1 9 3 2

ST BORN

THE ARCHITECTURAL RECORD

LLSIDE HOUSING • LAUNDRY PLANNING • AIR CONDITIONING

The "ROMANESQUE" (semi-indirect) in Macbeth Galax Glass

Tenanted . . . OFFICE
instead of TO LET

The difference between desirable and undesirable office space in these highly competitive days is very often merely a matter of appearance. The newer and brighter buildings attract where older but none the less worthy buildings repel because of their dim and dingy interiors. ● There is an immense field for the rejuvenation of such buildings in which re-lighting plays a principal part. Owners and managers of older buildings are fully aware of the fact that they must modernize or lose prestige. They also know that the cost of modernization will be lower now than at some later date. ● Many old buildings have already been restored to modernity and efficiency by slight interior alterations, new decoration and new lighting systems. Modernly efficient and beautiful, Macbeth Lighting Globes have played a big part in a large number of such restorations. Macbeth facilities afford the architect the widest possible choice in the selection of attractive and effective illuminating globes. See our catalogue in "Sweet's" and write for any special information desired . . . MACBETH-EVANS GLASS COMPANY, Charleroi, Pennsylvania.

Modernize with Macbeth *Lighting Glassware*

THE

ARCHITECTURAL RECORD

VOL. 72 NO. 4 OCTOBER, 1932

Yearly subscription: United States and Possessions, $3.00; Canada and Foreign, $5.00; Single Copy, 50c. Member Audit Bureau of Circulations and Associated Business Papers, Incorporated.

Entered as second class matter May 22, 1902, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Marshall Field Estate Building, Chicago.

Architects and Engineers: Graham, Anderson, Probst and White; *Contractor:* George A. Fuller Company.

BETHLEHEM STEEL COMPANY, *General Offices:* Bethlehem, Pa. *District Offices:* New York, Boston, Philadelphia, York, Wilkes-Barre, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Indianapolis, Detroit, Chicago, St. Paul, Milwaukee, St. Louis, Houston, Dallas. *Pacific Coast Distributor:* Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

FRAMEWORK OF

BETHLEHEM

WIDE-FLANGE

STRUCTURAL SHAPES

Webb C. Ball Company Bldg., Cleveland; *Architect:* Walker & Weeks, Cleveland; *General Contractor:* Sam W. Emerson, Cleveland; *Sub-Contractor on Aluminum Work:* John Harsch Bronze & Foundry Co., Cleveland.

Architectural Imagination, and 1022 lbs. of Alcoa Aluminum

. . . help this building present a more pleasing face to the world

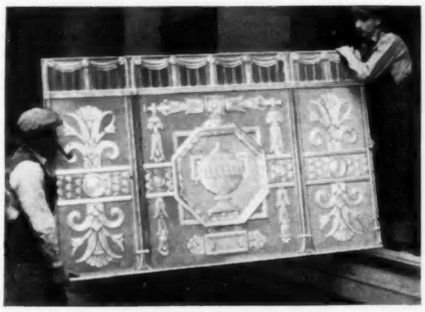
Obsolescent buildings are a challenge to architectural creativeness. Drab, old-fashioned store-fronts are a poor bid for trade—retail trade especially.

The "before and after" pictures of the Ball Building are vivid and conclusive evidence of what architectural imagination can accomplish. Good design, including 7 spandrels made of Alcoa Aluminum, have helped tremendously to increase the appearance and rental value of this building.

In the field of remodelling, the architect has an undisputed leadership. Without his creative imagination, his knowledge of new building materials and possibilities, remodelling can be so poorly done as to be money thrown away.

As an architectural material, both structural and decorative, Alcoa Aluminum has definitely proved its many varied and practical uses on thousands of buildings throughout the country. Its use is pre-eminently indicated where factors to be considered are lightness in weight and consequent ease of handling on the job; resistance to corrosion; permanence, and the use of a material that will not drip stain on to adjoining surfaces. It may be had in a wide variety of finishes and in every form known to the metal working art.

These natural advantages of Alcoa Aluminum have caused it to be used widely for store fronts, cornices and copings, sills, window frames and sash, skylights, roofing and decorative facades; for entrance doors, elevator doors and cabs and countless other objects.



7 foot 6 by 4 foot 4 . . . yet two men lift it easily . . . . . .

indeed, as the photograph shows, one of the "liftees" didn't have to lay down his pipe. Note too the sharpness of detail. The cast spandrel has been given a 3-tone finish.

To obtain absolutely satisfactory architectural aluminum specify Alcoa Aluminum and its alloys, made by Aluminum Company of America. In planning the use of Alcoa Aluminum in your next project, we urge you to accept our cooperation. Address ALUMINUM COMPANY *of* AMERICA; 2467 Oliver Building, PITTSBURGH, PENNSYLVANIA.

ALCOA ALUMINUM

The ARCHITECTS LIBRARY

THE GREAT CHURCH TOWERS OF ENGLAND. By Frank J. Allen. Published by the Cambridge University Press, London, and the Macmillan Co., New York. 196 pp. text, 111 pp. illus. $15.

This careful study of English towers deals principally with those of the Perpendicular Period. Of the 423 examples mentioned and described, 283 are illustrated photographically. They are treated in geographical or county groups. Measurements in many cases, architectural details, materials, classification by location and relation to other towers inside or outside the particular group, and brief criticisms are noted with archaeological care.

The classification is determined by the guild of masons which constructed the tower and whether their work shows or is free from the influence of other guilds.

The introduction and a summary page generalize principles of tower design from the author's fifty-year study of the subject.

IMMIGRANT GIFTS TO AMERICAN LIFE. By Allen H. Eaton. Published by the Russell Sage Foundation, New York City. 173 pp., 53 illus. $3.

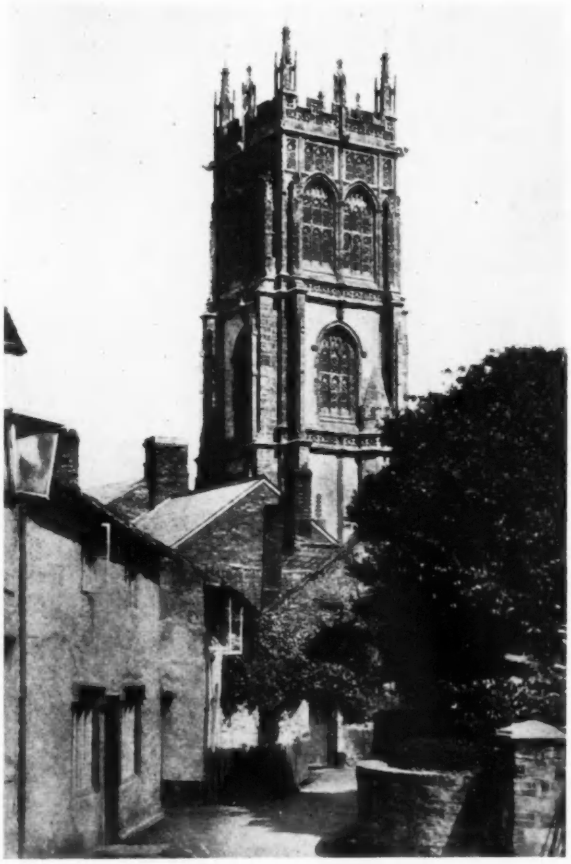
During the decade before the World War immigrants to the United States averaged nearly one million per year. Annual arrivals reached 100,000 as early as 1842. It seems only natural that these newcomers from older lands should have brought much of cultural importance with them. This book shows to what advantage an appreciation of skill in the arts and crafts may be put in racial assimilation. The greater part is devoted to the history of past exhibits and the methods and sources for future exhibitions of the products of these cultures.

ART AND CIVILIZATION. Unity Series. Vol. VII. Edited by F. S. Marvin and A. F. Clutton-Brock, Oxford University Press.

The thirteen essays in this volume make together a partial and intermittent survey of the history of art, by nine different essayists; but each writes on his own specialty and the whole is, in a way, more varied and stimulating reading than is usual or probable in a volume by one person who attempted to cover the subject so briefly.

In the 19th century, says Mr. Clutton-Brock, art criticism for the first time became an important branch of literature and learning. For that reason, and because of its nearness to us, it is possible for us to estimate the environment of the 19th century artist as in no other era. Most of the fine arts, except painting and sculpture, in that era show stagnation or very slow improvement.

Arthur W. Colton.



From "The Great Church Towers of England"

CHURCH TOWER AT NORTH PETHERTON

SOMERSET, ENGLAND

THE PRINCIPLES OF LITERARY CRITICISM. By A. I. Richards. Harcourt Brace. 298 pp.

It must be admitted that Mr. Richards' book, while it is far wider than its title readily implies, is not at all another book on architecture nor does architecture directly take more than the smallest place in it. Its connection with architecture is chiefly that it provides a wider background to which the theories of Geoffrey Scott may be related. For if the nineteenth century seems now to have been, as befitted an age primarily of intellectual disintegration, centrifugal in its activities, the twentieth century already seems to be in its more significant efforts centripetal. The nineteenth century thinker worked the better the more tightly he could circumscribe the province of his thought and the further he could remove it from all other fields of which the number increased with specialization almost beyond limit.

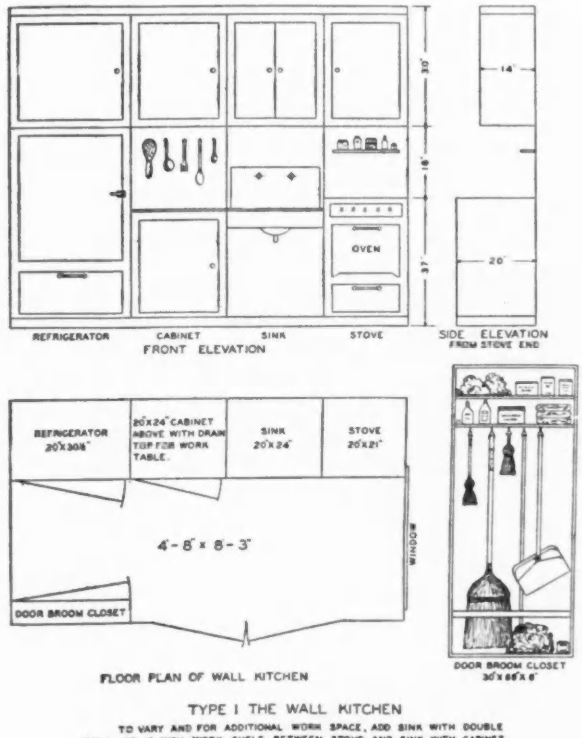
At the time of the appearance of "The Architecture of Humanism" any general ideas would have been felt out of place in a work on architecture. Mr. Richards, on the other hand, shows the meaninglessness of any theory of criticism which does not repose on an intelligible theory of values and function in relation to formulated psychology.

Henry-Russell Hitchcock, Jr.

HOUSE DESIGN, CONSTRUCTION AND EQUIPMENT

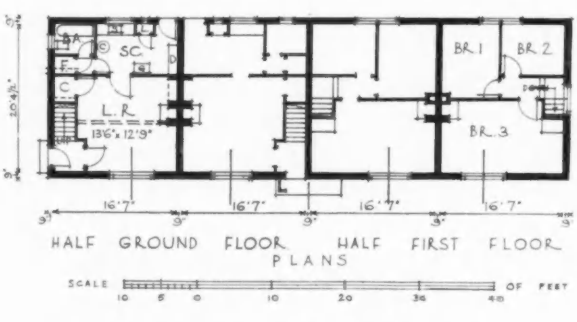
Vol. V, Reports of Committees of, and published by, The President's Conference on Home Building and Home Ownership, Washington, D. C. 313 pp., halftones, plans, tables. $1.15 postpaid.

This volume of the series is of particular interest to architects, contractors, and producers of building materials and equipment. Each hundred dollars taken off the cost of a good house enlarges the potential market. These committees have decided that such economy can be effected only by using an impartial source of accurate up-to-date information on the latest practices, materials and equipment and by study to eliminate nonessentials in design. In order that there be a market for this improved synthesis called a modern house the purchasing public, or what might be termed the lay builder, must be led to realize the economic, aesthetic, and social superiority of simplified, time- and labor-saving practice. This book devotes twice as much space to a very informative section on fundamental equipment (including heating, ventilating, air conditioning, plumbing, sanitation, electric wiring, lighting, and refrigeration), as it does to those parts concerned with dwelling design and construction. These earlier sections, nevertheless, make specific recommendations, including the means of economy before mentioned, and give in appendices much cost data based on studies of the whole country. It should be noted that these Committees have concerned themselves primarily with housing ranging from $2,000 to $10,000 in cost.



A TYPICAL ILLUSTRATION FROM "HOUSEHOLD MANAGEMENT AND KITCHENS"

From "Small Houses and Bungalows"



COTTAGES AT WELWYN GARDEN CITY

HERTFORDSHIRE, ENGLAND

LOUIS DE SOISSONS and A. W. KENYON, Architects

HOUSEHOLD MANAGEMENT AND KITCHENS.

Vol. IX, Reports of Committees of, and published by, The President's Conference on Home Building and Home Ownership, Washington, D. C. 222 pp., 5 illus. $1.15 postpaid.

Volume IX contains a synthesis of up-to-date statistical studies of management of household operations, purchasing and budgeting, work area planning, arrangement, equipment, storage and laundry requirements. Careful analyses of the efficiency of prevailing methods indicate the great cost, labor and quality economies dependent on careful planning of expenditures, and planning to relate adequate work centers and provide proper facilities for the comfort and development of each member of the family. Many specific recommendations, optimum dimensions, types of finish, equipment, and cost data make this book of interest to architects, builders, and realtors as well as to house owners.

SMALL HOUSES AND BUNGALOWS.

Edited by Frederick Chatterton. Published by The Architectural Press, London. 104 pages. Many sepia halftones. Price 7s.6d.

This is a collection of 104 examples of contemporary British domestic architecture ranging in cost from £292.10s. to £2,000. Each page is devoted to one house or bungalow with a photograph, brief summary of materials, details, finishes, and plans.

CALENDAR OF EXHIBITIONS AND EVENTS

October	National Conference on construction to be held in Washington.
October 3-7	Twenty-first Annual Safety Congress of the National Safety Council in Washington.
October 5-8	Meeting of the American Society of Civil Engineers in Atlantic City.
Until October 14	Exhibition of model housing for hillside groups at the Architectural League, New York City. Drawings and plans prepared by a summer study group of graduate students and university instructors under the direction of Mr. Henry Wright. These projects are illustrated in this issue of The Record.
October 15	Closing date of contest for double hung window designs. Samson Cordage Works, 89 Broad Street, Boston.
October 17	Closing date of Small House Competition conducted by The House Beautiful, 8 Arlington Street, Boston.
November 14	"Housing and Slum Clearance Technique"—a conference of architects and others interested in this subject to be held in Pittsburgh. For information address Frederick Bigger, 1802 Law and Finance Building, Pittsburgh.
December 1	Closing date of entries for 1932 Small House Architectural Competition conducted by Better Homes in America, 1653 Pennsylvania Avenue, Washington, D. C.
December 5-10	Tenth National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York City.
1933 April 23-30	Better Homes Week, an educational movement under auspices of Better Homes in America, 1653 Pennsylvania Avenue, Washington, D. C. Demonstrations of new and remodeled houses, lectures, contests, etc., are urged.
October	"A Century of Progress," International Exposition at Chicago.

UNEMPLOYMENT RELIEF IN PHILADELPHIA

To meet employment problems affecting professional technical workers, "The Engineers' Club of Philadelphia" has sponsored the Philadelphia Technical Service Council. This group consists of representatives from twelve National Engineering Societies, and the association of the State Employment Commission of Pennsylvania has been secured. Thus all requests for technical men are handled through the Committee for the Philadelphia Metropolitan area.

The work of the Committee is divided into four main divisions: Placement, Field Contacts, Publicity, Research. The primary object is to secure placement for the registrant. Since volunteers from the registrants do the work, this aid to industry is available to employer and employee alike, without charge.

On file are the applicants of 1,005 men, who have given their personal, educational and professional qualifications.

AUDAC LECTURES AT NEW SCHOOL

The first step toward establishment of a center of modern design will be taken by the New School for Social Research, New York City, this fall in a series of lectures on Living Design in cooperation with Audac. This series will be held on Monday evenings, beginning October 3.

ANNOUNCEMENTS

After 35 years in the Wall Street district Dodge and Morrison, architects, are moving to 198 Broadway, New York City.

Murad Narcissian, architect, has opened a temporary office, 390 N. Main Street, Woonsocket, R. I.

Architect trained in Europe with 6 years of experience in America desires association with established architectural firm as designer or consultant on housing developments. Address inquiries to editorial department of The Architectural Record.

Jean Francois Meunier of Paris, winner of awards in several French architectural competitions and of the Stillman prize at the Ecole des Beaux Arts, has been named the Delano and Aldrich Travelling Scholar by the Committee on Education of the American Institute of Architects, according to an announcement by Charles Butler, chairman.

SMALL HOUSE COMPETITION

Better Homes in America, 1653 Pennsylvania Avenue, Washington, D. C., announces a competition for awards to be made to practicing architects for the best design submitted for each of three types of houses—three medals in all:

(a) One-story house. Storage space but no living accommodations in roof space.

(b) Story-and-a-half house. Living accommodations partly in a second story which is actually a "half story."

(c) Two-story house.

The competition closes December 1.

BETTER HOMES WEEK

Under the auspices of Better Homes in America, an educational program is being formulated to raise standards of house building. A "Better Homes Week" has been set for April 23-30.

The first act of a Better Homes chairman is to accept appointment in a letter to the Washington office, which will promptly send complete instructions. The chairman will then consult with community leaders and appoint committees.

WINDOW DESIGN CONTEST

The Samson Cordage Works, 89 Broad Street, Boston, announces a contest for designs of double hung windows which illustrate new ideas in construction. Four cash prizes (from $300 to $25) are offered. The contest closes October 15.

TALIESIN FELLOWSHIP

Frank Lloyd Wright is establishing an experimental school at Spring Green, Wisconsin, where a group of 70 students, or "qualified apprentices," may receive instruction in architectural and industrial design. At the same time the students are expected to participate in all community activities by working three hours each day, either on the grounds or on the farm which will be maintained to supply food. The instruction staff will comprise, in addition to Mr. Wright, three technical advisers trained in industry, three resident associates—a sculptor, a painter and a musician—and seven "senior apprentices."

The institution is known simply as Taliesin Fellowship. The total tuition fee is $675, including living expenses. Work begins October 20.

Walter Rutherford

TENNIS STADIUM AT HAMILTON, BERMUDA
GEORGE H. HUTCHINGS, ARCHITECT

THE ARCHITECTURAL RECORD OCTOBER, 1932
VOL. 72—NO. 4

TENNIS STADIUM AT HAMILTON, BERMUDA

Walter Rutherford

GEORGE H. HUTCHINGS, Architect

J. Byron Bell, Keith B. Hudson and Everett S. Cofran, Associates

General direction of project by William Livingstone, Director of Public Works, Colonial Government of Bermuda

The stadium as planned is part of a *general tennis development* embracing stadium, two championship courts, nine outside courts and a tennis clubhouse building.

This in turn is part of a scheme for the development of a *recreational area* on the reclaimed Pembroke Marsh, embracing: (1) tennis group, (2) racecourse and buildings, (3) athletic playing fields, and (4) boating canal.

Work so far has been confined to land reclamation and the tennis stadium.

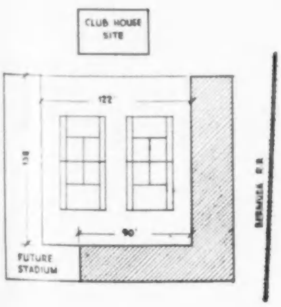
The whole development is prompted by the wish of the Colonial Government to add to the attractiveness of the islands in the interests of the better class of visitors.

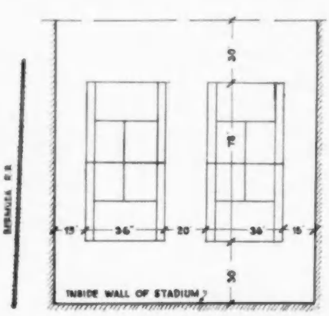
Site

The site is a level area on the edge of the reclaimed Pembroke Marsh, within a mile from the center of Hamilton, the principal town of the island. The new Bermuda Railway passes the site and has provided a special platform station for spectators.

Stadium

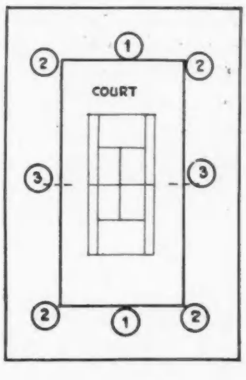
The portion of the stadium erected so far is somewhat more than one-half of the complete U-shaped structure. Intention is to close the fourth side with the tennis clubhouse, plans of which have been completed but upon which work has not yet begun. Within the U are two championship "En-Tout-Cas" courts. Two courts instead of one, as at Wimbledon, were decided upon to allow for "resting" of courts if desired; also upon the consideration that much of the play upon these courts would be in preliminary games of tournaments, in which as a rule players do not object to action on an adjoining court.





Stadium Plan

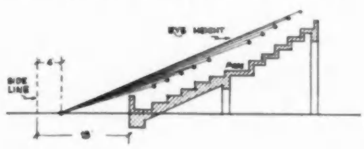
In any stand for viewing tennis matches the best positions to observe the strategy and tactics of the game are at points (1.1) along the end lines; for the general interest in the game and players, at points (2.2) where some of the maneuvers may be understood and appreciated and yet a fairly close view of players and action is possible. Points (3.3) are worst positions possible since movement of ball necessitates constant head movement to follow it, which is tiring and distracting.



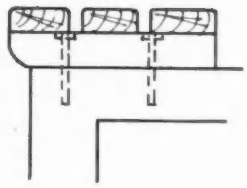
Onlookers seeking a view of the strategy of the game at a tennis tournament are comparatively few. Greater numbers wish a close position to one or the other of the players, where they can view the action better.

For these reasons this stadium was planned to give greater accommodation on side lines. Two groups of seating are along each side, but only the upper is carried along the back line, which allows for the high backstop wall which is desirable along this line.

The section of the structure was determined by a study of the *sight lines*. A perfect view over the heads of the onlookers on seats immediately below was sought over an area extending 4 feet beyond the side lines of the doubles court. This resulted in the adoption of a tier of 12" high by 25" wide in lower five tiers and 15½" high by 25" wide in upper five tiers on sideline portion of stadium. At end, tiers are 15½" x 25".



The seating is of wood, made up of continuous 1½" pitch pine slats raised from the concrete 1½" on native cedar blocks, cut to tilt back the seating, for greater comfort.



There are no subdivisions between seats, but each seat space is numbered and marked by a line across the seating. Each seat space is 18" wide.

That portion of the stadium now built accommodates 1,270 persons. The ultimate capacity of the complete stadium will be 2,000 persons.

Structure

The entire structure is of reinforced concrete. Until time of erection some doubt had always been raised as to the advisability of reinforced concrete being used in Bermudan exposed work, due to penetrating effects of moist salt-laden air during summer, affecting the steel reinforcement, and also as to the porosity and softness of the local aggregate, chiefly a winddrift limestone.

It was believed, however, that these fears had been exaggerated and that by the use of simple precautions the steel could be well protected, and that the opening of the government crushing plant on a new site of harder and denser stone would afford a thoroughly reliable aggregate.

The precautions taken were: (a) a rich mix; (b) care in pouring concrete to avoid "honeycombing" on outer faces; (c) doubling the usual "fireproofing" thickness of concrete around all steel reinforcement.

The construction in general conforms to the typical pattern of reinforced-concrete stands. The lower tiers on the side stand are built as a "stairway" slab, the upper tier and the end stand, with higher steppings afforded sufficient depth to use beam and slab construction. Each step 5" thick is reinforced as a beam, bearing on main cross girders from the columns. The slabs between, 3¾" thick, are reinforced with continuous galvanized welded wire mesh, carried down through the adjacent beams, and acting as web reinforcement to same.

The construction in general is more massive than usual in structures of this kind, for the following reasons:

(1) The doubtful compressive value of the aggregate made it advisable to increase the size of the members to gain an assured compressive strength.

(2) The additional protection around the steel, spoken of before.

(3) Certain allowances made to take care of moving loads due to mass movements of the crowd at the end of a day's tournament play.

Expansion joints. The range of temperature variations in Bermuda is not great, not exceeding 50°F., but the length of the stands and the exposure to the direct rays of the sun made necessary some provision for longitudinal expansion of the entire structure. Expansion joints are provided at approximately 70-foot intervals, making a complete subdivision of the construction, with duplicate beams and columns on either side of the joint. The ⅝" space between is a straight open joint filled with a patent plastic bitumen compound.

Exterior surfaces. Care was taken with the formwork and placing of the concrete to obtain a clean smooth surface on the exterior faces, particularly the high rear walls. The whole surface of these was rubbed down with carborundum brick and the finished surface now has a pleasant "concrete" texture.

Toilet Accommodations and Players' Rooms

The future clubhouse will include players' locker and rest rooms, as well as general toilet facilities. Pending the erection of this building temporary players' rooms and toilet facilities for players and the public are provided underneath the stand.

The remainder of the space below the stands has been left open as a shelter space to serve during the sudden rain showers not unusual in Bermuda as well as accommodating a refreshment room for the general public.

ADDITIONAL ILLUSTRATIONS OF THE TENNIS STADIUM APPEAR IN THE PORTFOLIO SECTION, PAGES 233-236

HILLSIDE GROUP HOUSING

A study of site planning and housing economics prepared during the summer months of 1932 under the direction of HENRY WRIGHT, architect. Collaborators were WILLIAM F. R. BALLARD, FREDERICK G. FROST, JR., KENNETH S. KASSLER and HERBERT PARKINSON. Studies and models were prepared by WILLIAM R. HUNTINGTON, ALLAN A. TWICHELL and LUCINDA BALLARD. Practicing architects served as critics.

HOUSING:

Adequate shelter in a desirable environment—to replace slums, rehabilitate blighted areas, and develop new neighborhoods as actually needed. Intended for those of lowest incomes, as a public responsibility; for clerical workers, as more suitably located than outer suburbs; for young well-to-do families, as better than usual speculative houses or apartments.

GROUP HOUSING:

An important form of housing having marked advantages of economy and adaptability for a wide variety of needs.

This type utilizes a reasonable minimum of land area per family to make possible a full complement of public services and neighborhood amenities, at a low upkeep cost with convenient community compactness, while affording a maximum of privacy and living independence.

Advanced interrelated community planning and public service economy may be applied through introduction of fully automatic, individualized service facilities, independent of costly street frontages.

A wide latitude of intergrouped single- and multi-family types of various sizes, combining the best qualities of single detached houses and apartments, is provided.

HILLSIDE GROUP HOUSING:

A relatively unexplored field for design and development of group housing.

Hillsides heretofore neglected but often conveniently accessible to the business center on the one hand or the high-class suburb on the other can be utilized.

The added cost of site development is offset by the efficient use of land area, preserving a high standard of good exposure and broad outlook.

Such housing is amenable to the most advanced techniques of design, construction, servicing, operation and community control.

ADEQUACY OF GROUP HOUSING:

A combination of two- and three-story space, which may contain within the group various sizes of one- or two-story single-family or flat dwelling suites, is adaptable. All suites accessible through individual entrance doors at the ground level.

Group housing has been advantageously extended in usefulness by recently developed individualized apartment heating, improved mechanical refrigeration and incineration. These advantages eliminate the necessity for direct street frontages so that deep blocks can be utilized and street noises insulated.

Dwelling types developed from the old monotonous "row" house can be utilized, if broken up into short rows or grouped together with improved plans through broader frontage.

Economies in construction, land use and maintenance costs are combined. Party walls are substituted for wasteful and useless exposed side court walls.

Cross ventilation and outlook in dwellings, and concentrated effective open spaces with useful play and garden areas, are provided.

PRINCIPLES OF HILLSIDE HOUSING:

All the principles of group housing, relieving monotony in grouping by economical and effective vertical offsets at party walls, are utilized.

Gradients from 12 to 18 per cent—a usual maximum—here are regarded as "moderate," and 20 to 43 per cent as "steep." Earth embankments for grade changes up to full-story drops economically retained by group foundations.

Interrelated building and site planning, with careful juxtaposition of groups, provides within small land area and efficient construction costs the following standards of amenity:

Sunlight penetration to practically all living areas at all seasons.

Broad outlook in a horizontal plane for main living rooms of every dwelling unit.

Dooryard or roof garden for every family with very few exceptions in end units.

Elimination of part or all internal stair climbing and avoidance of duplicated inside and outside stair climbing even in two- and three-story two-family dwellings.

Open recreational and park spaces are concentrated as effective foreground and barrier between adjoining developments, providing low-gradient walkways at park levels and, where necessary, additional driveways, parking and garages at secondary levels.

Orientation is on favorable slopes in respect to climatic conditions, but reinforced by the selection of favorable plan types and organization of grouping in relation to slope and direction.

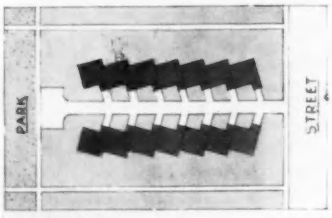
Roof gardens and penthouse workrooms are obtained by utilizing various vertical offsets for sheltering rear walls; open balcony rails toward outlook direction.

Landscape treatment is designed to isolate individual garden space; terraces and intervening common spaces devoted to easily-maintained ground-cover vines or low mass-shrubbery.

Form of occupancy is arranged to avoid administration of complicated deed lines and to permit overlapping of use for roof and garden areas.

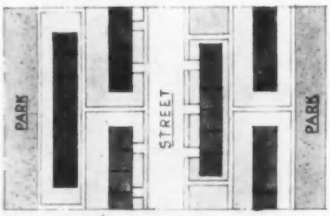
BASIC TECHNIQUE OF HILLSIDE GROUP HOUSING

SITE RELATIONSHIP:



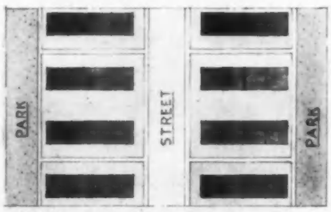
SLOPE DOWN FIG. 1

LATERAL to an entrance lane but perpendicular to public street, with individual garage approach for maximum 15 per cent slope. One lane for double group rows running north and south, one lane for each group row east and west.



SLOPE DOWN FIG. 2

PARALLEL to street. Group rows in two or more tiers above or below street are staggered for outlook and approach. Street front tiers have integral garages; others have garage groups on street front.



SLOPE DOWN FIG. 3

PERPENDICULAR to street. Group rows extend up or downhill from street as a base. Outlook is diagonal between groups, and dwelling units may be offset for direct view.

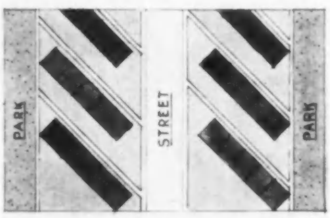


FIG. 4

DIAGONAL to street. Group rows are at a 45-degree (more or less) angle to the street and to general direction of hill slope. Where street also slopes the angle to contours will be additionally acute.

ORIENTATION AND SLOPES

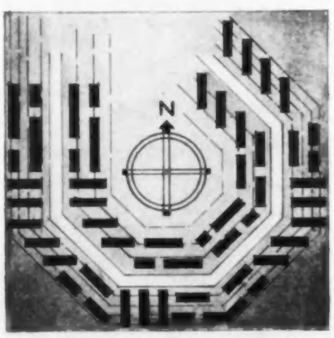
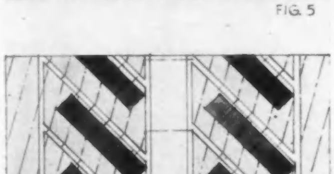


FIG. 5

CHART OF FAVORABLE EXPOSURES shows approximate range of desirable slope exposures for a north central region where the prevailing summer breezes are south to north and winter winds from the northwest.



LINES INDICATE CONTOUR INTERVALS EQUAL TO DROP IN UNITS. FIG. 6

PARALLEL SLOPE RELATIONSHIP is the case where streets are practically level and the group is at the same relation to the street and to contours.

COMPLEX SLOPE RELATIONSHIP results from placing a steeply sloping street on still steeper hillside gradients.

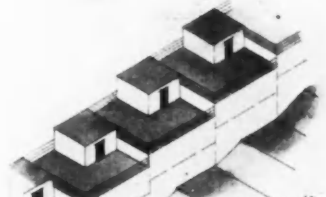
GROUP ORGANIZATION

SLOPE ± 7½% FIG. 7

SIMPLE STEP-DOWNS: When the street is approximately level there is a step-down of one-half to one full story either from front to back for groups parallel to the street, or from one dwelling unit to the next in groups perpendicular to the street. In the diagonal arrangement, step-downs occur in both directions.

SLOPE ± 10% FIG. 8

LESS THAN HALF-STORY DROPS: Fig. 7. May be utilized to secure a reasonably good outlook especially where groups are further elevated above each other through relation to sloping streets. Roofs may be reached by full flight stair to "own" roof. units may also be offset.



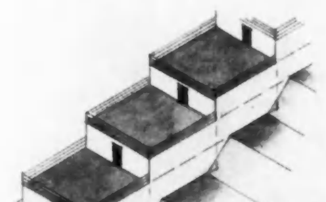
SLOPE ± 17½% FIG. 9

TWO ONE-THIRD STORY DROPS. Fig. 8. May be combined at alternate party walls to produce a 10 per cent slope and give each alternate unit direct roof access above adjoining unit.

SLOPE ± 20% FIG. 10

HALF-STORY DROPS: Fig. 9. Provide roof garden for each unit by full flight stairs to own or half-flight to adjoining roof. Combined height of drop and parapet provides back wall for penthouse space.

HOUSES PAIRED: Fig. 10. With alternate full-story drops and bedroom portions superimposed.

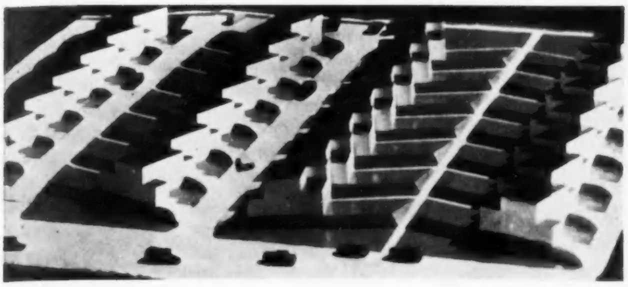


SLOPE ± 30% FIG. 11

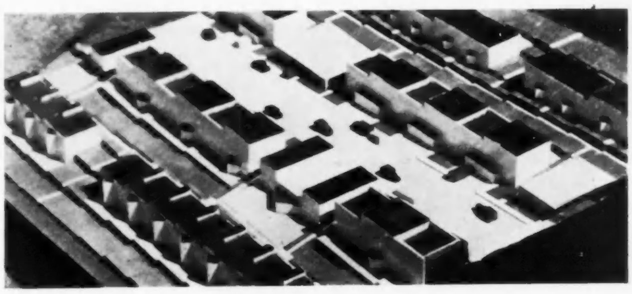
FULL-STORY DROPS: Fig. 11. Possible in many of the basic schemes, offering roof access directly upon next lower unit. Two-family (two story) units entirely without internal stairs. Portions of dwellings in one story may overlap those of another to superimpose plumbing or for storage. (See also Fig. 10.)

SLOPE ± 40% FIG. 12

COMPLEX STEP-DOWNS: Fig. 12. When the street also rises at a moderately steep gradient, the contours are rendered partially diagonal in perpendicular and parallel groupings, and more acute in diagonal groupings, providing an additional grade difference between groups and increasing outlook.



TYPE "A"— LATERAL



TYPE "B"— PARALLEL

"A"—LATERAL
15% Slope
One-Family Dwellings
With integral garages entered from private lane at approximate right angle to public street. Two group arrangements possible: one with drive between each pair of rows. The other with drive for each 14 dwellings, 14 garages.

"B"—PARALLEL
24¾% Slope
1- and 2-Family Houses
Grouped in tiers or rows parallel to street. Two rows on street have integral garages; garages for other rows are between. Complex relationship to hill slope with street rising 10% and vertical rise 22½%. 60 families, 54 garages.

"C"— PERPENDICULAR
31% Slope
Two-Family Dwellings
With full-story drop between all units. Offsets for diagonal views from garden side rooms. Roof gardens directly accessible to upper living floors. Entrance and garden courts alternate.
40 dwellings, 40 garages.

"D"—DIAGONAL
43½% Slope
Three-Family Dwellings
Full drop between units. Two stories high on entrance side, three stories on garden side. Entry side slope 31%. Upper story in three-story unit entered without internal stairs. Two duplexes in lower part. 48 dwellings, 44 garages.

TYPE "C"— PERPENDICULAR

TYPE "D"— DIAGONAL

UNIFORM BASIC ASSUMPTIONS FOR DESIGN OF HILLSIDE GROUP HOUSING

Engineering

Uniform hypothetical slopes or gradients, and not actual or specific site conditions. Favorable orientations of slope are from northeast to west, depending on type of plan. Soil susceptible to steam shovel excavation without danger of "slides," and providing built-up slopes suitable for landscape treatment at a maximum slope of 1′ rise to 2′ run, otherwise held by retaining walls which in all cases rest on natural earth. Outside steps: 6″ rise and 12″ treads.

Landscape

Parks form the foreground of all schemes, devoted in most cases to recreation and gently inclined paths or drives. Garden areas provide individual gardens, with all slope and unutilized space planted with "ground cover" vines or low mass shrubbery easy to maintain. Hedges are used for boundaries and formal effects.

Construction

It is assumed that of the various new methods now emerging, for housing primarily, a satisfactory, economical and effective form of construction will be available, offering walls thinner than brick and providing usable roof surfaces and reasonable sound-deadening and heat insulation.

Servicing

Refrigeration universally mechanical. Refuse disposal by incineration except in "Lateral" scheme. (Exhaust flues may be carried through groups to highest point.) Heating by piped fuel to individual unit or suite heaters, automatically controlled or accessible to outside janitoring. Utilities and sewers run irrespective of property dividing lines.

Ownership and Use

The obvious gains of hillside housing by the added use of roof space over adjoining suites, together with other complexities, make desirable and essential the adoption of some form of joint-stock or other semi-cooperative form of ownership or leasehold, which latter should, however, develop a sense of individual relation to and responsibility for the use of a given dwelling unit, or group unit, over a reasonable period of time.

Production Costs

Building construction is figured uniformly at 25¢ per cubic foot for the bare structure only, with carefully estimated costs in addition for all heating, plumbing, utility connections, fixtures, and incinerators.

"A" LATERAL
ONE-FAMILY DWELLINGS

ONE-FAMILY DWELLINGS: Five rooms each, including large living-dining room. Garages integral. Second-story terrace accessible from two bedrooms and hall; access also to adjacent roof terrace.

15% SLOPE as shown; adaptable to any grade between zero and 15%. Maximum fixed by grade for automobile access. Drop of 4½ feet between units at 15% gradient. Accessibility: average walk up to park or down to street, 2¼ stories in groups as shown.

10.1 FAMILIES HOUSED PER ACRE in scheme as shown, including upper 40-foot park strip and half of lower 55-foot street.

SEVEN ONE-FAMILY UNITS PER GROUP as shown. Number limited by desirable length of cul-de-sac. Groups perpendicular to street, with tributary motor lanes. Spacing: groups 75 feet apart (clear space) across two gardens, 67 feet in clear across motor lane, 98 feet, over-all on centers. Saw-tooth form adds to actual openness.

ORIENTATION: Advantageous on hills sloping between southeast and southwest for grouping as shown. Application to other slopes equally desirable with revision of site-plan.

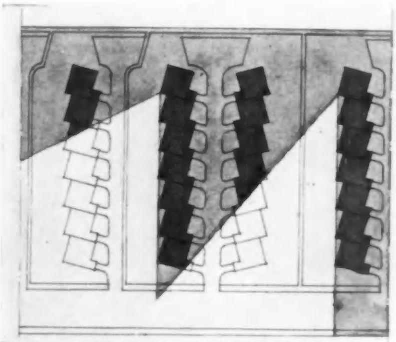
ECONOMIC DATA:
Dwellings contain five rooms and garage each.

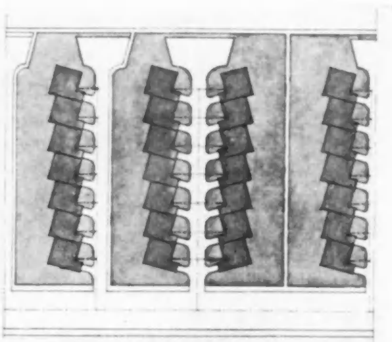
Cost of building per family:

16,069 cu. ft. @ $0.25	$4,017
Equipment (uniform basis)	$1,495
Land and site development	$1,520
15% of above: overhead, financing, profit	$1,054
TOTAL COST PER FAMILY	**$8,086**

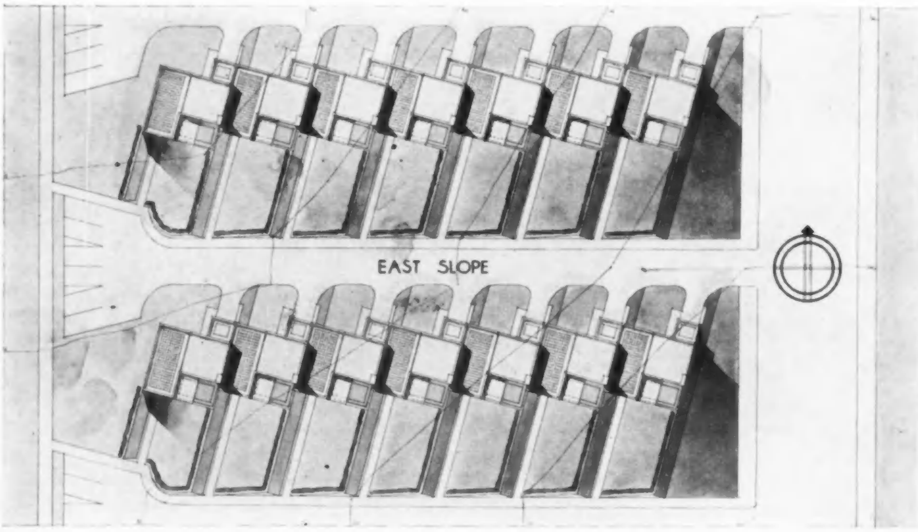
(Or per room: $1617)

MONTHLY COST:
AT 1%: $80.86
(Without heat)

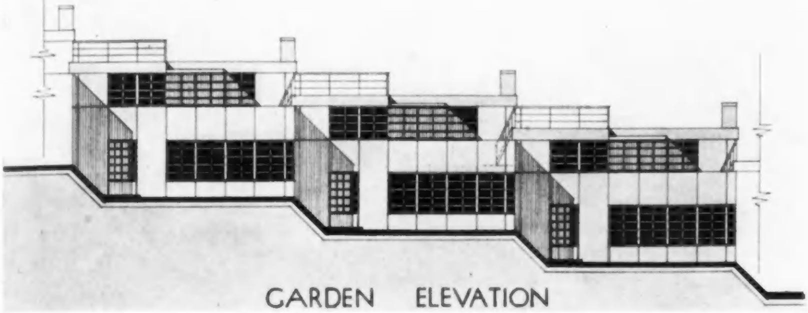

VIEW DIAGRAM

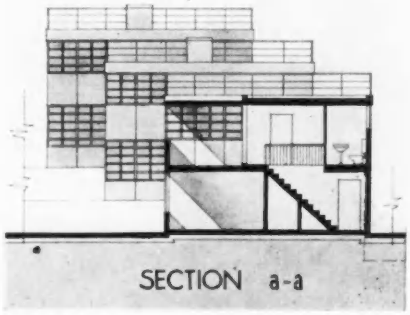

UTILITY DIAGRAM

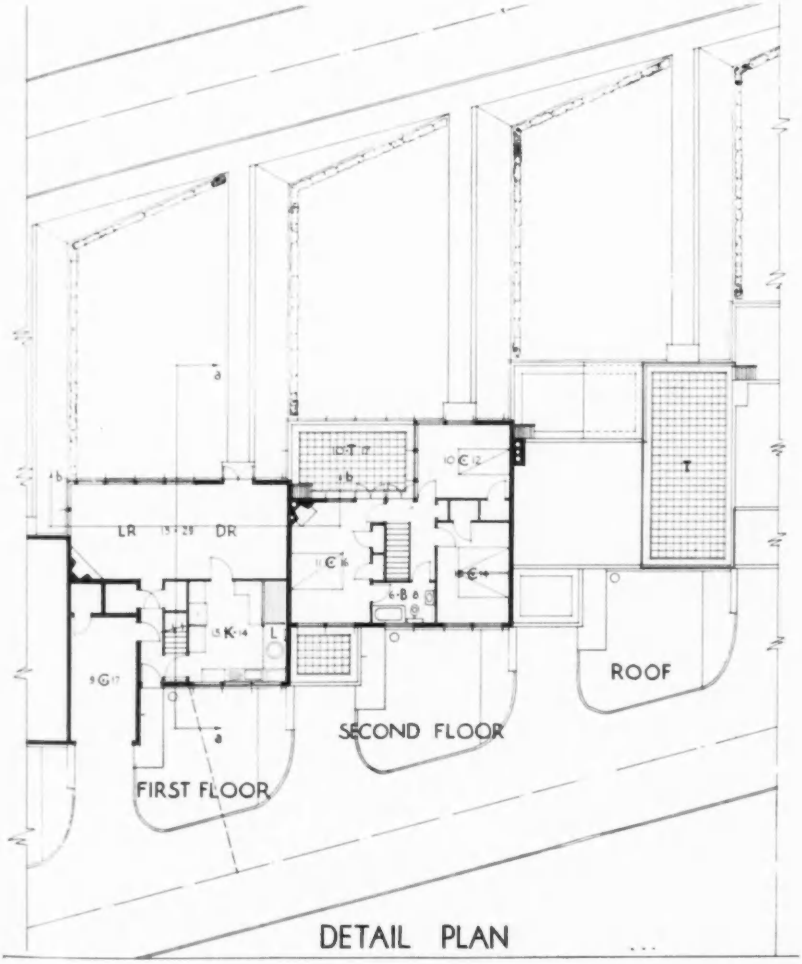
SPECIAL FEATURES: Large kitchen with convertible laundry. Fireplace in master bedroom. Each family has two terraces and garden. Pedestrians segregated from motor traffic as at Radburn.



PLOT PLAN


GARDEN ELEVATION


SECTION a-a

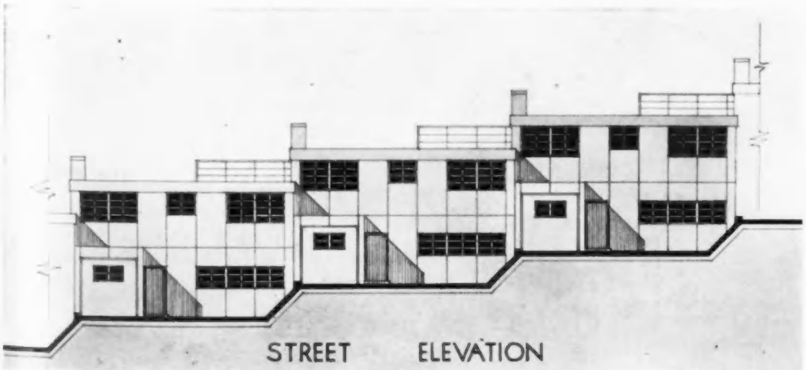


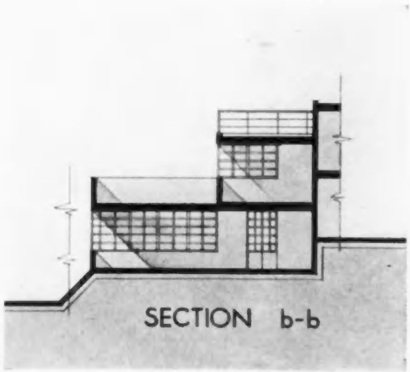
DETAIL PLAN

The "A" Type is based on the "Radburn" system of lane frontage for dwellings with individual garage access removed from the main street and its noise. It is planned for a maximum gradient of 15% within the lane, a grade which may be employed with enhanced effective outlook where the main street itself slopes appreciably. Two site organizations are possible—one in which the lane is repeated for each tier of dwellings; the other in which the lane serves two rows of dwellings. Either can be used where groups run north and south; the one illustrated only in case of groups running east or west.

In case of the double lane entrance arrangement it is necessary to provide a garden path from a central walk between groups to afford pedestrian entrance. In the plan shown the path adjoining the drive forms the pedestrian approach to the group served by the drive, so that the entire public entrance to the house may be confined to the driveway front.

This type, with its second-story balcony, may be developed without encroachment on adjoining roofs.


STREET ELEVATION


SECTION b-b

"B" PARALLEL

ONE- AND TWO-FAMILY DWELLINGS

ONE-FAMILY AND TWO-FAMILY (FLAT) DWELLINGS of several types distributed throughout the scheme. Suites average 5 rooms. Roof terrace or individual garden for each family.

24¾% SLOPE perpendicular to contours. Street diagonal to contours; 10% gradient in street and parallel walks; 22½% gradient perpendicular to street. Accessibility: two interior rows of dwellings have normal relation to street; for others the average walk up or down to street and garages is two stories.

17.4 FAMILIES HOUSED PER ACRE including two 40-foot park strips and 55-foot motor street. Spacing: groups 67 feet on centers, 40 feet in clear on garden side; 85 feet in clear across motor street.

MAKE-UP OF GROUPS: Four tiers all parallel to street. Upper tier: one-family houses. Second and third tiers: two-family and one-family dwellings in each group. Lower tier: two-family dwellings.

ORIENTATION: Advantageous on slopes between east and west through south. Northeast and northwest slopes retain desirable north-south axis of buildings, but inferior sunlight penetration.

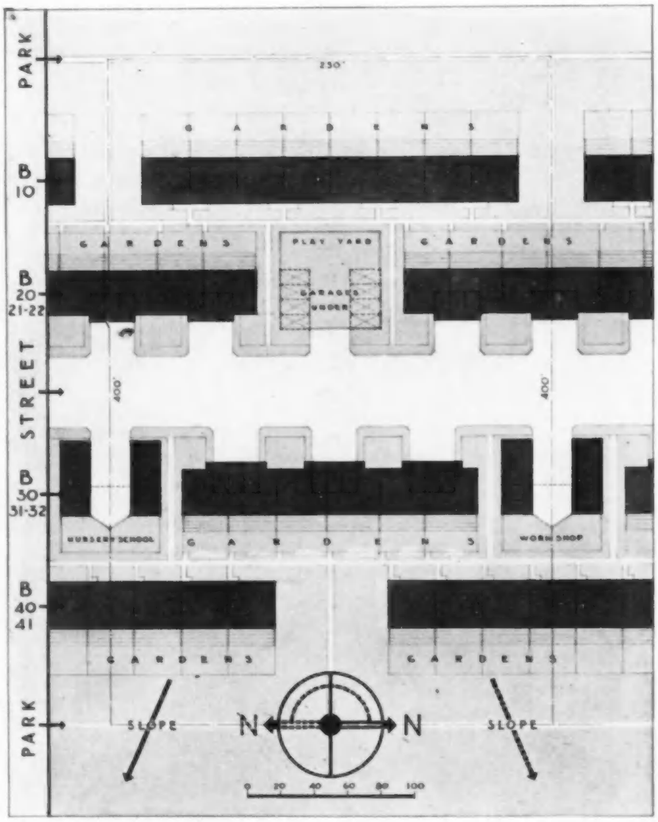
ECONOMIC DATA:

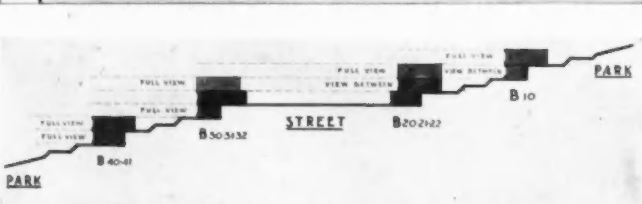
Average 5-room suite and 1-car garage.

Building cost per family	(average of entire scheme)
11,314 cu. ft. @ $0.25	$2,828
Equipment (uniform basis)	$1,343
Land and site development	$ 875
15% of above: overhead, financing, profit, etc.	$ 756

TOTAL COST PER FAMILY . . . $5,802
(Or per room: $1160)

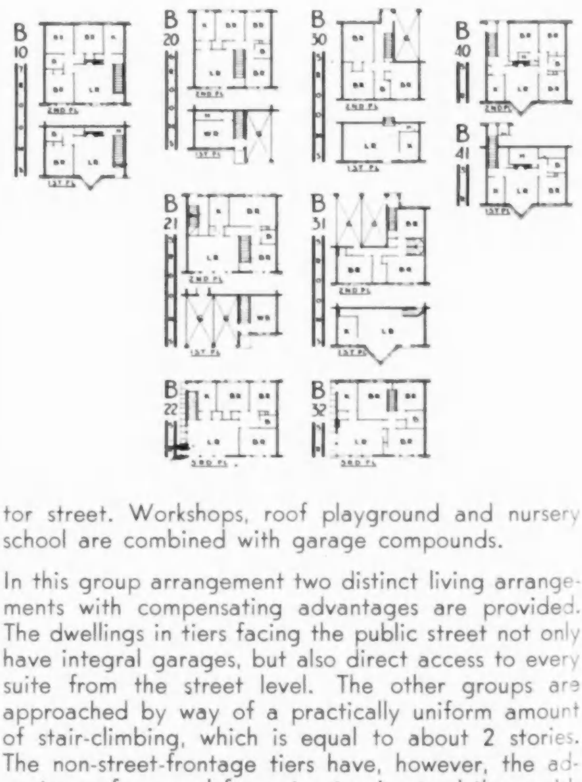
MONTHLY COST: AT 1%: $58.02
(Without heat)



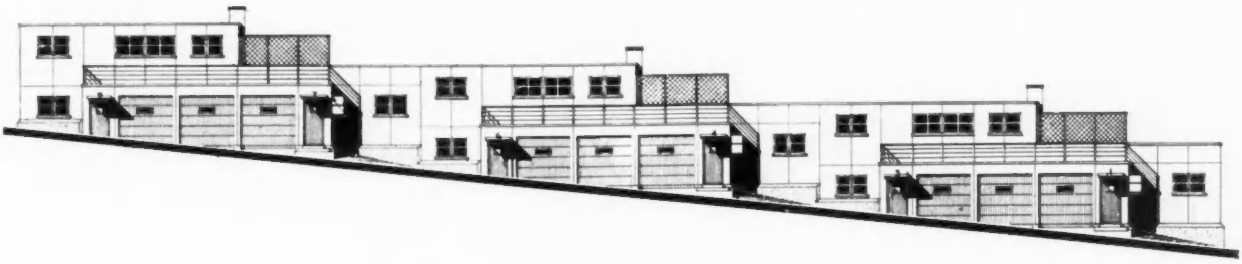


SECTION THROUGH PLOT
PERPENDICULAR TO STREET

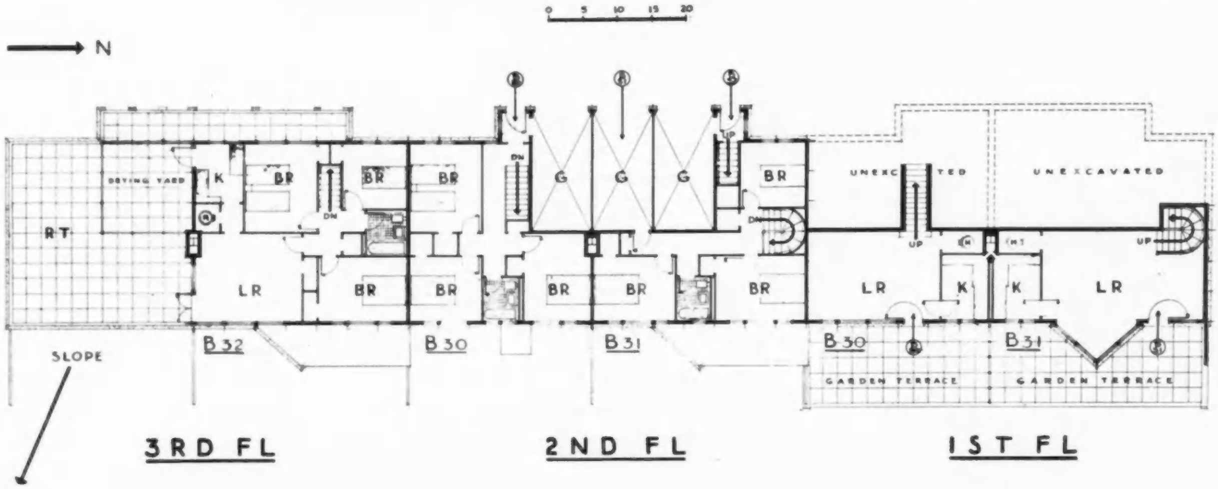
SPECIAL FEATURES: Included in building cost and site-area are 36 garages for 40 families. This scheme obtains closest average proximity to park and to motor street. Workshops, roof playground and nursery school are combined with garage compounds.



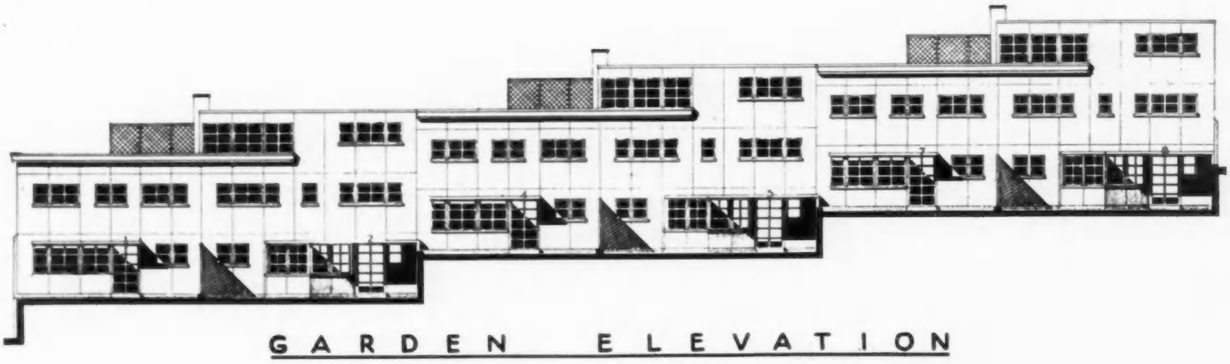
In this group arrangement two distinct living arrangements with compensating advantages are provided. The dwellings in tiers facing the public street not only have integral garages, but also direct access to every suite from the street level. The other groups are approached by way of a practically uniform amount of stair-climbing, which is equal to about 2 stories. The non-street-frontage tiers have, however, the advantage of removal from street noises and those with the greatest amount of climb have the most extended outlook over the common park areas. Garages are provided for these groups in the directly opposite location. The alternating of breaks between groups adds to the completeness of outlook for all dwellings in the scheme.



STREET ELEVATION



3RD FL 2ND FL 1ST FL



GARDEN ELEVATION

Several types of dwellings are here arranged in response to the various conditions obtaining in the different tiers. The resulting variety would serve a community of fairly complex make-up and yet permit sufficient repetition for economical construction. The dwellings range in size from B-10 in the upper tier, with 7 rooms and 2 baths, to B-41, with 3 rooms and bath, in the lower tier. In all tiers, the main living room of each suite faces downhill and toward the best outlook and exposure.

This grouping, together with the other non-street-frontage schemes "C" and "D," represents only a slight departure from principles already successfully employed at Sunnyside Gardens and at Chatham Village developments where certain houses have been entirely removed from street frontage—the major street functions of fuel and ice delivery and ash removal having been obviated by recent technical advances in these services. The economies of full separation of dwelling and public street thus become both feasible and logical for all forms of group housing.

The B-20 tier, facing the upper side of the street, has no living rooms at the street level, the space being occupied entirely by garages or a workshop.

The B-30 tier of dwellings provides again garages for every family, placing them on the second floor of the dwellings. In both street-frontage tiers, garage compounds are provided for the non-frontage houses of the other tiers. In the B-30 tier there are three differently arranged suites in each pair of units. A two-story one-family dwelling adjoins a three-story two-family unit in which one family occupies the two lower floors and the second family the upper floor. Each of the suites in the lower floors has a broad-front living room opening upon a garden terrace, while the top-floor suite has direct access to a roof terrace. All suites are entered from the street side, the lower suites having additional approach from the garden. The grouping of these tiers carries out the principle of a two-thirds-story drop at alternate party walls. The lower park-front tier, B-40, contains two dwellings in each unit.

"C" PERPENDICULAR
TWO-FAMILY DWELLINGS

TWO-FAMILY DWELLINGS ("FLATS"): Four rooms each, with two bedrooms and large living-dining room; workshop in basement for each unit. Each unit drops one full story below the preceding, upper flats opening directly upon the terraced roof of unit below. Gardens are provided for ground-floor families.

31% SLOPE: For full rows of six two-family units the average walk up to street or down to park is two stories. The average walk up to the two-level garage is three stories for all families.

16 FAMILIES HOUSED PER ACRE, including lower park 65 feet wide and half of upper 55 foot street.

SIX TWO-FAMILY UNITS in longer groups. Placed perpendicular to street. Spacing: groups 90 feet on centers, spaced 50 feet in clear on entrance, and 60 feet on garden sides. Saw-tooth form adds to actual openness.

ORIENTATION: Advantageous on slopes between southeast and southwest. East or west slopes require a different plan for alternate groups to give south exposure to living rooms.

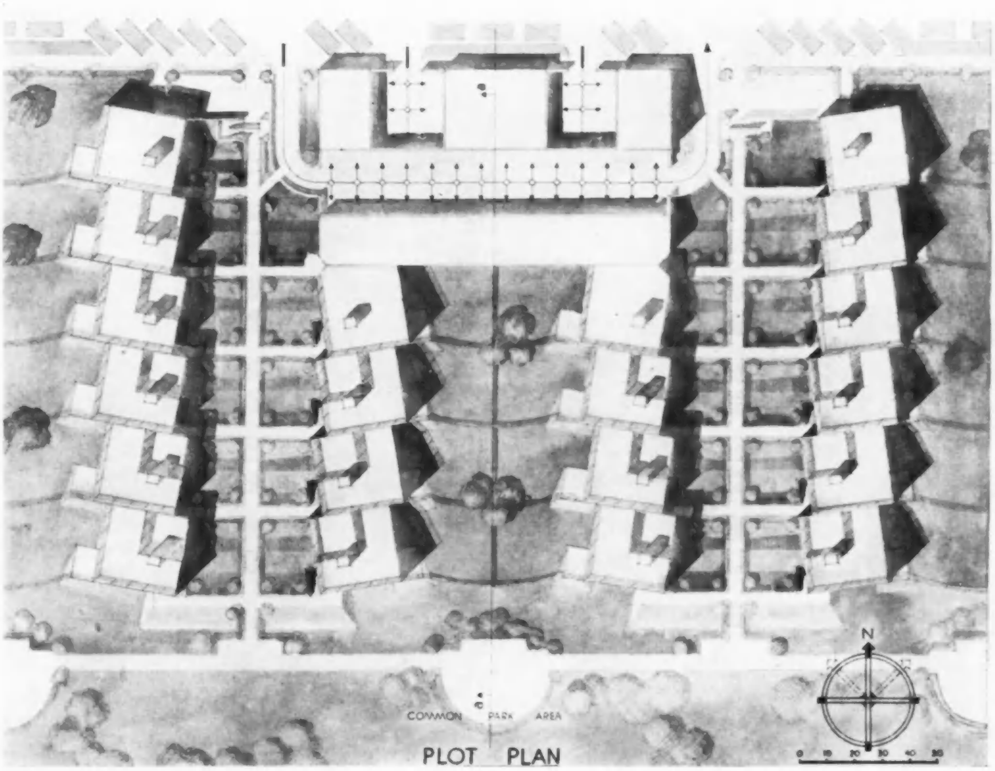
ECONOMIC DATA: Four-room suite and 1-car garage. Cost of building per family:

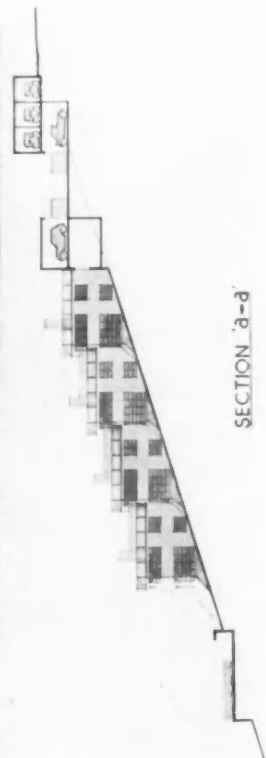
10,764 cu. ft. @ $0.25 . . . . $2,691
Equipment (uniform basis) . . $1,163
Land and site development . $ 942
15% of above: overhead, financing, profit, etc. . . . $ 719

TOTAL COST PER FAMILY **$5,515**
(Or per room: $1379)

MONTHLY COST: AT 1%: $55.15
(Without heat)

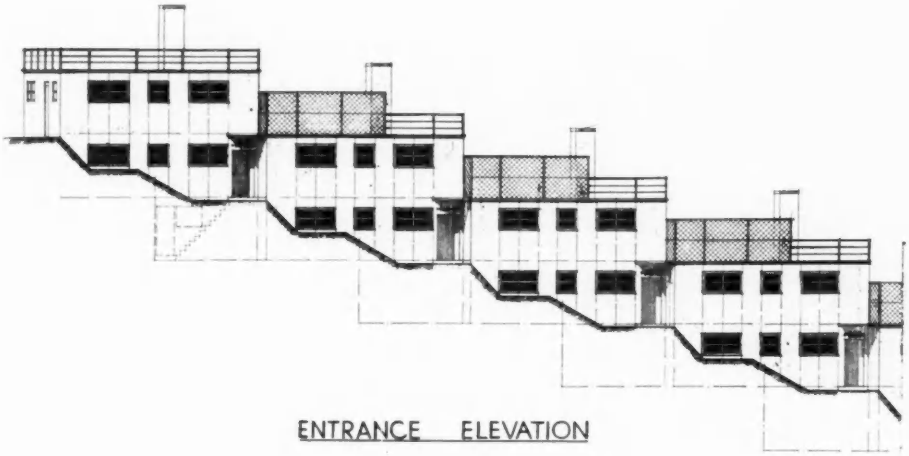
SPECIAL FEATURES: No internal stairs required to reach any dwelling or roof garden. One outside flight down from entry leads to basement workshop. Included in building cost and site-areas are 40 garages and workshop for 40 families in two-level garage compound.



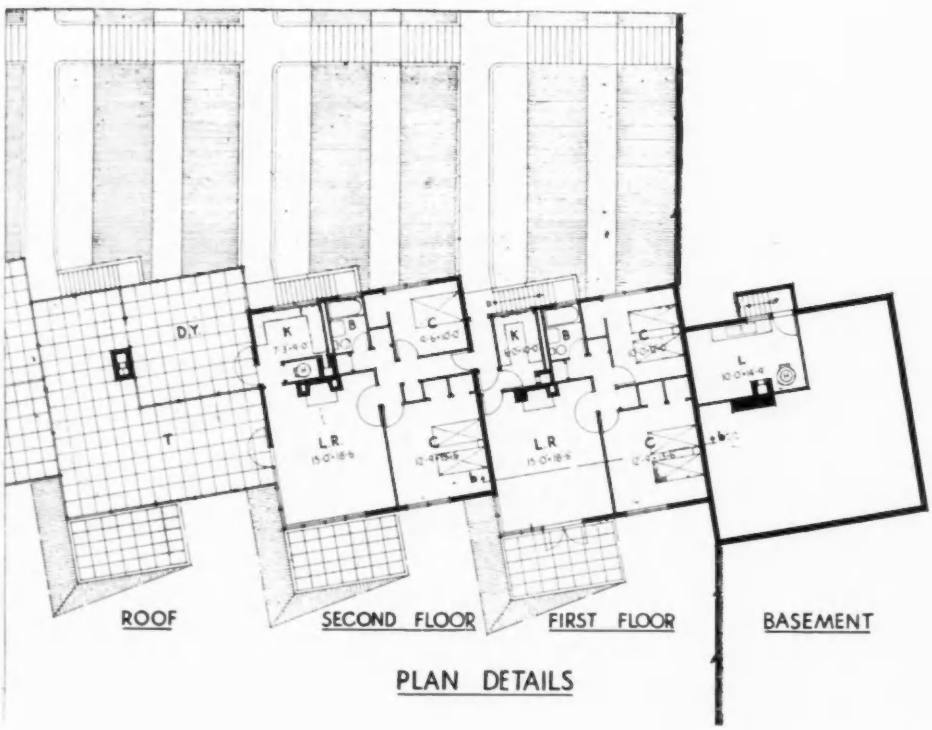


FIRST FLOOR SECOND FLOOR
VISIBILITY DIAGRAM

Groups of six two-family units are here arranged perpendicular to the street on a down-hill slope of 31% with entrance walks in alternate spaces, leaving garden fronts uninvaded and at approximately natural grade. A two-story garage unit provides one garage for each family in the four groups, accessible from the service walks. As shown, with a full story drop between adjoining units, the total stair-climb might be considered excessive, and could be relieved by providing both access and garages off a secondary road at the bottom of the park strip.

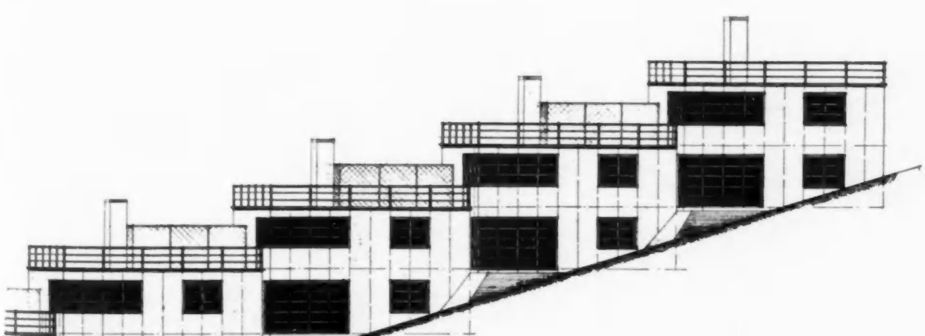


ENTRANCE ELEVATION



ROOF SECOND FLOOR FIRST FLOOR BASEMENT

PLAN DETAILS



GARDEN ELEVATION

The spacing on the garden fronts is 64 feet between rows (in the clear) with six feet additional space formed by the offsets on each side.

These offsets provide a corner downhill exposure for all living rooms on both floors. The visibility diagram (on opposite page) indicates the actual horizontal outlook from these first- and second-story corner viewpoints.

By reason of the full story drop between units — the principal approach being down-hill from the street— the entrance vestibules serve in each case the first-floor suite in one unit and the second floor of the next.

The basement workshop is accessible from this point of entrance for the same two families.

The upper suite has direct access to a kitchen yard and roof garden on the roof of the next adjoining building in all cases except for the lowest unit, which has the compensating advantage of uninterrupted outlook from its entire end wall.

Community and storage rooms may be provided under the garage unit, and in the normally unexcavated space of the lowest dwelling units facing the park. Baby carriages could be stored in both locations.

"D" DIAGONAL

THREE-FAMILY DWELLINGS

THREE-FAMILY DWELLINGS: Top story: one five-room flat. Two lower stories: paired two-story houses entered on the second floor, with three and four rooms respectively. Each unit drops a full story, with access to adjoining roof for upper flat.

43.5% SLOPE: Although diagonal entrance walks have gradient of only 31%. Accessibility: for twelve families in four units the average walk up is 1.7 stories to garage and 2.2 stories to street.

27 FAMILIES HOUSED PER ACRE: Including lower park strip of 60 feet from building wall, and half of 55-foot street.

FOUR THREE-FAMILY UNITS PER GROUP: Placed at 45° to street and to slope of hill. Spacing: groups 62 feet on centers; 88 feet on centers along street; 34 feet in clear between groups, affording adequate openness at this slope because of overlook.

ORIENTATION: Advantageously used on slopes between east and southwest, with possible use on slopes between northeast and west.

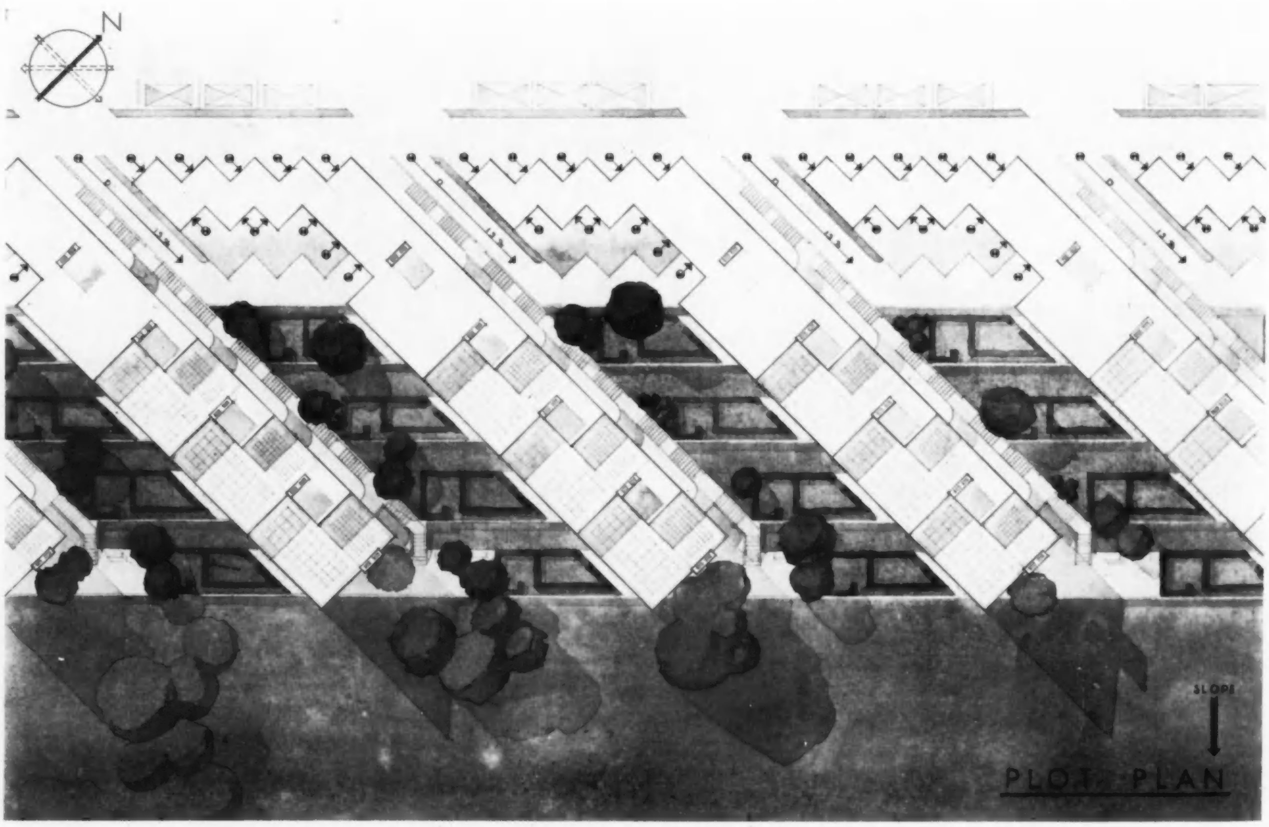
ECONOMIC DATA:
Average 4-room suite and 1-car garage.

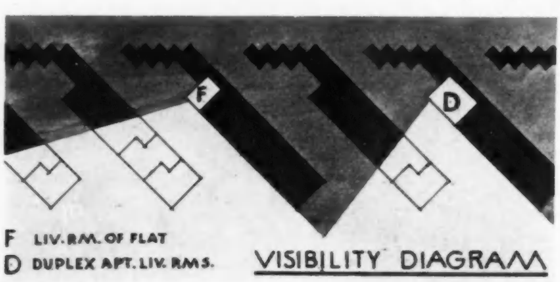
Cost of building per family	(average)
9,765 cu. ft. @ $0.25 . . .	$2,441
Equipment (uniform basis) . .	$1,062
Land and site development	$ 810
15% of above: overhead, financing, profit, ...	$ 646

TOTAL COST PER FAMILY . . . . $4,959 (Or per room: $1239)

MONTHLY COST: AT 1%: $49.59 (Without heat)

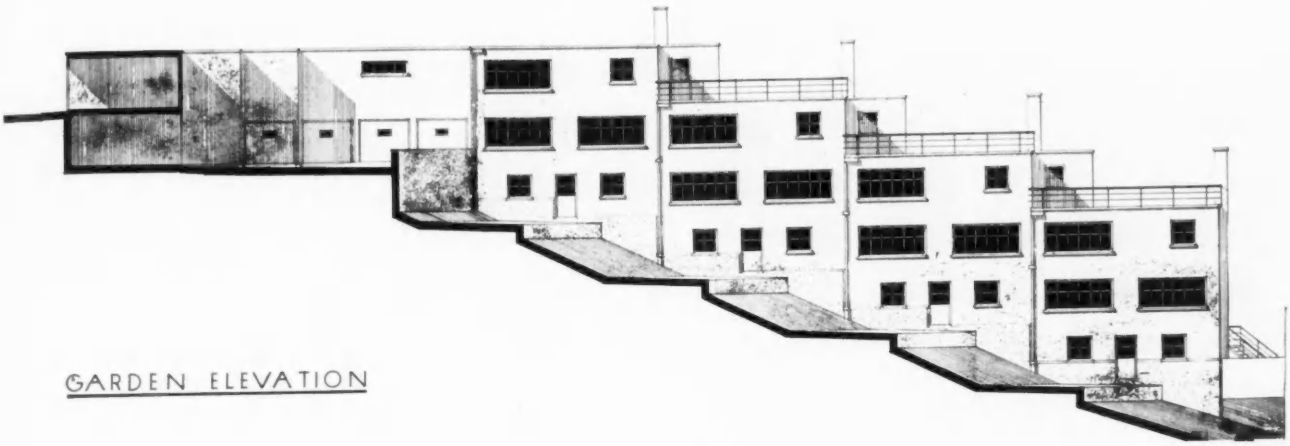
SPECIAL FEATURES: Included in building cost and site-area are 11 garages for each 12-family group; also storage room. Due to extreme steepness, park is for recreation only; all access is from the street.

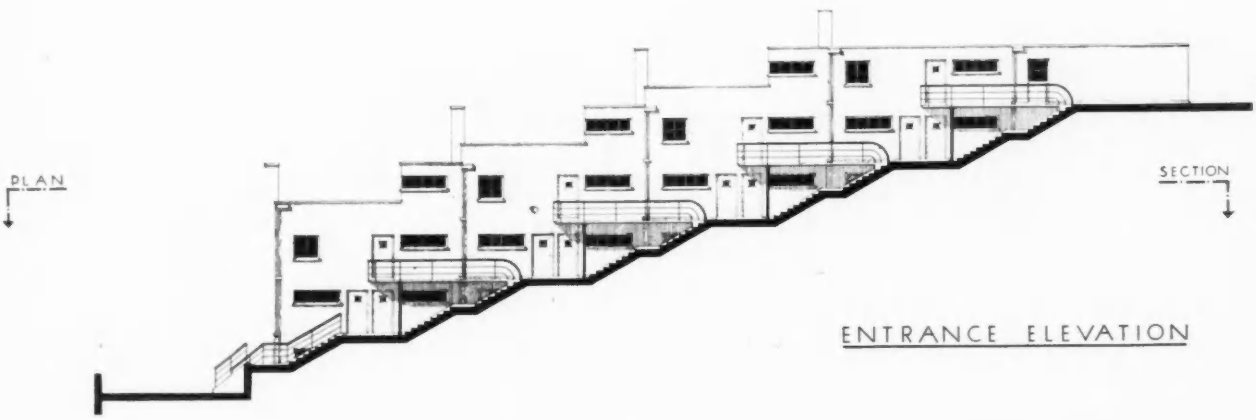


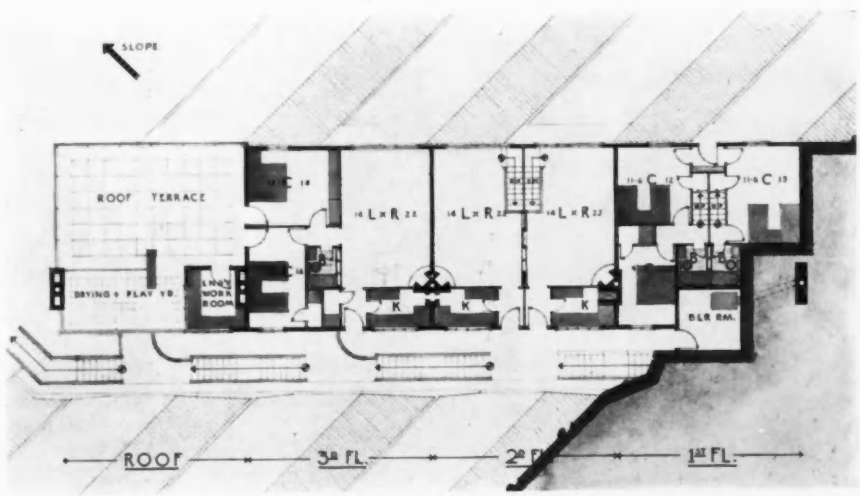


This study has been made at the extreme limit of steep gradient and intensive land-use to show the possibilities of full openness and outlook. In practice such intensity would seldom be needed; greater distance between groups would permit use of flatter grades while still preserving equivalent outlook.

In this scheme the groups are placed at an angle of 45 degrees to the hill slope and to the public street, which results in a difference in grade of one full story between the entrance and garden sides. Each three-family dwelling is arranged with entrance on the intermediate floor for two duplex houses which descend through their own internal stairs to the bedroom floor level opening on the garden. By having three dwellings in each unit, the full story drop from one unit to the next results in only four stories difference in grade for each group containing twelve suites.



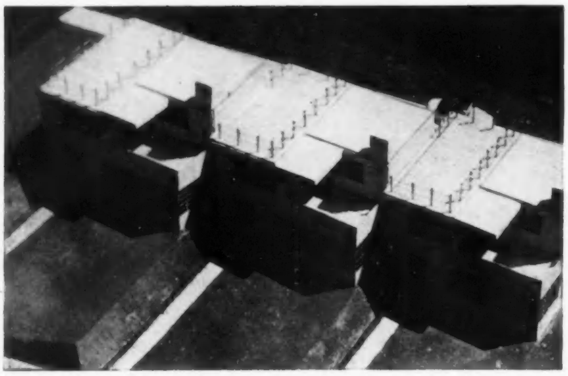




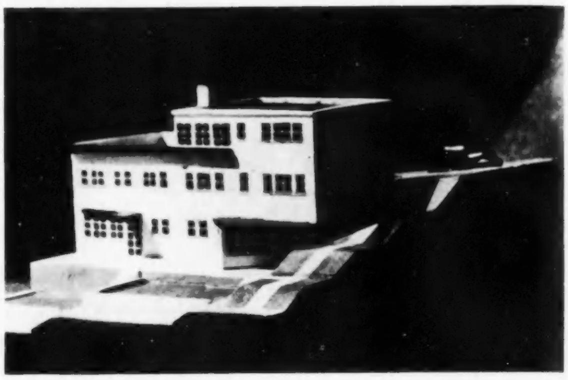
This entire study goes further toward the development of unusually steep slopes and the intensive use of land than would probably be either desirable or economical. It shows, however, the extent to which an ingenious adjustment to difficult grade conditions might be used to produce dwellings which would have a high degree of livability even under the most difficult conditions. In this case, even with a very narrow spacing beteen groups, a broad outlook is maintained for the two upper living floors in all the dwelling units, and even the lower bedroom story would have a satisfactory outlook over the roof of the lower units in the opposite group.

The actual engineering details of producing such a scheme would be by no means difficult, providing the character of the soil was such that it could be excavated to perpendicular surfaces during the period of construction, but not of such solid rock as to make excavation over-expensive. The relation of the foundations to the natural grades would not require an excessive amount of excavation, filling, or footings for either walls or buildings, other than those necessary to retain the actual garden terraces which have been shown on the model.

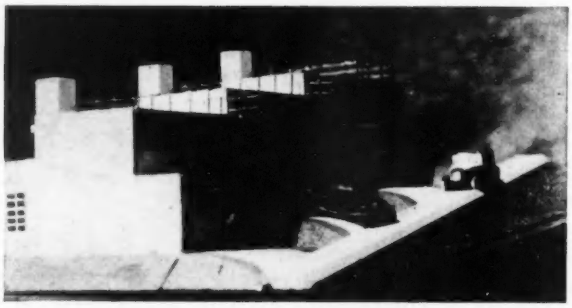
MODELS OF THE FOUR BASIC TYPES OF HILLSIDE HOUSING



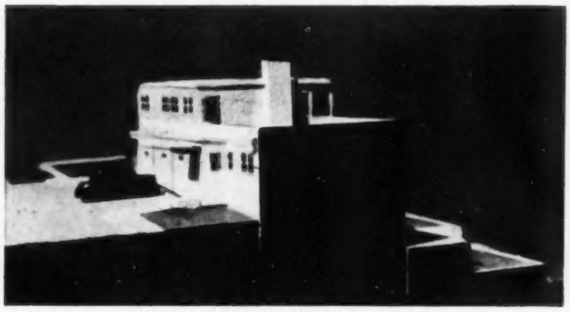
TYPE "A"



TYPE "B"



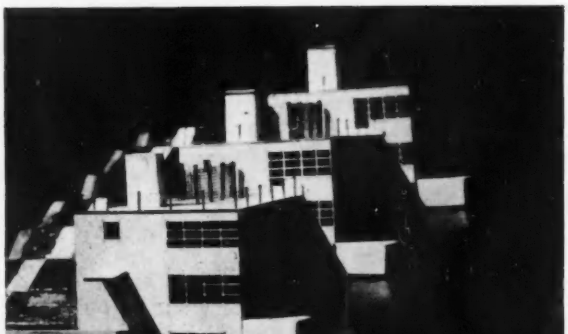
TYPE "A"—LATERAL



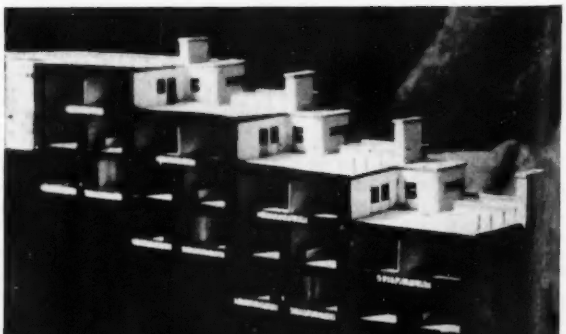
TYPE "B"—PARALLEL

TYPE "C"

TYPE "D"



TYPE "C"—PERPENDICULAR



TYPE "D"—DIAGONAL

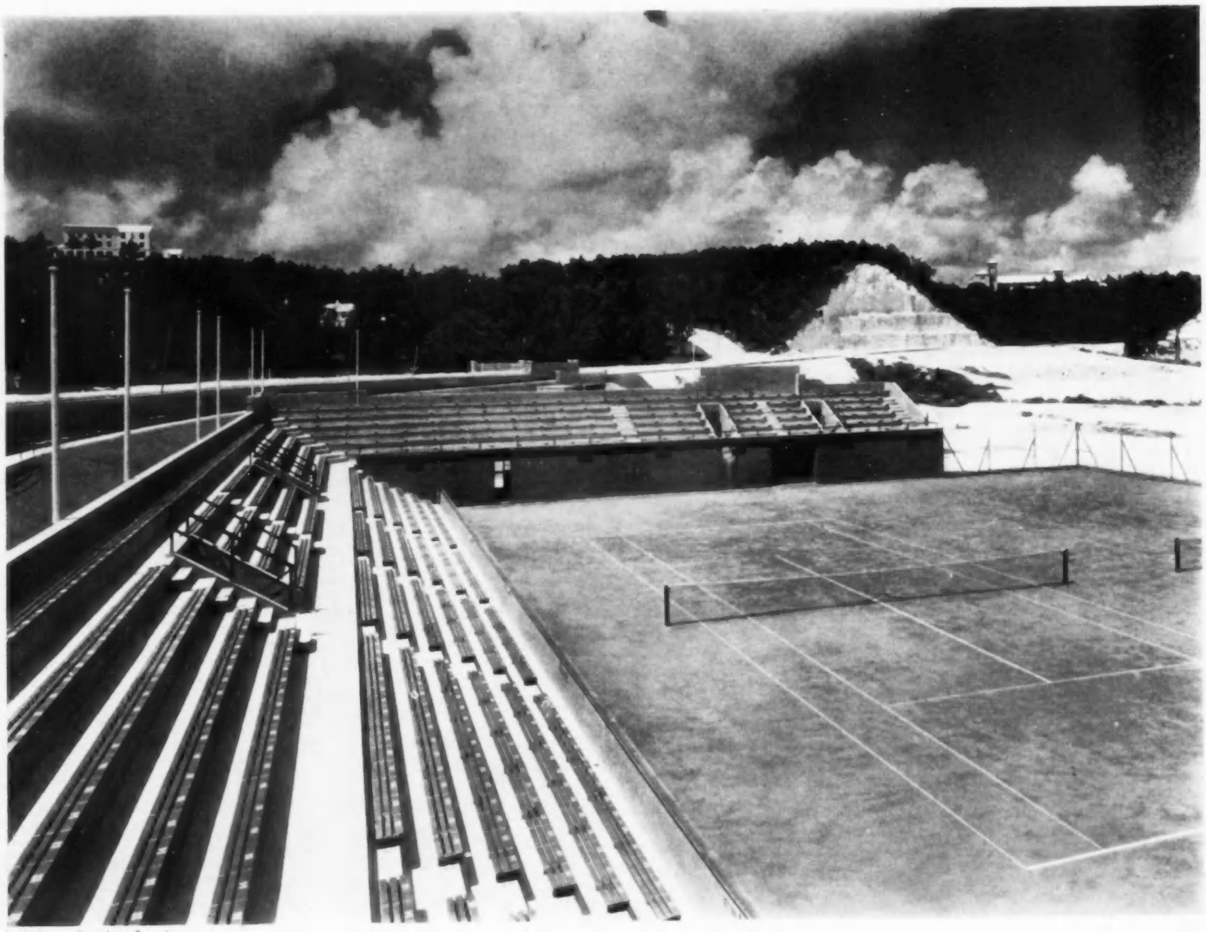
Walter Rutherford

TENNIS STADIUM AT HAMILTON, BERMUDA
GEORGE H. HUTCHINGS, ARCHITECT

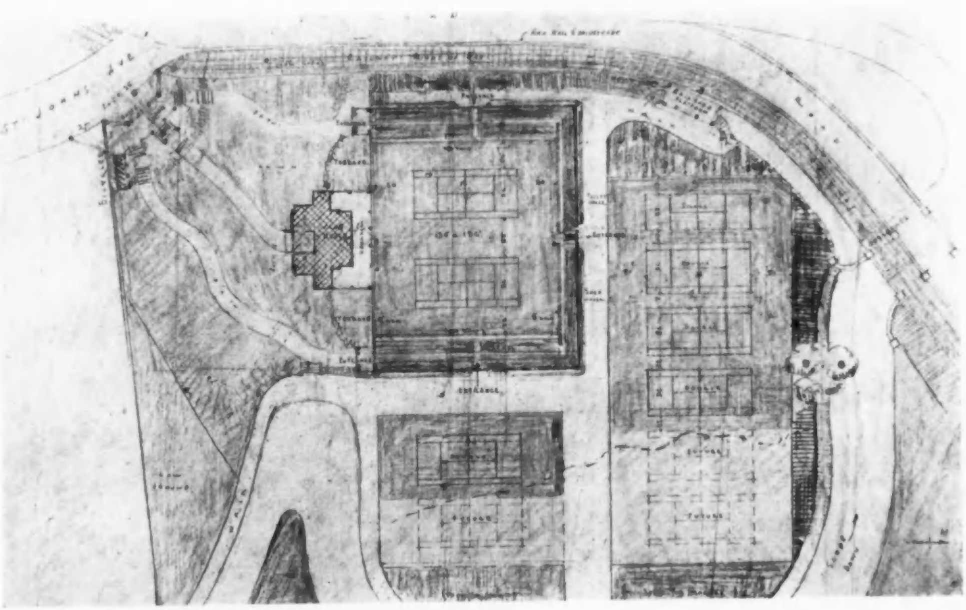
PORTFOLIO
OF CURRENT
ARCHITECTURE

OCTOBER
1932

IN ADDITION THIS PORTFOLIO FEATURES
A HOSPITAL, A PARISH HOUSE
AND A BIOLOGICAL LABORATORY

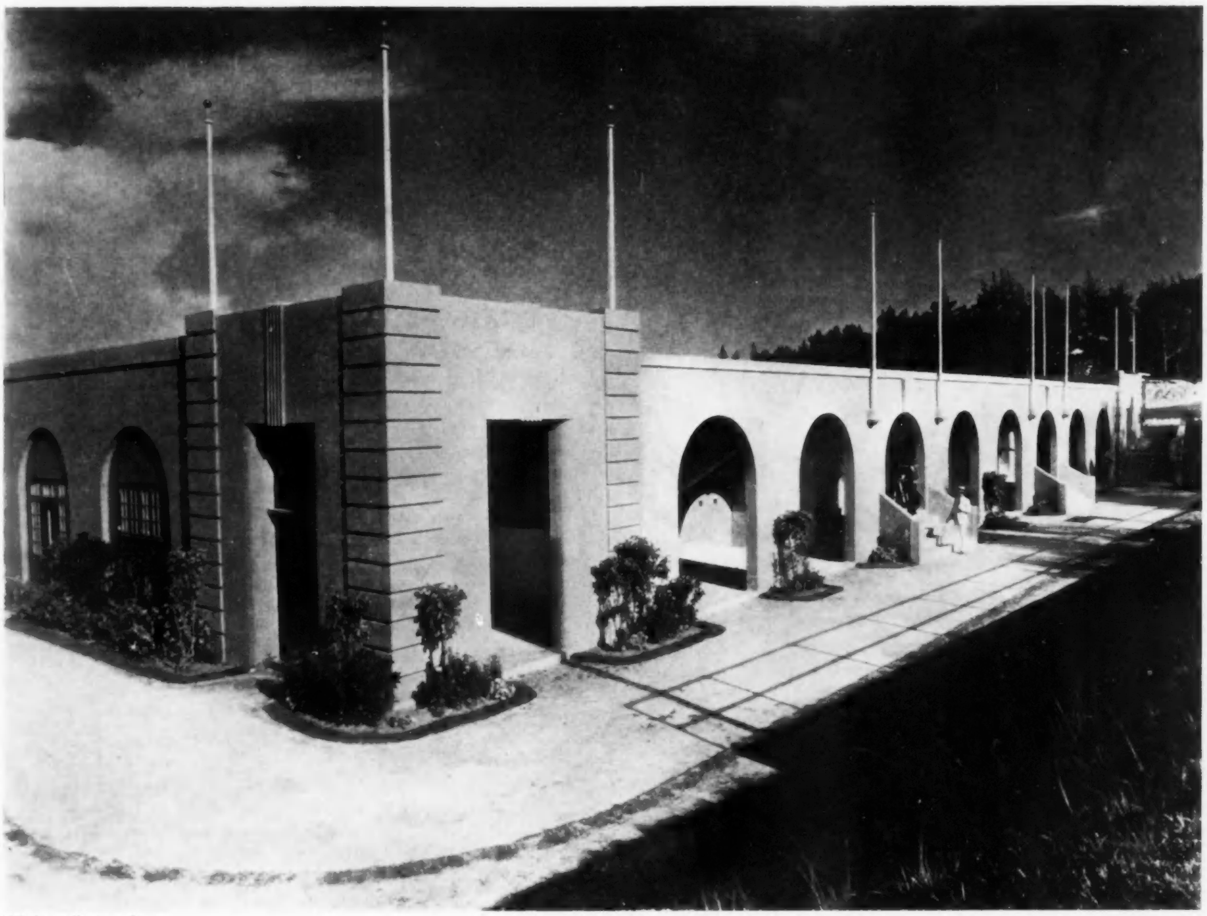


Walter Rutherford

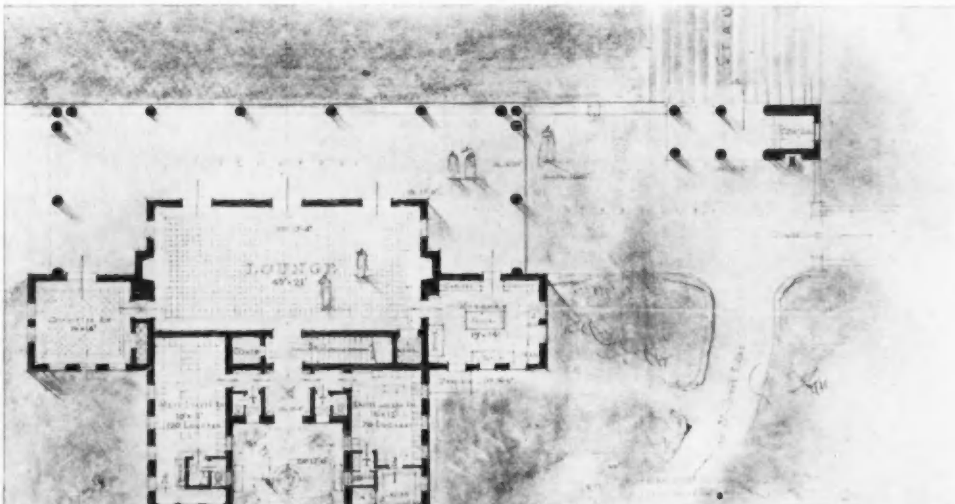


PLAN OF
TENNIS
STADIUM
and
TENNIS
COURTS

TENNIS STADIUM
HAMILTON, BERMUDA
GEORGE H. HUTCHINGS, ARCHITECT



Walter Rutherford

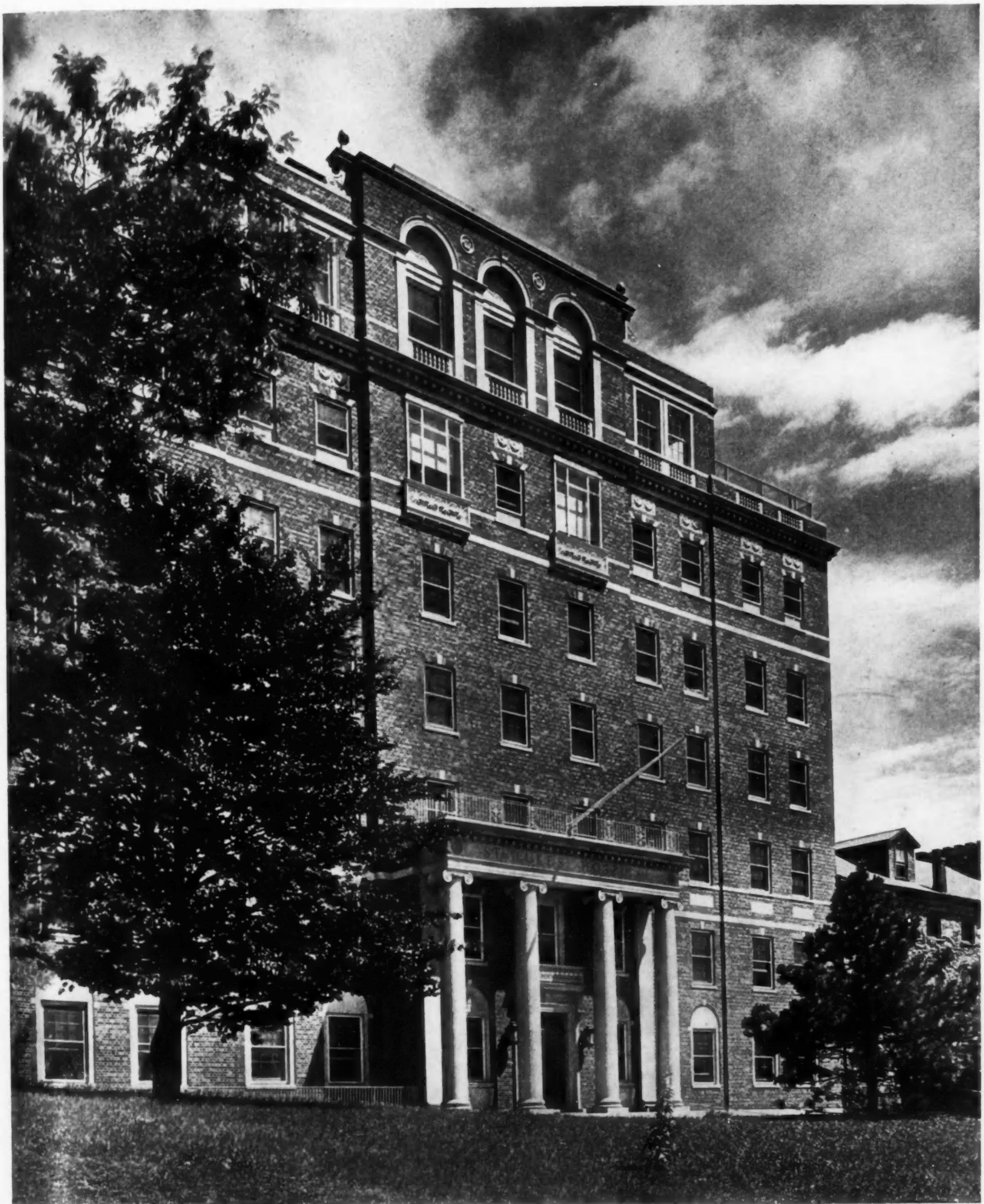


GROUND
FLOOR
PLAN
of
PROPOSED
CLUBHOUSE

TENNIS STADIUM
HAMILTON, BERMUDA
GEORGE H. HUTCHINGS, ARCHITECT

Walter Rutherford

TENNIS STADIUM
HAMILTON, BERMUDA
GEORGE H. HUTCHINGS, ARCHITECT

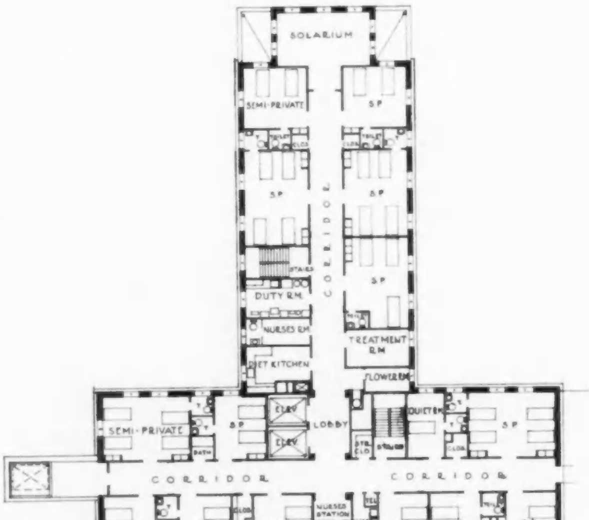


Glasgow

Main entrance on west front. This hospital accommodates 241 beds, 3 operating rooms, and a service staff of 120 persons. Cost, including equipment, was $950,000.

ST. LUKE'S HOSPITAL
NEWBURGH, NEW YORK
CROW, LEWIS AND WICK, ARCHITECTS

Glasgow

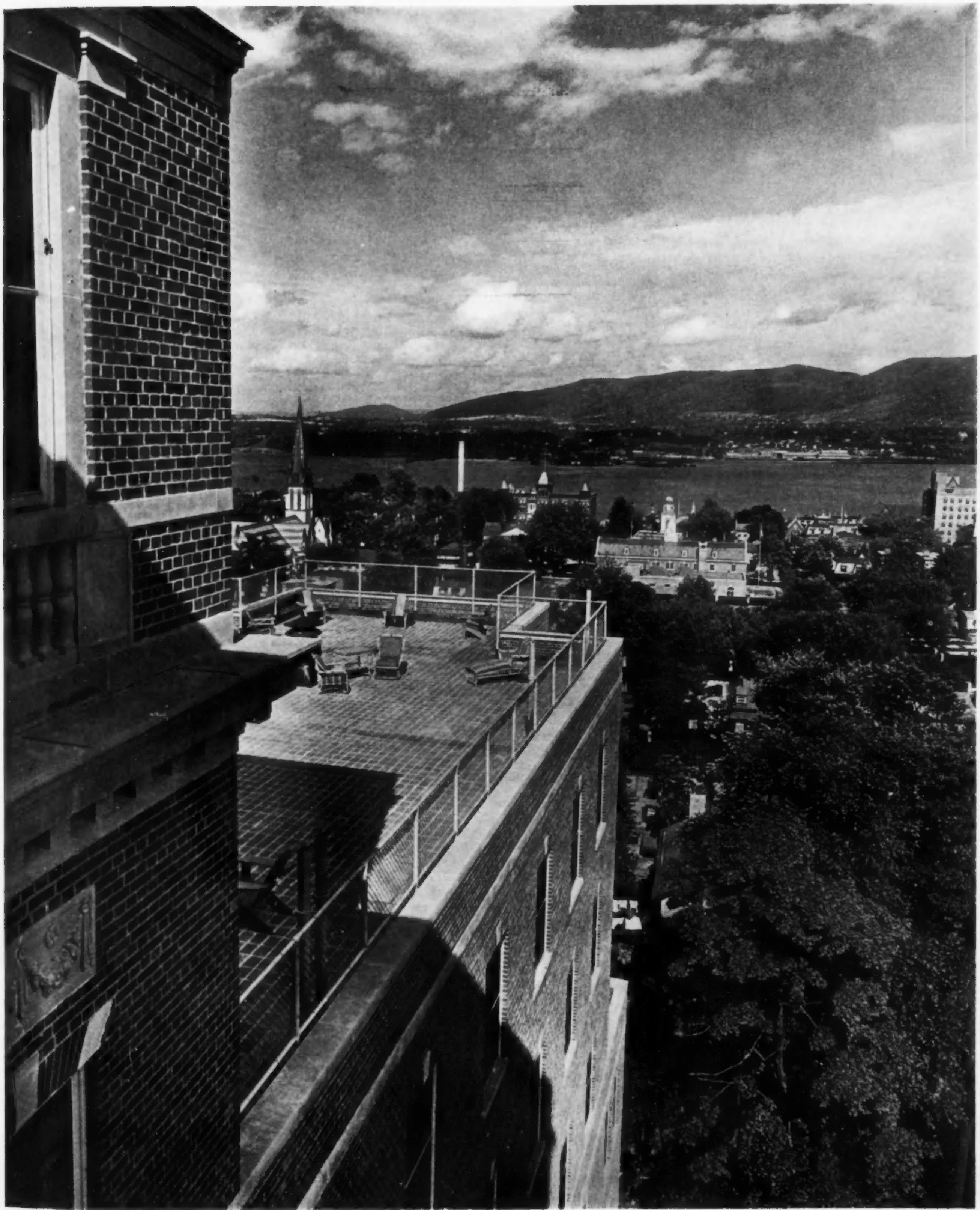


PLAN OF SEMI-PRIVATE-RM FLOOR

PLAN OF FIRST FLOOR

ST. LUKE'S HOSPITAL
NEWBURGH, NEW YORK
CROW, LEWIS AND WICK, ARCHITECTS

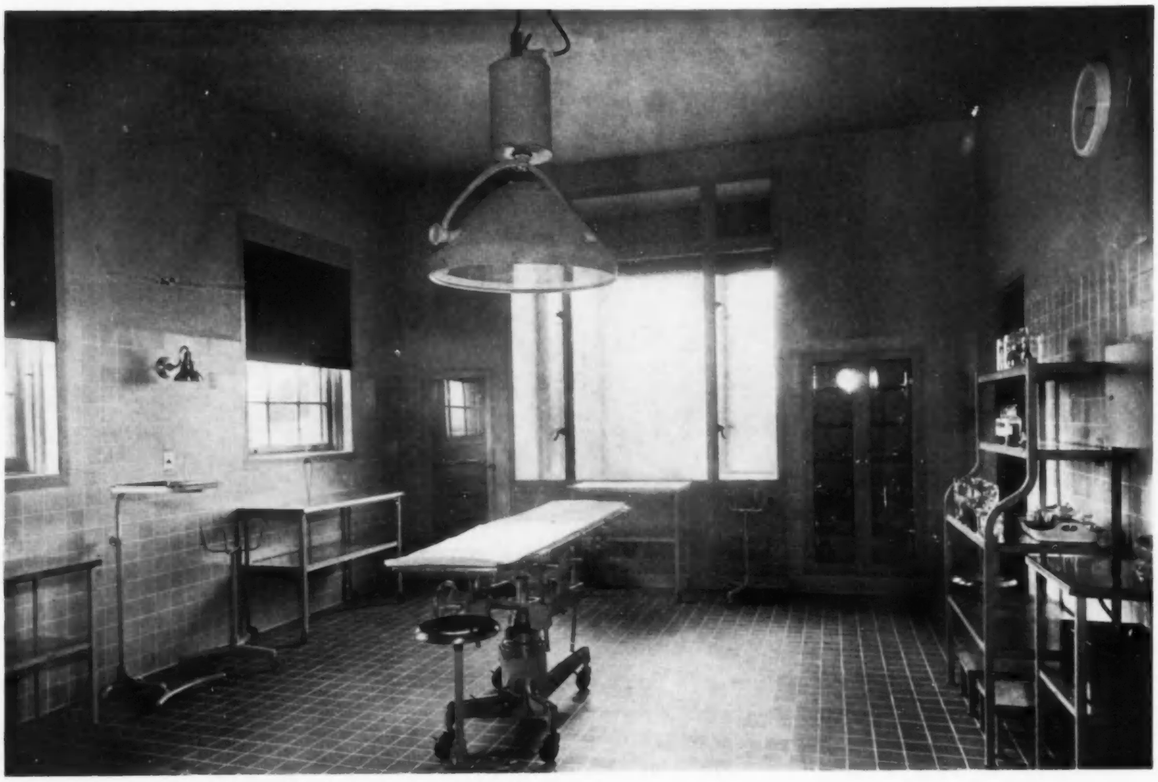
Hugh Findlay, landscape architect. Floors, linoleum and rubber finish, terrazzo base and border. Ceilings and corridors soundproofed with Acoustene.

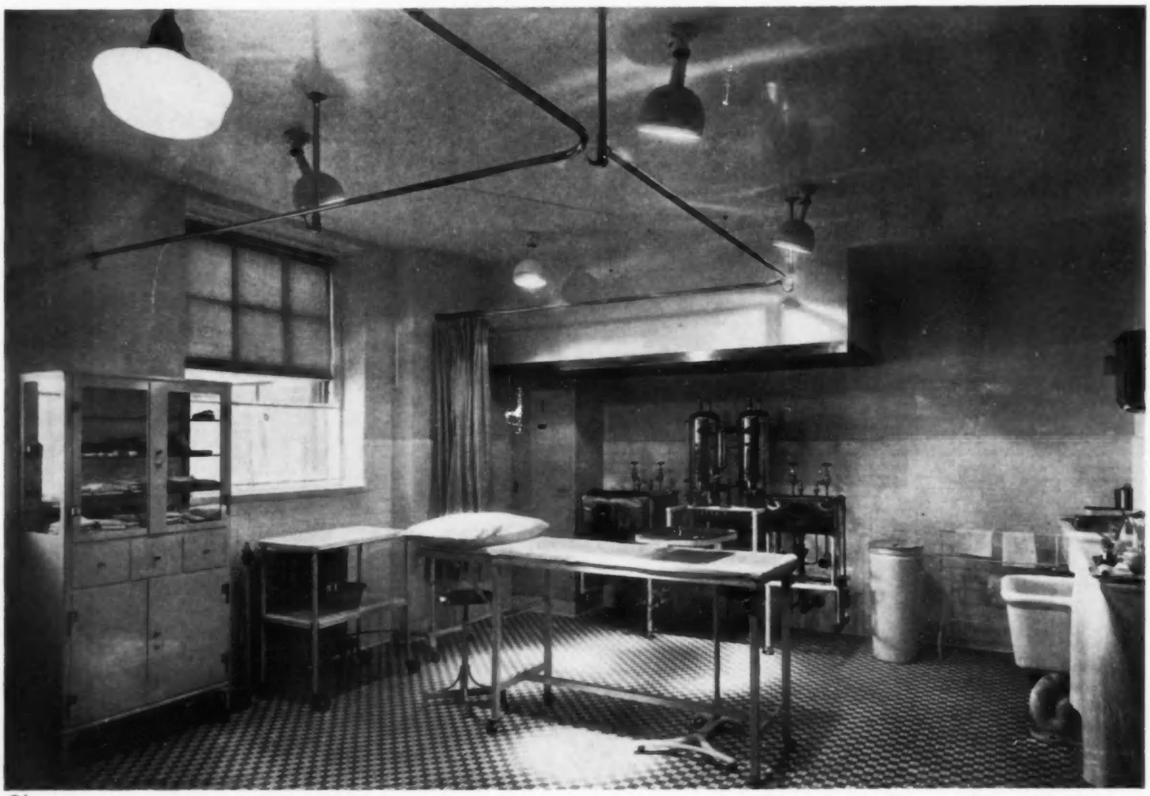


Glasgow

Roof pavilion overlooking Hudson River. Brick walls with limestone trim. Wood windows and sash.

ST. LUKE'S HOSPITAL
NEWBURGH, NEW YORK
CROW, LEWIS AND WICK, ARCHITECTS

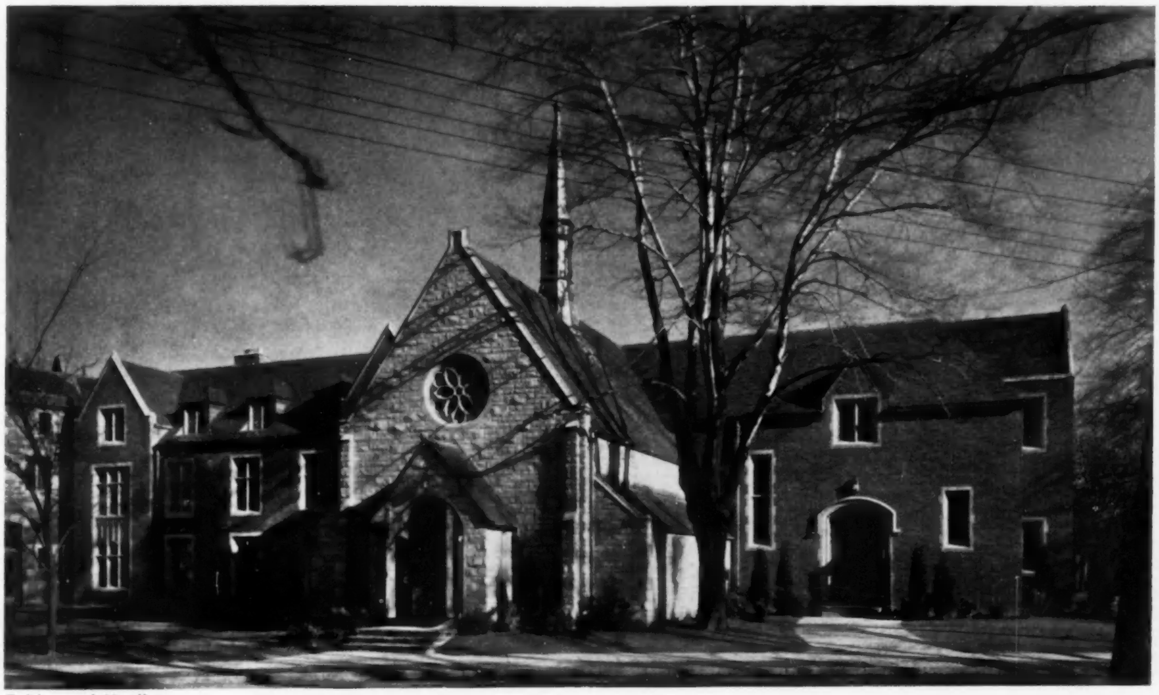




Glasgow

Operating rooms.

ST. LUKE'S HOSPITAL
NEWBURGH, NEW YORK
CROW, LEWIS AND WICK, ARCHITECTS



Tebbs and Knell

Approximate cost of this building was $300,000.

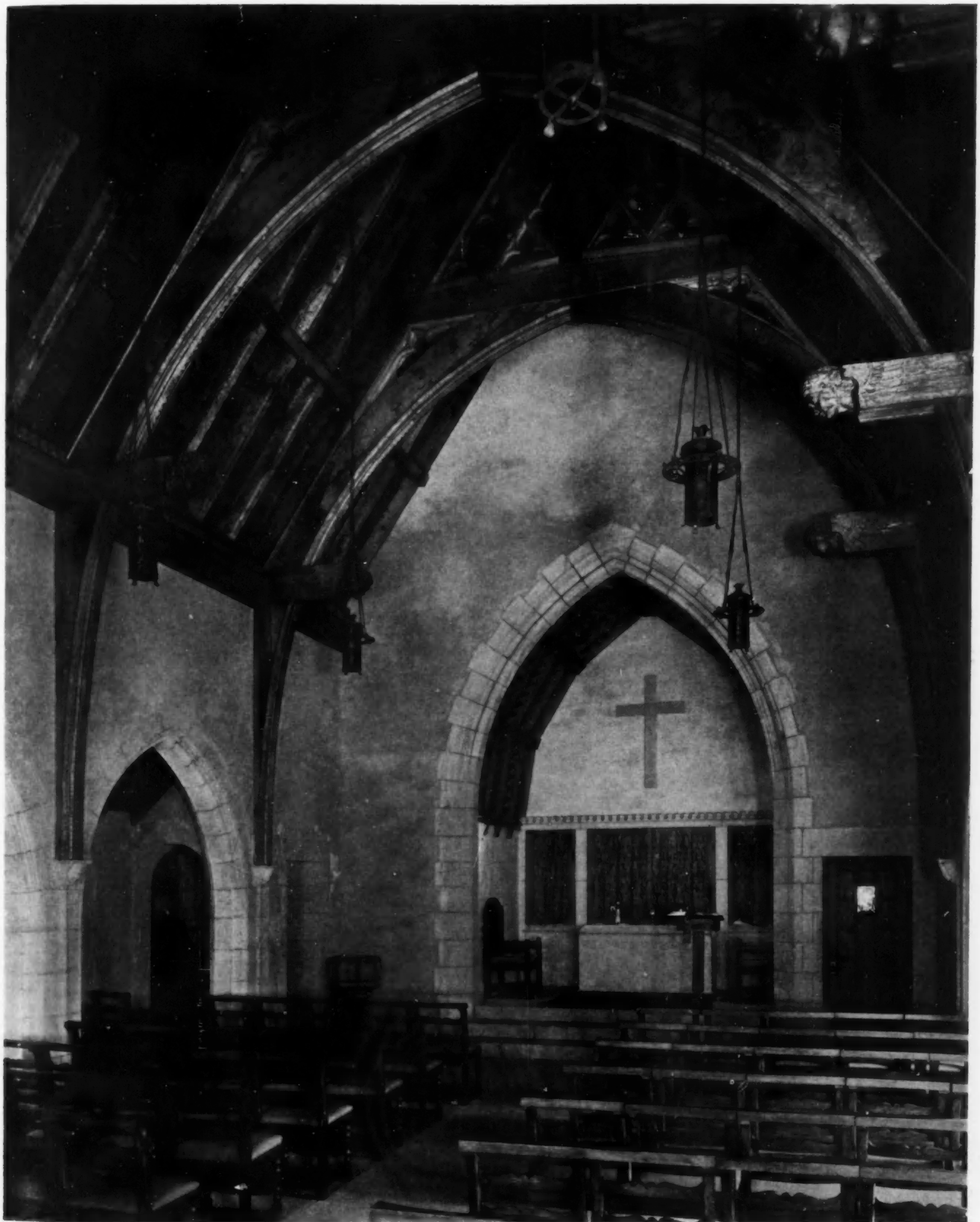
CRESCENT AVE. PRESBYTERIAN PARISH HOUSE
PLAINFIELD, NEW JERSEY
DELANO AND ALDRICH, ARCHITECTS

Junior Assembly Room.

Tebbs and Knell

Assembly Room.

CRESCENT AVE. PRESBYTERIAN PARISH HOUSE
PLAINFIELD, NEW JERSEY
DELANO AND ALDRICH, ARCHITECTS



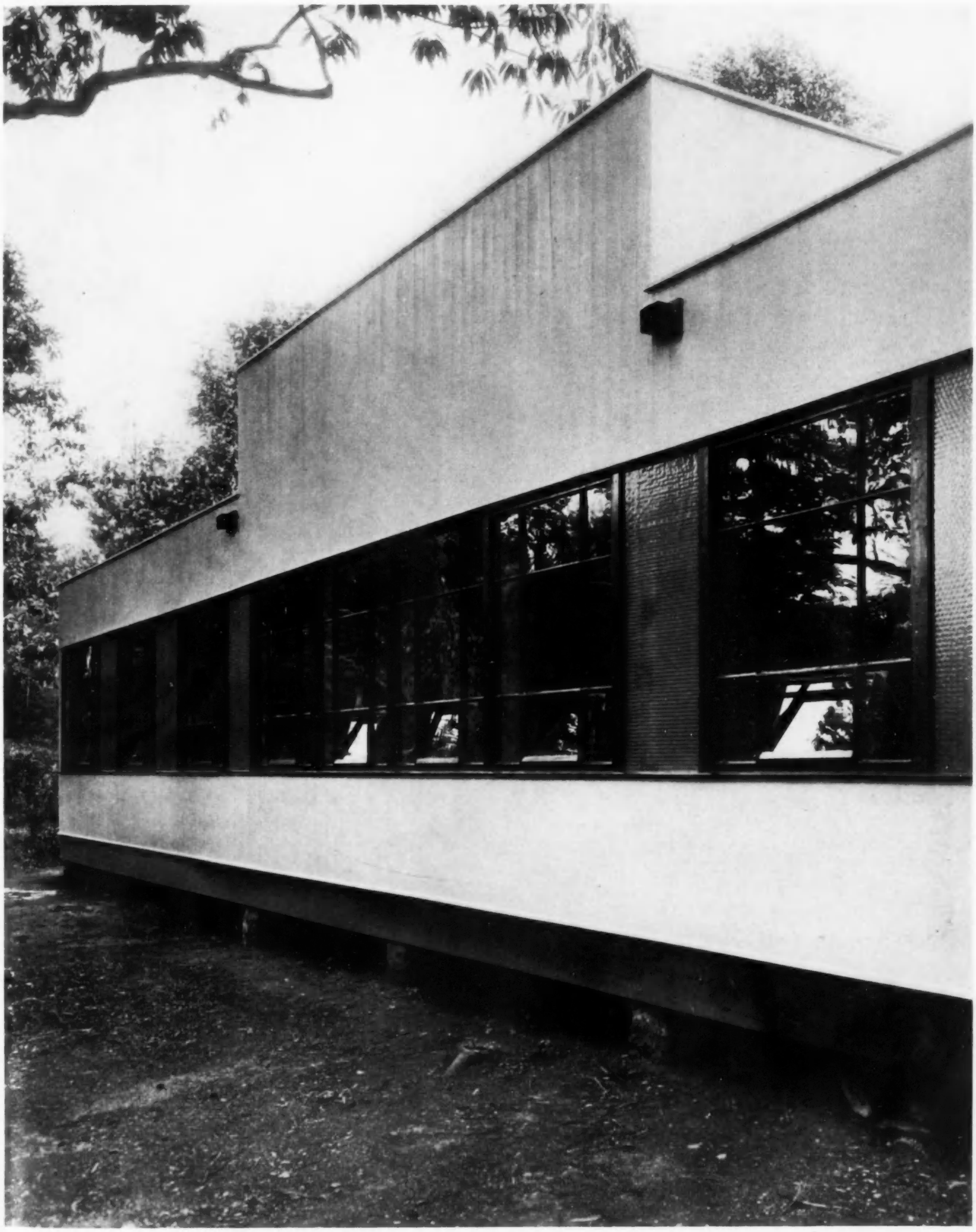
Tebbs and Knell

Chapel.

CRESCENT AVE. PRESBYTERIAN PARISH HOUSE
PLAINFIELD, NEW JERSEY
DELANO AND ALDRICH, ARCHITECTS

BIOLOGICAL LABORATORY OF THE MUSEUM
IN HIGHLANDS, NORTH CAROLINA
TUCKER AND HOWELL, ARCHITECTS
OSCAR STONOROV, CONSULTANT

Total length of building is 63 feet; width at central bay is 28 feet. The construction is entirely wood, since concrete is prohibitively expensive in this isolated locality.



This building is the only mountain biological station east of the Rockies.

BIOLOGICAL LABORATORY OF THE MUSEUM
IN HIGHLANDS, NORTH CAROLINA
TUCKER AND HOWELL, ARCHITECTS
OSCAR STONOROV, CONSULTANT

BIOLOGICAL LABORATORY OF THE MUSEUM
IN HIGHLANDS, NORTH CAROLINA
TUCKER AND HOWELL, ARCHITECTS
OSCAR STONOROV, CONSULTANT

MINNESOTA FEDERAL JAIL COMPETITION

By J. V. BENNETT
Assistant Director, Federal Bureau of Prisons

The competition for the construction of the Federal House of Detention at Sandstone, Minnesota, produced many interesting features in design. The principal difficulty was a plan which would provide the variety of housing needed for the several classes of prisoners and at the same time keep within the stipulated cost limit.

The program provided that the buildings should be adapted to modern methods and standards of treating and caring for short-term prisoners. The primary objective was a diversified type of housing which would permit a maximum classification of inmates according to their character and the reason for their detention. This objective would have been relatively easy to attain had it not been that the instructions to the architects demanded that the buildings must be so designed as to reduce to a minimum the cost of guarding and custodial vigilance. The institution was to be planned for the ultimate care of 600 inmates although the immediate needs of the Government required housing for only about 320 men. The cost limit was set at thirty cents a cubic foot.

The program stipulated that the housing units should provide for three groups of prisoners:

(1) Those awaiting trial, presumably innocent.

(2) Those serving sentences of a year or less.

(3) Those awaiting transfer to a Federal Penitentiary.

About 30 per cent of the population was presumed to be those awaiting trial and some 70 per cent to be those serving a sentence varying from ten days to a year.

Each of these main groups was to be classified according to whether the prisoners were young offenders, and according to whether prior records showed they merited something more than casual or custodial treatment. Another subdivision of the main group was to be that relatively large group of men who have become more or less inured to petty crime of one kind or another and who seem to give little promise of permanent regeneration, such as the vagrants, the petty thieves and bootleggers. The third subdivision of each of the main groups was the vicious and unregenerate prisoners. Requirements for each class are given in the following table:

Type of Offender	Approximate Number	Type of Housing
I. Those awaiting trial:		
(A) Young, first offenders	20	Single rooms
(B) Vagrants, etc.	60	Dormitories
(C) Vicious	20	Cells
II. Those serving sentences:		
(A) Young, first offenders	50	Single rooms
(B) Vagrants, etc.	160	Dormitories
(C) Vicious	10	Cells
	320	

In addition to the housing units, an administration, receiving and hospital building, mess hall and kitchen, laundry, mechanical shops, and other service units, as well as an auditorium, school and vocational training buildings for future construction were required.

Although the competition was limited to registered architects of Minnesota, the number of designs submitted showed unusual interest. The thirty-eight plans submitted fell into four general groups:

(1) The closely knit plan of buildings radiating from a central rotunda.

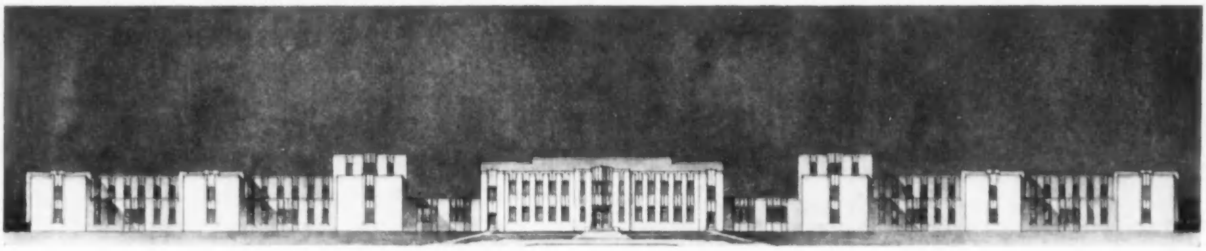
(2) The fairly compact group branching from a central connecting corridor.

(3) A series of cottage buildings or dormitories grouped in various ways about a central building, usually a mess hall or an administration building.

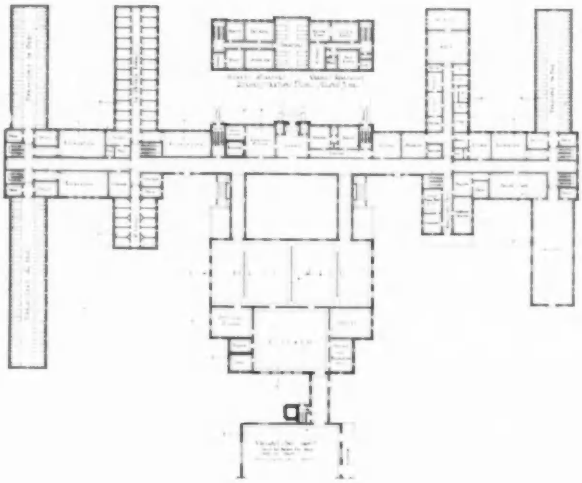
(4) A series of interconnecting buildings surrounding a central court or exercise yard.

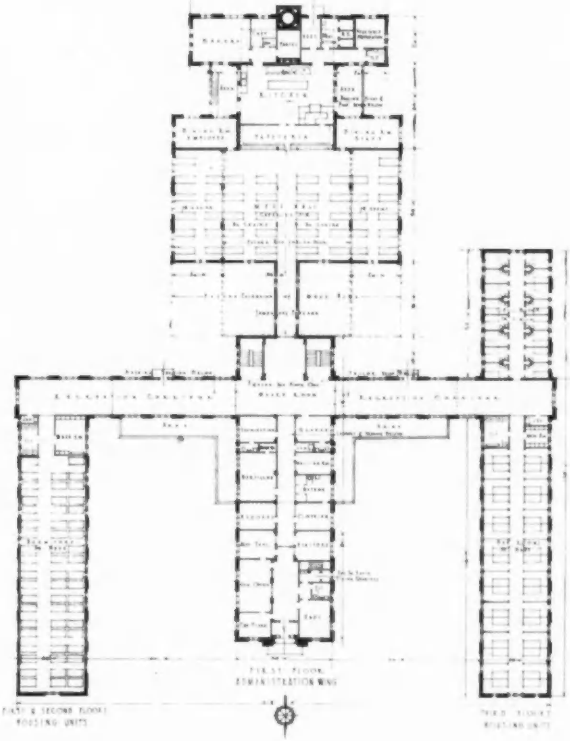
According to the report of the Jury of Award, only casual consideration was given to those plans which radiated from a central rotunda, for the reason that the Jury felt this type of institution was not consistent with the spirit of the program. It is apparent from the report that the jury felt that such plans showed no fundamental deviation from the type of penal institutions which have been, up until recent date, quite generally constructed by the various states and municipalities. There can be no doubt the type of prison panopticon designed by Jeremy Bentham more than 150 years ago was an ingenious scheme to reduce the amount of custodial force required in an institution of this kind, but present-day prison administrators almost universally feel that it is not adapted to modern theories of handling criminals. If penal administrators are to get away from the wholesale regimentation of prisoners and individualize the treatment of the upwards of 400,000 men who annually pass through the prisons of the country they must have facilities which are conducive to the more modern methods of reforming them. It is not enough to construct a building on the theory that all who enter are desperate and must be caged like wild beasts for a while and then turned loose still like wild beasts.

By far the largest number of architects submitted plans of the second type—buildings branching from a central connecting corridor. The advantage of this method of grouping is that it provides a compact and rather easily guarded institution and at the same time makes possible a diversified classification of the inmates without being unduly expensive from the construction standpoint. It was from this general group of plans that the successful competitor was selected.



WINNING DESIGN BY EKMAN, HOLM AND COMPANY, ARCHITECTS





Above: Winning Plan Arrangement by Ekman, Holm and Company, Architects

Right: General Floor Plans of Units by Clarence H. Johnston, Architect

DESIGN BY CLARENCE H. JOHNSTON, ARCHITECT

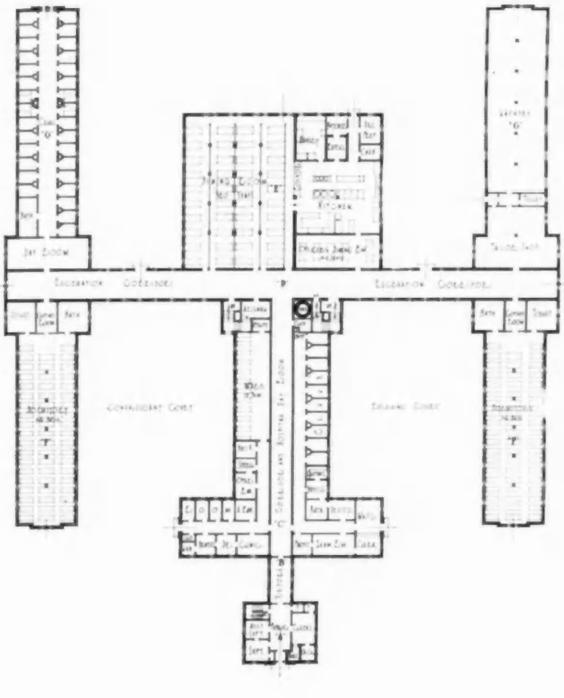
FEDERAL HOUSE OF DETENTION AT SANDSTONE, MINNESOTA

The architectural firm of *Ekman, Holm and Company* was given the award because of its excellent adaptation of this type of plan to the program. It is to be noted particularly that all of the various classifications stipulated in the program have been provided for most advantageously and that the winner of the competition has worked out his scheme in admirable detail. The reception unit is well integrated with the rest of the institution and yet it has its own separate entrance and is sufficiently isolated so that there is no danger of contagion. It is conveniently arranged so that the physician can readily oversee the hospital and the examination of incoming prisoners. The housing units are of adequate size without being too large or unwieldy.

Plans submitted by *Clarence H. Johnston, Magney and Tusler, Sund and Dunham,* and *Lang, Raugland and Lewis,* also fall into this same general type of scheme.

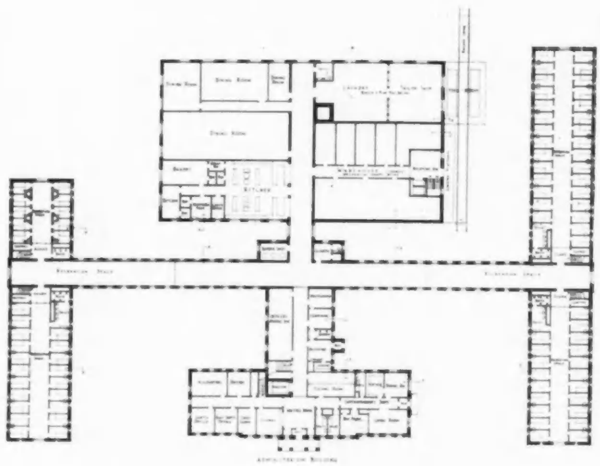
One of the most unique and ingenious schemes, submitted by *Buechner and Orth,* was given second

DESIGN BY MAGNEY AND TUSLER, ARCHITECTS



Left: General Floor Plan of Group Units by Magney and Tusler, Architects

Below: Plan of Housing Units and Utilities by Sund and Dunham, Architects



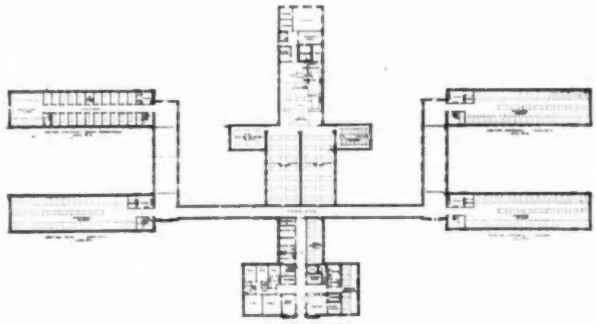
DESIGN BY SUND AND DUNHAM, ARCHITECTS

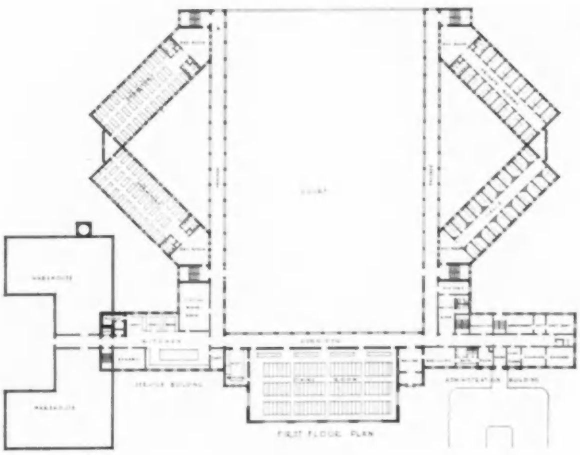
FEDERAL HOUSE OF DETENTION AT SANDSTONE, MINNESOTA

place by the Jury. The grouping of the buildings in a saw-tooth manner solved the vital question of orientation and provided at the same time an interior court which has always been considered a great asset by prison administrators since it minimizes opportunities for escape and provides an inclosed court for recreation purposes. The placing of the administration building at one side seems to be a clever deviation from the usual scheme which makes the administration building the central unit.

Practically all of the more modern penologists who assume that the primary purpose of incarcerating an individual is reformation rather than vengeance prefer and strongly advocate the cottage type of institution because it gives them facilities to classify and segregate the inmates according to type of treatment. Its greatest drawback, as has been previously indicated, is its initial cost of construction and its subsequent expensive administration. It also is objectionable in a small institution where a large number of classifications are desired,

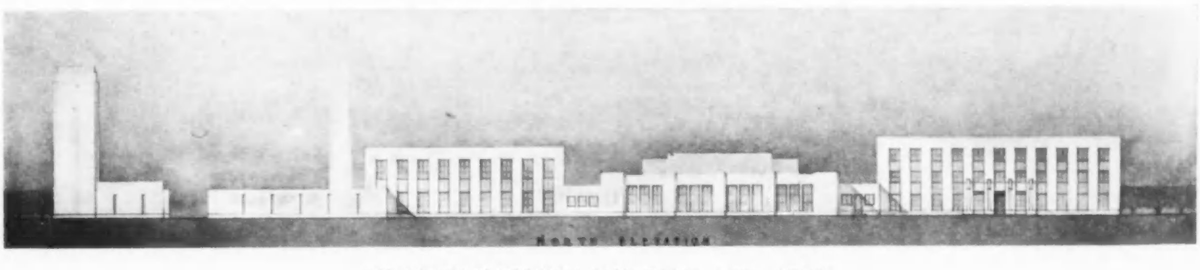
DESIGN BY LANG, RAUGLAND AND LEWIS, ARCHITECTS





Above: Floor Plan of Prison Units by Lang, Raugland and Lewis, Architects

Left: Saw-tooth Plan Arrangement by Buechner and Orth, Architects



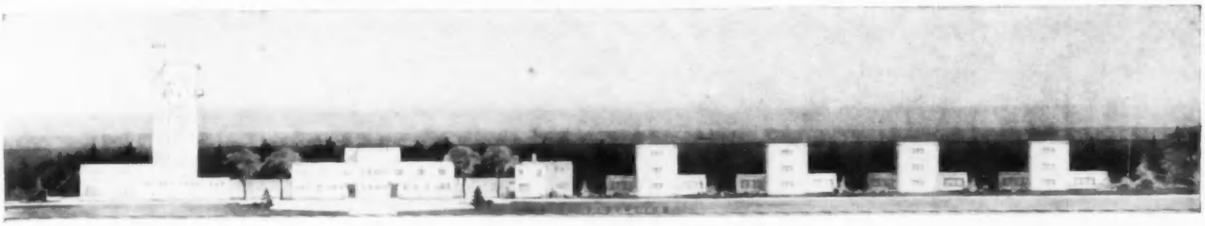
DESIGN BY BUECHNER AND ORTH, ARCHITECTS

FEDERAL HOUSE OF DETENTION AT SANDSTONE, MINNESOTA

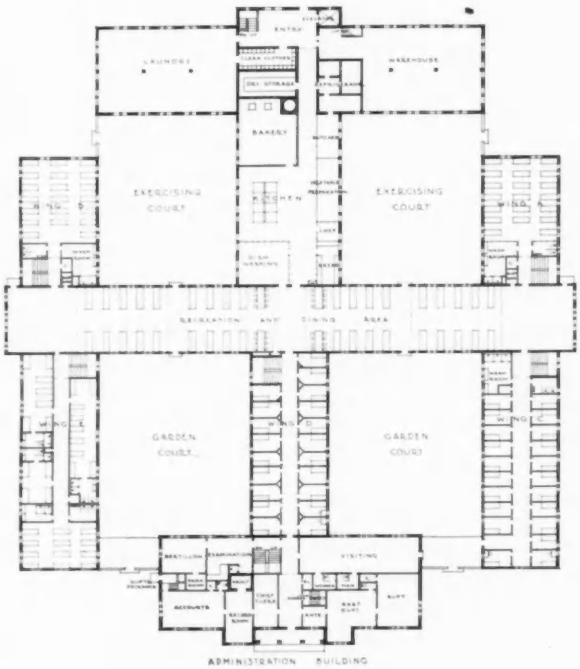
because it tends to complicate the housing units.

The scheme placed fifth by the Jury, submitted by *Hewitt and Brown,* is a very excellent cottage scheme. The interior arrangement of the housing units shows a great deal of painstaking study and makes possible a classification of the inmates within each building. It is to be noted also that each building has its own dining room and thus makes possible the permanent segregation of the men according to their classification. More and more penologists in this country are coming to the conclusion that the congregate mess hall must be abandoned if the theories of classification and individualization of the treatment of prisoners are to be carried to their logical conclusion. It has been found in the several institutions which have been constructed in this manner that it is altogether practicable to have a centralized kitchen with decentralized serving of the food.

The scheme submitted by *Ellerbe and Company* utilizes the central connecting corridor not only as recreation and day-room space but also as a dining room. It is an exceedingly compact plan and the placing of the cells in the innermost building assures a maximum of security for the type of prisoner who will be housed in this building. It



DESIGN BY HEWITT AND BROWN, ARCHITECTS



Above: Plans of Individual Units by Hewitt and Brown, Architects

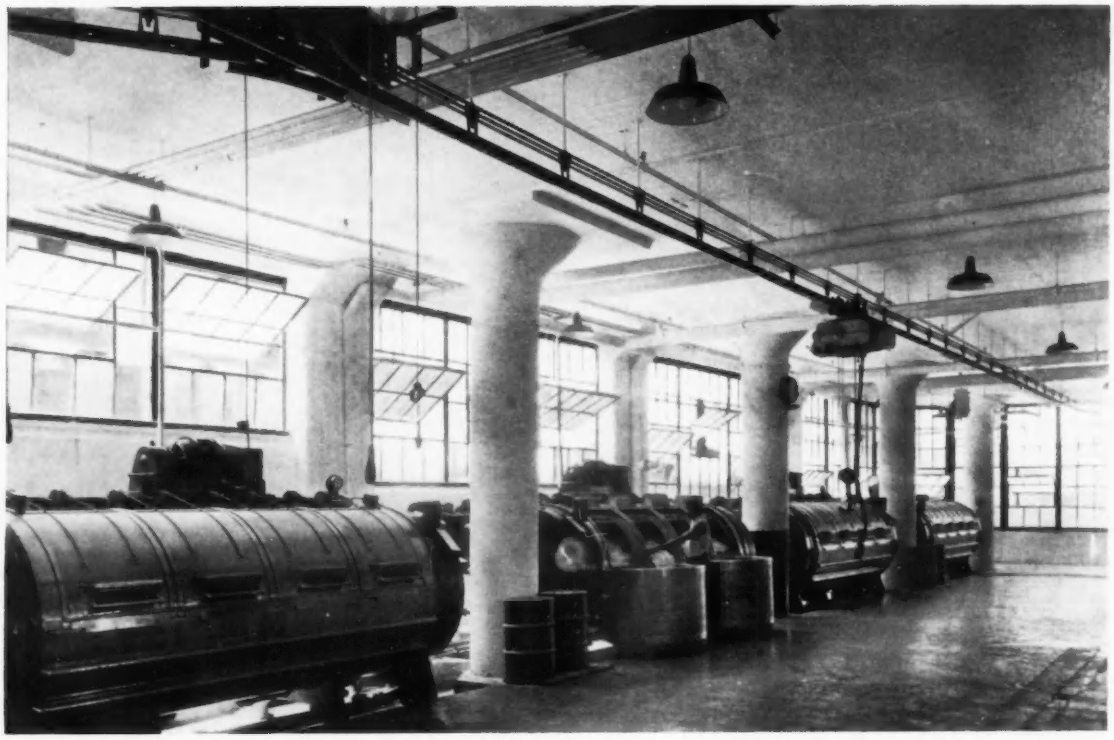
Right: Floor Plan of Prison Units by Ellerbe and Company, Architects

DESIGN BY ELLERBE AND COMPANY, ARCHITECTS

FEDERAL HOUSE OF DETENTION AT SANDSTONE, MINNESOTA

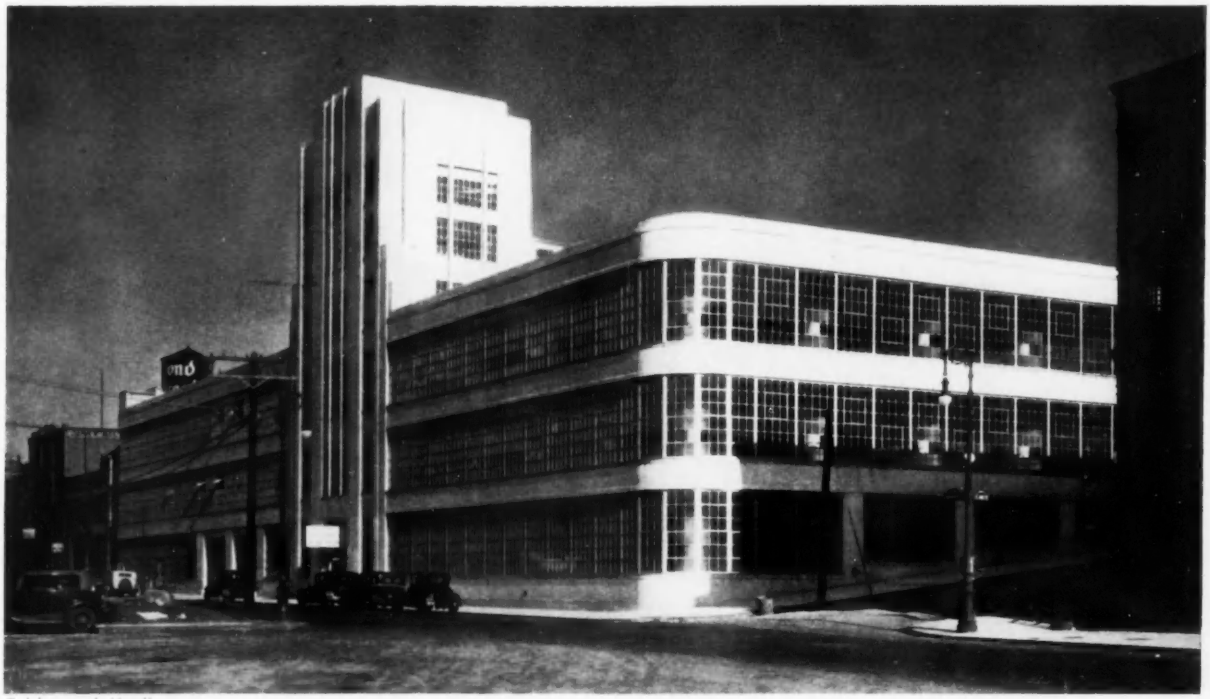
has all of the advantages of a walled institution for this group of prisoners and yet provides them with outside cells and eliminates the construction of an expensive wall. The individual exercise courts for each group of prisoners are also an advantage.

The competition, which was under the direction of Professor F. M. Mann of the University of Minnesota, as Professional Adviser, was as a whole, eminently successful. It indicates that the architects of the country are willing to deviate from the standard type of prison construction which has dominated this country for years. Not a single contestant suggested the construction of an interior cell block, a most commendable commentary upon the progressiveness of the architectural profession. The findings of the Jury of Award were approved by Honorable William D. Mitchell, Attorney General, and Mr. Sanford Bates, Director of the Bureau of Prisons. The members of the Jury of Award were Honorable John B. Sanborn, member of U. S. Circuit Court of Appeals; Mr. C. J. Swendsen, Chairman, Minnesota State Board of Control; Mr. Roy Childs Jones, Professor of Architecture, University of Minnesota; Mr. R. W. Zimmerman, Architect, and Mr. J. V. Bennett, Assistant Director, Federal Bureau of Prisons.



Peyser and Patzig

CASHMAN LAUNDRY CORPORATION BUILDING
NEW YORK CITY
R. G. AND W. M. CORY, ARCHITECTS



Tebbs and Knell

PLANNING FOR LAUNDRY EFFICIENCY

By R. G. and W. M. CORY, Architects

The new plant of the Cashman Laundry Corporation, located on the northeast corner of Gerard Avenue and East 140th Street, Bronx, New York City, embodies many new features in design and equipment. The primary objective was a modern building which would enable the owners to turn out the best grade of laundry bundle at minimum cost.

The plant occupies a site approximately 267 feet long, varying in width from 99 feet to 111 feet. The ground story comprises the full plot area, the second and third stories cover the entire plot length and have a width of 95 feet, thus maintaining a permanent light court along the rear line. The fourth or tower story is 45 feet wide by 76 feet deep. The plant is divided as follows:

Ground Floor: Boiler and Engine Room; Garage and Delivery; Sorting and Identification; Wash Room; General Offices.

Second Floor: Flat Work Department; Handkerchief Department; Blanket and Curtain Department; Zoric Department; Assembling and Packing.

Third Floor: Starch Department; Shirt and Blouse Department; Hosiery Department; Wearing Apparel Department; Assembling and Packing.

Fourth Floor: Cafeteria.

The plant has a total floor area of 81,000 square feet and a capacity of handling $50,000 worth of business each week.

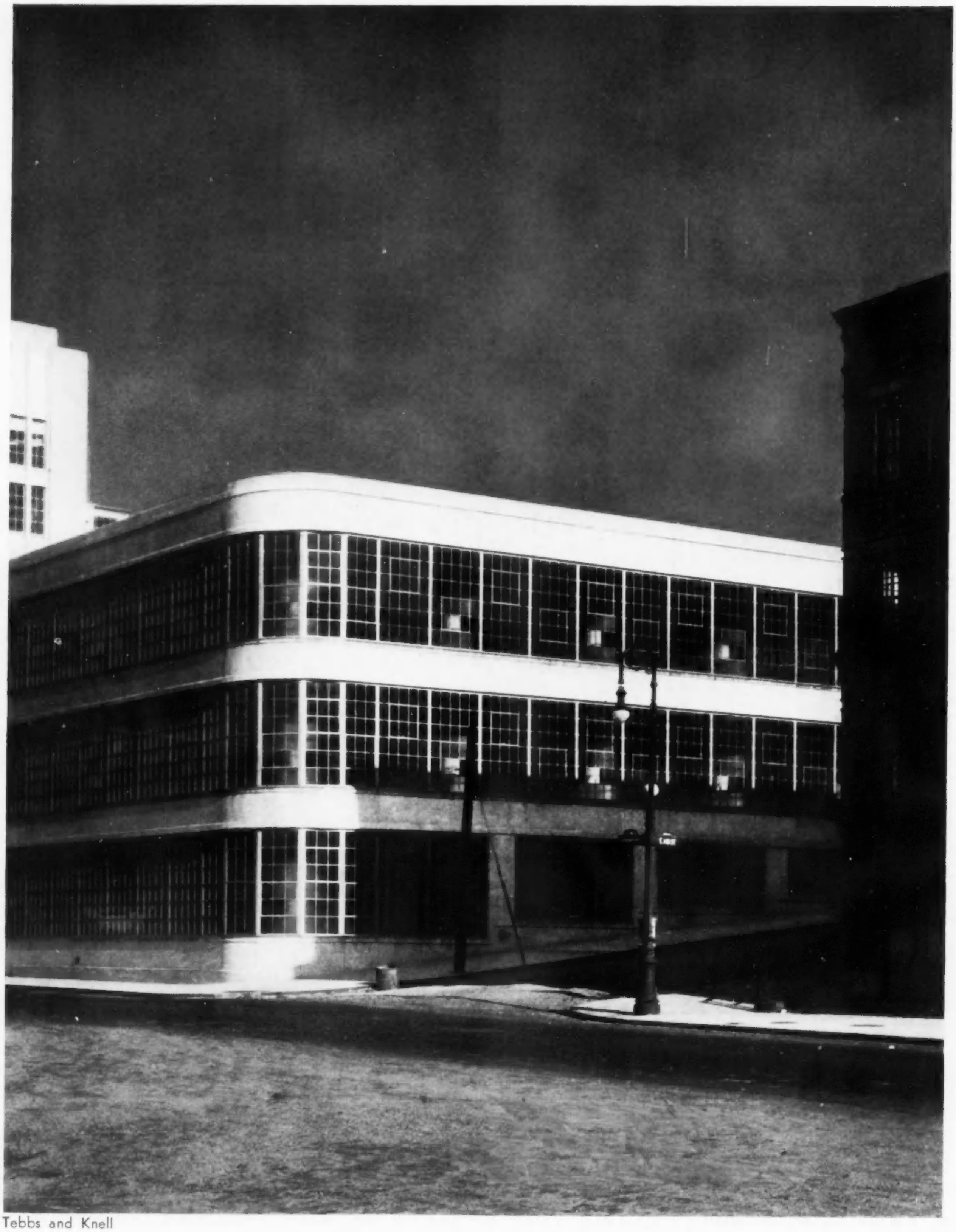
The building housing the plant is simple in design, with practically no ornamentation. The exterior concrete surface has a white sand finish, giving smoothness to the horizontal bands forming the spandrel walls. Window sash are aluminum.

A cantilever floor construction gives lighting efficiency and usability of floor space. This method eliminates any columns or pilasters in the outside walls. The first row of columns is 8′ 9″ from the wall, thus permitting the windows to be continuous and uninterrupted. These windows occur on three elevations, giving in effect a continuous window 590 feet long on each floor.

The outside walls are only 8″ thick without any pilaster projections into the floor area, whereas outside columns or pilasters for a building of this type would project probably about 20″ beyond the building line, giving a strip of floor space the entire perimeter of the building which would be lost space so far as usability is concerned. With this method, however, this unusable strip is only 8″ wide, adding about 630 square feet of usable floor space, per floor, over the old method.

The interior of the building, with the exception of the entrance lobby and the cafeteria, is finished in concrete rubbed smooth, on which three coats of white paint were applied. This white interior adds materially to the lighting efficiency.

On the second and third floors the toilet and locker rooms were placed along the north wall, which by reason of an adjoining structure contains no windows. Thus no light space is given up for these facilities.

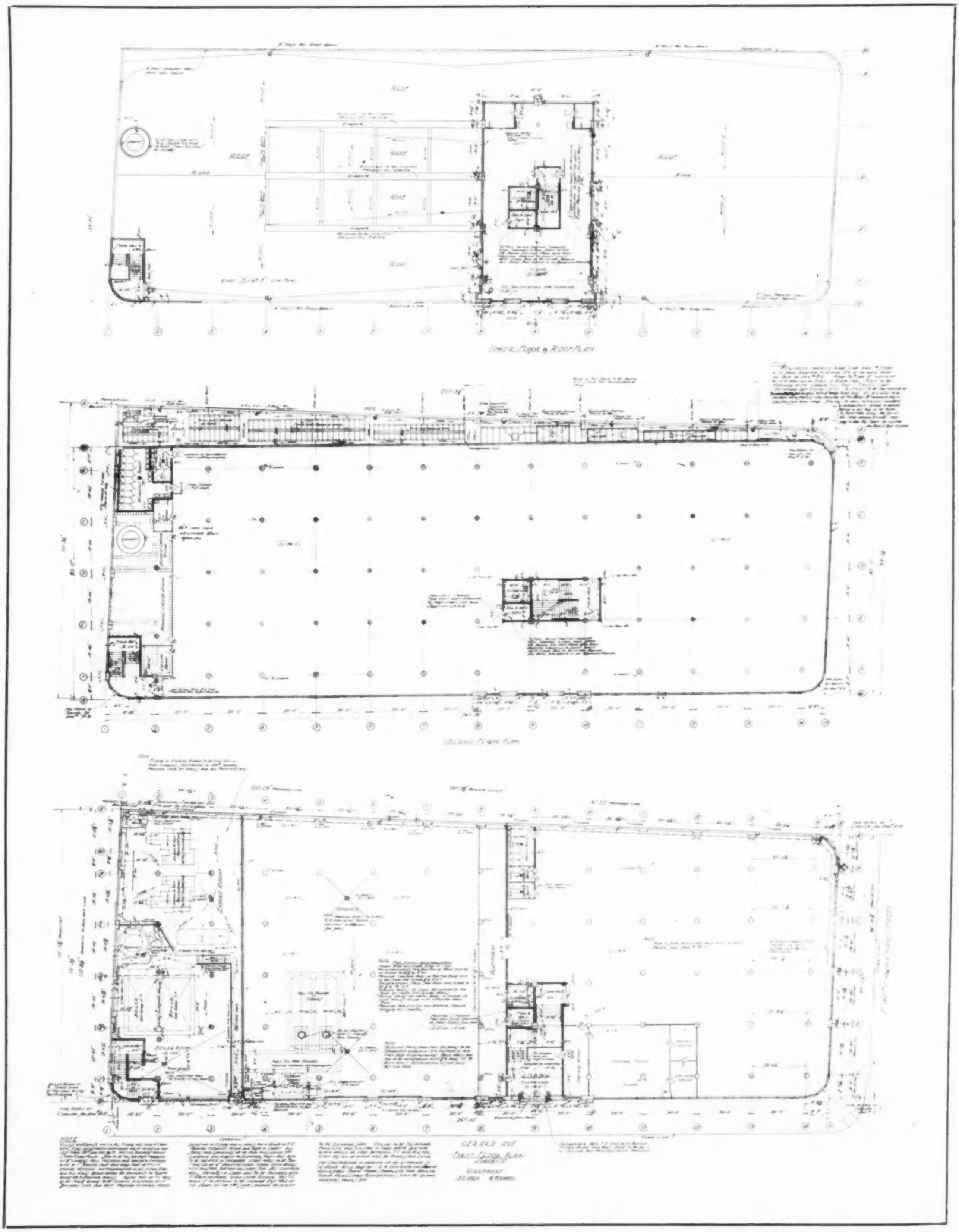


Tebbs and Knell

CASHMAN LAUNDRY CORPORATION BUILDING
NEW YORK CITY
R. G. AND W. M. CORY, ARCHITECTS

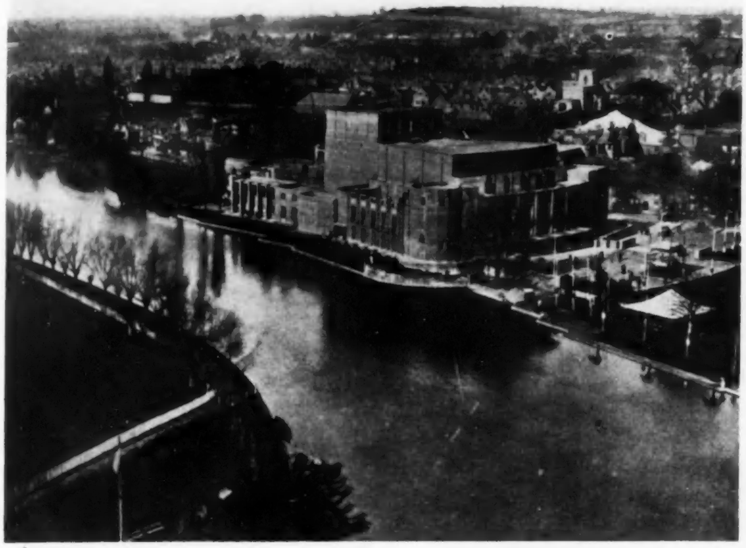
Peyser and Patzig

CASHMAN LAUNDRY CORPORATION BUILDING
NEW YORK CITY
R. G. AND W. M. CORY, ARCHITECTS



CASHMAN LAUNDRY CORPORATION BUILDING
NEW YORK CITY
R. G. AND W. M. CORY, ARCHITECTS

ILLUSTRATED NEWS



Acme

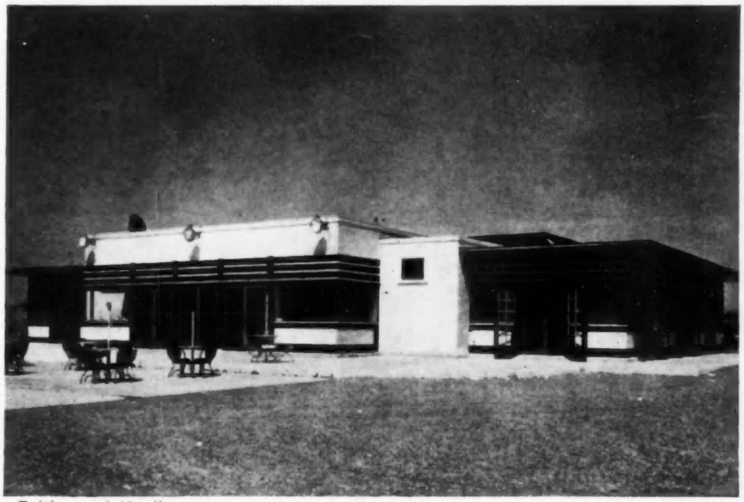
Shakespeare Memorial Theater, Stratford-on-Avon. Scott, Chesterton and Shepherd, architects.

Constructed from the prize-winning design submitted by Miss Elizabeth Scott in 1928. The theater is flexible in plan and is suited to any type of Shakespearean production, to opera or concert. It is almost completely devoid of applied decoration both internally and externally.

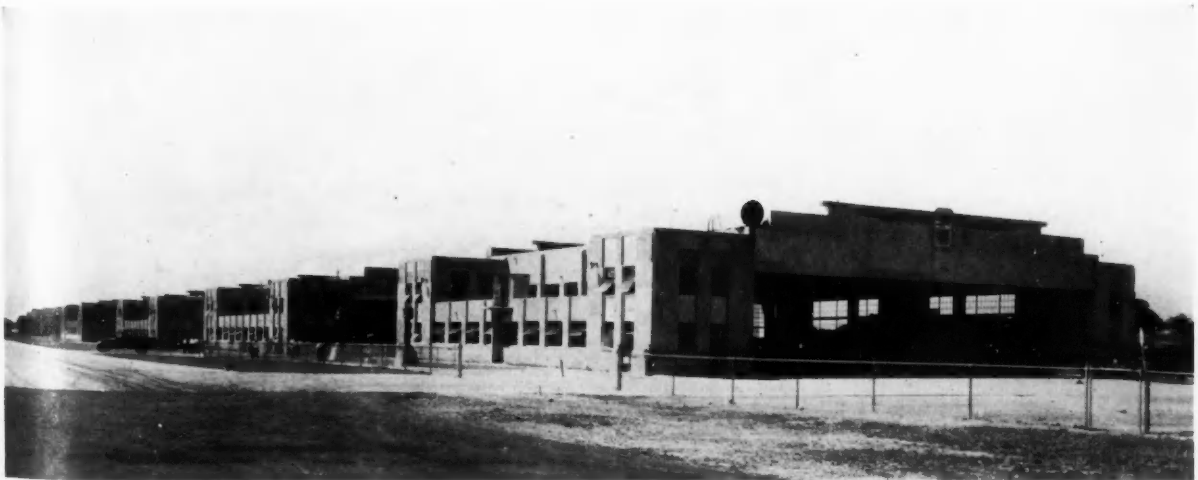
Curtiss-Wright Airport at Valley Stream, Long Island, N. Y.
Kenneth Franzheim, Architect.

Right:
Restaurant Building (Sky Harbor Inn).

Below:
Series of hangars adjoining flying field.



Tebbs and Knell



Tebbs and Knell

Northside Photo Print

The Church of Christ the King, Cork, Ireland.
Associated Architects: Barry Byrne, Chicago, and J. R. Boyd Barrett of Cork.

Walls of concrete; roof supported on steel trusses. Windows glazed with a deep blue glass. Artificial illumination from a central ridge skylight with white glass and from concealed side lamps.

Massachusetts State Building, Brockton Fair Ground. James H. Ritchie and Associates, Architects.

Mennen Hall, dormitory building, Cornell University, now under construction. Charles Z. Klauder, Architect.

TECHNICAL NEWS AND RESEARCH

© F. S. Lincoln

Model of 10-story building designed for exterior and interior atmospheric control. The building itself is supported tensionally from a utility tower-mast (see diagram on page 279). Surrounding this central structure is a streamlined shield free to move directionally with the wind. This transparent shield reduces wind pressures and permits inner walls to be very light in construction. Heat losses due to filtration are reduced. Designed by Buckminster Fuller with Starling Burgess as consulting engineer

AIR CONDITIONING

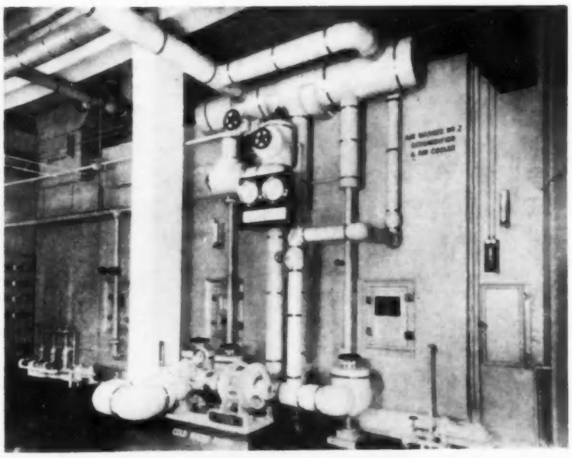
(PART TWO)

AIR CONDITIONING EQUIPMENT

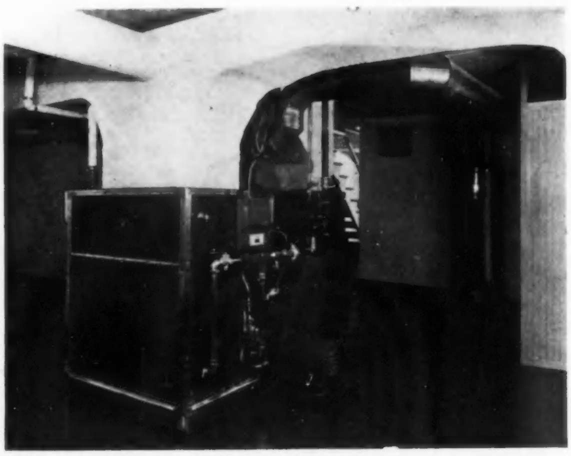
By C. THEODORE LARSON

Air conditioning is essentially a *system* of atmospheric control; the equipment is the *means* for conditioning air to meet specified standards. Many kinds of apparatus are now on the market, ranging from large custom-built industrial systems and ready-made unit-conditioners to various combinations of heaters, coolers, humidifiers, dehumidifiers, and air filters and purifiers. These separate elements, each with its individual effect on atmospheric control, are usually intended as accessories to existing ventilating systems which are deficient in such control.

In the profusion of available air conditioning devices can be seen a close parallel to the early history of the radio industry when new models were brought out in all shapes and sizes, all intended to serve a single purpose—the reception of transmitted sound. Equally rapid has been the growth of the new science of air conditioning, and the production of equipment has resulted in the same multiplicity of devices. But, as writers in *The Index* (July) and *Printers' Ink Monthly* (September) have pointed out, the confusion is even greater because all these devices do not perform the same functions.



Air conditioning system of the central station type, intended primarily for large industrial applications. York Ice Machinery Corporation.



Mettee

"Weathermaker" central unit for household use. Carrier-Lyle Corporation.

Some are merely room coolers, portable ice boxes with blowers which take in warm air and expel it chilled. Of the various domestic air conditioners which are available for connection with existing heating systems, some regulate humidity but do not cool or cleanse the air, while others provide cooling with or without humidity control. A limited number of manufacturers offer complete equipment in which the heating, cooling, circulating, cleansing, humidifying and dehumidifying units are all coordinated in a single comprehensive installation. Prices and sizes likewise vary considerably according to the design of the equipment, the functions performed, and the type of building in which it is to be installed.

The wide variety of merchandise offered as air conditioning equipment is evident in the following list, recently prepared by the *Plumbing and Heating Contractors Trade Journal*:

1. Portable electric room humidifiers (no heating).
2. Cabinet type room humidifiers with fan and fin radiation.
3. Wall-installed room humidifiers.
4. Basement-installed air conditioners using steam or hot-water boilers.
5. Room cabinets with radiator and cooling coils (separate refrigeration compressors).
6. Gas-fired dehumidifiers for cooling and ventilating only.
7. Warm-air furnace basement-installed air conditioning systems.
8. Room unit coolers (cooling only—with separate refrigeration compressors).
9. Air washer and fan units for attachment to warm-air heating systems (no refrigeration).
10. Non-mechanical room radiator and humidifier combined in cabinet.
11. Comprehensive custom-made air conditioning systems including large air washers, motor-driven fans, refrigeration, etc.
12. Non-mechanical humidifiers for insertion in warm-air furnace bonnet.
13. Room cooling (only) units in cabinets.
14. Recirculating-water cooling towers.
15. Room coolers for ice.
16. Basement-installed cooling system with ice.

Partial and Complete Air Conditioning

It will be observed that in this list air cooling and humidifying devices predominate. A legitimate need and demand exists for these products in domestic air conditioning. However, there is the danger, as many reputable manufacturers are already emphasizing, that exaggerated claims may be made for such single-function devices. The science of air conditioning is much more complicated than that of heating alone, and much pioneering research has yet to be done by laboratory investigators. It would be in the interests of both the public and the industry if, as *The Index** urges editorially, standards of manufacture and performances could be set up by an authoritative independent association and made widely known, as was the case in the gas industry. At the present stage of development the most imperative need is to make clear the difference between partial and complete air conditioning.

A *complete system* of air conditioning involves not only controlled circulation, filtration, heating and cooling, humidification and dehumidification, but also the scientific coordination and simultaneous control of all these functions. It has been suggested that a factor basis be established for proper classification of equipment according to degree of completeness. Nine such factors are set forth by *Heating and Ventilating*:

1. Measured and complete air distribution.
2. Provision for control of temperature for winter.
3. Cleaning of air (filtration or washing).
4. Automatic supply or control of humidity for winter.
5. Cooling effect by air circulation for summer.
6. Provision for summer cooling (mechanical refrigeration or other source of refrigeration).
7. Dehumidification or control of relative humidity for summer.
8. Ionization, deionization and deodorization.
9. Treatment of CO_2 factor.

This method of classification differentiates clearly between systems which heat and humidify for winter, and those which cool and/or dehumidify for summer, as well as those which combine these seasonal performances. If only the first two or three functions are fulfilled, then the air conditioning unit may be designated as a two- or three-factor unit. Since factors (8) and (9) at present are not important in household installation, a seven-factor system is considered to be of practical completeness.

For the convenience and guidance of architects specifying air conditioning equipment a checklist based on a similar classification of factors has been prepared by THE ARCHITECTURAL RECORD in collaboration with manufacturers. This checklist, presented on accompanying pages, itemizes products now commercially obtainable and describes their respective methods for conditioning air.

*Published by the New York Trust Company.

WHAT IS AIR CONDITIONING?

As explained in a companion Technical News and Research article which appeared in the September issue, air conditioning is the scientific preparation of atmosphere within a building to meet specific requirements—a definite temperature, a certain moisture content, a desired quality and quantity, uniformly distributed at a specified velocity. Because of the physical structure of air, these factors must be controlled simultaneously for human comfort.

Control of the moisture content (or relative humidity), for instance, depends on a definite control of the temperature and motion of the air. The interrelationship of these three factors—humidity, temperature and air motion—is known as the effective temperature, an arbitrary index of equivalent atmospheric combinations according to the degree of warmth or cold felt by a large number of experimental subjects. Under extreme humidity conditions, however, the sensation of comfort differs very markedly from the degree of warmth which is experienced.

From studies conducted by the Research Laboratory of the American Society of Heating and Ventilating Engineers in cooperation with the U. S. Bureau of Mines and later in collaboration with the Harvard School of Public Health, charts have been prepared showing the range of effective temperatures over which a majority of persons feel comfortable. This range is known as the comfort zone, and the particular effective temperature at which a maximum number feel most comfortable as the comfort line.

Since the comfort zones and lines vary from winter to summer and according to personal preferences as well as degree of physical activity, the specific requirements for an indoor "manufactured atmosphere" are comparatively flexible. According to Ventilation Standards recently established by the A.S.H.V.E., the relative humidity should not be less than 30 per cent nor more than 60 per cent in any case. The effective temperature should range between 64 and 69 in winter when heating or humidification is required, and between 69 and 73 in summer when cooling or dehumidification is required. At all times the air should be free from toxic gases and fumes, and relatively free from odors and dust. It should be in constant motion, without causing any drafts, at a velocity of not more than 50 feet a minute, and should be uniformly distributed. Not less than 10 cubic feet a minute for each occupant of the total air circulated should be taken from an outdoor source. A complete transcript of these atmospheric specifications adopted by the A.S.H.V.E. appeared on page 211 of the September 1932 issue.

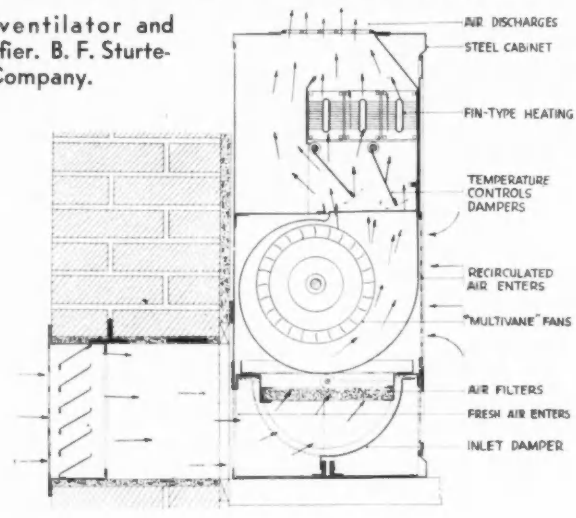
Industrial and Household Applications

Custom-made "central type" air conditioning systems, suitable for industries and public buildings, are so complex in design that many pages of description are required for the specifications contract. Demands have been variable, and in certain industries and businesses very precise conditions must be met. Such equipment ranges in cost from $20,000 to $50,000 for a typical movie theater and from $100,000 to $500,000 for an office building or department store.

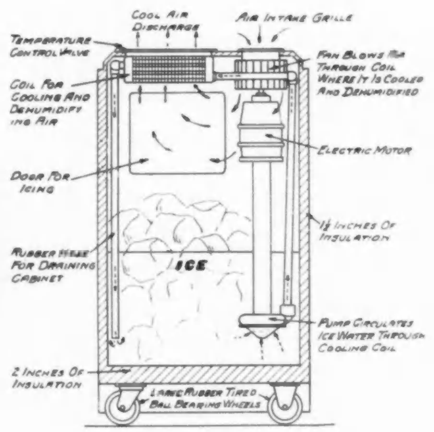
These larger installations have been successful in adding to human comfort, but an entirely different and particularly much less costly type of equip-

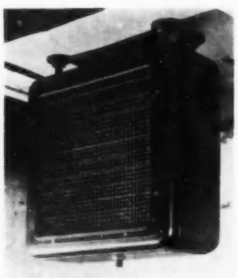
AIR CONDITIONING EQUIPMENT

Unit ventilator and humidifier. B. F. Sturtevant Company.

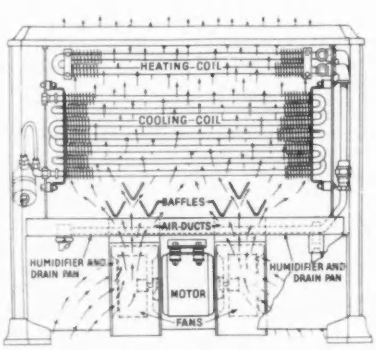


Right: Portable room cooler. Chicago Pump Company.

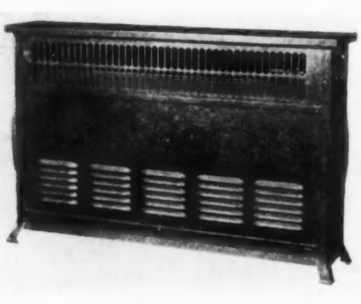




Above: Air cooler with mechanical refrigeration attachment for individual rooms. York Ice Machinery Corporation.



Right: Sectional diagram of Frigidaire cabinet for air conditioning.



Left: Combination steam-electric radiator cabinet produced by Air-Way Electric Appliance Corporation.

ment has been demanded in the effort to make air conditioning commercially practicable for residences and smaller public buildings.

Research has centered in these two fields—the domestic and the industrial (or commercial)—and a large degree of mechanical efficiency has been achieved, although prices are still relatively high, owing to the cost of experimental work, selling expenses and low production volume in a market which must be pioneered.

For complete comfort, treatment of all the air is necessary. Fortunately, in the home a *complete* treatment of the air is not necessary in order to provide a vast improvement in human comfort during the greater part of the year. Many individual devices, as shown by the equipment checklist, are available for *partial* conditioning, but for the most part—in the opinion of competent engineers—these are only makeshifts.

There is little doubt in the minds of engineers and most manufacturers that the ultimate aim and achievement will be the production of equipment which *automatically* will take care of all factors involved in air conditioning through all seasons without requiring more than casual attention from room occupants. At the present transitional stage comparatively satisfactory results can be secured during extremes in outdoor weather by the use of partial conditioners, although almost all of these demand much personal attention and adjustments.

Excessive dryness produced by artificial heat—a frequent condition in the average house—is easily and quite inexpensively corrected by the separate use of humidifiers. Stagnant atmospheres can be prevented by circulating the air with blowers or fans, and dust particles can be effectively eliminated by filtering or washing the air. It is only during the hot sultry days of summer, relatively few in number, that expensive refrigeration equipment is required for cooling and drying (dehumidifying) the air.

Central-Systems in Domestic Air Conditioning

Where the house is already equipped with a warm-air furnace and ducts leading to the various rooms, conditioned air for winter can be provided by the addition of a separate air-moistener, an electric blower and a filter or washer. A similar combination, together with cooling and drying units, is assembled in certain domestic air conditioners of the *central-system type*, which may be installed separately but are usually attached to a warm-air furnace and controlled automatically by thermostats and humidistats or hygrostats. Such a system may have the ducts and units so divided that the entire house can be supplied with warm, filtered and humidified air in winter, and only one or more particular rooms supplied with cool, filtered and dehumidified air in summer, thus reducing the initial cost and expense of operation for cooling. For instance, it would be possible to cool the living room by day and the bedroom by night

According to figures gathered in 1931 for The President's Conference on Home Building and Home Ownership by the Committee on Fundamental Equipment, the added first cost for cooling in such a system, when the whole house is involved, ranges between $750 and $1,500, and the operating cost per season, with electric current at two cents per kw., from $75 in cold climates to $175 in warmer regions. If only a single room is cooled, the first cost is cut down to $500—$800, and the cost of operation to $20—$50 per season. These prices are elastic, for equipment can be installed in houses under construction for much less than in houses already built.

Gas, oil and coal warm-air furnace systems which automatically clean, humidify and warm the air in winter, and which may be arranged to clean, cool and dehumidify the air in summer, are readily obtainable. A complete system of this kind ranges from $1,500 to $2,500.

Decentralized Unit-Conditioners

Where the house has a hot-water, steam or vapor-heating system already installed, the problem of providing accessory apparatus for air conditioning takes another aspect. Instead of bringing the air to a central source for warming and conditioning, the heating and conditioning units must be taken to each room where air treatment is desired. For this purpose an entirely different line of devices is manufactured. As the checklist descriptions illustrate, these decentralized room units must be distinguished from apparatus applicable to central warm-air heating.

One type of room unit adaptable to a radiator heating system (water, steam or vapor) is known as the cascade humidifier: water trickles down over a series of horizontal radiator sections and the surrounding air is both moistened and heated. Radiators equipped with water-evaporating pans require attention unless automatically supplied.

Several types of humidifying radiators equipped with electric blowers are obtainable in cabinets which can be built in to the walls or floor. The cost range is between $150 and $350 installed.

Complete air conditioners of the cabinet type offer electric blowers or fans with filters, a concealed radiator with heating connections, a humidifying element with water connections and drain, together with refrigeration lines from a refrigeration machine (located elsewhere) for cooling and dehumidifying in summer. Both outside air and recirculated air from the inside are conditioned, but the circulation is usually limited to the room containing the equipment. The cost of the installation is increased from $800 up by the use of refrigeration equipment and connections.

Unit coolers are available at less cost. These come in three types according to cooling medium: (1) cold-water spray, (2) cooling coil, and (3) melting ice in direct contact with the air. The spray and coil type can be installed as wall cabinets; the ice coolers are usually portable affairs.

AIR CONDITIONING EQUIPMENT

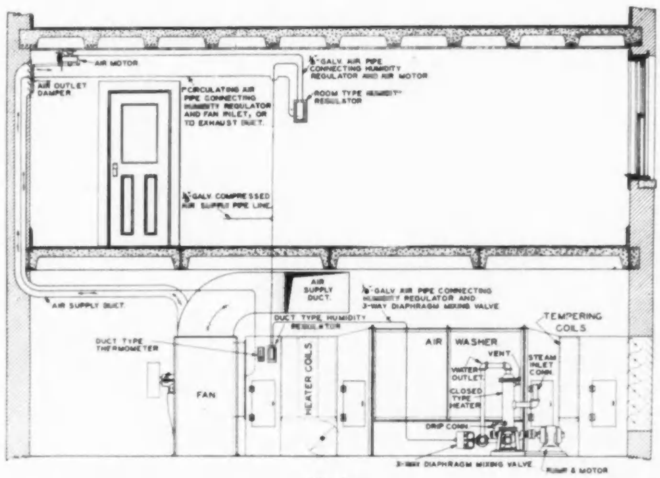
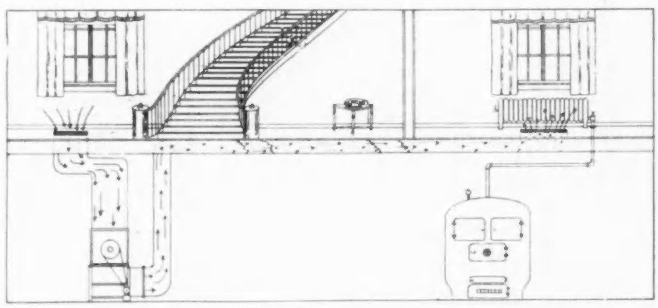
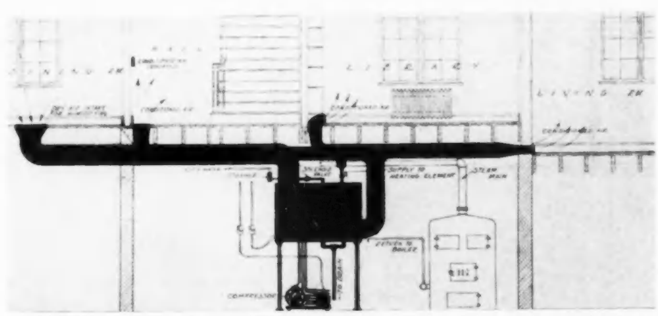


Fig. 27

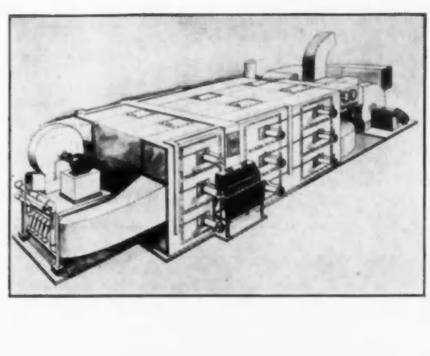
Arrangement of humidity control with automatic outlet dampers. American Blower Corporation.



Arrangement of apparatus to supplement existing heating system. Health-Air Systems.



Typical household installation of equipment. Conditioned Air Corporation.



Air conditioning unit. Silica Gel Corporation.

ALL-YEAR AIR CONDITIONING

(ALL ITEMIZED INFORMATION

Manufacturer	Trade Name of Product	Application	Winter Temperature Control	Winter Humidity Control	Air Distribution
Air-Control Systems, Inc., Chicago, Ill.	"Zephyr 75"	Domestic, Commercial	Room Heating by Replacing One Steam or Hot Water Radiator	Low Pressure Finely Atomized Spray. For Humidification Space up to 40,000 cu. ft.	Centrifugal or Blower Type Fan
	"Zephyr 50"	Domestic, Commercial		Low Pressure Finely Atomized Spray for Humidification Space up to 20,000 cu. ft.	Centrifugal or Blower Type Fan
American Blower Corporation, Detroit, Mich.	"Sirocco" Conditioner Series R	Domestic	Hot Water Heater Connection	Optional Equipment	Fans ("Sirocco") Thermostatically Controlled
	Series O	Commercial	Hot Water Heater Connection	Optional Equipment	Fans ("Sirocco") Thermostatically Controlled
	Cooler Series C	Commercial, Surface Cooler Type	Hot Water Heater Connection	Spray-type Humidifiers Humidistat Control	Fans ("Sirocco") Thermostatically Controlled
American Foundry & Furnace Co., Bloomington, Ill.	June-Aire (Gas Fired) Warm Air Conditioning, Filtered Air Climate-Maker (Coal and Oil Fired)	Domestic—Large Sizes Available for Schools, Churches, Theaters	One of Several Thermostats Controls Winter Temperature. Limit Control on the Furnace in Addition	Centrifugal Atomizing-type Humidifier. Humidistat Control	Positive Pressure Blower Connected to Ducts to each Room—Thermostatically Controlled
Betz Unit Air Cooler Co., Kansas City, Mo.	Unicool	Domestic, Commercial, Industrial	Hot Water or Steam	Water Spray	Fan or Blower
	Dricool	Commercial, Industrial	Hot Water or Steam		Fan
The Bishop & Babcock Sales Company, Cleveland, Ohio	B. & B. Massachusetts Air Washer	Public Building and Special Residential Type		Humidistat Control of Pumps and Closed Heaters	
Campbell Metal Window Corporation, New York, N. Y.	Maxim Silencer & Campbell Air Conditioner Model "C"	Domestic	Connection to Hot Water or Steam System	Water Reservoir	Fan, Rheostat Control
Carrier-Lyle Corporation, Carrier Corporation, Newark, N. J.	"Atmospheric Cabinet"	Individual Rooms and Offices	Connection to Central, Steam or Hot Water Heating Boiler	Spray Humidifier—Thermostatic, Hygrostatic Control	
	"Carrier Unit Air Conditioner"	Industrial—Self-contained Units	Steam Connection	Water Connection. Automatic Control	Uniform Distribution
Clarage Fan Company, Kalamazoo, Mich.	"HV" and "HSV" Fans, Type "H," "V," "CWW," "CDC" and "CF" Air Washers and Conditioners	Commercial & Industrial	Hot Water or Steam	Spray-type Humidifiers Humidistat or Dew Point Thermostat Control	Fan — Thermostatically Controlled. Indirect with Ducts
	Unit Air Conditioners	Commercial & Industrial	Hot Water or Steam	(Ditto)	Fan — Thermostatically Controlled. Direct or Indirect with Ducts
Conditioned Air Corporation, Detroit, Mich.	Airco	Residential, Commercial, Offices		Humidistat and Mercoid Controls	Fan 1,500 C.F.M.
The Edwards Manufacturing Co., Cincinnati, Ohio	Hot-Kold Air Conditioning System	Domestic, Industrial	Completely Automatic	Humidistat Control	Fan — Thermostatically Controlled; Pipe Sizes Control Distribution
Fox Furnace Co. Elyria, Ohio	"Sunbeam" (Oil and Coal) "Gas Automatic" (Gas)	Domestic, Schools, Churches, Shops, Stores	Thermostat and Electric Valve (Gas and Oil). Thermostat and Damper Motor (Coal)	Spray Humidifiers in Warm Air Chamber with Solenoid Valve Actuated by Humidistat	Fan Controlled by Thermostat
Frigidaire Corporation, Dayton, Ohio	Frigidaire Air Conditioner	Domestic, Commercial	Connects with Existing Hot Water, Vapor or Steam-Heating Systems	Evaporation from Humidifier Pan. Humidistat Control if Desired	Fans May Be Operated Independent of Cooling or Heating Functions
	Frigidaire Refrigerated Air System	Domestic Commercial	Connects with Existing Hot Water, Vapor or Steam-Heating Systems	(Ditto)	(Ditto)
Grinnell Company, Inc. Providence, R. I.	Thermolier, Air Conditioning Type	Commercial	Thermostatic	Humidifiers—Humidistat Control	Fan — Thermostatically Controlled
Health Air Systems Div. of Economy Baler Co., Ann Arbor, Mich.	"Healthair"	Domestic	Furnace Switch	Spray-type Humidifier—Humidistat	Positive Fan-Furnace Switch Control
A. F. Hinrichsen, Inc., New York, N. Y.	Zephyr Humidifiers	Domestic, Industrial		Spray Type with Humidistat Control	Equipped with Blower
Holland Furnace Co. Holland, Mich.	Holland Air Conditioner	Domestic, Small Stores, Churches, Schools	"Comfort Control" for Steam, Vapor, Hot Water and Warm Air	Spray-type Humidifier—Control Optional	Fan — Thermostatically Controlled

Air Cleaning	Summer Air Circulation	Summer Temperature Control	Summer Humidity Control	Ionization Factor	Overall Dimensions of Unit	Cost Range
Through Air Washing	Blower Type Fan	Mechanical Refrigeration. For Cooling, Equivalent to 1 ton Refrigeration	Dehumidification with Refrigeration		33″ H. 30″ W. 13″ D.	$295 Plus Connections and Refrigeration
Through Air Washing	Blower Type Fan	Mechanical Refrigeration. For Cooling, Equivalent to 1/3-1/2 ton Refrigeration	Dehumidification with Refrigeration		32″ H. 19″ W. 7″ D.	$75 Plus Connections and Refrigeration
Dry Filters—Cloth Bag Type	Fresh or Recirculated Air, Mechanically Controlled	Tap Water, Ice or Mechanical Refrigeration	Dehumidifying When Used with Water Below Dew Point Temperature		4 Sizes: From 44⅛″ W, 33⅜″ D, 66″ H, to 72⅛″ W, 52⅛″ D, 66″ H.	$460—$1,140 Plus Connections
	Recirculated Air	Ice or Mechanically Refrigerated Water	Dehumidifying When Used with Water Below Dew Point Temperature		4 Sizes: From 8″ D, 26″ H, 27″ W, to 18″ D, 38″ H, 48″ W.	$110—$300 Plus Connections
Spray or Filters	Fresh or Recirculated Air, Mechanically Controlled	Tap Water, Ice or Mechanical Refrigeration	Dehumidifying When Used with Water Below Dew Point Temperature		18 Sizes: From 56½″ W, 30″ D, 28¼″ H; to 86½″ W, 39½″ D, 69¼″ H.	$285—$5,800 Plus Connections
Dry Brass Air Filters, Cleaned by Tapping on the Floor	Summer Switch Provides Summer Air Circulation. Thermostat to Control this May Be Had at Extra Cost	As an Extra, Ice or Mechanical Refrigeration Is Available or if Deep Well Water Is Available This May Be Used for Summer Cooling	Humidistat to Be Wired to Turn on the Ice Water when Humidity Goes Above a Certain Point (This Is Not Standard)	Ozone Not Used or Recommended	All are Basement Units and Occupy about Twice the Usual Space Occupied by a Furnace Alone.	From $500 Up, Depending Upon the Size and Type of Building and Whether or Not Complete Equipment is Purchased
Washer	Sufficient to Provide Proper Circulation	Cold Water Cooled with Ice or Mechanical Refrigeration	Humidity Reduced with Ice Water Spray		12″ x 18″ x 7′ 6″ H. to 36″ x 36″ x 10′ 0″ H. 4 Sizes	$330—$1,140 Plus Water Cooling Tank and Refrigeration Plant
	Sufficient to Provide Proper Circulation	Cold Water or Direct Expansion	Dry Surface		16″ x 12″ x 13″ H. to 22″ x 15″ x 21½″ H.	$95—$174. Units only Cooling Equipment, Plant Extra
Continuously Flooded Scrubber Plates		Ice Water Mechanical Refrigeration				$95 and Up
Cloth Filtro-bac Mat	Cooling Effect	Mechanical Refrigeration	Dehumidification by Mechanical Refrigeration		50″ x 12″ x 28″ in Height or More.	$645 Plus Connections
		Connection to Refrigeration Machine				
Air Washing		Cools if Refrigeration Connections are Provided	Dehumidifies if Refrigeration connections are Provided		2 Sizes: 2,500 C.F.M. and 5,000 C.F.M.	
Spray Systems (Filters Optional)	Sufficient to Provide Accurate Control of Temperature and Humidity	Ice, Water or Mechanical Refrigeration	Spray-type Dehumidifiers. Dew Point Control		Varied	Varied
Spray Systems (Filters Optional)	(Ditto)	Ice, Water or Mechanical Refrigeration	Spray-type Dehumidifiers. Dew Point Control		Varied—12 Sizes and Types	$500—$2,000
Spray and Dry Filter	Cooling Effect	Thermostat Connected to Compressor Motor	Humidistat Connected to Sprays	Optional	2′ W. 4′ L. 3′ H.	$1,200 Up
Dry Filters	5°-8° By Air Circulation by Fan	Installation of Dehumidification Coils & Compressor of Capacity Up to 5 Tons	By Dehumidifying Air	Research Being Conducted	100,000 B.t.u Input Unit 3′x3½′x4′	Determined by Size of House, Heat Loss, etc.
Dry Type 2″ Thick, Split Wire, Woven in Pads	Cooling Effect	Refrigerating Units Can Be Installed			No. 10: From 42½″ x 66″ to 58½″ x 90″. No. 60: From 68″ x 46″ to 76″ x 63″. No. 3: From 30″ x 87″ x 90″ x 87″	$5—$12 per 1,000 B.t.u. Requirements of a Building
Cleaning by Condensation as Air Moves Over Coils	We Do Not Consider Movement of Air Alone as Cooling	Mechanical Refrigeration	Mechanical Refrigeration		39¼″ W. 14″ D. 31¾″ H.	One Unit Complete with Condenser, Installed, Approx. $650
Cleaning by Condensation as Air Moves Over Coils		Mechanical Refrigeration	Mechanical Refrigeration		28¾″ W, 14″ D, 42⅝″ H, 24″ W, 18¾″ D, 22″ H.	Prices Vary. According to Individual Requirements of Installation
Filters and Washer	Fan and Blower	Ice, Water, Steam Ejector, or Mechanical Refrigeration	Unit Coolers			
Spray-type Air Washer	Cooling Effect	Ice Water or Mechanical Refrigeration			Wide Range of Sizes.	$150—$500 Plus Connections
	Can Be Adapted for Cooling	Mechanical Refrigeration			32″ H. 18″ W. 6″ D.	From $100 Upwards
Closely woven Copper Mesh Screen Outside. Spray Water Inside with Eliminator Plates	Cooling Effect	Cold Water Provided by Mechanical Refrigeration—Optional			26½″ D. 40½″ H. 42½″ L.	$235 Plus Labor and Connections. Refrigeration Extra

ALL-YEAR AIR CONDITIONING (Continued)

Manufacturer	Trade Name of Product	Application	Winter Temperature Control	Winter Humidity Control	Air Distribution
Lennox Furnace Co., Marshalltown, Iowa	Aire-Flo Air Conditioning Systems	Domestic	Warm Air Furnace of Heavy Riveted Steel Construction to Insure Permanent Tightness	Spray-type Humidifier on Unit Using Dry Filters. Air Washer Provides Humidity on Units Equipped with Washers. Lewis Humitrols Used	Slow-speed Centrifugal Controlled Thermostatically for Bonnet Temperature
Lewis Air-Conditioners, Inc., Minneapolis, Minn.	Lewis Air Conditioner Model M-3	Domestic, Office, Small Buildings	Steam or Hot Water Boiler Connection	Warm Air Forced Over Films of Tempered Water. Lewis Humitrol Regulates Humidity	Long-hour Duty Motor Used to Operate Fan for Constant Air Distribution and Air Cleansing
	Model M-4	Domestic, Small Buildings	Steam or Hot Water Boiler Connection, Furnishing All Heat for Inclosure	(Ditto)	Steam Supply Modulated to Blast Heater Constant Air Circulation
McCord Radiator & Mfg. Co., Detroit, Mich.	McCord Convector	Stores, Restaurants, Beauty Parlors, etc.	Hot Water—Pump Circulated		Disk Fan—3 Speeds Manual
J. H. McCormick & Co., Williamsport, Pa.	Model "B" Airtrol	Domestic or Commercial	Steam Boiler Connection or Electric Tempering	Steam Valve Humidistat	Airtrol Mixed Flow Impeller. Rifled Nozzle Directional Control
Marlo Electric Corp., St. Louis, Mo.	"Marlo" Air Conditioning Equipment	Domestic, Commercial	Low Pressure—Steam or Hot Water	Spray-type Humidifiers—Humidistat Control	Fan, Squirrel-cage Type Thermostatic or Hand Control
Moss-Chase Co., Buffalo, N. Y.	(a) Niagara Air Conditioner (b) Niagara Air Conditioning Systems	Commercial and Industrial Including Comfort Conditioning for Any Application	Niagara Pilot Control or Niagara Differential Control with Steam as Prime Heat	Niagara Pilot Control or Niagara Differential Control with Spray Humidification	Fan (a) (b) With Ducts as Required for Secondary Distribution
L. J. Mueller Furnace Co., Milwaukee, Wis.	Climator II	Domestic	For Connection to Any Warm Air Furnace	Spray-type Humidifier Controlled by a Humitrol	Fan Controlled by Mercoid Fan Control
	Climator III	Domestic	For Connection to Any Warm Air Furnace	Spray-type Humidifier Controlled by a Humitrol	Fan Controlled by Mercoid Fan Control
Mumford-Hinrichsen, Inc., New York, N. Y.	"Zephyr" Air Conditioning Units	Domestic, Commercial Industrial	With or Without Connection to Heating System	Spray-type Humidifiers Humidistat Control	Electric Blower
Premier Warm Air Heater Co., Dowagiac, Mich.	Premier Washed Air Conditioners	Domestic, Churches, Educational, Public, Commercial	Automatic Connection with Steam, Hot-Water or Warm-Air Heating System	Manual or Automatic Water Spray Nozzle Type	Twin Blower—Automatic Control
Rudy Furnace Co., Dowagiac, Mich.	Rudy Coal- and Oil-Fired Air Conditioners. Rudy Gas-Fired Air Conditioners (Bon-Air)	Domestic	Thermostatically Controlled	Humidistat	Blower—Thermostatically Controlled
Servel Sales, Inc. Evansville, Ind.	Servel Comfort Coolers	Homes, Offices, Shops	Steam or Hot Water if Desired	Spray	Fans Contained in Unit
The Silica Gel Corporation, Baltimore, Md.	Silica Gel Air Conditioners	Domestic, Commercial	Warm Air Furnace or Indirect Heater (Steam on Coolers)	Spray-type Humidifiers or by Mechanical Injection of Water Mist in a Moving Air Stream	Fan and Duct System
	Silica Gel Dehydrators	Commercial	Indirect Heaters (Steam on Coolers)		Fan and Duct System or Local Recirculation
B. F. Sturtevant Company, Hyde Park, Boston, Mass.	Unit Ventilator Cooler-Ventilating Type	Domestic, Office, Room	Steam, Vapor or Hot Water	Evaporation Type, Automatic Control by Humidistat	Fan Under Automatic Control
	Cabinet Unit Recirculating Type	Domestic, Office, Room	Steam, Vapor or Hot Water	(Ditto)	Fan Under Automatic Control
Swartzbaugh Mfg. Co., Toledo, Ohio	Klenzair	Domestic and Office		Spray Disks Distribute Water Carried Up by Rubber Belts	Fan Direct into Room
The Trane Company, La Crosse, Wis.	Climate Changer	Residential	Yes	Spray—Humidistat	Fan—Thermostatically Controlled
York Ice Machinery Corporation, York, Pa.	Central System—Industrial—Human Comfort	Industrial—Human Comfort	Water Heater—Fin Surface Radiation	Various	Fan and Ducts Supply and Return
	Unit System—Spray Type	Industrial	Water Heater on Sprays. Fin Surface or Electric in Duct	Humidistat	Fan with Cowel Outlets
	Cabinet Type	Offices, Homes, Stores, etc.	Steam, Vapor or Hot Water—Thermostatically Controlled	Humidistat	Fan

A CHECKLIST OF EQUIPMENT

Air Cleaning	Summer Air Circulation	Summer Temperature Control	Summer Humidity Control	Ionization Factor	Overall Dimensions of Unit	Cost Range
Dry Filters. Owens - Illinois Type and Air Washers	Results from High-speed Blower Operation Sufficient to Change Air 8 Times per Hour to Provide Cooling Effect	Cooling by Evaporation Where Comparatively Low Relative Humidity Prevails. Ice Used Where Relative Humidity is too High for Cooling by Evaporation	No Provision as Yet	Not Concerned so Far	4′ x 8′ for Average Unit. Dimensions Vary with the Many Different Sized Units	$200–$900 to the Consumer Depending Upon Size Plus Installation Charges
Dry Filters	Produces Desirable Air Motion for Cooling	Ice, Low-Temperature Water or Mechanical Refrigeration	Unit Dehumidifies but Does Not Require Humidity Control	Optional	45″ W. 41½″ D. 46″ H.	$350 and Up. Plus Installation
Dry Filters	Desirable Air Motion for Cooling at Same Time Cleansing the Air	Ice, Low-Temperature Well Water or Mechanical Refrigeration		Optional	45″ W. 41½″ D. 46″ H.	Custom Built and Designed for Specific Requirements. Price Varies with Capacities
Large Area of Moist Surface	Recirculating by Disk Fan to Provide Good Diffusion	Cold Water	Modulating Water Valve-Manual		18⅝″ x 16½″ x 14¾″	$150 Less Pumps, Tanks and Installation
Silk Mesh Filter	Perceptible Air Movement. No Drafts	Mechanical Refrigeration or Refrigerated Water	Dehumidification by Refrigeration		Variable	
Dry Filters	Air Recirculated Over Cold Surface of Coil	Circulating Cold Water or Direct Expansion Using Mechanical Refrigeration	Humidistat	Optional — With or Without Ozonator	7 Models Cooling Units — Condensing Units from 1-15 Tons	$450 and Up Plus Installation
(a) Spray and/or Filters	Fan with Ducts as Required for Secondary Distribution	Niagara Pilot Control or Niagara Differential Control with Water or Mechanical Refrigeration	Niagara Pilot Control or Niagara Differential Control		7 Sizes: Systems for Any Requirement; Anti-Corrosion Construction; Niagara Standard Aluminum Heating and Cooling Coils	(a) $1,000 — $3,000 Plus Connections and Prime Heat and Refrigeration (b) $3,000 Up
Viscous Cell or Airmat Dry Filters	Circulation of Air from Basement and Outdoors	Cold Tap Water, Ice or Mechanical Refrigeration	Controlled by a Humiditrol or Manually		4 Sizes with Individual Fan, Air Washer and Filter Units	
Replaceable Viscous Cell Type or American Viscous Filters	Circulation of Air from Basement and Outdoors	Cold Tap Water, Ice or Mechanical Refrigeration	Controlled by a Humitrol or Manually		Made in One Size, with Fan, Washer and Filter in a Single Casing	
Through Air Washing	Constant Air Motion	Mechanical Refrigeration	Mechanical Refrigeration	Radi-ion Attachment at Extra Price	32″ H, 18″ W, 6″ D; 32″ H, 30″ W, 14″ D.	$75, $295 and Up Plus Connections
Air Washer and Twin Dry Filters	Forced Circulation and Washed Pure Air Materially Improve Comfort Condition	Water Sprays Where Tap Water Cold Enough, Otherwise Water Coils	Automatic in Conjunction With Water Coils		All Sizes Allow for Easy Passage Through Standard-Size Doorway	$239.60 (Retail) and Up, Automatic Controls Included, Plus Installation
Washing and Filtering	Cooling by Air Washing Sufficient to Provide Cooling Effect	Air Washing	Humidistat			
Copper Filter	Fans Contained in Unit	Manual	By Varying Machine Setting		Various Sizes	$200—$500 Plus Machine
Dry Filters "Air-Mat" or Equivalent	Sufficient to Provide Direct Dehumidification Independent of Cooling	Tap or Well Water Where Maximum Temp. Does Not Exceed 75°. Indirect Cooling Surface	By Direct Removal of Moisture from Air		6′ x 5′ x 3′	$1,000 Plus Auxiliaries and Connections
Dry Filters		(Ditto)	By Direct Removal of Moisture from Air			$100—$75,000 Completely Installed
Dry Air Filter if Desired	Units Various Sizes to Provide Necessary Cooling Effect	Mechanical Refrigeration, F12 or Methyl Chloride or Chilled Water	Dehumidifying Coil			$600 Up Plus Installation
No Filter	(Ditto)	(Ditto)	Dehumidifying Coil			$500 Up Plus Installation
4 Water Sprays	Cooling Effect	Water Evaporation	Nonforced Humidity		Standard Model No. 700 40″ H. (Hay-fever Attachment)	$35 List on All Models (Hay-fever Attachment Plus $10)
Dry Filters	Cooling Effect	Ice Water Mechanical Refrigeration	Yes		About 36″ x 48″ x 60″ High	$700—$800 Installed with Oil or Gas Burner
Sprays and Filter Dry or Oil	Cooling Effect	Mechanical, Brine Water or Ice	Dew Point Control		Dependent Upon Size and Type of Installation	
Sprays and Filter Dry or Oil	Cooling Effect	Mechanical, Brine Water or Ice	Dew Point Control		1-FSS 2′ 7″ x 5′ 11″ x 8′ 9″ 2-FSS 2′ 7″ x 7′ 5″ x 8′ 9″ 4-FSS 2′ 7″ x 10′ 8″ x 8′ 9″	
Dry Filters	Cooling Effect	Mechanical, Brine Water or Ice			Various Sizes	

WINTER AIR CONDITIONING

Manufacturer	Trade Name of Product	Application	Winter Temperature Control	Winter Humidity Control
The Bishop & Babcock Sales Company Cleveland, Ohio	Compact Insulated Furnace Blower	Domestic Warm-Air Systems	Furnace Bonnet Control	Spray-type Humidifier, Humidistat Control
The Bryant Heater & Mfg. Co. Cleveland, Ohio	Bryant Model 76 Air Conditioner	Domestic	Automatic Gas Controls Operated by Room Temperature Regulator	Water Pan Type
	Bryant Dualator	Domestic. Can Be Used with Existing Steam Systems	Automatic Gas Controls Operated by Room Temperature Regulator	Water Pan with Steam Coils
Campbell Metal Window Corporation New York, N. Y.	Maxim Silencer & Campbell Air Conditioners—Model "B"	Domestic	Connection to Hot-Water or Steam System	Water Reservoir
Carrier-Lyle Corporation Carrier Corporation Newark, N. J.	"Weathermaker"	Central Residential System	Gas, Fuel or Oil	Vaporizer—Hygrostatic and Thermostatic Control
	"Home Humidifier"	Domestic	Connection to Heating Boiler—Can Be Set as Grille in Floor or as Radiator Cabinet	Spray
Corozone Company Cleveland, Ohio	Aquazone	Washes and Humidifies		
Dail Steel Products Co. Lansing, Mich.	Dailaire System of Heating and Air Conditioning	Domestic, Commercial	Warm Air	Spray-type Washer and Humidifier, Humidistat if Desired
	Dailaire Conditioner	Domestic. For Furnaces or Steam and Hot Water Jobs		Spray Washers and Humidifier
General Electric Company, Air Conditioning Department New York, N. Y.	Humifilter	Domestic		Screen Type
	Air Conditioner	Domestic	Warm Air	Screen Type
Hess Warming and Ventilating Co. Chicago, Ill.	Hess Air Conditioner	Domestic	Attached to Warm-Air Furnace. Also Used with Steam or Hot-Water Heating Plants, by Circulating Air Through Ducts	Humidity Controlled Automatically. Unique Revolving Water Film Humidifier
Hexcel Radiator Company Milwaukee, Wis.	Control-Aire Humidifier	Domestic. Portable Electric Humidifier		"Steamed-Vapor" Humidifier Semi-Automatic
W. E. Kautenberg Co. Freeport, Ill.	Electric Vapor Heater	Portable. Electric Plug Connection	Electric Grill	Water Pan
Koolair-Maker Corp. St. Louis, Mo.	Koolair-Maker Type "C"	Stores		Spray
Lewis Air Conditioners, Inc. Minneapolis, Minn.	Lewis Air Conditioner[1] Model M-2 Model S-1	Domestic, Office	Steam or Hot-Water Boiler Connection Replaces Radiator. Furnishes Equivalent Heat Plus Humidity	Passage of Heated Air Over Films of Tempered Water. Lewis Humitrol to Regulate Humidity
J. H. McCormick & Co. Williamsport, Pa.	Model "A" Airtrol	Domestic or Commercial. Small-Portable Window or Pedestal Air Circulator-Humidifier and Filter		Steam Valve. Humidistat Control
Moss-Chase Co. Buffalo, N. Y.	(a) Niagara Fan Heater (b) Niagara Disk Fan Heater (c) Niagara Humid Heater	Commercial and Industrial	Steam or Hot Water with Any Desired Control	(a and b) None (c) Steam Type
Motor Wheel Corporation Lansing, Mich.	M-W Weather Control Units	Domestic. Also Adapted to Limited Commercial Field	Thermostat Connection to Oil Burner Controls	Automatic Thermostatic Water Valve Supplies Vaporizer in Hood of Heater
B. F. Sturtevant Company Hyde Park, Boston, Mass.	Residence Humidifier Recirculating	Domestic, Office, Room	Steam, Vapor or Hot Water. Heating Capacity Equivalent to 70 sq. ft. D. R.	Evaporation Type Automatic Control. Up to 1½ G.P.H. Water
Timken Silent Automatic Co. Detroit, Mich.	Timken Airlux	Domestic, Offices, etc. Radiator-type Humidifier Inclosed in Steel Cabinet	Connects Directly to Steam, Hot-Water or Vapor System	Automatically in Accord with Heating Load
Williamson Heater Co. Cincinnati, Ohio	De Luxe Comfort System	Domestic	Furnace	Thermostatically Controlled Drip into Evaporating Pan
Workrite Specialty Co. Milwaukee, Wis.	"Electric Humidifyer"	Portable. Electric Plug Connection		By Means of Electric Immersion Heater

(1) Ionization optional, not standard.

A CHECKLIST OF EQUIPMENT

Air Distribution	Air Cleaning	Summer Air Circulation	Overall Dimensions of Unit	Cost Range
Fan Continuous or Intermittent Operation	Dry Filters, Renewable Type	Air Capacity Can Be Increased for Summer Cooling	2′ x 2′ and 4′ x 4′	$65-$200
Low-speed, Large-volume Blower-Type Fan—Thermostat	Dry Filters	Cooling Effect	30¼″-114″ W. 52¾″- 59½″ D. 50⅝″- 50⅝″ H.	$558-$1,468 Complete with All Controls
Low-speed, Large-volume Blower-Type Fan—Thermostat	Dry Filters	Cooling Effect	68½″-108⅛″ W. 45⅝″- 60¼″ D. 62″ - 62″ H.	$1,230-$1,837. Air Conditioning Chamber (without Boiler) Can Also be Obtained for Use With Any Steam Boiler
Fan, Rheostat Control	Cloth Filtro-bac Mat	300 C.F.M. Plus Recirculation	50″ x 12″ x 28″ in Height or More	$245 Plus Connections
Forced Distribution by Blower	Dry Filters—Fine Wire		5 Sizes: 7′ L. 4′1″-6′6⅜″ W. 5′3⅝″-5′4⅝″ H.	
With or Without Blower	Dry Filter			
Fan Thermostatic Control	Forces the Air Through a Sheet of Water		40″ H. 16″ Square	$67.50
Blower "Furnstat" Controlled	Wet Filters and Washers	Summer Circulation and Washing and Cleaning		
Blower "Furnstat" Controlled	Wet Filters	Summer Circulation and Washing and Filtering		
Fan	Dry Filter		2′ H. 2′ W. 2′6″ L.	Approximately $125 Installed
Blower	Dry Filter		30″ W. 30″ L. 5′10″ H.	Approximately $300 Installed
Fan Operation Controlled by Furnace-stat with Furnace Installations; Controlled by Humidistat with Steam or Hot-Water Heating Installations	Dry Filter. Cellulose Pad Filter		No. 1, 28″ x 41″ x 51″ H. 1,500 C.F.M. No. 2, 30″ x 58″ x 54″ H. 2,000 C.F.M. No. 2A, 30″ x 58″ x 54″ H. 2,500 C.F.M.	No. 1, $200 No. 2, $250 No. 2A, $300
Fan	Air Forced Through Pocket of Live Steam		17″ x 12″	$42-$47
	Spray. Contact with Wet Surfaces		18″ x 18″. 45″ H.	$50
M-2, Fan Thermostatically Controlled S-1, Operates by Gravity	Passage of Air Over Scrubber Plates. Waste Drain Carries Dust and Dirt to Basement	Not Recommended for Summer Use	M-2, Wood Cabinet 25½″ x 36″ x 11¼″ S-1, Steel Cabinet 24″ x 34½″ x 9½″ Both Models Use the Same Cabinet	S-1, $150 M-2, $250 Plus Installation
Airtrol Mixed Flow Impeller Rifled Nozzle Directional Control	Silk Mesh Filters	Perceptible Air Movement. No Drafts	Variable	
Fan (a) With Ducts if Required for Secondary Distribution	(a) Dry Filters, Mat Type (b) None	Sufficient for Cooling and Ventilating in Some Applications	7 Sizes; Systems for Any Requirement; Anti-Corrosion Construction; Niagara Standard Aluminum Heating and Cooling Coils	$85-$600 Plus Connections Plus Prime Heat
Positive Pressure Blower Controlled Thermostatically	Optional	Cooling Effect Dependent Upon Temperature of Basement Air		$400-$725 Installation, Piping, etc., Extra
Fan Under Automatic Control	No Filter			$250 Plus Installation
Convection			6 Sizes: 31½″ L. to 4½″ L. 11¾″ W. to 11¾″ W. 24″ H. to 45″ H.	$115-$190 Completely Installed with Cabinet
Blower, Thermostatically Controlled	Dry Filters—Fabric or Moss Type	Cooling Effect	Various Sizes Ranging From 42″ x 89″ x 62″ to 50″ x 116″ x 62″	$275-$425 Plus Installation
Induction Type Motor and Fan			13¾″ H. 11½″ Diameter	$24.50

SUMMER AIR CONDITIONING

Manufacturer	Trade Name of Product	Application	Summer Temperature Control	Summer Humidity Control
Carrier-Lyle Corporation Carrier Corporation Newark, N. J.	"Portable Room Cooler"	Individual Rooms	Melting Ice (300 lbs.) No Automatic Controls	Removes Excess Humidity
Chicago Pump Co. Chicago, Ill.	"Northern Breeze" Room Cooler	Rooms, Stores, Offices, etc.	Ice	By Chilling Air Dry at Dew Point
Clarage Fan Company Kalamazoo, Mich.	Unitherm Coolers	Commercial Cold Storage	Mechanical Refrigeration	Humidity Control with Brine Spray Type Units
Copeland Products, Inc. Mt. Clemons, Mich.	Copeland Cooler	Room Cooler	Standard Condensing Unit	Dehumidifies Drip Pan and Sewer Connection
Corozone Company Cleveland, Ohio	DeLuxe Aquazone[1]	Room Cooler	Ice Water	
Hexcel Radiator Company, Milwaukee, Wis.	Control-Aire Space Heater	Domestic, Portable Electric Hot-Water Fan Forced Room Heater	Ice Water Can be Used to Assist in Circulating Air	
H. S. Kaiser Co., Chicago	"Ice Air"	Portable Room Cooler	Ice (200 lbs.)	
	"Kaiseraire"	Portable Room Unit	Ice (250-500 lbs.)	Dehumidifies by Chilling
Koolair-Maker Corp. St. Louis, Mo.	Koolair-Maker Type A	Domestic Offices, Shops	Ice or Mechanical	
Lewis Air Conditioners, Inc. Minneapolis, Minn.	Lewis Space Cooler[2] Portable Type	Domestic, Office, Hospital, etc. Suitable for Cooling Up to 3,500 Cubic Feet Space	Ice Melt Tank Holds 300 Pounds of Ice, 3 100 lb. Cakes	
	Lewis Space Cooler[2] Direct Cabinet Type	Domestic Office, Restaurant, etc., Wherever Cooling is Desired	Ice, Water or Mechanical Refrigeration	
J. H. McCormick & Co. Williamsport, Pa.	Model "C" Airtrol	Domestic or Commercial Portable Cabinet, Ice-Filled Room Cooler	Ice Cooling	Dehumidification by Ice Cooling
Modine Manufacturing Co. Racine, Wis.	Ice-Fan	Domestic	Ice	Dehumidifies
Moss-Chase Co. Buffalo, N. Y.	(a) Niagara Brine Spray Cooler (b) Niagara Fan Cooler (c) Niagara Disk Fan Cooler (d) Niagara Room Cooler	Commercial and Industrial, Including Comfort Cooling and Low Temperature Air Conditioning	Ice, Water, or Mechanical Refrigeration with Thermostatic Control	(a) Humidity Control as Required (b) (c) (d) Elimination of Condensed Moisture
Refrigerating Co., Inc. Chicago, Ill.	Hilger Unit Type Air Cooler	Industrial, Domestic	Brine or Direct Evaporation of Ammonia or Other Volatile Refrigerant	
Servel Sales, Inc. Evansville, Ind.	Servel Humidraft	Product Cooling and Storage	Thermostatic	Balancing Machine and Thermostat Adjustment
The Silica Gel Corporation Baltimore, Md.	Silica Gel Air Dryers	Industrial (Low Humidities)	Tap or Well Water Where Maximum Temperature Does Not Exceed 75°. Indirect Cooling Surface	By Direct Removal of Moisture from Air
The Trane Company La Crosse, Wis.	Room Coolers	Offices, Apartments, Residences, Hotels, Industrial	Ice Water, Mechanical Refrigeration	Yes
Wepsco Steel Products Co. Blue Island, Ill.	Roto Cooler	Domestic, Commercial	Ice	Dehumidifies by Passing Air Through Cooled Tubes
York Ice Machinery Corporation, York, Pa.	Unit System Dry Coil	Industrial—Human Comfort—Domestic, Commercial	Mechanical, Brine,Water or Ice	
	Utility Air Cooler	Industrial, Human Comfort	Mechanical, Brine,Water or Ice	

(1) Ionization by means of Corozone. (2) Ionization optional.

A CHECKLIST OF EQUIPMENT

Air Distribution	Air Cleaning	Summer Air Circulation	Overall Dimensions of Unit	Cost Range
Blowers		Cooling	52" H. 24⅝" W. 37⅝" L.	
	Water	Cooling	50" H. 30" W. 22" D.	$196 Complete
Fans		Direct or Indirect with Ducts	Varied—10 Sizes and Types	$160-$2,000
Fan and Motor		Cooling	20" x 14" x 14"	
Fan. Thermostatic Control	Forces the Air Through a Sheet of Water	Summer Temperature Control	49" H. 24⅝" D. 24⅝" W.	$147
Fan		Circulation of Air Only	8" x 10" x 13" Weight 13 lbs.	$22-$27
Fan and Motor		Cooling Effect	20" x 20" x 47"	$28.50
Fan and Motor	Oil Coated Filter	Cooling Effect	Two Sizes— 22" x 26" x 62" 26" x 32" x 68"	
Fan	Spray Contact with Wet Surfaces	500 C.F.M.	14" D. 45" H. 50" L.	$250
Motor and Fan		400 C.F. M.	32½" x 27½" x 50⅜"	$260
Motor and Fan With 4-Speed Motor Control	Optional	Sufficient to Add to Cooling Effect	36½" x 14½" x 30⅞"	$250 up
Airtrol Mixed Flow Impeller Blade Deflector	Air Passage Over Water from Ice Meltage	Perceptible Air Movement	20" x 32" x 50"	
Fan	Partial Washing	Cooling Effect		$25-$40 Inclusive
Fan (a) (b) With Ducts if Required for Secondary Distribution	(a) Spray and/or Filter (b) Filter (c) } None (d) }	Fan	7 Sizes; Systems for Any Requirement; Anti-Corrosion Construction; Niagara Standard Aluminum Heating and Cooling Coils	$125-$1,750 Plus Connections Plus Prime Cooling
Fans		Forced Air Circulation		
Thermostat Controlled Fan		Variable	Various Sizes	$100-$300 Plus Machine
	Dry Filters			$100-$75,000 Completely Installed
Fan		Cooling Effect	Varies According to Capacities	Varies
Two Fan Sizes. Two Positions of Air Inlet to Vary Capacity and Corresponding Temperature of Air	Air Through Wet, Dripping Tubular Ice Container		100 lbs. Ice 20" W. x 34½" H. x 28½" L. 300 lbs. Ice 25½" W. x 51" H. x 38½" L.	$35--$190 Plug-in Electrical Cord Only
		Cooling Effect	(1, 2, 3 and 4 Fan Floor and Ceiling Type Units—Top or Side Discharge)	
Fan		Cooling Effect	High—24⅝" x } These 24⅝" x } Dimensions Low—24¾" } Include Fan 19¾" } at Rear	

METHODS OF AIR CONDITIONING

In comparing the desirability of these many types of equipment it becomes necessary to distinguish between the various means by which the conditioning process may be performed. Practically, each factor in air conditioning can be accomplished in several different ways, just as the single function of heating offers several possibilities—steam, hot water, warm air, and more recently, electricity.

HUMIDIFICATION

Wet towels, radiator pans, or other makeshift devices depending on exposure of water surface to air in natural, conductive or forced circulation, are so low in evaporating capacity that their application is generally held unsatisfactory.

On the assumption that humidification is necessary to replace moisture carried away by outfiltering air—according to experiments reported in Engineering Experiment Station Bulletin 230 of the University of Illinois—it is calculated that 11.6 gallons per 24 hours per 10,000 cubic feet of space (approximately a 6-room house) with one air change per hour are required for an outside atmosphere of 0° F and an inside atmosphere of 69° F and 40 per cent relative humidity. This requirement varies to nothing on certain days. From these experimental results the conclusion is reached that, although much depends on the weather-tightness of construction, neither furnace pans nor radiator pans are sufficient to maintain a relative humidity of 40 per cent in 0° F weather.

It should be pointed out, however, that in the case of decentralized cabinet radiators with horizontal sections serving as water trays, the surface area is increased many times. The claim is made by their manufacturers that up to 100 gallons of water a day, depending on the size of unit, can be evaporated if required.

Obviously the amount of surface in contact with the air when water stands in a pan is very much less than when the water is broken up into small particles and each particle is completely surrounded by air. The finer the spray of water particles, the more rapid the evaporation.

Spray Systems

Humidifying apparatus designed to inject a moisture spray into the air can be classified in three general types:

1. *Direct*: Those which spray into the particularized space. The success of such locally-distributed units depends on their ability to produce particles small enough to be evaporated while they still float in the air so that there will be no precipitation on surrounding objects. The spray must be uniformly fine and effectively distributed.
2. *Indirect*: Those which spray directly against the current of incoming air and then allow the moistened air to be introduced where desired. Usually metal baffle plates catch unevaporated particles and prevent the spray from escaping from the humidifying chamber. Such humidifiers are used only with central ventilating systems, and provision is generally made for warming the water in winter so that the air may be saturated at a definite temperature.
3. *Combined*: Direct and indirect. Where a high relative humidity is desired, a combination of both types is found economical.

The A.S.H.V.E. *Guide* (1932) states that direct humidification is most satisfactory where high humidities but little cooling, ventilation or air motion are required. The indirect system is most applicable where either low or high relative humidities are desired with maximum cooling and ventilation effect. For conditions requiring an unusually large amount of heat to be absorbed by ventilation and a high humidity to be maintained, the combination system is preferable.

Humidifiers

Atomizing humidifiers are commonly used in units of relatively small capacity. Ease of cleaning, accuracy of construction and installation, possibility of inspection and repair service are factors to be considered in selecting an atomizer system. If the air is shut off at a distance from the heads and no provision is made to relieve pressure in the lines quickly, precipitation may occur. High-duty humidifiers, installed in units of relatively high capacity, are supplied with water under pressure from a centrally-located pump. The spray is generated by impact.

Centrifugal humidifiers are self-contained and require only connection to the lighting circuit, the water line and drain. Capacity, however, is lower than in other types and power consumption is high. An excess of water is thrown off from the revolving disk and runs to waste unless returned to a tank to be filtered and recirculated.

New Humidity Control

A new use of the photoelectric cell has been developed by the B. F. Sturtevant Company in collaboration with the General Electric Company. By directing a beam of light through the window and on a photoelectric cell, it is possible to control the humidifying equipment.

The humidity detector is installed at a window preferably on the north side of the building where the sun's rays will not interfere. Moisture on the glass obstructs the light and the sensitive photoelectric eye passes an impulse to a Pliotron tube which actuates a relay to stop the humidifier. Mirrors reflect the light back and forth through the window several times to cover a larger area and thus make the equipment more sensitive. When the moisture clears, the motor starts again.

DEHUMIDIFICATION

When water is evaporated, the energy required for change of state (the latent heat of evaporation) is drawn from the surrounding air which is thereby lowered in temperature. This cooling effect increases the demand for heat in winter, so usually the water supplied to the humidifiers is heated, a practice which serves to increase the rate of evaporation. This principle is also employed in *dehumidification* but the water supplied to the dehumidifiers is cooled instead.

Spray and Coil Systems

The direct spray of cooled water has almost entirely replaced the use of wetted refrigeration coils in the spray chamber because of the high effectiveness of heat transfer between the fine spray and the air, which is lowered—in well-designed dehumidifiers—to the temperature of the water leaving the chamber. All water vapor is thus condensed from the air to the saturation point at that temperature, and just as in standard air washers, the free moisture is removed by a series of baffles or eliminators.

In this paradoxical process of spraying water into the air in order to remove moisture, the object is to obtain heat absorption as well as surface, so a coarser spray and a larger quantity of cold water per unit of air than in humidifiers is demanded. Dehumidification systems are usually provided with a dew-point control at the apparatus and with either a thermostat or hygrostat for control within the room.

Silica Gel System

Entirely different in principle from either the spray or refrigeration coil systems of dehumidification is the comparatively new practice of using *silica gel* beds. Instead of dropping the temperature of the air below the dew point and thus condensing the water vapor, the moisture is extracted through a process of adsorption which utilizes the force of capillary attraction.

Silica gel—a hard glassy material, composed of sodium silicate and acid with the appearance of clear quartz sand—has this capillarity to an admirable degree. It is highly porous, but the pores are smaller than the wave length of light, which enables it to adsorb gases and water vapor. This adsorption* continues up to 40 per cent of silica gel's own weight with no change in volume. When heat is applied, the moisture is driven out, and the cycle can be repeated indefinitely.

The American Gas Association has been promoting this use. Research so far has been directed chiefly toward independent dehumidification and independent cooling. This theory of separate control holds that a slight reduction of dry bulb temperature and a proper reduction of relative humidity will, over a period of time, give more satisfactory domestic service than the chilly atmosphere frequently experienced in commercial buildings which are conditioned by refrigeration.

The silica gel gas system for household air conditioning consists of (1) an adsorption unit for dehumidification and (2) a recirculation and air cooling system. The adsorption unit comprises two adsorbers, a gas furnace, an adsorption and activation fan, an after-cooler, air filter and controls. It takes normally one hour for an air-drying adsorber to become saturated, after which it is activated or desorbed while the second adsorber is put into operation, the cycle being carried out alternately and automatically by time clock.

The moisture control in this system is always independent of any temperature control that may be required. A much lower relative humidity can be attained than is practicable by other methods. The only cooling necessary for comfort (comparatively small if the relative humidity is kept low) is that required for removal of sensible heat originating in the conditioned area. This can be effected by passing the air over tubes in which tap water is circulated (if the temperature of the cooling water is 70° F or less), or by means of a small refrigeration unit. In either case the cooling is indirect. In localities where the tap water is warm the cooler is eliminated and an excess of dehumidified air is produced which is then passed through a recirculated water stream where the air temperature is greatly reduced by the resulting evaporation.

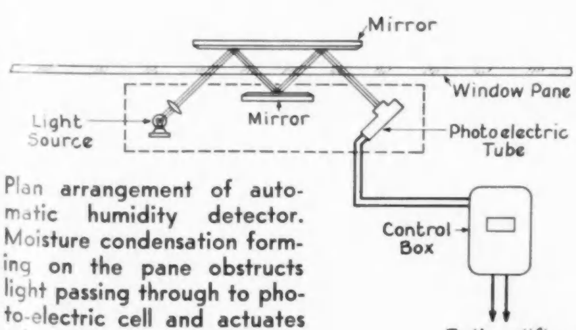
A low operating cost for summer air conditioning is claimed. From tests made by the American Gas Association (reported in *Refrigerating Engineering*) it is calculated that for an average well-built house with a volume of 25,000 cubic feet the requirements for complete circulation and cooling equipment, plus the dehumidifier, are:

(1) Gas—125 cu. ft. per hr. at 540 B. t. u. per cu. ft.

(2) Water—40 cu. ft. per hr. at 70° F.

(3) Power—1.5 kw.

Field tests indicate a summer season of 600 hours of operation in the vicinity of New York, 800 hours for Chicago and probably 1,000 hours in the southern States. Applying unit costs and total operating time for a particular locality, the annual operating cost may be readily computed.



Plan arrangement of automatic humidity detector. Moisture condensation forming on the pane obstructs light passing through to photo-electric cell and actuates relay stopping humidifier.

*Physicists define *adsorption* as a phase of capillary attraction more potent than simple *absorption*.

COOLING

It is evident from both experimentation and actual practice that experts differ in opinion whether cooling and dehumidifying should be done only by refrigeration or performed as separate functions either by refrigeration or some other means. It is also clear that dehumidification can be accomplished by refrigeration only in a very indirect manner, whereas cooling can be done directly by refrigeration.

The process of removing heat from the air consists essentially of establishing contact between the air and a cooling surface, which may be melting ice, a spray of cold water, or coils through which a refrigerant is passed.

Ice Cooling Systems

The National Association of Ice Industries has been active in promoting sales of comfort-cooling systems (reported in *Electrical World*) which use ice to produce cold water and electric power to drive the pump and fans. Ice manufactured in a central plant is delivered to a melting tank in the basement of the house, and the water used to cool the air is kept cold by constant circulation over the ice. The claim is made that the installation and maintenance costs are much less than when mechanical refrigeration is used.

Spray and Coil Cooling

Some systems depend on cold tap water from natural wells—if the temperature is 40° F or less—for spray cooling. If coils are used, several methods may be used to provide frigidity—cold water, brine, or some other liquid or gas.

The air volume required for cooling is said to be much greater than that for heating. For instance, a room requiring 5,000 cubic feet of air per minute for cooling would need only 2,000 to 3,000 cubic feet per minute for heating and humidifying. Obviously, for large buildings the amount of ice or cold water demanded would be excessive beyond practicability. In such cases mechanical refrigeration is necessary.

Mechanical Refrigeration

Equipment making use of the compression system of *mechanical refrigeration* depend, for their operation, on two physical factors: (1) the latent heat of evaporation and (2) the fact that increasing or decreasing the pressure on a liquid increases or decreases the temperature at which it can be made to evaporate or condense, when heat is applied or extracted. As an illustration of this second factor: water normally "boils" (i.e., changes from a liquid to a vapor) at 212°F, but if the external pressure is increased, say, 100 pounds per square inch, it will not boil until its temperature reaches 338° F. In this case heat is added to cause evaporation. If, however, the normal pressure (14.7 pounds) is reduced, the water will evaporate at a much lower temperature, ranging down to 32° F (normally the freezing point) for an almost perfect vacuum. As water evaporates at these lower pressures, it extracts its latent heat from the nearest source and produces a very low temperature corresponding to change of state temperature of the refrigerant at the given pressure.

Temperatures and pressures required depend on the *refrigerant*. Carbon dioxide requires pressures of more than 1,000 pounds per square inch and condensing water at low temperatures. Ammonia operates with pressure ranges usually below 200 pounds per square inch, but its use involves extreme care to make sure that no fumes will escape. The refrigerant should be absolutely nontoxic and noninflammable and noncorrosive to metals.

Commercial refrigerants which meet this requirement are available. For instance, *Carrene*—a refrigerant produced by the Carrier Corporation and used in their centrifugal refrigeration equipment—is a colorless water-white liquid (CH_2Cl_2) slightly heavier than water and immiscible. Its vapor is about 3½ times heavier than air and harmless. As a refrigerant *Carrene* functions at a "minus" pressure, i.e., below atmospheric.

Refrigerating Equipment

A refrigerating machine, in addition to valves and accessories, consists of three essential parts: (1) the *evaporator* or cooler in which pressure is maintained for evaporating the refrigerant at a sufficiently low temperature from the water, air or other medium in contact with the cooling surface; (2) the *compressor* which withdraws the gaseous refrigerant from the cooler and delivers it to (3) the *condenser* at a relatively higher pressure so that its heat can be absorbed by water at ordinary temperatures and the gas recondensed into a liquid and returned to the evaporator. Although the pressure in the condenser may be under atmospheric pressures, the vapor is *relatively* compressed. Being compressed, it will condense at a comparatively high temperature, giving up to the cooling water its latent heat of liquefaction.

Such machines should be fully automatic. Constant temperatures must be maintained. The refrigeration process must be continuous, and responsive to changes in demand or variation in load.

Cold water instead of brine is usually circulated in the coils, since in air conditioning the temperature need be reduced only to about 35° or 40° F., whereas commercial refrigerating machines must be capable of reducing the temperature of air or brine to a point far below 32° F.

Other Methods of Refrigeration

The *steam* system of refrigeration is used in a Carrier unit intended for summer cooling of stores. A tank in which ordinary tap water is sprayed has a small opening over which a jet of high-velocity steam is passed. This action sucks out the air and water vapor in the tank and causes a partial vacuum in which the water begins to evaporate at a temperature of approximately 40° to 45° F. The water remaining in the tank after the vapor is pulled out by the steam jet is sufficiently low in temperature to be used in the cooling coils, whither it is pumped. It is then returned to the tank for recooling, so there is a constant supply of refrigerated water flowing through the cooling coils.

Another refrigerator (described in *A.G.A. Monthly*) uses water as the refrigerating fluid, air for cooling and mercury vapor as the source of energy. A miniature mercury boiler discharges mercury vapor into a venturi tube which entrains and compresses water vapor drawn from the cooling unit in the ice box chamber. The pressure is reduced and the water in the cooler evaporates rapidly, producing refrigeration. Both the mercury and the water vapor condense, and the heavy mercury is used to pump the water back to its original height while the mercury itself flows back into the boiler. Pressures are below atmospheric. There are no mechanical valves or moving parts, and heat is applied by gas flame.

HEATING

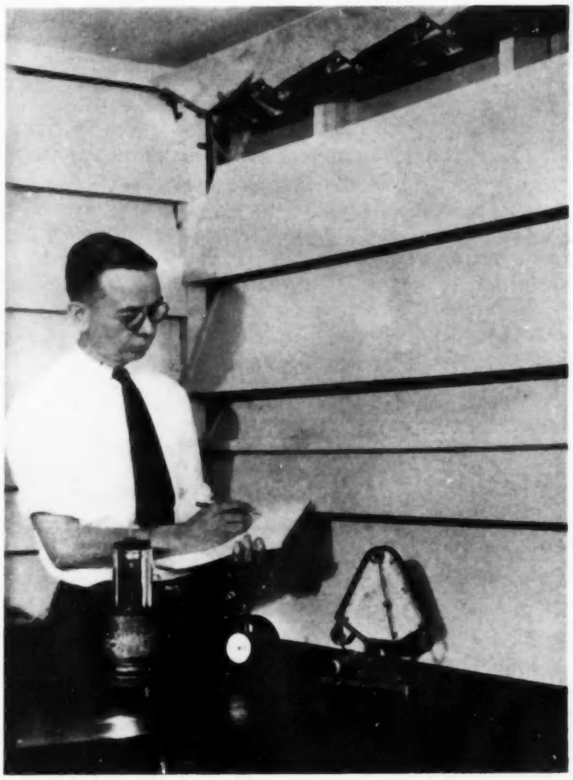
This subject is so complex in itself that space limitations prevent an adequate discussion of equipment. In the selection of any heating system—steam, hot water, vapor, warm air, electricity—careful consideration must be given to variable heating requirements, the initial and operating costs, types of fuel, ease of operation and servicing, quietness and cleanliness, even heating, good control, low depreciation.

For an impartial review of heating and ventilaing equipment, architects and specification writers will find the July, 1932, bulletin of *Consumers' Research* valuable. This purchasing handbook service, which is available only to subscribers,* lists products on the basis of quality as "recommended," "intermediate" and "not recommended."

Unit Heaters

For auxiliary or localized use unit heaters, consisting of a convector and electric fan, are available. In selecting such heaters it is necessary to determine if the required power is low enough to warrant a preference over a central fan installation and if the system will give adequate heat for worst weather conditions. The propeller type of unit heater, suspended from ceiling, is considered satisfactory for ceiling heights up to 12 feet. In large rooms with high ceilings, floor and ceiling types of heaters housing centrifugal fans which draw the air over steam coils at high velocity are necessary. Propeller fan units are more practical for small work since the construction of centrifugal fans under 24 inches in diameter is costly.

*Subscription rate for bulletins of Consumers' Research, Inc., 24 West 25th Street, New York City, is $2 a year. The recommended bulletin (Vol. VII, Part 2) also gives much information on lighting equipment, fire extinguishers, and building materials.



Electrically-heated panels in this windowless room control the wall surface temperature to agree with the body temperature, thus preventing loss of radiated body heat which is usually absorbed by cold walls. (A top panel is turned up to show electric units.) Humidity and air currents are controlled separately. Designed by Westinghouse.

Heating by Electricity

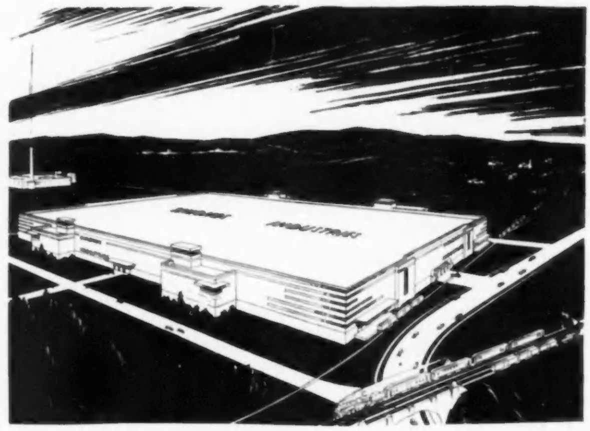
Electric heaters are of two general types: (1) the *radiant* or "spot" heaters which are ideal for giving immediate heat for short periods of operation but not for raising or maintaining the temperature of the air, and (2) the *convection* heaters which are designed to permit a large volume of air to be circulated for heating.

"Off-peak" electric power is also used for air heating in the indirect process of equipping large well-insulated tanks of water with immersion type electric heating units which are turned on automatically at night (when the central power station load is light and the rates are low). These units heat the water to any predetermined temperature when they are again turned off. Sufficient heat is stored up at night for use during the next day. The heat may be distributed satisfactorily either by circulating the hot water or by circulating warmed air in ducts.

Panel Heating

Within recent years the British *panel system* has been used in several American installations, notably the British Embassy Building in Washington, D. C. (described in the November, 1930, issue of

The influence of air conditioning on the design and construction of buildings is already becoming apparent. Windows particualrly are at present a means of heat loss, and to overcome this difficulty attempts have been made to design "windowless" structures. Typical of this line of development is the "Controlled Conditions Plant" of the Simonds Saw and Steel Company at Fitchburg, Massachusetts, designed and built by the Austin Company.



THE ARCHITECTURAL RECORD). Hot water pipes are embedded in walls and ceilings, giving large surface areas radiating heat at comparatively low temperature.

A variation of this panel system, making use of electric heating, has been developed by L. W. Schad, a Westinghouse engineer. Since it is known that 44 per cent of body heat is radiation which is usually absorbed by cold wall surfaces, it was theorized that, by controlling the temperature of walls and ceilings to agree with the body temperature, this loss could be prevented. Inside walls of the windowless experimental room are divided into panels supported by pivots so that they can be turned like shutters and thus control air currents. These panels are aluminum, painted ivory on the room side and left bright on the other. An electric heating unit is attached to the back of each panel and similar units are attached at regular intervals to the upper side of the ceiling for an even distribution of heat at all points. If too much human heat is generated, cold air is forced into the walls and ceiling and the surface temperature reduced to the desired point. All air entering through a floor vent is washed. This experimental work has already resulted in the production of portable low-temperature panel screens, with electric plug connections, for auxiliary heating use.

AIR CLEANING

Although every one is familiar with dust and dirt in the atmosphere, specific data on the nature and behavior of air-borne impurities—solids or gases, soluble or insoluble, etc.—are not readily available. Smoke, fumes and dust—particularly the size, shape and nature of the small particles which form dust suspensions in the air—present a vast field for analytical and experimental research. As one writer observes in a symposium on this subject in *Heating, Piping and Air Conditioning* (January), there are many questions which have been answered only empirically. For instance, the ability of dust particles to adhere to surfaces of cloth, liquid-coated baffles and other media is governed by laws which are extremely difficult to formulate. So far only practical experience has been applied in the design of air cleaning equipment.

Methods of Cleansing

Washing is a method frequently used because it may be part of the humidity control. The spray system brings the air into intimate contact with the water; scrubbing and eliminating plates remove the dust particles and unevaporated moisture.

Porous paper, cheese cloth, felt, jute, cellulose and other fibrous material against which the dust particles impinge have been used as *dry filters.* Such media, if the air flow is not to be obstructed with too great a resistance, must be replaced occasionally. Some fibrous fiiters are cleaned automatically by shaking or by vacuum cleaning. A recently developed dry filter is *"Dustop,"* a glass wool developed by the Owens-Illinois Glass Company of Toledo.

Another type of filter is the *viscous.* These employ coated surfaces, such as oil, to impinge dust particles which are thrown out of the air stream by centrifugal force. The cell type of viscous filter must periodically be washed and recoated; the automatic type cleans itself by renewing the viscous coating automatically.

IONIZATION

Although little definite information as to the value of ionization in air conditioning is at hand, the available evidence (as already related) points to its increasing importance. Larger commercial installations are now including ion-producing equipment in the conditioning system.

A new device, recently developed by Prof. Friedrich Dessauer at the University of Frankfurt, Germany, and first announced at the annual American Congress of Physical Therapy held in New York City in September, is able to increase the number of small negative ions in the air from the normal content of 50 to 10,000 per cubic centimeter to 20,000,000 or more per cubic centimeter. This machine by stepping up the quantity of negative ions, will be able to produce synthetically the kind of electrically-charged, health-giving air which one finds in bright sunshine and on mountain tops. Experimental results indicate that it will be valuable in treating conditions such as essential hypertension (a variety of high blood pressure), certain sinus infections and certain types of asthma.

AIR CONDITIONING AND BUILDING DESIGN

Even a rapid survey of this new practice of "manufacturing" atmospheres indicates the increasing importance of the design and construction of the building enclosure on the proper functioning of any heating and ventilating system. The general use of conditioned air is certain to bring about many changes. Windows particularly are now a major source of difficulty to the extent that "windowless" structures have been designed and built. The "leakiness" of certain materials and the lack of weathertightness in usual building methods are responsible for surprisingly large heat losses owing to the infiltration of outside atmospheres and the exfiltration of inside atmospheres.

From the evidence of actual experiments now going on, and from current discussions in technical and trade journals, it seems clear that continued progress will be along two lines: (1) the fabrication of more complete equipment to fit new as well as existing structures, and (2) the development of new structures and new materials which will allow a more efficient *use* of air conditioning facilities.

AIR DISTRIBUTION

It is generally agreed that conditioned air should be introduced within the room at a constant velocity which will not cause objectionable drafts in any occupied area and that the air distribution should be even and uniform, but just how this is to be accomplished is the basis for several schools of thought. One group, according to a report of the Research Committee of the American Gas Association, holds that air should be introduced only at or near the ceiling and exhausted near the floor. This *downward* method of distribution is considered by others to be not only technically unnecessary but also a potential handicap to the development of air conditioning by making impossible the use of conventional warm air heating equipment already installed. Such systems, which take advantage of the fact that air tends to rise when warmed, are known as the *upward* method.

Distribution is generally achieved by *pressure*, maintained by fans or blowers, sufficient to provide a regulated flow of atmosphere. Rarely is the room itself designed as an integral part of the duct system: the air distribution is usually handicapped by projections and a room geometry which tends to create eddies and drafts. The outlets should be so placed that there will be no direct drafts and the room enclosure so constructed that there will be no "dead corners" or pockets for the collection of stagnant air.

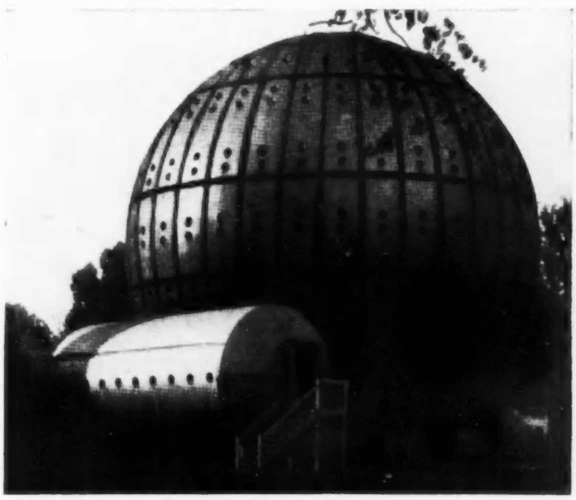
Pressure Variations

The editor of *The Aerologist* has raised the question, Why not control atmospheric pressures within the house? With such control the inhabitants could have seaside or mountain air as desired. Applications of this idea have been made to some extent in certain sanitariums where patients are treated under both low and high pressures. So far as known the only attempt to erect a building primarily for variable pressures has been the "Oxygen Hotel" in Cleveland, a spherical structure faced with steel and lined with 4 feet of concrete to insure airtightness. Valves regulate the amount of air for the residents who live under a stimulating pressure of oxygen. Portholes provide natural lighting. A similar control of atmospheric pressure is included in Buckminster Fuller's design of the Dymaxion House, a structure intended for factory reproduction and large-scale distribution.

HEAT LOSSES

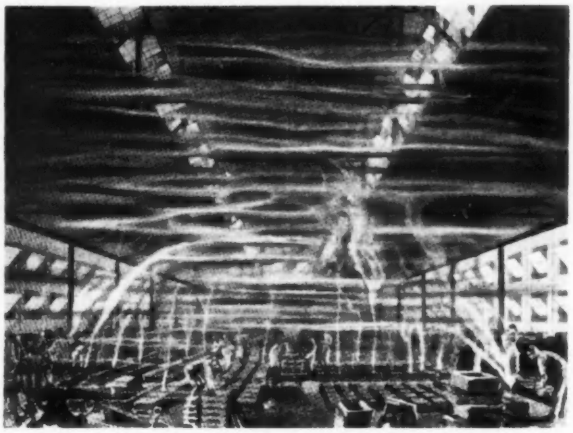
Under the impetus of aircraft design and accompanying studies on air currents, increased attention has been given to the effect of exterior wind movements on interior heating and ventilation of buildings. It has been a well known fact that on the windward side of a building the wind will press in through any apertures left open and the belief has been that a well-insulated wall could offset such heat losses. However, aeronautical studies as well as laboratory investigations by such agencies as the Department of Engineering Research of the Detroit Steel Products Company and the University of Michigan* have revealed that air can also be *pulled out* of a structure through any openings located near "suction areas." These areas of vacuum occur on the leeward side and along sides parallel to the wind. They are responsible for heat losses by exfiltration.

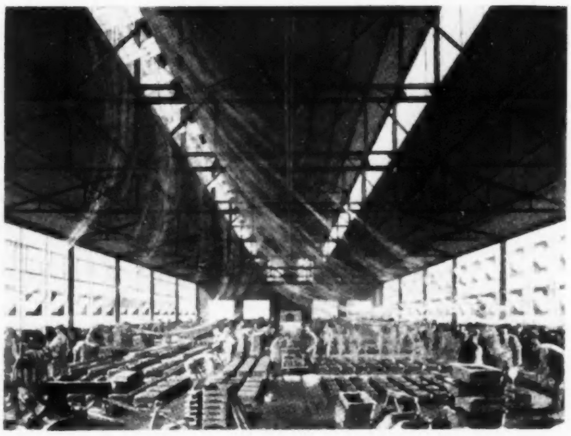
*This investigation is described in *Industrial Airation*, a booklet issued by the Detroit Steel Products Co.

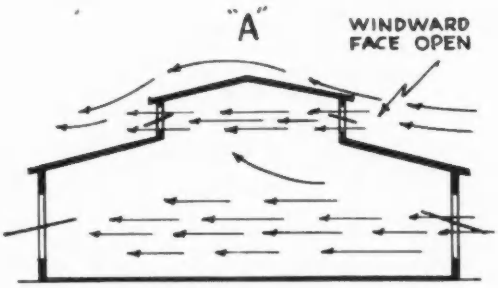


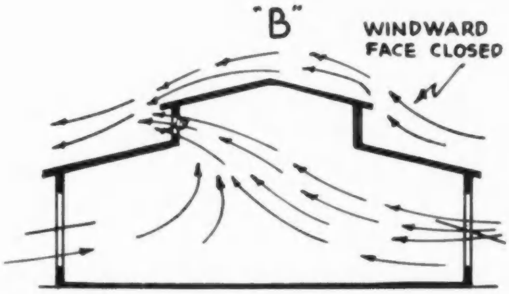
Courtesy The Architect & Building News

Another departure in building design is seen in this "Oxygen Hotel" in Cleveland. The interior air pressure is regulated by valves so that the residents live at a stimulating "altitude." The pressure of oxygen corresponds to seaside or mountain air as desired.







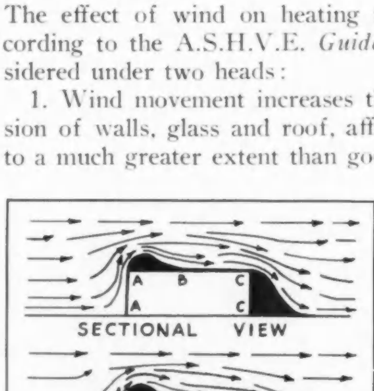


Filtration effects of wind movements have been studied by the Departments of Engineering Research of the Detroit Steel Products Company and the University of Michigan in order to provide better natural ventilation in industrial buildings. As shown in the illustration on this page, reproduced from "Industrial Airation," the wind blows straight through the monitors, holding the smoke down, when all windows ("A") are open. But if the windward side ("B") is closed, the suction to the lee will draw out the smoke.

Wind Movements

The effect of wind on heating requirements, according to the A.S.H.V.E. *Guide*, should be considered under two heads:

1. Wind movement increases the heat transmission of walls, glass and roof, affecting poor walls to a much greater extent than good walls.



The "hop of the wind" around sides and over top of a buildinq creates areas of suction which tend to draw out the inside air. In this diagram the arrows show wind "streamlining" and solid black areas the wind suction.

2. Wind movement materially increases the infiltration (in-leakage) of cold air through cracks around doors and windows, and even through the building materials themselves, if such materials are at all porous.

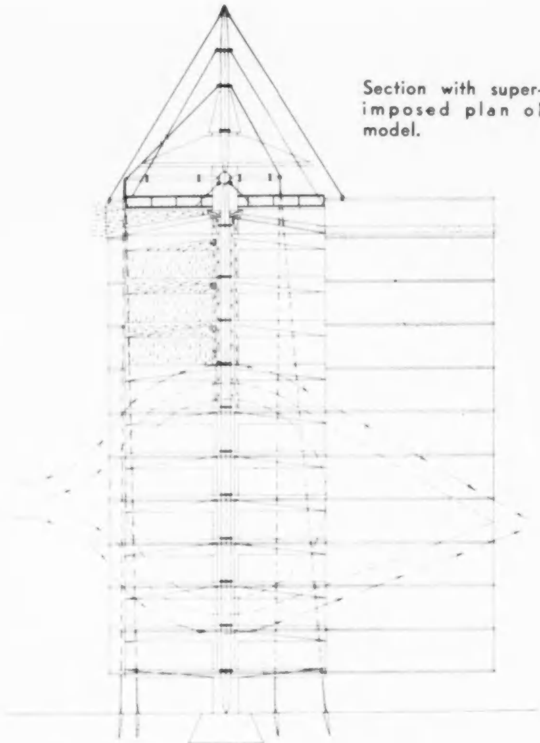
Since a building may require more heat on a windy day with moderately low outside temperatures than on a quiet day with much lower outside temperatures, it has been the practice to consider prevailing winds, particularly during winter months, in orientating the building. Since velocity as well as direction of the prevailing wind in any given locality must also be considered, an additional allowance of 15 per cent has usually been made for wall and glass transmission losses and for infiltration losses on the sides of the building directly exposed to the wind.

Streamlining

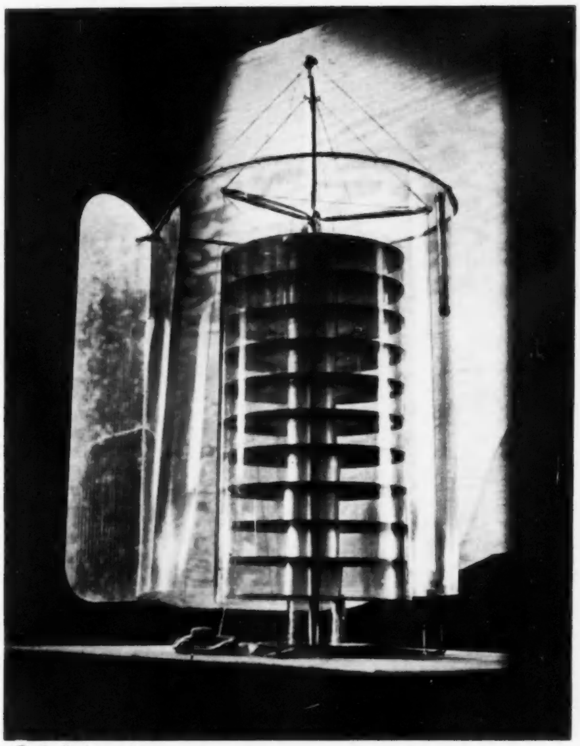
By the same token that air resistance can be cut down in streamlining moving objects, such as boats, automobiles and airplanes, it has been reasoned that strong winds could be streamlined past stationary objects, such as buildings, with a minimum of filtration effect and consequent heat loss. This theory has been applied in the model of a ten-story building designed by Buckminster Fuller with Starling Burgess* as consulting engineer.

The building itself is supported tensionally from a central mast and tower which contains necessary utilities and mechanical equipment. Surrounding this central core structure is the streamlined envelope which is free to move directionally

*Mr. Burgess, builder of the first hydroplane, was chief of design for the aviation division of the Navy Department during the War. He is also well known as a marine architect and as the designer of the *Enterprise*, the Cup Defender.



Section with superimposed plan of model.



© F. S. Lincoln

Strong air currents can be streamlined past buildings with minimum resistance, as demonstrated in this model of a 10-story building designed by Buckminster Fuller. Since the streamline form of the outside shield, which pivots slowly with the wind, overcomes the formation of any suction areas, there is practically no heat loss by exfiltration. Outside air is drawn in at the top of the building, conditioned, and then distributed downward under pressure to each floor. Ceilings are perforated to permit uniform distribution.

with the wind just as a ship at anchor moves slowly until it offers least resistance to the air motion. The envelope is of a fine wire mesh coated with a transparent plastic "dope" similar to that recently developed for airplane construction. Because of the decreased wind pressures, inner walls may be much lighter and thinner in construction than customary. At the top of the building is intended a cone-shaped sheltering cap (not shown in the model) which will contain a wind-rotor motor for supply of power. The water supply for the building is extracted directly from the moisture latent in the outside atmosphere by means of condensers similar to those used to produce water ballast on the dirigible *Akron*.

Although both specific knowledge and technical applications of the streamlining principle are relatively new, the phenomenon is old. It is apparent in almost all natural forms—fish, birds, animals, even the human body. Clouds and sand dunes are wind-shaped. So are candle flames in the updraft of air. Leaves of trees yield to the wind with minimum resistance. A falling drop of water assumes a pear shape due to pressure forces. In winter the ice formation at the base of bridge columns can be observed to take a shape which is determined by the stream current—hence the name.

Dirigibles, airplanes, ships, and to a less extent automobiles, are now streamlined, but few shelter forms have been designed, on this principle of wind forces. Windmills are, of course, an obvious exception. The hexagonal and octagonal buildings of Colonial days may be another possible exception, for according to their builders they were designed "to stop the wind whistling around corners." Again in such structures as Eskimo igloos, primitive huts, tents, thatched roofs, etc., the external form offers little wind resistance.

In the case of block forms characteristic of buildings, however, the principle of streamlining has been demonstrated in studies of aircraft and high-speed trains such as those made by the research division of the Westinghouse Electric Company. When air rushes against the face of a square block there is a "pile-up" in front and around each side as well as the top, taking a bulbous shape. Then, as the air currents rush past, a vacuum or "drag" is created on the rear face to suck in and regurgitate the air. If a sphere (which may be 4 times as large and offer equivalent frontal air resistance) is substituted for the cube the regurgitation is still present. To break up this vacuum resistance the final form must taper off in a pear shape. Compared with the original block this ultimate streamlined form may have approximately 8 times the width and offer no greater resistance.

WINDOWS AND WALL CONSTRUCTION

The many structures which now exist and which offer a large potential field for air conditioning installations make necessary the consideration of present methods of construction. The agencies which cause heat or air leakage are the natural forces of *wind* and *temperature* difference, and the areas where such transmission losses are most likely to occur in buildings include (1) outside walls, (2) outside glass, (3) inside partitions next to unheated spaces, (4) ceilings of upper floors, and (5) floors of heated rooms above unheated space. All such areas are involved in ventilation calculations and complete tables giving coefficients of transmission for many types of wall construction can be found in the A.S.H.V.E. *Guide* (1932).

Windows, as well might be expected, are the source of greatest heat loss at present. Proper fenestration is the principle improvement needed in building construction to obtain proper operation of air conditioning equipment.

Double Glazing

As W. D. Jordan, president of Air-Control Systems, Inc., writes in reply to an inquiry, "The prevailing tendency to provide the best of insulation in the side walls and ceiling and then do nothing about the excessive and extravagant heat loss through exposed glass appears to be very inconsistent from the standpoint of fuel cost. We are listing below the heat transmission coefficients for a few types of common walls compared with glass, these being expressed in B.t.u. per hour per square foot per 1° F. temperature difference:

8" brick wall with ¾" plaster	0.261
12" brick wall with ¾" plaster	0.216
8" hollow tile with 4" brick veneer outside and ¾" plaster inside	0.195
12" hollow tile with stucco exterior and ¾" plaster inside	0.186
Frame wall, 2" x 4" studs, 1" wood sheathing and wood siding on exterior, with wood lath and plaster on inside	0.262
Exposed glass, single pane	1.13
Exposed glass, double glazed	0.45

"The figures given on the different types of walls do not contemplate any insulating material. The heat loss through single glass is about 5 times as great per square foot as the average for those uninsulated walls. Despite that fact, people continue to buy expensive insulating material to decrease the comparatively small loss through the walls and then build in more and bigger windows having 5 times the heat loss.

"*Double glazing* should soon pay for itself through the reduction in cost of fuel. In summer it will increase the indoor comfort by greatly reducing the heat transmission rate. If the space is to be cooled, the double glazing will effect a real saving in the cost of refrigeration by materially decreasing the heat load. Moreover, the double glazing will make it possible to obtain a healthful humidity during the winter months without excessive condensation."

The most important requirement in double glazing is air-tightness, so that no dirt will be able to filter in. The glazing should be done during weather as dry as possible so that there will be a minimum of moisture in the air space.

Recently there has been placed on the market a new window product* consisting of two panes of glass permanently sealed together with ⅛" to ¼" air space between. This air space is chemically dehydrated so that no moisture exists to form condensation when the outside temperature drops. The product is handled like a single sheet of glass. The cost is approximately three times as great but said to be worth the difference in fuel economy.

Weatherstripping

Filtration can be reduced substantially with a saving in fuel during heating seasons and with a saving in refrigeration during cooling seasons by weatherstripping the windows. The heat savings possible in proper insulation of residences are indicated in the following table which appears in U. S. Bureau of Standards Circular No. 376:

	Heat Savings
Weatherstripping	15—20 per cent
Plus double windows	25—30 " "
Plus ½" insulation	50 " "
1" insulation	60 " "

Almost all air conditioning equipment manufacturers agree on the desirability of weatherstripping. However, as Mr. Jordan of Air-Control Systems, Inc., writes: "We see no advantage in decreasing the rate of infiltration below what will be obtained with well-fitted weatherstripped windows. Some ventilation is required, although an infiltration rate equal to ½ air change per hour is ample in an average residence or office from the standpoint of maintaining the oxygen and carbon dioxide at the proper volume. We do not believe it would be practicable to endeavor to decrease the infiltration rate below that point. If you were to go to the expense of hermetically sealing a building against infiltration you would then have to add mechanical ventilating equipment to provide a proper supply of outdoor air."

Condensation

A serious problem, when high humidities are maintained, is moisture condensation. Dripping water may cause damage to machinery and furniture. Short circuits may easily happen. If not removed, the water will cause rotting of wood, corrosion of metal, spalling of gypsum, etc., where such materials occur in the building structure.

With well-insulated walls, however, condensation will be found only on windows, where it can be materially reduced by double glazing. Adequate condensation gutters should be provided to carry off any water which does not condense.

*Marketed under the trade name "Thermopane" and manufactured by Charles D. Haven, Milwaukee.

Interiors, too, are *strikingly handsome*

De Vilbiss School (Toledo Board of Education), Architect, M. Ed. Gee, Board of Education, Toledo, Ohio
Painted throughout with 2400 gallons of Barreled Sunlight

Toledo's new De Vilbiss School chose Barreled Sunlight for *lasting* Beauty and Cleanliness —

BARRELED SUNLIGHT *is now available in two forms, Interior and Outside. Write for complete information on Outside Barreled Sunlight — its more pronounced whiteness, richer lustre and marked durability. (Note that both forms of Barreled Sunlight are readily tinted any desired shade.)*

It is easy to see why the Toledo, Ohio, Board of Education takes great pride in its fine new De Vilbiss School. Of strikingly handsome architectural design, exteriors embody both simplicity and charm. Interiors are distinguished by lasting beauty and cleanliness.

Painted with Barreled Sunlight, ceilings and walls will remain clean, bright, handsome for months to come. For the smooth, flawless surface of Barreled Sunlight can't hold dirt embedded. Finger prints, smudges, dust — so common to all public places — may be easily wiped off with a damp cloth.

Repeated washings do not harm the soft depth — handsome finish of Barreled Sunlight. Its extreme durability materially reduces the necessity for repainting.

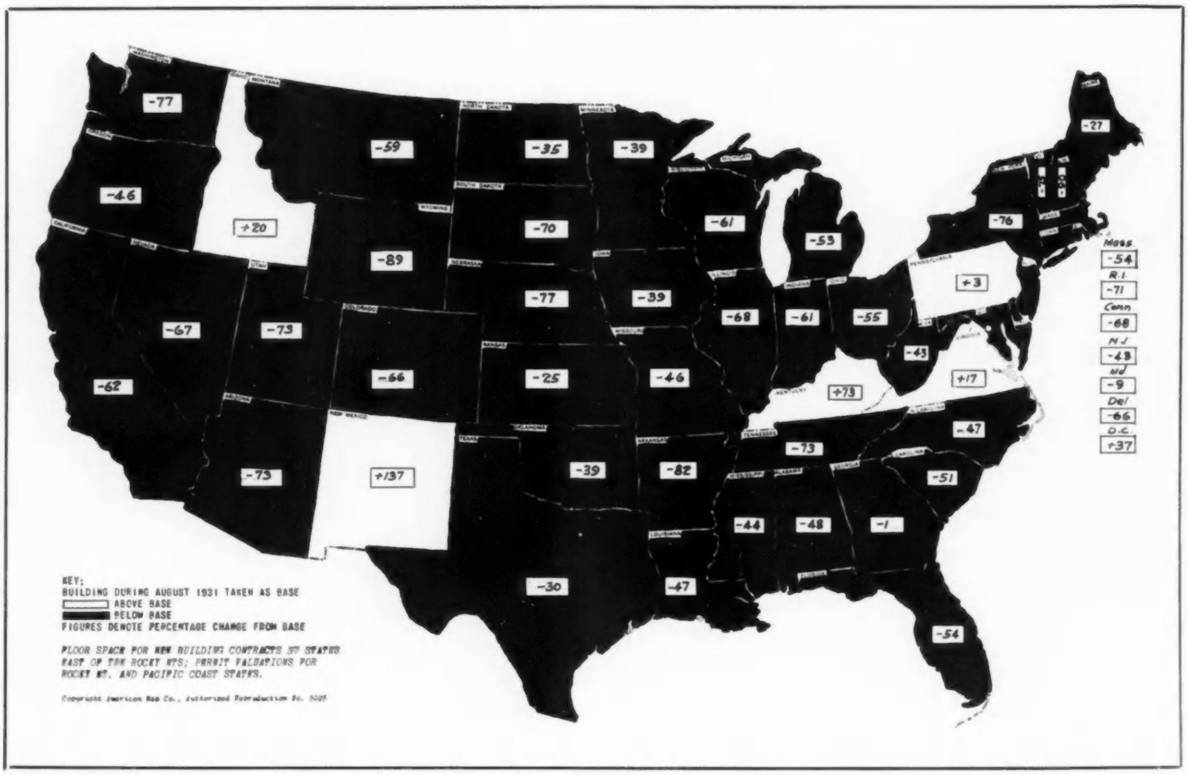
• • •

An all-oil product, Barreled Sunlight may be easily tinted in soft, pleasant colors appropriate to the surroundings.

Our catalog is in Sweets, but for your own files let us send you the new booklet, "For Interiors of Lasting Beauty and Cleanliness." Write to U. S. Gutta Percha Paint Co., **22-J** Dudley St., Providence, R. I. Branches or distributors in all principal cities. (For Pacific Coast, W. P. Fuller & Co.)

Barreled Sunlight

REG. U. S. PAT. OFF.



BUILDING TRENDS AND OUTLOOK

By L. SETH SCHNITMAN

With the single exception of May, contracts awarded during August showed a larger valuation than in any other month thus far in 1932. If allowance were made for the usual seasonal trend the August contract total would be higher than the seasonally adjusted figure for any other month this year.

It is now apparent that the third-quarter total of all construction awards should at least equal the figure of $381,000,000 reported for the second quarter. Normally the third quarter produces a lower contract volume than the second quarter.

The August contract total of $133,988,100 compares with $128,768,700 for July and $233,106,100 for August, 1931; each of the four major construction classifications showed a larger total in August than was reported for July. Of the August contract total $20,766,800 was for residential building; $49,071,100 was for nonresidential building; $56,728,700 was for public works; and $7,421,500 was for public utilities.

At the moment the August gain in residential building of almost 6 per cent when compared with July, though by no means conclusive, is decidedly encouraging; usually a seasonal decline occurs between the two months. The present improvement, though slight, suggests that the low point in the residential cycle, seasonal factors considered, may already have been witnessed.

MATERIAL PRICE MEASURING ROD*

The prices in this tabulation enable one to visualize at a glance the main trend of the material market.

Their significance does not extend beyond that point, and the explanation under them should be read carefully.

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

Material	This Month	Month Ago	Year Ago
Portland Cement	$2.00	$2.00	$1.98
Common Brick	11.75	11.80	12.09
Structural Steel	1.60	1.60	1.60
Lumber	15.55	15.60	17.39

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

*As previously published in *General Building Contractor*.

POINTS of DISTINCTION

of the PENBERTHY AUTOMATIC ELECTRIC SUMP PUMP

PENBERTHY PRODUCTS

1 MOTOR is $\frac{1}{4}$ h. p. and repulsion induction type with ball thrust bearings for vertical operation. Construction is exceptionally rugged. Available in any standard electrical specifications.

2 MERCURY SWITCH is sensitive, dependable and particularly adapted to float operation. It has no mechanical contacts to wear or spark.

3 CIRCUIT BREAKER protects motor against damage from overloading or improper voltage by automatically cutting off power. Reset by simply pushing small button.

4 IMPELLER SHAFT is fully enclosed and held in perfect alignment by bearings at both ends. Flexible spring coupling relieves motor shaft of sudden starting shocks.

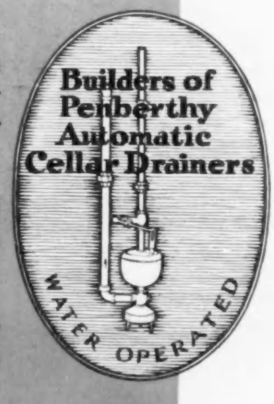
5 IMPELLER has high efficiency and operates successfully against head of 22 ft.

6 COPPER AND BRONZE THROUGHOUT; it is immune to corrosion.

7 COMPACT DESIGN—there are no protruding arms or levers to bend and get out of order.

8 RUGGED CONSTRUCTION assures long life and satisfactory operation.

9 Made in FIVE SIZES for any sump depth up to 8 feet, 6 inches.



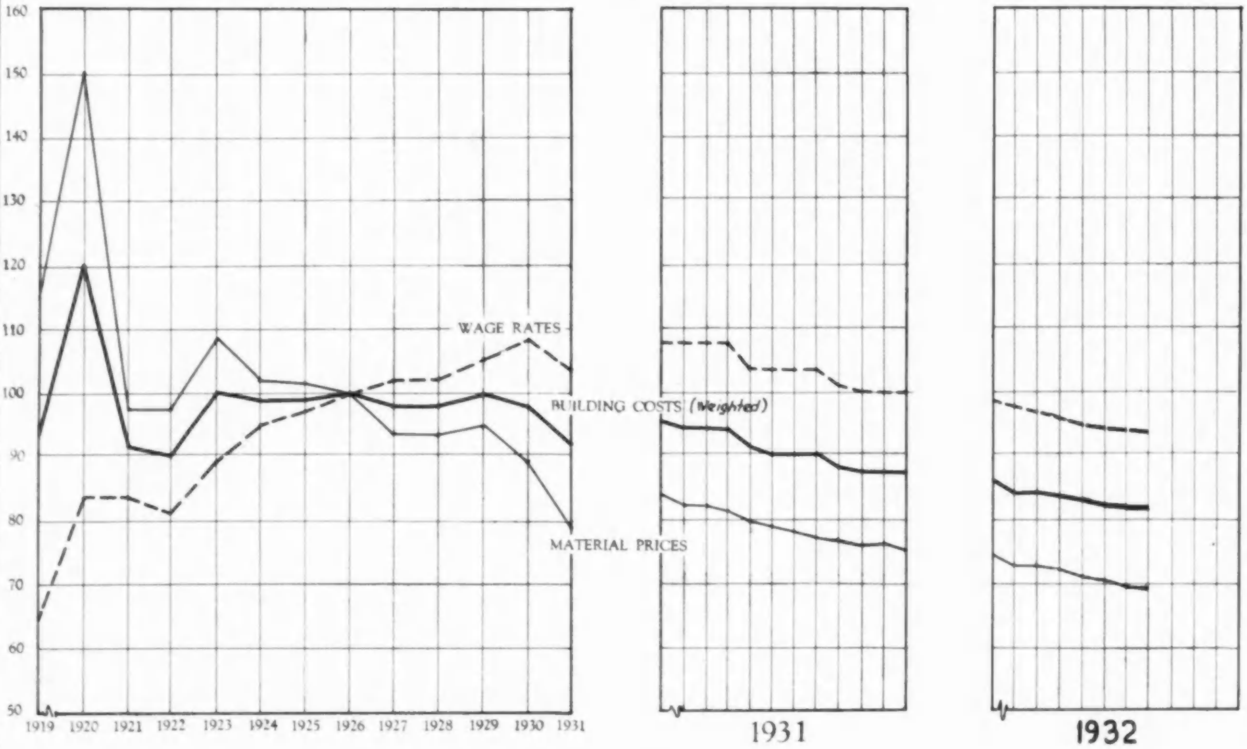
PENBERTHY SUMP PUMP

PENBERTHY INJECTOR COMPANY

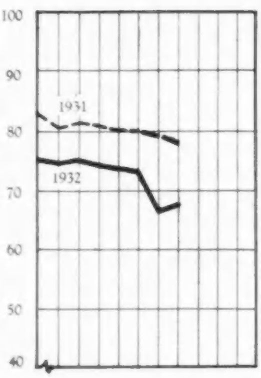
Established in 1886 | DETROIT | Canadian Plant Windsor, Ont.

MATERIAL PRICES, BUILDING WAGE RATES AND BUILDING COSTS COMPARED

1926 Monthly Average — 100

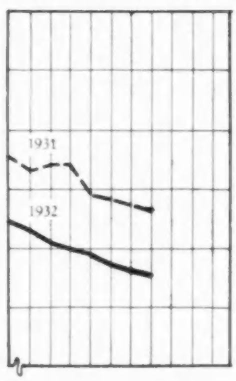


WHOLESALE PRICE INDEXES



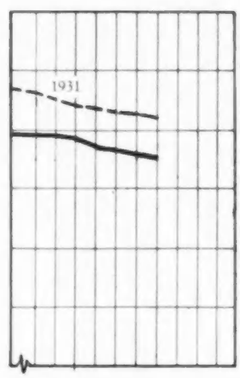
PAINT MATERIALS

Prices may stabilize around current levels.



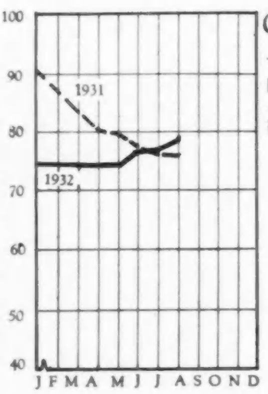
LUMBER

There is little likelihood of any important betterment in prices in nearby future.



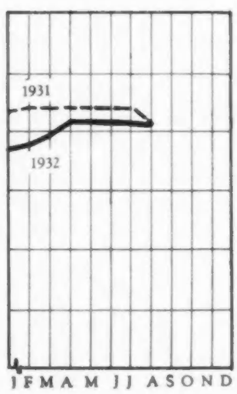
BRICK AND TILE

Further price declines are not improbable.



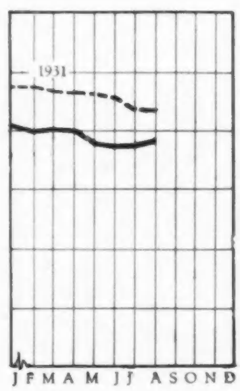
CEMENT

There is likely to be a severe test of current levels in near future.



STEEL

Present stability cannot long obtain without important improvement in heavy construction.



OTHER MATERIALS

Prices depend upon nearby building prospects. At the moment conditions appear a bit more favorable.

ETERNIT TIMBERTEX

a *NEW* Tapered Asbestos Shingle Textured Like Natural Wood yet Ageless and Fireproof

Companion Product To Eternit's Popular Gothic Shingle Ideal For Roofing And Siding Buildings Of Early American Architecture

Eternit invites you to appraise their latest achievement—TIMBERTEX,* an ageless, fireproof shingle with all the charm and beauty of weathered cypress reproduced in its texture.

This unique tapered asbestos cement shingle is of built-up construction which gives added strength and resiliency. Extra thickness is at the butts where most required. Double sets of nail holes permit the use of irregular shingle courses which further emphasize the deep shadow lines of the heavy butts.

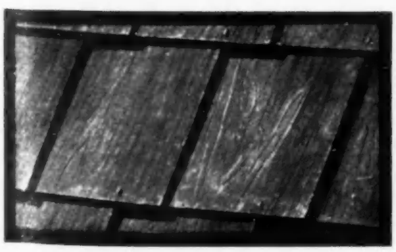
Five, rich, time-mellowed "wood colors" of lasting beauty are offered. In fact, in every detail TIMBERTEX has been built to meet your exacting specifications of beauty, individuality, durability, safety and economy.

Be sure to see this latest Eternit triumph. Architect folder in full color, specifications and samples will gladly be forwarded upon request. Write or telephone the nearest Eternit or Ruberoid office today.

TIMBERTEX SPECIFICATIONS

Full size shingles 8" wide x 16" high. Tapered construction. Butts approximately 1/4" thick. Colors: Colonial Grey, Cypress Brown, Tile Red, Jade Green, Quarry Blue. Applied with 7" exposure; spaced 1/8" apart. 260 shingles per square; approximate weight 500 lbs. Use full width shingles in Boston Hip method for finishing hips and ridges.

*Patents applied for.

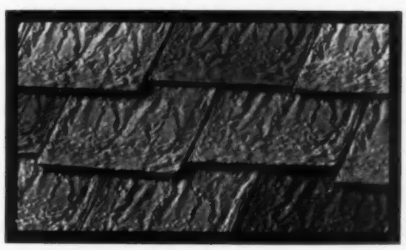


TIMBERTEX Dutch Laps*—a shingle that permits the utmost economy of both material and labor. Ideal for small houses or for reroofing.

Eternit

ASBESTOS CEMENT SHINGLES

ETERNIT, *Sales Division of* THE RUBEROID CO.
Offices: BALTIMORE, MD., CHICAGO, ILL., ERIE, PA., MILLIS, MASS., MOBILE, ALA., NEW YORK, N. Y.
Factory: ST. LOUIS, MO.



Eternit Gothic*—a de luxe asbestos shingle textured like rugged rock. Widely acclaimed by architects for its numerous distinctive features.

WAGE SCALES IN THE BUILDING TRADES

Information Furnished by National Association of Builders Exchanges and Compiled by Division of Statistics and Research, F. W. Dodge Corporation, as of September 15, 1932

	Asbestos Workers	Bricklayers	Bricklayers' Tenders	Carpenters	Cement Finishers	Electricians	Hoisting Engineers	Iron Workers—Ornamental	Iron Workers—Structural	Laborers	Lathers	Painters	Plasterers	Plasterers' Tenders	Plumbers	Roofers—Composition	Roofers—Slate & Tile	Sheet Metal Workers	Steamfitters	Stone Masons	Tile Setters	Tile Setters' Helpers
Akron	$1.00	$1.25	$0.40	$0.70	$0.70	$0.75	$0.70	$0.60	$0.60	$0.40	*$0.87½	$0.65	*$1.20	$0.62½	$0.85	$0.80	$0.80	$0.80	$0.85	*$1.25	*$1.25	*$0.50
Atlanta	1.00	1.25 1.40	.30 .45	.70	1.25	.90 1.10	.60 1.00	.35 1.85	1.25	.25 .35	1.00 1.25	.75	1.25	.30 .45	1.25	.80	.80	.90 1.00	1.25	1.00 1.25	1.25	.40
Baltimore	1.12½	*1.25	1.00	*1.00	*1.25	*1.43¾	*1.25	*1.65	*1.65	.35 .40	*1.50	*.90	*1.25	1.00	*1.00	1.00	1.00	*1.37½	*1.25	1.25	1.25	.72
Boston	1.25	*1.30	.70	*1.17½	1.17½	*1.37½	1.17½	1.20	1.20	.70	*1.25	1.12½	*1.37½	*.95	*1.25	*1.17½	*1.05	1.17½	*1.25	*1.30	*1.50	*.95
Buffalo	1.50	*1.25		*1.00	1.12½	*1.30	$49.50 to $55.00 wk.	1.25	*1.25	.50 .60	1.37½	*1.00	1.62½		1.25	.85	1.10	1.10	*1.25	*1.25	*1.43¾	
Chicago	1.37½	*1.37½		*1.31¼	1.31¼	1.25 1.50	1.31¼	1.31¼	1.35	.82½	*1.37½	*1.41	*1.37½	.88¾	1.37½	1.37½	1.40	1.37½	1.37½	1.37¼	1.37½	.96¼
Cincinnati*	1.15	1.37½	.70	1.20	1.02½	1.25	.80 1.25	1.25	1.25	.45	1.31¼	1.10	1.37½	.70	1.25	.92½	1.07½	1.07½	1.25	1.25	1.25	
Cleveland*	1.17½	1.37½	.72	1.12½	1.12½	1.05 1.25	1.12½	1.25	1.25	.72	1.37½	1.12½	1.37½	.72	1.25	1.15	1.37½	1.12½	1.25	1.37½	1.25	.81¼
Columbus	1.25	1.30	.90	1.00	.85 1.25	1.00	.60 1.25	1.25	1.25	.50	1.37½	1.00	1.00	.40 .50	1.00	.70 .80	.80 1.00	1.00	1.00	1.30	1.37½	.45
Dallas††	10.50	10.00	.50	8.00	10.00	*11.00	10.00	10.00	10.00	.35	10.00	*9.00	*10.00	*.50	12.00	8.00	9.00	*10.00	12.00	10.00	*12.00	†*.75
Dayton*	1.25	1.30	.80	1.00	1.15	1.55	1.25	1.35	1.35	.35	1.10	1.00	1.25	.80	1.15½	.85	1.00	1.00	1.15½	1.30	1.50	.60
Denver††	9.00	12.00 *13.00	6.50 7.00	10.00	10.00 11.00	10.00 11.00	10.00	10.00 11.00	10.00 11.00	4.00 5.00	11.00	*10.00	12.00	7.00	11.00	7.00 8.00	7.00 8.00	9.00	9.50	12.00 13.00	10.50	†.62½
Des Moines	1.00	1.25	.65	1.00	1.00	1.00	1.00	1.00	1.00	.55	1.00	1.00	1.25	.75	1.25	1.12½	1.12½	1.12½	1.25	1.50	1.25	.80
Detroit	1.37½	1.25 max.	.55 .60	.80 1.00	.70 .90	1.25 1.40	.60 1.00	1.00 1.20	1.00 1.25	.50 .55	1.37½	.80 1.00	1.00 1.25	.70 .80	1.00 1.50	.70 .90	.80 1.00	.80 1.00	1.25 1.50	1.25 1.50	1.00 1.25	.80
Duluth	.85	1.10	.35 .45	.75 .85	.75 .85	.90	.80	.80	.90	.35 .45	.85	.80	1.10	.70	.95	.70	.70	.80	.95	.75 1.10	1.25	.80
Erie	.80 .90	1.31¼	.50 .60	.75 1.00	1.00	1.00 *1.15	1.12½	.60 .90	1.10 1.12½	.35	1.12½	.75 .90	1.31¼	.50 .60	1.18¾	.60 .70	1.00	1.00	*1.18¾	1.31¼	1.00	.50 .60
Grand Rapids	.65 .80	1.25	.40	.60	.65	.90	.75	.80	1.00	.35	.80	.60	.80	.40	.90	.50	.70	.70	.90	1.25	1.25	.50
Houston	1.00	1.50		1.00	1.00	1.25	1.00	1.12½	1.12½	.50	1.37½	.62½	1.00		1.25	1.00	1.25	1.25	1.25	1.00	1.25	
Indianapolis	1.32½	1.62½	.90	1.22½	1.17½	1.50	1.37½	1.45	1.45	.40 .45	1.37½	1.25	1.57½	1.00	1.00	.60 .90	1.27½	1.22½	1.50	1.62½	1.50	.60
Kansas City	1.05	1.32½	.80	1.12½	1.12½	1.50	1.12½	1.12½	1.12½	.70	1.25	1.12½	1.32½	.80	1.25	.92½	.92½	1.12½	1.25	1.12½	1.25	.75
Los Angeles††	10.00	8.00	6.00	7.00	8.00	8.00	8.00	7.00	7.00	4.00	8.00	7.00	9.00	7.00	9.00	7.00	7.00	7.00	9.00	11.00	10.00	†.75
Louisville	1.12½	1.25	.50	.80	1.00	1.00	1.00	1.25	1.25	.25 .35	1.37½	.90	1.62½	.60	1.12½	.30 .50	.85	.85	1.12½	1.25	1.00	.50
Memphis	1.00	1.37½	.50	.50 .87½	.50 .75	1.00	.75	.75	.75	.20	1.00	.75	1.25	.50	1.25	.25 .40	1.12½	1.12½	*1.25	1.37½	1.25	.50
Milwaukee	1.00	1.00	.90	.85	1.00	1.25	1.15	1.05	1.05	.50	1.00	1.00	1.00	.90	1.00	1.00	.92½	.92½	1.00	1.00	1.00	.65
Minneapolis	1.06¼	1.10	.55 .65	.75 .85	.75 .85	.90	.80	.90	.90	.45	.75 .85	.80	1.10	.70	.95	.70	.70	.80	.95	1.10	1.25	.65
Nashville	1.00	1.00		.65		.75 .87½					1.00	.80	1.00	.30		.65	.65	.65	1.25	.90	.65	
New Haven*		1.40	.50 .65	.90 1.06¼	1.40	.80 1.00	1.16¾ 1.27½	1.37½	1.37½	.50 .65	1.27½	.80 1.00	1.40	.50 .65	1.06¼	.65	1.50	1.06¼	1.06¼	1.40	1.40	
New Orleans	.65 .80	1.25	.85	.55 .75	1.00	1.25	1.25	1.25	1.25	.35 .50	1.25	.75 .90	1.25	.75	1.00 1.25	.40	.90 1.15	.90	1.05 1.25	1.50	1.25	.35
New York City††	11.20	13.20	8.00	11.20	c11.20	13.20	13.20	11.20	13.20	6.60	11.20	11.20	12.00	8.50	c12.00	10.28	12.62	11.20	11.20	13.20	11.50	8.50
Oakland††	7.00	11.00	7.00	7.20	7.20	8.00	9.00	7.20	9.60	5.00	10.00	7.00	8.80	6.00	8.25	7.00	7.00	7.50	8.25	9.00	8.00	5.00
Oklahoma City††	8.00	8.00	4.00	6.00 8.00	8.00	6.00 8.00	8.00	8.00	8.00	3.50	.80	7.00 8.00	.80	4.00	.80	6.00	6.00	8.00	8.00		11.00	†.62½
Omaha	1.32	1.00	.45	.80	.90	1.00	1.00	.90	.90	.35	1.00	.80	1.00	.45	1.00	.72½	.87½	.87½	1.00	.90	1.00	.50 .60
Philadelphia	1.12½	1.50		1.00	1.05	1.25	$40.00 to $50.00 wk.	1.25- 1.37½	1.00 1.37½	.40 .45	1.62½	.80	*1.62½	1.12½	1.04	1.00	1.25	1.25	1.04	1.00	1.25	.75
Pittsburgh	*1.50	*1.50		*1.25		*1.56¼	1.37½ 1.43¾	*1.37½	1.37½			*1.18¾			1.50	*1.25	*1.50	*1.31¼	*1.71⅞	*1.40	1.33¾	.88
Portland, Ore.††	8.00	*12.00	4.80	7.20	*7.20	*8.00	6.40 9.60	8.80	8.80	7.20	*8.80	7.04	*9.60	*7.20	*8.80	7.20	10.00	*8.00	*8.80	*10.00	10.00	6.00
Reading	.70 .80	.90	.75	.75	.85	.75				.35	.75	.70	.85	.75	.90		.80	.80	.90	.75	.90	.50
Richmond	.60 .65	1.25	.55	.90	1.00	.80	1.00	1.25	1.25	.25 to .30	1.00	.70	1.25- 1.50	.30	.87½	.80	.80	.85	1.00	1.37	1.25	
Rochester	1.01¼	1.25		*1.00	*1.12½	*1.15½	1.00	.80-*1.00	.80-1.00	.55	1.00	*1.00	*1.25		*1.17½	*.90	*.90	*1.00	*1.17½	*1.25	*1.25	
Salt Lake††	6.00 7.20	9.00	6.00 8.00	7.20	8.00	8.00	9.00	8.00	8.00	4.00	10.00	7.20	10.00	8.00	9.00	7.20	7.20	8.00	9.00	9.00	9.00	†.50
San Antonio††	6.00 10.00	8.00 12.00	2.00 3.50	3.00 7.00	6.00 10.00	6.00 9.00	4.00 8.00	6.00 8.00	6.00 10.00	2.00 2.75	7.00	4.00 7.00	6.00 8.00	2.00 2.75	6.00 8.00	5.00 8.00	8.00	6.00 10.00	8.00	5.00 12.00	8.00 12.00	2.50 3.00
San Francisco	8.00	11.00	7.00	9.00	9.00	9.00	9.00		11.00	5.50	8.50 10.00	9.00	11.00	7.50	10.00	8.00	8.00	9.00	10.00		10.00	
Seattle††	8.00	9.60	5.28	7.20	7.20	*8.80	8.00	8.00	8.80	4.75	*8.80	*7.20	*9.60	*6.40	*8.80	7.20	7.20	8.00	*8.80	9.60	8.00	
Sioux City	.90	1.50		1.00	.75	1.00		1.00	1.00	.40	.90	.60 .90	1.15		1.00	.60 1.00	.60 1.00	.90		1.25	.60 1.00	
St. Louis	1.25	1.50	1.00	1.25	1.31¼	1.67½	1.35- 1.47	1.47	1.47	.78¾	1.25	1.25	1.50	1.06¼	1.43¾	1.17½	1.25	1.25	1.43¾	1.25	1.25	.76½
St. Paul	1.18	1.10		.75 .85	.75 .85	.90	.80	.90	.90	.45	.75 .85	.80	1.10	.70	.95	.70	.70	.80	.95	1.10	1.25	
Washington, D.C.	*1.50	1.75	.50 .75	*1.37½	1.25	*1.65	*1.37½	*1.65	*1.65	.75	*1.62½	*1.37	*1.75	*.75	*1.50	*1.37½	*1.37½	*1.50	*1.50	*1.25	*1.50	.75
Wichita	.60	.75 1.25	.25 .40	.40 .75	.40 1.00	.50 .87½	.30 .75	.40 1.00	.40 1.00	.20 .40	.50 1.25	.50 .87½	.60 1.25	.25 .50	1.00	.50 1.00	.50 1.00	.50 1.00	.75 1.12½	.75 1.25	.50 1.00	.25 .40
Youngstown††	*1.37½	12.00	6.80	10.00	9.00	11.00	10.00	12.00	12.00		12.00	10.00	12.00	6.80	11.00	10.20		10.00			10.00	.70

NOTE.—Where two figures are shown they are the minimum and maximum. All figures are for hour rates except as indicated. ††8-hour day. †Rate per hour. *On 5-day week basis. c Correction. Asterisk after city indicates all trades on five-day week basis.

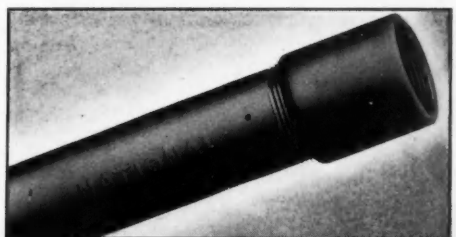
ABOVE DATA ARE WAGE SCALES AND DO NOT NECESSARILY INDICATE ACTUAL WAGE RATES BEING PAID IN THE RESPECTIVE TRADES.

ANOTHER NOTEWORTHY INSTITUTION JOINS DISTINGUISHED USERS OF *America's Preferred Wrought Pipe*

In institutional and monumental buildings, always designed and equipped with a view to long use, NATIONAL Pipe has a record of approval that is unequaled. To this record a noteworthy addition is made by the choice of NATIONAL for the major pipe tonnage in the impressive new Home for Incurables, New York City.

The fine philanthropy to which this building is devoted commands general recognition and has won the financial support of many well known patrons. Generous provision has been made to give it all that is required for efficiency and lasting character. The specification of NATIONAL Pipe makes this aim effective for the vast network of pipe lines in the heating system which is so important in a building of this character.

HOME FOR INCURABLES
Bronx, New York
Architect: Crow, Lewis & Wick, *General Contractor:* Wm. Crawford, *Heating & Ventilating Engineer:* Jaros & Baum, *Heating Contractor:* McQuillan & Chave. *All of New York City*



NATIONAL TUBE COMPANY · PITTSBURGH, PA.
Subsidiary of United States Steel Corporation

NATIONAL PIPE

MANUFACTURERS ANNOUNCEMENTS

NEW WALL COVERING

To meet the growing demand for a wall covering and wainscoting possessing the sanitary qualities and durability found in linoleum, the Armstrong Cork Company announces the development of Linowall.

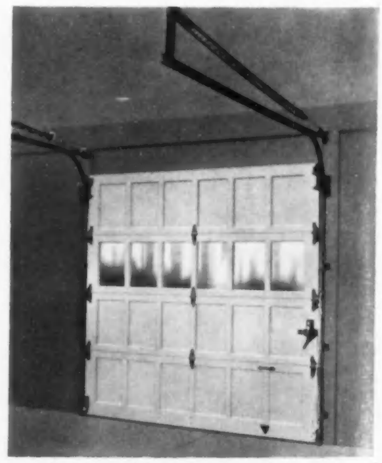
The new Linowall is thin and is made up of two types of material—one a linoleum mix keyed to a fabric back and the other a special embossed lacquered material which simulates glazed tile.

LINOLEUM UNDERLAY

A Linoleum Underlay—designed to eliminate board markings or unevenness in the subfloor showing through the finished linoleum floor—is also announced by the Armstrong Cork Company. This new product is a dense, hard composition wood fibre board, ⅛" thick, weighing approximately three-quarters of a pound per square foot. According to the announcement, it will not crack, split, or splinter. It is highly resistant to moisture and shows very little expansion and contraction with humidity changes.

A NEW GARAGE DOOR

Announcement has just been made by the Kinnear Manufacturing Company, Columbus, of the addition of a new low priced push-up door to their line of doors. It is to be known as the "Standard Model Rol-Top."



The Standard Model differs from the Deluxe Model in that the door sections are not equipped with special Kinnear Steel Reinforcing Adjustable Truss Bars, and counterbalance is accomplished by helical stretch springs placed along the horizontal door tracks instead of the single synchronized-tension spring. Hardware and operating parts are of heavy design.

You can learn about floors from nurses . . . .

FIFTEEN nurses at a well-known New York hospital took an important mileage test. They put on pedometers. The records showed that these nurses walk eight miles during the course of the day's work. That's the average, although two young women turned in totals of 12 and 13 miles respectively.

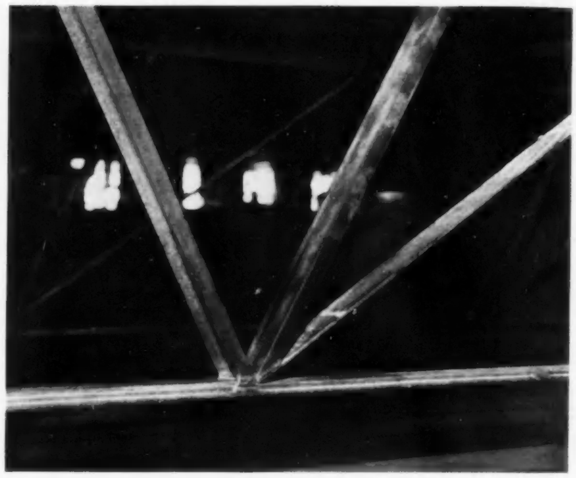
Nurses in hospitals that have installed Sealex Floors say that these are easy miles. Why? Because Sealex Linoleum Floors give their feet a friendly cushioning.

That's the big difference. Sealex Floors are really resilient. When you specify these modern, good-looking floors for hospitals—or for libraries, schools, banks, and other buildings—you are sure that they have the "give" so necessary for walking comfort. They conserve energy. They help to make people more cheerful, alert, and efficient.

You provide other important floor features with Sealex Linoleum. It is sanitary, easy to clean and stain-proof, and modest in cost. Write to us for full information about Sealex Floors and Sealex Wall-Coverings, including the facts about our Bonded Floors installation service, in which Sealex materials are backed by guaranty bonds.

CONGOLEUM-NAIRN INC., KEARNY, N. J.

SEALEX
LINOLEUM FLOORS



WELDED TRUSS DESIGN ONE-THIRD LIGHTER

Probably the first radical change in truss design within the last ten years is represented by the welded roof truss consisting of continuous tension straps as shown in the accompanying illustration. This new type of truss, developed by J. E. Webster, General Works Engineer of the Westinghouse Electric and Manufacturing Company will be used immediately in a new building at the company's Derry Plant.

In another specific case, a truss designed according to the best known present welding standards, already a saving over riveted construction, would weigh 3700 pounds. The new design for the same load would weigh 2380 pounds, a saving over the former welded design amounting to 35 per cent. The welding and assembly labor on the new design is less than that required on the older designs. This saving in weight is effected by designing the truss so that all members have uniform stress.

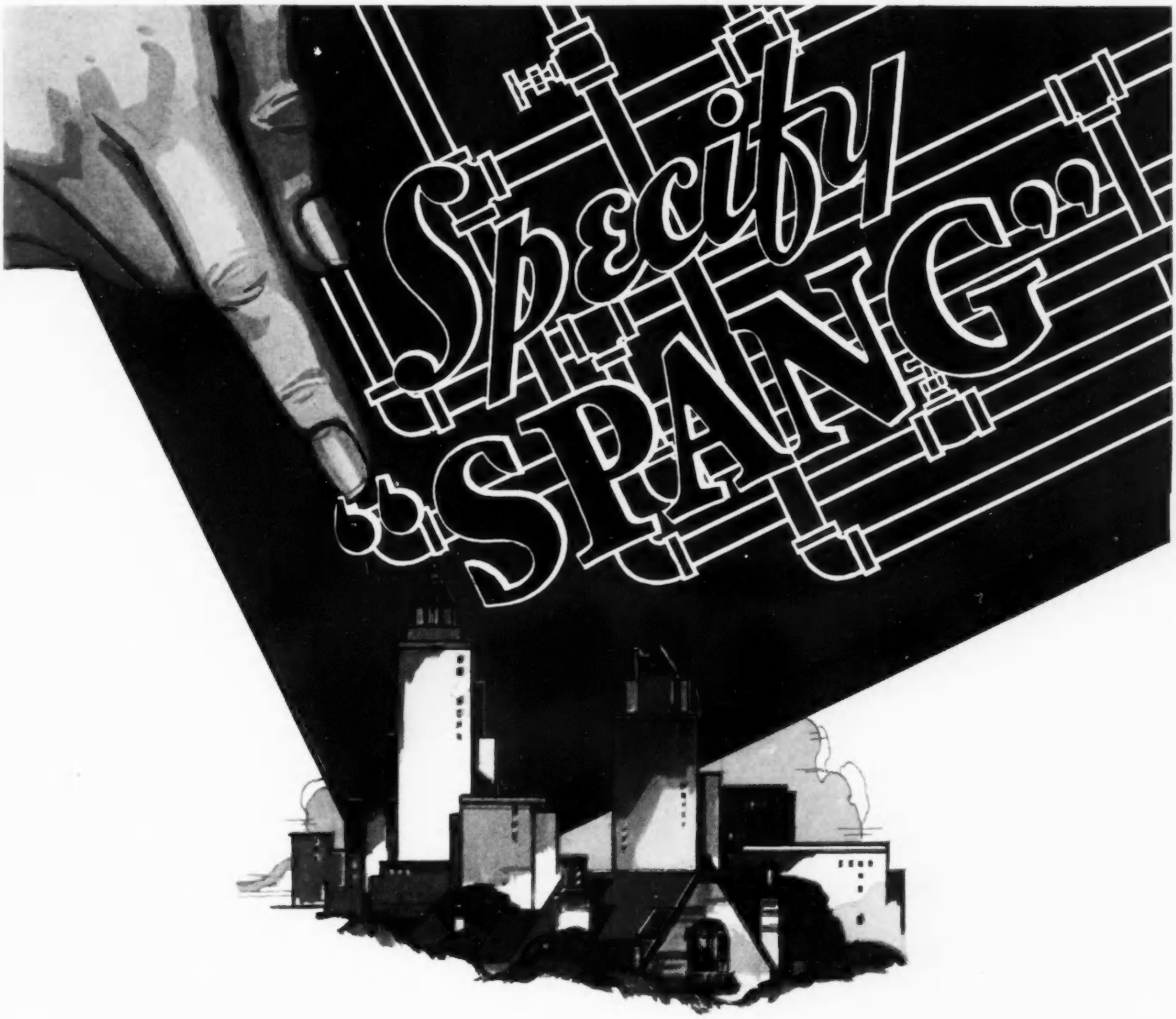
NEW POSSIBILITIES FOR GALVANIZED STRUCTURAL STEEL

A novel method of protecting rivet-heads from corrosion has recently been developed by the American Zinc Institute, Inc., and offers interesting possibilities for large new uses of hot-dipped galvanized structural steel.

The use of zinc-coated, or galvanized members in steel construction has thus far been restricted to comparatively light, bolted structures, wherein the individual angles, channels, plates and other units are first hot-dip galvanized and then fastened together with galvanized bolts and nuts.

A new method has now been provided whereby the individual units of riveted steel structures may be hot-dip galvanized before assembling, joined together by riveting in the usual manner (using the ordinary uncoated rivets), and the exposed rivet-heads then sealed off from the weather after the entire job is assembled in the field.

This method of preventing rivet corrosion opens up the possibility of using galvanized structural steel in the fabrication of bridges, towers, roof trusses, and many other steel structures exposed to the weather.



YOUR REPUTATION DEPENDS UPON YOUR INSTALLATIONS

FOR generations "SPANG" PIPE has been the standard by which all good pipe has been judged. Its soft, ductile qualities make it ideal for rapid cutting, threading, bending and coiling on the job,—the true, clean-cut threads assure tight-fitting permanent joints at all times.

Standardize on "SPANG" WELDED STEEL PIPE,—it is your best assurance of dependable pipe performance.

OUR CATALOGUE IS FILED IN SWEET'S

SPANG, CHALFANT & CO., INC.

***General Offices:* Clark Building, Pittsburgh, Pa.**

SALES OFFICES: New York, Boston, Pittsburgh, Chicago, St. Louis, Tulsa, Los Angeles, Dallas, San Francisco

WELDED MILLS: Etna, Penna., Sharpsburg, Penna.

SEAMLESS MILLS: Ambridge, Penna.

RELIABLE DISTRIBUTORS IN EVERY INDUSTRIAL CENTER

NEW NAIL TREATING PROCESS INCREASES HOLDING POWER

Everyone who has used wood may have observed wide differences in the case with which nails can be pulled from it. Some of the causes of difference in nail holding are splitting or mutilation of the wood in driving as affected by the nail point, moisture changes in the wood and the degree of frictional resistance between the nail surface and the wood.

The holding power of nails centers largely around the frictional contact of the nail with the wood fibers, hence the improvement of the surface by increasing its frictional resistance offers an excellent opportunity for enhancing nail-holding power. Such a surface condition may be obtained by a treatment developed at the Forest Products Laboratory for nails and metal fastenings for wood.

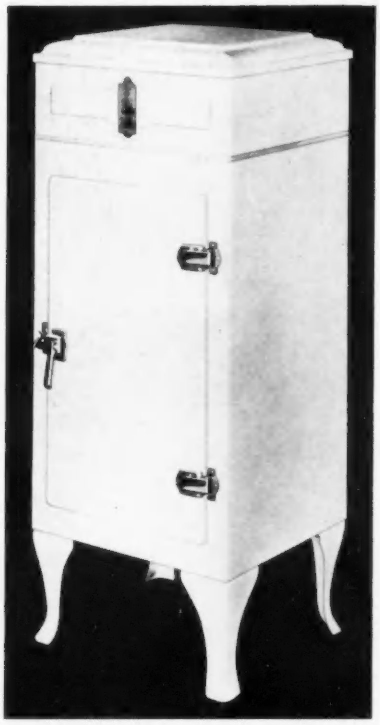
The improved surface is obtained by a chemical treatment that produces microscopic pitting or etching of the nail surface, thereby increasing its frictional resistance. To the unaided eye the pitted surface of the Forest Products Laboratory nail appears practically the same as the original in that there is no apparent roughening. What has actually happened, however, is a breaking up, by means of pits or minute etchings, of the smooth surface areas betwen striations left by the dies in the process of drawing wire in nail manufacture.

NEW OIL-BURNING CABINET HEATER

A complete line of Radiant and Circulating Type Cabinet Heaters are now in full production and ready for immediate shipment, according to Motor Whee Corporation executives. There are two Radiant Models and three Circulating Type MW Units available to handle small spaces up to 6,000 cubic feet, average construction.

Of the three MW Circulating Type Heaters, two have been finished in porcelain enamel walnut grain for installation in living rooms. The remaining circulating unit has been finished in a sturdy fireproof black for general utility. Radiant Models 501 and 501-A are constructed respectively of uniform blue steel and Wellsville polished radiating steel.

GENERAL ELECTRIC JUNIOR



Announcement of a low-priced secondary line of electric refrigerators of conventional design has been made by the electric refrigeration department, General Electric Company. The new machine will be known as the General Electric Junior. Merchandising efforts, however, will continue to be concentrated upon the hermetical-the hermetically sealed Monitor Top refrigerator.

Beginning in October the conventional line will be composed of three sizes, a small machine with a capacity of 4 cubic feet, a medium-sized model with 5 cubic feet capacity, and a 7-foot model. List price on the 5-foot General Electric Junior is $135.

IMPROVED VACUUM PUMPS

In announcing a redesigned line of Hoffman-Economy Vacuum Pumps, the Economy Pump Company points out improvements of interest to heating engineers.

Both vacuum and condensation pumps of this company have been greatly simplified and improved in appearance. They now employ rectangular receivers of cast-iron construction, sturdy and noncorrosive. Motors are of standard make, permitting quick replacement if necessary, and all pump parts are readily accessible.

NEW PENT-VENT

Bishop and Babcock Sales Co. offers Pent-Vent, a completely weatherproof fan, designed specifically for applications which formerly required a full housed centrifugal fan, and a separate penthouse for shielding it from the weather. The unit consists of a backward curved centrifugal fan, mounted directly on the motor shaft in a vertical position, and discharging through two outlets faced in opposite directions so as to compensate for wind velocity or direction. Each outlet is fitted with an automatic louver to prevent the entrance of rain, insects and back drafts when the fan is not in operation, and a set of stationary louvers to protect the automatic shutters and to prevent them from becoming inoperative due to the formation of ice. The entire unit is incased in a copper housing with removable top, which permits access to motor.