THE ARCHITECTURAL FORUM
IN TWO PARTS

ARCHITECTURAL ENGINEERING & BUSINESS

PART TWO

MAY 1928
For perfect safety standardize on R-W Elevator Hardware

Unit installation of Richards-Wilcox hangers, closers, checks, interlocks (mechanical, electromechanical or electric), and electric door operators insures complete efficiency in elevator door operation. And above all, it means perfect safety. A single responsibility covers all.

Write us for data on designs and specifications.
The wall illustrated is built of Natco Tex-Tile, a hollow building tile with a texture face as beautiful as the finest tapestry brick, and furnished in a range of attractive shades. Natco Tex-Tile walls are strong, self-insulated, moisture resistant, require no painting, repairs or maintenance, are unaffected by the elements, are permanently attractive and permanently satisfactory.

**THE BARRIER**

**NATCO FORMS A HAVEN FROM THE HEAT**

A GLANCE at a table of the insulating values of various walls will show why structures built of Natco Hollow Building Tile are more cool and comfortable in summer. (And, of course, warmer in winter.) Natco keeps out the summer heat, keeps in winter warmth.

Heat travel through hollow tile walls, ordinarily low, is even lower through Natco. For it has the exclusive double shell feature that increases the number of blankets of dead air which shield the building.


Natco forms a real haven from the heat—provides a complete line—makes it possible to fill all your tile needs from a single source of supply, backed by one united responsibility.

**NATIONAL FIRE PROOFING COMPANY**

**General Offices:** Fulton Building, Pittsburgh, Pa.
**Branch Offices:** New York, Flatiron Bldg.; Chicago, Builders Building
Philadelphia, Land Title Bldg.; Boston, Textile Bldg.

**In Canada:** National Fire Proofing Co. of Canada, Ltd., Toronto, Ontario.
The Olympia Arena, Detroit—one of America’s largest auditoriums—has a roof deck of Truscon I-Plates.

C. Howard Crane, Architect
Walbridge Aldinger Co., General Contractors

Here is another outstanding example of the economy and efficiency of this most advanced type of roof deck. Truscon Steeldeck Roofs are fire-safe, permanent, and because of their light weight provide decided savings in supporting structural work. They can be insulated to any degree to reduce heat loss and prevent condensation. Can be waterproofed with any standard roofing. This construction provides an economical, permanent roof deck for any type of building.

Write for suggestions, estimates and catalog. Sent without obligation

Truscon Steel Company
Youngstown, Ohio, U.S.A.

STEELDECK ROOFS
NOT OVER 5 LBS PER SQ FOOT
WHEN a barrow-full of concrete is poured to form a concrete pile, are you CERTAIN of what happens to it?

YOU can be certain of what happens to the concrete, by pouring it into Raymond Tapering Steel Shells. You can be certain for three reasons:

1st. Because, after driving, each steel shell interior can be inspected from point to top. And

2nd. Because each steel shell is spirally reinforced to retain ground compression and at the same time to protect the "green" concrete column against it. And

3rd. Because every Raymond shell is left in the ground. No doubt about what happens to the concrete in the Raymond Method.
Kewanee Boilers are built with plenty of space, above the water line, for the steam. This space has to be high so that the steam in the supply pipes will be dry. Also the space must be wide so that there will be enough steam in reserve to cushion all fluctuations of the heating load.

This is one of the many Kewanee features which definitely assure the greatest amount of heat for the building with the least fuel, and guarantee lower heating costs.

Right Here: there's high and wide space full of dry steam all ready to respond instantly to every sudden demand without commotion inside the boiler.

Kewanee Boiler Corporation
Kewanee, Illinois
Branches in 40 Principal Cities
REINFORCE plastered walls and ceilings against cracking and fire hazards with Steel—the ¼" flat rib PLASTA-SAVER Metal Lath. This protective construction makes financing easier and the completed building more durable and satisfactory.

Particulars, with samples of the very economical PLASTA-SAVER lath gladly sent

North Western Expanded Metal Company
1234 Old Colony Building, CHICAGO, ILLINOIS
THE MEN - THE METHODS BEHIND

Above, Van Kitchen in the Lake Shore Athletic Club, Chicago. Jarvis Hunt, Architect

Powerful brake in the new Van Plant, for bending sheet metal. Exerts a pressure of 22 tons.
To the fine old craftsmanship which first made Van Equipment famous seventy years ago, we have added one thing more — superlative new machinery. The spirit, the quality, the precision are the same, but production is faster and greater economy is possible through the most advanced manufacturing methods. Today the new Van plant stands unequaled, for size, efficiency and completeness.

Behind the tremendous array of machinery are the same men — seasoned craftsmen — who have helped make Van Equipment the nation’s preference. The personnel is unchanged. Many of these men have been with Van all their lives. Today they are aided by the most efficient scientific and mechanical devices.

Van Equipment is more than ever the choice of the careful buyer. It is low in first cost because of tremendous volume, widespread distribution and great buying power. It is built with the stamina that assures lifelong service without replacement. It is economical the day you buy it — and every day after that.

Precision marks every detail of Van Craftsmanship.

THE ALBERT PICK-BARTH COMPANIES
ALBERT PICK & COMPANY
218-224 W. RANDOLPH STREET, CHICAGO, ILL.
L. BARTH & CO., INC.
12 COOPER SQUARE, NEW YORK, N. Y.

THE JOHN VAN RANGE CO., CINCINNATI, OHIO, Manufacturing Division
It saves trouble—
insures satisfaction
to buy All your
Equipment from
One Manufacturer

WHY SHOP around when you can buy ALL you need in
heating systems and specialties and get ONE guarantee
from ONE manufacturer?

Today, the Milwaukee Valve Company, backed by 27 years of specialization in the
heating field, is fully organized and equipped to render this unusual service to the
heating industry.

In addition to making equipment for every size and type of heating installation the
line also includes an unexcelled variety of “Milwaukee” standard brass valves, packed
type radiator valves, gate, globe, angle, check valves, etc.

Get the habit of specifying and installing MILVACO exclusively.

Write for complete information, Dept. C

MILWAUKEE VALVE COMPANY
Manufacturers of
COMPLETE HEATING SYSTEMS
Milwaukee, Wisconsin
OFFICES IN ALL PRINCIPAL CITIES
Write for a free sample of this thermostatic wood

HERE is a genuine wood board that insulates permanently and at the same time deadens sound. It is also excellent for sheathing, and makes an ideal plaster base.

The name of this product is Masonite—the Thermostatic Wood for structural insulation. Millions of feet of it are going into homes and apartments of every type, from the moderate priced to the finest.

Masonite's co-efficient of heat conductivity per inch thick per hour is 0.328 (flat plate test made by Armour Institute). Write for sample, and for book of Specifications and Details.

MASON FIBRE COMPANY
Dept. 658, 111 W. Washington St., Chicago, Ill.
Mills: Laurel, Mississippi
Large floor areas—properly heated

RICH'S is one of Atlanta's largest department stores. Like other sizable buildings of this kind, it presents extensive floor areas that must be properly heated. Comfort is imperative both for shopper and employee.

These requirements the architects and engineers recognized when they specified a Jennings Vacuum Heating Pump on the return line of the heating system. A size D-20—of the duplex type to provide for unusual peak loads and emergencies—handles the condensation from the radiation and delivers it to the boilers against 20 lbs. working pressure. The air is removed by an independent element in the pump and discharged directly to atmosphere without back pressure.

Removal both of condensation and air is positive. It can be automatically controlled by the level of water in the returns tank and by the degree of vacuum in the system. Heating can be closely regulated to the heating demand.

NASH ENGINEERING COMPANY
12 Wilson Road, South Norwalk, Conn.

VIEW ABOVE SHOWS JENNINGS VACUUM HEATING PUMP, DUPLEX TYPE, SIZE D-20, AS INSTALLED IN THE RICH DEPARTMENT STORE.

Jennings Pumps
Modern Building Plans
Include this Specification

Now you can give any building positive protection against light failure

A GREAT assembly hall thronged with people—lights shining brilliantly... Suddenly the power fails—lights out... A blanket of darkness that can bring disorder and fear.

Continuous light is imperative where the public assembles. The emergency needs of a single operating room or an entire theatre vary—yet both must have positive protection against light failure.

Many architects are making the installation of Exide emergency lighting batteries a standard specification in their building plans.

Adaptable to any requirements... Exide-equipped emergency lighting is flexible. It can be adapted to suit any requirement—a single room or an entire building.

Automatic... Exide-equipped emergency lighting is automatic. If the regular power fails, the lights instantly draw current from the dependable Exide Battery. This happens without a hand touching a switch. The battery is automatically kept charged for instant use.

Dependable... Made by the world's largest manufacturers of storage batteries for every purpose, the Exide Battery for emergency lighting assures: (1) absolute power dependability, (2) long life, (3) freedom from trouble, (4) low first cost, (5) low operating cost.

Service for architects... One of our experienced representatives will be glad to consult with you on emergency lighting specifications. This entails no obligation. Our long experience may prove very helpful to you. Just write us.

For a more technical description of emergency lighting, see page 2876 of "Sweet's Architectural Catalogue"—Section C.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
Exide Batteries of Canada, Limited, Toronto
The economical Floor System
a wide range

The Martin Building, shown above, of Elizabeth, N. J., is one of the many office and store buildings of moderate size employing the Havemeyer Truss floor system. Frank A. Berry, Architect. John W. Ferguson Company, Builders

The Havemeyer Truss floor system is used throughout the building shown at right. Located at Ridgewood, N. J. Daniel J. Scrocco Architect. Corrado & Maturi, Contractors

The Havemeyer Truss has brought about a method of concrete floor construction which has resulted in new standards of economy and demonstrated its adaptability to a wide range of buildings. It has proved ideal for schools, apartments, hotels, hospitals, residences, industrial and commercial buildings—wherever problems of 100% safety and economy go hand in hand. The opportunities for using this truss are seemingly unlimited.

As a result, the outstanding merits of the Havemeyer Truss Floor system are being appreciated by an ever-widening group of architects and engineers. It makes possible lightness combined with dependability. Its simplicity of design eliminates chance of error and speeds up construction.

Havemeyer Trusses are made to meet spans from 4 to 31 feet. All sizes are in stock for prompt delivery. No cutting or fabricating is necessary on the job.

CONCRETE

Executive Offices:
Sales Offices and Warehouses in Principal Cities: Birmingham, Boston, Chicago, Cleveland, Detroit, Kansas City,
Havemeyer Truss is adaptable to buildings...

The Johnstown Inn, at Johnstown, New York, is another Havemeyer Truss floor system job. Above is a view of the attractive lounge room. R. E. Sluyter, Architect

An Engineering Service
In the many sales offices of the Concrete Steel Company are engineers thoroughly competent to deal with specific construction problems, from the specifications to the finished job. Please feel free to consult with them, without obligation. We believe it is to the betterment of all building to have the possibilities in this new type of floor construction as widely and fully understood as possible. Address CONCRETE STEEL COMPANY, 42 Broadway, New York City.

STEEL CO.

42 BROADWAY, NEW YORK, N. Y.
Our two new bulletins are now ready for distribution. In addition to giving detailed construction information and recommended specifications they contain scaled architectural blueprint pages, charts, tables and innumerable photographs of Gypsteel installations.

These bulletins are not advertising matter but technical data books which should be in every architect's, engineer's and contractor's file.

Copies sent upon request

STRUCTURAL GYPSUM CORPORATION
Linden, New Jersey

Offices in Principal Cities
Choice of Careful Corporations—

WHERE heating must be even, sure and economical—in the buildings of leading corporations all over the country—you find Heggie-Simplex electric-welded steel heating boilers in steadily increasing numbers. The most modern of heating equipment—making certain the most satisfactory service at the lowest final cost.


HEGGIE-SIMPLEX
ELECTRIC-WELDED STEEL HEATING BOILERS
VENTO
Is The Inevitable Choice of Big Builders

The Bamberger Department store of Newark, N.J. is equipped with approximately 18,500 sq. ft. of VENTO.

This continuing and growing acceptance of VENTO Cast Iron Heaters for so many of America's great structures is the result of careful engineering and architectural investigation. These leading builders find that in the 24 years of VENTO history there is not one instance of failure—The limit of VENTO'S durability is unknown—And where a review of bids has been made—in every case—the NET INSTALLED cost was in favor of VENTO.

Buildings that are built to stand indefinitely are equipped with VENTO.

AMERICAN RADIATOR COMPANY

VENTO DEPARTMENT: 816-820 South Michigan Ave., Chicago

Manufacturers of IDEAL Boilers, AMERICAN Radiators, ARCO Tank Heaters, VENTO Ventilating Heaters, AIRID Air Valves, MERCOID Controls and devices for drying, humidifying, cooling and refrigeration.

Castle Sterilizer Service Rendered by Competent Service Agents

Castle service and sales representatives are near you to give competent advice and data on any sterilizer installation you contemplate. Write us your requirements and you will be called on at your convenience.

Skilled Engineering Service

Castle engineers at Rochester will be glad to cooperate in furnishing plans, lay-outs, specifications and advice for new installations. Correspondence is invited from superintendents, consultants, architects and contractors. Data furnished without obligation on any installation on submission of general requirements.

Bed Pan Washer and Sterilizer

The Castle Bed Pan Washer and Sterilizer has the endorsement of prominent hospital executives because it actually does the work it is supposed to. A patented and exclusive washing feature gives this surety. Write for details and installation specifications.

WILMOT CASTLE COMPANY
1209 University Avenue
Rochester, N. Y.
Largest line of Hospital, Physicians', Dental and Bacteriological sterilizers
The cost of construction which protects occupants of a building against fire is very large. The cost of protection against panic fatalities is very small. Yet either one may be the means of saving many lives.

VONNEGUT HARDWARE CO.
Indianapolis, Ind.
For Every Refrigerator Need

ARCHITECTS appreciate the completeness of McCRAY service—not only in stock models for every purpose, but in built-to-order equipment to meet specific needs.

McCRAY refrigeration engineers are ready and willing at all times to consult with architects about the specific refrigerator needs of their clients.

For 38 years we have held to an unyielding standard of quality in refrigerator design and construction. Our reward is an army of satisfied users—more than 250,000!

For electric or mechanical refrigeration of any type—or ice—McCray refrigerators insure efficient, economical service. Remember, whatever the refrigerating agent may be, the refrigerator itself determines the character of service that is delivered.

Every architect should have the McCray portfolio, prepared by our engineers especially for architectural use. It contains valuable information on every type of refrigerator equipment—standard specifications—and many other facts for architects.

McCray refrigerators are available for every purpose—in homes, hotels, clubs, restaurants, hospitals, institutions, florist shops, stores and markets. Have you the McCray catalogs in your files? A postcard will bring them, without obligation.

McCRAY REFRIGERATOR SALES CORPORATION
864 Lake St., Kendallville, Indiana
Wherever the maximum in roofing protection is desired, Genasco Standard Trinidad Built-up Roofing offers all the waterproofing and long-lasting qualities for which Trinidad Native-Lake Asphalt is noted the world over—used in street-paving for more than a half-century.

Trinidad Lake Roofing Asphalt binds together the thoroughly saturated, tough, long-fibred rag felts which form the alternate layers of Genasco Built-up Roofs. It not only protects against weather and wear, but also resists corrosion from industrial fumes.

No other roofings of this type, nor asphalts intended therefor, seem to afford such adequate roof protection for public and private buildings of every description—and Genasco Standard Trinidad is specified by leading architects everywhere.

Write us today for full information and complete specifications for applying Genasco Standard Trinidad Built-up Roofing—free to architects and builders.

THE BARBER ASPHALT COMPANY
PHILADELPHIA
New York Chicago Pittsburgh St. Louis Kansas City San Francisco

“GUNITE” in Stadium Construction

This is highly illustrative of the architectural effects which can be obtained with a light, economical and permanent construction.

LELAND STANTORD STADIUM
“GUNITE” WALLS OVER LIGHT WOODEN FRAME

Let Us Aid You in Preparing Specifications and Estimates on Similar or Other Work

CEMENT-GUN CO., INC.
ALLENTOWN, PA.

We Also Have a Contract Department Prepared to Give You Bids on Any Work You May Have

Special Features

ATH15Y Shades are made of high-grade herringbone weave, 2 no. thread to the square inch, mercerized and calendered to a smooth finish. Resists dirt. Dyed in seven non-fading colors to harmonize with various office decorations. Always the same distance from the window. No rollers, latches, catches or springs to slip, stick or break. In thousands for clerical, semi-clerical, assembly-line, clerical or drafting windows. Also operating shades for skylights.

ATH15Y COMPANY
655 W. 65th Street, Chicago, Ill.
New York City:
F. H. Keele, 7 E. 42nd St.
Detroit: W. O. Lebuge & Co.
410 DeTour Bldg.
Montreal, Que.:
Cresswell-McIntoth, Reg'd
420 Seigneurs St.
An Educational Campaign for Better Homes

A springtime message to the home-buyers of America, which will appear in the May 19th issue of the Saturday Evening Post and in other national magazines, reaching more than 30,000,000 people during the month of May. It is the next step in our national campaign for better homes and the raising of America's standard of living comfort.

Spring is the peak of the home-buying season, yet the magic spell of Springtime which inspires families to build or buy a home, often causes them to give little heed to the heating plant. Yet upon the choice of a heating plant at this time depend the health, comfort and happiness of the family next winter and for years to come.

This message is a real service to the public. It safeguards the home comfort and health of the nation; it promotes better homes and, therefore, more homes; and it assures the architect the ready and enthusiastic approval of his client when he specifies American Radiator Products.

For descriptive literature address:
Advertising Division 45, 40 West 40th Street, New York City

AMERICAN RADIATOR COMPANY
Double folded sheets save waste

Onliwon toilet tissue is served in two interfolded sheets at once. It is convenient, economical and eliminates waste. Experience in hundreds of installations proves its saving. Onliwon cabinets are neat-looking... fool-proof... and will last for an exceptionally long period of time. Splendid service at low cost is the keynote of the Onliwon Service.

BOOK DEPARTMENT

A VOLUME ON THE COMPOSITION AND PLACING OF CONCRETE

Reviewed by C. W. SPENCER

To gain satisfactory results in any form of work it is of the greatest importance that the workman know thoroughly the materials with which he is to work. Thus in order for an artist to create paintings of lasting beauty it is necessary not only for him to understand how to mix his colors to obtain the necessary shades and tints, but it is also desirable for him to know something of the chemistry and the permanency of the pigments that make up his palette so that he will know which can be safely mixed and used so that the original effects will last indefinitely without fading or changing color. This is also true of the architect, who performs his work indirectly, using a large variety of building materials as his medium. The variety and complexity of these materials are rapidly increasing, but the three most important in order of their importance are steel, lumber, and concrete. The latter, which is of comparatively recent development, is rapidly gaining in importance and will undoubtedly soon surpass timber in importance as a structural building material. Portland cement, which is by far the most important binding material used in concrete, was invented in England a little over 100 years ago, but up until 1872, when David O. Saylor started his investigations with Portland cement, it was little used in America. From that time until the beginning of the twentieth century the development was very slow, and in 1894 there were only about 20 plants in the United States, producing about 800,000 barrels annually. The growth since then, however, has been phenomenal, so that at the present time there are about 140 plants producing more than 150,000,000 barrels of cement annually. This growth is due partly to new discoveries of suitable raw materials and new and improved methods of manufacture, and partly to the enormous demand for this type of building material which has arisen, its properties making it particularly suitable to the modern type of building. New equipment and elevating machinery now make it possible for the tallest structures to be constructed of reinforced concrete, producing a building of great strength, rigidity and permanence. The use of iron and steel as reinforcing for concrete also adds greatly to its possibilities as a structural material, and there is scarcely a single instance of a modern building of any considerable size which has been constructed recently without the use in at least some portion of this material. Another reason for the wide use of concrete is the necessity of building fireproof structures, and there is no material more useful in this connection, especially in floor construction. In addition to all this, the possibilities of concrete construction have been enhanced by its new use as a decorative medium.

In using concrete it is of the utmost importance that great care be taken in proportioning the mixture, mixing it, and placing it under proper conditions so that it is adequate for the purpose for which it is to be used. A slight error in any of these processes is capable of causing enormous damage, there being instances where entire buildings have collapsed due to carelessness in one of these details. While these problems are primarily the concern of the contractor, it is highly desirable that the architect be thoroughly familiar with them in order to render efficient service in designing a structure and supervising its construction. There is a large amount of material available as a result of the scientific research which has been carried on by the various cement companies as well as by public and semi-public agencies, such as technical schools and colleges. So great is the necessity of care in connection with concrete work that many of the larger construction companies maintain their own testing and research laboratories for the careful study of concrete.

Courses in the use of concrete are given in certain colleges and vocational schools throughout the country, and it is as a textbook for such a course that “Concrete Practice” by George A. Hool and Harry E. Pulver, professors of structural engineering in the extension division of the University of Wisconsin, was written. However, the subject is so presented that the volume should be a useful guide and source of information to those connected in any way with work in concrete. The book is divided into six main sections. The first deals with fundamental considerations, discussing the various parts of the mix, describing the aggregate, both fine and coarse, and placing special emphasis on the fact that strength in concrete depends largely on having the proportion of water to cement as small as possible and still have a workable mix. The properties of concrete and the effects of various substances on its strength are also discussed. The second section covers the proportioning, mixing and placing of the concrete, considerable space being devoted to description of the various methods of determining the proper mix to give the required strength according to individual requirements. Some description of forms, concrete block manufacture, and the making of cast stone is included. In the third section typical contracts, specifications, and plans are given for various kinds of structural work. Section six is of great practical value, as it shows the best practice in estimating all the different branches of concrete work, including forms and reinforcing steel. One section is devoted to outlining the procedure to be followed in the laboratory work in designing and testing concrete, and another is on field work and takes up the subject from the standpoint of the inspector, a section which should be especially interesting to the architect. Field methods in connection with several different kinds of concrete work are described. The appendix at the end of the volume contains much valuable and useful information in tabular form, including much material from reports of the American Society for Testing Materials, and a table from “the 1924 report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete,” by use of which it is possible to determine the composition of the mix which may be expected to give a required compressive strength after having been allowed to cure for 28 days.

THE IMPORTANCE OF SECOND MORTGAGE FINANCING

A Review by TYLER STEWART ROGERS

WITHIN recent years the architectural press in general, The Architectural Forum in particular, has been placing increased emphasis upon the importance to architects of a practical working knowledge of building economics and finance. Even a casual examination of the statistics showing the annual construction in the United States will indicate that but a fraction of 1 per cent of all building construction is of a purely monumental character, governed entirely by aesthetic considerations and free from problems of utility and cost. Except for the homes of the wealthy and a relatively small number of institutional and public buildings for which funds have been donated or appropriated, building construction depends upon the success of efforts to finance the projects. At least a great majority of homes and business buildings are constructed with funds supplied in part by others than the owners. The financing of real estate by mortgages has become such common practice that only rarely are new projects undertaken without securing a certain proportion of the funds through mortgage sources.

In presenting his book on second mortgages and land contracts, Dr. Reep has devoted himself to an exceedingly important aspect of real estate financing. First mortgages and the practices surrounding their procurement are practically standardized in all details. They can be obtained for almost any building venture. There are plenty of sources for funds for use in these "senior" securities. The real economic and social problem in real estate finance is the procurement of funds to bridge the gap between the amount available on a first mortgage and the amount of the owner's equity. This need for "junior" loans has never been satisfactorily filled, and yet it is of the utmost economic importance to the continued progress of the entire building industry that it should be. This book is an exceedingly clear and detailed presentation of the problem of junior financing of real estate. It is written by a man of broad experience in home financing. Dr. Reep is a lecturer on real estate at the University of Minnesota; Chairman of the Mortgage and Finance Division of the National Association of Real Estate Boards; and President of the Home Financing Corporation and Home Building and Loan Association of Minneapolis. Much of the data presented in his book has been collected through detailed researches carried on in connection with his work for the National Association of Real Estate Boards and his analysis of building and loan associations as sources for junior financing, and this work is the first complete and comprehensive study that has been published.

Junior financing has long been burdened with bad repute, due partly to its speculative nature, but very largely to the sharp practices which have commonly prevailed. There is a peculiar legal problem having an important influence on the junior financing field which Dr. Reep has analyzed in detail and for which he has sought a constructive solution. The early pages of the book are devoted to junior financing as the chief real estate finan

REAL ESTATE MERCHANDISING

By Albert G. Hinman and Herbert B. Dora
Assistant Professors of Economics, Northwestern University School of Commerce; Research Associates, Institute for Research in Land Economics and Public Utilities

A complete review of the business of dealing in real estate. It deals with the conducting of an active real estate business, with the buying and selling of realty by private investors, and with the improvement and holding of property for revenue. An eminently practical work on an increasingly important subject.

363 pp., Price $6

ROGERS & MANSON COMPANY
383 Madison Avenue New York

American Apartment Houses
CITY AND SUBURBAN

By R. W. Sexton

A comprehensive study of the modern American apartment house in its various phases, its designing and planning. Fully illustrated with views of exteriors, interiors and plans, and including text which makes plain the entire subject of apartment houses, their planning and management.

316 pages, 9½x12½ inches
Price $16

ROGERS & MANSON COMPANY
383 MADISON AVENUE, NEW YORK
Bloxonend is lowering trucking costs for nationally known concerns in these and other industries:

Automotive, Baking, Woodworking, Steel, Paper, Meat Packing, Wholesale Grocers, Railroad, Textile

Bloxonend is made of Southern Pine with the tough end grain up. It comes in 8 ft. lengths with the blocks dovetailed endwise onto baseboards.

65 Leading Newspapers and Printers use BLOXONEND

No floors are subjected to harder use and more abuse than are the floors in newspaper and printing plants where operations are often continuous 24 hours a day.

We are proud of the fact that BLOXONEND is fast becoming recognized as standard flooring in this and numerous other industries that demand the best in factory flooring. BLOXONEND renders efficient, economical service year after year under identical conditions that cause other floorings to become rough and rutted in a short time.

Lasting smoothness — durability — resiliency — these three essential qualities are combined to a greater degree in BLOXONEND than in any other flooring material. Laid directly over concrete without embedded sleepers.

Write for A. I. A. File Folder

Carter Bloxonend Flooring Co.
Kansas City, Missouri
Acoustics of Buildings

Including

Acoustics of Auditoriums and Soundproofing of Rooms

By

F. R. WATSON

Professor of Experimental Physics, University of Illinois

This book covers the entire subject of Acoustics of Buildings. It describes briefly the action of sound in buildings, and, in accordance with the present knowledge of the subject, gives detailed illustrations for guidance in the acoustic design of new buildings and in the correction of acoustic defects. In this volume, mathematical formulæ and theory have been minimized, but the results of experimental tests are set forth in considerable detail. Formulæ which are needed for calculating acoustic effects are illustrated by numerical examples and curves. The publication of this book was made necessary because of the repeated requests made by architects and builders for help in the correction of acoustic difficulties found in many buildings. Information is also needed about the construction necessary to avoid these defects in new buildings. As the scientific publications on the subject deal with special topics in more or less general terms, an extensive study is required before practical applications can be made with any degree of confidence. The existing knowledge of the acoustics of buildings is incomplete in many respects, with the result that a number of misleading ideas have grown up to explain the phenomena. The book is divided into two main divisions, “Acoustics of Auditoriums” and “Soundproofing of Rooms.”

152 pages; 6 by 9 inches; 72 figures. Cloth, $3 Postpaid

ROGERS & MANSON COMPANY
383 Madison Avenue, New York

Any book reviewed may be obtained at published price from THE ARCHITECTURAL FORUM

THREE VALUABLE TECHNICAL WORKS

By FRANK HALSTEAD

Architect, and Instructor in Architectural Drawing, William L. Dickinson High School, Jersey City

THE ORDERS OF ARCHITECTURE

A work on actual building construction, dealing with every detail of practical buildings, from excavating to interior finish. Useful to instructors and students in architecture, carpentry, and cabinet making.

283 pp., 7½x11 ins., 114 plates, $3.50 Net

ARCHITECTURAL DETAILS

Intended for the use of junior architects and builders, or for a textbook in technical and vocational schools. It covers every detail of actual architectural drawing.

283 pp., 7½x11 ins., 114 plates, $3.50 Net

ARCHITECTS’ AND BUILDERS’ REFERENCE BOOK

A work on actual building construction, dealing with every detail of practical buildings, from excavating to interior finish. Useful to instructors and students in architecture, carpentry, and cabinet making.

192 pp., 7½x11 ins., 67 plates, $3 Net

ROGERS & MANSON COMPANY
383 Madison Avenue, New York
Importance of Proper Application

A large percentage of so-called failures of protective paints is due to improper application.

PROPER application may be due to the fact that many paints are difficult to apply. This difficulty is usually because the paint drags under the brush resulting in great unevenness in the thickness of the coating. Or, it may be due to the heavy specific gravity of the pigment that causes sagging. In order to avoid this latter fault, the paint is brushed out so far as to make the coat exceedingly thin.

Even with expert workmen, these defects are decidedly a contributing cause of paint failures.

Neither of these objections is present in Dixon’s Silica-Graphite Paints. Anyone using them for the first time, wonders at the ease and certainty with which they are applied. The surfaces are easily and quickly covered, and because of the low specific gravity of the pigment, there is no sagging.

This ease of spreading is a direct result of the lubricating quality of the flake graphite pigment, and is also the explanation of the large volume of pigment which may be incorporated in Dixon’s Paints.

Before painting, all surfaces should be thoroughly cleaned and free from scale, dirt, blistered paint and moisture. The method of accomplishing is optional.

All surfaces should be given two coats of Dixon’s Silica-Graphite Paint; the second to be applied after the first is thoroughly dry. No adulterating oils or thinners should be used as Dixon’s Paints are properly compounded with the correct amounts of pigment, vehicle, driers, etc, at the factory.

Write for Color Card and Booklet No. 224-B.

Joseph Dixon Crucible Company
Jersey City

ESTABLISHED 1827

Dixon’s Silica Graphite Paint
Adequate Protection at Minimum Ultimate Cost
seller in case the buyer fails to live up to his agreement. A field of financing so essential to national welfare and prosperity, so important in all housing and many business building problems, and so hampered by unwise or antiquated legislation and by a reputation of an unsavory nature, is worthy of the authoritative and comprehensive treatment which Samuel N. Reep has given it in his new book. The volume will doubtless have some influence toward the corrections of the evils which now retard the sound development of second mortgage finance companies. It will enjoy wide distribution among real estate brokers, operators and investors, and it will do much to clarify the problems of those now engaged on a plane of high integrity in the essential work of providing second mortgage funds. The architect will find in this book much information of value to him and to his clients in securing adequate financing for building operations on a sound and proper basis.

The author has confessed that much difficulty attended the division of the subject matter into chapters. He has, nevertheless, achieved a very logical sequence covering all of the essential points and the important ramifications of the subject by basing his discussion on the sequence of operations in making a loan. The first chapter discusses "The Chief Real Estate Financing Problem," and the two following chapters take up the "Field of Junior Lien Financing" and "Junior Lien Security." Chapter 4 is entirely devoted to "Appraising the Security," which is the first practical operation in making or purchasing a second mortgage or land contract. The following chapter discusses "Commissions and Discounts" and is based on much special research in many cities. Chapters 6 and 7 are devoted to the "Preparation of Second Mortgage Papers" and the "Preparation of Land Contract Papers." These chapters are exceedingly practical and explain clearly even to the layman the meaning of the statutory requirements and phrases used in these documents. Since usury plays such an important role in junior lien financing and since it is determined as of the time the papers are delivered. Chapters 8 and 9 deal with this subject,—the former discussing the problem fundamentally, and the latter treating of its practical aspects. Chapter 10 is devoted to the important question of "Second Mortgages by Building and Loan Associations." After the second mortgage has been closed, or after the property has been sold on land contract, the next important operation may be the enforcement of its performance or some remedy in lieu thereof. In Chapter 11 on "Foreclosure of Second Mortgages" and Chapter 12, "The Cancellation of Land Contracts," these problems are analyzed in detail.

To assist in overcoming the many obstacles now present in junior lien financing of real estate, and on the theory that light dispels darkness, the author has devoted Chapter 13 to "Sharp Practices in This Field." Here are explained many of the methods employed by unscrupulous lenders, brokers and borrowers which have brought disrepute into the lay mind to this form of banking. The closing chapters are devoted to the "Broker and Junior Lien Field" (Chapter 14); the "Second Mortgage Market" (Chapter 15); the "Organization of Second Mortgage and Land Contract Companies" (Chapter 16); and the "Future of Second Mortgage and Land Contract Financing" at the close of the volume. These chapters form the basis for a constructive development of junior lien financing and point the way to what will probably become an important and ethical branch of real estate banking and financing.

In general, the author is to be commended for the clarity with which he has presented his facts, for the completeness with which the influencing factors have been analyzed and set in their proper order, and for the saneness and reserve which mark this conclusion at recommendations. The book will have a wide range of interest, benefiting the student, the layman, the broker and banker alike. It is a work to be recommended to the architect who appreciates the value to himself and his clients of a thorough knowledge of the business practices which are essential to the development of the business from which he derives his income.

The author has in no sense made this book a medium for propaganda; nevertheless his clear exposition of the legal difficulties besetting the junior lien field may become instrumental in bringing about much needed changes in usury laws. This matter deserves further notice here.

At present the several states (with Massachusetts as an notable exception) have usury laws which so definitely conflict with the natural operation of the laws of supply and demand in their influence on the second mortgage and land contract market that they compel evasion of infraction, and directly result in higher charges than are necessary because of the trouble or risk involved. These laws have teeth. The losses attending an action on the grounds of usury are very bad. Infraction is attempted only by the unscrupulous lender dealing with the most ignorant borrowers, and the rates then charged are accordingly exorbitant. Evasion is legally accomplished by the discount system involving a third party or straw man, whose service must be paid for as part of the borrower's expense. Either way, the borrower pays a premium he himself is the architect. The books designed for his protection limit the legal charges to a point substantially below a reasonable compensation for the risk involved.

The author does not seek the repeal of usury laws per se; rather, he feels the need for intelligent regulation of this branch of banking and real estate finance with a reasonable opportunity to place junior liens on a credit basis compatible with their worth under freely competitive conditions. Through such regulation, the cost of junior loan financing would be reduced, and part of the risk lessened to the benefit of lender and borrower alike and to the advancement of real estate building. Likewise, junior lien financing would regain its lost prestige and reputation and would be restored to its rightful place among legitimate and beneficial financial practices.

Another point of special interest to those concerned with building finance is the discussion of real estate security, and the corollary problem of real estate appraisals. The younger business generation, whose experience in real estate does not date back to pre-war periods of inflation, will find the author's review of the factors which influence realty values most instructive. The importance of the work should secure it wide circulation.

Stronger and Lighter
The INGALLS Truss

To gain even greater strength while radically reducing the weight of a structural unit . . . this has long been the aim of architects and engineers.

In the Ingalls Truss this combination of great strength and light weight is worked out to an unusual degree—and in a practical, sensible manner.

Here is a structural unit for fire-proof and sound-proof floors and roofs which is increasing in popularity day by day.

It is easily handled, can be installed by common labor, and effects remarkable economies not only in itself but by making possible reduction of weight in supporting members.

The progressive architect is always on the alert for better building materials—materials which will accomplish his purpose in a better way, at less cost, with less time and effort needed for construction. The Ingalls Truss is such a material.

For hospitals, schools, churches, public office buildings, garages, institutional buildings, and the better class of residences, Ingalls Truss Floors and Roofs present distinct advantages.

We will be glad to send you full details, specifications, etc., on request. Write us today.

MAIN OFFICES AND PLANTS: BIRMINGHAM, ALA.

Branch Offices:

- New York
  7 Liberty Street
- New Orleans
  1717 New Masonic Temple
- Atlanta
  715 Healey Bldg.
- Tampa
  1004 Tampa Theatre Bldg.

The Ingalls Steel Products Co.
BUILDING products today play an important role in the speed and economy of erection. But quite as important is the permanency they make possible in preserving architectural beauty. They are the sole dependents upon which the contractor must rely in carrying out the architect's rendering. Kalman offers a wide range of quality products —products that are so designed and produced that they may best depict the cognition of both architect and contractor.

KALMAN STEEL COMPANY

Plants or Offices at

Chicago    Detroit    Pittsburgh    Philadelphia    Kansas City
New York    Boston     Syracuse    St. Paul     Dayton
Buffalo     Baltimore  Milwaukee  Atlanta    Minneapolis

KALMAN LATH
## CONTENTS FOR MAY 1928

### PART ONE—ARCHITECTURAL DESIGN

**PLATE ILLUSTRATIONS**  
**Nazareth Hall, St. Paul**  
Maginnis & Walsh  
105-112  
**Detroit Masonic Temple**  
George D. Mason & Co.  
113-120  
**The Barbizon, New York**  
Murgatroyd & Ogden  
121-126  
**Essex Club, Newark**  
Guilbert & Betelle  
127, 128  

**LETTERPRESS DESIGN**  
**Nazareth Hall, St. Paul**  
Maginnis & Walsh, Architects  
Maurice Lavanoux  
633  
**Detroit Masonic Temple**  
George D. Mason & Co., Architects  
657  

**PART TWO—ARCHITECTURAL ENGINEERING AND BUSINESS**

**LETTERPRESS**  
**“Girdered Steel”**  
From a Woodcut by Louis Bromberg  
Frontispiece  

**ARCHITECTURAL ENGINEERING**  
Collaboration in Bridge Designing. Part I,  
The Architect  
Gilmore D. Clarke  
729  
Collaboration in Bridge Designing. Part II,  
The Engineer  
Leslie G. Holloran  
735  
Plumbing for the Tower Type of Building  
Harold L. Alt  
739  
A New Way to Determine Echoes  
R. F. Norris  
745  
Heating and Ventilating for the Architect  
Perry West  
749  

**ARCHITECTURAL LAW**  
The Dwellings Law  
John Taylor Boyd, Jr.  
755  

**DESIGN**  
The Barbizon, New York  
Murgatroyd & Ogden, Architects  
677  
Phi Delta Theta House, Burlington, Vt.  
William McLeish Dunbar, Architect  
697  

**SMALL BUILDINGS**  
705  
709  
Shedden House, Chestnut Hill, Mass.  
J. Robertson Ward, Architect  
711  
Betteridge House, Montclair, N. J.  
713  
Wildman House, Montclair, N. J.  
715  
Hawkins House, Montclair, N. J.  
717  
Babson House, Orange, N. J.  
C. C. Wendehack, Architect  
719  

**DETAILS**  
New York Academy of Medicine  
York & Sawyer, Architects  
721  
House of James L. Goodwin, Hartford  
Philip L. Goodwin, Architect  
725  

**BUSINESS AND FINANCE**  
The Architect’s Position in Relation to Mortgage Financing  
C. Stanley Taylor  
761  
The Building Situation  
Richard H. Marr  
764  
Planning Group Houses for Rent  
765  
The Architect as Constructor  
Wilfred W. Beach  
769  

**OFFICE PRACTICE**  
The Allied Architects Association of Denver  
Robert K. Fuller  
773  
The Allied Architects Association of Kentucky  
Ozias P. Ward  
775  
Charging for Professional Services  
Maud M. Acker  
777  
Cubic Foot Costs of Building  
James E. Blackwell  
779  
The Fairest of Competitions  
William O. Ludlow  
782  
Planning Religious Educational Buildings  
M. W. Brabham  
783  

---

PARKER MORSE HOOPER, A.I.A., Editor  
KENNETH K. STOWELL, A.I.A., Associate Editor  
Contributing Editors:  
Harvey Wiley Corbett; Aymar Embury II; Charles G. Loring; Rexford Newcomb; C. Stanley Taylor; Alexander B. Trowbridge  
Published Monthly by  
ROGERS & MANSON COMPANY  
383 Madison Avenue, New York  
Howard Myers, Pres.; James A. Rice, Vice-Pres.; Paul W. Hayes, Vice-Pres.; Robert Sweet, Sec. and Treas.
"THEY IMPRESS PROSPECTIVE TENANTS

Stephen W. Acheson

DESIGN and construction are always carefully considered by the builder. But what about leasing? And what immediately impresses the prospective tenant? Isn’t it equipment that is obviously superior?

This genius for selecting and installing superior equipment is displayed by John K. Turton & Co., builders of some of New York City’s most distinctive apartment houses, in one of their recent “jobs,” 350 East 57th Street.

“Here we installed twenty-six Smoothtop Gas Ranges,” said Stephen W. Acheson, treasurer of John K. Turton & Co., “because past experience has taught the owners and us that Smoothtops make a splendid impression on prospective tenants.

“It’s no wonder when you look at their smart console lines . . . almost like a piece of furniture. Then, the compactness of Smoothtop saves space in kitchen planning. There is no obstructing oven to cut off light from the cooking surface . . . it gets light from three sides.

“The Turton policy affords the tenant the best equipment on the market . . . so why shouldn’t we install Smoothtop?”
"GIRDERED STEEL"

From a Woodcut by Louis Bromberg
GRANTING that human happiness is greatly enhanced by beautiful and pleasing surroundings, it is highly desirable that utilitarian structures, such as bridges, should be as pleasing to the eye as it is practicable to make them, and that there should be a greater collaboration between the architect and engineer, with a realization on the part of each that science without art is apt to be unattractive, and art without science inefficient.—Wilbur J. Watson.

Ten years ago this spring, engineers of the American army were engaged in the construction of bridges across the streams in France to make possible the advance of the allied armies. The engineers were an important link in one of the greatest organizations of men ever assembled, and with a spirit of coordination and cooperation with other services these men made possible the advance of the armies over streams on bridges improvised at short notice. These bridge structures varied from passarelles, constructed of rafts kept afloat by gasoline cans, to steel structures of long multiple spans; naturally, appearance counted for naught so long as the structures sufficed for the exigencies of the occasion. We are concerned here with the design of unsightly and purely utilitarian bridges only insofar as to prevent, if possible, their construction on highways, railroads, and elsewhere. Such structures are good enough when built by armies in time of war, but they have no place in our modern civilization where beauty ought to be a much a part of life as food or shelter. But many, unfortunately the majority, of our modern highway and railroad bridges designed by engineers possess little if any more artistic merit than did those wartime structures. The creation of beauty is not primarily the business of engineers, and to obtain beauty we must call upon another profession, that of architecture. Bridges cannot be designed by engineers alone, nor by architects alone. Bridge design may be considered both an art and a science, which of course is true of almost every type of modern building construction. The fact that there have been few, if any, bridges designed by engineers within the past decade which can be said to possess beauty is a sufficient reason for considering the members of the engineering profession unfit to continue in this important work without the aid of architects. The engineer must be brought to a realization of the fact that the art and science of bridge building constitute a joint problem for architect and engineer.

When asked to prepare an article on bridges, I immediately replied that I thought the preparation of the article should be collaborative, since the architect's contribution is but one phase of bridge design. Modern bridge design must be based upon cooperative effort on the part of architect and engineer, just as during those trying times ten years ago the war had to be conducted by the cooperative effort of infantryman, engineer, artilleryman, etc. No one branch of the army service could have won the war alone; neither can the engineer alone produce a bridge structure possessing beauty of line, of mass, of texture, of detail. There is, nevertheless, a tendency today on the part of many an engineer to think that the bridge is solely his problem. We see the results all around us, expressed in hideous bridge structures on highways, railroads, and even in some of our parks. Of course there are exceptions, illustrated by such examples as some of the large river bridges about New York which are the result of collaborative design. The designing of bridges requires creative ability of the first order, from the standpoint of artistic as well as of scientific design. Collaborative effort is required, and both architect and engineer must realize that fact. A tremendous amount of effort on the part of that group of broad-gauged engineers who realize that the architect is necessarily a contributor in part to the design of the bridge, is required before artistic bridges will take the places of the ugly structures which are a disgrace to our civilization. The engineers with whom I have collaborated in the designing of many bridges believe thoroughly in collaborative bridge design. That neither architect nor engineer can alone design a satisfactory bridge structure has been proved to them. And they further believe that the architect must do more than merely attempt to "dress up" an engineering design; he must work on the problem with the engineer from the beginning. It has been shown conclusively by the engineers with whom I have collaborated that artistic bridges can be designed.
so as to cost very little, if any, more than the ugly.

In spite of a full knowledge of these facts, our nearby neighbors, the engineers in charge of the great program for the elimination of grade crossings in the Empire State, are unwilling to take heed, and still continue to perpetrate upon our highways structures that are a disgrace to an intelligent public. Their designs are still of the types originally developed when reinforced concrete was first used; or, if steel, are similar to those designed 50 years or more ago. How long the public will tolerate the construction of these concrete and steel monstrosities it is hard to tell. The bridge has apparently wandered a long way from the architectural fold of which it was once so charming and honored a member, and I hope the architect may be able to call it back.

In New York state there was for a time some hope of getting artistically acceptable bridge struc-
The formation of the state Fine Arts Commission, authorized by law to pass upon all structures for which state funds were spent in whole or in part, was a significant step forward. This Commission functioned effectively for a time, but was abolished a few months ago, and the state has thereby moved backward a decade or more. At present there is no control whatever to protect the public against the engineer, unwilling to admit his limitations, and who designs an ugly bridge which is an insult to the taste of the people who pay for it. The public needs to be informed in full concerning the facts; ugliness is not wanted; it will not be long tolerated. It is time for the architects to act, and I for one believe that the engineering profession will take the stand that the architect should be a collaborator in the designing of bridges as well as of tall buildings. The architectural profession should ac-

Photos. Nyholm

Footbridges, Tibbett's Brook Park, Yonkers, N. Y.

Gilmore D. Clarke, Landscape Architect

A. E. Jennings, Designer

Working Drawing of Footbridge, Tibbett's Brook Park
cept the challenge and make it a duty incumbent upon it to see that art becomes an inherent part in the design of bridge structures throughout the nation. Noble bridges live longer than any other structures built by man, as many of the old bridges of Europe bear witness,—the Pont du Gard, attributed to Agrippa, built in 19 B.C.; the Ponte Sant'Angelo in Rome, started by Hadrian; the old Pont Neuf, the finest over the Seine in Paris, and many others.

Accompanying this article are illustrations and sketches of several bridge structures built or to be built in parks and along parkways in the County of Westchester, New York, by the Bronx Parkway and Westchester County Park Commissions and designed by architects and engineers in close collaboration. A number of the structures are river crossings; others are at the intersections of parkways with highways, where a separation of grades is imperative for the
safety of modern transportation by automobile. Parkway systems are being developed, and similar types of bridge structures will be required, and let us hope that those charged with the conducting of the work spare no effort in order to clothe every structure with a charm only possible when aided by the creative ability of the artist.

Modern bridge design necessitates the use of steel and concrete. Neither one of these materials harmonizes with a naturalistic countryside, more particularly where rock outcrops abound; therefore the bridges of the Westchester County Park System have been faced with native stone, utilizing the latest developments in engineering design for steel or reinforced concrete. In sections of the country where it is impracticable to obtain stone for facing bridges and where the concrete must be exposed, that material can of course be interestingly treated. There
are many bridges of concrete which possess beauty of mass, of line, and of detail, and which harmonize with their surroundings. Where it is necessary to span railroads, a steel arch is often used in place of the stone-faced reinforced concrete arch, since the railroads are unwilling to bear the burden of the cost of a stone and reinforced concrete structure. A steel arch springing from stone-faced concrete abutments has been proved to be no more costly than the ugly, heavy steel girders on concrete abutments, which railroads are accustomed to build. The New York Central Railroad has cooperated splendidly with the Westchester County Park Commission where parkway and railroad closely parallel each other and where single structures must be had to eliminate grade crossings of intersecting highways.

We are making rapid progress in eliminating the ugly bridge, but there is still a great deal of work to be done, and the architects' aid must be enlisted to the end that the bridges of America may possess the same charm as those of Europe. Bridges are a measure of our civilization, as they have been for centuries. Do we want our present generation measured by the ugly bridges we see dotted along our highways, or by bridges treated by artist and engineer, aesthetically good and structurally sound?
COLLABORATION IN BRIDGE DESIGNING
II. THE ENGINEER
BY
LESLIE G. HOLLERAN
DEPUTY CHIEF ENGINEER, WESTCHESTER COUNTY PARK COMMISSION

WHAT has the engineer to do with bridge architecture or, for that matter, with the architecture of any structure? On the one extreme he may become the passive servant of the architect, and possibly lend himself to the perpetuation of unsuitable or uneconomical structural forms; on the other hand, he may become his own architect, with the disastrous results, from an artistic viewpoint, which Mr. Clarke has pointed out in the accompanying article. These extremes are equally undesirable. Between them, however, lies the middle ground of active cooperation between the engineer and the architect, by which the engineer is often able to lead the architect away from use of architectural designs which involve bad engineering, and by which on the other hand the architect must sometimes convince the engineer that a certain form of structure is bad architecturally or unsuited to the surroundings in which it is to be placed. It is gratifying to know that this active cooperation, which has long been customary in Europe, is gradually becoming more common in the United States. The movement in this direction will undoubtedly be accelerated by pressure from the general public, which is gradually acquiring a keen appreciation of properly designed structures that harmonize with their surroundings. This public will not much longer tolerate additions to our past mistakes in the way of ugly structures, such as continue and will continue to disfigure urban vistas and suburban landscapes throughout our

land until they are worn out or torn down through obsolescence.

This appreciation of better design is, strangely enough, being fostered to a very great extent by strictly commercial interests, such as the manufacturers of our motor vehicles, musical instruments, radios, and other everyday equipment, in which mechanical design has reached a high degree of perfection; and improvement in outward appearance has become one of the principal aids to sales promotion. The problem of adapting structural forms to satisfactory architectural requirements is often difficult and frequently requires the discarding of ideas and methods which have been considered essential since scientific design originated. While the basic theories of structural design, which are founded on natural laws, must necessarily be retained, the requirements of the engineer and those of the architect can, nevertheless, be brought into substantial conformity if there is a sufficient desire to have them do so. It will never be possible to reach common ground if the engineer assumes the attitude that the structural requirements are of paramount importance, nor if, on the other hand, the architect is unalterable in the belief that the architectural requirements are supreme. In any given problem it will almost invariably be found that the requirements of one or both can be modified without greatly compromising the requirements of either.

The architectural and structural forms illustrated

---

CROWN
KNEE ABUTMENT FOOTING

DEVELOPED PLAN OF INTRADOS STEEL
DEVELOPED PLAN OF EXTRADOS STEEL

6\frac{3}{4}

30 130

TYPICAL DETAILS OF SOLID SECTION
RIGID FRAME BRIDGE

Fig. 1

735
in these pages, it is true, adapted to the requirements of park and parkway construction, but there is nothing inherent in their design or construction which would preclude their use on highways throughout the country. Fig. 1 shows the design of a rigid frame reinforced concrete structure which was adapted for use in bridge construction by the Westchester County Park Commission's designing engineer, A. G. Hayden. Mr. Hayden describes this design in these words:

"The principle of continuity (rigid frame construction) was deliberately applied in the invention of a new structural form calculated to best meet conditions imposed by restricted headroom at highway crossings and possessing the utmost flexibility for architectural treatment. New methods of design were developed, which permitted great improvement over the few existing examples of simple frame construction. Moreover the new type of structure showed substantial economy over many other types.

Comparative estimates of the costs of different types of construction for the same location indicate that the rigid frame type has an advantage in the matter of cost of from 8 per cent to 10 per cent over other types of construction. The question naturally arises as to why, if there are advantages in the way of economy and adaptability, this form of construction has not been seized upon for general use. One
reason is that inertia must always be overcome before an innovation of any sort is generally adopted, and the second is that while most engineers in general practice are able to handle beam-abutment designs, reinforced concrete girder-slab-abutment designs, or even reinforced concrete arch designs, they are alarmed at the apparent complexity of the mathematics which must be employed in the designing of many statically indeterminate structures. It has been found in the work of the Bronx Parkway Commission and the Westchester County Park Commission, however, that as the designing of structures proceeds, new and shorter methods are continually being developed. These are being published in the technical journals, and as they become more and more widely known, they will, no doubt, be more generally adopted for use in highway bridge construction and for grade crossing elimination work.

In Fig. 2 the advantages of the rigid frame design in the way of economy of material, increase in headroom due to decrease in depth of material, and resulting decrease in grades for the same length of...
approach, are strikingly shown. This rigid frame design was used as the structural parts of several of the bridges shown in this and the accompanying article by Mr. Clarke, and in a number of other bridges not illustrated. Nor should the reinforced concrete structure without stone facing be entirely discarded. There are locations where a properly designed concrete bridge will be found not inharmonious. Fig. 3 shows such a bridge, which was erected in the Bronx River Parkway over the Bronx River and tracks of the New York Central Railroad near White Plains, N. Y. Fig. 4 shows a very economical reinforced concrete design which lends itself to certain forms of arch construction. Steel may also be adapted to certain locations and conditions, as is evidenced by the bridge shown in Fig. 5, which was designed to take the place of a broken-backed girder bridge originally proposed and shown in outline in Fig. 6.

The cooperative spirit under which the Bronx Parkway Commission and Westchester County Park Commission bridges have been designed, and the new structural forms which have been developed by Commission engineers for adaptation to the architectural requirements, have caused widespread discussion, particularly among engineers. Representatives from several state highway departments and railroad companies have visited the Commission's offices to study the methods used so successfully.

Reinforced Concrete Bridge of Unique Design, Bronx River Parkway
Delano & Aldrich, Architects
A. G. Hayden, Designing Engineer
PLUMBING FOR THE TOWER TYPE OF BUILDING

BY

HAROLD L. ALT

MODERN development in building construction tends toward the planning and erecting of higher structures. Congestion of population, rising real estate values, and the desire for light all combine to make increased heights desirable, and since the plans of a building over 100 stories high were approved by the New York Bureau of Buildings, no doubt of the possibility of making structures of lesser heights entirely stable should exist.

Granting that, with modern steel construction scientifically designed, buildings of from 40 to 80 stories are entirely feasible, the next problem has to do with the proper servicing of such an enormous amount of floor area so high above the street. Elevators to properly serve the upper floors require so much additional space as to seem almost prohibitive; heating lines grow to abnormal sizes, with the expansion increased in proportion to the height; the chimney occupies a gross floor area, owing to the large number of stories through which it must pass, as to seem unreasonable. But the greatest difficulty seems to concern the plumbing. It must be remembered that the plumbing system handles water, and as water is a commodity of considerable weight, difficulties arise in the plumbing which require special treatment. Roof drains, soil stacks and hot and cold water lines are some of the items which cannot be handled in the same manner as in lower structures. Pipes multiply and require space allotment which would be considered out of proportion in lower buildings.

Plumbing Work. It is the purpose of this article to point out some of the difficulties encountered with plumbing in the high or "tower" type of building, and to make constructive suggestions in connection with various schemes that have already been worked out for the purpose of overcoming these difficulties. For the purpose of this article the "plumbing" as far as covered, will be considered as consisting of soil, waste and vent stacks, hot and cold water pipes, and roof leaders. Special services, such as compressed air, gas, vacuum cleaning, drinking water, refrigeration, fire lines and so on, cannot be covered in an article of limited length, so these must be left for future consideration. In general, a building in which proper provision has been made for the incorporating of the major services, can have the special services included with only unimportant changes.

The Soil System. In providing for water closets in high buildings great care must be taken in arranging the soil piping; this is done, primarily, to the unusual height and to the excessive number of fixtures on a stack. In cities where combined soil and waste stacks are permitted, the load on the stack is increased by whatever number of waste branches drain from each floor. In order to assure the most dependable type of service, soil stacks are run so as to take care of alternate floors. Thus one stack would take the drainage from all the odd numbered floors in the manner illustrated in Fig. 1. In the event of one of these stacks becoming clogged up or having a stoppage occur in the horizontal basement section, only the toilets on alternate floors would be put out of commission, so that occupants by going either up or down one flight of stairs would find facilities in spite of the one stack's being unusable. At the base each stack would be run into a separate house sewer, which would be carried to and connected with different sewers in streets on either side of the building, so that even the temporary blocking of the street sewer or connection between the building and the street would still leave toilets on alternate stories in service.

Soil stacks for the lower portion of the building should be taken care of separately from those serving the higher portions, and the arrangement should be made so that stacks serving the upper portions have no connections of any nature with those in the lower stories, this again operating toward a reduction in stack size and also giving an opportunity for the building of an enormous head behind any stoppage which may occur near the bottom of the stack or in the horizontal run to the street. Setbacks, which usually accompany the tower type of construction, materially aid this arrangement by permitting soil stacks serving the lower portions of the building to be brought out of the lower setback roof and there terminated. Stacks serving the next higher section run through the lower section without openings and serve the portion of the building between the first setback and the next higher; this scheme is followed out until the stacks going to the top of the tower portion are encountered, which stacks serve alternate floors in the tower with no outlets below. This is diagrammatically shown in Fig. 2. It has been found that in tall structures it is not desirable to run soil stacks in a perfectly straight, vertical line, because the water flowing down the stack attains too high a velocity, giving rise to noise. For this reason soil stacks are deliberately offset at points about 10 stories or 15 stories apart, and the flow is thus retarded. Provision for such offsets or changes in direction should be made in the original building design, since otherwise considerable difficulty may be experienced in trying to incorporate them later.

Waste Stacks. Waste stacks must be provided where lavatories are to be installed in offices, and these in most cases will follow the structural columns. Considerable floor space may be saved if the installation of these waste stacks is anticipated in laying out the steel frame. It may sound unreasonable to suggest the arrangement of steel framing...
to suit the plumber's waste pipes, but such has already been done and the space saving is considerable. It is not necessary to make any changes in the structural steel beyond working out a special column connection for beams, so that a small opening is provided on each side of the column in the manner illustrated in Fig. 3. This is commonly termed a "bracket" connection as distinguished from the ordinary "angle" connection shown in Fig. 4. This scheme lends itself very readily to the putting of the waste stack and cold water riser on one side of the column and the vent stack and hot water riser on the other side, as illustrated in Fig. 5. If the ordinary steel framing should be used, about the best that could be done would be as indicated in Fig. 6. The remarks just made about soil stacks apply in less forceful form to the waste stacks; they should not be made over 3 inches in size if possible, and they should serve only certain horizontal sections of the building; they should be offset or shifted from time to time to break the water fall.

**Vent Stacks.** Venting and vent stacks should receive careful attention. Plumbing codes vary so greatly in their venting regulations that it is hard to give any recommendations except to say that in high buildings vent stacks should be installed whether the local code requires their use or not. Where larger sizes are not demanded by ordinance, the vent stack may be safely made somewhat smaller,—a 6-inch soil stack with a 4-inch vent stack or a 4-inch soil stack with a 3-inch vent stack. For waste stacks the same applies, only running to smaller sizes, such as a 4-inch waste stack and 3-inch vent stack, or a 2½-inch waste stack and a 2½-inch vent stack, or a 2-inch waste stack and a 2-inch vent stack. There is nothing to be gained in offsetting vent stacks, as there is no water flowing through them. Vent stacks should be parallel the respective soil or waste stacks which they serve, and as soon as the bottom connection on each particular stack is reached, the vent stack should be run back into the stack through a 45° ell and a Y fitting. There is no object in venting soil or waste below the bottom fixture connection, since any air caught below this point cannot blow out in fixtures below (owing to there being no lower connections to the stack), and any retarding effect on the falling water in the stack is really of beneficial character.

**Materials of Construction.** In all high building work, galvanized steel or galvanized wrought iron pipe can be used for waste, soil and vent stacks, this being made up with galvanized, cast iron, screwed recessed, drainage fittings, with all pipe most carefully reamed out. Where lines run underground, extra-heavy, uncoated, cast iron soil pipe and fittings with caulked lead and oakum joints should be used. Expansion joints are sometimes used in the vertical risers every 20 stories or less, but difficulty will probably be experienced with the local authorities if any type of slip joint is advocated. A corrugated copper joint with flanged ends and companion flanges can generally be used. There is also a cast iron slip joint which has been approved in some of the large cities.

**Water System.** Furnishing water supply for the building will have an important bearing on the building design, and this is one point on which it is well to be forewarned. It is most essential to keep the water pressures down to a point where excessive splashing and undue wear and tear on the equipment will be avoided. For this reason the building should be divided into horizontal sections or zones of 10 to 15 stories each, and each of the separate zones should have its own individual house tank and hot water heater. The house tanks and hot water heaters for the same zone will not come in the same tank room. In order to obtain satisfactory water pressure on the highest floor of each zone, the tank room for that particular zone should be located in the zone above.
and two stories higher. This will result in a pressure head on the fixtures in the top story of the zone equal to that of two stories plus the height of the water line in the tank (which usually is about 25 or 30 feet). The hot water heater for the same zone must be located at the bottom of the zone in order to circulate the zone by gravity.

**Hot Water Systems.** For convenience the hot water heater is usually placed in the tank room of the zone below, and the hot water is fed down one story without circulation, but it circulates to the stories in the portion of the zone above the hot water heater level as usual. This will probably he made a little more clear by referring to Fig. 7, where a typical zone is illustrated with the levels on which the house tank and hot water heater for that zone would be installed. Of course the hot water heaters may be dropped down to the story below the lowest in the zone, which will give hot water circulation to all stories included in the zone without dead ending. This will entail extra heater rooms at certain levels which will not be the same levels as those on which the house tanks are set, so that this arrangement, which is shown in Fig. 8, is usually not as economical in floor space as the scheme shown in Fig. 7.

**Materials for Water Systems.** It is the growing practice to use brass pipe and fittings for both hot and cold water lines in the best class of construction work, and especially when lines cannot be replaced readily. Steel and genuine wrought iron pipe, galvanized, are often installed in the larger sizes, owing to the greater thickness of shell and the rapidly increasing cost of brass as the diameter enlarges. All joints should be screw joints on the smaller sizes and flanged joints on the sizes of 6 inches or over. They should be made up with only red or white lead used as a lubricant on the male thread only, and they should be tested to a pressure 50 per cent in excess of the maximum working pressure. House tanks are invariably steel, usually square or rectangular, and braced with substantial angles; they are built with angle iron curbs, and have ½-inch steel covers, made up in sections and suitably stiffened. The house tank construction is similar to that in the building of ordinary height. The same may also be said concerning the hot water heaters; owing to the zoning of the building, the pressure on the heaters is no more than that ordinarily encountered in lower buildings, and the same heaters of proper capacity will give satisfaction in structures of the tower design.

**Hung Ceilings and Pipe Spaces.** It is highly desirable to zone the building for water supply purposes at the earliest possible moment, so as to provide hung ceilings with pipe spaces above for horizontal distribution mains. When such spaces are provided it not only means increased floor heights for those particular stories but also provides the heating system with horizontal distribution space for supply mains and drip lines. With a proper amount of forethought, ceiling spaces and tank rooms may be arranged so as to dovetail with the hot water and heating arrangement. Through lack of appreciation of certain possibilities in the original designs, most builders fail to take the full advantage possible from the hung ceiling owing to the fact that it is usually attempted to fit in the equipment installation with previously located hung ceilings instead of the hung ceilings being arranged to suit the requirements of the installation.

In Fig. 9 is illustrated an arrangement of hung ceilings so located as to accommodate:

(a) Cold water supply horizontal distribution for each zone.

(b) Hot water supply horizontal distribution for each zone.

(c) Hot water return mains for each zone.

(d) Heating supply and return distribution for each zone.
This is accomplished by placing the hung ceiling over the story just below the tank room and placing the tank room two stories above the particular zone which the tank may serve.

**Pumping to House Tanks.** In the matter of filling these tanks with water for the various zones and the keeping of them filled when each has a different amount of water taken from it each hour in the day, some real difficulties have presented themselves. It is not economical to pump all the water required in the building up to the highest house tank and then let it run down through consecutive tanks with ball cocks until the lowest tank is reached, because this means pumping all of the water to the highest portion of the building when some of it is only required in the lower portions, involving a considerable waste in electric power. Moreover, an extremely high-pressure pump is required to operate against gravity heads of 500 to 1,000 feet, to which must be added the pipe friction. This has led to the adoption of the scheme of locating a pump in each and every tank room. Each pump then uses the tanks in that room as suction tanks and lifts the water from the zone in which the pump is located into the tank of the next zone above; here another pump takes the water from the tank and raises it into the next higher zone. It is self-evident that with such an arrangement the water used in each zone is pumped no higher than the tank supplying that particular zone.

**Pump Capacities and Control.** The capacities of these pumps are carefully graded so that the higher pumps can never dry the lower house tanks, as this would interfere with the water supply for the lower zones. To forestall any such possibility, the capacity of the pumps is steadily reduced from the lowest pump to the highest. Thus, if the basement pump has a capacity of 100 g. p. m., then the pump in the
next higher zone should have a capacity not to exceed 80 g. p. m.; the next higher pump not over 60 g. p. m.; then 40 g. p. m., and so on. Usually the decreasing floor area in the upper sections will quite justify the cutting down of the house pump capacities in the upper zones. Pumps should be installed in duplicate sets with one for reserve and should have float controls from the tanks into which they discharge. The heads on the pumps will be governed by the vertical height and pipe friction as in any pumping installation. Pumps are generally of the centrifugal type, directly connected to motors and set on a common bedplate. Throw-over switches should be provided in the control wiring from the house tanks, so that either pump can be thrown into service as desired.

Roof leaders, owing to the numerous setbacks, occur at frequent intervals in the tower type of building. Here again, hung ceilings should be provided directly under the roofs of the setbacks, not only for leader boxes located in the roof immediately above, but to provide space in which leaders from the roofs above may be offset. The same space will also serve for the heating risers, and so it is doubly useful. In cases where it is intended to carry leaders down the outside, the roofs should be arranged to pitch toward the outer parapet, so as to bring the leader boxes as nearly vertical over the leaders as possible. It frequently happens that space is not available at the window pilasters to accommodate large leader lines as well as the heating risers; the alternative in such cases is to slope the roofs toward the middle of the building and to carry the leaders down in pipe shafts. It is not always advisable to join leaders from upper levels with those of lower roofs until the lower leaders have dropped down a couple of stories so as to have a head of water in the lower leader. There is an old saying that if the roof water can once get into the leader it will go. But if leaders are small, or if they are temporarily overloaded by a miniature cloudburst, it is very easy for the flow from the higher roofs to retard the incoming water from the lower roofs if connections are made too near the level of the roof outlets from the lower levels.

There is generally allowed 1 square inch of leader area to every 200 square feet of roof or other drainage area. This is the ratio customarily used in New York. In localities where very heavy rains are experienced, as in Pittsburgh, it is safer to use only 150 square feet or even 100 square feet of roof to 1 square inch of leader area to take care of short but exceedingly heavy rainfalls.

In designing high buildings it is sometimes forgotten that the water caught in setbacks may be increased by rains which do not fall in a truly vertical direction. The maximum amount of water which could be caught on the roof of any setback is governed by the area of the setback roof plus the area of the side of the building from the setback up to the next higher roof when projected at an angle of about 60° from the vertical. Reference to any high building elevation will show that if the rain is assumed to be falling at an inclination of 60° from the horizontal, or 30° from the true vertical direction, the setbacks on one side of the building will not only have to provide for carrying off their own normal rain water but will also receive a certain additional quantity which will strike the side of the building above the setback. This is indicated in Fig. 10, and it will be seen that the area which should be figured for any setback roof with a vertical wall at the back is the projected area of the roof and wall taken at 60° from the horizontal. In horizontal leader lines the sizes may be based on the "flow of sewers," which is given in almost any handbook, or it may be governed by the local plumbing code. In cases of combined roof leader and soil drainage systems it is customary to jump the size of the horizontal leader line one pipe size over that actually required.
to carry off the roof water, the extra area being usually more than sufficient to provide the necessary capacity for the soil and waste lines even during heavy rains.

Snow Melting Pipes. In vicinities where very low outside temperatures are encountered, snow melting pipes are often utilized. These are for the purpose of melting out the gutters over to the leader box, so that the leaders cannot become clogged with ice even when the combined action of the sun and the building warmth causes the snow on the roof to melt. They are usually made of perforated brass pipe with perhaps \( \frac{1}{4} \)-inch diameter holes on 2-inch to 4-inch centers, and the size of the pipe is made sufficient to supply all the holes with steam at full pressure; the end of the pipe is capped. The pipe is set 2 inches or 3 inches above the bottom of the gutter, with perforations pointing down. These perforated pipes are provided with valves inside the building and should be supplied with steam of at least 10 to 15 pounds gauge pressure. The ordinary heating system steam will usually not have sufficient pressure to satisfactorily operate these lines.

It is often necessary to make a steam connection to the leader just below the leader box so as to heat the leader pipe near the top as well as to thaw out the roof outlet. Unless this is done the action of the whole scheme may be prevented. These snow melting pipes and their cost of installation do not reach as high a figure as might be at first supposed; they have not returns to consider, and each roof,—or even each part of each roof,—may be thawed consecutively so that the risers are never carrying a very heavy load. Probably a 2-inch or 3-inch main steam pipe riser would be sufficient for any high building whose ground area does not exceed 200 x 300 feet.
To determine the proper period of reverberation for given auditoriums is not difficult, nor is making an estimate of the proper amount of sound-absorbent material necessary to obtain the desired acoustical results. This phase of the subject of acoustics has been clarified. With patience and care, the proper period of reverberation of echo in a room may be determined from formulae, and an acoustical correction may be computed.

Sometimes, after the proper period of reverberation in an auditorium has been ascertained, one finds places in the room where it is extremely difficult to hear. These places are usually called "dead" spots and are caused by the concentration of reflected sound that is out of phase with the direct sound by one-thirtieth of a second or more. To get rid of these spots, one must find the reflecting surfaces which cause them, then change the shapes of the surfaces or treat them with enough sound-absorbent material to eliminate the disturbing reflections.

Several methods have been employed for the detection of "dead spots." An ingenious plan developed by Prof. F. R. Watson of the University of Illinois uses an arc light at the focus of a parabolic reflector. A beam of light is cast and a hissing sound emitted simultaneously by this instrument. The apparatus may be set up on the stage of the auditorium to be tested, and the beam of light directed against any portion of the room's interior. By placing mirrors on the surfaces against which the beam of light is directed, the path of the light after it is reflected may be noted. A sound is reflected in much the same manner as a light beam.

In an auditorium being thus tested, the sound may be heard distinctly if the ear is moved into the path of the beam of light. By careful and assiduous manipulation of this apparatus, a thorough survey can be made of any auditorium, its "dead spots" plotted, and the surfaces which cause them determined. Then one may either change these surfaces in shape or pad them with a sound-absorbent material to eliminate the cause of the disturbance.

Another method, developed by Dr. Paul Sabine of the Riverbank Laboratories, involves making the model of a cross section of the auditorium to be studied, and the production of a very intense, single-sound wave at the spot where the speaker stands. This sound wave is then photographed. The machine may be timed so as to photograph the sound wave at any increment of time after it has left the source. In this way, a series of photographs may be taken, each one showing the spherical sound wave as a ring, expanding away from the source. With a succession of these photographs, the progress of the wave may be noted, its reflection from the various surfaces studied, and the disturbing surfaces determined. A third way of studying an auditorium in regard to its echo-producing surfaces is to lay out the significant sections of the room, then in each section take the speaker's location as a source, and draw lines or rays out to all the boundaries of the section from this point. The rays are assumed to reflect at an angle which is equal to their angle of incidence, and are reflected into the auditorium. These rays then show the paths in which sound travels after its first reflection. If a great number of these rays are accurately drawn, and the angles of incidence and re-
Reflection carefully measured, the resulting picture gives a fair idea of how the sound acts.

Of the methods mentioned, the first is applicable only to auditoriums which have been erected; it cannot be used on the sketches of proposed auditoriums. The models employed by the second method may be made from the architects' sketches of the room, but this method is laborious and time-consuming, due to the necessity of building plaster models of the various cross sections of the auditorium to be studied, and because carefully timed photographs are essential. The third method is applicable to auditoriums of which the plans are available, and it can be utilized in the case of buildings which are only in the sketch state. It had previously been employed by the Burgess Laboratories in making acoustical analyses of rooms before the buildings had been erected, or even fully designed. This method consumes so much time, however, that an accurate short cut was sought.

The significant sections of a room to be studied are usually: (1) the floor plan, (2) longitudinal section, (3) cross sections. They are laid out in line on a stiff white paper (Fig. 1). The section to be studied first is placed on a flat surface, and a highly polished strip made of metal \(\frac{1}{2}\)-inch wide is placed along the boundary lines of the section, the width (the \(\frac{1}{2}\)-inch dimension) being perpendicular to the plane of the section. This strip is bent to conform to the outline of the section, and is held in place by weights similar to spline weights. The section is then placed in a darkened room and a small bulb situated at the source of sound is lighted. The reflections from the polished metallic strip are found to make the same pattern on the surface of the paper as would be obtained if one should carefully construct lines representing all the rays of light from the same point and from the reflecting surfaces. This method gives results more accurate than those secured by drafting, and in a fraction of the time required for that method.

Although sound is reflected in the same manner as is light, sound is of such a long wave length in comparison to light that it is much more easily dispersed. Consequently, the engineers studied with extreme care this detail in their method of analysis, since light was employed in place of sound. Under the older method, where the rays of sound were laid out on the drafting board, they were laid out as rays, and no provision was made to correct for the dispersion of the sound. The new method is more accurate than the old, because the likelihood of there being drafting room errors in working out all angles of incidence and reflection is eliminated.

Several auditoriums were laid out and thoroughly studied by the old drafting table method. Small models were then set up with the reflecting walls, using an electric light at the speaker's position. The resulting patterns cast on the paper were found to coincide almost exactly with the patterns obtained from the drafting method. It was only necessary, then, to devise some way of making a record of the light patterns which were cast in the auditorium sections. This was done at first by setting up the sections on photographic paper in a darkened room. The bulb was placed at the desired position and lighted. The intensity of the light is greater where the light is reflected from the walls in addition to the general lighting, so that paper is exposed more at these places, and a shadow picture of the reflections is obtained. In studying the effects of the reflected sound, pegs or pins inserted at different points along the floor and balcony of the auditorium (in the cross section at points in which auditors would be stationed) proved to be exceedingly helpful. These pegs cast shadows which pointed directly away from the surfaces from which the light was being reflected. By reversing the direction and following these shadows, each surface causing a shadow was found. If the distance from the source of the sound to any one of the surfaces and then onward to the listener were greater than the direct distance from
the source to the auditor, a confusion of the sound would be heard. If the difference in the two paths were more than 70 feet, an echo would be heard; if it were less than 70 feet but more than 35 feet, a blurring effect would make it hard for auditors to understand the speaker.

Referring to Fig. 2, which is the plan view of an auditorium, it will be seen that, with a source at S on the stage, there is a reflection from each side wall toward the center of the room, and that there is a reflection from the rear wall which concentrates at E. The reflections from the side walls are everywhere divergent and do not come to a focus. For this reason, the intensity of this reflection to any single auditor is small, and in all probability would cause no disturbance. Investigations in actual rooms have proved this to be the case. The concentrated reflections at E, however, produce an irritating conflict of sound waves in this region. The reason for this is that practically all of the reflected sound from the rear wall is concentrated in this area, and the intensity of the reflected sound here may be greater than that of the direct sound. In Fig. 3 the curvature of the rear wall has been changed, with the result that all of the concentration at E is eliminated. The sound from the source at S is now reflected in paral-
lne lines, and the intensity of the reflection at any given point is small. A wall of this type produces no disturbing echo. From these two figures, it is easily seen that the curvature of the rear wall should not be greater than that shown in Fig. 3.

The next two diagrams, Fig. 4 and Fig. 5, show longitudinal sections of the auditorium. Fig. 4 shows the auditorium as originally designed. The ceiling surface nearest the proscenium arch is curved in both directions, and the main part of the ceiling is flat. When this section was set up for study, the reflections from this first ceiling surface A, with the sound source at S, showed a decided concentration of sound at B. This sound then diverged and covered an area (C-C) at the floor level. In this section pegs were inserted along the floor and balcony surfaces to simulate auditors. The fourth, fifth, and sixth pegs from the stage cast two shadows. One, when prolonged past the peg, intersected the source; the other, similarly prolonged, touched a portion of the ceiling surface A. Lines drawn from the source to the points where these prolonged shadows intersect this ceiling surface would properly represent the path of the sound. Since these sections were made to a definite scale, the distance traveled by the direct sound and that traveled by the reflected sound could be accurately measured. If the difference in these distances is more than 35 feet, acoustical trouble over the area C-C occurs. It will generally be found that in a case of this kind, the difference between the two paths is relatively small,—less than 35 feet,—and that the reflected sound acts as a reinforcement of the direct sound, and improves audition in the balcony seats. Notice that the reflection indicated at C is unchanged, but as before said, this reflection is from the flat ceiling surface D, and has no bad effect on audition at this point.

In Fig. 5 the ceiling surface A has been changed. The curve has been started lower at the stage, and has been run to meet the surface D, which is flat. For this reason, as in the case of the floor plan, the reflected sound does not come to a focus, but is everywhere divergent, and is so dispersed when it reaches the auditor as to cause no troublesome echo or blurring.

In Fig. 5 the ceiling surface A has been changed. The curve has been started lower at the stage, and has been run to meet the surface D. The reflections from this surface are not directed into the main floor of the auditorium as they are in Fig. 4, but are thrown back into the balcony, striking the area H-H.
HEATING AND VENTILATING FOR THE ARCHITECT

BY

PERRY WEST
CONSULTING HEATING AND VENTILATING ENGINEER

Editor's Note. In this article Mr. West takes up the practical standards in regard to temperature, humidity and air motion requirements. He considers the questions of artificial ventilation; the ways of determining whether or not such ventilation is necessary and, if so, the character of the ventilation to be provided; and air conditioning. The first article of this series by Mr. West appeared in The Architectural Forum for April, 1928, Part Two.

CONSIDERING the matter offhand, the heating of a building is a simple problem, but when thoroughly analyzed it is found to present a number of interesting sides which are well worth the consideration of the careful designer. Good heating consists in the maintenance of comfortable temperatures throughout the occupied spaces of any building, an economical “process temperature” where required in manufacturing buildings, and enough heat elsewhere in all classes of buildings to prevent freezing of pipes, etc. An important consideration in any of these cases is the maintenance of the required temperature where it is needed, with as little waste as possible in the adjacent spaces where heat is not required. This is of importance in all kinds of buildings, but especially where heat may be required at or near the floor, where because of the natural tendency of heated air to rise, there may be a high degree of overheating in the upper spaces, with much unnecessary loss of heat through the upper walls and roof. Heat may be required in certain parts of a space only. In such cases the problem is to control the heat so as to establish the required conditions where needed and waste as little heat elsewhere as possible. Recent research has shown that much economy may be had by confining the heat to the 6-foot height of rooms, thereby preventing the usual difference of about 1½° Fahr. per foot in height between the floor and ceiling. This difference may be reduced to about 2/10° Fahr. with some of the newer types of radiators or concealed heaters. This may mean a saving of 40 per cent in extreme cases, and something over 10 per cent ordinarily.

Theory of Heating Standards. When we speak of the “temperature,” we generally refer to the “dry bulb” temperature. This measure of temperature is of little value for determining the conditions of comfort for human beings or the proper atmospheric conditions for the processes of manufacture. Recent research at the American Society of Heating and Ventilating Engineers’ Research Laboratory, operating in conjunction with the United States Bureau of Mines and the United States Bureau of Public Health, has shown that there are three important factors which go to make up the effective temperature, or the physiological temperature effect which atmosphere will exert upon human beings. These are dry bulb temperature, wet bulb temperature, and air motion; on them our comfort depends.

The dry bulb temperature is that taken with an ordinary thermometer (usually reading in Fahrenheit degrees), and this represents the temperature of the air without reference to the effect of its moisture content.

The wet bulb temperature is that taken with a similar thermometer, which has its bulb encased in a silk mesh bag; the reading being taken after the bag has been moistened with clean water and the instrument has been whirled through the air until the indication has become stable. This wet bulb temperature takes into account the conditions of the atmosphere as to its moisture content, due to the fact that the rate of evaporation of the moisture from the bag and the consequent cooling of the thermometer bulb, caused by this evaporation, depend upon the relative amount of moisture in the air.

By air motion is meant the velocity of the air in feet per minute. Its effect is that of a breeze, in removing the enveloping air and bringing new air to take its place, thus producing a cooling effect by increasing evaporation.

The combined effect of these three factors is designated as the effective temperature. An idea of the relative importance of these factors may be gained by taking an ordinary dry-bulb temperature of 70° and considering that there is an effective temperature of 60° when the air is absolutely dry and without motion, an effective temperature of 50° when dry and with an air motion of 500 feet per minute, and an effective temperature of 70° when fully saturated and without air motion. These factors have a similar bearing upon the effect that an atmosphere will have upon processes or products of manufacture. They affect the drying, cooling, heating, expanding, contracting, hydrating, dehydrating, cracking, warping, sweating and other effects and variations which any particular or varying atmospheric conditions may exert upon the product.

The effective temperature, not the dry bulb temperature or the wet bulb temperature, or both without the consideration of air motion, determines the heating requirements as far as the health, comfort and efficiency of workers or the quantity and quality of products of manufacturers are concerned. The exact physiological effect of these factors has been established by the American Society of Heating and Ventilating Engineers’ Research Laboratory, as illustrated by the accompanying chart shown in Fig. 1. This shows the effective temperature chart for human beings at rest in still air with different dry bulb and wet bulb temperatures corresponding to different percentages of relative humidity, or moisture in the atmosphere. The relative humidity is
calculated from the difference between the wet and dry bulb readings. This chart is made up of vertical isothermal lines representing the dry bulb temperature, as shown on the horizontal scale at the bottom; horizontal lines, representing the grains of moisture per pound of dry air as shown on the vertical scale at the left; light oblique isothermal lines sloping downward toward the right, representing the wet bulb temperatures as shown in the scale along the upper curved line; heavy oblique effective temperature lines, representing the effective temperatures as shown on the same scale as the wet bulb temperatures; and the oblique curved lines, representing the relative humidity in percentages of the quantity of moisture required to saturate air at the particular dry bulb temperature under consideration. The shaded section between the effective temperatures of 62° and 69° covers the conditions of substantially equal human comfort and is designated as the "comfort zone." The effective temperature of 64° is the optimum for the average human being at rest in still air, and is designated as the "comfort line."

To use this chart, start with the dry bulb temperature, for example, of 70°, at (A) and follow the vertical line to its point of intersection with the wet bulb temperature, say of 57°, at (B). The curved line passing through this point of intersection will represent the relative humidity, which in this case happens to be 45 per cent. Starting from (B) a line drawn parallel to the nearest effective temperature line to the scale of effective temperature will intersect this scale at the effective temperature reading, which happens to be 64° in this case. Starting again from (B), a horizontal line will intersect the scale of moisture contents at the number of grains per cubic foot of air, or 44°. Similarly, by starting with any two known factors, the other may be found. The example represents the optimum effective temperature condition for a dry bulb temperature of 70°. It will be seen that for this dry bulb temperature the moisture contents may be varied between 24 and 100 grains per cubic foot, corresponding to a variation from 28 to 92 per cent of relative humidity, and an effective temperature variation from 62 to 69 degrees, without getting outside the comfort zone in either direction.

It should be borne in mind, however, that this comfort zone covers the extreme limits for health and comfort, and that the nearer the conditions are kept to the comfort line the more ideal they will be. It should be noted that around 70° dry bulb the allowable variation in humidity is greater than at temperatures far below or above. Also the dryer the air the hotter it must be, and the more moist the air the cooler it must be, in order to produce the proper degree of comfort. It should be noted in connection with air motion that a dry bulb temperature of 76 2/5° with 150 feet per minute air motion, and 82 3/5° with 500 feet per minute air motion, are required to meet the comfort line requirements of 70° without air motion, with 45 per cent relative humidity in each case. Also that the widest allowable variation in humidity is near these temperatures.

There are conditions, therefore, under which moisture in the air assists the cooling effect of air movements, and other conditions under which it retards it. This is why the wind makes one feel colder on a cold, damp winter day and hotter on a hot, damp summer day. So far we have discussed the conditions pertaining to human beings at rest. For those actively engaged in work, there is considerable variation from these conditions of comfort, depending upon the character of the work. These conditions have not been very accurately determined as yet, but present indications are that for human beings at hard work the effective temperature may be reduced at least 5 degrees, as far as health and comfort are concerned. Some recent studies throughout the industries indicate that male workers show best results at a temperature of 72° and a relative humidity of 40 per cent, and female workers at 80° and a corresponding lower relative humidity, with both conditions corresponding to an effective temperature of about 65°.

It has long been known that overheating is very enervating and greatly lowers the capacity of workers, but this condition cannot be diagnosed from the dry bulb temperature alone. If the humidity is decreased in proportion, the temperature may frequently be increased with advantage, as shown by these studies. Studies of the New York Commission on Ventilation indicated that the capacity of workers is reduced about 28 per cent with a temperature of 78° and a high relative humidity as compared with a temperature of 68° and a low relative humidity. This report is not definite, but the higher temperature and humidity would probably correspond to an effective temperature of 75° and the lower conditions to about 63°. It is fairly safe to say that an increase of each degree in effective temperature will decrease the capacity of workers about 2½ per cent. These studies are being further carried out, and more definite results will be forthcoming, but it can be seen that the already available data are very useful if properly understood and applied. The reason that the data on proper standards of heating are not more definite is that the physiological reactions upon human beings are so different and indefinite that a great amount of very careful and laborious research is necessary to determine the exact conditions of comfort, and vastly more to determine the effects on health, efficiency and longevity. In the effects upon processes and products, the determinations are much easier and the available data much more exact. For this reason it is sometimes found that better heating and ventilating conditions are maintained for making chewing gum, candy, tobacco, textiles and other products of manufacture than for the employees working in the factories producing them.

Practical Heating Standards. The proper standards for heating comfort where the occupants are
not engaged in manual labor, is from 62° to 69°, with an optimum of 64° effective temperature, but as already pointed out, the dry bulb temperature necessary to produce these results may be varied from 62° to 90°, depending upon the relative humidity and air motion. Optimum conditions for all of these factors are perhaps around 70° dry bulb, 45 per cent relative humidity, with a light air motion. Where occupants are performing light work, the dry bulb temperature may be reduced to 67½°, and where performing heavy work to 65° with 60° as the low limit. Departures from these standards will represent a loss in comfort and efficiency of about 2½ per cent per degree.

In producing these results it is necessary to take into account not only the heat to be supplied by the heating and ventilating equipment, but the body heat given up by the occupants themselves, as well as the heat given off by the lighting, motors and other equipment, and these must be properly balanced against the heat losses from the building. In special cases where furnaces or other large heat-emitting sources are present, it is important to know the exact physiological effects which these will produce on the occupants, as it sometimes involves a problem of cooling by air motion or other means to prevent overheating at these points, and at the same time maintain sufficient heat elsewhere in the room. The Kata thermometer, which is an instrument which can be held at body temperature and at the same time record the rate of heating or cooling effect of surroundings, is used to determine the conditions to be met in such cases.

Kinds of Heating Apparatus to Use. Cast iron boilers are desirable for residences or small buildings, or even for larger buildings where low pressures are carried and load fluctuations are small. They have the advantage of high resistance to corrosion, ease of rigging to the point of erection, flexibility in the addition or replacement of sections, low first cost, and small space requirements. Steel boilers of the fire-box or self-contained types are desirable for larger buildings with fluctuating loads and higher pressures, and have larger water and steam storage capacity, great tensile strength, freedom from cracking, high economy, quick response and capability of being forced. Water tube boilers are desirable for high-pressure plants where large capacity must be gotten into small floor space and where the duty is heavy and continuous, loads fluctuating, and extreme safety an important item.

The use of oil fuel is largely a matter of choice.
and opinion with the owner. Generally speaking, it is cleaner and requires less labor than coal, is more easily stored, and requires less space. It is not a panacea for all fuel troubles, as oil burners depend on electrically or steam-driven machinery which must be kept in repair and is subject to many difficulties if not properly installed, understood and taken care of. Here again the psychology of the situation should be well considered, and use of oil should not be forced on unwilling owners or operators, as it takes good will, good service and good operation to make it successful. In residences, schools and small buildings generally, where expert operating organizations are not in charge, the lighter oils which are subject to automatic control should be used. The cost of heating with oil at about 10 cents per gallon is equivalent to that with $15 coal. The cost of the apparatus will add from 20 to 50 per cent to the cost of the heating system, most of which is offset by the saving of space, especially in larger buildings. In larger structures heavy oil may be used at from 4 to 5 cents per gallon, which is equivalent in cost to heating with coal at from $6 to $8 per ton.

Gas fuel is very satisfactory; requires little space; is entirely free from dirt and labor; and susceptible to ready automatic control. Its cost with the ordinary heating system and at $1 per 1000 cubic feet of 500 B. t. u. gas, is equivalent to that with $32 coal.

Concealing radiation in recesses or cabinets is being done to a great extent, but care should be taken to see that this is done so as not to interfere with proper heating (see pages 77 and 78 of the American Society of Heating and Ventilating Engineers' Guide, 1928). Concealed and cabinet radiators are fast coming to the front and are very effective and economical, but have hardly been in use long enough to determine the effect of dust and lint collecting between the fins, or to demonstrate as to how they stand up otherwise after long usage. Radiation with a preponderant radiant factor as compared with ordinary radiators which operate largely on the convection principle, has recently been developed. It is claimed that this new type gives the same degree of comfort in the lower parts of small rooms as the other types of radiation, but with appreciably less heat input. It is interesting to note that the concealed or cabinet radiators tend to accomplish the same purpose by causing a more rapid and extensive circulation of air in the lower portions of small rooms to and from the radiator, thus reducing the overheating of the air in the upper parts and reducing the heat loss. These new developments seem to be along the right lines. Their tendency is toward more efficient heating with much better opportunity for artistic treatment than afforded by the architect's old enemy,—the radiator.

The Ventilating Problem. Ventilation perfection is a very definite thing, and may be thus defined: that atmospheric condition in every part of indoor space occupied by human beings which is continuously maintained with a proper amount of oxygen; free from dust, bacteria, objectionable odors; poisonous and other objectionable substances; with suitable air movements, and at the temperature and humidity condition within the zone of human comfort as scientifically determined. Good ventilation may be considered as that percentage of perfection of these factors which is warranted by the requirements of human health, comfort and efficiency on the one hand, and expense and labor to produce these conditions (whenever they do not naturally exist) on the other. In the popular mind the general subject of the theory and practice of ventilation is in a state of complete flux. There is, however, a very rapid crystallization toward very definite standards and practices.

Is Ventilation Necessary? The answer to this depends upon the particular requirements for the space in question, but generally speaking, any space within which the atmospheric conditions cannot be naturally maintained within the range of comfort can well be given the best mechanical ventilation desirable. It is no longer felt that the chemical composition of the air is the important factor, but that proper ventilation depends more largely upon a number of other factors which are given here in approximately the order of their importance:

1. Air supply.
2. Air temperature.
3. Air cleanliness in reference to its freedom from dust and other suspended matter.
4. Air sanitation with reference to its freedom from bacteria.
5. Relative humidity.
7. Air motion.
8. Freedom from odors.
9. Freedom from other injurious substances.
10. Freedom from monotony, in regard to noise and too much regularity of indoor conditions.

Air supply is put at the head of the list, because without air supply there can be no artificial ventilation. Air temperature is second, because it has been proved by practically all of the accredited experimenters that overheating is more detrimental to the quality of ventilation than any other one thing. Air cleanliness is third, because it has to do with human health from the standpoint of freedom from dust and other suspended substances which irritate and clog the air passages, and from the standpoint of freedom from bacteria and other media of infection carried along with these substances. Air sanitation is fourth, as it also affects human health and is correlated with the third item. Relative humidity is fifth, not because it is of so much less importance than air supply and temperature, but because it also bears such an intimate relationship with these two items that it receives a part of its due consideration in their determination. Distribution is sixth, for a similar reason, for while it occupies a much more important place than this position might indicate, it is intimately connected with the effective air supply
May, 1928  
THE ARCHITECTURAL FORUM  

because it is a factor in effective temperature. Air motion is seventh, in the same way. Freedom from odors is eighth, for the reason that odors are seldom dangerous or permanently detrimental to health, though quite disagreeable and even nauseating. Freedom from other injurious substances is ninth, because these substances are seldom found in ordinary ventilating practice and must be practically eliminated in any case. Freedom from monotony is tenth, because it has to do with the last refinements and the psychology of ventilation only.

In order to properly measure and compare the effects of these various factors the synthetic air chart as shown in Fig. 2 has been devised and adopted as the standard measure of the quality of ventilation. This chart takes air supply into account under the heading of carbon dioxide content, CO₂. The scale for this factor is based on the assumption that 300 parts of CO₂ in 10,000 parts of air, together with the other vitiation which would accompany this quantity of CO₂ when exhaled with the human breath, might produce results that would be permanently injurious to health. For each part of CO₂ in 10,000 (above that ordinarily contained in the outside atmosphere and assumed at four parts in 10,000) a deduction of ½ per cent is made for this particular column or department, and 0.3 per cent as the deduction in the final per cent of perfection column. The various other air factors are given their proper weight in determining the percentage rating of the ventilation conditions in the test. Air temperature, air motion and relative humidity are represented under the column of effective temperature difference. The percentages of perfection for good ventilation as thus determined range from 95 in new school classrooms to 80 in existing churches.

In the normally crowded city places of assemblage the heat given off by the occupants together with that given off by the lighting and power equipment is usually more than the normal heat loss through the structure to the outside air, even in winter under cold climatic conditions. This means that in order to preserve an equilibrium of effective temperature the entering air must be cooler than the leaving air, so that the problem is usually one of cooling and ventilating rather than heating and ventilating. In the practical work of engineers who design ventilating systems, and of architects and owners who pass upon these systems, the one item involving standards which is the basis of all calculations and layouts is the quantity of air to be handled by the system. The functions of the air are to supply the necessary oxygen for respiration, to keep the dilution of CO₂ and other objectionable substances down to the proper point, and to maintain the proper effective air temperature.

On the basis that the air brought in from the outside is for oxygen supply and dilution only, these cubic feet per minute per person would be required for the ventilation percentages shown, if all other factors are 100 per cent perfect.

---

**SYNTHETIC AIR CHART**

FOR DETERMINING PERCENTAGE OF PERFECT VENTILATION

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Final Percentage of Ventilation</th>
<th>Final Temperature</th>
<th>Primary Sense Impression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Fig. 2. Chart for Recording Results of Ventilation Tests**

Cu. ft. of air per Cu. ft. of air per
Percentage of minute required minute required
perfection per person at per person at
rest hard work
98 15.0 30 96 7.5 15.0
94 5.0 10.0 92 3.75 7.5
90 3.0 6.0

In theaters, assembly rooms, auditoriums and other places of public amusement and assemblage there are usually several other factors to consider, such as the removal of excess heat, excess moisture, dust raised by the movements of the occupants, and odors. We may not hope to get better than from 40 to 60 per cent ventilation in warm summer weather without some method of air cooling. Air motion will assist, but unless increased beyond the usual 10 to 20 feet per minute ordinarily obtained from the movement of the air through the room, it will not improve the percentage of ventilation by more than from 2 to 3 per cent. By the use of refrigerating and dehumidifying apparatus this effective temperature department can be maintained at any desired percentage of perfection. The use of a good air washer should reduce the temperature about 70 per cent of the difference between the wet and dry bulb temperatures. About 10 cubic feet of air taken in from the outside, per person per minute, is
sufficient for winter conditions but inadequate for summer climates, where heat and humidity are the determining factors, unless refrigeration is used. It should also be noted that increasing the air supply from 10 to 50 cubic feet per person per minute gives little improvement unless some form of artificial cooling is used.

It would seem that about 75 per cent ventilation can be obtained under reasonably severe summer conditions with an air supply of 30 cubic feet per person, using an air washer, and that beyond this point there is little to be gained by increasing the supply. It should be noted that this is based on upward ventilation and that the cooling effect of from 5 to 10 degrees with air washers of perhaps twice this amount with refrigeration will produce uncomfortable drafts on the occupants at times. For this reason and for the further reasons that it is more sanitary and more easily controlled, the downward system of ventilation is perhaps more efficacious in large and constantly used places of assembly. On account of transporting all of the heat from lights downward and of forcing the body-heated air back over the occupants, it is usually necessary to do much more cooling of the air than can be done with the air washer without refrigeration. On the other hand, the air is brought in high enough to permit of its being diffused and brought to the proper condition before coming into contact with the occupants. It can be seen, therefore, that the air supply per person per minute for assemblies could be 10 cubic feet in winter, 30 cubic feet in summer with the air washers, and anywhere between these two figures for the entire year with refrigeration. Also that nothing better than about 75 per cent ventilation can be secured in hot, sultry, summer weather without artificial cooling, but that with cooling, especially if the air supply is taken from overhead and exhausted from below, almost any percentage of perfection can be maintained.

Recirculation. The foregoing does not take into consideration the matter of recirculation, but it can readily be seen that there is little to be gained by recirculation unless an appreciable amount of CO₂ and attendant impurities which are put into the air can be taken out during recirculation. The handling of the larger quantity of air may be of value to produce air motion or for use as a better cooling medium with less temperature difference between incoming and outgoing air. Recirculation may also be used as a purely economic feature during the warming up of the building or during periods when the space is only partly occupied and the mechanical arrangements are inadequate for properly varying the quantity of air handled to suit. A good arrangement is to provide apparatus for handling 30 cubic feet of air per person per minute with provisions for recirculating any amount up to as much as two-thirds of this. The percentage of air recirculated may be varied to suit the seasonal change so as to conserve heat in winter and refrigeration in summer.

Where effective temperature is controlled, according to the usual method, from the dry bulb temperature in the room, there may be a wide variation in this effective temperature due to the varying amounts of moisture in the air, unless humidifying apparatus with accurate humidity control is employed. Between the condition of absolute dry air at 70° and absolutely saturated air at 70°, there is a difference of 10 degrees in effective temperature which means an average difference of 25 per cent in the quality of ventilation. This may be taken to mean about 10 per cent on each side of the neutral point for ordinary ventilating conditions, so that the air washer and humidity should improve the ordinary ventilating plant another 10 per cent on this count. Good filters will of course serve the same purpose for cleaning the air of suspended matter, and may improve the ventilation about 10 per cent.

Relative Humidity. It should be noted, in connection with our present means of measuring and comparing qualities of ventilation, that we do not take into account any of the functions of the relative humidity of the air except that bearing upon effective temperature. This means that air of any temperature and relative humidity, within proper physical range, i.e., below 64° wet bulb, may be made to meet the comfort line by either heating or cooling without addition or deduction of moisture. Absolutely dry air may be heated or cooled to 78° and be 100 per cent as far as effective temperature is concerned, and still be far from perfect as far as effects on the membranes of nose, throat and lungs are concerned. Such dry air is also very conducive to the increase of dust in the atmosphere of a room from the standpoints of dryness and electro-static agitation. The air washer and humidifier correct these difficulties, and there should be some definition of limits for the relative humidity in our measure of ventilation.

Eliminating Dust. It is not unusual to find from one to two million particles of dust per cubic foot in the outside air surrounding city buildings, and unless this is eliminated it will give dust counts in rooms equivalent to a deduction of from 5 to 20 per cent in the perfection of ventilation. A good air washer should eliminate from 80 to 90 per cent of the dust entering the intake and perhaps reduce the dust penalty in the rooms to less than one-half of these figures. It will be seen, therefore, that air washing and humidification may improve the quality of ventilation about 10 per cent in the effective temperature department, plus another 10 per cent in the dust department, plus other improvements in the quality of ventilation by maintaining proper humidity and removing injurious substances and odors.
RARELY has an item of legislation so interested New York architects as the proposed “Dwellings Law,” which was submitted to the legislature last winter by the “Temporary Commission to Examine and Revise the Tenement House Law.” The Real Estate Board of New York requested the appointment of this Commission for the purpose of making changes in the existing tenement house bill, which applies to the design, construction and maintenance of apartment houses in New York and in Buffalo. The request was worthy, for there can be no question that the existing law is obsolete in many provisions, and that it imposes unreasonable and costly penalties on design and construction.

So a new standard was demanded. Should it be a higher or a lower standard? That is the question. “We want a higher standard in some respects,” said the Real Estate Board in effect, in its detailed recommendations to the Commission. “But,” said the Real Estate Board, and here there was raised a large issue, “we want the privileges of building a greater bulk of structure on a given site, up to the limits permitted by the local zoning regulations which allow greater bulk for business structures, hotels, apartment hotels and institutional buildings, than does the tenement house act in the case of apartments.” In other words, the real estate organization demanded lower standards of light and air, although generally it favored adequate protection of sanitation and fire safety. But the Commission thought otherwise. In its proposed law the Commission stood squarely for somewhat higher standards of light and air than those in the existing tenement house bill. It went further. In order to protect the light and air of the individual property owner from the blanketing effect of tall non-apartment structures, the Commission greatly broadened the scope of the law. It included within its jurisdiction hotels, lodging houses, boarding houses, boarding schools, furnished room houses, lodgings, club houses and college and school dormitories, as being multiple dwellings, designating them as “Class B.” “Class A” designation means multiple dwellings of the apartment class and includes apartment hotels. By this means, practically all structures that are likely to be erected in a residential district are brought under the same regulations governing height and bulk, thus enforcing a more orderly arrangement of buildings and blocks and preventing blanketing light and air.

The Commission went still further. It enforced certain requirements of plan arrangement, sanitation and fire safety for dwellings likely to be converted in the future for multiple occupancy, in order that undesirable building may not result; and it also en-
forced additional requirements of fire safety and sanitation on tenement houses erected prior to 1901, which have proved veritable fire traps and dangerous sources of infectious diseases. It also enforced higher standards on houses already “converted” illegally which had escaped the administration of the tenement house law, and of which the Commission says that some 30,000 cases exist. These requirements are chiefly matters of alteration and repairs. They are very important, however, as will be realized from a detailed reading of the law.

It is the new standards set for new multiple dwellings that are of the greatest interest for architects. Here the new law goes well ahead in the prescription of an improved type of apartment house. The net rentable area permitted under the Dwellings Law appears to be about the same, or even a little greater than under present practice, as indicated by the table of comparative floor areas under the existing law and under the proposed measure, and by several typical floor plans of apartment houses. This is part of the work of the consulting architect of the Commission, Leonard Cox, of Arthur C. Holden and Associates. But, although the volume of building is roughly identical, a new shape of building is required. Larger courts and rear yards are necessary;—on the street fronts the cornices must be dropped about 30 per cent lower than at present, and on all four sides, if the building is to rise higher, there must be stepbacks until the maximum height limit is reached. This maximum height is raised above the limit of the existing tenement house law, thus giving back to the property owner the bulk taken away from him in the lower stories of his building. This is the great advance in standards made by the law. It brings us nearer the ultimate goal of the free-standing city building, which is essential for the skyscraper. On page 27 of its report, the Commission says that “the ideal condition (for light and air) involves a spacing between structures equal to twice their average height.” The lower of the standards prescribed in the law shows, as the result of scientific candlepower measurement, 50 per cent more daylight and 20 per cent more sunlight than under the existing law’s minimum standard. Judged by this criterion, the advance can be carried much further before a wholly satisfactory condition is reached. But, judged purely architecturally, the advance is greater than that. In the lower stories the skyscraper is partly disengaged from its neighbors along the lot lines, through larger court requirements,—something the Commission was very particular about,—but even more important, the buildings are completely disengaged beginning at a height approximately above the sixth story. "Dormers" are permitted on the street front, much as in the New York zoning regulation. In addition, a tower, covering no more than 20 per cent of the area of the site, where the plotage is 2,500 square feet or more, may be built up to an indefinite height under certain circumstances. The operation will be seen in the diagram, and one is referred to The Forum for February, to the article on “Architectural Law.”

The purpose of the lower cornice heights, larger courts and yards and the pyramidal stepbacks is to admit more daylight into the lower stories of the city block. In the individual structure, a much larger proportion of rooms will be arranged two deep, and the stepbacks will facilitate the planning of single apartments with two or three exposures and terrace spaces. Quarters will be more like homes, with some of the amenities which make life decent. Architects will certainly approve of this standard, and will view with favor the appearance of the new type of city building which it introduces. They will see that it brings architecture back into city buildings and makes for order and an orderly city, as Harvey Wiley Corbett has well said. Under present conditions, skycrapers,—yes, and lower buildings,—are jammed together, usually on undersized or ill-shaped plots, the buildings themselves distorted, box-like, ugly. The result is bound to be low-standard, no matter what the architect’s ability. What has become of architecture as an art of three dimensions? There is no real planning but merely a skillful piecing together of a few standard parts and details. Homes have no character, and all look as much alike as rooms in a hotel. The people who must live in these abortions are getting well fed up with them.

As regards elevations of the typical New York apartment, what more favorable can be said? Eleva-
tion as an integral part of a mass,—which is the essence of architecture,—is nowhere to be seen, unless in a few exceptionally well situated buildings. The architect is a mere surface decorator,—as the engineer has at times unkindly called him,—a beauty specialist, who "lifts" the faces of buildings. Where are there any signs of beauty on Park Avenue, with its miles of solid walls of casemates? Billions of dollars' worth of buildings in New York, built from acres of blue prints skilfully contrived, but scarce a cent's worth of architecture!—The Dwellings Law engineer has at times unkindly called him,—a beauty less in a few exceptionally well situated buildings.

The ideal of separation of adjoining buildings, which has become essential in the modern city because of the introduction of the skyscraper and the increase of traffic in the streets. Indeed, in these many provisions governing bulk, mass and planning, may one not conclude that here is an almost new type of law governing buildings? It is an architectural law, instead of a construction or sanitary law, a plan law,
as distinct from the usual specification law which the average building code is;—is this not significant? To be sure, building codes and zoning laws have provisions governing plan, and this Dwellings Law, as well as its progenitor, the existing tenement house law of 1901, contains provisions requiring standards of sanitation and of fire safety. But the distinction seems sound. Its introduction is significant today, when every evidence points to a growing public demand for a more scientific coordination of buildings, one with another, and with the city plan.

One other important provision of the law deserves the sympathy of architects. That is in the further restrictions which are placed on the narrow lot of about 25 feet frontage, making more difficult its use for a skyscraper. The existing tenement house law legislated indirectly against the narrow lot to such an extent that in Manhattan and the Bronx it generally forced the abandonment of the 25-foot lot for five- and six-story tenements, at first to the despair of builders, but afterwards to their satisfaction, because they now use wide frontages, 100 feet or more, for either skyscrapers or "walk-ups." But in Brooklyn, multi-family dwellings are still built on narrow plots. On the whole, it is just as unreasonable to ask that a tall building be allowed on a narrow lot as that an automobile be run on the sidewalk!

Again, let it be remembered that all these questions are fundamentally those of light and air. "Shall I develop my property at my own expense, or shall I contrive it so that I can force my neighbors to pay for it?" In England there is the law of "ancient lights" which protects a property owner in his rights to light and air, and it is said that portions of Westminster Abbey had to be set back in order to maintain the neighbors' rights. Would that a similar law could have been invoked in the United States when the skyscraper appeared! Then we should have seen this wonderful modern invention of the architect used as a blessing and not as an apple of discord! In New York, as already suggested, no one can be found to admit that he disbelieves in light and air. In fact, the tendency of both real estate promoters and of tenants is increasingly in the other direction. The difference is that the tenants are more willing to pay for it themselves. The real estate promoters, on the other hand, have engaged in a scramble for special sites where, paradoxically, the other fellow pays the bill. There are plots which are situated on street corners, or opposite parks or beside low buildings of a fairly permanent character, such as single-family houses, public structures, schools, churches, etc. But, as more and more skyscrapers appear, the number of these strategic sites grows smaller. There is increasing danger for the man who blankets his neighbor's property that his own building in turn may be blanketed or closed in. The opponents of the Dwellings Law, in alleging cases (in which they were rarely sustained) of hardships created by the new law, appeared to forget that the existing law creates infinitely more cases of damage to property.

Furthermore, the existing law was originally designed to apply to "walk-up" tenements, at a time before the skyscraper problem became acute, and consequently the coverage and court sizes prescribing for low buildings none too sufficient light and air, are impossible for skyscrapers of from two to three times that height.

There are many other provisions in the law relating to new buildings which will repay study. Complex as it is, it is admirable in being written in every line under the supervision of an architect, in cooperation with the counsel of the Commission, Harold Riegelman. The consulting architect had the criticism of other architects and many experts. As a result, the bill is free from those grotesque provisions that are now and then found in building codes, and which indicate the hands of engineers who lack knowledge of planning. Also, the bill is purposely drawn to serve as a handy manual for architects, builders and owners, instead of being merely the usual catalog of "can do" and "cannot do," which wastes so much time on a drafting table. The provisions regarding sanitation and fire safety are worth study in themselves, in their application to both new and existing buildings. Interesting facts in this connection are that 60 per cent of fires in non-fireproof buildings originate below the second floors, and that the worst hazard is a non-fireproof stair. Particularly necessary is the requirement that
Comparison of Requirements in Regard to Sizes of frame buildings be spaced farther apart, about 12 feet as compared with the 4 to 6 feet permitted by the New York code. The result of this local practice has been to create huge areas of little frame dwellings, often of flimsy construction, equal in total area, it is said, to that of Chicago at the time of its great fire. This frame construction is located in the borough of Queens. In many cases it is without adequate fire protection, and is probably one of the worst fire hazards in the world, comparable only to Yokohama and Tokio before the recent fire and earthquake. The New York Chapter of the A. I. A. had previously publicly called the attention of the city on this hazard as preventing an illegitimate use of lumber. The underwriters also supported the law. These portions of the law are important for architects, because in similar situations architects may find it difficult to gain the political support of other interests for improved standards for new buildings, unless they themselves are willing to take a stand in regard to structures already existing. One can readily see that such a law as the Dwellings Law, enforcing higher standards for nearly all classes of residence buildings, provoked certain real estate circles. These interests viewed the Commission as its own progeny and were shocked to find disobedience to their wishes. A small hornet's nest was stirred up, and in the excitement it was even rumored that some architects thought they had been "stung." The result of the controversy at the time of writing is that the Commission will be continued for another year for the purpose of proving its case to the public. In nearly a hundred years of tenement house legislation in New York, no measure looking toward improvement has ever failed to be enacted. Nevertheless, the bearing of real estate opinion is important in evaluating an architectural law. In New York, the opposition developed from a small minority which had been guilty of violating or evading existing laws. Others had an interest in low standards, such as the frame construction fire hazard or ramshackle "old law" tenements. The latter were built prior to 1901, have paid for themselves, and should be scrapped. The more powerful opposition to establishing improved standards is of a different type, coming from people holding a number of views. There are those who will not take time to examine the law carefully. Others want no change under any conditions, and object to the inconvenience of change. Judging from the approval of the new law given by a few prominent real estate men and builders, the Commission may expect to overcome this opposition in the course of a year. It should be able to prove to the more responsible real estate men that the law will give better protection to property than does the existing regulation. The Commission should be able to demonstr-
strate that not only is the rentable area of buildings as large under the Dwellings Law, but that this area has, in one way or another, greater rentability, since it is generally more desirable space, even in the lower stories. In addition, the Commission has simplified the intricate provisions of the existing tenement house bill relating to stairways, halls, elevator vestibules and other means of egress. These latter economies are appreciable, and they offset any slight increased cost of the stepbacks. Most of these minor improvements which relate to new buildings are heartily approved by real estate men and builders. These considerations, however, do not entirely explain the basis of the real estate attitude. The speculative foundation under so much real estate activity is, of course, the real reason for opposition to architectural laws enforcing higher standards. It is this speculative phase which works such injury to the building industry. Excessive speculation is obsolete today in most of the American industrial, business and financial world. The trend is all the other way,—toward a solid investment basis,—and it is doubtful how long real estate can lag behind. At any rate, the havoc wrought in New York by low standards of development is terrific, if we are to believe the statement made to The New York Times by Thomas Adams, the well known city planner and city borough director of the Regional Plan of New York and Environs. "It is giving people what they want that makes buildings profitable," said Mr. Adams. "The demand today, even among the comparatively poor, is for buildings that have light, air and good sanitary conditions." Then Mr. Adams referred to the startling fact that low standards were doubtless the chief reason for the exodus of New York's population to Westchester County on the north, to Nassau County on the east, and to New Jersey across the river. In Nassau and Westchester Counties "the increase in population was, during the five-year period previous to 1925, 34.6 per cent as against 4.5 per cent" in New York, or about 8 to 1. There is plenty of room left in New York where, as the Regional Plan had previously pointed out, about 90 per cent of the population lives in about 10 per cent of the area. This is the answer to those who defend congestion in the greatest and most congested city in the world! The zoning resolution of 1916 has done practically nothing to relieve congestion in New York. One might even argue that zoning has increased it. The Dwellings Law is perhaps the first real step toward that end. Since, at the same time it establishes better living conditions and brings back architecture into city dwellings, the law is an aid to architecture.
The use of mortgage financing for residential projects of all types has become so general within the past few years that practically no dwelling is built without the provision of a large proportion of the necessary funds through such channels. In fact, it may be said that probably 75 per cent of the total amount expended for new dwelling construction is originally derived from mortgage sources of various types. This includes, of course, first and second mortgages, or, as the terms are often used today, "senior" and "junior" financing.

For a great many years mortgage financing in the residential field was somewhat haphazard in its nature, mortgages being obtained usually from individuals or from savings banks, estates or institutions. The last two decades, however, have seen a sound and scientific development of this function of mortgage financing for residences. There have been established, often with very rapid growth, banking institutions having as their sole function the provision of mortgage money for the residential field. These include not only building and loan associations, but divisions or offshoots of title guarantee or trust companies and also real estate bond houses whose function it is to secure money from the public for use in this manner. The older types of mortgage sources, such as savings banks and insurance companies, have developed their departments to such a degree that in some cases a great many million dollars are loaned annually by individual organizations. In addition to these large individual loaning sources, we find that the organizations which specialize in building and permanent loans for residences have grown in some cases to such sizes that thousands of homes are financed annually through individual companies. As might be expected, this tremendous extension of mortgage financing has brought with it exhaustive economic study on the part of those who are interested in the subject, and particularly by those who are investing their money in this manner.

Before going into this phase of the subject, it might be well to deviate for a moment in order to describe briefly the more or less standardized existing sources and methods through which money is obtained for the purpose of financing residential construction. The various forms in which senior or first mortgage financing is obtained include straight building and permanent loans, which are placed on the property for a definite period of years, usually three or five, and the amortizing type of first mortgage which is reduced periodically until it is paid off or replaced by a straight loan. The most usual form of amortizing first mortgages is typified by the financing which is provided through building and loan associations. As a general rule, the owner of the house pays 1 per cent of the face value of the loan each month. By doing this, the interest and principal of the mortgage are completely paid in approximately eleven years and seven months. Other types of amortizing mortgages have no standard rate of payment, but are simply developed through individual agreements between owners and mortgage sources, and can be arranged to meet the owners' personal financial situations.

The junior financing or second mortgage phase of a home-building operation is usually developed in one of three ways: (1) by a direct second mortgage loan, established for a given period of years (usually expiring when the first mortgage does); (2) by a second mortgage, provided through an arrangement with the building contractor; or (3) as is often done, when part or the whole of the purchase price of the land is subordinated to the first mortgage and takes the form of a second mortgage. Most second mortgages are today placed on an amortizing basis to be reduced by easy payments over a period of a few years. This entire junior financing market is entirely disorganized, or it might be more correct to say that it has never been organized. For some reason it has received practically none of the careful study which has been given to senior financing. As a result, the second mortgage field presents many dangerous factors. It abounds with evil practices in which shrewdness and unscrupulous manipulation in many instances threaten the home owner with direct loss of his money, if not of the property itself. Because there are no organized methods of second mortgage financing, and few if any recognized channels for the clean handling of this important phase, it is difficult to obtain junior financing except by the payment of high premiums, and there is also a constant traffic in the discounting of second mortgages, which as a rule the contractor or the speculative builder figures in as part of the cost in the building of homes.

The customary sources through which first mortgage money for home-building is obtained include primarily savings banks, insurance companies, title guarantee companies, trust companies, real estate loaning institutions, estates, and individuals. The amortizing type of first mortgage is primarily obtained from building and loan associations which function also as savings banks for prospective home-
builders who wish to accumulate part of the necessary investment before actually beginning building operations. Some of the real estate loaning institutions offer various types of amortizing first mortgages, and because of the amortization feature, it is usually possible to obtain a larger loan in proportion to the value of the property. With this general background in mind, it soon becomes apparent that the more scientifically mortgage financing is administered in the residential field, the more important becomes the architect's relationship and his responsibility. Many of the established loaning institutions or sources have come to realize that they must to a considerable degree control both the quality and the design of the buildings which are to become collateral for mortgage loans. The customary first mortgage loan is approximately 60 per cent of the appraised value of land and building, while through second mortgage channels from 15 per cent to 20 per cent more of the cost may be borrowed. Thus if a project carries both a first and a second mortgage, the owner as a rule will have only 25 per cent or less of the cost as his immediate equity.

Obviously, it is really the loaning institution which pays the bills for materials and labor, for architects' fees and contractors' profits. It is but natural, therefore, that many of the loaning institutions have developed departments or employed supervising architects to check carefully the plans and specifications submitted in connection with mortgage applications. Here is where the architect of the individual project enters very importantly into the financing picture. If his plans are efficient in character, representing sound, economical construction methods, and if his specifications present a selection of materials which seem to insure permanency and low maintenance cost, it is quite apparent that when the mortgage company makes an appraisal, the home owner will receive much more favorable financial consideration and will be able to carry out his project with a smaller cash investment. An examination of the records of mortgage companies will show a great many instances where mortgage loans have been refused because plans were impractical or specifications were not drawn in a manner which would insure good construction. After all, the ultimate real estate valuation of a completed project and the likelihood of its maintaining a consistent, good market value must be highly important from the point of view of those who provide mortgage money. Not only must the property hold its position in competition with other dwellings which may be offered for sale in the immediate neighborhood, but it must be of a character which is readily salable, so that it will not enter the so-called "white elephant" class of dwellings on which past experience has shown extensive losses, not only for owners but for mortgagees.

In designing dwellings for individual owners or for speculative builders, the architect in modern practice is usually called upon to have a clear understanding of mortgage financing methods and to assist the owner in obtaining favorable financing. In fact, in many instances today the architect performs the financing function and finds it to be a valuable part of his service. If he designs many houses, he soon becomes well known, at least to local loaning institutions. It is not an unusual experience to hear bankers make the statement that on houses designed by certain architects, they will readily give higher appraisals and make loans perhaps 10 per cent greater. This is because they know through experience that the particular architects in question plan efficiently and build well. In other words, they know how to create collateral better than the average. Most architects probably know by experience that the average home-building client is not familiar with mortgage sources or mortgage methods. As a result, the business aspect of many of these projects is not good as originally established by the home-builder. Often it turns out that the home-builder has not sufficient money to provide the necessary equity, and if the architect understands local mortgage financing, he may be able to rearrange the situation so that the project may proceed instead of being abandoned or held in abeyance until the owner finds himself better situated financially.

There are at least three ways in which the architect benefits directly through the development of knowledge of this kind. He gains an enviable prestige, not only with financing institutions but in real estate and local home-building circles, so that such knowledge often brings in commissions which he would not otherwise obtain. He will find that local real estate operators and real estate brokers appreciate business-like administration on the part of the architect, and that they are much oftener ready to work with an architect who combines knowledge of both design and the business phase of a residential project than with one who must be constantly checked from this angle. It is also often the case that mortgage institutions will recommend architects because they have developed appreciation of the architects' business-like service as well as of their designing ability.

It should, of course, be apparent that no one expects the architect to have an intimate, detailed knowledge of mortgage rates, discounts, and the other technicalities of this type of financing. If he possesses such knowledge, it is of great value, but the type of knowledge and experience which is really desirable in this connection involves primarily technicalities of design and construction. In other words, the architect's function is to design a project in a manner which will be consistent with the requirements of those who are expected to loan money for the operation. For this reason, it may be of interest to review briefly some of these requirements as they have been expressed from time to time by those in charge of the appraisal or technical departments of loaning institutions.

When a mortgage application covering a home-
building project is brought to one of the modern types of mortgagees, the first consideration is usually given to the location of the property and the physical evaluation of the land. There are certain districts as affected by neighborhood conditions which are considered much more favorably by loaning institutions than others. The general environment is important; the trend of local development is considered; the existence of community facilities and mechanical improvements such as water, sewer, gas, electricity, etc., is thoroughly examined; the physical condition of the land is analyzed, together with local real estate valuations. In more than one instance architects have taken part in this and rendered important service to clients. Just because a client happens to own a given plot of land on which he intends to build a residence does not mean that he should build there. It may be that unfavorable local conditions exist or are developing. It may be that the location or the physical aspects of the particular plot are not suitable for the type of house which the client prefers. It is, therefore, quite possible that through the architect’s suggestion a change of site may be found practical and desirable, and in this manner the project may be made more readily subject to favorable mortgage financing.

The next consideration is given to the plans of the house. Here is where an extremely careful study is made primarily to eliminate two dangerous factors,—first, waste space which is uneconomical from the point of view of both owner and mortgagee, and, second, impractical building construction conditions as imposed by the plan. Here is where an architect has an opportunity to display both ingenuity and practical knowledge, because if the plan is efficient, a much more favorable appraisal will be rendered, and if it is not efficient, the mortgage application may be refused or the amount granted may be considerably less than the owner wishes to obtain. After the plans have been thoroughly analyzed, the element of design is given consideration, not from the aesthetic point of view but primarily from the market aspect. Is the house designed in such a manner that it will appeal to the type of prospective purchaser to whom it might ultimately be offered for sale? Is it designed in a manner suitable for its environment, and does the design offer a balanced ratio with probable construction costs? In other words, mortgage lenders realize that there may be waste or increased construction cost imposed not only in the plans of a house but also in its general design. If it is overelaborate or if it calls for details which are inconsistently expensive, it will not make a favorable impression at the time when the loan is being considered.

After the plan and the general design have each received careful analysis, the next, and one of the most important considerations, is the question of specifications. Here as a rule the requirements of mortgage lenders are becoming constantly more stringent and more definite. The value of various building materials and types of equipment is known today and can be measured accurately. Manufacturers have done much to educate not only architects, contractors and owners, but also those who are interested in loaning mortgage money as to the merits of various materials. The particular points of interest include permanency and low maintenance cost as primary factors. The dwelling that soon begins to require replacements and shows comparatively rapid deterioration naturally does not constitute good collateral for mortgage loans. The banker is interested in the owner’s ability to pay his interest, his amortization payments, and ultimately the principal of the mortgage, and he knows that if a dwelling is costly from the maintenance and depreciation point of view, the owner is in a less favorable position to keep up his payments. He knows, too, that even the quality of appearances after a few years has much to do with the appraised value of the property, and if a dwelling begins to look shabby and to show the need of repairs, thousands of dollars may drop off its market value. For this reason, the architect’s specifications are in most cases quite thoroughly analyzed before the mortgage loan is made, and while some lending institutions may take the trouble to suggest changes in plan and in specifications, many of them will simply turn down the application or offer a smaller amount of money without any special explanation of the reasons. Specifications are, of course, analyzed also from the point of view of construction cost. The materials and equipment used should in the main be consistent with the general cost of the house. It is, of course, permissible for the owner to exercise his own judgment in the use of comparatively luxurious appointments, but these will gain very little recognition in the general appraisal of the dwelling, except where they might be in the nature of unusually good mechanical equipment, which has a definite utility value and which might function as an additional factor of value in the ultimate sale of the property.

It must be quite apparent that the architect in his service exercises a very definite relationship with mortgage financing, because in practically each division of appraisal, his function has its place and his work will meet with approval or disapproval. It must be remembered also that in appraising the value of property, those who are making an analysis in the way described in this article must sum up the total favorable and unfavorable points in relation to the land and its treatment, the house and its design, the plans and the specifications. The final total sum of impressions and facts forms the basis of the appraisal itself, and there may be a variation of thousands of dollars between two dwellings of equal cubic footage. Making the most of this variation is the architect’s responsibility, and it is for this reason that he should thoroughly understand how mortgage appraisals are made and should constantly think of this ultimate test when he is developing each part of a project.
THE BUILDING SITUATION
A MONTHLY REVIEW OF COSTS AND CONDITIONS

In spite of many predictions to the contrary, construction activity for the year 1928 has opened in record-breaking volume which bids fair to continue for at least the first half of the year. According to figures of the F. W. Dodge Corporation covering the 37 states east of the Rocky Mountains, there were contracts let for new construction during the first quarter of this year to the amount of $1,485,067,000, which is an increase of approximately 6 per cent over the amount of building started in the first quarter of the year 1927. This figure also represents the highest first quarter record ever established in the 37 Eastern states. A glance at the chart included here would indicate graphically the comparison of activity between this and other first quarters, and it becomes obvious that the year 1928 will add another record volume to the construction history of the last four years.

The new work contemplated, as indicated by plans filed, during the month of March, is considerably lower than the figure for March of 1927. The types of buildings for which plans have been filed are somewhat different and include a much larger number of institutional and commercial projects with a definite decrease in the amount of speculative building of both apartments and residences. On the other hand, the amount of building by owners for their own occupancy in the residential field is evidently increasing this year as compared with the 1927 figures. Contracts let during March amounted to $592,567,000, 46 per cent for residential buildings, 19 per cent for public works and utilities, 12 per cent for commercial buildings, and 6 per cent for educational projects.

Considering the plans which were filed for new construction in the month of March, as compared with March of 1927, we find these territorial changes which perhaps offer some basis for predicting trend of activity in the various districts. New York state and northern New Jersey show a 16 per cent gain in plans filed as compared with March, 1927. The New England States show an increase of 32 per cent; the Middle Atlantic States show a loss of 44 per cent; the Pittsburgh district shows a gain of 35 per cent over the contemplated record of March, 1927. In the Central Western States there is a loss of 44 per cent; in the Northwest a loss of 22 per cent; in the Southeastern States a drop of 54 per cent, and in Texas a drop of 35 per cent. It is probable that part of the unusual activity of the first quarter has been the result of an effort to let contracts early in order to partially avoid the usual spring buying activity.
PLANNING GROUP HOUSES FOR RENT

BY

RICHARD H. MARR, ARCHITECT

We have seen, illustrated in our professional journals, numberless fine examples of residence architecture,—in plan, with exterior and interior views,—permanent homes of happy and (occasionally, perhaps) satisfied owners. Why not attempt further to endow with the same taste and completeness the homes of the great number, who of necessity must rent? When we erect a building to rent we are in a position akin to that of a merchant investing in a stock of merchandise, for we must please the public fancy and also make profit in the transaction. The one great point of difference, however, is the fact that the merchant may vary his next order in whole or in part through his knowledge gained by the previous sale and owing to any change in the trend of public desire. The builder, however, must so present his merchandise of land, buildings, and equipment that it will meet with the approval of the clientele for which his building is designed, not only one year but for each year during the expected life of the structure. It is, of course, assumed that the responsibility of the builder is not to be transferred to some unfortunate investor after the first group has tenanted the building!

For the purpose of analyzing this problem, we might consider the most usual type of building investment,—that of multiple housing, and a more specific and not as widely treated subject, that of the semi-detached dwelling,—the suburban brother (or sister) of the urban apartment house. The particular group used to illustrate this text was not chosen because of merit in the solution of the problem, but because it represents the average solving of the problem facing the investment builder. The questions which the author attempts to answer are not indigenous to any special location. The problem of financing will not be touched upon except to say that buildings erected as outlined here will, perhaps, bear a closer investigation and warrant a more favorable loan than those in which these apparently obvious, but often neglected, points have been overlooked or treated in a careless manner. Principal and interest must be paid from earnings, which in turn come from satisfied occupants. The three main divisions in order of procedure are: (1) choice of location; (2) plan and arrangement; (3) material and equipment.

Choice of Location. As the buildings illustrated would cost approximately the same in any part of a given area suited to their clientele, it is evident that a good location will complete a good scheme, or a poor location make good buildings unrentable. Assuming that an approximate decision has been made on the total amount to be invested, and a portion allotted to the purchase of a site, these details should be considered:

(a) Permanence. Is the adjacent property of suitable character and likely to remain so?
(b) Competition. The site should be selected to give the group a decided advantage over any similar project that might be contemplated in the neighborhood. An effort should be made to obtain property facing a park or open space, or with a decided advantage in regard to view.
(c) Accessibility. The site must be chosen with due regard to transportation facilities, street car service.
and good roads, streets or boulevards for motorists.  
(d) Good address. The appeal of a fine, accepted residence avenue has a decided advantage over a short, unimportant street.

*Plan and Arrangement.* The great amount of construction material made available through advertising in the architectural press should assist one in developing almost any given type of plan. Bear in mind, however, that too great a difference in rentals in the same building is not advisable. Do not attempt to get a few extra dollars by putting mediocre or small apartments adjacent to those for which a considerably larger rental is asked. There are several considerations in regard to plan that are very important. A plan should be as direct and simple as possible. This not only saves in construction costs, but usually improves both the appearance and the utility of the rooms. The shapes of the rooms should be considered very carefully to make sure there is available space for the usual furniture of the people to whom the house will be rented. Rugs come in various more or less standardized sizes and will not fit well in rooms of unusual proportions or odd shapes.

Windows should be so placed as to not only admit ample light and air, but to leave adequate wall spaces at the corners of the rooms for the placing of furniture. Weather-stripping of the windows is often a very desirable feature. Some operators have found that the use of glass admitting the ultra-violet rays of the sun is very desirable in sun-rooms or certain of the south rooms, if possible. It is well to consult the booklet of the United States Bureau of Standards in making the choice of such glass in order to make sure that the glass specified really admits enough ultra-violet light to be worth while. It is
naturally necessary to keep the service entrances well separated from the main entrances of the houses, and to make sure that the service entrance for one house does not come close to the main entrance of another. It is well to build in as few equipment cases, etc. as possible, except in the kitchen. The individual taste of tenants is too varied to make much built-in furniture usable, and the unused bookshelves of the tenant who has no books are depressing as well as useless. The planning and equipment of the kitchen constitute one of the greatest factors in renting houses, as the mistress of the menage usually scrutinizes this very carefully and is a competent judge of the working efficiency of the kitchen plan and arrangement. The provisions in regard to servants’ rooms should be commensurate with the living standards of the tenants. One must consider, also, the paths of travel of servants in order to plan for their work with as little interruption or contact with the household as possible.

In group houses built for renting it may be economical to have a central heating plant for the group. However, if there is any likelihood of the houses being sold separately, it is well to provide a separate heating plant for each house. Garage space must be provided for each tenant, and it is sometimes well to provide an extra garage or two for the use of guests of the tenants or for the use of the tenant who uses two or more cars. In the case of an apartment that rents for $300 or more a month, the family frequently needs space for two cars. On the general plan it is desirable to have a play yard or recreation space for young children, area well separated from the street in order to avoid accidents. Provision for the welfare of children is an important item in suburban groups of this kind. It is advisable
to provide a play room in the basement of each house or over the garage. The newer types of heating plants and the cleaner fuels often make possible the use of the basement as a play or recreation room.

_Materials and Equipment._ The choice of the materials for the exterior should be made with due consideration of maintenance cost as well as of first cost. Choose, if possible, materials which will age gracefully and which are not drab in color. The attractiveness of the exterior is the first factor influencing the prospective tenant, and first impressions are very often lasting. By all means, avoid use of the theatrical and the sham. This does not mean that color should not be used. It should be, but used with taste and restraint to make the houses attractive.

The equipment of the building is most important. The innovations and so-called luxuries of five years ago have become the necessities of today. It is well to introduce as many modern notes (of tested merit) as the rental will allow, as these items are desirable from the renting agent's point of view. A list of such equipment to be considered and specified, if possible, should include:

- Mechanical refrigeration.
- Thermostatic heat control.
- Provisions for mechanical equipment,—washers, mangle, dryer, etc.
- Resilient floors in kitchens.
- Dining alcove furniture.
- Ironing board provisions.

Built-in bathroom accessories.
- Color in bathrooms,—tile and fixtures.
- Cedar closets, etc., etc.

Ample electric outlets, including power outlets for cooking equipment, laundry equipment or electric heaters should be installed. Careful consideration must be given to the placing of base plugs to make them useful in connection with various arrangements of furniture. The wiring should be done with radio connections in mind. If these are provided in the initial wiring, unsightly and dangerous make-shifts will not be put up by the tenants. After all, this may seem to be a bromidic prescription, but it is the author's belief that a thorough study of the buildings most easily rentable and those most successfully operated will reveal the fact that most of the features enumerated here have been incorporated in the structures.

It is necessary for the architect to bear in mind constantly the desires and needs of the class of people who will be the tenants, rather than his own personal prejudices or desires. The owner of the development is usually informed in these matters, as he is in close touch with the local renting conditions and understands the requirements. The architect can fulfill these needs economically and efficiently and add his own good taste. He will always find that the requirements can be met without outraging good taste and good architectural design. It is his function to be the guide.
THE ARCHITECT AS CONSTRUCTOR

BY WILFRED W. BEACH, ARCHITECT

The present building boom in our larger cities has brought such a satisfying amount of business into the offices of most of the country's architects that it seems quite unnecessary to even suggest a question as to what tomorrow may bring forth. Yet the "tomorrow" of architecture is what most interests the younger men in the profession. Is the architectural practice of the future to mean a continuation of methods now in vogue, or will it be vastly different? If different, wherein will lie the variation? Architecture and building are so fundamentally interlocked that it is quite obvious that a change of procedure in either calling is bound to affect the other. Hence a study of the evolution of either must, perforce, be accompanied by due consideration of the progress of the other.

When our nation was young, it harbored few architects; and still fewer of those who called themselves such were worthy of the appellation, as is amply evidenced by such of their drawings as are still in existence, notably those submitted in competition for the capitol at Washington. For many years, construction work of the young republic was handled by four classes of individuals: (1) the architect, per se, more or less as of today, but of a quite limited sphere; (2) the "surveyor," forerunner of the modern engineer; (3) the "undertaker," who bid upon and undertook the construction of the concepts of the two first named; and (4) lastly, the "architect and builder," generally a country carpenter, by whom was performed the major portion of the building of that day.

Some have described the present-day architect as an outgrowth, the fruit, so to speak, of this latter group, but that seems hardly fair, true only to a very limited extent. Rather, we of today are really an outgrowth, the fruit, so to speak, of this latter

Some have described the present-day architect as an outgrowth, the fruit, so to speak, of this latter group, but that seems hardly fair, true only to a very limited extent. Rather, we of today are really an outgrowth, the fruit, so to speak, of this latter 

...
But the growth in the influence of the engineer and the influence of the ready-made plan on the volume of work in architects' offices pales to insignificance when compared with the steady advance into our field of the modern general contractor. This entity, formerly a willing and earnest bidder for the architect's favors and working under his supervision, has now become a most formidable rival in the securing of business direct from the owner; getting, in short, the planning of the work in order to be sure of getting its construction. Frank N. Watson, Secretary-manager of the Dallas Associated General Contractors, deals candidly with this situation. He speaks quite frankly of the demoralizing effect on building in general of the operations of the shyster and the novice in both architecture and contracting, and repeats the oft-reiterated complaint against awarding building construction by competitive bidding. He further says: "In too many instances, even the architect who appreciates his professional obligation permits himself to be over-ridden by the demands of the owner, and stands idle while the owner indulges in the common pastime of 'whip sawing' the three low contractors, or disregards his own interests by buying construction on price alone." This we all admit, and we also know to our sorrow that "entirely too many contractors, who make claim to skill, integrity and responsibility, are bidding for the profit instead of for the contract and are giving their 'subs' and 'dealers' the same or worse treatment than they complain of on the part of the owner and architect."

Well, why shouldn't they? If we consider only those offices which have never mistreated a contractor nor permitted a client to do so, can we find therein any fundamental reason that should lead a contractor to make a building better, simply for the love of that building? No, that is the sole privilege of the architect! The contractor is to make the building good because he is compelled to do so and for no other reason. In fact, he could not be depended upon to make it good without being hedged about with restrictions that prevent his doing otherwise. Such is the being created by our building contract. Nevertheless, our practice is so predicated on the custom of competitive-bidding contracting that we remain its sponsor and will probably continue to do so. We do not willingly try to educate the owner to other methods. We know full well that there are no ethical standards in such a game, and we write our specifications and contracts accordingly. Then, after the contracts are let, we accept the post of paid detective in an independent architect be favored, or find other points of advantage to aid them. But the large builder, operating his own architectural supervision; that the unscrupulous contractor, or even the ordinary honest contractor, faced with a possible loss through a price-competition, forced bid, can find many ways to skimp his work, —giving construction that will pass the eye of the average inspector, but not giving the owner the quality he wants or thinks he is getting." This from the contractors themselves! But, suppose a builder of character and commensurate reputation has opportunity to serve a friend who wishes to build and wants him to do the work? "Even then," Mr. Watson complains, "by reason of the fact that our industry cherishes a taboo that design and construction are inviolably separate, the contractor must turn the prospective owner over to an architect who cherishes the same taboo, and the project usually ends in the same old free-for-all competition, and 'price' emerges the victor."

Discouraging this, for a builder who has the interest of a prospective client at heart and who steers him to a good architect. Why shouldn't he be instead, if his initial hold on the owner be sufficiently strong, hire a good designer (away from some architect, if necessary) and execute the whole work as he knows it should be done and in a way that he and the owner may both take pride in? That's exactly what he's doing today,—and he's going to do it more and more often as the days go by. "Truth endures",—perhaps more fully in architecture than in some other fundamentals. Are we building with truth when we make use of unworthy vehicles, questionable materials and unrighteous intents? Competitive-bidding contracting is a relic of the day of caveat emptor. Why should the architectural profession collectively strive to maintain that iniquitous slogan when all the better class commercial world is seeking to place all business on a higher plane? Is it not natural for the business of building to follow suit, in spite of the architect? Then may we expect Mr. Watson's conclusion: "But, in the main, future construction work will be handled by firms which unite in one organization the functions now separately performed by architects or engineers and contractors."

Who may this entity of the future be, who is thus to combine the former distinct functions of architect and builder? Obviously, at the start, it is whoever first occupies the field. To an alarming extent, we find the contractor already there. But, is the field rightfully his? To a very large degree, his ability to sell his services in the dual capacity has been aided andabetted by a most powerful ally,—his willingness to finance, as well as to design and build the projected structure. It is in this line of endeavor that the large builder, operating his own architectural and engineering departments, has found the greenest pastures,—the ripest fields. Such a concern, functioning through a reciprocal agreement with a powerful bond house, wields a potential lever under that unassigned project. Even if the tradition be observed and an independent architect be favored, his retention is by sufferance of the builder, over whom he exercises no control whatever. If architects are to compete with this formidable protagonist, they must either equip themselves accordingly or find other points of advantage to aid them.
in securing the business. It is very largely a selling proposition, pure and simple; a setting forth of the qualifications of the seller of services. To begin with, the architect finds himself possessed of one worth-while asset which connotes a corresponding weakness in the armor of his rival; he is a subscriber to a well defined code of ethics. No matter what one may think about this or that particular architect who is alleged to have side-stepped the code, the fact remains that the public has a sufficient respect for the standard of business dealings of the profession at large to hold such a transgressor to be an out-and-out crook, whereas a contractor may do those same things and worse, and be regarded merely as a shrewd business man.

Naturally, the architect's most ready entry into the construction field is by means of some form of cost-plus building. The solicitation of building construction without a guarantee of cost presupposes the highest type of salesmanship,—and architects pride themselves on being poor salesmen. They,—the best of them,—are sometimes heard to say that they never went out after a commission. Well, be that as it may, this article must be for those others who are willing and eager to expand; whose joy in the conception of an appropriate design can best be completed by the greater inspiration of the actual creation of the thing of materials enduring, that shall make the ideal real. Nor need such a one be deterred by Mr. Watson's showing of the scant profits in building construction. After saying that "statistics recently compiled from data in the Bureau of Internal Revenue show the average profit of general contractors to be only 2.1 per cent," he adds his impression that, if consideration were given also to the savings he can effect,—can turn back to the owner as part of the reduced cost of safe and sane building over that of cut-throat contracting. In a measure, the general contractor has "cooked his own goose" in the cost-plus game by the opprobrium brought upon it by his very lack of ethical procedure therein. Unless he can convince the owner that he himself is an exception (admitting that his competitors are not to be trusted), he must either be backed by the financial interests bonding the project or must have recourse to super-selling propaganda. In the last instance, he is likely to add a maximum guaranty to his offer,—and the owner is landed, tied up in a deal whereby the builder is both contractor and judge of what that contract is supposed to include, without price competition. This situation is always puzzling to an architect, who can with difficulty conceive how an astute business man can allow himself to be inveigled into such a palpable swindle. The answer is,—superior salesmanship. Nor is the salesman necessarily dishonest, though he may prove his employer to be. If the owner is so supremely foolish as to entrust cost-plus work to someone in whom he hasn't absolute confidence, perhaps he deserves to reap the proceeds of his own imbecility. Caveat emptor! And the warning is quite apropos in modern building, unless the prospective owner is careful to assign his work only to a firm of known integrity.

Let us cite, briefly, some actual instances. "A" was a banker who "fell for" the elaborate advertising of a concern grown plethoric with gain on such victims. The ordinary architect might not serve him, nor yet one extraordinary. He had so educated himself on biased propaganda as to believe he wanted a single entity to take all the building worry off his hands down to the inkstands on the counters. He couldn't see that that was exactly what any dependable architect would prefer to do, if permitted. But he got what he wanted, plus. The contractors were to get "cost, plus 10 per cent, not to exceed $7,500," and made much of an assertion that they had once turned back over $3,000 under such a contract. When this project was finished and the banker demanded a statement, all he received was a "certified accountant" to the effect that, inasmuch as the guaranteed maximum did not allow the builders the 10 per cent to which they would otherwise have been entitled, no further statement was necessary,—and none was forthcoming. Referring to his contract, the banker found that it called for "a statement," but that nothing was said about its being detailed or itemized.
That the building could have been reproduced for less than $40,000 was amply proved by the experience of "B," another banker in the same town who built a year later, in the same block with "A." Costs were slightly higher; his building was exactly half as large as that of "A." The same builders offered the same kind of contract, with a guaranty not to exceed $36,000. But "B" didn't think that "A" had fared any too well, and he looked up an architect who wanted the work, but wouldn't solicit it, wouldn't cut his price below the American Institute rate, and wouldn't guarantee the cost,—"quite evidently a poor business-getter." This architect had planned other banks of the sort and had the best of references, as the banker's investigation proved. He thought the building could be produced for under $22,000, and submitted an itemized estimate in support of his theory. The owner employed him, and the work which the architect had estimated at $22,000 was executed for under $21,000, and is at least 25 per cent better than that in "A's" building. "C" was a banker in a distant city, solicited by the same concern that had built for "A." But "C" was a perspicacious individual, who could at least see through ordinary glasses. Marvelous salesmanship and extravagant advertising fell upon barren soil. He sought an architect experienced in bank work and discovered one with a construction division in his organization. But, when that architect said "cost-plus," he found he was "waving a red flag at a bull."

The memory of much ill-used privilege, which had masqueraded under that title, was fresh in the mind of the wide-awake Mr. "C." However, after thoroughly investigating this architect's past performances, he employed him for architectural services only, freely asserting that "no cost-plus-everything-else-possible builder would get a chance to stick a harpoon into him and twist it." But his troubles were not so easily disposed of. His appropriation was $60,000, and his architect's estimate was $65,000. Bids, solicited by the cautious banker, elicited a minimum of $66,000 for the general contract alone. Impasse! There remained the heating, plumbing, wiring, bank fixtures, marble work, vault equipment decorating and numerous other et ceteras, for all of which the architect thought an additional $25,000 or $30,000 would be required. After several weeks of hesitancy, during which prices were steadily trending upward, the unfortunate banker allowed his need to over-rule his better judgment, closed his eyes and signed, "on the dotted line," a wide open contract, whereby his architect was to deliver the building which he had planned, and would be paid "cost, plus a lump sum." The portion of the work, for which the low bidder had demanded $66,000, was done for under $40,000, and the entire building turned over complete, within the estimated total cost. These are isolated instances, cited to prove nothing, but rather to indicate that an architect need not be timid about entering the practical building field.
TO complete plans for the development of Denver's civic center and to provide architectural service for the proposed municipal building of Denver, were the principal objects which led to the formation of the Allied Architects Association of Denver. It seemed appropriate and feasible that this service be undertaken as a civic enterprise by the Institute architects of Denver because of widespread interest among members of the profession. The project contemplated by the city involved the expenditure of $5,000,000 for the proposed municipal building, and the erection of this structure will form the major development of the civic center. The importance and responsibility of the architectural service necessarily required a high standard of excellence.

After careful investigation, the Colorado Chapter, which sponsored the enterprise, became satisfied that a properly organized association of architects could render the service required. Such an organization would permit of the selection and functioning of specialized groups, directing respectively the problems in plan and design, construction and engineering, and construction supervision. The proposal of the architects was received with favor by the city of Denver, and as a consequence the Allied Architects Association of Denver was employed by the city to render the service proposed. The membership of the Association includes all Denver members of the Colorado Chapter of the American Institute. The Association functions as a cooperative organization, incorporated under the state laws, and is governed by a board of seven directors. To render the service for the municipal building, a separate office organization was set up, and it has functioned similarly to that of any large firm of architects. Problems arising in plan and design, in construction engineering, and in construction supervision are reviewed by the respective committees on these subjects. The active direction, control and responsibility of the organization rest with the board of directors, to which all committees report. A member of the Association may enter the drafting room, if the need of such employment arises, but upon entering the drafting room his status becomes that of an employee only. Members are privileged, and were required at the beginning of operations, to submit preliminary sketches for the design of the building, and from this procedure much valuable information was procured for the later development of the scheme.

The work of the Association has proved of great interest to the members, and the cooperative character of the service has insured unity and harmony in the affairs of the Association. The working drawings and specifications have been fully completed and have received the official approval of the Denver Art Commission, the Mayor and the City Council of Denver. The Supreme Court of Colorado has recently rendered a decision clarifying certain phases of legal procedure in the awarding of contracts, and it is now contemplated by the city that the actual work of construction on the municipal building shall begin within the next few months. The construction of the building will probably require three or four years' time, and when the service is completed the principal object of the association of architects will have been accomplished, and it will then in all probability disband.

The Allied Architects Association of Denver is committed to these principles of operation, which make it unlike other associations and which may be briefly summarized as:

1. Dealing with a single work,—a civic center and municipal building.
2. The adoption of a policy of non-interference with the private practices of its members.
3. Carrying out an enterprise undertaken by the profession in the interest of civic responsibility by the Institute architects of Denver, sponsored by the Colorado Chapter of the Institute.
4. The purpose of the Association to conserve profits, in order that, upon completion of the work, such funds may be administered for the benefit of the profession in Colorado.

The success of the Association in its work may be attributed to these dominant characteristics:

1. The urge of civic responsibility accepted by the architects.
3. The altruistic purpose concerning disposition of accrued profits.

Enduring benefits have already been attained in the profession from the unifying influence of a constructive work undertaken for Denver by the members of the Association. As a consequence, the Chapter's prestige has been elevated to new significance in municipal and state affairs. In recognition of this influence, members of the Institute are now serving on the State Examining Board of Architects, the Colorado Engineering Council, the Denver Art Commission, the City Zoning Commission, and the Denver Smoke Commission, in addition to having active representation in the Chamber of Commerce, the City Club, and various other civic organizations.
ELEVATION, CITY AND COUNTY BUILDING, DENVER

PLAN OF THE CIVIC CENTER, DENVER
ALLIED ARCHITECTS ASSOCIATION OF DENVER, ARCHITECTS
HERE had been considerable discussion as to the forming of an Allied Architects Association of Kentucky. This was brought to crystallization and consummation by the opportunity to design some buildings for the University of Louisville. On March 31, 1925, the Allied Architects Association of Kentucky was incorporated under the laws of the state of Kentucky. This Association was organized primarily for the advancement of architecture in connection with the designing of public buildings, and not for the profit of its members. Quoting Article 1 of the by-laws: "The paramount purpose of this Association is to advance the art of architecture, and by professional cooperation and collaboration to secure for and provide municipal, county, state and national governments and organizations formed for civic betterment or mutual or business advancement with the highest and best expression of the profession of architecture at the least possible cost in the design and construction of buildings, structures and improvements." This organization will not accept commissions or perform architectural services for private individuals, firms or corporations.

The board of directors, of whom there are five, elected by the members of the Association, have the power to fix the compensation to be paid to its officers, representatives and employees. In the month of January of any year, the directors can at their discretion divide the profits acquired by the Association among the members whose membership has been continuous for a period of one year prior to the date of said division. So far there has been no division of profits among the members of this Association. The conducting of the architectural work of the Association is carried on very much as it would be in any architect's office, except that the board of directors, instead of the individual architect or partners of a firm, manages all the affairs of the Association. The field of endeavor, however, being limited to public buildings, is very much restricted.

The board of directors selects the members best suited to take charge of the different branches of the work, and employs draftsmen and outside help whenever necessary. In connection with the only work that the Association has had to date, the board of directors became the executive committee and had charge of the preparation of plans and specifications and the supervision of the construction, holding frequent meetings during the progress of the work. It is not the intention of the Association to cut commissions or compete with architects outside of the Association, except, of course, in the field of public buildings, and even in this field there is a disposition to give the individual architects first chance, or at least every opportunity, to obtain the commissions.

A complete set of books is kept, and also a record of the cost to the Association of conducting the various branches of the architectural work. The question of legal responsibility is very important, and one that I may not be able to answer properly. So far there has been, in our experience, no occasion to decide any legal responsibility, but it would seem
that what would apply to any other corporation in Kentucky would apply to the Allied Architects Association, incorporated under the laws of Kentucky. In our articles of incorporation it is provided that "the highest amount of indebtedness and liability which the corporation may at any time incur shall be $30,000," and also that "the private property of the stockholders of the said corporation shall not be subject to any extent whatever to the payment of the debts and obligations of the corporation." The laws of Kentucky require that every corporation shall own capital stock, so each one of the 11 members of the Association owns three shares of stock of par value of $33.33 each. No person shall own more or less than three shares of stock in this corporation, and every member has the same rights.

At the outset it appeared as though the University of Louisville would have $500,000 or $600,000 out of a bond issue of $1,000,000 to expend for new buildings, and the Allied Architects Association obtained the contract to erect three buildings for the University. Unfortunately, the resultant funds dwindled, and so far the Association has designed only one building—a new administration building, for the University of Louisville, costing, with driveway, approximately $300,000. As this is the only work that the Association has performed, its success or failure must necessarily be rather limited. The building itself has been quite generally commended, and we hope will satisfactorily fulfill its purpose. The relations and associations of the various members of the organization working upon this project have been cordial, friendly and enjoyable, and it seems that there are many beneficial features in such an organization, provided enough work can be obtained to permit proper organization and to hold the interest and co-operation of the members. On the other hand, there seems to be a difference of opinion, even among the members of the organization, as to the possibility of such an organization's working efficiently and satisfactorily. Our organization has been and still is in an experimental stage, and its future success or failure is dependent upon enough work to keep the Association together and interested; for no organization can endure and properly function without something to do. It also requires a leader who can devote considerable time to the affairs of the organization, one who can inspire the members and arouse their interest and loyalty. Much can be done, and great benefit can be derived by the members of such an organization, provided that it is properly organized and governed. The things that militate against the success of such organizations as allied architects associations, are the complexity of modern life; the busy and crowded hours of most architects, which make it hard for them to devote much time to anything outside of their routine business; and the fact that it is harder for a group to come to a decision and function than for an individual.

In conclusion, in my humble opinion, an allied architects association may be very successful provided it is properly organized, led and has plenty of work. On the other hand, there can very easily be failure if there are little work and lack of leadership and interest on the part of the members. On the whole, it would seem that the advantages in an association such as this outweigh the disadvantages, and that bringing competing architects together into a group working for the same cause creates and fosters cordiality that would not otherwise be obtained.
CHARGING FOR PROFESSIONAL SERVICES
THE COST PLUS SYSTEM OF ROBERT D. KOHN AND ASSOCIATED ARCHITECTS
BY MAUD M. ACKER

EDITOR'S NOTE. In the April issue of The Architectural Forum, William Stanley Parker wrote of the "Fee Plus Cost System for Architects," as employed in the office of R. Clipston Sturgis, Architect. Mrs. Acker describes the interesting cost-plus system used in the office of Robert D. Kohn and Associated Architects, which differs, in some respects from the method described by Mr. Parker.

We have used the cost-plus charge for professional services in our office for many years and have found it works out to the advantage of the client and to our own. The form in which we write to clients is substantially given here:

"As you know, it is the usual practice of architects to charge a fee based on a certain percentage of the cost of the work executed. This has worked fairly equitably in the past. But in view of changing prices and other conditions it may not always work equitably now for both owner and architect. We have therefore in recent years proposed a plan to our clients which bases the payments to be made to us as architects entirely on the actual cost of the work we do, plus overhead and a reasonable profit. We protect the owner against any excessive cost by placing an upset maximum price. The owners pay us monthly for the amount of work done for them in the previous month. If the work goes along smoothly and no extraordinary complications arise they are likely to pay for our service a lesser total sum than would be involved under the old percentage rate of charge. If, on the other hand, the work is complicated or delayed by unusual conditions that arise, or if changes have to be made which involve additional drawings, the cost is more. But there is never any question as to what the amount charged should be, since the whole matter is based on actual expenditures in our office. The scheme which we propose for your building is as outlined in the next paragraph.

"We are to give full professional services including all the usual plans, details, specifications and superintendence for this work, and we are to receive as compensation therefore for the direct cash expenditures of our office in the payment of the salaries of our staff and other assistants of any character for necessary work done while engaged on this project, plus 66 2/3 per cent for overhead, plus a charge for the time of the principals charged for on a salary basis when the time of the principals is devoted to this work, plus fees paid to structural engineers, plus one-third for profit, plus the net cost of blue prints and cash expense incurred for long distance telephoning, traveling expenses, etc. We hereby agree to pay us will not exceed the basic rate of .... per cent of the proposed cost of the building work, as a basic fee of that amount would be calculated under the normal conditions of practice mentioned in the latest schedule of the American Institute of Architects."

Our cost on an imaginary case would be kept in this way:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draftsmen's time</td>
<td>$100.00</td>
</tr>
<tr>
<td>66 2/3 overhead</td>
<td>66.66</td>
</tr>
<tr>
<td>Total</td>
<td>$166.66</td>
</tr>
<tr>
<td>Principals' time (hourly salary basis)</td>
<td>$50.00</td>
</tr>
<tr>
<td>Engineer's fees</td>
<td>50.00</td>
</tr>
<tr>
<td></td>
<td>$100.00</td>
</tr>
<tr>
<td></td>
<td>$266.66</td>
</tr>
<tr>
<td>33 1/3 profit</td>
<td>88.88</td>
</tr>
<tr>
<td>Blueprints</td>
<td>30.00</td>
</tr>
<tr>
<td>Cash expense</td>
<td>4.46</td>
</tr>
<tr>
<td></td>
<td>$390.00</td>
</tr>
</tbody>
</table>

We have often been asked how the principals keep a record of their own time and what they charge as their salaries. It will be noted that the scheme as defined in the contract includes in the cost of production the time spent by the principals. Each of the principals keeps a separate time sheet, just as do the draftsmen. To be sure, it is impossible for the principals to find more than half of their actual working time that can be directly entered on the time slips. This is due to the fact that it is impossible to charge up time spent in telephone conversations, dictation and general office supervision. A careful record kept for the better part of a year shows that the average is just about one-half of the number of working hours. That being the case, the principals' time entered for each commission is doubled. We have also been asked how we arrive at our overhead. We find that our costs for office rent, stenographers, materials, telephones, telephone operator, office boys, printing, etc. (all the unassignable costs) averaged for a number of years 66 2/3 per cent of the amount expended in the same years for directly assignable salaries of draftsmen and superintendents. In busy times the overhead is less,—at other times more. We have therefore thought it right to take the average of a number of years as a constant to be applied to every project in figuring the overhead. If a surplus accumulates under this heading in one year, it should be retained as a reserve fund to meet the deficit of another.

Aside from the overhead, an item of profit had to
be determined on. It was quite customary to assume formerly that something like 40 per cent of the total fees collected ought to be profit to the architect, the profit being the total amount which the architect himself was supposed to receive as clear of all expenses. Some architects claim that half of their total fees are profit, but we believed that to be exceptional, and that in the general run of work the expenses of a commission amount at least to 60 per cent. But in the instance given here the profit is calculated on a cost which includes the architect’s salary. Accordingly, after considerable calculation and discussion, we reached the conclusion that 33 1/3 per cent would be a reasonable profit item to charge when based on such inclusive costs.

There are two or three considerations which are of importance in this cost-plus scheme. The first is that any waste in the office on the part of draftsmen or carelessness in duplicating work is naturally to the detriment of the client, just as would be waste in a cost-plus contract for building construction work. Though the owner is protected by the upset percentage fee, it might be claimed that there is still leeway enough for considerable waste, since we always make this upset maximum 1 per cent more than the usual Institute percentage fees. That is a valid criticism. It is up to the office unquestionably to guard most carefully against waste. We have found in our experience that on several occasions we felt called upon to credit an account with the salaries of men who had for one reason or another neglected their work or failed to produce drawings that were of value to the client. Such items are charged back against the profits of the office. In every such case the men in the office are informed of the items, so that they realize that this is a charge against their shares in the profits. The scheme of charging a distinct item for profit sets aside a certain fund which can be divided under a profit-sharing scheme with the whole office force. The architect himself has been paid a salary, an amount at any rate which gives him some return for his services, even if not an entirely adequate return. It is therefore simple to work out a profit-sharing scheme in which the workers can share in a reasonable ratio to the amount of profit.

The next important point is that the architect does not benefit by receiving an enormous fee on work that is simple, where the client makes few demands and where the work is repetitious; but he does not lose large amounts where the client is difficult and the work complicated, as is the case with some residential work. A New York architect in criticizing this scheme to Mr. Kohn one day said: “Your plan may be all right, but you can never make a killing”; to which was replied: “We do not have to make a killing, since under our scheme we make no loss on any commission.” Under our plan an architect does not profit inordinately on one project and give his work away on another. The client pays for exactly what he gets. Another advantage under this scheme is that each month, the first of the month, a bill is rendered to the client for the expenditures of the previous month, plus overhead and profit. Without exception our clients have become accustomed to this plan and pay these bills promptly, and the whole financial health of the office has been improved since we do not run credit accounts. The old habit of borrowing money from the bank to carry on commissions is gone, we trust for good. Just as a reform, it would be well if the whole architectural profession adopted the habit of sending monthly bills, whatever might be the system of their charges. At the beginning of a project the client is always comparatively flush and is ready to pay bills, while otherwise, under the old plan, the architect has been the last one to be paid, because the client is often short of cash after paying the contractors. Under our scheme of monthly bills the greater part of the architect’s fee is paid long before the contractor gets in his final work.

This outline of our plan is a somewhat revised and corrected statement of the working of our cost-plus plan as prepared by Mr. Kohn some years ago. Considering it now in the light of more than eight years’ experience, we would not change back to the percentage basis under any circumstances. We have to acknowledge that once or twice we have come out badly on commissions, despite the cost-plus basis. The reason was that we fixed too low an upset percentage. In one case, on a hospital built at a remote point, we made a contract on the cost-plus basis with an upset percentage of 8 per cent plus traveling expenses and cost of a clerk of the works. Owing to a disagreement between the members of the medical staff, the work stretched over a great length of time and the costs ran inordinately high. But we maintain that had this been a straight percentage commission, the story would have been the same. It happened to be one of those cases where it was hard to prove, without going to court, that the nature of the changes imposed upon the architects justified extra compensation.
CUBIC FOOT COSTS OF BUILDINGS

BY JAMES E. BLACKWELL, ARCHITECT

The practical man always wants a "thumb rule"; speed is the demand of modern life; there is often no time for long calculations, and we begrudge the time it takes to make reliable estimates. As a draftsman once said, upon hearing a client's demand for speedy work, "a man will take a year to decide whether he will build or not, and when he does decide, he wants the plans finished day before yesterday." There is no short rule uniformly accepted as reliable in estimating the cost of buildings, and many times what is called an estimate, is what an old architect called "a mere guessimate." There have been in use the methods of cost obtained by the cubic foot; by the square foot, or floor area; and by the room. Of these the cost by cubic foot seems to be the only one approximately reliable and used generally and for many years.

The cost by floor area is obtained by measuring the aggregate area of all the floors and dividing the total cost of the building by the total number of square feet. To get the approximate cost of a proposed structure, its floor area is multiplied by the cost per square foot of an actual building of the same type recently completed.

The cost by number of rooms is used by taking a building of known cost and rooms; dividing the number of rooms into cost, to ascertain the cost per room. This cost can be used as a constant in multiplying the number of rooms in a proposed structure to obtain the approximate total cost. This is the most unreliable of the three methods mentioned, as the cost per room may vary from $500 to $2,000 or $3,000, depending upon the sizes of the rooms and the materials of which the building is constructed.

The cubic foot method was brought to this country from Great Britain and has been in use some 50 years or more, and so far as the writer knows, a table of costs and explanation thereof was first published in 1887, giving the cost per cubic foot of some 38 selected United States government buildings of various classes and materials of construction, ranging in cost from $0.08 for a frame building to $1 per cubic foot for a granite, "fireproof" structure. It may be said at the start that a man without wide and long experience and good judgment cannot use this method with any reliability whatever. The practice is to obtain the cost per cubic foot of a known building and to use this rate per foot to multiply the measured cubic contents of a proposed structure to determine its cost. The proposed building should, of course, be similar to the known structure in sizes of rooms, in total contents and in the materials of which the building is constructed. If it is not exactly so, then good judgment must be used in making due allowance for the differences.

In measuring the cubic contents of a building, the actual volume is usually taken from the outside of all walls and from the bottom of the foundations to the top of the roof, considering the slopes, towers, and dormers, chimneys, projecting courses and cornices as immaterial. In judging the rate per cubic foot a building should cost, careful consideration must be given to the sizes of the various rooms and enclosed spaces and the total size of the building, as well as the interior fittings, finish, the number of finished fronts and the kinds of materials of which they are constructed. Consideration must be given to the materials, such as brick, etc., and also to the construction of the interior partitions, frame or fireproof, and to the interior decorations, plaster, marble, tiling, etc. It is in this that the experienced judgment of the estimator is necessary—in knowing the cost of completed buildings, in order to arrive at the cost of the structure and to make proper allowances, because very often a demand is made for such information in a very short time, and often before a line of the design or drawings has been made.

The accompanying table shows the cost of some fairly representative buildings constructed in Seattle and neighboring cities of the state of Washington, giving dates of completion and costs at those times, and the costs per cubic foot to conform to price costs of 1927, using for this conversion the changes as shown on page 128 of The Forum for January, 1928. These changes in prices taken from the chart assume 1913 and previous years as 100 per cent, and figures for subsequent years are: 1914, 98 per cent; 1915, 114; 1916, 156; 1917, 189; 1918, 190; 1919, 200; 1920, 268; 1921, 198; 1922, 171; 1923, 186; 1924, 194; 1925, 190; 1926, 187; and 1927, 185. The table printed herewith includes 69 buildings, 41 fireproof and 28 of cheaper construction, compiled from the best sources obtainable (generally the architects' figures). Using the costs as of 1927, this table gives 17 office buildings, varying in cost per cubic foot from 32 cents to 74.8 cents, average 52.6; two hotels, 40 and 60 cents; four apartments, 44 to 58.7 cents, average 51.2; four theaters 26.7 to 44.2 cents, average 36.9; nine loft buildings, 12.6 to 25.1, average 18.9; and five school buildings, 22.3 to 30.8, average 25.8 cents. This table of such varyings costs shows conclusively the necessity of having the completed and the proposed buildings approximately the same in size, in number of rooms and in construction. It also shows somewhat the effect in costs of much decoration and yet large inside spaces, as in theaters, compared to buildings having less decoration but many small spaces or rooms, as in office buildings or hotels. The buildings of cheaper construction shown in the table are simply given as statistics for varieties in uses and construction, varying in cost from 9 to 54 cents per cubic foot. These

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Cost per Cubic Foot</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>32-74.8 cents</td>
<td></td>
</tr>
<tr>
<td>Hotel</td>
<td>40-60 cents</td>
<td></td>
</tr>
<tr>
<td>Apartment</td>
<td>44-58.7 cents</td>
<td></td>
</tr>
<tr>
<td>Theater</td>
<td>26.7-44.2 cents</td>
<td></td>
</tr>
<tr>
<td>Loft Building</td>
<td>12.6-25.1 cents</td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>22.3-30.8 cents</td>
<td></td>
</tr>
</tbody>
</table>
may be used only when the proposed building is similar to one of these. It is to be noted, however, that even in this type of building, larger structures often cost less per cubic foot than smaller buildings.

The writer has a list of costs of many residences, but they vary so greatly in cost, plan, equipment and finish that they would be of no value as a guide in estimating. The accompanying table may be of some aid to architects and builders in cities other than Seattle, but as there is a wide difference in costs of materials and labor in various cities, a table of costs in each city would be of more value. It is to be hoped that tables will be prepared for other large cities.

The estimator in comparing the requirements of the proposed building to those of a structure of known cost should know the relative costs of materials and labor in the different cities and the dates of construction. He must know the class of building, its purpose; whether fireproof, mill or ordinary construction; the kinds of finish for interior and exterior walls, etc., and the class of people who are to occupy the proposed building. Manifestly, in connection with the last item, the kind of building required for a hotel or apartment for laborers, sailors, or lodgers, would not be so expensive as a first class hotel or apartment. The kind of apartment for well bred, well educated people, but of moderate means, would not be as elaborate and expensive as for the very wealthy. The variations in customs or in demands in different cities are sometimes very great; for instance, the demand for apartments in Seattle and many western cities is for two- or three-room suites,—seldom more than four or five rooms, with rents varying from $70 to $125 per month; while in New York, Chicago, Washington and some of the eastern cities there may be considerable demand for apartments of from 10 to 15 rooms, renting for from $800 to $1500 per month. In such cases the rates given in the table for apartments would be of no value for comparison.

Of course, no thumb rule is as good as a detailed estimate, and the latter is not as conclusive as bona fide bids; but neither can be reliable until after working drawings and specifications have been made. An owner never wants to pay for all this architectural service as long as there is a doubt of proceeding with the building, and he always asks for an estimate before proceeding beyond the preliminary drawings stage. The estimates based on cubic foot costs are never accurate, except by a lucky coincidence, but they do serve a useful purpose in approximating the cost in the quickest way yet devised. An expert in actual costs can give a much more reliable estimate if he is provided with carefully drawn plans and an outline specification. Such an estimate can be made quickly by an experienced man.

### COST OF BUILDINGS IN SEATTLE PER CUBIC FOOT

#### FIREPROOF BUILDINGS

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>Year</th>
<th>Use</th>
<th>Complete Cost</th>
<th>Stories</th>
<th>Total Cost</th>
<th>Cost per Cubic Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigelow</td>
<td>1923</td>
<td>Office &amp; Stores</td>
<td>R.C.</td>
<td>7</td>
<td>68 x 120</td>
<td>$45.00</td>
</tr>
<tr>
<td>Lloyd</td>
<td>1924</td>
<td>&quot;</td>
<td>&quot;</td>
<td>10</td>
<td>819,910</td>
<td>52</td>
</tr>
<tr>
<td>Shaler</td>
<td>1924</td>
<td>&quot;</td>
<td>&quot;</td>
<td>10</td>
<td>850,090</td>
<td>60</td>
</tr>
<tr>
<td>Allen</td>
<td>1924</td>
<td>&quot;</td>
<td>S.F.</td>
<td>10</td>
<td>866,520</td>
<td>54</td>
</tr>
<tr>
<td>White</td>
<td>1924</td>
<td>&quot;</td>
<td>R.C.</td>
<td>14</td>
<td>911,020</td>
<td>66</td>
</tr>
<tr>
<td>Henry</td>
<td>1924</td>
<td>&quot;</td>
<td>R.C.</td>
<td>16</td>
<td>967,080</td>
<td>62</td>
</tr>
<tr>
<td>Cobb</td>
<td>1924</td>
<td>&quot;</td>
<td>&quot;</td>
<td>10</td>
<td>520,000</td>
<td>50</td>
</tr>
<tr>
<td>Eagle Temple</td>
<td>1924</td>
<td>AND, Office &amp; Stores</td>
<td>&quot;</td>
<td>7</td>
<td>2,350,000</td>
<td>22</td>
</tr>
<tr>
<td>Northern Life Tower</td>
<td>1925</td>
<td>&quot;</td>
<td>S.F.</td>
<td>10</td>
<td>2,710,926</td>
<td>55</td>
</tr>
<tr>
<td>Puyallup Power &amp; Light</td>
<td>1925</td>
<td>&quot;</td>
<td>S.F.</td>
<td>2</td>
<td>2,301,000</td>
<td>53</td>
</tr>
<tr>
<td>Mutual Life Annex</td>
<td>1925</td>
<td>&quot;</td>
<td>S.F.</td>
<td>6</td>
<td>2,992,000</td>
<td>66</td>
</tr>
<tr>
<td>Douglass House</td>
<td>1925</td>
<td>&quot;</td>
<td>R.C.</td>
<td>14</td>
<td>4,550,000</td>
<td>80</td>
</tr>
<tr>
<td>Mead &amp; Dental</td>
<td>1924</td>
<td>&quot;</td>
<td>&quot;</td>
<td>13</td>
<td>2,490,600</td>
<td>60</td>
</tr>
<tr>
<td>Telephone</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>10</td>
<td>1,852,000</td>
<td>102</td>
</tr>
<tr>
<td>Vann Hotel</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,710,800</td>
<td>85</td>
</tr>
<tr>
<td>Scandinavian Hotel</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,720,000</td>
<td>89</td>
</tr>
<tr>
<td>Terminal Sales</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,709,800</td>
<td>89</td>
</tr>
<tr>
<td>Hubbell Building</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,498,688</td>
<td>179</td>
</tr>
<tr>
<td>Huntford Building</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,294,333</td>
<td>159</td>
</tr>
<tr>
<td>Grumman Store</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,350,670</td>
<td>156</td>
</tr>
<tr>
<td>Michelli</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,217,000</td>
<td>126</td>
</tr>
<tr>
<td>Republic</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,095,200</td>
<td>116</td>
</tr>
<tr>
<td>Liberty</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,217,000</td>
<td>126</td>
</tr>
<tr>
<td>Century Addition</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,080,600</td>
<td>112</td>
</tr>
<tr>
<td>Sherman-Clay W. H.</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,050,000</td>
<td>110</td>
</tr>
<tr>
<td>Type Building</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,095,200</td>
<td>116</td>
</tr>
<tr>
<td>Kelly-Schrofield</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,149,000</td>
<td>154</td>
</tr>
<tr>
<td>Los Angeles Building</td>
<td>1925</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,294,333</td>
<td>159</td>
</tr>
<tr>
<td>Mint Building</td>
<td>1926</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,237,500</td>
<td>145</td>
</tr>
<tr>
<td>Paramount Seattle Theater</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,833,920</td>
<td>84</td>
</tr>
<tr>
<td>New Oregon</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,893,204</td>
<td>84</td>
</tr>
<tr>
<td>Mayflower Theater</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,680,400</td>
<td>82</td>
</tr>
<tr>
<td>Lawton Apartments</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,217,000</td>
<td>84</td>
</tr>
<tr>
<td>Windham Apartments</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,399,000</td>
<td>85</td>
</tr>
<tr>
<td>Stockbridge Apartments</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,567,000</td>
<td>86</td>
</tr>
<tr>
<td>Paramount Apartments</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,758,729</td>
<td>87</td>
</tr>
<tr>
<td>St. Benedict's School</td>
<td>1927</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,989,279</td>
<td>82</td>
</tr>
<tr>
<td>Bryant School</td>
<td>1926</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,989,279</td>
<td>82</td>
</tr>
<tr>
<td>Town School</td>
<td>1926</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,643,000</td>
<td>84</td>
</tr>
<tr>
<td>Marshall School</td>
<td>1926</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,989,279</td>
<td>82</td>
</tr>
<tr>
<td>Garfield School</td>
<td>1926</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>1,480,790</td>
<td>81</td>
</tr>
<tr>
<td>Roosevelt School</td>
<td>1926</td>
<td>&quot;</td>
<td>&quot;</td>
<td>19</td>
<td>2,208,000</td>
<td>83</td>
</tr>
</tbody>
</table>
### NON-FIREPROOF BUILDINGS

#### WOOD FLOOR CONSTRUCTION

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>Year</th>
<th>Type of Occupancy</th>
<th>Construction Type</th>
<th>Number of Floors</th>
<th>Total Cost</th>
<th>Actual Cost Per C. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>School at Mt. Vernon</td>
<td>1921</td>
<td>High School</td>
<td>Brick</td>
<td>1</td>
<td>715,000</td>
<td>$167,000</td>
</tr>
<tr>
<td>School at Blaine</td>
<td>1925</td>
<td>&quot;</td>
<td>R. C.</td>
<td>1</td>
<td>210,000</td>
<td>53,600</td>
</tr>
<tr>
<td>School at North Bend</td>
<td>1921</td>
<td>Grade</td>
<td>Brick</td>
<td>1</td>
<td>266,000</td>
<td>55,188</td>
</tr>
<tr>
<td>School at Ronald</td>
<td>1913</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>2</td>
<td>108,650</td>
<td>10,080</td>
</tr>
<tr>
<td>L. &amp; M. Stores</td>
<td>1925</td>
<td>Stores</td>
<td>R. C. &amp; Mill</td>
<td>3</td>
<td>343,440</td>
<td>27,416</td>
</tr>
<tr>
<td>Buckau Building</td>
<td>1909</td>
<td>&quot; &amp; Offices</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>436,800</td>
<td>48,827</td>
</tr>
<tr>
<td>Graves Building</td>
<td>1908</td>
<td>&quot;</td>
<td>R. C. &amp; Mill</td>
<td>4</td>
<td>2,733,400</td>
<td>202,000</td>
</tr>
<tr>
<td>Sears-Reddick, Mail Order Bldg.</td>
<td>1916</td>
<td>&quot;</td>
<td>Garage</td>
<td>2</td>
<td>58,910</td>
<td>35,812</td>
</tr>
<tr>
<td>Willis-Overland Bulidg.</td>
<td>1925</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>700,000</td>
<td>101,229</td>
</tr>
<tr>
<td>Chancellor &amp; Lyon Bldg.</td>
<td>1919</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>700,000</td>
<td>101,229</td>
</tr>
<tr>
<td>Alvin Investment Co.</td>
<td>1924</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>462,000</td>
<td>49,268</td>
</tr>
<tr>
<td>Coldrey Stores</td>
<td>1926</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>720,000</td>
<td>66,700</td>
</tr>
<tr>
<td>Wenatchee Realty Co.</td>
<td>1910</td>
<td>&quot; &amp; Apartments</td>
<td>Brick &amp; Mill</td>
<td>3</td>
<td>471,120</td>
<td>72,000</td>
</tr>
<tr>
<td>Nelaka Apts.</td>
<td>1913</td>
<td>54 Apts.</td>
<td>Brick &amp; Mill</td>
<td>5</td>
<td>335,160</td>
<td>64,726</td>
</tr>
<tr>
<td>Lake Investment Co.</td>
<td>1926</td>
<td>&quot;</td>
<td>Brick &amp; Mill</td>
<td>3</td>
<td>231,700</td>
<td>60,000</td>
</tr>
<tr>
<td>L. &amp; M. Apartment</td>
<td>1921</td>
<td>Apartments Jt</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>152,779</td>
<td>51,624</td>
</tr>
<tr>
<td>Fairfax Apartment</td>
<td>1923</td>
<td>Apartments</td>
<td>Masonry &amp; Wood</td>
<td>2</td>
<td>456,996</td>
<td>21,768</td>
</tr>
<tr>
<td>Carnegie Libr'y, Olymipia</td>
<td>1914</td>
<td>Library</td>
<td>Masonry &amp; Wood</td>
<td>2</td>
<td>5,995</td>
<td>9,507</td>
</tr>
<tr>
<td>Carnegie Libr'y, Wenatchee</td>
<td>1912</td>
<td>Fraternity House</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>112,640</td>
<td>38,463</td>
</tr>
<tr>
<td>Delta Upsilon House</td>
<td>1924</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>134,759</td>
<td>49,689</td>
</tr>
<tr>
<td>Theta-XI</td>
<td>1926</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>117,589</td>
<td>38,463</td>
</tr>
<tr>
<td>Alpha Sigma Phi</td>
<td>1920</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>140,000</td>
<td>49,000</td>
</tr>
<tr>
<td>Ingleswood Club</td>
<td>1926</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>447,900</td>
<td>133,017</td>
</tr>
<tr>
<td>C. M. &amp; Sr. F. Gateway</td>
<td>1927</td>
<td>&quot;</td>
<td>Masonry &amp; Wood</td>
<td>2</td>
<td>1,012,353</td>
<td>247,272</td>
</tr>
<tr>
<td>Armory N.G.W., Bellingham</td>
<td>1911</td>
<td>Drill Hall &amp; Co. Rooms</td>
<td>Masonry &amp; Wood</td>
<td>3</td>
<td>851,640</td>
<td>64,880</td>
</tr>
<tr>
<td>Gray's Harbor Power House</td>
<td>1908</td>
<td>Steam Power Machy.</td>
<td>Brick &amp; Mill</td>
<td>2</td>
<td>541,440</td>
<td>59,987</td>
</tr>
</tbody>
</table>

Sigma Alpha Epsilon House, University of Washington, Seattle
Stuart & Wheatley, Architects
THE FAIREST OF COMPETITIONS

BY

WILLIAM O. LUDLOW

OF LUDLOW & PEBODY, ARCHITECTS

So many times have I told my spellbound friends the inside story of that marvelous feat of legerdemain,—the taking of a two-million-dollar commission out of a hat,—that I don’t mind telling it again.

It happened this way: Frank Manville, president of the Johns-Manville Corporation, decided that his company must have a larger building to take care of its larger business. So far easy enough; they had the land, the money, the will to do; but immediately Mr. Manville was faced with a staggering question,—how could he select one architect, from all the architects who had been giving him business, without offending the individuals of the entire profession,—save one,—and without thus jeopardizing the future of the Johns-Manville business? If, for instance, he handed the commission outright to Cass Gilbert, imagine the look of scorn on the face of Whitney Warren’s specification man when next the Johns-Manville salesman suggested asbestos for the latest Park Avenue skyscraper! Again, if he held a competition, he knew he would be set down as a man of execrable taste and bad judgment by the personnel of the entire profession,—save one,—when the winning design was exhibited! While pondering this difficulty one day, one of his men (said to have been originally on the stock exchange) suggested to Mr. Manville: “Why not let them draw for it?” Mr. Manville, naturally a quiet and cautious man, at first laughed at the joke for, knowing the haughty dignity and the high ethical standards of the members of the profession, he didn’t propose to insult his good friends and customers.

The foregoing is from reputable hearsay,—from now on I speak from personal knowledge. One day a well known officer of the Johns-Manville Corporation appeared in our office and asked if it would be beneath our dignity or contrary to our ethical standards to take a chance on drawing from a hat an opportunity to design the new Johns-Manville building. Of course we said that it certainly would,—but possibly we might consider the matter,—just this once. We understood that some of the members of the profession thus approached did not take the same high ground that we did, but trampling on all principle, simply answered: “We would be glad to.” A few days later we received a personal invitation for a “representative of our firm” to a luncheon given by Mr. Manville at the Union League Club. As there happen to be two representatives of our firm, we decided that the firm would not be adequately represented unless both went,—not harboring for a moment the thought that some firm might have only one representative when the hat passed!

Twenty of us sat down to a big round table overburdened with delicious food. Finally, we recognized a cool, yellow, sparkling liquid served in beer mugs, and then the stillness was broken by Mr. Manville, as he arose with a derby hat in one hand and a bunch of little white envelopes in the other. In a few well chosen words he told his guests of his proposed project and said that he had confidence that any one of the gentlemen present would design for him an admirable building, adding that he would be glad to give it to all of us, but as that method might be unsatisfactory, would we kindly each one draw from the hat an envelope? In each envelope, he said, was a blank card excepting one in which would be found a card saying “You Win,” and he would like the man who drew that card to be his architect. As the fateful hat went around each man dipped in. I hasten to interject here, to avoid being suspected of double dealing (perhaps that is in the wrong metaphor), that my partner was so scrupulously generous and honest, that he passed his opportunity over to his partner; was ever virtue so instantly rewarded? I am going to ask Briggs to draw a cartoon entitled “What does a man think about when he holds in his hand an envelope containing either a two-million-dollar commission,—or nothing?” Something like this went through my benumbed mind:—In this little envelope a skyscraper or a blank piece of paper! One chance in twenty! Pshaw, that’s what I take every time I jay-walk across Fifth Avenue, and I’ve never been hit yet! I wonder whether Tom Hastings, or Breck Trowbridge, or Whitney Warren will get it!

“No,” said Mr. Manville, “begin here and open up,—each one announcing in turn what he has drawn.” With painful slowness the words began to come to my somewhat clouded mind,—“Nothing doing,” “Blank,” “Blank,” “Left again.” Then the brilliant deduction began to dawn in my mind that if all the others got blank, I got it! The suspense was terrible, so with my table knife I slit my envelope and cautiously pulled a little at the card inside,—cat and mouse performance. Hello, what’s this! One chance in twenty! Pshaw, that’s what I take every time I jay-walk across Fifth Avenue, and I’ve never been hit yet! I wonder whether Tom Hastings, or Breck Trowbridge, or Whitney Warren will get it!

“Now,” said Mr. Manville, “begin here and open up,—each one announcing in turn what he has drawn.” With painful slowness the words began to come to my somewhat clouded mind,—“Nothing doing,” “Blank,” “Blank,” “Left again.” Then the brilliant deduction began to dawn in my mind that if all the others got blank, I got it! The suspense was terrible, so with my table knife I slit my envelope and cautiously pulled a little at the card inside,—cat and mouse performance. Hello, what’s this! A tiny wreath appears;—yes, I suppose they all have wreaths on them like other tombstones. Great —— “You Win!” I took the blow just like Tunney,—manfully,—everything went around inside my head, but at the count of ten I recovered, found everybody still there, and sat trying to look like a sphinx but feeling like an opium addict. Then John Cross, who had peeped at my card, spilled the beans by shouting “Here he is!” I faintly heard yells of “Speech! speech!” Twenty handshakes from as many slightly disappointed but complacent men;—then, “Glad you fellows are going to be my architects, I want to begin right away, see you tomorrow,”—and so ended the fairest and most satisfactory competition on record.
PLANNING RELIGIOUS EDUCATIONAL BUILDINGS

BY

M. W. BRABHAM

THE phenomenal increase of interest and investment in religious education during the past ten years has been followed by a like increase in attention to the standard requirements for buildings suited to the purposes. Leaders in religious education are today considering their work in a manner approaching if not equaling the seriousness of leaders in general education processes. This has resulted in the study and gradual development of a new type of building which is a far cry from the “Sunday School room” or “annex” of a few years ago. The introduction of a definite program of training involving theories and practices in educational processes of a religious nature extending far beyond the customary one-hour Sunday School, calls for structures as carefully planned and equipped as the best educational buildings for public schools. The numerical growth has also been astonishingly large, until today it is not an unusual thing to find structures accommodating from 1000 to 5000 persons.

The Sunday School is coming to be known generally nowadays as the “Church School,” the very name implying a change of emphasis and a broadening of program. The school for religious work is graded in all its educational processes, and this is calling for buildings also graded in arrangements. Within the organization there are eight age groups commonly recognized, these being based on well founded psychological principles. Within each of these eight age groups there are subdivisions by grades and classes. The program for each age group varies in essential points, all of which calls for different arrangements as to sizes, shapes and general appointments of rooms. This can be readily seen as a highly specialized field, demanding preparation and experience not commonly regarded as a part of the general architectural preparation of those practicing in this field. To date the number of architectural organizations employing specialists in the field of religious administration and theory is very small, but the probabilities are that these workers will be engaged for handling such aspects of the work in increasing numbers. There are several available books on the subject which may be found helpful to architects in connection with this special line of service: “Building for Church Work and Life,” by Mouzon William Brabham (Cokesbury Press, Nashville, 1928); “Building for Religious Education,” by Henry Edward Tralle and George Merrill (The Century Company, New York, 1925); “A Complete Guide to Church Building,” by P. E. Burroughs (Baptist Sunday School Board, Nashville).

The schedules printed here have been worked out as a general guide for architects and committees to be used in determining some important features of religious educational buildings.

TABLE I

<table>
<thead>
<tr>
<th>Group</th>
<th>Ages</th>
<th>Per Cent</th>
<th>No. of Pupils</th>
<th>Sq. Ft.</th>
<th>Assembly Rooms</th>
<th>Classrooms</th>
<th>Members Per Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cradle roll</td>
<td>1-2-3</td>
<td>5</td>
<td>45</td>
<td>675</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Beginner</td>
<td>4-5</td>
<td>8</td>
<td>72</td>
<td>1080</td>
<td>1-2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>6-7-8</td>
<td>10</td>
<td>90</td>
<td>1350</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>9-10-11</td>
<td>10</td>
<td>90</td>
<td>1350</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>12-13-14</td>
<td>10</td>
<td>90</td>
<td>1350</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Senior</td>
<td>15-16-17</td>
<td>10</td>
<td>90</td>
<td>1350</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Young people</td>
<td>18-23</td>
<td>20</td>
<td>180</td>
<td>2700</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>24 upward</td>
<td>27</td>
<td>243</td>
<td>3645</td>
<td>1</td>
<td>6-9</td>
<td>15-150</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>900</td>
<td>13,500</td>
<td>9</td>
<td>44-55</td>
<td></td>
</tr>
</tbody>
</table>

Note. Classrooms not opening into the assembly room are to be preferred where shape of lot and size of building lend themselves to this arrangement.

Other Rooms. Social hall, which may also be the assembly room for one of the departments of pupils above 12 years old; kitchen and serving rooms; mothers’ room or rooms, in close proximity to the cradle roll; women’s parlor or parlors; boy scout and camp fire girl rooms, both of which may be figured in floor space for either intermediate or senior classes; chapel adapted to prayer meetings and other gatherings, which may be used as an assembly for one group, such as intermediate or senior. Rooms adapted to meetings of young people; these may also be used for an assembly or for large classes; pastor’s office and study; room for pastor’s assistant or assistants; church offices; Sunday School officers’ room; library and reading room; coat room facilities; toilets; cabinets in each assembly room and in library; storage and janitor’s room; gymnasium. Where local conditions require it and where adequate supervision will be maintained. Minimum size classroom: 8 x 10 feet. Blackboards should be provided in classrooms and in assembly rooms.

TABLE II

<table>
<thead>
<tr>
<th>Group</th>
<th>Ages</th>
<th>Per Cent</th>
<th>No. of Pupils</th>
<th>Sq. Ft.</th>
<th>Assembly Rooms</th>
<th>Classrooms</th>
<th>Members per Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cradle roll</td>
<td>1-2-3</td>
<td>5</td>
<td>60</td>
<td>900</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Beginner</td>
<td>4-5</td>
<td>8</td>
<td>98</td>
<td>1,440</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>6-7-8</td>
<td>10</td>
<td>120</td>
<td>1,800</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>9-10-11</td>
<td>10</td>
<td>120</td>
<td>1,800</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>12-13-14</td>
<td>10</td>
<td>120</td>
<td>1,800</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Senior</td>
<td>15-16-17</td>
<td>10</td>
<td>120</td>
<td>1,800</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Young people</td>
<td>18-23</td>
<td>20</td>
<td>240</td>
<td>3,600</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>24 upward</td>
<td>27</td>
<td>324</td>
<td>4,860</td>
<td>1</td>
<td>6-10</td>
<td>15-150</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1,200</td>
<td>18,000</td>
<td>10</td>
<td>54-72</td>
<td></td>
</tr>
</tbody>
</table>
Note. Classrooms for primary and junior groups should be apart from the assembly room when size and shape of lot permit separate arrangement. The number of classrooms for each of these groups may be reduced by providing for one-half to be in classes while the other half is in assembly.

Other Rooms. Social hall, which may also be used as an assembly room for one of the departments,—this room should accommodate from 800 to 1000; kitchen and serving room; kitchenette convenient to room or rooms used for smaller social gatherings; or young people’s department; mothers’ rooms (2) convenient to cradle roll rooms. These may be counted in as a part of the total floor space for adult classes; women’s parlors (2), which may also be used as adult classrooms, or one may be arranged for young people: boy scout and camp fire girl rooms, which may also be counted in total classroom space for either the intermediate or senior classes; pastor’s study; pastor’s office and conference room; church offices; assistant pastor and director of religious education (2 rooms); Sunday School officers’ room or rooms; library and supply room; reading room, which may also be training classroom and figured in total classroom space for young people; coat room or rooms; chapel for prayer meetings, which may also be used as assembly room; rooms adapted to young people’s meetings; men’s club room; girls’ club room; boys’ club room; nursery.

TABLE IV

Church School Having 2,000 Members

<table>
<thead>
<tr>
<th>Group</th>
<th>Ages</th>
<th>No. of Pupils</th>
<th>Sq. Ft.</th>
<th>Assembly Rooms</th>
<th>Classrooms per Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cradle roll 1-2-3</td>
<td>5</td>
<td>80</td>
<td>1,200</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Beginner 4-5-8</td>
<td>8</td>
<td>128</td>
<td>1,920</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Primary 6-7-8</td>
<td>10</td>
<td>160</td>
<td>2,400</td>
<td>1</td>
<td>16-20</td>
</tr>
<tr>
<td>Junior 9-10-11</td>
<td>10</td>
<td>160</td>
<td>2,400</td>
<td>1</td>
<td>16-24</td>
</tr>
<tr>
<td>Intermed. 12-13-14</td>
<td>10</td>
<td>160</td>
<td>2,400</td>
<td>1</td>
<td>12-20</td>
</tr>
<tr>
<td>Senior 15-16-17</td>
<td>10</td>
<td>160</td>
<td>2,400</td>
<td>1</td>
<td>10-18</td>
</tr>
<tr>
<td>Young people 18-23</td>
<td>20</td>
<td>320</td>
<td>4,800</td>
<td>1</td>
<td>10-14</td>
</tr>
<tr>
<td>Adult 24 upward</td>
<td>27</td>
<td>432</td>
<td>6,480</td>
<td>1</td>
<td>8-10</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1,600</td>
<td>24,000</td>
<td>10</td>
<td>72-105</td>
</tr>
</tbody>
</table>

Note. Junior and primary classrooms should not open into assembly room unless the size and shape of lot make other arrangements impossible. The number of classrooms for each of these departments may be reduced by planning for one-half of the department to be in class session while the other half is in assembly. This is an administrative matter for the local school.

Other Rooms. Social hall, which may also be the adult or young people’s assembly room,—this room should care for at least 1,000 to 2,000; kitchen and serving rooms; kitchenette for smaller gatherings; mothers’ rooms (2) near cradle roll rooms may be counted as adult classes; women’s parlors (2 or more); church parlor and steward’s rooms, boys’ and girl rooms; also counted as interme-
Kohler Designs a Handsome Mixing Faucet

An outstanding Kohler achievement, from the standpoint both of artistic design and of mechanical perfection. Softly lustrous Kohler chromium plate enhances its beauty.

Note these features of superiority:

1. New octagonal design, graceful and modern.
2. Lever handles swing clear and do not clash with spout.
3. Swinging mixing spout has high clearance above sink.
4. Splash-control inside spout gives an even flow of water.
5. Removable soap dish, self-draining, is made in white or colored vitreous china or in chromium-plated brass.
6. Eccentric union shanks permit easy installation and adjustment by plumber.
7. Rinsing hose receives water through switch valve. Improved hose clamp makes replacement easy.
8. Spray nozzle has removable face. Small diameter facilitates rinsing of dishes set close together.

New beauty... new quality in KOHLER Plumbing Brass

The fitting described above is one of many distinguished members of the Kohler line of plumbing brass for bathrooms, kitchens, and laundries.

These fittings are made by Kohler at Kohler, permitting centralized super-vision and insuring a strict adherence to the Kohler tradition of fine workmanship.

The line includes fittings of all types, embodying many improvements in design and construction. Special attention is given to the weight and quality of metal used, in order to make them exceptionally substantial and durable. One piece construction is employed wherever possible. Sharp edges and dirt-collecting grooves are avoided.

In addition to staple fittings, Kohler makes numerous special designs of unusual distinction, such as the Kohler Duo-strainer and the swing-arm mixing faucet illustrated above. Kohler chromium plating, beautiful, durable, and non-tarnishing, adds the final touch of quality to these and other fittings. Superior Kohler nickel plating is also furnished.

These admirable fittings make it possible to specify Kohler quality for the entire installation. Kohler Brass; Kohler Enameled and Vitreous China Ware, in colors or white—there you have the perfect combination of all that is newest and finest in the plumbing field.
Fourteen years ago they put Speakman Showers and Fixtures in this apartment house.

Robert P. Brownlee, manager, examined Speakman valves in use in this apartment house for 14 years—They did not show the slightest sign of wear—Speakman has always made good brass.

Now Speakman Showers and Bath Fixtures are being installed in the latest 20-story apartment house in Philadelphia—the last word in apartment house construction.

Recently Speakman Showers and Fixtures were installed in their Atlantic City Apartment house.

Mcllvain-Roberts, Architects in Philadelphia, know apartment houses—they operate seven. They prove that they like the low upkeep cost of Speakman Showers and Fixtures by installing them time and again.

The entire line of Speakman Showers, Bath Fixtures and Lavatory Fixtures is shown in the new Speakman Catalog K—150 pages, two colors, complete with roughing-in and ready to file under A.I.A. system if desired. Copy will be sent to architects upon request.

Speakman Company
Wilmington, Delaware

Speakman Showers and Fixtures
Look in the Speakman Catalog for it

K2653-M—Metal escutcheons and handle finished in Speakman Chromium Plate—a permanent silver platinum lustre—especially beautiful on a background of color.
Lavatory Combination with Pop-up Drain

For Fine Plumbing

BRASS goods for fine plumbing must be designed to operate without possibility of failure, must be made only of the highest grade of materials and must have that fine appearance that is required for modern bathroom appurtenances.

The model shown is one of the newest designs by Mueller of Decatur. Its beautiful finish suits it to the finest of modern interiors and the quality that is built into all Mueller products insures satisfaction in service.

When Mueller fittings are specified it's an investment in lasting satisfaction.

MUELLER CO., (Established 1857) Decatur, Illinois

World's Largest Manufacturers of Plumbing Brass Goods

Branches: 101 Park Avenue, Architects Building, New York, Dallas, San Francisco, Los Angeles

MUELLER OF DECATUR
PLUMBING BRASS AND VITREOUS WARE
MADDOCK’S forceful national advertising is convincing people of the folly of installing cheap, unhygienic toilets, and of the superiority of the Improved Madera. Now you can specify this scientific, highly-sanitary toilet knowing, not only that the product will satisfy in every way, but also that your clients will welcome it for its known advantages.

The Improved MADERA

by

MADDOCK

THOMAS MADDOCK’S SONS COMPANY, TRENTON, N.
TIME
robs Crodon of none of its beauty!

A everlasting lustre—a non-corrosive, non-tarnishing finish—an enduring, clean, sanitary appearance. These are long sought features that CRODON now gives to plumbing fixtures.

Because CRODON, the chromium plate, is exceptionally hard—many times harder than nickel—it withstands continuous use indefinitely. Because it resists acids, alkalis and atmospheric corrosion, it retains its brilliance.

In office buildings, hotels, apartments, hospitals and in many modern homes—in public washrooms, bathrooms, kitchens—CRODON is beautifying plumbing fixtures. Polishing is abolished—care beyond an occasional wiping with a damp cloth is unnecessary.

CRODON plated fixtures, now carried in stock by leading manufacturers and jobbers, give many worth while advantages. Let us tell you about them. Upon request our service department will supply the names of licensees who will gladly estimate the cost of CRODON plating for any building project.

CHROMIUM CORPORATION of America
120 Broadway - - - New York City
Branch Offices and Plants:
Chicago, Ill. ................. 4649 West Chicago Avenue
Cleveland, Ohio .................. 3125 Perkins Avenue
and at Waterbury, Conn.

Metal and Thermit Corp., Agents So. San Francisco, Cal.

CRODON
TRADE MARK REG. U. S. PAT. OFF.
THE CHROME PLATE

PERMANENTLY BEAUTIFUL - DOES NOT TARNISH - WEARS INDEFINITELY
When the Blueprint reads "Pipe-chamber"

Suggest the Te-pe-co "Universal"

The "Universal" has all the advantages of the wall-hung closet plus a simplified installation that requires no carrier. Its center of gravity is within itself. It is of full syphon jet construction with extended lip and a large vent passage from the bowl opening vertically into the pipe chamber.

The Plumbing Contractor will find the installation of the "Universal" easy and economical. Since the type of installation is the same as on an ordinary closet bowl, no time need be wasted by the journeyman in learning its intricacies. All supplies and wastes are back of wall finish, which allows the use of rough material at considerable saving.

Since the pipe corridor is becoming so popular in the planning of buildings where closets must be used in groups, we suggest that Plumbing Contractors seeking this type of business would do well to write us for detailed information on the "Universal."

Note that the "Universal" projects only 19\(\frac{1}{2}\) inches from the wall while a syphon jet wall closet measures 25\(\frac{3}{4}\) inches, and a blow-out type 22\(\frac{3}{4}\) inches—thus saving 3 to 6 inches of material in width of each partition.

All supplies and wastes are back of wall finish, which allows the use of rough material at considerable saving. "Universal" operates with either flush valve or high tank.

TRENTON POTTERIES COMPANY
TRENTON, NEW JERSEY, U.S.A.
World's Largest Makers of All-Clay Plumbing Fixtures

TE-PE-CO Water Closets
FOR EVERY PLACE AND PURSE
To men who plan hotels, the selection of equipment designed to forestall those emergencies which disrupt highly organized routine and bring discomfort to guests is a matter of primary importance.

In the Schroeder Hotel, Milwaukee, a not uncommon source of trouble was guarded against through installing Jenkins Valves in all plumbing and heating lines. The hotel is assured of low valve maintenance and of the trouble-free service which has characterized the performance of Jenkins Valves for 64 years.

When specifications read "Jenkins Valves, marked with the Jenkins 'Diamond' and signature," architects and their clients are assured of long-term service.

**JENKINS BROS.**
80 White Street . . . . . . New York, N. Y.
524 Atlantic Avenue . . . . . Boston, Mass.
646 Washington Boulevard . . . Chicago, III.

**Jenkins Valves**
Always marked with the "Diamond"

SINCE 1864
A beautiful bathroom could hardly have a more magnificent "center of interest" than this Tarnia with its shower enclosure of sparkling glass. Eminently practical, the substantial, piano-hinged doors at once suggest to the beholder the swan song of the clinging duck curtain. Above them is a ventilating grille. The entire effect is a new eye-filling charm of simple, direct line. Lending itself admirably to a wide variety of architectural treatment, the Tarnia offers in any background convenience that is supreme. It is only one of the many inspiring suggestions in the recently published Crane book, New Ideas for Bathrooms. To architects it is gladly sent in an enlarged edition. In writing, please ask for the Architects' Edition. . . Visit Crane Exhibit Rooms.
There will never be any expense for repairs—
if this toilet seat is selected

Our guarantee for the Church Sani-Black Seat carries no time limit. As long as any building stands in which it is installed, this toilet seat will remain as good as new. It will never have to be replaced. It will never cost anything for repairs.

In effect, we guarantee the Church Sani-Black Seat forever. And actual installations are proving, year after year, that our guarantee is justified. In hotels, industrial plants, office buildings and other public buildings, where toilet seats must undergo the hardest and most constant usage, Church Sani-Black Seats are giving complete satisfaction. They have gained national recognition for their permanence.

The core of the Sani-Black Seat is formed by cross-grained layers of wood and rubber, vulcanized into a compact, solidly welded unit that will never warp nor crack. The outside covering is composed of a hard composition, vulcanized to the core under heat pressure. It completely seals the core. It has no joints—no breaks of any kind in its lustrous, jet-black surface. It cannot scratch, chip nor wear off.

This same hard composition covers the hinges on the all-black seats. They are completely sanitary. They cannot tarnish, rust nor become corroded. And they are held in place by screws, which are tapped through solid steel bars—molded into the seat core.

Let us send you, for your files, our illustrated, 100-page architect’s catalog. It describes our full line of Sani-White and Sani-Black Seats. Let us send you, also, a cross-section of the Sani-Black Seat. We want you to see for yourself the permanent character of its construction. Mail the coupon today to C. F. Church Manufacturing Co., Holyoke, Mass.

G. F. CHURCH MANUFACTURING CO.
Dept. 6-S, Holyoke, Mass.

Gentlemen: Kindly send me your architect’s catalog, together with a cross-section of your Sani-Black seat.

Name
Street
City
State

A Church Sani-Black installation in the Park-Murray Hotel, New York City.
Flush Valves
Used Throughout

Write for details
PLUMBING DIVISION
THE IMPERIAL BRASS MFG. CO.
1238 West Harrison Street
Chicago

BRANCH SALES OFFICES
W. T. Frey, 601 Westland Bldg., Cleveland, Ohio
John Sherin, Park View Hotel, Cincinnati, Ohio
W. S. Blake, Jr., Park Coronado Hotel, St. Louis, Mo.
W. C. Shanley, 973 Holmes St., Kansas City, Mo.
H. E. Darron, 500 Carondelet St., New Orleans, La.
Dillard-Lewis & Co., Construction Industries Bldg., Dallas, Tex.
K. L. Shank, 929 Grand Ave., Des Moines, Iowa.
Rex W. Williams, 462 Scott Bldg., Salt Lake City, Utah
Wm. P. Horn Co., 58 Federal St., San Francisco, Cal.
L. C. Coombs, 1010 North Gardner St., Los Angeles, Cal.
Richard O'Brien, 324 22nd St. North, Seattle, Wash.

"Red Metal"
Solid Bronze
SASH CHAINS

Universally Used Because of Quality and Strength

Our Sash Chains are also manufactured in
"Giant Metal" (Phosphor Bronze) and Steel (Cold Rolled)

THE SMITH & EGGE MFG. COMPANY
BRIDGEPORT, CONN.

ORIGINATORS OF SASH CHAINS

Look and Efficiency
The Twinpax Toilet Fixture is most attractive; made in tile, any color.
Carries two packs of tissue; when one is exhausted the other is ready for use.
Ask us for blue prints, prices, etc.

NATIONAL PAPER PRODUCTS CO.
Architectural Service Division, CARTHAGE, N.Y.
NEW YORK — CHICAGO — SAN FRANCISCO — LOS ANGELES — SEATTLE
Ask for A.I.A. filing catalog
Now—a new achievement in quality. The design remains the same—the popular Syenite—effective, efficient; but a new process of manufacture—an exclusive Mississippi feature—adds a perfect plate glass finish and a uniformity of quality heretofore unknown. The new Syenite is now ready, wired or plain, for doors and partitions in buildings where beauty and uniformity are desired.

Syenite distributes the light with a soft and pleasing effect, and its design does not clash with any style of architecture. Whatever the scheme of the building, Syenite looks “at home”.

Let us send you a sample of this new Syenite Polished.

Specify "Mississippi"

Mississippi Glass Company
220 Fifth Avenue New York
Chicago St. Louis
Avenues For Fire—are they guarded?

Vertical shaft openings in any building are veritable highways for fires starting on lower floors. That is why small fires spread from floor to floor, even in "slow-burning" buildings.

The building at the left has all vertical shaft doors, stair hall doors and fire escape doors of United hollow metal construction. So positive is this protection, that United Doors bear the Underwriters' label.

Yet there is no sacrifice of beauty. United finishes rival the finest woods, and steel construction has a degree of permanence that wood can never have.

Send for the United handbook.

THE UNITED METAL PRODUCTS CO.
CANTON, OHIO
This long-lived low-cost sheet metal will satisfy your clients, too

Here's a client that emphasizes durability for the sheet metal construction of his new residence... another, harmony and modernity of details... still another, long life at low cost...

You can meet these and other sheet metal requirements with rust-resisting ARMCO Ingot Iron...

Much the same as did Architect Hiram Elder in the Gas City, Indiana, residence pictured above. When this far-visioned architect planned it in 1912 he chose ARMCO Ingot Iron for all sheet metal details—cornices, gutters and flashings.

Today, despite long-continued exposure to Rust-Fire® the “pure iron” installations need no attention, no repairs or replacements.

You, too, will find ARMCO Ingot Iron the ideal sheet metal where clients desire utmost durability at reasonable original outlay.

The American Rolling Mill Company
Executive Offices, Middletown, Ohio
Export: The ARMCO International Corporation
Cable Address—ARMCO, Middletown (O.)

Here RUST-FIRE is retarded. The only difference between rusting and burning is time—both are oxidation. You can feel and see the fire produced by rapid burning. But when metal rusts, the process is too slow to see. Rust is the “ash” of this fire.
Youngstown Pipe in New York City

New York City, in 1927, set the pace in modern building construction, for all other American cities. It is significant therefore, that Youngstown Pipe was selected for the heating or plumbing lines for a large percentage of the newer and better buildings in the big metropolis. Those shown on this page are a fairly representative group, and beginning at the left, include The Midway Theatre and Hotel—The 1060 Fifth Avenue Apartment Building—The New York Central Building—The Tudor City Apartment Project—The Paramount Hotel. What further conclusive evidence can we offer of the merits of Youngstown Pipe than arguments such as these buildings, themselves, present to you?

The Youngstown Sheet & Tube Co.
Youngstown, Ohio

DISTRIBUTED SALES OFFICES
ATLANTA—Hasley Bldg.
BOSTON—Chamber of Commerce Bldg.
BUFFALO—Liberty Bank Bldg.
CHICAGO—Conway Bldg.
CINCINNATI—Union Trust Bldg.
CLEVELAND—Union Trust Bldg.
DALLAS—Magnolia Bldg.
DENVER—Continental Oil Bldg.
DETROIT—First National Bank Bldg.
KANSAS CITY, MO.—Commerce Bldg.
LONDON REPRESENTATIVE—The Youngstown Steel Products Co., Dashwood House, Old Broad Street, London, E. C., England
A Genuine Wrought Iron Pipe installation (if it is Cohoes) permits you to look far into the future with the satisfaction of knowing the pipe will perform as long as the building stands.

Hydrostatic Pressure tested 7 to 10 times more than its use will require. Made by the original formula that insures real Genuine Wrought Iron. Cohoes Pipe is an insurance and an economy.

COHOES ROLLING MILL CO.
COHOES, NEW YORK

BRANCH OFFICES: PHILADELPHIA - CHICAGO - LOS ANGELES - NEW YORK
CLEVELAND - MINNEAPOLIS - BOSTON - NORFOLK - FORT WORTH
Recent years have brought a marked improvement in our grade and high school buildings. In the march of progress in buildings generally, the high school has undergone practically a complete change in both architectural design and interior plan.

From the modest "school house" of yesterday has come the "institution" of today. Beautiful in outward appearance—efficiently planned within—the modern school building reflects the trend of modern thought in meeting today's needs and anticipating tomorrow's requirements.

In keeping with architectural achievement, engineering skill has been diligently applied—the hand of genius is seen in the specifications for various materials used. Behind the walls and beneath the floors is one of the most important of these materials—a vast net work of pipe lines. There could be no substitute for quality here. Efficient service and long life were factors carefully considered and only pipe which bore unmistakably a reputation for proven quality received consideration.

It is significant that in many of America's modern school buildings "NATIONAL" Pipe has been generously used.

The Taylor Allderdice High School in Pittsburgh, illustrated above is one of the many schools throughout the country in which "NATIONAL" Pipe has been installed.

NATIONAL TUBE COMPANY
Frick Building, Pittsburgh, Pa.
DISTRICT SALES OFFICES IN THE LARGER CITIES
New Edition of Bulletin No. 14

Trane Bulletin 14 contains valuable data on vapor and vacuum heating. It includes complete descriptions of Trane Bellows Radiator Traps, Trane Bellows Packless Valves, and the complete line of Trane specialties, for vapor and vacuum heating systems.

The new edition, now ready for distribution, contains added information on recent developments in the Trane line — the Thermo-static Drip Trap, New Quick Vent, New Valves, etc.

Dirt Strainers Now Available

Dirt strainers of Trane manufacture — sizes ½", ¾", 1" and 1 ¼" — are recommended as substitutes for dirt pockets on all main drips, riser drips, and unit heaters. Adaptable to either horizontal or vertical pipe lines.

When You Specify Trane Pumps, You Can Depend on All-Round Satisfaction

Trane Pumps help any heating system deliver the performance you expect — and a little bit more. The completed installation carries out the ideas you had in mind when planning the layout and writing the specifications. To layman and engineer alike, it is always a pleasure to inspect and test a Trane-equipped job.

Trane Pumps are designed to give a well-balanced installation in actual service. No "feature" receives too great emphasis at the expense of all-round results.

Write for Bulletin 20 containing complete facts.

THE TRANE CO., 220 Cameron Ave., La Crosse, Wis.

HEAT CABINETS TRANE CONCEALED HEATERS

... PUMPS AND HEATING SPECIALTIES ...
They Can't Stand Unflushed...

Unflushed closets are filthy, dangerous headquarters for filthy, dangerous insects, smells and germs. Clow Madden Automatics never stand unflushed.

Each time, each time, no matter how many times they are used . . . Clow Madden Automatics flush themselves. They're Automatic. They can't stand unflushed.

Each time, a deluge of water whirls away all waste. Each time, the bowl is purged of taint. And Clow bowls co-operate with water. They have no bumps or hollows to cause eddies.

CLOW MADDEN

Forty-Eight Styles, Heights and Types to Meet Your Requirements
Probably for the Next 35 Years

Simple, sure, strong, describe the Clow Madden Valve (it has no by-passes, floats or temperament). It’s sensible about water . . . never wastes it . . . never stints it.

Sanitation follows Clow Madden Automatics — through thirty-five years and sometimes more. Water bills become easy to pay. Repair bills seldom happen. (Read Records No. 103 and No. 106.) Send for the Clow School Plumbing Booklet.

James B. Clow & Sons, 201-299 N. Talman Ave., Chicago

AUTOMATIC
Forty-Eight Styles, Heights and Types to Meet Your Requirements
What’s the Difference Between a Genuine Vitreous China Urinal Stall and an Ordinary One?

The same difference that you would understand in considering a water closet or lavatory made of anything but Genuine Vitreous China.

The superiority of vitreous china over other materials being well known—the advantages of specifying Douglas urinal stalls are apparent.—Bear in mind they will not craze or discolor, that they are easily kept clean and absolutely impervious.

Write for Catalogue and list of Buildings where the Genuine Douglas Vitreous China Urinal Stalls are being used.

Manufactured by
The John Douglas Co.
Makers of High Grade Plumbing Fixtures

A Sectional Piece of Douglas Vitreous China Urinal
A Sectional Piece of the Ordinary Urinal
A Selected List of Manufacturers' Publications

FOR THE SERVICE OF ARCHITECTS, ENGINEERS, DECORATORS, AND CONTRACTORS

The publications listed in these columns are the most important of those issued by leading manufacturers identified with the building industry. They may be had without charge, unless otherwise noted, by applying to your manufacturers' representative or to The Architectural Forum, 383 Madison Avenue, New York, or the manufacturer direct, in which case kindly mention this publication.

ACOUSTICS
R. Gossartino Co., 40 Court St., Boston
Akoastikluster Plaster. Booklet, 6 pp., 10 x 12½ ins. Important data on a valuable material.  
U. S. Gypsum Co., 305 W. Monroe St., Chicago, Ill.

ASH HOISTS—ELECTRIC AND HAND POWER
Gilles & Gillis, 530 Madison Ave., New York, N. Y.
Gilles & Gillis General Catalog. 8½ x 11 in. 20 pp. Fully Illustrated. Contains specifications in two forms (with manufacturers' name and without). Detail 1½ in. scale for each telescopical model and varies with material handling section.

BASEMENT WINDOWS
Gillis & Geohegan, 535 West Broadway, New York, N. Y.

BATHROOM FITTINGS
A. P. Van der Donk, Grand Rapids, Mich.

BRICK
Gillis & Geohegan, 535 West Broadway, New York, N. Y.
Kostkos Portland Cement Company, Louisville, Ky.
Louisville Cement Co., 305 Guthrie St., Louisville, Ky.
M. F. & M. M. Company, 325 Wabash Ave., Chicago, Ill.

Cement and Mortar. Bulletin. 16 pp., 8¼ x 11 ins. Illustrated. Contains a table of data on a valuable material.

Cement Color Mix Company, 325 Wabash Ave., Chicago.

CONCRETE BUILDING MATERIALS
Cosmo Portland Cement Company, Louisville, Ky.
Concrete for Exterior Masonry. Folder, 6 pp., 8½ x 5¾ ins. Data on structural and working qualities of Cosmortar, the Mortar for Cold Weather. Folder, 4 pp., 8¼ x 11 ins. Tells why Cosmortar should be used in cold weather.

Super Dampproof Cement. Booklet, 20 pp., 8½ x 11 ins. Illustrated. Contains complete data on a valuable waterproof material.

Lovelace Cement Co., 311 Guthrie St., Louisville, Ky.
BRIXMIXT for Perfect Mortar. Self-setting handbook 8½ x 11 inches. 16 pp. Illustrated. Contains complete technical description of BRIXMIXT for brick, tile and stone masonry building work.

North American Cement Corporation, 240 Madison Ave., New York, N. Y.

Portland Cement Association, Chicago.
Concrete Masonry Construction. Booklet, 47 pp., 8½ x 11 ins. Illustrated. Deals with various forms of construction.

Portland Cement Association.
Concrete Masonry Construction. Brochure, 16 pp., 8½ x 11 ins. Illustrated. A study of construction work.

Cement—Continued
Design and Control of Concrete Mixtures. Brochure, 22 pp., 8½ x 11 ins. Illustrated.
Portland Cement Stucco. Booklet, 64 pp., 8½ x 11 ins. Illustrated.

Concrete in Architecture. Bound Volume, 60 pp., 8½ x 11 ins. Illustrated. An excellent work, giving views of exteriors and interiors.

CONCRETE COLORINGS


Concrete Surface Corrugation. Markets Bldg., New York.
Bonding Surfaces on Concrete. Booklet, 12 pp., 8½ x 11 ins., Illustrated. Deals with an important detail of building.

Dovetail Anchor Slot Co., 149 West Ohio St., Chicago.


Sound Absorption of Cinder Concrete Building Units. Booklet, 8 pp., 8½ x 11 ins. Illustrated. Results of tests of absorption and transmission of sound through Struck building blocks. Philadelphia, Cinder Concrete Building Units. Brochure, 36 pp., 8½ x 11 ins. Illustrated. Full data on an important building material.

Kosmos Portland Cement Company, Louisville, Ky.
High Early Strength Concrete. Using Standard Kosmos Portland Cement. Folder, 1 p., 8½ x 11 in. Complete data on securing high strength concrete in short time.

CONCRETE DAMPPROOFING
Master Builders Co., Cleveland, Ohio.

Dychrome, Concrete Surface Hardener in Colors. Folder. 4 pp., 8½ x 11 in. Illustrated. Data on a new treatment.

CONSTRUCTION, FIREPROOF
Master Builders Co., Chicago, Ill.
Color Mix. Booklet, 18 pp., 8½ x 11 ins. Illustrated. Valuable data on concrete hardener, waterproofer and dustproofer in permanent colors.


Northwestern Expanded Metal Co., 125 West Jackson Blvd., Chicago, Ill.
Northwestern Expanded Metal Products. Booklet, 8½ x 104½ in. 16 pp. Fully illustrated. Describes different products of this company, such as a new metal mesh, 20th Century Corrugated. Plaster-Saver and Longspan lath channels, etc. A. I. A. Sample Book. 16 pp., 8½ x 11 ins. Contains actual samples of several materials and complete data regarding their use.

DAMPPROOFING
Philip Carey Co., Lockland, Cincinnati, Ohio.
Architects' Specifications for Carey Built-Up Roofing. Booklet, 8 x 10½ in. 24 pp. Illustrated. Complete data to aid in specifying the different types of built-up roofing to suit the kind of roof construction to be covered.

Carey Built-Up Roofing for Modern School Buildings. Booklet 8 x 10½ in. 32 pp. Illustrated. A study of school buildings of a number of different kinds and the roofing materials adapted for each.

Cosmo Steel Company, Youngstown, Ohio.

The Master Builders Co., 2016 Euclid Ave., Cleveland.
Waterproofing and Spraying Manual. Booklet. 16 pp., 8½ x 11 ins. Deals with methods and materials used.

Wid Newspaper and Damp Proofing. Field 16 pp., Complete descriptions and detailed specifications for materials used in building with concrete.

Somersene Son, Inc., L., 165 Fifth Ave., New York, N. Y.
Specification Sheet, 8½ x 11 ins. Descriptions and specifications continuously for dampproofing exterior and interior surfaces.

The Vertex Mfg. Co., Cleveland, Ohio.
SELECTED LIST OF MANUFACTURERS’

DOORS AND TRIM, METAL

The E. V. C. Mortgage Company, Waterbury, Conn.
Anacorda Architectural Bronze Extruded Shapes. Brochure, 16 pp., illustrated, describes more than 2,000 standard bronze shapes of cornices, jambs casings, moldings, etc.

Fire Traps and Hardware. Booklet, 97 pgs. x 11 in. 64 pp. Illustrated. Describes entire line of thin-clip and corrugated fire doors, complete with automatic closers, truck hangers and all required accessories—all approved and labeled by Underwriters’ Laboratories.

DOORS, SOUNDPROOF

Irving Hamlin, Evanston, Ill.
The Evanston Soundproof Door. Folder, 8 pp., 8½ x 11 ins. Illustrated. Deals with a valuable type of door.

DUMBWAITERS

Sedgwick Machine Works, 151 West 15th St., New York, N. Y.
Concrete Engineering Co., Omaha, Neb.
Benjamin-Starrett Panelboards and Steel Cabinets. Booklet, 80 pp., 8½ x 10½ ins. Full data on these details for light and power.

Sedgwick Machine Works, 151 West 15th St., New York, N. Y.
Benjamin-Starrett Panelboards for Light and Power. Booklet, 107 pp., 8½ x 11 ins. Illustrated. Data on company’s line of panelboards, steel cabinets, etc.

Benjamin, Electric Co., Schenectady, N. Y.

“Typical Door—Hundred Centurian.” Booklet, 40 pp., 8 x 10½ ins. Illustrated. Decks on importance of adequate wiring.

Pick & Company, Albert 208 West Randolph St., Chicago, Ill.
Sedgwick Machine Works, 151 West 15th St., New York, N. Y.
Office Telephones. Booklet, 9 x 6 in. Illustrated. The design and equipment of school cafeterias with photographs of installation, floor plans, specifications, plans and prices for various types, etc. 8½ x 11 ins. 60 pp. Illustrated. Catalog and pamphlets. 8½ x 11 ins. Illustrated. Valuable data on dumbwaiters.

FLOORING


Concrete Floor Treatment. File, 100 pp. Bound volume, 5½ x 11 ins. Contains actual samples of several materials and complete data regarding their use.

FLAGSTONES


FLOOR HARDENERS (CHEMICAL)

Master Builders Co., Cleveland Ohio.

FLOORING


Linoleum for Home Floors. Brochure, 7½ x 10½ ins. 27 pp. and colored enclosures of floor installations.

Armstrong Cork Co. (Linoleum Division), Lancaster, Pa.
Armstrong Cork Co. (Linoleum Division). Linoleum Floors, catalog. 30 pp., 8½ x 11 ins. Color plates. A technical treatise on linoleum, including table of standard linoleum samples and specifications for installations in school linoleum floors.


Linoleum Sample Book. Booklet. 8½ x 11 ins. 35 pp. Showing all gauges and thicknesses in the Armstrong line of Linoleums.

Linoleum Layer’s Handbook. 5 x 7 ins. 28 pp. Instructions for linoleum layers and others interested in learning most satisfactory methods of laying and taking care of linoleum.

Enduring Floors of Good Taste. Booklet. 6 x 9 in. 48 pp. Illustrated in color. Explains use of linoleum for offices, stores, etc., with reproductions in color of suitable patterns, also specifications and instructions for laying.

Barber Asphalt Co., Philadelphia.

Planning the Color Schemes for Your Home. Brochure illustrated in color; 36 pp., 8½ x 10½ ins. Contains plans and equipment of school cafeterias with photographs of installation, floor plans, specifications and instructions for laying.

A series of booklets, with full color inserts showing standard colors and designs. Each booklet describes a real tile material as follows: Battleship Linoleum. Explains the advantages and uses of this durable, economical material.

Marble-laid (Composition) Tile. Complete information on composition-laid marble tile and the many artistic effects which can be had with it.

Treadlite (Composition) Tile. Shows a variety of colors and patterns of this adaptable composition floor covering.

Natural Cork Tile. Description and color plates of this super-excellent floor covering.

Practical working specifications for installing battleship linoleum, composition tile and cork tile.

Carter, Robertson Flooring Co., Keith Perry Blvd., Kansas City, Mo.
Bloxonend Flooring. Booklet 8½ x 11½ ins. 20 pp. Illustrated. Describes uses and adaptability of Bloxonend Flooring to concrete, wood or steel construction, and advantages over loose floor coverings.

File Folder, 8½ x 11½ ins. For use in connection with A. I. A. Asked for filing. Contains detailed information on Bloxonend Flooring in conditioned, loose-leaf form for specification writer and selecting room. Literature embodies the same information contained in standard Specification Sheet covering the use of Bloxonend in general, industrial service, and Specifications Sheet No. 1, which gives detailed description and explanation of standard specification for installing Bloxonend in gymnasiums, armories, drill rooms and similar locations where maximum resiliency is required.

FIREPROOFING

General Fireproofing Company, Youngstown, Ohio.

DEPARTMENT STORES

Continued from page 177

Continued from page 177
No air valve ~ no storage tank

You will find neither air valves nor storage tanks in Jennings Sewer Ejector installations. At best the use of air valves for reducing high pressure air for low pressure ejector service is an inefficient practice. Intricate and complicated, such valves always are a source of trouble.

The Jennings Ejector does away with both air valves and storage tanks, reciprocating compressors and their auxiliaries. In standard sizes for handling up to 1500 g.p.m. Heads up to 50ft. Bulletin 67 is the one to write for.

NASH ENGINEERING COMPANY
So. Norwalk, Connecticut
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 178

HEATING EQUIPMENT

American Blower Co., 6004 Russell Street, Detroit.

American Radiator Company, The, 40 West 40th St., N. Y. C.

A famous line of heating apparatus. Describes the entire line of products. May be had in any size, may be had in any size, in the various kinds of houses. 

American Radiator Co., Baltimore.

American Radiator Co., Providence.

American Radiator Co., Chicago.

American Radiator Co., Kansas City.

American Radiator Co., St. Louis.

American Radiator Co., Seattle.

American Radiator Co., Milwaukee.

American Radiator Co., Pittsburgh.

American Radiator Co., Cleveland.

American Radiator Co., San Francisco.

American Radiator Co., Los Angeles.


American Radiator Co., Buffalo.


American Radiator Co., New Orleans.

American Radiator Co., New Haven.

American Radiator Co., Boston.

American Radiator Co., Newark.

American Radiator Co., Detroit.

American Radiator Co., Cincinnati.


American Radiator Co., Minneapolis.

American Radiator Co., Kansas, Kansas.

American Radiator Co., Des Moines.

American Radiator Co., Dallas.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.


American Radiator Co., Chicago.

American Radiator Co., Pittsburgh.

American Radiator Co., Cleveland.

American Radiator Co., St. Louis.

American Radiator Co., Cleveland.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.


American Radiator Co., Buffalo.


American Radiator Co., Newark.

American Radiator Co., Detroit.

American Radiator Co., Cincinnati.


American Radiator Co., Minneapolis.

American Radiator Co., Kansas, Kansas.

American Radiator Co., Des Moines.

American Radiator Co., Dallas.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.


American Radiator Co., Chicago.

American Radiator Co., Pittsburgh.

American Radiator Co., Cleveland.

American Radiator Co., St. Louis.

American Radiator Co., Cleveland.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.


American Radiator Co., Buffalo.


American Radiator Co., Newark.

American Radiator Co., Detroit.

American Radiator Co., Cincinnati.


American Radiator Co., Minneapolis.

American Radiator Co., Kansas, Kansas.

American Radiator Co., Des Moines.

American Radiator Co., Dallas.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.


American Radiator Co., Chicago.

American Radiator Co., Pittsburgh.

American Radiator Co., Cleveland.

American Radiator Co., St. Louis.

American Radiator Co., Cleveland.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.


American Radiator Co., Buffalo.


American Radiator Co., Newark.

American Radiator Co., Detroit.

American Radiator Co., Cincinnati.


American Radiator Co., Minneapolis.

American Radiator Co., Kansas, Kansas.

American Radiator Co., Des Moines.

American Radiator Co., Dallas.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.


American Radiator Co., Chicago.

American Radiator Co., Pittsburgh.

American Radiator Co., Cleveland.

American Radiator Co., St. Louis.

American Radiator Co., Cleveland.

American Radiator Co., Los Angeles.

American Radiator Co., San Francisco.

He Stopped the Leak as Best He Could

Over a long period of troublesome years, architects, contractors and owners of large buildings also have contended with leaks; ever increasing steam leakages from Expansion Joints used on heating pipe risers.

Joint packing, as was the Dutch boy's arm, is only temporarily efficient. A joint stuffed with commercial packing is bound to leak eventually. It is totally unfit for a vacuum system or a system where a slight vacuum is pulled.

The over-loaded pump fails to retain the vacuum, heating efficiency becomes poor, and fuel and repair costs multiply.

**Sylphon**

**PACKLESS EXPANSION JOINT**

Allows Absolutely No Leakage

Its heart, the all metal, original and genuine Sylphon Bellows acts as a continuous yet flexible barrier to steam escape. It is steam tight now, tomorrow or ten years from today, requires no attention, and yet has perfect freedom of motion without risk of "jamming." It does away with "Expansion loops" those story-height space wasters. No more packed or "sliding sleeve" expansion joints, almost impossible to repack in the case of a riser concealed in furring.

**Sylphon Packless Expansion Joints Are Easily Installed in the Vertical Riser**

We will be glad to send you complete data, sizes, prices and shipping weights. Use the coupon or write if you prefer.

**THE FULTON SYLPHON COMPANY, Knoxville, Tenn., U.S.A.**

Sales Offices: New York, Chicago, Philadelphia, Boston, Detroit. All Principal Cities in the U. S.

Gentlemen:

We are interested in the application of the Sylphon Packless Expansion Joint to

Name
Address
City State

DEPT. F
SELECTED LIST OF MANUFACTURERS’ EQUIPMENT

HEATING EQUIPMENT—Continued

Phillips, John & Company, 511 Fifth Avenue, New York.


Trane Co., The, La Crosse, Wis.


HOSPITAL EQUIPMENT

The Frick Co., Inc., 24th St. and Teech Ave., New York City, Catskill. A booklet illustrated with photographs and drawings, showing the types of light for use in hospitals, clubs and other buildings. Shows tinted and multifluid concentrates, ward reflectors, bad lights and microscopic effects, glasses and dimmers, explaining their particular fitness for special uses.

The International Nickel Company, 57 Wall St., New York, N. Y.

Hospital Applications of Monel Metal. Booklet. 8½ x 11¼ ins. 32 pp. Illustrated. Data on industrial installations of Monel Metal. Used, for its reasons, with its sources of supply. The design and equipment of hospital catheterists with photographs of installation and plans for standardized outfits.

The Pick-Barth Companies, Chicago, and New York.

About Hospital Food Service Equipment. Booklet, 22 pp., 7½ x 9¼ ins. Valuable data on an important subject.

Williamson Steeltex Co., 131 West Liberty St., Kansas City, Mo.

Sterilizer Equipment for Hospitals. Book. 76 pp., 8½ x 11 ins. Illustrated. Describes the most complete equipment for the sterilization of utensils and water, information on dressings, etc.


Hospital Sterilizing Technique. Five booklets, 8 to 16 pp. Each. Describes technique and gives complete specifications for use of architects and contractors.

LANTERNIER EQUIPMENT

Tohdunker, Arthur, 119 E. 57th St., New York.

Hand-Brought Lanterns. Booklet. 56 pp., 8½ x 11 ins. Illustrated. Black and White. With price list. Lanterns appropriate for exterior and interior use, designed from old models and meeting the requirements of modern lighting.

LATH, METAL AND REINFORCING

Genfire Steel Company, Youngstown, Ohio.


National Steel Fabric Co., Pittsburgh.


Steeltex Data Sheet No. 7, 8½ x 11 ins. Illustrated. Describes principles and design of the Kernerator-Phenol-Agglomerate-Steel Lath. Contains actual samples of several materials and complete data regarding their use. Northwest Metal Lath. Folder. 8½ x 11 ins. Illustrated. Data on 14-inch Rb Lath. Truscon Steel Company, Youngstown, Ohio.


Laundry Chutes

The Pfau Co., 271 Carter Building, Rochester, N. Y.


Laundry Machinery

American Laundry Machinery Co., Norwood Station, Cincinnati, Ohio.

Equipment for the Hotel and Hospital Laundry. Brochure, 8 pp., 8½ x 11 ins. Illustrated. Data regarding an important subject.

Library Equipment

Art & Library Construction Co., Jamesport, N. Y.

Planning the Library for Protection and Service. Brochure, 32 pp., 8½ x 11 ins. Illustrated. Deals with library firings of different kinds.

Library Furniture

Division, Remington Rand, N. Tonawanda, N. Y.

Like Stepping into a Store Book. Brochure, 24 pp., 9 x 12 in. Illustrated. Deals with equipment of Los Angeles Public Library.
Drinking Water in the St. Louis Masonic Temple

IN the Masonic Temple, St. Louis, all the distributing lines, pump connections, and tanks are insulated with Armstrong's Cork Covering. This dependable insulation, which engineers everywhere recognize as the standard, insures the maintenance at all times of proper water temperatures at the fountains with the minimum use of refrigeration. Operating cost is therefore extremely low and the water at the farthest fountain is always "just right"—within a very few degrees of the tank temperature.

Maintenance cost is almost negligible since Armstrong's Cork Covering is moisture proof and not subject to deterioration in either structure or insulating value from normal operating conditions. Lines insulated with Armstrong's Cork Covering may, therefore, safely be enclosed in pipe chases or run in inaccessible places with every assurance of permanence and security against staining since cork covered lines do not sweat.

Engineers of the Armstrong Cork & Insulation Company have had many years' experience in the designing and insulation of refrigerated drinking water systems. Their counsel is freely available to architects and engineers. Armstrong Cork & Insulation Company, 132 Twenty-fourth St., Pittsburgh, Pa.; McGill Bldg., Montreal; 11 Brant St., Toronto 2.

Armstrong's Cork Covering
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 182

LIGHTING EQUIPMENT

The S. S. White Dental Mfg. Co., 217th St. and 10th Ave., New York City. Catalog 415, 8% x 11 in., 46 pp. Photographs and scaled cross-sections, tables, key to sections, and cut sheet reflectors, double and single deck reflectors and Polaroid Signs.

Gleenon-Tiebout Glass Co. (Celestialite Division), 300 Fifth Avenue, New York. Catalog No. 18, 8% x 11 in. Illustrated. Next to Daylight Brochure, 19 pp., 4 x 8½ in. Illustrated. Deals specifically with type of lighting fixture on decorative plaster. Celestialite Circular No. 40, Folder, 4 pp., 3½ x 6 ins. "What Does the Sun, Celestialite does to the Mazda lamp?" Attractive Units in Celestialite, Folder, 12 pp., 8½ x 11 ins. Illustrated. Celebrated Celestialite Units. It has been immunized. Folder, 4 pp., 10 x 13 ins. Data in an important detail of lighting equipment.

MAIL CHUTES

Cutler-Mail Chute Company, Rochester, N. Y. Cutler Mail Chute Model F. Booklet. 4 x 9½ in. 8 pp. Illustrated.

MANTELS


MARBLE


MEMORIALS


METALS


MILL WORK—See also Wood

Curtis Companies Service Bureau, Clinton, Iowa. Architectural Interior and Exterior Woodwork. Standardized Book, 9 x 11½ in. 240 pp. Illustrated. This is an Architects' edition of the complete catalog of Curtis Woodwork, as signed by Trowbridge & Ackerman. Contains many color plates.

Better Built Homes. Vols. XV-XVIII incl. Booklet, 9 x 12 in. 40 pp. Illustrated. Designs for houses of five to eight rooms respectively, in several authentic types, by Trowbridge & Ackerman, for the Curtis Companies.

Curtis Details. Booklet, 5½ x 20½ in. 20 pp. Illustrated. Work details of all items of Curtis woodwork, for the use of architects.

Hartmann-Standlee Company, 2515 Elston Ave., Chicago, Ill.

Column Catalog, 7½ x 50 ins. 48 pp. Illustrated. Contains a complete listing of porgla lattices, garden furniture in wood and cement, garden accessories.

Rodda Lumber and Veneer Co., Marshallfield, Wis.

Rodda Doors. Brochure, 24 pp., 9½ x 11¼ in. Illustrated price list of doors for various types of buildings.

Rodda Doors, Catalog G. Booklet, 182 pp., 9½ x 11 ins. Completely covers the subjects of doors for interior use.

Rodda Doors for Hospitals. Brochure, 15 pp., 8½ x 11 in. Illustrated work on hospital doors.


MORTAR COLORS

Clinton Metallic Paint Co., Clinton, N. Y.

Clinton Mortar Colors. Folder, 8½ x 11 ins. 4 pp. Illustrated. Gives full information concerning Clinton Mortar Colors with specific instructions for using them.

Color Card. 9½ x 6¼ in. Illustrates in color the ten shades in which Clinton Mortar Colors are manufactured.

Somerset, A line of track and hangers for every style of siding, parallel, accordian and flush door partitions.

OFFICE SUPPLIES

Eugene Ditzen Co., 166 W. Monroe St., Chicago. Catalog 21, 6 x 9 in. 51 ins. Illustrated. Complete line of drafting and surveying supplies.


Omalid. Booklet, 16 pp. 4 x 9½ ins. Illustrated. Data on a positive reproduction paper.

ORNAMENTAL PLASTER


Architectural and Decorative Ornaments, Cloth bound volume. 183 plates. 9 x 12 ins. 18 plates. Price, $3.00. A complete catalog of fine plaster ornaments.

Geometrical ceilings. Booklet, 23 plates. 7 x 9 ins. An impressive introduction.

PAINTS, STAINS, VARNISHES AND WOOD FINISHES


Cabot's Creosote Stains. Booklet. 4 x 8½ in. 16 pp. Illustrated.

National Lead Company, 113 Broadway, New York, N. Y.

Handy Book on Painting. Book, 59½ x 3½ in. 100 pp. Gives directions and formulas for painting various surfaces of wood, plastic, metals, etc., both interior and exterior.


Came Lead. Booklet. 8½ x 6 in. 12 pp. Illustrated. Describes various styles of lead came.

Zapon Co., The. 247 Park Ave, New York City.


PAPER

A. P. W. Paper Co., Albany, N. Y.

"Here's a Towel Built for Its Job." Folder, 8 pp., 4 x 9 in. Deals with "Chilowin" paper towels.

PARTITIONS

Circle A Products Corporations, New Castle, Ind.

Circle A Partitions Sectional and Movable. Brochure. Illustrated. 8½ x 11¼ in. 32 pp. Full data regarding an important line of partitions, along with Erection Instructions for partitions of three different types.

Hartman-Rese Company, E. F., Cleveland, Ohio.

Hollow Steel Standard Partitions. Various folders, 8½ x 11 in. Illustrated. Give full data on different types of steel partitions, together with details, elevations and specifications.

Improved Office Partition Company, 23 Grand St., Elmhurst, L. I.

Telesco Partition. Catalog. 8¼ x 11 in. 34 pp. Illustrated. Shows typical offices laid out with Telesco partitions, cuts of three important lines of partitions in various woods. Gives specifications and cuts of buildings using Telesco.

Detailed Instructions for erecting Telesco Partitions. Booklet. 24 pp., 8½ x 11 in. Illustrated. Contains instructions, with cuts and drawings, showing how easily Telesco Partition can be erected.


Partitions. Booklet. 7 x 10 in. 32 pp. Illustrated. Describes and illustrates various types of partitions for inner partitions.

PIPE

American Brass Company, Waterbury, Conn.

National Products are dependable—all time-tested, proved, in every type of building throughout the nation. National delivers satisfaction that springs from demonstrated quality.

Your every heating need can be filled, for National offers the finest products of six old-established companies. A line diversified in nature, and backed by one united responsibility. You will find this responsibility behind every phase of National Service, every piece of equipment that bears the name, “National Product.”

National Radiator Corporation

Ten Plants devoted to National Service through these Branch Offices and Warehouses:

Baltimore, Md.—2622 Frisky Street
Buffalo, N. Y.—McKinley Bldg., Delaware, Ave.
Chicago, Ill.—246 N. Keeler Avenue
Cleveland, Ohio—905 E. 63rd Street
Cincinnati, Ohio—Spring Grove & Elmira Avenue
Indianapolis, Ind.—411 W. Georgia Street
Johnstown, Pa.—221 Central Ave.
Louisville, Ky.—1126 W. Breckenridge St.
Milwaukee, Wis.—124-130 Jefferson St.
New York, N. Y.—55 W. 42nd St.
Omaha, Neb.—308-312 S. Tenth St.
Philadelphia, Pa.—121 N. Broad St.
Pittsburgh, Pa.—1359 Avott Building
Richmond, Va.—302 Norfolk St.
St. Louis, Mo.—402 Central Industrial St.
Washington, D. C.—200 Fifth St., N. E.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 184

PLUMBING EQUIPMENT

Central Foundry Co., 442 Franklin St., Kewanee, III.
Catalog No. 2. Corrosion of Hot Water Pipe. 8% x 11 in. 24 pp. Illustrated. Shows complete descriptions, with all necessary data, on Standard Service, circulating, house, boiler feed and fire pumps.

Eljer Company, Dayton, Ohio
Complete Catalog, 3% x 4% in. 104 pp. Illustrated. Describes fully the complete Eljer line of standardized vitreous china plumbing fixtures, with diagrams, weights and measurements.

Empire Brass Mfg. Co., 1200 W. Harrison St., Chicago, 111.
Catalog "M." 9% x 12 in. 184 pp. Illustrated. Shows complete line of plumbing fixtures for Schools, Railroads and Industrial Plants.

Crane Company, 836 S. Michigan Ave., Chicago, Ill.
Plumbing Suggestions for Home Builders. Catalog, 3 x 6 in. 80 pp. Illustrated.

Duriron Company, 104 So. Michigan Ave., Chicago, Ill.
Catalog of Acid, Alkali and Rust-Proof Drain Pipe and Fittings. Booklet, 8% x 11 in., illustrated. Important data on a valuable line of pipe.

Pumps

Chicago Pump Company, 2300 Wolfram St., Chicago, Ill.
The Use of Pump in Use. Portfolio, containing handy data. Individual bulletins, 85% x 11 in., on sludge, sewage, condensate, boiler feed and fire pumps.

Kewanee Private Utilities Co., 442 Franklin St., Kewanee, Ill.
Building Code Data. 7% x 10% in. Illustrated. Catalog contains detailed descriptions, with all necessary data, on Standard Service Pumps, Indian Brand Pneumatic Tools, and Complete Water Systems. Supplied by Kewanee Private Utilities Co.

The Trane Co., LaCrosse, Wis.
Trane Brochure. 1 x 9 in. 16 pp. Complete data on an important type of pump.

REFRIGERATION

The Fulton Sylphon Company, Knoxville, Tenn.
Temperature Control of Refrigeration Systems. Booklet, 8% x 11 in. 24 pp. Illustrated. Deals with cold storage, chilling of water, etc.

Lollard Refrigerator Company, Kingston, N. Y.
Kwik-Kool System. Catalog. 13% x 11 in. 24 pp. Illustrated. Deals with the complete Eljer line of standardized vitreous china plumbing fixtures with brief history of Sanitary Pottery.

PLASTER


Interior Walls Everlasting. Brochure, 20 pp., 9% x 9% in. Illustrates wide range of plastering from origin of Keene's Cement and views of buildings in which it is used.

PLASTERING EQUIPMENT

Central Foundry Co., Graybar Building, New York, N. Y. Bulletin E. Bulletin. 7% x 11 in. 8% x 11 in. 24 pp. Illustrated. Describes various causes of corrosion, and details are given of the deactivating and reactivating systems for eliminating or retarding corrosion in hot water supply lines.

National Tube Co., Frick Building, Pittsburgh, Pa.
"National" Bulletin No. 3. The Protection of Pipe Against Internal Corrosion. 8% x 11 in. 20 pp. Illustrated. Discusses various causes of corrosion, and details are given of the deactivating and reactivating systems for eliminating or retarding corrosion in hot water supply lines.

"National" Bulletin No. 2. Corrosion of Hot Water Pipe. 8% x 11 in. 20 pp. Illustrated. Describes various causes of corrosion, and details are given of the deactivating and reactivating systems for eliminating or retarding corrosion in hot water supply lines.

"National" Bulletin No. 1. Protection of Pipe Against External Corrosion. 8% x 11 in. 20 pp. Illustrated. Describes various causes of corrosion, and details are given of the deactivating and reactivating systems for eliminating or retarding corrosion in hot water supply lines.

Referee Corporation, 21 East 40th St., New York.
Bulletin E. Bulletin. 7% x 11 in. 8% x 11 in. 24 pp. Illustrated. Discusses the need for modern mid-city parking garages, and describes the J-Hummy Motoramp system of design, on the basis of its superior space economy and features of operating convenience. Gives cost analyses of garages of different sizes, and calculates probable earnings.


ROOFING


The Barrett Company, 43 Rector St., New York City.
Architects' and Engineers' Built-up Roofing Reference Series; Volume I. Roof Drainage System. Brochure. pp. 85% x 114% in. Illustrated. Deals with a new type of V-r expanded metal.

Heath Roofing Tile Co., 3025 West Third Avenue, Denver.
Plywood-Shingle Tile with Sprocket Hips. Leaflet, 8% x 11 in. Illustrated. Shows use of English shingle tile with special hips. Italian Promenade Floor Tile. Folder, 2 pp., 8% x 11 in. Illustrated. Floor tiling adapted from that of Daznasser Castle. Mission Tile. Leaflet, 8% x 11 in. Illustrated. Tile such as are used in Italy and southern California.

Georgei Laminated Roofing, Inc., 8% x 11 in. Illustrated. Tiling as used on the San Diego Electric Railway.;

Ludwici-Colored Company, 104 So. Michigan Ave., Chicago, Ill.
"Ancient" Tapered Mission Tiles, hand-made with full colors and designed to be applied with irregular exposures.

Structural Gypsum Company, Linden, N. J.
Relative Effectiveness of Various Types of Roofing Construction in Preventing Condensation on the Inside Surface. Folder, 4 pp. 8% x 11 in. Important data on the subject.

Graystone Pre-Fireproof Roofing. Folder, 48 pp., 8% x 11 in. Illustrated. Informs about roofing according to the "New" Gypsum System of roofing.

U. S. Gypsum Co., Chicago.
Porcelain Roof Construction. Booklet. 8% x 11 in. 48 pp. Illustrated. Great value on the use of tile in roof construction.

Shettler-Pre-Fireproof Roof Construction. Folder, 8% x 11 in. Illustrated. Covers use of roof surfacing which is poured in place.

SEWAGE DISPOSAL

Kewanee Private Utilities Co., 442 Franklin St., Kewanee, Ill.
Specifications Sheets. 7% x 10% in. 40 pp. Illustrated. Detailed drawings and specifications covering water supply and sewage disposal systems.

SASH CHAIN

Smith & Egge Mfg. Co., The, Bridgeport, Conn.
Chain Catalog. 6% x 11 in. 24 pp. Illustrated. Covers complete line of chain.

SEWAGE DISPOSAL

Kewanee Private Utilities Co., 442 Franklin St., Kewanee, Ill.
Specifications Sheets. 7% x 10% in. 40 pp. Illustrated. Detailed drawings and specifications covering water supply and sewage disposal systems.
Seat and Hinge Now One
Unbreakable, Solidified Unit!
An Exclusive Whale-bone-ite Feature

The makers of the Whale-bone-ite Seat have perfected a new hinge which brings a new standard of sanitation, strength and beauty to this finest of closet seats. This Whale-bone-ite Hinge brings strength to the weakest part of a closet seat—where seat and hinge are joined together. It makes both the seat and hinge one unbreakable solidified unit, impervious to moisture, absolutely non-corrosive. And because the surface is of Whale-bone-ite, this hinge will keep its highly polished surface under the most severe conditions of use.

Any model of closed or open back Whale-bone-ite Seats may now be obtained with this new hinge. Guaranteed for the life of the building. This new Whale-bone-ite feature makes this seat more than ever the logical choice where long life and unfailing service are desired.

WHALE-BONE-ITE TOILET SEAT

THE BRUNSWICK-BALKE-COLLENDER COMPANY, CHICAGO

For a free cross-section of a Whale-bone-ite Seat, address Dept. 211 Seat Division, The Brunswick-Balke-Collender Co., 623 South Wabash Ave., Chicago
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 186

SCREENS

American Wire Screen Co, New York, N. Y. Specialties, Catalog, 40 pp., 8% x 11 in. Contains details of wire screens.


When Cleveland's City Hall was re-roofed...

A four-PLY Carey Built-up Roof now protects Cleveland's stately municipal building. A weather-tight, trouble-free roof that can be depended upon for many years of faithful service.

The Carey reputation for roofing dependability in Cleveland must be a good one, for so many great structures in Ohio's metropolis are Carey-roofed.

And what is true of Cleveland is true of the great cities from coast to coast. Leading architects and engineers everywhere know that Carey roofing can be depended upon absolutely for lasting protection. They know that only the finest of long-fibred felts, Carey-made—only the best grade of asphalts, especially refined and blended at the Carey plant—go into a Carey Built-up Roof. They know, too, Carey roofs have been tested and approved under the most rigorous of conditions.

May we send you full particulars? Write.

The Philip Carey Company
Lockland, Cincinnati, Ohio

Carey
BUILT UP ROOFS
"A ROOF FOR EVERY BUILDING"
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 188

WATERPROOFING—Continued

Toch Brothers, 130 East 46th St., New York City. Specifications for Dampproofing, Waterproofing, Enameling and Technical Painting. Complete and authoritative directions for use of an important line of materials.

The Vortex Mfg. Co., 1975 West 77th St., Cleveland, Ohio. Par-Lock Specification "Form D" for waterproofing surfaces to be finished with Portland cement or tile. Par-Lock Specification "Forms E and G" membrane waterproofing of basements, tunnels, swimming pools, tanks to resist hydrostatic pressure. Par-Lock Method of Bonding Plastic to Structural Surfaces. Folder, 6 pp., 8 1/2 x 11 ins. Illustrated. Data on combinations of gun-applied asphalt and cotton or felt membrane, built up to suit requirements.

WATERPROOFING


The Only Weatherstrip with a Cloth to Metal Contact. Booklet. 6 x 9 in. 21 pp. Illustrated. Data on an important type of weather stripping.


WINDOWS


WINDOWS, CASEM ENT

Crittall Casement Window Co., 10591 Hearn Ave., Detroit, Mich. Catalog No. 22. 9 x 12 in. 36 pp. Illustrated. Photographs of actual work accompanied by scale details for casements and composite steel windows for banks, office buildings, hospitals and residences.
STURDINESS

DELICATE, easily disabled mechanisms have no place in any system of interior telephony. To fulfill its purpose, the equipment must be dependable under any circumstances that may arise.

That Strowger P-A-X has stood the test of time and use, functioning under circumstances which might well be expected to disable any electrical equipment testifies to the sound engineering principles and superior materials that characterize all Strowger products.

But what is more important is the absolute dependability of P-A-X to save time and money in your business. Will you let one of our engineers make a survey at no cost to you and furnish full details.

S T R O W G E R  A U T O M A T I C
Communication, Control and Signalling Systems


Engineered, Designed and Manufactured by

Automatic Electric Inc.
Factory and General Offices: 1005 West Van Buren St., Chicago, U. S. A.

Los Angeles, Calif.  Cleveland, Ohio  Minneapolis, Minn.
Bostom, Mass.  St. Louis, Mo.
Seattle, Wash.
DOVETAIL

These beautiful buildings, built side by side on Wacker Drive and Wells Street, designed by different architects and built by different contractors—both specifying and using Dovetail Anchor Slot—prove that leading architects and contractors recognize the superior value of the Dovetail System of Masonry Anchorage.

Complete Technical Illustrated Data Designed for Your File on Request

The Dovetail Anchor Slot Company
Not Incorporated
660 Builders Bldg. Chicago, Ill.

PHONE FRANKLIN 4416
BRANCH OFFICES IN PRINCIPAL CITIES

D. B. Burnham & Co.—Architects
Paterson Branch—Engineers

SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 190

WINDOWS, CASEMENT—Continued

Genfire Steel Company, Youngstown, Ohio.
Architectural Details, Casement Windows and Doors. 8½ x 11 ins. 28 pp. A. I. A. File No. 16E. Specifications and construction details.
Hope & Sons, Henry, 103 Park Ave., New York, N. Y.
The Kawneer Company, Niles, Mich.
David Lupton’s Sons Company, Philadelphia, Pa.
Lupton Casement of Copper-Steel. Catalog C-122. Booklet 16 pp. 8½ x 11 in. Illustrated brochure on casements, particularly for residences.
Lupton Heavy Casements. Detail Sheet No. 101, 4 pp., 8½ x 11 ins. Details and specifications only.
Lupton Casement of Copper-Steel. Catalog C-122. Booklet 16 pp. 8½ x 11 in. Illustrated brochure on casements, particularly for residences.
Casement Window Hardware. Booklet, 24 pp. 8½ x 11 in. Illustrated. Shows typical installations, detail drawings, construction details, blue-prints if desired. Describes All-way Multifold Window Hardware.
Architectural Details. Booklet, 8½ x 11 in. 16 pp. Tables of specifications and typical details of different types of construction.
List of Parts for Assembly. Booklet, 8½ x 11 ins., 16 pp. Full lists of parts for different units.
Truscon Steel Co., Youngstown, Ohio.
Architectural Details. Booklet, 8½ x 11 ins. 16 pp. Tables of specifications and typical details of different types of construction.
List of Parts for Assembly. Booklet, 8½ x 11 ins. 16 pp. Full lists of parts for different units.
Truscon Steel Co., Youngstown, Ohio.
David Lupton’s Sons Company, Philadelphia, Pa.
A Rain-shed and Ventilator of Glass and Steel. Pamphlet, 4 pp. 8½ x 11 in. Deals with Pond Continuous Sash, Sawtooth Roof, etc.
Truscon Steel Co., Youngstown, Ohio.
Drafting Room Standards. Book, 8½ x 11 in., 120 pages of mechanical drawings showing drafting room standards, specifications and construction details of Truscon Steel Windows, Steel Lintels, Steel Doors and Mechanical Operators.

WINDOWS, STEEL AND BRONZE—Continued


WOOD—See also Millwork

American Walnut. Booklet, 7 x 9 in. 41 pp. Illustrated. A very useful and interesting little book on the use of Walnut in Fine Furniture with illustrations of pieces by the most notable furniture makers from the time of the Renaissance down to the present.
“American Walnut for Interior Woodwork and Paneling.” 7 x 9 in. pages, illustrated. Discusses interior woodwork, giving costs, specifications of a specimen room, the different figures in Walnut wood, Walnut floors, finishes, comparative tests of physical properties and the advantages of American Walnut for woodwork.

Curtis Companies Service Bureau, Clinton, Iowa.
Better Built Homes. Vols. XV-XVIII, incl. Booklet, 9 x 12 in. 40 pp. Illustrated. Designs for houses of five to eight rooms, respectively, in several authentic types, by Trowbridge & Ackerman, architects, for the Curtis Companies.

Low-Bell Lumber Co., Kansas City, Mo.
The Perfect Floor. Booklet 54½ x 7½ in. 16 pp. Illustrated. Valuable for the data given on the use of wood for floors.


Experience in Home Building. Booklet 6 x 9 in. 16 pp. Records the testimony of a number of builders and contractors as to the value of certain materials.


West Coast Lumber Trade Extension Bureau, Seattle, Wash.
“Durable Douglas Fir: America’s Permanent Lumber Supply.” Booklet, 32 pp., 7 x 11 ins. Illustrated. Complete data on this valuable wood.


“Where to Use Douglas Fir in Your Farm.” Brochure, 32 pp., 6 x 9 ins. Data on use of this wood for farm buildings.
Panelboards for every purpose

When you specify panelboards—

Specify Westinghouse because Westinghouse offers—

A complete line—There is a Westinghouse panelboard for every application, from cottage to skyscraper.

Engineering service—Westinghouse panelboard engineers are available to help you solve the problems that may arise in laying out panelboard installations. These engineers are as near as the nearest Westinghouse district office.

Immediate deliveries—Large stocks of Westinghouse panelboards are available at many advantageously located warehouses.

A quality product—Westinghouse panelboards embody unit section construction, indicating trim clamps, adjustable corner irons, and other features that permit rapid installation and assure long life under severe conditions.

Use Westinghouse panelboards on your next job. You will find them time and trouble savers.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States and Foreign Countries
Fire chiefs agree that the sure preventive of chimney fires is fire clay flue lining

CLAY PRODUCTS ASSOCIATION
CONWAY BUILDING
Chicago

You Will Like
these 11 big features

in the New Heavy Duty Line of
BENJAMIN-STARRETT
Panelboards and Steel Cabinets
for Light and Power

1 Heavy Gauge—One-Piece Steel Panel Back on which are mounted Standardized Unit Bases.
2 Panels are provided with adjustable Mounting Studs so that Panel Adjustment may be made both in and out and laterally in box.
3 All Fuse Receptacles are individual and are easily removed from front.
4 Switches removable individually from front without removing trim.
5 Underwriters Approved 30 ampere 250 volt Heavy Duty Tumbler Switches in both single pole and double pole.
6 Fuse Receptacles have slot at side which permits testing of fuse without removing fuse.
7 All Metal Panel Parts are Rust-proofed.
8 Full Four-Inch Gutter Space on all Four Sides of Panel.
9 Switch Cover Plates Removable Individually from the front.
10 Unit Composition Base for all types of Branch Switches assures interchangeability of parts.
11 Boxes shipped from stock for immediate installation. Unit section assembly assures prompt delivery of panelboard.

Send for our new 80-page catalog, free.
Ask for Catalog SF-5.

Benjamin Electric Mfg. Co.
New York
247 W. 17th St.
Chicago
120-128 S. Sangamon St.
San Francisco
448 Bryant St.
Manufactured in Canada by the Benjamin Electric Mfg. Co.
of Canada Ltd., Toronto, Ontario.
No back-talk for 20 years at least!

Y that we mean: A roof that can be forgotten—a roof so free from trouble that the building owner never has to give it a thought!

When a Barrett Specification Roof is laid, a Surety Bond is issued guaranteeing the building owner against air or maintenance expense for the next twenty years—until 1948. And 20 years is not the whole story by any means. Many American business buildings of the 70's, 80's and 90's are still protected by their original roofs of Barrett Coal-tar Pitch Felt. And what is more, these old roofs are in first-class condition after 40 and even 50 years of service.

When a Barrett Specification Roof is laid all work must be done by an experienced roofer who is approved by the Barrett Company—a Barrett Inspector supervising each step of the job.

Directly after the roof is down the Barrett Inspector makes the famous "cut test." And not until this test is made does his O.K. release the Surety Bond.

Two years after the roof is finished the Barrett Inspector again checks up—makes a thorough re-examination of the roof.

Little wonder that Barrett Specification Roofs give dependable service many years after the 20-year guarantee has expired.

* The Barrett Company also offers a Specification Type "A" Roof which is bonded for 10 years. This type of roof is adaptable to a certain class of buildings. The same high-grade materials are used, the only difference being in the quantities applied.

Depend on the Barrett Approved Roofer

Throughout the United States and Canada a limited number of roofing contractors have been approved by Barrett to lay the Barrett Specification Bonded Roof. These men have earned a reputation for doing efficient work—a name for absolute dependability.

Good workmanship is a big part of any good roof. Good workmanship is a certainty when you provide for a Barrett Specification Roof.

THE BARRETT COMPANY
40 Rector Street, New York City

IN CANADA:
The Barrett Company, Limited
551 St. Hubert Street, Montreal, Quebec
something better than a pointed peg to rest your building on—

Mac ARTHUR
Compressed Concrete PILES

Even assisted by his cane, Peter Stuyvesant found his tapered peg-leg sank into the ground.

The MacArthur Method of compressing the concrete under seven tons pressure eliminates tapered pile weaknesses.

If necessary a pedestal can be formed at the base of the pile—but remember the standard MacArthur Pile is of uniform diameter its full length.

Uncertain soils don't bother us for we have a special pile for every condition.

Mac ARTHUR CONCRETE PILE CORPORATION
19 West 44th Street, New York

SEDGWICK DUMB WAITERS and ELEVATORS
For All Purposes

Thirty-six years of specialization in the design, manufacture and installation of Hand Power Dumb Waiter and Elevator Outfits have given us a wealth of information which may be of value to you when preparing plans.

Recommendations gladly furnished on request.

SEDGWICK MACHINE WORKS
151 West 15th Street, New York
Manufacturers of "The Invalid Elevator"
OTIS ELEVATORS
FOR
AIRPLANES
ARE PROVIDED IN
THE MAGNIFICENT NEW AIRPLANE CARRIERS
U. S. S. LEXINGTON and U. S. S. SARATOGA

Otis Engineers co-operated with the Navy Department in designing this installation and solving the intricate problems involved in this most important part of the equipment of these ships. The outcome of a naval battle may conceivably rest upon the absolute reliability and constant operation of these Otis Elevators.
Modern plaster is reinforced—just like concrete!

The same principle used in reinforcing concrete is now applied to plaster. STEELTEX has been successfully used in over 110,000 installations. Besides guarding plaster with fabricated steel (rust-proofed and completely embedded) STEELTEX insulates, damp-proofs, and deadens sound—thanks to the heavy specially processed backing.

Even more—the entire job is automatically "back-plastered." STEELTEX is welded steel mesh locked to a waterproof backing. The steel strengthens the plaster—the backing seals it. Each room is bound by a network of galvanized steel, embedded in the plaster.

Send the coupon for a copy of our booklet, "Better Walls for Better Homes." It is free.
BATES-TRUSS JOISTS
Throughout the Country!

Behind the development of the Bates-Truss Joist is years of experience in the manufacture of expanded, one-piece, structural steel sections. There is nothing experimental in the expanded structural beam. Railways and Utilities in all parts of the world are users of Bates-Truss sections. Below is pictured a part of the twenty-seven mile Chicago, North Shore & Milwaukee Electrification system—a splendid example of the use of Bates-Truss one-piece expanded beams in a most exacting service. We suggest that you write us if you are not already familiar with the details of the Bates-Truss Joist.

BATES EXPANDED STEEL TRUSS CO.
EAST CHICAGO, IND.
ORANGE SCREENS

Orange ALUMINUM FRAME Screens

Orange Aluminum Frame Screens do not mar the architectural beauty of any building. They retreat modestly into the picture and are absorbed by the bolder lines around the windows . . . . For inside use, Orange Screens are strong and practical. The sturdy aluminum frame is light in weight and can be finished to match interior trim.

Advantages of Aluminum Frames:

Aluminum has many recognized advantages. Light and strong, it has replaced heavier metals in many industries. From industry to the home, it was just a step, for capital, with unlimited resources for experiment, long has led the way for improvement in home building.

The alloy used in the manufacture of Orange Aluminum Screens was developed for our use by the Aluminum Company of America, and is exclusive with the Orange Screen Company.

It is one of the strongest non-ferrous alloys; light, with great tensile strength, extreme elasticity, and rigidity that makes it unsurpassed for metal screen frame construction. Orange Aluminum Screens will not rust, corrode or oxidize. Aluminum forms no colored salts and therefore will not discolor or stain draperies or other materials that may come into contact with it.

These screens are of close grain structure with natural smooth finish that permits engaging parts to slide freely. The surface is excellent for lacquer, enamel, or any finish desired.

The metal is formed in long bars by a process known as extrusion, which gives strength equal to steel or bronze with only one-third their weight.

The corners are carefully mitered and welded to form a solid, seamless frame. The wire cloth is held securely in place by an extruded aluminum bar forced into a channel on the back of the frame and locked in by friction.

This improved construction eliminates unsightly ridges, irregular corners, and uneven or corrugated surfaces that would mar the beauty of the frame.

Orange Aluminum Screens combine the desirable qualities of Beauty and Durability at a price in keeping with their value.

Service and Dependability

Write to our Maplewood, N. J. office for information or estimates and we shall instruct our nearest branch office to take care of your inquiry.

Orange Aluminum Frame Screens are manufactured and sold on a guarantee by the Orange Screen Company, a company which is backed by financial responsibility and 18 years of manufacturing experience.
A Famous Builder Chooses

The Lutton V-BAR Greenhouse

ONE of the many experienced builders who have chosen the Lutton V-Bar Greenhouses for their private use is Dr. Charles V. Paterno of New York.

At his magnificent home on upper Riverside Drive, Dr. Paterno has built a range of Lutton V-Bar greenhouses, which includes 28 growing houses, a large conservatory and a service building with swimming pool and gymnasium below.

The choice of Lutton V-Bar construction by such an expert speaks for the superior design, construction and economy of our greenhouses. While no work is too large for us, neither is any too small. Consult us on any greenhouse problem.

Notice the difference in the shadow cast by the Lutton Steel V-Bar (left) in comparison with the ordinary wooden bar (right). The Lutton V-Bar, though three times as strong as the wooden bar, casts far less shadow, and gives a pleasant impression of airy lightness.

KEY FOR RANGE

1. Breakfast Room
2. Passage
3. Conservatory
4. Billiard Room
5. Orchid House
6. Gardenia House
7. Carnation House
8. Rose House
9. Potting Room
10. Leanto
11. Propagating House
12. Propagating House
13. Propagating House
14. Potted Fruit Compartment
15. Potted Fruit Compartment
16. Potted Fruit Compartment
17. Bulb and Ornamental Plants
18. Lilies, Cut Flowers and Ornamen tal Plants
19. Carnation House
20. Rose House
21. Propagating House
22. Sweet Pea House
23. Chrysanthemum House
24. Propagating House
25. Late Grapery
26. Early Grapery
27. Conifer House
28. Palm and Fern House
29. Boiler House

WM. H. LUTTON Company
266 Kearney Ave., Jersey City, N.J.
Residence models as low as $95, and the masonry adds but little more when regular chimney is used.

One Word from You Prevents This!

HOW often have you seen proud owners of new homes enthusiastically satisfied but for one thing? Garbage and drudgery was not thought of in time! How the new owners would have welcomed the suggestion of a Kernerator! In the rush of other matters, they simply overlooked it. And how disappointed they are later when they find that the Kernerator must be built in — it cannot be installed after the building is completed.

Suggest the Kernerator in plenty of time. It will be another step toward assuring satisfied clients.

No Upkeep Cost — No Fuel Required

All waste—not only garbage but sweepings, tin cans, broken glass and crockery, paper and the like —dropped through the handy hopper doors, falls to the brick combustion chamber, where an occasional lighting is all that’s needed. No gas, oil, wood, coke or any fuel required. Metallic objects (tin cans and the like) are flame-sterilized for removal with the ashes.

See Sweet’s, write for Kernerator catalog in ready-to-use A. L. A. Folder 33141 or phone your local Kernerator representative. Offices in 89 cities.

KERNER INCINERATOR CO.
715 East Water St., Milwaukee, Wis.

Make fine lines in Color

JUST the pencils you need for marking blueprints, sketching, retouching, checking, figuring, underscoring, etc.

UNIQUE THIN LEAD COLORED PENCILS have the best and most usable thinnest lead of utmost strength and durability.

Can be sharpened in a pencil sharpener and easily erased. The 12 colors are ideal as symbols for executives.

Blue Purple Pink
Red Brown Lt. Blue
Green Orange Lt. Green
White Yellow Maroon

As at dealers or write direct American Pencil Co., 229 Fifth Ave., N.Y.

KERNERATOR
THE CHIMNEY- FED INCINERATOR
"Garbage and Waste Disposal without Leaving the Kitchen"
A GREAT new apartment hotel—the Lombardy—erected in the heart of New York’s most exclusive residential section—22 stories of Italian Renaissance beauty—every detail of construction and equipment the finest. Electrolux put in each apartment after exhaustive tests by the architects.

Small wonder, when one considers the advantages of this marvelous new invention. A refrigerator without moving parts ... absolutely silent ... that never wears out ... that requires no attention. And, best of all, costs much less to operate. Instead of mechanical compression, a tiny gas flame causes a physical change that produces a steady cold. And it is absolutely safe. If the flame goes out, the gas stops automatically.

Electrolux is not merely an improved mechanical refrigerator. It is entirely different. It goes far beyond old methods of refrigeration. The features that appeal to the architect and builder attract the tenant as strongly. Apartments equipped with Electrolux are much easier to rent.

The wide range of Electrolux sizes are all available in four color harmonies as well as white. These color finishes ... Biscay Blue ... Silver Grey ... Ivory Tan ... Crystal Green ... can blend nicely with your decorative scheme.

We shall be glad to send you detailed specifications. Please write: Servel Sales, Inc., Evansville, Indiana.


The Kitchenette
Model Electrolux
Four cubic feet storage capacity. Excellent for smaller families. Other models are the Hostess ... the Chef ... the Mansion, with 5, 7 and 10 cubic feet capacity. Also the Double Duty, with 5 cubic feet storage capacity. This model is table-top height and makes the base for a gas range or can be used as a table. An excellent space-saver. All boxes are constructed of steel and Armco Ingot Iron ... Vitreous porcelain seamless lining ... Extra-thick cork board insulation.

In the oval is pictured the completely sealed unit that makes cold from heat. This is entirely hidden from sight—nothing on top or outside the cabinet.

ELECTROLUX REFRIGERATOR
MADE BY SERVEL
Par-Lock Protects the House of Studies

The new House of Studies at Weston, Mass., is a noteworthy addition to the educational architecture of America and the use of Par-Lock in this stately structure is an endorsement of the highest authenticity.

Par-Lock Specifications A and B were used on columns, beams and ceilings throughout. Par-Lock Specification I was used on all exterior walls that were furred.

The architects are Maginnis & Walsh, Boston; the general contractors, J. P. Keating of Boston and the plastering contractors, Nicholson, Ferris and Sheehy of Boston. The Par-Lock Appliers of Boston, Inc., applied the Par-Lock as described.

There is a Par-Lock Applier ready to help you with your problems of damp-proofing and plaster key.

The Vortex Manufacturing Company

1984 West 77th Street
Cleveland, Ohio

Par-Lock Appliers

NEW YORK CITY, 50 Church Street
PHILADELPHIA, 1700 Walnut Street
PITTSBURGH, 207 Fulton Building
SCRANTON, PENNA.
Cedar Avenue
ST. LOUIS, 906 Chemical Building
TORONTO, 2250a Bloor Street, West
TRENTON, 319 Broad St., Bank Bldg.
YONKERTOWN, 903 City Bank Building
WILKES-BARRE, PA. 904 Second Nat'l Bank Building

PAR-LOCK CORK INSTALLATIONS
United Cork Companies, Lyndhurst, N. J.

Par-Lock Cork

Concrete or other masonry

Plus gun-driven asphalt coats

Plus an imbedded coating of grit

Makes the Par-Lock base.

Ideal for plastering 28.
All over the world—Europe, Asia, Australia, Africa and South America, York refrigeration is being profitably used. One of the most interesting European installations is that at Selfridges, prominent London department store. Here, the York carbon dioxide system of refrigeration is used to maintain low, dry temperatures for the fur storage vaults.

The two great detrimental factors in the life of fine furs—the ravages of the moth and the summer heat which destroys a fur's lustre, are absolutely and entirely overcome in this York equipped freezing chamber.

To architects and builders contemplating the subject of fur storage facilities, the York engineering department offers a definite service. Plans, specifications, costs, etc. will be furnished without obligation and the benefit of nearly fifty years experience in the commercial and industrial refrigeration field provides an authoritative background invaluable to the prospective client. Let us assist you on any application of mechanical refrigeration.

York Ice Machinery Corporation
York, Pa.

Without obligation please fully describe your service to architects contemplating the application of modern centrally located refrigerating systems.

Name
Address
WHERE MONEL METAL SHINE


F. W. WOOLWORTH BLDG. NEW HAVEN, CONN.
DUMB-WAITERS THAT STAY SPIC-AND-SPAN THROUGHOUT THE BUSIEST HOURS

NO one buys more shrewdly than the big chains. When they plan new stores, they plan for the most economical operation commensurate with satisfactory and efficient service.

In planning their new building at New Haven, F. W. Woolworth weighed the need for dumb-waiters that would be sanitary, attractive, clean, long-wearing, and consequently, economical. With such properties required, their logical choice was Monel Metal...Monel Metal has all the advantages already mentioned, and of equal importance, it has no coating to wear off.

The use of this platinum-like metal is spreading by leaps and bounds. In the finest of the new hotels, restaurants, and soda fountains, Monel Metal equipment occupies a prominent place. Because of Monel Metal's rare combination of essential properties, when you specify Monel Metal, you are assured of your client's enthusiastic acceptance and satisfaction.

SEND FOR SPECIAL ARCHITECTURAL FOLDERS

Monel Metal is a technically controlled Nickel-Copper alloy of high nickel content. It is rolled, swaged, refined, reduced and marketed solely by The International Nickel Company. The name “Monel Metal” is a registered trade-mark.

THE INTERNATIONAL NICKEL COMPANY (INC.) 67 WALL STREET, NEW YORK, N.
The institutional laundry — a present-day necessity

You probably have observed that, nowadays, practically every modern hotel has its own laundry department. Hospitals, too, as well as clubs and schools. For the officials of all these institutions know the many advantages of having the laundry work done under their own watchful supervision. Dependable service—perfect quality. Economy, too, of course.

The laundry at Leland-Detroit Hotel, Detroit, is an excellent example of the present-day institutional laundry. Like so many other such modern departments, it was designed and equipped in collaboration with the engineers of The American Laundry Machinery Company. These men will be glad to confer with you on problems pertaining to laundry practices—furnish you with first-hand information—show you typical layouts and photographs of specialized equipment. "American" service—yours for the asking.

The American Laundry Machinery Company
Norwood Station, Cincinnati, Ohio

THE CANADIAN LAUNDRY MACHINERY CO., LTD.
4705 Sterling Road, Toronto 3, Ont., Canada

Agents: BRITISH-AMERICAN LAUNDRY MACHINERY CO., LTD.
Underhill St., Camden Town, London, N. W. 1, England
This Architect's book
is an invaluable aid for specifying pure, clean and lowest-cost hot water.

Illustrating the Fourteen Typical Installations of
EXCELSO WATER HEATERS

OF STANDARD A.I.A. file-size and showing the best practices for connecting Excelso Indirect Water Heaters to heating boilers under fourteen different conditions, this book furnishes information every architect will want.

ASK YOUR SECRETARY to write for this informative book — today, lest she forget.

Excelso Products Corporation
DIVISION OF AMERICAN RADIATOR COMPANY
69 Clyde Ave., Buffalo, N. Y.

Sold and Installed by All Plumbing and Heating Contractors

SIZES FOR ONE FAMILY OR ONE HUNDRED FAMILIES

ALL WATER SUPPLIES
In This Great Country
Of WATER CONSUMERS
Are
STEADILY DETERIORATING

Established 1880
B. T. LOOMIS
Originated and Patented
First Mechanical Filter
1880

They Will Never Be Better
EXCEPT? WHY?

Send For Booklet

The Loomis-Manning Filter Distributing Company
1424 South 37th Street, Philadelphia, Pa.

You need this Specification Book

Free This reference book on water supply, electric light and sewage disposal, gives you data and specifications for handling any private utility job from a cottage or bungalow to the largest country hotel, club or estate. It's free—if requested. If it doesn't answer all your problems, Kewanee engineers the country over are at your service. One of them is near you.

Kewanee

“Bungalow Model Jr.”
Water Supply System
Now $103.00

For the average residence this new Kewanee “Bungalow Model” puts in “city water” comforts at a surprisingly low cost. It has the same high Kewanee quality and “Engineered” Excellence as the other 200 Kewanee systems for water supply, electric lighting and sewage disposal, Automatic and requires only occasional oiling. Write for the Architect's Specification Book Today.

Kewanee, Private Utilities Co.
442 S. Franklin Bt.
Kewanee, Ill.
Dealer Correspondence Invited
A poor "finish" on commercial floors is only a costly beginning

The direct and indirect loss to the owner of the floors pictured above is estimated to have been more than $60,000.00. Tenants viewed them and canceled their leases.

Bad floors are no longer "mysterious accidents," or "acts of God." The reasons for failures and deteriorations in floors are now known, as well as how such troubles may be prevented. One important step in preventing floor troubles, as well as in floor economies, is to give the finish coat some sure means of bonding to the underslab.

A clean-stone bond surface is readily obtained on any slab by Top-Surface Con-Tex. To this clean-stone surface an applied topping will bond as though it had been cast integral with the slab.

And on this clean-stone surface, the topping may be laid when you are ready—even months later—with full assurance of bond. And this topping need not be an inch or more in thickness as is old practice. It can be as thin as one half an inch, thereby securing not only an unmarred, perfect finish, but economy as well.

Mechanical roughening, as with rakes, is not sufficient. "There is a reason" and this reason is fully given in our new book on "Bonding Surfaces on Concrete."

It is sent free, but only on application. Write us today for your copy.

CONCRETE SURFACE CORPORATION

342 MADISON AVE.  NEW YORK, N. Y.

THE DAVANZATI PALACE, FLORENCE

A Restored Palace of the XIV Century, Measured and Drawn, Together with Short Descriptive Text, by Louis Conrad Rosenberg

This work is issued to provide for architects, decorators and students a volume of moderate cost on one of the old Florentine palaces, a building which abounds in suggestions readily adapted to present-day work. The Davanzati Palace is one of the most notable of the early Italian palaces and belongs to a period when Italian architecture excelled in simplicity, charm, and all the qualities which lead to its use today.

In this monograph the famous building is illustrated in a most careful manner; half-tone reproductions of original photographs show the exterior and different rooms of the interior, all accompanied by measured drawings and full descriptions.

Measured drawings of bases, columns, capitals, mouldings and corbels; mantels, ceilings, door and window trim, paneled doors and inner blinds or shutters; floors laid in tile or specially modeled Roman brick; wrought iron hinges, bolts, knockers, escutcheons, holders for flag poles or torches, and hooks for wall hangings. Measured drawings for polychrome ornament on plaster walls or wooden coffered ceilings or tabernacle doors, with descriptions of colors used.

Architects interested in the design of any structural detail of an early Italian Renaissance building will find here examples which in vigor and freshness leave nothing to be desired.

70 pp., 10½ x 13½ ins. Bound in cloth. Price $10

ROGERS & MANSON COMPANY

COLONIAL INTERIORS

Photographs and Measured Drawings of the Colonial and Early Federal Periods

By Leigh French, Jr., A. I. A.

Interior woodwork during the Colonial and early Federal periods was exactly what is demanded for "Colonial" interiors today. The character of workmanship in the colonies insured craftsmanship of excellent quality, and this, together with design carefully studied from the simpler contemporary English work, resulted in woodwork which it would be difficult to improve upon. For this reason close study is being made of such old American interiors as still exist, and measured drawings make possible the reproduction today of much of the finest woodwork of the seventeenth or eighteenth century. These forms, while they involve not a little subtlety in the details of design, demand merely the use of simple mechanical processes which are not beyond the skill of any reasonably proficient woodworker, sometimes of an ordinary carpenter.

In this valuable work on the early American periods there are given illustrations from new photographs of interiors of the time, many of which are little known. These illustrations are of rooms of different kinds and of widely different types—the early, somewhat severe type as well as that which was later and more refined and luxurious. Valuable illustrations are supplemented in many instances by invaluable working drawings—details of wall paneling, mantels, over-mantels and fireplace surrounds; door and window trim; china closets; newels, balusters and other details of stairways, and designs for the stenciling of floors, together with notes on the colors originally used. It is a volume which in its practical usefulness will be of great value to architects whose work involves much use of early American interior design.

125 plates, 10 x 15 inches. Price $15

ROGERS & MANSON COMPANY
ON great construction projects everywhere, MEYER Steelforms are saving time, labor and money. In the mammoth structure above—the Hudson Department Store Building, Detroit—more than 1,500,000 feet of MEYER Removable Steelforms will be used.

How about your next job? Call our nearest office for a representative or write for further information. Address 501 North 11th St., Omaha, Nebraska.

CONCRETE ENGINEERING COMPANY
General Offices: OMAHA, NEBRASKA
Sales Offices and Warehouses: Chicago, Detroit, Milwaukee, Minneapolis, Des Moines, Kansas City, St. Louis, Dallas, Houston, San Antonio, Oklahoma City, Los Angeles, Pittsburgh

Other Ceco Products
Meyer Adjustable Shores
Meyer Adjustable Column Clamps
Ceco Reinforcing Bars and Bar Chairs
Ceco Welded and Triangle Fabric
Ceco Column Spirals
Ceco Metal Lath and Hook Hangers
Ceco Hot and Cold Rolled Channels
Ceco Corner, Base Bead and Mouldings
Ceco Metal Weather Strips and Screens
PFAUDLER LAUNDRY CHUTE
IS USED IN MANY OF THE
LARGEST HOSPITALS
AND HOTELS BECAUSE:

1. It is constructed of open hearth steel and lined with genuine glass enamel.

2. It is the most sanitary chute construction—no seams—door throats welded, not riveted.

3. It can be cleaned easily. Provided with water flushing nozzle and also may be sterilized with live steam.

4. It can be used indefinitely without wear—will outlast the building in which it is installed.

5. It is fireproof and corrosion proof.

6. It is the lowest priced chute of its kind on the market.

7. There is only one cost—maintenance costs are unknown.

Specify Pfaudler—there is no equal!

Send for this new Laundry Chute Bulletin No. 696, Fifteen Years of Architectural Advice behind the Pfaudler Laundry Chute. Contains full specifications and data sheets which you may fill out for quotation.

THE PFAUDLER COMPANY
Laundry Chute Division, Rochester, N. Y.

The Significance of the Fine Arts
Published under the direction of the American Institute of Architects

CLASSICAL ARCHITECTURE. By C. Howard Walker.
ARCHITECTURE OF THE MIDDLE AGES. By Ralph Adams Cram.
THE RENAISSANCE. By H. Van Buren Magonigle.
MODERN ARCHITECTURE. By Paul P. Cret.
SCULPTURE. By Lorado Taft.
PAINTING. By Bryson Burroughs.
LANDSCAPE DESIGN. By Frederick Law Olmsted.
CITY PLANNING. By Edward H. Bennett.
THE INDUSTRIAL ARTS. By Huger Elliott.
MUSIC. By Thomas Whitney Surette.

THE Committee on Education of the A. I. A. has produced this volume for use as a textbook in American colleges, and for general reading and study by the public, with the purpose of arousing interest in the fine arts and creating a better understanding and appreciation of them. The book is intended specifically to appeal to those who have heretofore taken but little interest in the arts, and have had no realization of the fact that the fine arts are for them and that these arts are already inseparably connected with their everyday lives.

Each of the chapters has been prepared by a recognized authority on the subject. Written for the laity, the work is free from technical matter and is notable for the clarity of its language and absence of complicated theoretical discussion. It presents in simple form the vital principles of design and construction which not only govern good architecture, but should also influence the character of all other arts and every manufactured product and material thing that human hands can make.

483 pp., 5¼ x 8½ ins. Fully illustrated, bound in cloth

Price $3.50

ROGERS & MANSON COMPANY
383 Madison Avenue, New York
STERLING LIFELONG BLACKBOARD

Guaranteed for the Life of the Building
A. I. A. FILE No. 35-b.-12
FREE—TO ARCHITECTS

Prepared for you by our architects—ready for your files—fifteen pages of plans, elevations, and detailed specifications for the installation of this foremost Blackboard. Guaranteed for the life of the building by a 46-year old institution. Hundreds of thousands of feet of Sterling are giving Sterling performance daily, in better schools throughout America. Black—and black all through. A finer writing surface, and a body that seasons and improves with age. Warp and buckle proof—strictly fireproof. Easy on eyes and nerves—and schoolboard pocketbooks too. If you don’t know all about Sterling Lifelong Blackboard send for free sample and A. I. A. File No. 35-b.-12. Address Department ZS5

Weber Costello Co.
Chicago Heights Illinois.
"Click"... goes the client's mind

When you tell him there's a FUEL-LESS water heater that will give him hot water—plenty—always

Scores of architects have discovered Taco. They've tried it out, found that, in the proper size, it gives a continuous supply of clean hot water, without gas or extra fire. Taco heats the domestic water supply from waste heat of the steam heating plant. And now these men specify a Taco with every steam-heating system.

No building is too large—no bungalow too small for Taco water heating.

Why not assure every client a never-failing supply of hot water at an operating cost that's next to nothing. If you are not already specifying Tacos you will be interested in the Taco story. Especially the facts concerning the Super Taco, the water heater for big jobs. We will gladly give you all the specifying facts and engineering data—show you how to add the finishing touch to heating specifications. A post card brings you the whole interesting story.

TACO HEATERS, Inc.
Successor to Thermal Appliance Co.
342 Madison Avenue New York City
Makers of

TACO

Automatic FUEL-LESS Water Heaters
Less cubic footage that pays Greater
—a Standard Conveyor feature

In all of industry, the necessity of concentrating production operations in the smallest plants possible, is of great consequence. This conservation of cubic footage reacts favorably to production efficiency and to production economy. It saves ultimate capital investment. It decreases operating expense and lowers depreciation over larger plant.

The Automotive industry is symbolic in its manufacturing policies and practices of production efficiency. It is indicative of possible efficiency in all industrial manufacturing units. A highly competitive market with the necessity of continually increasing quality and reducing costs resulted in such a condition.

Engineers and Architects today, in planning buildings, are specialists in figuring space, material handling facilities, lighting and other important factors that enter into manufacturers' production economy.

Where built-in Standard Conveyor Systems were included in the plans, engineers and architects have made possible most successful material handling operations.

Out of the old, man-power, material handling methods have come modern conveying methods. Today, material is kept off of the floor and in motion to its final assembly. Material is not allowed to pile up between departments. Man power and floor space is more efficiently applied and utilized.

Our conveyor counselors will be glad to show you how we have helped design efficient material handling units in the automotive field.
The Most Important Financial Structure in New England

In order that there would never be any question of a dry basement, the contract for waterproofing—with our Cow Bay Waterproof Cement—the most important financial structure in New England, was awarded to us.

*We also waterproofed the Federal Reserve Bank in New York which has five basements—the lowest being 92' 0" below grade.*

*Small work receives the same careful attention as the largest contracts.*

The Waterproofing Company
Engineers and Contractors for Waterproofing

345 East 33rd Street
New York

65 Albany Street
Boston

“In our 23 years of Waterproofing none of our work has had to be done over.”
S. T. Johnson Co. oil burners in the Norma Talmadge Apartments

Covering a range of 250 to 27,800 square feet of steam radiation or its equivalent, Johnson burners, made in five sizes and three types, assure an installation exactly suited to any need.

The S. T. Johnson Co. Burners operate efficiently with lowest grades of commercial fuel. The fully automatic type has five positive safety controls (room thermostat, master switch, oil shutoff, and one other depending on the type of furnace) electrically in series to protect and regulate the whole system at all times. Only one fuel tank, outside underground, is required.

The picture shows the simplicity, accessibility, compactness, and neat appearance of the Johnson burner. All moving parts are entirely enclosed for protection, and require practically no attention.

Called by engineers "the most scientific oil burner on the market" the full automatic models are approved by the Underwriters Laboratory, by the New York Board of Standards and Appeals, and by fire prevention bureaus of principal cities everywhere.

Precision manufacturing, the result of 23 years of oil burner experience, assures a dependable, efficient, clean, quiet burner.

S. T. JOHNSON CO.
OIL BURNERS

Main Office and Factory: 943 Arlington Avenue • Oakland, California
Factory Branch Offices: San Francisco • Sacramento • Philadelphia

DISTRIBUTORS AND DEALERS THROUGHOUT THE UNITED STATES
NEPONSET BLACK is a tough, heavy Waterproof Building Paper that keeps out dampness and drafts. Its glistening, asphalt-coated surface sheds water like a duck's back.

For a permanent barrier against the elements, specify Bird's Neponset Black. Over roof boards and under slate, tile, metal or asphalt shingles it makes a watertight covering. When placed back of stucco and under clapboards or shingles it keeps out drafts and dampness and makes the heating of the house more economical.

Your contractor or builder can get Neponset Black at a moment's notice. It is standard stock with dealers in Bird's Building Products. Refer to Sweet's or write to us for complete specifications.

BIRD & SON, inc.
Established 1795
EAST WALPOLE, MASS.

Chicago Office and Plant: 1472 West 76 Street
New York: 205 Fifth Avenue

Neponset Twin Shingles
Paroid Roofing
Bird's Asphalt Shingles
Bird's Design Roofing
Bird's Neponset Black Building Paper
Bird's Neponset Rugs
and Floor Coverings

THE CUTLER MAIL CHUTE CO.
GENERAL OFFICES AND FACTORY
ROCHESTER, N. Y.

MINERAL WOOL
The Perfect Insulator

is daily adding to the comfort of home owners everywhere.

Buildings lined with it are many degrees cooler in Summer and many degrees warmer in Winter. The saving alone which it effects in Winter fuel will pay for installation within a short period.

For greater economy and comfort in your home we urge your investigation of this fireproof, soundproof and vermin-proof mineral insulating material.

Sample and illustrated booklet on request

U. S. MINERAL WOOL COMPANY
280 Madison Avenue, New York

Western Connection:
INSULATING PRODUCTS COMPANY
1553 W. Madison Street, Chicago, Ill.
HARDINGE
FUEL OIL HEAT

for any heating requirement

Our two models, Domestic and Industrial, in 12 different sizes and combinations, enable specific treatment for any heating problem. See our catalog in Sweet's. You can be specific and specify HARDINGE with confidence for any type or size building from Bungalow to Skyscraper.

Hardinge Brothers, Inc.
Manufacturers of Precision-Built Machines for 38 Years

Factory and General Offices:
4149 Ravenswood Avenue, Chicago, Ill.

Factory Branches:
CHICAGO
Michigan Avenue at Ohio Street

BOSTON
839 Beacon Street

Distributors in All Principal Cities
Schools have been a splendid proving ground for "GLOBE" Ventilators. They have given such efficient service in this field that many architects who have been identified with school planning have come to consider "GLOBE" Ventilators as the standard school ventilation.

Low first cost—efficient—no upkeep

GLOBE VENTILATOR COMPANY
TROY, NEW YORK

A size for every space
small office
large factory

No matter what your heating problem may be—a small office or large factory—there's a Thermodine Unit Heater to exactly fit your requirements. Thermodine Unit Heaters suspend from the steam main. They deliver a generous supply of heat down to the floor—to the working area where heat is needed. They can be rotated to face in any direction, the downward path of the heat directed by deflectors.

We will be glad to send you full particulars and the name of our nearest representative.

MODINE MANUFACTURING CO.
(Heating Division)
1718 Racine St., Racine, Wisconsin
Branch offices in all large cities

FOR OFFICES

Ventilation in offices can be more easily controlled with the Ventador than with the old over-door transom... Information on request.
For Silent unit ventilation . . .

specify the "Silent" Sturtevant

NOISELESSLY, the new Sturtevant Unit Ventilator draws in fresh energizing air. Not a sound comes from the attractive metal cabinet to disturb the quiet of the schoolroom, church or office.

Silent unit ventilation is an outstanding Sturtevant achievement. Because of the special design of the fan wheels used in the "Silent" Sturtevant Unit Ventilator the air is moved noiselessly, and in addition a saving in electric power is effected.

For silent unit ventilation . . . specify the "Silent" Sturtevant Unit Ventilator. Bulletin No. 344-A contains complete information. Write to our nearest office for a copy.

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

Atlanta  Buffalo  Chicago  Dallas  Indianapolis  Minneapolis  Portland  San Francisco
Birmingham  Camden  Cincinnati  Denver  Kansas City  New York  Rochester  Seattle
Boston  Charlotte  Cleveland  Detroit  Los Angeles  Pittsburgh  St. Louis  Washington

Canadian offices at: Toronto, Montreal, and Galt, Ontario; also agents in principal Foreign countries

Sturtevant Unit Ventilator
Architects are Specifying Electrol

For Homes of Every Type and Size

The Electrol automatic oil burner is being specified by architects for some of the most costly city and country homes in America. For homes and buildings of all types and sizes. There is an Electrol for every heating requirement. Quiet...Economical...All-Electric...Entirely Automatic. It employs the proved principles of positive, automatic, electric ignition and mechanical fuel atomization.

Over every phase of this finer burner’s operation, The Master Control stands guard day and night, like a living sentinel always at the furnace door. * * * Wherever there is an Electrol distributor complete oil heating service is available, backed by a sound, large and growing manufacturing organization. Your request will bring a copy of Electrol Regulation A.I.A. Folder containing much information you will want.

ELECTROL INC. of MISSOURI
179 DORCAS STREET - ST. LOUIS, U. S. A.

ELECTROL
The OIL BURNER with The Master Control

Listed as Standard by the Underwriters’ Laboratories, and bears their label

KNOW ELECTROL BY THE HOMES IT HEATS

Home of Mr. M.B. Wallace, Jr., St. Louis. © Maritz and Young, Architects
THE owner put the heating problem up to the architect. The architect favored the Quiet May but consulted his engineer.

The engineer confirmed the architect's selection.

In the magnificent new residence of Mr. F.F. Proctor at Larchmont, N.Y., three Quiet Mays were installed, two in the eighteen-room residence, one in the garage, exactly as specified by the architect.

GEORGE J. FERNSCHILD, JR.
Registered Architect
The Proctor residence is but one of many notable Westchester County show places to his credit.
TO THE ARCHITECT

THE AMERICAN BLOWER CORPORATION OFFERS YOU COMPLETE DATA ON ANY SUBJECT OF AIR HANDLING - ELECTRIC VENTILATION, AIR WASHING, HEATING, THE COLLECTION OF CINDERS AND FLY ASH AND MECHANICAL DRAFT

THIS advertisement appearing in the May 5 issue of Liberty is one of a series by the American Blower Corporation in the interests of proper ventilation.

The American Blower Corporation also publishes from time to time a beautifully illustrated magazine devoted entirely to electric ventilation. If you are not already receiving this magazine, send us your name and address.

AMERICAN BLOWER CORPORATION, DETROIT — CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
TAMING THE GIANT STEAM

STEAM is a giant of tremendous power. For more than a century it has been harnessed to drive the world's steamships and railway trains, and to supply power for the world's industries.

Fifty years ago, when steam was first used for heating, the giant knew no leash. He was permitted to hold noisy dominion over the entire heating system, where he clanked and rattled to his heart's content, because steam pressures in the old-fashioned heating systems of the seventies were usually maintained at high levels, regardless of outdoor temperatures. Often these high steam pressures were the only means by which the steam could be forced through the piping and into the radiators against the accumulated air and water they contained.

Thus the Giant Steam knew no master in the heating field until a quarter century ago, when the invention of the Dunham Thermostatic Radiator Trap effectively controlled his force and subdued his strident voice. This remarkable invention, a typical Dunham development, made possible the Vacuum Return Line System using pressures in the steam main and vacuums in the return mains. Then followed other important Dunham contributions to heating, such as the Dunham Vapor Heating System, using steam at tea-kettle pressure, and the Dunham Return Trap System.

These developments, all pioneered by Dunham Engineers, were worthy forerunners of the present day Dunham Differential Vacuum Heating System, which, in this Dawn of a New Era in steam heating, has not only fully tamed the Giant Steam through its successful application of Sub-Atmospheric Steam to heating, but, of even greater importance, has removed the great fuel waste which had accompanied its use.

By making use of steam produced at pressures below atmosphere, and at temperatures to correspond with these pressures down to as low as 133 degrees, the Dunham Differential Vacuum Heating System does away with the need for wasteful window opening. In a building heated with Sub-Atmospheric Steam you will not find windows flung open to permit the surplus heat to escape, for indoor temperatures are effectively controlled so as to eliminate this waste of fuel. And in addition to this fuel saving, Sub-Atmospheric Steam insures better health among building occupants, because the indoor air is neither overheated nor dried out by excessive temperatures. Only in the Dunham Differential Vacuum Heating System are these vital advantages obtainable.

C. A. DUNHAM CO.
DUNHAM BUILDING
450 East Ohio Street, Chicago
You can make one simple change in any set of dwelling specifications, and save the owner half his annual fuel bill by specifying a Spencer Magazine Feed Heater. Make no other change. The Spencer uses the same flues, same radiators, same everything as a flat grate boiler—except the fuel.

The Spencer has a sloping grate, designed to burn No. 1 Buckwheat anthracite, at half the cost of domestic size. For apartments, schools, and other buildings the Spencer saves—even when Buckwheat anthracite is now being used.

The Spencer requires attention only once or twice in twenty-four hours, instead of constant firing. There is a size and type for every heating requirement from small home to large building.

Do you really know the Spencer—how simple in operation it is? Write for illustrations and the data about rating and other specifications that you need to give your clients the lowest cost heat they can buy.

SPENCER HEATER COMPANY

General Offices: WILLIAMSPORT, PA
New York City Boston Philadelphia Baltimore Buffalo Rochester Hartford Albany Syracuse Scranton
Division of Lycoming Manufacturing Company

STEAM CAPACITIES: — Cast Iron Sectional from 600 feet to 3,200 feet. Steel Tubular from 2,000 feet to 16,000 feet.
Petro Takes Care of Any Heating Plant

from 200 sq. ft. steam radiation
to a 1000 h. p. boiler

In this one line alone, you have a listed oil burner for every building that has a central heating plant. Whatever its type or size, there is a Petro Oil Burner built expressly for it. The four domestic sizes, all automatic, ranging in capacity from 200 sq. ft. of steam radiation to 18,000 sq. ft. are all listed to operate with 24 gravity fuel oil. Industrial sizes range from 50 h. p. to 1000 h. p. using fuel as low as Bunker C oil.

For 25 years Petro Oil Burners have been used extensively in large heating and power plants. Their success led to the development of a domestic line of Petros 5 years ago. Every single one of these installed is in active service today in the original house. We believe this to be the only perfect 5 year record ever established in the history of oil heating.

Being an engineering organization, we have a wealth of technical data available for architects on request. Or your local Petro dealer will supply you with full information and assist you in writing up your heating specifications. Factory engineering service is offered on all large industrial installations. Write today.

PETROLEUM HEAT & POWER COMPANY
Makers of oil burners since 1903
511 5th Ave. New York City
FESS SYSTEM CO. (Subsidiary) 220 Natoma St., San Francisco, Calif.

Petro Heats Equitable Building, New York City
Many hundreds of such buildings as the Metropolitan Life Ins., Ritz-Carlton Hotel and Harvard University enjoy all the advantages of Petro Oil Heat.

Domestic and Industrial Oil Burners

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity</th>
<th>Fuel Consumption</th>
<th>Motor</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD-0</td>
<td>200 sq. ft. st. rad. to 1000 sq. ft.</td>
<td>1 gal. to 2½ gal. per hr.</td>
<td>½ h. p. motor</td>
<td></td>
</tr>
<tr>
<td>LD-1</td>
<td>800 sq. ft. st. rad. to 2000 sq. ft.</td>
<td>2 gal. to 5 gal. per hour</td>
<td>1-6 h. p. motor</td>
<td></td>
</tr>
<tr>
<td>LD-2</td>
<td>1800 sq. ft. st. rad. to 4000 sq. ft.</td>
<td>5 gal. to 10 gal. per hour</td>
<td>1 h. p. motor</td>
<td></td>
</tr>
<tr>
<td>LD-3</td>
<td>4000 sq. ft. st. rad. to 18,000 sq. ft.</td>
<td>10 gal. to 42 gal. per hour</td>
<td>1 h. p. motor</td>
<td></td>
</tr>
</tbody>
</table>
NATIONAL RADIATOR CORPORATION. "Announcing a New and Greater Boiler and Radiator Corporation."

Announcement has recently been made of the formation of this new corporation, formed by consolidating a number of concerns which have hitherto operated separately,—the Continental Heater Corporation, the Gurney Heater Mfg. Co., the National Radiator Company, the Niagara Radiator & Boiler Company, the Union Radiator Co., and the Utica Heater Co. The announcement says: "The size and scope of the new National Radiator Corporation tremendously increase the breadth and degree of service which any of the component companies has heretofore been able to offer to the heating industry, without affecting in any way the manufacture and distribution of those products for which an appreciable demand exists. The annual capacity of the new National's ten plants will be more than 90,000,000 pounds of boilers and over 60,000,000 feet of radiation. Through these combined facilities, the previous standards of service of all the merged companies will be vastly improved, and the close personal relations with the trade maintained and strengthened. The fact that these plants are located at strategic points throughout the country makes short hauls possible, effecting savings in freight charges."


The countless advantages which use of aluminum paints presents make them particularly useful for many purposes. Aluminum paint is fundamentally different from other paints. It is made with metallic aluminum flakes called aluminum bronze powder, which no other paint pigment has. The mere simple mixing of this aluminum bronze powder with a suitable oil or varnish vehicle at once provides an aluminum paint which renders unusually satisfactory service in a wide variety of applications. Among the advantages suggested there are: (1) Its "hiding" or "covering" power, for one coat will readily obscure or cover a surface already painted or unaltered. (2) Its reflectivity or lighting efficiency, so high that sometimes as much as 70 per cent of the light falling upon a surface so painted is reflected and but 30 per cent absorbed. (3) Its lessening of evaporation, which be­comes evident when it is observed that in cooling tanks or oil storage tanks. (4) Its waterproof­ing, which makes it possible to paint many a yield of timber they will afford many a yield. "It is esti­mated that the growth in new forests on cut-over land that instead of being completely ruined after giving one year of service of all the merged companies will be vastly improved, and the close personal relations with the trade maintained and strengthened. The fact that these plants are located at strategic points throughout the country makes short hauls possible, effecting savings in freight charges."

GENERAL FIREPROOFING CO., Youngstown, O. "G F Floor Enamel; G F 115." Data on a valuable material.

UNLESS they are properly treated, cement floors do not always meet the expectations of those who demand their use. While most serviceable and adaptable under many conditions, such floors are sometimes objectionable because they dust up and wear away easily, are cold and cheerless in appearance, do not harmonize with furnishings and decor­ative effects, become quickly stained and unsightly, and are hard to clean. In such cases a cement floor paint or enamel is the easiest material with which to impart a bright colored finish, to prevent dusting up, and to hide any stains or discolorations that may exist upon the surface. A paint made with linseed oil is of very little value upon a cement surface. The lime contained in the cement acts chemically upon the linseed oil, turning it into a soap. This soap is readily water soluble, so that it is gradually washed away and the coat of paint washes off until finally only a lining of which is China wood oil, one of the few oils upon which is one of the few oils upon which small folder deals with an admirable floor enamel, the vehicle carrying with it a portion of the coloring pigment. This therefore, be made of an oil that is unaffected by lime of upon the linseed oil, turning it into a soap. This soap is made into a floor enamel, to prevent dusting up, and to hide any stains of the coloring pigment. This therefore, be made of an oil that is unaffected by lime of upon the linseed oil, turning it into a soap. This soap is made into a floor enamel, to prevent dusting up, and to hide any stains upon the linseed oil, turning it into a soap. This soap is made into a floor enamel, to prevent dusting up, and to hide any stains. Size of the diamonds in the connecting mesh—3/16 x 15/16. ‘Longspan’ is cut from standard sheet and painted black. ‘Copper-bearing Longspan’—i.e., cut from Keystone sheet and painted red—also furnished on special order. Sheets are nested, shipped uncrated, as they are not easily injured."


Architects and engineers well know the importance, in any building, of equipment which supplies energy for lighting, for operating many different kinds of mechanical equipment, and at times for furnishing heat as well. Prob­ably with a view to placing before architects data which will aid them in intelligently selecting from the countless details of equipment which it sells, the Westinghouse firm issues quite a number of booklets or brochures containing matter of the highest practical value. This particular brochure, for example, is a reprint of an article by E. B. Dawson, General Engineer of the Westinghouse Electric & Mfg. Building, which is published in one of the architectural journals. Its purpose is to outline the sources of electric power available, the characteristics of the various systems which may be selected, the power re­quirements of the various loads, the characteristics of the loads in several types of buildings, and to place in the hands of those responsible for the selection of electrical apparatus reliable performance and cost data. As might be expected, Mr. Dawson gives the matter close study and analysis, and the result is a collection of data well worthy a place in the equipment of any architect or engineer.

WEST COAST LUMBER TRADE EXTENSION BUREAU, Seattle. "Douglas Fir; America's Lumber Supply."

Travellers in certain parts of the country bring back dis­concerting reports of the appearance of entire regions, once covered with thick forests, but now "cut over" and merely dreary wastes of bare land and stumps of trees. This brochure, besides giving data regarding a most valuable wood, gives a reassuring report regarding the progress be­ing made by re-forestation,—by so renewing the forests that instead of being completely ruined after giving one present-day fire protection and modern methods of lumber­ing and forestry, it is rightly estimated that the West Coast forests will supply the lumber wants of the nation for all time." As the late Mr. Roosevelt said, "wise forest pro­tection and modern methods of lumbering and forestry, it is rightly estimated that the West Coast forests will supply the lumber wants of the nation for all time."

Constant improvement takes place in the production of different kinds of metal base for plaster and reinforcement for concrete, and along with this improvement there goes the development of new materials. This particular brochure, for example, describes and illustrates "a new type of U-rib expanded metal used as a combined centering and reinforcement for concrete construction in which there have been incorporated several valuable new features. Paral­lel, heavy, cold-drawn, 3/4" deep, U-shaped ribs are spaced 4.8" center to center and connected by sections of expanded metal mesh. These sections consist of two "panels," each composed of six rows of diamonds with a 3/4" head of sec­ondary stiffening rib through the center. Ribs, mesh and heads are all formed from a single sheet of steel. Long­span 3/4" rib lath is made in sheets seven ribs or six sec­tions wide. Ribs are 3/4" high, spaced 4.8" center to center. Size of the diamonds in the connecting mesh—3/16 x 15/16. ‘Longspan’ is cut from standard sheet and painted black. ‘Copper-bearing Longspan’—i.e., cut from Keystone sheet and painted red—also furnished on special order. Sheets are nested, shipped uncrated, as they are not easily injured."

REVIEWS OF MANUFACTURERS' PUBLICATIONS

Data on a valuable material.
Greater Beauty — PLUS
Quicker, Better Heating

McQuay
Cabinet
Radiator

Meeting every architectural requirement for a radiator that combines real beauty with more efficient heating, McQuay Cabinet Radiators and McQuay Concealed Radiators fill a long felt need.

Cold air from the floor enters the cabinet at the bottom, passes thru the heating unit and is impelled thru the grille with sufficient velocity to insure positive circulation. This means quicker heating. A water chamber above the heating unit humidifies the air, resulting in more comfortable and healthier heat.

The Heating Unit

A distinctive McQuay development consists of a series of flat horizontal tubes, tinned inside, securely held in place by copper fins, and firmly nested in bronze headers. It is immune from rust and corrosion—will not "clog"—and is practically indestructible.

Tested in actual installations McQuay Cabinet Radiators prove their ability to heat quicker and more efficiently, without the "bulky ugliness" of ordinary radiators. Yet their cost, installed, is only slightly more.

Also: A complete line of UNIT HEATERS
Descriptive literature upon request

McQuay Radiator Corporation
General Sales Office: Pure Oil Building, Chicago
Eastern Branch—2148 Graybar Bldg., New York City
Branches in most principal cities
REVIEWS AND ANNOUNCEMENTS

W. Newton Diehl has recently opened offices in the New Monroe Building, Norfolk, Va.

Andersen & Young announce the opening of offices in the Vermont Building, Salt Lake City.

The Callan Co. Inc., has opened offices in the Stroh Building, Detroit, and desires the publications and other matter issued by manufacturers. The organization includes J. A. McCullough, F. W. Langhenrich, and Barton D. Wood.

EDISON ELECTRIC APPLIANCE CO., INC., Chicago.

"Architect's Handbooks of Electric Cooking."

The arguments likely to be advanced for use of electricity for cooking are much the same as are urged for its use for any other purpose. Among them are the ease with which electricity is used, and its cleanliness, since it produces neither smoke nor soot. In fact almost the only argument brought against this use of electricity is that of its higher cost, and most service companies are meeting this objection by giving special rates on current used for cooking—rates considerably lower than those for current used for other purposes. These two brochures—"Architect's Handbook of Electric Cooking for Residences and Apartment Hotels" and "Architect's Handbook of Electric Cooking for Hotels, Hospitals, Institutions, Clubs, Ships, etc." cover fully the scope indicated by their titles. Each is replete with data of great value to architects and engineers.


To insure correct use of its widely known and extremely useful product, the Celotex Company issues what are practically specifications, which if followed will guarantee satisfaction with Celotex when used for any one of the many purposes for which it is sold. This publication is a folder, prepared in accordance with the recommendations of the A. L. A. and in the folder there are fastened (so that they may be removed) "Technical Notes" on use of the material—applying Plastic Paints on Celotex; Celotex in its Relation to Fires; the Strength of Celotex; Bonding of Concrete and Portland Cement to Celotex; Wall Paper on Celotex; Celotex for Sound Insulation; Celotex Carpet Linings; Ashlar Stone Decoration; Celotex Panelled Interiors; Celotex for Cottages, Cabins and Camps; and attaching Celotex to Steel Framing. The care with which these "notes" have been prepared and the inclusion in their pages of numerous diagrams illustrating approved methods of construction should result in a wider use of this highly adaptable material. They are replete with information.

CHARLES CORY & SON, INC. 185 Varick Street, New York. "Seamless Flexible Metal Hose."

The practical value of a metal hose is, very naturally, determined by its durability and strength. There are many purposes for which metal hose is used which involve considerable pressure, and the force of this pressure is likely to develop leaks which presently result in breaks, generally between the hose and its fittings. This brochure or booklet describes and illustrates a type of hose which is built to withstand pressure and to prevent leaking. "Cory Seamless Flexible Metal Hose," as its name implies, is seamless from the tip of one fitting to the tip of the fitting at the opposite end, and therein lies its superiority to other types of hose. Fittings are brazed or welded to the hose, forming an integral part of it." This hose is designed for use as a flexible conveyance of non-solids and non-abrasives, and for flexing and expansion between delivering and receiving connections at moderate and very high pressures and temperature as well as for the alleviation of destructive vibration. The booklet is replete with data which could hardly fail to be of interest to an engineer or to anyone requiring a strong and thoroughly dependable metal hose.

Milton M. Friedman, of Los Angeles, announces his removal to 6001 Santa Monica Boulevard.

Carl C. Tallman, formerly of Auburn, N. Y., has opened offices at 29 West Third Street, Williamsport, Pa.

Lang, Raugland & Lewis, of Minneapolis, announce the opening of a branch office at 1955 University Avenue, St. Paul. They desire catalogs and publications issued by manufacturers and to have their name added to mailing lists.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE ARCHITECTURAL FORUM

Published Monthly at New York, N. Y., for April 1, 1928 State of New York, County of New York, ss.

Before me, a Notary Public, in and for the State and County aforesaid, personally appeared Robert Sweet, who having been duly sworn according to law, deposeth and says that he is the business manager of The Architectural Forum and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager, are:

Publisher—Rogers & Manson Co., 383 Madison Avenue, New York, N. Y.

Editor—Parker Morse Hooper, New York, N. Y.

Managing Editor—None.

Business Manager—Robert Sweet, New York, N. Y.

2. That the owners are:

Rogers & Manson Co., 383 Madison Avenue, New York, N. Y.

Stockholders holding 1 per cent or more of the total amount of stock:

Howard Myers, Bronxville, N. Y.

C. Stanley Taylor, New York, N. Y.

J. A. Rice, Chicago, Ill.

Robert Sweet, New York, N. Y.

Paul W. Hayes, New York, N. Y.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder is a corporation, the names of the officers of the corporation, the names of the persons holding stock and securities in a capacity other than as so stated by him.

ROBERT SWEET.

Business Manager.

Sworn to and subscribed before me this 12th day of April, 1928.

(Seal)

STELLA L. BOWMAN.

Notary Public.

VAN RENSSLAER, P. SAGE, C.E.

Consulting Engineer

STRUCTURAL STEEL

CONCRETE CONSTRUCTION

Knickerbocker Building Baltimore
Through the years, a building must withstand as much water and moisture as if it were placed under Niagara.

The question is not whether to waterproof a building but how to waterproof it most efficiently and permanently. There is one waterproofing hat has won the support of architects for its serviceability. This is Hydrocide Colorless Waterproofing, the product of L. Sonneborn Sons.

The reputation of Sonneborn is your assurance of the unvarying quality of any Sonneborn product. By specifying Sonneborn’s Hydrocide you have the satisfaction of knowing you are giving your client the most dependable protection for the walls of his building.

L. SONNEBORN SONS, INC.
114 Fifth Avenue
New York

Protected by Hydrocide Colorless Waterproofing, walls ward off moisture and retain their beauty. Hydrocide corks every pore deeply and cannot be abraded. This is its advantage over waterproofings that form a film that in time is either broken or worn away.

Hydrocide
Colorless Waterproofing

Some other Sonneborn Life Savers for Buildings

LAPIIDOLITH
Protects concrete floors as Hydrocide Colorless protects your walls. Makes floors granite-hard, dustless, lasting.

LIGNOPHOL
Is the only wood floor preservative that lasts. Linseed oil is useless. Shellac and varnish wear off. Lignophol stays.

CEMCOAT
Reduces painting costs. A white paint that will not turn yellow. Can be washed over endlessly.

LAPIDOLITH
Protects concrete floors as Hydrocide Colorless protects your walls. Makes floors granite-hard, dustless, lasting.

LIGNOPHOL
Is the only wood floor preservative that lasts. Linseed oil is useless. Shellac and varnish wear off. Lignophol stays.

CEMCOAT
Reduces painting costs. A white paint that will not turn yellow. Can be washed over endlessly.
## INDEX TO ADVERTISING ANNOUNCEMENTS

### Part 1—Architectural Design

<table>
<thead>
<tr>
<th>Company</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexoline Corporation</td>
<td>98</td>
</tr>
<tr>
<td>Fink Co., Inc.</td>
<td>132</td>
</tr>
<tr>
<td>General Electric Company</td>
<td>97</td>
</tr>
<tr>
<td>Georg's Marble Co., The</td>
<td>80</td>
</tr>
<tr>
<td>Gibson-Tiboth Co., The</td>
<td>88</td>
</tr>
<tr>
<td>Grauer &amp; Co., Albert</td>
<td>12</td>
</tr>
<tr>
<td>Hamlin, Irving</td>
<td>28</td>
</tr>
<tr>
<td>Hanley Company, Inc.</td>
<td>Third Cover</td>
</tr>
<tr>
<td>Hartmann Sanders Co.</td>
<td>26</td>
</tr>
<tr>
<td>Hausserman Co., The E.</td>
<td>23</td>
</tr>
<tr>
<td>Hens Roofing Tile Co., The</td>
<td>23</td>
</tr>
<tr>
<td>Hess Warming &amp; Ventilating Co.</td>
<td>114</td>
</tr>
<tr>
<td>Hodgins Co., Inc.</td>
<td>95</td>
</tr>
<tr>
<td>Hope &amp; Sons, Henry</td>
<td>104</td>
</tr>
<tr>
<td>Improved Office Partition Company</td>
<td>42</td>
</tr>
<tr>
<td>Indians Limestone Company</td>
<td>8</td>
</tr>
<tr>
<td>International Cement Corporation</td>
<td>5</td>
</tr>
<tr>
<td>Jackson Company, Wm. H.</td>
<td>62</td>
</tr>
<tr>
<td>Jacobson &amp; Sons, The</td>
<td>47</td>
</tr>
<tr>
<td>Jackson Company</td>
<td>47</td>
</tr>
<tr>
<td>Kaiser Co., The</td>
<td>119, 123</td>
</tr>
<tr>
<td>Kansas City, The</td>
<td>29</td>
</tr>
<tr>
<td>Kansas City Portland Cement Co.</td>
<td>108</td>
</tr>
<tr>
<td>Kasco Company, The</td>
<td>10</td>
</tr>
<tr>
<td>Libby-Owens Sheet Glass Company, The</td>
<td>113</td>
</tr>
<tr>
<td>Louisville Cement Company, The</td>
<td>108</td>
</tr>
<tr>
<td>Macbeth-Evans Glass Co.</td>
<td>89</td>
</tr>
<tr>
<td>Master Builders Company, The</td>
<td>9, 24</td>
</tr>
<tr>
<td>Matthew Brothers Mfg. Co.</td>
<td>56</td>
</tr>
<tr>
<td>McDougall Company</td>
<td>110</td>
</tr>
<tr>
<td>McKinney Glas Co.</td>
<td>91</td>
</tr>
<tr>
<td>Mount &amp; Robertson, Inc.</td>
<td>28</td>
</tr>
<tr>
<td>Murphy Varnish Company</td>
<td>73</td>
</tr>
<tr>
<td>National Lead Company</td>
<td>68</td>
</tr>
<tr>
<td>National Lumber Manufacturer's Ass'n</td>
<td>46</td>
</tr>
<tr>
<td>National Terra Cotta Society</td>
<td>78</td>
</tr>
<tr>
<td>New York Galleries, Inc.'s Association</td>
<td>99</td>
</tr>
<tr>
<td>North American Cement Corporation</td>
<td>109</td>
</tr>
<tr>
<td>Ornamental Plasters</td>
<td>55</td>
</tr>
<tr>
<td>Peabody-Guillbert Company, Inc.</td>
<td>71</td>
</tr>
<tr>
<td>Portland Cement Association</td>
<td>5</td>
</tr>
<tr>
<td>Pratt &amp; Lambert, Inc.</td>
<td>70</td>
</tr>
<tr>
<td>Rant Building Corporation</td>
<td>13</td>
</tr>
<tr>
<td>Reeves Company, Robert C</td>
<td>115</td>
</tr>
<tr>
<td>Robinson, J. G.</td>
<td>194</td>
</tr>
<tr>
<td>Riddle Lumber and Veneer Company</td>
<td>77</td>
</tr>
<tr>
<td>Russell &amp; Erwin Mfg. Company</td>
<td>23</td>
</tr>
<tr>
<td>Shelby State Company, F. C.</td>
<td>14</td>
</tr>
<tr>
<td>Sherwin-Williams Co., The; Fourth Cover</td>
<td>33, 34</td>
</tr>
<tr>
<td>Smith Wood &amp; Mfg. Co., Inc., George W.</td>
<td>81</td>
</tr>
<tr>
<td>Smyser-Royce Company</td>
<td>85</td>
</tr>
<tr>
<td>Stanley Works, The</td>
<td>24</td>
</tr>
<tr>
<td>Stone &amp; Webster, Inc.</td>
<td>26</td>
</tr>
<tr>
<td>Tohliner, Arthur</td>
<td>69</td>
</tr>
<tr>
<td>Trico, Inc.</td>
<td>104</td>
</tr>
<tr>
<td>Vortex Mfg. Co., Inc.</td>
<td>208</td>
</tr>
<tr>
<td>United States Gotta Porch Co.</td>
<td>69</td>
</tr>
<tr>
<td>United States Gypsum Co.</td>
<td>6, 16</td>
</tr>
<tr>
<td>United States Rubber Company</td>
<td>63</td>
</tr>
<tr>
<td>Valentine &amp; Company</td>
<td>67</td>
</tr>
<tr>
<td>Van Nostrand Company, Inc., D.</td>
<td>112</td>
</tr>
<tr>
<td>West Coast Lumber Bureau</td>
<td>74</td>
</tr>
<tr>
<td>West Point Porcelain Company, The</td>
<td>214</td>
</tr>
<tr>
<td>Western Brick Company</td>
<td>81</td>
</tr>
<tr>
<td>Whittall</td>
<td>104</td>
</tr>
<tr>
<td>Wild &amp; Co., Joseph</td>
<td>102</td>
</tr>
<tr>
<td>Wilson Corp., The J. G.</td>
<td>47</td>
</tr>
<tr>
<td>Zouri Drawn Metals Company</td>
<td>17</td>
</tr>
</tbody>
</table>

### Part 2—Architectural Engineering and Business

<table>
<thead>
<tr>
<th>Company</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Blow Mfg. Co.</td>
<td>224</td>
</tr>
<tr>
<td>American Laundry Mfg. Co.</td>
<td>287</td>
</tr>
<tr>
<td>American Machine &amp; Tool Co.</td>
<td>276</td>
</tr>
<tr>
<td>American Radiator Co.</td>
<td>138, 143</td>
</tr>
<tr>
<td>American Sheet Metal Corp., The A. P. W.</td>
<td>Paper Co.</td>
</tr>
<tr>
<td>American Steel &amp; Wire Co.</td>
<td>94</td>
</tr>
<tr>
<td>American Tobacco Co.</td>
<td>142</td>
</tr>
<tr>
<td>American Wire Co.</td>
<td>142</td>
</tr>
<tr>
<td>Barber Asphalt Co., The</td>
<td>142</td>
</tr>
<tr>
<td>Barrett Co., The</td>
<td>195</td>
</tr>
<tr>
<td>Bates Expanded Steel Truss Co.</td>
<td>194</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>144</td>
</tr>
<tr>
<td>Bird &amp; Son, Inc.</td>
<td>218</td>
</tr>
<tr>
<td>Brunswick-Baile-Calender Co., The</td>
<td>185</td>
</tr>
<tr>
<td>Carey Company, The Phillips Co.</td>
<td>185</td>
</tr>
<tr>
<td>Carter Bloomfield Co.</td>
<td>147</td>
</tr>
<tr>
<td>Cement Gun Company, Inc.</td>
<td>147</td>
</tr>
<tr>
<td>Central Ramo Co.</td>
<td>172</td>
</tr>
<tr>
<td>Central States Co., The Third Cover</td>
<td>173</td>
</tr>
<tr>
<td>Chromium Corp. of America</td>
<td>162</td>
</tr>
<tr>
<td>Church Manufacturing Co., C. F.</td>
<td>163</td>
</tr>
<tr>
<td>Clay Products Association</td>
<td>174</td>
</tr>
<tr>
<td>City &amp; Son, James W.</td>
<td>174</td>
</tr>
<tr>
<td>Cohoes Rolling Mill Co.</td>
<td>171</td>
</tr>
<tr>
<td>Commonwealth Steel Mill Co., The</td>
<td>211</td>
</tr>
<tr>
<td>Connecticut Steel Co.</td>
<td>134, 135</td>
</tr>
<tr>
<td>Concrete Surface Corporation</td>
<td>209</td>
</tr>
<tr>
<td>Crane Co.</td>
<td>164</td>
</tr>
<tr>
<td>Cutler Mill Chute Co.</td>
<td>218</td>
</tr>
<tr>
<td>Dixson Crucible Co., Joseph</td>
<td>149</td>
</tr>
<tr>
<td>Dodola Products Co.</td>
<td>174</td>
</tr>
<tr>
<td>Dotyleigh Anchor Slot Co., The</td>
<td>197</td>
</tr>
<tr>
<td>Dunning Co., L. A.</td>
<td>188</td>
</tr>
<tr>
<td>Duriron Co.</td>
<td>168</td>
</tr>
<tr>
<td>Electric Storage Battery Co., The</td>
<td>133</td>
</tr>
<tr>
<td>Electric Co., Inc. of Missouri</td>
<td>222</td>
</tr>
<tr>
<td>Elliot Mfg. Co.</td>
<td>174</td>
</tr>
<tr>
<td>Exsclus Products Corporation</td>
<td>208</td>
</tr>
<tr>
<td>Fulton Sylphon Company, The</td>
<td>181</td>
</tr>
<tr>
<td>Gillis &amp; Coopheaden</td>
<td>196</td>
</tr>
<tr>
<td>Globe Ventilator Company</td>
<td>220</td>
</tr>
<tr>
<td>Hardinge Brothers, Inc.</td>
<td>259</td>
</tr>
<tr>
<td>Haggie Simplex Machine Co.</td>
<td>108</td>
</tr>
<tr>
<td>Illinois Engineering Company</td>
<td>233</td>
</tr>
<tr>
<td>Imperial Brass Mfg. Co., The</td>
<td>166</td>
</tr>
<tr>
<td>Ingalls Steel Products Co.</td>
<td>157</td>
</tr>
<tr>
<td>International Nickel Co.</td>
<td>206</td>
</tr>
<tr>
<td>Jenkins Bros.</td>
<td>163</td>
</tr>
<tr>
<td>Johnson Co., S. Y.</td>
<td>217</td>
</tr>
<tr>
<td>Kalman Steel Co.</td>
<td>152</td>
</tr>
<tr>
<td>Kerner Incotor, The</td>
<td>252</td>
</tr>
<tr>
<td>Kewanee Boiler Company</td>
<td>128</td>
</tr>
<tr>
<td>Kewanee Private Utilities Co.</td>
<td>208</td>
</tr>
<tr>
<td>Kohler Company</td>
<td>157</td>
</tr>
<tr>
<td>Loosin-Manning Fiber Distributing Co., The</td>
<td>208</td>
</tr>
<tr>
<td>Lutton Company, Wm. H.</td>
<td>201</td>
</tr>
<tr>
<td>MacArthur Concrete Pipe Co.</td>
<td>196</td>
</tr>
<tr>
<td>Maddock's Metal &amp; Ornamental</td>
<td>160</td>
</tr>
<tr>
<td>Mason Fibre Company</td>
<td>131</td>
</tr>
<tr>
<td>May Oil Burner Co.</td>
<td>233</td>
</tr>
<tr>
<td>McCoy Refrigerator Sales Co.</td>
<td>141</td>
</tr>
<tr>
<td>McQuay Radiator Co.</td>
<td>149</td>
</tr>
<tr>
<td>Milwaukee Valve Co.</td>
<td>120</td>
</tr>
<tr>
<td>Mississippi Wire Glass Co.</td>
<td>219</td>
</tr>
<tr>
<td>Modine Manufacturing Co.</td>
<td>136</td>
</tr>
<tr>
<td>Mueller Co.</td>
<td>159</td>
</tr>
<tr>
<td>Nash Engineering Co.</td>
<td>132, 179</td>
</tr>
<tr>
<td>National Fireproofing Co.</td>
<td>121</td>
</tr>
<tr>
<td>National Paper Products Co.</td>
<td>166</td>
</tr>
<tr>
<td>National Radiator Co.</td>
<td>180</td>
</tr>
<tr>
<td>National Steel Co.</td>
<td>190</td>
</tr>
<tr>
<td>North Western Expanded Metal Co.</td>
<td>127</td>
</tr>
<tr>
<td>Orange Screen Co.,</td>
<td>200</td>
</tr>
<tr>
<td>Otis Elevator Co.</td>
<td>197</td>
</tr>
<tr>
<td>Petroleum Heat &amp; Power Co.</td>
<td>227</td>
</tr>
<tr>
<td>Plummer Plumbing Co., The</td>
<td>212</td>
</tr>
<tr>
<td>Pick-Barn Co.'s, The Albert.</td>
<td>128, 129</td>
</tr>
<tr>
<td>Raymond Concrete Pipe, The</td>
<td>125</td>
</tr>
<tr>
<td>Richards Wilson Mfg. Co., Second Cover</td>
<td>208</td>
</tr>
<tr>
<td>Sedgwick Machine Works</td>
<td>176</td>
</tr>
<tr>
<td>Sedgwick Sales, Inc.</td>
<td>203</td>
</tr>
<tr>
<td>Signal Engineering &amp; Mfg. Co.</td>
<td>190</td>
</tr>
<tr>
<td>Smith &amp; Egle Mfg. Co., The</td>
<td>166</td>
</tr>
<tr>
<td>Someburn Sons, Inc., L.</td>
<td>231</td>
</tr>
<tr>
<td>Speakman Company</td>
<td>158</td>
</tr>
<tr>
<td>Spencer Heater Co.</td>
<td>226</td>
</tr>
<tr>
<td>Standard Conveyor Co., The; Fourth Cover</td>
<td>214</td>
</tr>
<tr>
<td>Steel Gas Equipment Corp.</td>
<td>154</td>
</tr>
<tr>
<td>Structural Gypsum Corporation</td>
<td>136</td>
</tr>
<tr>
<td>Stuart Engineering Inc., B. F.</td>
<td>221</td>
</tr>
<tr>
<td>Taco Heaters, Inc.</td>
<td>214</td>
</tr>
<tr>
<td>Trane Company, The</td>
<td>173</td>
</tr>
<tr>
<td>Trenton Porcelain Co.</td>
<td>184</td>
</tr>
<tr>
<td>Truscon Steel Company</td>
<td>124</td>
</tr>
<tr>
<td>United Metal Products Co., The</td>
<td>168</td>
</tr>
<tr>
<td>U. S. Mineral Wood Co.</td>
<td>226</td>
</tr>
<tr>
<td>Van Zilie Ventilating Co.</td>
<td>220</td>
</tr>
<tr>
<td>Vonnegut Hardware Co.</td>
<td>140</td>
</tr>
<tr>
<td>Vortex Mfg. Co.</td>
<td>204</td>
</tr>
<tr>
<td>Waterproofing Co., The</td>
<td>216</td>
</tr>
<tr>
<td>Weber Costello Co.</td>
<td>213</td>
</tr>
<tr>
<td>Weiss Co.</td>
<td>208</td>
</tr>
<tr>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>193</td>
</tr>
<tr>
<td>Wilmot Castle Co.</td>
<td>129</td>
</tr>
<tr>
<td>Woodlawn Ornamental Iron Co.</td>
<td>194</td>
</tr>
<tr>
<td>York Ice Machinery Co.</td>
<td>205</td>
</tr>
<tr>
<td>Youngstown Sheet &amp; Tube Co., The</td>
<td>170</td>
</tr>
</tbody>
</table>
WHERE heating requirements are most exacting—where both fuel economy and luxurious comfort are demanded—you will find ILLINOIS Heating Systems. "ILLINOIS" are the original vapor systems, circulation at pressures below atmosphere—pioneers in the prevention of overheating. They have a background of over 25 years experience and thousands of enthusiastic owners.

This page shows a few of the Seattle buildings equipped with ILLINOIS Systems.

Write for Bulletin 22

REPRESENTATIVES IN 40 CITIES OF U.S.A.

ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD President

INCORPORATED 1900

CHICAGO
Something's been going on

Within the walls of these plants things have been happening!

One of the most complete lines of vitreous china fixtures ever offered has been developed. There is scarcely an item you cannot get—and have it delivered quick, too.

New pieces of outstanding design have been produced. The kind that make hard installation jobs easy by exactly fitting conditions.

Service has been polished up till it runs like a well-oiled watch. Twenty-four hours or less on all but unusual specialties—from receipt of order till the shipment rolls out of the yard. That means something when you’re in a hurry.

For Special Attention

Consider the Carlton, No. 545, an example of Eljer progressiveness in design. A compact, quiet, beautifully shaped syphon jet bowl with square base and extended lip. No exposed metal valve to corrode. It’s shielded from view. The Carlton has the good points of a hundred types and designs rolled into one.

Catalog, Catalog—have you got a Catalog?

By all means have an Eljer Catalog on hand, the key to fine fixtures and fast service. Send for it now. Eljer Company, Ford City, Pa. Factories at Ford City, Pa. and Cameron, W. Va.

Eljer China is similar in texture to the finest French Table China—but with the added toughness necessary to stand rough usage. Acid-proof and rustproof.

ELJER
VITREOUS CHINA PLUMBING FIXTURES
All of the GREAT IMPROVEMENTS in Soil Pipe have been made by

THE CENTRAL FOUNDRY COMPANY

Strength Where Strength Is Needed Most

Patent Pending

Look for the Bead at the Base of the Hub and the
Led-LoK Groove inside!

NUHUB

Soil Pipe

Fifteen years ago The Central Foundry Company introduced the Led-LoK groove, the first successful lead groove on soil pipe and since imitated by the remainder of the industry.

Today the pioneering leadership of The Central Foundry Company is again demonstrated with the perfection of NUHUB trade mark soil pipe.

NUHUB is the soil pipe with the bead at the base of the hub. This bead assures double strength where the hub and the barrel of the pipe meet—where strength is needed most.

No matter how many stories high, NUHUB trade mark soil pipe meets all requirements of proper pipe hanging in steel and reinforced buildings.

Every length of NUHUB soil pipe is tested under fifty pounds hydrostatic pressure. Made in extra heavy only.

Price? No higher than that asked for old style pipe. For sale by jobbers of plumbing supplies.

Look for the bead at the base of the hub and the Led-LoK groove inside.

THE CENTRAL FOUNDRY COMPANY

AND ASSOCIATE COMPANIES: ESSEX FOUNDRY, CENTRAL RADIATOR COMPANY, MOLBY BOILER COMPANY, INC., AND CENTRAL IRON AND COAL COMPANY

SUBSIDIARIES OF THE UNIVERSAL PIPE AND RADIATOR COMPANY

General Offices: Graybar Building, Lexington Avenue at 43rd Street, New York

Also manufactured under special agreement by ESSEX FOUNDRY, NEWARK, N. J.
Two-Way Vacuum Inlet.
Also made in three-way vacuum. Applied to combination vacuum lines, where two or three stations are served by one pick-up or return line. Also illustrates method of supporting from desk. 2 1/4 in., 3 in., and 4 in.

Putting the Air to Work

The Chase Bage Company of Saint Louis does not believe in spending money for work that can be done free. They have connected the various departments of their plant with a Standard Pneumatic Tube system and inter-office memorandums, invoices for O. K., production orders, shipping instructions, and the thousand-and-one other daily messages of business are zipped in the flicker of an eyelash from one end of the plant to another. No dallying messenger boys, no losses in transit, no confusing of verbal messages—everything written, yet delivered with telephone speed. And, the saving in salaries pays for it all. To architects whose clients could use pneumatic tubes to advantage, we offer a detailed analysis of this job and others. No charge—a request on your letterhead will be honored.

STANDARD
CONVEYOR COMPANY
NORTH ST. PAUL, MINNESOTA