AMERICAN ARCHITECT

AND ARCHITECTURE

- MOUNT VERNON
- NORRIS DAM
- HEATING MANUAL II

FEBRUARY

1938

Dwight James Baum, Architect

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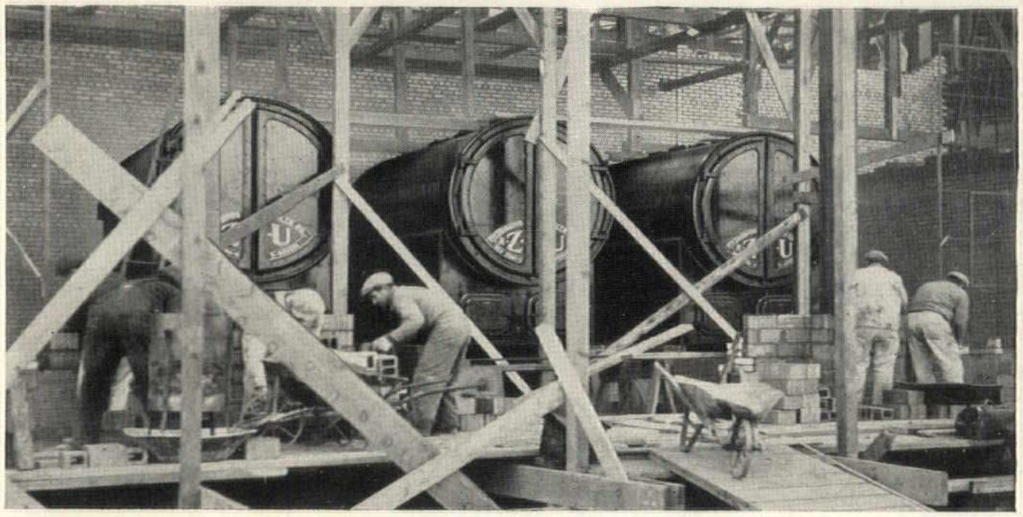
The LARGEST COMMERCIAL HANGARS *in the* U. S. *are heated by* FITZGIBBONS R-Z-U BOILERS



Three 30,000 sq. ft. oil-fired R-Z-U boilers heat the new municipal hangars at the Newark, N. J., airport. Engineers, Runyon and Carey, Newark, N. J. Heating Contractor, John H. Nelles Co., Irvington, N. J. The upper photo shows one of the fine new Douglas planes on the New York-Miami, New York-Houston routes of Eastern Air Lines, by whose courtesy these photos are available for reproduction.

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The industry of air transportation is officered by men of vision, foresight, keen intelligence, particularly in regard to matters of engineering combined with profitable operation. It is thus no surprise that in the fine new municipal hangars at Newark, N. J., Fitzgibbons R-Z-U Steel Boilers were selected to carry the heating load.

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Services for WROUGHT IRON pointed out by "CORROSION STUDY"

KANSAS CITY MUNICIPAL AUDITORIUM

ALONZO H. GENTRY,
VOSKAMP & NEVILLE
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When it comes to your own problems of material selection for piping, tanks and smokestacks, we offer specific, valuable assistance. Our Engineering Service Department is the clearing house for experience, covering over half a century, by leading architects and engineers — and also for aid in analyzing your local corrosive conditions.

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AMERICAN ARCHITECT AND ARCHITECTURE

CONTENTS FOR FEBRUARY, 1938

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TRENDS . . . .

CONSTRUCTION

Increasing sharply over the November total, December building permit volume as shown by Dun and Bradstreet's 215 selected cities reflects the haste of New Yorkers to file permits before the new building code became effective on January first. Compared with the preceding month of November, there was a whacking rise of 42.1%—$118,763,851 against $69,567,549. However, if New York City is excluded, the rest of the nation does not look so hot—registering a drop of 12.4% from November and 34.6% from December, 1936. During the year just closed, total value of building permits in our 215 centers aggregated $1,130,624,471 compared with $980,496,615 in 1936—an increase of 15.4%. New York City was way ahead of the other cities, though, with a bulge of 44.4%. The other 214 included in the compilation managed to score a gain of 7.3%, nothing like the total which seemed in the offing when 1937 began.

With the thought that maybe you will be interested in seeing how your section stacks up with the others, we present the following table of building permit values, which is lifted right out of Messrs. Dun and Bradstreet's report:

Groups	Twelve Months 1937	1936	Change P. Ct.
New England.......	$75,259,594	$55,444,707	+35.7
Middle Atlantic.....	412,768,047	306,565,005	+34.6
South Atlantic......	109,221,843	105,774,917	+ 3.3
East Central.........	209,454,572	186,954,766	+12.0
South Central........	96,186,453	105,156,238	+ 8.5
West Central........	47,737,724	44,022,519	+ 8.4
Mountain	21,561,857	20,349,895	+ 6.0
Pacific	158,434,381	156,228,568	+ 1.4
Total United States.	$1,130,624,471	$980,496,615	+15.3

■

To place in proper perspective our present position and outlook, it may be helpful if we review briefly America's construction activity over the last ten years or so.

After a half decade during which the horn of plenty spewed its blessings on the industry, 1928 witnessed a contraction in building permit values which grew progressively more marked with each succeeding year. Finally, in 1937 the irreducible minimum was reached when total volume ran 90.8% smaller than 1933; the next year, 1934, saw a reversal of the precipitate decline and an upward movement began which continued through the first quarter of 1937. But in April, due to factors still widely debated, a recession set in which by June had caused a dip below the previous year's comparative for the first time in two and one-half years. At year's end, 1937's total construction volume held its head 15.3% above that of 1936, for about half of which, as stated above, New York City may be thanked.

The industry is now faced with what

Zodiac symbols in relief in an astronomical pavement designed by Oskar J. W. Hansen, sculptor, as part of a large sculptural project at Boulder Dam

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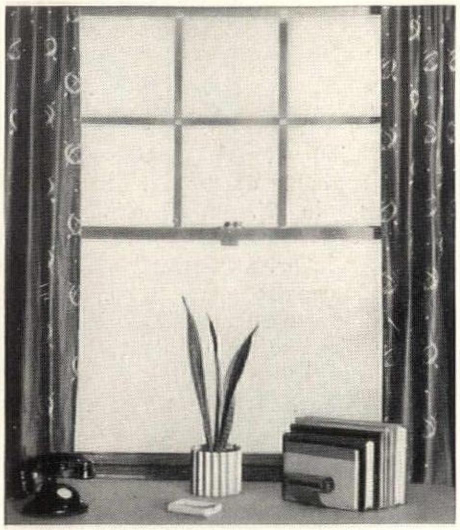
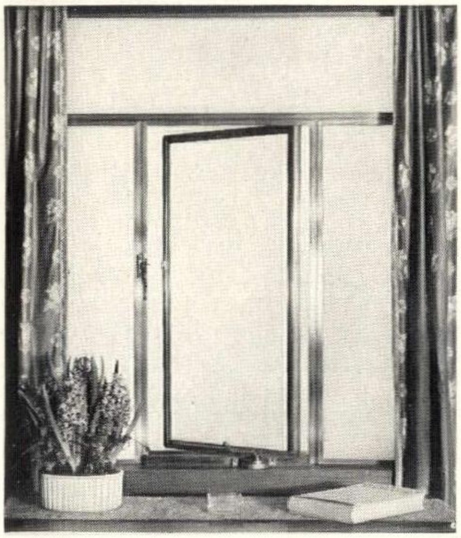


PERMATITE WINDOWS



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New VALUES are established by these remarkable, patented Permatite Windows—casement or double hung. Here is beauty that makes a building distinctive, outside and in. Here is weathertightness that insures comfort and better health. Here is airtightness—so important for air-conditioning. And here is quietness—no rattling windows to disturb peace at home or at work.

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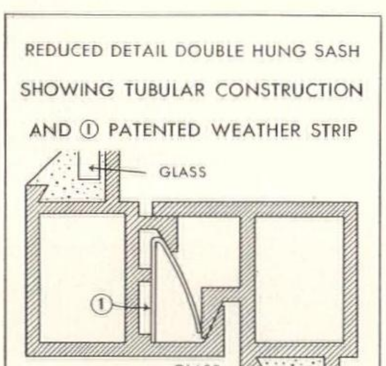
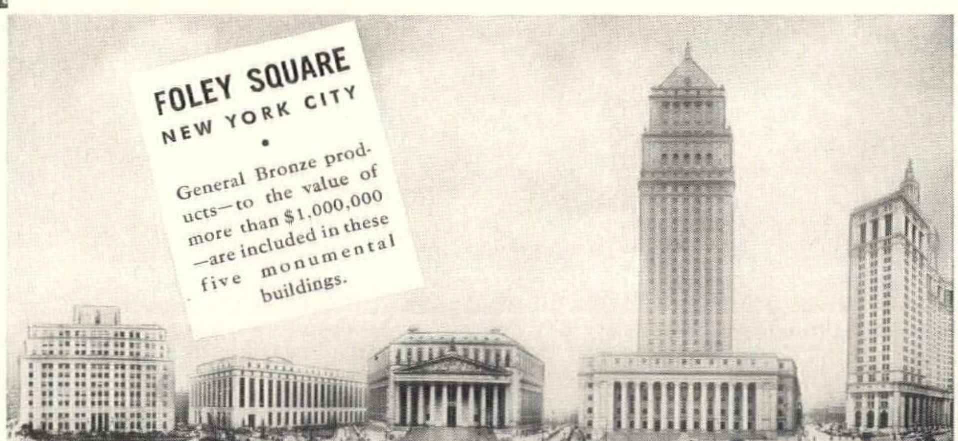
Sweet's Catalog contains 24 illustrated pages, giving complete construction details and specifications of Permatite Windows. We invite you to consult Sweet's or to write to us for this material.





Depts. of Health, Hospitals and Sanitation Building · *New York State Office Building* · *New York County Court House* · *United States Court House Building* · *Municipal Building*

GENERAL BRONZE CORPORATION

34·19 TENTH STREET . . . . LONG ISLAND CITY, N.Y.

Architectural Metal Work · Windows · Revolving Doors · Tablets appears to be a huge potential business, for recovery has never been sufficient to make up for deficits—chiefly in housing—incurred and increased during the depression. Vacant housing units, which at the end of 1932 stood at about 8% of the total, are now as low as 1% to 3% in many large cities.

Since 1929 the relationship of residential construction has been badly out of kilter and has in no year equalled the usual 25% to 30% of each year's building volume. The Department of Commerce estimates the average number of dwelling units built from 1920-29 at 700,000; the five year average, 1932-37, appears to be about 145,000.

Activity of the sort seen during the preceding decade is far from attainment at the present time, and speculation is now widespread as to which direction will be taken in 1938 by those serpentine lines charting the ups and downs of construction. Some prophets are optimistic, some woeful; in the following paragraphs we present the prognostications of various individuals who have seen from their particular crows-nests divers signs, auspices and portents.

■

For instance, Frederick H. Meyer, vice president of the A.I.A., is particularly reassuring. Nineteen forty-four, he believes. is going to be a veritable pip of a year—the culmination of steadily increasing prosperity. "Lucky, indeed," says he, "is the architect or contractor starting in business at this time, on an ascending rather than a descending wave." (Hear that, O.S.W.?)

The demand for dwellings will become so insistent that high costs of construction and high rents will be ignored, he predicts.

The history of the building industry, he points out, shows that revival begins with the erection of homes, and spreads to school, industrial, public utility, and other large structural operations.

To prevent recession, Mr. Meyer urges architects and contractors to fight the trend toward higher costs rather than to rely upon economic forces to bring about the needed adjustments. These groups, he asserts, should support vigorously any program which will lead to "a sensible, reasonable growth" in the price structure of labor and material.

Mr. Meyer's choice of 1944 as the "peak year" is based on a study of construction statistics over a long period of time. These show that previous highs were scored in 1852, 1870, 1890, 1910 and 1926—an average of 18 years apart. Adding 18 years to 1926, Mr. Meyer not illogically gets 1944.

"The Building Outlook in New England" is the title of a report made to the A.I.A. by George H. Gray of New Haven, Conn. In this report Mr. Gray's outlook is based on what is going to happen to costs, for he believes the building industry will not go forward until they are reduced. This is because an investment in building, unlike purchases of food and clothing, can and will wait on favorable prices. Mr. Gray states his incomprehension of why supplies of materials and bosses of labor have not grasped this "fundamental idea."

■

To New York City, according to Stephen W. Dodge, president of the Brooklyn Chapter of the A.I.A., 1938 will bring greater building activity and architectural progress. His prediction is based on the belief that changes made last year in the laws and conditions governing the building industry will encourage "more and better" buildings.

■

From down in the ex-capital of the Confederacy, along with a hopeful forecast comes a warning grumble from Merrill C. Lee, South Atlantic District Regional Director of the A.I.A. In his annual report Mr. Lee declares that State legislatures are now erecting barriers which keep every architect fighting for his right to exist, and that grave consequences may accrue to the profession if efforts are not made by the national organization in order to control adverse state legislation.

Appraising construction prospects in the South, Mr. Lee cites the record of 1937 and the extensive building needs as hopeful indications. "Construction awards of approximately $700,000,000 for the first nine months of this year in the sixteen Southern states more than equalled the total for the same period of 1936 and went ahead of similar periods in all other years since 1930," he says.

"General building shows a decided increase in private and commerçial work that has been lacking for some time. Unquestionably many orders and commitments have been deferred; when uncertainties prevail, care in making commitments is no more than prudent. But despite the caution that has governed the operations of business and industry during the past four months the figures show that construction so far has marched on undisturbed. This record, coupled with the well-known fact that there are large unfilled needs for construction, gives little support to pessimism.

"In South Carolina the general conditions of architectural activity are good. Private and commercial work have increased, and practically every architectural firm in the state has a steady business with indications of continuity. There are no available draftsmen. Reports of conditions in North Carolina, South Florida, and South Georgia are very encouraging in private work."

The Southern Chapters of the Institute are planning to sponsor State legislation which will make mandatory the employment of registered architects, Mr. Lee says. The South Carolina Chapter will introduce a bill in the coming session of the legislature to revise and strengthen the registration law. The Virginia Chapter, with engineering societies and officers of the state public utilities, will also back a new registration bill. The North Florida Chapter is expanding its activity in public relations to acquaint the public with the need for architectural service.

■

And from the National Capital, William C. Nolting of Baltimore, Middle Atlantic District Regional Director of the A.I.A., reports a great increase in construction but adds that only a small amount is being done by architects. Mr. Nolting says an attempt will be made to remedy this situation by the Washington Chapter, which in 1938 plans to work for legislation that will make mandatory the employment of registered architects.

Reviewing conditions in other parts of his district, Mr. Nolting finds Pittsburgh enjoying a fairly appreciable volume of construction—a greater percentage of it private than has been the case during the last five years. Five or six of the offices are extremely busy and the current situation with regard to experienced draftsmen is reported good, though younger men are finding it rather difficult to get located.

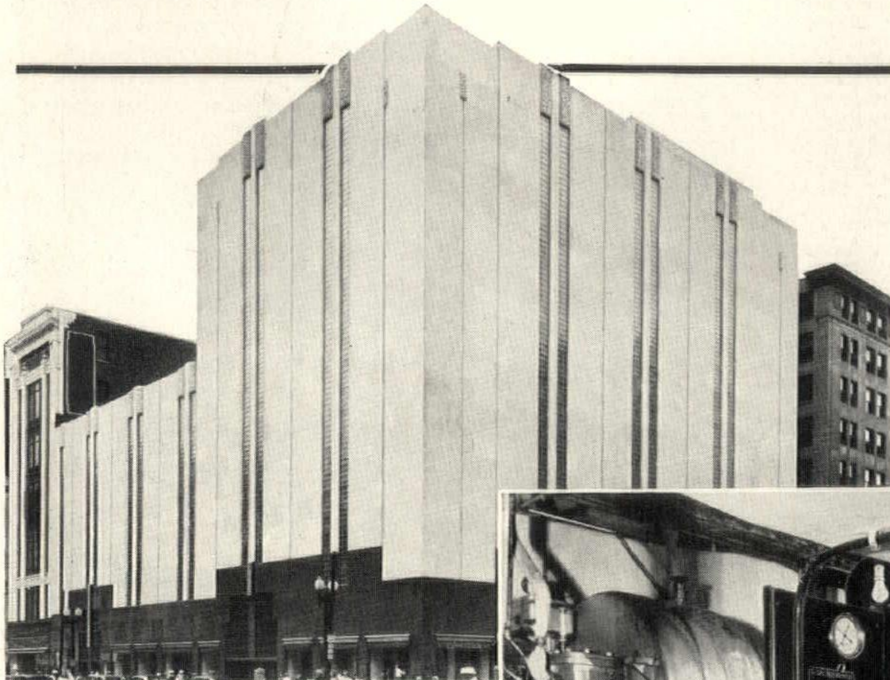
In other parts of his district, Mr. Nolting says, 1937 started well, but activity tapered off and is now at a level below that of 1936. He does not essay to read the near future, but indicates that architects in his territory are in a militant mood and ready to campaign for measures which would mean greater activity and stability.

■

The statistician's viewpoint on things to come we obtain from a recent issue of Standard Trade and Securities, published by Standard Statistics Company, Inc. After reviewing the various factors likely to affect construction in 1938, this concern concludes that a cold appraisal of future prospects offers small basis for enthusiasm. Reduced costs, so often spoken of as the sine qua non, are hardly possible, what with the increased taxes

IN THIS MODERNIZED STORE

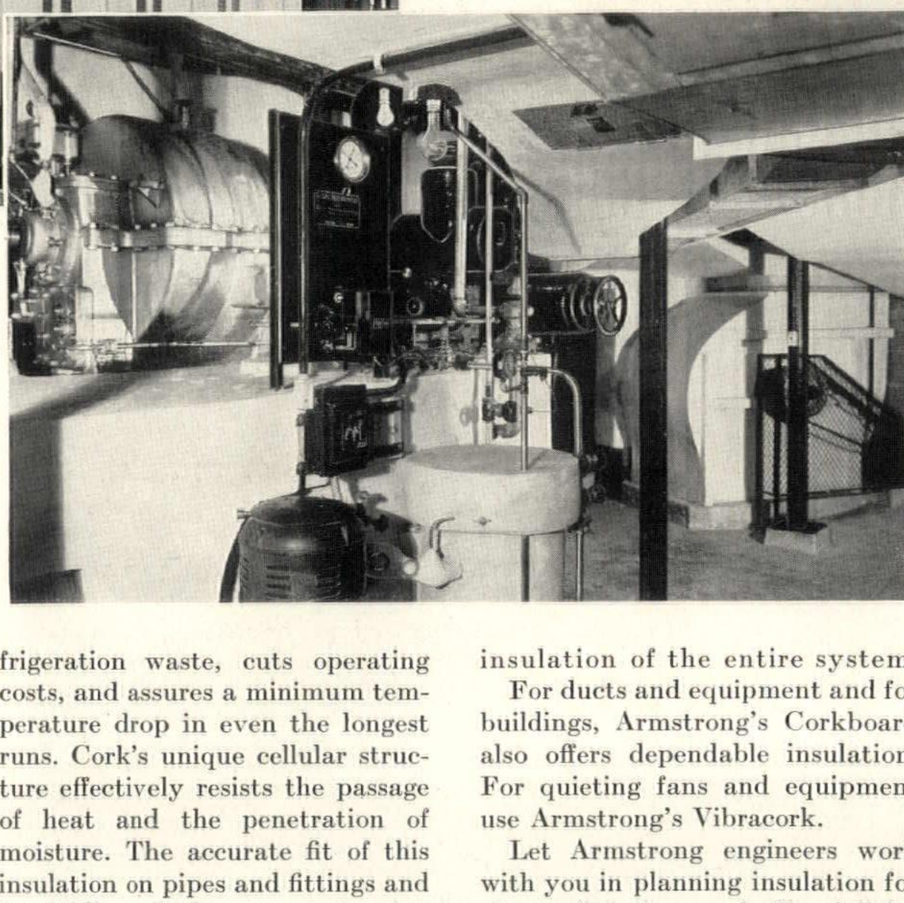
ARMSTRONG'S CORK COVERING AIDS MAXIMUM AIR CONDITIONING EFFICIENCY



LEFT: *Modernized department store of H. P. Wasson Company, Indianapolis, Ind. Rubush and Hunter, Architects; Bevington and Williams, Engineers, all of Indianapolis.*

~ ~

BELOW: *A 4" thickness of Armstrong's Corkboard insulates this 175-ton Carrier Centrifugal Compressor and ice water thickness Armstrong's Cork Covering and Fitting Covers guard the 6", 7", and 8" cold water circulating lines.*



Cold water circulating system is completely insulated for refrigerating economy

•

IN the modernized department store of the H. P. Wasson Company in Indianapolis, four sales floors and a basement restaurant are air conditioned. A central refrigerating system supplies cold water to several "Weather Maker" units. To prevent refrigeration losses, cold water lines in the circulating system are insulated with Armstrong's Cork Covering and Fitting Covers.

On all cold lines Armstrong's Cork Covering guards against refrigeration waste, cuts operating costs, and assures a minimum temperature drop in even the longest runs. Cork's unique cellular structure effectively resists the passage of heat and the penetration of moisture. The accurate fit of this insulation on pipes and fittings and its rigidity which prevents sagging away from the line, are important aids to long, efficient service. When Armstrong's Cork Covering is used there are no weak spots in the insulation of the entire system.

For ducts and equipment and for buildings, Armstrong's Corkboard also offers dependable insulation. For quieting fans and equipment use Armstrong's Vibracork.

Let Armstrong engineers work with you in planning insulation for air conditioning work. For full information write Armstrong Cork Products Co., Building Materials Division, 926 Concord Street, Lancaster, Pa.

Armstrong's CORK COVERING

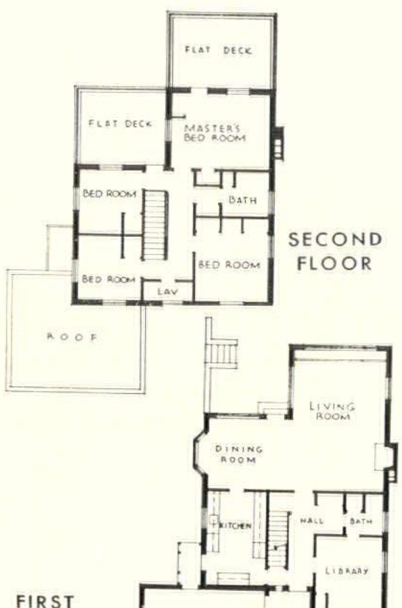
CORKBOARD INSULATION **VIBRACORK**

Home of Mr. Charles B. McGowan, Harmony, R. I.

THIS NEW AMERICAN HOME HAS

A Kitchen Unashamed!

SAYS ITS ARCHITECT, LLOYD W. KENT, PROVIDENCE, R. I.



"When Mr. Charles McGowan and I talked over plans for his proposed home in Harmony, R. I., we agreed that the keynote should be quality rather than quantity.

"This decision was based on the firm conviction that today people who wish to live graciously, recognize the fact that the kitchen must be brought out of its unseen corner and made an integral part of that graciousness.

"So with both quality and delightful living in mind, it was but natural for us to turn to General Electric for kitchen equipment and heating plant.

"In a concentrated use of space, we have, with the help of G-E appliances, obtained a compact, well-organized kitchen which functions as an unashamed part of the entire household.

"It is because I feel Mr. McGowan and his family have faced the problem of modern American living so squarely and sensibly, that their example might well be followed by all who are contemplating a new home."

L W Kent
Architect

THE G-E kitchen in the home of Mr. McGowan at Harmony, R. I., follows the favored U-shape arrangement which not only reduces steps to a minimum, but permits ready accessibility from one unit to another. Where space is limited and the mistress of the home prepares the food, or has but one servant, such an arrangement is ideal.

General Electric kitchens, with their gleaming refrigerators, beautifully proportioned, efficient electric ranges, matching sinks with Disposalls (waste unit) and time and health-saving electric dishwashers are indeed contributing much to a freer, more delightful, infinitely gracious mode of living.

INVITATION TO ARCHITECTS

Should you wish full details of G-E kitchen units—expert information on electrification, heating, lighting, or air-conditioning—the General Electric Home Bureau stands ready to serve. Through this Bureau, engineers will check your plans, prepare wiring, heating specifications and render all types of helpful service as it pertains to the heating and electrical problems of the home. This service is free and is rendered gladly. Should you be faced with a problem right now, write the General Electric Home Bureau, 570 Lexington Avenue, New York.

In the basement of this well organized home, stands this efficient G-E heating and winter air-conditioning unit—assuring clean, circulated, properly humidified air 24 hours a day.

GENERAL ELECTRIC APPLIANCES FOR THE HOME

Dishwashers	Percolators	Immersion-Heaters
Disposall Units	Sandwich Grills	
Disc Stoves	Toasters	Radiant Heaters
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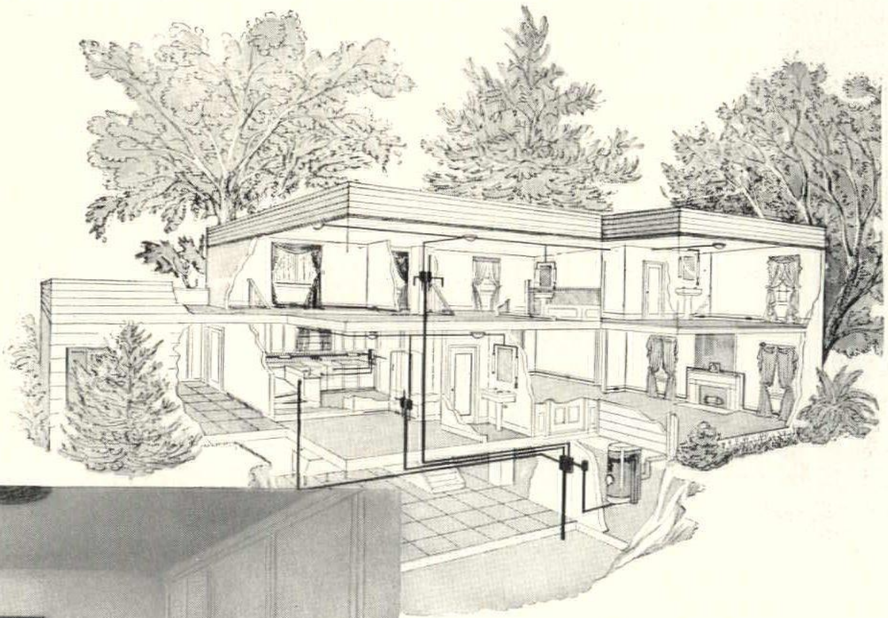
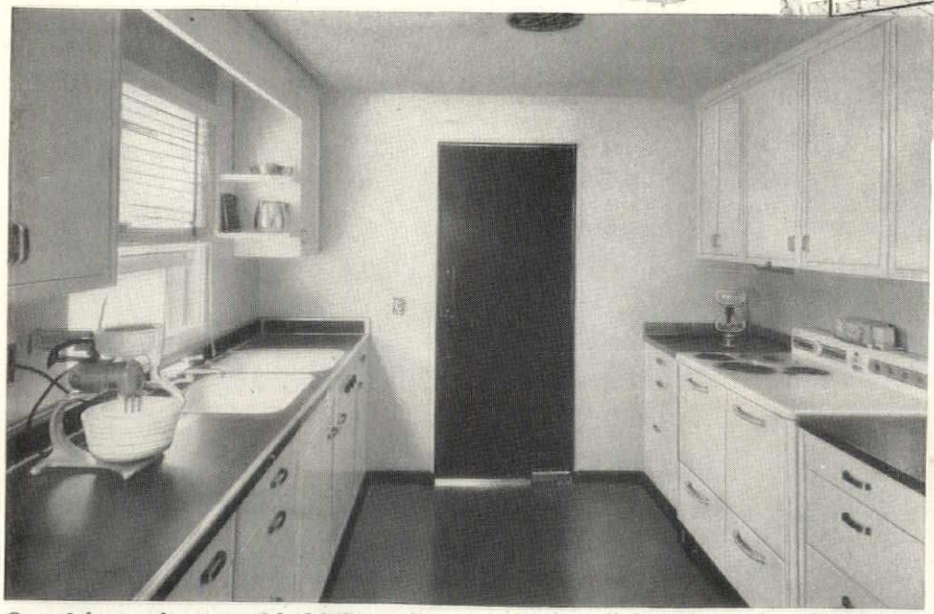
Food Mixers	Waffle Irons	Gas Furnaces
Hot Plates	Electric Blankets	Oil Furnaces
Radios	Heating Pads	Christmas Tree-Lights
Ranges	Room Coolers	
Refrigerators	Sunlamps	Floodlights
Ventilating Fans	Electric Irons	Photo Lamps
Clocks	Ironers	Mazda Lamps
Fans	Washers	Vacuum-Cleaners
Chafing Dishes	Curling Irons	
Coffee Makers		Water Coolers



This hypothetical radial wiring diagram shows how overload is eliminated and full current assured every outlet.



One of the grandest spots of the McGowan home is its bright, well planned, smooth-working General Electric kitchen—indeed a "Kitchen Unashamed."

HOME BUILDERS

Don't Build an Obsolete House!

Get your copy of folder describing the "10 POINTS"—from Architecture to Electrification—that should be considered when building or modernizing a home. The folder also explains interesting HOME BUILDING CONTEST—costs you nothing, offers *substantial cash awards!* Write General Electric Home Bureau, 570 Lexington Ave., New York, N.Y. Be sure to give the name of your Electric Service Company.

Name ________________

Address ________________

GENERAL ELECTRIC

RESEARCH KEEPS GENERAL ELECTRIC YEARS AHEAD and higher wages which must be borne by companies in the construction field. These necessarily high costs, a lower trend in rents and the adverse factors affecting investment funds are cited as causes for a rather gloom-clouded outlook. First, says Standard Trade and Securities, government should aid business, for better construction prospects will come as a result . . . while the other way round is simply putting that much-mentioned cart before the mare. Until general business and confidence are restored, Standard Trade and Securities sees no excuse for optimism in the present situation.

■

From the financial angle, 1937 was not such a good year for real estate securities. This we glean from the fact that the Amott-Baker Real Estate Bond Price Index—which is based upon the market action of 200 representative eastern property issues—showed a drastic decline compared with the average price of these securities at the end of 1936. At the end of 1937 average price of the 200 issues stood at $326.00 which looks pretty deplorable when contrasted with an average of $433 at the close of '36.

■

A stirring gesture of confidence was made recently by John D. Rockefeller, who announced plans for the completion of Rockefeller Center. More than $12,000,000 will be expended in the erection of three buildings, all of which, it is expected, will be finished by next autumn. Commenting on the decision to resume construction, Mr. Rockefeller said:

"Idle capital means idle labor.

"I believe that if capital and labor will face the future confidently and unafraid, and will move forward together, they will find the nation not only ready but willing to back them. As a concrete expression of this confidence, we are proceeding forthwith to the completion of the Rockefeller Center development.

". . . Constructive programs for revitalizing the economic life of America are today being widely discussed. Let us hope these discussions will be translated into early action. There is firm ground for the belief that a generous extension of production programs, with an adequate wage scale and a fair return on the capital invested, will not outrun a steadily developing demand."

PHOTO: GLOBE

Nipponese can gaze with ease in the Planetarium of the new Electrical Science Museum in Osaka

■

The Mortgage Bankers Association of America doesn't seem to be a particularly encouraging group. In commenting on the outlook for construction, Mr. A. D. Fraser, president, declared that concerns engaged in construction financing face 1938 with greater uncertainty than they have known at any period of the past decade. Regarding home construction, Mr. Fraser said that business men are in dire need of more confidence—that investors are frightened as never before. In his opinion, revision of the capital gains tax and repeal of the excess profits tax are necessary before residential building can be restored to normalcy.

■

Of guaranteeing workers steady employment if they will accept low wage scales, Howard Brubaker, in a recent *New Yorker,* observed: "Building-trades unions are cool to the theory that their members could make more money per year at a lower rate per day. A carpenter loves to sit around the house thinking about the high wages he is unemployed at."

■

HOUSING

The outstanding architectural opportunity for 1938, according to a forecast made by William Stanley Parker of Boston, Chairman of A.I.A.'s Committee on Construction Industry Relations, lies in the field of privately-financed, large-scale rental housing projects. Such undertakings furnish architects with an opportunity to make a real contribution towards sound city development and, in addition, satisfy the requirements of a safe, long-term investment, says Mr. Parker. But, he adds, architects must take it upon themselves to hypnotize financiers so that they will see the possibilities of the type of investment. Commenting on the outlook for housing in 1938, Mr. Parker sees the lending agency as a hurdle still to be overcome, although he thinks that the Federal Home Loan Bank's Home Building Service Plan marks a very significant forward step.

■

That Business is awakening to the investment possibilities of low-cost housing is indicated by a recent announcement made by Frederick H. Ecker, Chairman of the Board, Metropolitan Life Insurance Company. Mr. Ecker's statement came on the heels of New York Governor Lehman's message to the state legislature urging that laws be passed legalizing investments in housing. Said Mr. Ecker: "Our own investigations have satisfied us that a definite shortage exists in suitable accommodations for families of modest incomes, which has been confirmed by the Honorable Louis H. Pink, Superintendent of Insurance. There is now being made no adequate provision for this shortage.

"This company has had successful experience in the construction and management, over a period of years, of its notable project at Woodside, L. I. It is our belief that there is an opportunity to provide safe and sanitary dwelling accommodations for persons of moderate income which will assist in relieving the emergency in the housing situation and be a factor in relieving unemployment; that economies inherent in continuous operation under comprehensive plans of a community character may not only be safely undertaken at this time but also be sufficiently remunerative to justify the investment.

"This company is prepared to invest $100,000,000 commencing as soon as such investment is authorized by passage of legislation recommended by the Governor for which a bill has been drafted by the Superintendent of Insurance for introduction into the Legislature."

■

The Housing Committee of the A.I.A., of which Walter McCornack of Cleveland is Chairman, has adopted a 1938 program which is designed to solve some of the problems which have blocked the way to progress in the low-cost housing field. A radical reduction in costs is the first goal and this will be attempted along the following lines: revision of building codes, elimination of price fixing, at exorbitant levels, outlawing of jurisdictional disputes, cleaning out "racketeers," obtaining permission to use new, less-expensive methods, elimination of unnecessary middlemen, purchase of land at use value, revision of taxation methods and lowering of interest rates.

Mr. McCornack invites other elements

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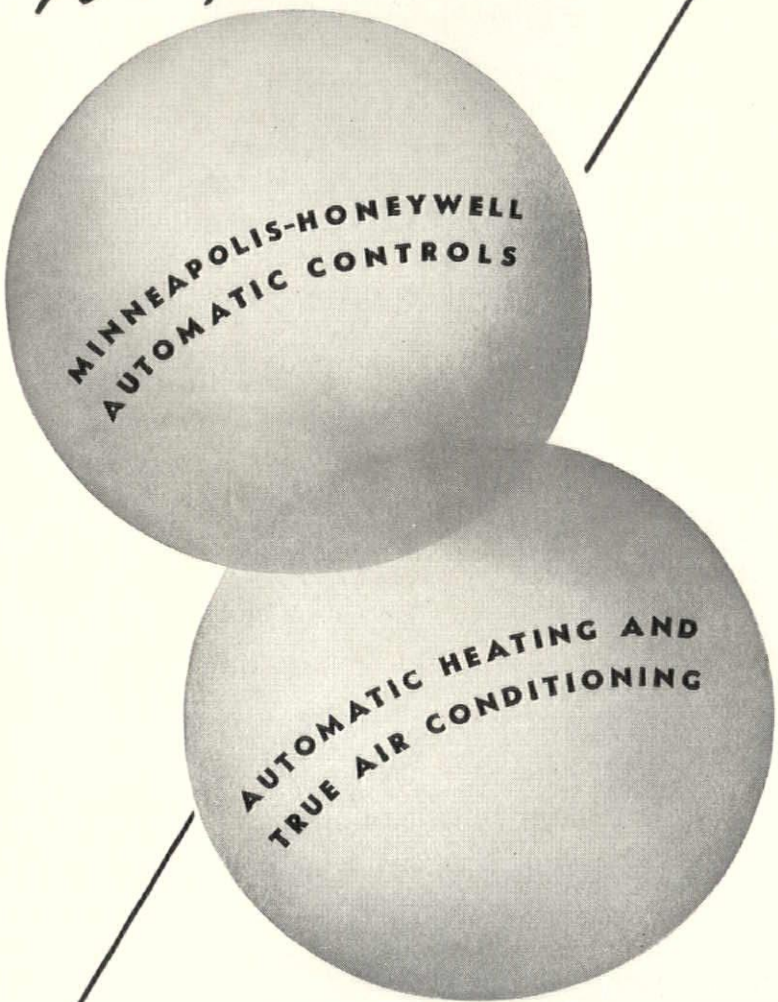

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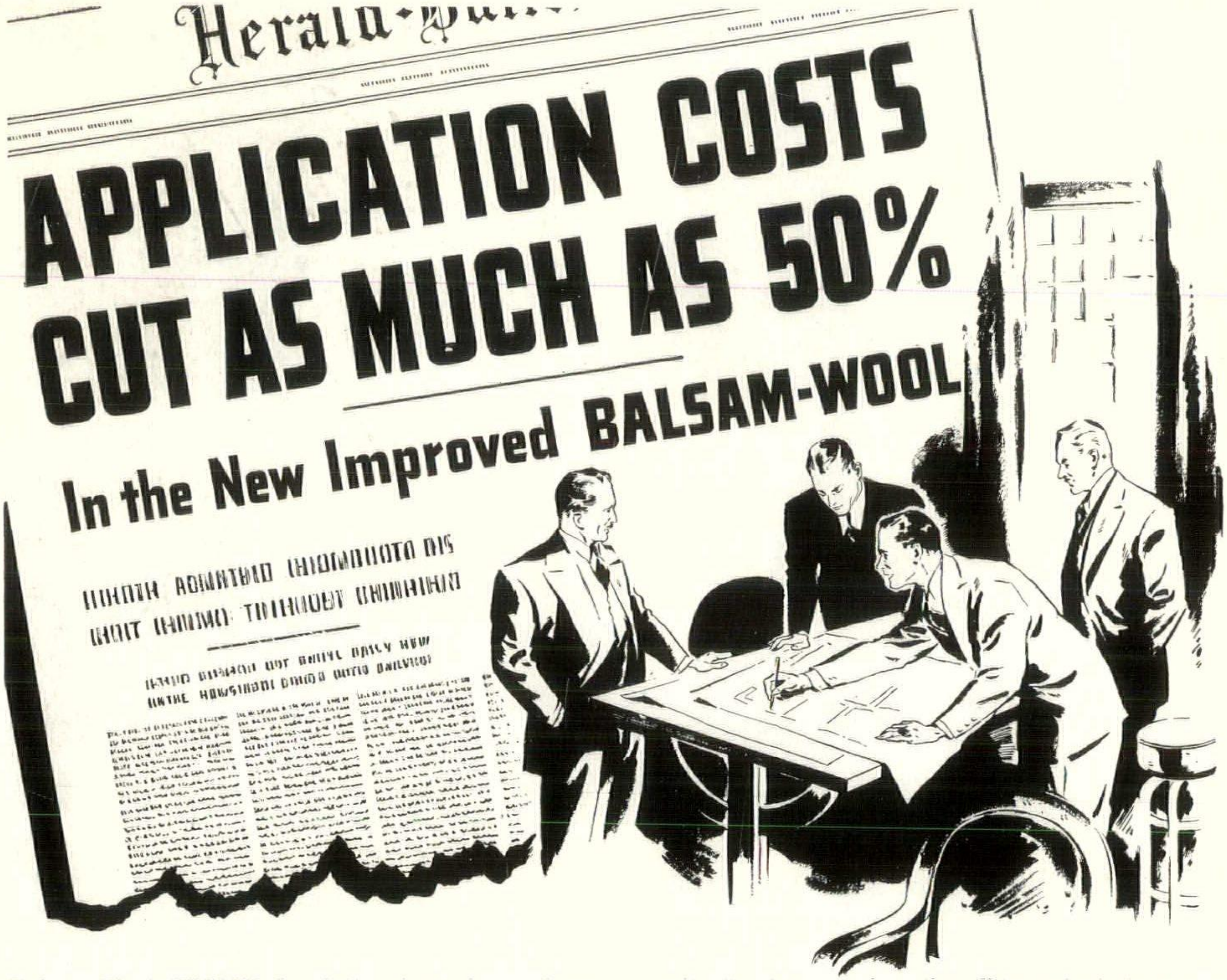

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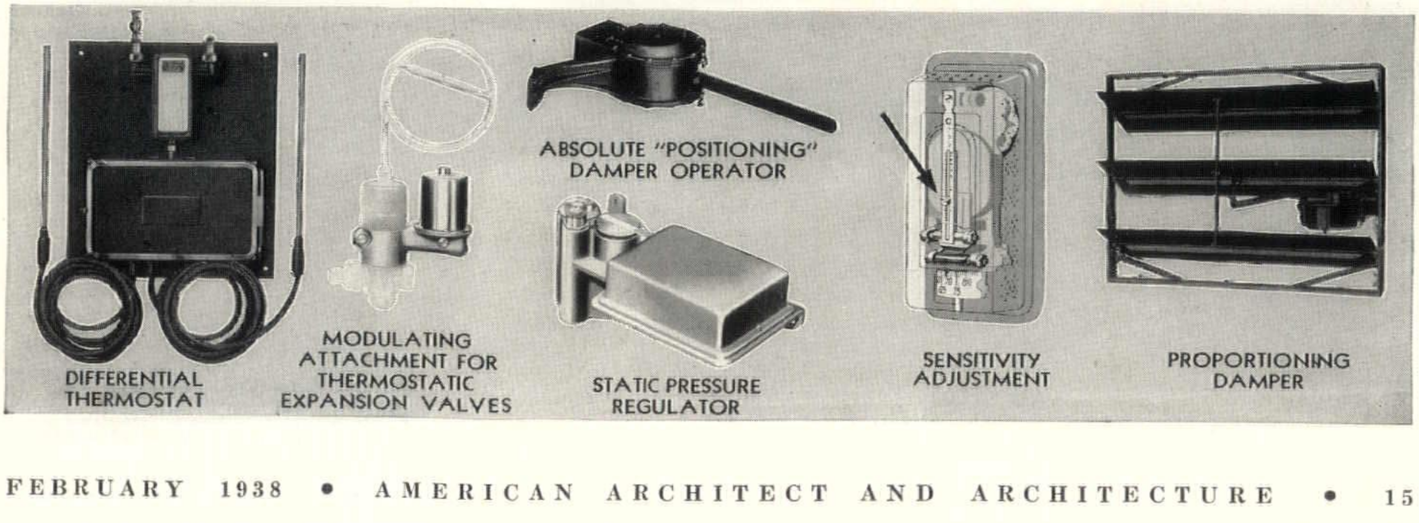


TRENDS . . . .

in the building industry to join architects in a mass attack on the housing problem. The fact that a housing shortage is imminent is, he believes, an encouraging factor. Pointing out the limitations of the market, Mr. McCornack cites figures of the National Housing Committee showing that 2,000,000 dwelling units are needed by families unable to pay more than $30 per month rent, with 78% of them unable to pay more than $25 per month. This means, he says, that the average cost per unit cannot be more than $2,500, with a goodly number at $2,000. Present methods are of little value in meeting these limitations, he concludes, and it is apparent that a new approach must be devised—to the development of which all branches must make concessions and contributions—if this vast market is to be served.

■

Plans for a huge home-building industry, capable of producing more than one million low-priced, single-family detached homes a year, were outlined at the recent Home and Community Builder's National Association convention in Washington. At this meeting leading community builders from twenty-five states, gathered to launch a $2,000,000,000 home building campaign in 1938, agreed to throw their strength behind a plan offered by Don A. Loftus, president of the association and head of Permanesque Homes Village, Inc., at Alexandria, Virginia.

This plan provides for the formation of a private corporation through which licensed community builders in cities of 20,000 or more in population may purchase plans and specifications, materials and equipment, to be used in the construction of specially designed houses.

The plan envisions an extensive educational program, conducted by the Home and Community Builders' Association through newspapers, radio and other publicity media, in which the trade name of the construction type will be prominently featured, along with the name of the local development. Mr. Loftus explained that merchandising methods would be similar to those of large national advertisers.

More than 2,000,000 sets of plans and specifications for low-priced homes are now available for use by qualified community builders, similar to those used in the Permanesque development, Mr. Loftus said.

In accordance with the general plan, these homes would be sold, through display models, with house and lot as a unit, in advance of construction, at prices within reach of the middle class. At present the plan specifies a 20 per cent down payment; first mortgages and two-thirds of the appraised value of the property at low rates; junior mortgages, if necessary, at 5½ per cent interest. Mr. Loftus said he had received definite assurance that large financial institutions and life insurance companies were ready to back the plan with upward of $5,000,000,000.

Members of the association and others attending the convention estimated they could produce an aggregate of $50,000,000 worth of homes this year under the plan, and an additional $50,000,000 was indicated by correspondence from other community builders.

Cities in which operations are expected to start immediately as indicated by the response are Boston, New York, Philadelphia, Pittsburgh, Indianapolis, Chicago, Cincinnati, St. Louis, Atlanta, Boston and Washington.

That this is a development well worth watching cannot be gainsaid. However, the provision requiring a 20% down payment, in view of the finding of the National Association of Real Estate Boards, would seem to limit the applicability of this plan to the problem of those in direst need of low-cost housing.

■

The Housing Division of the P.W.A. reports that in a group of 13 low-rent housing projects—8 located in the South, 5 in the North—the average cost was $979 per room, a figure below that attained by private builders for comparable construction in the same localities. It is pointed out that the comparison does not equalize the facts that P.W.A. expenses were lowered by lower interest rates and the absence of an allowance for profit.

■

Pittsburgh and Allegheny County provide an outstanding example of the nation's housing needs, says a report of a three-year social survey of this region just issued by the Columbia University Press. According to this report, new family quarters equal to the whole number of new units built in the city since the War, about 27,000, would not be an over-estimate of present requirements.

The report pleads for a double-barrelled attack on the problem of providing low-cost housing. First, the elimination of unsafe and unsanitary dwellings and, second, the provision of adequate low-rental homes to take their places. The modern housing program, it is stated, should proceed along a definite ordered schedule to plan and zone intelligently, to build homes in large quantities for low-rental families, to eliminate bad housing and to enforce health laws and building codes. New construction of low-rental housing may be attempted by private capital, but requires in the beginning, at least, public subsidies. It is also set forth that these subsidies, whether Federal or municipal, should be placed under local housing authorities.

■

Colonial styles of architecture still enjoy highest favor in Westchester County, New York, one of the outstanding residential sections of this country. At least one may assume so from the answers to a question asked eighteen representative architects by the Rye Ridge Realty Corporation. This concern, in answer to its query regarding the trend of Westchester architecture during the next decade, found that a majority of architects expect that the Colonial-type home will continue to be the standout, ten of the eighteen indicating it to be their preference.

The opinion of William Carter Halpert, vice president of the Westchester County Society of Architects, is quite representative of the others; in brief, he feels that the conservative attitude of Westchester residents shows no marked change. "The modern or functional styles have obtained little acceptance," he says, "although they have had influence on both planning and details. The most popular present style is derived from the American Colonial. The Williamsburg restoration in Virginia will doubtless accelerate the movement toward the Georgian style as the public becomes familiar with the enduring charm and dignity of buildings of that period."

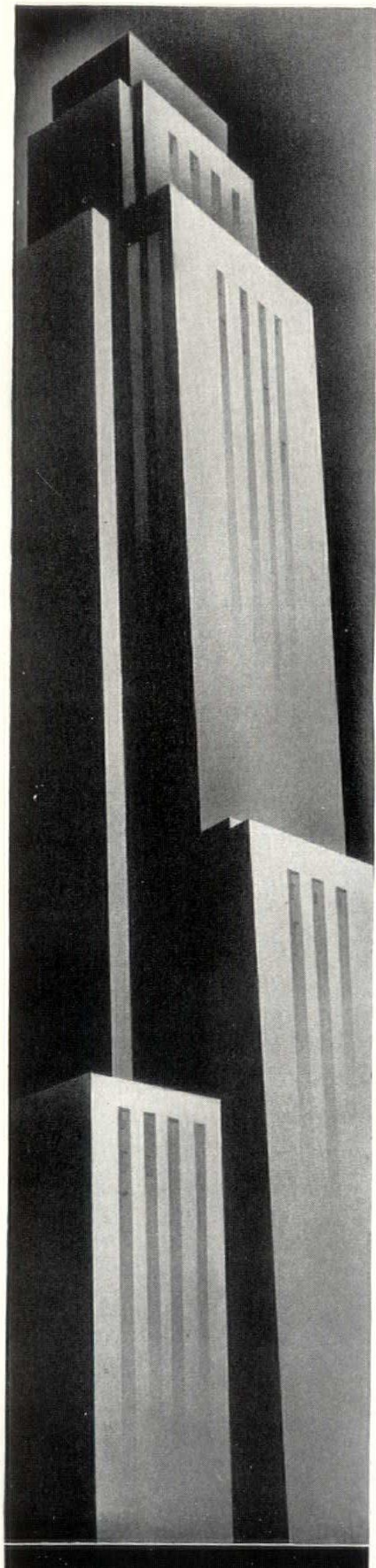
■

THE COMPETITION MOVEMENT

Continuing its fight for competitions as the suitable means of providing designs and architectural talent for public construction activities, the New York Chapter of the A.I.A., through its committee on public information, of which Wesley S. Bessell is chairman, issued a statement recently disclaiming hostility to the merit system governing employes in public service.

In advocating the selection of architects for public service by open competition, the architectural profession has been accused of attacking the merit system, the statement explains. The contention is made, it is pointed out, that the public interest is better served by Civil Service workmen because work is done by them at a lower cost to the Government than under guidance of the private architect. "We do not believe this contention can be substantiated," declares the statement.

(Continued on page 104)



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CONCRETE JOIST CONSTRUCTION

ARCHITECTS..

AYMAR EMBURY II SEE PAGES 25-28

was born in New York City in 1880 and received his early education both here and abroad. In 1900 he was awarded the degree of C. E. from Princeton University and in 1901 the degree of M. S. His architectural training was received in the offices of George B. Post, Cass Gilbert ("the most useful of all"), Howells & Stokes, and Henry Hornbostel. The first work done under his own name was in 1902, and three years later he established his own office, practicing independently ever since with the exception of fifteen months' foreign service during the war. Appointed architect to the Port of New York Authority in 1932, Mr. Embury has been associated with a variety of municipal engineering projects, among them the Triborough Bridge, the Henry Hudson Bridge, Marine Parkway Bridge, and Whitestone Bridge on which he is now engaged. In January 1934 he was appointed Consulting Architect for the Park Department of the City of New York, and since that time has been in charge of the architectural design of the department. He adds, "For the benefit of those in my profession who think that I have made a fortune, all these jobs have been salary jobs and in the case of concentrated activities, one salary has been apportioned among several enterprises."

ROLAND A. WANK SEE PAGES 29-38

answered our request for biographical material with a characteristic sentence, which went in part, "for gosh sakes, don't give me any more credit than I am asking for." Connected with the Tennessee Valley Authority since its organization in 1933, the Wanks have played a consistently important part in the intellectual and out of door life of Norris. He paints in water color and has organized a drawing class. Both he and his wife swim incredible distances, row and ride horseback but, most important, they inspire conversation with good Hungarian food and his mother, a pianist, inspires silence with Bach and Brahms. Born in Hungary, he received his training at the Royal Technical University and the Academy of Fine Arts in Budapest and the German Technical University in Brunn. After war service as an officer in the Austrian army, he became Chief Architect of a large German firm on industrial projects and housing. In this country he was employed by Fellheimer and Wagner on the Cincinnati Union Terminal, Toronto, Hamilton and Buffalo station (AMERICAN ARCHITECT and ARCHITECTURE, July 1937) and other semi-public work. Previously he had been with Springsteen and Goldhammer on the Grand Street Apartments, "Our Apartment House," and other housing projects.

PASQUALE IANNELLI, SEE PAGES 61-62

as the name implies, is of Italian descent. One of the youngest designers who has contributed to AMERICAN ARCHITECT and ARCHITECTURE, his architectural training has consisted primarily of practical experience. An architectural course in high school completed his formal education and thereafter he resorted to the professional journals, field observations, and leading text books for further study. To more fully understand the fundamentals of architecture, he decided to engage actually in the construction of projects that he had planned, one of which was the Gardner residence, herein presented. His later work has been the planning and construction of a new restaurant in which glass blocks, similar to those used in the Gardner residence, play a large part. At present he is working on plans for a number of small, low cost, fireproof houses, in which lightweight insulating blocks are the standard unit of construction. Because of his practical experience, youth and freedom from many of the clichés of formal architectural education, Mr. Iannelli approaches each architectural commission as essentially a problem of soundly constructed shelter instead of a problem in style. Thus with this philosophy and experience at the age of 26 years, his future work should be worth watching.

MORLEY J. WILLIAMS, SEE PAGES 41-52

Director of the Research and Restoration Department of the Mount Vernon Ladies' Association, started research into plantation estates of Maryland and Virginia under a grant from Harvard University, made in December 1930. Special Mount Vernon research has been carried on since the summer of 1931. Previous to this time, Mr. Williams was for six years a member of the Faculty of Architecture of Harvard University, teaching construction and assisting in a course in Fine Arts. He has made research surveys at Monticello, home of Thomas Jefferson, Stratford, birthplace of Robert E. Lee, and a number of other old Virginia properties. His education and experience covered engineering dams and the designing of concrete and other buildings. After three years' graduate work at Harvard University he was appointed Sheldon Traveling Fellow and he traveled a year in Europe and Northern Africa. Assisting Mr. Williams in the Mount Vernon research are Lawrence A. Emerson, graduate of Carleton and Harvard, Alden Hopkins of Rhode Island State and Harvard, John D. Scruggs of Berea and Harvard, Barbara Smith of Smith College and the Cambridge School of Domestic and Landscape Architecture, and Nathalia Ulman of the Cambridge School and M. I. T.

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"Eagle White Lead and Eagle Lead Reducing Oil are especially good for Sewickley homes because the paint can be washed periodically. Smoke and grime are easily removed. Homes can be kept spic and span white for many years."

RIGHT. Stucco home in Sewickley, Pa., painted by David Rupert with Eagle White Lead and Eagle Lead Reducing Oil.

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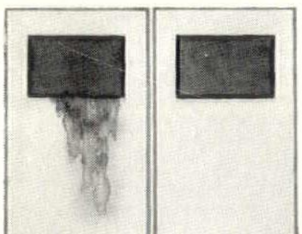

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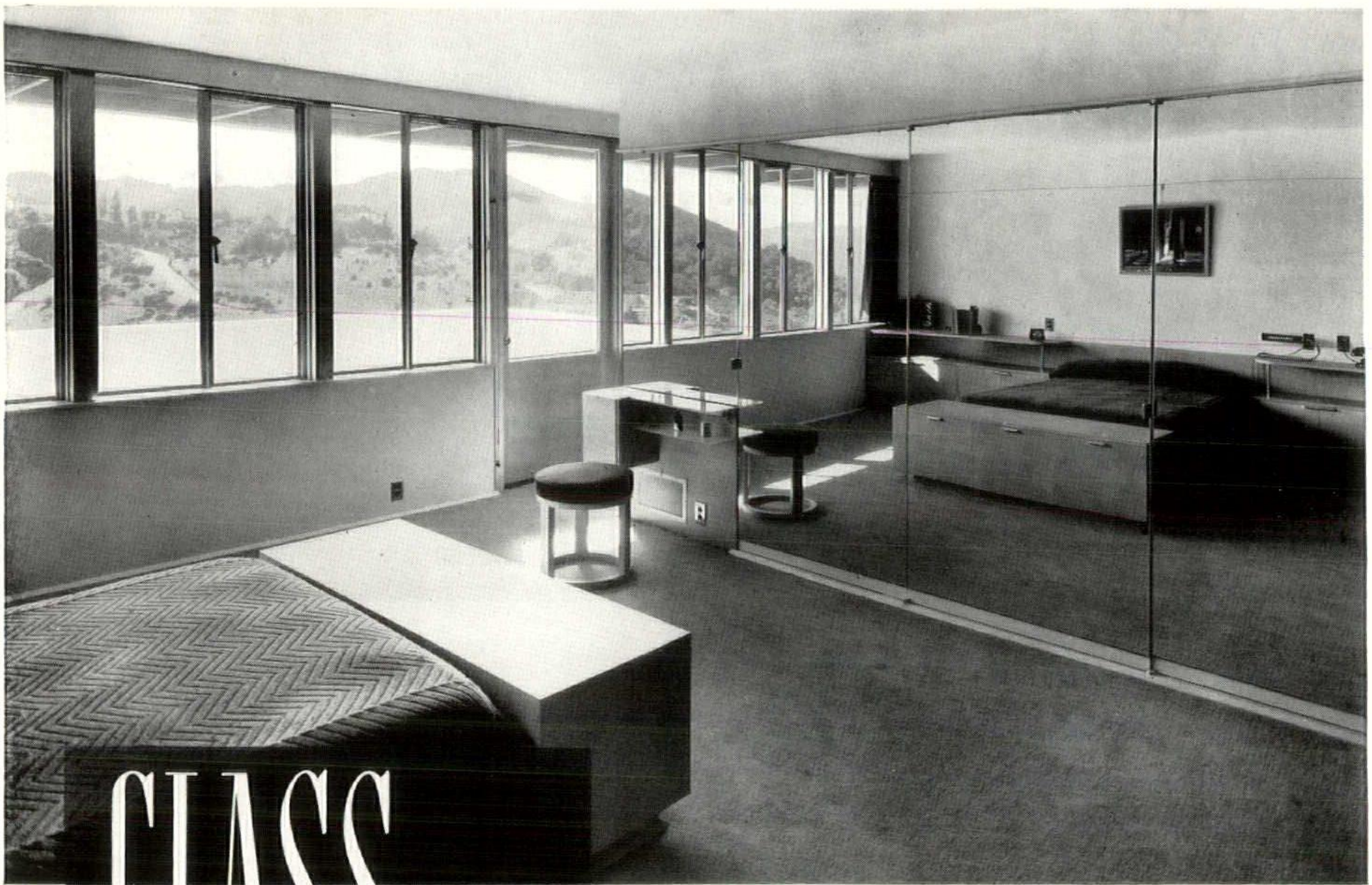

GLASS . . .

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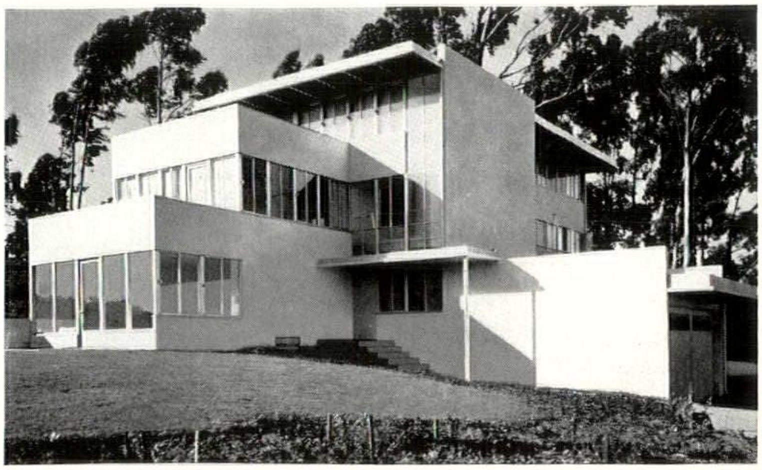

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PROFESSIONAL DESIGNERS

THE late 19th Century saw the development of the "age of specialization." Buildings became very complicated in their mechanical and structural aspects, and the architectural profession, as we know it today, developed. As architects, we have become specialists in the design of buildings only. The very name architect today implies this limitation. Now we have further subdivided into specialties and become known as school architects, bank architects, commercial or domestic architects, but, by being thus known, we have lost our universality and perhaps the opportunity to exercise our versatility. This—plus the fact that the public has a fixed, if erroneous, idea of what an architect does and does not do (not altogether complimentary to the profession)—has stood between us and the possible greater use of our talents.

Circumstances have provided the opportunity for a number of designers to step into the larger field of design and to publicize their ability to provide designs for anything and everything, buildings included. Starting with gadgets and domestic utensils, their talents are employed on machines, vehicles and exhibitions. Their sleek, simplified, "streamlined" designs for ships, shops or suspenders provide the selling slogan of the day. They and their staffs will style the exterior appearance and determine the colors, materials and forms of any physical object, especially th designed for mass production. They are above the self-impos limitations of the architect, and because they speak the langua and adopt the sales techniques of their business-men clients wh are interested in merchandising, their services are growing i demand.

Many young architecturally-trained men find an outlet for thei creative abilities in these unlimited design offices. In the industrial designer's office they need not be bothered with the structural and mechanical drudgery, as usually this phase of production will be turned over to the technicians of the manufacturer, or, if a building is being designed, engineers or other architects will have the problems of making the working drawings and worying about the structure and equipment.

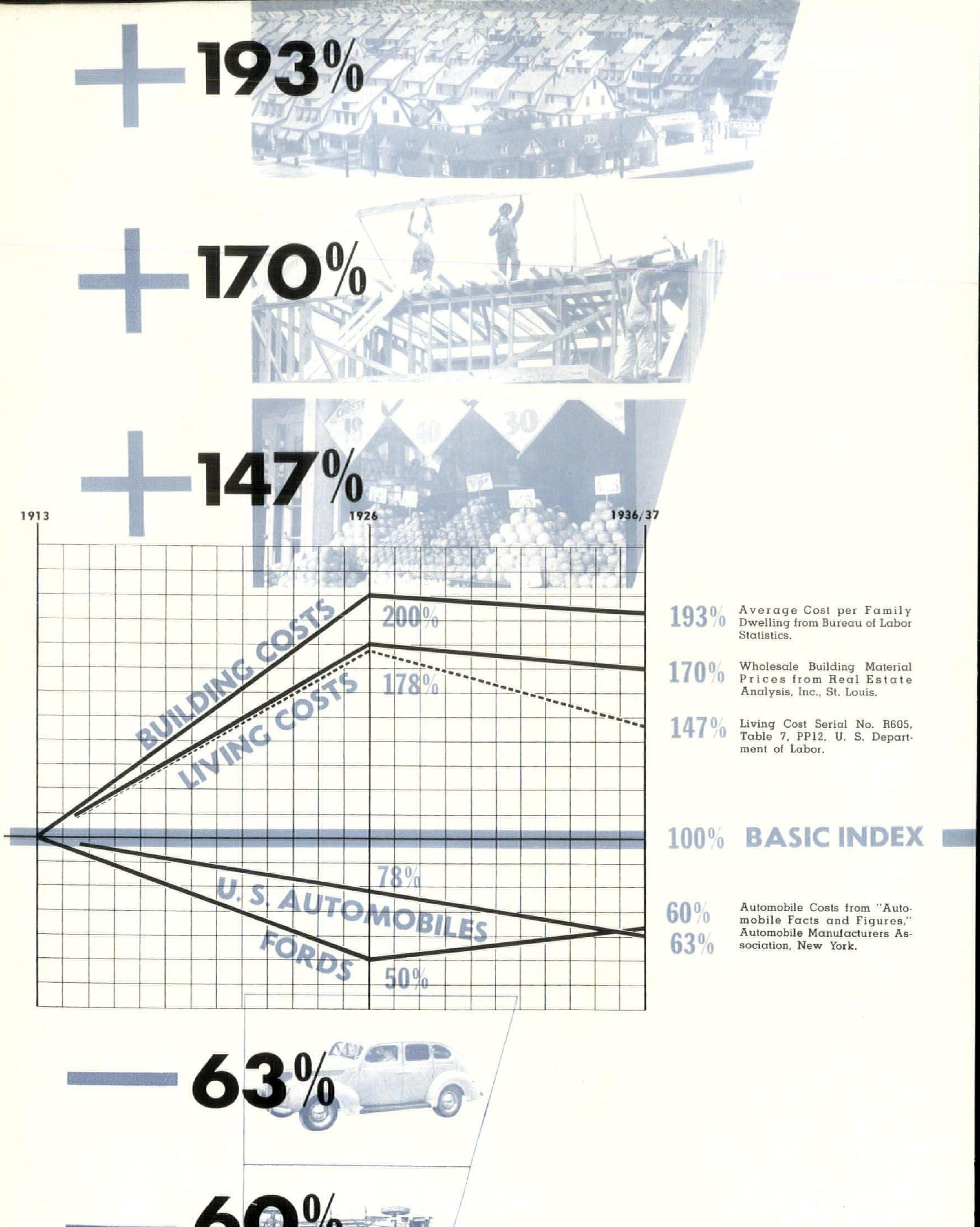
Michelangelo, Bramente and famed Leonardo were designers unhampered by the appellation "architect" in its modern sense. Even Robert Adam provided designs for almost everything that went into his houses, as well as for the house itself. We are glad to see more and more of our architects expanding into greater fields of usefulness and exerting their influence on the design of all things we see and use. Why cannot the architect of today be the industrial designer also?

A FORGOTTEN WORD

I REMEMBER that about a quarter of a century ago most architectural schools in their prospectuses referred to architecture as "the fine art of building." The emphasis was on the art, and beauty was a word frequently used and a quality diligently sought in designs. It was assumed, in those good old days, that the plan articulated properly, that services were grouped for convenience, that adequate circulation for communication and control was provided, that all space was used properly and not wasted. In addition, the courses in construction impressed on the student that certain ways of enclosing space and spanning a void were more efficient and more economical than others. Functional planning was just called "making a plan that works." This and structural safety were taken-for-granted elements in the endeavor to produce a beautiful building. If anyone told the student that he was involved in the science of "enclosing space economically for efficient use," he would have replied: "Sure, that is the basis of architecture, always has been, but we go on from there." Then he would have described how well he had organized his units, his areas, his materials, and his fenestration to produce a building of beauty and distinction. He would probably have used such words as relative proportion, balance and symmetry. He would have talked of the distribution of the elements of his composition for emphasis, the use of light and shade on moldings and surfaces to produce a pleasing effect, the introduction of color, of visual accents introduced by sculptured ornament. He was interested in architecture as a Fine Art and was not afraid to use the word beauty. And he went pretty far, rather in a spiral that led to an Ivory Tower, a bit apart.

The pendulum has been swinging in the other direction for 25 years, gathering momentum. The things that were taken for granted in the design of buildings are now receiving all the emphasis and the adjectives used are "efficient," "swell," "functional," "clean"—and the word "beautiful" seems limited to the designation of feminine pulchritude. This reaction has succeeded admirably in ridding us of our inhibitions regarding the expression of our own age. It has created a dissatisfaction with the emphasis on exterior decoration by the appliqué of the forms from the past. Ideas of beauty change with the changes in emphasis. The things admired in one epoch are ridiculed in the next, and years later their good qualities are rediscovered. Within the next decade our new architecture may have developed so that the forgotten word beauty will be used to characterize it again. The student of yesteryear was referred to the books to see how architects of the past had achieved beauty in their buildings. They were steeped in the tradition of the past. Now even the word "tradition" is anathema to those who are following the new tradition. Objecting to the clichés, plagiarisms, copying of the past, they still find it advisable to use, without hesitation, the clichés of "modern," the flat roof, the vast expanse of glass, the cantilevered projection, the round bay, the pipe column. Inexpert handling has produced some ugliness, awkward shapes, and ungainly compositions.

Kenneth K. Stowell EDITOR



DESIGN BY HERBERT MATTER

TOWARD A LIVING ARCHITECTURE

BY DR. WALTER GROPIUS

II A WAY OUT OF THE HOUSING CONFUSION

THE idea of eliminating waste by rationalization has permeated the modern life of communities and individuals alike. But rationalization must not be mixed up with ability to produce profit, because social requirements of the population, as well as economic problems, are involved.

● The rationalization of building should imply collecting, concentrating and unifying all isolated efforts for the various building activities in order to obtain a general plan covering the building field.

● Creative research for improvement and refinement can become effective only by systematic organization of the existing material and mental equipment applied to the process of building and by their mutual interrelation. Most delay in the progress of modern building is caused by lack of unification.

● Housing, the most urgent and also the most complicated building problem, illustrates this statement strikingly: Today, the main task of the building profession—socially and technically—is to build up an adequate service to provide sufficient, decent up-to-date dwellings for the community. These buildings, which have to satisfy the material and psychical requirements of life, must be constructed at the lowest possible expense of time and material, and at a price the average man can afford. Is this sort of dwelling on the market? No, it is not. Although the average man buys his food, his clothing and his other every-day goods at a reasonable price, adapted to his income, the only dwelling he can obtain is an obsolete building originally built for more wealthy people, and now out-of-date.

● Recent governmentally-built settlements around New York, Boston and Cambridge show these facts: (1) About forty-five per cent of the building capital provided by the government is in the nature of a subsidy, necessary in order to obtain fairly decent dwellings which will rent for from seven to eight dollars a room per month. (2) This price is still much too high to be afforded by the average man. (3) About three-quarters of the population, with an income of one thousand to fifteen hundred dollars or less, cannot pay more than four or five dollars a room per month.

● Something must be wrong with the whole building trade if the rent of even these dwellings, only half paid for by their tenants, remains out of reach of the poorest people. Here it becomes evident why the market is not interested in building dwellings for the average man in spite of the wide demand. Prices and rents, which give the builders and owners of dwellings a good profit, are far out of proportion to the prices of all the other articles in daily use which are well adapted to the average income. What is the reason for this devitalizing process? What must be changed in the economic structure in order to rebalance the market price of adequate dwellings?

● In 1928, I discovered in this country a most illuminating diagram, roughly comparing the trend of prices for building and for automobiles between 1913 and 1926. It shows the remarkable fact that, within the same period (thirteen years), the average costs of building were doubled, whereas the price of the Ford car was halved. The greater proportion of hand-work involved in building increased the price in accordance with the increasing labor costs. Refinement of mass production methods, on the other hand, considerably lowered the price of automobiles. A decent dwelling became unattainable for the poor, yet the car became an everyman's tool. The up-to-date completion of the diagram shows that the price of the average car has steadily declined, whereas the cost of the average dwelling has been only slightly lowered since 1926. This diagram reveals that our building methods — being far behind the times — are not fit to solve the problem.

● As building is the most extensive and complicated field of human production, it could not keep pace with the development of the machine—and it is the last field to be conquered by it. Further, there is no balanced organization of the building trades yet, as there is in other industries; it is still rather tied up with hand-work and individual management which, forced into competition with industrial methods, have lost their former quality and efficiency. Although more and more parts of the building are constantly being made by machine, progress is hampered by lack of comprehensiveness, with which this problem should be attacked as a whole. For this is not a problem of mere manufacturing. Surely mass production methods must eventually permeate the building trade; but deep changes in the economic structure are indispensable before the market will be ready for prefabrication on a large scale. The first enthusiasm towards prefabrication has calmed down, after many drawbacks have given evidence that no single person or single firm alone can solve that gigantic task as Ford solved it for the automobile. The solution of this problem seems to be self-evident; yet, it is so deeply rooted in our economic structure that the community as a whole can master it only by attacking it from all angles simultaneously. It is, first of all, a problem of integration. Much time will be gained, therefore, if a comprehensive scheme of action is set up by the best experts, co-operating in all the many fields of building activity. A guiding key-plan offers authoritative significance which should direct the future efforts towards housing. The many brilliant private efforts, now lost by isolation and lack of power, must be united.

● It is obvious that private enterprise, in its struggle for existence, is bound to overemphasize subjective interests. A public institute, however, would be apt to investigate more objectively all sorts of ideas and inventions and their practicability for the good of commonwealth. Only technological approach, undisturbed by any political or private interference, can set the standard.

● An Institute of Building Integration should be created, in which federal, state, and municipal authorities would co-operate with architects, engineers, contractors, manufacturers, trade unionists, and consumers, to further the common good; where all the existing institutions for public and private research and building practice could exchange their experiences and results and also acquire a better insight into the difficulties of correlated problems; where the inter-relation of everything concerned with housing would be the major task, set above the innumerable special problems involved in housing.

● The key plan to be set up by such an Institute certainly would be most complicated, as everything would have to be considered which would help to bring down the prices of dwellings and to raise the social standard.

● Primary considerations would involve:

Lowering the costs of land by legislation without shaking basic conceptions of property.

Preparing the investment market for prefabrication and for the idea of housing service (lower interests and shorter amortization).

Regulating regional planning by inter-state legislation.

Improving building regulations by adapting them to new building techniques.

Research in the most suitable form of dwellings—separate houses, blocks of medium height (3 to 5 stories) or tall blocks (10 to 12 stories).

Research in the most socially and economically suitable types of dwelling units.

Unifying the standard sizes of the component parts of dwellings in order to increase their practicability and to encourage prefabrication.

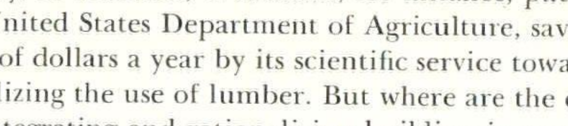
Research in standardizing prefabrication, including mechanical units—such as kitchen, bathroom, and air-conditioning plant.

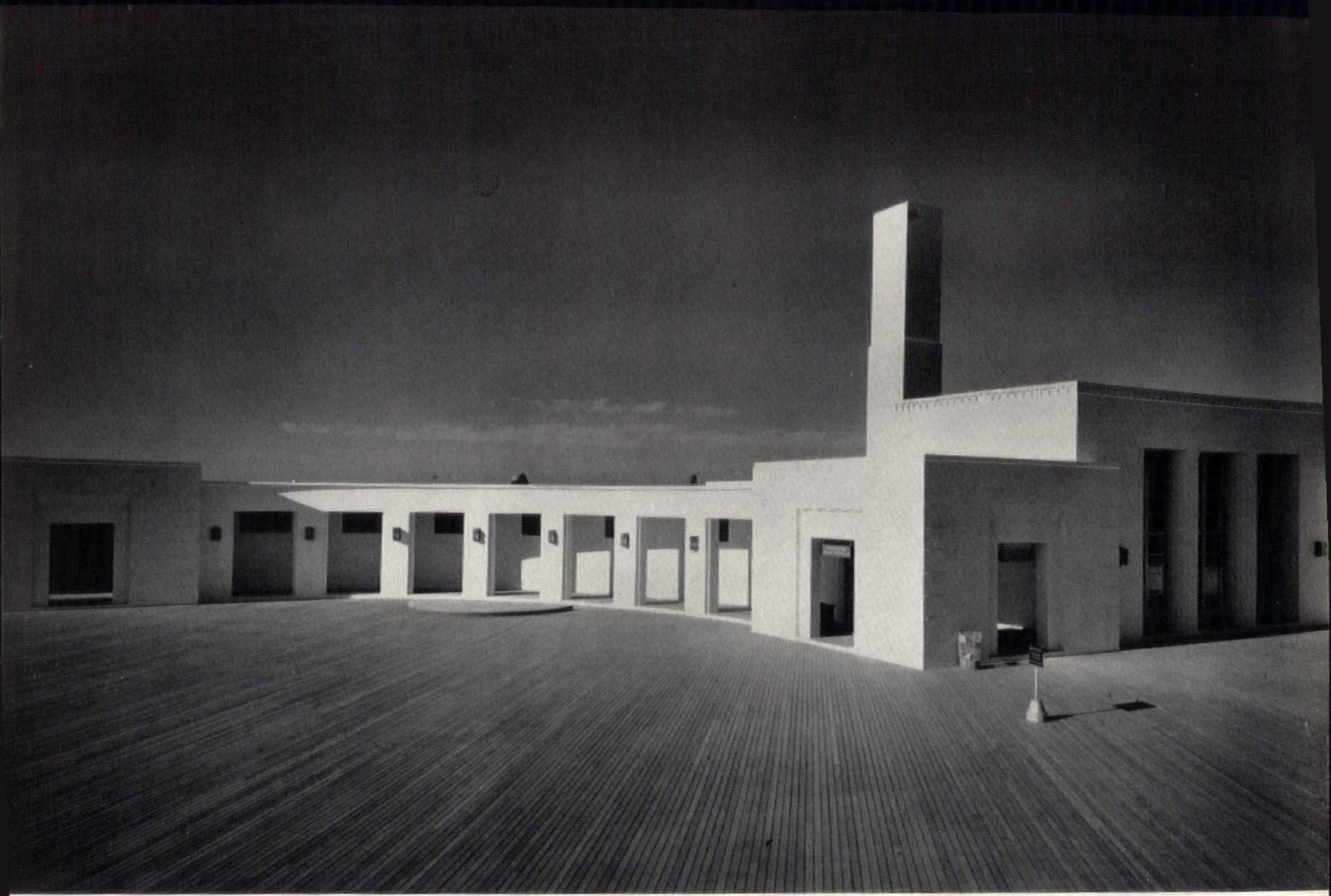
Simplifying the building organization in offices and on building sites, and . . . the many minor fields of rationalization.

● No doubt all these various realms are well looked after, but they are rather isolated from one another instead of being parts of a well-tuned organism which is so badly needed. The suggested Institute of Building Integration should fill this gap. But, as so much organization work would be involved, this should be its keynote: Rationalizing is no mere mechanical order; creative impulse must not be stunted by it.

● The costs for such an Institute, put up by the Government along these lines, seem to be irrelevant when compared with the savings to be expected from economizing on housing costs throughout the country by means of concentration and integration. The Forest Products Laboratory, in Madison, Wisconsin, for instance, put up by the United States Department of Agriculture, saves millions of dollars a year by its scientific service towards rationalizing the use of lumber. But where are the centers for integrating and rationalizing building in general to stop the enormous waste of money, time, labor and material on this largest field of production? During the war gigantic funds were spent for defense. Nobody asked for direct financial gain. Is defending health and welfare of the population by adequate housing less important? It is a startling fact that the amount of money spent by this country for the World War would be sufficient to furnish every second family in the United States with a decent new dwelling containing all necessary modern amenities. By proper rationalization, however, the efficiency of money spent for housing could even be doubled and bring this key-problem of social welfare close to its final solution, simultaneously increasing private initiative and employment.

Let us mobilize against the waste!

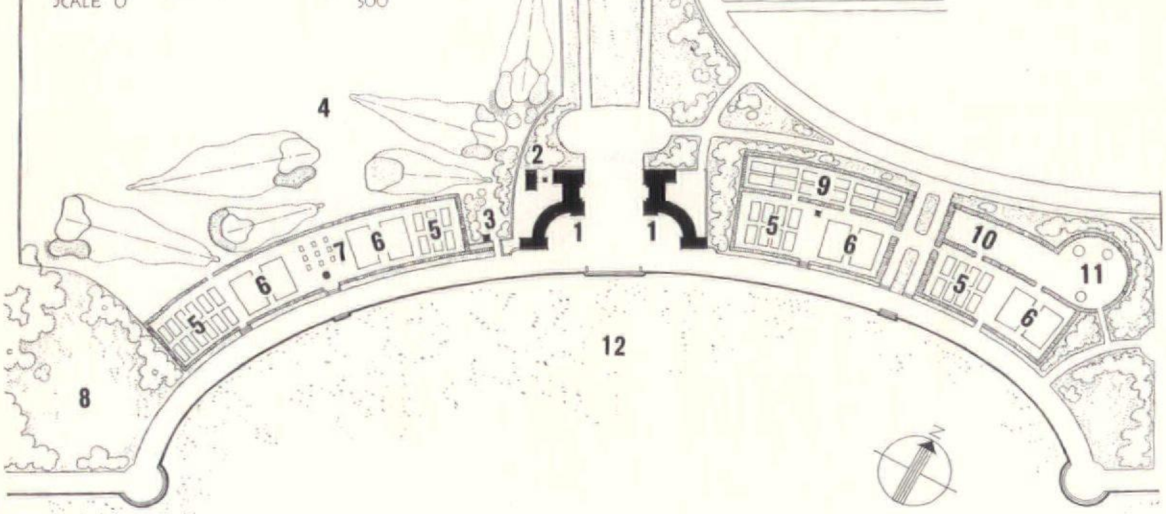




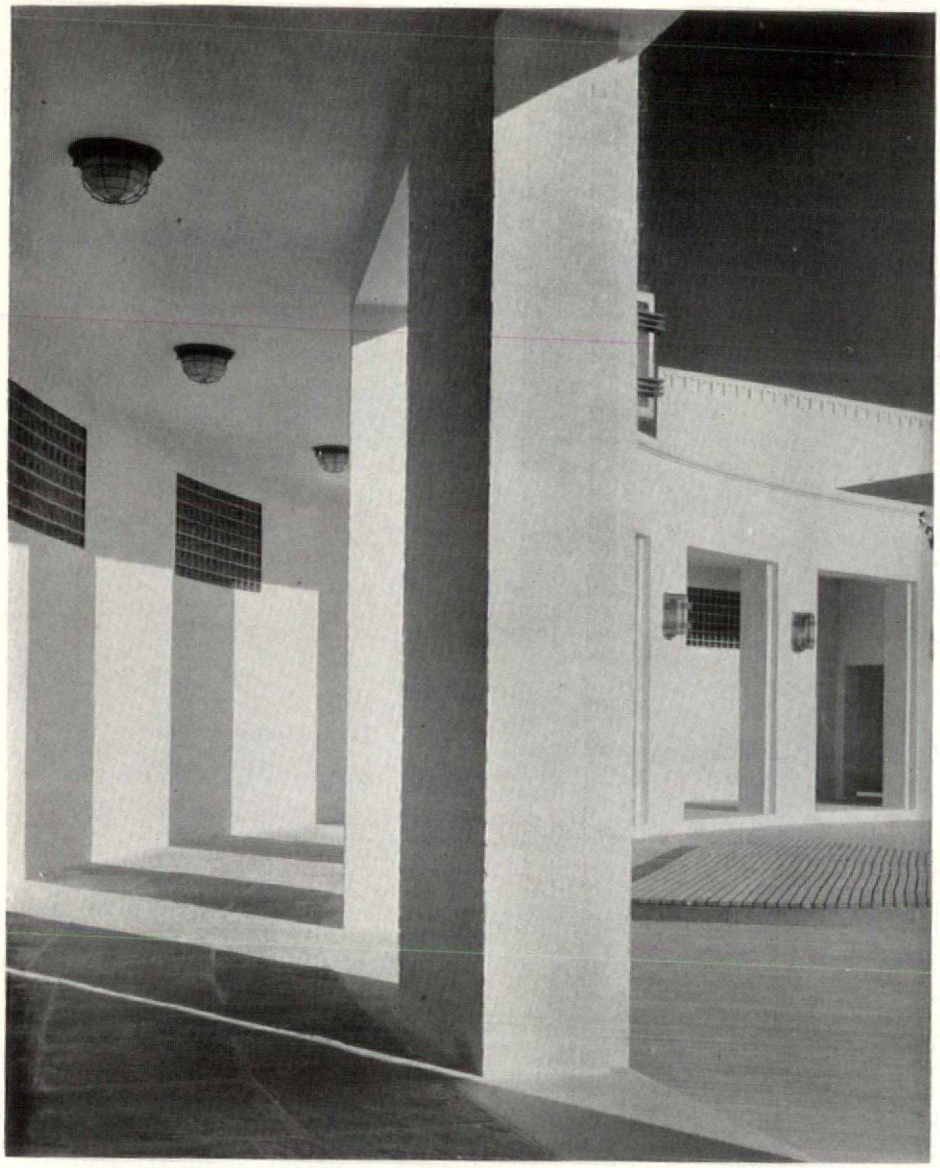
PHOTOS: SCHNALL

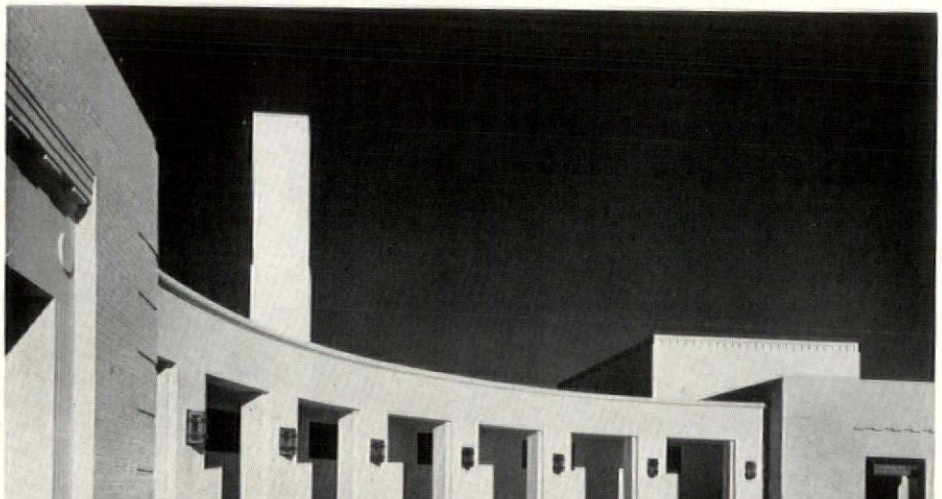
CENTRAL MALL BUILDINGS, JACOB RIIS PARK, N. Y.

DEPARTMENT OF PARKS, NEW YORK CITY, ROBERT MOSES, COMMISSIONER
FRANK WALLIS, DESIGNER, AYMAR EMBURY II, CONSULTING ARCHITECT



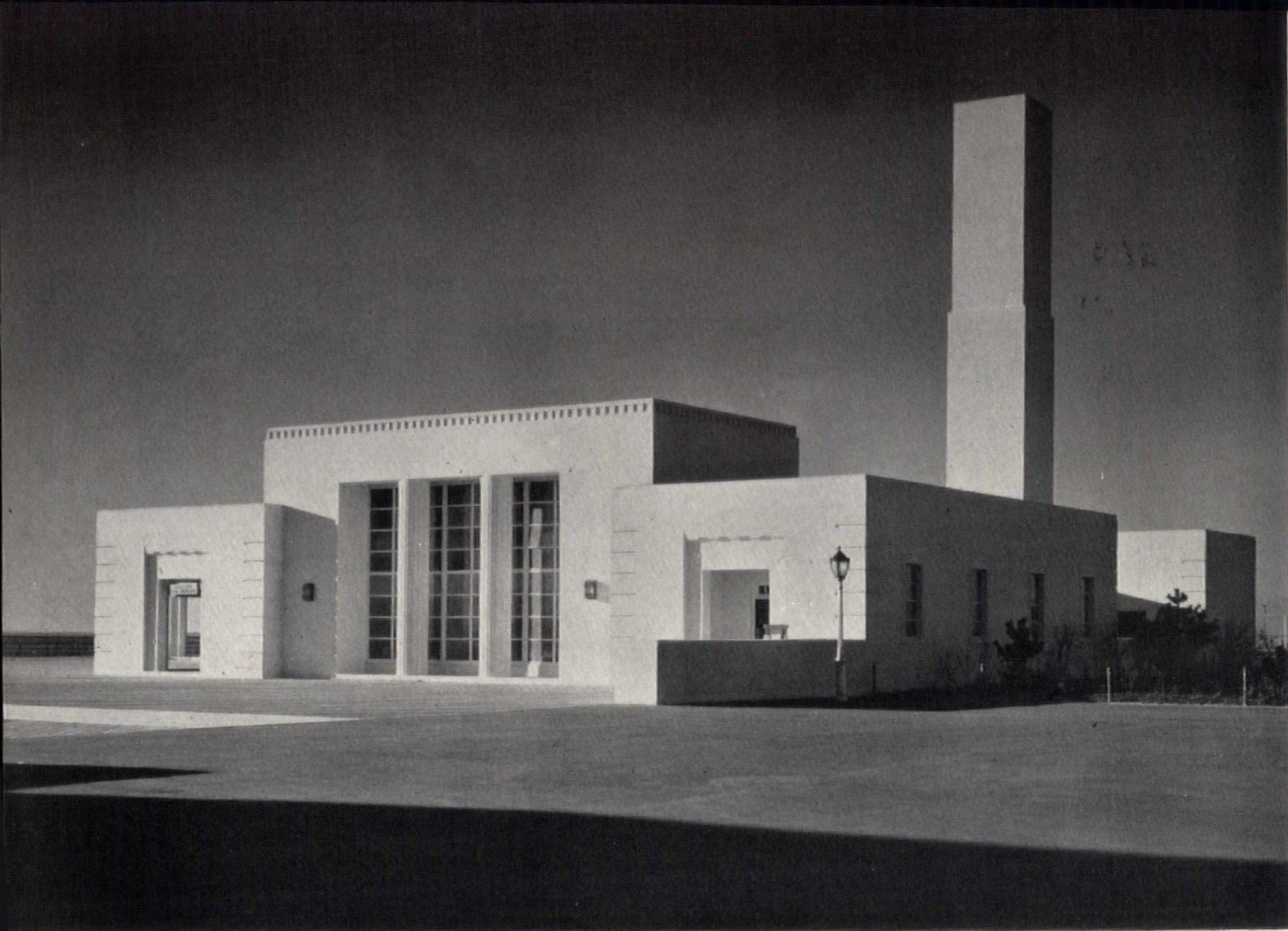
1 Concessions
2 Boiler Room
3 Golf House
4 Pitch and Putt Course
5 Paddle Tennis
6 Shuffleboard
7 Ping Pong
8 Informal Lawn
9 Handball
10 Children's Apparatus
11 Indian Village
12 Beach

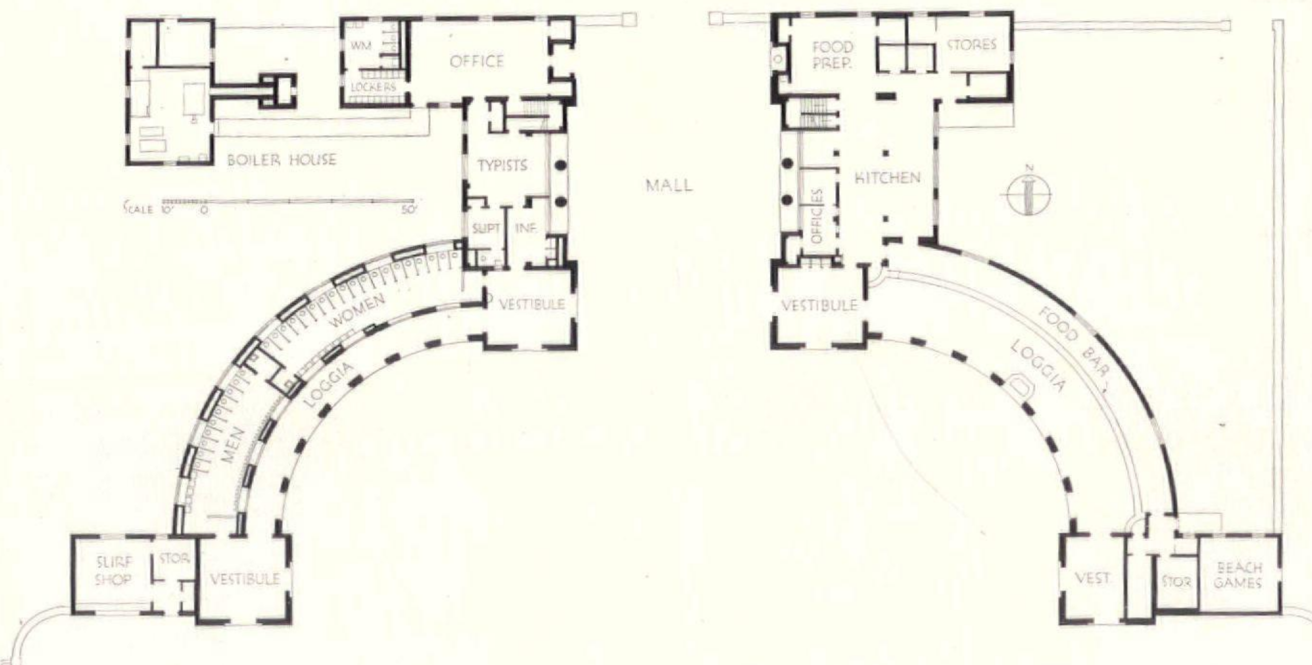




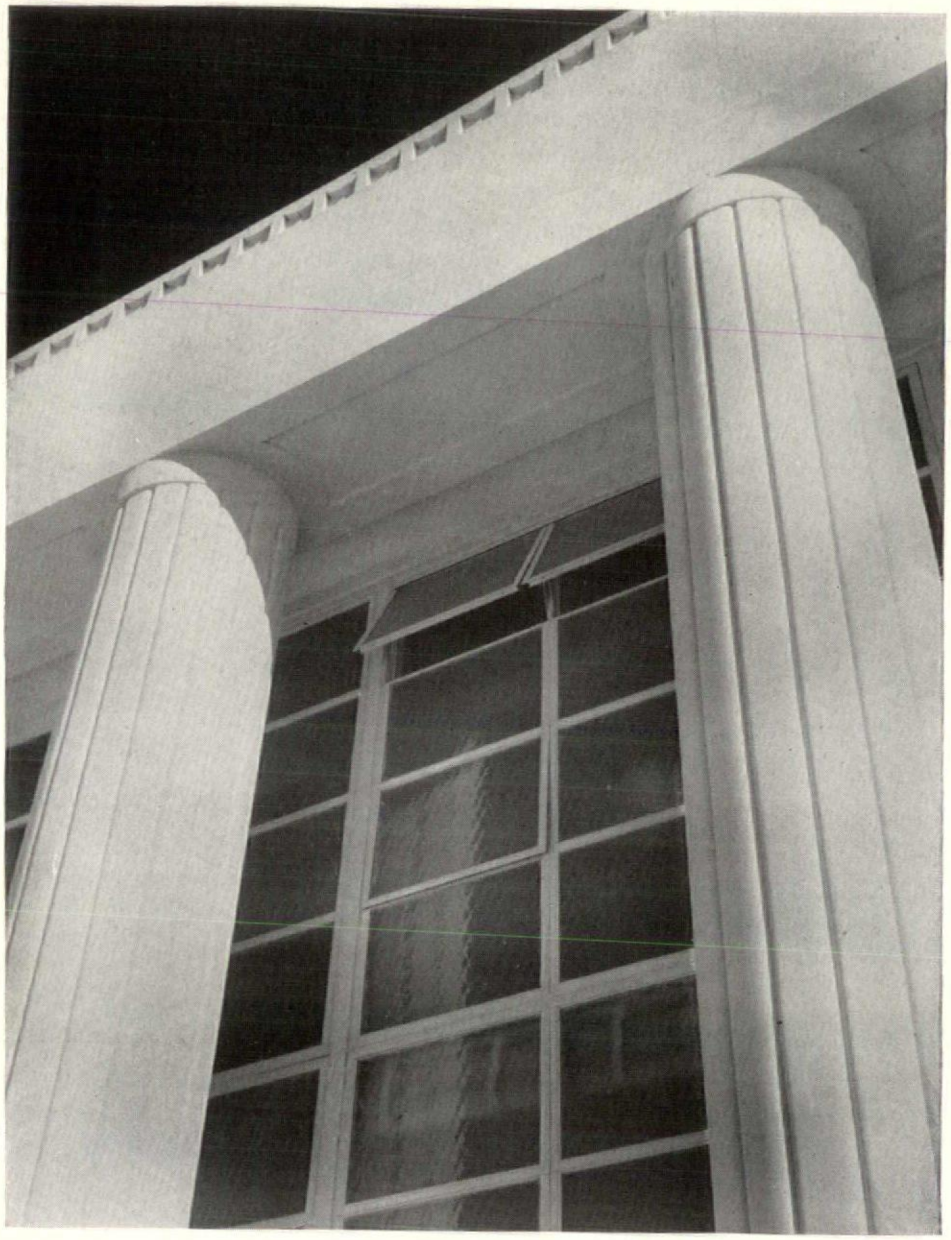
This is one of the most recent additions to New York's incredibly large civic improvement campaign which includes among other things additional transportation and recreational facilities. Prior to this campaign, there had been precious little precedent for good architecture and civic improvement in the role of handmaidens. Since taxpayers were inclined to think of the dollar sign as an esthetic symbol, dripping wedding cake ornamentation looked like full money value. It augurs well indeed that the citizens of New York like their new thoughtfully-planned but ornamentally-reticent buildings. This executive and concessions group is only part of the development.

CENTRAL MALL BUILDINGS,

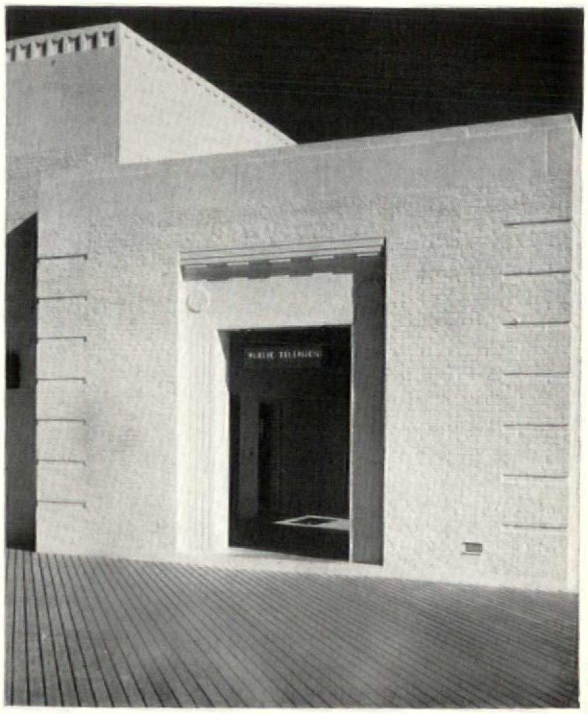




JACOB RIIS PARK, N. Y. • FRANK WALLIS, DESIGNER, AYMAR EMBURY II, CONSULTING ARCHITECT



Exterior walls are of painted brick, limestone and cast stone. Partitions and insulation are of terra cotta. The interior finish is of plaster and terra cotta. Foundations are of concrete while concrete and tile are used for roofing. Floors are concrete, ceramic tile and terrazzo. Windows are steel.



CENTRAL MALL BUILDINGS, JACOB RIIS PARK, N. Y.
FRANK WALLIS, DESIGNER, AYMAR EMBURY II, ARCHITECT

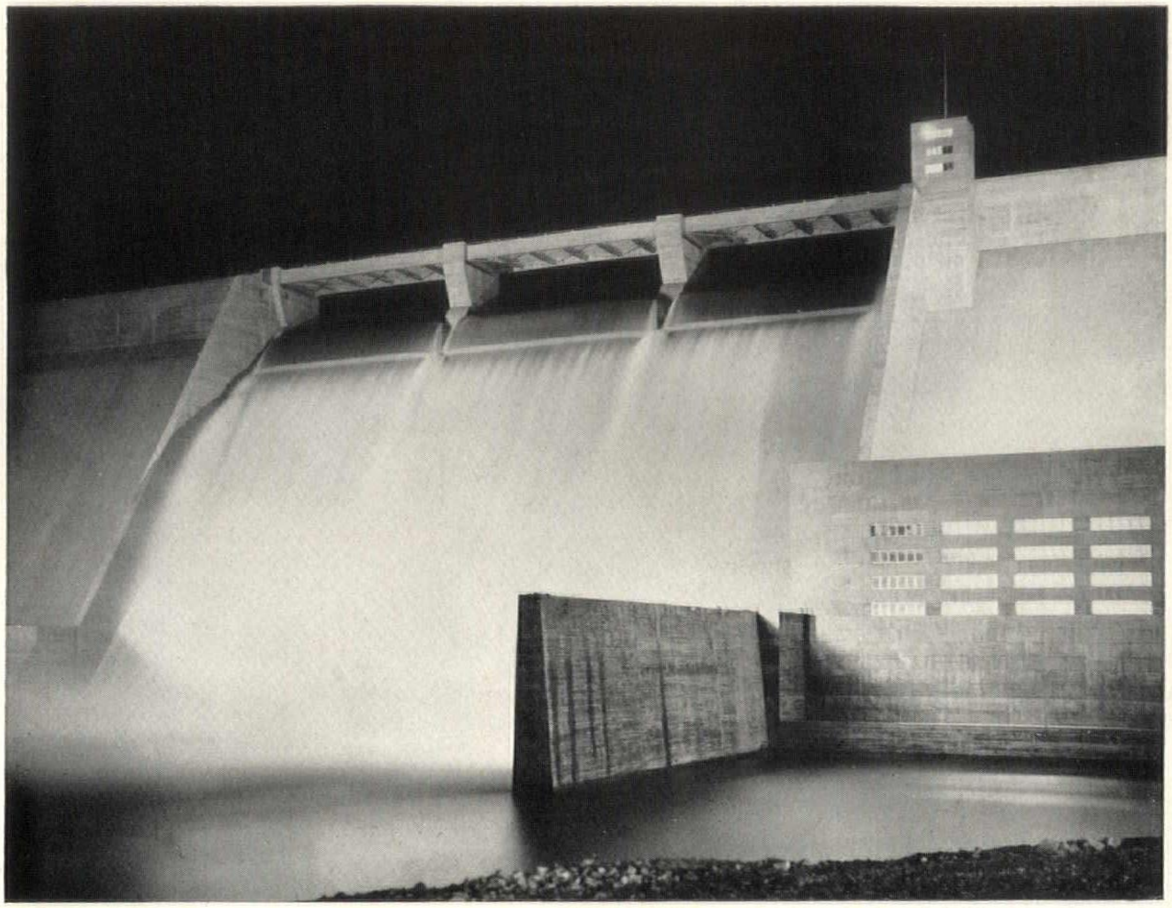


PHOTO: E. N. TORBERT, TVA

NORRIS DAM AND POWER HOUSE

By ROLAND A. WANK

Principal Architect, Department of Regional Planning Studies, TVA

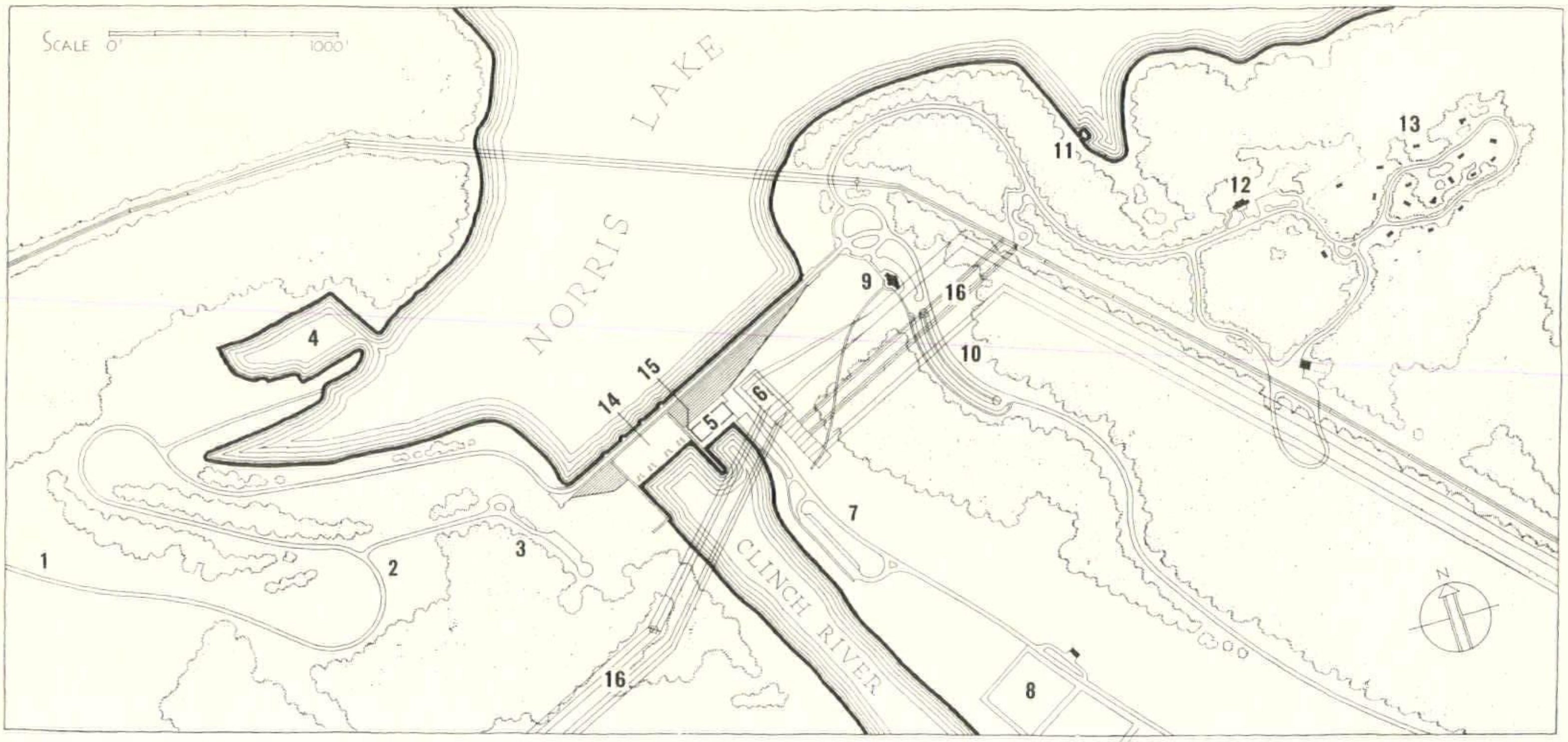
A STRUCTURE containing a million cubic yards of concrete would be impressive as an outstanding engineering accomplishment, if for no other reason than sheer bulk. When, however, the engineering requirements also embody esthetic qualities, as in the Tennessee Valley Authority's new dam at Norris in northeastern Tennessee, the result becomes of some importance in contemporary American architecture.

Nor is the site of this project so remote from access by the general public that the effect on popular architectural taste is rendered negligible. More than a million tourists and sight-seers visited Norris Dam last year. This widespread interest on the part of the public was anticipated from the inception of the project. The Board of Directors of the Authority and those in charge of the engineering program recognized that a work destined to dominate its surroundings during generations to come is appropriately an object for careful architectural design; doubly so in the case of a public project to be scrutinized through the years by throngs of its taxpayer-owners.

Furthermore, it was realized that in the field of publicly financed construction it was particularly necessary to define the scope of architectural treatment, limiting it to the appropriate adjustment and proportioning of the necessary structural elements rather than the introduction of extraneous forms. Thus, in the case of Norris Dam and its appurtenances, it was considered that superfluous ornamentation would be not only out of place, but that illogical adornment would tend to detract from the dignity of the whole.

In an architectural sense the most interesting feature of the Norris project is the power house, a building 97 feet wide by 204 feet long, with a clear height in the generator room of almost 70 feet from floor to roof slab.

The exterior deisgn of the power house was influenced by such factors as the possibility of extremely high tail-water, which rendered windows impracticable below a certain elevation, and the mammoth crane rail, which would have bisected tall vertical windows, but is concealed by spandrels of the horizontal lines of the fenestration which were adopted. Another requirement was the provision of a large opening at the end of the power house so that huge transformers from the switch yard could be taken indoors for repairs. It was necessary that the doors be rigid enough to withstand wind pressure and yet light



1 WEST FREEWAY VIEWPOINT
2 WEST FREEWAY APPROACH
3 WEST ABUTMENT OVERLOOK (Head-tower platform during construction)
4 BOAT HARBOR (Quarry during construction)
5 POWER HOUSE
6 SWITCH YARD
7 POWER HOUSE PARKING AREA
8 FISH HATCHERY
9 COMMISSARY AND HANDICRAFTS BUILDING
10 EAST ABUTMENT PARKING AREA
11 NORRIS PARK BOAT DOCK
12 NORRIS PARK LODGE
13 NORRIS PARK CABINS
14 SPILLWAY
15 VISITORS' OVERLOOK
16 TRANSMISSION LINES

Both before and during the construction stage, consideration was given to the conversion of temporary features to permanent future uses. The construction access road became an important highway, the quarry a boat harbor, the head and tail tower platforms became overlooks and building sites for service buildings, sites graded for repair shops, etc. became parking spaces, etc. Norris Recreational Camp adjoins the east abutment, with provisions for vacationing, swimming, fishing, horseback riding, and the like. The impression produced by the landscape is one of planned orderliness with minimum interference with natural conditions

enough to be operated by one person. After some investigation this opening was built of aluminum shapes and plates arranged in the form of two door leaves, each nine feet wide by 23 feet, 3 inches high, with a hinged transom and removable bar above.

In conformity with the material used for the dam, concrete was also used for the powerhouse. Here, however, it seemed fitting that the plain wall surfaces be given some evidence of scale and individuality, a result that was attained through a somewhat novel treatment of the formwork. The forms were faced with 6-inch-wide boards, rough-sawed to produce texture, and tongue-and-grooved to prevent leakage and excessive fins. The direction of the graining of the boards was alternated between adjoining panels, and the V-joints between panels were produced by means of triangular, one-inch-wide wooden strips nailed to the forms—all together resulting in an economical and attractive over-all wall pattern, very appropriate to the conditions.

The roof of the powerhouse is noteworthy as offering an ingenious solution of a difficult problem. This surface is conspicuously exposed to view from many vantage points along the crest of the dam and from the surrounding hills and overlooks. Therefore, it seemed highly desirable to finish it in a manner that would harmonize with the walls in scale, color, and texture. Accordingly, instead of the more conventional promenade tile, 40-inch square slabs of precast concrete two inches thick were laid with ⅜-inch open joints for expansion and for the passage of rainwater. After the castings were removed from the steel forms, but before they had set, the finished faces of the slabs were textured with a rubber roller which, through suction, raises innumerable parallel ridges on the surface. The structural portion of the roof proper consists of pan-shaped precast slabs supported by steel framed roof trusses and covered with built-up roofing. Small blocks of precast concrete placed under the adjacent corners of each four finish slabs and resting on the structural roof provided a 3-inch air space between the surfaces, thus providing shade and ventilation directly over the roofing. This arrangement reduces the heat gain through the roof and provides instantaneous drainage of the top surface after rains, preventing unsightly puddles. It is also expected that the protection offered will increase the life of the roofing material.

In addition to the engineering requirements for equipment and operation, the planning of the power house was influenced by the necessity to provide for enormous crowds of visitors. Thus, it was necessary to arrange for the assembly of large groups of people at a point where rest room facilities were available and from thence to route sightseeing parties through the generating plant in continuous lines of travel leading past all points of interest, but avoiding the mingling of incoming and outgoing groups.

Where subject to difficulty of access or considerable wear and tear through frequent and long-continued use, structural materials were selected on a basis of durability and low expense of upkeep rather than first-cost. Aluminum for windows and for doors in the line of heavy travel, structural glass wainscoating for public toilets and vestibules were used only where it was evident that savings in maintenance would soon repay the original investment. Lighting, however, received somewhat greater emphasis because of the interest of the Authority in the development of advanced methods in the use of electricity.

Particular attention was devoted to the visitors' reception room, where indirect general illumination is combined with direct lighting on the reception desk and on the walls. The indirect light originates in a suspended metal reflector, oblong in plan, wired for four intensities. The light is reflected by a similarly shaped ceiling cove, from the top of which accumulated hot air is exhausted. This cove, of acoustic plaster, is painted a warm off-white, while the various other ceiling and wall surfaces range from that color to darker shades in the same key, running into a maroon color. Furniture and floor are tied in with the color range. The floor, of Venetian terrazzo (large marble chips, up to ¾-inch size, displaying the texture of the marble), has a light colored panel under the ceiling cove to insure better light reflection.

Direct lights are used in continuous coves in the dropped section of the ceiling which follows the exterior walls. The light is directed by control lenses and louvers onto the walls, one of which is decorated with a map showing the scene of TVA operations and the location of the various water-control projects. Another mural shows cross sections of Norris Dam, used by the guides to explain the operation of the project. A third wall contains photographs of the construction of the dam and other phases of the TVA program. A lens-controlled footlight strip is added to the illumination of the cross-section mural, and with the overhead illumination a startlingly three-dimensional result is obtained.

The control room, office, and the reception room with its toilets are all air conditioned—a very important requirement in the southern climate and also a demonstration of use of electric power which is new to many of the visitors. Supply and exhaust grilles are worked into the designs of rooms in each case.

Norris Dam itself presents a severely simple outline stretching for more than a third of a mile across the river valley in a straightforward application of the laws of hydraulics and stability. On the downstream side—the most conspicuous face—the main mass rises from the valley as a buttress-like inclined plane, its sheer surface uninterrupted except by the 300-foot-wide spillway section with a crest higher than Niagara. The training walls flanking the spillway are purely functional, serving to prevent the spread of rushing water along the sides. The tower at one end of the spillway encloses the upper portion of an elevator shaft communicating with inspection and operating tunnels which traverse the core of the dam from end to end. The bridge above the spillway consists of three spans of 100 feet each, supporting the roadway which extends along the crest of the dam. The rather interesting shapes of the piers of the spillway bridge were derived from the combination of structural requirements and the circular arc form of the huge hydraulic drum-gates which regulate the overflow of water during periods of high water.

The elevator penthouse, which is the highest portion of the structure, fittingly carries the flagpole and inscription, the latter so designed as to be seen by motorists when they drive across the dam.

Many bridges and viaducts, which are otherwise notable accomplishments of engineering and architectural design, suffer from high solid railings which appeal to one's sense of proportion on the drafting board, but are extremely annoying to the motorist whom they deprive of the views which such vantage points usually offer. At Norris, the concrete lower part of the parapet was treated as a curbing, high enough to cover and carry through the line of the steel girders of the spillway bridge. A 4½-inch galvanized pipe forms the top rail.

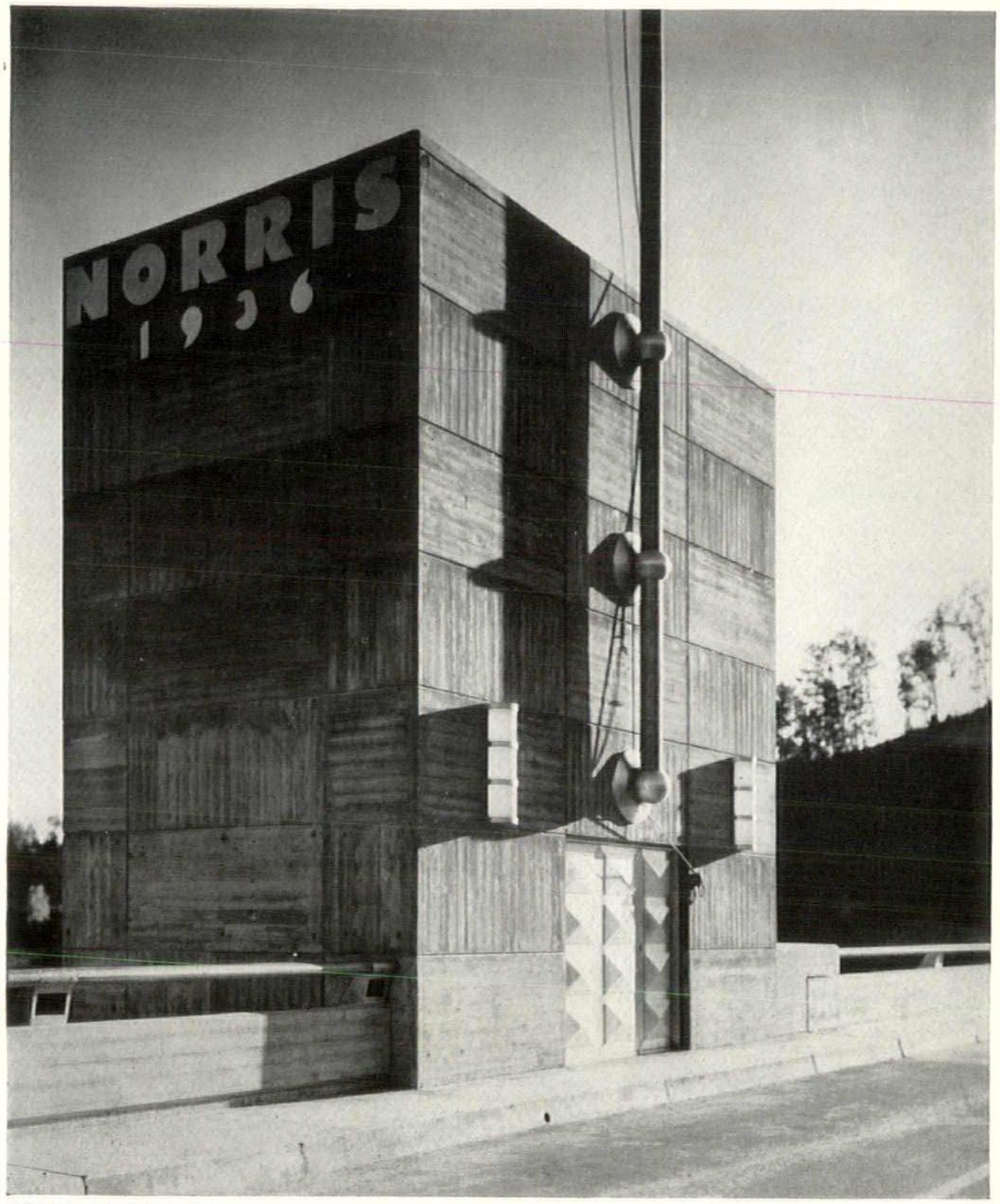
This rail is supported on cast iron brackets which are really hollow boxes and contain one of the noteworthy features of the roadway: the lighting, which is practically an indirect system of street illumination. The light of a 100-watt bulb in each bracket, spaced approximately 14 feet apart, is directed downward by a control lens, further protected from upward spill by a louver panel. A sheet of clear glass, to exclude dust and bugs, completes the assembly. The light-beams overlap across the road, and also sideways, sufficiently so that possible simultaneous blanketing of several light sources by persons leaning on the rails directly in front of a bracket will not produce any very noticeable shadows. The backs of the brackets, which also serve as access doors, contain opal glass lenses, the diamond or hollow-faceted shape of which was dictated by clearance requirements inside the fixture. These lenses, shaded from direct rays by clip-on reflectors on the bulbs, transmit a subdued glow to mark the crown of the dam from the outside. The galvanized pipe rail also serves as a conduit for the electric lighting cables. The same lighting fixture, varied only to suit a different application, is used at the abutments of the dam where the concrete parapet has been carried higher and takes the place

General View from downstream

PHOTOS: CHARLES KRUTCH, TVA

NORRIS DAM AND POWER HOUSE

ROLAND A. WANK, PRINCIPAL ARCHITECT



PHOTOS: CHARLES KRUTCH, TVA

View of elevator penthouse as it appears from the roadway on top of the dam. Lettering appears on the sides of the penthouse because these surfaces are most conspicuous to motorists using the highway. Flagpole supports are of cast aluminum. Lettering is also aluminum

of the pipe rail. The light boxes are countersunk here, exposing an approximately flush face.

While the absence of conventional light poles is pleasing during the day, the really striking effect is produced at night when the roadway and sidewalk are flooded with light to such an extent that a motorist may switch off his headlights without noticing the difference and yet there is practically no spill above waist height so that the view of the lake, the hills and of the power plant and valley below may be enjoyed without interference. A similar result is anticipated from a lighting fixture of different type, but of similar principle, to be used to illuminate the traffic circle at the east end of the dam. Also, the parking spaces will be illuminated by a type of luminaire to be mounted on poles. This fixture is intended to accomplish the same result, namely, a concentration of light on the parking area without any direct rays visible beyond the area to be illuminated.

Aside from the attraction that large-scale engineering projects have for sightseeing Americans, the Norris area is the center of other far-reaching activities which appeal to the public interest. The nearby town of Norris, built to accommodate TVA workers, was among the earliest of the New Deal's housing projects. Laboratories and testing grounds for practical research work in hydraulics, ceramics, tree crops, forest management, fish and game propagation and so on are operating in the vicinity and attract specialists and business men from the entire country and abroad. During its brief existence Norris Lake with its 700 miles of shore line has developed into a major recreation center. Most of the land acquired by the Authority to protect the reservoir is designated as permanent forests and conservation areas, but at strategic points vacation camps, picnic grounds, and facilities for water sports have proved to be extremely popular.

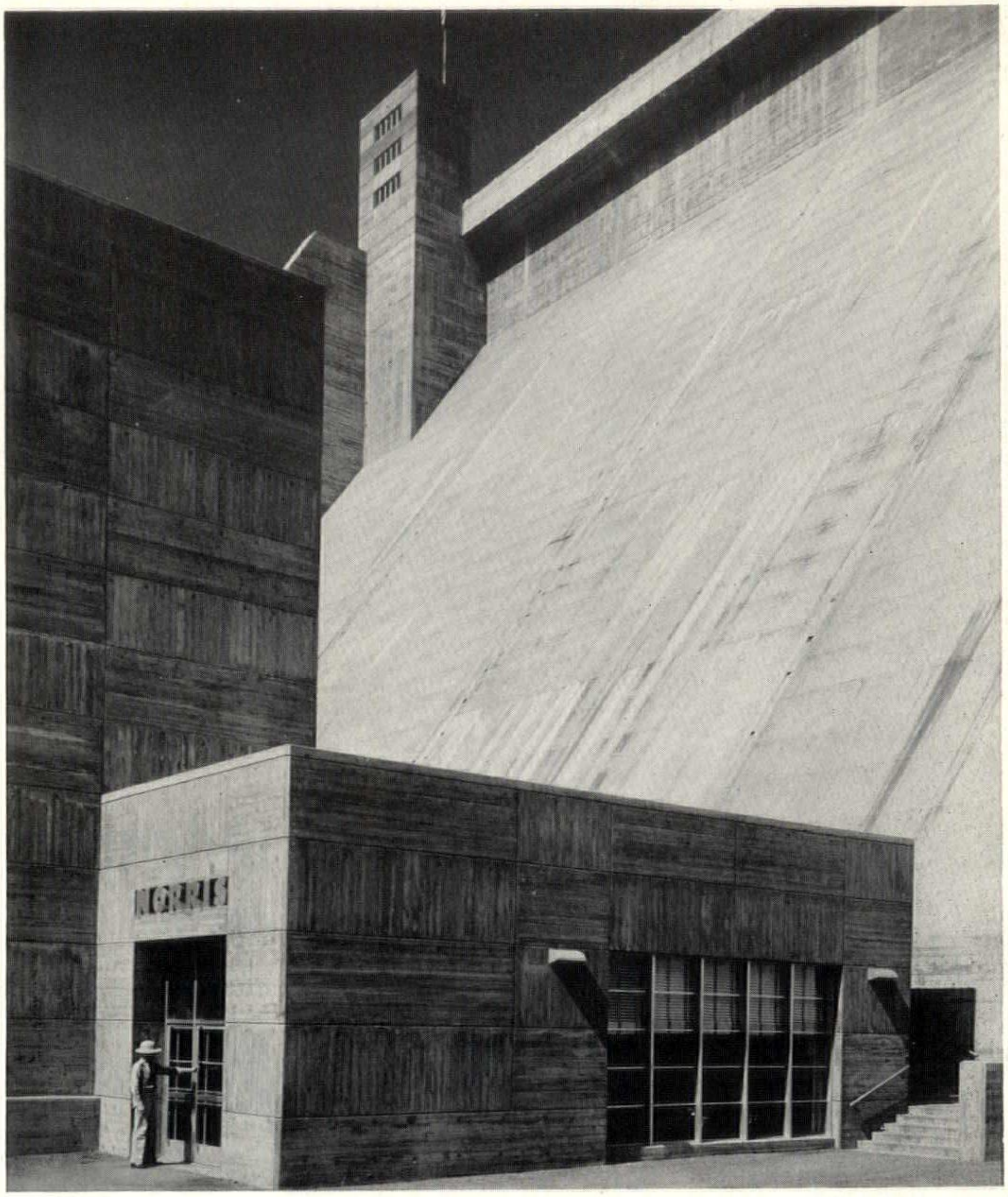
The immediate access to the dam is by means of the Norris Freeway, which, free from roadside "developments" and unauthorized intersections or cross-roads, has rapidly taken its place among America's great scenic travelways. Originally built as a construction road and later converted into the first rural freeway in the United States, this road utilizes the crest of Norris Dam as a river crossing and forms a popular short-cut connecting important north-and-south tourist routes.

Few, if any, of the myriads of people who have visited Norris were on an architectural pilgrimage; but many of them carried away a new realization that simple, unaffected, utilitarian forms—though on a vast scale—can be tremendously alive and dignified—even beautiful.

SPECIFICATIONS OF NORRIS DAM

Maximum height	265 feet
Length	1,872 feet
Thickness at base	204 feet
Reservoir area	34,200 acres

Excavation work involved the removal of 275,000 cubic yards of rock and 170,000 cubic yards of earth. A nearby mountain furnished the bulk of rock and sand used in the more than 1 million cubic yards of concrete required for construction



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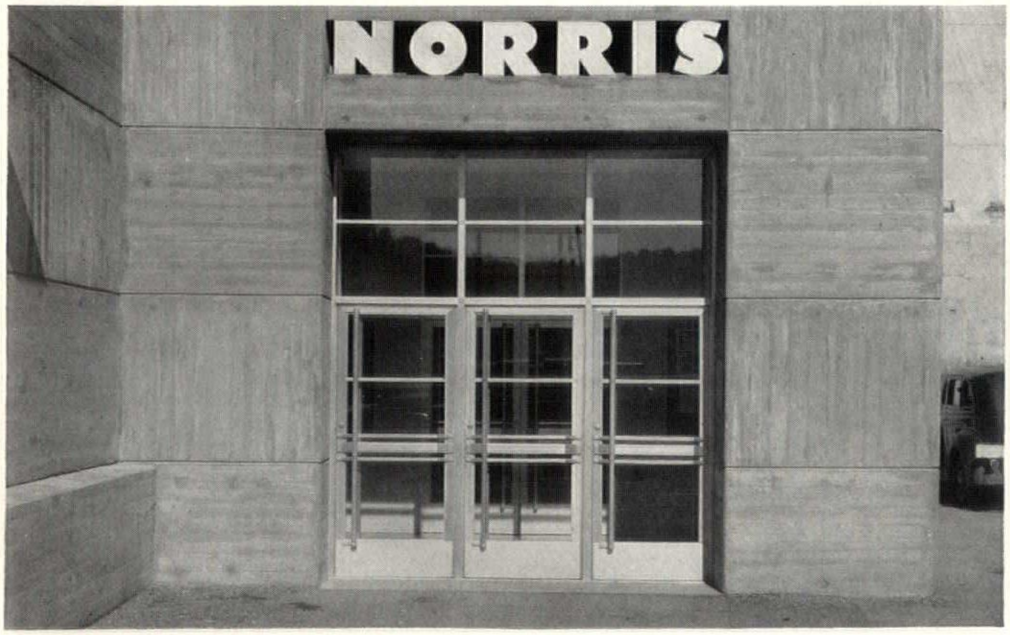

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1. View of the visitors' reception room. The tower beyond houses the elevator by which the operating and inspection galleries become accessible. The lighting fixtures appearing on either side of the corridors repeat around the building where walks occur, flooding them with light carefully directed by control lens. **2.** View of entrance doors to visitors' reception room. These aluminum doors were designed to insure safety against glass breakage while providing minimum interference with visibility. All aluminum, including lettering, has anodic oxide finish

NORRIS DAM AND POWER HOUSE
ROLAND WANK, PRINCIPAL ARCHITECT

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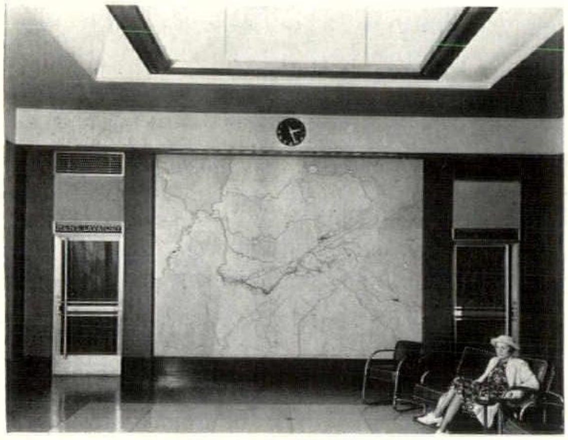

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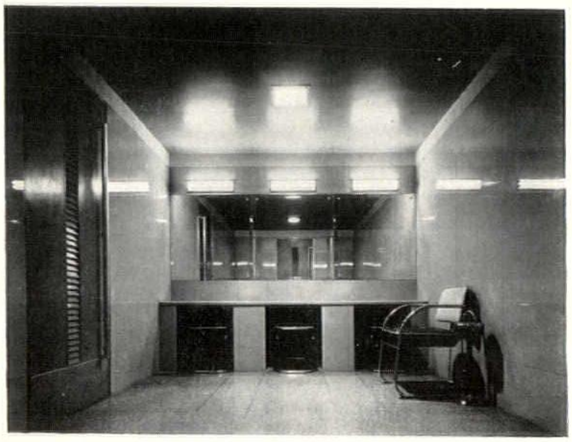

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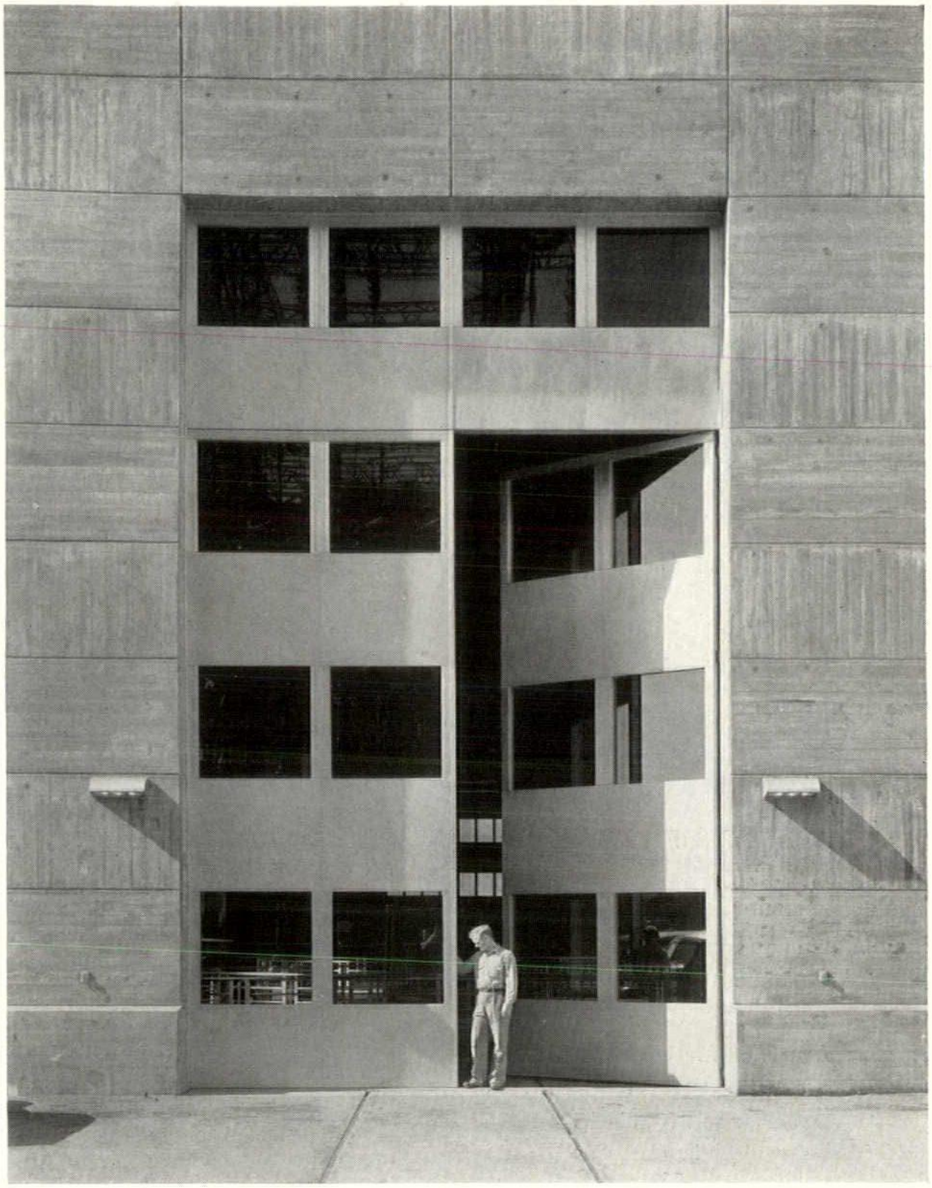

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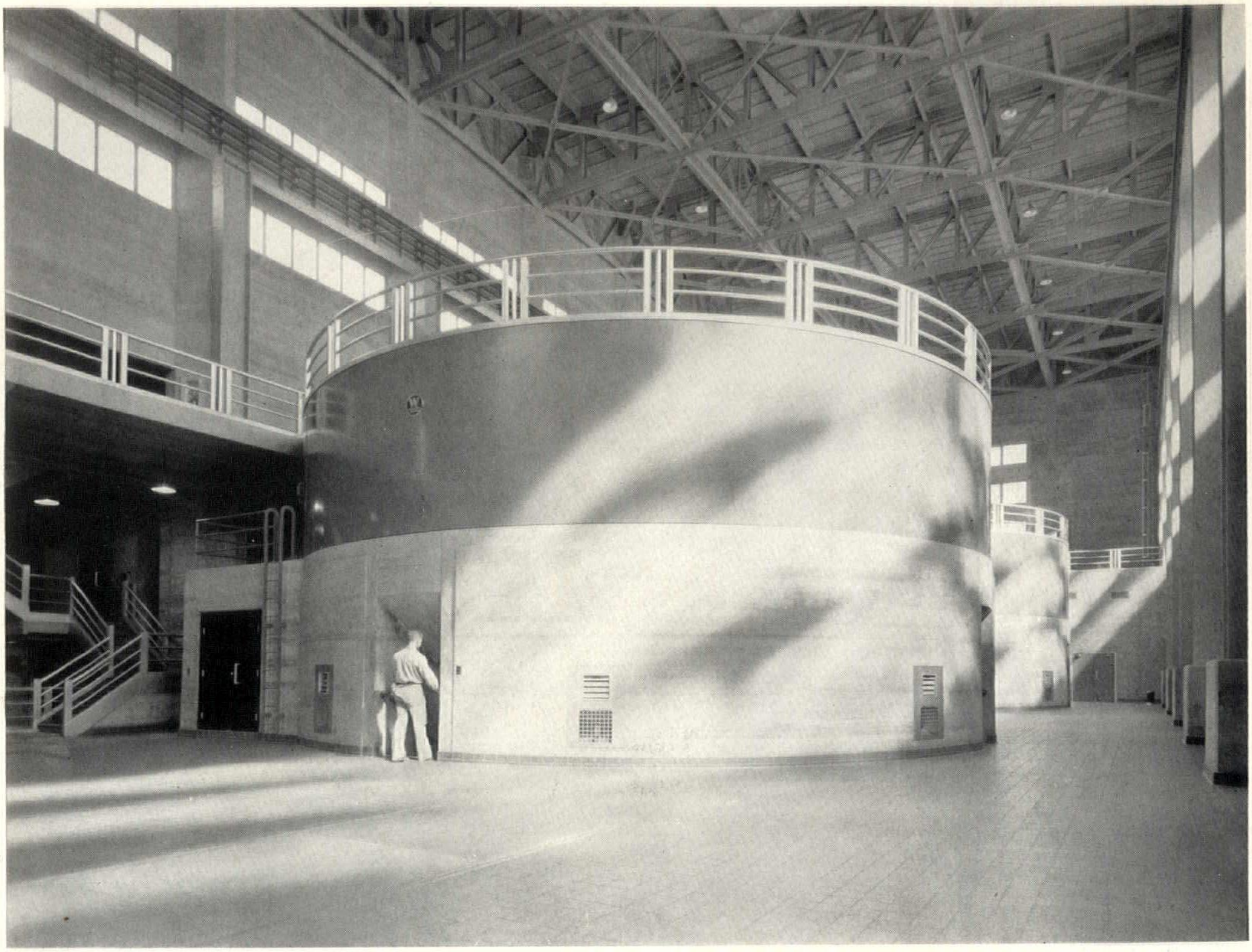
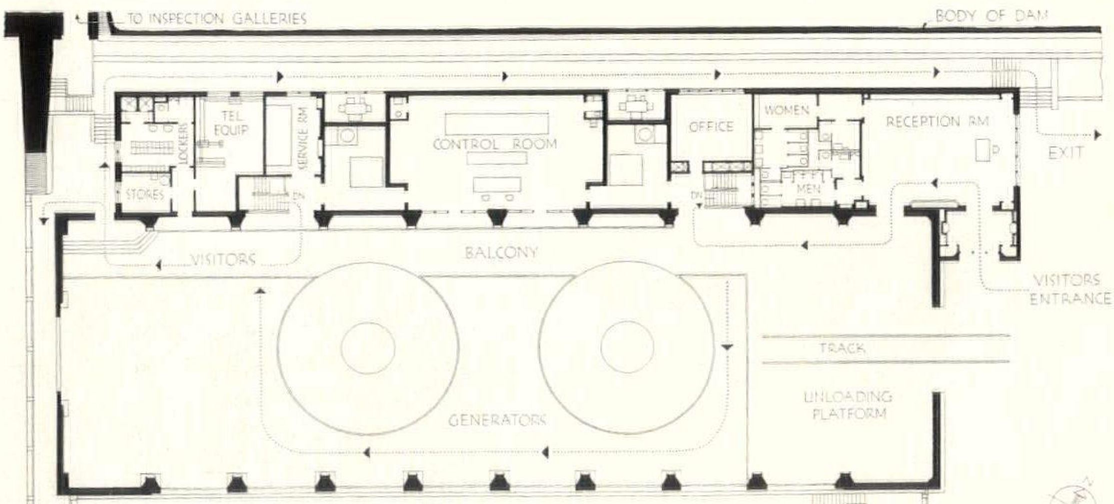
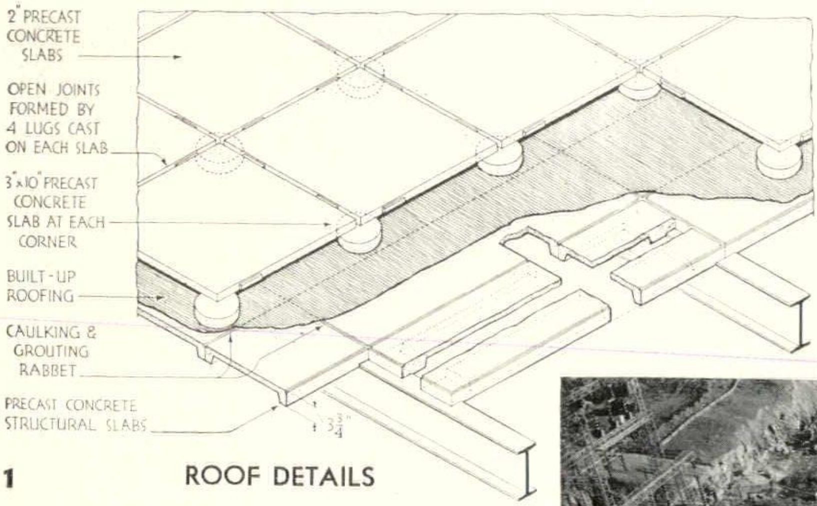
1. The mural in the reception room shows cross sections of dam and is used by guides to explain operation. The long, slender, rail-like shaft mounted below the mural is a single piece of limestone, core-drilled when investigating foundations. **2.** Also used by the guides to explain the project to visitors is the large oil-painted map. Walls are canvas-covered, painted maroon, and the floor is Venetian terrazzo. **3.** Walls and dressing table in the women's rest room are gray structural glass. The floor is bluish gray terrazzo and the steel door is painted a dark blue. Piers between units of the dressing table contain wastebaskets accessible from the top. **4.** The large door at the east end of the power house is required for the passage of transformers or other bulky machinery for major repairs which are effected inside the building. The door is of aluminum and is easily operated by one person. The transom bar is removable and the sash is hinged to allow clearance for equipment of extraordinary height



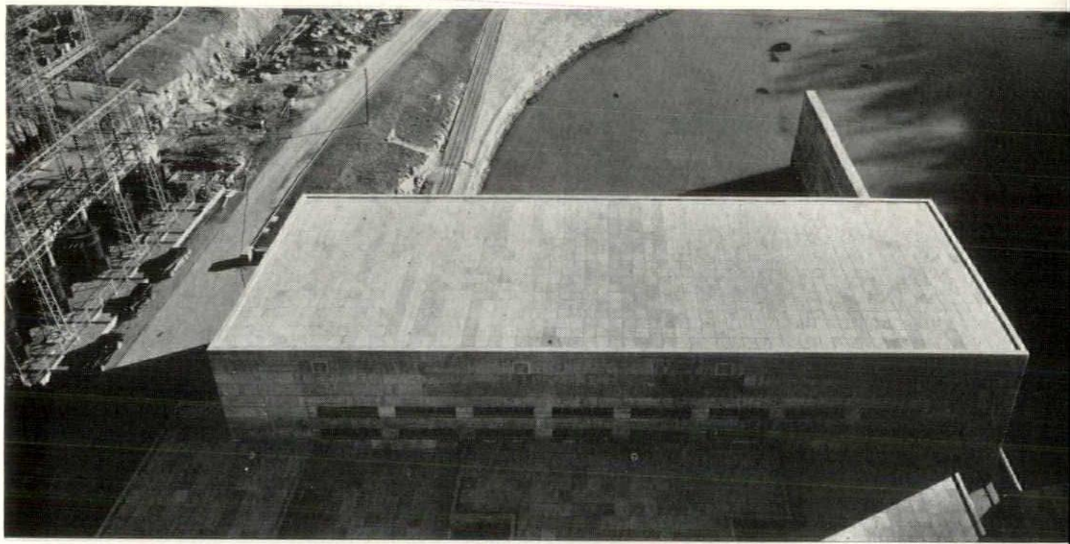


Structural columns, roof slabs and concrete walls are all left exposed in the generator hall. Steel is painted a bluish gray, light for structural members, darker for machinery. The lower portion of the generator casings are concrete and the upper part steel. Floor is quarry tile and railings are aluminum



1 ROOF DETAILS

1. The top view, of the roofs of the various levels of the power house, assumes unusual importance since the structure is viewed by most visitors from above. To preserve scale and harmony of materials, precast vibrated slabs were used for finished roofing. The slabs are supported at four corners, to clear the built-up roofing, and are laid with open joints for the passage of air and rain-water. Spacer bosses cast onto the edges of the 2" slabs insure uniform joint widths. For structural roof slabs, cost comparisons between poured concrete and prefrabricated units resulted in the choice of pan-shaped reinforced concrete slabs, precast and vibrated in steel forms. Delivered from a plant 22 miles away, they cost about 20¢ a square foot including the special shapes required to produce uniform margins around supporting steel members as seen from below. **2.** General view of power house roof showing effect obtained by use of precast concrete slabs for finished roofing. **3.** By alternating the direction of the form boards, scale and texture were obtained in the appearance of the power house walls. The spacing of horizontal jointmarks corresponds to the heights of the lifts in which concrete was poured. The shape of the bridge piers above the spillway was derived from hydraulic requirements involving air pressures caused by the rush of water



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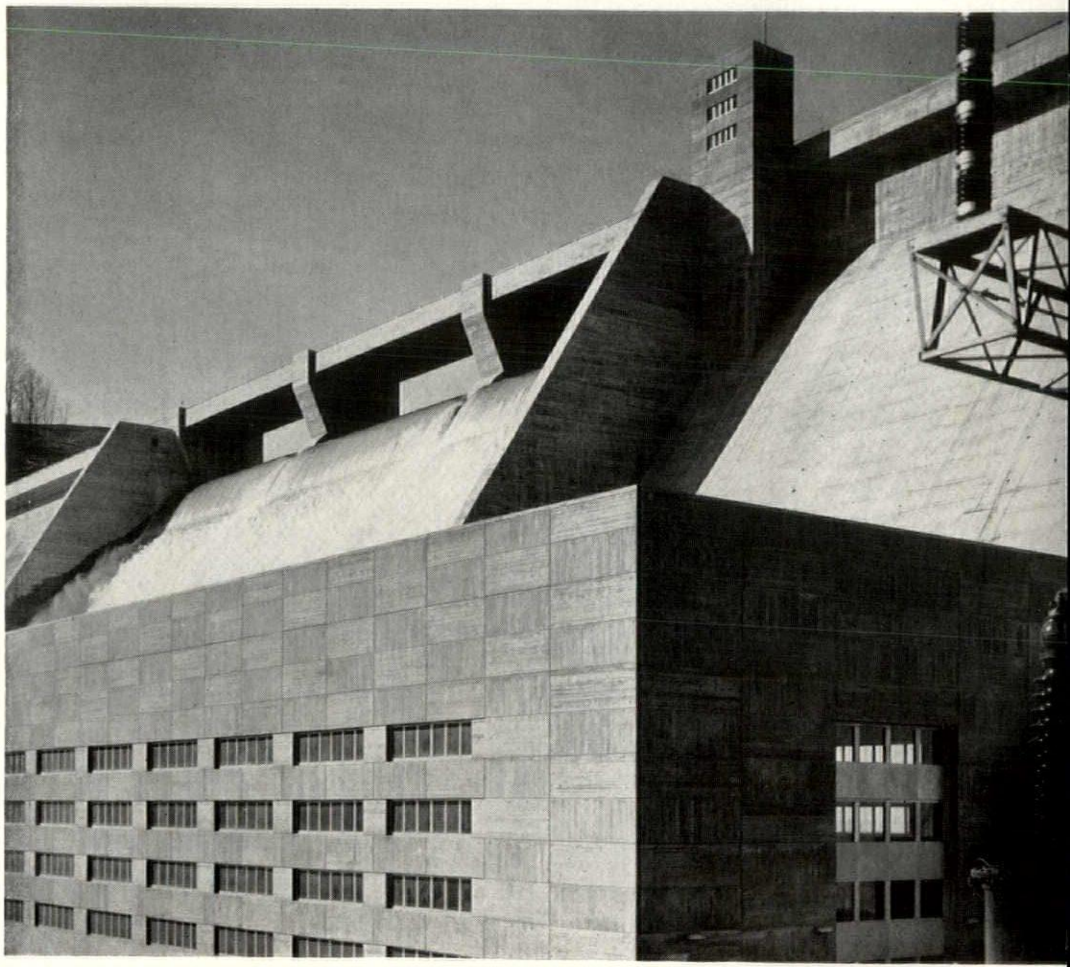
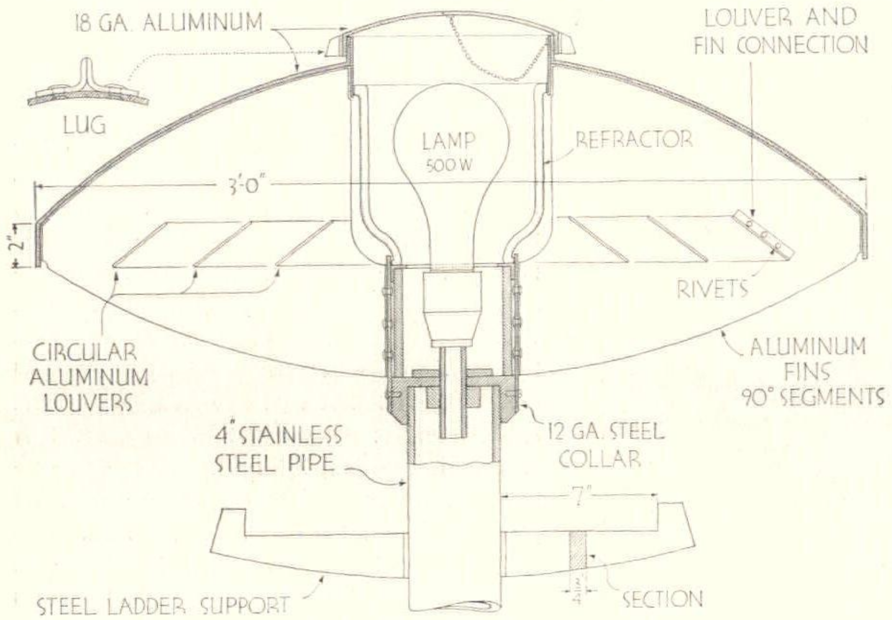
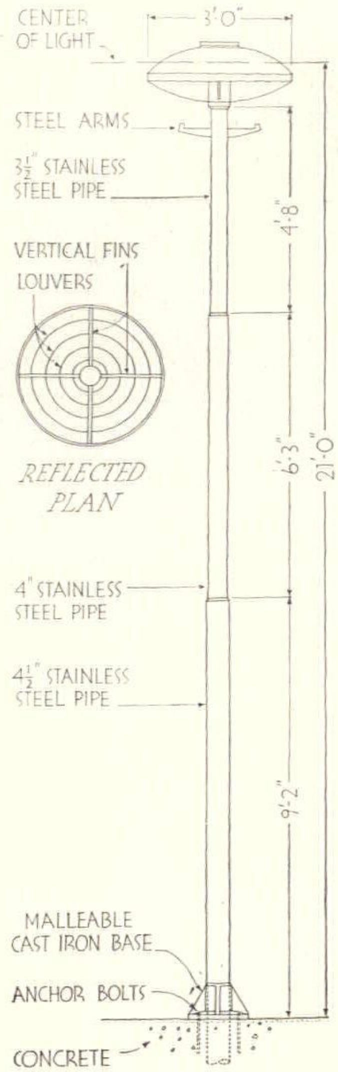


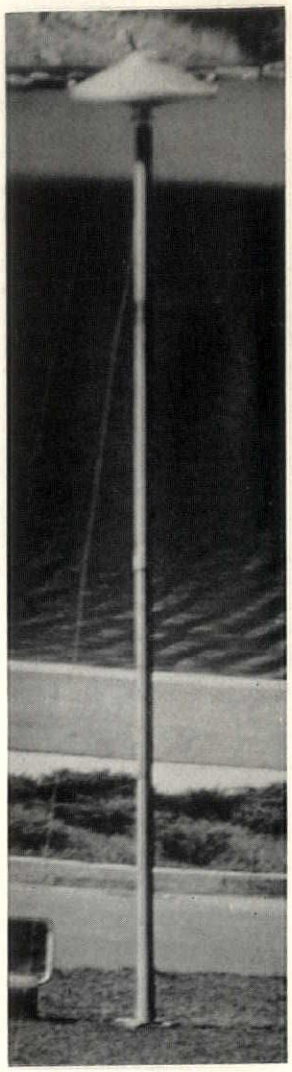
3

NORRIS DAM AND POWER HOUSE

R. WANK, PRINCIPAL ARCHITECT

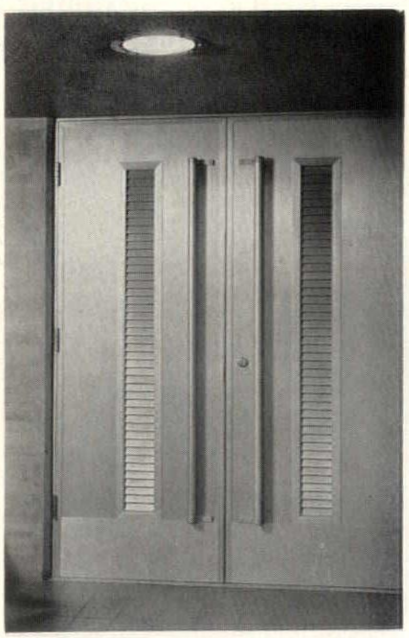






This hooded fixture was designed for the illumination of parking spaces in the vicinity of the dam, where spill of light beyond the area to be lighted is objectionable. The hood and louvers cut off direct view of the refractor beyond that area. Light distribution within those limits may be controlled by the choice of the refractor and by adjustment of the bulb center. The fixture may be relamped from the top

1



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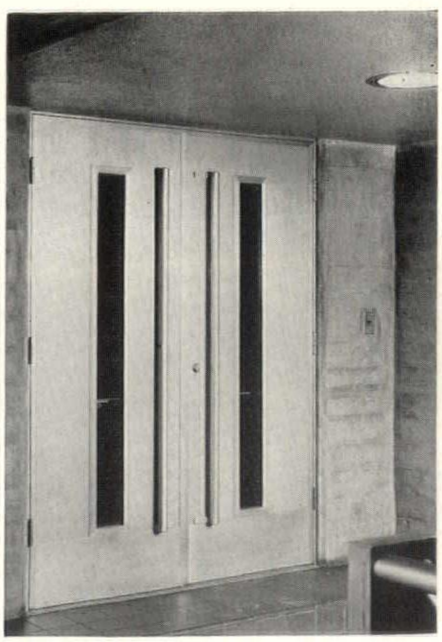
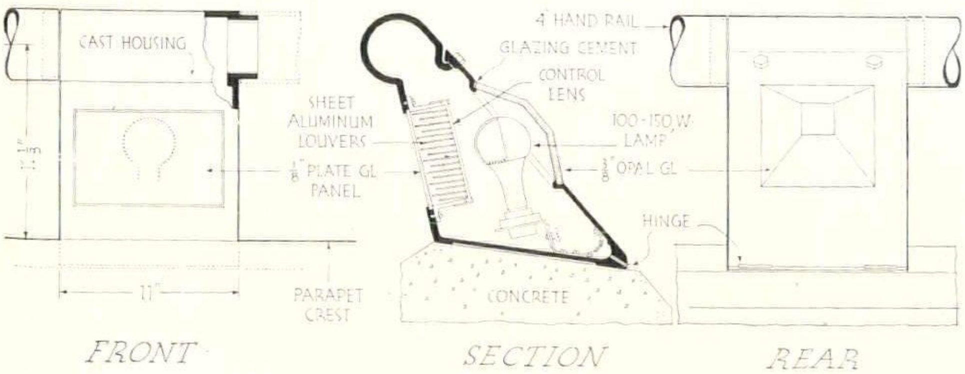


1. In rooms which house extremely sensitive instruments, this louver-paneled door is bucked up by interchangeable glass wool filters, composed of standard 6" wide units, for which the width of the louver panel was designed. The door is made in either aluminum or enameled steel. **2.** For doors in places where glass is required for inspection purposes only and its area is limited by fire and explosion safety requirements, this glass-paneled door is used. Both doors serve to illustrate how an effective design may result from a fresh approach in combining familiar elements

1

1. Highway handrails are of galvanized pipe, supported with flush joints on galvanized cast-iron brackets which also serve as housing for the roadway illumination. The shape of the brackets was designed to throw the rail inward for more convenient support and for assistance in properly directing light beams. The raised opal glass panels on the outside of the light housing serve as warning lights for aerial and water navigation. 2. A night view taken from overlook at west abutment shows lack of upward spill of light or glare from roadway lights or from external marker lights. 3. The semi-circular contour of the spillway piers, required for hydraulic reasons, was carried up to sidewalk level to create points of vantage from which the lake and aquatic sports might be viewed



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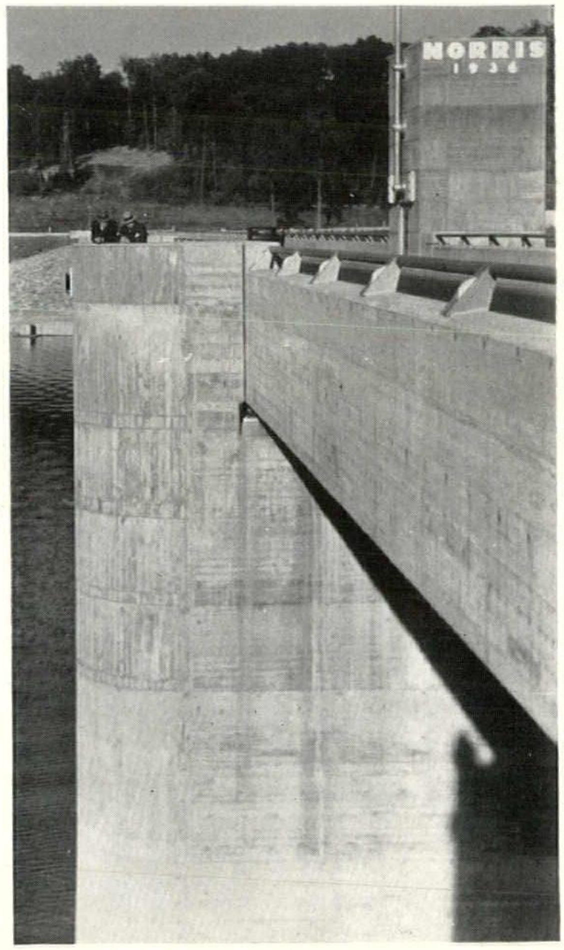
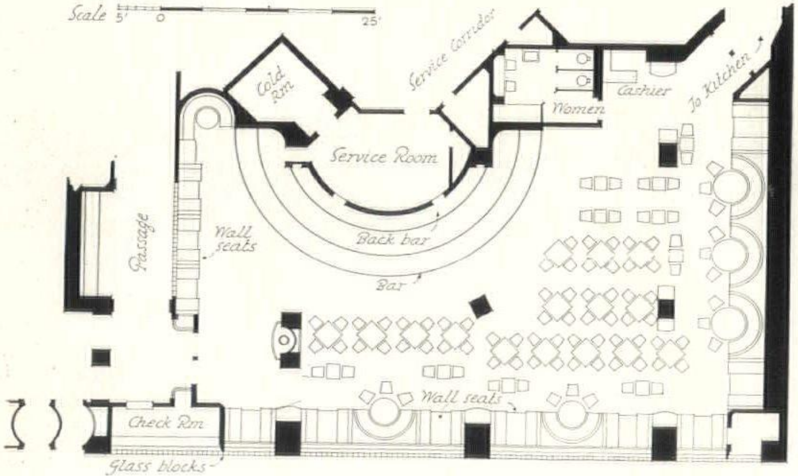


3

NORRIS DAM AND POWER HOUSE
R. WANK, PRINCIPAL ARCHITECT

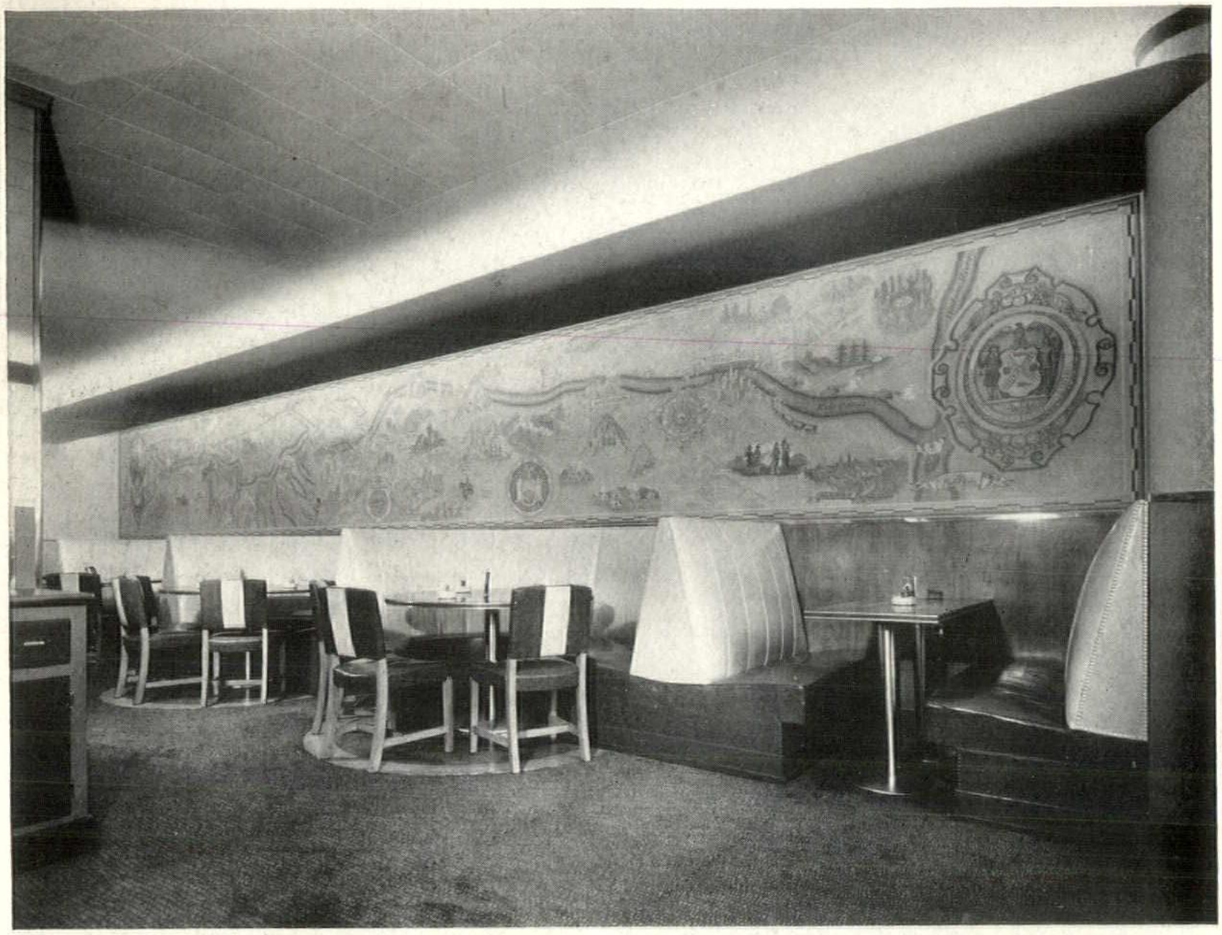
PHOTOS: ARNOLD

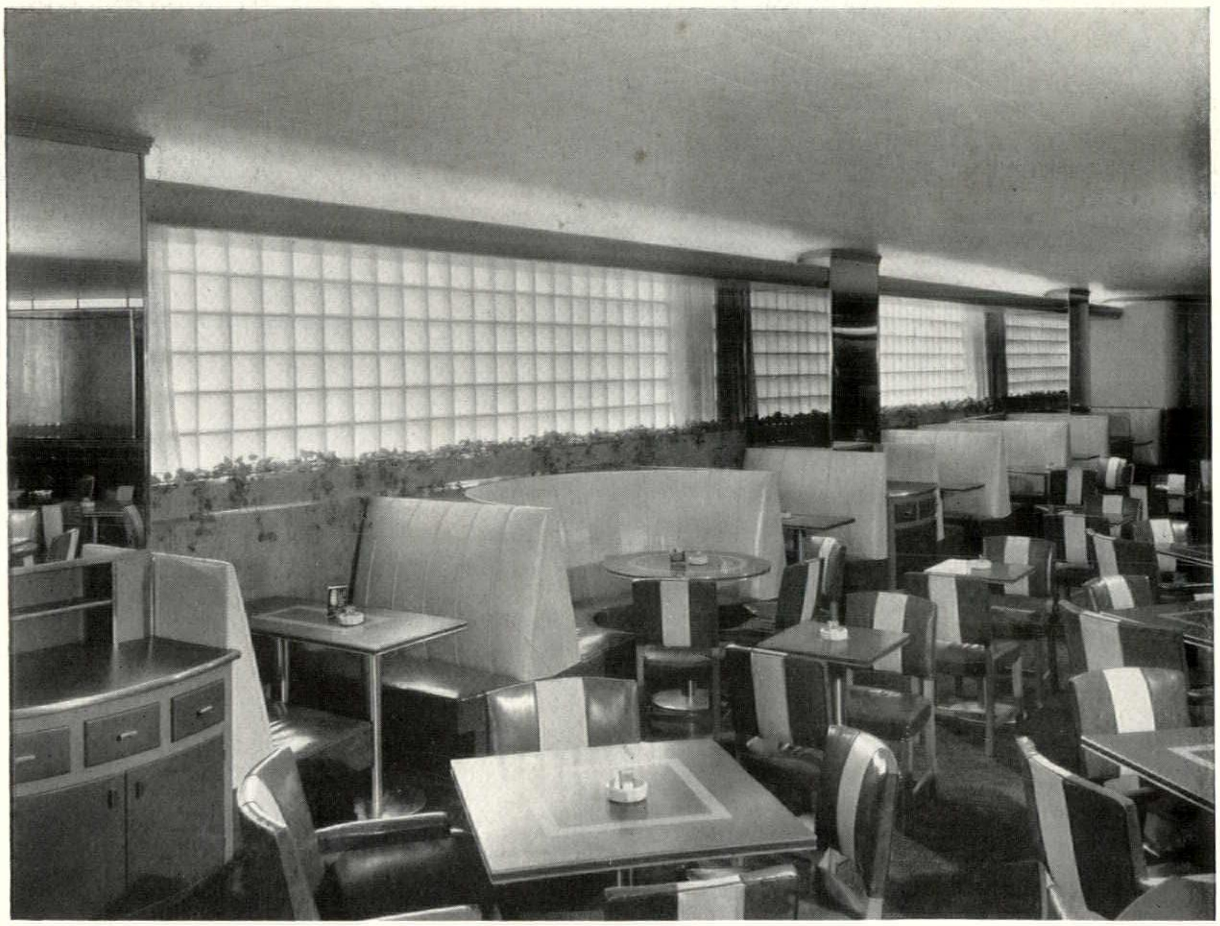
RAINBOW LOUNGE, HOTEL SYRACUSE, SYRACUSE, N. Y.



PAUL HUEBER, ARCHITECT

Cocktail lounge design is in many respects rather restrictive because of accurately determinable needs. On the other hand, its decoration offers the architect an opportunity to exercise originality and showmanship. It is naturally good sales psychology to make a feature of a glistening, fantastic bar. This semi-circular arrangement of structural glass, Formica, stainless steel, mirrors and indirect light is an excellent example. Semi-circular cubicles around two walls and the treatment of columns as an integral part of the design add further interest to the plan.





A large mural, tracing the course of the Erie Canal from Albany to Buffalo, occurs along one wall. Other walls are either glass block or marshwood. Cove lighting reflects from a white Sanicoustic ceiling. Terrazo is used around the bar and the remainder of the floor is carpeted. The color scheme is white, terra cotta, black, green and gold.

RAINBOW LOUNGE
PAUL HUEBER, ARCHITECT

PHOTOGRAPHS: Miss Frances Benjamin Johnston. Copyright by Mount Vernon Ladies' Association

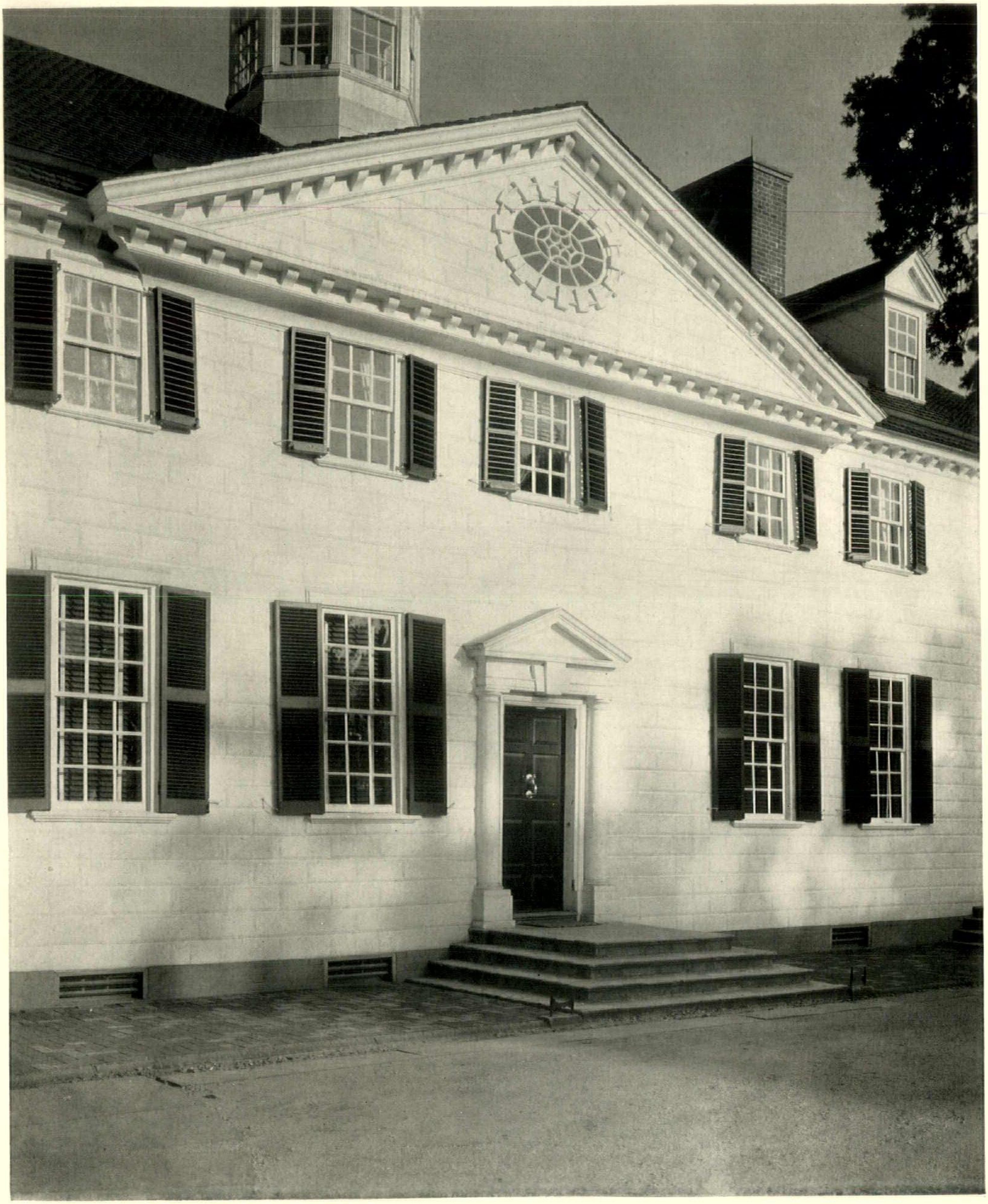
THE PORTFOLIO

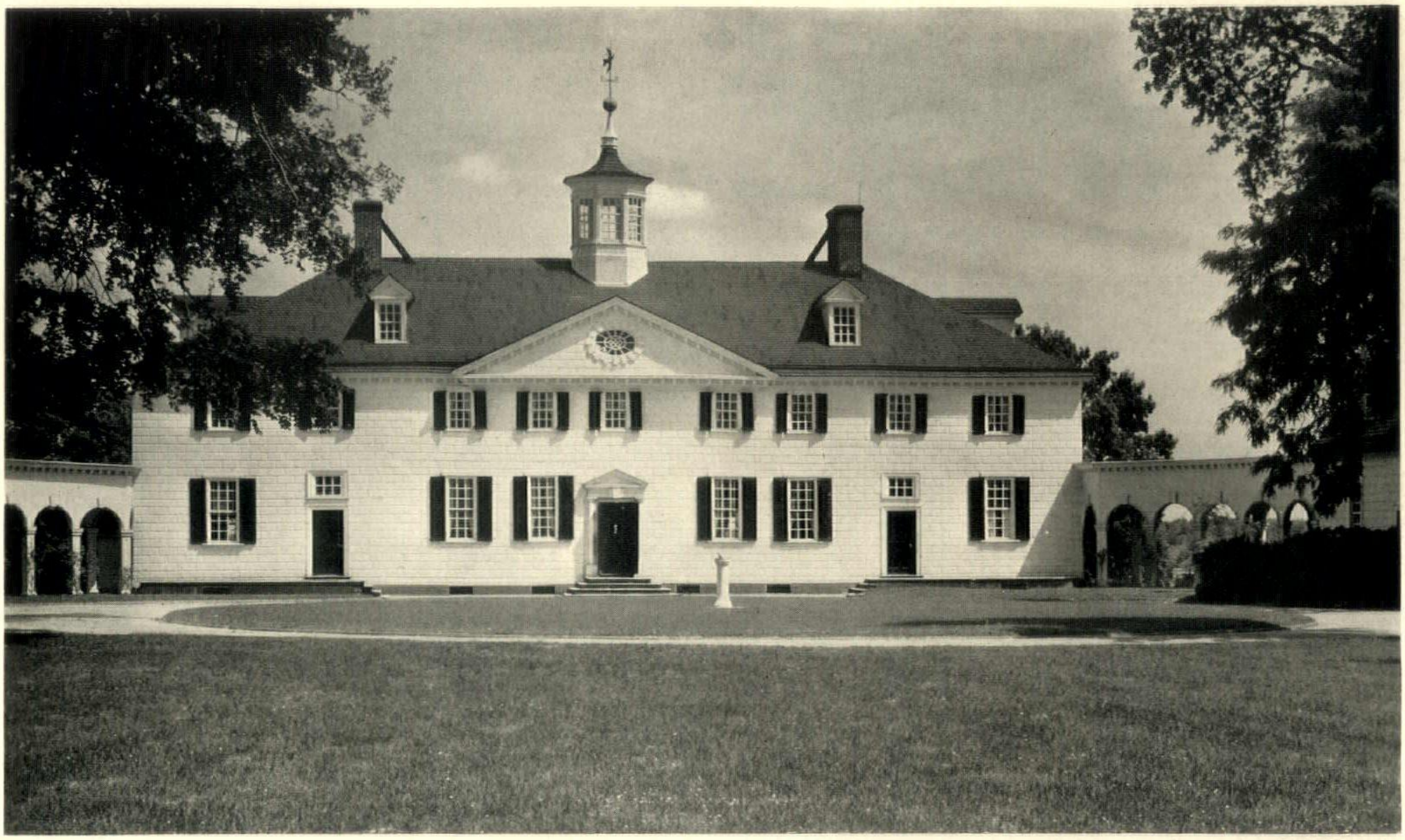
The MANSION HOUSE

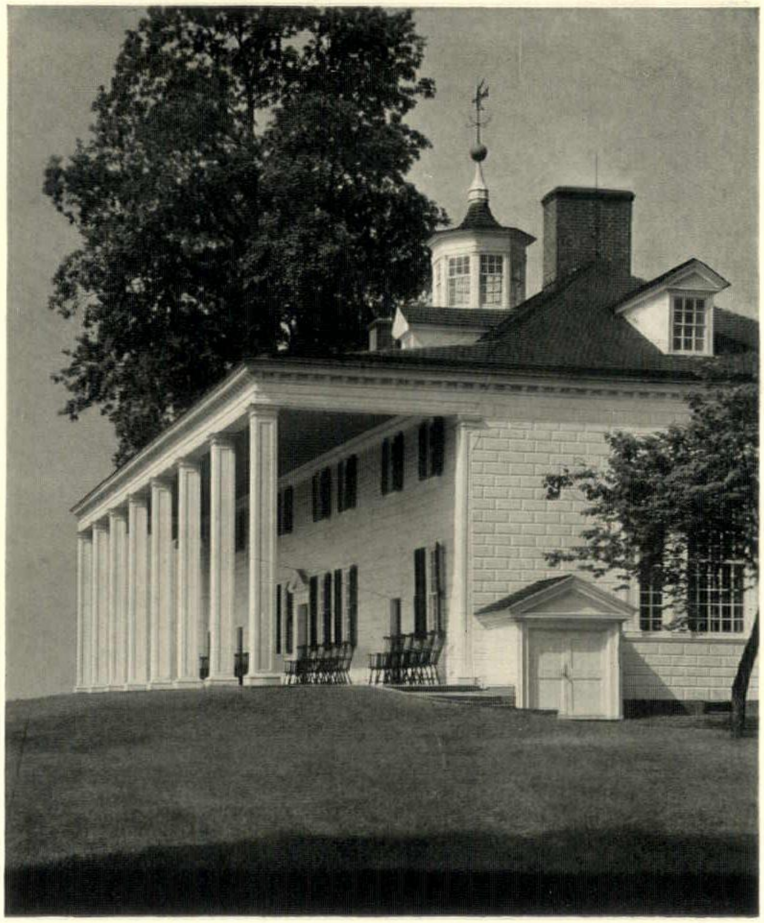
Mount Vernon, Virginia

Seat of GEN^{l} GEO^{e} WASHINGTON

ALTHOUGH Mount Vernon is one of the most important patriotic shrines in America, appallingly little has been known of its architecture until recently. Under the supervision of Morley Jeffers Williams, *Director* of *Research* of the *Mount Vernon Ladies' Association*, a meticulously accurate survey has been and still is being made of the entire structure. Thanks to the gracious generosity of Mrs. Horace Mann Towner, Regent of the Association, *American Architect* and *Architecture* is honored in publishing for the first time some of the most important of the official drawings and photographs of the Mansion.





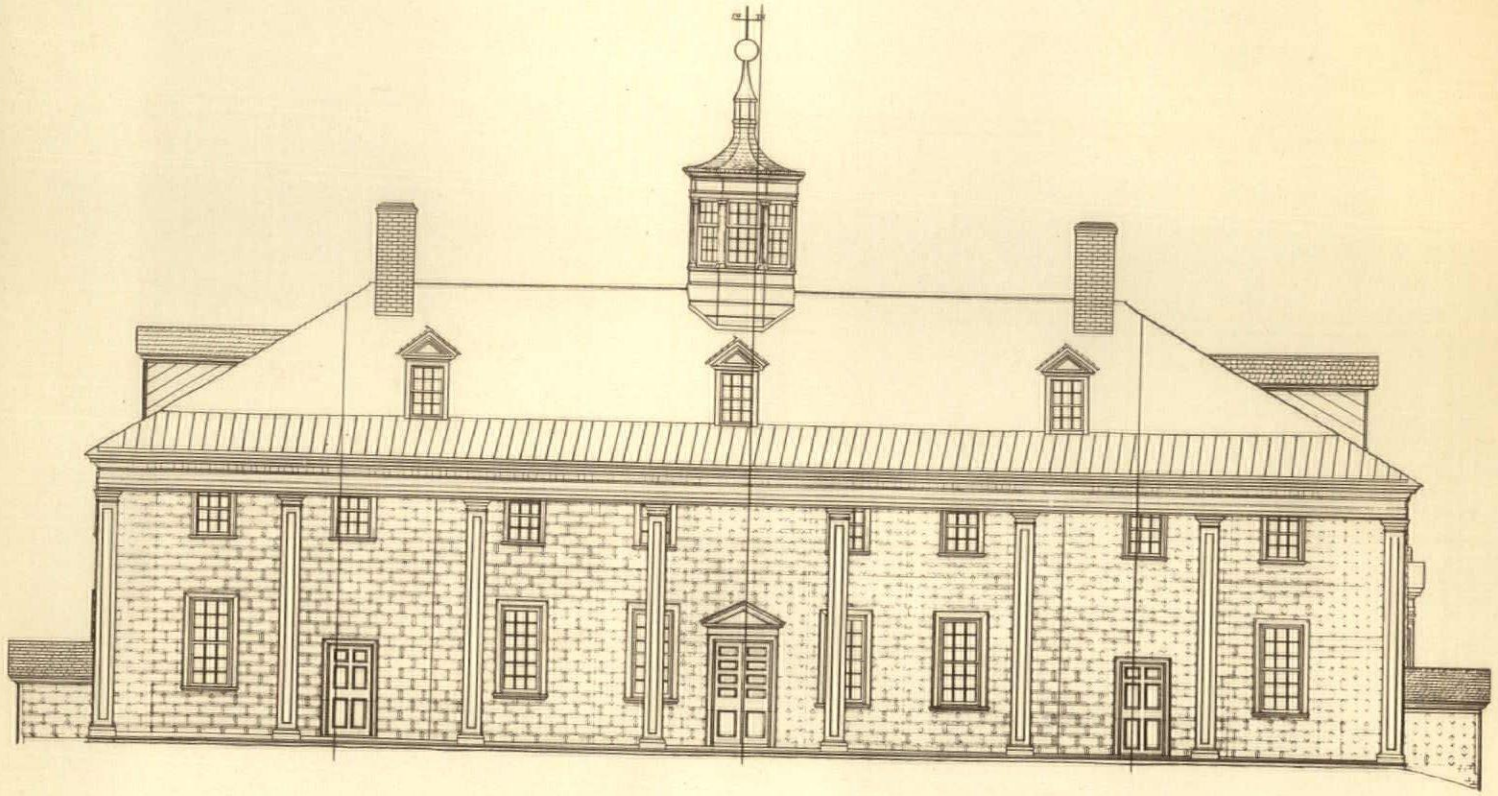


When George Washington came into the full possession of the property as an inheritance from his half-brother, Lawrence, it had been in the family for eighty-three years. Some time after 1690 a small story and a half house had been built which remained to serve as the nucleus of George's substantial additions. These began in 1758, just prior to his marriage to Martha Dandridge Custis, and continued intermittently until about 1787. Most of the more important changes began in the Spring of 1774, despite Washington's absence from home, first as a member of the House of Burgesses and later as Commander in Chief of the forces of the United Colonies. ¶ The unorthodox pediment (opposite) was added in 1778. The roof line breaks out in the customary way but the break, taken up by a cove below the dentil band, is not otherwise recognized on the elevation

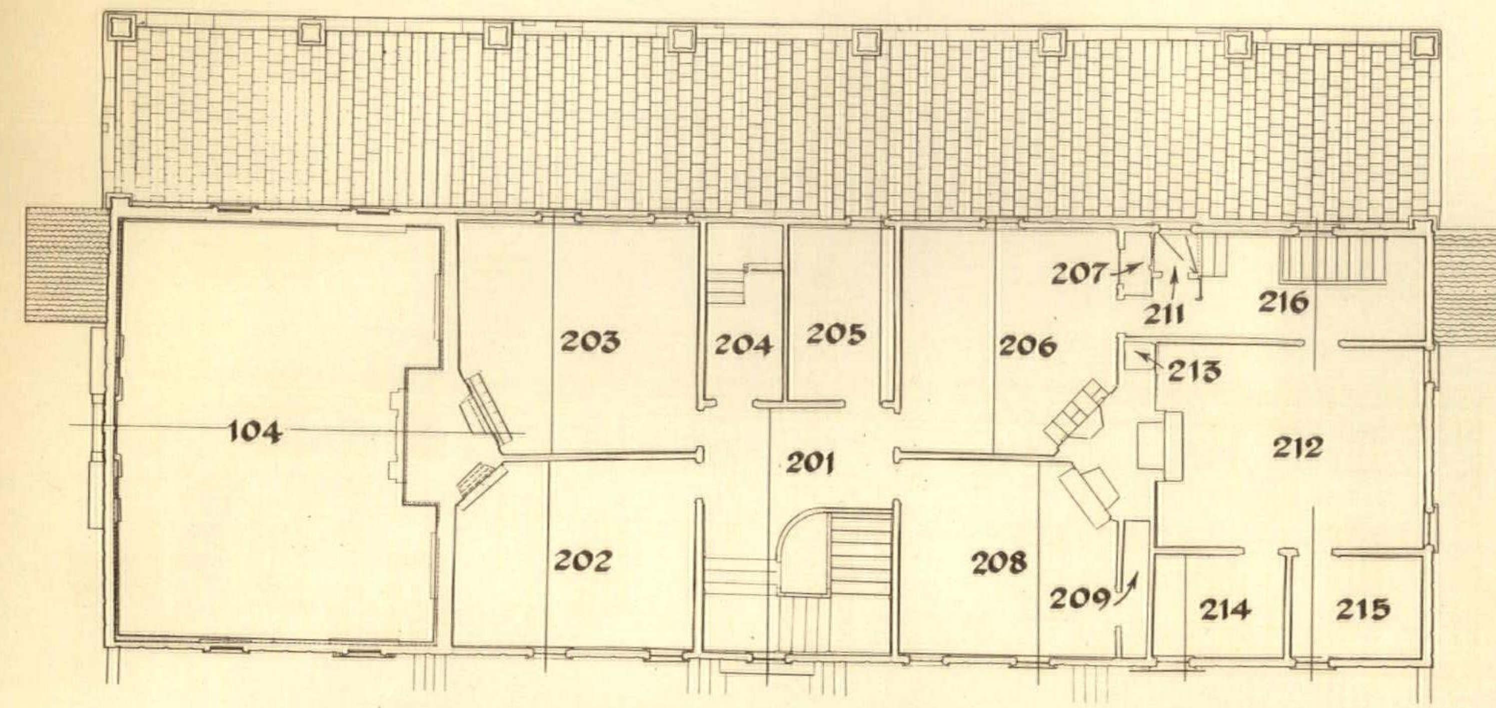
One of the most widespread avocations among gentlemen of the eighteenth century was the study of architecture. The works of Batty Langley, Vignola, Palladio, et al., were owned, admired and extensively copied. General George Washington was no exception. The "Palladian," which he knew as "Venetian Window," on the north addition (opposite) was inspired by a plate in a contemporary book of architectural design. On the other hand, there is considerable speculation as to the source of inspiration for the Piazza on the east front (page 43). Since nothing like it is known to have appeared on contemporary or earlier buildings in that part of the country, it would appear to be Washington's much-copied contribution to American architecture. ¶ The Chippendale railing which for years surmounted the Piazza was not an original feature and was therefore removed in 1935. ¶ The cupola is another element new to the vicinity. In Philadelphia in August, 1787 he paid twenty-four pounds in Pennsylvania currency for its top

DEPENDENCIES were always given the same architectural study as the main house on any large well-organized eighteenth century plantation which Mount Vernon undoubtedly was

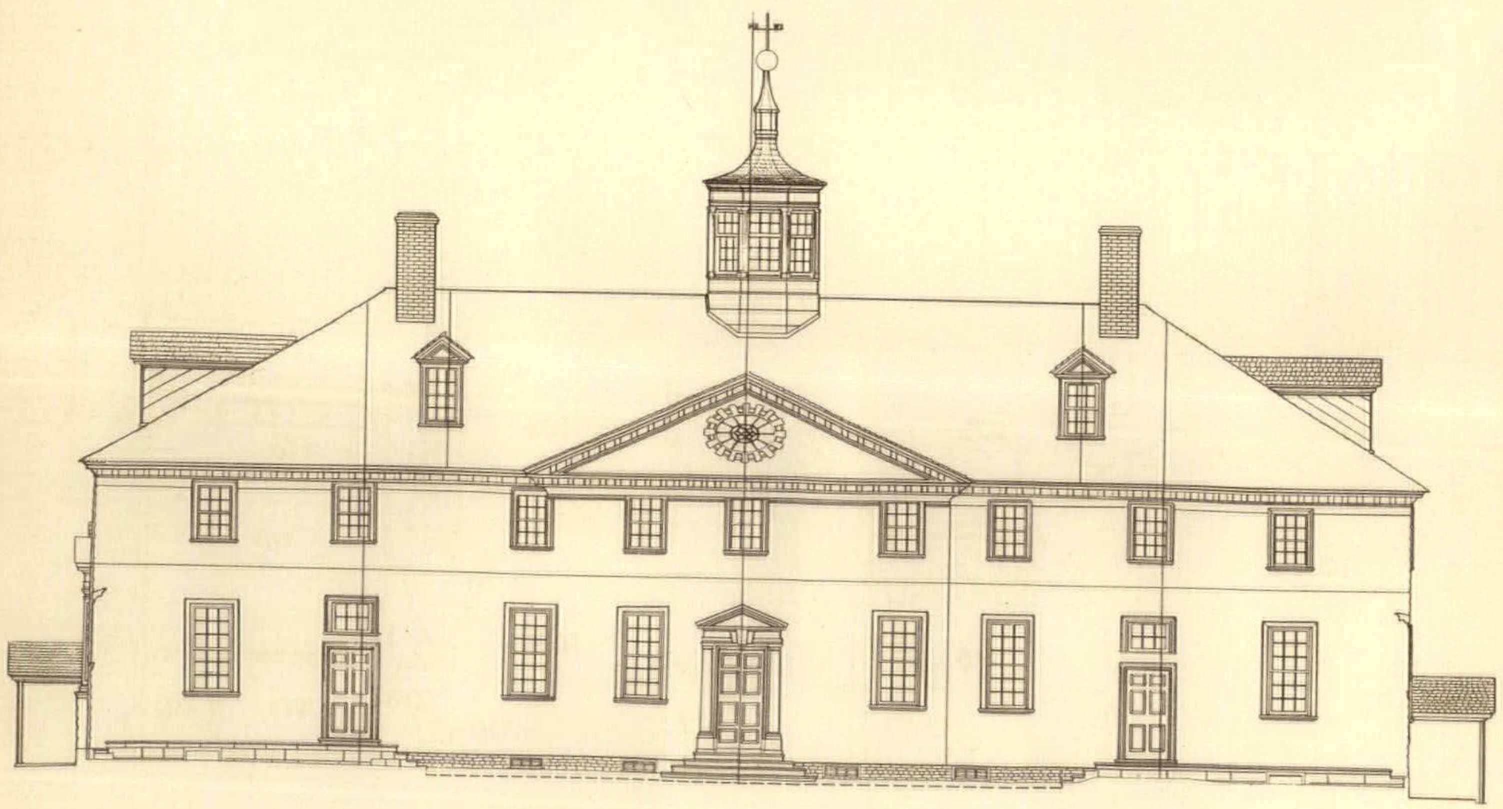
The MANSION HOUSE, MOUNT VERNON,



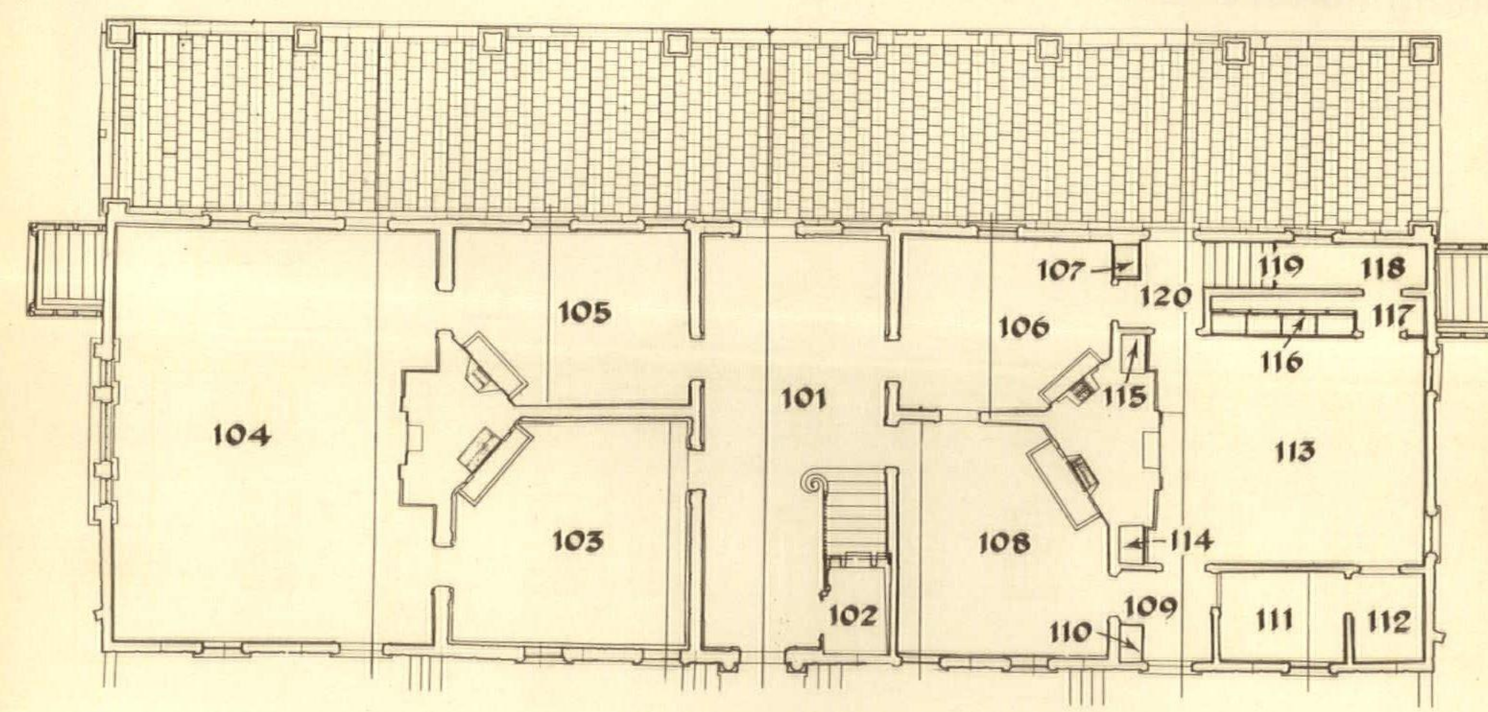
RIVER FRONT



SECOND FLOOR PLAN



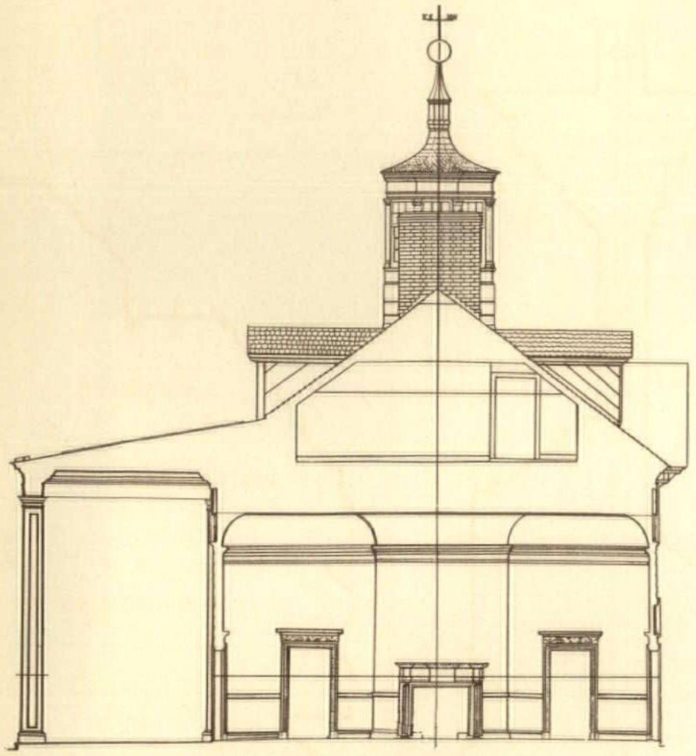
WEST FRONT



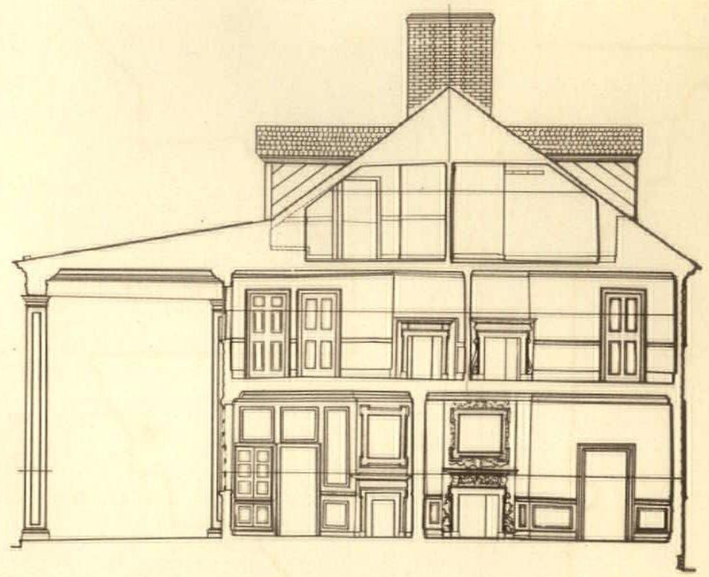
FIRST FLOOR PLAN

Copyright *Mount Vernon Ladies' Association*, Mrs. Horace Mann Towner, Regent, Morley

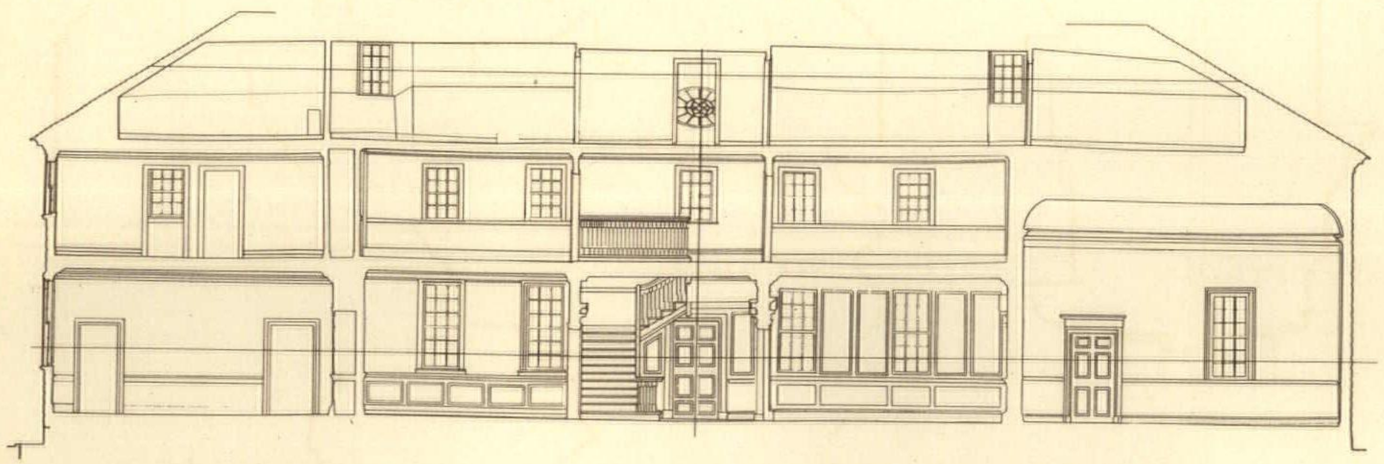
Virginia, Seat of GEN[l] GEO[e] WASHINGTON



NORTH SECTION

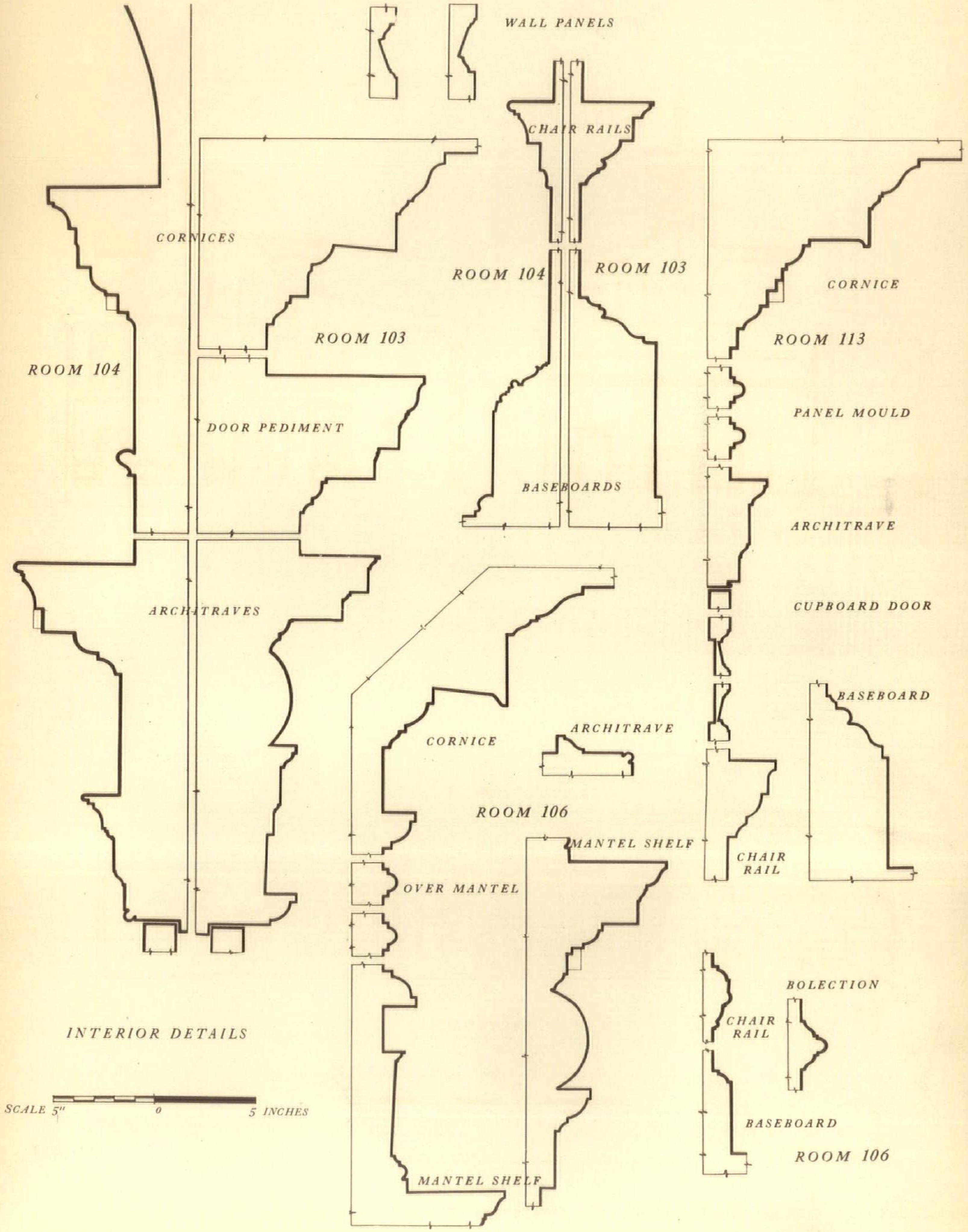


SOUTH SECTION



SECTION

SCALE 5' 0 25'

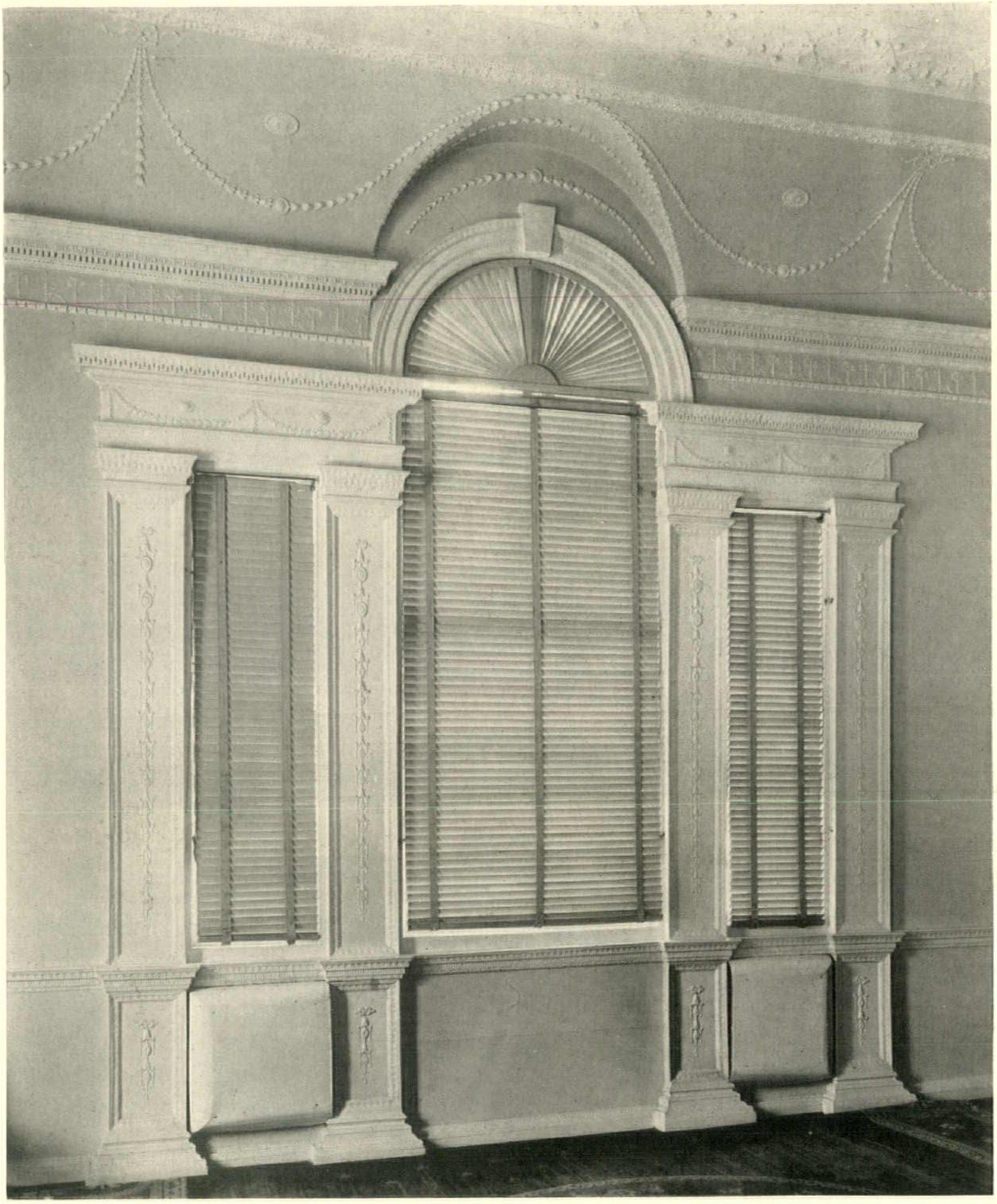


INTERIOR DETAILS

SCALE 5" 0 5 INCHES

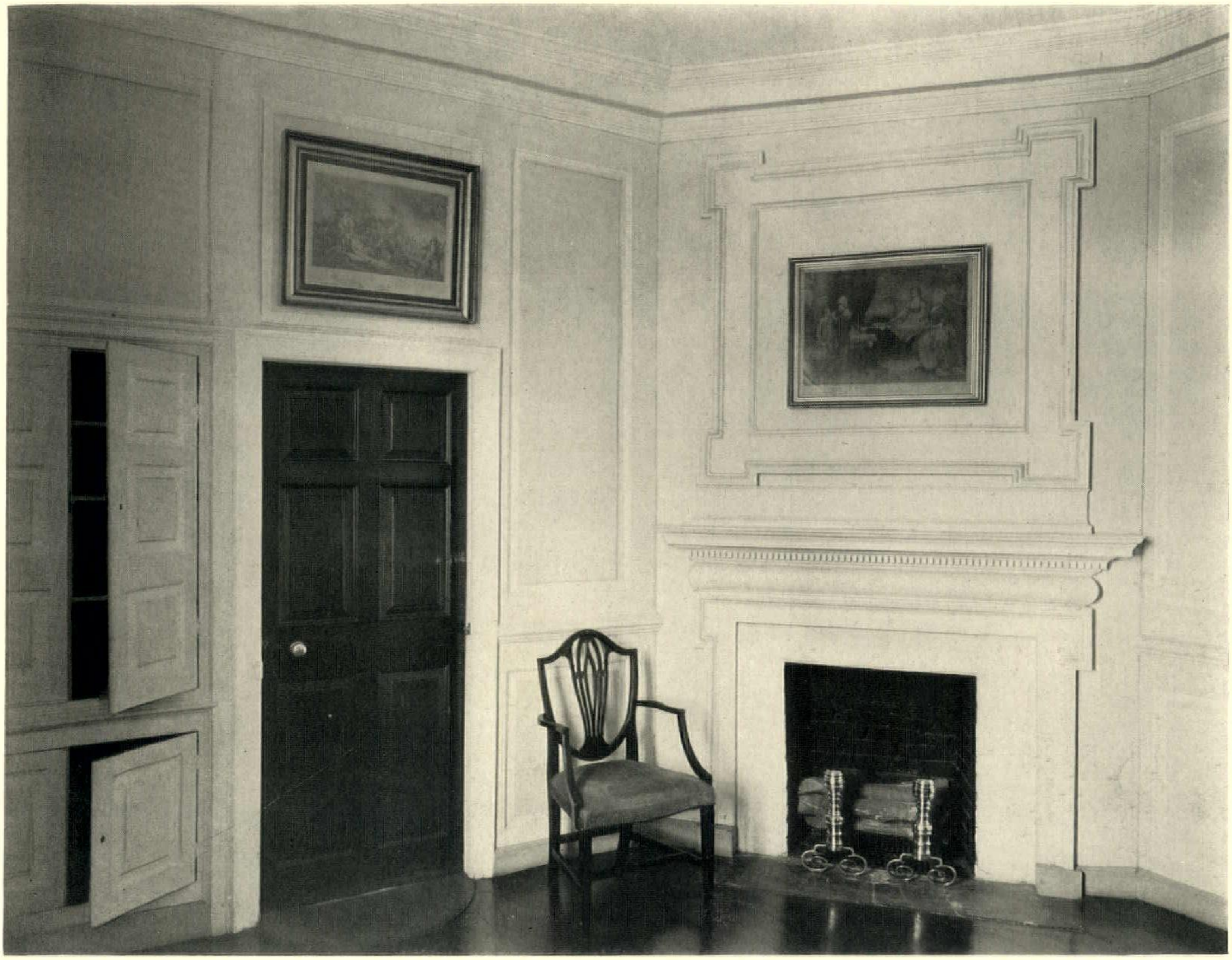
Williams, Director of Research. *American Architect* and *Architecture*, February, 1938

THE progressive stages of the work at Mount Vernon are best recorded by the detail of the individual interiors. In the Spring of 1776 the enlargement of the north end of the house was begun and by Fall was closed in. The "New Room," Number 104 *on the plan,* is in this addition. It was not finished until 1786 and General Washington was anxious that it should be exactly in the prevailing mode and was at pains to find out how such things were being done in England. Consequently we find that the moldings are made up of many fine members but the greatest innovation is pressed compo ornament

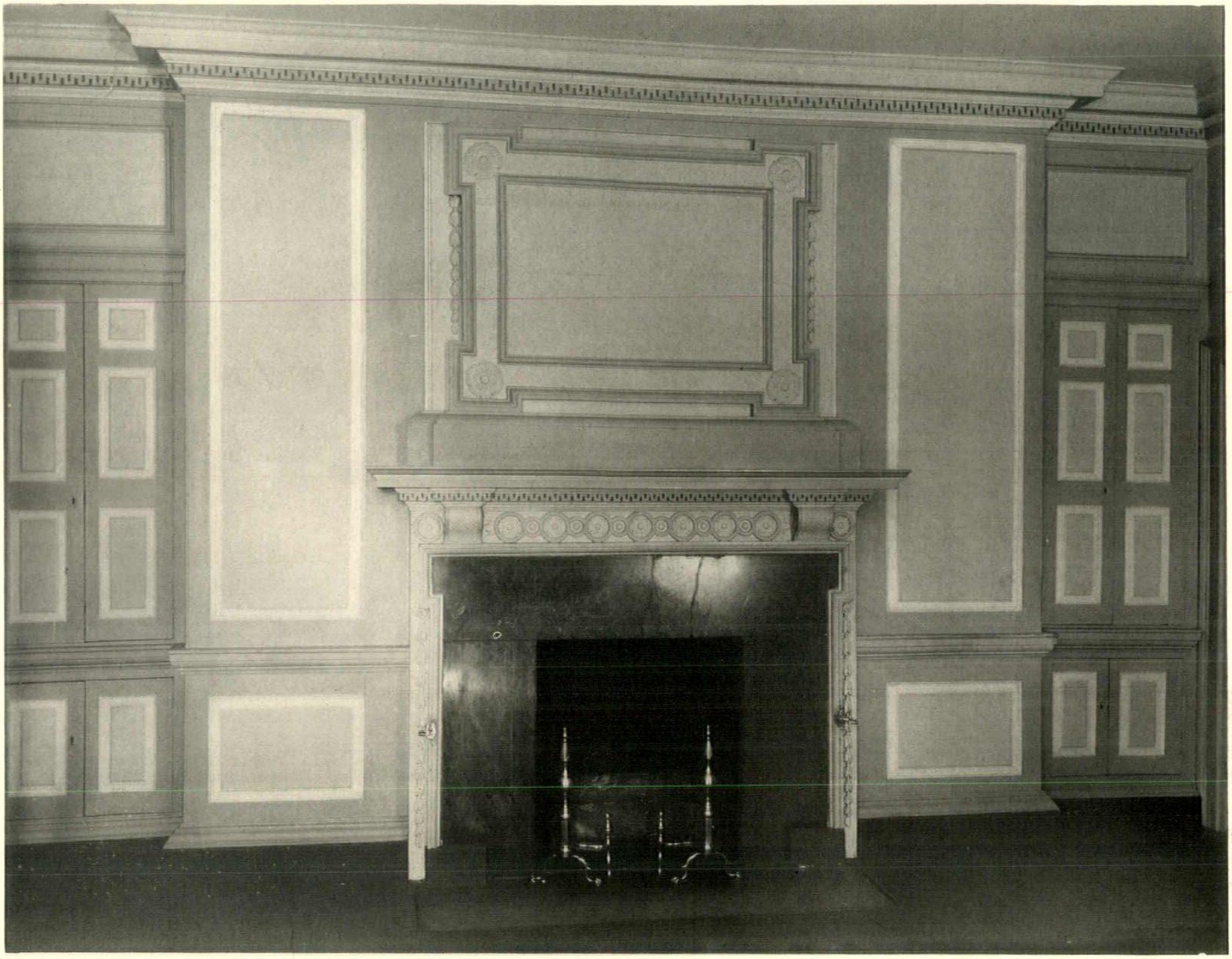


THE "New Room," Number 104, *on the plan,* is not only larger and more refined in detail than the others in the house, but two other features contribute to make it different. They are the "Palladian" window, previously discussed, and the marble chimney piece. The latter, a gift from Samuel Vaughan, an old friend, was bought and removed from a house in England where it had been in use. It is of Italian marble and apparently of Italian workmanship. Of superb size, it contributes a definitely Georgian quality to the room

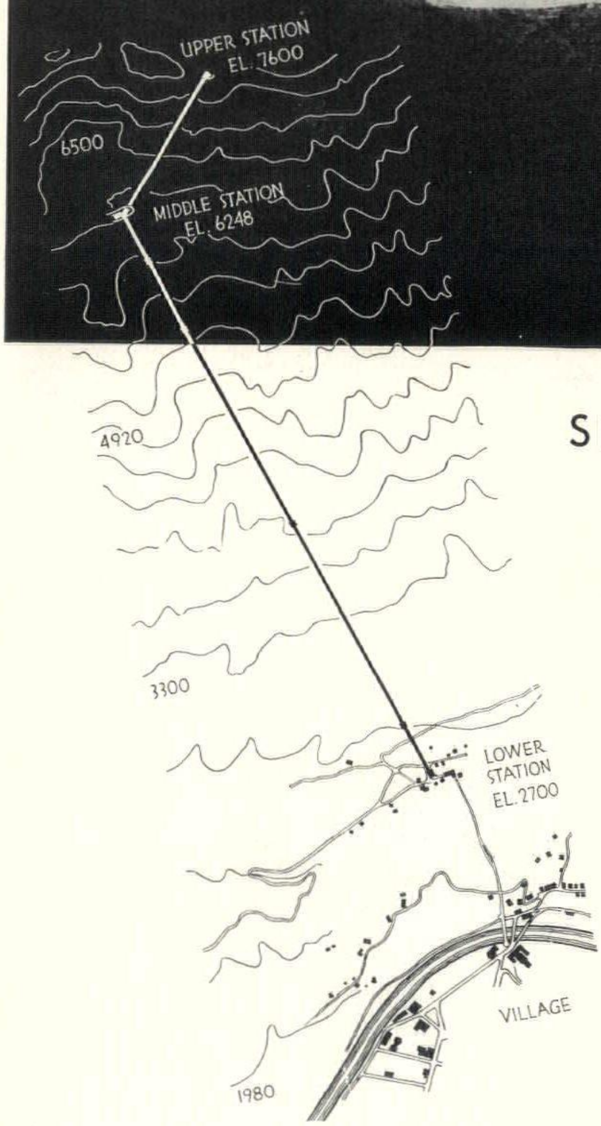
A SMALL room, Number 103 *on the plan,* in the older part of the house, clearly illustrates the influence of contemporary documents. More elaborate than the others it closely follows the then current English taste. ¶ The heavy pediment over the door, the roccoco mantel and the ornamental plaster ceiling are typical.



ANOTHER small room, Number 106 *on the plan*, in the older part of the house, is more characteristic of current colonial tastes. This room served as a model for Washington's study (following page). Comparison of the moldings in these rooms can be made by referring to the sheet of measured details published herewith.



WASHINGTON'S study, Number 113 *on the plan,* in the South Wing, begun in 1774, follows in detail one of the old rooms (previous page) from which it opens. The old room, however, is paneled entirely in wood while the new one is finished in stucco with wood moldings. ¶ The book cupboards flanking the mantel seem to have been installed after Washington's death.

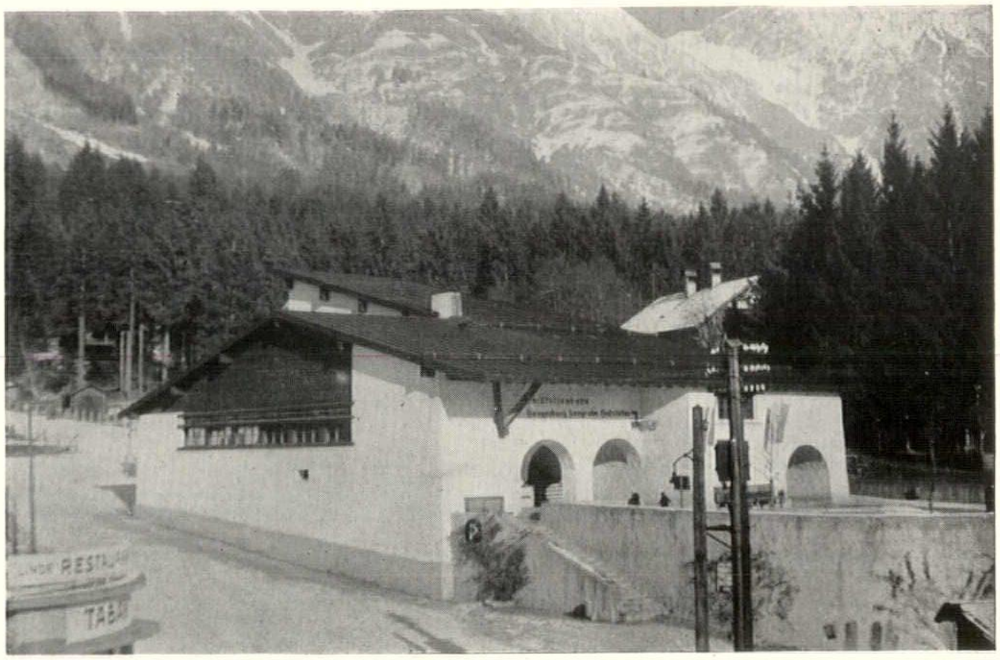


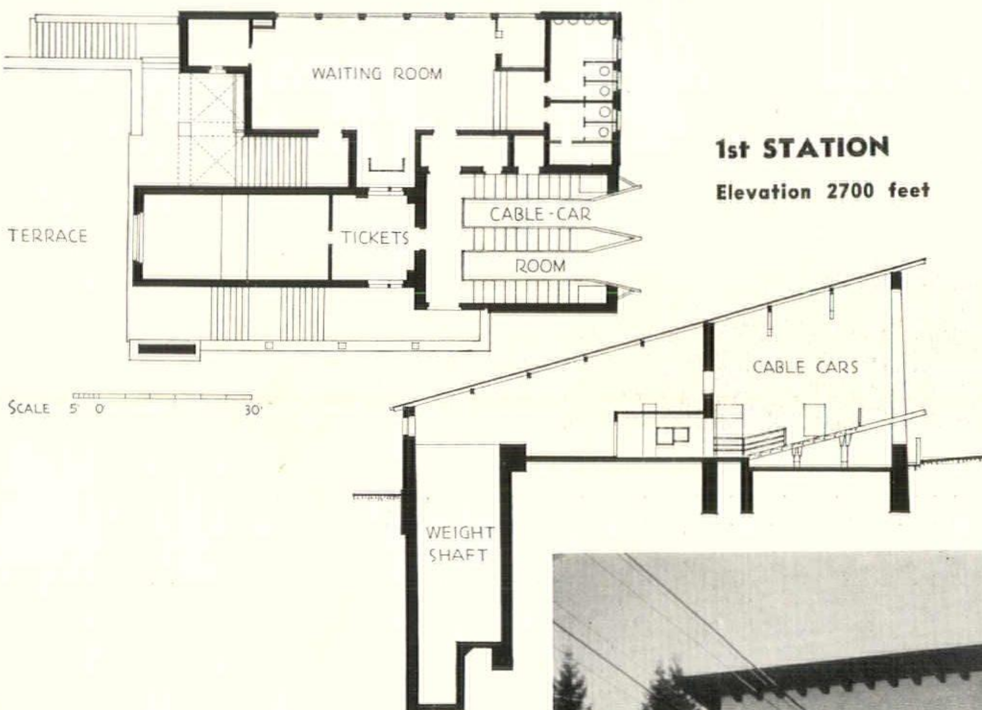
SKI STATION AND AERIAL RAILWAY

INNSBRUCK, AUSTRIA

In Austria, especially in the Tyrol, skiing practically amounts to a heavy industry. Innsbruck, surrounded as it is by high mountains, is naturally an important skiing center. Because of the topography of the neighborhood, facilities for the sport constitute a major engineering problem. This aerial railway, located a short distance from the town, is 11,900 feet in length up an average slope of 32°.

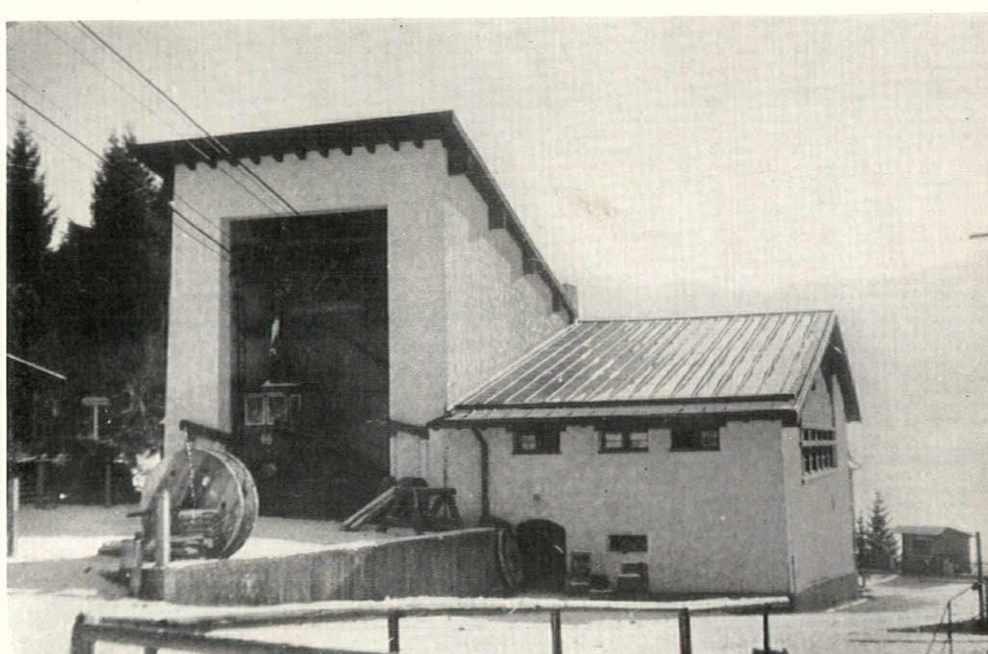
EDUARD SENN-GLIDTSTEIN, DIRECTOR,
FRANZ BAUMANN, ARCHITECT



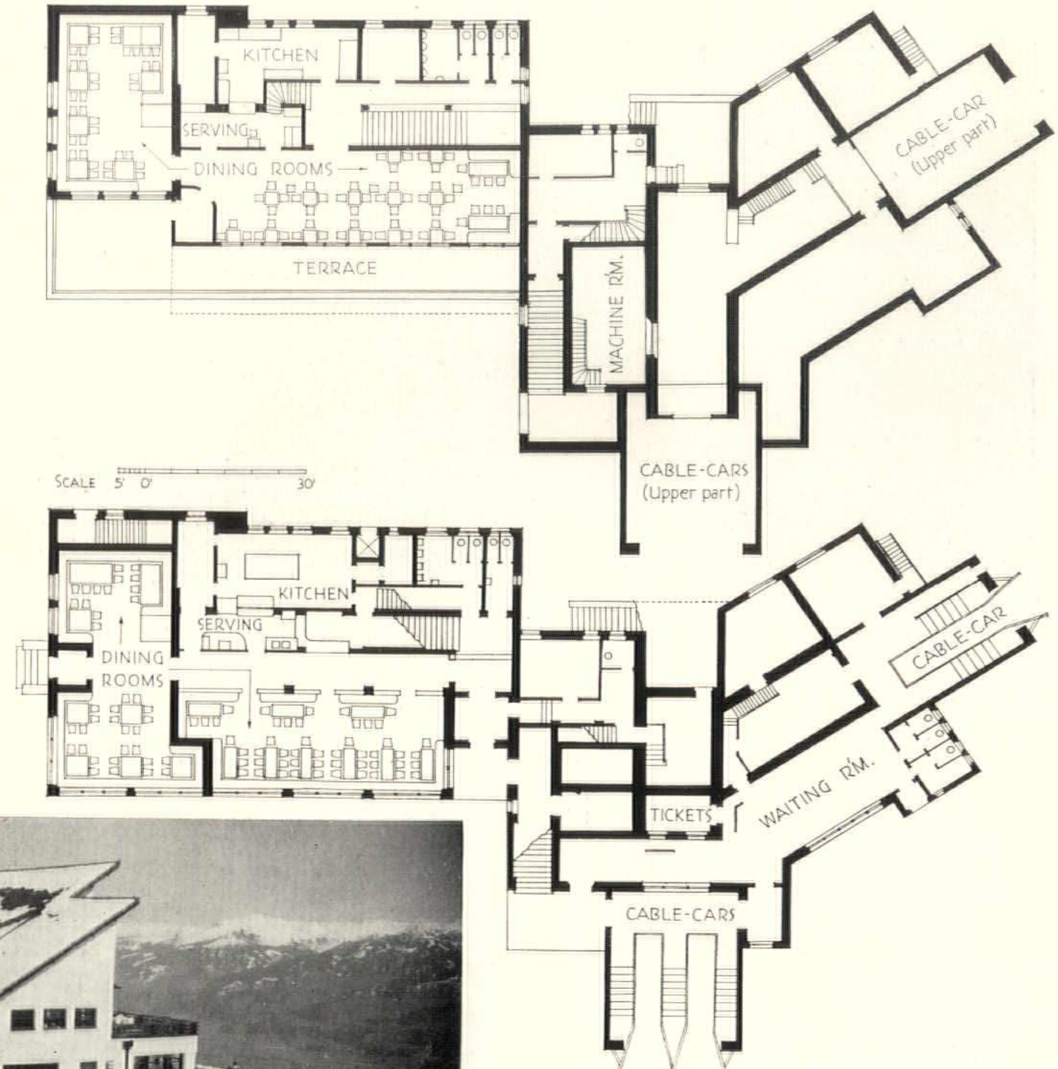


1st STATION
Elevation 2700 feet

Essentially merely a waiting room and ticket office, the first station is characteristic of the architectural treatment of all three. Built of reinforced concrete with cement-finished walls of brick and stone, its forms recall local precedent. Wood trim is stained dark brown and the steep pitched roofs are of metal



SKI STATIONS
INNSBRUCK, AUSTRIA

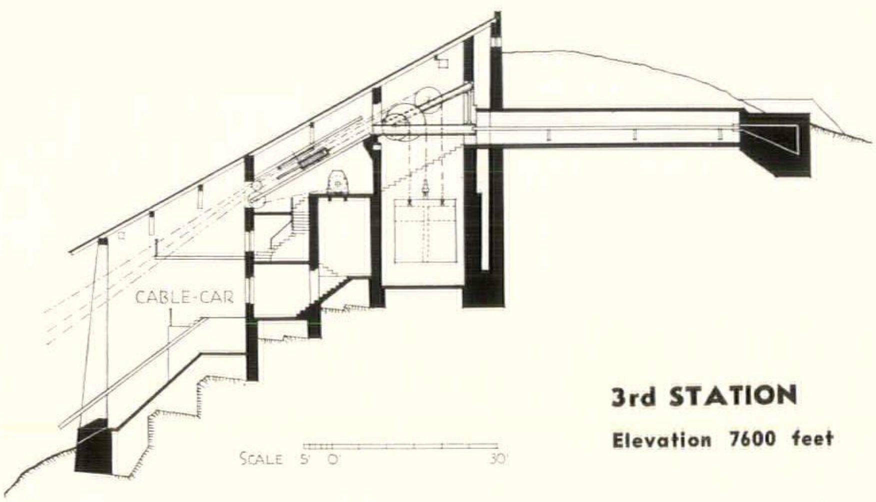


2nd STATION

Elevation 6248 feet

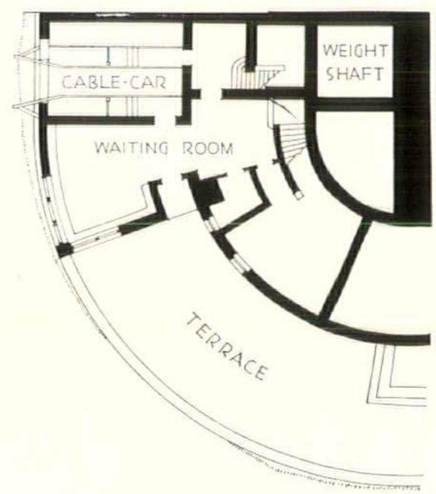
This station is primarily a huge restaurant. It is the most popular because of excellent skiing conditions and because of the beautiful view of the valley nestled in surrounding mountains. Here also the more expert may change cable cars for the topmost station. Both the furniture and the interior design recall the light stained rugged native wood forms

REST STOP . . There are four intermediate stops between the first and second stations. They are of the simplest possible nature, consisting of a railinged wood platform.



3rd STATION

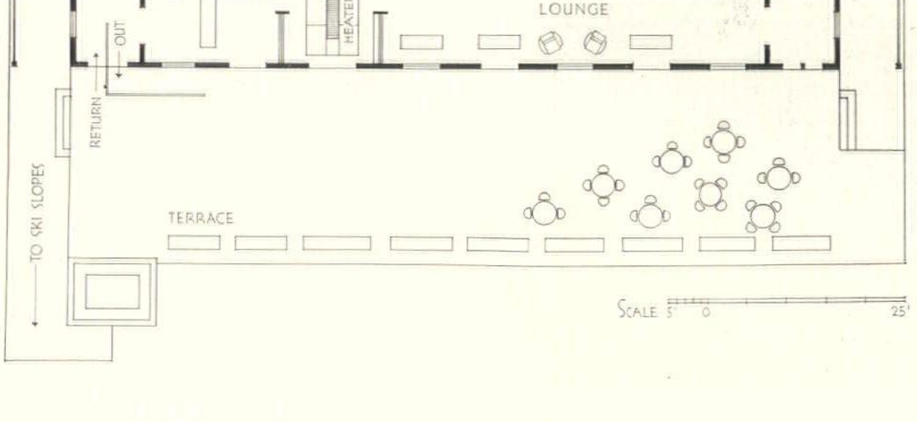
Elevation 7600 feet



This station is perched almost on the pinnacle of the mountain. It is most interesting in the manner in which the architecture literally follows the form of the hill. Outside of the necessary mechanical equipment and waiting room, it consists of a series of terraces.

SKI STATIONS
INNSBRUCK, AUSTRIA

SKI LODGE, YOSEMITE NATIONAL PARK, CALIFORNIA



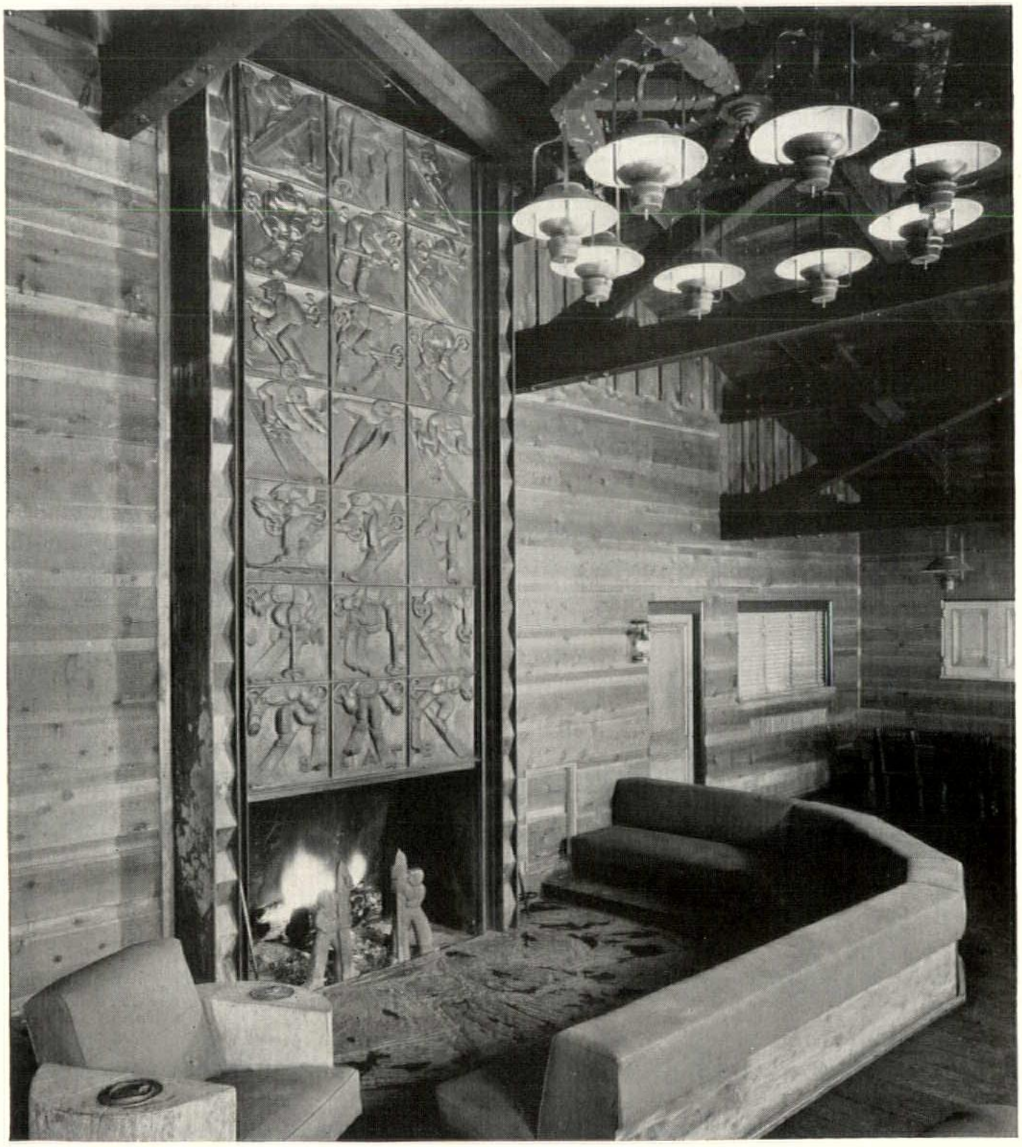
Badger Pass Ski Lodge is particularly significant as a demonstration of the increasing importance of recreational architecture. Since the utilization of leisure has become almost a social theme song, the American public has shifted from sports observation to actual participation in sports ranging from quoits to *slaloms*. Situated on the rim above Yosemite Valley at an elevation of 8,000 feet, the average snow pack in this locality is 12" with an average winter temperature of 15 degrees. As many as 3,000 skiers use this building on holidays.

ELDRIDGE T. SPENCER, ARCHITECT

BADGER PASS SKI LODGE, CALIF.

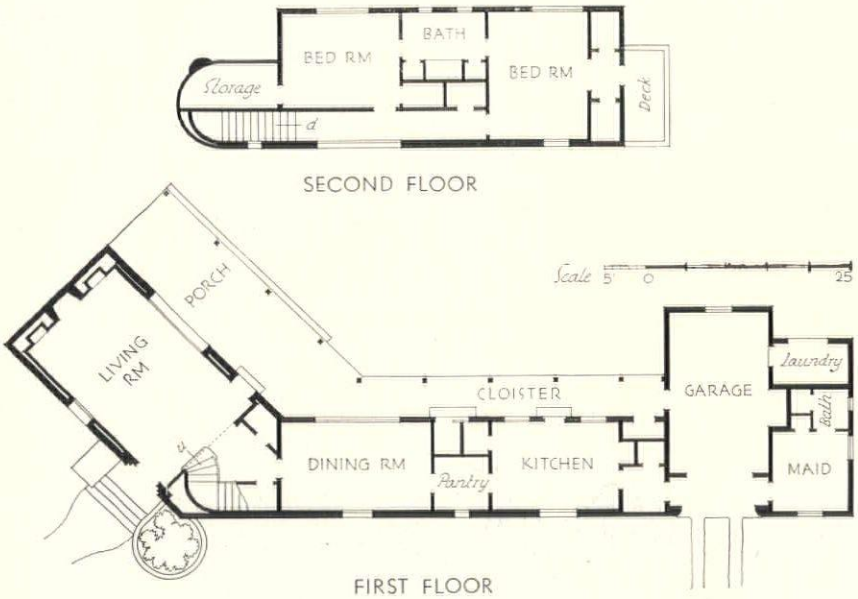
ELDRIDGE T. SPENCER, ARCHITECT

Construction is entirely of wood with exteriors of slab. Exterior walls are insulated with double-faced installation. The roof is designed to carry a snow load of 200 pounds per square foot. The building contains its own electric generating plant and dormitories for the help. No guest accommodations are provided since the lodge is operated as part of the hotel units on the floor of the valley.



PHOTOS: SAMUEL GOTTSCHO

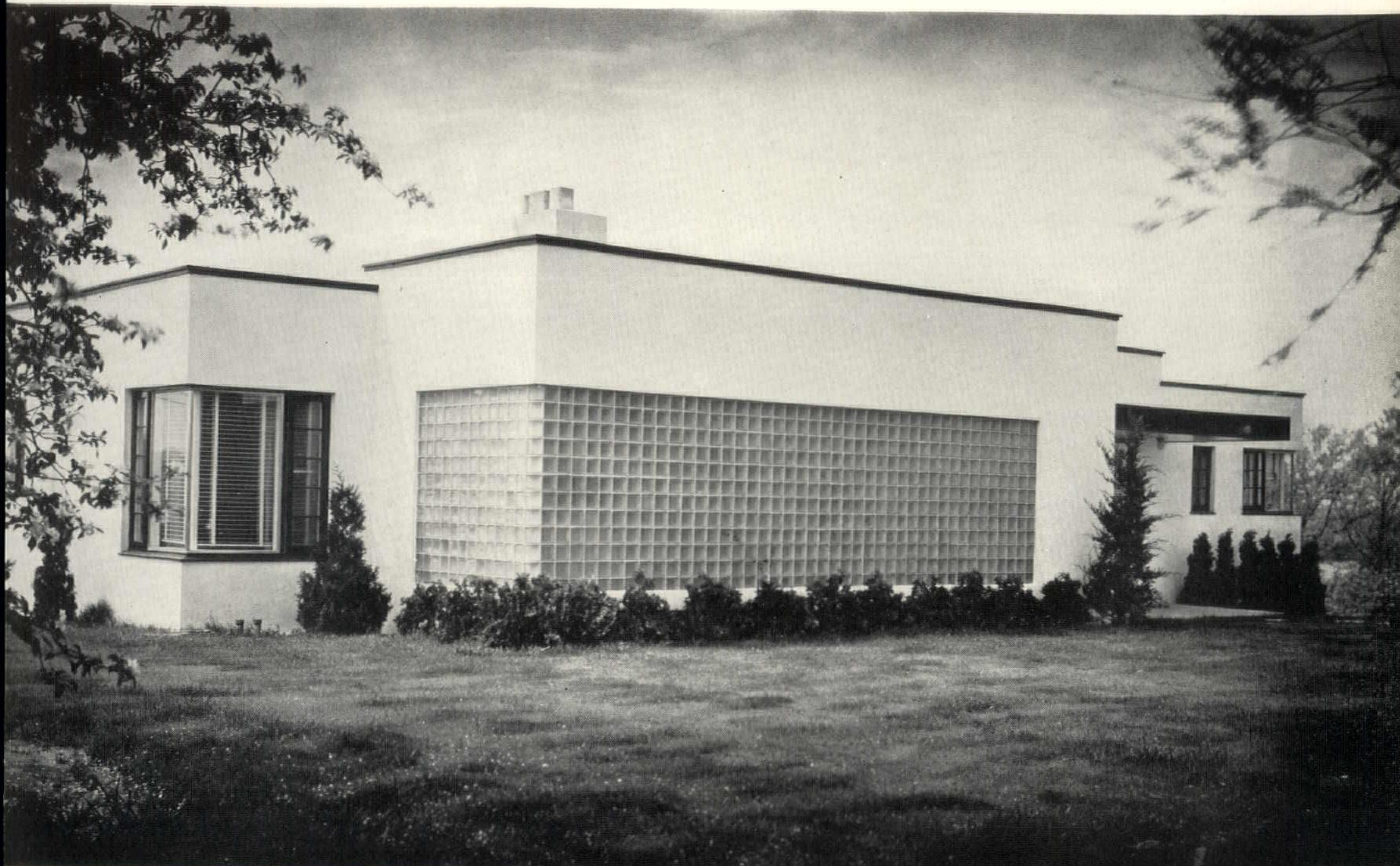
HOUSE OF I. N. MELTZER, MIAMI, FLORIDA



Spread reinforced concrete footings and reinforced concrete foundation walls are used for this house which has no basement. Common brick intersperses the 4" x 8" x 6" hollow concrete exterior walls. Second floor walls are stucco over this. Interior walls have 1 x 2 treated wood furring, 16" o.c., wood lath and plaster; interior partitions have wood studs. Roofing construction is of wood rafter cover with wood sheathing, roofing felt asphalted, slate surfaced felt and red roofing tile. Windows are steel casement.

L. MURRAY DIXON, ARCHITECT

All interior trim, including ceiling and fireplace wall paneling, is of cypress. Flooring is of oak. The second floor exterior wall on the garden side (below) is of frame, sheathed roofing felt, metal lath and stucco. Porch flooring is of handmade Cuban tile on concrete slab.



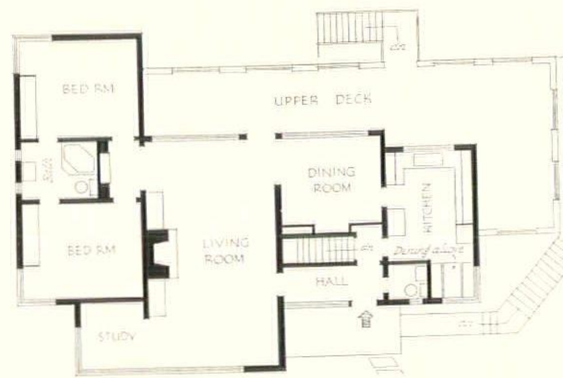
S: DUNCAN

HOUSE FOR JACK GARDNER, BENTON HARBOR, MICHIGAN

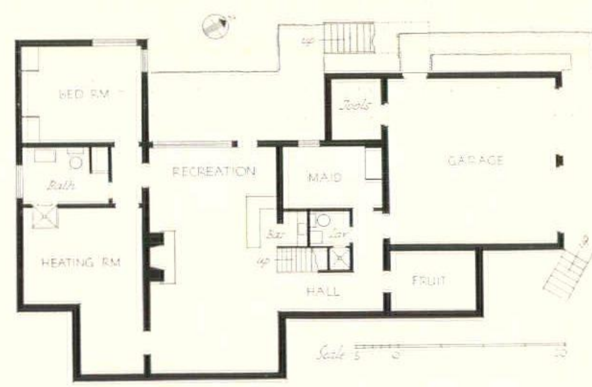
• A primary requisite in the design of this house was the owner's demands for maximum privacy and yet for sufficient fenestration and ventilation. The plan was conditioned by two requirements: one a desire for minimum hall areas and the other a sloping site with living accommodations on both floors of the house. The site slopes down to the west from the front of the lot. Built on a foundation of asphalt-waterproofed 10″ concrete units, exterior walls are of 8″ light weight slag units, finished with three coats of smooth troweled cement and a coat of waterproofing.

PASQUALE IANNELLI, ARCHITECT

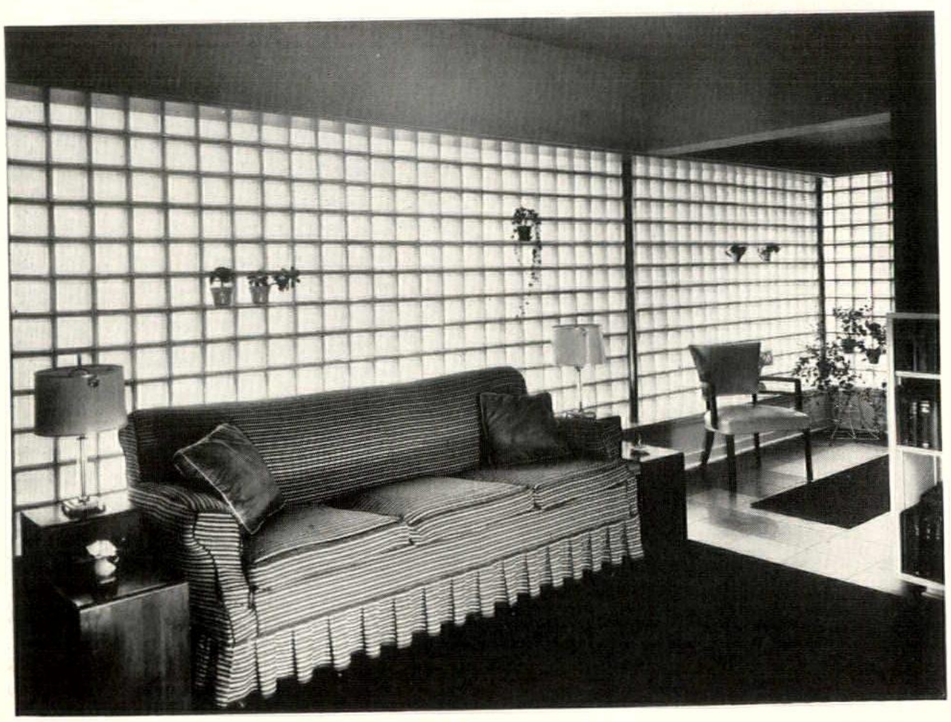
HOUSE IN BENTON HARBOR
PASQUALE IANNELLI, ARCHITECT



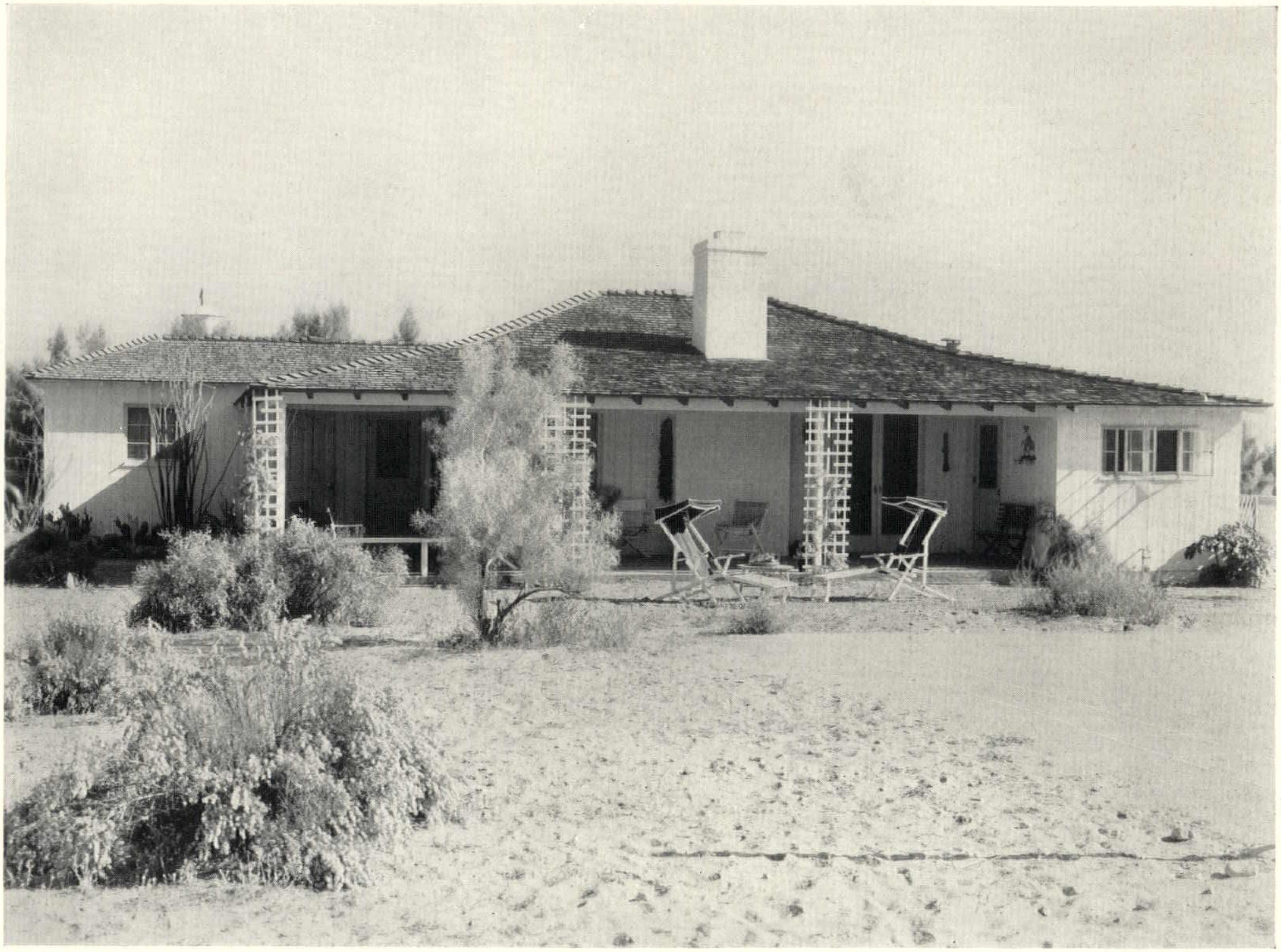
UPPER LEVEL



LOWER LEVEL

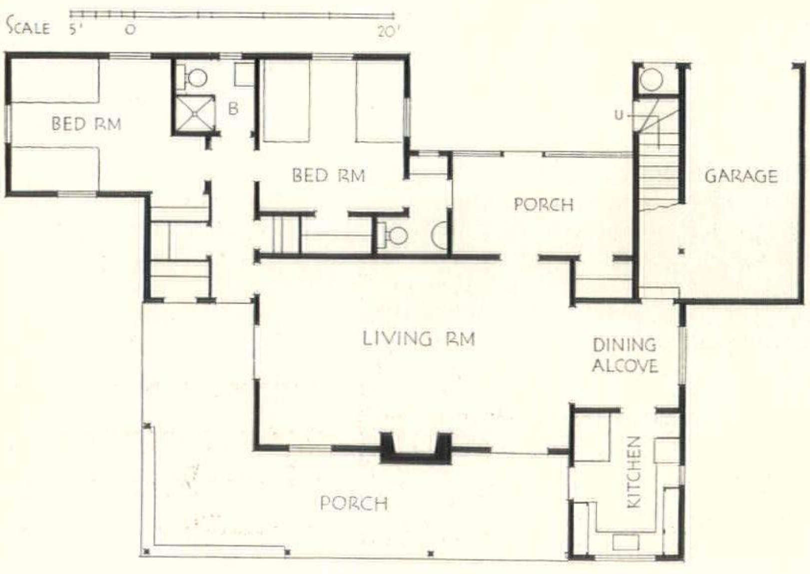


• Insulux glass blocks contributed considerably to the solution of the problem of natural light in rooms on the street front. This great glass area also ties the living room and adjacent study together. The kitchen and breakfast nook (above) are finished in Micarta with stainless steel trim. The venetian blinds are of metal. Floors are 5″ concrete finished in some instances with cork tile and in others with asphalt tile.



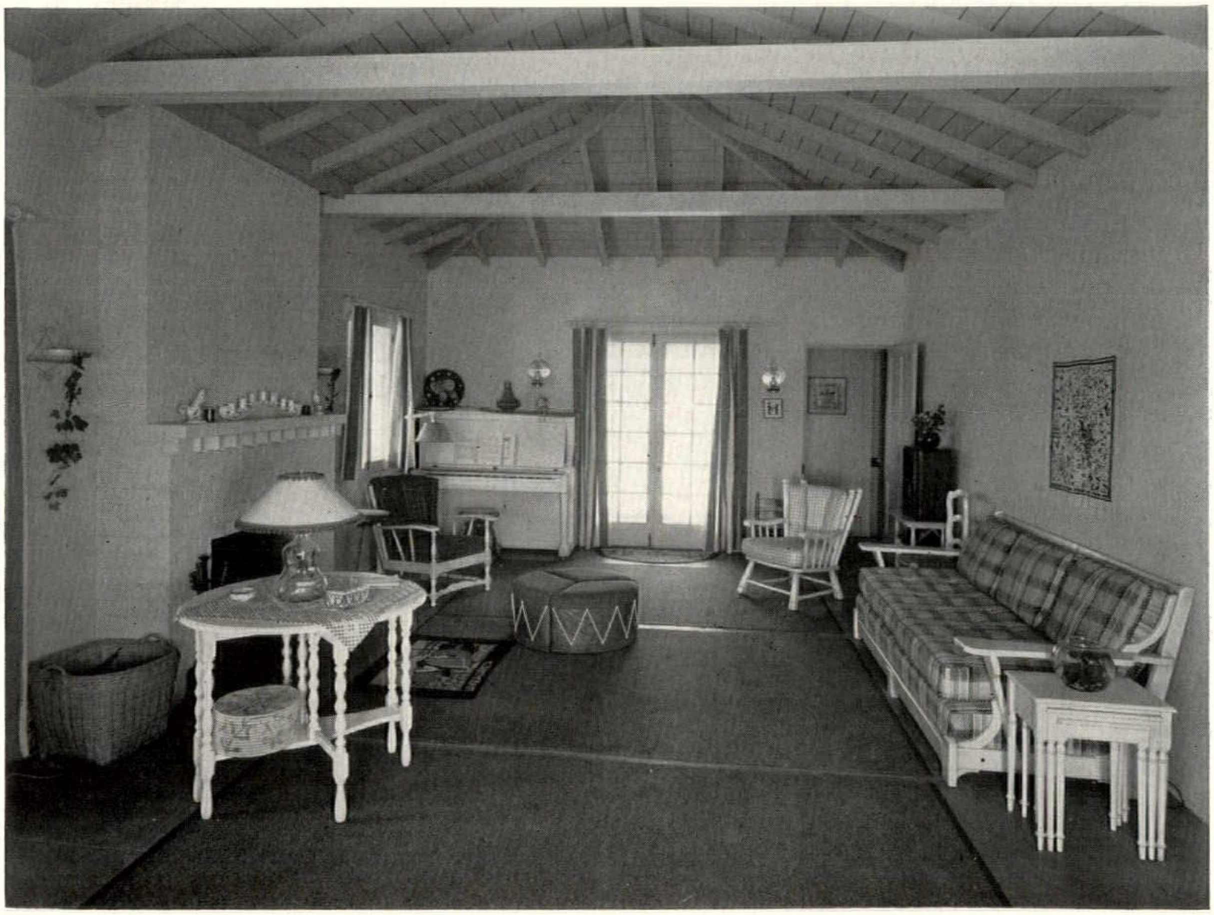
PHOTOS: WILLARD

WEEK-END HOUSE, PALM SPRINGS, CALIFORNIA



HAROLD G. SPIELMAN, ARCHITECT

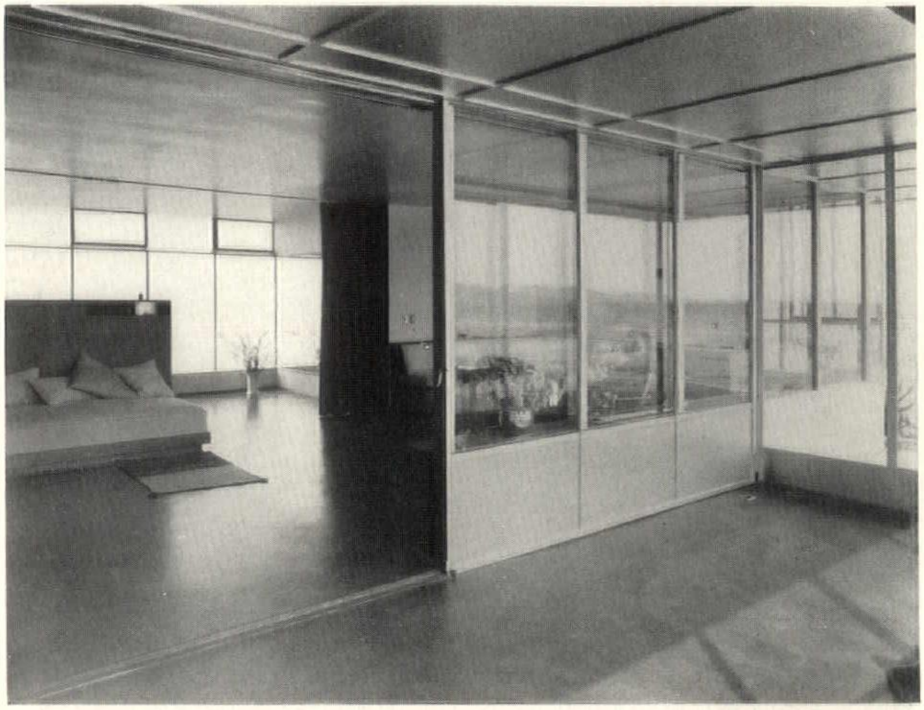
Designed for maximum entertaining and minimum housekeeping, this residence is well-suited to week-end living. Extra sleeping space is available in the living room and on the rear porch, with baths readily accessible to both. Construction is cement slab and heavily tongue and groove siding on wood frame



On the exterior the siding is painted white with yellow trim. The redwood shingles are weathered a deep brown. The living room has white walls, pale blue painted ceiling, doors and trim painted yellow

WEEK-END HOUSE
PALM SPRINGS, CALIF.
HAROLD G. SPIELMAN
ARCHITECT

DESIGN DETAILS:
PARTITIONS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Greater openness of plan has brought about a revision in attitude concerning both the design and function of interior partitions. Previously thought of primarily as a division between rooms, they have become a means of orientating room function. The previous method of a plain or decorated solid wall has given way to new and ingenious uses of widely diversified types of design and materials. Just how various they can be is well illustrated by the two examples on this page. That at the top, a series of sliding doors, recalls a Japanesque influence, while that at the bottom is merely a fanciful arrangement of interlaced vividly-colored metal rods.

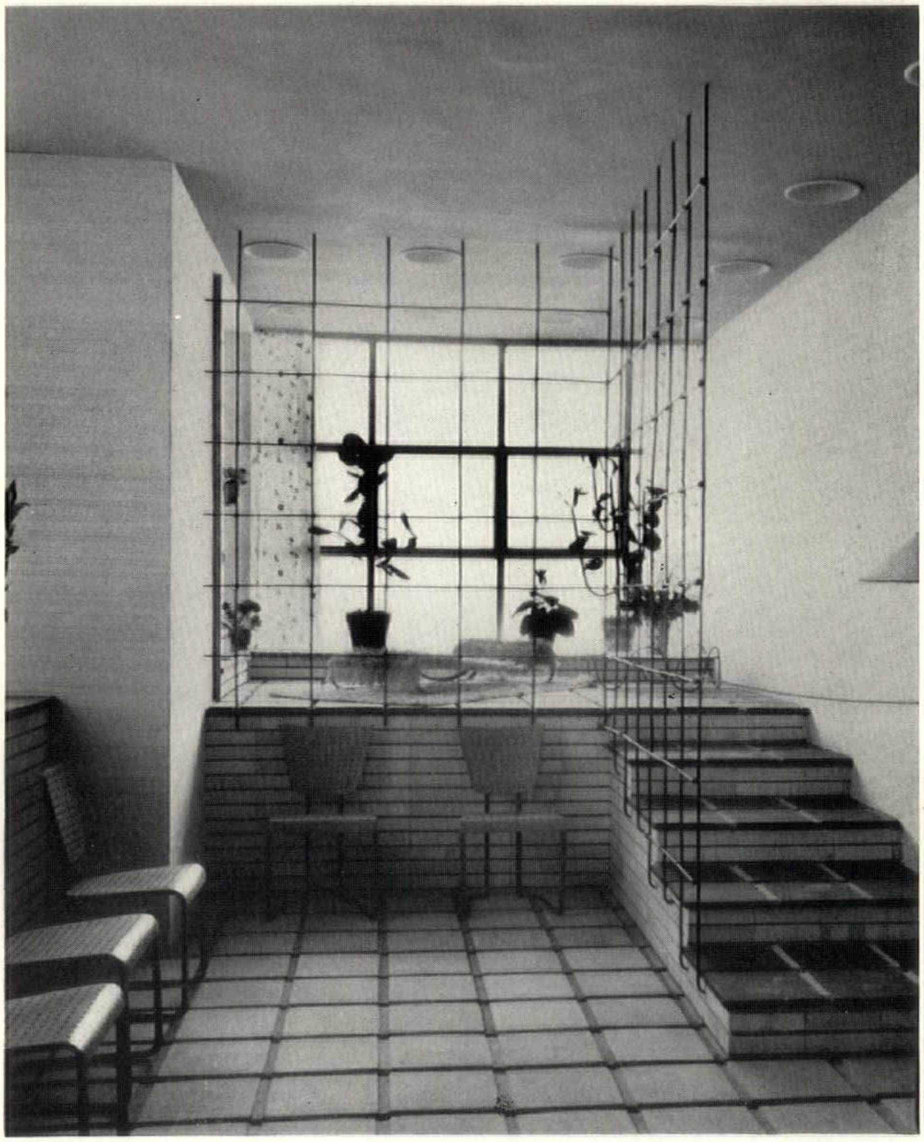
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PHOTO: BONNEY

1. House in Palm Springs, Calif., Richard Neutra, Architect

2. Exposition Room in Paris, Jean Royère, Designer

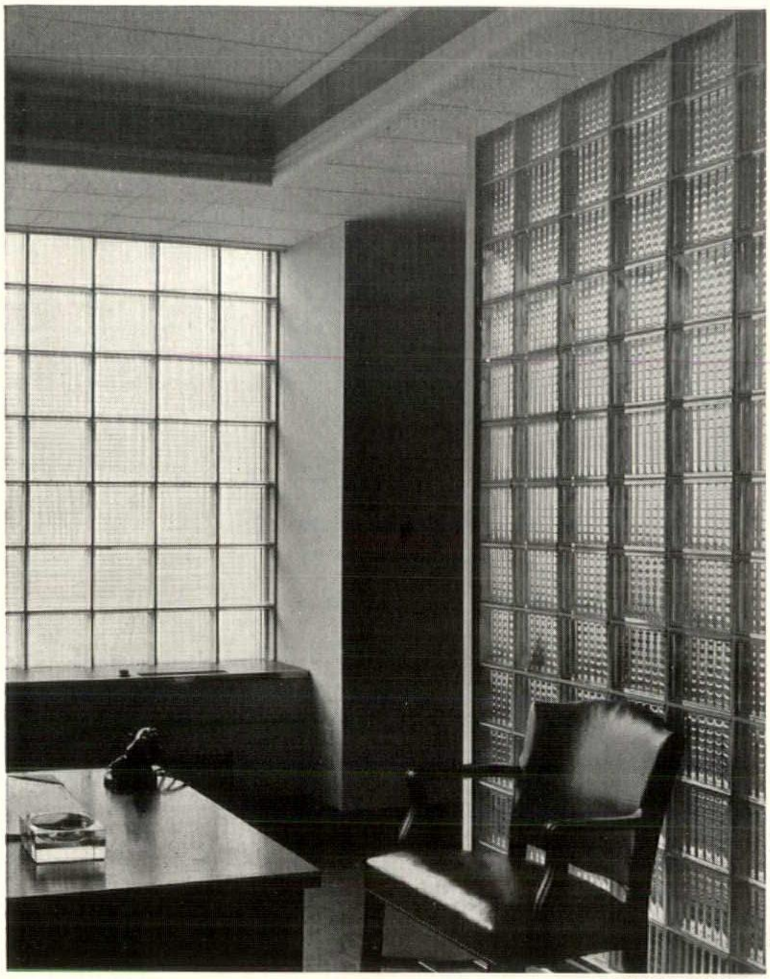

PHOTO: GOTTSCHO

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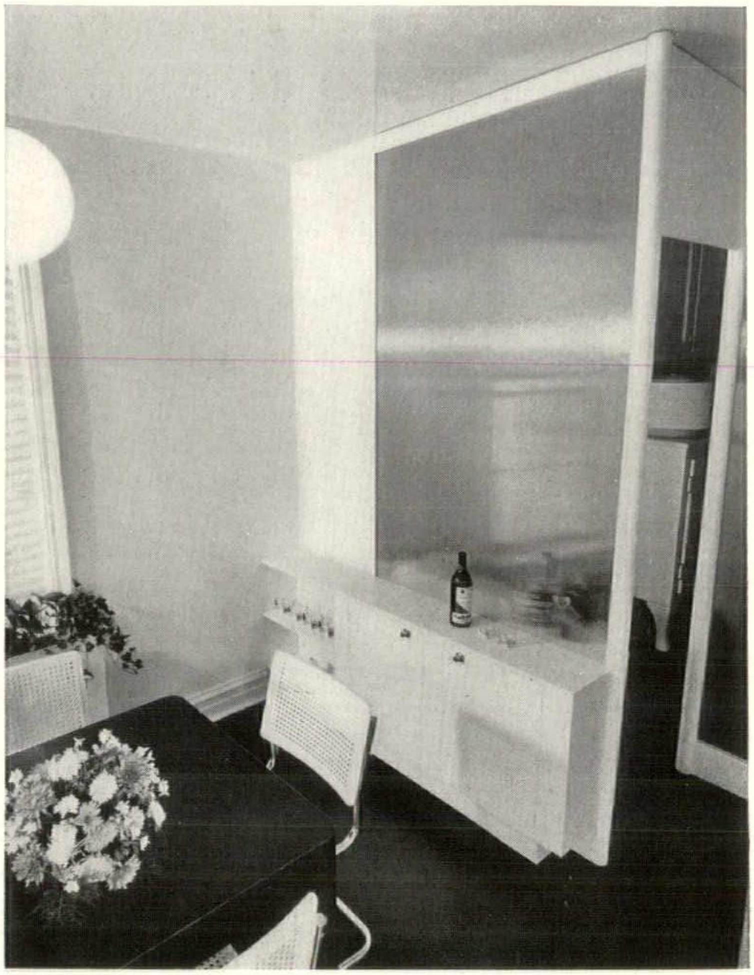

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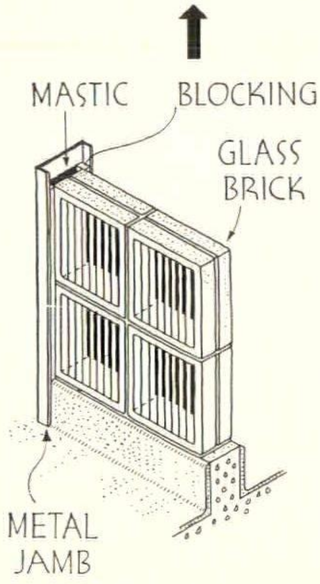
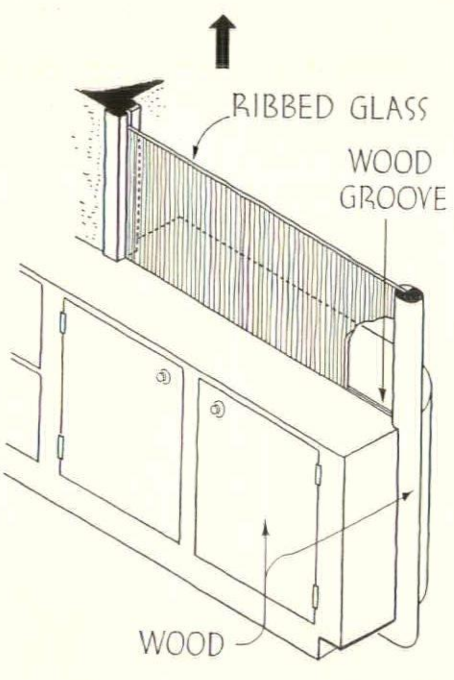


GLASS in various forms is a favored medium for certain types of interior partitions because of both its transparent and translucent qualities. Thus a partition helps to light what usually would have been a dark corridor or room. Another popular type of partition is that which conceals cabinets, drawers and lighting. This type can also be considered built-in furniture. Still another treatment is the frank use of a partition without doors **(5)**.

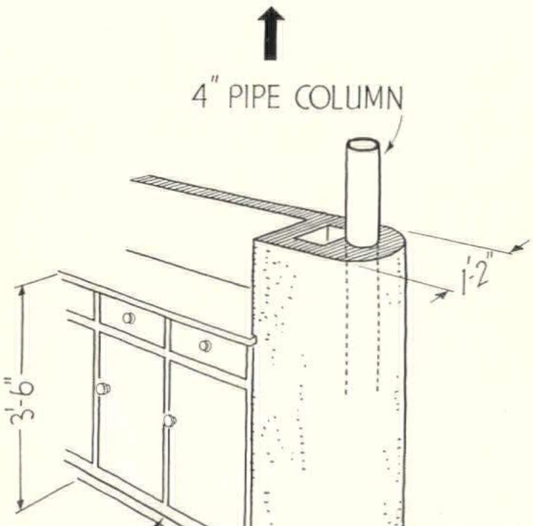


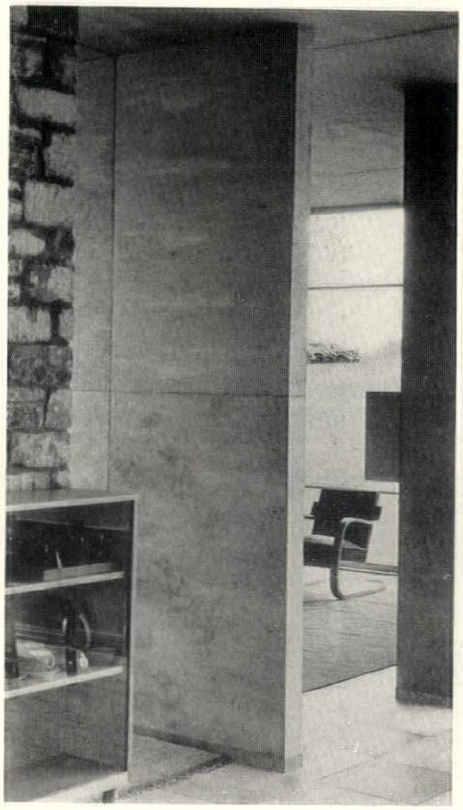
1. **Office in New York, William & Geoffrey Platt, Architects**
2. **Apartment in New York, Joseph Aronson, Designer**
3. **House in Madison, Wis., Beatty and Strang, Architects**

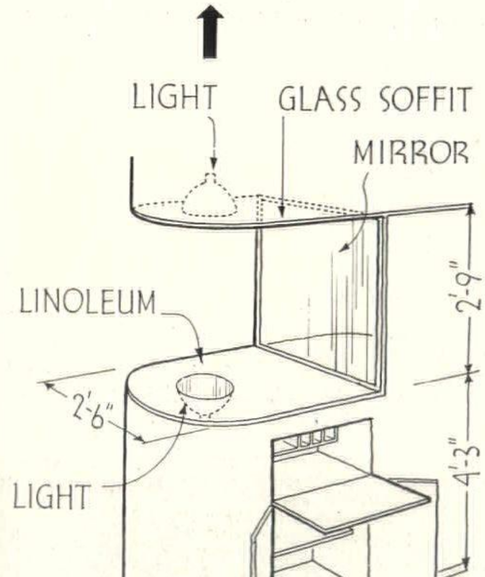
DESIGN DETAILS: PARTITIONS

3

4



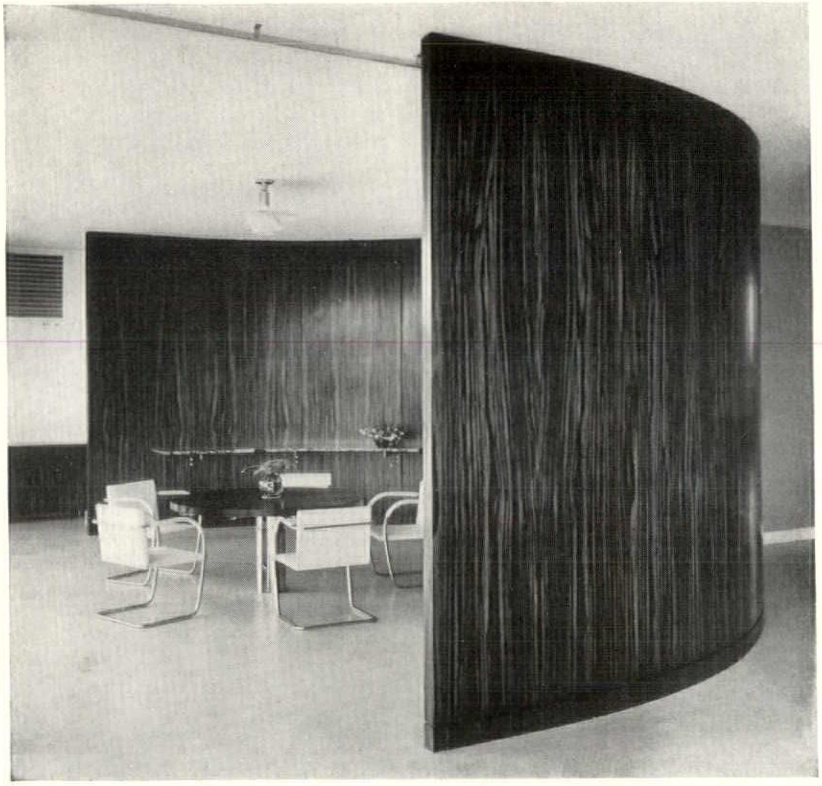




4. House in Red Bank, New Jersey, C. C. Briggs, Architect

5. Exhibition House in Bristol, England, Marcel Breuer & F. R. S. Yorke, Architects

5



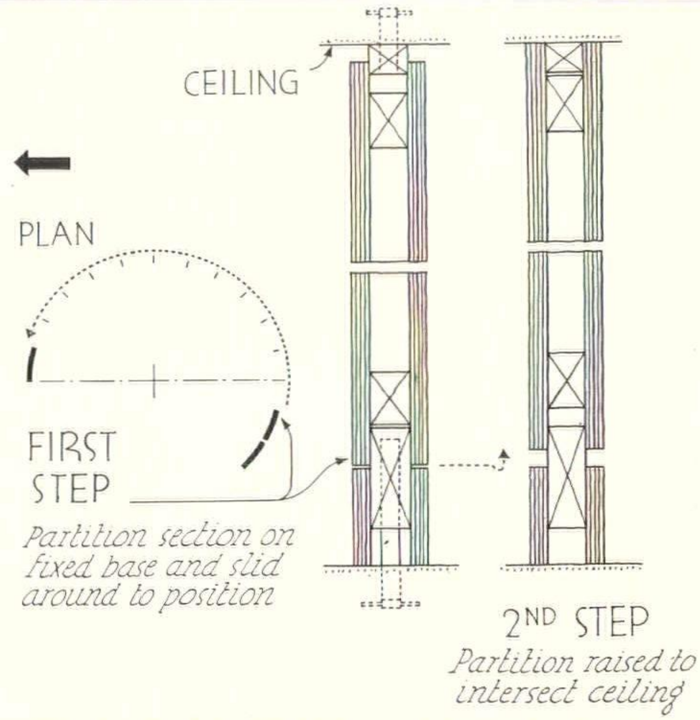
MUSEUM OF MODERN ART

1

1. House in Brno, Czechoslovakia, Mies van der Rohe, Architect.

2. House in Tyler, Texas, Hobart Plunkett, Architect

3. House in Highland Park, Ill., Gilmer V. Black, Architect



A semi-circular screen of wood separating the dining area from the living room constituted a minor engineering problem because the large radius required that prefabricated sections be ingeniously assembled on the job. Below, two other examples of the use of glass, **(2)** mirrored partitions, and **(3)** a metal-framed clear glass windscreen.

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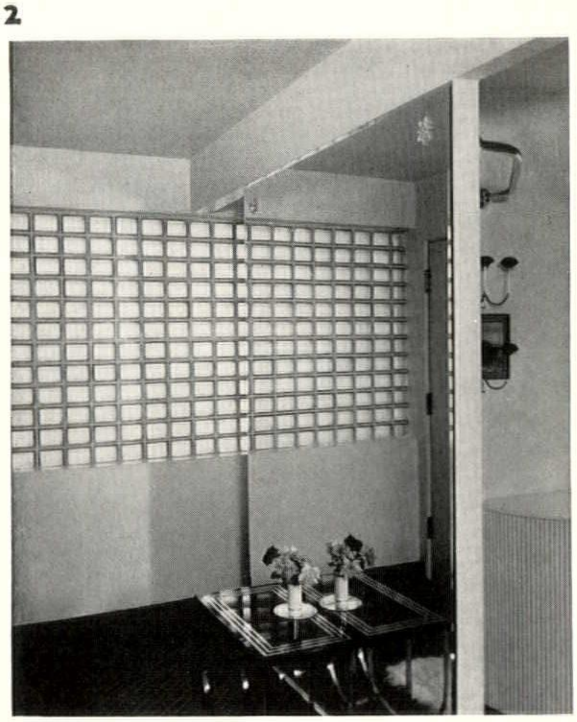

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PHOTO: HEDRICH-BLESSING

DESIGN DETAILS

PARTITIONS

AUTOMATIC HEATING AND AIR CONDITIONING

By GRAHAM FORD

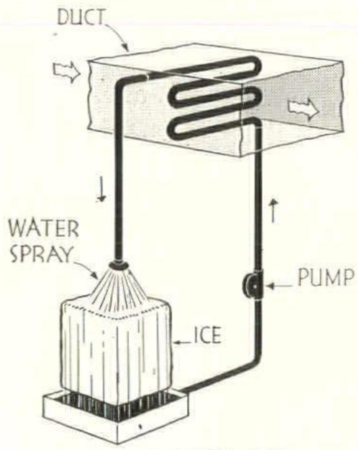
I SYSTEMS • II EQUIPMENT • III DESIGN • PART ONE CONTINUED

THIS up-to-the-minute survey of modern automatic heating and air conditioning practices began in the January issue. Part I opened with a statement of the standard conditions to be satisfied by a normal installation and a thorough review of the five types of systems from which a selection may be made. These are: (1) the Direct Fired system using a warm air furnace as the primary source of heat; (2) the Indirect system using a boiler coupled to a heat exchanger in the duct work; (3) the Split system using a boiler serving standing radiation where heating alone is required and a heat exchanger in duct work for rooms to be air conditioned; (4) the Auxiliary system, using a normal boiler-radiation type heating installation with a separate air circulating and conditioning unit for a limited group of rooms; and (5) the Unit system in which unit air conditioners are installed in each room to be treated.

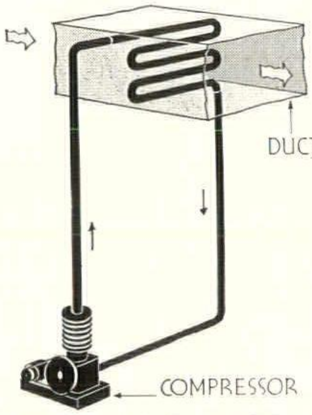
• Continuing, the January article analyzed all of the principal types of heating systems, including one-pipe steam and vapor, two-pipe vapor, vacuum and free-vented systems and hot water heating systems, describing their elements, performance characteristics, advantages and limitations.

• The section of Part I which is concluded here deals with systems employing duct work and with the several functions of complete air conditioning which normally may be incorporated in the central plant. Air motion, air cleaning, humidification and dehumidification were covered in the January installment. We begin here with the cooling methods.

AUTOMATIC HEATING AND AIR CONDITIONING



COOLING WITH ICE



COOLING WITH MECHANICAL RERIGERATION

COOLING

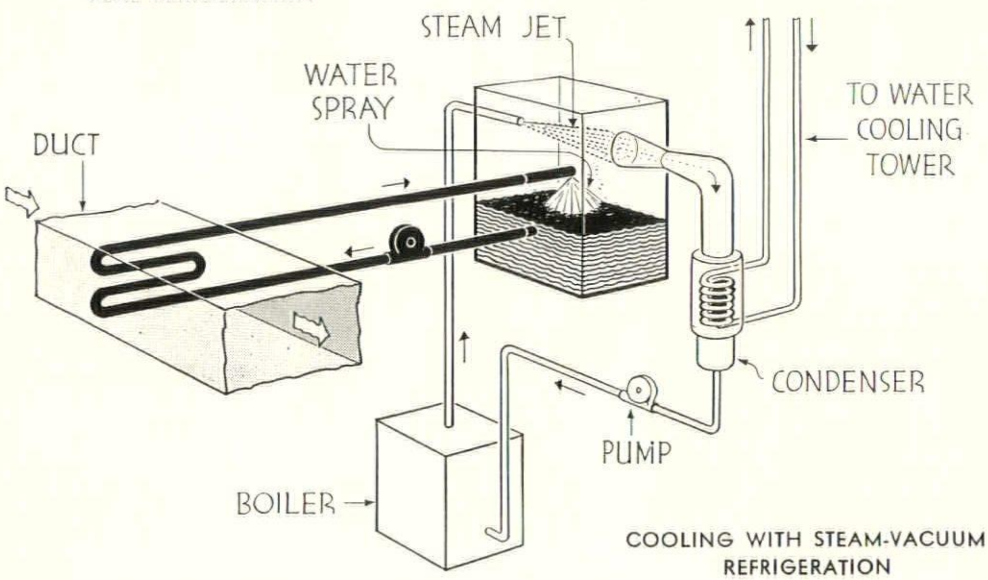
There are six basic methods of comfort cooling: by ice, well water, mechanical refrigeration, steam-vacuum refrigeration, evaporative cooling, and by the use of fans to air-cool the interior of buildings at night as a means of retarding the effect of solar radiation in the day. The characteristics of each type follow:

Ice Cooling requires relatively inexpensive equipment consisting usually of an ice storage tank or cabinet, a means of melting the ice with water, and a means of forcing the cooled water through suitable heat exchangers which indirectly cool circulated air. Equipment is available for both central cooling and unit room cooling. The operating cost of such equipment depends largely upon the delivery cost of ice in bulk and the periodic charging of the ice container.

If the ice storage chamber is thoroughly insulated, there need be little loss overnight or between periods of demand. Under such conditions ice cooling may be one of the least expensive methods available. However, it requires regular delivery of ice or constant supervision of the quantity on hand.

Mechanical Refrigeration may be used in two ways: first, by direct expansion of the refrigerant in cooling coils or unit coolers through which air is circulated, or second, by cooling water and the use of this chilled water in sprays or in cooling coils.

With either method of applying mechanical refrigerating equipment there is a further choice as to whether the compressor shall be water cooled or air cooled. If air cooled, the compressor must be located outside of the room to be cooled or else be separately ventilated. With water-cooled units the compressor may be installed within the space being conditioned. This affects the choice of unit summer air conditioners, and this choice in turn may be influenced by the cost of city water consumed by the condenser.



COOLING WITH STEAM-VACUUM REFRIGERATION

Steam-Vacuum Refrigeration has only recently come within the field of normal architectural practice, having hitherto been adapted to relatively large installations requiring special engineering design. Today steam-jet refrigerating units are available in sizes small enough for use in the larger residences or equivalent store, restaurant or commercial and institutional structures.

The underlying operating principle is based upon the fact previously noted that when water is evaporated, heat is absorbed. A jet of steam under high velocity is used to create a vacuum in a container that is equipped with spray nozzles from which city water at ordinary washer temperatures is diffused in the form of a fine mist. Under the high vacuum conditions prevailing within the chamber, evaporation takes place at relatively low temperatures, producting a chilling effect similar to that developed at normal atmospheric pressures.

The recirculating water entering at perhaps 55 F. is chilled to a temperature of 40 F. to 45 F. and this cooled water is thereupon circulated for air conditioning purposes in exactly the same manner as cold water produced by mechanical refrigeration or ice melting. However, the vapor thus produced within the spray chamber and the steam used in the jet have to be withdrawn and condensed. This requires the use of additional water as in the case of water cooled mechanical refrigeration condensers, but more water is required in the steam-vacuum process. A similar process uses no steam, creating the vacuum with centrifugal exhausters.

The choice of vacuum refrigeration as compared with mechanical refrigeration therefore depends upon several factors: (a) the cost of water, (b) the cost of generating steam, and (c) the cost of electric current. Where water costs are very high, cooling towers are usually employed to cool the water used in the condensers and thus permit it to be reused over and over again except for that which is lost in the cooling tower.

Evaporative Cooling is a practical and low cost method of comfort cooling in climates where the outdoor relative humidity prevailing throughout the cooling season is below that required for summer comfort. In such locations the addition of moisture to the air is permissible and, therefore, evaporative cooling is logical as well as effective.

Evaporative coolers are similar to air washers or spray humidifiers and consist of a spray chamber through which the indoor air is constantly circulated. A part of the spray water, which is at substantially the same temperature as the entering air, is evaporated and draws its heat of evaporation from the air, cooling it. At the same time it increases the moisture content or relative humidity of the outgoing air. Evaporative cooling is low in cost and requires a minimum of equipment. It should not be attempted where prevailing outdoor relative humidifies cannot be increased and still produce comfort conditions within the summer effective temperature range.

Fan Cooling should not be confused with the cooling effect produced by vigorous air circulation. The latter does not lower temperatures but simply increases the rate of evaporation of body moisture

AUTOMATIC HEATING AND AIR CONDITIONING

and thereby produces a cooling effect upon the body, just as a summer breeze on a sultry day may make high temperatures more bearable.

Fan cooling, as considered here, uses cool night air to lower the temperature of the building mass. All materials absorb and hold heat. During warm days the interior building surfaces, and even the furniture and fixtures, are warmed and retain this heat for some time after the air itself becomes cooler. In most sections of the United States night temperatures are considerably below day temperatures throughout the summer season. Fan cooling takes advantage of this and thoroughly ventilates the interior of a building during the night period, thereby removing as much as possible of the heat retained by the building mass before the next period of daytime heat arrives.

This night cooling effect can be secured without the use of any fans or other equipment if the windows of a building are kept open from about six o'clock in the evening until six in the morning and are then closed and sunny windows shaded during the day. Since this is not practical in all buildings, fans are used to augment natural circulation.

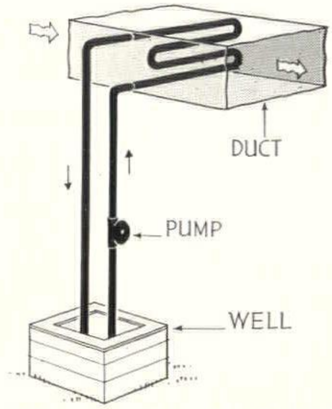
In residences, fans are located in the top floor or attic, and the attic stairway or other suitable opening becomes a duct for conveying the air from the lower floors through the fans to the outside. The fan capacity should be such as to change the air in the space to be cooled from 30 to 35 times per hour.

The advantage of this method is that it may reduce the cooling load on mechanical refrigerating equipment possibly 60% or more of what would be required if night cooling were not employed. The chief disadvantage of this method is that it makes no provision for cleaning the large volume of air passing through the dwelling. People who suffer from hay fever or asthma may find their condition aggravated by the dust brought in, whereas air conditioning systems using filters or washers offer a high degree of relief to most of these sufferers.

A system that avoids this difficulty but that requires oversize filter or air-washer capacity and abnormally large ducts employs the usual central heating or cooling unit fan and filter equipment with an auxiliary attic fan. The basement fan is then arranged to introduce outside air at night instead of recirculating the indoor air, and the attic fan serves to remove the air thus introduced.

Well Water Cooling provides an economical method of cooling at a low operating cost. Initial costs, too, are often low. The system is ideally adapted to duct systems where provision has previously been made for circulating and filtering the air. In such cases, all that is required is a well, an electric pump, an air washer or indirect cooling coils in the main ducts and controls. The greatest application of well water cooling lies in the residential field although many installations have been made in stores, theatres, churches and many types of commercial buildings. Investigation should be made to ascertain the probable depth to which drilling must be made and the availability of water.

Calculations of the cooling load and the selection of equipment should be entrusted to a qualified engineer experienced in this type of work.



COOLING WITH WELL WATER

AUTOMATIC CONTROL OF SYSTEMS

Automatic control of heating, cooling or air conditioning is one of the prime essentials of comfort. Human comfort exists within a remarkably narrow range and is affected by temperature, humidity and air motion. It is beyond the normal skill of laymen to manually control these variables to maintain comfort conditions even if convenience and economy of operation are left out of consideration. Hence it is essential that equipment be so balanced in design and so governed by sensitive automatic controls that the foregoing standard conditions will be maintained regardless of changes outdoors, and with a minimum of attention.

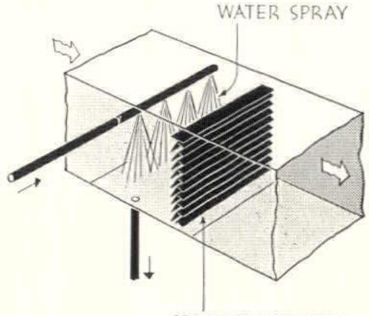
Consideration of this problem involves three separate aspects: (1) Uniformity of indoor conditions secured by balancing distribution of heat or conditioned air according to individual room requirements; (2) automatic control of the delivery of heat or conditioned air according to both indoor and outdoor conditions; and (3) automatic control of equipment operated for safety.

Although the importance of providing automatic controls cannot be over-emphasized, if satisfactory and economical operation of installations is desired, the task of selecting control equipment has become so complex as to require the services of an expert on all except the simpler systems. Manufacturers of control devices, with rare exceptions, have added new and improved units year by year constantly increasing the complexity of this new art. There is much need for simplification of their control systems to aid the architect or the owner in selecting and specifying the preferred combination of devices for any given set of conditions. Until this simplification occurs, it devolves upon the architect to know what can be accomplished and the basic principles involved in different types of controls, and to secure the counsel of qualified engineers or control specialists on the final choice of equipment.

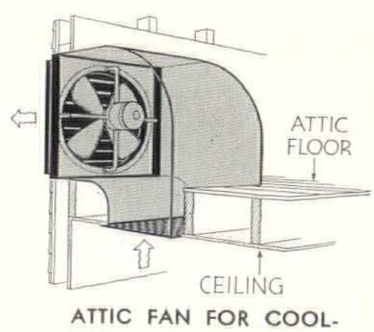
BALANCED DISTRIBUTION

Fundamental to the satisfactory operation of any heating or air conditioning system is the correct determination of individual room loads and the installation of radiation ducts and grilles or unit conditioners—properly sized to carry these loads. This is wholly a matter of proper design (discussed in greater detail in Part III) combined with certain devices which permit balancing the operation of equipment after installation.

With systems distributing heated or conditioned air through ducts practically all balancing after installation is accomplished by means of dampers controlling air delivery to individual supply grilles.



EVAPORATIVE COOLING FOR ARID CLIMATES



ATTIC FAN FOR COOLING WITH NIGHT AIR

AUTOMATIC HEATING AND AIR CONDITIONING

With systems employing radiation heating there are three methods applicable under varying conditions: (1) adjustable venting valves on individual radiators; (2) orifice valves or discs; and (3) zone control equipment.

Adjustable Venting Radiator Valves have air ports that can be set to relieve air rapidly or slowly. An installation may be balanced by retarding air release from radiators that heat up too quickly and opening the vents to the maximum on remote radiators that respond slowly, until the whole installation responds uniformly.

The Orifice Principle, while not necessarily a control system in itself, should be considered here as it is an element in a number of trade-marked systems.

Orifices are usually discs (with small apertures) inserted in supply pipes at or near the radiator valve. The hole drilled in each disc is of such size that only as much steam as the radiator is able to condense can pass through under the maximum pressure normally maintained in the distribution system.

The underlying purpose of orifice controls is to increase the steam flow resistance of radiators until it exceeds that of the piping. Then steam will fill the entire piping system before it fills individual radiators and all are heated simultaneously.

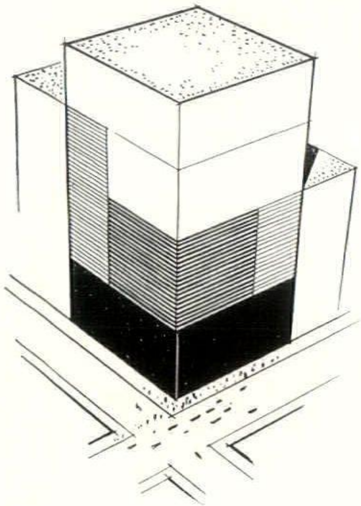
The Zoning Principle is broader than the other two methods in that it controls groups of radiators or whole sections of buildings rather than individual units. It is not only a means of balancing distribution but is also one of the primary methods of controlling the delivery of heat.

Wind, sun and outside temperatures are constantly varying factors affecting the heating load on a building as a whole and its different parts according to their orientation and exposure. When the sun is shining it affects the east, south and west sides at different periods and the roof all day. At night and on cloudy days this effect is missing. The lower stories may be sheltered from wind and sun by adjacent buildings. Chimney effect is constantly robbing the lower floors of tall buildings, increasing infiltration; and the upper floors are receiving this rising heat which may cause exfiltration around windows.

These variations in load with changing outdoor conditions may be met by dividing the building into zones. Each zone should embrace rooms having substantially the same exposure and subject to approximately the same chimney effect. Zones may be horizontal according to orientation or vertical according to the number of stories, shelter of adjacent buildings, etc. Each zone may then be subject to a separate control of any desired type.

In addition to thermostatic control of each zone by either indoor or outdoor thermostats, some of the larger systems employ a central control board, manually supervised, where temperatures prevailing in each zone may be checked by indicating thermometers or signal lights and adjusted as required by means of remote-control automatic valves.

There are many developments and adaptations of standard distribution systems in which one or more of the foregoing principles of control are utilized to provide superior performance. The majority of them have meritorious features warranting careful consideration.



ZONING TO COUNTERACT CHIMNEY EFFECT WITHIN A TALL BUILDING

CONTROL OF RADIATION HEATING

Heating systems are designed to operate at full capacity only in the most severe weather: at all other times this operation must be controlled to prevent overheating. Two basic methods of accomplishing this are available: (1) by limiting the amount of steam or vapor delivered to radiators and (2) by governing the temperature of the heating medium. Both methods may be combined.

Control may be applied at the source (boiler or public utility supply); within the system of mains forming separate zones; at individual radiators, or by control at two or more points in any desired combination.

Furthermore, indoor temperatures may be governed by an outdoor thermostat which proportions the supply of heat according to outdoor conditions; by one or more thermostats indoors, or by a combination of both.

Thus there is an infinite number of combinations from which to select a control method suited to the conditions of a particular project. Only the more important basic methods are analyzed here.

The Intermittent Method employs the "on or off" principle of supplying heat only when demanded by a governing thermostat or at regular intervals of time established by a clock mechanism. The latter is in turn manually or automatically adjusted to outdoor weather conditions, reducing the interval of off periods in severe weather and increasing it on mild days. Thermostatic control of the central heat source is the method commonly used on small domestic installations. Obviously intermittent operation tends toward fluctuating indoor temperatures; hence these methods of control are best adapted to heating systems having some inherent stability.

The Modified Temperature Method changes the temperature of the heating medium according to the demand for heat indoors or the prevailing conditions outdoors, or both. All hot water and some vacuum systems are controlled this way. Vapor systems operate on this principle most of the time except for periods when steam pressures are developed to purge pipes and radiators of air.

The Controlled Delivery Method supplies some heat all of the time but controls the quantity according to indoor or outdoor temperatures, or both. The two-pipe free vented system operates on this principle, as do several trade-marked or patented systems, admitting only enough steam to each radiator to meet prevailing requirements, the rest of the radiator being filled with air.

CONTROL OF COOLING

Automatic control of cooling introduces a factor not present in thermostatic control of heating. Experience indicates that the total temperature drop during the summer period should never exceed 15°F. and rarely should exceed 10° F., if persons move from the cooled building to out-of-doors at frequent intervals. Thus in summer it is necessary to maintain a limited temperature difference, not a constant temperature. Furthermore, summer comfort is so definitely a product of dry-bulb temperature and relative humidity in relation to air movement that the desired effective temperature range can only be maintained when all four factors—outdoor temperature, indoor temperature, air motion and relative humidity—are properly correlated.

While the type of controls necessarily varies according to the kind of summer air conditioning equipment employed, the general principle underlying this four-part control is to use a differential thermostat to keep the temperature difference within proper bounds and then to control the indoor relative humidity in relation to the indoor temperature either by means of wet-and dry-bulb thermostats, by so called "effective temperature" control devices, or by a humidistat integrated with suitable thermostats. Air motion is usually constant during the period when cooling is needed.

CONTROL OF HUMIDIFICATION

Control of humidification should be automatic to the highest possible degree. It can be effected in four ways: (1) By balancing the capacity of the humidifier to the heating plant so that the amount of moisture evaporated is approximately proportioned to the amount of heat supplied. This method fails to recognize variations in outside relative humidities; hence it is far from being a precise or normally satisfactory control. (2) By interconnected thermostats of the wet-bulb and dry-bulb types arranged to maintain the proper differential between wet-bulb and dry-bulb temperatures. (3) By the direct use of humidistats controlling the operation of the humidifying sprays or the supply of water to evaporators or atomizers. Humidistats are not as sensitive or accurate as thermostats; hence their control is not so precise. (4) By the use of a thermostat controlling the temperature of the air leaving the spray chamber before it is reheated or mixed with warm and circulating air. This control is precise because the air leaves the spray chamber 80 to 90% saturated and at substantially the temperature of the water; hence by governing the temperature of the leaving air and by the use of thermostatic controls on the reheaters or mixing dampers, both the final temperature and the final humidity are readily controlled.

Automatic controls of any type should be capable of manual adjustment to reduce humidities temporarily when excessive condensation appears on windows. This limiting of humidities can also be accomplished automatically. The simplest method employs an auxiliary humidistat mounted close to the glass of an exposed window which cuts the humidifying unit out of operation when the air near the window approaches the saturation point and restores the operation of the circuit when the likelihood of condensation has passed.

CONTROL OF DEHUMIDIFICATION

Equipment used to control dehumidification varies according to the dehydrating method employed. With absorption systems, using lithium or calcium chloride sprays, special controls are centered on the evaporator which maintains the desired concentration in the sprays. Absorption systems using silica gel or some equivalent may be governed directly by a humidistat.

All systems which dehumidify by cooling the air below the saturation point (mechanical or steam-jet refrigeration, ice and well water cooling) subordinate air drying to cooling unless reheating coils are employed. That is, on days when only a little cooling is required there is correspondingly small reduction in relative humidity, unless a sufficient proportion of the air is cooled below the dew point temperature for dehumidifying purposes primarily, and then reheated before entering occupied rooms.

When reheaters are employed, humidity is controlled by wet and dry bulb thermometers in the central apparatus, inter-connected to the refrigeration equipment or the cold water sprays (as the case may be) and to the tempering coils.

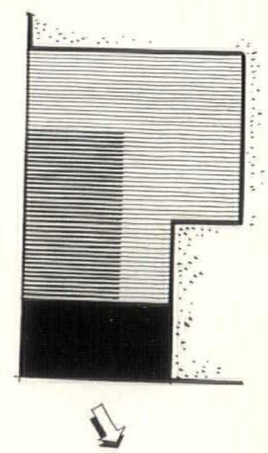
When no reheating is provided mechanically, dependence is placed entirely upon by-passing part of the recirculated air around the cooling and dehumidifying unit. The untreated air is then mixed with the treated air to temper it to the required comfort range. Integrated wet and dry bulb thermometers are again employed, governing the refrigeration unit or cold sprays and the by-pass dampers.

CONTROL OF AIR MOTION

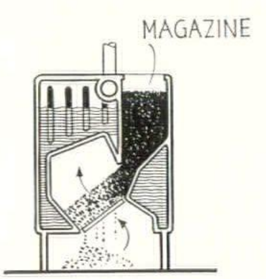
As stated elsewhere, air motion should theoretically be maintained as a constant, except for a possible change in the volume of air moved between summer cooling and winter heating periods. This ideal is attained in relatively few installations. Normally the blower or fan is interconnected to other controls so that it operates only when certain conditions are set up. With Direct-Fired systems the blower is controlled by bonnet temperature, independent of the firing mechanism. With Indirect and Split systems the blower may be governed by air temperature in the heat transfer chamber (operating only when the coils are releasing heat) or by delayed-starting relays after some room thermostat operates the mechanism.

In Auxiliary systems air motion is usually governed by the humidistat, but may operate simultaneously with the stoker or burner. Manual control is frequently employed entirely independent of other units but this leads to misuse and disuse of the equipment. Units, of course, are locally controlled and the fan or blower operates with any call for heat, humidity or cooling.

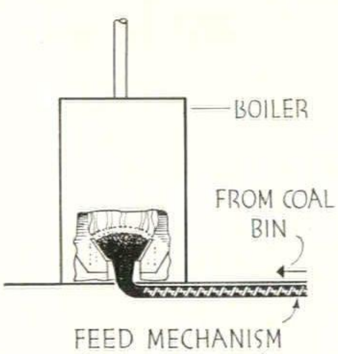
Night fan cooling is usually controlled manually as windows should be opened at the start and closed at the end of the operating period. If all air passes through the duct system, time switches may control the cycle, in conjunction with a thermostat or alone.



ZONING (IN PLAN) TO ADJUST HEATING TO VARIED EXPOSURES



MAGAZINE FEED
SECTIONAL BOILER



STOKER-FIRED BOILER
WITH FEED FROM BIN

PROGRAM CONTROLS

All automatic controls may themselves be subject to equally automatic time governors or "program" controls. The simplest is the day-night switchover for heating in which a timing mechanism changes the required temperature night and morning, or resets the temperature in the morning after manual lowering the evening before. For schools, commercial structures or other buildings that remain unoccupied over night, during week-ends or on holidays a program clock may be used to conserve fuel during the vacancy periods. The final step is the summer-winter switchover that automatically reverses the action of winter controls in warm weather so that a rise in temperature starts the cooling apparatus immediately.

TYPES OF THERMOSTATIC CONTROLS

The brain of the control system which regulates the supply of heat is the thermostat. This unit may be electrically operated on line voltages or through transformers on low voltages, the latter type generally being more sensitive and accurate. Thermostats are also developed for operation on air pressures with suitable air piping in lieu of electric wiring. The thermostat itself may be governed by electric or handwound clock which will automatically vary daytime and nighttime temperatures, or may even be equipped with program mechanisms to maintain lower temperatures over week-ends or holiday periods. Usually thermostats operate to open or close an electrical or air pressure mechanism which either starts or stops the firing device according to the call for more or less heat. Another type of thermostat "modulates" the generation of heat in precise accordance with the changes in temperature.

An improvement over simple thermostatic control has been developed to maintain periodic operation of the heating plant during protracted idle periods such as occur in mild weather. If radiators or warm air registers remain cold for any considerable period of time the air tends to stratify with cold air near the floor line, tempered air at the breathing zone where the thermostat is located, and warm air at the ceiling. This condition may create a sensation of cold even though the middle zone is at the desired temperature. These secondary thermostatic controls start the plant when the system cools enough to permit stratification and warms radiators sufficiently to re-establish circulation.

Several types are available: (1) clock operated thermostats that periodically operate the firing mechanism for short intervals, before there is enough loss of heat to permit stratification; (2) "low-limit" devices attached to radiators, heating ducts or supply mains, that call for heat when the adjacent air cools to a predetermined temperature; (3) and thermostats with an internal heating coil that accelerates the shut-off in such a manner as to prevent overheating. By this means the regular operating periods are more frequent, extremes of temperature are eliminated and stratification has considerably less opportunity to develop.

OPERATING AND SAFETY CONTROLS

In this division there are a number of different types of controls. Those which govern the automatic operation of oil burners, gas burners, and stokers should always be provided by the burner manufacturer as part of the original equipment. These controls vary according to design of the apparatus. They usually include primary safety controls which stop the burner mechanism when any abnormal condition exists, such as (a) excessive pressure in steam or vapor boilers, or excessive temperatures in hot water or warm air systems, (b) failure of electric power or fuel supply, and (c) failure of flame due to improper ignition or other causes at any point in the operating cycle. Some types of control and safety equipment simply shut down operation in case of failure of any element; others automatically re-cycle—that is, attempt to start the firing mechanism over again one or two times—in case of initial failure.

Inasmuch as these primary operating and safety controls should be considered a part of the firing mechanism, their selection is not a burden, but available equipment should be compared to ascertain the relative adequacy of control devices offered.

SUPPLEMENTARY CONTROLS

Certain supplementary controls may be desirable for safety, operating economy or convenience. Among those to be considered are: (a) On steam or vapor boilers, a low water cut-off or an automatic water feeder, or both. Municipal ordinances in many cities and towns require the use of an approved type of low water cut-off on automatically fired installations. (b) On warm air furnaces equipped with fans, a means of starting the fan to protect the furnace from overheating if thermostatic control does not properly shut down the firing mechanism. (c) On automatic stoker mechanisms, a control that will intermittently operate the stoker to keep the fire from going out during protracted periods of idleness. (d) On conditioned air installations, automatic controls providing an adjustable sequence of operation for fire or furnace bonnet temperature and for air circulation. (e) Such supplementary controls as may be required for summer operation of hot water supply systems or circulation of cool air.

This last type may be applied to any boiler equipped with submerged hot water coils or other heating device to permit automatic operation of the boiler during the summer season as a source of hot water supply. On steam and vapor systems these devices prevent the firing mechanism from developing steam by maintaining the water temperature at any desired point from 120 to 180° F. On hot water heating systems flow control valves prevent circulation of boiler water through the piping while maintaining sufficient heat in the boiler to keep the water storage tank hot.

The operation of the circulator is governed by the room temperature and a uniform temperature constantly maintained in the boiler usually between 160 deg. and 220 deg. When the circulator is operating the pressure head of the water opens the flow control valve and permits the water to flow from the boiler to the radiators.

AUTOMATIC HEATING AND AIR CONDITIONING EQUIPMENT

PART II

Equipment for heating and air conditioning installations is commercially available in confusing variety. In order to limit the final choice within reasonable bounds it will be helpful to make an early decision as to the basic type of equipment to be used. This should be founded on a knowledge of the distinguishing characteristics of the major types.

Only the more important items to be selected and specified by the architect are considered in this article, including boilers, furnaces, stokers, radiation, piping, etc. Air conditioning units and systems are usually offered with such elements as blowers, filters, washers, humidifiers or cooling apparatus combined in balanced relationship, requiring the designer only to check the capacities of the elements in relation to the contemplated loads. When installations are abnormal, or are too large for such conditioning units, the task of selection should be entrusted to a competent engineer.

BOILERS, FURNACES AND FUELS

Boilers, furnaces and fuels should all be selected with due regard to present or future air conditioning requirements. Automatic operation is highly desirable in all small heating installations for reasons already given. Only large plants that are constantly attended may be manually operated with reasonably satisfactory results. Therefore, the boiler or furnace originally selected should either be equipped with an oil burner, gas burner or automatic stoker, or should be readily adapted to such units when opportunity affords.

STOKER-FIRED BOILERS AND FURNACES

Boilers and furnaces designed for manual firing of solid fuels—anthracite or bituminous coal or coke—may be equipped with automatic stokers without basic change in design in the majority of heating installations. Stokers require somewhat greater combustion space within the fire pot or boiler furnace than is needed with manual firing, but this space is usually gained by placing the stoker fire pot at the level of the original grates, using a shallow pit if necessary. Stokers are designed to make such location possible. Only in large boilers, and particularly in high pressure steam plants, is it necessary to increase combustion volume either by providing a pit for the stoker installation or by raising the boiler setting to a suitable height. In this class of installation the services of a competent mechanical engineer should be employed.

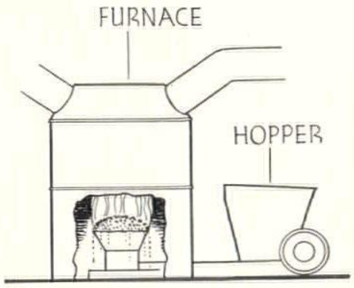
Disregarding commercial and industrial stokers used on large installations, the principal choice is between underfeed and overfeed stokers. In the residential class the most common type of mechanism is an underfeed stoker, consisting of a fire pot fed from the bottom by a worm screw or plunger mechanism with a forced air blower operated by the same motor that drives the coal feed. A hopper is commonly provided which will hold a supply of coal sufficient for several hours, or a full day's supply in severe weather, and several days' supply in mild weather. This hopper may in itself be automatically fed by gravity from an overhead coal bin or by a screw-type conveyor from a coal bin at floor level. In certain types, particularly in smaller residential sizes, another conveyor may automatically remove ash and deposit it in a suitable receptacle. Another basic type of relatively recent development consists of an overfeed mechanism which operates through the fire door of the heater and which throws coal on the fire according to the rate of combustion.

These residential stokers, and the smaller sized apartment house and commercial heating stokers, are readily subjected to complete automatic control which eliminates all care except a periodic filling of the hopper and removal of ash receptacles. Controls have been devised to hold fire in stokers during long periods of idleness by occasionally putting the stokers in operation when boiler temperatures drop to a point which indicates the fire may die out. Stoker-fired heating plants may also be controlled so that the boiler may be used for summer hot water supply where an indirect heater is employed. Stokers are made for all solid fuels, including small sizes of anthracite, coke, and coking or semi-coking bituminous coals. Bituminous stokers do not have ash removal equipment.

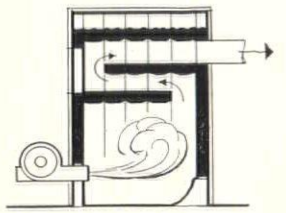
Standard types of warm air furnaces designed for manual firing with coal or coke are well adapted to installation of automatic stoker mechanisms and suitable control devices, making the plant completely automatic except for occasional handling of coal or ash.

MAGAZINE FEED BOILERS & FURNACES

Many advantages of automatic stoker firing are obtained without use of such mechanism by employing magazine feed steam or water boilers. These boilers have one or two hoppers within the boiler itself large enough to hold fuel sufficient for 12 to 48 hours without refilling. The fuel drops by gravity onto a sloping fire bed, and when combustion is completed ashes drop off the edge of the grate to the ash pit. With automatic controls magazine feed boilers perform the same functions as an automatic stoker installation,



STOKER-FIRED FURNACE WITH HOPPER FEED


OIL BURNING SECTIONAL CAST-IRON BOILER

except that (a) they have no ash removal equipment, (b) they are not normally equipped with blowers or forced draft mechanisms and therefore require a good chimney draft, and (c) they are primarily adapted to small sizes of anthracite and coke rather than to bituminous coals. Illustrated on these pages are diagrammatic representations of several single grate magazine feed boilers.

Magazine Feed Warm Air Furnaces have been developed recently for burning anthracite. In most respects, construction very closely resembles that of the magazine feed boiler. All the advantages of magazine feed boilers apply to these warm air furnaces.

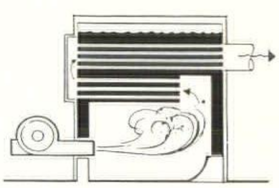
OIL BURNING BOILERS

In selecting heating plants for oil burning installations it is convenient to compare their design to that of standard coal burning boilers. The oil burning boiler should provide in proper proportions (a) considerably increased combustion space, (b) relatively smaller passages for the hot flue gases, and (c) a considerable increase in the distance flue gases must travel before reaching the stack.

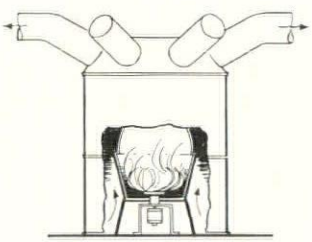
In the design of horizontal cast iron sectional boilers requirements for greater combustion space are usually satisfied by extending the water cooled legs surrounding the combustion chambers or by firing into the ash pit space, while increased heat transfer area is provided by more flue gas passages of relatively smaller area. (See illustrations.) In steel and copper tubular boilers the difference between an oil burning boiler and one designed for coal is usually observed in the use of longer tubes or of more tubes of smaller diameter, with appropriate changes in the combustion chamber.

In addition to these adaptations of coal burning boilers to oil burning type there are a number of boilers of special design which have been developed exclusively for use with oil fuel. Typical examples are diagrammatically illustrated.

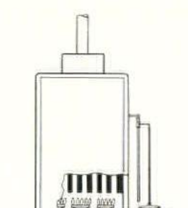
Advantages claimed for cast iron sectional boilers for oil burning are: (a) initial low cost, (b) ease of replacement of individual sections, and (c) ease of installation—especially of large boilers where sections may be introduced through narrow passages. Advantages claimed for steel boilers, including those made of wrought iron, steel or copper, are: (a) with these materials, relatively thin walls can be employed and rapid transfer of heat obtained, (b) tubular construction permits development of long, small area gas passes ideally adapted to requirements of oil heating, and (c) materials may be chosen for their resistance to the high temperatures and corrosive effects of the combustion gases of oil.



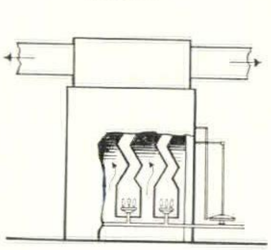
OIL BURNING HORIZONTAL TUBULAR BOILER



WARM AIR FURNACE WITH VERTICAL OIL BURNER



GAS-FIRED SECTIONAL BOILER



GAS-FIRED WARM AIR FURNACE

OIL BURNING WARM AIR FURNACES

Warm air furnaces designed for oil burning are substantially like those which have traditionally been used for solid fuels, or they may be of radically new design. In the traditional form the furnace consists of a stove surrounded and enclosed by a jacket or casing. The furnace may be made of cast iron assembled in sections cemented together, or it may be of steel with welded or riveted joints. In every case the furnace must be gas-tight and must present sufficient heat radiating surface to permit air passing between casing and furnace to absorb all of the heat generated. Newer designs seek to provide a maximum amount of heat transfer surface with which hot gases must come in contact before reaching the stack.

In selecting warm air furnaces designed for oil, the same considerations given above for heating boilers apply again. That is, (a) there should be ample combustion space in the fire pot, (b) there must be adequate heat absorbing surfaces with (c) relatively small and extended flue gas passes.

GAS BURNING BOILERS

While adaptation of coal burning boilers to gas fuel is readily accomplished by the installation of a gas-conversion unit, boilers designed especially for gas burning devices differ radically from those using ordinary solid fuels.

Conditions ideal for combustion of gas include: (a) small combustion space as compared to solid fuel practice, (b) considerable increase in heat absorbing surfaces and in the scrubbing effect brought about by (c) relatively narrow flue gas passes. Materials of construction must be resistant to the acid condensation which may occasionally form within the boiler when flue gas temperatures are very low.

One type is sectional in construction with a single burner beneath each section. Sections are placed much closer together than would be possible when burning a soot-forming fuel. The aim is to break up hot gases into thin streams so that all particles of heat-carrying gases can come as closely as possible to the heat-absorbing surfaces. Another type of boiler uses copper coils closely interlaced to provide the requisite heat transfer area with a multiplicity of constricted gas passages. Typical gas burning boilers are diagrammatically illustrated.

In selection of gas-fired boilers, the American Gas Association has determined by experience that the factor to be allowed for loss of heat from pipe and pick-up load must vary somewhat from that commonly employed with solid fuels. The following table gives this selection factor for installations ranging from 500 to 4,000 square feet of steam radiation.

PIPING AND PICKUP LOAD FACTORS FOR GAS BOILERS

Equivalent Cast Iron Steam Radiation (Square Feet of 240 Btu. Each	Add to Standing Radiation Load (per cent)
500	56.0
800	54.0
1,200	51.0
1,600	48.0
2,000	45.0
3,000	42.5
4,000 and over	40.0

Since gas appliances have heat generating capacities that can be predicted accurately within one or two per cent, makers of these appliances rate their product on the basis of hourly Btu. output rating. The uniform standard for such rating has been developed by American Gas Association Testing Laboratory. To convert this rating to square feet of equivalent direct radiation divide the hourly Btu. output by 240 for steam and 150 for water. Either the original Btu. rating or the converted direct radiation rating should be increased by the pick-up factor given above to find the minimum size boiler that will handle the load. The next size larger boiler should be chosen if there is any likelihood of future additional load.

Architects should recommend only gas appliances that bear the approval seal of the American Gas Association Testing Laboratory.

GAS-FIRED WARM AIR FURNACES

In the warm air heating field, as in steam and water boilers, heating furnaces designed for coal may be adapted to gas by use of conversion units, but the furnace designed solely for gas-firing differs radically from solid fuel practice. Special designs include (a) relatively small combustion space, (b) widely extended heat absorbing surfaces, and (c) narrow flue gas passes designed to bring hot gases in intimate contact with the heat transfer surfaces. Representative units are diagrammatically illustrated in the marginal figures on the facing page.

Gas warm air heating embraces a variety of special types of systems in addition to the usual central system with appropriate distribution ducts. These special adaptations include warm air floor furnaces for heating one or two rooms, space heaters, radiant heaters, and individual gas-fired warm air radiators. In most of these units products of combustion are released in the space heated rather than carried to an exterior flue or stack.

Recirculation of air should always be arranged with gas-fired warm air furnaces, not only as an aid in heating, but because it is essential to economy. Use of a fan or blower for forced air circulation is also recommended.

RADIATION AND UNIT CONDITIONERS

Appearance, space requirements, performance characteristics and cost are all factors in the architect's choice between radiator convectors, unit heaters or unit conditioners.

RADIATORS AND CONVECTORS

Radiators require floor space (or its equivalent if suspended on walls). They heat partly by radiation and partly by convection, hence they do not induce as rapid air motion as convectors unless enclosed in cabinets of suitable design. Free standing high, short radiators produce minimum air circulation and maximum air stratification; low, long radiators produce maximum circulation and relatively low temperature differentials. Radiators are normally rather less expensive than convectors of equal capacity.

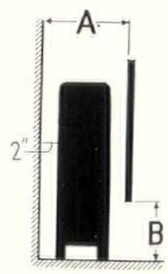
The rate of heat emission from radiators is affected by their height, width and length and for this reason they are now usually rated in terms of equivalent square feet of direct steam radiation (EDR = 240 Btu. per hour) or in equivalent direct hot water radiation (150 Btu. per hour) instead of, as formerly, in square feet of superficial surface.

Heat emission from radiators is also affected by the finished surface. If a given cast iron radiator, finished with a dull black paint is rated at 100% in heat-emission, the same radiator would emit from 1% to 2% more heat if painted in light colors and nearly 10% less if finished with flake bronze or aluminum paints.

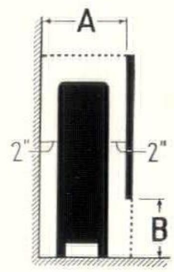
Radiators in Enclosures may be slightly more efficient or much less efficient than open radiation according to the type of enclosure employed. See figures for diagrammatic presentation of types commonly used and their effect on radiator performance.

Convectors have the following advantages. They are light in weight; are constructed so they may readily be concealed; they induce vigorous air circulation and thereby tend to keep the temperature differential per foot of height from floor to ceiling well below 0.75° F. They heat quickly

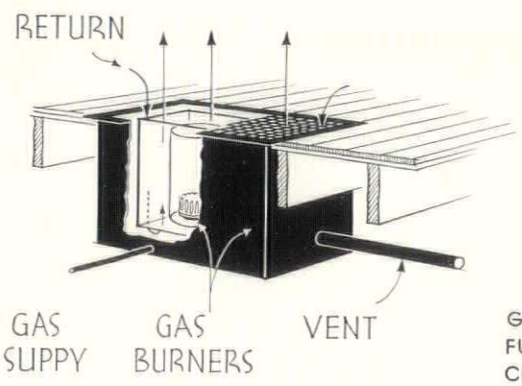
EFFECT OF RADIATOR ENCLOSURES COMPARED TO HEAT EMITTED BY A FREE STANDING RADIATOR



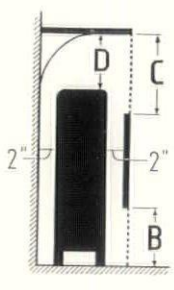
10% increase when dimension B equals 80% of dimension A; others as shown



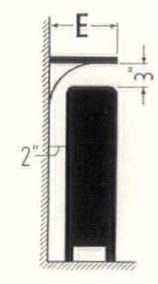
5% increase when dimension B equals 80% of dimension A; others as shown



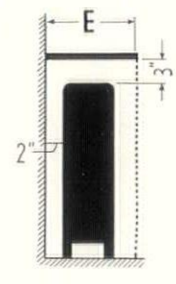
GAS-FIRED FLOOR FURNACE OF RECIRCULATING TYPE



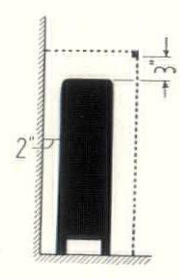
No change when B = 80% of A as in preceding figures; C = 150% of A and D = A



10 to 35% reduction when dimensions are: E = 50% of A, 10%; E = A, 20%; E = 150% of A, 35%.



30% reduction when dimension E is equal to dimension A; others as shown



5% reduction when radiator is completely inclosed in grille as shown but cool just as rapidly. Of the two principal types, the non-ferrous units are more responsive in both heating and cooling than those of cast iron. The performance of convectors is directly related to the amount of chimney effect produced by the enclosure or flue. Manufacturers' ratings are necessarily based upon definite recess or cabinet sizes. Outlet grilles may project air either vertically or horizontally; generally the latter produces lower temperature differentials within the room if the outlet is 2 to 4 feet from the floor. Intake openings should always be at the floor level.

Convector-radiators, usually consisting of a cast iron front or face which radiates heat directly and some form of flue which induces convection currents, combine the features of both radiators and convectors. They are usually wall hung or built in the wall, occupying little or no floor space. They produce somewhat less air circulation than true convectors, and hence, like radiators, should be long rather than short, but with as much vertical distance between floor inlet and warm air outlet as possible.

COMBINING RADIATORS AND CONVECTORS

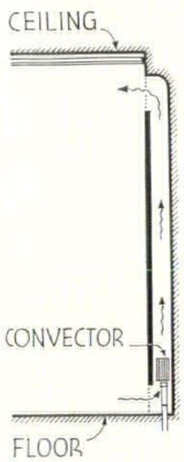
Cast iron radiators should not be indiscriminately used with convectors (particularly those of non-ferrous construction) within a zone or building controlled by a single thermostat. Cast iron radiators heat and cool more slowly than convectors: hence if the heat source is intermittent, rooms in which quick-acting convectors are used will be subject to wider fluctuations of temperature than rooms having free-standing radiation. Cast iron convectors and convector-radiators have more mass than copper or aluminum convectors; they are less subject to wide fluctuation than non-ferrous types and therefore combine better with direct radiation. In general it is good practice to use 60 to 80% of either direct radiators or convectors and to install the alternate type in rooms where greater or less heat can be tolerated than is called for by the governing thermostat.

Location of Radiation is governed by the location of major heat losses; that is, radiation should be placed where it will counteract cold down-drafts where they originate and prevent them spreading over the floor. Since windows usually cause the greatest heat losses, radiation should be placed beneath them wherever possible. Otherwise distribute the radiation along the exposed walls more or less in proportion as these walls contribute to the heating load. Large skylights should have enough radiation around their wells to offset their heat losses.

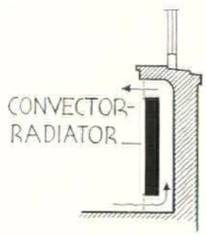
UNIT HEATERS AND CONDITIONERS

When radiation is equipped with a power driven fan its characteristics change, and it falls into one of four classifications: unit heaters, unit coolers, ventilating units or unit conditioners.

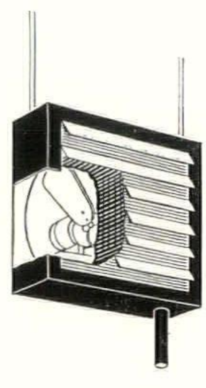
Unit Heaters are made in both industrial and residential types. Industrial unit heaters are high capacity, very compact, extended-surface air heaters equipped with fans which recirculate the room air. They may be suspended from the ceiling, upper side wall or interior columns or be floor mounted. Their high velocities produce wide diffusion before reaching the breathing zone but most of the air is delivered against this zone to counteract the tendency of warm air to rise and blanket the ceiling. They are efficient low cost devices suitable for industrial, commercial and some auditorium or gymnasium applications where appearance and high velocity air currents are not factors. They may also be concealed behind grilles either near the floor or high up on the side walls of large rooms if served by recirculating ducts brought up within the wall from the floor level.



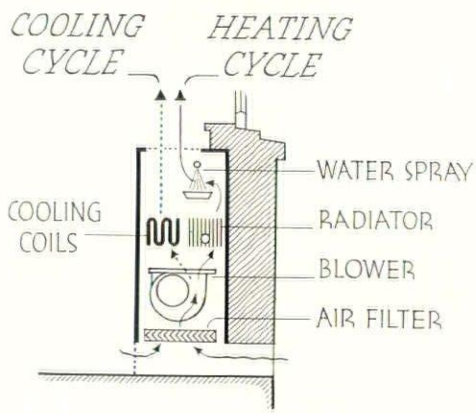
CONVECTOR WITH FLUE EXTENTED TO UPPER WALL



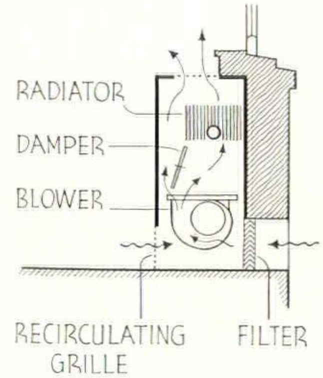
CONVECTOR RADIATOR



UNIT HEATER OR COOLER. SUSPENDED TYPE



UNIT AIR CONDITIONER FOR COMPLETE CONDITIONING



UNIT VENTILATOR WITH HEATER AND FORCED CIRCULATION

Residential unit heaters resemble ventilating units except they do not introduce any outside air.

Unit Coolers are substantially like unit heaters except that they are designed to handle direct expansion refrigerants or chilled water. They are also equipped with condensation drips to be connected to a suitable drain.

Ventilating Units are so named because they are provided with intake opening from outside air. Dampers under manual or automatic control are usually provided to permit partial or complete recirculation as well as ventilation and to govern room temperature. They consist of a cabinet, suitable radiation of the convector type, one or more centrifugal fans and usually filters for cleaning either the outside air or both outside and recirculating air. The recirculating inlet is at the floor and the outside air inlet may be at any point in the back of the enclosure where it can be brought through the wall or beneath a window. The outlet grille is generally at the top, inclined to project the air upward and slightly outward so it will not strike occupants of the room before it has been diffused widely against the ceiling.

Unit Air Conditioners have heating as well as cooling coils and may be treated as either convectors or ventilating units with respect to their location and performance. In their more complete forms they enclose within their cabinet: (a) heating coils, (b) humidifying sprays or pans, (c) blower or fan, (d) filter, (e) cooling coils or a complete refrigeration machine for cooling and dehumidifying. Connections are required to heating mains, electric supply, water supply and drain.

Such units are effective in reducing temperature differentials to as low as 0.25° F. per foot of height from floor to ceiling. They also have the merit of factory assembly and testing so their performance may be relied upon more fully than that of poorly constructed duct systems. Heat output is governed by varying the steam supply, by by-passing the air around the heater or by both. It is generally controlled automatically.

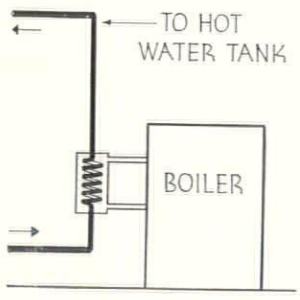
DOMESTIC HOT WATER SUPPLY EQUIPMENT

Whenever a Direct-Fired heating plant is installed some auxiliary domestic hot water heater is required. When any type of boiler supplies heat to the building, the choice lies between an auxiliary domestic water heater or some type of indirect heater involving all-year operation of the boiler. This latter choice often depends upon the fuel used and the extent to which automatic operation is to be carried.

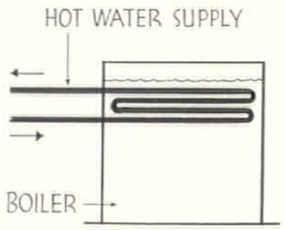
An adequate hot water supply may be obtained from steam and water boilers by means of indirect heaters attached to the exterior of the boiler, by water heating coils submerged within the boiler itself, or by steam coils submerged in a separate hot water storage tank. Several modern heating boilers have been developed with submerged coils of sufficient length and capacity to eliminate need for a separate storage tank, unless hot water requirements are exceptionally heavy.

By means of suitable control mechanisms any automatically-fired water or steam boiler may be operated throughout the summer season to provide an adequate hot water supply. Controls used on steam system usually keep the temperature of boiler water well below the boiling point (a maximum of 180° F.) and thus prevent heat from rising to radiators. Those used on hot water systems generally involve a flow valve on the main at the boiler outlet to prevent circulation through the radiators. All-year operation of boiler and

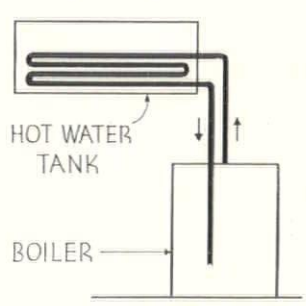
THREE INDIRECT METHODS OF GENERATING DOMESTIC HOT WATER



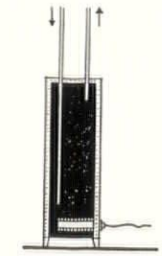
INDIRECT HEATER SERVING STORAGE TANK

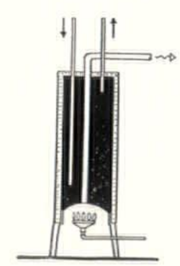


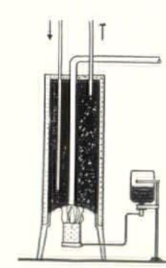
TANKLESS HEATER IN BOILER



STEAM COILS IN STORAGE TANK


ELECTRIC


GAS


OIL WITH NATURAL DRAFT BURNER

DOMESTIC HOT WATER HEATERS COMBINED WITH TANKS burner is considered advantageous as it tends to minimize deterioration of equipment. Water is heated economically and room heat is constantly available.

ELECTRIC HOT WATER HEATING

In many sections of the country, electric water heaters are popular, particularly where electric rates are low enough to make this method practical from an economic standpoint. Some utility companies have a special off-peak rate that is attractive. Electric water heating units are extremely simple, entirely automatic and reliable and the storage tanks are well insulated. As an adjunct to a direct-fired system, provided the rate structure of the local utility has been adjusted for such loads, electric water heating is desirable.

GAS HOT WATER HEATERS

While steam and hot water heating plants fired by gas may be employed to supply hot water, a separate automatic gas hot water heater is frequently used. This practice has the merit of simplicity and operating economy although initial cost may be slightly higher than for an indirect heater in the boiler. An auxiliary water heater is, of course, an essential item in gas heating installations of the warm air type. Typical units are diagrammatically illustrated on page 79. Automatic control may take two forms: (a) by the temperature of water in the storage tank—a low temperature automatically starting the burner—and (b) by a demand for water, using a "pressure-release" control.

OIL BURNING HOT WATER HEATERS

Except in the proportioning of the boiler element and the size of the units employed, the oil-fired water heater is substantially like a hot water heating boiler. Exceptions to this statement are mostly found in oil-fired water heaters using natural draft burners. Representative units are diagrammatically illustrated on page 79. They are used primarily as adjuncts to warm air heating installations and for hot water loads large enough to require a separate unit.

PIPES, FITTINGS, VALVES AND TRAPS

Steam heating supply pipes are seldom subject to any appreciable corrosive activity and therefore almost invariably may be made of wrought iron or steel. Steam heating returns may also be of the same materials, except for air-vented systems or vacuum systems having air inleakage, where brass, copper, cast iron, or at least extra strong iron or steel pipes should be used. For systems requiring much make up water or on street steam supply where the condensate is wasted, the returns should be of brass, copper or cast iron for long life.

Steel or Wrought Iron pipes are standard for heating work with some popular preference for genuine wrought iron where durability is a primary consideration. Alloys of iron and steel with copper, molybdenum, etc., are slightly more expensive, but their superior durability for this particular service is yet to be established. Black steel pipe is lowest in cost and is considered adequate for many types of commercial structures where changing land values indicate ultimate reconstruction.

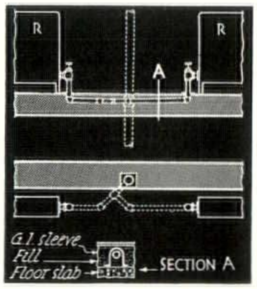
Where the same water is recirculated over and over, as in hot water heating systems, the corrosive activity may be negligible provided there is no appreciable leakage of air. In such work ordinary steel or iron pipe may be used.

Ammonia and some other refrigerants require steel or iron pipe, but most modern refrigerants may be piped with copper tubing.

Copper Pipe has recently come into use for alteration work and for converting one-pipe systems into two-pipe systems because its relative flexibility simplifies installation and reduces the number of fittings.

Brass Pipe is too costly for general heating use but finds application where water conditions harmful to other types of pipe prevail or where great durability is sought.

TYPICAL ONE-PIPE STEAM HEATING RISER AND RADIATOR CONNECTIONS



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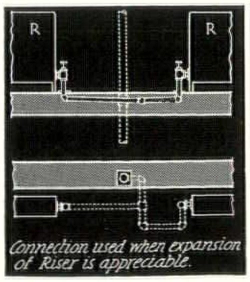

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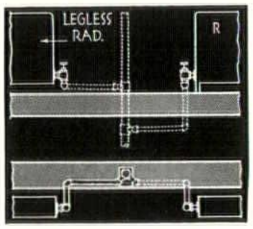

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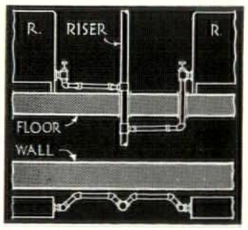


EXPOSED CONNECTION

Fittings on iron or steel steam-heating piping should be steam pattern cast iron, screwed up to 6″ and flanged 8″ and above. On brass returns they should be heavy steam pattern screwed.

Fittings on brass tubing or iron weight brass pipe may be of the union or brazed-joint type with adapters for attaching to iron-sized pipe where necessary. Fittings on ammonia and some other refrigerant piping are of special flanged type.

In all piping work fittings play an important part because the natural expansion and contraction of heating lines compels the use of offsets which will take up movement without leaking. Where combinations of elbows will not provide the necessary flexibility at connections between mains, risers and branch connections, and where mains are very long, slip-type expansion joints or large radius pipe bends must be introduced.

Pipe Insulation is of utmost importance in reducing operating costs. All steam, vapor and hot water lines, including returns and all refrigerated water and other cooling lines, should be covered with suitable pipe insulation.

Valves commonly used in low pressure heating work may be classified as to application as follows: Radiator valves should be of angle type on all one-pipe installations, with no obstruction to the flow of condensate from radiators. Angle type valves are preferable but straight through globe valves may be used on all two-pipe systems. For economy, packed stem valves may be employed on all steam and hot water systems, but packless valves having a flexible diaphragm or bellows must be employed on vapor and vacuum installations to avoid constant trouble from air leakage.

In the use of valves, the gate type is always preferable to globe valves except where close regulation is to be accomplished through partial opening of the valve. Globe valves form a trap or water pocket and cannot be used where free drainage is required. Valves for 125 lb. working pressure are used up to and including 100 lb. and valves rated for 250 lb. are used above. Swing check valves are used wherever small pressures are required to open the valve and around the boiler returns.

Various patented heating systems have supply valves particularly adapted to their system, such as valves that drain and vent around the seat when closed, all kinds of graduated fractional distribution valves and orificed valves. Some of the latter are orificed when partly closed and are ordinary valves when open. Manufacturers should always be consulted as to the use of these different kinds of valves.

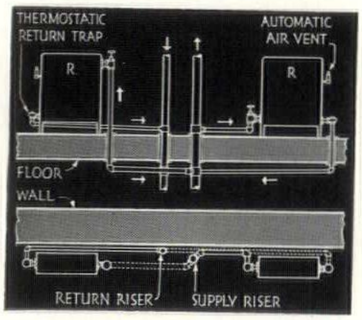
Thermostatic Traps used on return ends of radiators in vapor and vacuum systems are made in many styles. The principal features to consider in selection are (1) durability of the thermostatic element, (2) free opening for condensate and air, and (3) positive and rapid closing when steam or vapor reaches the trap. Traps should be rated for steam or vapor temperatures according to the type of system. In residence work they should be quiet in operation. They must be air tight under all conditions yet capable of disassembly for cleaning.

Air Vent Valves are available in many styles and in several grades. The cheaper lines have small air ports, small thermostatic elements and are of light construction. Their use is seldom desirable in place of the better grades which have greater durability, are quicker and more positive in operation and less subject to leakage or noisiness. Plain air vent valves are low in cost; the vacuum-type or non-return air vent valves are more expensive but their performance is far more critical in the success of the system, hence the best quality should be specified. They should operate freely when the slightest steam pressure exists in the system. They should close upon contact with steam and remain tightly closed regardless of the temperature so long as sub-atmospheric pressures prevail in the radiator.

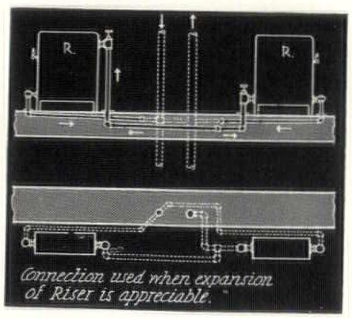
The bellows-type vacuum valve vents at lower pressures than the disc type (which is merely a thin metal disc that lies in a horizontal position on a ground seat). Moisture or dirt on the disc or on the seat frequently causes the disc to stick to the seat, thereby rendering the valve inoperative or sluggish.

Whether atmospheric valves or vacuum valves are used, the adjustable orifice type should be specified—particularly when used on systems that are automatically fired in order that balancing of the system may be readily accomplished.

TYPICAL TWO-PIPE STEAM HEATING RISER AND RADIATOR CONNECTIONS



EXPOSED CONNECTION



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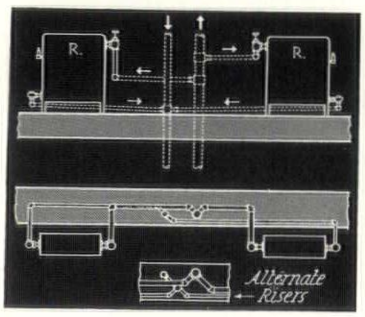

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AMERICAN ARCHITECT
TIME-SAVER STANDARDS

Serial No. 99

FEBRUARY 1938

DUCT DESIGN—Heating & Air Conditioning

Tabular information contained in this sheet has been prepared from data obtained by Graham Ford, and is intended to aid in the design of heating and air conditioning duct systems for all normal cases. In Table II, "Equivalent Round and Rectangular Ducts," note that the *effective* area of rectangular ducts is always less than the *actual* area, due to the coefficient of friction.

Table IV contains equivalent factors expressed in Btu, sq. ft. EDR (both steam and hot water), and standard code Room Basic Factor, from which can be obtained duct sizes for gravity warm air systems as well as forced air heating and cooling systems.

In connection with these tables, T-S.S. N1.2.1, —2 and —3 (Serial Nos. 57, 58 and 59, September 1936) may also be consulted.

TABLE I

Cross Sectional Areas—Round Ducts

Diam.	Area	Diam.	Area	Diam.	Area	Diam.	Area	Diam.	Area	Diam.	Area
4.0	12.6	9.0	63.6	14.0	153.9	19.0	283.5	24.0	452.4	29.0	660.1
4.1	13.2	9.1	65.0	14.1	156.1	19.1	286.5	24.1	456.2	29.1	665.1
4.2	13.9	9.2	66.5	14.2	158.4	19.2	289.5	24.2	460.0	29.2	669.7
4.3	14.5	9.3	67.9	14.3	160.6	19.3	292.6	24.3	463.8	29.3	674.3
4.4	15.2	9.4	69.4	14.4	162.9	19.4	295.6	24.4	467.6	29.4	678.9
4.5	15.9	9.5	70.9	14.5	165.1	19.5	298.6	24.5	471.4	29.5	683.5
4.6	16.6	9.6	72.4	14.6	167.4	19.6	301.7	24.6	475.3	29.6	688.1
4.7	17.3	9.7	73.9	14.7	169.7	19.7	304.8	24.7	479.2	29.7	692.8
4.8	18.1	9.8	75.4	14.8	172.0	19.8	307.9	24.8	483.1	29.8	697.5
4.9	18.9	9.9	77.0	14.9	174.4	19.9	311.0	24.9	487.0	29.9	702.2
5.0	19.6	10.0	78.5	15.0	176.7	20.0	314.2	25.0	490.9	30.0	706.9
5.1	20.4	10.1	80.1	15.1	179.1	20.1	317.3	25.1	494.8	30.1	711.6
5.2	21.2	10.2	81.7	15.2	181.5	20.2	320.5	25.2	498.8	30.2	716.3
5.3	22.1	10.3	83.3	15.3	183.9	20.3	323.7	25.3	502.7	30.3	721.1
5.4	22.9	10.4	84.9	15.4	186.3	20.4	326.9	25.4	506.7	30.4	725.8
5.5	23.8	10.5	86.6	15.5	188.7	20.5	330.1	25.5	510.7	30.5	730.6
5.6	24.6	10.6	88.2	15.6	191.1	20.6	333.3	25.6	514.7	30.6	735.4
5.7	25.5	10.7	89.9	15.7	193.6	20.7	336.5	25.7	518.7	30.7	740.2
5.8	26.4	10.8	91.6	15.8	196.1	20.8	339.8	25.8	522.8	30.8	745.1
5.9	27.3	10.9	93.3	15.9	198.6	20.9	343.1	25.9	526.9	30.9	749.9
6.0	28.3	11.0	95.0	16.0	201.1	21.0	346.4	26.0	530.9	31.0	754.8
6.1	29.2	11.1	96.8	16.1	203.6	21.1	349.7	26.1	535.0	31.1	759.6
6.2	30.2	11.2	98.5	16.2	206.1	21.2	353.0	26.2	539.1	31.2	764.5
6.3	31.2	11.3	100.3	16.3	208.7	21.3	356.3	26.3	543.3	31.3	769.4
6.4	32.2	11.4	102.1	16.4	211.2	21.4	359.7	26.4	547.4	31.4	774.4
6.5	33.2	11.5	103.9	16.5	213.8	21.5	363.1	26.5	551.5	31.5	779.3
6.6	34.2	11.6	105.7	16.6	216.4	21.6	366.4	26.6	555.7	31.6	784.3
6.7	35.3	11.7	107.5	16.7	219.0	21.7	369.8	26.7	559.9	31.7	789.2
6.8	36.3	11.8	109.4	16.8	221.7	21.8	373.3	26.8	564.1	31.8	794.2
6.9	37.4	11.9	111.2	16.9	224.3	21.9	376.7	26.9	568.3	31.9	799.2
7.0	38.5	12.0	113.1	17.0	227.0	22.0	380.1	27.0	572.6	32.0	804.3
7.1	39.6	12.1	115.0	17.1	229.7	22.1	383.6	27.1	576.8	32.1	809.3
7.2	40.7	12.2	116.9	17.2	232.4	22.2	387.1	27.2	581.1	32.2	814.3
7.3	41.9	12.3	118.8	17.3	235.1	22.3	390.6	27.3	585.3	32.3	819.4
7.4	43.0	12.4	120.8	17.4	237.8	22.4	394.1	27.4	589.6	32.4	824.5
7.5	44.2	12.5	122.7	17.5	240.5	22.5	397.6	27.5	594.0	32.5	829.6
7.6	45.4	12.6	124.7	17.6	243.3	22.6	401.2	27.6	598.3	32.6	834.7
7.7	46.6	12.7	126.7	17.7	246.1	22.7	404.7	27.7	602.6	32.7	839.8
7.8	47.8	12.8	128.7	17.8	248.8	22.8	408.3	27.8	607.0	32.8	845.0
7.9	49.0	12.9	130.7	17.9	251.6	22.9	411.9	27.9	611.4	32.9	850.1
8.0	50.3	13.0	132.7	18.0	254.5	23.0	415.5	28.0	615.8	33.0	855.3
8.1	51.5	13.1	134.8	18.1	257.3	23.1	419.1	28.1	620.2	33.1	860.5
8.2	52.8	13.2	136.8	18.2	260.2	23.2	422.7	28.2	624.6	33.2	865.7
8.3	54.1	13.3	138.9	18.3	263.0	23.3	426.4	28.3	629.0	33.3	870.9
8.4	55.4	13.4	141.0	18.4	265.9	23.4	430.1	28.4	633.5	33.4	876.2
8.5	56.7	13.5	143.1	18.5	268.8	23.5	433.7	28.5	637.9	33.5	881.4
8.6	58.1	13.6	145.3	18.6	271.7	23.6	437.4	28.6	642.4	33.6	886.7
8.7	59.4	13.7	147.4	18.7	274.6	23.7	441.2	28.7	646.9	33.7	892.0
8.8	60.8	13.8	149.6	18.8	277.6	23.8	444.9	28.8	651.4	33.8	897.3
8.9	62.2	13.9	151.7	18.9	280.6	23.9	448.6	28.9	656.0	33.9	902.6

TABLE III—Recommended Air Velocities (CFM)

Part of System	Residences	Churches	Schools	Garages, Shops
Horiz. Branches	350 to 550	500 to 700	600 to 800	700 to 1100
Heat Risers	350 to 550	400 to 600	500 to 600	500 to 900
Low Registers	200 to 300	250 to 350	350 to 400	400 to 600
High Registers 6'-6" off Floor	400 to 600	500 to 800	500 to 800	600 to 1000
Main Trunk Duct	400 to 750	600 to 900	800 to 1000	900 to 1300
Register Temp. °F	135 to 150	135 to 150	135 to 150	150 to 180

TABLE II—Equivalent Round and Rectangular Ducts for Equal Friction

Formula: $D = 1.265\left(\sqrt[5]{\frac{(AB)^3}{A+B}}\right)$

A and B = Sides of Rect. Duct.

Diameter (D) of Equivalent Round Duct

Side of Rect. Duct. → ↓	2½	3	3½	4	4½	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
8	4.7	5.2	5.7	6.1	6.5	6.9	7.6	8.2	8.8											
8½	4.9	5.4	5.9	6.3	6.7	7.1	7.8	8.5	9.1	9.6										
9	5.0	5.5	6.0	6.5	6.9	7.3	8.0	8.7	9.3	9.9										
9½	5.1	5.7	6.2	6.6	7.1	7.5	8.2	8.9	9.6	10.2	10.7									
10	5.2	5.8	6.3	6.8	7.2	7.7	8.4	9.2	9.8	10.4	11.0									
10½	5.4	5.9	6.5	7.0	7.4	7.8	8.6	9.4	10.0	10.7	11.3	11.8								
11	5.5	6.0	6.6	7.1	7.6	8.0	8.8	9.6	10.2	10.9	11.5	12.1	12.6							
11½	5.6	6.2	6.7	7.2	7.7	8.2	9.0	9.8	10.5	11.2	11.8	12.4	12.9	13.4						
12	5.7	6.3	6.9	7.4	7.9	8.3	9.2	10.0	10.7	11.4	12.0	12.6	13.2	13.7						
12½	5.8	6.4	7.0	7.5	8.0	8.5	9.4	10.2	10.9	11.6	12.2	12.9	13.5	14.0						
13	5.9	6.5	7.1	7.7	8.2	8.7	9.6	10.4	11.1	11.8	12.5	13.1	13.7	14.3						
13½	6.0	6.6	7.3	7.8	8.3	8.8	9.7	10.6	11.3	12.1	12.7	13.4	14.0	14.6	15.1					
14	6.1	6.7	7.4	7.9	8.5	8.9	9.9	10.8	11.5	12.3	12.9	13.6	14.3	14.9	15.4					
14½	6.2	6.8	7.5	8.1	8.6	9.1	10.1	11.0	11.7	12.5	13.2	13.9	14.5	15.1	15.7	16.2				
15	6.3	6.9	7.6	8.2	8.7	9.2	10.2	11.1	11.9	12.7	13.4	14.1	14.7	15.3	16.0	16.5				
15½	6.4	7.0	7.7	8.3	8.9	9.4	10.4	11.3	12.1	12.9	13.6	14.3	14.9	15.6	16.2	16.8	17.3			
16		7.1	7.8	8.4	9.0	9.5	10.5	11.4	12.3	13.1	13.8	14.5	15.2	15.8	16.5	17.1	17.6			
17		7.3	8.1	8.6	9.2	9.8	10.8	11.8	12.6	13.5	14.2	15.0	15.7	16.3	17.0	17.6	18.2	18.7		
18			8.2	8.8	9.5	10.0	11.1	12.1	13.0	13.8	14.6	15.4	16.1	16.8	17.4	18.1	18.7	19.2	19.8	
19				9.1	9.7	10.3	11.4	12.4	13.3	14.2	15.0	15.8	16.5	17.2	17.9	18.6	19.2	19.8	20.4	20.9
20						10.5	11.6	12.7	13.6	14.5	15.4	16.2	17.0	17.6	18.4	19.0	19.7	20.3	20.9	21.5
21						10.8	11.9	12.9	13.9	14.9	15.7	16.5	17.4	18.0	18.8	19.5	20.1	20.8	21.4	22.0
22						11.0	12.1	13.2	14.2	15.2	16.1	16.9	17.8	18.5	19.2	19.9	20.6	21.3	21.9	22.5
23						11.2	12.4	13.5	14.5	15.5	16.4	17.3	18.1	18.9	19.6	20.4	21.1	21.7	22.4	23.0
24						11.4	12.6	13.8	14.8	15.8	16.8	17.6	18.5	19.3	20.0	20.8	21.5	22.2	22.8	23.5
25						11.6	12.8	14.0	15.1	16.1	17.0	17.9	18.8	19.6	20.4	21.2	21.9	22.6	23.3	24.0
26						11.8	13.1	14.3	15.4	16.4	17.3	18.3	19.2	20.0	20.8	21.6	22.3	23.0	23.8	24.4
27						12.0	13.3	14.5	15.6	16.7	17.6	18.6	19.5	20.4	21.2	22.0	22.7	23.5	24.2	25.0
28						12.2	13.5	14.8	15.9	17.0	18.0	19.0	19.8	20.7	21.5	22.4	23.1	23.9	24.6	25.3
29						12.4	13.7	15.0	16.1	17.2	18.2	19.2	20.2	21.0	21.9	22.7	23.5	24.3	25.0	25.7
30						12.6	13.9	15.2	16.4	17.5	18.5	19.5	20.5	21.4	22.2	23.1	23.9	24.7	25.4	26.2
31						12.7	14.1	15.4	16.6	17.7	18.8	19.8	20.8	21.7	22.5	23.4	24.2	25.0	25.8	26.6
32						12.9	14.3	15.6	16.9	18.0	19.1	20.1	21.1	22.0	22.9	23.8	24.6	25.4	26.2	27.0
33						13.1	14.5	15.8	17.1	18.2	19.3	20.4	21.4	22.3	23.2	24.1	25.0	25.8	26.5	27.3
34						13.2	14.7	16.1	17.3	18.5	19.6	20.7	21.6	22.6	23.5	24.4	25.3	26.2	26.9	27.7
35						13.4	14.9	16.2	17.5	18.7	19.8	20.9	21.9	22.9	23.9	24.7	25.6	26.5	27.2	28.1
36							15.1	16.4	17.7	19.0	20.1	21.2	22.2	23.2	24.2	25.1	26.0	26.8	27.7	28.5
37							15.2	16.6	17.9	19.2	20.3	21.4	22.5	23.5	24.5	25.4	26.3	27.1	28.0	28.8
38							15.4	16.8	18.2	19.4	20.6	21.7	22.8	23.8	24.8	25.8	26.7	27.5	28.4	29.2
39							15.5	17.0	18.4	19.6	20.8	21.9	23.0	24.1	25.1	26.1	27.0	27.8	28.7	29.5
40							15.7	17.2	18.6	19.8	21.1	22.2	23.3	24.4	25.4	26.4	27.3	28.2	29.1	29.9
41							15.9	17.4	18.8	20.0	21.3	22.4	23.5	24.6	25.6	26.6	27.6	28.5	29.4	30.3
42							16.1	17.6	19.0	20.3	21.6	22.7	23.8	24.9	25.9	26.9	27.9	28.8	29.8	30.7
43								17.8	19.2	20.5	21.8	22.9	24.0	25.1	26.2	27.2	28.2	29.1	30.0	30.9
44								18.0	19.4	20.7	22.0	23.1	24.3	25.4	26.5	27.5	28.5	29.5	30.3	31.2
45								18.2	19.6	20.9	22.2	23.3	24.5	25.6	26.7	27.8	28.8	29.8	30.6	31.5
46								18.4	19.8	21.1	22.4	23.6	24.8	25.9	27.0	28.1	29.1	30.1	31.0	31.9
47								18.6	19.9	21.3	22.6	23.8	25.0	26.1	27.2	28.3	29.3	30.3	31.3	32.2
48									20.1	21.5	22.8	24.1	25.2	26.4	27.5	28.6	29.6	30.5	31.6,	32.5
49									20.2	21.7	23.0	24.3	25.4	26.6	27.7	28.9	29.9	30.9	31.9	32.8
50									20.4	21.9	23.2	24.5	25.7	26.9	28.0	29.2	30.3	31.3	32.2	33.1
51									20.6	22.0	23.4	24.7	25.9	27.1	28.2	29.4	30.5	31.5	32.5	33.4
52									20.8	22.2	23.6	24.9	26.2	27.4	28.5	29.6	30.7	31.8	32.9	33.8
53									20.9	22.4	23.8	25.1	26.4	27.6	28.7	29.8	30.9	32.0	33.1	34.1
54									21.1	22.6	24.0	25.3	26.6	27.8	29.0	30.1	31.2	32.3	33.4	34.4
55									21.3	22.7	24.2	25.5	26.8	28.0	29.2	30.3	31.4	32.5	33.6	34.6

AMERICAN ARCHITECT
TIME-SAVER STANDARDS

Serial No. 99

DUCT DESIGN — Heating & Air Conditioning

FEBRUARY 1938

TABLE IV EQUIVALENTS | **↓ GRAVITY WARM AIR** | **FORCED AIR CIRCULATION**

Key Number	1 Btu	2 Sq.Ft.Radiation Steam	2 Sq.Ft.Radiation Hot Water	3 Std. Code Room Basic Factor	4 Sq. In. Pipe	5 Register Size Floor Type	5 Register Size High Side-Wall	6 120° Register Temp. CFM	6 Area—Sq. In. Round Pipe for Velocities in ft./min. of: 300	6 400	6 500	7 130° Register Temp. CFM	7 Area—Sq. In. Round Pipe for Velocities in ft./min. of: 300	7 400	7 500	8 140° Register Temp. CFM	8 Area—Sq. In. Round Pipe for Velocities in ft./min. of: 300	8 400	8 500	9 150° Register Temp. CFM	9 Area—Sq. In. Round Pipe for Velocities in ft./min. of: 300	9 400	9 500
1	1200	5	8.0	1.20	8	7.20	4.80	20.16	11.04	8.16	6.60	17.04	9.24	6.96	5.52	14.76	8.04	6.0	4.80	13.08	7.08	5.28	4.20
2	1440	6	9.6	1.44	10	8.64	5.76	24.19	13.25	9.79	7.92	20.45	11.09	8.35	6.62	17.71	9.65	7.2	5.76	15.70	8.50	6.34	5.04
3	1680	7	11.2	1.68	11	10.08	6.72	28.22	15.46	11.42	9.24	23.86	12.94	9.74	7.73	20.66	11.26	8.4	6.72	18.31	9.91	7.39	5.88
4	1920	8	12.8	1.92	13	11.52	7.68	32.26	17.66	13.06	10.56	27.26	14.78	11.14	8.83	23.62	12.86	9.6	7.68	20.93	11.33	8.45	6.72
5	2160	9	14.4	2.16	14	12.96	8.64	36.29	19.87	14.69	11.88	30.67	16.63	12.53	9.94	26.57	14.47	10.8	8.64	23.54	12.74	9.50	7.56
6	2400	10	16.0	2.40	16	14.40	9.60	40.32	22.08	16.32	13.20	34.08	18.48	13.92	11.04	29.52	16.08	12.0	9.60	26.16	14.16	10.56	8.40
7	2640	11	17.6	2.64	18	15.84	10.56	44.35	24.29	17.95	14.52	37.49	20.33	15.31	12.14	32.47	17.69	13.2	10.56	28.78	15.58	11.62	9.24
8	2880	12	19.2	2.88	19	17.28	11.52	48.38	26.50	19.58	15.84	40.90	22.18	16.70	13.25	35.42	19.30	14.4	11.52	31.39	16.99	12.67	10.08
9	3120	13	20.8	3.12	21	18.72	12.48	52.42	28.70	21.22	17.16	44.30	24.02	18.10	14.35	38.38	20.90	15.6	12.48	34.01	18.41	13.73	10.92
10	3360	14	22.4	3.36	22	20.16	13.44	56.45	30.91	22.85	18.48	47.71	25.87	19.49	15.46	41.33	22.51	16.8	13.44	36.62	19.82	14.78	11.76
11	3600	15	24.0	3.60	24	21.60	14.40	60.48	33.12	24.48	19.80	51.12	27.72	20.88	16.56	44.28	24.12	18.0	14.40	39.24	21.24	15.84	12.60
12	3840	16	25.6	3.84	26	23.04	15.36	64.51	35.33	26.11	21.12	54.53	29.57	22.27	17.66	47.23	25.73	19.2	15.36	41.86	22.66	16.90	13.44
13	4080	17	27.2	4.08	27	24.48	16.32	68.54	37.54	27.74	22.44	57.94	31.42	23.66	18.77	50.18	27.34	20.4	16.32	44.47	24.07	17.95	14.28
14	4320	18	28.8	4.32	29	25.92	17.28	72.58	39.74	29.38	23.76	61.34	33.26	25.06	19.87	53.14	28.94	21.6	17.28	47.09	25.49	19.01	15.12
15	4560	19	30.4	4.56	30	27.36	18.24	76.61	41.95	31.01	25.08	64.75	35.11	26.45	20.98	56.09	30.55	22.8	18.24	49.70	26.90	20.06	15.96
16	4800	20	32.0	4.80	32	28.80	19.20	80.64	44.16	32.64	26.40	68.16	36.96	27.84	22.08	59.04	32.16	24.0	19.20	52.32	28.32	21.12	16.80
17	5040	21	33.6	5.04	34	30.24	20.16	84.67	46.37	34.27	27.72	71.57	38.81	29.23	23.18	61.99	33.77	25.2	20.16	54.94	29.74	22.18	17.64
18	5280	22	35.2	5.28	35	31.68	21.12	88.70	48.58	35.90	29.04	74.98	40.66	30.62	24.29	64.94	35.38	26.4	21.12	57.55	31.15	23.23	18.48
19	5520	23	36.8	5.52	37	33.12	22.08	92.74	50.78	37.54	30.36	78.38	42.50	32.02	25.39	67.90	36.98	27.6	22.08	60.17	32.57	24.29	19.32
20	5760	24	38.4	5.76	38	34.56	23.04	96.77	52.99	39.17	31.68	81.79	44.35	33.41	26.50	70.85	38.59	28.8	23.04	62.78	33.98	25.34	20.16
21	6000	25	40.0	6.00	40	36.00	24.00	100.80	55.20	40.80	33.00	85.20	46.20	34.80	27.60	73.80	40.20	30.0	24.00	65.40	35.40	26.40	21.00
22	6240	26	41.6	6.24	42	37.44	24.96	104.83	57.41	42.43	34.32	88.61	48.05	36.19	28.70	76.75	41.81	31.2	24.96	68.02	36.82	27.46	21.84
23	6480	27	43.2	6.48	43	38.88	25.92	108.86	59.62	44.06	35.64	92.02	49.90	37.58	29.81	79.70	43.42	32.4	25.92	70.63	38.23	28.51	22.68
24	6720	28	44.8	6.72	45	40.32	26.88	112.90	61.82	45.70	36.96	95.42	51.74	38.98	30.91	82.66	45.02	33.6	26.88	73.25	39.65	29.57	23.52
25	6960	29	46.4	6.96	46	41.76	27.84	116.93	64.03	47.33	38.28	98.83	53.59	40.37	32.02	85.61	46.63	34.8	27.84	75.86	41.06	30.62	24.36
26	7200	30	48.0	7.20	48	43.20	28.80	120.96	66.24	48.96	39.60	102.24	55.44	41.76	33.12	88.56	48.24	36.0	28.80	78.48	42.48	31.68	25.20
27	7440	31	49.6	7.44	50	44.64	29.76	124.99	68.45	50.59	40.92	105.65	57.29	43.15	34.22	91.51	49.85	37.2	29.76	81.10	43.90	32.74	26.04
28	7680	32	51.2	7.68	51	46.08	30.72	129.02	70.66	52.22	42.24	109.06	59.14	44.54	35.33	94.46	51.46	38.4	30.72	83.71	45.31	33.79	26.88
29	7920	33	52.8	7.92	53	47.52	31.68	133.06	72.86	53.86	43.56	112.46	60.98	45.94	36.43	97.42	53.06	39.6	31.68	86.33	46.73	34.85	27.72
30	8160	34	54.4	8.16	54	48.96	32.64	137.09	75.07	55.49	44.88	115.87	62.83	47.33	37.54	100.37	54.67	40.8	32.64	88.94	48.14	35.90	28.56
31	8400	35	56.0	8.40	56	50.40	33.60	141.12	77.28	57.12	46.20	119.28	64.68	48.72	38.64	103.32	56.28	42.0	33.60	91.56	49.56	36.96	29.40
32	8640	36	57.6	8.64	58	51.84	34.56	145.15	79.49	58.75	47.52	122.69	66.53	50.11	39.74	106.27	57.89	43.2	34.56	94.18	50.98	38.02	30.24
33	8880	37	59.2	8.88	59	53.28	35.52	149.18	81.70	60.38	48.84	126.10	68.38	51.50	40.85	109.22	59.50	44.4	35.52	96.79	52.39	39.07	31.08
34	9120	38	60.8	9.12	61	54.72	36.48	153.22	83.90	62.02	50.16	129.50	70.22	52.90	41.95	112.18	61.10	45.6	36.48	99.41	53.81	40.13	31.92
35	9360	39	62.4	9.36	62	56.16	37.44	157.25	86.11	63.65	51.48	132.91	72.07	54.29	43.06	115.13	62.71	46.8	37.44	102.02	55.22	41.18	32.76
36	9600	40	64.0	9.60	64	57.60	38.40	161.28	88.32	65.28	52.80	136.32	73.92	55.68	44.16	118.08	64.32	48.0	38.40	104.64	56.64	42.24	33.60
37	9840	41	65.6	9.84	66	59.04	39.36	165.31	90.53	66.91	54.12	139.73	75.77	57.07	45.26	121.03	65.93	49.2	39.36	107.26	58.06	43.30	34.44
38	10080	42	67.2	10.08	67	60.48	40.32	169.34	92.74	68.54	55.44	143.14	77.62	58.46	46.36	123.98	67.54	50.4	40.32	109.87	59.47	44.35	35.28
39	10320	43	68.8	10.32	69	61.92	41.28	173.38	94.94	70.18	56.76	146.54	79.46	59.86	47.47	126.94	69.14	51.6	41.28	112.49	60.89	45.41	36.12
40	10560	44	70.4	10.56	70	63.36	42.24	177.41	97.15	71.81	58.08	149.95	81.31	61.25	48.58	129.89	70.75	52.8	42.24	115.10	62.30	46.46	36.96
41	10800	45	72.0	10.80	72	64.80	43.20	181.44	99.36	73.44	59.40	153.36	83.16	62.64	49.68	132.84	72.36	54.0	43.20	117.72	63.72	47.52	37.80
42	11040	46	73.6	11.04	74	66.24	44.16	185.47	101.57	75.07	60.72	156.77	85.01	64.03	50.78	135.79	73.97	55.2	44.16	120.34	65.14	48.58	38.64
43	11280	47	75.2	11.28	75	67.68	45.12	189.50	103.78	76.70	62.04	160.18	86.86	65.42	51.89	138.74	75.58	56.4	45.12	122.95	66.55	49.63	39.48
44	11520	48	76.8	11.52	77	69.12	46.08	193.54	105.98	78.34	63.36	163.58	88.70	66.82	52.99	141.70	77.18	57.6	46.08	122.57	67.97	50.69	40.32
45	11760	49	78.4	11.76	78	70.56	47.04	197.57	108.19	79.97	64.68	166.99	90.55	68.21	54.10	144.65	78.79	58.8	47.04	128.18	69.38	51.74	41.16
46	12000	50	80.0	12.00	80	72.00	48.00	201.60	110.40	81.60	66.00	170.40	92.40	69.60	55.20	147.60	80.40	60.0	48.00	130.80	70.80	52.80	42.00
47	13200	55	88.0	13.20	88	79.20	52.80	221.76	121.44	89.76	72.60	187.44	101.64	76.56	60.72	162.36	88.44	66.0	52.80	143.88	77.88	58.08	46.20
48	14400	60	96.0	14.40	96	86.40	57.60	241.92	132.48	97.92	79.20	204.48	110.88	83.52	66.24	177.12	96.48	72.0	57.60	156.96	84.96	63.36	50.40
49	15600	65	104.0	15.60	104	93.60	62.40	262.08	143.52	106.08	85.80	221.52	120.12	90.48	71.76	191.88	104.52	78.0	62.40	170.04	92.04	68.64	54.60
50	16800	70	112.0	16.80	112	100.80	67.20	282.24	154.56	114.24	92.40	238.56	129.36	97.44	77.28	206.64	112.56	84.0	67.20	183.12	99.12	73.92	58.80
51	18000	75	120.0	18.00	120	108.00	72.00	302.40	165.60	122.40	99.00	255.60	138.60	104.40	82.80	221.40	120.60	90.0	72.00	196.20	106.20	79.20	63.00
52	19200	80	128.0	19.20	128	115.20	76.80	322.56	176.64	130.56	105.60	272.64	147.84	111.36	88.32	236.16	128.64	96.0	76.80	209.28	113.28	84.48	67.20
53	20400	85	136.0	20.40	136	122.40	81.60	342.72	187.68	138.72	112.20	289.68	157.08	118.32	93.84	250.92	136.68	102.0	81.60	222.36	120.36	89.76	71.40
54	21600	90	144.0	21.60	144	129.60	86.40	362.88	198.72	146.88	118.80	306.72	166.32	125.28	99.36	265.68	144.72	108.0	86.40	235.44	127.44	95.04	75.60
55	22800	95	152.0	22.80	152	136.80	91.20	383.04	209.76	155.04	125.40	323.76	175.56	132.24	104.88	280.44	152.76	114.0	91.20	248.52	134.52	100.32	79.80
56	24000	100	160.0	24.00	160	144.00	96.00	403.20	220.80	163.20	132.00	340.80	184.80	139.20	110.40	295.20	160.80	120.0	96.00	261.60	141.60	105.60	84.00
57	26400	110	176.0	26.40	176	158.40	105.60	443.52	242.88	179.52	145.20	374.88	203.28	153.12	121.44	324.72	176.88	132.0	105.60	287.76	155.76	116.16	92.40
58	28800	120	192.0	28.80	192	172.80	115.20	483.84	264.96	195.84	158.40	408.96	221.76	167.04	132.48	354.24	192.96	144.0	115.20	313.92	169.92	126.72	100.80
59	31200	130	208.0	31.20	208	187.20	124.80	524.16	287.04	212.16	171.60	443.04	240.24	180.96	143.52	383.76	209.04	156.0	124.80	340.08	184.08	137.28	109.20
60	33600	140	224.0	33.60	224	201.60	134.40	564.48	309.12	228.48	184.80	477.12	258.72	194.88	154.56	413.28	225.12	168.0	134.40	366.24	198.24	147.84	117.60
61	36000	150	240.0	36.00	240	216.00	144.00	604.80	331.20	244.80	198.00	511.20	277.20	208.80	165.60	442.80	241.20	180.0	144.00	392.40	212.40	158.40	126.00
62	38400	160	256.0	38.40	256	230.40	153.60	645.12	353.28	261.12	211.20	545.28	295.68	222.72	176.64	472.32	257.28	192.0	153.60	418.56	226.56	168.96	134.40
63	40800	170	272.0	40.80	272	244.80	163.20	685.44	375.36	277.44	224.40	579.36	314.16	236.64	187.68	501.84	273.36	204.0	163.20	444.72	240.72	179.52	142.80
64	43200	180	288.0	43.20	288	259.20	172.80	725.76	397.44	293.76	237.60	613.44	332.64	250.56	198.72	531.36	289.44	216.0	172.80	470.88	254.88	190.08	151.20
65	45600	190	304.0	45.60	304	273.60	182.40	766.08	419.52	310.08	250.80	647.52	351.12	264.48	209.76	560.88	305.52	228.0	182.40	497.04	269.40	200.64	159.60
66	48000	200	320.0	48.00	320	288.00	192.00	806.40	441.60	326.40	264.00	681.60	369.60	278.40	220.80	590.40	321.60	240.0	192.00	523.20	283.20	211.20	168.00

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AMERICAN ARCHITECT
TIME-SAVER STANDARDS

Serial No. 100
FEBRUARY 1938

SYMBOLS—Heating, Air Conditioning, Insulation, Electrical

HEATING SYMBOLS

Unless otherwise noted, these are A.S.A. Standards (Z 14.2, 1935), as recommended by A.S.H.V.E. . Symbols starred (*) are assembled from other sources. When possibility of misinterpretation exists, incorporate symbols in a key or legend. See also T.S.S. A 1.3.1

PIPING

- General
- Air - *Pressure Flow*
- * Air - *Return*
- Gas
- Oil
- Refrigerant
- Steam - *Supply*
- Steam - *Return* (*Condensate*)
- Vacuum
- Water - *Cold*
- Water - *Hot, Flow*
- * Water - *Hot, Return*

PIPE FITTINGS

Screwed type shown; for other types & fittings see T.S.S. A 1.3.1

- Bushing
- Expansion Joint, *Flanged*
- * Sleeve
- Stop Cock
- Trap - *Radiator* (*Elev.*)
- Trap - *Radiator* (*Plan*)
- Union
- Valves (*see also "Controls"*)
  - Check
  - Float Operated
  - Gate
  - Globe
  - Lock and Shield
  - Quick Opening
  - Safety

RADIATION

- Indirect Radiator - *Plan*
- Indirect Radiator - *Elev.*
- Pipe Coil - *Plan*
- Pipe Coil - *Elev.*
- Tube Radiator - *Plan*
- Tube Radiator - *Elev.*
- Wall Radiator - *Plan*
- Wall Radiator - *Elev.*

AIR DUCTS and FITTINGS

Ducts

- Supply - *Section*
- * Supply - *Plan*
- Exhaust - *Section*
- * Exhaust - *Plan*

Dampers

- Butterfly - *Plan*
- Butterfly - *Elev.*
- Deflecting

- Vanes
- Supply Outlet
- Exhaust Inlet

CONTROLS

- * Aquastat (A)
- * Damper Motor - *General* (D)
- * Damper Motor - *Modulating* (M)
- * Damper Motor - *2 Position* (2)
- * Diaphragm Damper Motor
- * Ductstat - *Extended Tube* (D)
- * Ductstat - *Rigid Tube*
- * Humidistat - *Room Type* (H)
- * Relay (R)
- * Stop and Waste Cock
- * Switch (S)
- Thermostat - *Room Type* (T)

Valves

- * Air Reducing
- Diaphragm
- Gate - *Motor Operated*
- * Globe - *Motor Operated*
- Reducing - *Steam*
- * Self-contained Thermostatic

INSULATION SYMBOLS

Symbols shown here have been proposed to the Research Committee on Insulation, A.S.H.V.E., for use on working drawings to assist in calculating heating and cooling loads. In scale details, show type, location and amount of insulation by any clear graphic indication.

- Any insulation type not determined
- Any fill type batt or loose
- Rigid board as sheathing
- Rigid board on interior
- Any flexible blanket or curtain
- Reflective curtain 2 sides or multiple
- Reflective metal one side only
- To show transmittance "*u*" — *u* = .09

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AMERICAN ARCHITECT
TIME-SAVER STANDARDS

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Serial No. 100
FEBRUARY 1938

This sheet supersedes T-S.S. A1.2.1 ("Electrical Symbols"; Serial No. 30, December 1935). Accompanying electrical symbols were prepared by Committee Z32 of the American Standards Association and are sponsored by the following members of the Industry Committee on Interior Wiring Design: Edison Electric Institute, Illuminating Engineering Society, Intn'l Assoc. of Electrical Inspectors, Nat'l. Elec. Contractor's Assoc., Nat'l. Elec. M'f'rs' Assoc., Artistic Lighting Equipment Assoc., Nat'l. Elec. Wholesalers' Assoc., Radio M'f'rs' Assoc., and others. These electrical symbols were published in the Industry Committee's "Handbook of Interior Wiring Design" and have been submitted for approval to replace Standard C10 which was approved in 1924. Additional symbols or those not yet commonly accepted should be included in a legend.

ELECTRICAL SYMBOLS FOR ARCHITECTURAL PLANS

Prepared by American Standards Association and published by Industry Committee on Interior Wiring Design

GENERAL OUTLETS

Description	Ceiling	Wall
Outlet	○	–○
Capped Outlet	(C)	–(C)
Drop Cord	(D)	
Electrical Outlet: *use when plain circle may be confused with column or other symbols*	(E)	–(E)
Fan Outlet	(F)	–(F)
Junction Box	(J)	–(J)
Lamp Holder	(L)	–(L)
Lamp Holder with Pull Switch	(L) PS	–(L) PS
Pull Switch	(S)	–(S)
Outlet for Vapor Discharge Lamp	(V)	–(V)
Exit Light Outlet	(X)	–(X)
Clock Outlet (Lighting Voltage)		

CONVENIENCE OUTLETS

Description	Symbol
Duplex Convenience Outlet	
Convenience Outlet other than Duplex 1 = Single, 3 = Triplex, etc.	1, 3
Weatherproof Conv. Outlet	WP
Range Outlet	R
Switch and Convenience Outlet	$
Radio and Convenience Outlet	R
Special Purpose Outlet (desc. in Spec.)	
Floor Outlet	

SWITCHES

Description	Symbol
Single Pole Switch	$
Double Pole Switch	$_2$
Three Way Switch	$_3$
Four Way Switch	$_4$
Automatic Door Switch	$_D$
Electrolier Switch	$_E$
Key Operated Switch	$_K$
Switch and Pilot Lamp	$_P$
Circuit Breaker	$_{CB}$
Weatherproof Circuit Breaker	$_{WCB}$
Momentary Contact Switch	$_{MC}$
Remote Control Switch	$_{RC}$
Weatherproof Switch	$_{WP}$

SPECIAL OUTLETS

Description	Symbol
Any standard symbol, with a lower case subscript added, may be used for special indications. When so used, a legend on each drawing and description in specifications are strongly recommended	○ a,b,c etc. a,b,c etc. $ a,b,c etc.

PANELS, CIRCUITS, MISC.

Description	Symbol
Lighting Panel	
Power Panel	
*Branch Circuit—Ceiling or Wall	
*Branch Circuit—Floor	
**without other designation indicates 2-wire circuit.* *For 3 wires, use*	
For 4 wires	
Feeders: *use heavy lines and designate by number for quick reference*	
Underfloor Duct & Junction Box - Triple System: *for double or single systems use two lines or one. Symbol also adaptable to Auxiliary or Low Voltage systems*	

PANELS, CIRCUITS, MISC.

Description	Symbol
Generator	(G)
Motor	(M)
Instrument	(I)
Transformer	(T)
Controller	
Isolating Switch	S

AUXILIARY or Low Voltage SYSTEMS

Description	Symbol
Push Button	
Buzzer	
Bell	
Annunciator	
Telephone	
Telephone Switchboard	
Clock (Low Voltage)	
Electric Door Opener	D
Fire Alarm Bell	F
Fire Alarm Station	F
City Fire Alarm Station	
Fire Alarm Central Station	FA
Automatic Fire Alarm Device	FS
Watchman's Station	W
Watchman's Central Station	W
Horn	H
Nurse's Signal Plug	N
Maid's Signal Plug	M
Radio Outlet	R
Signal Central Station	SC
Interconnection Box	
Battery	
Auxiliary System Circuits: *without other designation indicates 2-wire circuit. For others, use numbers, as: ——12 - #18 W - ¾"C. or designate by number for quick reference*	
Special Auxiliary Outlets: *subscripts refer to notes in plans, schedules or specifications*	a,b,c

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BOOKS . . . .

GREAT GEORGIAN HOUSES OF AMERICA, VOL. II: Published for the Benefit of the Architects Emergency Committee by the Editorial Committee. 256 pages, 11 by 14 inches. Illustrations from photographs and drawings. New York: 1937: The Scribner Press. $20.00.

Until the appearance of the first volume of *Great Georgian Houses of America* there was no single volume that we know of that contained a record of historically important 17th and 18th century mansions in various sections of the country. To enhance its value, if that were possible, it had been published to give employment to draftsmen thrown out of work by the depression. One hundred and ten men were thus employed in the period from 1932 to 1937. This represents nineteen thousand, two hundred and one work hours. The entire profits from the sale of both these books have been expended for this purpose.

The second volume has just been issued. It is perhaps even more interesting than the first, since in it, as William Lawrence Bottomley points out in his able preface, "the word, 'Great,' has been used in the sense of excellence of design rather than as an indication of the size of the houses." Furthermore this volume covers a far wider range of styles, including those during the reign of the four Georges and the intervening Regency. Many of the examples shown are also relatively little known. Among them the Samuel Forman house in Syracuse, a little Regency gem of brick, causes one to pause and speculate on the possibilities of American architecture today if we had continued in the direction indicated, without the intervening Godey's Ladies Book house patterns and the Beaux Arts.

GLASS IN MODERN CONSTRUCTION: Its Place in Architectural Design and Decoration. Introduction and text by Harold Donaldson Eberlein and Cortlandt Van Dyke Hubbard. 31-page introduction and 62 plates. 9½ by 12 inches. Illustrations from photographs. New York: 1937: Charles Scribner's Sons. $3.75.

Slogan makers have, among numerous other designations, called the twentieth century the age of glass. Whether this is entirely accurate is open to debate but certainly today more glass is being used in more ways than ever before. The present work is a handsome re-editing of previously published winning designs in the Pittsburgh Glass Institute's competition in 1937. There is also a brief but informative text covering the history and use of glass in structure and decoration.

PAUL BONATZ: ARBEITEN AUS DEN JAHREN 1907 BIS 1937. By Friedrich Tamms. 94 pages, 9 by 11½ inches. Illustrations from photographs and drawings. Printed in Germany. Stuttgart: 1937: Julius Hoffmann. RM 8.

KUNST UND KUNSTHANDWERK AM BAU. 190 pages. 9 by 11¾ inches. Illustrations from photographs. Printed in Germany: Stuttgart: 1937: Julius Hoffmann. RM 18.

During the past few years we have had startling examples of the influence of political theories on architectural design. No definite conclusions about the effects of dictatorships on taste can be reached, however, since what is considered communistic architecture in Germany receives government sanction in Italy. One thing is clear. Architecture definitely reflects the personality of the party in power.

These recent books from Germany are interesting exhibitions of a reactionary trend. That on Bonatz, one of the very few internationally known architects still acceptable to the Hitler regime, records thirty years of his work. Beginning practice in 1907, he was naturally on the turgid, imperialistic bandwagon of the Wilhemnische style which was well under way by 1911. After the war he tamed down somewhat, although his best known work, the Stuttgart Railroad station, 1914-1928, clearly indicates an inability to break with beer hall traditions. Strangely enough, his best work was done in the, to the Nazis, abhorrent free days of 1926-1928 when he designed a series of magnificent dams, canals and bridges on the Neckar. Since then he has engaged in a Romanesque revival.

Since Hitler was himself a housepainter, and since he received tremendous support from various craft guilds, it is scarcely a shock to find German buildings breaking out in a veritable rash of painted and sculptured swastikas, irate eagles, patriotic messages and heroic figures seemingly capable of raising large families. The examples shown in *Kunst und Kunsthandwerk am Bau* are in every instance beautifully executed. This book should provide fertile food for anyone working on the New York World's Fair.

SMOLEY'S SEGMENTAL FUNCTIONS—TEXT AND TABLES. Offering simple methods of solving a circular segment and of computing its area, etc., etc. By C. K. Smoley. 184 pages, 4½ by 7 inches. Illustrated with diagrams for solving mathematical formulae. Flexible covers. Scranton, Pa.: 1937. C. K. Smoley & Sons: $5.

The aim of this handbook is to accomplish for the solution of circular segments what trigonometric functions have done for the triangle. To that end it sets up formulae capable of solution by the logarithmic method, so that, given any two of the five parts of a circular segment (arc, chord, radius, central angle, and height), the remaining parts and the area may be found. The author has evolved tables of logarithms of the segmental functions described in the text as well as tables for laying out circular curves, etc. Also included are logs of numbers and of feet, inches and fractions from 0 to 200 feet; circumferences, areas, squares, etc.; decimal equivalents; and other pertinent data, some of which is reprinted from earlier works by the same author.

ROOFING TERNES—Simplified Practice Recommendation R30-37, effective Nov. 1, 1937. 10 pages, 6 by 9 inches. Pamphlet binding. U. S. Dept. Commerce. $0.05.

A second revision, adding packaging and marking recommendations to the original.

AIR CONDITIONING in summer and Winter. By Richard E. Holmes. 296 pages, 6 by 9 inches. Illustrations from photographs, line drawings, charts and tables. New York: 1937: McGraw-Hill Book Company. $3.

An elementary, comprehensive treatment of theory and practice of air conditioning, simply written and suitable for those with limited engineering training as well as those already familiar with the subject. The author is design engineer for the Westinghouse Electric and Manufacturing Company.

SHEET METAL WORK. By William Neubecker. 360 pages, 6 by 9 inches. Illustrations from line drawings, geometrical diagrams and tables. Chicago: 1938: American Technical Society. $2.50.

A new edition of a standard work intended primarily for sheet metal draftsmen, containing practical geometrical methods of pattern making and developing unusual shapes.

ARCHITECTURAL DESIGN OF CONCRETE BRIDGES. 36 pages, 8½ by 11 inches, paper covers. Illustrations from photographs, drawings and renderings. Chicago, Illinois: Published by the Portland Cement Association.

This treatise distinguishes between architectural design of concrete bridges and architectural "treatment" of the engineer's finished product. In so doing, the subject is attacked principally from the engineer's point of view, in an attempt to present to him a few of the fundamentals of architectural design.

STUDY OF VIBRATED CONCRETE. By John Tucker, Jr., G. L. Pigman, E. A. Pisapia, and J. A. Rogers. U. S. Department of Commerce, National Bureau of Standards, Research Paper RP1048—Part of Journal of Research of the National Bureau of Standards, Volume 19, November 1937. 18 pages, 6 by 9 inches.

A determination of the relative effectiveness of vibration on strength of concrete in relation to water content and character of vibration.

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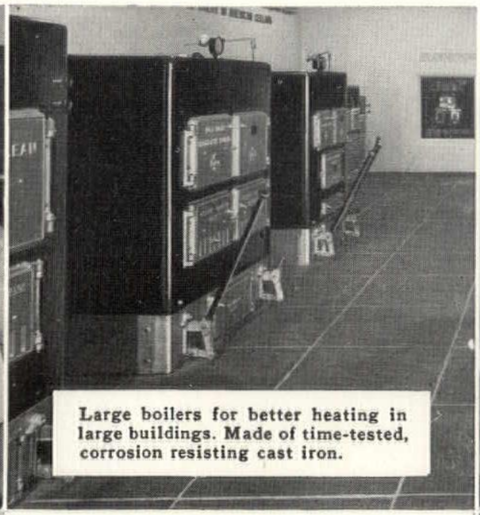
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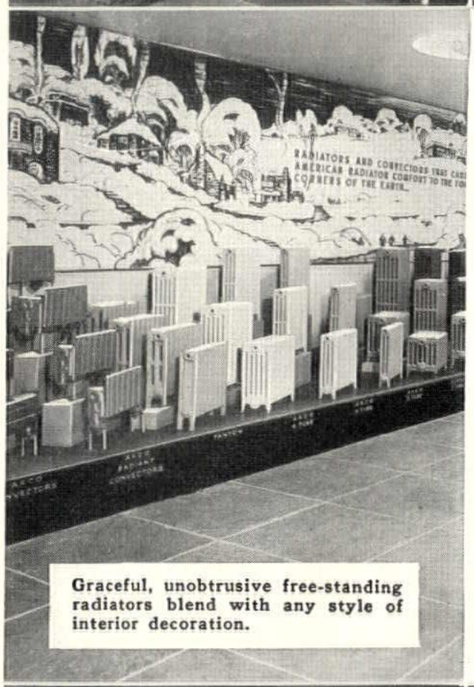
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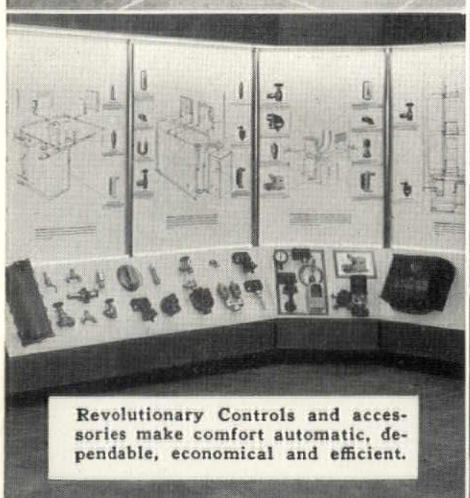
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TECHNICAL DIGEST . . . .

KEY TO PRESENTATION

Typical reference: 15 F'38:14-26 **gptv**

This indicates: Issue of February 15, 1938, pages 14 to 26 inclusive, presented according to the following key:

d—detail drawing
s—section
g—graph
t—text
p—plan
v—photo view

Accordingly, **gptv** means graph(s), plan(s), text and photographic view(s) in the article mentioned.

NOTE: Readers desiring to secure copies of any publications mentioned herein are advised to have their local bookseller obtain them, or to write to the periodical of origin, either directly or in care of AMERICAN ARCHITECT AND ARCHITECTURE.

ACOUSTICS

The Prevention of noise in buildings. (C. J. Morreau). R. I. B. A. Journal. (London). 6 D'37:117-124 **gst**

Air-borne, impact and equipment noises are considered in turn. There is a graph correlating the sound reduction in decibels and the weights per sq. ft. of various partition constructions. Differences of less than 5 db are claimed to be useless. Since sound insulation increases in the logarithm of the weight "it is necessary to double the weight each time to get a corresponding increase." This means that if a 9-inch solid wall is not satisfactory an 18-inch solid wall will be required to give a 5 db decrease in the sound transmitted. The great weights involved usually rule out solid walls in favor of more complicated construction with greater sound reduction. There are tables in the article giving sound transmission through various types of walls and floors. Floor impacts seem deadened only by some sort of independent finish isolated by resilient supports from the structural floor.

There are many notes of a practical nature.

Same: Architects' Journal. (London). 25 N'37: 826 **t**. The Builder. (London). 26 N'37:983-986 **gst**

AIR CONDITIONING & HEATING

Air conditioning. Chicago Tech News. D'37: 2-4 **t**

A simply-phrased article covering the main physiological points basic in air conditioning theory. Among items considered are the effects of breathing, and natural cooling methods (evaporation of perspiration, respiration, radiation, convectional air currents).

It is a curious fact that adults asleep produce more carbon dioxide than when awake and at hard labor. Respiration is the polite term for panting. In this connection it is noted that dogs are completely "internally cooled" by the air they inhale, since they possess no perspiration glands.

The cooling effect of the radiation of body heat takes place only when the air temperature is higher than body temperature. (normal 98.8°F)

99% Pure—Air cleaning. Domestic Engineering. N'37:74-76 **dtv**

A description of the new electrostatic dust precipitator in the Field Building, Chicago. In this process dust particles are charged electrically and then pulled out of the air as they pass through an electrostatic field. The charging is effected by fine tungsten wires at 12,000 volts, the attraction of aluminum plates at 5,000 volts. The 18 units installed will clean 272,000 cu. ft. air per minute. It is estimated that in one year's time these will have collected 600 bushels of impurities, 90% of which will be particles 1/100th of the diameter of human hair. By weight, approximately 1/3 ash, 1/3 fixed carbon, soot, etc., and 1/3 volatile oils. Other particles such as sulphur, bacteria and pollen in season are also collected.

The plates require cleaning only about ten times a year.

Show-window ventilation. (L. T. Avery). Heating, Piping and Air Conditioning. D'37: 741-742 **stv**

Description of an installation in Cleveland. Total lighting load for each of a series of large show-windows was 8.6 KW, producing about 29,300 Btu per hour in the volume of 840 cu. ft. Both supply and exhaust fans were provided (1,000 and 800 cu. ft. per minute respectively), but the exhaust is only to be used for extreme heat. The difference in capacity provides some static pressure in the window to prevent dust infiltration. The low rate of air change per minute does not disturb draperies, cards, etc.

Outside air is used to prevent high dewpoint inside the window and consequent condensation and frosting in winter. Ordinary store air is too warm and humid.

1926 products vs. 1937 quality. Domestic Engineering. N'37:58-67, 173-175 **tv**

A factual comparison of the mechanical equipment of 1926 and 1937, including (in many cases) list prices. Among items considered are: boilers, bath tubs, water closets, lavatories, flush valves, oil burners, water feeders, air valves, convectors, water systems, gas-fired boilers, circulators, controls, swing faucets.

The index for 1937 plumbing and heating equipment is only 78.7% of 1926 prices, and great improvements in design are evident in this parallel.

Continued: D'37:48-53, 56, 151 **tv**

Water softeners, septic tanks, steel boilers, radiators, traps, valves, unit heaters, shallow well pumps, round and square boilers, shower and tub combinations.

CONSTRUCTION

Bond studies of different types of reinforcing bars. (G. R. Wernisch). Amer. Concrete Inst. Journal. N-D'37:145-164 **gtv**

An investigation of the bond strengths of thirteen types of bars.

It was found that in these tests: (1) diagonal types of deformation were most resistant to slip. (2) Threaded bars may develop 50% more bond resistance than the best commercial bars. (3) Twisting two bars together does not increase bond resistance. (4) Increasing concrete strength from 3000 to 7000 lb. per sq. in. increases initial slip resistance of the bars in beams from 50-100% and the ultimate bond resistance from 20-110%.

Welding in reinforced concrete construction. (J. Cuerel). The Builder. (London). 12 N'37:890 **t**

The progress of reinforced concrete has demanded use of longer bars. The ensuing problem of joints has been handled lately by field welding instead of developing stress by bond through overlapping the ends of bars. Bars up to 130 feet long have been fabricated in an Irish bridge project. Several canal bridges in Belgium have 200 ft. butt-welded bars (up to 1⅞-inches in diameter). In Australia, spot-welding is used in place of wire for securing crossing bars. Electric-arc welding is claimed to be superior for this purpose.

For bars over 1¾-inch, a butt-weld is the cheapest method of obtaining continuity but the saving is small. The advantages are gained by the elimination of laps, secondary bars, hooks, decrease in size of concrete members, less weight, smaller moments and shears.

Research shows how to correct condensation. (L. V. Teesdale). Domestic Engineering. D'37:64-67, 151 **stv**

Deals with problem of condensation within walls, in attics and roofs. Modern practices, such as double-glazing, insulating and weatherstripping, tending to make tighter construction, also increase the normal humidity or vapor pressure within a house. Humidifiers add to this. This causes a constant exfiltration of water vapor and when the temperature of the exterior sheathing is much lower than the room dewpoint condensation occurs. When insulation is used condensation will occur on the sheathing with lower room humidities than when it is not used.

The best method of control so far discovered is the use of vapor-resistant bar-

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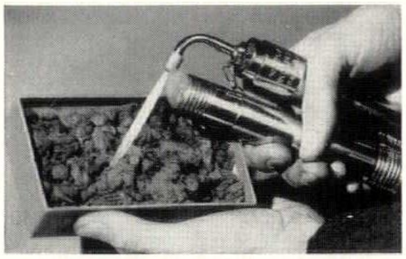
Put two pans of water on your kitchen range. Under the second, place a pad of Eagle Insulation. Then turn on the heat under both. The first pan of water boils quickly. But if the flames do not reach around the pad of Eagle Insulation, the water won't even get warm in the second pan . . . positive proof of the thermal efficiency of Eagle Insulation. It acts as a remarkable barrier to summer heat and winter cold.



Fire Retarding Test

Place a layer of Eagle Insulation in a shallow cardboard box. Now play the flame of a blow-torch on the top of the mineral wool. Note how fireproof this material is! Think of the fire protection a 4-inch layer of Eagle Insulation gives when installed in the walls and roof of a home.

Water Repellence Test

Form a small wad of Eagle Insulation and dip it into a glass of water. It sheds water like the proverbial duck's back. . . . Take a small box of Eagle Insulation and make a small valley in the surface of the wool. Pour in a few drops of water. Note how the water stays on top—rolls around like beads of quicksilver on glass. This simple test shows that water does not harm Eagle Insulation or cause it to lose efficiency in the walls of a home.

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riers at or near the inner face of the wall and under ceiling joists under the attic. This will resist the passage of moisture while it is in vapor form and before it condenses into water.

There is much data on the better types of insulation in this article, and a strong plea for attic ventilation.

DESIGN & PLANNING

Finnish architecture of the last decade. (C. Meissner). Monatshefte für Baukunst. (Berlin). D'37:417-424 **pstv**

Review in German of the work of Bryggman, Huttunen, Paatela and Taucher. A school, a hospital, a sport building and a mill with silos are illustrated. Each is a great structure of an ascetic probity of design.

Libraries—Reference article. (R. Campanini). Rassegna di Architettura. (Milan). O'37: 363-398 **dpstv**

Brief historical section in Italian. Functional diagrams. Examples: National Library in Florence; Congressional Library, Washington; Stockholm; projects for Moscow; Ghent; Vienna; Sterling (Yale); Leipzig; large Swiss library; Frankfort-on-Main competition; Leeds; Viipuri (Finland).

Details: stacks, natural and artificial lighting, ventilating, seating and tables in reading rooms, and catalogs.

An amusing error lists James Gamble Rogers' University Library in Georgia as located in Anatolia.

Nursery-Infant Schools. Architects' Journal. (London). 25 N'37:827-830 **dptv**

One of A. J.'s Library of Planning articles. Includes suggestions for furniture, equipment, playthings, and assembly halls. Chair and table sizes for children from 2 to 7 are given by keyed diagrams.
Continued: 9 D'37:961-966 **dptv**

Notes in this issue include data on lavatories, coatrooms, bathroom, kitchen, and medical inspection.

The Junior School. Architects' Journal. (London). 23 D'37:1055-1061 **ptv**

The present condition (aims, children, co-education, training). Plan units: circulation, outdoor elements.

Each of these three articles is illustrated by plans and views of typical modern schools of the types discussed.

Factories — Reference article. Architects' Journal. (London). 2 D'37:873-937 **ptv**

A lengthy article on factories with notes on sites, planning and construction. There are thirty British examples illustrated, and a final section on equipment with references to British factory law.

Hotels, Inns and Public Houses—Reference article. (F. E. Towndrow & B. E. Verstone). Design & Construction. (London). D'37:542-565 **ptv**

Technical articles. Examples: five hotels, thirteen inns. Details. All British. One page of plans of American examples, and a two-page bibliography.

Why a dining room? River Oaks Magazine. D'37:20 **ptv**

Brief article comparing four methods of combining living and dining space in one room: (1) Separation by furniture arrangement; (2) Separation by built-in equipment; (3) Separation by change of level; and (4) Separation by movable partition.

LIGHTING

Carbon dioxide-filled lamps. Science Digest. Ja'38:48 **t**

Short note on new type of incandescent lamp filled with carbon dioxide to provide artificial daylight. Because of its white spectrum carbon dioxide has been tried many times but these experiments have not been successful, the gas tending to decompose with the electric charge and causing changes in pressure. A method of electronic pressure control has overcome this defect in the new lamp.

Natural lighting. . . . (A. T. Edwards). R. I. B. A. Journal. 22 N'37:89-90 **gst**

Constructive criticism of suggested standards for natural light in habitable buildings. Ingenious graphs (for Latitude 51°30′) correlate orientation of streets, widths of streets and hours of sunshine.

What we know as "one-time districts" in zoning are objected to on basis of appearance, a square street section lacking interest. Methods of overcoming this are suggested: (1) by set backs; and (2) by measuring height from ground floor sill height instead of from ground.

There are also comments on a claimed necessity for narrow streets, on the heights of buildings, and on monotonous zoning.

MATERIALS & FINISHES

The advance of stainless steel. (H. E. Blank, Jr., from Automotive Industries). Science Digest. Ja'38:27-29 **t**

Stainless steel was discovered simultaneously nearly thirty years ago by Brearley in England and Strauss in Germany. Now more than fifty different kinds are being produced commercially.

Ten per cent of chromium will result in a corrosion resistant steel. Straight chromium steels may have up to 30%. There are marked changes in the properties (particularly corrosion resistance) at the points of 12%, 22% and 25% of chromium content.

Copper, nickel, manganese, molybdenum, tungsten, vanadium, titanium and columbium are sometimes alloyed with chrome steels to meet definite requirements of various sorts. No one stainless steel will withstand all corrosive agents.

Stainless steels would be cheaper if they could be made by the open-hearth process which produces 225 tons per 24 hours. Instead they must (at present) be made in electric furnaces (temperature 3500°F.) producing only 40 to 50 tons per 24 hours. Research is seeking some way of making the open-hearth method practicable.

What science has done for lacquers. (L. A. Pratt, from Monsanto Current Events). Science Digest. D'37:87-90 **t**

Difference between lacquer and paint or varnish is that the former "dries solely by the evaporation of a solvent rather than by the oxidation of one of its component parts." This results in quicker drying.

Lacquers may be compounded accurately to meet a wide range of requirements of elasticity, hardness, viscosity and drying time. Early lacquers (1882) were very viscous, and were limited in use and color possibilities.

The non-volatile part of lacquer is mostly nitrocellulose. Research during the World War developed this industry and its by-products became useful in lacquer production.

The new "emulsion lacquers" use water as a solvent and are finding use for finishing paper, leathers, textiles and porous materials. Synthetic resins have made better lacquers for wood finishing.

Handbook of Douglas Fir plywood. American Builder & Building Age. D'37:41-84 **dpstv**

A collection of illustrated articles on many phases of plywood use, including: subflooring, sheathing, roof sheathing, paneling, various joint treatments, ceilings, finishing of plywood, hanging wallpaper over plywood, decorating plywood, cabinet work of plywood, use of plywood in prefabricated houses, as concrete forms, as a portable basketball floor, plywood in industrial buildings, on farms, and the uses of weatherproof plywood.

The final section gives a grade-use guide, a glossary, sizes and thicknesses available, and structural data for plywood use.

Inside a metal. (L. R. van Wert, from Mining & Metallurgy). Electrical Engineering. N'37: 1371 **t**

Brief note on metallurgy. Metals are crystalline with a "definite internal architecture" due to the regularity of patterns of atomic spacing. These patterns are called the space lattice, indicating by this term a three-dimensional framework upon which the atoms hang. The cohesive characteristics of a metal are electrostatic in nature.

This crystalline structure may be thought of as two "interpenetrating lattices, one of positive metal ions, the other exclusively of electrons" (negative).

Coherence, rigidity, electrical conductivity, thermionic emission, photo-electric and thermo-magneto phenomena are due to this sharing of electrons between atoms of metal.

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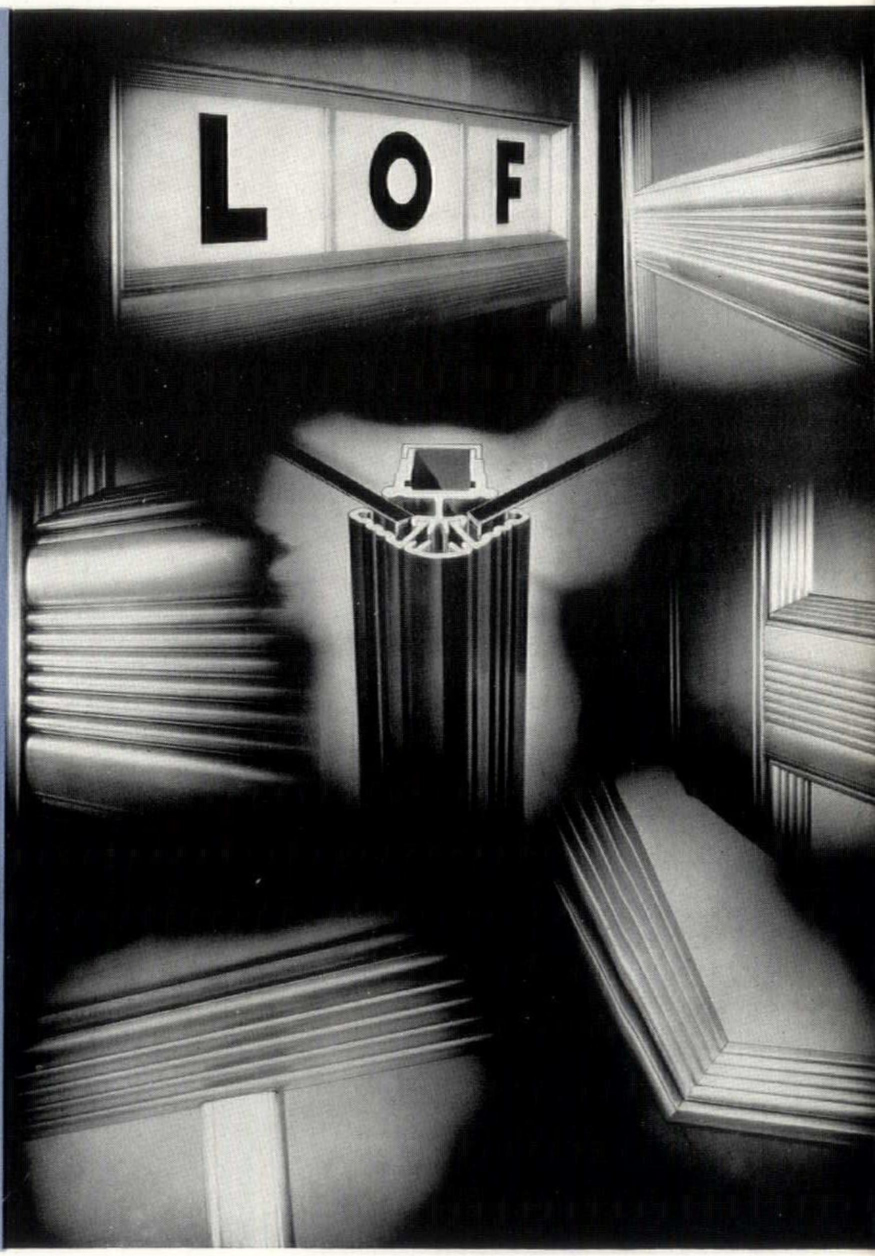

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PREFABRICATION WITH STRESSED PLYWOOD PANELS

Of great importance to those who are interested in a better house produced by rationalized methods, and to those who are searching for a lower priced dwelling, is the recent announcement by the Forest Products Laboratory of its new prefabricated plywood house. Famed for its researches into the characteristics and uses of woods, this research arm of the Department of Agriculture erected its first stressed-panel plywood house in 1935.

Like its predecessor the new house, just completed in the environs of Madison, Wisconsin, is one-story. It contains a living room, kitchen, two bedrooms, bathroom, and utility room, and incorporates the use of plywood made up with synthetic-resin adhesive, the provision of moisture barriers within wall, floor, and roof panels, and the use of mineral insulation to increase fire resistance and give heat and sound insulation.

The house is intended to serve the following purposes: (1) as an example of the prefabricated method of all-wood construction; (2) as a test of its permanency under actual weather conditions; (3) to obtain data on the efficiency of the moisture barriers and thermal insulation used.

STRUCTURAL SYSTEM

The system is based on the use of standard units, sections, or panels to be made in large quantities by factory methods, and then assembled quickly and without waste on the site. Ultimate success will depend on good workmanship and technique in the construction of the plywood and house units, accurate dimensions of units, and efficient painting practice.

Each panel consists of two plywood faces glued to either side of an inner structural framework to form what is virtually a box girder, and has a complete and continuous rigid joint between the plywood and the framework formed by the glue between them. This causes the entire panel to act as a unit similar to a box girder and as a result it will deflect only fractionally as much under a given load as would the framework and faces when nailed together.

WALL PANELS

A typical wall section, 4 by 8 feet in area, is shown in figure 1. The exterior panels are 3 inches in thickness and consist of ⅜-inch three-ply plywood on the outside, and ¼-inch three-ply plywood on the inside. The framework consists of vertical members made of 1-inch material 2⅜ inches wide, spaced approximately 12 inches apart with two end headers to which the plywood faces are glued. The partition panels are also 4 by 8 feet. Both faces of the partition panels are, however, of ¼-inch plywood, and the vertical members are 2½ inches wide, the overall thickness being 3 inches.

Experiments indicate that these panels when tested as a beam require a load of over 200 pounds per square foot to cause failure. A 60-mile wind has a pressure of about 12 pounds per square foot, which is approximately one-seventeenth the load required to break the panel.

The plywood projects beyond the framework of the panel forming a continuous right-angle groove. A 2½ by 2⅜-inch solid vertical member is fitted into the grooves on the sides of adjacent wall panels. This vertical member serves as a connecting piece between panels, and also carries a part of the roof and floor loads (figure 2). At the roof a strip glued to the roof panel fits down into the groove at the top of the wall panel (figure 1). After assembly the wall, floor, and roof panels are securely fastened by screws or nails to those parts which fit into the groove, tying wall, foundation, and roof together.

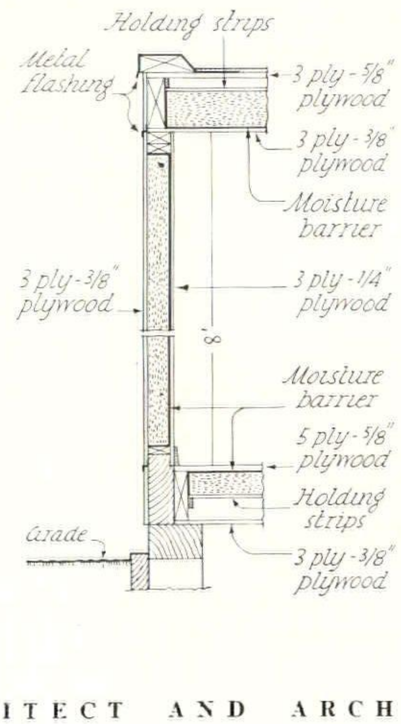
The edges of the face of the panel which form the interior house wall are beveled to form a V-joint when the panels are assembled (figure 2). The panels which form the exterior surface are beveled on the outside and inside edges, the outside is beveled to form a V-joint similar to that for the interior wall surfaces but is slightly opened, and the inside is beveled to form a pocket for mastic which is placed between the panels directly after erection. This pocket permits a sufficient amount of mastic to be placed between the panels so that it will remain plastic indefinitely, and thereby make a tight and permanent seal against the entrance of moisture and infiltration of air through the exterior panel joints.

FLOOR PANELS

The floor panels are 4 feet wide and 12 feet long. The upper face is ⅝-inch plywood of five plies, and the lower face is ⅜-inch plywood of three plies. These faces are glued to a structural framework consisting of three nominal 2 by 6-inch members spaced approximately 24 inches apart, with end headers. All parts of the panels act as a unit and therefore the panels can be substituted for the usual 2 by 10-inch joists spaced 16 inches apart as ordinarily used in house construction.

The lateral edges of the floor panels are grooved to permit a spline connection for the distribution of weight to adjacent panels. When panels of this type are tested as a beam over a 13½-foot span more than 300 pounds per square foot are required to cause failure. Accordingly, the panels far exceed in strength any normal loads.

With the exception of the kitchen and the utility room the upper ⅝-inch plywood is faced with birch ⅛-inch thick to form the wearing and finished floor



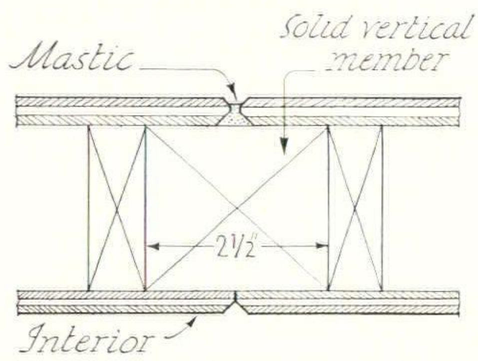


Figure 1 (left). Section showing typical assembly of floor, wall and roof panels. Figure 2 (above). Plan showing solid vertical member fitted into the grooves on the sides of adjacent wall panels

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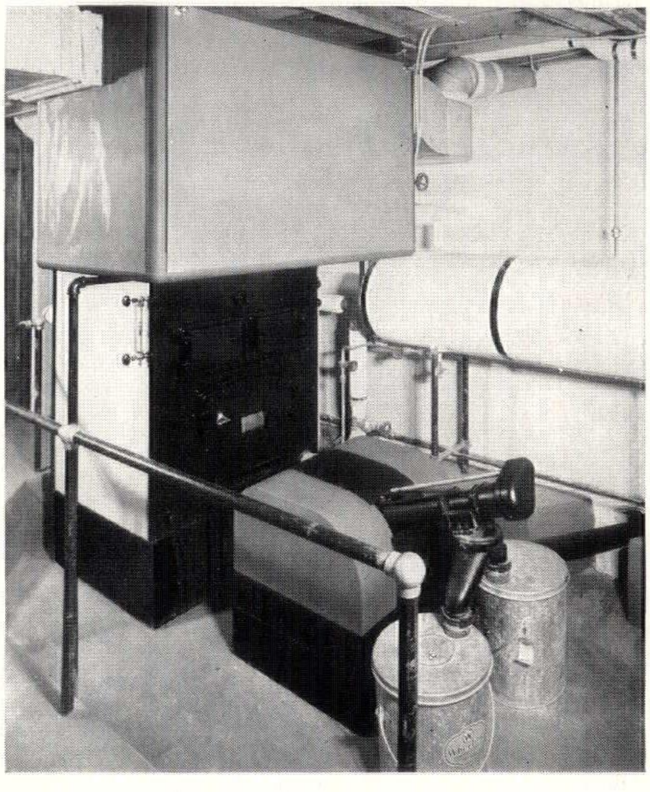

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Figure 3 (left). Showing all house panels assembled and garage nearing completion. Figure 4 (above), plan of house

surface. This construction eliminates the necessity of putting a finished floor over a subfloor as in ordinary construction.

ROOF PANELS

Roof panels are similar to the floor panels in construction. The top plywood covering of the roof panels is cut back ¼ inch to allow a groove between the panels, and this groove is filled with a caulking compound. With this size of groove it is believed that the caulking compound in the joint will remain plastic for a long time and, therefore, form a better and more permanent seal. After the joints are filled, the entire roof is covered with a material similar to a thin caulking compound.

WOODS

All exterior surfaces of the experimental house are of hot-pressed resin-bonded plywood.

Present indications are that plywood glued with hot-pressed resin will withstand the weather indefinitely without separation of plies, provided ordinary care, such as painting the edges and surfaces, is used. Resin-bonded plywood is also used for interior surfaces because of its somewhat greater fire resistance.

MOISTURE BARRIERS

Because of the introduction in recent years of more moisture into homes by means of humidifying apparatus and the more general use of insulation within the walls and roofs, moisture, which flows from the warm inside to the outside, is not easily carried away, and condenses when it reaches the cooler areas within the wall. Over extended periods considerable moisture accumulates, the insulation becomes wet, and its efficiency is likely to be greatly reduced. Even when warm weather arrives the moisture disappears slowly and makes conditions favorable for rust, mold, and decay. Many paint problems, such as the peeling of outside paint, arise from the accumulation of moisture within the walls. Consequently, moisture barriers are used in the outside walls of this house.

These consist of asphalt-impregnated and coated paper weighing 50 pounds per 500 square feet, placed within the panel and against the back face of the inner walls, against the back of the upper face of the floor panels, and against the back of the lower face of the roof panels. All the moisture barriers are placed within the panels and against the back of the face nearest the inside of the room (figure 1).

A moisture barrier is also placed in each space between framing members, and consists of a single piece of paper so folded as to fit snugly against the plywood face and along the sides of the framing members. Those parts of the sides of framing members that are in contact with the moisture barriers are given a brush coating of asphalt paint just before the barrier is placed, after which the barriers are held to the framing members with wire staples at intervals of not more than 6 inches to keep the paper tightly against the framing members and in contact with the fresh asphalt paint.

FIRE RESISTANCE

Fire tests at the Forest Products Laboratory of plywood show that the plies of vegetable-glued plywood separate while burning whereas the plies of resin-bonded plywood do not. Resin-bonded plywood will therefore give somewhat greater resistance to fire than will plywood glued with a vegetable glue. On this account, and also because it offers somewhat greater resistance to the passage of moisture, resin-bonded plywood was selected for the inside walls as well as the outside walls.

To obtain greater fire resistance a mineral wool of high density was selected as an insulating material.

INSULATION

Walls of the experimental house are 3 inches overall with a 2½ or 2⅜-inch inside space depending upon the thickness of the plywood used. This space is entirely filled with mineral wool insulation giving a co-efficient of heat transmission for the wall of approximately 0.13. This is superior to ordinary construction with ½ inch of blanket insulation. In addition, the use of large plywood sheets in wall panels is very effective in making the structure wind tight. Insulation has also been placed in the partition walls for sound-deadening purposes.

The floor panels are insulated with nominal 2-inch mineral wool bats and the roof panels with 4-inch bats.

THE HOUSE

The floor area of the house is 24 by 36 feet and includes a 12 by 20 living room, kitchen, two bedrooms, bath, connecting halls, and utility room. In addition there is a coat closet and a linen closet off the main hall, two closets in the larger bedroom, and a wardrobe closet in the smaller bedroom. Placed close to the house there is also a large garage, with a space at one end partitioned off for storage. The garage is connected to the house by a roof made of roof panels.

The living room walls are of birch finished natural, while the ceiling is painted a light color. The floors are of birch-faced plywood, as are all other floors, except the kitchen and utility room, which are of Douglas fir plywood. The walls of the hall are also of birch finished natural. The walls of the other rooms are of Douglas fir painted.

The house is heated with an oil burner. A warm air forced circulation system is used, and the heating ducts are confined mostly to that portion of the hall connecting the various rooms. This portion of the hall has a lowered ceiling to accommodate the ducts.

A post and plank foundation of creosoted wood has been used.

John W. Root of Holabird & Root, Chicago, was consulting architect, and the Goodwillie-Green Box Company, Rockford, Illinois, were the contractors.

NEW CATALOGS...

Readers of AMERICAN ARCHITECT and ARCHITECTURE may secure without cost any or all of the manufacturers' catalogs described on this and the following page by mailing the prepaid post card printed below after writing the numbers of the catalogs wanted. Distribution of catalogs to draftsmen and students is optional with the manufacturers

Acid-Proof Piping

466 . . . The Acid Test of Better Piping—Bulletin 902—issued by the U. S. Stoneware Co., Akron, Ohio, features the advantages of FLEXLOCK rubber joints for chemical stoneware pipe. Information on how to make a FLEXLOCK joint and the use of split sleeves for handy connections and quick repairs are included. Types and sizes of U. S. Stoneware bell and spigot pipe and fittings are shown in drawings and tables.

Air Conditioning Furnace

467 . . . A direct fired furnace equipped for winter air conditioning, identified as their Series 25 A. C. Unit for Gun Type Oil Burners Only is shown with illustrations, diagrams and a table of performance data in a 4-page folder by Richardson & Boynton Co., N. Y. C.

Air Diffuser

468 . . . In an 18-page pamphlet, the Anemostat Corporation of America, New York City, lists the outstanding features of their ANEMOSTAT High Velocity Air Diffuser with a table of capacities and an adequate selection guide. Its many uses is indicated by photographic reproductions of actual installations.

American Gas Products

469 . . Gas Heating, Hot Water and Air Conditioning Appliances are presented in a 12-page booklet. All data has been pre-printed from material to appear shortly in Time-Saver Standards and includes heating boilers, air conditioners, furnaces, hot water heaters and other gas-fired devices of American Gas Products Corporation, New York City.

Auer Registers

470 . . . The Auer Register Company, Cleveland, Ohio, Register Book No. 37 contains complete catalog information—sizes, prices and illustrations—of the various types of registers, ventilators and ornamental grilles included in the Auer line. In a small illustrated folder is featured their DURABILT Floor Registers and Cold Air Faces.

Automatic Boiler Regulation

471 . . . The Brown Automatic Boiler Regulation System for boilers under 1,000 H.P., comprising the Brown Steam Damper Regulator and the Brown Overfire Control, is fully described and illustrated in a 24-page manual—Catalog No. 5001. Application diagrams are included.

Beaver Board Products

472 . . . Beaver BENT Board, Beaver COLO Board and Beaver PEB.MET Board are illustrated in a series of 6-page folders by the Certain-Teed Products Corporation, New York City. Another 6-page folder features the New Modern G.D.S. (General Display System) Pilasters and Re-In Strips developed by W. L. Stensgaard & Assoc., Inc., Chicago, Ill., for display construction using Beaver Board products.

Boiler Protection

473 . . The Webster Boiler Protector is described in an 8-page bulletin B-727-C issued by Warren Webster & Company, Camden, New Jersey. The device provides an automatic water feed when the minimum water level is reached.

Building Products of Steel

474 . . . Truscon Steel Company, Youngstown, Ohio, offer an 80-page catalog covering its complete line of steel building products. Each item is presented individually with illustrations and diagrams of practical value to the architect and designer in preparing his plans and specifications. Construction details to insure proper erection and adjustment of the products are included.

Controlled Air Circulation

475 . . . Catalog Section B of Bulletin No. 205 issued by The Swartwout Co., Cleveland, Ohio, contains design and capacity information on the Swartwout Rotary Ball Bearing Ventilator for controlled air circulation for industrial and commercial buildings. Included in the tabular data on how to estimate capacities is information on wind velocity factors and the average wind velocities compiled from U. S. Weather Bureau Records.

Compressors and Vacuum Pumps

476 . . . Nash Engineering Co., South Norwalk, Conn., gives complete catalog information with diagrams and tabular data on new Nash products in three 8-page catalogs: Compressors Types MD & AL (Bulletin No. 252); Jennings Unit Type Vacuum Heating Pump (Bulletin No. 267); and Jennings Manifold Type Vacuum Heating Pump (Bulletin 264.)

Door Controls

477 . . . Illustrations of Stanley Magic Door Control installations are contained in a 24-page booklet issued by The Stanley Works, New Britain, Conn. A brief technical data section is included.

Fireplace Heating

478 . . . A cardboard cutout which forms an accurate descriptive model of the Majestic Circulator Fireplace is offered in a convenient file folder, including design and capacity data. The Majestic Company, Huntington, Indiana.

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Heating and Air Conditioning

479 . . . In a series of illustrated pamphlets, Airtemp, Inc., Dayton, Ohio, stress the outstanding features of Chrysler's Airtemp oil burners, oil-burning boilers, and winter air conditioners. Specification data and diagrammatic details of installation are included.

Insulation

480 . . . The story of rock wool insulation is told in a 16-page booklet "Year Round Home Comfort With Barrett Rock Wool" published by The Barrett Company. Historic and technical facts and specifications of this product are illustrated with photographs and diagrams.

Recording Thermometers

481 . . . Foxboro Recording Thermometers, their use, application, installation, parts and accessories are described in a 40-page catalog—Bulletin 198-1—issued by The Foxboro Company, Foxboro, Mass.

Low Ceiling Lighting

482 . . . Major Equipment Company, Chicago, Ill., in their 4-page Bulletin No. 28 describe ALZAK Flush Mounting Lighting Units which are designed for downward lighting from low ceilings where hanging units would be obstructive. Dimensions, prices and mounting accessories are included.

Milcor Expanded Metal "Sample Kit"

483 . . . Samples of Milcor Standard Expanded and Flat Expanded Metal are offered in a new "Expanded Metal Sample Kit," A.I.A. File Nos. 4-E-2, and 14-M-1, by the Milcor Steel Company of Milwaukee, Wis. Complete description, size and weight information and the many uses of Expanded Metal are also included.

Paint and Decoration

484 . . . A 40-page reference manual on the use of washable, water-thinned paints is offered by the United States Gypsum Company, Chicago. "Modern Principles in Paint and Decoration" tells the complete story of protein-base paints and their decorative possibilities for high quality interior work. Color illustrations supplement practical working data on: light reflected by various colors; how to mix and blend colors; how to prepare various surfaces; how to produce various finishes (textures, stipples, stencilling, etc.) and the proper method of cleaning painted surfaces. This comprehensive file-sized booklet also contains a tabular guide to the selection of USG Paint Products, with available colors shown in actual color chips.

Prefabricated Piping

485 . . . Grinnell Prefabricated Piping Data Book covering pipe fabrication, prefabricated piping, adjustable pipe hangers and supports for high pressure and high temperature service uses illustrations, diagrams and tables to present authoritative, basic information for ready-reference. A visible index aids fact-finding in this 76-page book by Grinnell Co., Inc., Providence, R. I.

Pumps

486 . . . Fairbanks, Morse & Company, Chicago, Illinois, have released a series of six and eight page bulletins containing capacity and size data and other pertinent information on their Oil Lubricated Turbine Pumps with Enclosed Impellers (Bulletin 6920); Water Lubricated Turbine Pumps with Enclosed Impellers (Bulletin 6920-R); Fairbanks-Morse Duplex Steam Pumps for Boiler Feed and General Service (Bulletin 6205); and Fairbanks-Morse Two Stage Built-Together Pump (Bulletin 5592).

Radiation Calculator

487 . . . The Koven Waterfilm Lightning Radiation Calculator offered by L. O. Koven & Bro., Inc., Jersey City, N. J., should prove useful to architects. By means of three revolving discs in a small celluloid folder, the square feet of steam (or hot water) radiation required for any given room is quickly estimated. A chart on the reverse of the calculator lists cubic contents of various sized rooms.

Sump Pumps

488 . . . Complete data on the Imperial line of Floatless Automatic Electric Sump Pumps and also valuable information on the use of sump pumps, including their use for the prevention of backwater, is embodied in an 8-page catalog which has been issued by The Imperial Brass Mfg. Co., Chicago, Ill.

Swimming Pools

489 . . . "Everson Swimming Pool Equipment and Accessories" published by the Everson Manufacturing Co., Chicago, Ill., is a reference manual on swimming pool equipment. It covers the design and layout of swimming pools and specifications for equipping the ideal pool, with illustrations, selection tables, sizes and other pertinent information on Everson products and fittings. Bulletin No. A-794-1 features the Everson Rota Meter Chlorine Control Apparatus.

Tile Specifications

490 . . . Tile Specifications For House Construction—Booklet No. 100—issued by American-Franklin-Olean Tiles, Inc., Lansdale, Pa., is a carefully organized tab-indexed 90-page manual containing graded tile specifications for dwellings in different price classes, recommended design and color combinations, structural details, tile accessories and a series of 4-color plates showing a wide range of colors and patterns.

Water Heater Specialties

491 . . . "EXCELSO Domestic Hot Water Supply Equipment and Accessories" is a 20-page loose-leaf catalog of the Excelso Products Corporation, Buffalo, N. Y. In addition to the usual catalog information, there appears tabular data as to capacities, guide for proper selection, typical installations and construction features of the various products.

Wiring Devices

492 . . . Catalog "W" on "H & H" Wiring Devices contains complete and up-to-date information on the devices manufactured by the Hart & Hegeman Division of The Arrow-Hart & Hegeman Electric Co., Hartford, Conn. A complete price-list and index are included.

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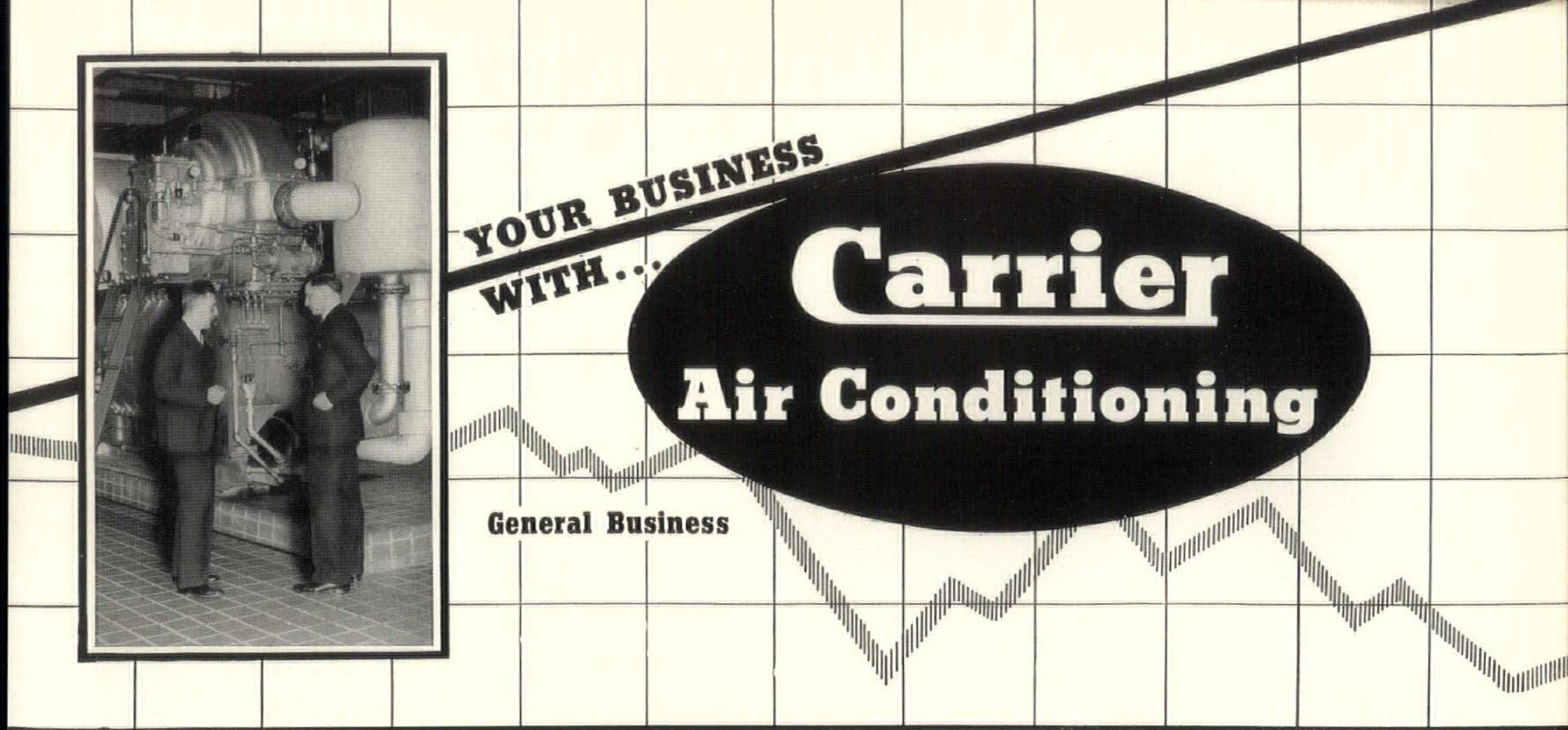

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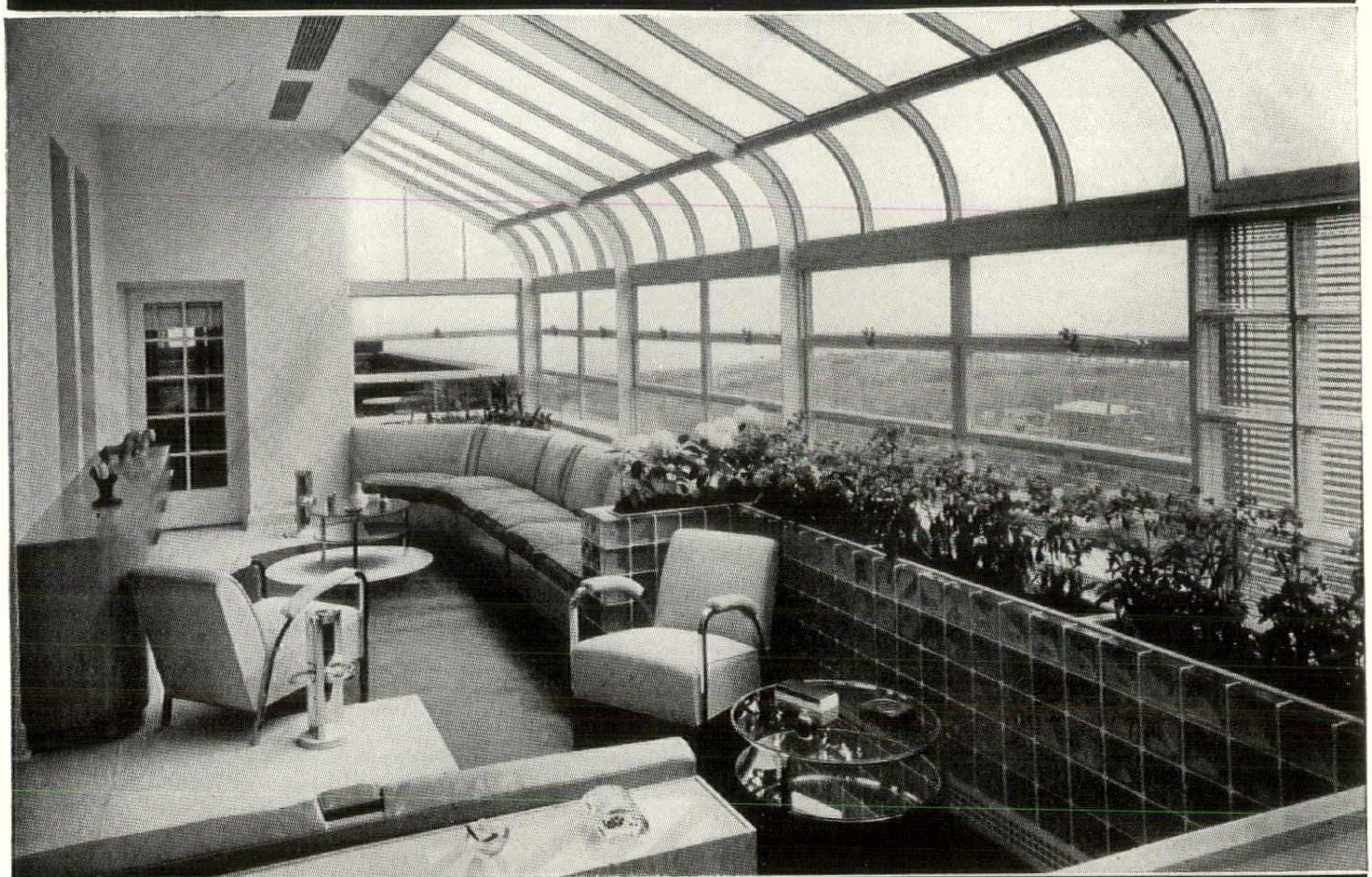

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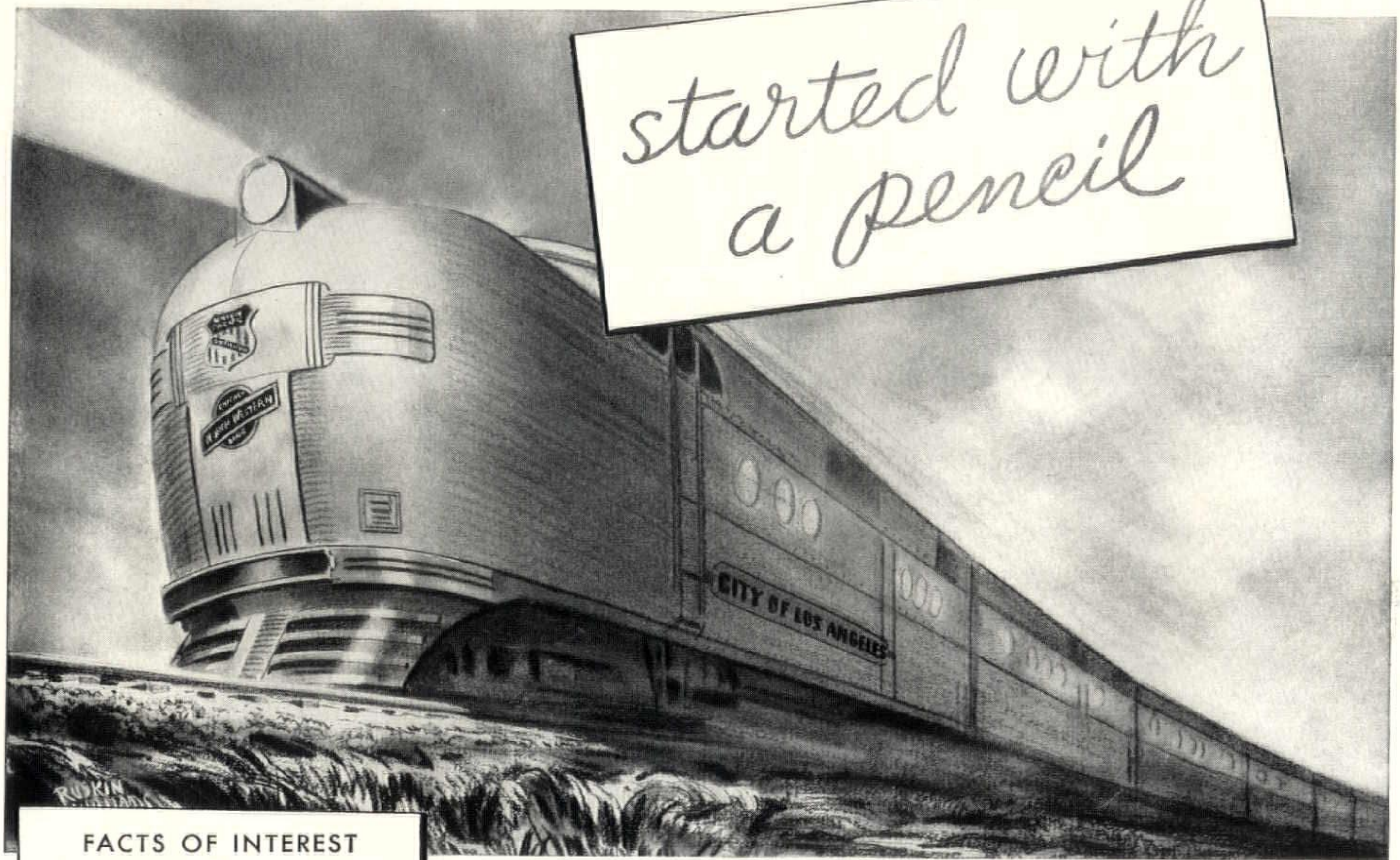

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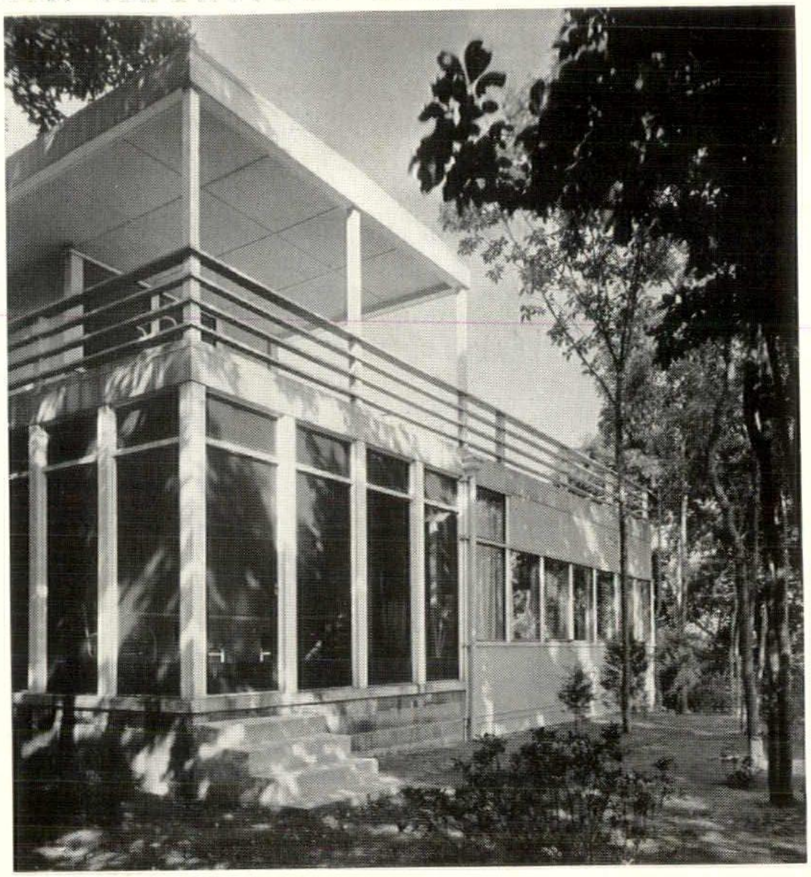


40 PAGES OF MODERN HOUSES AND THEIR DETAILS

ALSO IN THE MARCH ISSUE

INSULATION—one of the most significant articles ever published on the subject, reporting for the first time to architects the results of field research conducted for the industry at the University of Minnesota and Forest Products Laboratory.

TIME-SAVER STANDARDS—also devoted to Insulation.

AUTOMATIC HEATING AND AIR CONDITIONING—Part III.

WALTER GROPIUS—the third in the series of monthly critical essays.

PORTFOLIO—on rain head leaders.

TECHNICAL DIGEST . . . TRENDS . . . and all other regular features.

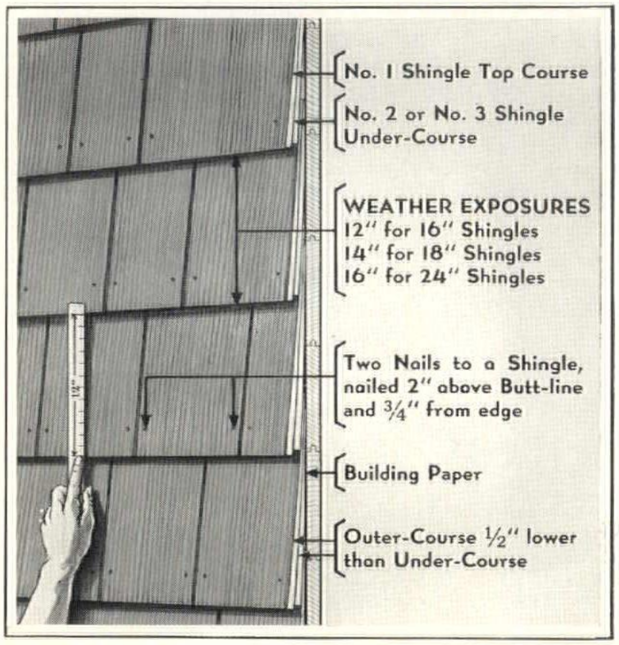
8 SUCCESSIVE INCREASES IN RENEWAL RATE since 1933 is proof of the growing popularity of American Architect with architects everywhere. Also, during the last six months of 1937, the architect circulation of American Architect increased from 7,081 to 7,412—a gain of 331, as many architects as there are in Cleveland and Pittsburgh combined!

Inexpensive, yet effective.....
DOUBLE-COURSING
Introduces the new vogue in side wall construction!

Wide shingle exposures—far wider than were usual in the past—with charming deep shadow lines that accentuate and emphasize, actually COST LESS when this fully proven method is used. But there is no sacrifice of QUALITY.

The exposed shingles are of the highest grade, edge-grain red cedar. Only half as many are needed. Underneath are shingles of a lower grade more economical in price, protected from the weather . . . on the outer course 100% edge-grain No. 1 Certigrades. The result is a more substantial, effective wall *plus* the high heat insulating value of this low-density but extremely durable wood.

Economy in construction, with greater latitude in handling from the architectural point of view, and definite assurance of long-time performance, are matters of interest to architect and client alike.



This handbook prepared by a wood technologist mailed free on request. 100 pages detailing uses, application and technical data. Write—

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The Certigrade label on every bundle is your assurance of correct grades guaranteed by official inspection. F. H. A. makes it easy to pay—advise your client.

CERTIGRADE *Red Cedar Shingles*

FOR SALE BY ESTABLISHED LUMBER DEALERS

TRENDS • (*Continued from page 16*)

"Cost is a very debatable question. Costs under Civil Service have never been made public, nor are they available to the architectural profession, while the schedule of fee charges of the American Institute of Architects is available to everyone. If the authorities will place before us the exact costs of any given project, this question can then be answered.

"Another contention made is that the private architect does not pay a living wage to his draftsmen. This is absolutely untrue, as is proved by the fact that during good times the average draftsman preferred to work in the office of the private architect rather than that of the Government bureau, and only took Civil Service employment when the private architect was unable to make a living himself. Even today, the Civil Service ratio of salaries is lower than that which the private architect is still paying.

"One of the objectives of the American Institute of Architects in fostering the competition idea is to offer to the Government its best available talent by a fair method of selection instead of having the selection made through political favoritism or bureaucratic domination.

"There is no reason why the talent which is available throughout the private architectural field should not be allied with the Civil Service set-up, through a cooperative system. It is wrong to assume that the American Institute of Architects has attacked, or even criticized, the merit system of Government employes."

The Chapter reiterates its opposition to "Bureaucratic" Government architecture. Conditions under which one-half of the population will support the other half are rapidly developing, and there is danger that Government usurpation of architecture will spread to business and the professions generally, it is asserted. The Federal Government and the State and the City of New York are cited as examples of the encroachment of bureaucracy on architecture which imposes an unwarranted burden upon the taxpayer and excludes private architects from earning a living.

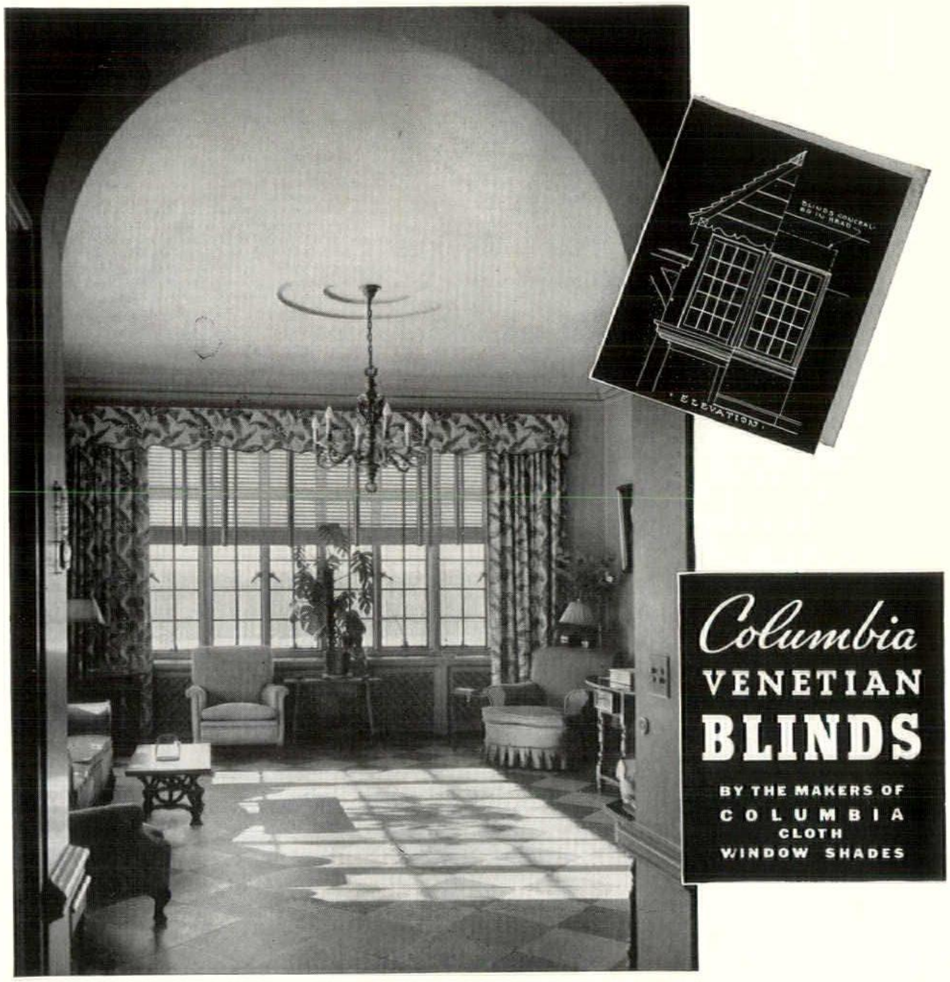
CHURCH ARCHITECTURE

The North American Conference on Church Architecture will hold an all-day public convention on March 4, 1938, at the Cathedral of St. John the Divine, New York. Problems of modern American church design and plan will be discussed by experienced architects, with special attention being given to the use of the arts in church building. John Angel, sculptor, will give a moving picture display on sculpture, and Maurice Lavanoux, of the Liturgical Arts Society, will speak on the demands of worship. Readers desiring information may write E. M. Conover, The Interdenominational Bureau of Architecture, 297 Fourth Avenue, New York City.

STUDENT COMPETITION

Announcement is made by the American Institute of Steel Construction of a competition to design an urban elevated highway, open to students of architecture and engineering in recognized technical schools of the United States and its possessions. There will be three cash prizes for the best designs submitted, i.e., $150, $100 and $50. The subject of the competition will be a steel elevated highway to carry through express vehicular traffic in a straight line along a marginal avenue. The structure will provide for two lanes in each direction divided by a curb. A jury of nationally-known authorities will be chosen to select the prize-winning designs. This judgment will be made on April 19, 1938, and drawings entered in the competition must be in the hands of the Institute not later than April 9.

Specifications for the competition are as follows: Each pair of lanes in the projected highway shall be twenty-two feet between curbs, and the curb separating the two-directional traffic shall be at least two feet wide. No run-offs, entrances or exits are to be shown. The required underclearance above the surface of the street below is fifteen feet. Suitable lighting is to be provided



Casement Windows and Venetian Blinds

THE relation in scale between windows and wall area usually presents a somewhat difficult problem where composite openings are required. A pleasing decorative effect of multiple windows may best be obtained by the use of Columbia Venetian BLINDS. The horizontal effect tends to unite the openings. To plan for this condition, the BLIND installation should be taken into consideration even in the preliminary sketch as well as specifications. Our Architectural Plan Department has prepared detail drawings (Data Sheet No. 1) of unusual installations. They are accompanied by a series of interesting photographs.

Write for your copy of "Architectural Data Sheets No. 1"

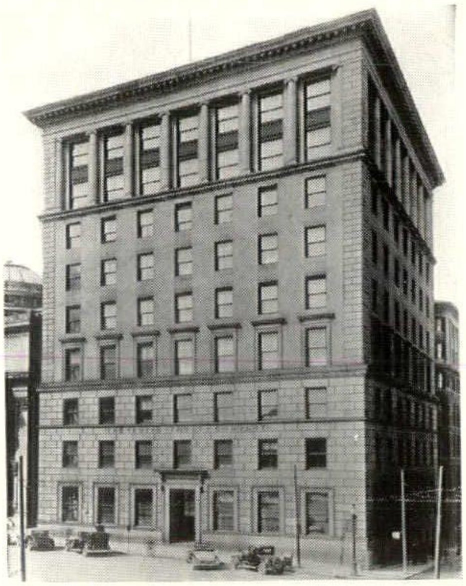
THE COLUMBIA MILLS, Inc., 225 Fifth Ave., New York

Wire for the H&H Path of Light all through the house

Plan to put SWITCHES at all room entrances, so a person walks in a PATH OF LIGHT from one room to another! Eliminate stumbling in the dark when passing *anywhere* through the house, or up and down stairs. Install THREE-WAY switches at *both* entrances of a large room, to turn lights on or off at either doorway. This is the new idea of CONVENIENCE — which helps make owners "see the light" in the matter of adequate wiring...Number 8601 Single-Pole Switch; Number 8603 Three-Way, *execute the idea!*

HART & HEGEMAN DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.



Royal Trust Building, Montreal, Que.

REDUCE HEATING COSTS $2,900 IN ONE SEASON

Webster Hylo System, Installed in Montreal Financial Building, Provides Big Savings

COMFORT IN COLDEST WEATHER

Montreal, Que. — Refusing to believe that the cold Canadian winters were the sole cause of their excessive steam consumption, the owners of the 9-story Royal Trust Building carried out a Webster Heating Modernization Program that saved $2,913.79 in one heating season.

In the two seasons before installation of the Webster Hylo System, the cost of heating the Royal Trust Building averaged $9,162.47. After M. Walsh & Co., Ltd., Montreal plumbing and heating contractors, had completed the orificing of all radiators, fitting all traps with Webster Sylphon Attachments and making the changes necessary to accommodate the Webster Central Controls, the modernized installation heated the building for only $6,248.68 during the ensuing heating season.

This is a first-season reduction of 31.8 per cent in heating steam consumption. An accurate record of performance is available because the Royal Trust Building is heated by metered steam generated in the Bank of Montreal Building next door. The total installed direct radiation is 13,250 sq. ft.

Formerly slow to heat, the Royal Trust Building now receives steam evenly and rapidly. In a section noted for the severity of its winters, the modernized heating system has given complete satisfaction during five years of operation.

The Webster Hylo System was used to modernize heating in the Royal Trust Annex one year after modernization of the main building. The same balanced heating service has been provided.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938
Pioneers of Modern Steam Heating
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ANNOUNCEMENTS . . . .

SCHOOLS

NEW YORK UNIVERSITY School of Architecture and Allied Arts announces courses in Design and Practice. These courses review the fields of design, construction, and practice. They have been planned to meet the needs of architectural school graduates who have not had the opportunity of taking courses in certain specialized fields or those whose practical experience did not give them the opportunity to pursue certain subjects required for the various State examinations for the licensing of architects. Admission: Open to graduates of architectural schools or those who have equivalent professional qualifications. Schedule: Courses meet in the evenings and Saturday afternoon. Each course consists of fifteen two-hour sessions. Fees: $24 per course (for two or more courses), including registration fee, payable in advance. For one course only: $25. Registration begins Thursday, January 27. Classes begin Monday, February 7. Also announced is a course in Community Planning by Carol Aronvici. Among the essential techniques of planning, consideration is given to zoning, traffic control, neighborhood rehabilitation, subdivision planning and control as well as the various methods of architectural control. Schedule: Course meets Thursdays—8:05 to 9:50 P. M. Certification and credit: A certification for the satisfactory completion of this course will be furnished upon request. Two points university credit may be granted, providing application for such credit is made at the time of registration and all additional work required for university credit is submitted. The right to withdraw this course is reserved, if there is not sufficient enrollment for it. Fees: $25, including registration fees, payable in advance. Registration began Thursday, January 27. First class meets Thursday, February 3.

THE DESIGN LABORATORY of the Federation Technical School announces the registration dates of the spring term as being from January 31 to February 4. The regular term starts February 7, and all regular and special entering students must call or write for appointment for interview with an instructor. Four year courses lead to the Certificate in Industrial Design.

PRINCETON UNIVERSITY School of Architecture announces the Lowell M. Palmer Fellowship in Architecture, the purpose of which is to enable a student of unusual promise to undertake advanced study at the School of Architecture, Princeton University. The holder is exempt from tuition fees, and may receive in addition a cash award from the Lowell M. Palmer Fund sufficient to enable him to complete a year of residence at Princeton. In awarding the fellowship particular consideration will be given to (1) personal character; (2) achievement in architectural design; (3) scholastic record; (4) professional experience. All applicants must be citizens of the United States of America, less than 27 years of age on October 1, 1938, and in good physical condition. To receive consideration for appointment for 1938-39, applications, together with supporting documents, must be received not later than March 15, 1938. The award will be announced on or about April 15, 1938. Application blanks may be obtained by addressing the Secretary of the School of Architecture at Princeton, New Jersey.

COMPETITIONS

THE METROPOLITAN LIFE INSURANCE COMPANY announces a competition for a commission valued at $8,000, open to all sculptors who have completed at least one professional piece of statuary, the winning design to form the central unit of that company's exhibit in the Business Administration Building at the New York World's Fair 1939. The jury which will pass upon the models submitted will be composed of A. Conger Goodyear, president of the Museum of Modern Art, who will serve as chairman; Edward M. M. Warburg, well-known collector and patron of the arts; George Howe, Architect; Frederick H. Ecker, chairman of the board, and Dr. Louis I. Dublin, third vice president of the Metropolitan Life. They will render a decision as soon as possible after April 1 of this year, which has been set as the closing date of the competition. Requests for copies of the program should be addressed to Louis I. Dublin, third vice president, Metropolitan Life Insurance Company, 1 Madison Avenue, New York City.

OFFICES

MACKIE AND KAMRATH, ARCHITECTS, announce the removal of their offices from the Shell Building to 2017 West Gray Street, Houston, Texas.

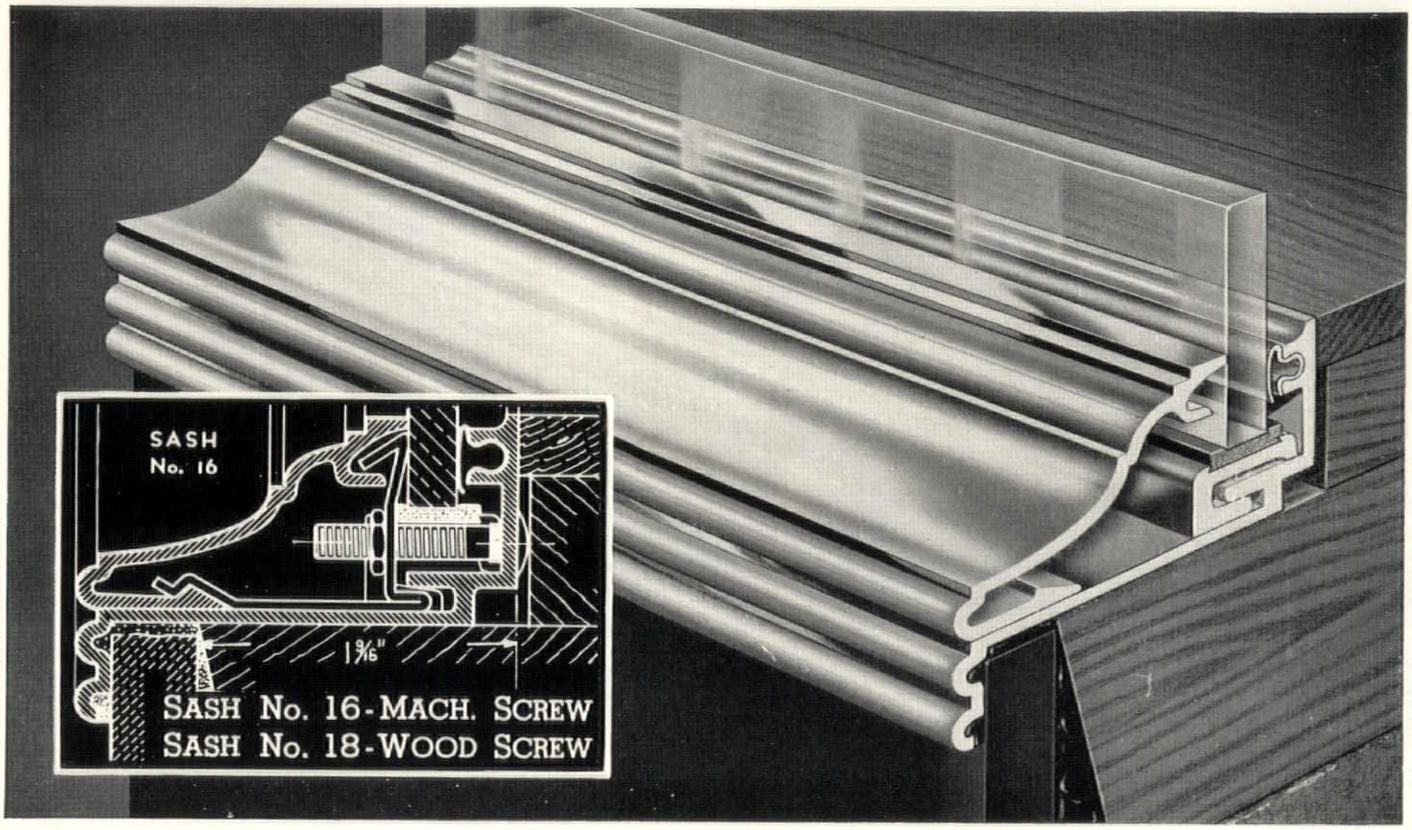
ARTHUR A. FISHER announces that he has formed a co-partnership with Alan Fisher and Edward L. Hubbell, and presents the firm of Fisher, Fisher and Hubbell, Architects, 827 Denver National Building, Denver, Colorado, as successors to William E. Fisher & Arthur A. Fisher.

PROFESSOR STANLEY McCANDLESS, lighting consultant at Yale University, announces his association as lighting consultant with Edward B. Kirk. Offices will be maintained in the Architects' Building, 101 Park Avenue, New York City.

Here's a New

PITTCO METAL SASH

which broadens the possibilities for effective Store Front Design



THIS new member of the Pittco Metal family presents a variation of the well-known No. 10 Pittco Sash which the architect will find extremely useful in designing store fronts of beauty and effectiveness.

As illustrated, the new Pittco Sash includes a beaded face member which overlaps the facing material used on the front. This results in two desirable advantages. First, it increases the attractiveness and display value of the show window . . . because the double bead of the new face member combines with the bead on the sash unit itself to form a wide, effective frame for the show window, setting off the merchandise displayed in a pleasing manner. And second, it adds to the durability and continued good looks of the front by protecting, with its overlap, the edges of the facing material.

You will find this new Pittco Sash a worthy addition to the present line of Pittco Metal units, which has won the enthusiastic approval of architects throughout the country. We invite you to send the coupon for complete information and detail drawings of various applications of Pittco Store Front Metal.

PITTCO
STORE FRONT METAL

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Pittsburgh Plate Glass Company,
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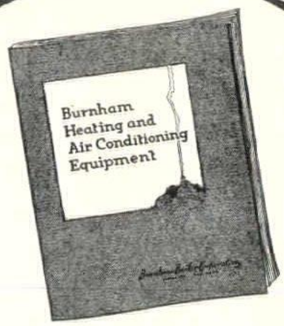
Please send me, without obligation, your folder containing full information on Pittco Store Front Metal and detail drawings.

Name..........

Street..........

City.......... State..........



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Boilers for coal, gas and oil. Slenderized Radiators. Air Conditioning Unit.

Attic Fan for Summer cooling.

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Burnham Boiler Corporation
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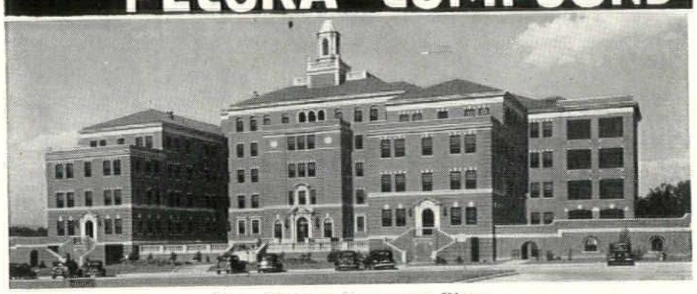
Burnham Boiler

CALK all Joints WITH PECORA COMPOUND



New Female Receiving Ward
St. Elizabeth's Hospital, Washington, D. C.

Calked with Pecora

Where buildings are designed for long service, it is essential that a *permanent* calking compound such as Pecora be used to seal all joints around windows and exterior door frames, and to point up masonry. Pecora has continually demonstrated its superiority since first introduced in 1908. Properly applied, Pecora will not dry out, crack or chip. It is an important factor in preventing heat losses and for temperature control in air conditioning. Available in metal cartridges of approximately one quart and one pint size for use in New Pecora High Pressure Cartridge Calking Gun.

Pecora Paint Company, Inc.
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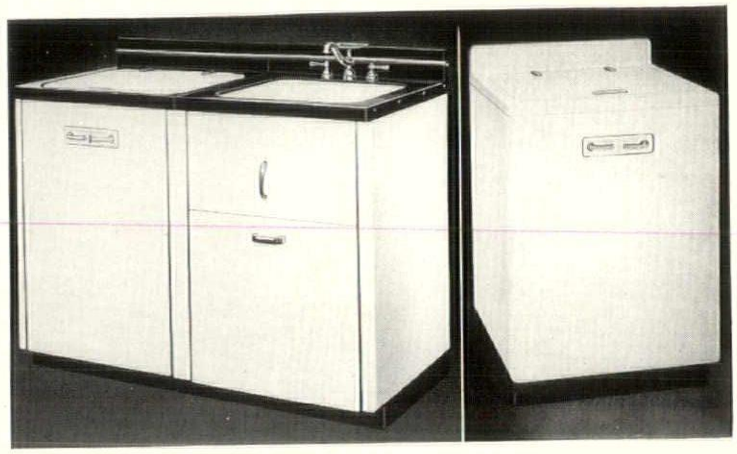
Member of Producers' Council, Inc.
Established 1862 *by Smith Bowen*
ALSO MORTAR STAINS ● SASH PUTTIES ● SUCTION MASTICS

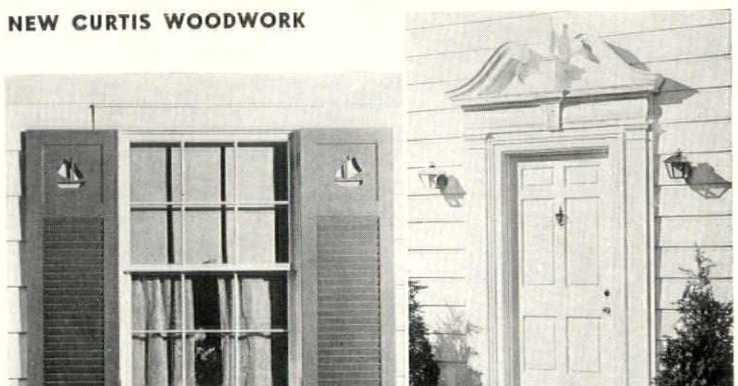
PRODUCTS . . . .

ELECTRIC DISHWASHERS AND SINKS



Features of the new line of electric dishwashers and sinks recently introduced by General Electric Company, Nela Park, Cleveland, Ohio, include simplified operation with a detergent cup and an improved two-handle control, streamlined cabinets with kick space and back splash, and an improved cover gasket of a grease-resistant rubber substitute. The detergent cup, mounted in the hinged center section of the top tray, is designed so that the detergent placed in the cup while loading the dishes will be washed into the solution only in the power-washing operation after the initial spray has been completed. Vented hinges tighten to hold the cover upright and a recessed handle gives an additional smooth work surface. Cabinets are finished in white glyptal-baked enamel. Trays will hold eighty dishes of all sizes and shapes, including glassware and silverware, as well as pots and pans. The G-E Dishwasher may be obtained separately or installed in a dishwasher cabinet, or in a G-E sink which includes a G-E Disposall. The cover hinged to the tub, rather than the cabinet, comes in porcelain, Monel metal, or stainless steel. **870M**

NEW CURTIS WOODWORK



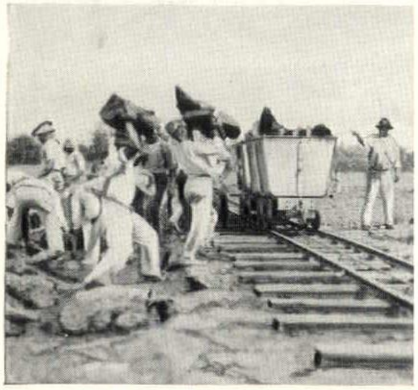
Dwight James Baum has designed a complete new line of Curtis woodwork, including doorways, doors, windows, shutters, mantels, stairs, china closets, trim, etc., according to an announcement by Curtis Companies Service Bureau, Clinton, Iowa. Production has started and products will be available through Curtis dealers shortly. All designs are based on historic precedent. Designs appropriate to the more popular styles are included. **871M**

THE VITAL ELEMENT

(*Trinidad Native Lake Asphalt*)

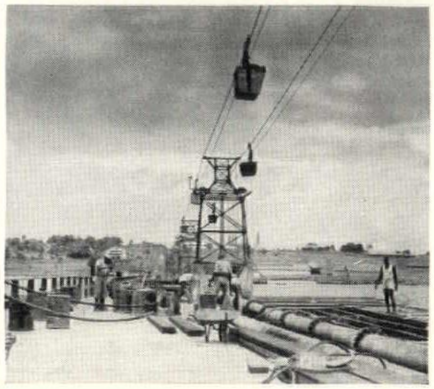
—the Asphalt news of 1595—is making roofing history in 1938!

HERE'S THE STORY OF TRINIDAD NATIVE LAKE ASPHALT IN PICTURES



The Vital Element is dug from the surface of the asphalt lake with mattocks.

"Headers" carry it on their heads and load it into waiting dump-cars



It then traverses the half-mile cableway that leads to the loading pier —

and is emptied into ships bound for Barber plants in the United States

where it is used to make Barber Genasco Bonded and other types of Built-up Roofings for such structures as the imposing Fairmount Mausoleum, Denver, Colorado

IT WAS NEWS in 1595 when Sir Walter Raleigh discovered the huge lake of native asphalt on the southern Caribbean Island of Trinidad.

And this same asphalt is making roofing history today—history of primary importance to every architect. Because Trinidad Native Lake Asphalt is *The Vital Element* responsible for the longer and better protection afforded by Barber Genasco Roofings.

Trinidad Lake Asphalt has an inherent vitality that definitely resists the parching rays of the sun, the destructive forces of rain, snow and ice. Its self-healing properties form a particularly important contribution to the long life of Barber Genasco Roofings. And—*it is an exclusive Barber feature.*

You can recommend and specify Barber Genasco Roofings with complete confidence, for they—and only they—contain genuine Trinidad Native Lake Asphalt. And when questions regarding asphalt arise, Barber will welcome your inquiries without cost or obligation. The Barber Company, Inc., Asphalt Headquarters since 1883, Philadelphia, Pennsylvania.

BARBER Genasco PRODUCTS

Nationally advertised Barber Genasco Products, made with *The Vital Element*, include: BONDED AND OTHER TYPES OF BUILT-UP ROOFINGS, MASTIC FLOORINGS, SHINGLES. Other Barber Asphalt Products include: Waterproofing Asphalts and Fabrics, Damproofing Asphalts, Resaturator, Resurfacer, Asphalt Protective Products (Plastics and Liquids), Spandrel Beam Waterproofing (Spandrel Cloth and Cement).

Burrowes Rustless Screens

Y. W. C. A. at Grand Rapids, Michigan. Equipped with Burrowes Rustless Screens throughout.

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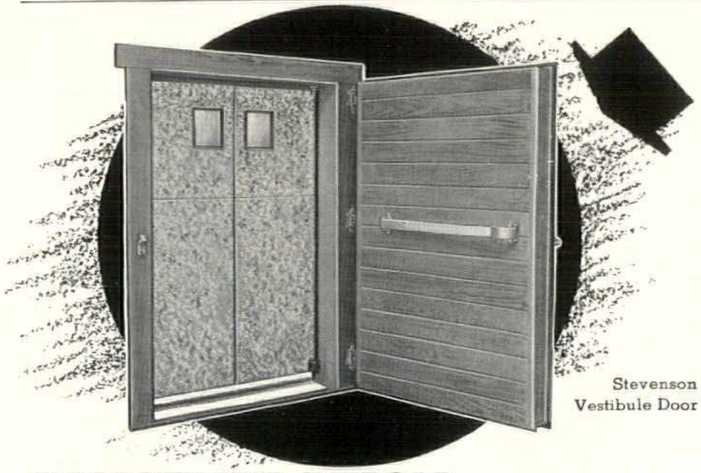
Screens that can take it, year after year, are important for public buildings. That's why it's a long-standing habit, with many architects, to call for the custom-made Burrowes product. Whether your next job is a summer house, a year-round residence, a sanitarium or a skyscraper, you'll find it worth while to specify Burrowes Rustless Screens.

THE Burrowes Corporation

72 FREE STREET, PORTLAND, MAINE

BURROWES SCREENS RUSTLESS ALL CITIES



Stevenson Vestibule Door

CONCENTRATION At the doorway comes the test of refrigerated rooms. Unless the doors seal efficiently, open easily, close with certainty; unless doors and hardware are built to stand up year after year—profits, products, and reputation for quality are in danger. Designing and constructing doors that will do all this is no "part-time" job—it has engaged ALL our attention, has called for ALL our experience of 50 years past.

When so much depends on doors, can users afford less than JAMISON-BUILT DOORS—the best, at no price penalty?

JAMISON COLD STORAGE DOOR CO.

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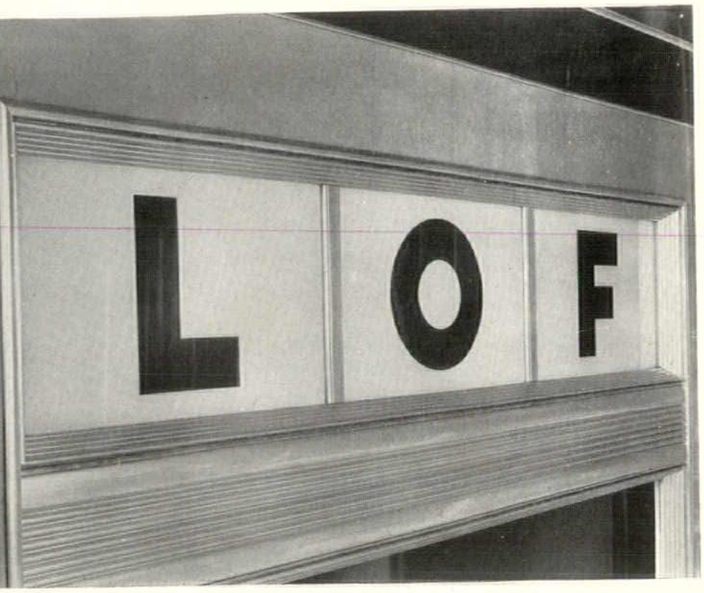
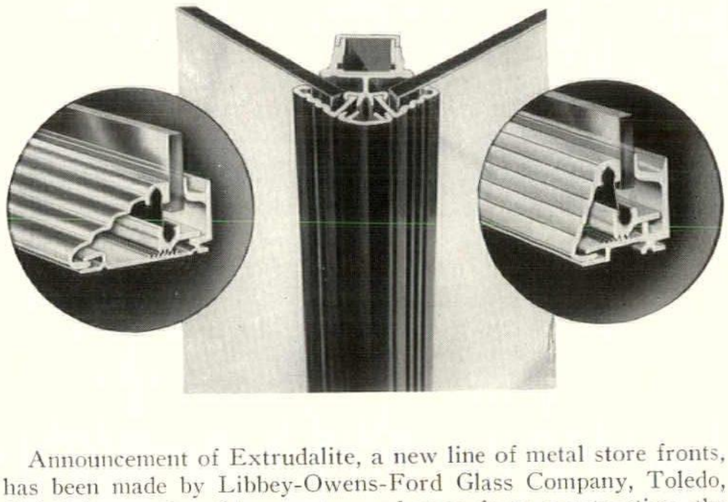
JAMISON-BUILT DOORS

(See our catalog in Sweet's Catalog File)

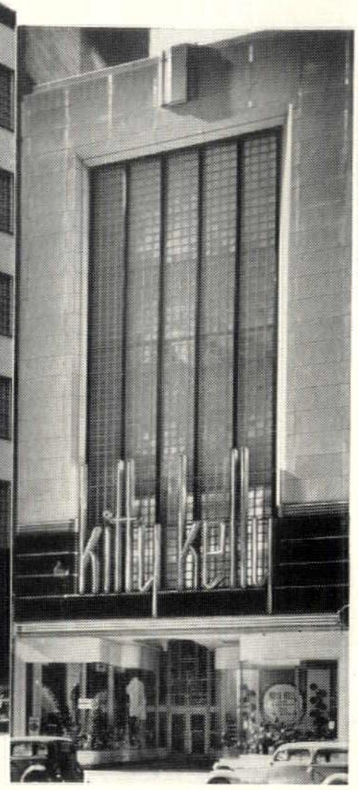
PRODUCTS . . . .

STORE FRONT CONSTRUCTION





Announcement of Extrudalite, a new line of metal store fronts, has been made by Libbey-Owens-Ford Glass Company, Toledo, Ohio. In creating this new type of store front construction, the company's technicians sought to produce a metal sash strong enough to be self-supporting and able to retain its own alignment for the glass to rest against. This was accomplished by using solid extruded metal. Instead of placing a cushioning spring against the glass itself, Extrudalite cushions the rigid members which hold the glass. In this way, the glass is held in a firm, rigid velvety grip by cushioned, indirect pressure which is evenly distributed. Correct pressure for holding the glass is automatically obtained. When setting glass in Extrudalite sash, the installator has only to run down the set screws until they strike the positive stop. Interlocking teeth in the base member and in the clip member assure correctly applied pressure regardless of thickness of glass. The direct pressure exerted by the set screws is transferred from the rigid clip lever to the cushioning spring. The spring cushions the pressure and transfers it to the rigid face piece which applies it evenly all along the face of the glass. Reversely, the spring acts as a shock absorber and absorbs all shocks, vibrations and expansions. It likewise acts as a stabilizer by throwing pressure back against the glass under contraction. Extrudalite comes in three sizes, each offering a complete line of all units necessary for any type of metal store front construction. Sections are of solid, extruded metal—Aluminum Alloy No. 53S standard, with bronze also available. The standard finish on aluminum is Alumilite. **872M**



These distinctive stores . . . designed by Alfred S. Alschusler, Architect, for Benson & Rixon Company and Kitty Kelly . . . are noteworthy additions to Chicago's State Street.

OWENS-ILLINOIS

Insulux GIVES STORES **New and Greater PULLING POWER**

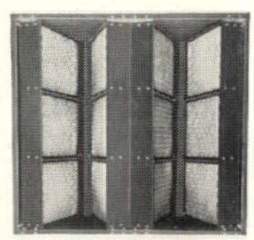
● On shopping thoroughfares from coast to coast there are literally hundreds of demonstrations of the completeness with which Owens-Illinois INSULUX Glass Block fulfills the requirements of store design. By admitting an abundance of diffused daylight and, at the same time, retarding heat and sound transmission, INSULUX makes shopping pleasant and easy. The interesting effects that may be created with the variety of INSULUX face patterns add beauty and character and compel attention. INSULUX has a clean, sanitary appearance, and can be kept glistening and immaculate with a minimum of effort. You will surely want all the facts about Owens-Illinois INSULUX Glass Block—especially information about its *patented* and *exclusive* features . . . so send the coupon today. Owens-Illinois Glass Company, Toledo, Ohio.

OWENS-ILLINOIS *Insulux* GLASS BLOCK

CLEAN AIR BOOSTS SALES

Merchandise is kept in a more salable condition and shoppers in a better buying mood in stores with modern heating, ventilating or air-conditioning systems equipped with Owens-Illinois DUST-STOP *Replacement-Type Air Filters. That's because* DUST-STOPS *catch and hold from 96% to 98% of the dust and lint in the air that passes through them.*

There are two types of DUST-STOP *Filter Frames. The L-type consists of an assembly of interchangeable L-shaped members that may be assembled vertically or horizontally to provide capacity for any c.f.m. requirement.*



The V-type is designed for use in limited space. Its frontal area is 40% less than that required by an L-type assembly of the same capacity. Details of filter installation are identical in frames of both types.

Let us send complete, illustrated details about DUST-STOP *Replacement-Type Air Filters. Check and mail the coupon. No obligation, of course.*

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Industrial and Structural Products Division
316 Madison Avenue, Toledo, Ohio

Please send full information as checked below:

☐ INSULUX Glass Block
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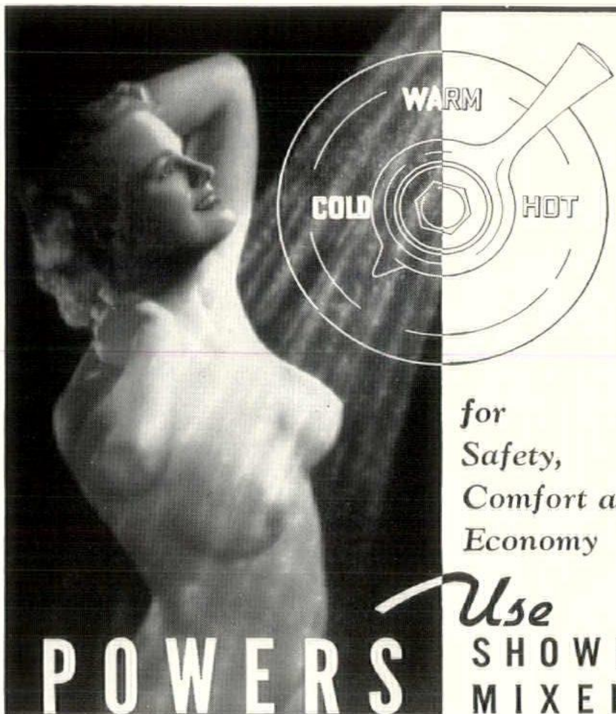
Name ____________________
Address ____________________
City ____________ *State* ____________



for Safety, Comfort and Economy

Use

POWERS SHOWER MIXERS

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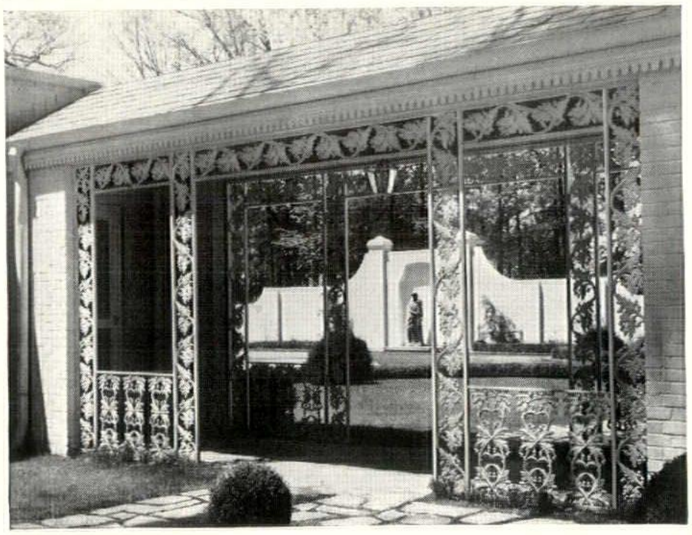

Smyser-Royer Cast Iron Veranda Design in Loggia Ironwork
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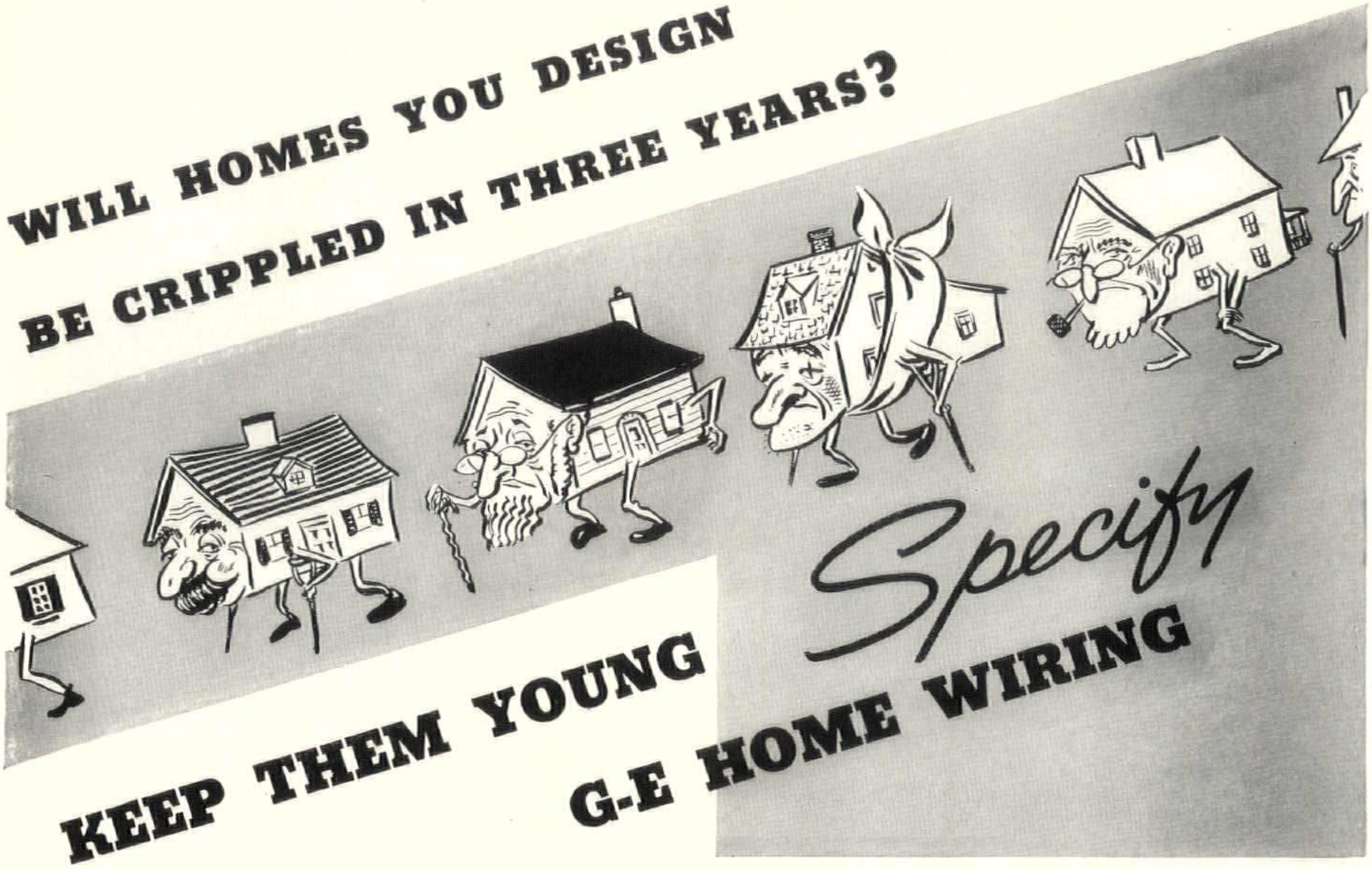

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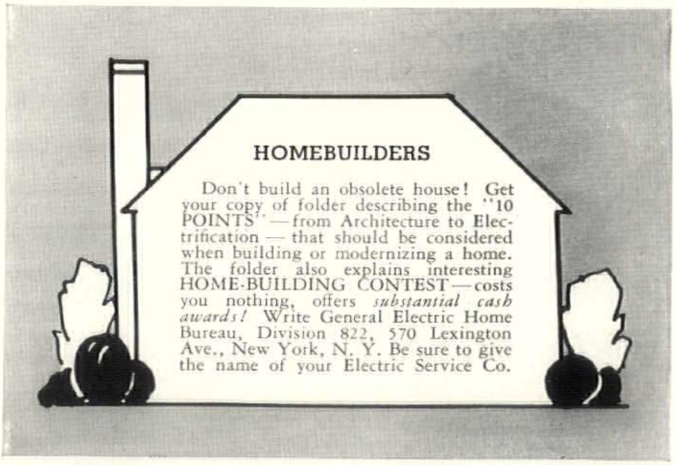

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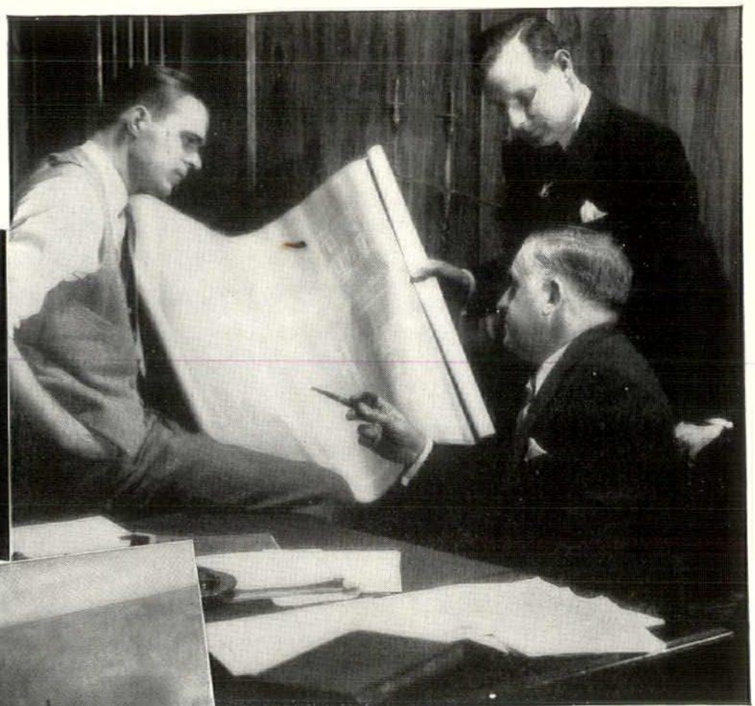
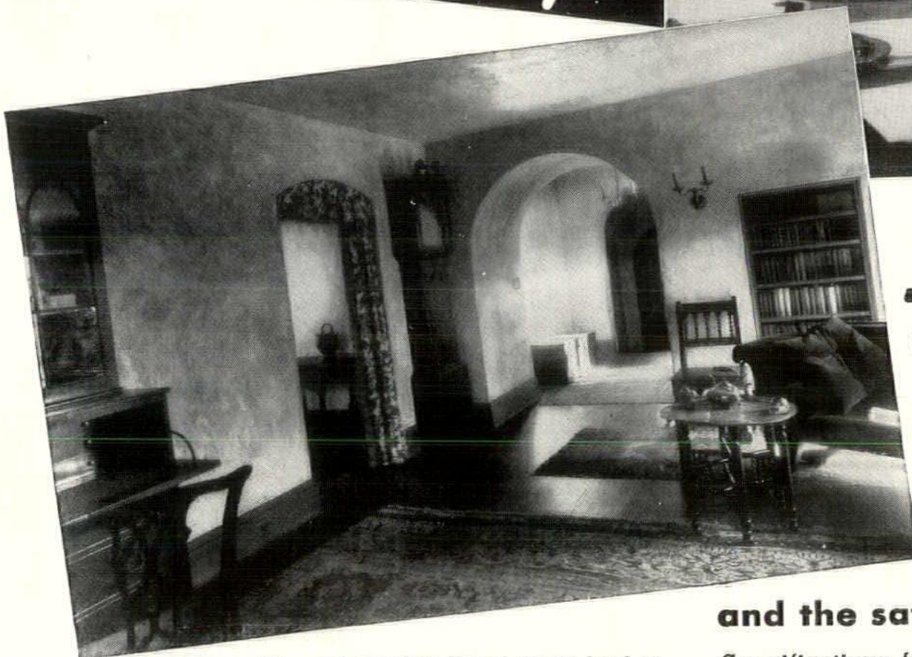
"Gentlemen, beauty in plaster is *more* than *skin-deep*"





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and the satisfaction of your client . . .

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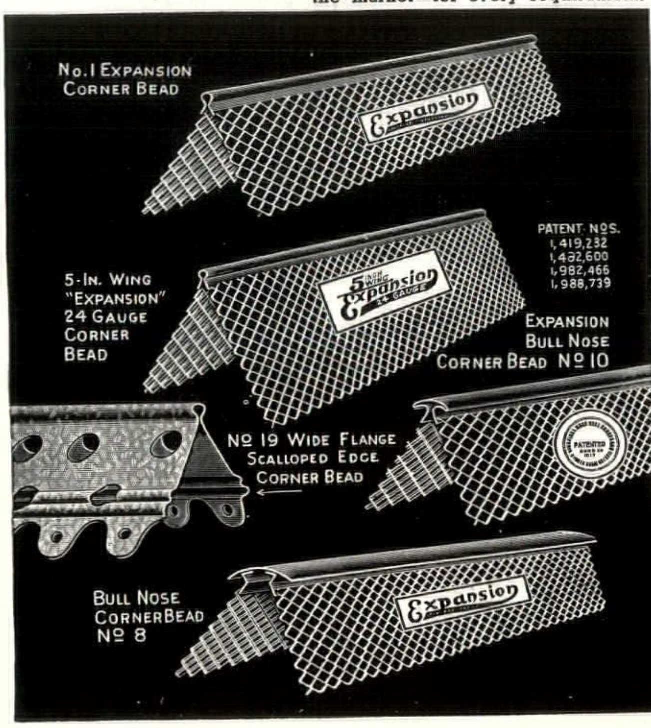

Specifications for plaster *base* — in all of its details — are just as important in the long run as your feeling about surface texture. Perhaps more so, for nothing less than Milcor's interlocking web of expanded metal gives you full confidence that the corners will last . . . Corner bead (including the expanded type originated and patented by Milcor) is an important element in steel plaster base. Milcor makes the most complete line on the market — in this as in other types of steel plaster base materials. No Milcor representative is ever tempted to recommend the wrong product — because he always has the *right* one available. See the extensive Milcor catalog in Sweet's, or write for the Milcor Manual.

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Milcor here uses the word "system" in its true sense — not to signify a limited, inflexible set-up applicable only under certain conditions, but to represent so great a range of individual products, types, weights, metals, etc., that a complete, co-ordinated metal backbone can be designed to suit any condition of fireproof construction — all with Milcor products engineered to work together.

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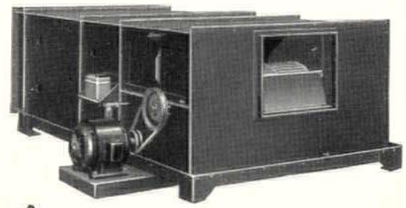

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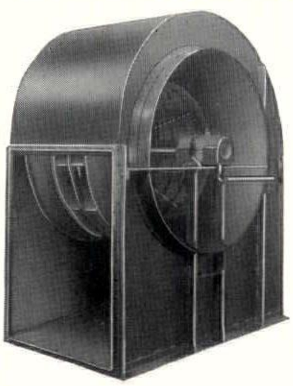

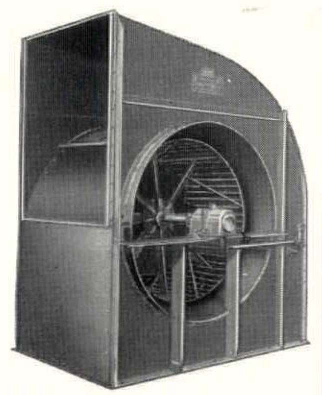

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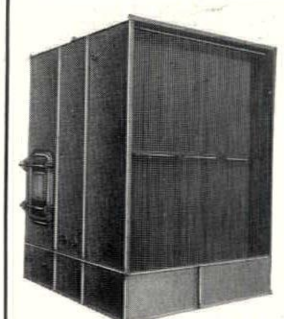

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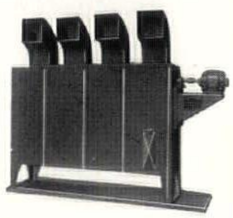

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FANS and BLOWERS for INDUSTRIAL NEEDS

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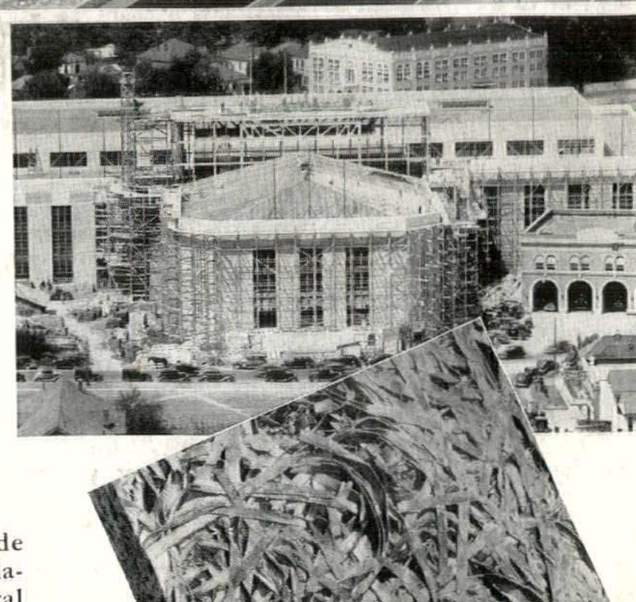
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

A WHALE OF A ROOF DECK

IN MORE THAN JUST SIZE!



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