for that matter, but material men as well as contractors are entitled to a reasonable profit which, during the depression, has not obtained. Indeed, existing conditions have spelled bankruptcy for many.
The Code will no doubt require revision after fair trial, but I am for it.

GORDON B. KAUFMANN
Architect
Los Angeles

The effect of the Code locally has been to increase costs without increasing the volume of building.
Where fixed Code minimum prices are quoted, these appear to become adopted. The architect should not be placed in a position to recommend one firm where there is no difference in prices. The result is that the owner selects the weakest subcontractor and strikes a private bargain with him—to the detriment of the rest of the "competitors." That is the weak spot of all Code requirements and will be until the control of prices is definitely eliminated.

H. ELDRIDGE HANNAFORD
Samuel Hannaford and Sons, Architects
Cincinnati

In our opinion the Code will abolish the building industry's greatest evils and will be the means of preventing the further pauperizing of many reputable contractors. Article 7 and its various subsections, which prevent bid peddling, collusion between bidders and so on, are splendid provisions.
It is obvious that construction prices will increase under the Code, but there are other reasons why prices will be higher. The industry has been impoverished for the last few years due to bid peddling and cutthroat practices, and it is time that conditions change.

BEN F. McMURRY
Barber and McMurry, Architects
Knoxville, Tenn.

One thing of great importance resulting from the development and adoption of the Code and the activities of the Construction League is the unification and consolidation of the construction industry. In the past we have been operating as several separate and distinct groups, forgetting that the designing and construction of buildings is one big industry. It is our opinion that the Code in operation will do much to impress this fact.

The effect of the Code on building costs has been to increase costs materially over the low point of early 1933, but we do not believe it will raise costs as high as the peak reached between 1926 and 1929, nor do we believe that the higher costs will be prohibitive or will prevent construction work going ahead when improvement of business in general supplies the urge.

The most practical advantages obtained in the Code are embodied in Article 7 concerning Competitive Bidding Practices. If the regulations prescribed under this heading are enforced and lived up to in the right spirit by all parties concerned, much good will come from them.

EMERY ROTH
Architect
New York City

In my opinion the effect of the Construction Code will be to raise the cost of buildings. This result was foreseen and, in as far as it provides better conditions in the hours and wages of labor, will on the whole be beneficial to the building industry, and function along the lines intended by the "New Deal."

My adverse comment on the Code is that one of the parties interested in construction—namely the owner and investor—is not represented on the Authority, nor has he been heard from or considered in the making of the Code. I refer particularly to Article 7 (Competitive Bidding Practices). This section, while intended to stop bid peddling and bid shopping, is very apt to lead to bid collusion. One of my first experiences since the Code went into effect was a bid for some casement sash. Of the three bidders, each deals in different steel shapes, uses different fittings and different methods of manufacture, and yet the three estimates were identical to the penny and considerably higher than I had previously been able to get casement sash for. I do not claim there was any collusion in this, but had their estimates been double what they actually were, I should have been placed in the position of having to accept their bids.

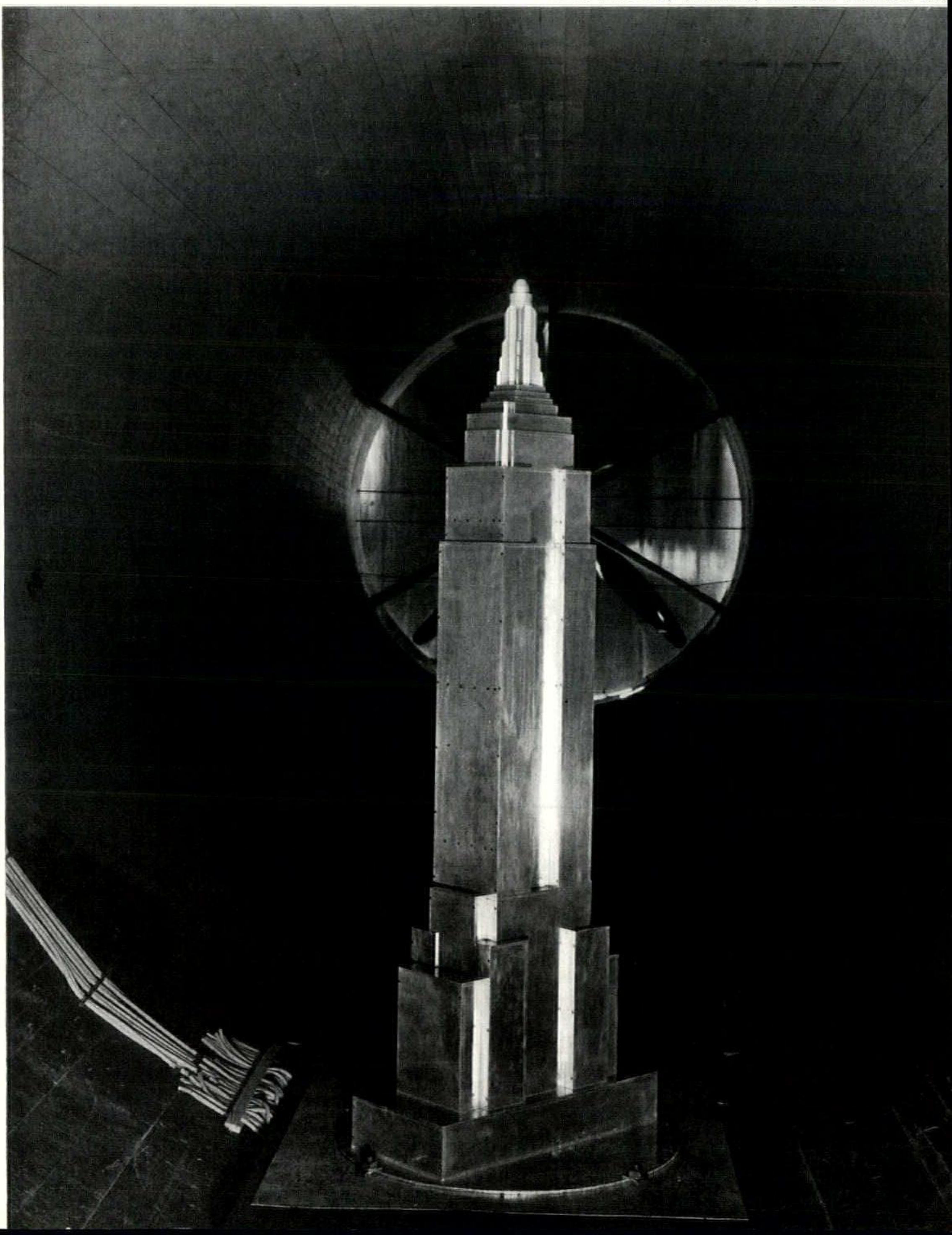
There is a difference between dishonest chiseling and negotiating, and I believe that negotiation is essential to any business. I also believe that more progressive methods are employed in the building industry when there is keen competitive figuring, and that the trade becomes slipshod when liberal prices prevail.

In my opinion Section 7 should be revised with due regard to both owners and builders and also the building trades. It would be sufficient for every purpose to provide that no work shall be taken at less than cost including a reasonable overhead.

MUNICIPAL BUILDING

TO DETERMINE THE EFFECT OF WIND PRESSURES ON LARGE BUILDINGS THE BUREAU OF STANDARDS HAS CONSTRUCTED THIS 5-FOOT MODEL OF THE 1,250-FOOT EMPIRE STATE BUILDING. THE SCALE MODEL, MADE OF ALUMINUM EXCEPT FOR THE WOOD TOWER, WAS DESIGNED TO BE TESTED AT VARIOUS POINTS. IT WAS MOUNTED IN THE WIND TUNNEL AND WIND GENERATED BY A PROPELLER WAS BLOWN AGAINST IT AT VELOCITIES OF 27, 41 AND 55 MILES AN HOUR. A ROTATING TURNTABLE ALLOWED THE PRESSURE OF THE ARTIFICIAL STORM TO BE MEASURED ON ALL SURFACES AND AT ALL ANGLES. THE PRESSURE VARIES FROM POINT TO POINT, ACCORDING TO PROFESSOR C. L. HARRIS OF PENNSYLVANIA STATE COLLEGE. OVER THE LARGER PART OF THE MODEL IT IS REDUCED. NEIGHBORING STRUCTURES ALSO HAVE AN ENORMOUS EFFECT ON A SKYSCRAPER: THE PRESSURE TENDS NOT ONLY TO SHEAR AND OVERTURN A BUILDING, BUT ALSO — A NOT GENERALLY RECOGNIZED FACT — TO TWIST. IN A BUILDING THIS TWISTING FORCE IS APPLIED FITFULLY AND UNEQUALLY BECAUSE OF SURROUNDING STRUCTURES.

U. S. Bureau of Standards, American Standards Ass



REGULATIONS

Revise Building Codes Now

By WILLIAM LYNCH MURRAY, Architect

FEW building codes are in effect today that do not severely penalize building construction. Even those codes adopted recently impose regulations which achieve only added construction costs, while those of a decade or more ago are for the most part entirely obsolete. These obstructions are retarding building activity now and unquestionably they will impede the programs which are certain to follow when building money becomes more readily available.

The era when money could be lavished on labor and materials, regardless of building costs, is gone. Construction activity will continue at its present low ebb regardless of improvement in other industries unless building regulations are revised to permit justifiable economies, based on the accumulated evidence of scientific tests and on experience, making possible a closer approach to the minimum consistent with safety.

Low-cost housing and slum clearance should be holding the center of the construction stage in many cities right now. Instead, activity is being postponed in most instances because of municipal building regulations which, if followed, would wipe out every possibility of making the buildings pay their own way. An example of this is to be found in Philadelphia where the City Planning Commission in attempting to eliminate code barriers has retained D. Knickerbacker Boyd to act as its director of code revisions. The Philadelphia building code was adopted in 1929.

Before studying in detail some of the impositions to be found everywhere in building regulations, let us consider a significant statement made by the United States Senate Committee on Reconstruction and Production: "In almost every city where hearings were held statements were made to the effect that local building laws required more materials and refinements of workmanship than were justified. . . . They involve an additional cost of construction without assuring more useful or more durable buildings."

PROHIBITIVE restrictions keep garage construction at a minimum. Buildings of this class in most instances are required to be fully-protected fireproof construction, regardless of size, location, dividing fire-walls or sprinkler equipment. Reasonable regulations would encourage this type of building, which is quite a field when one considers the abundance of open-air parking lots and the increased regulatory measures being adopted to limit street parking and to break up all-night parking.

Revision groups should give serious attention to the minimum requirements recommended for such structures by the Building Code Committee of the Department of Commerce. Their recommendations follow the very latest technical thought on the subject and vary with specific site conditions, the type of construction employed, and whether or not sprinkler equipment is provided. Briefly, their recommendations are as follows:

(A) *Fully-Protected Fireproof Construction*: No restrictions.

(B) *Protected Construction* (Light fireproof, as bar joists, etc.):

- (1) *Not Sprinklered.* 25,000 to 50,000 square feet, when not over 50 feet high.
- (2) *Sprinklered.* 50,000 to 100,000 square feet.

(C) *Mill Construction*:

- (1) *Not Sprinklered*
  - (a) *One story.* 20,000 to 40,000 square feet.
  - (b) *Two story.* 10,000 to 20,000 square feet.
- (2) *Sprinklered*
  - (a) *One story.* 40,000 to 80,000 square feet.
  - (b) *Two story.* 20,000 to 40,000 square feet.

(D) *Ordinary Construction*:

- (1) *Not Sprinklered.* One story, 10,000 to 20,000 square feet.
- (2) *Sprinklered.* One story, 20,000 to 40,000 square feet.

(E) *Frame Construction*:

- (1) *Not Sprinklered.* One story, 3,000 to 6,000 square feet.
- (2) *Sprinklered.* One story, 6,000 to 12,000 square feet.

Site conditions, such as whether or not the lot is on the corner of two or more streets, accessibility for fire fighting, and the like, are the factors which determine when the minimum square footage figures may be exceeded.

AS much as 30 per cent can be saved in concrete sizes and concrete costs where tests based on performance are used instead of the antiquated method usually prescribed in building codes of basing concrete design on conventional low fiber stress limits.

No material has received the intensive study during the last few years that has been devoted to concrete. In accordance with the water-cement ratio theory, tables have been worked out which serve as a guide in mixing for the particular strength desired. The use of the water-cement ratio not only eliminates much of the guessworkin concrete, but also provides a reward for merit to those who work with laboratory control by permitting them to take advantage of higher stresses as recommended by authorities everywhere. To secure economical and sure results, requirements should be altered to conform to these new findings.

Many cities still use a basic stress of 16,000 pounds per square inch in the design of structural steel. If the conventional stress is raised to 18,000 pounds per square inch, as recommended by the country's most prominent engineers, it is estimated that a saving of 12 per cent can be accomplished on steel and steel erection costs.

PERHAPS one of the heaviest penalties imposed by building codes is in the stipulated live load minimums governing every type of structure. One authority states the case splendidly as follows: "Traditional live load figures insisted upon in many codes suffer severely in the light of scientific inquiry. The simple process of weighing the contents of floors in typical occupancies has thrown light on the whole subject and has pointed the way to a more rational treatment."

The following study indicates that it is not unusual for a code to specify a required live load 8 to 10 times as great as the superimposed load can ever equal.

A typical example is to be found in average requirements governing schoolroom floor loads. Several codes were selected at random and the average for classroom live load design was 82 pounds per square foot, some cities requiring as much as 125 pounds.

The need for setting a more reasonable figure is apparent when it is considered that the maximum load that could possibly be placed in a classroom approximates 28 pounds per square foot. This figure is based on a standard classroom 23 by 32 feet with a capacity of 45 pupils and a floor area of 736 square feet. However, to arrive at an absolute maximum load, it was assumed that two adults were placed on each seat with 30 persons grouped around the walls, making a total occupancy of 120 persons having an average weight of 150 pounds, or a total of 18,000 pounds. The weight of 45 desks at 40 pounds each adds 1,800 pounds; the teacher's desk was set at 400 pounds with an allowance of 10 pounds for each of the pupil's books, and 250 pounds added for odds and ends, or a grand total of 20,900 pounds. Instead of the 28-pound maximum, the figure would have been only 10 pounds if the normal occupancy of 45 pupils had been used in making the computations.

There can be no excuse on any basis for requiring a live load minimum in excess of 40 pounds per square foot in the design of schoolroom floors, and codes should be altered to conform to such standards.

THE report of the Building Code Committee of the Department of Commerce recommends that codes require wood floors in dwellings, to be designed to sustain a live load of 40 pounds per square foot, and floors of monolithic construction be designed for 30 pounds per square foot. This recommendation was made after much research and careful study. The heaviest furniture loads discovered by investigators were pianos, weighing up to 55 pounds per square foot, and bookcases weighing up to 170 pounds per linear foot, but in both cases the distribution was such as to bring the equivalent uniform load well below that recommended. The reported observations of many architects and builders are that the furniture and occupancy loads in residential types of structures seldom exceed 50 per cent of the recommended minimum design load, even in extreme cases. Regardless of such recommendations from authoritative sources, 29 cities require minimum live load design of 50 pounds per square foot; 42 cities require 60 pounds; 4 require 70 pounds; 1 requires 75 pounds, and so up the scale until 1 city is reached requiring 100 pounds. In other words, out of 109 codes studied, only 27 permit the use of reasonable design figures.

The same committee recommends that floors in office buildings be designed for a live load of 50 pounds per square foot. The recommendation also states that provisions shall be made in designing office floors for a load of 2,000 pounds placed upon any space 2½ feet square wherever this load upon an otherwise unloaded floor would produce stresses greater than the 50-pound distributed load.

To ascertain the average requirement, 101 codes were studied. It was found to be 114 pounds per square foot. Of the cities 30 required a minimum live load design of 100 pounds, while 27 required a minimum of 150 pounds.

In a recent investigation by an authority in an office building, it was found that the weight of furniture per square foot averaged slightly over 7 pounds, with the heaviest load totaling 11½ pounds. All files, desks and the like were considered as being 100 per cent full or furnished with all necessary accessories. Weight of employees, computed at the rate of 150 pounds each, added 1 to 2 pounds per square foot of floor area.

Other investigations from time to time showed a somewhat higher average, and the committee took into full consideration heavier loadings in making their recommendations.

In a crowded hospital ward the live load per square foot was found to be 9 pounds. The Building Code Committee of the Department of Commerce and other authorities recommend a minimum live load design of 40 pounds per square foot. These facts do not alter the requirements in many cities which call for designs far in excess of 40 pounds and even up to 150 pounds in several localities.

One typical fireproof building, picked at random, was checked recently by the writer. The survey revealed that the total cost of the structure could have been pared 19 per cent by substituting for the local code requirements a live load design twice as great as the floors would ever be called on to sustain. In considering these various excessive live load requirements, it should be borne in mind that the effect is cumulative. The sum of the increased dead load and the excess live load represents the additional weight for which columns, foundation walls and footings must be designed, or if it is a wall bearing job, the walls may have to be increased to sustain the excessive beam loads.

The added cost of overdesigned floor construction is strictly a penalty, and does not accomplish any constructive results. Certainly codes should be altered to remove such penalties by making them conform with authoritative recommendations such as those of the Building Code Committee of the Department of Commerce and other competent sources.

A COMPILATION by the Common Brick Manufacturers' Association of America of the allowable thicknesses of solid brick exterior walls as given in 113 building codes, discloses that 25 of the cities will not permit walls less than 12 inches thick in one-story dwellings, while 31 require walls not less than 12 inches thick in both stories of two-story dwellings. These conditions prevail regardless of the fact after extensive research the Building Code Committee of the Department of Commerce recommends that exterior solid brick bearing walls of one- and two-story dwellings may be 8 inches thick when not more than 30 feet in height. Seventy-six building inspectors from various sections of the United States expressed their opinions recently on this subject, almost unanimously endorsing the use of 8-inch walls for one- and two-story brick dwellings.

Such an unnecessary penalty placed on buildings of the dwelling class cannot help but retard construction in this field, while everything else is being done to promote it.

It is difficult to believe, but true nevertheless, that of 84 building codes examined, 30 do not distinguish between panel walls supported at every story and bearing walls or nonbearing walls not thus supported. Six codes recognize panel walls as a separate class, but require that their thickness for the lower stories be increased with the height of the building in the same manner as for walls not thus supported. No explanation is needed to emphasize the ridiculousness of such procedure.

While it is virtually impossible to arrive at any percentage of cost which might be saved on the average building if the requirements covering wall thicknesses were put on a scientific basis, it is reasonable to assume that the saving would approximate or surpass an ethical architectural fee for designing the structure and supervising its construction.

SAFETY must not be sacrificed for economy. We are not advocating a compromise with unsafe or untried methods, but simply the enactment of sane regulations based on authoritative data. It is imperative that codes be made to require only common sense standards based on the latest engineering thought and trends, with the penalties to satisfy whims, and trade and labor organization fancies, abolished.

It is definitely incumbent upon the architectural profession to take the lead in seeing that these reforms are instituted. By securing the aid of various civic organizations, it is not difficult to interest local authorities in making the necessary revisions. Inertia on the part of the architects has had much to do with the continuance of obsolete codes. When they become definitely interested and show their willingness to cooperate in securing common sense regulations, local organizations and local authorities are usually ready to follow the lead.

In organizing a committee to formulate a draft of a new code, care should be taken to secure a diversified group, which should include the following: architect, structural engineer, sanitary expert, general contractor, chief of the fire department, master mason, master carpenter, and the head of the local building bureau. It is essential to secure the services of a specialist in this field to assist the committee in avoiding common errors and to make available the latest information from research laboratories and technical organizations. It should be needless to state that it is entirely fallacious to think that copying the code of another city will achieve ideal results.

Special consideration should be given to regulations governing multi-family buildings. Great emphasis, with government assistance, is going to be placed on housing during the next few years. Every artificial barrier should be removed by revision groups so that the full benefits to be derived from such structures may be obtained. The example that Philadelphia is setting should be followed by all progressive communities.

A wealth of material is available from many sources to guide these revisions. The various publications of minimum requirements and recommended standards by the United States Department of Commerce are invaluable in securing data for this work. A publication by George N. Thompson, "The Preparation and Revision of Local Building Codes," published by the Municipal Administration Service, contains much pertinent information, as the title suggests, and lists many sources of authoritative data.

Obsolescence as a Factor in Building Regulations

In an article, *Revision of Building Codes to Meet Changing Conditions*, published in the November 25, 1933, issue of *The Real Estate Record and Builders' Guide*, Frank Burton, former building commissioner of Detroit, analyzes three factors which must be considered by building officials in drafting regulations:

(1) What constitutes a proper measure of *physical safety?*

(2) What degree of *fire resistance* is adequate for structures presumed to be fireproof?

(3) What degree of *permanence* is necessary in a structure?

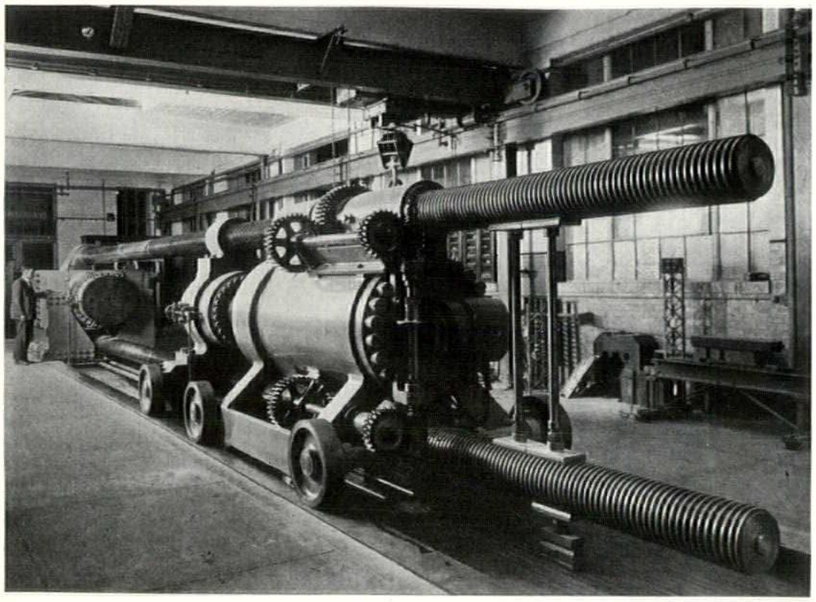
The work of the Bureau of Standards and the Underwriters' Laboratory is directed toward supplying answers for the first two questions. The third question, according to Mr. Burton, has proved most difficult of all:

> The old viewpoint was that a house should be built to last for generations. Men built houses expecting that their sons and grandsons would use them. We know now that at least as far as American cities are concerned this point of view is wrong. Constant change in form, appearance and materials is demanded by popular tastes and, except for the slight recession due to the depression, this tendency grows stronger each year. Some have gone so far as to say that houses should be designed to last only a few years and should be replaced from time to time. . . . Building permits for such structures should be issued only for a short period at the end of which the structure should be dismantled. Building officials, so far as I know, have never seriously considered the propriety of giving a permit for a dwelling that was not constructed of what they considered permanent materials, in spite of the fact that when a frame house is erected on posts it is known that the posts will rot in about 15 years, the sills in 25, the shingles in 12 to 15, the siding in 35 to 40 years. Such a structure is hardly permanent. . . .

A limited life-span for buildings, as a control device to prevent the accumulation of obsolete structures and to promote the optimum use of new designs, has been suggested by K. Lönberg-Holm in an article, *Time Zoning as a Preventive of Blighted Areas* (see the November 1933 issue of THE ARCHITECTURAL RECORD, pages 340, 341):

> The socio-economic desirable life spans—as opposed to life spans determined by potential private profit, would at present probably be found in most cases to be less than ten years, and would vary according to flexible time-use zones based on latest findings of socio-economic trends.
>
> Time zoning would involve a license provision for the parking of any form of shelter for a given time on a given site, with the obligation for the erector-owner to remove the unit and clear the site when the license expired. The license could be renewable until occupancy became a public nuisance or liability. The licensee should be required to post bond with the city to insure compliance with the terms of the licensee.

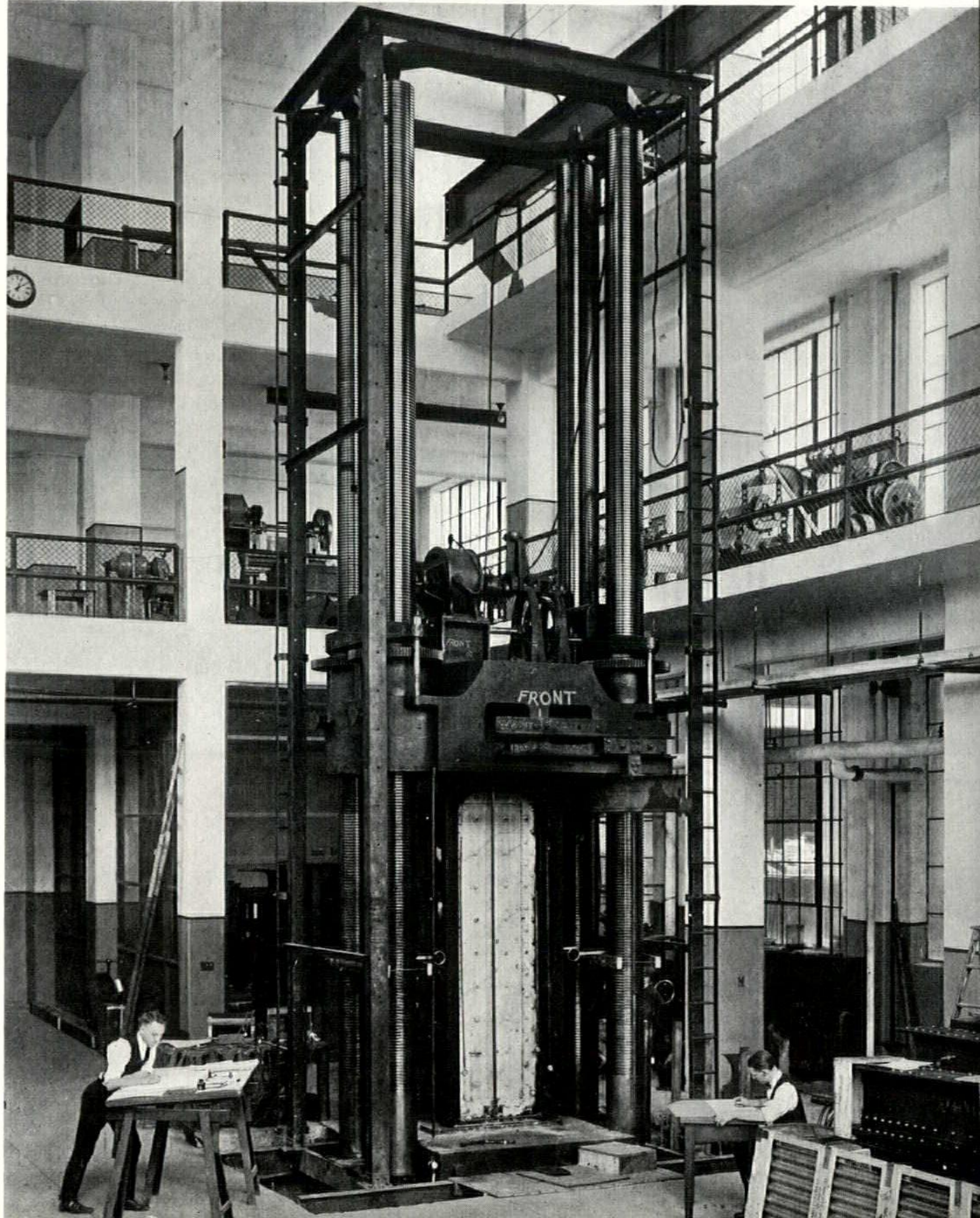
MUNICIPAL BUILDING



HIGH PRECISION EMERY TESTING MACHINE. CAPACITY 2,300,000 POUNDS IN COMPRESSION, 1,150,000 POUNDS IN TENSION. BUREAU OF STANDARDS.

COLUMN UNDER TEST IN 10,000,000-POUND TESTING MACHINE. BUREAU OF STANDARDS.

U. S. Bureau of Standards, American Standards Association



The building code program of the American Standards Association, described in the following article, was the subject of an address by Dr. Agnew at the Joint Conference of Building Officials of America and the New England Building Officials Conference, held in Boston during April.

Until 1928 the American Standards Association was known as the American Engineering Standards Committee, originally organized by the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers. This group served as a clearing house for national standards and was soon expanded to include in its membership many trade and technical societies other than the organizers. One of the chief functions of the AESC was to establish contact with international standardization work through the medium of the International Standards Association.

Today the American Standards Association has 39 member-bodies, including several Government departments. It has approved 226 standards and safety codes as American Standards and has nearly 200 more in process of development.

REGULATIONS

BUILDING CODE ACTIVITIES OF THE AMERICAN STANDARDS ASSOCIATION

BY P. G. AGNEW

AT the time the Building Code Committee of the Department of Commerce was founded progress was believed to be secured more quickly by recommending standards of practice in those portions of building codes subject to the greatest general criticism. This basic principle led to the development of the series of reports on the various phases of building construction now so well known and recognized throughout the United States. These efforts have gone far in rationalizing building code provisions and have resulted in laying a firm foundation for future progress in this field.

Last summer representatives from the Department of Commerce came to the American Standards Association with a proposal that it assume responsibility for certain standardizing activities previously carried on by the Government. Unforeseen events have delayed the time when it seemed advisable to continue actively the work on building codes. That time is now at hand.

A plan of cooperation has been developed with the Bureau of Standards on various phases of standardizing problems. The plan in a nutshell is this: the American Standards Association is to assume responsibility for the development of building codes; the Bureau of Standards is to furnish whatever assistance it can on research and testing in connection with technical questions that may arise.

The value of the Bureau's research and testing on fire resistance of construction materials and assemblies, on the compressive strength of masonry walls, on mortars, on stucco, on wind pressures and on much of the equipment that goes into a modern building, is well known. Many other laboratories have also added to the available supply of knowledge concerning building materials and appliances. Without such tests, progress would be be made exceedingly difficult. It seems especially fortunate that the Bureau offers to continue its excellent work in this field.

THOSE who are not familiar with the activities of the ASA may not fully understand its relationship to building codes. The most recent code published as an American Standard which is closely tied up with building code regulation is the Safety Code for Elevators, Dumbwaiters, and Escalators. The first edition was published in 1921 and was prepared by a committee of the American Society of Mechanical Engineers with the assistance of manufacturers, insurance carriers, and regulatory bodies.

The practical application of this Code in the formulation of state regulations and municipal ordinances pointed the need for its further development. The American Society of Mechanical Engineers then requested the ASA to authorize a revision of the Code under its procedure. This was done through a sectional committee on which all the groups concerned were represented, and under the joint leadership of the American Institute of Architects, the Bureau of Standards and the American Society of Mechanical Engineers. This sectional committee held meetings for two years and in 1925 the revised code was published as an American Standard.

After publication of this standard, the need for research and testing on the design and construction of auxiliary devices for elevators became more apparent. Consequently, a Subcommittee on Research Recommendations and Interpretations was appointed. Under the auspices of this committee an extensive testing program was carried on at the Bureau of Standards and was financed by the industry through the Subcommittee.

The results of this series of tests, the experience of State and Municipal officials with regulatory provisions of the code, the ever-increasing need for more knowledge of elevator installation for high buildings, prompted the Sectional Committee to undertake a revision of the 1925 code to clarify some of the rules as well as to include those advances which had been made in elevator construction and installation.

This second revision was published in 1931. An important feature of this last revision was the character of the membership of the sectional committee responsible for the work. It consisted of 37 members fully representative of the building, manufacturing, insurance, and governmental interests.

At many other points our work has been closely related to building regulation. The National Electrical Code and the National Electrical Safety Code have been approved as American Standards. Quite recently approval has been given to standards to safeguard building operations. Many other American Standards concerning civil engineering and building trades, mechanical and electrical engineering form important sections of the technical content of building codes, such as the Fire Tests of Building Construction and Materials, and the Code on Ventilating Standards now under way.

In addition to the standards already mentioned, the ASA has been instrumental in the development of specifications for materials used in building construction. It appears likely that material standards will play an increasingly important role in future building codes.

The relation of this considerable group of standards already completed or under way to building codes has been well summarized by a definition of a building code given by George N. Thompson in a symposium on building codes*:

> "The building code is a medium through which standards—standards of quality, standard methods of tests, and so on—may be correlated and made to function as a smoothly working piece of machinery in the interest of protection of the public."

WITH respect to building codes generally, a number of points have appealed to me as a layman. In the first place, there appears to have been a decided tendency to perpetuate obsolete requirements. Evidence of this is given in the mimeographed circular entitled, "Status of Municipal Building Codes," compiled by the Bureau of Standards. For 1933, according to this summary, 108 cities had building codes 20 years old or over; 37 had building codes 15 to 20 years old; 216 had building codes 10 to 15 years old; 420 had building codes from 5 to 10 years old; and 296 had building codes less than 5 years old. In addition 453 cities reported that they had no building codes. At least some of the requirements in these building codes must mean an added burden on the pocketbooks of future building owners. What may be important, their provisions may not insure adequate protection of the public health and safety.

Secondly, the burden imposed on a municipality which has arrived at the point of building code revision is enough to break the camel's back. An excerpt from the AMERICAN ARCHITECT for March, 1932, illustrates this point:

> "The time and effort required to completely revise a building code is demonstrated by a few statistics gathered from the New York Building Code Committee. The work was divided into six main parts, each under the direction of an architect, engineer, or contractor. Twenty committees comprising 125 individuals were formed, more than 476 committee meetings were held, of average duration of 3 hours, representing a total of about 1,420. The average attendance was 7, making a total of about 10,360 man hours. This did not include informal conferences which if included, it has been conservatively estimated, would represent a total of over 20,000 man hours of labor in committee meetings, conferences and study."

And this proposed New York Code has not yet been made law! Similar instances have occurred in Chicago and Detroit, and perhaps on a lesser scale in municipalities all over the country. The situation becomes discouraging when

*INDUSTRIAL STANDARDIZATION, October, 1933, page 161.

it is necessary for the fruit of technical effort to rot on the tree because politics prevent its being harvested.

With the exception of the largest cities municipalities in general evidently have not had the staff, time, or funds to conduct the research essential in order to prepare amendments to building codes which will keep them up-to-date, rational, and reasonably standardized. Most states have either neglected responsibility in this connection or have not had the funds and facilities to undertake the task.

The public attitude toward building regulation is almost too lethargic to mention. Recently Los Angeles rejected a bond issue to rebuild and strengthen school buildings in the face of the clamor raised by some citizens last year about unsafe schools and building regulations.*

THE increasing tendency to put provisions of building codes on a performance basis instead of attempting to lay down detailed requirements as to what is to be used is thoroughly sound. It is an indication of the future trend of these documents. The day is rapidly passing when building codes can be drafted or revised by using shears and paste on those which are already obsolete. Nor will the practice survive in the end where small municipalities endeavor to cut down the code of a large city to fit their size. Construction progress maintains such a fast pace that building regulations, if they are not to lag too far behind, must be founded on a systematic study of test data supplemented by experience in building design, construction and its supervision. The collection of the large amount of test data on building materials now extant, the bringing together at the start of all interested parties, the outlining of necessary research programs, and the work of adapting this test data to regulatory provisions, would seem to be a task for a centralizing agency. Building code work should proceed from the point where it now finds itself. It should not be necessary to retrace steps over much of the ground covered in the past.

There is still need for more reasonable uniformity of fundamental requirements in building codes. Progress has been made, but it has been slow due to the very nature of the work. Building codes must be conservative if unscrupulous builders are to be held to construction standards necessary for public safety.

At present building construction needs all the help it can obtain to reduce cost. Better buildings at reduced costs should encourage building and in turn provide more employment. In the state of New York a project was started not long ago with funds from CWA to study all building codes in the state. One objective of this work is to point out where improvements might be made tend-

*Engineering News Record, March 29, 1934, page 422.

ing to lower the construction bill.

A nation-wide program on housing will soon be under way, according to recent reports. The salient features of this program have been summarized as follows:

1. Modernization of existing houses that are worth the cost.
2. Stimulation of new home construction that can be justified economically.
3. Demolition of obsolete construction by discouraging repair of such structures and encouraging new construction.
4. Repair and replacement of industrial structures.

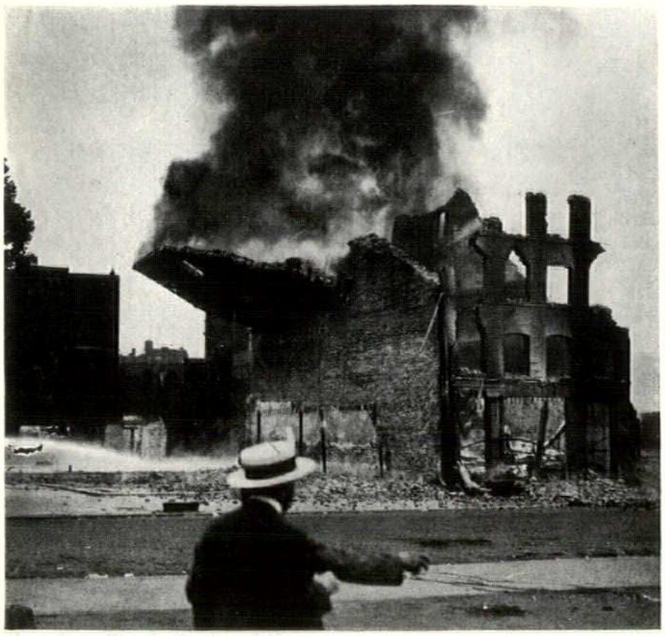
The provisions of local building ordinances will have a direct bearing on much of this proposed construction. The question may arise, are present building code requirements too severe or too lax? Do they hamper construction by requiring excessive amounts of building materials or do they go to the other extreme and permit "jerry-building"?

Representatives of a large research organization expressed the opinion a year or so ago, that local building ordinances might prove a stumbling block in the development of mass production of houses. Whether this is so or not it seems to focus attention on the importance of the detailed provisions of building codes. A delicate balance must exist if equity is to be done to all concerned.

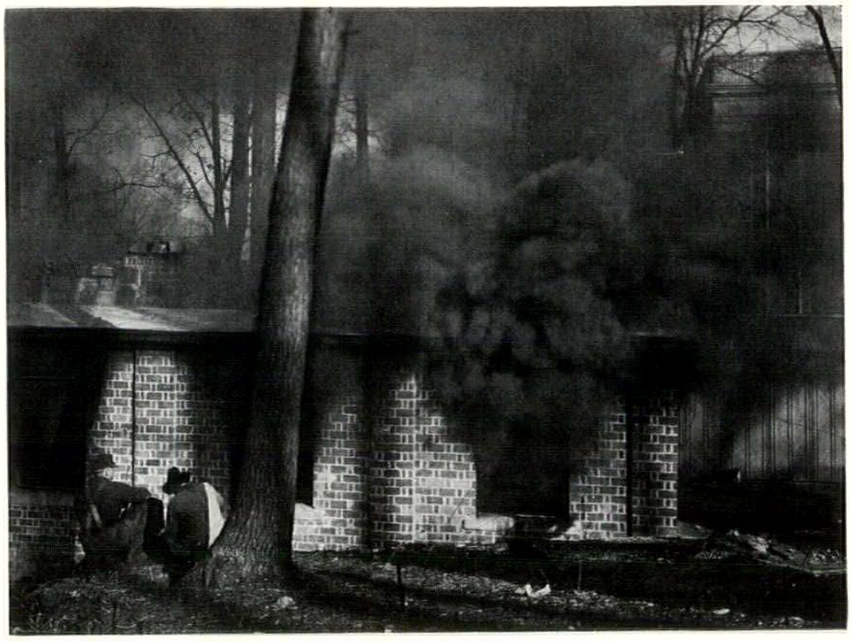
While construction is at a low ebb, it would seem to be an excellent time to prepare for future activity. Architects, engineers and building officials are better able to discuss the many phases of the subject when not overtaxed with getting out plans for some irate owner or builder.

Even when the technical problems have been solved and the draft prepared, much may happen to building codes when they are brought before a council for passage. It seems reasonable that the defense of code provisions would be made easier somewhat in proportion to the completeness of the representation inherent in their drafting. Certainly a councilman or mayor should be more convinced of the unbiased standing of any particular code when he understands that such a code represents the combined view of experts from all sections of the country. This broad representation in the preparation of building ordinances offers a solution which should go a long way in removing the suspicion attached to many building codes in the past whether it was justified or not.

There will always be need for improvement in building codes, especially when considered on a national scale. Whatever can be done to broaden the base on which these codes are founded seems to me to be a step in the right direction. It is my hope that with the cooperation of architects and others, the American Standards Association can contribute to this end.

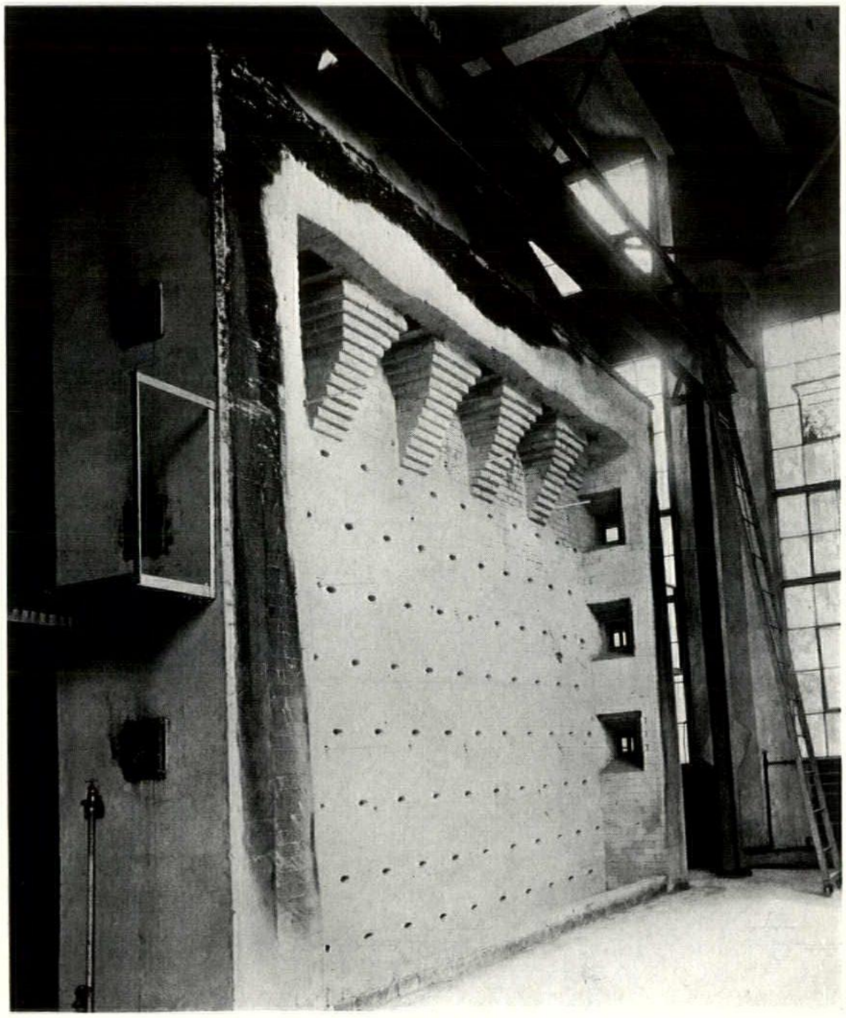

American Standards Association

FIRE TESTS ON BUILDINGS IN THE MALL ABOUT TO BE RAZED TO DETERMINE SEVERITY OF FIRES AND PROTECTION AFFORDED RECORDS IN SAFES.



PROGRESS DURING TEST TO DETERMINE SEVERITY OF FIRES IN BUILDINGS.

GAS FURNACE USED FOR TESTING FIRE RESISTANCE OF WALLS AND PARTITIONS. WALL OR PARTITION TO BE TESTED FORMS OTHER SIDE OF FURNACE DURING TEST. BUREAU OF STANDARDS.



EXPERIMENTS CONDUCTED BY U. S. BUREAU OF STANDARDS

FIRE CONTROL
IN THE DESIGN OF MODERN BUILDINGS

BY
PAUL W. KEARNEY

The architect's importance in fire control is fixed by the old adage, "It is easier to fight a fire at the drawing board than at the hydrant." The architect has the greatest influence over fire's two most vital factors:

(1) Fuel.

(2) Draft.

Neither can be eliminated: both can be minimized, lessening the possibility of a sweeping blaze. But the man at the drawing board is apt to miss the objective unless he approaches the problem with at least a little of the practical fireman's viewpoint. The best introduction is afforded by a test the U. S. Bureau of Standards made when it burned down a pair of attached, five-story, brick-and-timber buildings being razed for a park project. The structures were in fairly good repair, in the wholesale produce section of Washington and typical of a million other commercial and mercantile occupancies everywhere. The floors were reasonably stocked with packing boxes to simulate a tenancy, and a torch applied on the main floor. The stop-watched progress of the unmolested fire was as follows:

In 5 minutes the fifth floor *was involved;*

In 10 *minutes flames belched from every window in both buildings;*

In 15 *minutes the roof fell in;*

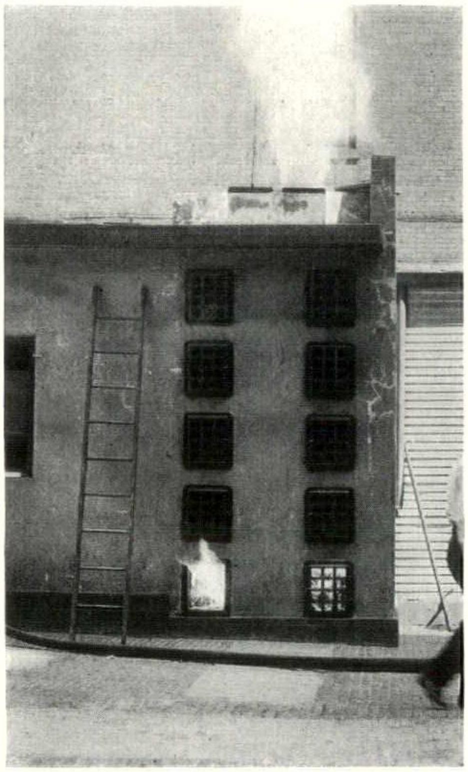
In 20 *minutes the wooden floor joists were burning through;*

In 28 *minutes part of the front wall fell;*

In 45 *minutes all walls above the first floor were down.*

Too much emphasis cannot be placed on the first item: it is the critical factor in many serious outbreaks. At the Baltimore *Post* Building blaze in 1931 the whole structure was involved two minutes after the discovery of the fire; at the famous Binghamton clothing factory fire ten years ago, 35 employees

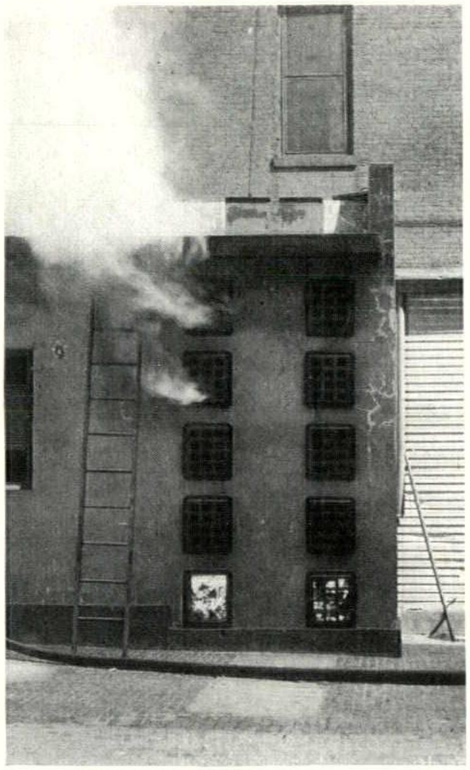
HIDDEN DRAFT SPACES ARE THE BANE OF THE FIREMAN'S LIFE. A FIRE MAY BE EXTINGUISHED IN 15 MINUTES BUT IT MAY TAKE AN HOUR TO "OVERHAUL" THE PREMISES, FOLLOWING THE FURTIVE SPARK THROUGH ALL POSSIBLE CONCEALED AREAS. THE REASON WHY FIREMEN TEAR BUILDINGS WIDE OPEN IS THE SIMPLE FACT THAT ARCHITECTS HONEYCOMB THEM WITH HIDDEN VOIDS!



DEMONSTRATION OF THE "MUSHROOM FIRE" AT THE NEW YORK FIRE DEPARTMENT SCHOOL

THIS MODEL REPRESENTS TWO ATTACHED 5-STORY FIRE-RESISTIVE BUILDINGS SEPARATED BY A FIRE WALL. AN OPEN STAIRWAY EXTENDS FROM MAIN FLOOR TO ROOF IN THE REAR. THE FRONT OF EACH FLOOR IS STOCKED WITH SMALL BUNDLES OF EXCELSIOR AND MATCHES APPLIED TO BOTH MAIN FLOORS AT THE SAME MOMENT. THE PICTURE WAS SNAPPED A FEW SECONDS AFTER THE "FIRE" STARTED.

THE "APARTMENT" ON THE RIGHT HAS AN AUTOMATIC VENT IN THE SKYLIGHT; THE ONE ON THE LEFT HAS A SECURELY-SHUT SKYLIGHT. WHEN HEAT OF 150° IS PRESENT, A FUSIBLE LINK IN THE AUTOMATIC VENT OPERATES TO RELEASE A COUNTER-BALANCED DOOR. THIS OPENING ALLOWS THE RISING HEAT TO ESCAPE INSTEAD OF COMPELLING IT TO MUSHROOM THROUGH THE BUILDING. THE SMOKE CAN BE SEEN EMERGING FROM THE VENT.



APPROXIMATELY 10 SECONDS LATER

THE FIFTH AND FOURTH FLOORS OF THE UNVENTED APARTMENT ARE ALREADY INVOLVED WITH FIRE; THE CORRESPONDING FLOORS NEXT DOOR ARE SAFE AND THE EXCELSIOR NOT EVEN SCORCHED. BEFORE THE PLATE COULD BE CHANGED IN THE CAMERA, THE THIRD AND SECOND FLOORS OF THE UNVENTED BUILDING WERE BELCHING SMOKE.

THE AUTOMATIC VENT, WHEN EQUIPPED WITH AN ALARM SIGNAL, CAN BE AN INVALUABLE LIFE SAVER. IF PROMPT ACTION AGAINST THE FIRE FOLLOWS, IT WILL ALSO HELP THE FIREMEN MATERIALLY BY TEMPORARILY HOLDING THE BLAZE IN CHECK. SUCH VENTS ARE COMPULSORY OVER THE STAGE OF EVERY NEW YORK THEATER.

were dead within five minutes after the outbreak originated, and in thousands of less dramatic cases the building, if not its occupants, is doomed with equal rapidity. The recent wave of New York tenement fatalities demonstrates these points quite graphically: the pity is that the average private dwelling is a worse firetrap than the old law tenement—and will continue to be so long as builders ignore the facts.

The point is that fire's principal mode of travel is by convection. Heated air at around 1000° F. rises under great pressure, follows the ceiling in the original room and then sweeps up from there through every available artery. These may be the open stairwells, elevator and other shafts, or less obvious paths such as pipe recesses, belt openings, ventilating ducts, hollow walls, and so on.

When and if the heated air can go no higher, it spreads laterally—"mushrooms" as the firemen say—banking up under its obstruction and working downward again as pressure and volume mount. At 1000° this air is igniting all combustible furnishings and trim in its uppermost reaches, *starting another blaze upstairs and independent of the original flames.* The classic demonstration of this action occurred in a modern skyscraper with a minor basement outbreak in a cable shaft. The heat went up until blocked by a stone cut-off at the 45th floor; it then worked downward again until it reached an open door at the 36th story. Going up, the unobstructed heat naturally passed this opening: coming back under pressure it flooded through the doorway, ignited the combustibles in those offices, and caused $100,000 damages on that floor.

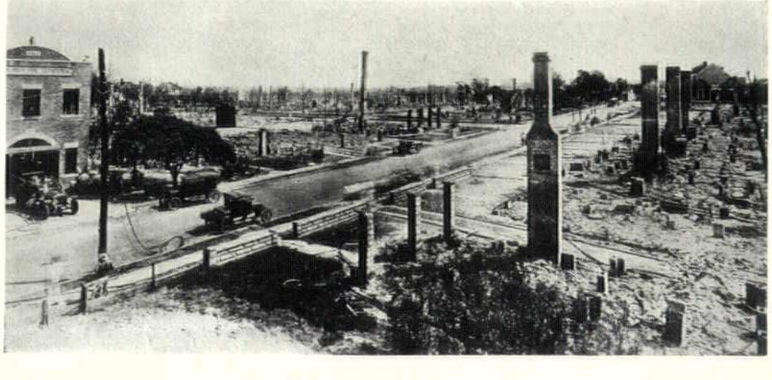
In a nutshell, this is the explanation of the first item in the Washington test. It is also the reason why fire control engineers keep harping on their contention that most of our buildings are "built to burn." Even when sturdily constructed, too many are so full of unprotected vertical arteries that any unnoticed outbreak will be a quick spreader if given just a few moments' headway.

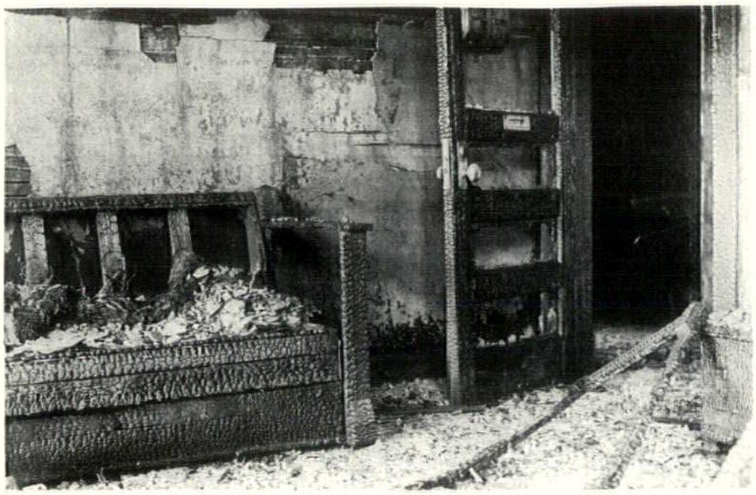
FIREMEN OPEN UP A ROOF TO LET THE PENT-UP HEAT ESCAPE, THUS RETARDING ITS LATERAL SPREAD WHILE OTHER COMPANIES WORK ON THE MAIN BODY OF FIRE. AFTER A BUILDING HAS BEEN "VENTED," MEN CAN GET IN CLOSE TO THE BLAZE AND OPERATE COMPREHENSIVELY—WITHOUT "VENTILATION" AT A GOOD FIRE, THEY'LL BE LUCKY TO STAY ON THE SAME SIDE OF THE STREET WITH IT!

This factor is quite as important in the life hazard as in property damage. Long before the rising heat is intense enough to ignite wood, it is fatal to breathe, hence most fire victims are the prey of convection, not flames. Years ago 13 bodies were taken out of one room on the fourth floor of a New York tenement house whose fire never got above the *second floor,* and not a single body had a mark on it. In a country-wide survey of several hundred fatal dwelling fires (mostly private houses), the National Fire Protection Association found that 74 per cent of the deaths occurred on upper floors from downstairs fires. Since two-thirds of all our fire victims die in residential blazes, the factor appears vital.

In schools and other populous public buildings the same principles will apply if not curbed by intelligent building codes. In old schools, especially, the prime failure is to place too much stress on speedy evacuation alone. Exits can never be too numerous or accessible and drills which permit the emptying of a building in 3 minutes are commendable, but both factors are still inadequate in a structure which can be flooded with lethal heat in a minute or two.

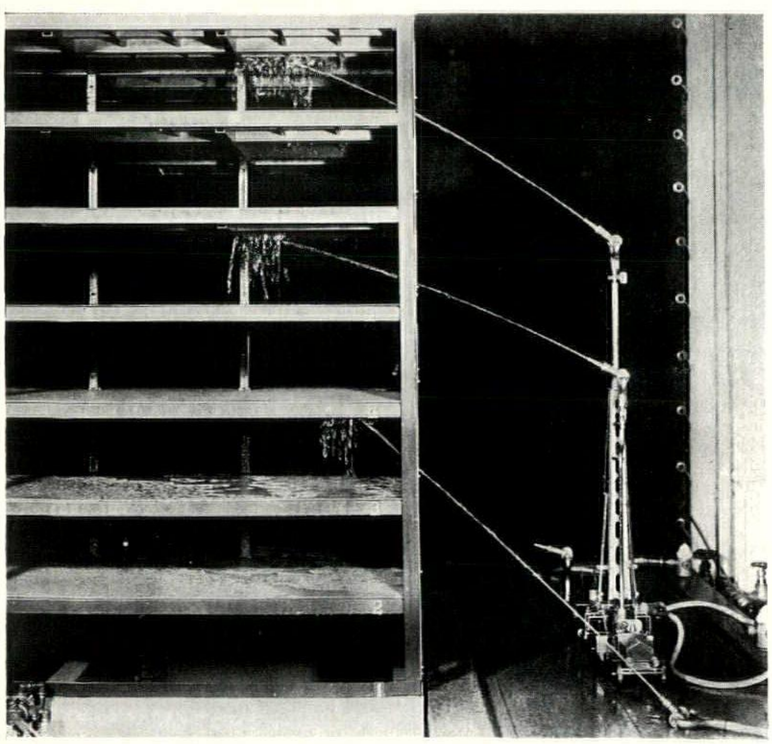
THE MENACE OF THE WOODEN SHINGLE ROOF: SHREVEPORT, LA., AFTER A FIRE LEVELED 196 DWELLINGS IN 1925. THE OUTBREAK STARTED ACROSS THE STREET FROM THE FIRE STATION, BUT SPREAD WITH SUCH RAPIDITY FROM ROOF TO ROOF THAT IT COULDN'T BE CHECKED. THE MENACE OF SHINGLES IS NOT ALONE THAT THEY BURN BUT, MORE IMPORTANT, SEND FLYING BRANDS INTO THE AIR TO BE CARRIED AS FAR AS A MILE WHERE THEY START NEW FIRES.





LIGHTWEIGHT DOOR PANELS GAVE FIRE AN ENTRY TO THIS APARTMENT. PENT-UP HEAT IGNITED THE WOOD WHICH BURNED THROUGH QUICKLY. THE APARTMENT WAS GUTTED ALTHOUGH THE ORIGINAL BLAZE WAS THREE FLOORS BELOW. A SOLID DOOR WOULD HAVE MATERIALLY DELAYED THIS ACTION—A FIREPROOFED STAIRWAY WOULD HAVE PREVENTED IT.

SCALE MODEL BY WILLIAM F. CONRAN, NEW YORK, SHOWING LIMITS OF FIRE DEPARTMENT OPERATIONS FROM THE STREET. DISTANCE FROM WINDOW TO 1ST SUPPORTING COLUMN REPRESENTS 10 FEET: FIRE BURNING MORE THAN 10 FEET BACK ON ANY OF THE INDICATED FLOORS WOULD NOT BE TOUCHED BY WATER FROM OUTSIDE BECAUSE NOZZLE ANGLES KILL PENETRATION. THIS IS WHY BELATED DISCOVERY OUTBREAKS PRESENT SUCH A DIFFICULT PROBLEM TO FIREMEN.



Reverting again to the fireman's viewpoint, his reaction to convection is most simply demonstrated at an ordinary dwelling fire in the city. Even though the smoke is pouring out of the main floor windows, the first truck company in will usually race for the roof to "open up" over the stairway—the principal vertical artery in a residence. The firemen know that in a few seconds more the top floor may be ablaze; and their object is to provide a roof opening through which that pent-up heat can escape harmlessly into the air. This retards the "mushroom" condition or lateral spread; makes the structure more tenable; facilitates rescue and fire fighting. Without that roof opening at a good blaze, a fireman won't get inside the top floor window from the fire escape or ladder: when it has been made, he could comfortably stand in the bedroom door and watch the fire go past him in the hall! The heat is simply going on up instead of horizontally.

Extinguishing operations as such do not interest the architect, but a few points bear mention. Much of the damage at a blaze is done by water because large volumes are required to check a going fire. While estimates vary with the type of fuel, it is moderate to count on 6 to 8 pounds of water for a pound of burning material. It has been calculated that a brick building of combustible interior will contain 19 lb. of combustibles per square foot of floor area, of which 14 lb. are structural elements and the balance trim, decoration, etc. Contents will add 5 lb. more in an apartment or hotel; 10 lb. in an office; more elsewhere. Thus a fire in one 10 by 15 foot bedroom will have a ton of fuel on which to feed: if only half of it is involved, three to four tons of water will be needed to extinguish the blaze. Convert this into terms of a big fire and it becomes clear why buildings with highly absorbent contents so often collapse when those saturated materials expand.

This moderate water delivery applies only under "ideal conditions" which, to the firemen, means getting in on the "fire floor" where they can put the water on the fire. When the heat is too punishing they must keep their distance and, perhaps, operate from outside more or less blindly. Then three-quarters of the water will be wasted because they can't see where it goes and the volume must be proportionately increased.

When firemen have to work from the street, they're beaten. Not only do intervening walls and partitions block the flow of water, but as nozzle angles increase to reach upper floors, penetration is radically diminished.

All of this may appear extraneous yet it serves to establish three fundamentals rarely emphasized in lay fields:

(1) *A fire spreads with amazing speed when its rising heat has free access to new fuel;*

(2) *It generates terrific temperatures quickly, necessitating excessive water volume;*

(3) *Even excessive volume is impotent unless it can be applied in "hand to hand" combat.*

These three elements are definitely related to the architectural factors, fuel and draft. Indeed, they are the basis of every adequate building code no matter how irksome it may seem at times. For, generally speaking, the popular disposition is to leave fire fighting entirely to the firemen whose obstacles are magnified by architects who continue to honeycomb their structures with *unprotected draft spaces* which convey heat to *new fuel.* This is exactly what converts a burning waste basket into a $6,000,000 Equitable Building conflagration in 15 minutes. Spread over a wider field, it is the reason why, after twenty years of intensive fire prevention education, our national loss has trebled. Were it not for the fact that we spend twice the fire loss for fire fighting, the annual toll would be much higher!

The remedy is not fire-resistant construction in itself but what might be termed "fire-conscious building." Steel and concrete frames alone do not make structures "fireproof" so long as the unprotected contents are burnable and excessive draft areas prevail. Such buildings simply become giant furnaces, sturdy enough to house a conflagration for hours with obvious results. Of 48 serious outbreaks in fire-resistive buildings, the damage to contents exceeded $25,000 in 58 per cent of the cases; in six of the fires the total damages amounted to $1,755,000.

This is no criticism of modern, fire-resistant buildings: it simply means that this fact alone is passive resistance against a very dynamic foe. The war against fire must, rather, be waged on a clear-cut anticipation of its behavior, resulting in plans to forestall that action.

In view of what has already been said, it is obvious that the worst fires are those discovered tardily, for delay is what brings into play the draft and fuel factors. The significance of this is best expressed by the annual experiences which attribute some 65 per cent of the total damages to approximately 1 per cent of the outbreaks.

The solution is two-fold. First, it is essential to reduce the draft areas to minimize the available fuel; second, it is vital to introduce automatic control of one type or another to limit the size of the fire.

The first precept is covered in detail by the Standard Building Code of the National Board of Fire Underwriters which need not be gone into here. The general principle aims at the *isolation* of an outbreak to its point of origin, and the more completely that can be done, the better. Open stairways and shaftways of all types represent the most flagrant hazards: connecting each floor with the next, they make a building one unit so far as rising heat is concerned. Excessive floor areas are another fire spreader, enabling heat which cannot rise to flood an entire floor and ignite its contents, presenting a stiff problem to the firemen who may be summoned a bit late.

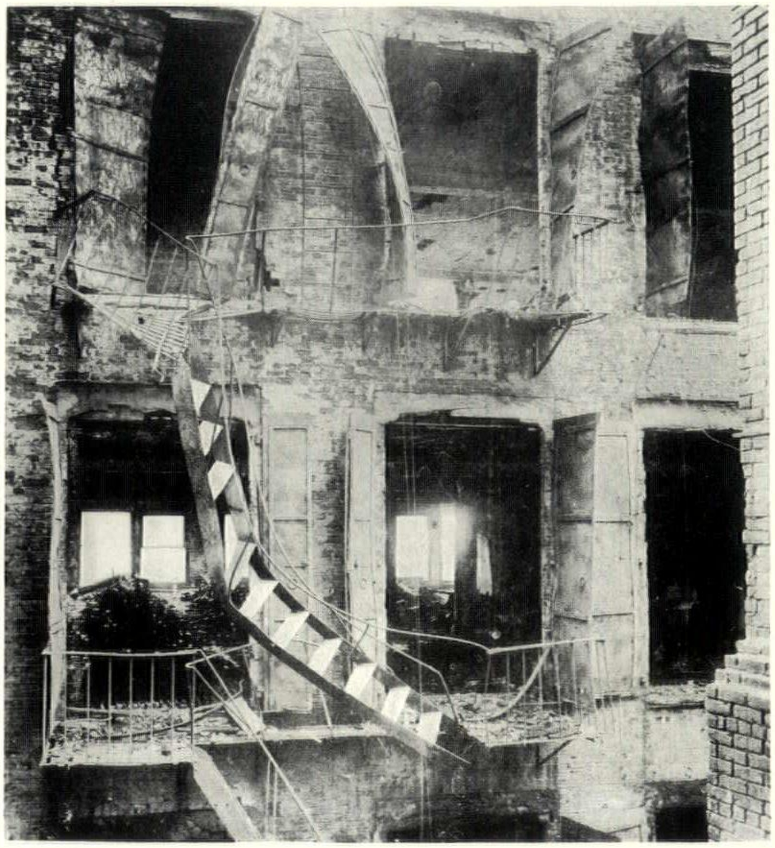
Concealed openings are equally vital, and the good code calls for firestopping which will cut off all such draft areas in furred walls, studded-off spaces, partitions, exterior walls, stairs, and the like. Often architects take pains to seal up stairs and shafts, leaving other less obvious spaces unguarded. Ventilating ducts are common flaws in otherwise good buildings, and a good many school fires have become destructive because they were swept into every room via the ventilators. Automatic traps or doors operating on fusible links meet this threat.

Without actual fire-fighting experience, it is easy to forget that heat will negotiate an opening small enough to discourage an insect. Yet since that is true, any skimping on firestopping and

Underwood & Underwood

EFFECT OF INTENSE HEAT ON FIRE-RETARDANT MATERIALS ON THE OUTSIDE OF A BUILDING. CONCRETE MELTED AND DRIPPED OFF COLUMNS INSIDE THIS STRUCTURE. WHEN UNPROTECTED BY AUTOMATIC CONTROL A BUILDING OF THIS TYPE CAN HOLD A RAGING FIRE ANYWHERE FROM 10 HOURS TO SEVERAL DAYS.

OUTSIDE FIRE ESCAPES ARE FINE—UNTIL THE HEAT CONVERTS THEM INTO GRIDDLES! IT TAKES ABOUT 2000° TO DISTORT METAL IN THIS FASHION. THAT IS WHY INSIDE SMOKE-PROOF TOWERS ARE ADVOCATED BY MODERN CODES.



THE REAL "SKYSCRAPER FIRE MENACE" IS FROM THE SMALL ADJOINING BUILDING NOT PROPERLY PROTECTED. THIS BLAZE STARTED IN A 4-STORY FRAME HOTEL; ITS RISING HEAT IGNITED CURTAINS, SHADES AND AWNINGS ON THE 5TH AND 6TH FLOORS OF THE BANK BUILDING AND GUTTED THOSE AND UPPER STORIES BEFORE THE POORLY-EQUIPPED FIRE DEPARTMENT COULD DO ANYTHING ABOUT IT.

cut-offs, especially where that omission can't be detected, is a crime.

So far no particular stress has been laid on the use of incombustible materials for several reasons. When practicable economically, the value of such construction is incontestable and self-convincing. When not practicable economically, argument is pointless. For that reason, this subject of isolating fire in small areas by structural confinements merits all the study and intelligence the architect can bring to it. Where thoroughly applied, this doctrine will render even the combustible building relatively fire safe, hence it has a direct bearing upon the task of rehabilitating an existing structure or building a new one outside of a city's fire limits. Perhaps the outstanding exception to this theory involves roofing, especially of dwellings. The popular wooden shingle roof accounts for a direct property loss of over $16,000,000 annually due to "sparks on roof." In many cities wooden roof fires account for 40 to more than 50 per cent of all the fire department's runs, and on a single day in Indianapolis 67 alarms out of 68 were for shingle roof fires.

In addition to these smaller blazes there have been 22 major conflagrations since 1900, aggregating $95,000,000 in damages, directly due to the ability of these roofs to spread fire from house to house. Consequently, the subject of roofing falls outside of mere economic into the field of public welfare.

Apart from this, incombustible materials play their strongest rôles in the existing building as firestops for the sealing of draft spaces, vertical arteries, and the like. Yet even here they must be employed with intelligence else their purpose will be defeated. They must do more than refuse to burn: they must keep the heat from passing, and that calls for sensible installation. A good-grade plaster ceiling won't burn in the accepted sense, but if it is laid on wooden lath, it can transmit heat enough to ignite the lath. Indeed, an unburnable asbestos ceiling can accomplish the same treachery if the proper air space isn't provided behind it or its base composed of incombustible supports, too. Those who criticize certain code requirements as being too stringent have never seen a fire conveyed through an apparently sturdy wall to ignite the adjoining room!

From the opposite angle, the unintelligent use of incombustibles often proves a hazard rather than a help. Bare steel or cast iron supporting columns, to cite a single case, are the bugbear of firemen in the old building where intense heat will weaken them or cold water crack them. It was demonstrated years ago that bare, structural steel would fail under genuine fire conditions in from eleven to twenty-one minutes; when reinforced with 4-inch stone concrete, similar columns stood up seven to eight hours.

The first fundamental of fire control then, in new structure or old, is isolation. The ideal is to break up a building into units as far as possible, each unit being capable of holding an outbreak within its confine for at least an hour. The nearer we approach that objective, the safer the combustible building will be from the dread menace of a quick-spreading blaze.

The second step, which becomes more vital "as the square of the impractibility" of the first, is automatic control. The firemen say "the first five minutes are worth the next five hours," and that maxim tells the whole story of mechanical protection in ten words. The bad fires—the 1 per cent that cause 65 per cent of the losses—are fires in which the first five minutes or more were wasted. In most instances they are night-time outbreaks, discovered accidentally by a passer-by—which means that the building is doomed before the firemen arrive. The only remedy is some provision for early discovery and prompt action, and this may take either of two forms:

A. The supervised automatic sprinkler system;

B. The approved fire detection system.

Automatic sprinklers need no elaboration here: for 35 years or more they have proved effective in 98 per cent of the demands made upon them. What does bear mention is the fact that their occasional failure is generally due to the collapse of the human element: gate valves have been closed; water pressure has been allowed to drop; steam in the boilers is low, or whatnot. The lesson from these cruel experiences is simple: the best sprinkler system is one electrically supervised through an outside central station, for then the fickle human element is virtually eliminated.

Recalling earlier references to temperatures created and water volumes required in a real fire, the value of the automatic sprinkler beggars debate. Operating, usually, at approximately the melting point of wax, sprinklers extinguish 60 per cent of their fires with the operation of but one to three heads giving a shower of water rather than a deluge.

For architects chiefly concerned with residential construction, this ally is now feasible at very nominal costs for at least partial protection. The domestic cellar sprinkler recently made available by several manufacturers ranges in price from $65 to $150 and can be extended to the first floor. The house water supply is employed, obviating the need for roof tanks, and the installation can be made by any competent plumber. Since about three-quarters of our dwelling outbreaks originate in the cellar, this area is a vital one.

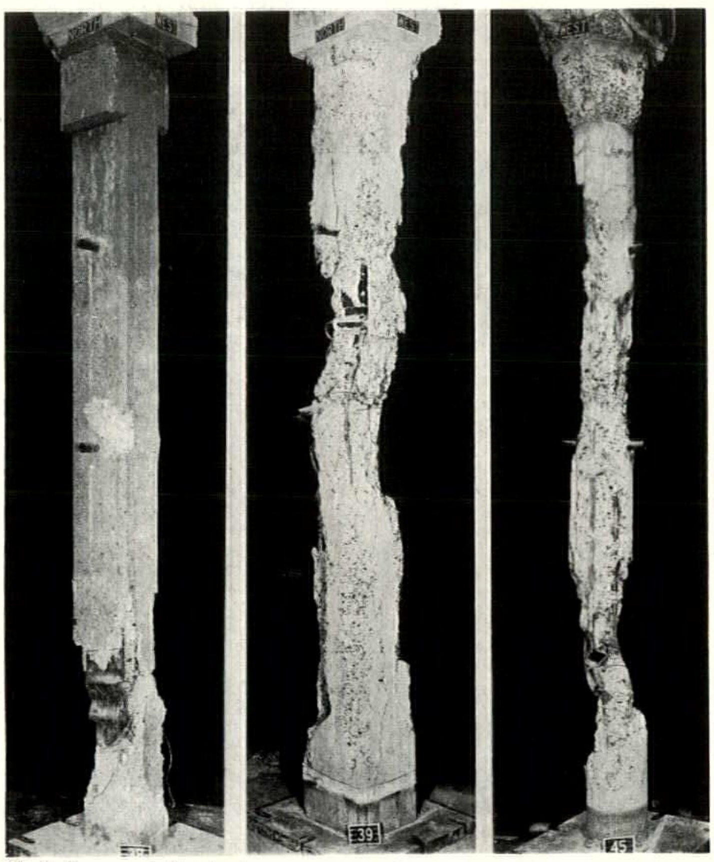
Considering regulation sprinklers however, there are many occupancies in which an immediate water flow is not advisable because of the nature of contents or where complete installations would prove too costly. Here the automatic detection system supplants the sprinkler to good purpose, giving an early alarm which will bring prompt action.

The most widely used devices fall into two classes: thermostatic and pneumatic. The former employs either spot thermostats or, better yet, continuous "fire wire" which is sensitive to heat. The expansion or fusing of these detectors either closes or opens a circuit which transmits an alarm. The pneumatic type employs continuous copper wire containing air at "room pressure." Heat causes this air to expand and escape forcefully from fixed vents, thus bulging a diaphragm and closing an electrical circuit.

The distinction is that the thermostatic systems work at a fixed temperature—usually 150°—while the latter uses the "rate of rise" principle which usually spells quicker action. Ordinarily, the rate of rise device will operate upon a jump of 20° in room temperature within the period of a minute since it is tuned to report a *quick rise* in temperature rather than to wait for a predetermined mark to be attained.

A HOT FIRE — LARGE VOLUMES OF WATER — ABSORBENT CONTENTS — BUILDING COLLAPSES. THIS 6-STORY BUILDING DIDN'T BURN DOWN: IT FELL DOWN WHEN ITS BALED PAPER AND RAGS SWELLED WITH WATER AND PUSHED OUT THE WALLS.

RESULTS OF FIRE TESTS OF COLUMNS PROTECTED BY PLASTER ON METAL LATH. THE PROTECTION WAS APPLIED AS A SINGLE LAYER OR IN DOUBLE LAYER WITH AN AIR SPACE BETWEEN LAYERS, THE PROTECTION AFFORDED BY THE TWO TYPES OF COVERING BEING ONE HOUR AND TWO HOURS RESPECTIVELY, WHEN THE COLUMNS WERE CARRYING THEIR FULL WORKING LOAD.



U. S. Bureau of Standards

Aside from merely transmitting an alarm, automatic systems can perform other emergency services in addition. In certain occupancies they operate chemical tipping systems to flood an area with extinguishing gas; they can be employed to switch on emergency lights on stairs and halls; illuminate exit signs which will direct occupants away from the fire area to unobstructed stairways; close fire doors and windows; shut off motors and fans; and perform numerous other useful acts which might be forgotten by excited humans. One system, especially designed for school use, broadcasts the alarm through amplifiers in the form of a bugle call, gives verbal instructions for the egress, and then plays a rousing piece of band music to facilitate the exit march.

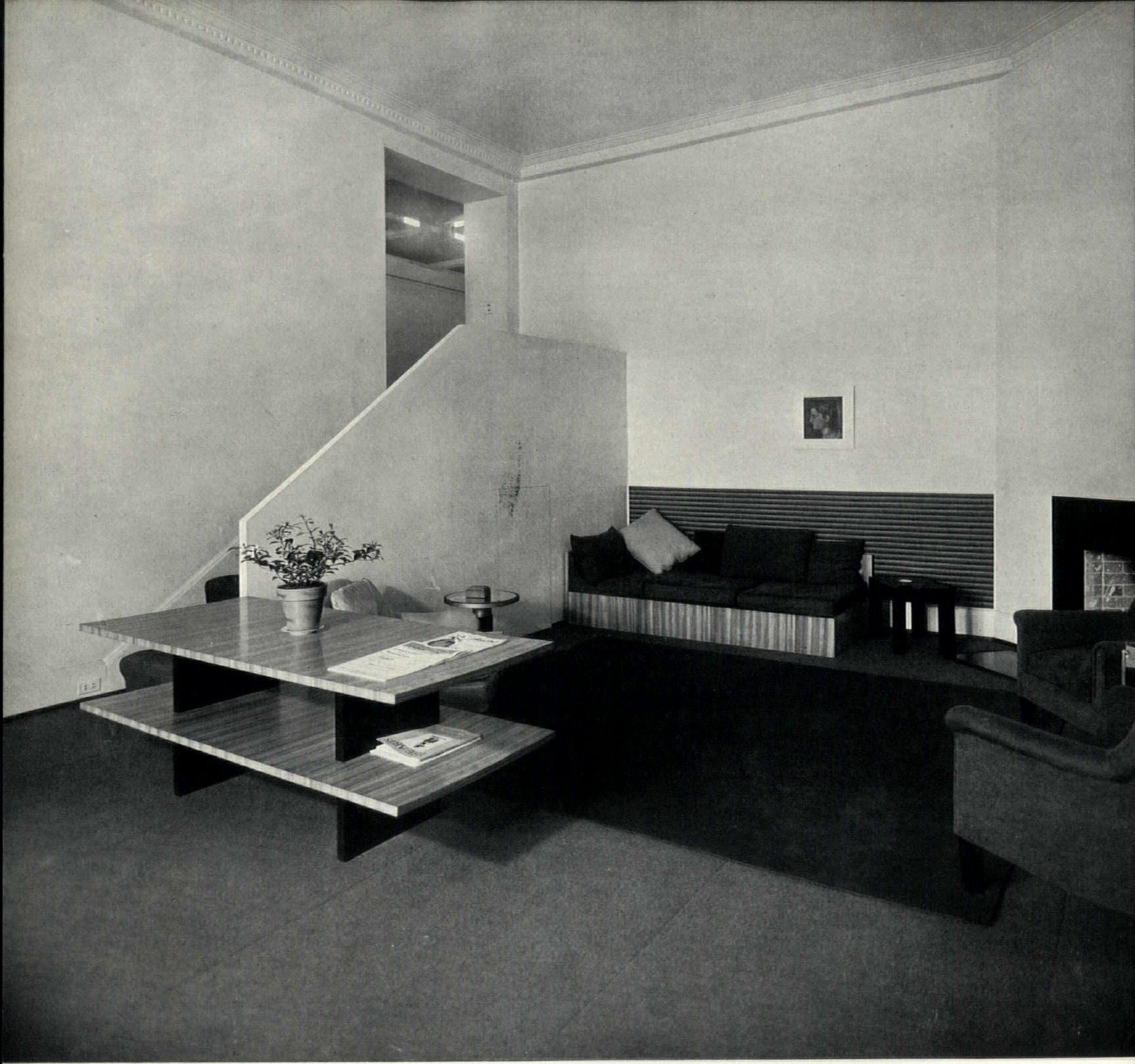
As with sprinklers, supervision again becomes vital, for the system which has become inoperative is worse than none at all. Approved detectors are self-supervisory: i.e., their own circuits continuously check up on the system and give a trouble signal when anything goes wrong. With such a system, silence is the perfect guarantee of workability—with others, silence is at best dubious.

Where central station tie-ups or direct fire department connections in the approved manner are possible, the automatic detector becomes indispensable for two salient reasons. The first is that professional supervision is always at hand; the second is that professional help is immediately forthcoming upon receipt of an alarm. The second factor meets the constant flaw of the "local" system—the fact that nobody may be around to hear it when it goes off—or that those who hear it may be so inexperienced or become so excited that they fail to do the right thing.

In general terms, then, automatic control is the body blow that really hurts fire. It eliminates that costly curse of belated discovery with the destructive train of events following in its wake. And, dollar for dollar, it affords more genuine protection to the average building than any other investment can. This doesn't imply that sensible construction is to be ignored for automatic devices: in some measure they go hand in hand. The best of mechanical devices can fail under adverse conditions—the flash fire, for instance, in vapors or dusts which gets out of control in a split second; the explosion, likewise, which may not only scatter a large body of fire instantaneously but which may also cripple the automatic system.

Such ever-present possibilities simply emphasize the fact that the burden of fire safety can never be placed entirely upon any single element. Yet granting that, it is still patent that approved automatic control can take a lion's share of the job. In the old building where the most generous reconstruction plans will be severely limited, the automatic system will be extremely vital, not to say extremely economical, in the effort to control fire. And in the ultra-modern fire-resistant structure, packed with thousands of tons of combustible contents, it is the one factor which can really prevent that building from being turned into a twenty-story furnace!

The cheaper way is control rather than combat. And control comes right back to the architect who has it in his power to put up buildings so equipped that an outbreak can be localized, that its heat can be confined to a small unit instead of sweeping through the whole structure to new fuel, that its possible outbreak can be reported in its infancy and killed with dispatch.



VIEW OF LIVING ROOM

APARTMENT OF JOHN ATKINSON DUNBAR, NEW YORK CITY

WILLIAM MUSCHENHEIM, ARCHITECT

LIVING ROOM (Above)

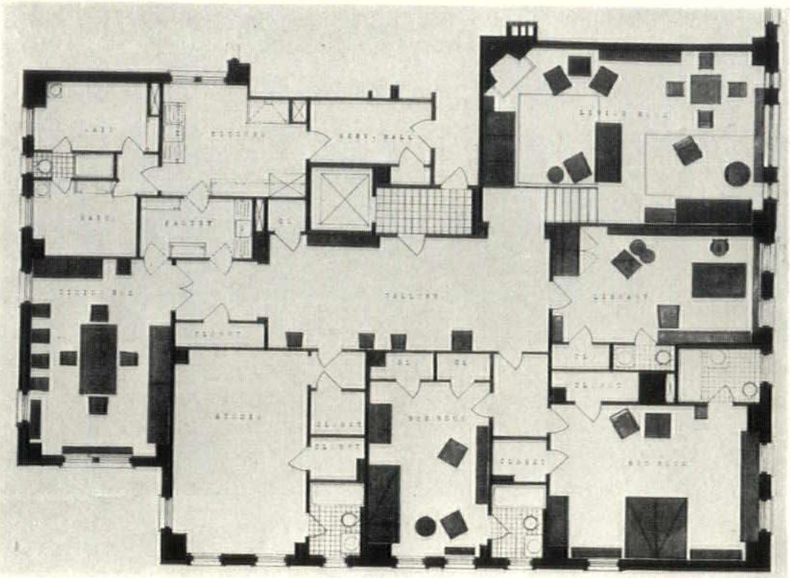
FURNITURE: ZEBRA WOOD.
UPHOLSTERY: RUST COLOR, ROYAL BLUE AND SULPHUR YELLOW.
WALLS AND CEILING: ALL WHITE.
NATURAL COLOR HAIR CARPET ON FLOOR WITH HEAVY PILE BLUE RUG.

LIBRARY (Preceding Page)

BOOKCASES AND DESK: BRAZILIAN ROSEWOOD.
DESK TOP AND UPHOLSTERED CHAIRS OF PIGSKIN.
WALLS AND CEILING PAINTED BATTLESHIP GRAY FLAT.
HEAVY PILE YELLOW CARPET.
DESK CONTAINS TYPEWRITER, TELEPHONE, FILING CABINET AND HUMIDOR.

PORTFOLIO

MODERNIZATION AND ALTERATION



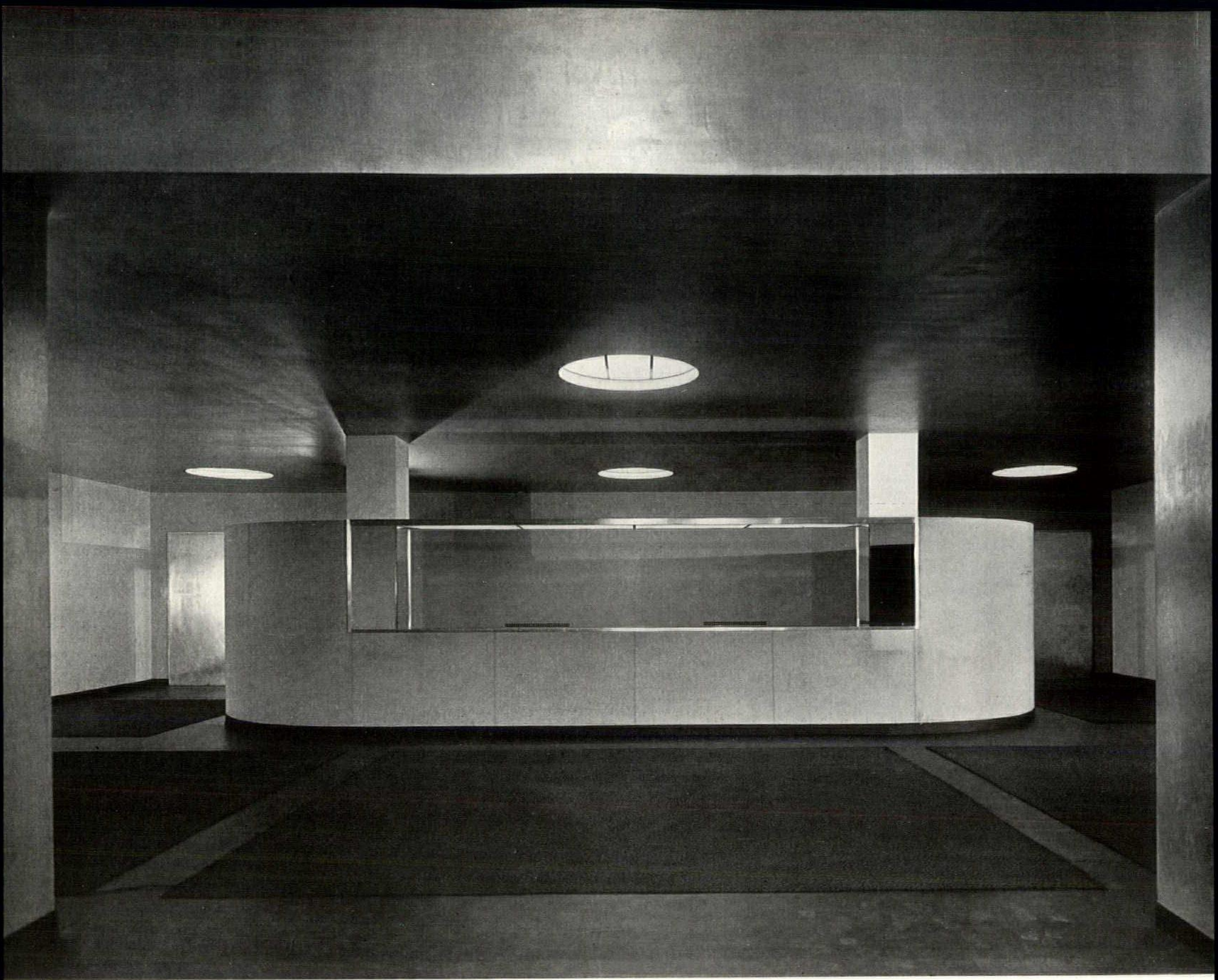
PLAN OF THE APARTMENT

BEDROOM

FURNITURE PAINTED YELLOW.
WALLS AND CEILING: WHITE.
WIENER WERKSTAETTE WALLPAPER: YELLOW AND GREEN-BLUE.
COVERING ON BEDS: GREEN-BLUE.
GRAY CARPET.
GRAY WALL PANEL: CELOTEX UNDERNEATH FOR TACKING PICTURES.
ORANGE CUSHIONS ON TUBULAR CHAIRS AND WINDOW SEAT.
BLACK GLASS TABLE TOP.

BEDROOM

Byron Co.



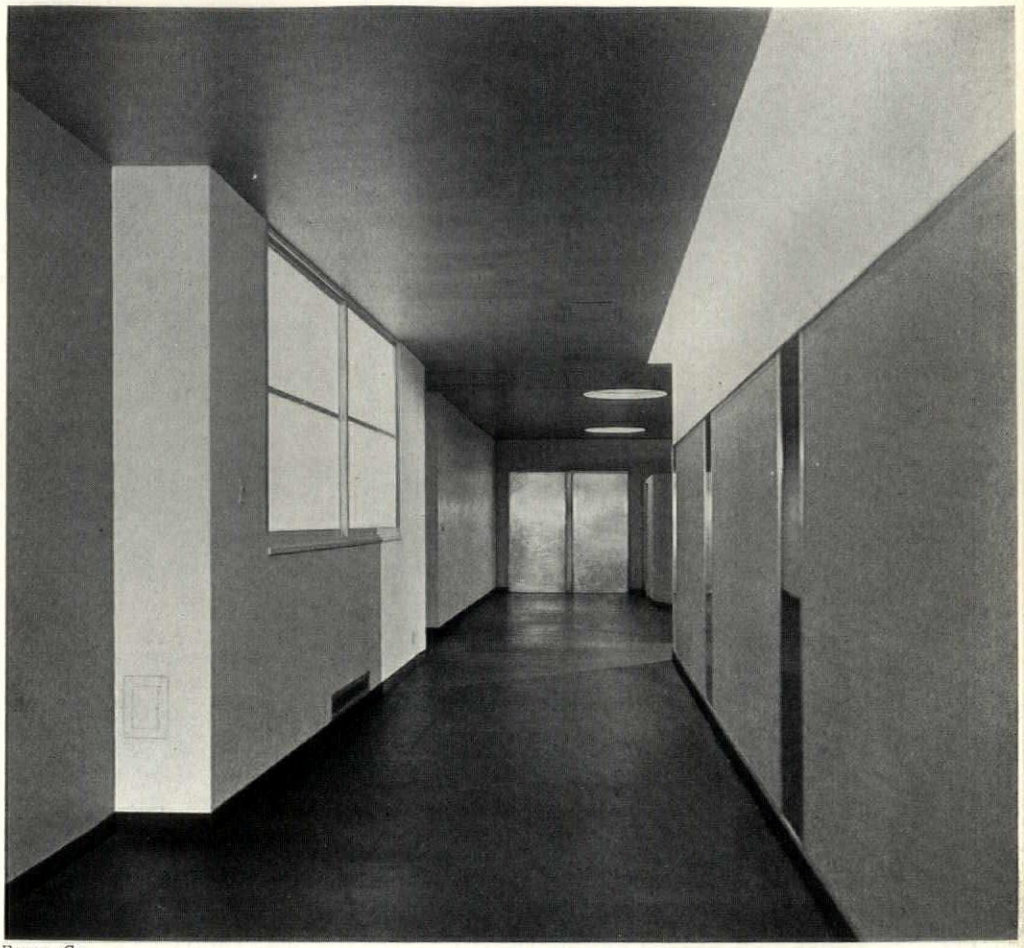
ron Co.

CHECKING COUNTER

BALLROOM FOYER AND COATROOM
HOTEL ASTOR, NEW YORK CITY

WILLIAM MUSCHENHEIM, ARCHITECT

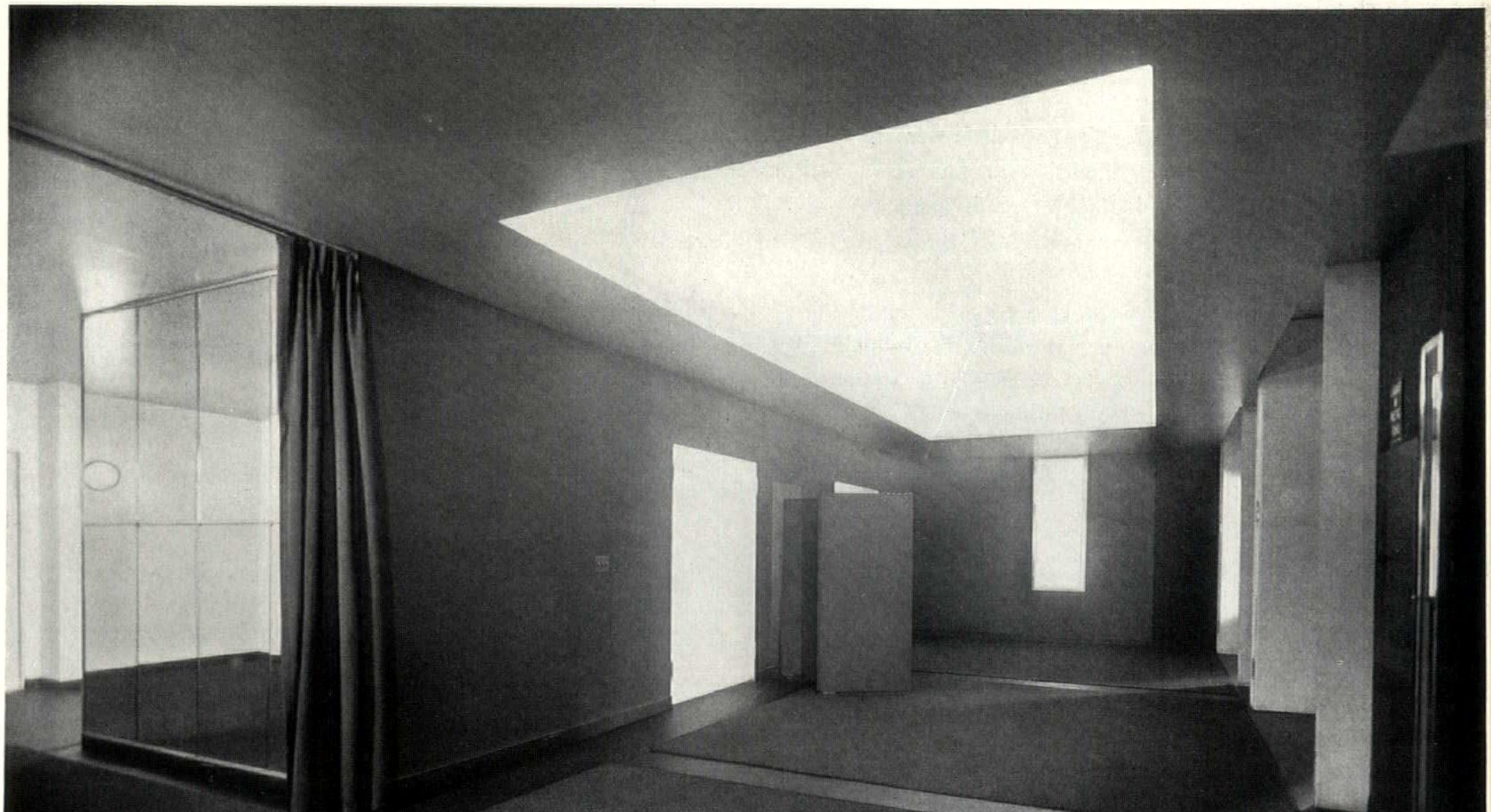
CHECKING COUNTER OF COATROOM: MIRRORS WITH REFLECTOR ABOVE.
WALLS OF INCLOSURE: PALE YELLOW.
WALL IN BACK OF INCLOSURE: VERMILION.
ALUMINUM DOORS.
CEILING PAINTED ALUMINUM, OTHER WALLS WHITE.
WALLS OF THE NARROW PASSAGE: BLACK LINOLEUM WITH HORIZONTAL STRIPS OF MIRROR.



PASSAGE TO FOYER

Byron Co.

HALLWAY



Samuel H. Gottscho

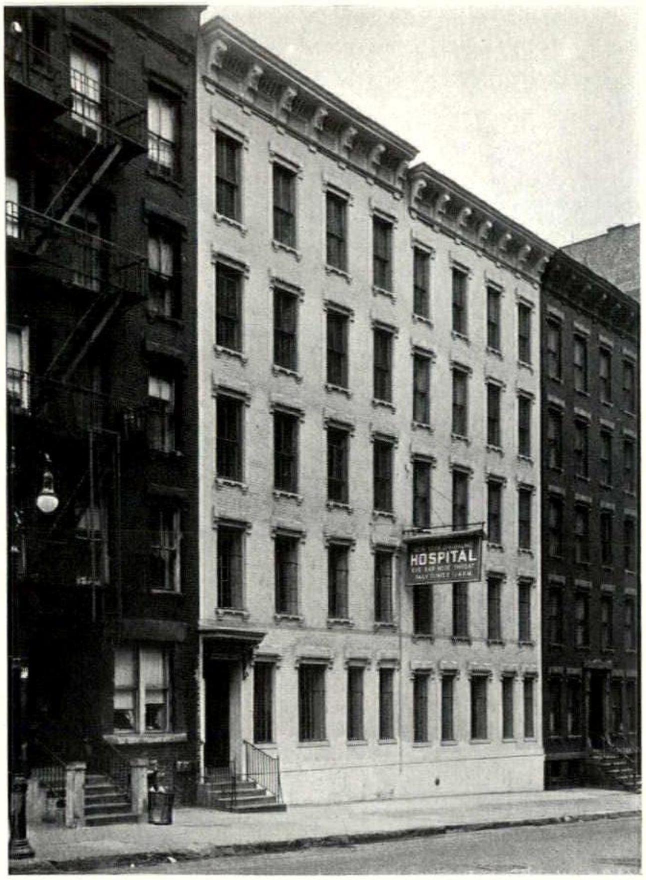
NEW YORK OPHTHALMIC HOSPITAL, 415 EAST 63RD

The buildings remodeled for the new clinic were formerly occupied as tenement houses. Floors were reinforced with steel girders to carry a live load of 100 pounds per square foot. All existing windows in all clinic spaces were removed and replaced with steel casement sash. A new interior fireproof stairway was installed. The wood floors were covered with composition tile. Walls and ceilings were newly plastered. New plumbing, heating and electrical work were installed. The building was newly decorated inside from top to bottom.

For lack of funds, very little was done to the exterior. The appearance of the front was improved by removing existing basement windows and bricking up the openings. New entrance steps were built with a wrought iron balustrade on each side and a new wrought iron entrance gate. The entire front of the building was given two coats of paint.

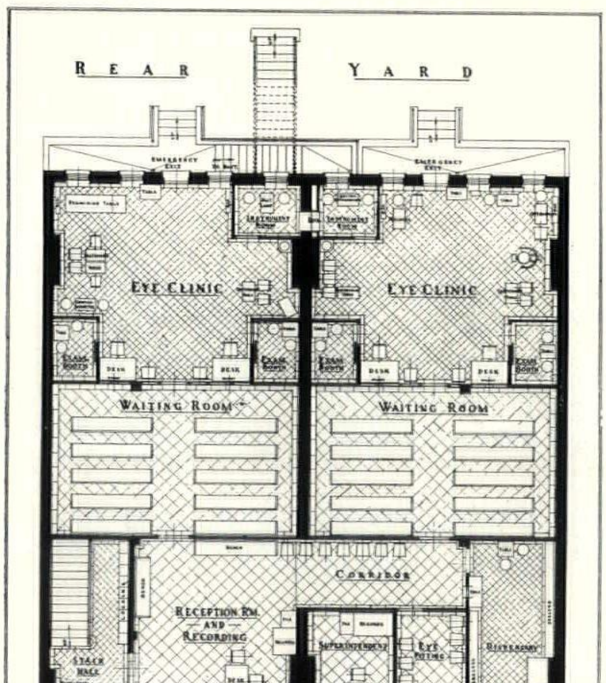
The operation is an example of the current trend to capitalize the economic value of obsolete buildings by altering them for an entirely different use. Remodeling and modernization, therefore, offer a practical method of expansion for hospitals until money is again available for new buildings.

The entire cost of the alterations, exclusive of furnishings, but including architect's fee, approximated $27,000.

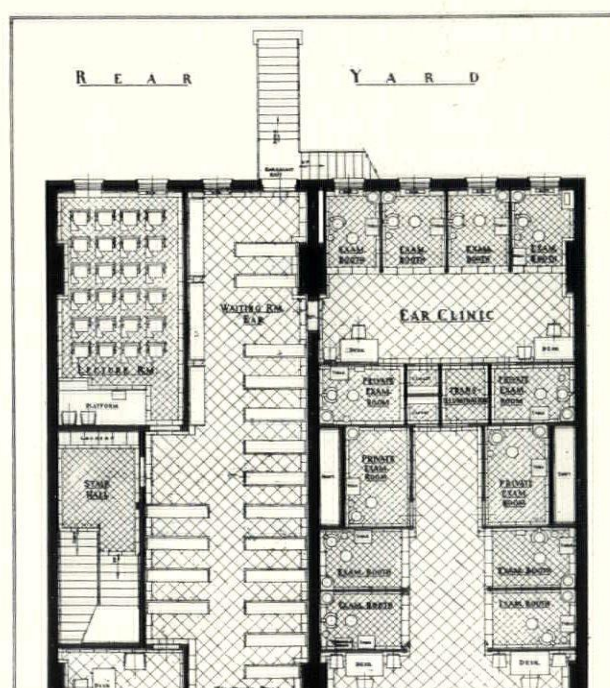


Samuel H. Gottscho

STREET, NEW YORK CITY   CHARLES H. LENCH, ARCHITECT



FIRST FLOOR PLAN



SECOND FLOOR PLAN

APARTMENT AT 2 BEEKMAN PLACE, NEW YORK CITY

EUGENE SCHOEN & SONS, ARCHITECTS

Lincoln

BEDROOM

WALLS PAINTED LIGHT GREEN.

CARPET: DARK BOTTLE GREEN.

FABRIC ON WALL: METROPA IN SEVERAL SHADES OF GREEN AND YELLOW.

FURNITURE: AMERICAN MAPLE AND BRAZILIAN ROSEWOOD.

F. S. Lincoln

DINING ROOM

WALLS PAPERED IN SALUBRA.

FLOOR: BLACK CARPET.

FURNITURE: EUROPEAN CHERRY AND AFRICAN CHERRY TRIM; WHITE LEATHER COVERING.

WHITE WOVEN DRAPERY.

F. S. Lincoln

STUDY

WALLS: JAPANESE GRASS CLOTH.

CARPET: OLIVE GREEN.

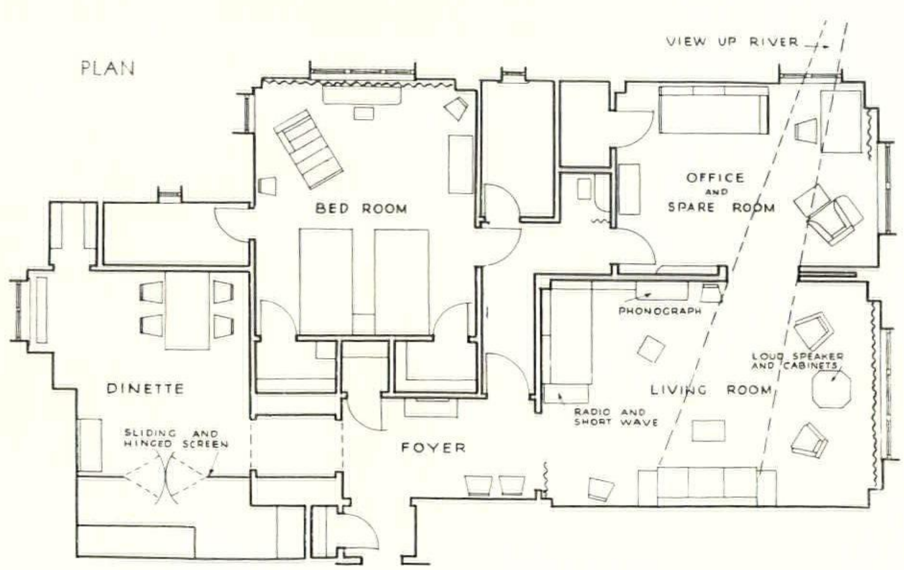
FURNITURE: FRENCH STRIPED SATINE AND EAST INDIAN ROSEWOOD.

TRIM: RED.

APARTMENT AT 2 BEEKMAN PLACE, NEW YORK CITY

EUGENE SCHOEN & SONS, ARCHITECTS

PLAN



BUILT-IN FURNITURE: YUBA WOOD WITH DARK BROWN LACQUER BASES.

DRAWER PULLS: POLISHED ALUMINUM AND DARK BROWN CATALIN.

THE FURNITURE PIECES ARE INDIVIDUAL AND CAN BE USED IN OTHER ROOMS IN DIFFERENT COMBINATIONS.

SOFA DESIGNED TO BE USED AS A BED WITH REMOVABLE BACK.

SMALL TABLE AND LAMPS: FORMICA AND ALUMINUM.

CEILING FIXTURE: DIRECT DOWN LIGHT THROUGH ETCHED FLASH OPAL GLASS.

COLOR SCHEME RANGES FROM CHOCOLATE BROWN WALLS TO WHITE OR LIGHT CREAM WOODWORK.

CARPET: VERY LIGHT BEIGE.

CEILING: CORRESPONDING COLOR.

CURTAINS: WHITE, ROUGH TEXTURED FABRIC, FLANKING WHITE VENETIAN BLINDS WITH DARK BROWN TAPES.

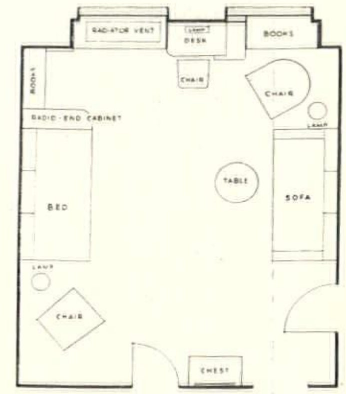
LARGE ROUND BACK CHAIR IN FRONT OF WINDOW: CREAM COLOR CRUSHED PILE FABRIC.

SOFA: HORIZONTAL STRIPES OF BEIGE, RED, AND BROWN.

DESK CHAIR: SAME COLORS IN A CHECKED MATERIAL.

APARTMENT OF WILLIAM ROSENFIELD, CHICAGO

DONALD DESKEY, DESIGNER



Hedrich-Blessing

Hedrich-Blessing

EDGEWATER BEACH APARTMENTS, CHICAGO

APARTMENT SUITE DESIGNED AND OCCUPIED
BY MR. AND MRS. A. S. KIRKEBY

WALLS: CHALK WHITE.

FLOORS: ENAMELED BLACK AND CARPETED WITH SEAMLOC IN SPANISH TILE COLOR.

WINDOWS: BLACK VENETIAN BLINDS; WHITE TAPE AND WHITE COTTON CORD.

CARD TABLE: CHROMIUM TUBES, WASHABLE FABRIKOID UPHOLSTERY, LEMON COLOR.

END TABLES: VITROLITE TOPS.

Hedrich-Blessing

REMODELED APARTMENT INTERIOR
HOTEL SHORELAND, CHICAGO
J. R. DAVIDSON, DESIGNER

One salient point of the problem, in remodeling the interiors of this residential hotel, was to obtain individual treatment in each room, but at the same time to design the various units in such a way that they would be interchangeable and would fit the different floor plans of other apartments in the hotel. Consequently, the remodeled and the few newly-built pieces were designed in small units.

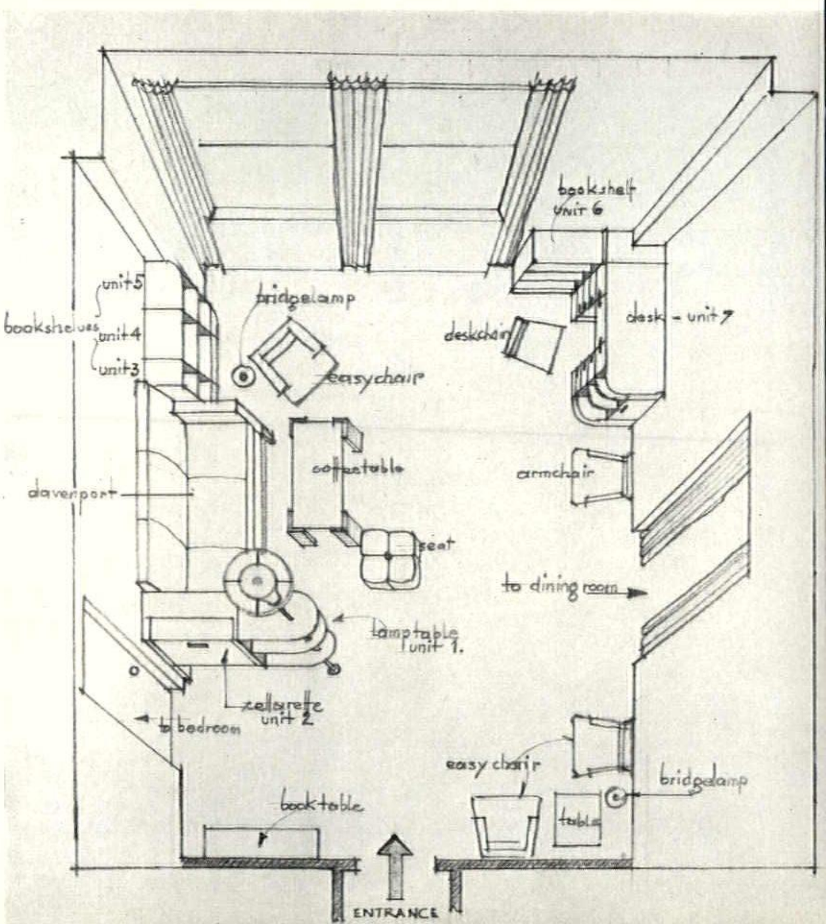
REMODELED APARTMENT INTERIOR
HOTEL SHORELAND, CHICAGO

J. R. DAVIDSON, DESIGNER

Hedrich-Blessing

INTERIOR

PERSPECTIVE PLAN



COLOR SCHEME: VERY DARK MULBERRY CARPET; WHITE WALLS AND CEILING; LIGHT BEIGE HANGINGS.

COVERINGS: PLAIN, GOLD-BROWN; BEIGE, CORAL, AND BROWN STRIPED; PLAIN ABSINTHE YELLOW.

WOOD: WALNUT (NATURAL FINISH).

HARDWARE AND LIGHT FIXTURES: CHROME WITH IVORY CATALIN; PLAIN PARCHMENT.

DAVENPORT, CHAIRS AND WRITING DESK ARE REMODELED OLD PIECES. BRIDGE LAMP AND DESK LAMP, BOUGHT FROM STOCK OF LAMP FACTORY. BOOKSHELVES AND CELLARETTE NEWLY CONSTRUCTED.

h-Blessing

ALCOVE IN THE BAR AND COCKTAIL ROOM

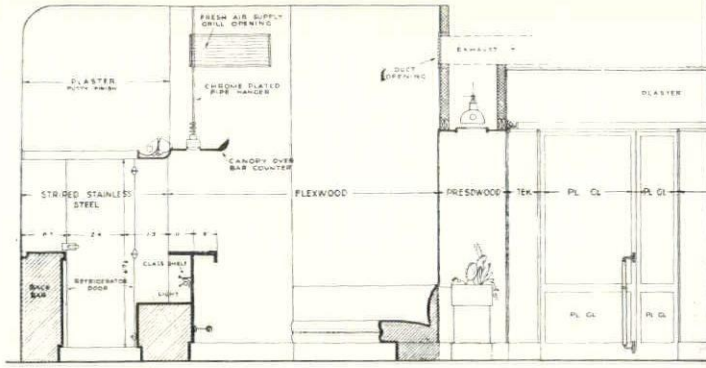
BAR AND COCKTAIL ROOM, HOTEL SHORELAND, CHICAGO

J. R. DAVIDSON
DESIGNER

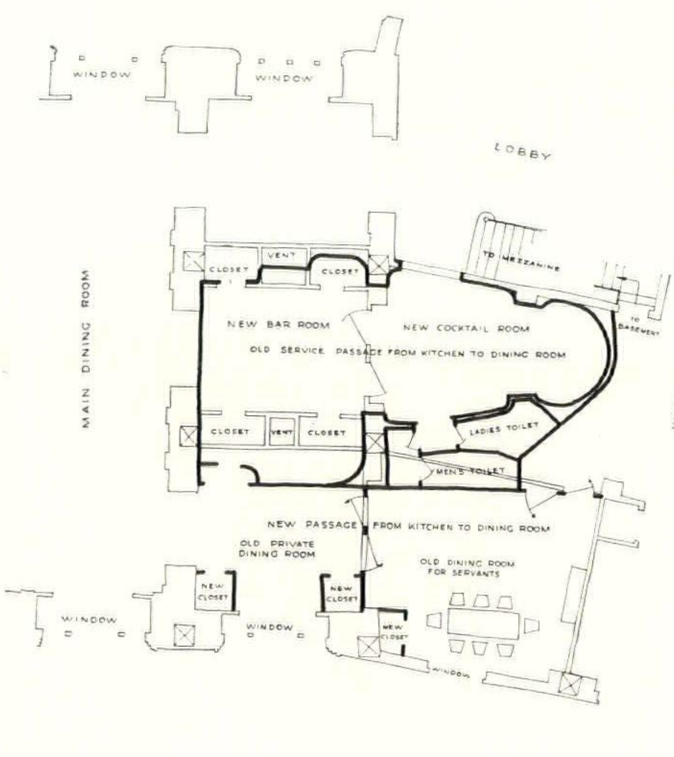
As the bar naturally had to be near the main dining room, preferably directly in front so that guests could stop for an apéritif before or a digestive after dinner, only a very small space, the pantry and service passage from kitchen to dining room, was available (see plan on page 518, also plan on back of frontispiece). A small private dining room and a kitchen officers' dining room were opened up as the new pantry and service passage.

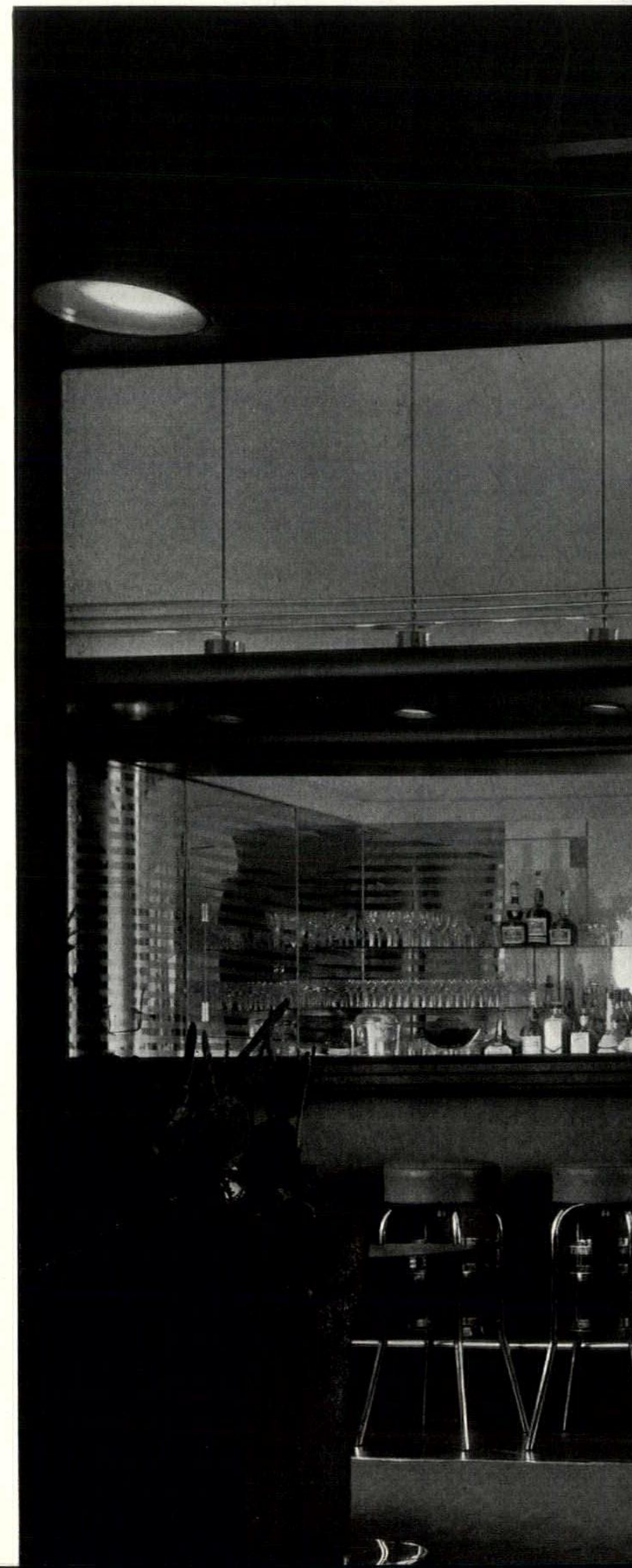
Advantage was taken of the peculiar angles and different ceiling heights of this incidental space in creating a feeling of spaciousness. Colors and artificial light effects were used to a large extent to attain this end.

MATERIALS AND COLORS



FLOOR COVERING: THREE TONES OF BROWN VELOUR CARPET, EXCEPT THE BROWN LINOLEUM IN FRONT OF BAR.
WALLS IN COCKTAIL LOUNGE: PALE GOLD TEKKO.
CEILING: LIGHT CORAL.
WALLS IN BAR ROOM: ZEBRA-FLEXWOOD.
WALLS BACK OF BAR COUNTER: LOWER PART, STRIPED, ETCHED, STAINLESS STEEL, GLASS AND LACQUERED WOOD; UPPER PART, LIGHT YELLOW.
ENTIRE CEILING: LIGHT YELLOW.
BAR COUNTER: BLUE FRONT, BLACK EBONIZED MAHOGANY TOP, STAINLESS STEEL BACK.
BLUE CANOPY OVER BAR.
BLUE LIGHT BACK OF THREE-ETCHED GLASS PANELS IN BACK OF BAR.
CIRCULAR BENCH; FLAME-COLORED FRIEZE.
TWO STRAIGHT SEATS AND ALL CHAIRS: CHROME METAL, TWO-TONE BLUE FABRIKOID.
TWO CORNER SEATS: PLAIN BLUE FABRIKOID.
BAR STOOLS: FLAME-COLORED FABRIKOID.
ALL TABLES: CHROME METAL BASE AND BLACK GLOSSY FORMICA TOP.
LIGHTING: ENTIRELY INDIRECT—IN COCKTAIL LOUNGE AND BACK OF CIRCULAR SEAT, A CONTINUOUS LIGHT TROUGH, REFLECTING ON CEILING; IN BAR ROOM, CONCEALED IN CANOPY, SUSPENDED ON CHROME-METAL HANGERS. ALSO BUILT-IN SPOTLIGHTS, THROWING LIGHT DOWN INTO DRINKS SERVED ON COUNTER.





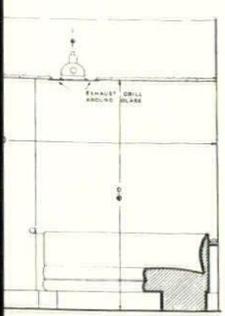
Hedrich-Blessing

BAR ROOM IN THE SENECA HOTEL, CHICAGO

LOUIS R. SOLOMON AND ASSOCIATES, DESIGNERS

BAR: MARINE BLUE, BLACK AND SILVER.

FURNITURE: NATURAL WOOD UPHOLSTERED IN BLUE LEATHER.



SECTION THROUGH THE BAR
AND COCKTAIL ROOM

THE HOTEL SHORELAND BAR—J. R. DAVIDSON, DESIGNER.

Hedrich-Blessing

GRANADA CAFE, CHICAGO

GORDON GUNDLING, DESIGNER

The bar was built to meet existing conditions in the lounge.

CONSTRUCTION: BLACK FORMICA AND CHROME STRIPS, WITH BLACK FORMICA BAR TOP.

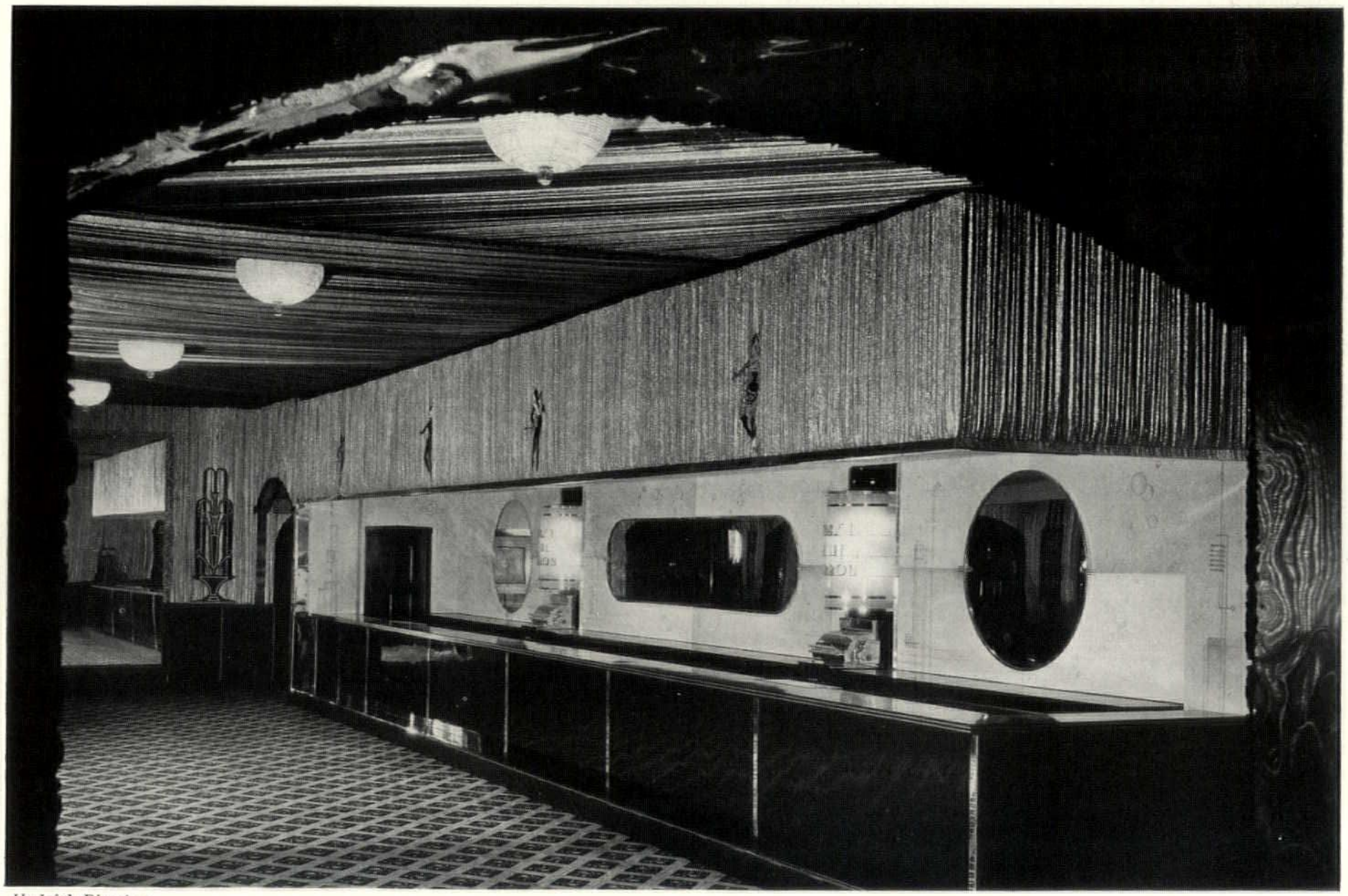
BACK BAR COUNTERS FINISHED IN BLACK FORMICA.

CHROME-PLATED CASH REGISTERS. AT BACK OF EACH CASH REGISTER IS A BLACK FORMICA PANEL RUNNING TO THE CEILING OF THE CANOPY, WITH A HALF CYLINDER OF OPAL GLASS AND METAL LETTERS ON BANDS. ON THE BACK BAR WALL THREE MIRRORS ARE SET IN CHROME FRAMES.

LIGHTING: A SERIES OF FLOODLIGHTS IN THE CANOPY CEILING.

CANOPY: GOLD MATERIAL WITH GOLD FIGURES AFFIXED; THESE FIGURES ARE ILLUMINATED BY PIN SPOTLIGHTS ON THE OPPOSITE SIDE OF THE ROOM.

COLOR SCHEME OF THE BACK WALL: TWO-TONE PEACH COLOR WITH SALMON COLOR AIR-BRUSH WORK.



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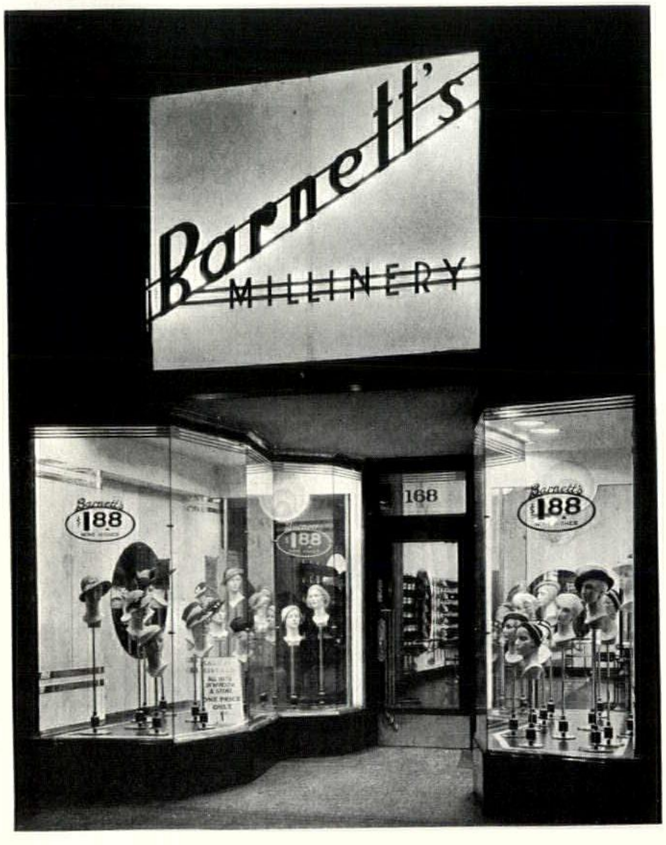
SHOP INTERIOR

Hedrich-Blessing

SHOP ENTRANCE



BARNETT'S MILLINERY, CHICAGO

GORDON GUNDLING, DESIGNER

STORE FRONT EXTERIOR: BLACK VITROLITE AND CHROME METAL.
WINDOW BACKGROUNDS: METAL LATH AND PLASTER TRIMMED WITH POLISHED ALUMINUM IN IVORY AND TERRA COTTA RED.
STORE INTERIOR: IVORY AND TERRA COTTA RED.
COLUMNS: TERRA COTTA RED STRIPED IN GOLD.
WALLS: IVORY WITH TERRA COTTA RED AIR-BRUSH WORK.
HAT STANDARDS: SIX RACKS MOUNTED ON ONE CHROME CHANNEL.
AT EACH MIRROR A VANITY TABLE IS SUPPORTED ON POLISHED ALUMINUM TUBES COMING FROM THE WALLS.
CEILING: WHITE.
FLOOR: BLACK WITH IVORY FEATURE STRIP.
CHAIRS UPHOLSTERED IN CHARTREUSE GREEN.

VIEW TOWARD ENTRANCE

Hedrich-Blessing

BARNETT'S DRESS SHOP, CHICAGO GORDON GUNDLING, DESIGNER

The shop is of stud construction finished with plaster board and Masonite. Millwork dress cases are built in. The plan has three sections: (1) a dress salon, (2) fitting rooms and cashier, and (3) the rear section, a coat and suit salon.

COLOR SCHEME: ROSE, IVORY, AND CHARTREUSE GREEN STRIPED IN GOLD.
CARPET: BURGUNDY RED.
FURNITURE: SALMON COLOR AND CHARTREUSE GREEN LEATHERETTE.

VIEW TOWARD REAR

Hedrich-Blessing

WINDOW BULKHEAD: BLACK GRANITE.
ALL STORE FRONT METAL: EXTRUDED BRONZE.
WINDOW BACKGROUNDS: CHOCOLATE BROWN AND TONES OF LIGHTER BROWNS AND IVORY STRIPED IN GOLD AND BROWN.
SHOE CASES: AMERICAN BLACK WALNUT.
LIGHTING: INDIRECT TO ILLUMINATE THE CEILING.
CHROME CHAIRS: POLISHED IN A CINNAMON BROWN.
CARPET: SOFT SHADES OF SEPIA BROWN AND BURNT ORANGE.
CEILING AND WALLS: LIGHT YELLOW AND CREAM COLOR STRIPED IN ORANGE AND DEEP YELLOW.

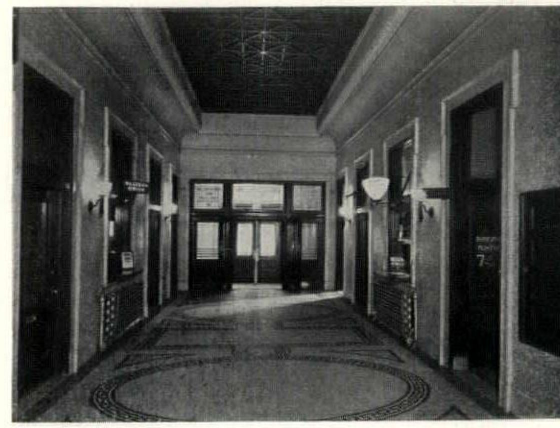
SMITH SHOE SHOP
CHICAGO
GORDON GUNDLING
DESIGNER

Morris Rosenfeld

AFTER

21 - 24 STATE STREET

BEFORE



TWO REMODELED ELEVATOR LOBBIES

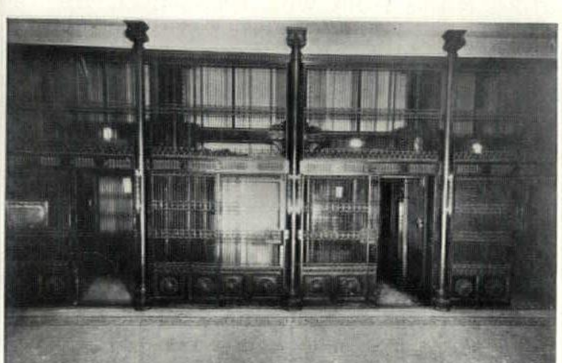
DESIGNED BY R. M. KARGER, CITIES SERVICE COMPANY, NEW YORK CITY

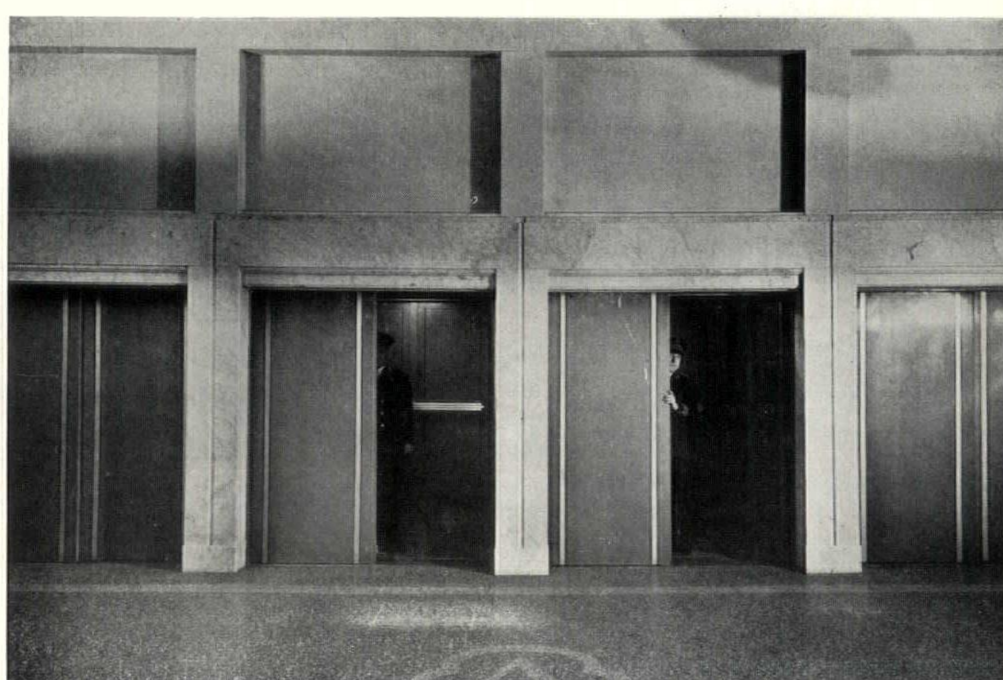
MOSAIC TILE FLOORING WAS REMOVED AND NEW BLACK TERRAZZO WITH WIDE WHITE METAL STRIPS INSTALLED.
NEW LIGHTING FIXTURES: WHITE METAL FINISH WITH FLASHED OPAL GLASS.
EXPOSED RADIATORS EITHER CONCEALED IN MARBLE OR ALUMINUM INCLOSURES OR NEW PRESSURE SYSTEMS INSTALLED BEHIND ALUMINUM GRILLES.
NEW ENTRANCE AND VESTIBULE DOORS OF THE BALANCED TYPE INSTALLED WITH NEW SCREENS.
DOORS AND METAL PARTS OF SCREENS: STEEL WITH BAKED ENAMEL FINISH; ALUMINUM HANDLES AND KICK PLATES.

AFTER

8-10 BRIDGE STREET

BEFORE





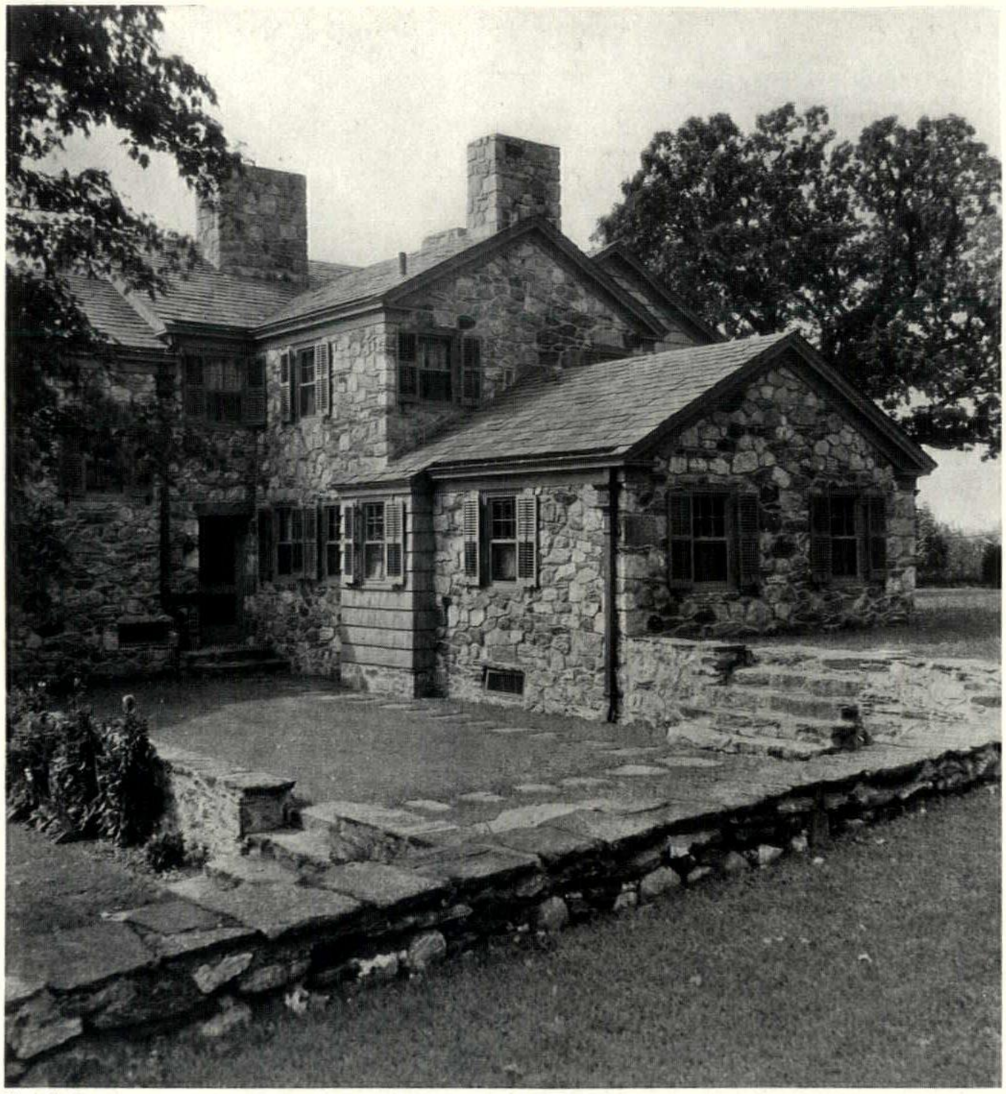
Morris Rosenfeld

Van Anda
WEST APPROACH AFTER ALTERATION

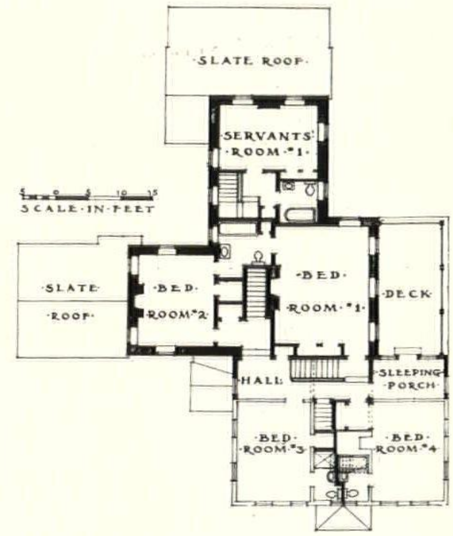
HOUSE OF MRS. JOHN ERSKINE, WILTON, CONNECTICUT

EVANS, MOORE & WOODBRIDGE, ARCHITECTS

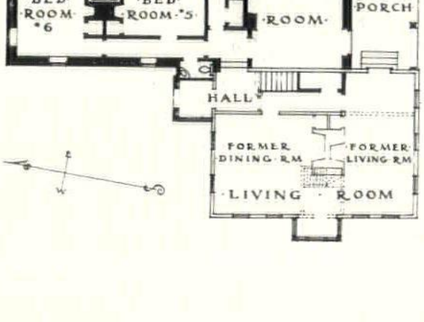
The original house was a small frame farmhouse about 80 years old with simple Greek revival details. The owner is fond of native stone work which was used for the additions. The original house had a dull weather-beaten color which was kept for new woodwork blending into the tones of the field stone. The new roof is of rough-textured greenish gray slate. The entire main portion of the original house was converted into a living room, retaining old woodwork and exposed timbers. For the dining room walls, paneling was made out of oak flooring from the original attic.

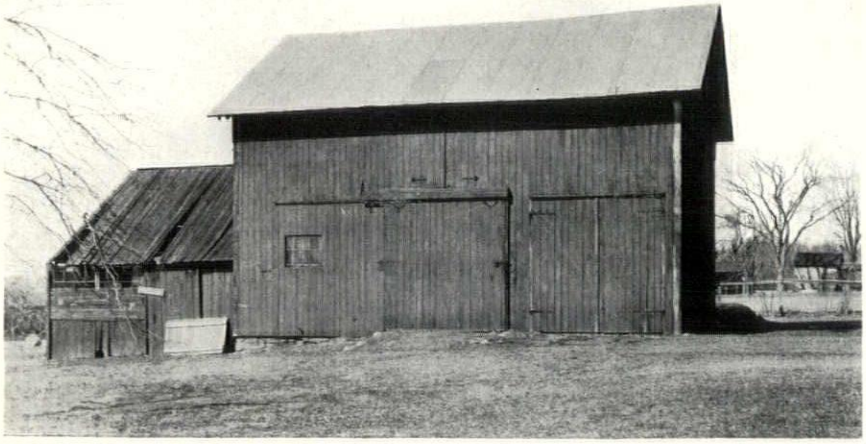


Van Anda
NORTH ELEVATION AFTER ALTERATIONS



WEST ELEVATION BEFORE ALTERATIONS

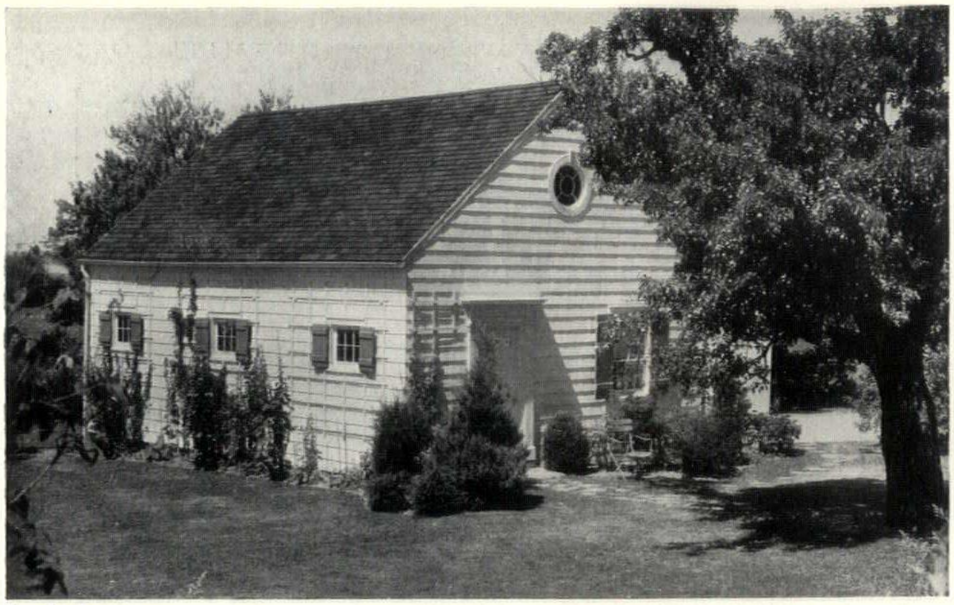




THE ORIGINAL: AN OLD RED BARN, TOO TALL AND SOMEWHAT OUT OF REPAIR, WITH TWO DOORS ON THE WRONG SIDE.

DETAIL OF ENTRANCE AND EXIT DOORWAY

Van Anda



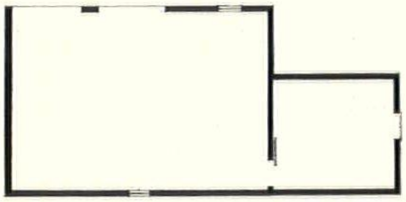
Van Anda

THE CHANGES: ROOF LOWERED. THREE DOORS PUT IN OPPOSITE SIDE. WING UTILIZED AS POTTING SHED FOR GREENHOUSE. SIDES RESHINGLED, PAINTED ALL WHITE.

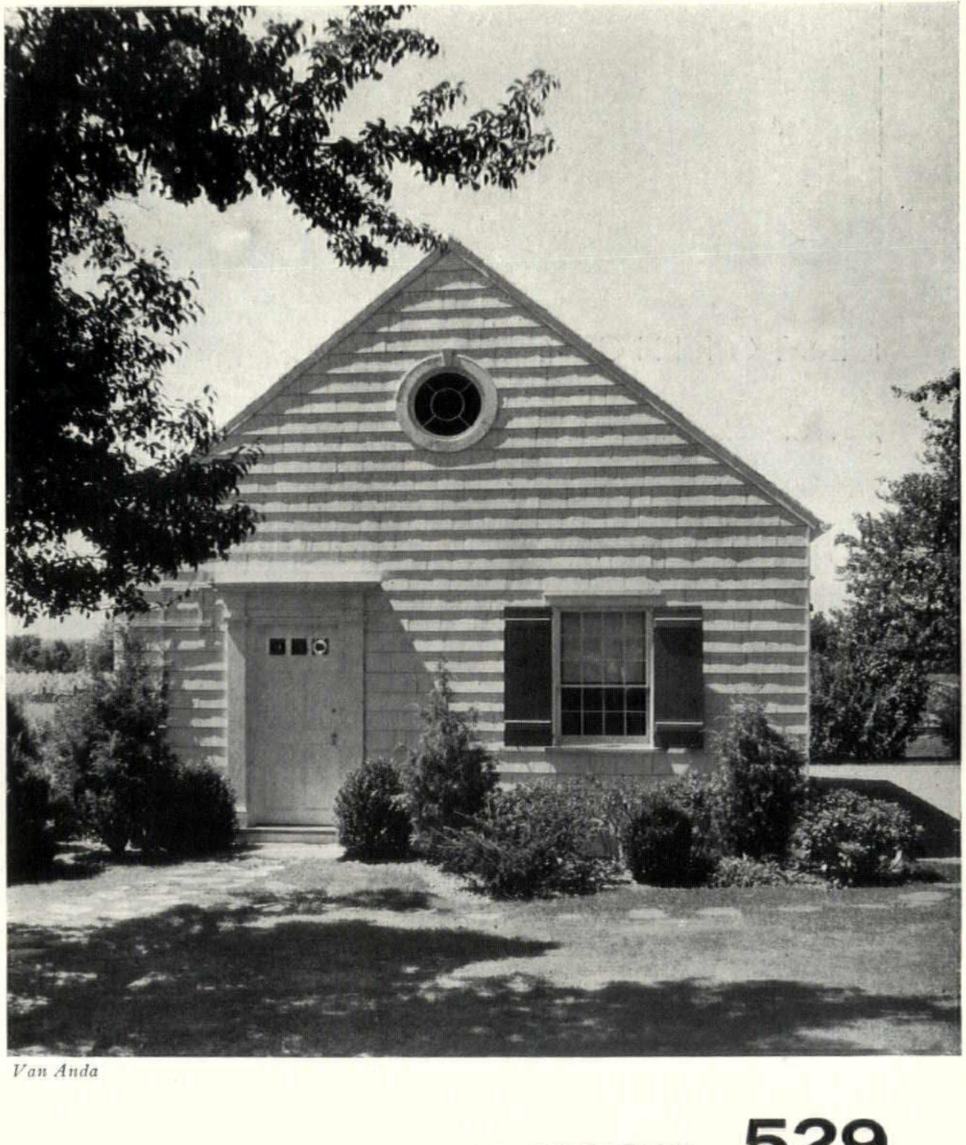
GARAGE ON ESTATE OF WALTER S. BREWSTER
GREENFIELD HILL, FAIRFIELD, CONNECTICUT

CAMERON CLARK, ARCHITECT
AGNES SELKIRK CLARK, LANDSCAPE ARCHITECT

BEFORE



AFTER



Van Anda

Photographs by Paul J. Weber

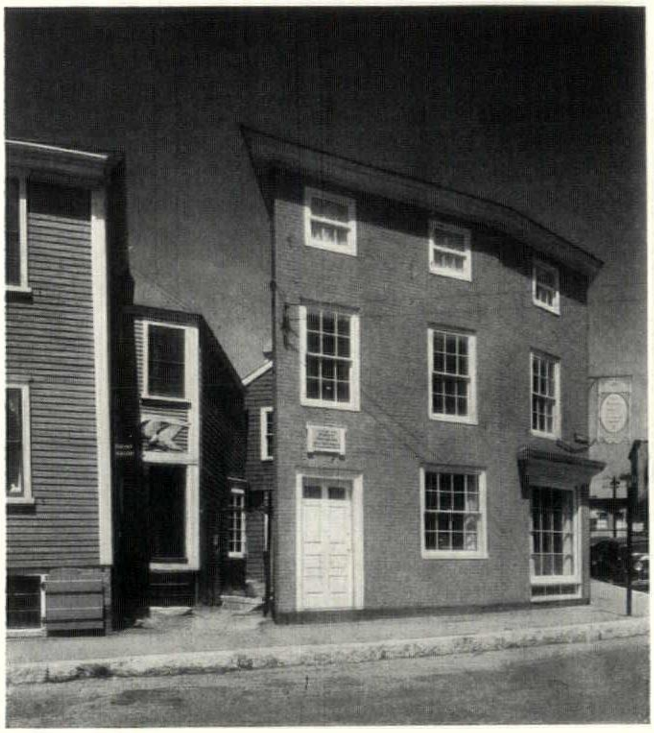
RESTORING COLONIAL HOUSES

STRICKLAND AND STRICKLAND, ARCHITECTS

FROM the restoration of parts of the three earliest streets of historical Plymouth, Massachusetts, came the thought that the entire old section of this New England town might be restored. As the old buildings forming these early rambling streets were quite picturesque, and with the added charm of the Town Brook at the foot of the hill, parallel with Summer Street, the neighborhood offered possibilities of becoming a splendid place for those in search of an economical place in which to live.

The Market Street section, between Leyden, the first street, and Summer, the third street, is a shopping district. The groups of houses at that corner have been restored with this in mind. A brick building, built probably in 1825, constituting "The Book Shop," and in which the young couple who operate the shop live upstairs, No. 5 Summer Street, is called "Plymouth House," and contains a glass shop, weaving and antiques. Also tucked away in what is called "Faunce Court" is the "Boat Shop," devoted to prints of the sea, ship models, and other marine objects.

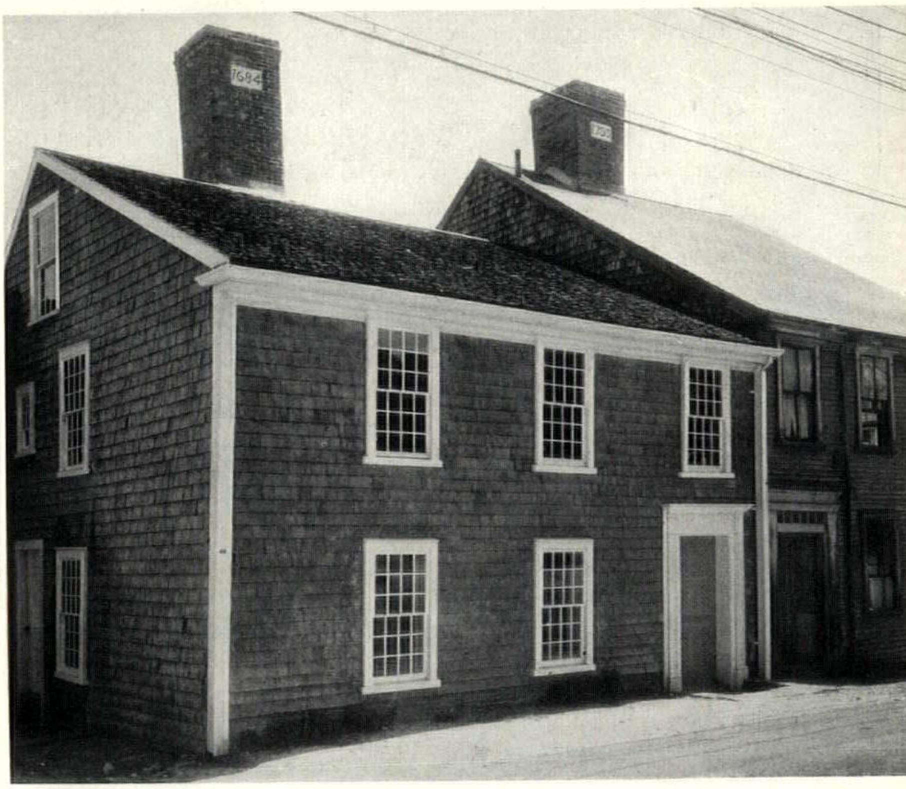
During the restoration and rehabilitation of the seventeenth and eighteenth century houses on Summer Street, we have been astonished at the excellent condition in which we found most of the old framework. The old oak frames are as hard as iron. Decay has occurred for the most part about the sill, where dampness has crept in; most of the roofs are framed with purlins and



ABOVE:
FAUNCE COURT IN PLYMOUTH, MASSACHUSETTS. THE BRICK BUILDING AT RIGHT WAS BUILT IN 1830, AND RESTORED AS A BOOKSHOP BY STRICKLAND & STRICKLAND, ARCHITECTS. AT THE LEFT IS PLYMOUTH HOUSE WITH SMALL APARTMENTS ON SECOND FLOOR AND ANTIQUES AND HANDICRAFTS ON FIRST FLOOR; BUILT AROUND 1685.

OPPOSITE PAGE:
CORNER OF SUMMER STREET, LOOKING UP SPRING LANE, PLYMOUTH, MASSACHUSETTS. HOUSE AT RIGHT WAS BUILT BY GEORGE BONUM IN 1679.

BELOW:
THE MILLER'S HOUSE ON SUMMER STREET, BUILT IN 1684 AND RESTORED FOR A. RODMAN HUSSEY, JR., BY STRICKLAND AND STRICKLAND, ARCHITECTS.



boarded in with wide, rough-sawed pine boards, running vertically to catch any moisture which might creep through the shingles. The framing in an old house, however, is one of the first things to be investigated. This is not always easy, as most beams and corner posts have been cased in.

It should be understood that we are writing about restoration from the more practical point of view. We assume that for the most part the renovizing is to bedone with the intent of restoring the old houses as nearly as possible to their original details of sash, doors and hardware on the inside, and window frames, cornice and doorways on the exterior. But at the same time, due consideration shall be given in the plan to modern conveniences—new plumbing, electric wiring and perhaps heating.

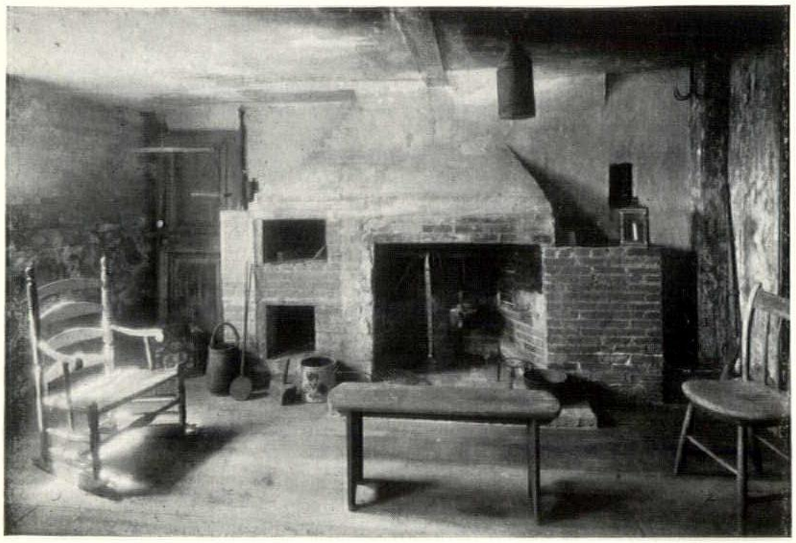
The most complicated part of the work is the plumbing and heating. Much unsightliness can be prevented by bunching the pipes so that the carpenter can case them in as corner posts and not mar the general appearance of antiquity.

The client should be persuaded to have as many floor and base plugs and as few wall brackets as possible. Most early houses have scant 3-inch partitions which are not over-hospitable to B.X. cables. Such an arrangement also eliminates too many switch boxes, which are always hard to manage.

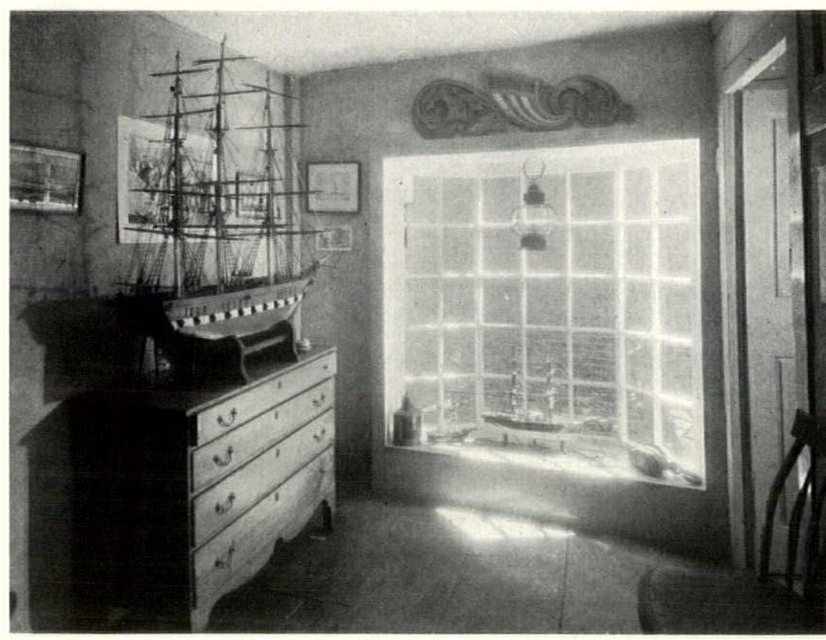
In measuring for new sash, each individual window should be checked and noted on the plan. Often they are of such varying sizes that a specially dimensioned drawing is necessary for the mill.

A small section of flooring in each room should be taken up to make sure that the earliest widest boards are restored.

The following figures are the minimum required to renovate a six-room house similar to those at Plymouth,



CELLAR KITCHEN IN PLYMOUTH HOUSE, 5 SUMMER STREET. BUILT IN 1685 AND RESTORED BY STRICKLAND AND STRICKLAND, ARCHITECTS.



THE BOAT SHOP IN PLYMOUTH HOUSE. STRICKLAND AND STRICKLAND, ARCHITECTS.

Massachusetts. These figures include some, not all, new sash; patching of the roof only, not new roofing; one old mantelpiece; a few old doors with old latches and hinges:

Carpentry, materials, etc.	$500
Masonry	75
Plumbing	300
Heating	375
Electric wiring	50
Electric fixtures	35
Painting	225
Wallpapers	30
Window shades	25
	$1,615

Before this work was started there was a poor, unsteady income, and sales seemed out of the question owing to the fact that people had come to look with disfavor upon the property. Getting rid of the old tenants, followed by cleaning up; patching, tearing down old dilapidated fences and erecting new ones of fitting design and character—all this, with painting, and planting the open areas, changed completely the entire area and brought many applications for the reconditioned buildings. These properties, reconditioned, can be purchased for much less than it would cost to build them new. The mortgages for the most part were from $2,500 to $3,500, and with restoration costs of from $1,500 to $3,000 in some cases, a property can be acquired for from $4,000 to $6,500.

LIGHTING THE CLASSROOM MORE EFFECTIVELY WITH LESS ILLUMINATION

By HENRY L. LOGAN
ENGINEERING CONSULTANT

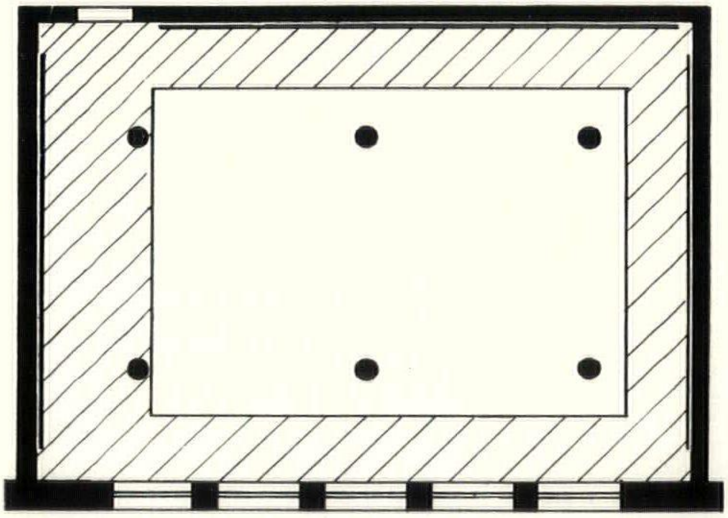
Four outlets, if planned for the working area rather than the entire classroom, can deliver as much light on the desks as the standard six-outlet layout based on the room dimensions and distributing unused light to the traffic areas. The saving in both initial and operating costs may make possible remodeling that would otherwise be too costly.

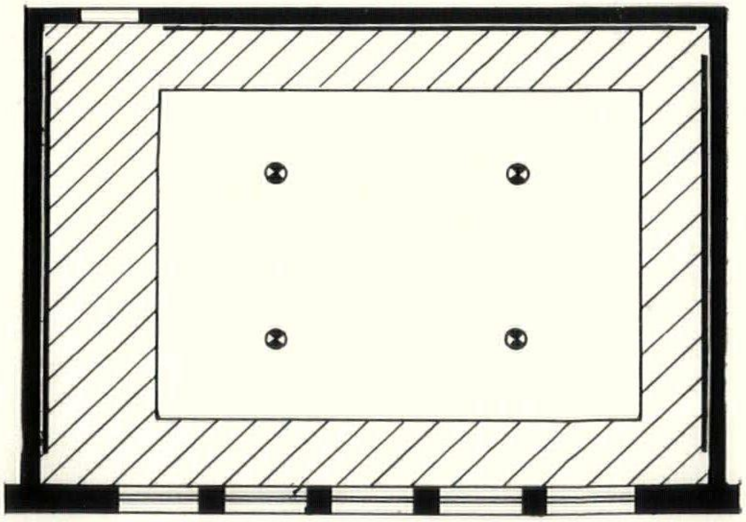
The standard classroom is 30 feet long and 22 feet wide. Its area is 660 square feet. Six lighting units equally spaced provide 110 square feet of floor per lighting unit or 1.8 watts per square foot, using 200-watt lamps per outlet. However, classrooms normally have an aisle at least 3 feet wide around three sides of the room, and a space across the front of the room 7 feet deep occupied only by the teacher's desk. Thus, the working area is only 49 per cent of the total room area.

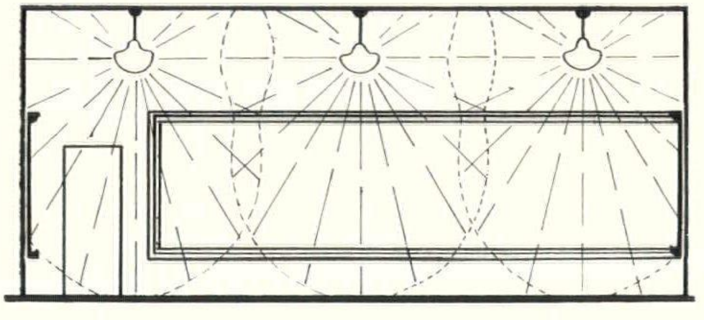
It is not scientific or economical to light the floor area devoted only to traffic as brightly as the working area. If four units are quartered on the working area it is found that each covers 88 square feet, or 22 square feet *less* than when six units are used on the standard spacing, and that the wattage per square foot of working area is *increased* from 1.8 to 2.3, despite the reduction of units from six to four, and without increasing the size of the lamp.

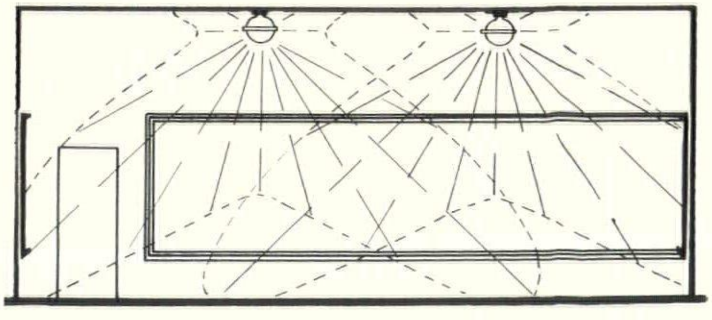
There may be an offset to these figures in the additional light returned to the working plane from the surroundings if six units are used, but blackboards, wardrobes and glass areas occupy most of the four walls, reducing the light salvage to a negligible point and leaving only the ceiling, to favor the six-outlet system slightly. The two front units, however, are the chief source of glare and eye discomfort to the pupils as they are in the field of vision all the time; the four-outlet system eliminates this disadvantage.

A further refinement of the four-outlet system is to install light-control units having an "extensive distribution at the ceiling, with no drop, thus keeping them as much as possible out of the field of view and increasing the spread to include the blackboards a little more liberally. Contrary to general opinion very little light is required to make blackboards easily readable if an efficient direction of light is chosen, as the most favorable conditions for vision exist —the maximum contrast of white on black. This placing of the four units causes the light to strike the blackboards at an inclination more nearly normal to the surface, and therefore more effectively reflected from the chalk than is the case with light from the units of the six-outlet system that are closer to the boards and strike at more glancing and less effective angles.







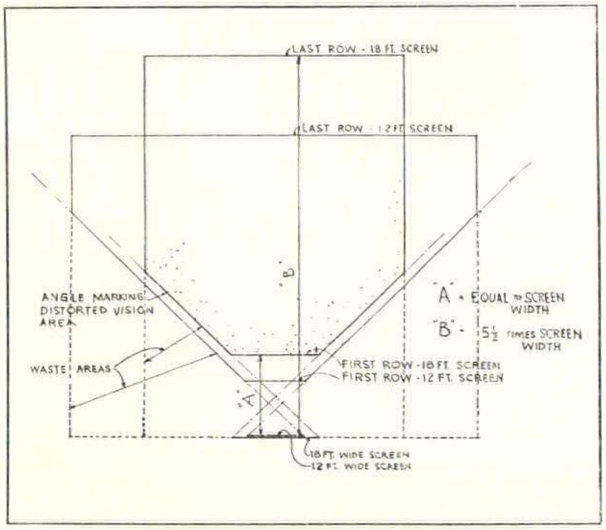


THE SMALL MOTION PICTURE THEATRE

By **BEN SCHLANGER**, Architect

20 REASONS INDICATE A NEED FOR, AND DESIRABILITY OF, NEW AND SMALLER MOVIE THEATERS

1. CONSTRUCTION HAS BEEN RESTRICTED DURING PAST FOUR YEARS.
2. GENERAL OBSOLESCENCE IS APPARENT.
3. NEIGHBORHOOD POPULATIONS HAVE SHIFTED.
4. A GREATER NUMBER OF SMALL THEATERS WITHIN WALKING DISTANCE OF HOMES ARE MORE DESIRABLE THAN A FEW LARGE THEATERS IN CENTRAL LOCATIONS.
5. MANY THEATERS WERE ERECTED BEFORE SOUND AND OTHER TECHNICAL ADVANCEMENTS WERE MADE.
6. SMALL THEATERS OFFER INTIMATE SURROUNDINGS FOR MORE EFFECTIVE SCREEN PRESENTATION.
7. FIRE-RETARDING OR SEMI-FIREPROOF CONSTRUCTION IS ACCEPTABLE BECAUSE PANIC HAZARD IS MINIMIZED IN SMALL CAPACITY AUDITORIUMS. MOST BUILDING CODES RECOGNIZE THIS BY COMPARATIVELY LENIENT REGULATIONS FOR THE SMALL THEATER.
8. SIMPLE STRUCTURAL FRAMING IS REQUIRED.
9. SIMPLE INTERIOR TREATMENT IS EFFECTIVE IN SMALLER AUDITORIUMS, SO THAT COSTLY DECORATION AND ORNAMENTATION CAN BE ELIMINATED.
10. EACH SEAT LOCATION HAS GREATER ACCESSIBILITY.
11. FULL COMFORTABLE VISION OF SCREEN IS MORE EASILY OBTAINED.
12. MORE FAVORABLE ACOUSTICAL SHAPE AND SIZE IS PROVIDED.
13. MINIMUM PROJECTION AND VIEWING ANGLES MINIMIZE DISTORTION OF SCREEN IMAGES.
14. INITIAL INVESTMENT IS MINIMUM.
15. EXPENDITURES FOR ADVERTISING, HOUSE STAFF AND OTHER OVERHEAD ARE LESS.
16. VARIOUS TYPES OF EXISTING STRUCTURES CAN BE ALTERED FOR THEATER USE.
17. POSSIBILITY OF THE EXHIBITOR FINANCING AND CONTROLLING SMALL THEATER CONSTRUCTION IS PREFERABLE TO SPECULATIVE BUILDING WHICH USUALLY RESULTS IN TECHNICALLY INEFFICIENT STRUCTURES.
18. AN INCREASED NUMBER OF FILM PRODUCTS OF HIGH QUALITY ARE AVAILABLE FOR REVIVAL SHOWINGS IN SMALL THEATERS.
19. NEED FOR COSTLY STAGE STRUCTURE AND STAGE TRAPPINGS IS ELIMINATED IN SMALL THEATERS.
20. COSTLY AIR CONDITIONING SYSTEMS ARE UNNECESSARY; INSTEAD, MODIFIED AND LESS EXPENSIVE AIR CONDITIONING CAN BE ATTAINED BY PROPER VENTILATION COMBINED WITH PARTIAL COOLING AND DEHUMIDIFICATION.



SEATING CAPACITY

A minimum seating capacity naturally allows a structure of minimum size, thereby reducing cost, but the small theater does not always have the lowest cost per seat. The lowest cost per seat is more easily obtainable in a large unit than in a small unit.

But it must be remembered that initial low cost per seat is a foolish objective if the income per seat becomes less than the income of a seat with a higher initial cost. Since the per-seat income is greatly reduced when a theater has more seats than necessary it is important to arrive at the absolute minimum seating capacity which will insure a sufficient economic return.

Exactly how small a motion picture theater can be and still be an income-producing unit is determined by a number of factors, some of which are (1) *population to be drawn from,* (2) *transient or residential location,* (3) *competition offered by other houses,* (4) *number of program changes per week,* (5) *local building ordinances, and* (6) *admission prices.*

The expected patronage consists of those persons who are within fairly short walking distance in towns and cities, and the shortest riding distance in rural locations. In a big city it would be those persons who could be attracted to a theater located on a popular street as transient patronage.

A residential territory lacking a motion picture theater and having a population of approximately as little as from 4,000 to 6,000 could utilize a 600-seat unit. This population may produce about 450 patrons at one time as an average. But 600 seats would be necessary to take care of peak good days and week-end business.

A greater population within a limited territory, such as may occur in large multiple-dwelling neighborhoods, does not necessarily justify the erection of an increased capacity unit. Such a neighborhood could more readily do more business totally in two small units than in one large unit. The greater choice in program for the patron permits this, thus encouraging more habitual patronage on the whole.

Theaters with a capacity of from 200 to 500 seats are feasible under two different conditions—the first for rural districts of population below 4,000, and the second for transient locations in big cities. In the case of the transient unit 300 seats have the efficiency of twice as many and even more, because of the repeated use of each seat during the day's business.

These small units can be erected very economically, especially in small towns where luxurious materials and superfluous eye-catching architecture can be dispensed with. This should be true for city locations as well.

SIZE OF STRUCTURE

The second consideration affecting the cost of the motion picture theater is the size or the total number of cubic feet of structure. Besides the seating capacity are such factors as the proper seating arrangement, the proper size of the motion picture screen, lounge and toilet facilities, circulation spaces in lobby, foyers, standee area, aisles, and so on. To these items there can be, and usually is, given an enormous amount of cubic feet. Correct minimum sizes for these portions will control the initial construction cost without sacrificing the effectiveness of the whole.

The size of the screen and the size and shape of the auditorium seating space are interdependent. For each seating capacity problem there is a seating plan which will require a minimum of square-foot area. This at the same time will have a maximum of floor area affording an undistorted view of a screen. The screen size will accommodate rear as well as front row seats. Some of the factors which will control the size of the structure are:

1. *Distance from screen to first row:* A minimum distance equalling at least the width of the screen.
2. *Distance from last row to screen*: A maximum distance equaling no more than 5½ times the width of the screen.
3. *Circulating aisles arrangement:* A minimum number of aisles across the width of the auditorium.
4. *Side seat distortion.*
5. *Size of screen.*

In the accompanying illustration is shown diagrammatically the effect that the width of the screen may have on the seating plan arrangement. Two screen widths are shown—one 12 feet wide, the other 18 feet wide. A seating capacity of approximately 600 is the basis of the study.

In each case the last and first rows are located as governed by the screen width. Note that the shape of the seating plan necessary for the 12-foot screen utilizes a rectangle greater in area than necessary for an 18-foot screen. Note also that the 18-foot screen in this diagram has much less of the extreme size seats. The smaller screen to use the narrower deep-shape plan with the wider screen. The deep shape is commonly used, but with too small a screen to permit comfortable vision from the last rows.

The aisle arrangement of the narrower plan, which would have a bank of seven seats against each side wall, two aisles and a center bank of 14 seats, is a most efficient space-saver. Adding more seats to the width would force the use of two additional wall aisles, because most building codes do not permit more than seven seats in a bank with access to one aisle only.

Much space can also be saved in the planning of the smaller cinema if minimum area is given to lobbies, foyers, promenades, standee space, and the like. The distance between the first set of entrance storm doors and the next set of doors need never exceed much over 10 feet. The standee space behind the last row of seats, usually made more than 10 feet deep, can be reduced to 5 or 6 feet.

It is better to provide a lounge room for patrons who must wait for a seat. Space for this lounge room could be found by eliminating separate men's and women's lounges adjoining the respective toilet rooms, and instead of having two lounges, arranging for one common lounge placed near the auditorium seating. Only a very small anteroom, approximately 5 by 8 feet, is necessary in front of each toilet room.

The total height of the auditorium should be no higher than 2 feet above the top of the screen. Any additional height only serves to increase cost without giving any worthwhile advantage. Given the approximate simple architectural form and lines, low ceiling heights can be treated successfully.

THE WEATHER OBSERVATION
TOWER IN NEW YORK CITY

Ewing Galloway

THE ARCHITECTURAL RECORD, JUNE 1934

TECHNICAL NEWS AND RESEARCH

BY

REALTO E. CHERNE
CHESTER L. NELSON

AIR CONDITIONING

PRELIMINARY PLANNING

FOR AIR CONDITIONING

IN THE DESIGN OF MODERN BUILDINGS

Realto E. Cherne
Chester L. Nelson

When the architect or engineer comes to the problem of installing an air conditioning system in a building, a number of questions must be answered before plans can be drawn. Since these questions are similar for all types of buildings, a brief explanation of some fundamentals of air conditioning that must be considered for the general design problem is necessary. This article, therefore, differs from the usual discussion of individual air conditioning installations in which difficult designs were encountered because of architectural peculiarities; instead, it covers the more general problem of designing or renovating a building with proper initial consideration of the air conditioning problem.

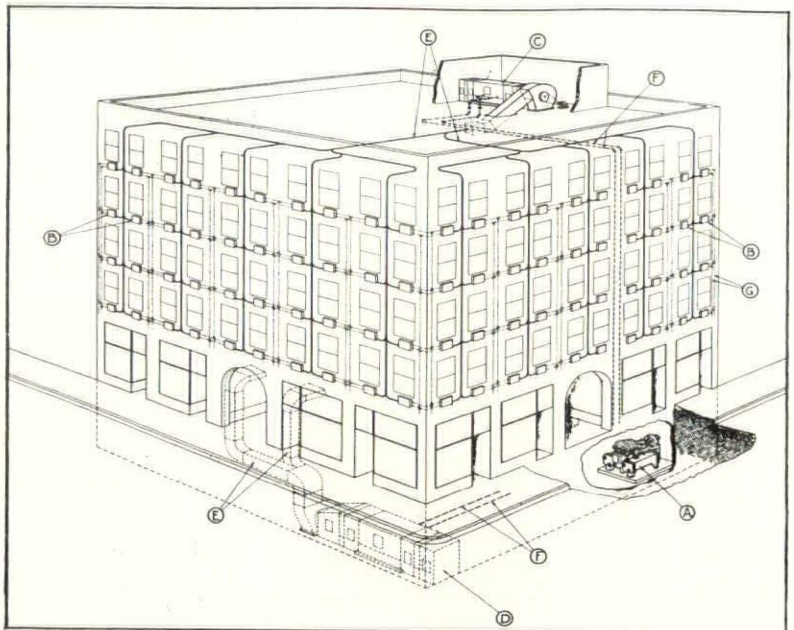
All architects and engineers are more or less familiar with the requirements of ordinary ventilation, direct radiation, sprinkler systems, plumbing systems, and other mechanical features. The required floor area, riser space, equipment space and approximate costs of installation and operation may be quickly approximated for use in a preliminary study of a building. Many designers have asked if a similar array of constants can be set up in order to include scientific air conditioning in the preliminary study rather than delay until after the fundamentals have been determined—thereby causing a greatly increased cost of both equipment and building. The owner objects to a new building designed without complete modern mechanical equipment; the architect objects to adding something that is not completely within his practice; and the air conditioning engineer dislikes having to overcome needless and very often costly design problems which are almost certain to appear when proper initial consideration has not been made. Generally considered, the present procedure is quite unsatisfactory to every one interested in modern building construction. Nevertheless, as the following discussion will point out, the air conditioning engineer is reluctant to broadcast unit figures when he does not use them himself; in other words, every job is "tailor-made."

It is a comparatively simple matter for one familiar with the science of air conditioning to design and approximate the cost of an installation after preliminary building plans have been made. In many cases, however, the prospective owners and designers of new structures must make a complete study of the unit as a whole before even preliminary drawings are made. Too much emphasis cannot be placed on the possibility of erroneous application of constants and unit figures for the reason that air conditioning capacities cannot be determined by air-change values as ordinary ventilation calculations commonly are made. The following discussion of fundamentals presents the general problems encountered in air conditioning work which have direct bearing on preliminary plans.

SOURCES OF HEAT: It is generally understood that different concentrations of occupants and illumination, together with variable outside weather conditions, affect considerably the load placed on an air conditioning apparatus. For this reason, it is well to discuss briefly the various factors upon which capacities and loads are dependent. This discussion will be limited to air conditioning for comfort since the inclusion of data on industrial air conditioning would necessarily be of a more technical nature.

(1) The first factor to be considered is the variation of outside weather conditions and the amount of outside exposure in relation to the total cubical contents of the building. Further, in the northern hemisphere the south, east and west sections are affected to a greater extent than the north exposure by heat from sunlight. The top floor or spaces immediately beneath the roofs or offsets require special consideration because of the roof load which is usually high owing to poor heat insulating qualities of the roof construction.

(2) This leads to a second variable involved in load calculations—building construction. It is evident that better heat insulating qualities of walls, partitions, floors and roofs will make possible smaller apparatus and lower operating costs. Recent studies have indicated, on specific installations, that it is more economical to insulate the roof properly



A DIAGRAM SHOWING HOW AIR CONDITIONING MAY BE APPLIED TO A MULTI-STORIED OFFICE BUILDING. THE STORES ON THE FIRST FLOOR LEVEL ARE HANDLED BY A SEPARATE SYSTEM. AS INDICATED, THE REFRIGERATED WATER IS PUMPED FROM THE REFRIGERATION MACHINE IN THE BASEMENT TO THE TWO DEHUMIDIFYING UNITS. THE ONE LOCATED ON THE ROOF SUPPLIES CONDITIONED AIR TO THE DISTRIBUTING SYSTEM LEADING TO THE WINDOW BOX UNITS. THE APPARATUS LOCATED IN THE BASEMENT SUPPLIES CONDITIONED AIR TO THE VARIOUS STORES. THE LETTERS SHOWN IN THE SKETCH INDICATE THE FOLLOWING:

Schill Studio

than to install and operate equipment of sufficient capacity to provide for the increased load involved where ordinary construction is maintained.

(3) The removal of heat and moisture from occupants is a greater portion of the total load than most individuals realize. Heavy concentrations of people very often require special study. The activity of the population greatly affects the total amount of heat dissipated. Sensible and latent heat* must be separated in the calculations, because the method of providing for the removal of each is different. In general, the sensible heat affects the amount of conditioned air, while the latent heat directly affects the refrigeration load.

(4) Heat given off by lights has a direct bearing on, and often is a major portion of, the total air conditioning load. Modern methods of illumination with increased application of indirect lighting and a consequent increase in wattage per unit of floor area will add still greater weight to this factor in the future. The use of independent ventilation units, to remove the major portion of the heat from the light coves, will prove economical.

(5) Another important variable involved in load calculations is the item of air infiltration or leakage. This factor requires special consideration in tall buildings due to pressure conditions and stack effect of vertical risers, stair ways and elevator shafts. The possibility of large heat losses or gains due to leaky sashes has indicated the advisability of double windows or double glazing in some cases.

After a proper analysis has been made of the conditions to be maintained and the heat loads encountered, the next step is to determine the most applicable

**The total heat given off by people is composed of the sensible heat, or heat due to the temperature as indicated by the thermometer, and the latent heat, or heat of vaporization of the moisture or perspiration. Thus, at 80 degrees dry bulb and 50% relative humidity, the total heat given off by an average man at rest is 400 B.t.u. per hour, of which 55% is sensible and the remainder latent.*

ZONING:

A. REFRIGERATION EQUIPMENT.
B. WINDOW BOX UNITS.
C. AIR CONDITIONING APPARATUS FOR OFFICES ON UPPER FLOORS.
D. AIR CONDITIONING APPARATUS FOR STORES.
E. AIR DUCTS.
F. REFRIGERATED WATER PIPING.
G. STEAM AND RETURN PIPING.

type of system. When dealing with air conditioning systems for large buildings, it is generally considered best practice to divide the complete job into a number of suitably sized units. In some cases a unit per floor or group of floors may accomplish the work satisfactorily, whereas in others it may be necessary to have separate units for each of the quadrant exposures of the building. Where the floor area is large in relation to the outside wall exposure, it is evident that provision must be made for the variable load to which the outer bay is subjected. The heat loads on inside rooms or bays are apt to be less variable since the fluctuations of the outside weather conditions are not a direct factor in load. Such a condition often results in a natural zoning or segregation of rooms having similar exposures and internal heat loads.

LOCATION OF EQUIPMENT:

One of the first questions to be settled in any air conditioning design is the location of dehumidifying and refrigeration equipment. In general, it is best to place all the dehumidifiers, commonly called air washers, on the same level, preferably on one of the upper floors where clean outdoor air is readily available, so as to allow a closed circuit for the cold water system. The cold water pumps then need only work against friction head since the vertical or static head is balanced in the supply and return lines. The refrigeration equipment is usually located in the basement along with boilers, fire pumps, and the like. In the case of a system designed with all the dehumidifiers on one level it is generally necessary to have booster fans located on the various floors to provide for local control and also to insure proper distribution of supply air.

SOUND:

The problem of sound insulation and isolation in connection with air conditioning work is increasing in importance. With the advent of sound studios and "talkies" it became necessary for the engineer to develop methods of preventing transmission of noise through ventilating ducts. Gradually some of this information has been applied to other types of work. The cost of sound control is a direct function of the "quietness" desired, and for this reason certain sound levels have been recommended to assist in attaining the proper economic balance for various applications; for example:

Residences	10 db*
Sound Stages	5 db
Hotel Sleeping Rooms	10 db
Broadcasting Studios	8 to 12 db
Private Offices (extra quiet)	10 db
(ordinary)	15 db
Theaters	12 to 18 db
General Offices (small)	25 db
(large)	30 db

**db is the abbreviation for decibel which is a commonly used unit for the intensity of noise or sound. Technically, the decibel is a logarithmic ratio of the energy of a sound to the energy of a sound just barely audible.*

Acoustical problems encountered in air conditioning work, as outlined by V. O. Knudson in the October 1931 issue of HEATING, PIPING AND AIR CONDITIONING, are in part as follows:

1. "The selection of equipment which operates without generating excessive noises.

2. The location and insulation of the equipment room so that no direct noises are transmitted through its walls and ceilings into adjacent rooms.

3. The mounting of the equipment on flexible supports which have been designed (based upon calculations, not guessed) to provide sufficient insulation to prevent solid-borne vibrations from disturbing any part of the building.

4. The design of suitable filters for the ducts to prevent sound transmission from the equipment room to audience or work rooms, or from room to room.

5. All of these problems can be solved quantitatively in advance of installing the equipment, so that the control of sound in the air conditioning of buildings can be removed from the realm of guesswork and empiricism, and placed upon an unfailing and rigorous engineering basis."

Recent research has been directed toward determining the effect of noise on health and efficiency. The fact that efficiency falls off when a person works in a high noise level has been established and is generally known. An air conditioning system allows the windows to be closed during all seasons of the year, and thus most of the extraneous or street noises are eliminated.

AIR DISTRIBUTION:

Among points to consider in determining the method of distributing conditioned air in buildings are such items as ceiling heights, locations of partitions and construction of ceiling (that is, beamed or hung).

Up to this time, the major portion of building air conditioning has been accomplished by means of grille outlets located in permanent corridor walls.

Recently, however, the trend has been toward low-pressure nozzles placed under the windows or in permanent corridor partitions. The former, a window box unit, is designed for cooling and dehumidifying in summer and heating and humidifying in winter; such an installation will dispense with supplementary direct radiation under windows since a heating coil is an integral part of each unit. The latter, a wall unit, may be used to advantage when a central corridor is available for the distributing ducts. However, direct radiation, or other means of providing for heat losses, must be used in conjunction with the system.

In general, it should be remembered that space must be allotted on the plans for a complete system of supply and return air ducts leading from the equipment or fan room to the various conditioned areas. Whether a particular installation should be designed for use of side wall outlets, window box units, or overhead pan distribution should be determined by a competent air conditioning engineer. He must analyze the load conditions, room usage, available equipment space, operating costs, and the possibility of obtaining suitable automatic control of the system. This latter item is generally overlooked despite its importance. An air conditioning system loses its effectiveness if it is designed in such a manner as to preclude the use of automatic controls for temperature and/or humidity.

COOLING TOWERS—CONDENSER WATER:

A problem of major importance which often does not receive proper consideration, both in building construction and in the operation of an air conditioning system, is that of providing water for condensing purposes. Where the refrigeration load is large, it may be impossible to obtain sufficient water from city mains, wells, rivers or lakes to operate the condensers. This makes advisable the installation of a cooling tower or spray pond on top of the building. In order to do this, however, the steel work must be designed for the additional load. Architectural design of modern buildings seldom provides suitable roof area for cooling towers or spray ponds, and to overcome this difficulty it may be necessary to provide space for a forced draft cooling tower which is essentially nothing more than an air washer and fan assembly.

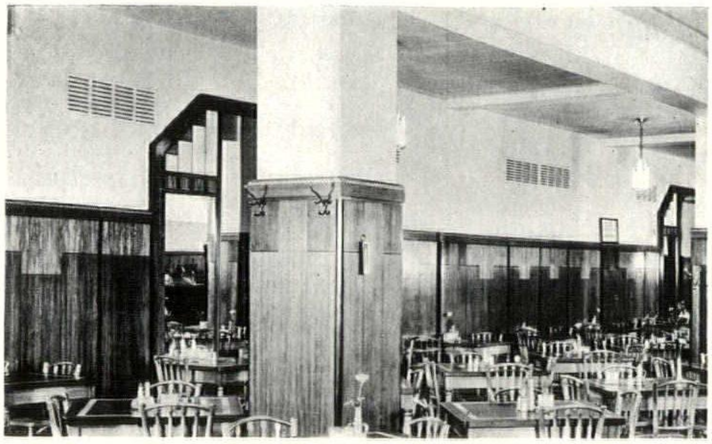
It should be borne in mind that although sufficient condensing water is available at present the supply may be restricted at some future date. For this reason, on some recent installations, provision has been made for the future addition of a cooling tower although city water at the present rate is more economical than owning and operating such a tower.

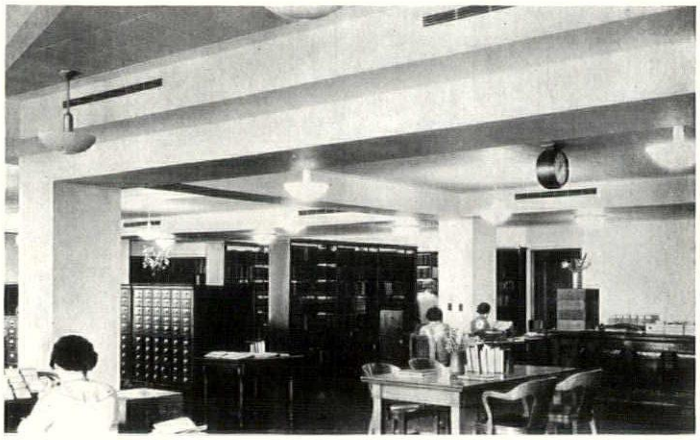
AIR CONDITIONING EQUIPMENT:

A complete air conditioning system consists essentially of the following equipment:

1. Refrigeration equipment.
2. Washers, fans, heaters, filters, motors.
3. Duct work.
4. Automatic controls.
5. Water piping and pumps.
6. Insulation and isolation.

These divisions in equipment are listed to show the number of items which enter into the cost and space taken by an installation. It is apparent that any duplication of motors, pumps, and so on, for emergency or auxiliary use will forestall the use of a unit price based on a standard installation. Specifications calling for copper dehumidifiers, copper dampers, brass pipe or other special





construction or controls will also tend to make unit costs and factors unreliable. From actual costs of air conditioning installations in large buildings (excluding theaters and auditoriums) in various localities, it has been found that present initial costs may vary from 75c to $2.50 per square foot of usable floor area. For small buildings the cost is somewhat higher. On a cubical content basis, it may be said that the cost will run from 7c to about 25c per cubic foot depending on the variables discussed above.

OPERATING COSTS:

In recent years industry has gradually adopted the idea of analyzing equipment installations on the basis of balancing the cost of operating against the first cost of equipment, and has begun to consider this relation essential in the initial determination of new building features. Naturally this trend has entered the field of air conditioning with the result that such analysis is being made in the design of all current projects.

Such a method of balancing consists of striking an economical relationship between size of equipment and the first cost. The first cost of installation is quite often a poor index of the total cost of owning and operating an air conditioning system and this should not be the sole deciding factor for the purchaser. For example, an installation may be of sufficient capacity to maintain the desired conditions and yet be of such design and size as to entail excessive cost of operation. The equipment may be taking insufficient outside air to provide for intermediate seasons* when neither refrigeration or steam should be used. In such instances it is necessary to run the refrigeration equipment more hours each day and many more days each season than for a well-designed system capable of circulating sufficient outside air. The additional cost of operating the refrigeration machines and cold water pump would readily pay for the small increase in air capacity required of the dehumidifier.

To determine the operating costs of an air conditioning system it is necessary to consider an array of variables so complex in nature that all calculations must be considered as approximations only. Due to these many variables it

Intermediate seasons may be taken to apply to late summer and early fall, as well as late spring.

LEFT: APPLICATION OF HIGH-PRESSURE WALL TYPE OUTLET FOR EFFECTIVE DISTRIBUTION OF CONDITIONED AIR.

RIGHT: AN OFFICE AIR CONDITIONING APPLICATION WHERE THE AIR DUCTS ARE FURRED IN AS BEAMS, AND LOW-PRESSURE SLOTTED OUTLETS ARE USED FOR DISTRIBUTING THE AIR.

is impossible to obtain a purely mathematical solution.

It is necessary to make certain basic assumptions or approximations regarding the weather and operating efficiencies. In this connection it should be noted that a good operator will save money and a poor one may waste much more than the difference in salary required to acquire a good man. Inefficient results may often be traced back to the fact that the man in charge does not fully understand the principles involved.

Obviously, the only accurate method of determining the operation cost of a system is by the use of meters and methodical records. When an attempt is made before installation to predict the yearly cost of owning and operating equipment, however, a thorough knowledge of the machines and an understanding of fundamental principles is essential. The complexity of the problem is increased still further by fluctuating outside weather conditions which vary from hour to hour and day to day; this condition precludes the use of temperature averages and makes a detailed study necessary.

A detailed approach to the problem is presented:

OPERATING COSTS IN DETAIL

A. Fixed charges (commonly known as capital charges).

(1) *Depreciation charges* involve determination of the total first cost of the equipment, which includes not only the air conditioning contract price but also a reasonable addition for all supplementary work necessary for the completion of the installation. The total first cost of the installation should be distributed over a period of years consistent with the nature of the installation and stability of real estate values. For well-designed air conditioning equipment it is possible to use the same rate of obsolescence as used for the building.

(2) *Interest loss* is generally figured at a reasonable rate (say 4-6 per cent) on the average amortized value of the apparatus.

(3) *Taxes* are difficult to figure accurately since the assessment valuations do not always coincide with the theoretical value of the property. This item naturally varies with locality.

(4) *Rental value* of the floor space which is occupied by apparatus must be considered in the complete analysis.

(5) *Insurance* on the property should be figured at appropriate rates.

B. Service charges.

(1) *Salary of operator* or operators should be based on the amount of time required and the relative value of that time. Normally, when a licensed refrigeration engineer is required, the responsibility of the entire operation is entrusted to his charge. Quite often, the salary of operators is included in the *capital charges*.

(2) *Maintenance* consists of normal replacements, oiling, greasing, and repletion of refrigerant. Periodical painting of equipment may also be included under this item.

(3) *Make-up water* is the very minor water load which is used by the humidifier or dehumidifier. Under ordinary conditions this consists of evaporation losses and water necessary for cleaning and replacement.

(4) *Steam consumption* is computed after study of the prevailing weather conditions for the particular locality, and after evaluation of the heat gains and losses which may be credited to the particulr building. For convenience in computation, the steam load should be divided into three parts:

(a) Steam required to preheat or raise the air from the outside temperature to the apparatus saturation temperature.

(b) Steam required to provide for heat losses through walls, windows and roof.

(c) Steam necessary to reheat the air from the apparatus saturation temperature to the room dry-bulb temperature.

(5) *Condenser water* costs for refrigeration purposes must also be computed. If a cooling tower or spray pond is used, the pumping power cost must be added to the windage and evaporation losses.

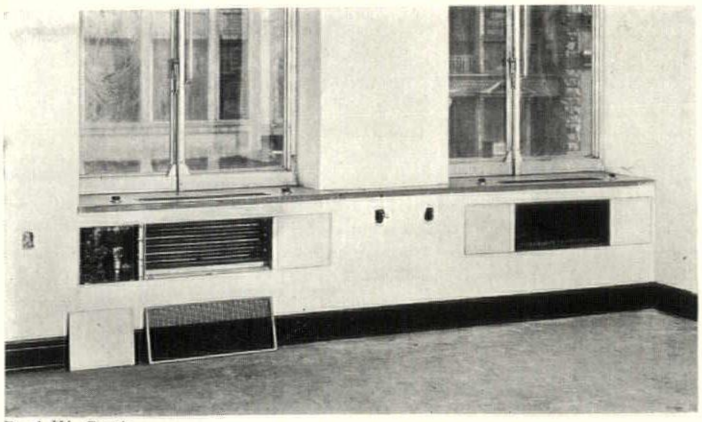
(6) *Apparatus power,* exclusive of refrigeration power, is determined by the length of time the related apparatus—pumps, fans, and so on—is in operation. The efficiency of power transmission should not be neglected.

(7) *Refrigeration power* may be computed only after a study of complete weather conditions together with all the variable load factors involved.

From the nature of the variables it may be readily appreciated that total owning and operating costs will vary considerably. Actually these values may range from 15c to 35c per square foot of usable floor area per year in large installations. It should be remembered that these values include all fixed charges and service charges as previously listed. For smaller projects the cost will increase owing to the fact that the ratio of initial cost to conditioned area is greater.

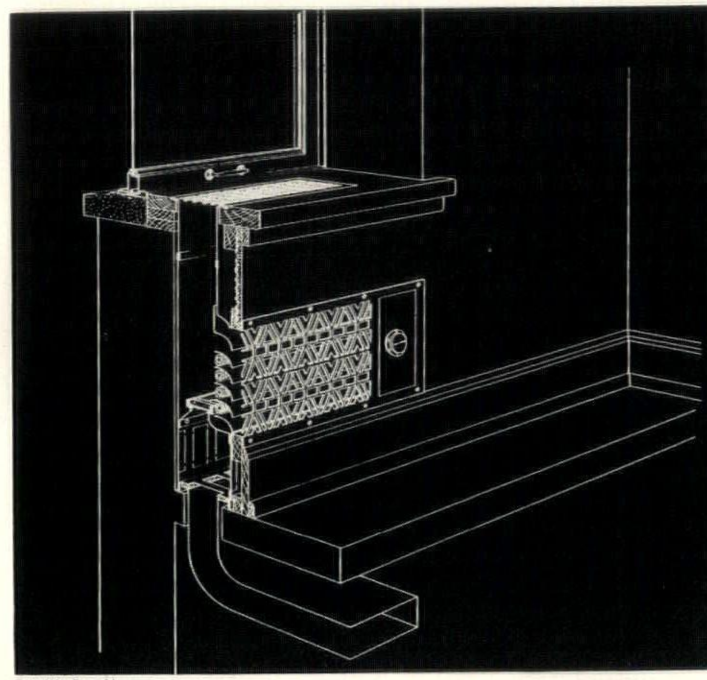
CHANGES IN EQUIPMENT

During the last fifteen years there have been many changes in air conditioning equipment. While systems installed that long ago are still producing the proper conditions within the rooms, it does not follow that the same design would be used in a modern installation. Much has been learned about air diffusion, air distribution, mechanical refrigeration, and sound absorption. This knowledge has been incorporated in recently designed systems. Occasionally the ques-



Paul W. Davis

THE WINDOW BOX UNIT, AS APPLIED TO OFFICE BUILDING CONDITIONING. THE UNIT AT THE LEFT IN THE PHOTOGRAPH HAS THE OUTER GRILLE REMOVED TO SHOW STEAM CONNECTIONS TO HEATER.



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tion is raised whether it is advisable to design a building today with provision for installing air conditioning at some future date, say ten years distant. Since research is constantly bringing out and developing new ideas, it is possible that space provisions made today may become entirely inappropriate in the future. In this event, it would be necessary for the future designer to go back to antiquated equipment or design special equipment to make a system fit the old plans.

Among the more recent developments in effective distribution of conditioned air are the low-pressure nozzles for location under the windows or in permanent corridor partitions. Both these types of distribution have considerable merit over the pan or grille supply systems in office buildings because individual control of each unit is possible without disturbing the balance of the installation. In addition, it is possible to use a higher temperature differential between the air entering the room and the room temperature and in this manner decrease the quantity of air supplied to the units. Thus, in comparison with an old type system, smaller ducts may be used. A higher temperature differential may be used because a primary current of air is introduced in such a manner as to induce a secondary air circulation greater than its own volume. In this way, the actual air diffused in the room may be greater than that in an overhead system even though a much smaller amount is carried through the ducts.

One of the chief problems of a building designer is to maintain as much rentable floor space as possible without sacrifice of efficiency in the mechanical equipment. The window box unit lends itself quite readily to the conservation of floor space and ceiling height because the duct work usually consists of vertical risers furred in the pilasters, with small horizontal ducts leading to the individual units. In some instances it may be advisable to have the vertical risers in the general utility space and then have horizontal ducts in the corridors from which small horizontal leads may be made to the individual units.

In any case, it is desirable to plan the steel framing with provision for simple duct work rather than to determine the steel design first and then be confronted with intricate problems of duct design and resultant higher costs for operation of the system. When the duct and riser requirements are known, it is generally a simple matter to provide proper steel framing. On the other hand, if the steel is designed before thought is given to air conditioning requirements, the result is a much more costly and inefficient installation.

One of the recent developments particularly adapted to individual office installations is the self-contained automatic air conditioning unit. In summer, when used in conjunction with a refrigerating machine, it distributes cool, dehumidified air, while in winter, when connected to the building's regular heating system, it provides evenly warmed humidified air. The cooling and heating coils are built into the cabinet itself, as is the blower for circulating the air. Cooling only, heating only, or both in the proper season may be furnished according to the type of cabinet selected.

CONCLUSION

The importance of accurate preliminary planning for air conditioning in the design of modern buildings cannot be over-stressed. Such initial consideration is justified by the reduced cost made possible to the owner both in building construction and in equipment, and also because maximum operating efficiency may be made possible through proper design of the equipment installed. The large number of variables encountered and the difficulties met with in air conditioning work tend to place such preliminary study in a highly specialized field. For this reason, the problem cannot be properly solved by the use of constants and unit values in the same manner as problems of ordinary ventilating, direct radiation, sprinkler systems, and the like. The problem is complicated still further by the ever increasing number of new developments being continually brought out by the rapidly expanding science of air conditioning. It is possible, however, for the air conditioning specialist to make a preliminary survey of a project and to formulate the design of equipment which will meet the building requirements set down by the owner; also, it is possible to predict roughly the yearly operating cost of the equipment. It is therefore the function of the air conditioning manufacturer, who must of necessity be a specialist, to cooperate with the owner, architect, and consulting engineer from the start in the preliminary planning of a building.