THE ARCHITECTURAL FORUM

IN TWO PARTS

ARCHITECTURAL ENGINEERING & BUSINESS

PART TWO

APRIL

1929

Slidetite SLIDES DOORS INSIDE

Where they are away from snow and ice

No garage is better than the doors which enclose it. That is why *Slidetite* equipped doors are such a good investment.

And they not only assure your car the protection it deserves, but they save you an endless amount of time, trouble and annoyance.

Because they slide *inside* the garage, *Slidetite* doors are not exposed to wind, rain, sleet, ice or snow. They won't blow shut. They won't stick. They won't sag, shrink or rust.

Another advantage of *Slidetite* garage doors is that they do away with dangerous center posts, and thus give you an unobstructed, full-width opening.

Slidetite, with lock-joint brackets, is packed in complete sets for 3, 4, 6 and 8 doors. To insure satisfaction buy complete sets only.

Richards-Wilcox Mfg. Co.

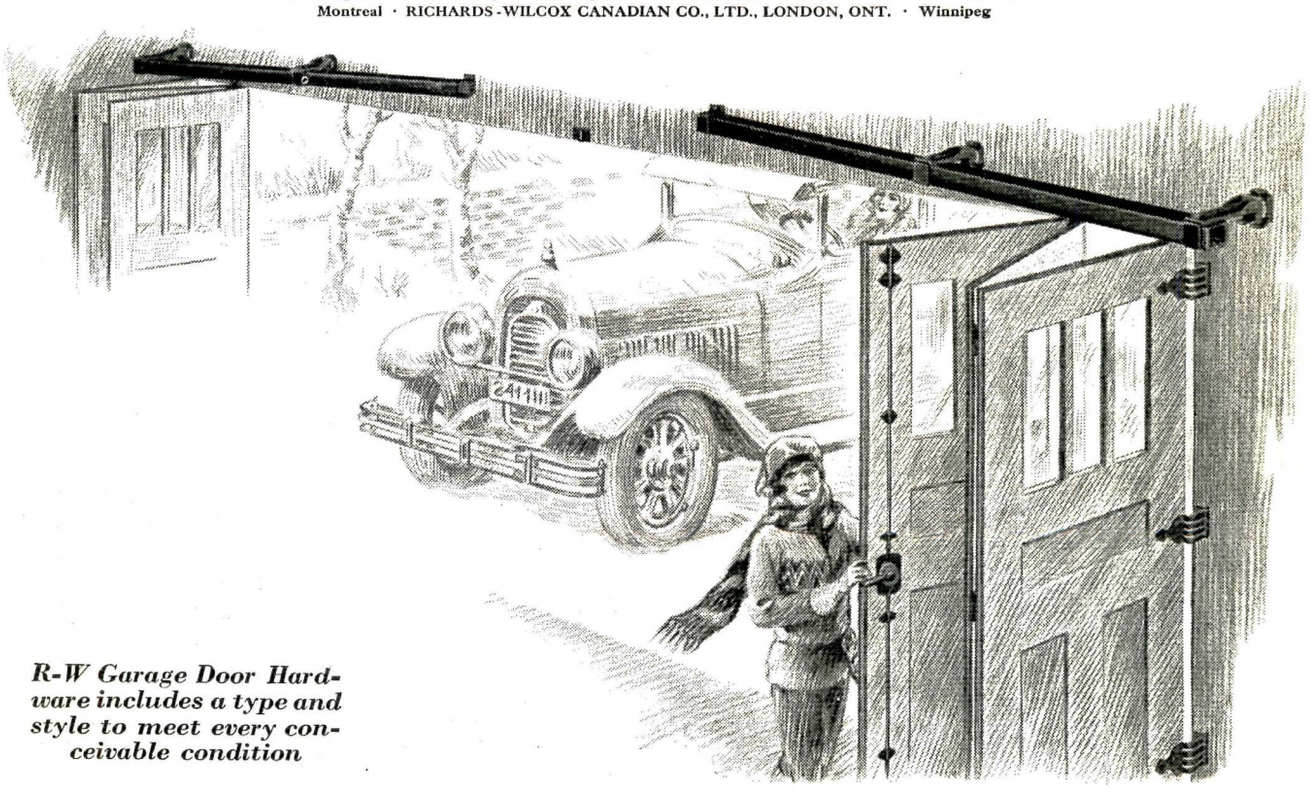
"A Hanger for any Door that Slides."

AURORA, ILLINOIS, U.S.A.

New York · · · · · · Chicago

Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Des Moines Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit

Montreal · RICHARDS-WILCOX CANADIAN CO., LTD., LONDON, ONT. · Winnipeg

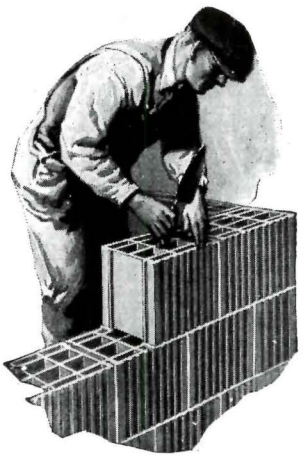


R-W Garage Door Hardware includes a type and style to meet every conceivable condition

BRICK FACE

Natco Unibacker is a *universal unit* which promotes great speed of erection, and consequent labor economies. It is admirably adapted for use in all brick-faced load-bearing or curtain closure walls. A mechanical bond is provided every sixth course, so strong that full bearing value is allowed on the full masonry wall thickness. The weight of Natco Unibacker as compared with solid brick masonry materially reduces foundation and steel costs in large structures, without sacrifice of strength and permanence. Three courses of Natco Unibacker can be bonded with two courses of column covering. The mortar requirements are decreased one-third. Full bearing is provided for floor joists. The standard tile is dovetail scored for interior plaster, but can be furnished glazed on special order.

OR STUCCO BASE



Natco Double Shell Load Bearing Tile is designed for vertical web load-bearing walls to receive exterior stucco and interior plaster directly on its surfaces. The outstanding feature is the double shell web construction which provides a wide, non-continuous mortar joint, which positively seals the outside face cell structure, and positively prevents moisture passage from outside to inside by capillary attraction. With properly staggered joints all webs are brought into vertical alignment, developing maximum wall strength. Natco Double Shell Load Bearing Tile provides permanent fire safety; eliminates cutting and fitting; provides "built-in" insulation, which adds to comfort and economy; provides through the dovetail scored tile surface an ideal base for both plaster and stucco; prevents plaster discoloration by its non-continuous mortar joints; and furnishes chases for pipe and conduit installation.

NATIONAL·FIRE·PROOFING·COMPANY

General Offices: Fulton Building, Pittsburgh, Pa.

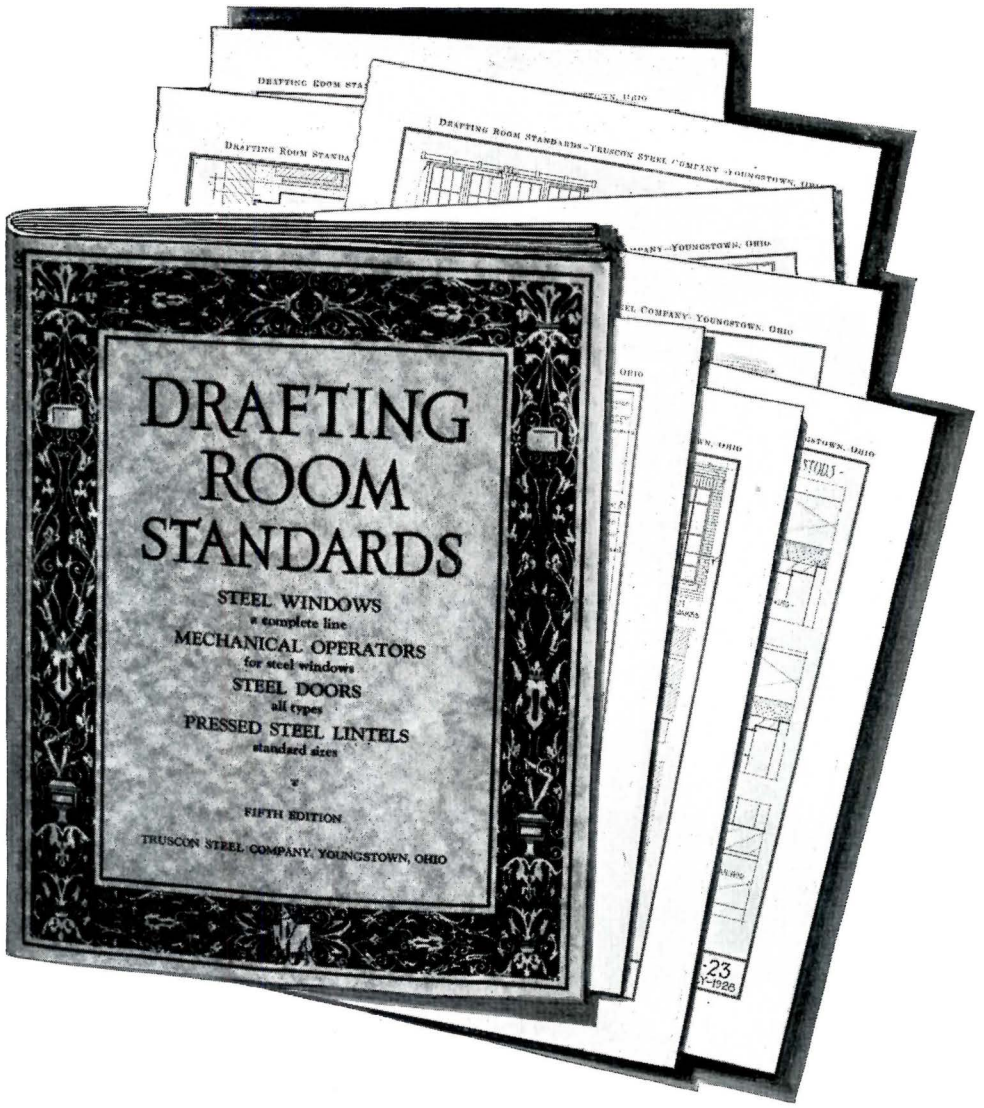
Branch Offices: New York, Flatiron Bldg; Chicago, Builders Bldg; Philadelphia, Land Title Bldg; Boston, Textile Bldg.
In Canada: National Fire Proofing Co. of Canada, Ltd., Toronto, Ontario

NATCO
THE COMPLETE LINE OF STRUCTURAL CLAY TILE

TURN TO "SWEET'S"

The Handbook *of the* Steel Window Industry

Free to members of the Architectural and Engineering Profession

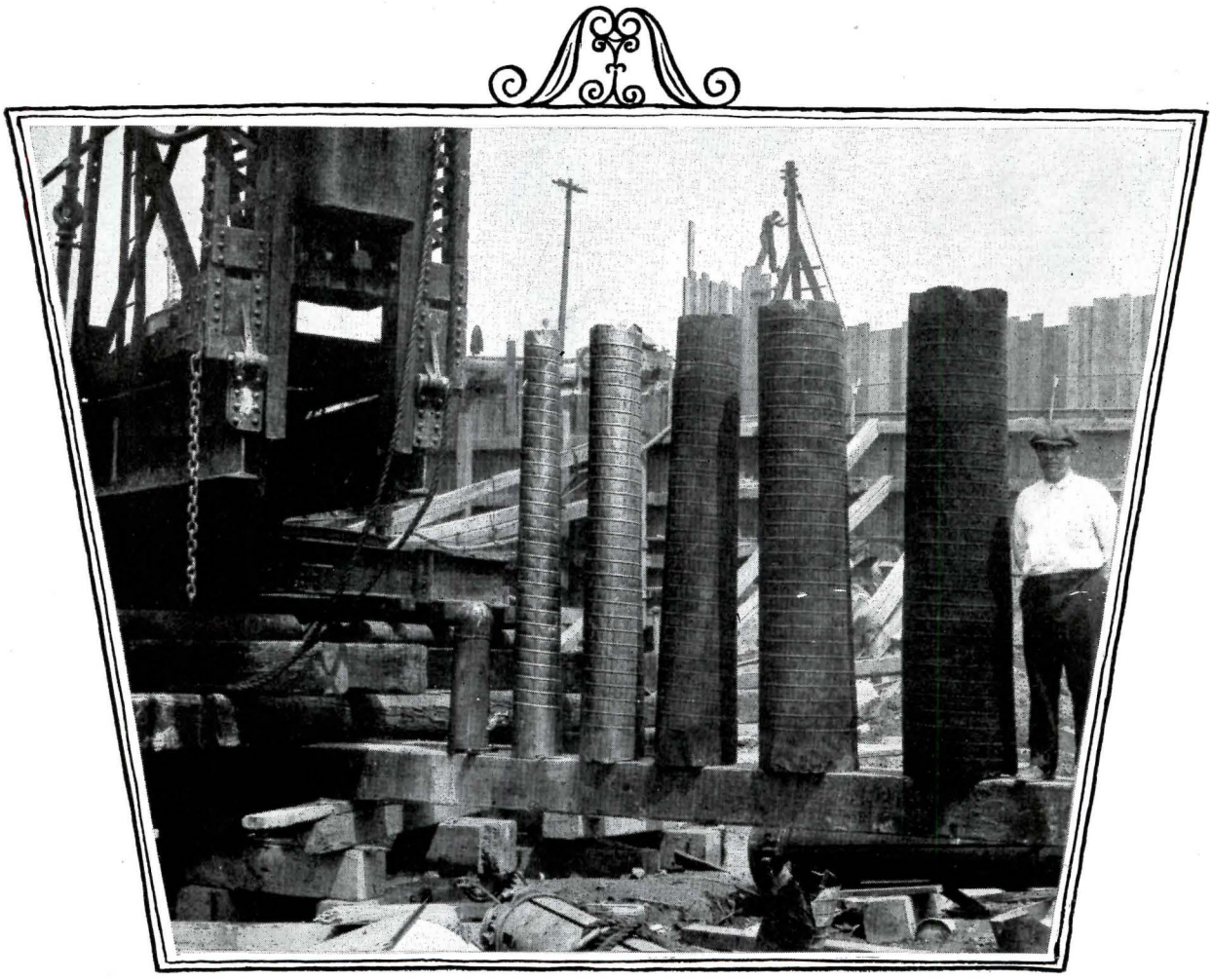


THIS new addition of "Drafting Room Standards" (A. I. A. file size), was developed in accordance with the simplified schedule of nomenclature, sizes, styles and division of products recommended by the Bureau of Standards of the U. S. Department of Commerce. It contains scale details of the application of steel windows, mechanical operators and steel doors to constructions of all kinds including Double-Hung, Casement, Projected, Donovan Awning Type, Continuous, Basement and Underwriters' Windows; Steel Frames; Tension, Torsion, and Rack and Pinion Operators; Stock, Slide, Swing, Folding, Bi-Fold, Lift, Lift-Swing, Industrial, Railroad, Fire Department and Hangar Doors; Steel Lintels.

THE SECRET ΔΓM OF SUCCESS

The Handbook "Drafting Room Standards" contains practical and useful data for the architect's office. Copies will be sent on request.

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO
STEEL WINDOW DIVISION
The Largest Company the World Over Manufacturing a Complete Line of Steel Building Products



The outstanding and exclusive feature of standard Raymond Concrete Piles is the use of these spirally reinforced steel shells that are left in place on every pile in the ground—for very sound reasons.

Raymond Concrete Pile Company

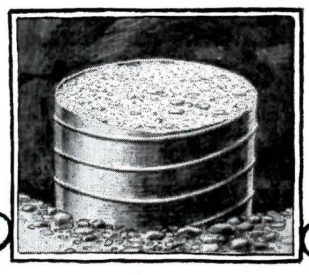
New York • 140 Cedar St. Chicago • 111 West Monroe St.

Raymond Concrete Pile Co., Ltd., Montreal, Canada

Branch Offices in All Principal Cities

Atlanta, Ga.	Chicago, Ill.	Kansas City, Mo.	Milwaukee, Wis.	Portland, Ore.	Washington, D. C.
Baltimore, Md.	Cleveland, Ohio	Los Angeles, Cal.	Philadelphia, Pa.	San Francisco, Cal.	Montreal, Canada
Boston, Mass.	Detroit, Mich.	Miami, Fla.	Pittsburgh, Pa.	St. Louis, Mo.	London, England
Buffalo, N. Y.	Houston, Tex.			St. Paul, Minn.	Hong Kong, China

A Form for Every Pile—



A Pile for Every Purpose

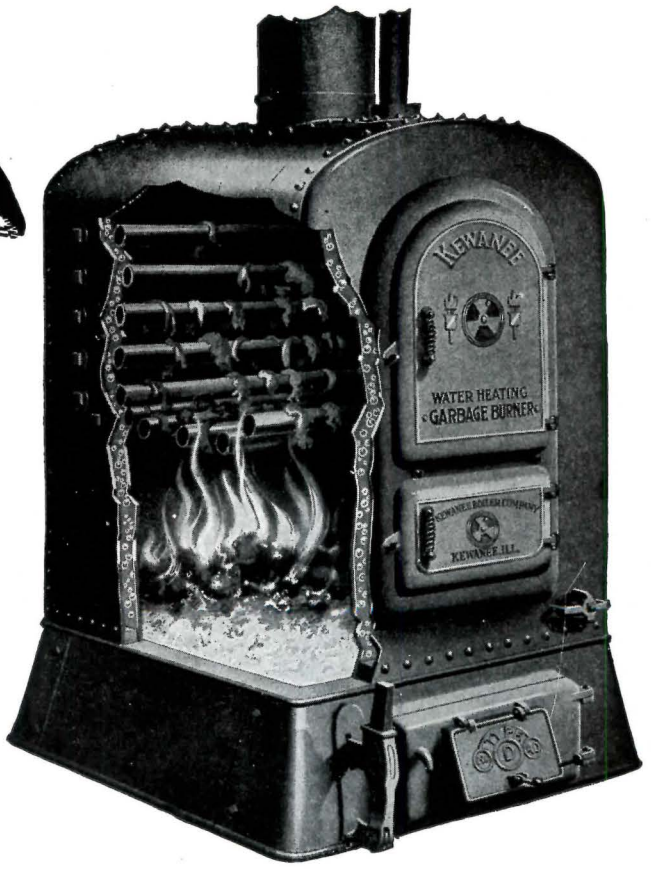
KEWANEE

Water Heating GARBAGE BURNERS

The By-Pass (a distinctive Kewanee feature) prevents the garbage from smothering the fire—the flames circulating thru it and around the garbage until the refuse is dry enough to burn.

Every building must have hot water, and the most economical method of getting it is by using rubbish and garbage as part of the necessary fuel.

Here is a real Kewanee Product—solidly built of steel, riveted. A water-heating garbage burner as strong and dependable as Kewanee Boilers.



Three types—fourteen sizes to heat from 200 to 2600 gallons per hour

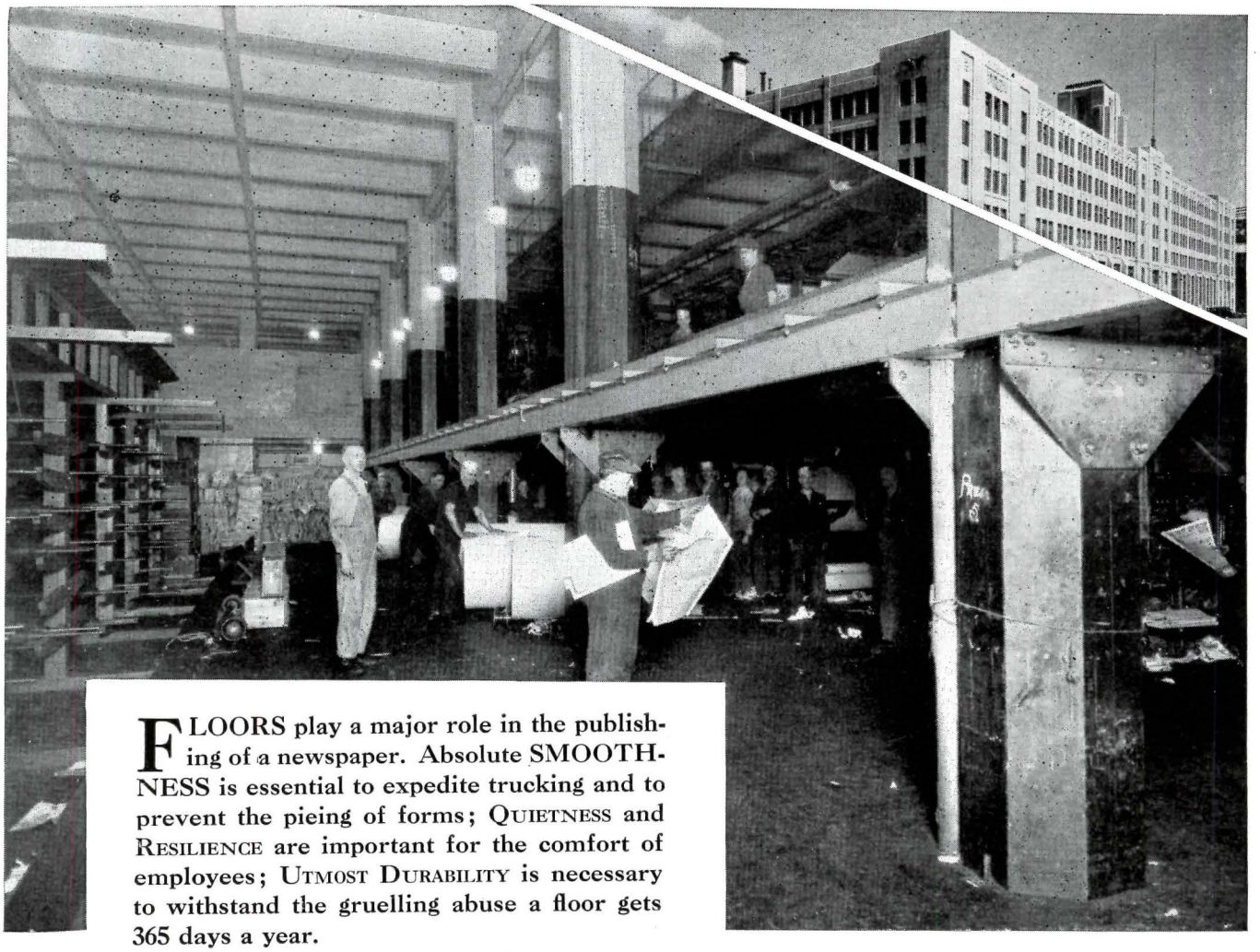
Catalog 75 gives details

KEWANEE BOILER CORPORATION

Kewanee, Illinois *Branches in 40 Principal Cities*

STEEL HEATING BOILERS RADIATORS WATER HEATERS
TANKS AND WATER HEATING GARBAGE BURNERS

75 Leading Publishers Use BLOXONEND Flooring



FLOORS play a major role in the publishing of a newspaper. Absolute SMOOTHNESS is essential to expedite trucking and to prevent the pieing of forms; QUIETNESS and RESILIENCE are important for the comfort of employees; UTMOST DURABILITY is necessary to withstand the gruelling abuse a floor gets 365 days a year.

That BLOXONEND meets these requirements is evidenced by the fact that 75 of America's leading newspapers have installed it. In addition to Hearst, users include Cleveland News, New York Telegram, Chicago Daily News, Philadelphia Record and Kansas City Star.

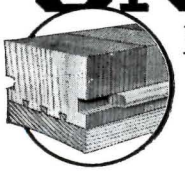
The durability, resiliency and lasting smoothness of BLOXONEND will appeal to your industrial or school client. *Write for sample and specifications.*

CARTER BLOXONEND FLOORING COMPANY
Kansas City, Mo.
Branch offices in leading cities

Bloxonend Flooring installed throughout Mechanical Departments of new home for Hearst's New York *American* and *Evening Journal*. Geo. Pancoast, Engineer. C. E. Birge, Architect.

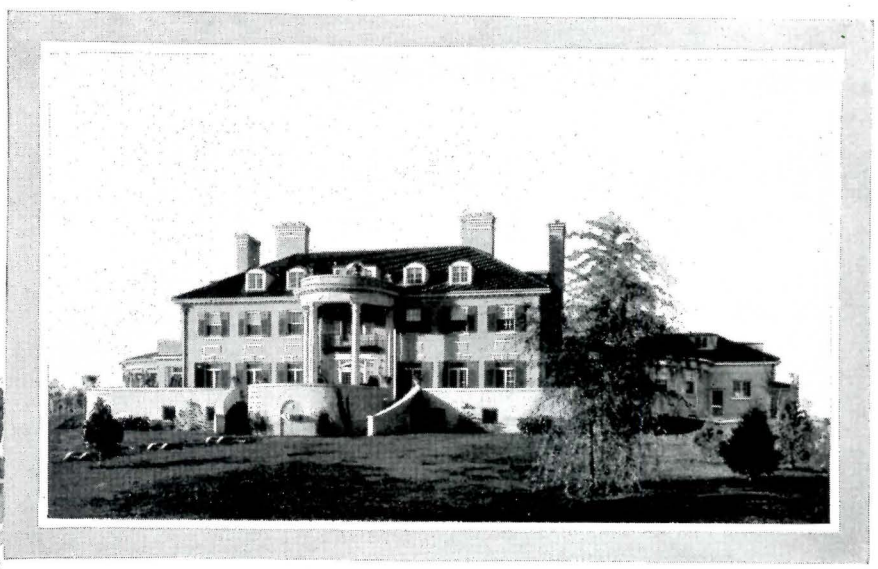
Bloxonend comes in 8 ft. lengths. The tough endgrain forms the wearing surface.

BLOX-ON-END FLOORING



Lay's Smooth
Stay's Smooth

Residence of Mr. David Lawrence, Washington, D. C.; A. B. Heaton, Architect.



Residence of Mr. S. N. Hicks, Cherry Hills, Denver, Colo. W. A. Marean & A. J. Norton, Architects.

There can be but one "Best"

PRICE is the most unimportant thing in the world—when an automobile won't run or an incinerator won't w-o-r-k.

The Kernerator is made by a permanent, solidly organized company which introduced flue-fed incineration 15 years ago. It has never been successfully imitated—in design, quality of parts or in the thoroughness with which it destroys all garbage and waste without fuel.

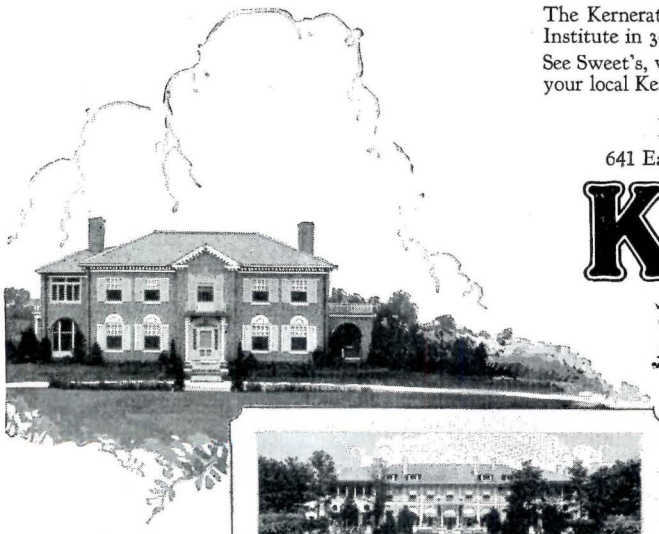
The owners of many of the homes it serves read like "Who's Who". Some of them appear below. But remember this—the owner of a bungalow is often a severer critic of poor performance than he who dwells in a mansion.

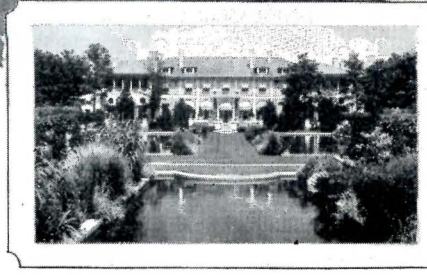
Miss Anne Morgan, New York
Payne Whitney, Manhasset, L. I.
Samuel Appleton, Marblehead, Mass.
S. Z. Mitchell, Locust Valley, L. I.
Senator Walter Edge, Atlantic City, N. J.
Dr. Gilbert Grosvenor, Washington, D. C.
H. Watt Ellison, Richmond, Va.
Asa G. Candler, Atlanta, Ga.
Chas. E. Ringling, Sarasota, Fla.
Edsel Ford, Detroit, Mich.
Senator James Couzens, Detroit, Mich.
Booth Tarkington, Indianapolis, Ind.
L. M. Alexander, St. Petersburg, Fla.
John F. Jelke, Jr., Lake Forest, Ill.
Craig Cullinan, Houston, Tex.
E. B. Stern, New Orleans, La.
Judge Wilson A. Taylor, St. Louis, Mo.
Newton D. Baker, Cleveland, Ohio
Fred'k B. Patterson, Dayton, Ohio

The Kernerator was selected for each of the Model Homes of the Home Owner Institute in 30 principal cities.

See Sweet's, write for Kernerator catalogs in a ready-to-file A. I. A. Folder or 'phone your local Kernerator representative. Offices in over 100 cities.

Residence of Mr. F. L. Maytag, Newton, Iowa. Cervin & Horn, Architects, Rock Island, Ill.





Residence of Mr. J. Ogden Armour, Lake Forest, Ill. Arthur Heun, Architect.

KERNER INCINERATOR CO.

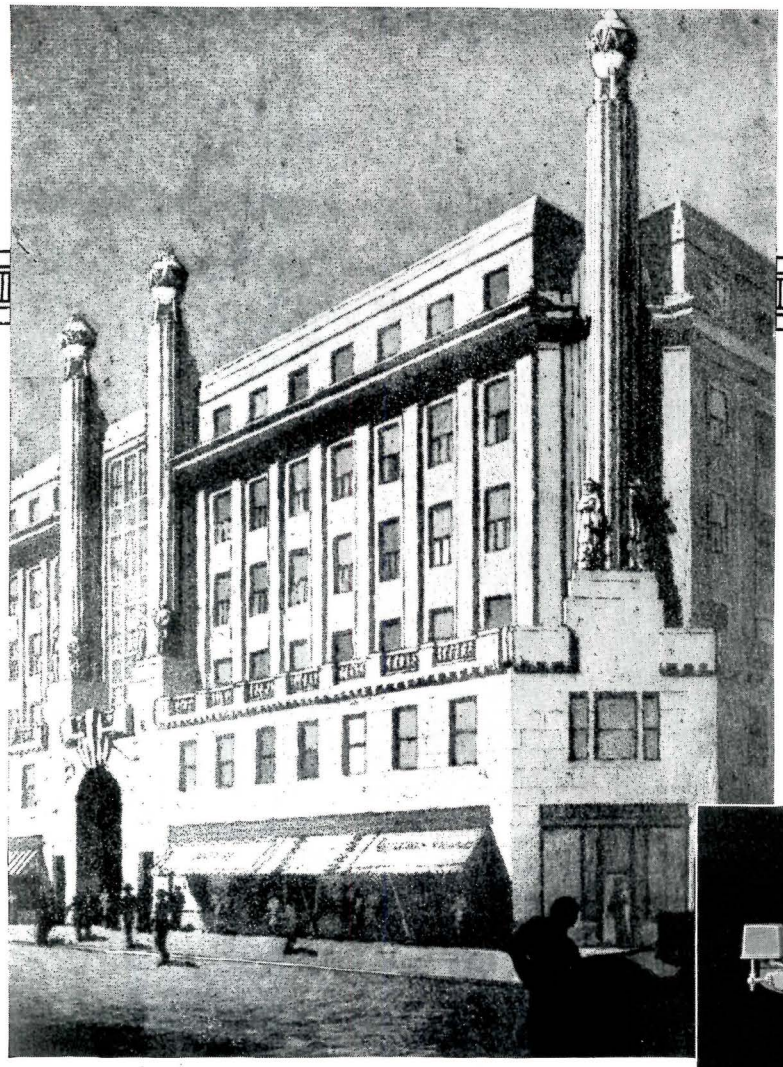
641 East Water Street Milwaukee, Wisconsin

KERNERATOR

REG U.S. PAT OFF.

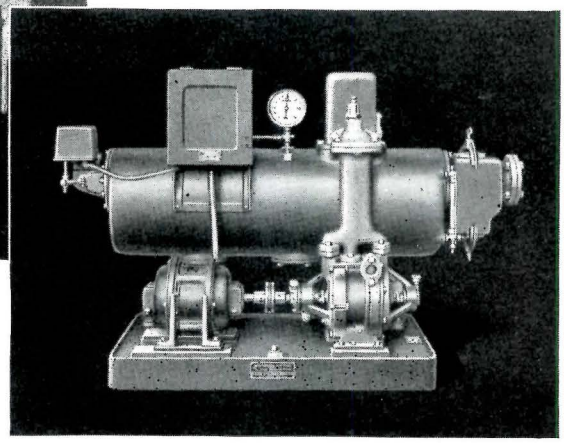
INCINERATION

Garbage and Waste Disposal for New and Existing Buildings



Hearst Publications Building, 8th Ave. and 57th St., New York, N. Y. Joseph Urban, architect; Geo. B. Post & Sons, associate architects; Turner Construction Company, builders; Eugene Duklauer, plumbing contractor.

Jennings Vacuum Heating Pump, for removing condensation and air from return line heating systems.



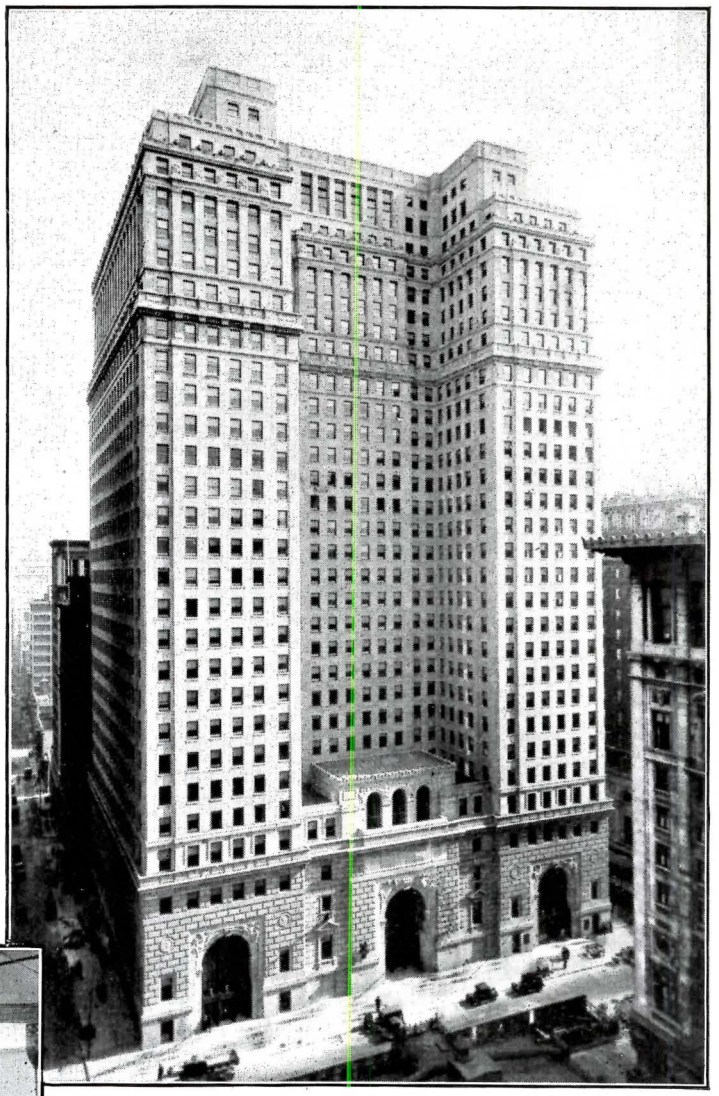
Quality~ where quality is wanted

In the construction of the new Hearst Publications Building in New York, quality products only were installed in the heating and plumbing systems—quality valves, piping, fixtures, and, of course, a Jennings Vacuum Heating Pump.

Jennings Pumps

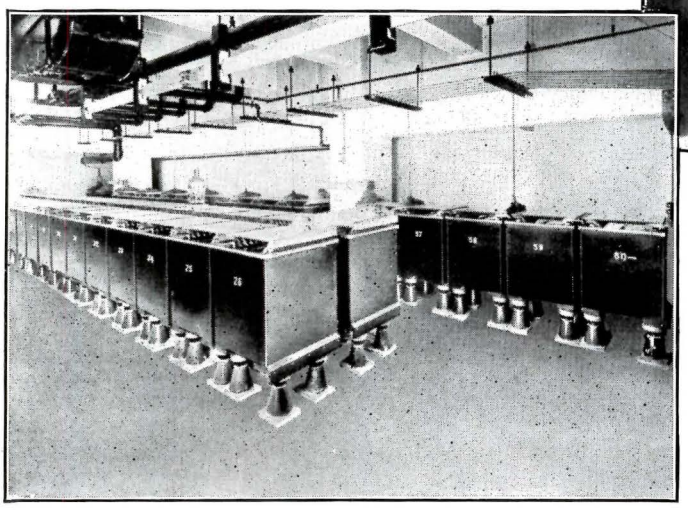
THE NASH ENGINEERING CO. 12 WILSON ROAD, SOUTH NORWALK CONN.

The new Fidelity-Philadelphia Trust Building in Philadelphia . . . designed by Simon & Simon, Architects, is protected against any outside current interruption with Exide Batteries for Emergency Use.



NO Light Failure Here

The architect protected the new Fidelity-Philadelphia Trust Building with Exide Batteries for Emergency Use



This large Emergency Lighting Battery of 60 cells has a capacity of 1600 ampere hours at the 8-hour discharge rate, capable of carrying an emergency lighting load of *33,000* watts for two hours to a final voltage of about 105 volts at the battery terminals. The battery is connected to emergency circuits, providing lights in the bank, elevators, stairways and basement rooms, in case the power supply to the building is interrupted.

The battery is also connected at all times to the control circuits of the oil circuit breakers in the power supply system, and to the clock, fire alarm and watchman's circuits.

It is kept fully charged by means of a small motor generator or trickle charger, floating across its terminals at a low charging rate.

In the event of an emergency lighting discharge, the battery is afterwards charged from a large motor generator set of sufficient capacity to fully recharge the battery within 12 hours, after which it is again placed on trickle charge with the small motor generator.

ANOTHER huge structure protected against light failure. For, today, the Architect guards the hospital, school, auditorium, office building, against the chance of current interruption.

And he specifies protection that is flexible and reliable. His building needs vary, but the protection must never vary in dependability.

The natural choice is Exide Batteries for emergency use. They are available in a wide range of sizes. They are designed with forty-one years' experience behind them and are controlled with *simple and automatic devices*.

Consult an experienced Exide Representative. This entails no obligation. Just write.

Exide
EMERGENCY LIGHTING BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
Exide Batteries of Canada, Limited, Toronto

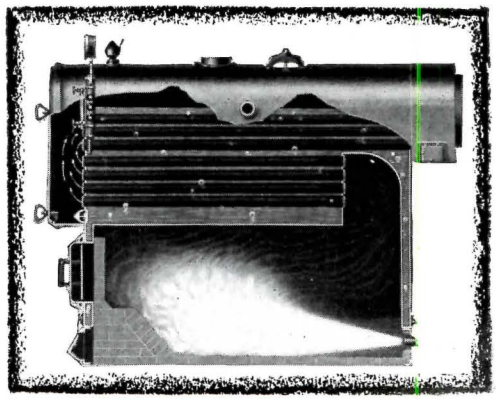
THE ARCHITECTS OF AMERICA ARE INVITED

TO ATTEND THE THIRD ARCHITECTURAL AND ALLIED ARTS EXPOSITION — WHICH ACCORDING TO EMINENT AUTHORITY "WILL CLIMAX THE GREATEST EXHIBITIONS OF ARCHITECTURE AND THE ALLIED ARTS EVER HELD ANYWHERE."

APRIL 15TH—27TH 1929

AT GRAND CENTRAL PALACE NEW YORK

UNDER THE AUSPICES OF THE ARCHITECTURAL LEAGUE OF NEW YORK AND WITH THE ENDORSEMENT OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS AND OF THE NEW YORK BUILDING CONGRESS.



Supreme Tribe of Ben Hur, Crawfordsville, Ind. Building heated by two Heggie-Simplex Boilers, oil fired.

Heggie-Simplex Boilers SAVE $2,600 a Year

"For a number of years we purchased heat for our 5-story building which contains approximately 14,000 square feet of radiation from a public heating plant. This service cost us from $5,400 to $6,000 per year.

"Last year we installed two Heggie-Simplex Boilers, with oil burners. The total cost of operating them during the first heating season was only $3,400. That is, we saved over previous years $2,000 to $2,600.

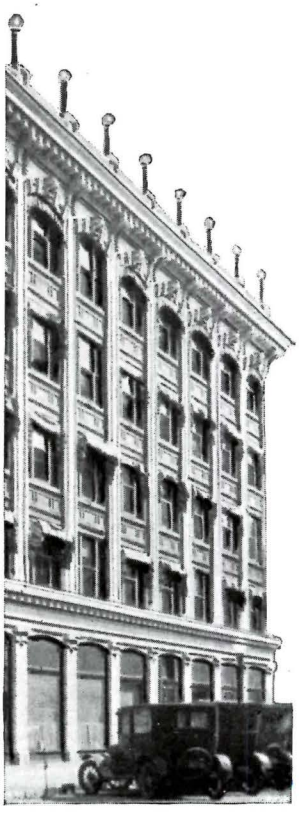
"In addition we kept the building heated for a longer period of the year than we had formerly done."

(*Signed*) J. C. SNYDER, Supreme Chief
Supreme Tribe of Ben Hur, Crawfordsville, Ind.

▼

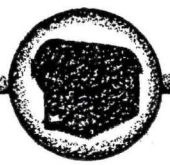
It will pay you also to use Heggie-Simplex Boilers in your buildings—in the new ones to assure, at the start, maximum efficiency and economy—in the old ones to reduce heating costs hundreds, perhaps thousands of dollars annually.

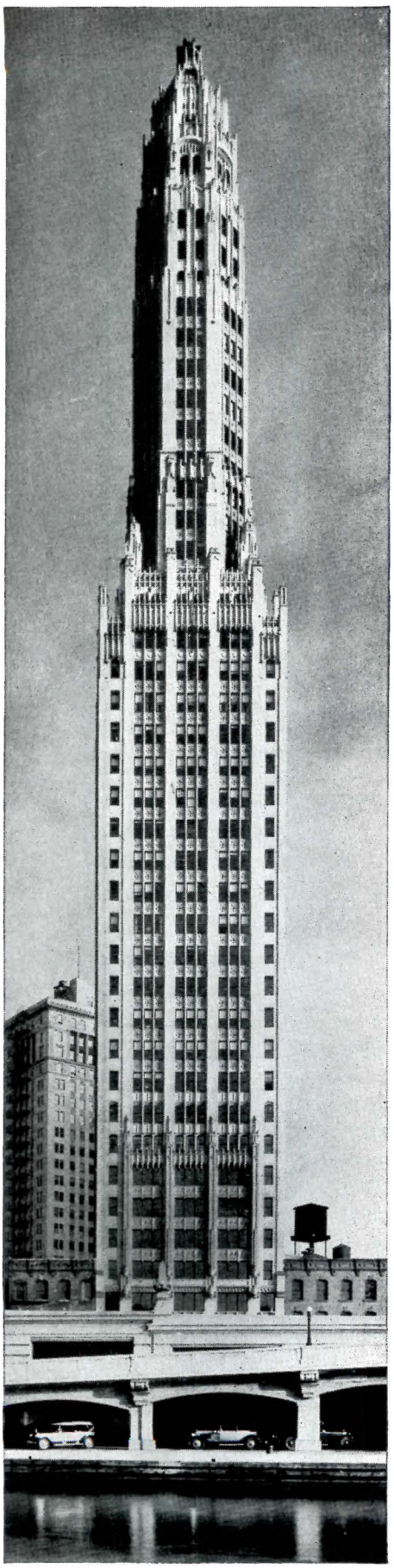
Heggie-Simplex Boiler Co., Joliet, Ill. Representatives in principal cities—telephone and address listed under "Heggie-Simplex Boilers."



HEGGIE-SIMPLEX

STEEL HEATING BOILERS





When You Are In Chicago

We will be delighted to have you call at our new offices

75 East Wacker Drive

MATHER TOWER BUILDING

THE ARCHITECTURAL FORUM is pleased to announce that its mid-western staff is now located in new offices in the Mather Tower Building, 75 East Wacker Drive, Chicago, Ill. Together with the staffs of the other fifteen publications which make up NATIONAL TRADE JOURNALS, INC., they are now occupying the entire sixth floor of this beautiful new structure. With all modern facilities now available to make for prompt and efficient service, the members of THE ARCHITECTURAL FORUM staff extend a cordial invitation to all their friends to call.

If visitors wish to make our offices their business headquarters while in Chicago, they will be furnished a private office for conferences and with stenographic, telegraphic and mail service to suit their requirements. Delivery of telegrams and mail will receive most careful attention.

As now organized, there are four groups, and a nucleus for a fifth, making up NATIONAL TRADE JOURNALS, INC., each group having their respective staff in these offices. These groups are: National Building Publications; National Food Products Publications; National Diesel Publications; National Sports Publications; and a National Textile Publication. Specialty Salesman Magazine is also a property of NATIONAL TRADE JOURNALS, INC.

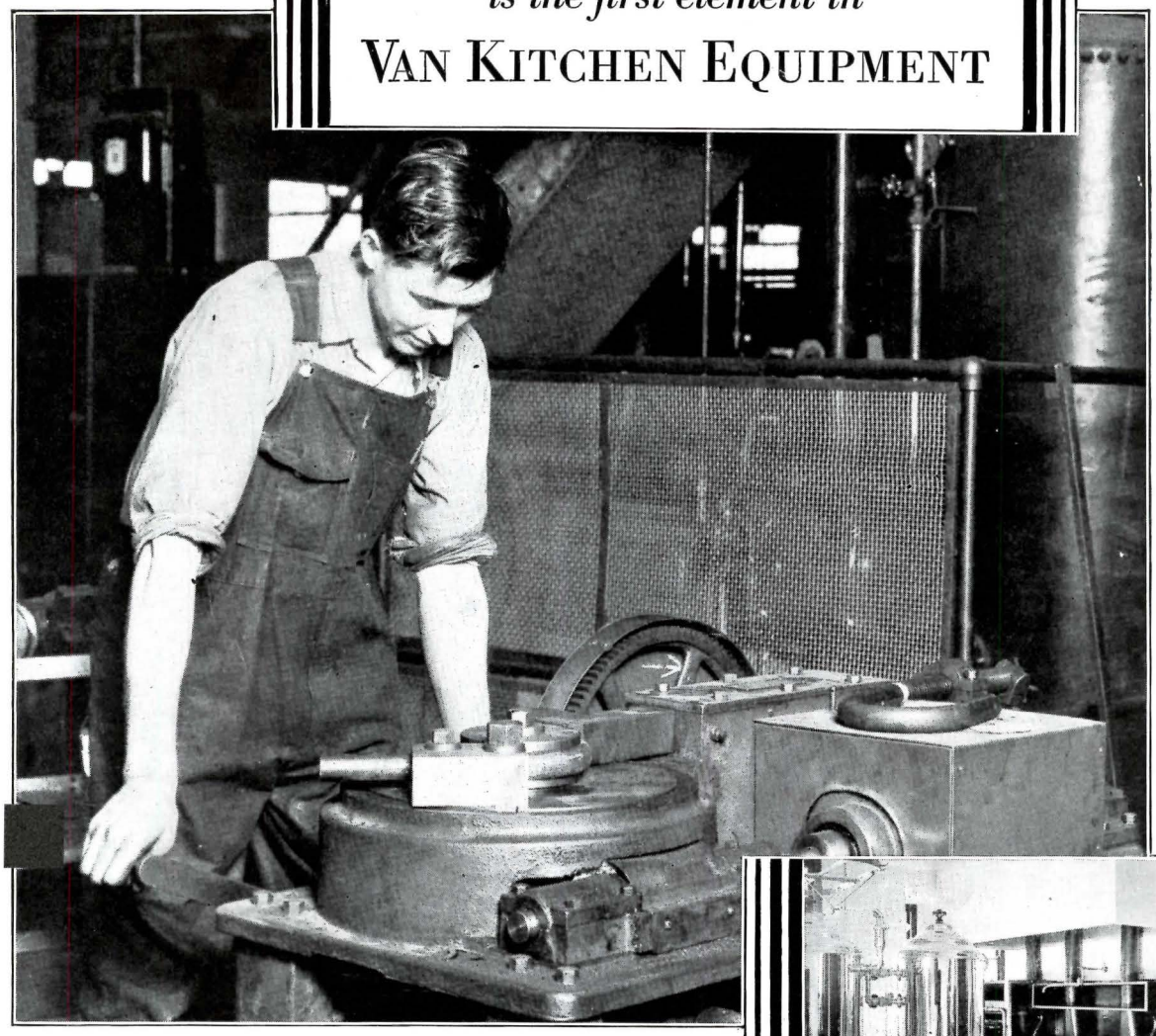
The magazines of NATIONAL BUILDING PUBLICATIONS are THE ARCHITECTURAL FORUM, BUILDING AGE, HOME BUILDERS' CATALOG, GOOD FURNITURE MAGAZINE, THE HEATING & VENTILATING MAGAZINE.

Mather Tower Building is conveniently located for business visitors to Chicago. THE ARCHITECTURAL FORUM staff will welcome the opportunity to serve you when you are in Chicago.

CRAFTSMANSHIP

is the first element in

VAN KITCHEN EQUIPMENT



A specially designed machine in the Van Factory bends pipes to any desired shape.

Those who use and those who specify equipment invariably prefer Van products—because of low cost, negligible upkeep and long life. Shown here is part of a recent Van Kitchen in the Christian B. Holmes Hospital, Cincinnati, Ohio.

Samuel Hannaford & Sons, Architects.

VAN CRAFTSMEN have at their hands the most ingenious machinery, the most durable materials and the latest scientific designs — to which they add their own incomparable skill of manufacture. Not by chance has the Van plant grown from a modest origin seventy years ago to the largest kitchen equipment factory in the world. It is the personal pride of every Van Craftsman that his handiwork shall be superior to any you have ever known, shall cost less than you expect, and outlive your expectations for it.

The John Van Range Co.

EQUIPMENT FOR THE PREPARATION AND SERVING OF FOOD

Cincinnati

DIVISION OF ALBERT PICK-BARTH COMPANY, INC.

Chicago Sales Office 1200 West 35th Street

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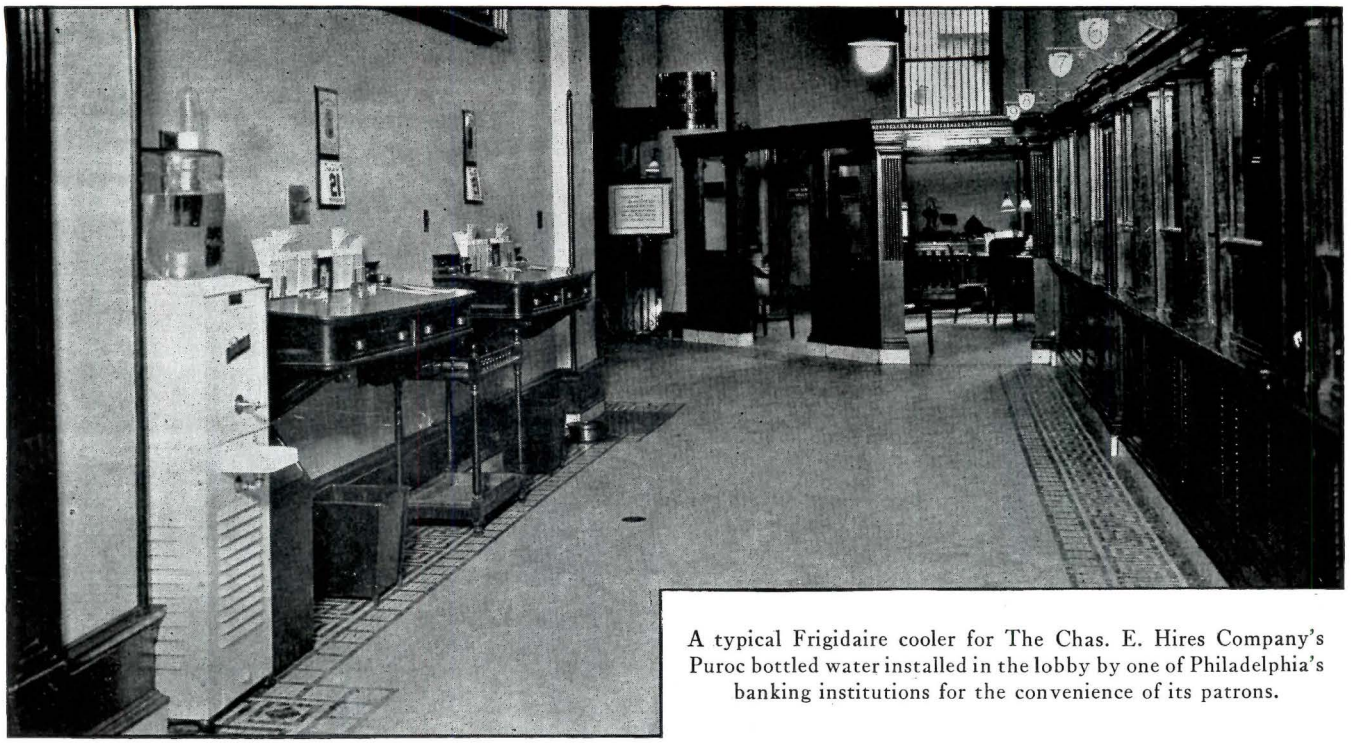
New York Sales Office 38 Cooper Square

See SWEETS, pages C4040 to C4045 for important architectural information.



A typical Frigidaire cooler for The Chas. E. Hires Company's Puroc bottled water installed in the lobby by one of Philadelphia's banking institutions for the convenience of its patrons.

Proof! 3,000 Frigidaire Water Cooler Units installed by *a single water company in 10 months*

IF you have any doubt as to the wide application of Frigidaire-equipped Water Coolers, read this interesting letter.

"Our first frank reaction was that the public would not think of drinking water in terms of electrical refrigeration, but after trying the idea out, there seemed to be no question as to the receptive mood of the average office and industrial plant. They could not overlook the value of convenience, sanitation and properly cooled water."

"The result has been that in the past ten months with but very little advertising we have succeeded in placing *3,000* Units."

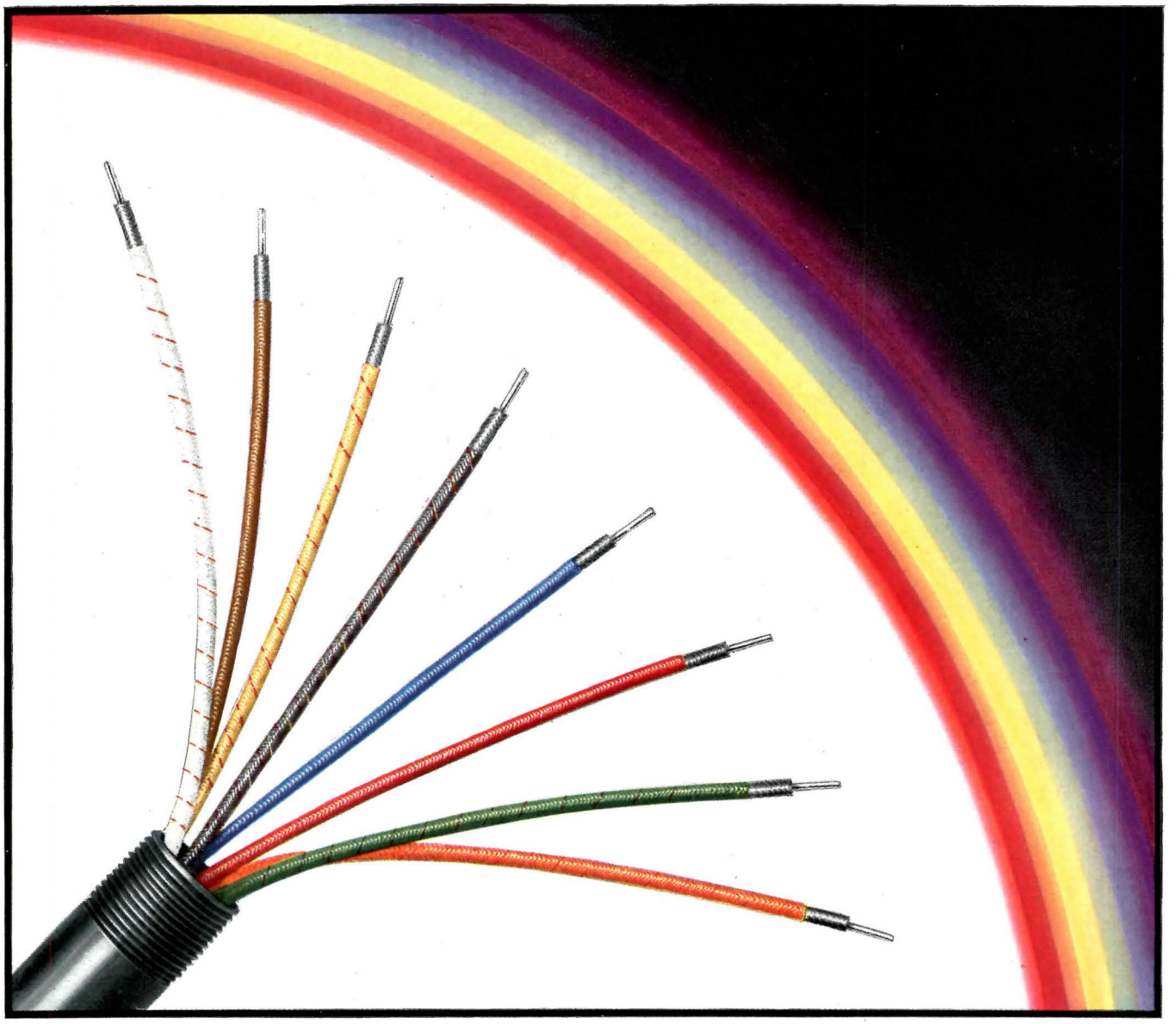
"We can attribute our success to the fact that there is a distinct need for an apparatus of this kind, and, due to the public's confidence in Frigidaire's mechanical performance, appreciation of its convenience, its sanitary features and its attractiveness, it has not been very difficult to interest the average user of Water Coolers."

Charles E. Hires, Jr., *President*,
The Chas. E. Hires Company, *Philadelphia.*

Such experiences as this demonstrate that buildings are more salable, more rentable—more profitable in every way when equipped with Frigidaire Water Coolers. Let us send you the facts and show you how our complete line can furnish the service adapted to your specific needs. Let us quote the favorable G.M.A.C. terms to architects and builders by use of which payment can be made out of income, if desired, rather than out of capital. Frigidaire Corporation, Subsidiary of General Motors Corporation, Dayton, Ohio.

FRIGIDAIRE

PRODUCT OF GENERAL MOTORS



"U. S." Paracore Rainbow Finish

And many years from now—

This permanent record of your electric circuits may save your client from added expense

These 8 colored wires give you a permanently marked wiring system—a different colored wire for base outlets, side wall outlets, main outlets, switches, etc.

The Rainbow Line of "U. S." Paracore Wires costs no more than ordinary black insulation wire. With the Rainbow Finish, circuit testing is practically eliminated. Alterations and additions are easily and quickly made. Saves time in checking the contractor's work. Years after your building has been erected a stranger to the job can trace out the electric circuits as easily as though they were on blueprints.

The Rainbow Line of "U. S." Paracore Wires is a valuable addition to the present complete line of wire now furnished by the United States Rubber Company. It is made with all the skill, resources and facilities that are at the command of this world-wide organization.

"U. S." Paracore Wire—Rainbow Finish—can be furnished from size No. 18 A.W.G. to 1,000,000 C.M., and in Code, 30%, and Intermediate grades.

Judge the many advantages of this outstanding advance in wire manufacturing yourself. Samples on request. Please address inquiries to Room 409 of the New York office, or to the "U. S." branch nearest you.

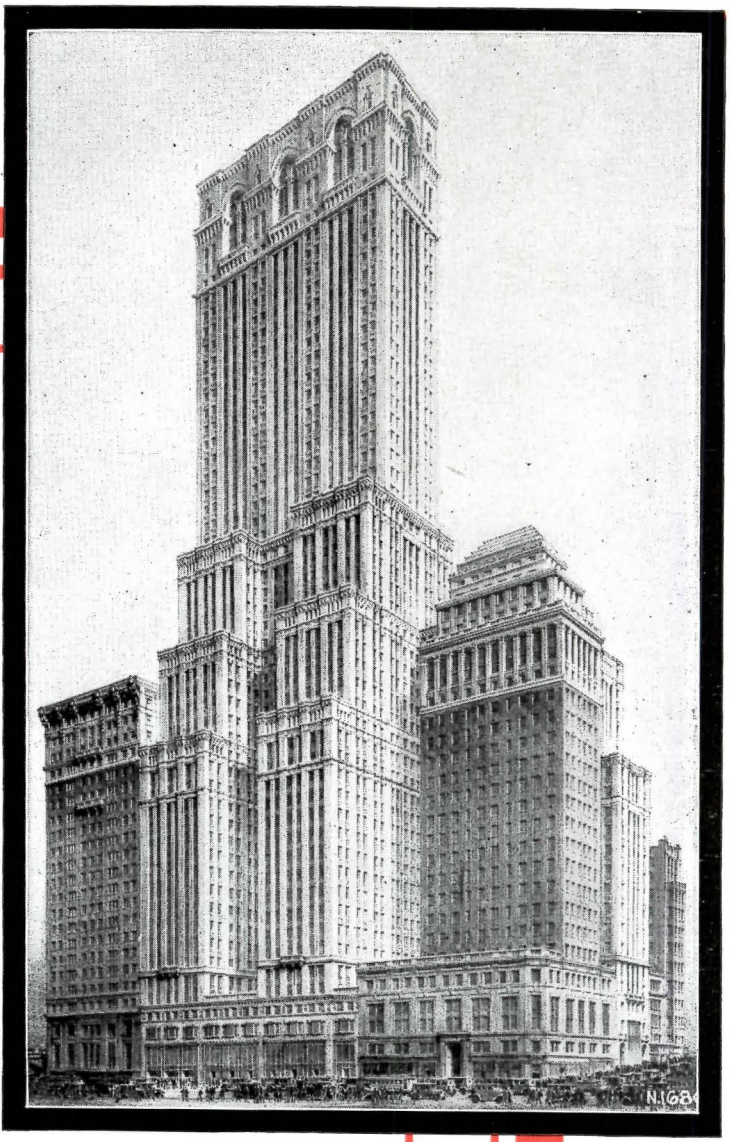
United States Rubber Company

Trade Mark

1790 BROADWAY · NEW YORK

Branches in every industrial center

THE RAINBOW LINE **OF "U. S." PARACORE WIRES & CABLES**



The Lincoln Building, New York City. Another 100% Youngstown Pipe and Youngstown Buckeye Conduit job.

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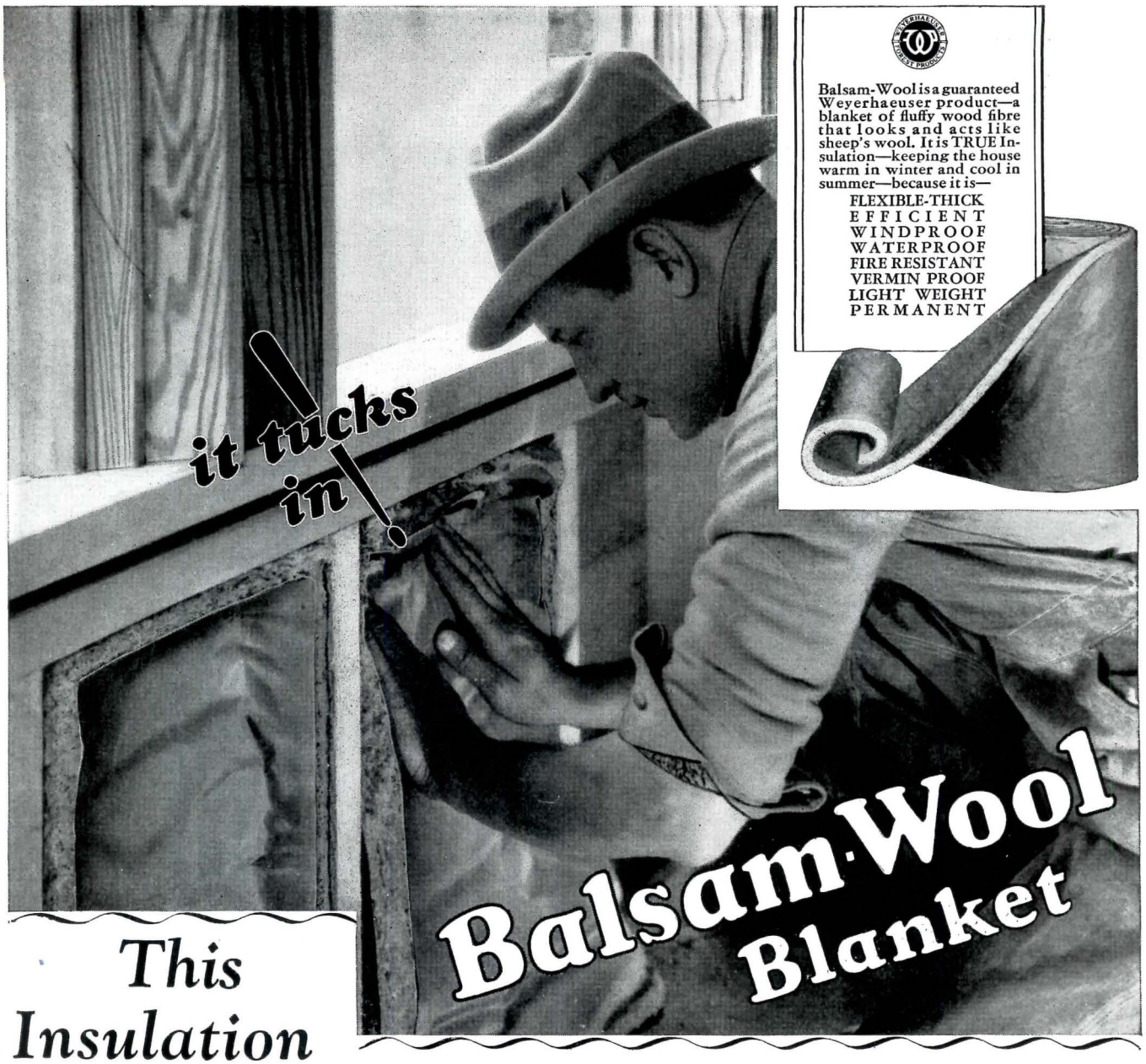

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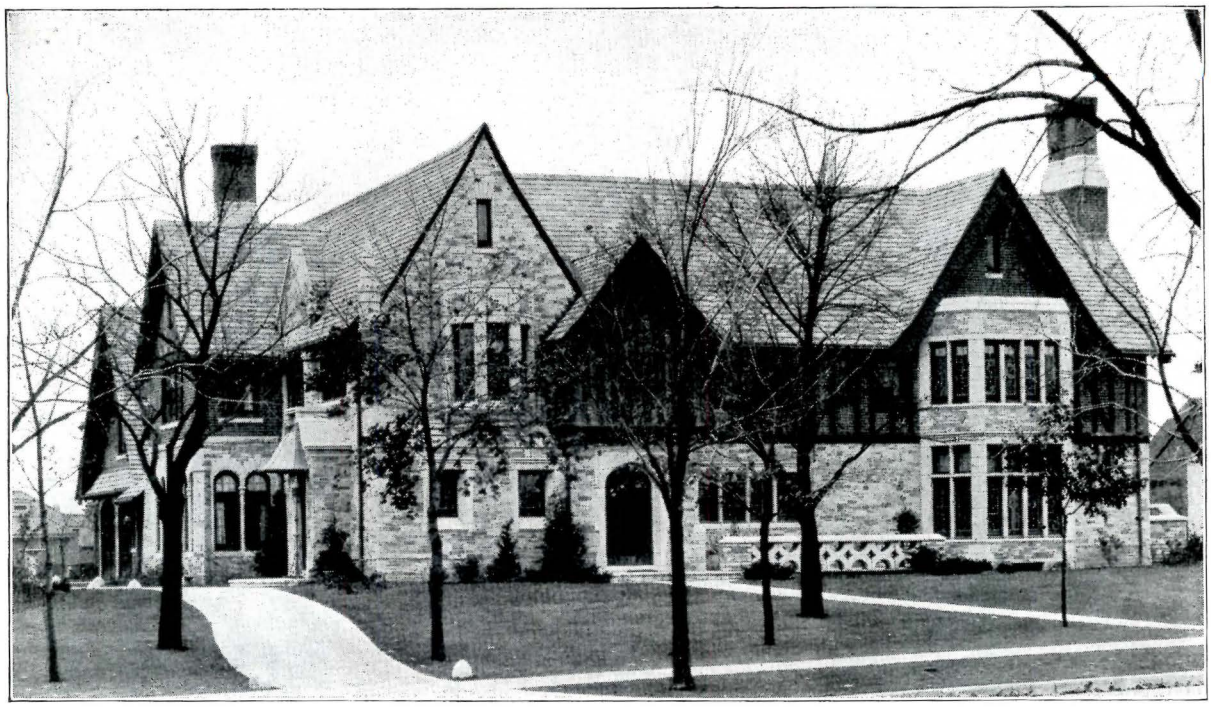

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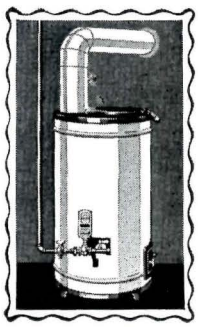

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BOOK DEPARTMENT

"THE FERRO-CONCRETE STYLE"

A REVIEW BY

CLIFFORD WAYNE SPENCER

IF the new style of architecture which is undoubtedly now in the process of development is to have a permanent place in the annals of architectural history, it is evident that it will have to be known by some less transitory and more descriptive name than any of those now in general use. In centuries to come it will doubtless seem highly incongruous to speak of a style of architecture developed in the first half of the twentieth century as the "modernistic" or "contemporary" style. In choosing a definite and permanent name for this type there is much to be said in favor of calling it "the ferro-concrete style," since it is largely by the use of this combination of materials that the new effects are made possible. All the great traditional styles of architecture have had their inception immediately following the discovery of new materials or of new methods in the use of materials which were old. By the use of iron and steel in connection with concrete the chief structural limitation of the traditional styles has been overcome,—that of not being able to build extensively in the third dimension. Due to the nature of materials available, it was necessary to build vertically,—one stone or one brick above another, so that all the emphasis was necessarily placed on the vertical treatment. Now, however, by the use of reinforced concrete it is possible to extend unsupported members horizontally for much greater distances, and since all good design must conform to construction possibilities, an entirely new field in architectural design is thus opened up. The ability of modern engineering science to ascertain accurately the supporting power of structural members affords unlimited opportunities to the present-day designer.

The slowness of architects, especially in this country, to take advantage of these opportunities is probably due to a rather general, erroneous belief that concrete is not adaptable to æsthetic treatment in design. The book entitled "The Ferro-Concrete Style," by Francis S. Onderdonk, should do much in correcting this mistaken opinion, since merely to glance at the illustrations is enough to impress one with the fact that so far as form is concerned, use of reinforced concrete has no limits. This fact is brought out by illustrations of such remarkable examples as a garden statuette showing a gracefully poised figure, with wings, rendered in concrete and steel, and another illustration showing a pavilion suspended in mid-air with no means of support other than the stairway leading up to it. The author points out that it is generally true that those living at the times of great achievements remained ignorant of their advent, and that the general public, as well as the majority of architects, do not now realize that we are witnessing the birth of a new architecture, and that the false opinion in the minds of many as to the design possibilities of concrete is due to the habit of considering the limitations of concrete design as identical with those of wood form construction. As a matter of fact, using wood centering is only one of many ways of shaping concrete, and many of the others are much more suitable from a design point of view. One of the valuable features of the work is that while the design possibilities are given greatest importance, the text matter gives much technical and practical information as to the up-to-date methods of handling this adaptable material.

The author of the work was born in New York, but he spent 20 years of his life in Europe, where he received his architectural training and devoted much time to investigating the possibilities of ferro-concrete architecture. He is now a member of the faculty of the College of Architecture of the University of Michigan, so it may be said that his viewpoint is international, which adds greatly to the interest and value of the work. France, the country in which Gothic architecture had its greatest development, seems to have taken the lead in using the new style of design, and the examples of ferro-concrete work found there and in Germany, as well as in some of the other continental states, are generally much more advanced than those found in America, although a great deal has been done in the Pacific coast region. True, a great deal of the so-called modern work is trashy and has been done by those who have not sufficient background to do good work in any material, and yet there are plenty of good examples to point the way to a rational development and to show the possibilities latent in the style. Many of the illustrations in this volume are chosen with a view to showing that which is bad as well as what is worthwhile, and the text explanation as to why certain things constitute poor design will give a good basis for developing an appreciation of the good in this new architectural style.

Perhaps the two most characteristic features of the ferro-concrete style as yet developed, and features that are destined to play a most important part in its future development, are the use of concrete tracery and the parabolic arch. Concrete tracery has been used considerably both on our own Pacific coast and in Europe, and it offers a great many new possibilities in the decorative treatment of wall surfaces. The tracery is formed of reinforced concrete in an unlimited variety of pattern, and the apertures are often filled with glass, thus taking the place of windows and achieving very beautiful effects both in the daytime and at night when they are lighted from within. This concrete tracery is being used in residence work as well as in more monumental buildings such as the Bahai Temple at Wilmette, Ill., which is to

have a dome formed completely of concrete tracery. The use of concrete tracery will enable the architect to "fulfill his supreme duty to create poetry and tell stories in stone" much more readily than ever before. Wall surfaces treated in this way can be made as decorative or as simple as may be desired without losing any of their structural soundness. The record characteristic feature of the ferro-concrete style which is stressed by Mr. Onderdonk is the beautiful parabolic arch. Reinforced concrete structures have the advantage of being made up of one complete mass and not having reams or joints as is the case with other materials where columns or walls are laid up and the intervening spaces spanned by horizontal members or arches of very limited extent. In the new designs, arches based on the parabola, nearly vertical at the base and curving gradually more and more till at the top it approaches a semi-circle, permit of vastly greater unimpeded floor areas, and produce buildings of great dynamic beauty. The parabolic arch is more or less familiar in bridge construction, but it has not been used extensively for buildings in this country. In Europe, however, a surprising number of important buildings have been built from designs based on the parabola. The collection of illustrations of this type of building contained in this book is very complete and well chosen, and one cannot help being inspired to a firm belief in the future of this style. In addition to being a remarkable treatise on the use of ferro-concrete architecture, this volume may be said to be one of the most complete and inspiring recent works on modern style in architecture.

THE FERRO-CONCRETE STYLE. By Francis S. Onderdonk. 265 pp., 8 x 11 ins. Price $12. Architectural Book Publishing Co., New York.

THE VILLA MADAMA. By W. E. Greenwood. 76 pp., 10 x 12¾ ins. Price $20. William Helburn, Inc., New York.

A FELLOW of the Institute of British Decorators, this author shows great fidelity to and love of his subject in his compilation on the Villa Madama, and his publisher is equally to be congratulated on producing a fine piece of book making. This volume, of some 75 pages of text, has been generously enriched with fine color reproductions, to the number of about 30 plates. It has the extraordinary advantage over most architectural studies of being, within its limited scope, exceedingly scholarly and well annotated. The full color reproductions are not only delightfully done and well reproduced, but they present a very complete synthesis of what is probably the most representative, and possibly the finest, bit of Italian Renaissance wall and interior vault decoration still existing. They will be invaluable to any architect working in that style.

Mr. Greenwood has evidently made of this reconstruction a labor of love, and his text omits no detail of the subject which might for any reason be worth mentioning. In fact he precedes the introduction and historical notes with four pages of references which not only tie the Villa Madama in with the work of other students, but with other good contemporary examples. His references include the works of Vasari, and extend on down to the later German students, and the people whose imagination and genius went into this magnificent work come in for a series of illuminating notes. In his introduction, Mr. Greenwood says: "There is no doubt that the perfections we have hinted at in this work

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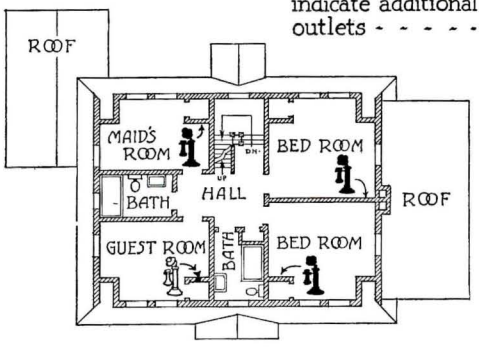

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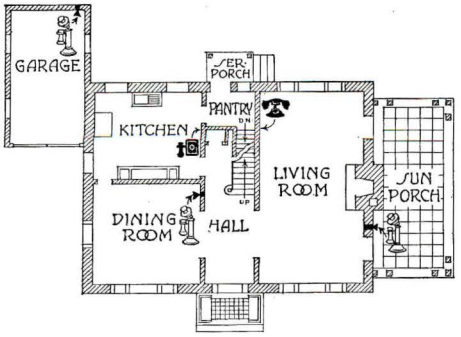

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are, as examples of mural decoration, among the finest, if not the finest, in the world today. They are certainly the best of the period, that golden age of art, of which the divine Raphael was the guide and shining light. As the same artists were employed on both the Vatican Loggia and the Villa Madama, and as the work at the Villa was executed after the completion of the decorations in the Vatican, the artists had, of course, profited from their experience and perhaps from kindly criticism. We in this later age may be over-critical, but many of the criticisms that can be leveled against the Vatican decorations cannot be made against those in the Villa Madama."

Libraries of Italy and the continent which have been delved into to enrich this volume have apparently yielded some remarkable facts. In his historical notes, the author in referring to them says: "We may well surmise that, were it not for a number of original drawings and plans that have, from time to time, been identified as bearing upon its genesis and construction, the Villa Madama would have had little interest apart from its marvelous interior decoration. These drawings, few though they be, and altogther inadequate for a complete understanding of the splendid project of Cardinal Giulio de Medici, are nevertheless of untold value. For they are intimate documents bearing upon the planning and decoration of what, had it been completed, would have been the most sumptuous villa of the Italian Renaissance." It would appear that the Villa Madama may be considered not only as an almost perfect example of the Italian villa of the Renaissance, but also as the most important example of the mural paintings of that period, particularly as representing the work of Raphael and his assistants. And Mr. Greenwood has gone into these matters carefully. He notes that, "when Bramante died and Raphael was made architect of St. Peter's, two worthy assistants were given him,—men whose knowledge and talent had already been appreciated by Bramante. These two were Giuliano San Gallo and Fra Giocondo. As a matter of fact, Raphael had several talented architects around him besides these, not the least being Antonio and Aristotile San Gallo. It was in 1516 that Antonio San Gallo joined him. As this was the date when, so far as we can ascertain, the Villa Madama was first projected, and a large plan of the Villa designed by Antonio has been identified at the Uffizi, we need have no hesitation in affirming that, while Raphael may have inspired the first designs for the Villa and watched the work closely, it is to Antonio San Gallo that we must give the honor as its architect. From other plans existing in the Uffizi we know that we must also add the names of Battista and of Antonio, the younger. From 1516 to 1521 the work proceeded, and though only a part of the project as originally planned by San Gallo was actually completed, the plan seems to have been followed so closely that, as Clausse says, 'the architect who was the author must have also superintended the execution.'"

And Mr. Greenwood is not without his prophetic vein. He is particularly pertinent, in this reviewer's estimation, where he calls attention to the inconsistency in our great architecture of today in the lack of application of correspondingly great mural treatment therein. It is difficult to wholly agree with the author where he says "we need a greater demand for mural decoration to give

stimulus to artists and to arouse their latent powers." The present-day disuse of murals in our buildings has its cause rooted in something deeper. What we do need today is perhaps, first of all, architects with a feeling for fine and significant wall decoration. The result of their foresight and coöperation would doubtless be a healthy stimulus to the work of our contemporary painters. There is no lack of painters, but there is undoubtedly a lack of understanding, of coöperation between these men and successful architects of our period. If there are to be great murals painted to adorn the fine free spaces of our public buildings today, it is undeniably from the hands of the architects that opportunities for this work will be given,— not primarily from the hands of building committees. This in spite of the fact that there have probably been notable examples where it was the painter's initiative which created his own opportunities,—witness Raphael of Italy of the sixteenth century and Diego Rivera of Mexico today. It is unfortunately true that in present-day America the excellent work being done by a number of gifted men is not receiving proper recognition.

A reconstruction such as has been accomplished in this volume is truly stimulating. This work on the "vineyard of the pope," which received the best efforts of a Raphael and the San Gallos, will be peculiarly important to those of the architectural profession who are interested in significant wall decoration. The importance of the volume's subject matter well deserves the care with which the work has been produced. It is a volume which will delight the decorator, and its value to the architect should secure it a place in every library.

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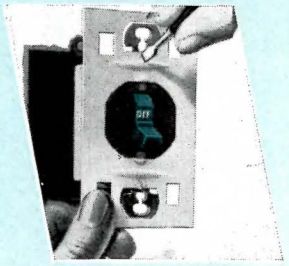

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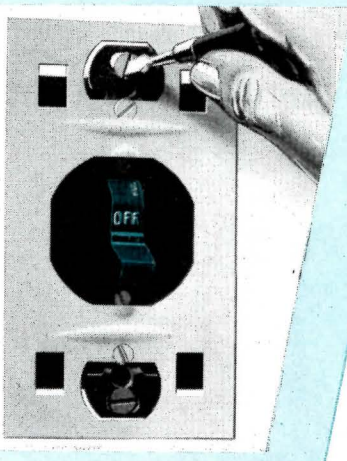

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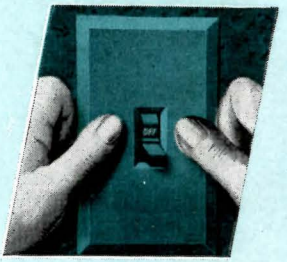

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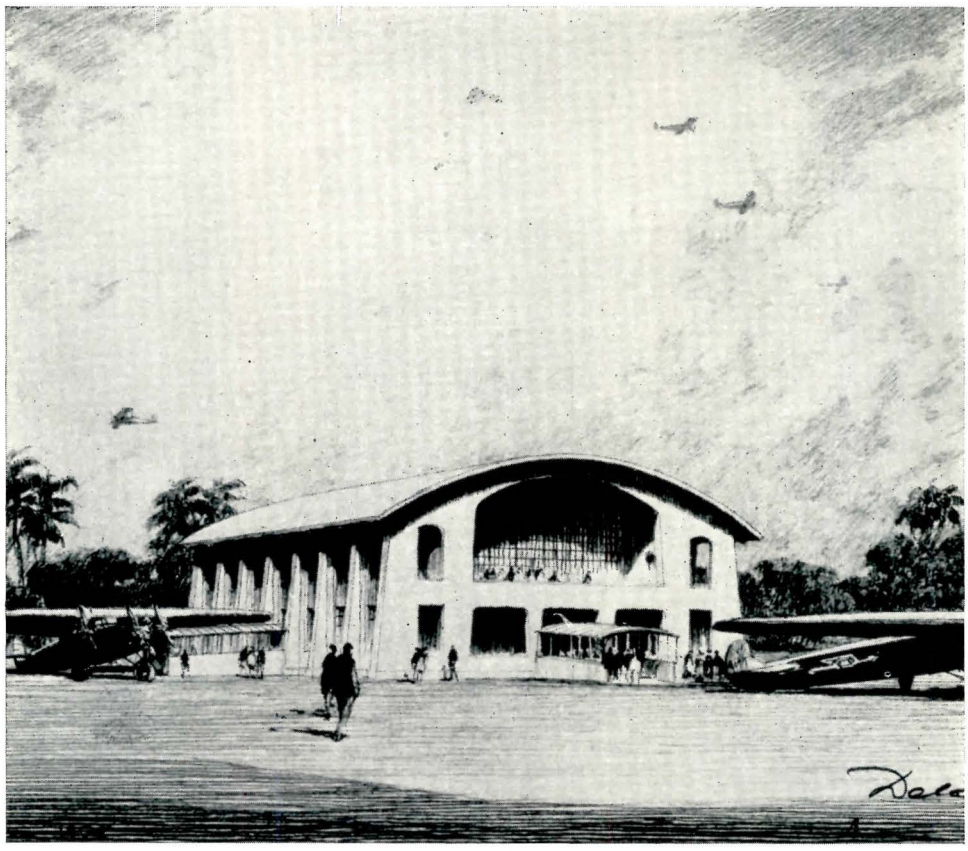

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AIRPORTS,—THE NEW ARCHITECTURAL OPPORTUNITY

BY

TYLER STEWART ROGERS

SO rapid has been the development of civic and commercial aëronautics that it has already reached the point where its further growth is largely dependent upon the provision of adequate ground facilities in the form of landing fields, airports, and the many types of accommodations that must be provided for the care of airplanes, pilots, passengers, and cargo. It is only within the last year or so that American cities have awakened to the fact that they must provide airports immediately if they are to benefit by the stimulation which aviation can give to commerce, industry and transportation.

In a bulletin issued in the fall of 1928,—less than six months ago,—the United States Department of Commerce listed fewer than 400 airports either completed or actually under development, exclusive of those used for military and naval forces. During an address presented before airport interests at the aviation show in New York in February, Colonel Harry H. Blee, Chief of the Airways and Airports Section of the Department of Commerce, said that there were approximately 1,000 airports then actually in use or under construction, and that about 1,000 others were being studied by chambers of commerce, municipalities and other interests with a view to selecting sites, arranging finances and otherwise preparing for active work. He qualified the statement by saying that even these figures were not reliable because they were changing daily. Estimates of the amount of money being expended in this new field are likewise vague for this same reason. Figures covering the last year and a half showed the enormous amount of $300,000,000 already spent or pledged for airport development, and a forecast was made that at least $500,000,000 would be spent in the next year and a half for such work. If these figures are out of date today, they are merely conservative, and undoubtedly a few years hence will be insignificant compared to the amount of money being expended annually for ground facilities to serve air transportation systems and the use of private aëroplanes for recreation and commuting.

Here is a vast new field of activity that involves very important problems in architecture, engineering and city planning. What have architects done to take their logical place in this new work? A recent bulletin published by the Department of Commerce lists 28 organizations or individuals rated as airport designers and constructors. Of these 28 not over four or five are architects or engineers serving in a purely professional capacity on design problems. The others are former aviators who have entered this new field or construction organizations that have seized the opportunity to capture desirable contracts of this character, and in a few instances companies that have been formed to advise professionally on airport designs, calling themselves "airport engineers." No implication is intended in this statement that the 23 or 24 organizations, exclusive of established architects and engineers, are not qualified for the work they are engaged upon; it is merely significant that so few well trained and well established architects and engineers or city planners have yet achieved recognition in this field.

Architects, engineers and city planners can and must solve America's airport problems. They are already trained for this work. They alone have the background needed to handle such operations in a constructive and farsighted manner, and they lack only an appreciation of some basic aëronautical requirements. Even these requirements are rapidly becoming public property through the dissemination of information by the Airways and Airports Section of the Department of Commerce, the National Aëronautical Association, the National Advisory Committee for

Entrance to Passenger Station, Tempelhof Field, Berlin

Modernistic Restaurant in Tempelhof Field Airport, Berlin

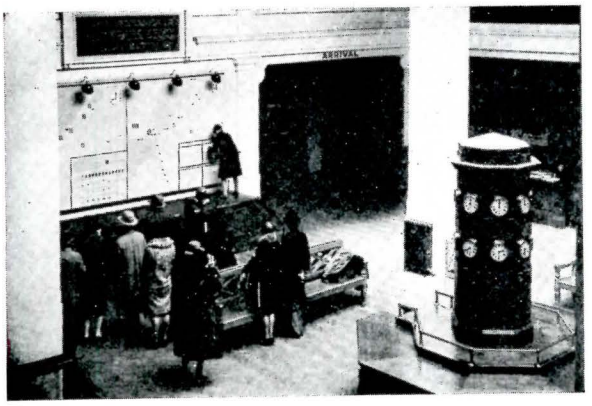
Aëronautics, and other organizations of like character.

There is a close parallel between the present-day development of airports and the early expansion of railway transportation systems and terminals in this country. The passenger stations and terminals that were built a half-century ago were badly designed structures, not adapted to serve the enormous expansion in railroad traffic that subsequently followed. They were designed poorly (from the present-day point of view) largely because there was little precedent for planning such structures and because few people could visualize the requirements that were subsequently imposed upon them. Within recent years hundreds of millions of dollars have been spent to revamp, reconstruct and often re-locate not only important terminals but literally thousands of minor railway stations to adapt them to modern needs.

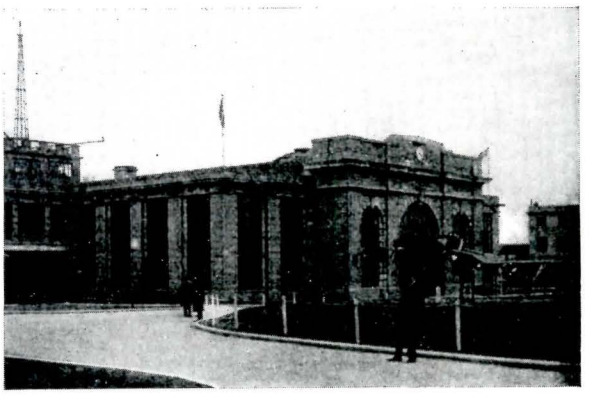
The modern airport, like the railway station, will become a gateway to the city which it serves. It must possess dignity and quality in keeping with its important civic character. There is already a very noticeable tendency for some airport developers to create structures of more or less temporary character which will rapidly become obsolete and inadequate to meet the requirements of air traffic. In fact many of America's existing airports are comparable to a railroad terminal consisting of a round house, track yards and a freight shed which also houses the ticket office and waiting room. Out of the hundreds of millions of dollars to be expended for airport development in the immediate future, a very substantial proportion will be wasted through obsolescence if the problem is not immediately attacked in a broad way and if an effort is not made to visualize future requirements and to provide for them in the initial layout and construction of airport facilities. This has already occurred at Croydon, England, where structures which cost some $600,000 have been scrapped and replaced by modern buildings costing over a million dollars. Even the famous Tempelhof airport at Berlin, undoubtedly the finest airport in the world today, has been undergoing constant evolution for the past several years to meet the rapidly expanding air traffic of which it is the center. Comparatively few American airports have yet been carefully planned to provide for expansion at the rate already experienced by the leading European airports. Most of them have started with merely landing fields, and their structures have grown haphazardly. There is not even general consensus of opinion as to the proper method of developing American airports, and in some cases municipalities have leased parts of the landing areas they control to air transportation systems which have erected their own structures without any regard to the others or to the general utility of the field.

Such conditions are regrettable but perhaps inevitable at this stage. It is a fact that the development of commercial aëronautics has been so rapid that the ground problems which have been created have multiplied far more rapidly than they have been solved. It is essential that airport design be considered with the intelligence and foresight that has been applied to aërodynamics and the design of flying machines. Architects, engineers and city planners, trained to solve planning problems of this magnitude, must turn their attention to airports, not only for the sake of commercial and civic aëronautics but because here is a new field of business which they should logically develop.

Undoubtedly the very recent announcement of the Lehigh Airports Competition among architects and engineers for the design of a modern airport is the most significant move that has been made to bring architects, engineers, and city planners into public notice as the logical persons to guide the future development of America's airports. This competition is sponsored by the Lehigh Portland Cement Company of Allentown,



The Waiting Room in the Croydon Airport, Showing Time Indicators and Weather Map



Entrance to Airport Administrative Buildings, Croydon, England. Control Tower on Left

Pa., which has posted $10,000 in prize money to be awarded those supplying the 14 best designs which are submitted. The competition has been planned with the utmost care and under the guidance of some 25 recognized authorities in the four fields of architecture, engineering, city planning, and aëronautics. The preliminary work which had to be accomplished in order to formulate a sound competition program is in itself of considerable interest to architects, because it was necessary to touch upon every phase of airport layout and facilities and to attempt to visualize the hitherto undeveloped possibilities for the arrangement of airport units, in order to give the competitors free rein to work out new and ingenious solutions of the problem without being hampered by the often unsatisfactory precedents which the world's existing airports now constitute. Some of these matters will be touched upon later. The competition is exceedingly timely and should prove of the utmost value to the architectural and engineering professions and to city planners, as well as to the entire aëronautics industry.

A number of people prominent in public life, including William P. Mac Cracken, Jr., Assistant Secretary of Commerce for Aëronautics; F. Trubee Davison, Assistant Secretary of War; Senator Hiram Bingham; former Postmaster General, Harry S. New; Dr. Samuel S. Stratton, President of the Massachusetts Institute of Technology; and others, have indicated their interest in this competition because of its potential value in stimulating sound airport development. In commenting on the work of the committee, Mr. Mac Cracken said:

" 'Build the bird house and the birds will come' is an old saying, but it is more true of human beings than it is of our feathered friends.

"The character and attractiveness of America's airports have a direct relation to the people's interest in the growth of air traffic, public and private. The degree to which any community can participate therein is directly in proportion to the provision which that community makes for getting airplanes in and out of the air. In other words, it means bigger and better airports and more of them. Any municipality which overlooks today's great opportunity for providing for air traffic of not only the future but of the present, will be found in the same position as those which refused to accept the railroad in pioneer days.

"The airport architecture which is being developed by the Lehigh Airports Competition will be of particular help to American municipalities in solving their airport problems. It should, therefore, command the good will of all forward-looking people."

The company in sponsoring this competition has entirely removed any possibility of there being a commercial aspect by giving the program committee and the competition management carte blanche authority to establish the requirements of the competition in whatever manner will be of the greatest value to the competitors and to municipalities, air transport companies, flying clubs, chambers of commerce, and others interested in the creation of future airports. It is a far-sighted gesture for the benefit of many interests, from which the sponsors expect no return other than added good will and prestige. Roland D. Doane, representing the company, has merely asked that the competition drawings indicate the structures as though built of Portland cement products where feasible, admitting reinforced concrete construction, concrete blocks, or stucco over other sound and permanent structural materials.

When this competition was first proposed it immediately became apparent that the program could be prepared only after a great deal of study of the character and the facilities demanded in

General View of Croydon Airport, Showing New Administrative Buildings, Control Tower and Several Hangars

a complete, well appointed airport. It was then decided to obtain the advice and counsel of leading architects, engineers, city planners, and aëronautics experts through the medium of a program committee to which would be entrusted the preparation of the competition program and subsequent oversight of the entire contest. Harvey Wiley Corbett, is general chairman of the program committee, and Francis Keally is the professional adviser. The architectural section of the committee includes Mr. Corbett as chairman, Raymond M. Hood, Professor William A. Boring, Dean of the School of Architecture, Columbia University; Parker Morse Hooper, Editor of THE ARCHITECTURAL FORUM, and Mr. Keally. Engineering matters bearing upon airport design were considered by an engineering section headed by Morris Knowles, of Pittsburgh. Other members of this section are Francis Lee Stuart, one of America's outstanding engineers specializing in port, terminal, and transportation work; Harold M. Lewis, Executive Engineer of the Regional Plan of New York and its environs; Gavin Hadden, and Colonel Willard Chevalier, Publishing Director of *Engineering News-Record*.

Airport planning is so definitely a part of city and regional planning in the relationship of airports to other transportation methods and to the communities they serve, that it was quite essential to have guidance on these problems. At the same time it was recognized that municipal, state, and county authorities are keenly interested in airport design and location. In consequence, a third section of the program committee was organized, headed by George B. Ford, city planner, as chairman. The membership of this group includes E. P. Goodrich, city planning consultant to the Chinese government, who is now in China planning airports as a means of expanding aërial transportation systems in that country in lieu of the slower and more expensive extension of the national railway system; Fred C. McLaughlin, Mayor of White Plains, N. Y., and President of the New York State Conference of Mayors and of the Westchester County Federation of Planning Boards; Samuel P. Wetherill, Jr., President of the Regional Planning Federation of the Philadelphia Tri-State District; and Harold Buttenheim, Editor of *American City*.

Necessarily, the most vital matter in the formulation of a competition program as well as in the actual designing of any airport is the need for solving practical aëronautical problems. The aëronautics section, headed by Dr. George W. Lewis, Director of the National Advisory Committee for Aëronautics, as chairman, was thus organized to secure the counsel of men representing every leading aëronautical organization as well as the practical management of commercial and municipal air terminals. The membership of this committee includes Porter Adams, Chairman of the Executive Committee, National Aëronautic Association; Major John Berry, Manager of Cleveland Municipal Airport; Colonel Harry H. Blee, Chief, Airways and Airports Section, Department of Commerce; L. K. Bell, Secretary of Aëronautical Chamber of Commerce; Colonel Paul Henderson, Vice-president, Transcontinental Air Transport, Inc.; Charles S. (Casey) Jones, President Curtiss Flying Service; Ernest Jones, Aëronautics Expert, Department of Commerce; and Harry Schwarzschild, Editor of *Airports*. The problems considered by these four sections of the competition program committee are the problems which face any architect, engineer, or city planner undertaking the design of a well equipped air terminal, and a brief discussion of the more vital matters may prove of interest.

Site Requirements for Airports

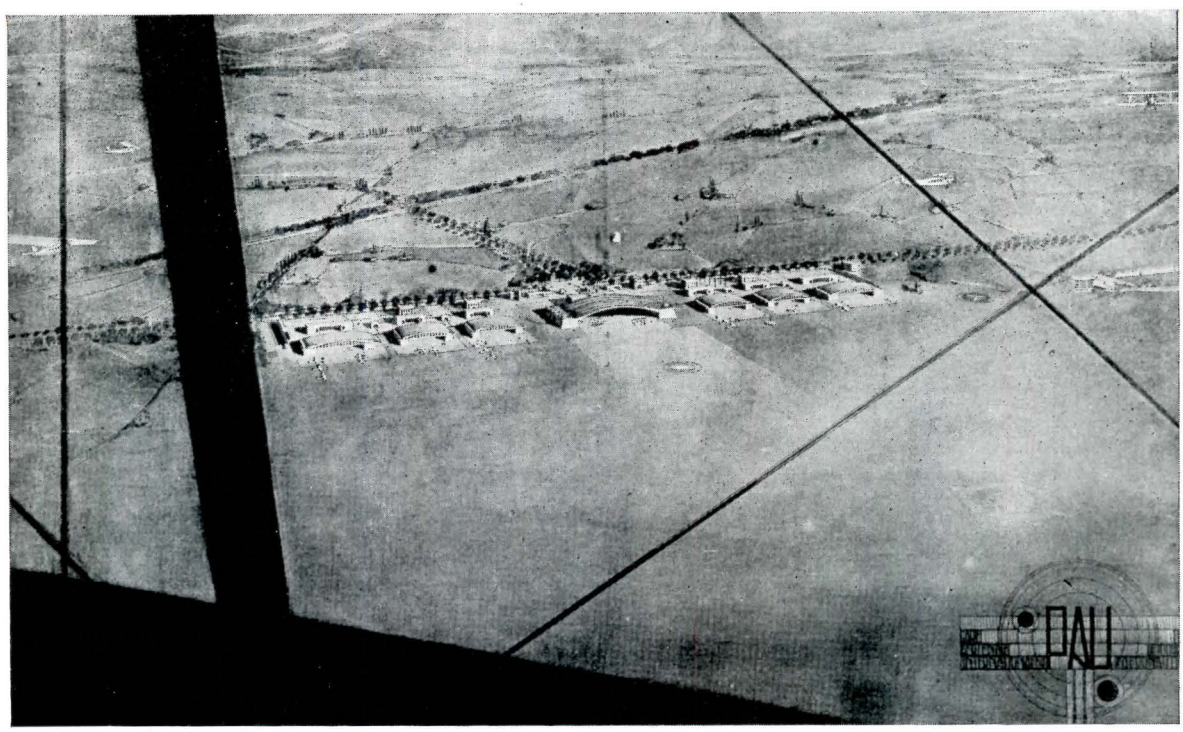
There is a universal feeling that airplanes will be so developed in the future that they can land

Hangars at the Ford Airport, Dearborn, Mich.

and take off in less space than is now required. Undoubtedly, this is true, and the progress already made, including the development of the autogyro abroad, will probably make it possible in the future to utilize less landing area than is now necessary. On the other hand, it must be remembered that there will be an equivalent expansion in the use of planes, not only for commercial transportation, but by private owners for recreation and commuting, and as this growth takes place, more planes will arrive and take off simultaneously, requiring correspondingly larger areas for maneuvering. Furthermore, it has already been demonstrated that the establishment of an airport stimulates realty values in the locality and leads to development of vacant land nearby with industrial plants associated with the aëronautical industry, with homes, and with all of the structures which naturally congregate around any center of transportation, such as hotels, stores, and amusement places. Thus, when the boundary of an airport site is once established, it is exceedingly difficult to expand the site by acquisition of adjacent vacant land, because in a few years increased values make such land out of reach for airport use, or what vacant land there was when the airport was established becomes developed with more or less costly structures which cannot be removed. Consequently, it is important to take as much land as possible when an airport is first established and to maintain control of the entire area in order to provide for future needs as well as to give an adequate, effective landing area for present-day airplanes.

It is not necessary to discuss in detail the permissible minimum sizes for flying fields. The United States Department of Commerce, through its Airways and Airports Section, publishes bulletins which are available to architects, engineers, and others interested, in which these dimensional requirements are discussed and a rating system is established. Colonel Harry H. Blee, chief of this section of the department and a member of the Lehigh Airports Competition Program Committee, in considering this matter felt it advisable to recommend an effective landing area of 3,500 feet in all directions, but at the same time he said that this is in excess of the space required for the highest airport rating. In other words, while 2,500 feet in each direction or even shorter runways, will suffice for minor airports and emergency landing fields, it is good judgment to take the largest area available up to approximately a square mile.

The gross area consists of three major space units, the first of which is the landing and take-off area which is wholly free from obstructions of any kind, and it is this part of the field which should be as large as circumstances will permit. Modern airplanes have a safe gliding angle of 7 to 1 and can gain altitude in approximately the same ratio. Hence, the effective landing area must be protected by the second space unit, which may be termed a marginal strip. The marginal strips must have a width which is seven times the height of any building or other elevated obstacle bordering on the landing field. It is perfectly feasible to utilize these marginal strips in various ways, providing the structures erected upon them do not project above a line having a 7 to 1 starting at the edge of the effective landing area. Such space may be used for parking automobiles and for mooring planes which do not require hangar protection, as well as for playgrounds, outdoor restaurants, parks, and various other types of concessions and amusements. In fact, the marginal area may be developed to produce an important revenue to the airport, for all of the European airports experience a steady flow of visitors who come to watch the flying activities. Over weekends from 10,000 to 12,000 persons regularly visit the Tempelhof field in Berlin to patronize the beer garden, the promenades, and the amusements while they watch transport



Perspective by Maurice Chauchon, French Architect, for a New International Airdrome at Pau, France

planes arrive and depart. The third section of the site is that part reserved for the important airport structures which will be mentioned later and which must be separated from the effective landing area by the same type of marginal strip which protects the other borders of the field. This vacant space, however, between the airport buildings and the landing field, is usually reserved for the maneuvering of planes, and is not available for public use.

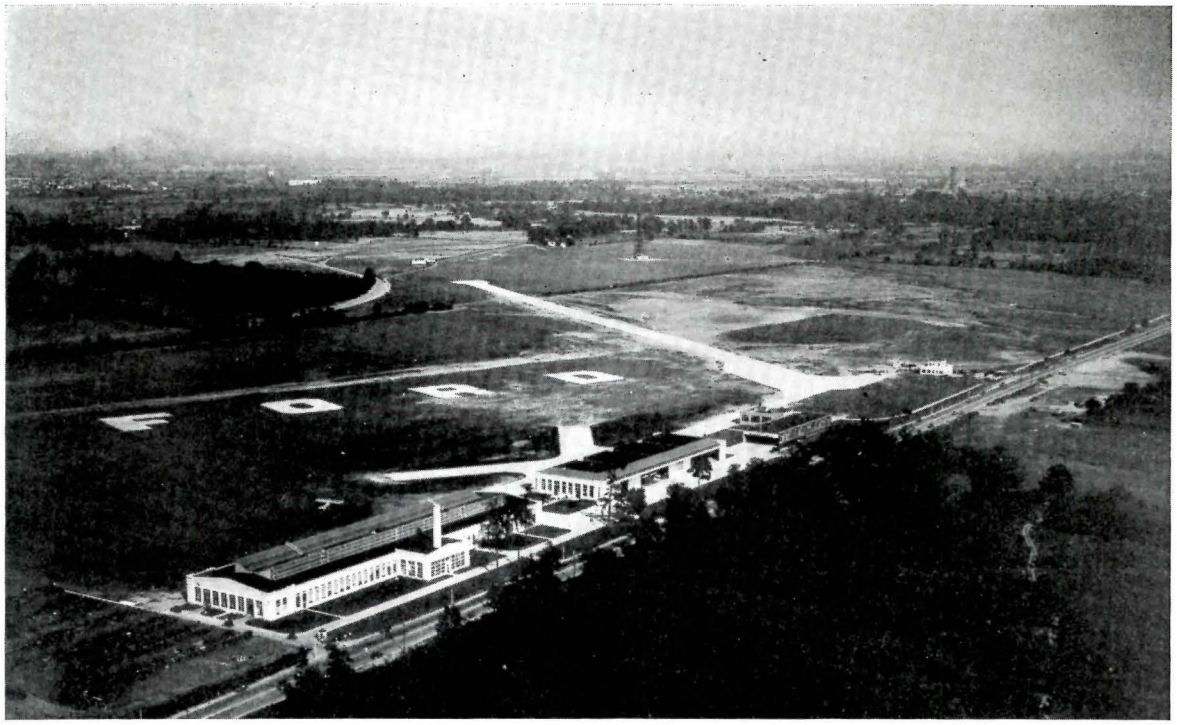
The ideal airport must permit airplanes to land and take off into the wind at all times. Theoretically, the field should provide runways or lanes in all directions, even though the prevailing wind in any given locality may be predominantly from one quarter. Experienced flyers find no difficulty in landing into a quartering wind, but it is exceedingly difficult to land a plane crosswise with the wind. It is practicable, therefore, to have runways or landing strips in eight directions, equivalent to the four cardinal and four quarter points of the compass.

The problem of developing the field surface for landing and take off is one of the most difficult and expensive matters that is encountered in creating an all-purpose airport. Perfect drainage is essential at all times, and particularly for spring conditions, when the ground is thawing. When funds permit, it is of course vastly better to have the entire landing area surfaced or paved uniformly, but today the expense of such preparation is quite prohibitive. For some years to come, therefore, it will be necessary to provide landing strips or runways especially prepared for the landing and take off of planes, but these must be absolutely flush with the adjacent unpaved areas and as level as possible. The arrangement of these runways should be such as to allow the maximum number of planes to depart and arrive simultaneously without danger of interference or collision. It is also important that the runways as well as the entire field be surfaced with a material which will make artificial lighting for night flying effective at minimum cost.

Airport Structures

The modern airport must be conceived as a transportation terminal and must be equipped to handle passengers, mail, express, and even freight. It must also provide for private planes which do not operate on schedule, and for sightseeing planes which use the port as a base of operations. The required structures to serve these functions may be divided into three basic groups, exclusive of the accessory buildings which are desirable but not essential to the airport proper. These three groups include the terminal facilities, caring for passengers and cargo; hangars for the care of planes; and service units for housing maintenance equipment, supplies, and possibly also the personnel of the field.

At Miami there is probably the most completely



Airplane View of the Ford Airport, Dearborn, Mich., Showing Buildings and Field

appointed terminal building yet erected in the United States. It was designed by Delano & Aldrich, architects. It contains a passenger concourse or waiting room with the usual ticket offices, check room, public toilet facilities, newsstands, and other concessions associated with the ordinary railroad passenger station. The main floor is so arranged as to control passengers arriving by plane from Cuba, for inspection by immigration, customs, and health authorities. This feature suggests that every airport in the United States may ultimately become a possible port of entry, for flights have already been made from Mexico to northern points in the United States, and from Canada to southern and western points. This building also provides offices for the air transport officials, and on the second floor, overlooking the flying field, there is a large dining room adjacent to an open air terrace which is a wonderful vantage point from which to observe the arrival and departure and the maneuvering of airplanes.

This building, more completely than any other, suggests the character of the ideal terminal structure for an airport. An important feature of such a building, unless provided for in a separate unit, is a control room, commanding an unobstructed view over the entire airport from which an operations executive can exercise complete control over all activities on the field. This control room is usually elevated above surrounding buildings, generally in the form of a low tower above the roof line of the highest structure, and it adjoins a radio and communications room equipped to maintain contact with other airports in all directions and by radio with planes in the air. These units constitute the nerve center of the airport and are vital to its operation because it is necessary to prevent planes from landing, especially at night or in fog, when others are about to depart, and to notify planes en route of other machines flying in their general directions to minimize the possibility of collision in mid-air and to aid them in keeping to their courses. Undoubtedly also the modern air terminal must provide post office facilities and a sub-station, although at present the Post Office Department does not consider these elements essential because the present custom is to remove air mail by motor trucks direct from the planes to existing post offices.

Another requirement of the well designed terminal building is provision for the safety and protection of passengers using private or transport aëroplanes. There should be some type of covered runway leading from the waiting room to the loading point for planes which is so devised as to prevent the passengers from getting in the way of whirling propeller blades. At a separate point there should be similar provision for protecting arriving passengers from inclement weather and for keeping them under control until

Malmo, Sweden's Spacious Airport, Showing Interesting Housing Development Near the Field

they have passed the immigration and customs authorities if the plane happens to have come from a foreign port. Separation of these two loading and unloading points is desirable. It is also essential to have the entire flying field protected by a suitable wall or fence which will keep unauthorized persons and often stray animals from the field and permit the control of even those using private planes in their entrance and egress from the flying area.

The second group of structures,—the hangars,—needs little discussion, because the functions of hangars are well understood. They require unobstructed floor space, good lighting, and should be fireproof, weatherproof and easily heated. In some European airports hangars are made two stories in height, using a ramp to reach the upper floor, and it is possible that the reverse will be true of some future airports having part of the storage space below ground. The most difficult problem in hangar design is to provide the vast doorways necessary for the admission of large planes. After much study the Lehigh Airports Competition Program Committee suggested some openings 125 feet wide by 20 feet in clear height, and others for smaller planes 90 feet and 100 feet in width and 18 feet and 19 feet respectively in clear height. These requirements may change as transport planes become larger, but for the present they will house the typical units now contemplated or in use.

Building at the Dennison Airport, Atlantic, Mass.

The third group of buildings includes fire and ambulance stations with quarters for emergency crews and garages and storage buildings for trucks, tractors, snowplows, rollers, grass cutters and other equipment needed for the care and maintenance of the fields. A gasolene and oil filling station is an important requirement to this group. Frequently the tanks are buried underground and supply lines are run to pumps near the hangars or to underground receptacles located in concrete aprons on the fields themselves. These sub-surface filling points are covered by manholes which can be lifted and the fill pipes withdrawn so that when the covers are replaced planes can run over the surfaces without difficulty. There must also be provision for housing the field personnel, but this may be provided for outside of the airports proper or in parts of hotels which are mentioned under the heading of "accessory structures."

The arrangement and grouping of these various units constitute a problem that has not yet been solved with a certainty that the ultimate plan has been discovered. In some airports the hangars are separate units, and in others they are grouped together as elements of a large structure. In some places they are adjacent to the passenger terminals, and elsewhere they may be separate from these units for considerable distances. It is essential to provide a well paved and practically dustproof apron connecting the hangars and the loading

Construction in Progress, New Croydon Airport with System of Concrete Aprons and Maneuvering Space

point at the passenger terminal for maneuvering planes either under their own power or by means of tractors and for warming up motors where the wind stream from the propellers will not throw up a cloud of dust. If the flying field is of adequate size and the buildings can be separated from the field by a sufficient marginal strip as already noted, their precise relationship to the flying area seems to be of secondary importance, and their location is largely governed by the highways and other means of communication between the port and the city which it serves. If the field is of limited area and the runways are of minimum length, it should be considered essential that no buildings be located opposite the end of any runway, and particularly that they should not be in the direction of the prevailing winds.

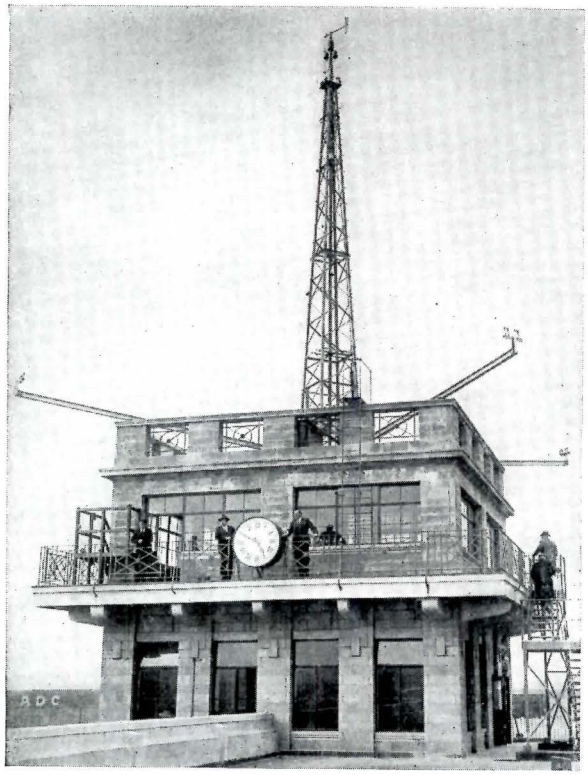
Accessory Structures

Under this head fall a number of possible units which have already found their place in well established European airports but which may not be absolutely essential to port operation. First of these is a hotel. At Croydon, England, a 200-room hotel has been erected near the airport buildings and has proved successful. It has been found that many visitors to the field use its extensive restaurant facilities, which overlook the flying area, and that passengers frequently use it as headquarters from which they make visits to the surrounding country during interruptions to their air travel. Such a building may also provide accommodations for pilots and the ground personnel of the field as well as provide apartments for the important officials and executives of the field and the air lines which converge there. Under this heading also fall all types of concessions and amusements as well as parking spaces for visitors' automobiles, outdoor restaurants, motor bus and rapid transit stations, stores and shops. Undoubtedly commercial activities of these various sorts will contribute to the support and maintenance of airports, and their control by the airport owners is economically desirable.

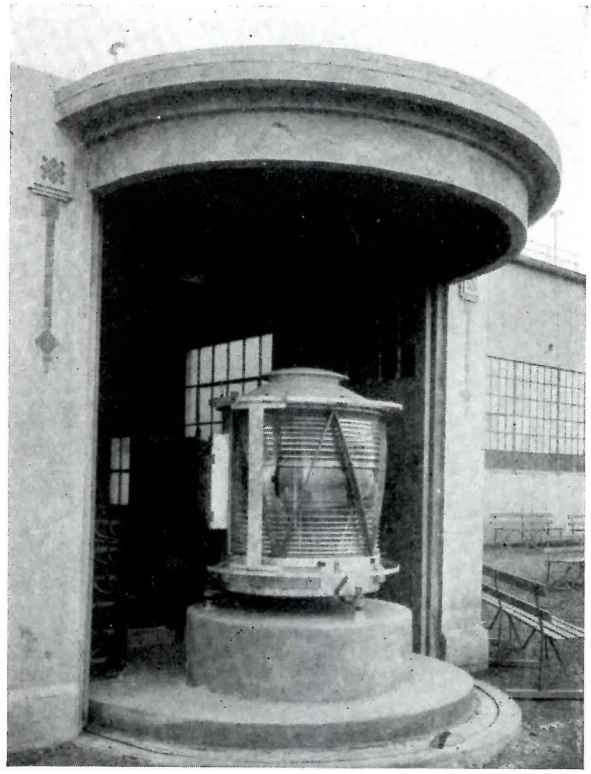
Other Requirements in Airport Design

Night lighting is one of the first essentials for the well equipped airport. The subject needs little discussion here, however, because the problem does not influence the architectural development of an airport to any great extent, and because the subject is quite fully covered in publications issued by the Department of Commerce and other authorities. Adequate lighting involves border lights to indicate the margins of the field; air beacons; an illuminated wind direction indicator; danger lights on all surrounding obstructions; and flood lights to illuminate the field for landing and take off. Every airport must be identified by huge signs visible from the air and preferably illuminated at night. These may be on the roofs of units or other buildings on the field itself or

Buildings of the Oberweisenfield Airport, Berlin



Control Tower, Croydon Airport, with Signal Cabin and Wireless Equipment

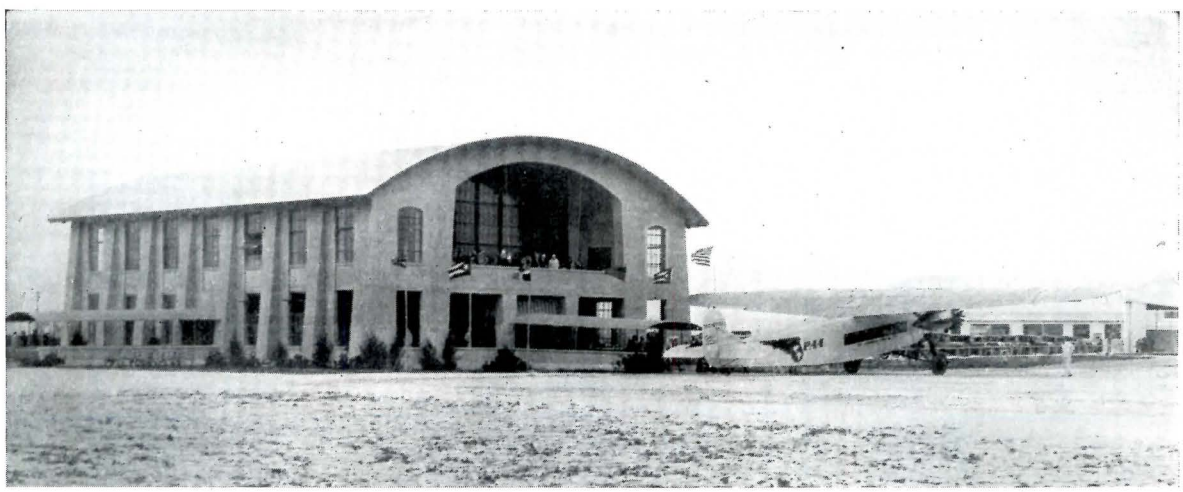


Airport Beacon of 30 Million Candlepower, at Oakland, Cal.

even on adjacent buildings in the vicinity, with arrows pointing to the airport itself. Here again the Department of Commerce has established recommendations and requirements which are easily followed. The wind direction indicator referred to, sometimes called the "wind-tee," is something like a mammoth weather vane with its flat surface *horizontal* so as to be visible from the air and to constantly point the direction of the prevailing wind.

One of the major problems in airport design involves locating the field with relation to adjacent highways and transportation facilities. The amount of traffic ultimately to be expected at airports suggests the desirability of having a broad plaza, such as may be found adjacent to the better planned railway terminals, which will care for the traffic converging at the passenger terminal and give this structure a proper and dignified setting.

EDITOR'S NOTE. We are indebted to Mr. Harry Schwarzschild, Editor of *Airports,* for giving us permission to publish here many photographs from his personal files.



Airport Passenger Terminal of the Pan-American Airways, at Miami
Delano & Aldrich, Architects

CHOOSING THE STRUCTURAL SYSTEM AND MATERIAL

BY
THEODORE CRANE
ASSOCIATE PROFESSOR OF BUILDING CONSTRUCTION, YALE UNIVERSITY

PART I—BUILDING FRAMES

IN looking over the vast quantity of printed matter dealing with the subject of building materials, one can hardly fail to be impressed by the amount of study and research which has been expended in this field. If an architect is considering the use of a particular type of construction, there are usually technologic papers, textbook references or society reports bearing upon its value. Very little attention, however, has been given to that aspect of the subject which might be called "comparative construction," that is, the *relative* value of materials and systems.

To make the matter clear, let us consider a very simple illustration,—the choice of a floor system. Every textbook on reinforced concrete describes the so-called "beam and slab" and "girderless" designs. An architect's office is flooded with manufacturers' literature illustrating any number of proprietary methods of construction. The architect's problem, however, is not the detailed study of a particular system, but the selection of the most suitable type for the conditions existing. With this in mind, these articles have been written to point out the individual characteristics of various materials and systems, as affecting their use, and to suggest methods of arriving at a satisfactory choice in structural work.

The first question of this nature, and a question which can usually be very easily answered, is regarding choice between bearing walls and skeleton construction.

In most cases the problem is purely economic, and the thickness of bearing walls, where such are employed, is governed by the requirements for stability rather than by the strength of the materials in compression. Under the New York building code, which represents in this particular those of our larger cities, brick masonry laid in Portland cement mortar is allowed to take a working load of 250 pounds per square inch, Portland cement concrete 500 pounds, and sandstone masonry 400 pounds. These stresses are seldom critical in bearing walls. The limit of economy is determined rather by the wall thicknesses required for various heights and unsupported areas. For instance, a building of the residence class, under 75 feet in height, would require, by this same code, 12-inch walls for the "uppermost 55 feet, and 16-inch below that." For public or business buildings between 60 and 75 feet in height the bearing walls would have to be 16 inches thick for the "uppermost 50 feet, and 20 inches below that." In both cases additional thicknesses are required for walls built of rubble masonry. Furthermore, when the clear span between bearing walls is over 26 feet, or the length of the wall without lateral support is over 105 feet, or more than 30 per cent (45 per cent when wall area is laid in Portland cement mortar) of the horizontal wall area is occupied by openings, the thickness must be increased. Wall thickness for wall-bearing buildings over 75 feet in height increases very rapidly. For example, in the class of public and business buildings a structure 80 feet high would require, under the New York code, 16-inch walls for the uppermost 25 feet, 20-inch walls for the next lower 35 feet, and 24-inch walls below.

Compared to these requirements, a 12-inch panel wall, supported at each floor level by a structural steel or reinforced concrete spandrel, is usually more economical, all things considered, for fire-resistant construction over three or four stories in height, and for garages or industrial buildings of even lesser height. The use of structural steel frames for one-story buildings is often desirable to meet the requirements of certain industries, and although still in an experimental stage, the application of steel sections to the construction of dwellings has interesting possibilities for classes of work where economy is a chief consideration. These uses of steel are, however, the exception, and its particular function is in the frames of comparatively tall buildings.

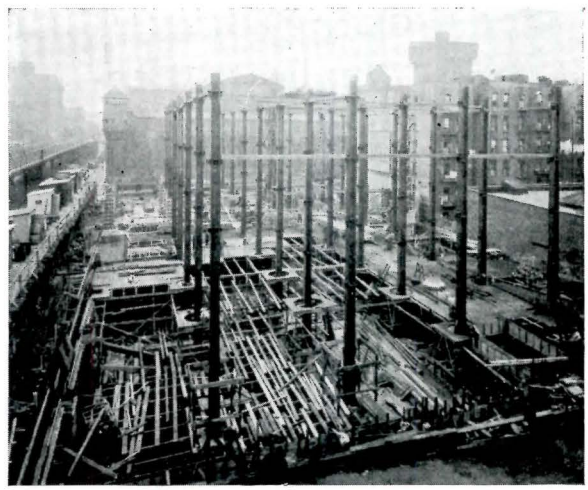
For this type of work the practice of a few years ago of employing columns built up of plates and angles has largely given place to the use of solid rolled sections, normally two stories in height and designed to carry the load of the lower story. A comparatively recent development is the use of column sections, five to six stories in height, for the support of reinforced concrete floors. Finding that two-story lengths were impracticable and desiring to use a heavy H-section through the lower stories in order to save floor space, these long columns fitted with angles at each floor level have been successfully used for buildings of 10 to 20 stories, to support stone-concrete floors of girderless design. This type of column construction, as built in New York, usually calls for a reinforced concrete section through the upper stories of the building, which is carried down until the size becomes objectionable. For

Photo. Tebbs & Knell, Inc.

Uppercu-Cadillac Building, New York. Reinforced Concrete Frame with Interior Steel-cored Columns

example, let us consider that the upper eight floors and roof of a 14-story building are supported by reinforced concrete columns. Under the New York code these would probably be of hooped section in the two upper stories and of spiraled design below. Even the latter, however, would require a gross diameter of about 2 feet, 6 inches, when carrying large bays subjected to light manufacturing loads. If this were considered to be a limiting size, the fifth story columns would then be designed with rolled steel cores of H-form, the sections being based on the loads which the fifth story columns are required to support and plates added to take the increments due to the floors below. The gross column size, 2 feet, 6 inches, would then be the same in all of the remaining lower stories.

Such a combination of structural steel and reinforced concrete makes it possible to utilize the advantages of each material, now that the mechanical difficulty of field erection has been solved by obtaining long sections from 60 to 75 feet in length. With this one important exception, however, the structural steel frame, or the reinforced concrete frame offers two distinct alternatives in the field of skeleton construction. For buildings of certain classes the choice is obvious; factories and warehouses with heavy floor loads ranging from 125 to 300 pounds per square foot and of comparatively low height can generally be built more cheaply of reinforced concrete than of structural steel. Office buildings, hotels and apartments, 15 stories or more in height, can usually be



Framing of the Uppercu-Cadillac Building. The Floor Construction is of the Girderless Type
Charles E. Birge, Architect

built more cheaply with steel frames. But we must not place too much confidence in such broad generalizations. The tallest concrete building in the United States is the recently completed Master Printers' Building in New York, which has 20 stories. In this case the use of concrete showed a very substantial saving over steel. Let us investigate the conditions. A live load of 250 pounds per square foot was required on all floors; the plan of the building was adaptable to a girderless floor system, which is extremely economical for heavy industrial loads. As the conditions of occupancy demanded that headroom be computed to the bottoms of girders in a beam and slab design, their elimination permitted several additional stories in the same total height of building. Furthermore, the lighting was better with girderless construction, and the cost of sprinkler installation was about 25 per cent less.

The same solution has been worked out economically in the case of several other structures erected in New York during the last year. For example, there are the Appraisers' Stores Building, 11 stories high, with 250-pound live load; a service station for the Packard Motor Company, eight stories high, with 150-pound live load; and the building at 653-659 Eleventh Avenue, 14 stories high, with 200-pound live load. These were all concrete-framed buildings employing structural steel cores in the lower stories of the interior columns and with girderless floor systems of spans varying from 20 feet x 20 feet to 31 feet, 6 inches x 33 feet. If we are to assume, as would seem reasonable, that these operations represent an actual trend in design, it is probably safe to say that reinforced concrete frames, particularly where a girderless floor system can be used, are well adapted to comparatively heavy loads for buildings even up to 20 stories in height.

Framework U. S. Appraisers' Stores, Combined Long Column-cores with Girderless Floor System

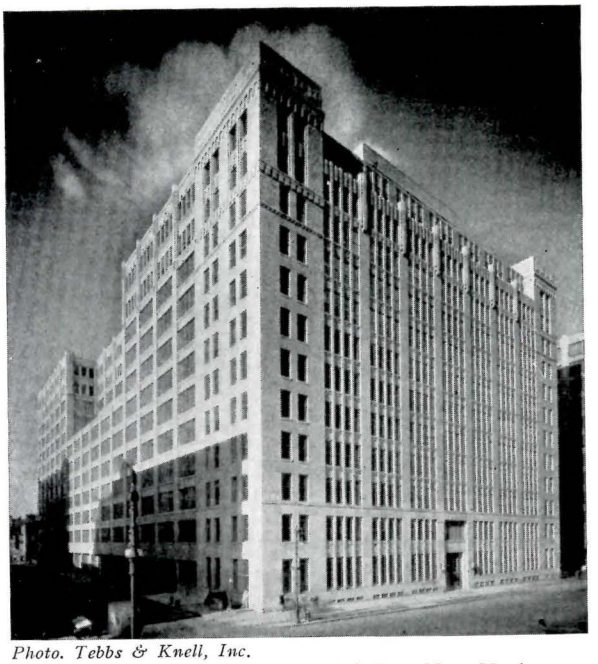


Photo. Tebbs & Knell, Inc.

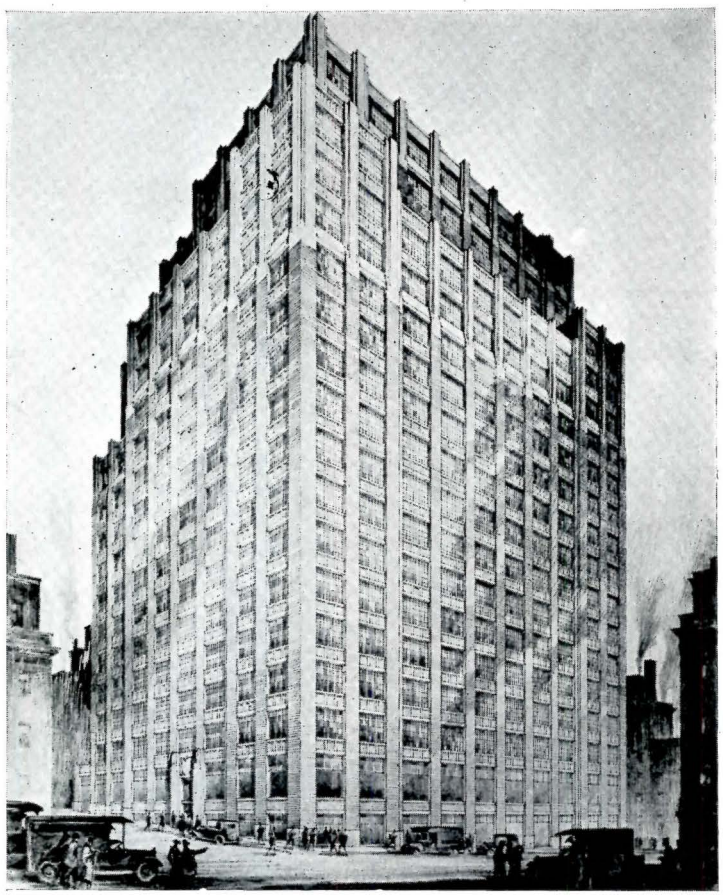
U. S. Appraisers' Stores Building, New York

Buchman & Kahn, Architects

Structural steel is particularly suited to light loads and tall buildings. Although we have approximately 650 reinforced concrete structures in this country that are ten or more stories in height, the vast bulk of such work is of steel. Under the New York code a structural steel frame with cinder-concrete "arches" is a very economical type of construction for normal designs based on office loading of 60 pounds per square foot throughout typical floors. For buildings of over 20 stories in height, steel has practically no competitor in any part of the country. Below that height, offices, hotels and apartment houses in New York are built almost exclusively of steel with cinder-concrete floor arches. In many western cities, on the other hand, even where material prices are no more favorable to use of concrete, the latter has been widely and successfully used for work of this class. Trade conditions and the tendency to follow the established custom of one's own locality, would often appear to play a larger part than the matter of comparative costs.

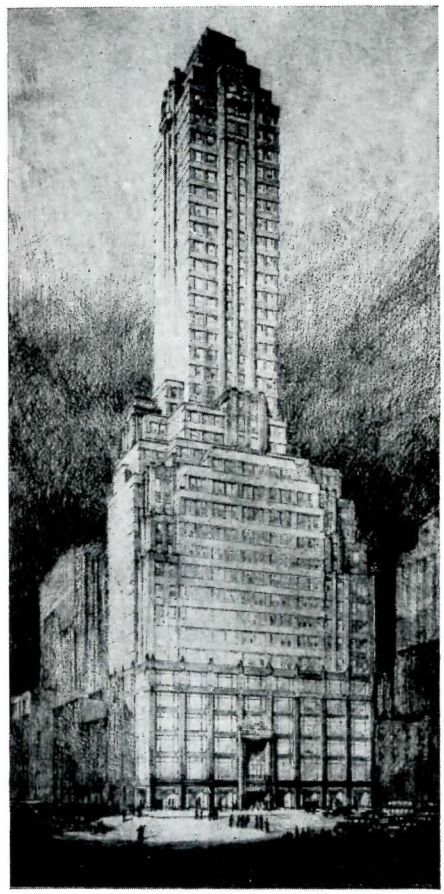
Second only to the matter of live load, the architectural plan of a building plays an important part in the choice of construction. One of the great structural advantages of reinforced concrete, as ordinarily used, is its monolithic character, permitting assumptions of continuity in design. When the architectural arrangement lends itself to a series of continuous bays of approximately the same size, the use of a reinforced concrete frame may be an economical solution for even light loads and, as previously mentioned examples indicate, will almost always be suitable for heavy loads. The matter of continuity will not, ordinarily, make any difference in the depth of beams or girders, in beam-and-slab construction, but it will save anywhere up to 35 per cent of the reinforcement that they require. Reinforced concrete is particularly suitable for buildings that permit a column spacing that results in square or nearly square bays. As a large proportion of the cost of concrete work is expended on the construction of forms, this material is most economically used for buildings whose structural members can be standardized. The importance of this principle can be judged by the fact that on typical work one set of forms serves in turn for the structural members of each floor, often being used as many as ten times. Neither is it usually desirable to reduce the sizes of beams supporting a roof construction, as the surplus concrete is more than offset by the saving in not changing the forms.

The ideal spans, in both reinforced concrete and structural steel, vary between 18 and 24 feet, depending upon the live load and the type of floor construction employed. In most buildings outside of the industrial and commercial classes, the columns have to follow the room arrangement, and it is seldom possible to use the most economical spacing. As far as practicable, the designer should start with the primary element of a floor system, such as the slab, and lay out his typical floors to use each member to best advantage. We have an excellent example of this principle applied in most New York buildings now under construction. The city code permits cinder-concrete slab or "arches," as they are called, to be used on spans up to 8 feet. A minimum thickness of 4 inches is specified for floors. The designer's problem is then to locate the floor beams, which support the slabs, as closely as possible to the 8-foot limit. As it works out very well to frame the beams into the girders



Master Printers Building, One of the Highest Concrete-framed Buildings. Floors of Girderless Design

Frank Parker, Architect and Engineer



The Fuller Building, New York, Typical of Work Economical in Steel

Walker & Gillette, Architects

at the third points of the girder spans, we have a column spacing which approaches 24 feet if we wish to fully develop the strength of our 4-inch slab which the building code requires.

This same principle can be applied to other matters in the design of structural frames. A 3½-inch thickness of stone-concrete, which is the minimum allowed for roof construction under the present New York code, when fully continuous will carry a 43-pound superimposed load between beams placed on 10-foot centers. The limit of the 4-inch stone-concrete slab, when supporting a 100-pound live load, is 8 feet, 6 inches when fully continuous and 7 feet, 9 inches for end spans. The weight of reinforcement per square foot of floor area naturally increases as the column spacing is increased. For example, a girderless floor system designed under the two-way requirements of the New York code, to support a superimposed load of 125 pounds per square foot, would require 1.85 pounds of steel per square foot of floor area with bays 16 feet square; 2.35 pounds for bays 20 feet square, and 3.10 pounds for bays 24 feet square. These figures are based on full continuity. Considering the cost of footings and columns, the most economical bay would probably be about 18 feet square. Considering the loss of floor space occupied by the columns, the present practice is to space them about 20 feet on centers,—probably a little over rather than less.

For long spans of 40 feet or more, reinforced concrete can be used in either arch or truss construction. Such designs have been cleverly executed both in this country and abroad, but if economy is the governing factor, steel should be used in most problems of this nature encountered in building construction. There is even a tendency to use concrete girders on shorter spans where structural steel would be more economical.

Consider, for example, that it is required to span a distance of 34 feet between masonry walls. If we assume a uniformly distributed load of 100,000 pounds and a floor system capable of giving lateral support, a structural steel girder 24 inches deep and weighing 120 pounds to the linear foot will meet the requirements of the American Institute of Steel Construction. If headroom is not important, we could probably obtain a 28-inch

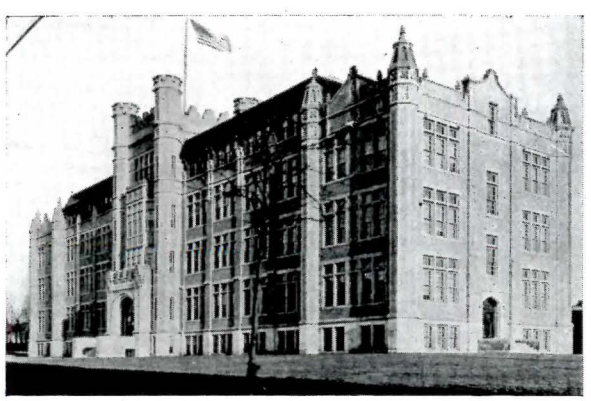
section, weighing 112 pounds per linear foot which would also serve the purpose. In reinforced concrete, a T-beam section, economically designed, would have a total depth of about 36 inches, a width of 14 inches, and approximately 1,650 pounds of steel if computed at working stresses of 650 and 18,000 pounds per square inch for the concrete and steel, respectively. Even these large proportions would have to be greatly increased unless the floor system chosen by the designer provided an adequate thickness of concrete to act as a compression flange. It is also true that the weight of large concrete beams and girders may easily be 20 or 25 per cent greater than that of steel, including fireproofing.

These facts would favor the use of a structural steel frame, or bearing walls with structural steel interior framing, for buildings requiring wide spans. Balconies, such as are found in many auditoriums, may also influence the designer in his choice of structural frame, as such can usually be more expeditiously and economically built in steel than in reinforced concrete.

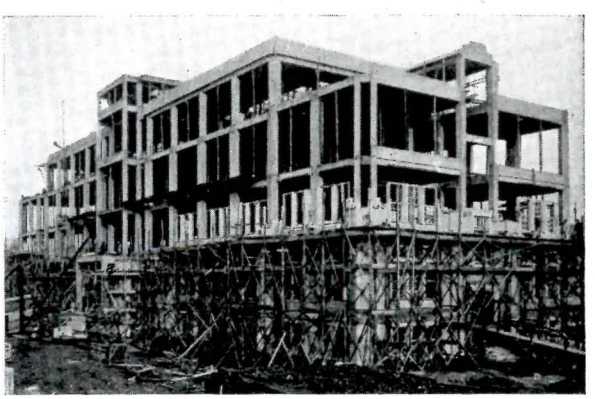
The question, however, is too often decided by making merely a relative estimate of the costs of labor and materials, both based upon the *same design*. A valid comparison cannot be obtained in this way. As far as the architectural requirements permit, comparative estimates should be based on designs which employ the type of material under investigation to its fullest advantage. Reinforced concrete is particularly suited to some forms of architectural expression, and even if it is not possible to actually "express" the feeling of concrete in the form or ornamental features of a building, it is entirely practicable to reserve its use for types of construction which are easily built of this material. The same should be true of structural steel; many architectural offices use steel sections more as a matter of habit than as the result of analytical comparison. Not a few designers look upon concrete as suitable for industrial work, but hardly to be considered for other types of buildings except in floors and footings and as a fireproofing material. On the other hand, there are sections of the country where concrete frames are very widely used for buildings of moderate height even with comparatively light loads. A study of relative costs, as influenced by local conditions, does not seem to justify this difference in practice. From these data, and many similar considerations, we can be fairly confident that both the structural and architectural character of a building should play an important part in determining the type of skeleton to be used.

The design of the reinforced concrete members forming the structural frame of a building is very largely influenced by the code or standard accepted by the designer, and it is not the province of this journal to treat of matters pertaining to the details of structural engineering. The architect is seldom interested in determining the number of stirrups in a concrete beam any more than he is concerned with rivet spacing on structural connections. It is important, however, to know that concrete beams of T-section require about 1 inch in depth for every foot of span; if the beam is of rectangular section, there being no concrete floor serving as a flange, 1¼ inches would be a fair estimate. These figures are based on economical design for normal conditions and could be reduced by increasing the reinforcement if the additional cost were warranted. The width of the web of a concrete T-beam should be between one-half and one-third of its total depth, including the slab. Rectangular beams are usually about one-half as wide as they are deep.

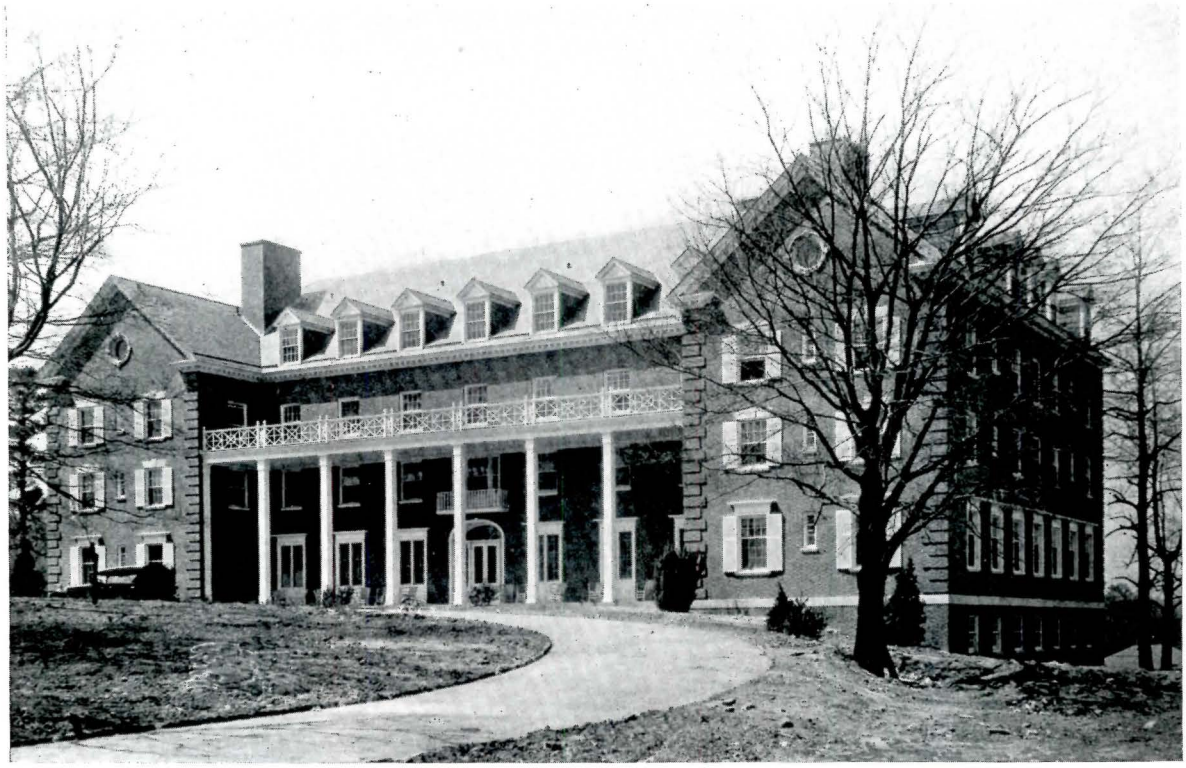
Columns composed of concrete reinforced with only vertical rods are allowed under most codes, to sustain concentric loads computed as 500 pounds or 600 pounds per square inch on the "effective concrete section," the value depending upon the quality of the mixture. The effective concrete section should be taken as the net area,



The Women's Institute Building, Scranton, Pa.
William Lowndes, Architect



The Frame is Reinforced Concrete and the Floors of R. C. Beam-and-Slab Construction



Brick Used Over Reinforced Concrete Frame, Sanitorium Near Atlanta, Ga.
Hentz, Reid & Adler, Architects

exclusive of the steel, allowing 2 inches outside of the reinforcement for purely fireproofing purposes. Some codes, such as that at present in force in New York, allow the effective area to be taken as the *gross* column section, deducting only the space occupied by the reinforcement, which seldom exceeds 1 per cent of the area. The total supporting capacity of the column is then computed, in either case, by adding to that of the concrete the carrying value of the reinforcement, which is considered to support 7,500 pounds or 7,200 pounds per square inch when used respectively with 500-pound and 600-pound concrete.

Although the design of columns with only vertical reinforcement is pretty well standardized, there is no uniformity in regard to spiraled columns. Unfortunately there is some slight justification for computing their sustaining value on several entirely different principles. These have been picked up by the authors of our various building codes and combined with a variety of limiting percentages applied to both the amount of spiral and of vertical reinforcement. Although the present situation is an amusing commentary on our knowledge of this branch of structural engineering, or rather a reflection upon our ability to apply what little we do know, the matter is too technical to be of interest to the average architect. Suffice it to say, that under the New York code a spiraled column, economically designed with 1 per cent of vertical steel and 2 per cent of spiral, can be considered to support 1,466 pounds on each square inch of the core enclosed by the spiral. In other more benighted sections of our country this same column would be permitted to carry only 971 pounds on each square inch of the core. These absurd differences, although more pronounced in the field of concrete design, exist in the ordinances governing use of other materials. There seems to be no particular reason why structural grade steel of exactly the same quality should be considered to carry a working stress of 16,000 pounds per square inch in one city and 18,000 pounds in a neighboring city. The proper remedy for these inconsistencies lies in an honest attempt to make municipal codes conform with good practice. The specifications and suggested regulations promulgated by the American Concrete Institute, The American Institute of Steel Construction, and the building committees of the Department of Commerce, contain much valuable information which could be applied to advantage.

Footings. The study of comparative construction as applied to footings offers an interesting field for the architect who desires to control the major decisions in connection with the structural work, without going into the details of engineering. For all buildings of skeleton construction, whether of steel or reinforced concrete, the problem of footing design is merely to choose the most

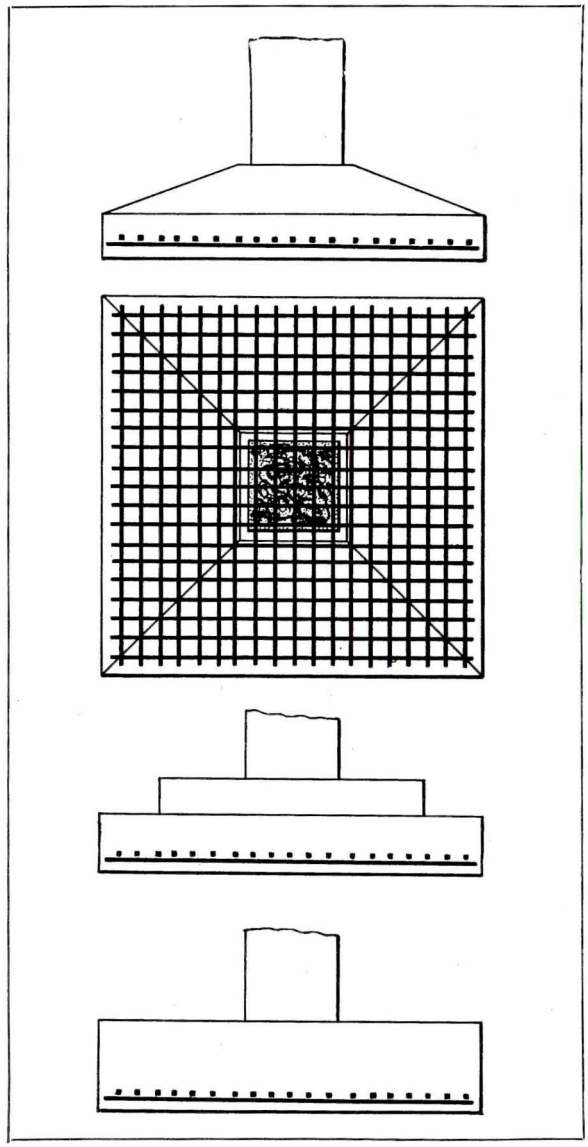
Reinforced Concrete Frame of Building Shown on Opposite Page
Hentz, Reid & Adler, Architects

economical means of distributing the concentrated loads of the columns over an area sufficiently large to bring the load per square foot within the safe bearing capacity of the soil. Foundations upon rock involve one aspect of this same problem, and the use of wood, concrete or steel cylinder piles is only to increase the soil capacity. Independent footings, rectangular and preferably square in plan, of stepped or pyramidal pattern, are normally used to support the interior columns of a building and are also economical for exterior columns of skeleton structures, if there is space outside of the building line to permit concentric design. The chief problem is to choose economical footings for exterior columns when there is little or no space available beyond the building line. With the exception of a type known as the "buttress footing," and not widely accepted, the choice falls on either a continuous, a cantilever or a combined footing.

A continuous footing, which is nothing other than an inverted beam loaded with a soil reaction of usually from 6,000 to 8,000 pounds, and supported by the columns, will probably be the most economical if the area available without eccentricity is sufficient to carry the column load. For example, if we are permitted a projection of 1 foot beyond the faces of the columns, which we will assume as the building line, and if the basement columns are 2 feet thick, we can make the footing beam 4 feet wide and still have its axis directly below the column centers. If the column spacing is 20 feet, we then have 80 square feet of available bearing area for each column. If the safe soil load is 6,000 pounds, this type of footing is capable of supporting a column carrying 480,000 pounds with some small deduction for the weight of the footing beam.

The next choice, usually resorted to where no projection is permitted beyond the faces of the columns, and referred to as the "cantilever" footing, is merely the application of a device for overcoming the tendency of the exterior columns to fall outwards owing to the fact that their footings cannot be centered beneath them owing to the proximity of the property line. The design, in this case, is similar to that of an interior, concentric footing but a concrete or steel beam, called a "strap," is built connecting each exterior footing with the nearest interior footing. The strap balances the eccentric moment and holds the exterior footing in equilibrium.

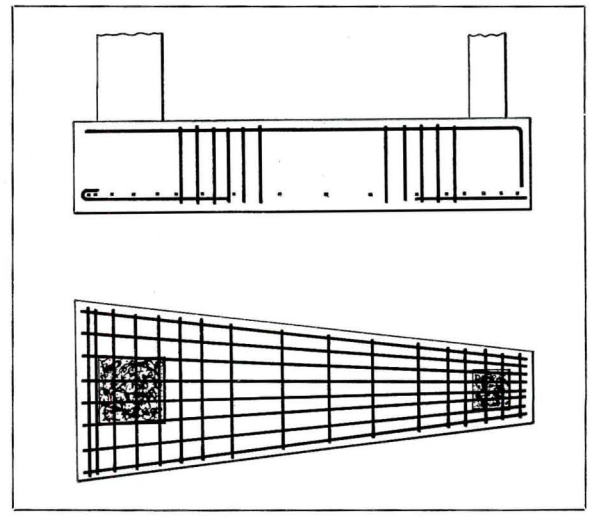
The third choice for the footings of exterior columns adjacent to property lines is called the "combined" footing. Instead of employing a strap, as in the cantilever design, a heavy, continuous slab forms the footing for an exterior column and the nearest interior column. As the name implies, this is merely a joining, or combining of the two footings and is resorted to when



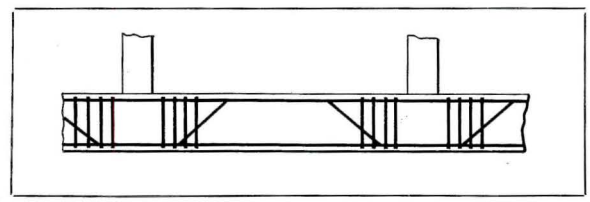
Typical Design of Reinforced Concrete Footing for Isolated Columns of either Structural Steel or Concrete; the Stepped Type is Preferable

it is necessary to overcome eccentricity in an exterior column and use the *entire area* between columns for bearing purposes. When possible, combined footings are built rectangular in plan and extend toward the interior of the building a sufficient distance to insure that the center of reaction of the footing area coincides with the center of load between columns. If such extension is not practicable, owing to the interference of an elevator well, or some similar obstruction, the portion of the footing supporting the interior column, which is usually carrying a heavier load than the exterior, is widened with the result that the footing slab is trapezoidal in plan.

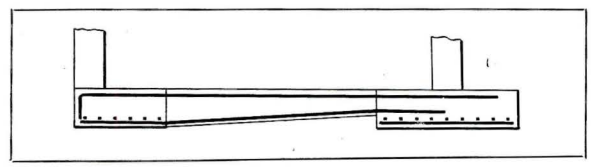
Footings on piles follow these same classifications and are designed in exactly the same way



The Combined Footing of Trapezoidal Type; Exterior Column at Right of Illustration



This Continuous Footing Acts as an Inverted Beam to Distribute the Loads of Exterior Columns



A Typical Cantilever, or "Pump-handle" Footing; the Exterior Column is at Left of Illustration

except that the individual pile reactions replace the uniform load assumed as the safe bearing capacity of the soil. Footings resting on rock are designed for loads varying from 15 to 40 tons per square foot, depending upon its hardness. Under our tall steel structures the typical billet and grillage design has become the general practice for foundations carried to hard rock. Where it is necessary to obviate vibration, such as that due to the movement of trains, specially designed vibration mats, composed of layers of lead and sheet asbestos, are employed at the bases of columns supporting buildings over railway tracks.

The next step in planning the structural design of a building is the choice of the floor construction. This subject will be covered in a succeeding article in THE ARCHITECTURAL FORUM for May.

The illustrations of footings are from "Concrete Building Construction," by Theodore Crane.

WINTER CONSTRUCTION AND SUPERINTENDENCE

BY
LEICESTER K. DAVIS

THE trials of keeping winter construction going smoothly and on unbroken schedules are over. The vigilance required to meet the attacks of cold and ice and snow has settled down to being a far less difficult matter. It is a good time in which to make a check-up of results secured during that short but difficult period, and for architects and builders to consider the effectiveness of their combined efforts in keeping winter activities going at high levels of efficiency and economy.

The records of superintendence will doubtless settle many questions, show the wisdom of using precautionary specification clauses, and justify closely coupled contacts that follow each step and stage of construction most likely to be adversely affected by winter's influence. The purpose of all architectural superintendence is constructive, not destructive,—the obviating of faults which if not discerned in their early stages result in piling up those disconcerting "extras" always associated with elaborate correction or replacement of work not up to required standards.

The difference between supervision and superintendence is not, perhaps, as fully appreciated as it should be. The former term deals mainly with results and passes judgment according to standards established for completed work; the latter follows more closely each unit of work throughout its progress, giving attention to immediate materials and methods, as well as taking into account those supplementary elements not strictly within the province of the specifications. Supervision stresses final responsibility; superintendence performs a more coöperative service, which begins at the beginning and keeps on to final completion. All architects may not agree upon this grouping of relations, but many do, and it is from the point of view of those who do that distinction is here made in describing the more important specific methods with which architectural superintendents should be thoroughly familiar in order to render the coöperation which contractors welcome and by which owners benefit.

Reading through many notes made during interviews with representative architects, I have been impressed by unanimity of their opinions in regard to winter superintendence. All seem to be agreed on:

1st: The need of many and frequent architectural contacts with winter work at every stage.

2nd: The value of familiarity with the precautionary methods developed by various trades.

3rd: The necessity of forecasting procedure in regard to conditions under which each phase of construction shall go on.

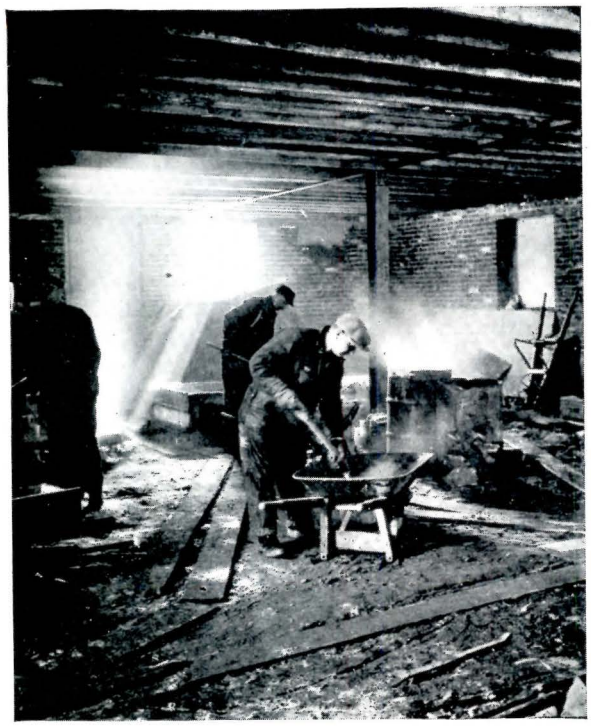
4th: The good to all concerned of thorough understanding between the architect, contractor and owner as to the powers and responsibilities of the architect or his representative in advising or requiring specific forms of structural practice.

5th: The benefits which result from carefully worked out methods by which accurate progress reports of superintendence may be kept for incorporation within a permanent record for current and future reference.

Most architects with whom I have talked emphatically recommend employment of a "clerk of the works" for all construction of any size that extends through the winter months, this individual to be selected by the architect and to be under his direction with services paid for by the owner, and to have duties, powers and remuneration covered by contractual clauses. Maintaining superintendence of this character is a regular procedure in many offices. In others the office personnel includes a "field man" who is assigned, at an extra charge, to work during all or certain winter stages.

Perhaps the first preliminary consideration of the architect in his approach to problems of winter construction should be the preparation of an outline which indicates how his contacts shall be governed. A comprehensive plan, worked out well in advance of the cold weather period, is sure to be of assistance in preventing otherwise puzzling twists and turns. Such an outline need not be elaborate. It should be built about only those definite phases of the work most likely to be seriously affected by lack of proper precautionary methods. It should cover uncertain points with clear indication of possible contingencies and directions regarding the manner in which they should be provided for.

In this schedule of defence, one might well start from a list of materials and uses having definitely known requirements for protection, classifying with each the possible circumstances to be faced. In an analysis of this kind, proper protective ways and means almost automatically suggest themselves for situations that might not be thought of until a crisis in construction had arrived. At this preliminary stage the value of coöperation by an experienced winter constructor will often be extremely valuable, since what are sought are not merely descriptions of "textbook happenings," but rather those out-of-the-ordinary run of things which happen once in a blue moon,



Interior Brickwork and Proper Temperature Control. Note Muslin Covering Door and Window Spaces, and Salamander Placed to Effect Equal Radiation of Warmth

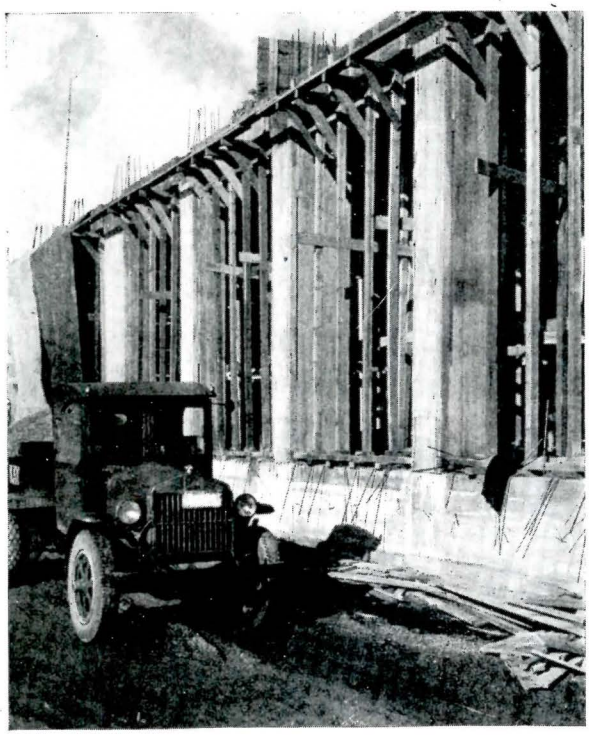
Thawing Out a Snow-covered Pile of Bricks with Steam Hose Should not be Necessary. Brick Should be Stacked with Complete Coverage of Top and Sides of Stack

and which sooner or later may happen again.

One architect with whom I have discussed the subject has made a series of "pre-structural conferences," as he calls them, with winter-seasoned contractors a routine matter, even before specifications are ready for bids. This practice he considers especially important where the construction schedule is to include a part or all of the winter months. By frankly explaining his purpose to prospective bidders, he has gained information regarding precautionary methods which has not only aided subsequent superintendence but has also clarified sections of his specifications covering winter performance. In an outline such as that here referred to, several divisions are quickly established. The first of these will very likely deal with those elements of the structure upon which superintendence should be most thoroughly concentrated. Next, logically, follows the storage of material prior to its use; next, the methods to be employed during and following such use; finally, there will be the general standards of winter practice and the specific forms of protection best suited to the locality and the type of structure. Included in this last should be provisions for "potentials,"—those things which probably will not occur, but which may.

Structural safety is, of course, one of the prime factors with which superintendence should deal at any time of year. There must be assurance of soundness in the bones and sinews upon which a building depends for ability to carry its load. And these, in practically all modern construction are steel, concrete and brick. Erecting steelwork in winter requires few departures from the routine of other seasons, except perhaps extra provisions for workers subjected to hazards and discomforts of weather, wind and bitter temperature.

Construction of concrete and masonry, on the other hand, calls for more carefully worked over methods. The aggregate that slushes to December wall and floor and column forms, and the courses of brick that rise steadily despite numbing January days, are propositions very different from like work carried on in fair and warmer months of the calendar. Winter concrete is a finicky jade, and she exacts very definite forms of attention at equally definite stages of preparation, application and setting. In order to make sure of final structural dependability in concrete, superintendence by the architect or his representative is of the utmost importance from the start to the finish of operations. Freezing temperature is concrete's greatest enemy,—one that is present from the minute the dumped sand and gravel start on their way to the mixer. Therefore the architect's plan of superintendence should include a check-up on provisions made for heating, while actual superintendence should see that the means provided are adequately employed.



Supports Ready for Tarpaulins. The Frames Must be Sturdy to Withstand High Winds. There Should be Projection to Insure Space for Ample Circulation of Warmed Air About the Exteriors of Forms

In Winter Superintendence it is Well to See that Snow Accumulations are Removed Before a Thaw Forms Puddles which an Overnight Freeze May Turn to Treacherous Sheets of Ice

The warming of sand and gravel before they reach the mixer must be thorough and constant,—on small work, by the heat from wood-fired pipes traversing the mass, and on larger work, having considerable tonnage, by spreading the mass over and around grilles or coils of perforated steam pipes, so placed that distribution of warmth is evenly made throughout the material. The mixing water should be kept at tested temperature by a steam nozzle run into the water barrel at the mixer.

These are but preliminaries. It is after the mix reaches the forms that the closest watch must be kept against laxity in maintaining protection of the concrete as it attains the final set. Protective methods for concrete have become pretty well standardized. It is the duty of the architectural superintendent to see that they are employed at the right time and in the right way. Before winter concrete work is begun, the architect and his contractor should be satisfied that apparatus adequate in type and capacity is ready to operate as soon as forms are built. The number and sizes of tarpaulins required should be carefully figured. The methods by which they are to be hung and lashed should be determined. Salamanders in number sufficient to maintain correct temperature under the most trying conditions produced by a record cold snap should be provided. Heat holes in floor and ceiling forms should be properly prepared and spaced for control of covered areas above slabs. The distributive outlets from main steam lines should be placed at the most strategic points.

No matter how well protective equipment is selected, its proper use is imperative. The handling of tarpaulins should be carefully supervised. Their placing should be such that definite areas are included, with perhaps a number of sections throughout the structure treated as localized units, each having its own form of heating apparatus, this obviating risks that always attend the attempt to spread a volume of warmth over a large area in parts of which temperature is certain at times to be lowered perilously close to the danger line. Extra precautions should be exercised wherever structural safety is particularly essential.

Winter superintendence should insist upon a record of day and night temperatures, and with these should be included readings taken frequently at the bases of exterior columns and under the canvas above floor slabs, in order to prove beyond all doubt that protection is being kept at a constant level.

Contractors specializing in winter concrete have worked out well defined rules by which are determined the efficiencies of various types of apparatus used for temperature control. As examples of these, in one locality the protective efficiency of top covers on reinforced concrete

Concrete Faults Due to Improper Winter Precautions. The Criss-cross Cracks Shown Extend Clear Through the Body of the Slabs

Flat Scaling Caused by Concrete Surface Freezing Before Coverage was Applied. The Defect did not Affect the Structural Quality of the Slab

beam and girder construction in ordinary winter weather has been figured at 48 hours as standard for time before coverage should be removed, 96 hours being the minimum for side curtains. Flat slab construction, with more protection required, calls for extension of the protective period. The efficiency of salamanders has also been calculated, it having been determined, for example, that in northern sections temperatures of from 60 to 80° may be maintained by one salamander to every 300 square feet of floor. Heat holes, which permit transmission of warmed air from areas below slabs to the upper surfaces of the slabs, are figured in a similar manner. Each of these auxiliary units should permit circulation of warmed air over approximately 300 square feet of properly "topped" area during average winter weather. Should temporary radiation by steam be utilized in place of or in addition to salamanders, it also can be handled according to rule.

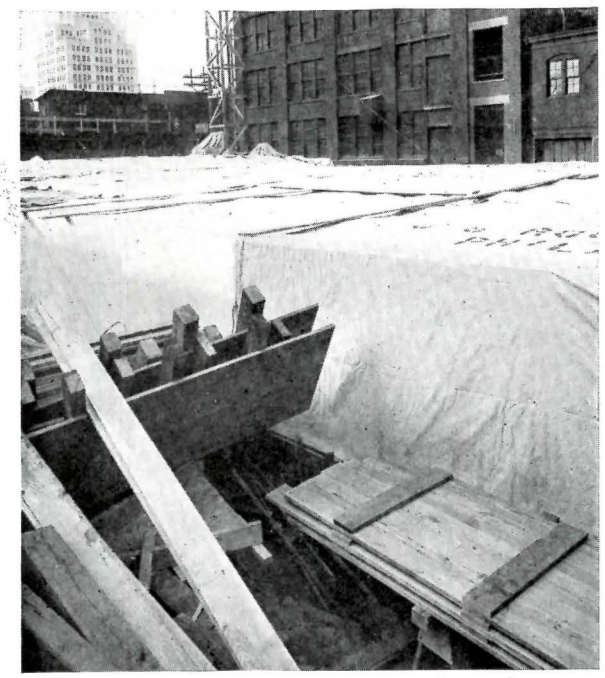
Whatever methods are decided on, their application to the work in hand should be understood by the architect when planning and forecasting the duties involved by winter superintendence. If unusual conditions are encountered, the plan should be flexible enough to deal with them. The thing of main importance, so far as architectural responsibility is concerned, is to be sure that the most effective forms of protection are provided and conscientiously employed. Conditions will naturally occur in which necessity of the moment may demand radical departure from original intent, and in such cases, the superintending architect must act quickly and with decision fortified by judgment. Many architects, if in doubt as to justification of a change in method, feel that the responsibility should be placed squarely upon the contractor, final acceptance being based upon tests for structural dependability.

On a recent large industrial project, a decided innovation in the protection of winter-poured concrete floors came to my attention. It may or may not suggest use under similar conditions. In this particular locality it was standard winter practice to cover concrete floors with layers of marsh hay until the set had passed all risk of freezing. In repeated cases the architectural supervisor detailed to the work found that the feet of laborers who spread the hay caused marks and depressions which actually impaired the structural quality of the finished slabs. In addition to this, tufts of hay and other debris became imbedded in the mix as it set, necessitating a "burn off" with fired gasolene before sleepers for the final floor could be placed. The supervisor had used a rather daring remedy by deliberately leaving the wet surface exposed until a skin of ice formed, strong enough to bear a laborer's weight without footprinting. Marsh hay was then applied in the usual way, thawing out the ice sheath before there had been penetration of cold sufficient to injure the body of the floor. Seemingly the only effect from this treatment was a slight flaking away on the surface, possibly to an average depth of 1-16 inch, but the architect should decide whether to allow use of such questionable methods.

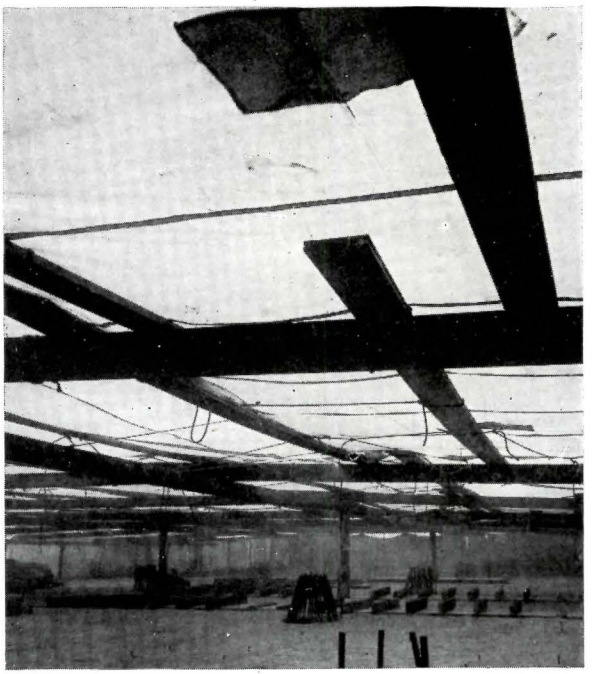
Essentials on which to be satisfied in superintending the winter care of concrete are:

(1) Assurance that proper types of apparatus are on hand to provide adequate and constant working warmth for material before going to the mixer, properly warmed mixing water, immediate exclusion of freezing temperature from forms until all risk is passed by the set. (2) Assurance that all apparatus is properly placed and working.

Leaving concrete, we come to brickwork, perhaps the next most important structural element to be safeguarded. In general, the protective measures for temperature control surrounding use of concrete apply to winter brick building. Tarpaulins, salamanders, steam lines, radiation as independent units or in combination, are util-



Temperature Control Assured by Tarpaulin "Topping" of Upper Surfaces of Concrete Floor Slabs. The Manner in which Such Protection is Carried Out Should be Carefully Checked. Note the Snug Overlap Given Exterior Tarpaulins



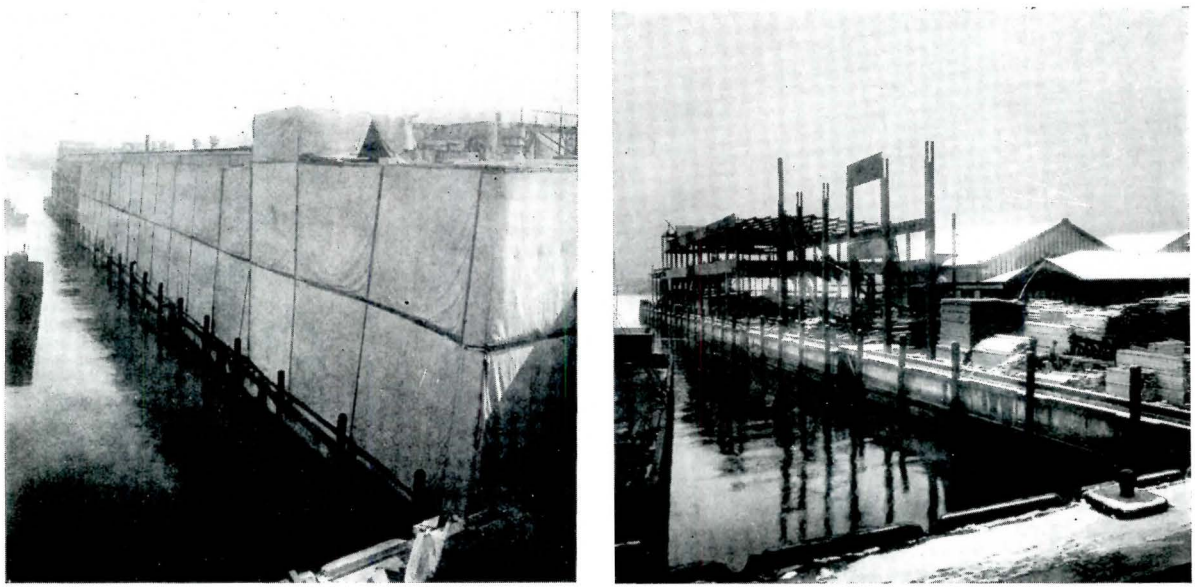
Interior View of Same Protection Shows Canvas Lashed to Framework. Clusters of Pipes Are Also Shown Projecting through Heat Holes Placed for Effective Distribution of Warmth from Salamanders on Floor Below

ized in much the same way for both materials. With brick, moisture becomes an added factor which winter protection must take into account. Wet brick for summer, dry brick for winter, is the rule. That section of the superintendence outline should begin with the storage of brick at the site. Obviously brick should not be piled helter-skelter as it is delivered from the truck, but should be stacked and covered over by sheds or canvas in a manner that protects sides as well as edges against contact with the weather. The ideal way in which to store brick awaiting use is within one of the areas kept warm by salamanders or other heating apparatus. This serves not only to keep it away from snow or rain but also prevents absorption of atmospheric moisture.

It is well established practice to lay all brickwork at temperature well above freezing point. As with concrete, the materials which go into brick mortar should be prepared and mixed where temperature control is assured.

Inside brickwork seems to offer no great problems where adequate protective measures are planned for and employed. Care in checking temperature to keep it at constant working point is, of course, essential. The desire for comfortable warmth on the part of the bricklayer is an aid in securing proper temperatures for laying brick. With brick laid outside the zones of temperature control, more closely coupled contacts are required than with inside work. Outside joints, which may freeze and "pop", carry a decided winter risk. Various anti-freezing compounds at the disposal of the contractor are valuable when speed of erection is a pressing need. Nothing, nowever, seems to quite fill the bill as well as good old fashioned mortar, applied with cleanly struck joints, and thin enough to permit compacting that assists in a final set which prevents there being cracking or leaky walls.

Many experiments have been carried out in an endeavor to find an ideal cold weather mortar. A test result and recommendation were published some time ago by the National Lime Association. The Association's report said that "lime cement mortars are least affected by cold weather when mixed to a formula of 1 part cement, 2 parts lime and 9 parts sand." The advantages stressed in its favor are: increase in tensile and compressive strength under low temperature; plasticity and ease in handling during winter weather; ease in proportioning; and low cost. The architect should investigate the mortar mix thoroughly. It has become widely accepted practice to defer laying outside brickwork in winter when a falling temperature reaches 34°, and to begin only when a rising temperature has reached that point. Brickwork known to have been frozen should not be built upon until most thoroughly thawed out, and portions in which frozen mortars might later cause disintegration should be torn out and replaced. Outside brickwork in



All-over Coverage Given a Municipal Pier which Was Completed on Scheduled Time Through a Winter of Record Cold and Snow. Behind the Tarpaulins, a Carefully Worked out Radiation System Provided the Requisite Heat

winter should be protected by tarpaulins for three days after laying, with temperature maintained well above 32°. So much for winter brick and brickwork as they must of necessity be treated here.

As winter construction progresses, various auxiliary structural elements begin to play their parts. Not all of them, by any means, require special winter consideration. But those in which water is used should be on the list of those that demand use of precautionary methods. More and more tile work is being used in the architectural-structural scheme of things, and when in winter its application becomes extensive, cold weather precautions must be taken. Temperature has an important bearing upon the enduring success of the winter-laid tile. Experienced tile contractors know that tiles set at or below freezing point will sooner or later come down of themselves. A conscientious rule of practice regards 50° as the ideal temperature for setting tile in winter, with maintenance at about that point for 48 hours after the tiles are in place. Work should stop immediately when the thermometer registers close to 32°.

Exterior tile work should never be carried on when there is even a remote possibility of there being freezing weather. Anti-freezing compounds are not very popular with most tile men. Those with whom I have talked discourage their use, claiming that results have not been satisfactory and that staining of the tile face is likely to occur. Tile body, like that of brick, absorbs moisture readily, and in winter, tiles should be kept as dry as possible before application, within areas where working temperature is maintained.

Plastering is another phase of work which should be safeguarded against too low a temperature. Luckily, plastering is usually done when winter construction has reached the semi-finished stage, when necessary temperature is easily provided and kept constant.

With a clearly defined plan of procedure to follow, effective winter superintendence is not difficult for the thoroughgoing architect. The measure of its success depends largely upon having a clear idea of what is to be encountered, of knowing in advance the reactions of given materials to winter conditions if left to themselves, and of knowing what must be done to prevent these reactions from taking place.

In an article such as this some mention should be made of the effect of winter superintendence upon the attitude of the craftsman toward his work. The success of winter construction is not wholly dependent upon adherence to rules and standards for the storage and handling of material. Securing the comfort, safety, and team spirit of the men who do the work, from the pick and shovel gang on up the line to division foremen, should be a substantial part of the architect's superintendence plan. In his contacts he should be on the alert for any difficulties which might impair morale, and be quite as frank with recommendations for their correction as he is in matters of purely structural interest. I know the stimulus which follows an architect's mingling with rank and file of workers on a cordial common ground; the impetus that follows his showing more than an impersonal interest in a craftsman's efforts; the support he receives when it is understood that he is there to do his part in creating a structural success for everyone concerned.

BUILDING PROMOTION FROM THE BUILDER'S STANDPOINT

BY

WILLIAM A. STARRETT

WHAT THE TRUE BASIS OF PROMOTION SHOULD BE. FINANCING METHODS, GOOD AND BAD

IT is needless to say that I was flattered to receive an invitation to come to Chicago, particularly to speak to architects. We in the East feel that the leadership in sound promotional ideas comes out of the West.

One such idea is that of financing buildings by the issue of so-called "leasehold bonds." In the State of New York, and I believe in two other states in the Union, securities that are founded on leaseholds are not accepted by fiduciary institutions as investments for trust funds, thus limiting the use of this method of financing, which is, when soundly planned, about the best and most advanced form of real estate security.

There is a legitimate and alluring field of endeavor for those interested in architecture and building in connection with the financing of building projects. We builders and architects hear of and see many that are meritorious. We know the great increment in value that comes about through our active participation in worthy projects. It is well, however, to remember that we hear most of the successful cases of building promotion, and that very little is said about the unsuccessful. We can always point to examples where great profit has accrued; but we should not forget that the path of this whole matter of promotion is strewn with wrecks of failure, and that bankruptcy courts silently carry on, without front page publicity, the foreclosure enforcement of liens.

Land Worth What It Can Be Made to Produce. Now the true basis of promotion is really the putting together of two valuable components of a creative enterprise. We have on the one hand a piece of land, either vacant or encumbered by obsolete buildings that must be destroyed in order that the land may realize its economic value; and we have on the other hand a brilliant conception of a great improvement which might be made,—the land to be worth so much and the building erected to be worth so much. The sum of those two will be so much; and no matter what it costs, within those reasonable limits that we here discuss, there has been an increment the minute the key turns in the doorway it is opening. Therein lies the lure to the promoter and the legitimate profit in the thing we are here considering.

Now, here is a thing builders and architects are tremendously concerned in, because we help to create that happy combination by bringing together an unproductive or absolutely unimproved piece of land and the highest possible improvement for that piece of land. It would be an impertinence in the presence of real estate experts to suggest a short cut in the matter of appraisals, for we have all used land appraisals of other generations and running down even to very modern times;—that method of calculation which compares what another piece of land cost with that of land under consideration, without reference to the earning power of the newer project. Out of such a circumlocution of appraisal, we finally come to the solemn moment when the appraiser grudgingly says that our project is worth only about so much. However, I dare to pronounce a bit of dictum as a short cut for the whole thing, by saying that land is worth what it can be made to produce. If you want to be very meticulous in your definition, you may go on to say: "What it can be made to pay over a period of years"; but it is all said in those few words;—land is worth what it can be made to produce,—its earnings. And therefore the builder and the architect, in their skillful, constructive activity, create a part of that increment.

"Cost" and "Value" Defined. Now, this brings us to the crossroad which might be regarded as a dilemma, and sometimes taxes the consciences of us who may not think carefully and cleanly (I should say clearly) in these matters. The difference that must be recognized, and the first thing, is the difference between *cost* and *value*. Cost, however, is the sum of those actual outlays of cash necessary to produce and complete the whole; that is cost of the operation. The value of the operation is the complete thing,—the cost increased by creative effort that has been put into the operation by the work of the builder and the architect.

The Wrong Sort of Promotion. Promoters are of so many different kinds that one must almost define it every time he uses the word. Considering that type of promoter whom I should describe as reckless, but who calls himself a conservative, we think of him as reaching down into the very bowels of the building business, and with prospective values and deferments in payment, he ponders on that as a possible ground upon which to build his slender project. He thinks of engaging the efforts of the architect and the builder, and then reaches over the shoulders of both and proposes to engage the profits and the support of all the subcontractors involved. I have found this to be the case,—I am not speaking of territory

with which I am not familiar, but in my own part of the country we find that the greatest mistake among promoters is that which leads a promoter to think that he can reach over the shoulders of the architect and builder and assess the subcontractor for a large percentage of the cost of the work. Here is the way that thing works, speaking for my own part of the country. Take items like structural steel, elevators and perhaps one or two other major items, and you find concerns vending those materials are able to take any part of the financing they say they will take. It is also to be observed that they carefully scrutinize the terms, and prices generally run correspondingly high. Beyond that, there is in the whole industry running down the line, a tendency to lean on the architect and the general contractor for advice, or rather for assumption of advice, concerning the taking of securities. There are 50 or 60 or sometimes as many as 75 subcontractors that enter into the making of a large, complicated, metropolitan structure. You have a great army of those people, ready to take any kind of paper offered, as a portion of their profit. Now what happens? If I could show you into the treasury departments of a dozen of the leading builders of this country, you would find a very sinister state of affairs. You would find there men who promised to take anything in the way of paper and deferments, who are suddenly confronted with the fact that, after all, arithmetic on their books will not produce dollars,—and this is one of the fruitful sources of bankruptcy. Men not skilled or versed in this matter of deferred payments agree to take almost anything, and thereby damage and demoralize their own industry by these rash promises, which, of course, meet a judgment day sooner or later. I think, therefore, that one of our pernicious growths in this matter of promotion is the feeling that there lies, in the subcontractor, an almost untapped source of wealth. As a matter of fact, it doesn't lie there at all. It is detrimental and pernicious to undertake to extract by means of promises of subcontractors, part of the financing requisite for such operations.

We all know, in this swift transition that has passed through the business, that borrowing is necessary for metropolitan development, and indeed it has become one of the fundamental sources of our strongest outlets for capital. Insurance companies for years made loans when skyscrapers were early being introduced; they did it with a considerable amount of what they then thought was risk. It has turned out, of course, as we know now, that there was no risk to it. Nevertheless, there is every credit due to those early institutions for the courage and forward-looking point of view that made possible the financing of these earlier constructions, when, as I have said and as many of you remember, buildings of even 12 stories were regarded as dangerous. More recently in the development, however, we have come upon the investment banker, or rather he has come upon us, and he has come out of a certain situation. In moments of pessimism I sometimes think no new idea ever entered the minds of the comptrollers of insurance companies after the year 1900. The absurd point of view, arising out of that ancient fetish that occurred with the first skyscraper and was met by the courage of that time, has made the lender feel that he is extending a tremendous favor to the borrower, even though the security were as high as it is in conservative lending. Of course, being of that class which benefits by borrowing, I naturally whoop it up for anything that produces larger loans. Nevertheless, I want to say that there is a responsibility there that I think has never been squarely met by the so-called orthodox lending institutions, and that is this responsibility: When an owner (and let's call him also a promoter, because we are also speaking of that) has found a project meritorious, creative, needed and necessitous, if you please, and goes to an orthodox lending institution, and is told that his estimates are too high and that the architects' fees ought to be cut, and that his allowances for this and that and the other thing should all be pared down to arrive at a figure which is not only the cost but something below the cost; then when the loan is made on that basis, with no creative vision, and the owner is forced to the very edge of his financial scheme (and it is not without historical record that often an enterprise entered into hopefully by people intending to avail themselves of loans, has actually been wrecked through the very paucity of the loan, where a proper, forward-looking, optimistic view of the merit of the project would have given a better loan, without one particle of disparagement of the value of that loan or its security), then, I say, the lender has much to answer for.

Investment Banking. Of course we know that out of that situation we have evolved the "investment banker." He has been the subject of all kinds of speculation. We have even had one or two go to the wall, but it is no more an indication of unsoundness of investment banking than the failure of a single bank is an indication of the unsoundness of our banking system. What really happened was this:—that out of this lethargic situation of old time lending there was created an institution that would come in with vision and foresight and see the potential value of putting together the vacant land and the completed structure. That situation produced, our investment

banker has rendered an inestimable service to architecture and the building industry. Cities everywhere have been benefited by the splendid vision and foresight of those investment bankers; and if we can point to an occasional failure, we can also point to a great number of successes.

Sound Projects Should Be Encouraged. We are here together at least for one brief evening, taking to ourselves the virtue of being creators, and it seems a proper occasion to make a mighty protest in favor of the reliable, well organized, capable architect and the builder. These people, as I have said through the burden of this talk, do a great creative thing. It is scandalous that they should be subjected to the losses and disappointments and be pushed out on the end of the limb at the very last quarter of these creative enterprises, in reality and truly carrying the burden of the risk. That's what happens when you put your fees in as part of the enterprise. There is a mission in the whole architectural profession. The architects and the builders are really doing a creatively helpful thing and are entitled to a rightful share of the emoluments of the project by reason of their having taken the great risk involved. We can almost talk unionism when we get on that subject, though we are not going to do it; but I say, as of other matters connected with the ethics of these two professions, that there is no greater field of effort, no more fruitful field of effort, than the constant, everlasting harping on that particular thing, and a demanding on behalf of architects and builders, of a fair share of emoluments of the enterprise, they having really assumed the major risk therein.

This business of promotion is also new; just think of it! We can all hark back to those days, here in Chicago, when a 15-story building was really a city wonder. The evolution and metamorphosis of the whole industry have precluded the possibility of getting down to a code of standard practices, but I think the time has come, and in fact enough has been developed out of the many great metropolitan structures that have already been built, for us all to find out what the standards,—at least the major standards,—of practice should be. It starts with questions of credit, questions in which bankers can help, questions in which realtors and bankers can take a sympathetic interest. Their attitude toward the high ethics of these two professions will in the end tend to stabilize the business. We want promoters. A promoter is a most valuable factor in the economic forward progress of this country. The wrong kind of promoter is just as wrong as you want to make him, and the good, legitimate producer, who sees the values to be created by putting together the unimproved land and sound, well-thought-out building projects, is an asset and and institution of great value to us. My whole urge in the matter is this: With these fundamentals perhaps a little better understood, there could be no better objective for all of us concerned than to stand out for a higher, more ethical and properly fashioned standard for promotion; for the exposing of flimsy, unsound promotion and enterprises.

There is a back-kick in all of this promotion business, which need hardly be referred to. It is the last straw that always breaks the camel's back. Builders have an old saying: "All money lost in building is lost in laying the thresholds." That has particular significance with reference to unestimated items such as delayed receipts of rentals, unexpected necessary expenses that come up in connection with renting, etc., disappointments that are only temporary, in connection with renting during the first months of a building's occupancy. We must consider not only the value created between the cost of the vacant lot and the finished building, but also those items of expense necessary for the closing of that last gap, and the provision for them demanded of the promoter, so that those investments we make of our fees and time in the equity, will be productive in accordance with the great effort which we put into it.

EDITOR'S NOTE. This article by the vice-president of Starrett Brothers, New York, is based on his address recently given before the Chicago Chapter of the American Institute of Architects.

THE PAINTING PROBLEM AND ITS SOLUTION

BY
W. C. WOODYARD

HIGHER standards in living conditions have demanded a correspondingly greater refinement of finish and decoration. Whether it be the home, the school, or place of business, we find ourselves taking a fleeting, momentary pride in its exterior architecture, while living all day inside with decorated walls and woodwork. These may produce a refining influence, foster *esprit de corps,* and inspire pride, or the opposite reactions, —disappointment and depression. The value of this idea is well illustrated in the modern skyscraper. Almost without exception the 35 fine Chicago office buildings built in recent years have been trimmed in genuine mahogany or walnut. Almost without exception, the wood carries a highly polished, piano cabinet finish. One of the largest leasers of Chicago loop property, in specifically demanding a piano-like finish, declared it to be one of the differentiating marks between an "A" and a "B" class building. This trend toward refinement of finish and decoration in the office building, the theater, the school, and particularly in the modern home, is so evident as not to require elaboration. The value of attractive and effective surface protection is accepted. It is easy to visualize the result desired, and comparatively easy to define what is expected, but the problem of getting these results is a matter of interest if not of perplexity to the architectural profession.

It is the purpose of this article to analyze the factors contributing to this perplexing situation, with the hope of suggesting a tried and proved policy which will insure more uniformly satisfactory results. With proper procedure, we may deal, first, briefly with the situations which reflect lack of understanding and thoroughness, and secondly, more comprehensively, with the situations in which apparently sound theory has not vindicated itself in practical results. Careless and unstudied specifications deserve only passing mention. Obviously, it is only human that a painting contractor would readily take advantage of one who reveals an inadequate knowledge of requirements. Such specifications lead to costly bartering on the job,—bartering in which the architect and the client invariably lose. We are not warrented in condemning painters as a class, and assuming dishonesty on their part. The whole problem is frequently dismissed in this manner, and unfairly so. We shall make more constructive progress, for the purpose of this discussion at least, if the architect assumes responsibility for the situation and for the improvement thereof.

It is recognized that no trade offers the possibilities for evasion, substitution, and dishonest practice that the painting trade does. Sufficient reason, therefore, to tighten up all along the way in the method of specifying, contracting, and supervising painting work. This is the only way to give the better contractor, who takes a pride in his work, a chance. In general, pride in workmanship is an inherent quality in all of us. It is unreasonable and unfair to assume, therefore, that the painter is not motivated by a desire to do good work. If, however, there is evidence to the contrary, and one will search deep enough for the cause, it will freqeuntly be found that the painter is forced by circumstances to depart from his ideal in order to survive. The better painting contractors will welcome the tightening-up policy which will enable them to do a type of work more satisfactory to all concerned. The "human factor," or the reaction of the painting contractor to specifications and superintendence, is all-important in considering this problem. The painter is a very human, understanding sort of fellow. As a matter of fact, when he makes up his bid he usually has to take into consideration three things, —first, the plans and specifications; secondly, the architect involved, and what he is likely to exact or fail to exact; and thirdly, how far his competing bidder is likely to go in discounting both of these factors. Too often, instead of being given a definitely lined-up proposition, the painter is asked to gamble in competition with others confronted with the same alternative. The general contractor contributes to the unsatisfactory situation by seemingly being interested only in the lowest possible figure, and the only hope for the trustworthy painter lies in a more careful definition, enforcement, and discrimination among painting contractors on the part of the architect.

Now, we may logically turn to certain constructive suggestions which a broad survey of painting problems reveals as the more outstanding causes for unsatisfactory results. Specifications should be varied according to the cost of the building and the general line-up of the investment. A greater proportionate decorative expenditure is expected, for example, in a $60,000 residence than in an ordinary apartment building yielding a moderate income. In the latter case, a decorative result approaching in appearance the effect secured in the $60,000 residence is desired at a considerably smaller expenditure,—and it is possible to secure it. However, the curtailed specification is usually more difficult to write. The element of serviceability is necessary to both projects. It is true,

and generally so accepted, that there is no economy in letting down on the quality of materials used. This would result in a very negligible saving,—a saving that would prove very expensive in the long run. The quality of materials, in fact, looms more important in the curtailed job. A five-coat rubbed enamel job may be cut down to a four-coat eggshell or a three-coat enamel job if necessary. The proper selection of coating in a three-coat enamel job is very important. Likewise the size, three coats of paint, glazed and starched wall coating job may be cut down in the extreme case from six coats to two coats,—a coat of primer and a coat of paint. In each instance it is not claimed that an equivalent job is secured, but a decorative effect approximating the more perfect finish is had, and if the best materials are used, it is one that is reasonably durable and serviceable. On a large apartment hotel recently, an architect wrote a curtailed painting specification, specific as to requirements in coats and materials, that was practically fool-proof. He emphasized to the six contractors he had bid on the work that it represented exactly what was wanted. There was less than a 7 per cent differential between the highest and the lowest bid. It is not an uncommon experience for the highest figure to be double the amount of the lowest figure. This represents a pretty large difference in appraisal of what is desired or will be exacted. It relegates the bid to a gamble. It represents a rather important need of the "tightening-up" process heretofore alluded to.

The practice of cutting bidders down to a price, likewise offers a poor investment. We need not expect to get more than we pay for. It is far more logical and business-like to change the specification, know exactly what one is going to get, and be in a position to insist on the terms of the contract. Of all the evils in connection with the painting problem, the one most complained of is substitution of cheaper materials for those specified. This may be done in an underhanded way, such as displaying boldly a few cans of the specified materials and actually using cheaper materials from barrels, refilled cans and the like, or it may be more above-board,—in out and out requests for approval of other goods. In the latter event, regardless of how represented, the material offered for approval is practically always cheaper in price and quality.

We must first look to the specifications for improvement in this regard. Here again, the human factor plays a prominent part, and the manufacturer's representative can play a constructive role. Let us trace the reaction of various types of specifications. First, consider the specifications calling for several brands "or equal." On the face of it, it appears theoretically sound. It is intended to leave the matter open to competition.. It must be recognized, however, that materials such as paint, varnish, enamel and lacquer, with their complex chemical make-up, are not "equal" in quality or performance. The paint industry exists on a highly scientific basis necessary to meet the ever-increasing demand for a greater variety of paint finish. Products made from the same basic ingredients frequently differ widely in qualities of finish and durability. The large expenditures for laboratory research and control, which constitute quite an item in this age, have found their justification in a greater refinement of finish, flexibility of use, and durability of results. A manufacturer establishes a reputation for progressive research and integrity of purpose. Competition in quality fosters research, whereas an accepted theory of equality would prevent progress. Added to that is the fact that usually one or two of the brands included are cheaper, which automatically makes them the standard of materials for the specification, and nullifies any value in including the higher priced brands. Furthermore, it tends to eliminate possible coöperation from the manufacturer's representative. The representatives of the manufacturers mentioned may be successively stalled off if the contractor chooses to be evasive. In any event, the salesman selling the job, whether it be of the grades specified or otherwise, is entirely indebted to the painter for the business and is likely to be in no position to coöperate effectively with the architect in the interest of the finished result.

We may go from this type of specification to the other extreme. Unquestionably, the exclusive specification offers the most definite proposition for the bidder; likewise a definite basis, an obligation in fact, for the manufacturer's representative to interest himself in the result which should be secured with his materials under the provisions of the specifications. This system has proved to offer the best investment and protection for the client. The plan, however, is objectionable to many because it does not leave the matter sufficiently open to competition. It is frequently maintained that the manufacturer would use this advantage to hold up the price to the contractor. That contention, however, is not substantiated by fact, and where made it should be carefully run down. The larger manufacturers have so many jobbers and independent, overlapping methods of distribution in the various communities that they create competition within their own representatives' ranks and make it practically impossible for the painter to be held up on price. Furthermore, it would not be sound business tactics for the enlightened, reputable manufacturer in this age to be so shortsighted as to take advantage of an ex-

clusive specification if it were in fact in his power to do so under his distributing arrangement.

However, if we seek a specification that offers a uniform standard of materials for each contractor to bid on, which provides for competition, which definitely eliminates the bartering for approvals after the contract is let, let us consider this plan. Definitely specify the product which you believe best adapted for the work, as you would probably do if you were writing a specification for your own home, incorporating as a part of your specification these clauses: "The bids to be considered must include a bid on goods herein specified, but the contractor may submit alternate bids on materials which he considers fully equal to those specified, provided he appends the name of the manufacturer and explicit designation of each product he offers as a substitute, stating the amount to be added to or deducted from his bid for such substitution. The architect reserves the right to award the contract to the lowest bidder on the goods specified or on any accepted substitutes proposed in the alternate bids submitted as just explained. After the award is made, no substitution of materials for those mentioned in the accepted bid will be permitted."

The basic bid on the standard set up commits all contractors to one figure on exactly the same thing, permitting a fair comparison of figures. The architect is not put on the defensive, later on after the contract is let, with requests to approve this or that material, the purpose of which request is usually to offer a saving to the contractor. If there is a saving to be made in the use of an alternate, architect or owner should get the benefit of the saving. How often is there an allowance offered with the request for an approval under the open specification? Furthermore, the matter is definitely settled when the contract is let. The numerous time-consuming requests for approvals are obviated. It is not left to the superintendent on the work to pass on materials, as is frequently the case. Best of all, it is a protection to the better element among the painting contractors who prefer to use the better grade products but hold mental reservations regarding the grades of goods some of their competitors would try to put across if they got the contract.

We cannot deal comprehensively with the painting problem without some reference to superintendence of the work. The plan and specifications may be worked out most painstakingly, and their effect be completely lost, as is so often the case, by laxity and lack of system in their enforcement. We cannot hope to deal with the subject of superintendence in an entirely adequate manner in this article of small extent, but these suggestions to the architect's superintendent may prove helpful:

(1) Definitely familiarize yourself with the scope of the specifications, particularly as regards to coats and materials.

(2) Learn definitely from the office what materials are to be used if the specifications are not explicit. Check up definitely with the office any details regarding which there is uncertainty, such as color, decorative schemes, etc.

(3) Make brief outline of specifications in your note book, particularly the sequence of coats and materials to be used.

(4) Go over the specifications and details of the work with the painter when he first comes on the site. It is essential that both know that each understands that which is to be done.

(5) Provide the painter with a room for storage of painting materials, retaining a key to the lock of the door.

(6) Make regular inspections of storage room, taking care to identify contents of unlabeled cans. Reject and have removed immediately from the site materials not in accordance with the specifications. Look for the original seals on goods.

(7) In the early portion of the work, observe opening of a new can and application of each coat for at least one room to establish a standard result for the entire work.

(8) Check painting work regularly, requesting information as to the particular coat being applied and record data in note book for later use.

(9) Be as careful in the check-up toward the end as at the beginning.

We have made only scant mention of the manufacturer's representative, and the part he can play in improving painting conditions. If he is a product of the modern school, which increasingly demands a more thorough and technical knowledge of the business, he can prove to be quite an asset. Ask him for suggestions in connection with specifications. If you are specifying and using his products, feel perfectly free to insist on his following up the work and coöperating in getting a creditable result. You have a right to expect his interest to be more than in a sale of gallons of material; he should be interested in selling results.

We have gone to some length to suggest a tightening-up process as a means of improving painting work. We have suggested taking into account the human factor and making it more difficult to discount the intent of the specifications. These steps are necessary if the better element in the painting contracting business is to triumph. The better painting contractors will give a sounder investment, and will give added meaning to the common slogan of the paint industry: "Save the surface and you save all!"

SOUNDPROOFING APARTMENT HOUSES—PART ONE

BY
V. L. CHRISLER
ASSOCIATE PHYSICIST, U. S. BUREAU OF STANDARDS

SOUND insulation is one of the most important details to be considered in building hotels, apartment houses, and office buildings. In the past little consideration has been given by architects to this necessary requirement. There is, however, on the part of the people who occupy these buildings, a growing demand for sufficient sound insulation to ensure a reasonable degree of privacy. Sounds which come through the ceilings are especially annoying to the person hearing them. In many cases the noises coming from adjoining apartments finally get on the nerves to such an extent that a tenant moves, though his apartment may be satisfactory in all other respects.

Up to the past four or five years there has been little reliable information available on this subject, and our present knowledge as to what is the best type of construction is somewhat limited. Many people have thought they had a perfectly satisfactory type of construction, and some buildings which they completed were pronounced satisfactory. Possibly the next building, which was constructed as nearly as possible in the same manner as the others, would be a complete failure. On account of this uncertainty and in order to get comparative data on different types of construction, the Bureau of Standards several years ago constructed a special building (Fig. 1) in which measurements could be made determining numerical values for the sound insulation of different types of construction. Most of the common types have been tested, and considerable work has been done in making various modifications in wall and floor construction so as to get the necessary degree of sound insulation. The problem as a whole is very interesting, as there seem to be so many unknown quantities that it is generally impossible to predict with any degree of certainty whether or not a partition will be a better sound insulator if certain changes are made in it. Owing to the work which has been done during the past three or four years, it is possible to make a much better guess than when the work was started,—but there are still many elements of uncertainty.

It may be of interest to consider some of the factors which enter into the transmission of sound through a partition and to see how they may be controlled. To begin with, suppose we consider a sheet of metal which is fastened over a hole in a wall. If a source of sound is placed on one side of this sheet of metal, the sound energy is carried to the metal by the air, and the sheet is set in vibration. This in turn sets the air on the other side in vibration, and the sound energy is thus transmitted from one side to the other. By studying the sound transmission through a number of sheets of different metals, it has been found that the weight per unit area is, generally speaking, the most important factor. It is not the only factor, for a sheet of lead will transmit sound more than a sheet of iron or aluminum of the same weight. This difference is not large enough, however, to be of much practical importance.

In studying these thin sheets of metal, a very surprising result was found. A year or so ago a few double masonry walls were built and were found upon test to be quite effective as sound insulators. In fact the conclusion was reached that air was the best filling material. Sabine also reached the same conclusion. From these results it was then expected that two sheets of metal separated by an air space would be a much better sound insulator than a single sheet of metal. Much to everyone's surprise, it was found by experiment that two sheets of aluminum with a 1¾-inch air space between them transmitted almost as much sound as a single sheet of material. It thus became evident that the behavior of a double masonry wall was different in kind rather than in degree from that of a partition composed of two thin metallic sheets. The thin sheets of metal apparently need something in the air space between them to help damp out the vibrations. Filling materials, such as hair, felt, cotton and balsam wool, were tried and found effective.

From these results and other measurements on walls, there may be drawn some conclusions which appear to be more or less general. As long as a wall is constructed of masonry and is more or less homogeneous, the sound insulation is almost proportional to its weight per unit area. This means that to get a proper degree of sound insulation the wall must be excessively heavy. To avoid this we may split the wall into layers, and in some way try to damp out the vibrations and prevent them from passing from one layer to another.

One such method which has been devised is to hang the wall and ceiling surfaces on springs which are attached to the main part of the wall. The springs are supposed to act as do shock absorbers for an automobile. They must be of just the right strength and stiffness, so that the wall surface can vibrate without transmitting too much energy to the main part of the wall. This principle was illustrated in some of the first measure-

ments that were made at the Bureau of Standards on stud partitions. One partition was covered on both sides with expanded metal lath and a very thin scratch coat of gypsum plaster. The second panel was as nearly identical as possible, except that it had both a scratch coat and a brown coat of gypsum plaster. When the measurements were completed, the results were found to be somewhat surprising. The panel with the scratch coat only was found to be the best sound insulator. An examination of the two panels showed that the panel having only the scratch coat had a surface so thin that it had no rigidity and could easily be moved back and forth between the studs for perhaps an eighth of an inch without exerting an appreciable force on the studs. The panel having both the scratch and brown coats had a more rigid surface and could not be moved so easily; hence a force exerted on this surface was also exerted in considerable measure on the stud, and was thus transferred to the other side.

The reasons are now apparent why the scratch coat was the best insulator. It had sufficient mass in its surface to prevent the sound setting up vibrations of sufficient force, so that the air between the studs would act as a good tie, as in the case of thin sheets of metal; also the damping in such a surface is fairly large, and the energy would not be carried very efficiently to the stud and hence to the other surface. Moreover, what little energy was carried through was not sufficient to produce any great amount of vibration in the other side, as the movements produced in the stud were but slight, and the opposite scratch coating was not stiff enough to be set into vibration by small movements of the stud. In the case of the panel having the scratch and brown coats, the sound waves which set the first surface in vibration caused the second surface to vibrate also, as this surface was stiff enough to form a rather rigid connection with the studs and thus could be put into vibration by a small motion. From this experiment we see that if the surface can be attached to the main part of the wall so that it is free to vibrate without transmitting too much of the energy to the wall, we have an ideal condition. To accomplish this, one company which is specializing on sound insulation, is supporting wall surfaces on the special spring mentioned here. By another method which is on the market the wall surfaces are supported on small metal chairs, which are lined with felt. In addition to this a lining of hair felt is used between the main wall and the plaster surface. Neither of these particular types of construction has been tested by the Bureau of Standards, but it is expected that either should give good results.

A special type of masonry wall which has been tested in several different combinations by the Bureau of Standards, and which promises to give very satisfactory results at relatively slight increase in cost over ordinary construction, consists

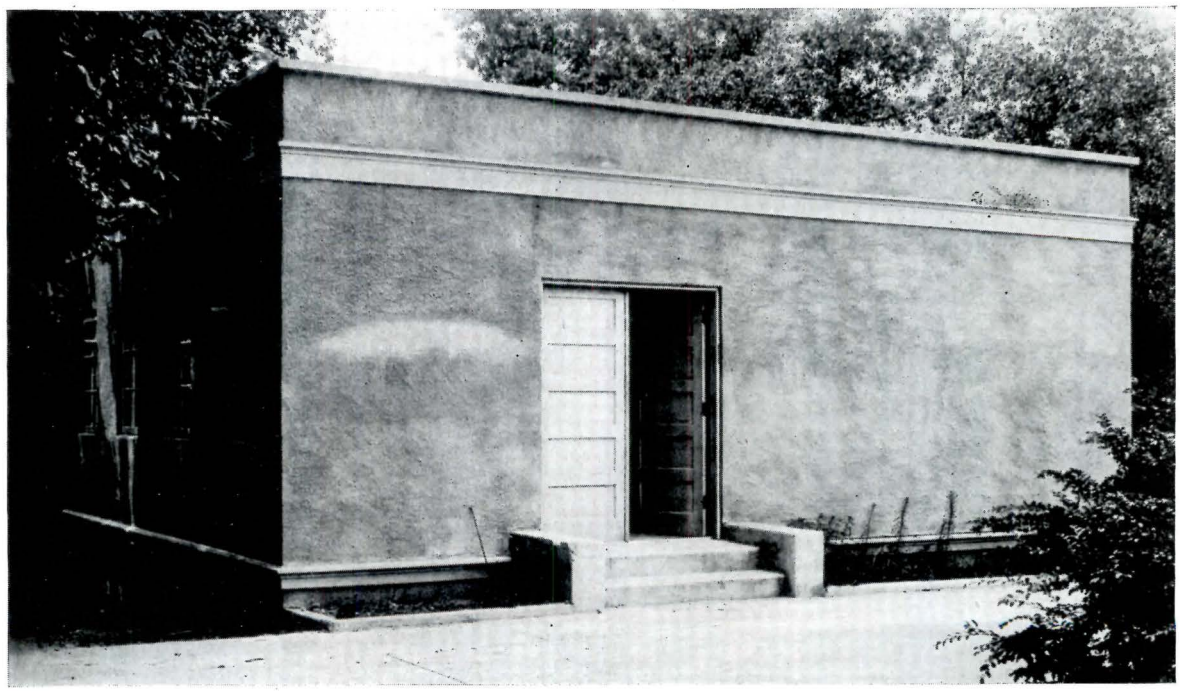


Fig. 1. Special Building of the Bureau of Standards for Testing Sound Insulation.

of a masonry core of 4-inch hollow clay tile or brick turned on edge for the center portion. If the wall is a load-bearing wall, a heavier construction could be used and probably still better results be obtained. At the time the masonry wall was laid, wires were placed in the wall so that wooden furring strips could be tied to the wall 16 inches on centers. The plaster base was nailed to these furring strips, and plaster was applied in the ordinary manner. For the plaster base expanded metal lath was used with tar paper behind it to prevent the plaster from forming a bond with the masonry core. Two different kinds of fiber board and a gypsum plaster board were also used as a plaster base. Where there was a direct comparison, the fiber and plaster boards showed a slight advantage in sound-insulation value over the metal lath as a plaster base. This difference was not large enough to be of much importance, and was probably due to the fact that the plaster was only half an inch thick over the boards while it was seven-eighths of an inch thick when metal lath was used, and as a result gave a somewhat heavier surface.

When the panels were in place, conversational tests were made as well as a determination of the reduction factor. In every case it was found that a conversation carried on in an ordinary tone of voice was barely audible to a listener on the other side, provided he was listening intently, but that he was unable to understand anything that was said; also that if there were the slightest noise in the room he was in, the listener failed to detect any sound from conversation on the other side of the panel. Attempts were also made to carry on a conversation through these panels by shouting. In this case one could always hear the other person, but as a rule failed to understand anything that was said. Compared with the walls in many apartments, this is a decided improvement. It should also be borne in mind that the rooms in which these tests were made had bare concrete walls and were so situated that no distracting noises entered from the outside. If they had been rooms in an ordinary apartment, where there were draperies and furniture to absorb part of the sound, and if there had been some noise due to traffic or other causes, the panels would have given still better results.

A very interesting illustration of the effect of absorbing material was found when a box was built and lined with some very absorbent material. There were some plate glass windows in the box, and when a person was on the inside his lips could be seen to move, but as a rule unless he raised his voice slightly no sound could be heard. The person on the inside, however, could hear every word said by anyone outside. A practical use of this might be made in offices where typewriter noises come through thin partitions and are annoying. If considerable material is placed in the room where the noise originates, it is sometimes possible to reduce the intensity to such an extent that the partition becomes satisfactory, and the noise is no longer disturbing. There is also a second advantage to use of such a treatment. The intensity of the noise being reduced makes the room much better for those working in it. Where tests have been made it has been found that this increases the efficiency of workers.

Up to the present we have considered only airborne noises. Noises due to impact form another class. They are among the most difficult to insulate, and are at the same time highly annoying. From experience we all know that a noisy machine often sounds almost as loud in the room below as in the room where it is located. To experiment with noises of this kind, a special machine (Fig. 2) has been built by the Bureau of Standards. It consists of a set of five rods which are raised in succession by a set of cams. The speed of the cams is such that one rod is allowed to fall every fifth of a second. On a wood floor it is quite noisy—sufficiently so that it is rather trying to hold a conversation with anyone in the same room. Where there were wood joists there was some reduction of the noise transmitted through the partition, but it was still decidedly annoying. Some contractors build a so-called "floating floor" by using a fiber board, and then laying the finish floor on top and nailing through the fiber boards. This form of construction was tested to determine if such a structure was an improvement, and somewhat to the experimenters' surprise (although the results might have been expected), the structure transmitted exactly the same percentage of sound within the limit of experimental error as did the

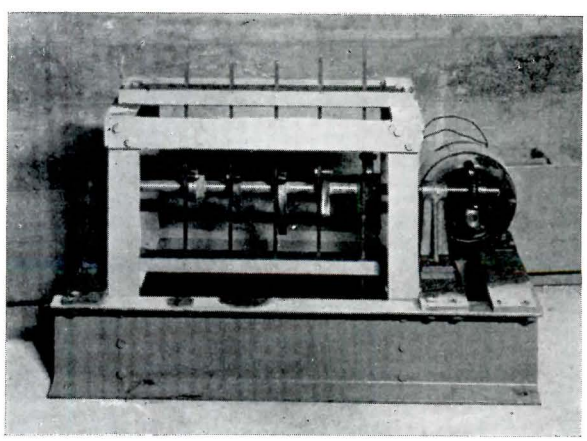


Fig. 2. Machine for Experimenting with Impact Noises.

structure before the fiber board was added. In other words, the vibrations were carried through the nails and destroyed any effect due to the fiber board. This applies to both air-borne and impact noises. In the next attempt a rough subflooring was laid and on top of this was placed fiber board, on which nailing strips were placed, and on this the finish floor. This will be referred to as a "floating floor." Details have not been worked out as to how these nailing strips should be fastened, but it is not believed that it will be difficult to do this and still preserve what sound insulation is gained. For air-borne noises, such a structure is quite satisfactory. Under usual conditions a conversation carried on in an ordinary tone of voice is not audible through it. For impact noises, however, the structure was rather disappointing. It was to some extent an improvement, but footsteps could be easily heard.

The next attempt was to separate the ceiling from the floor joists. This gave about the same results, although not quite as good as the single set of joists and floating floor. A floating floor was then added. This combination gave the best results that were obtained with wood joists and was very satisfactory as far as air-borne noises were concerned. It still needs improvement in regard to insulating against impact noises. In fact, at this point in the investigation the conclusion was almost reached that the most practicable way to prevent noise coming through from the floor above was to minimize the noise being produced. This can always be done by using carpets or rugs. Cork tile and rubber tile are also good, and even linoleum is much better than a bare wood floor. After considering this type of construction still further, it is hoped that possibly some type of double ceiling will help and that it will be possible to prevent ordinary impact noises from coming through and being annoying. Further work will be done along this line in the near future.

The other type of flooring which was studied was masonry. When impacts were allowed to fall directly on the masonry, the noise in the room below was practically as loud as in the room where the machine was situated. A floating floor was then added, with decided improvement. Finally a suspended ceiling was placed, and this gave the best results which have been obtained. For air-borne noises this is probably the best panel that has been tested. For one of the listening tests a radio loud speaker was used. The loud speaker was driven somewhat harder than is usually customary for home use, and even then when listening through the panel it was impossible to tell whether someone was talking over the radio or an orchestra playing. In fact it is doubtful whether a person could have been sure that the radio was going. It is certain that if the test had been made anywhere except in a room which was absolutely quiet, the radio could not have been heard. For impact noises it was not as good, but was quite an improvement. The noise from the impact machine was distinctly audible, but not loud enough to be readily noticeable if two people were talking in the room. A practical method of fastening the nailing strips remains to be worked out, as in the tests just described, they were simply laid on the fiber board. From some experiments on brick walls it is believed that these strips can be nailed or lagged to masonry at intervals so as to prevent their bowing up without affecting the sound insulation.

From all this it is evident that the best form of sound insulation for masonry which has been found would be constructed somewhat in this way. What might be called the "core" of the building would be built in the customary manner, that is, with the walls and floors of masonry. From this point the procedure would be different. Each room has been formed by this rough masonry, and inside of this the finished surfaces are to be built. Instead of plastering directly on the masonry to form the wall and ceiling surfaces, this part should be furred out so that the finished plaster surfaces are not in direct contact with the masonry. In the same way the floor should be of a floating type. In other words, we might picture it as a box within a box, the inner box being attached to the outer in as few places as possible, and these connections should not be any more rigid than is necessary. Exactly how these connections should be made to get the best results is rather a difficult matter to decide and needs more investigation.

For wood construction, the progress has not been as encouraging as for masonry. This is possibly due to the fact that sounds do not pass through most types of wood construction as easily as through masonry, and therefore the incentive for improvement has not been as great. Use of staggered studs and staggered floor and ceiling joists has been suggested as a good method of construction. The laboratory tests do show an improvement in such cases, but not as large as was expected; and it is a question whether the improvement is sufficient to justify the additional cost. Another method is to use fiber board bebetween the studs and lath. The improvement in this case was not as great as had been hoped for. Work is still being done along this line, and it is hoped that a satisfactory solution will be obtained which will not necessitate an expensive installation.

In all of the laboratory work done, one impor-

tant factor has had to be ignored, and that is water pipes, soil pipes, electric conduits, gas pipes, etc. All of these form excellent paths by which sound may travel, and they may frustrate all attempts at sound insulation unless care is taken to install them properly. One suggestion might be made about noisy water fixtures. To begin with, a fixture should be bought which is as quiet as possible. Even then fixtures are often noisy if the water pressure is quite high, and considerable energy has to be dissipated as the water flows through. This often sets the fixture and with it the pipe in vibration which can be heard in all of the adjoining rooms. It is practically impossible to insulate against such sounds, but it is relatively simple to prevent their being produced by installing a reducing valve where the water enters the house and reducing the pressure so that it shall not exceed say five pounds per square inch at the fixtures. To secure a good flow of water this necessitates a somewhat larger pipe than usual. Doors and other openings also present problems which have to be dealt with according to their individual cases. Ventilation pipes also present problems. One rather costly mistake in planning an apartment building came to the writer's attention. The bathrooms were built directly over one another. As there were no outside openings, the ventilation was taken care of by a shaft into which there was an opening from each bathroom. As a result, a person standing in one bathroom could hear everything that went on in all of the other bathrooms, since the ventilating shaft acted as a speaking tube. As a result of this the owner was unable to keep tenants in the apartments, and he has spent several thousand dollars trying to remedy this faulty construction, but with only partial success.

The foregoing is intended to be only a brief outline of the work that has been done on sound insulation and to suggest some of the things that are to be avoided. It is not felt that this article would be complete unless a brief reference were made to results of laboratory tests which have been published. Unfortunately, these figures do not give absolute results, such as can be obtained for heat insulation, but depend on the manner in which the measurements were taken and also to some extent on the rooms in which the measurements were taken. For this reason it is rather difficult to compare results made by different observers. If comparisons are to be made between different panels, it is rather desirable that all of the results to be compared should be made by the same observer. It is also desirable to call attention to the form in which the results should be published. Most of the laboratory measurements on sound transmission are made by using a telephone or microphone to pick up the sound energy which is to be measured. These instruments measure sound on what we shall call the "physical" scale. But the most universally used instrument for detecting sound and estimating its intensity is the ear, and unfortunately the ear scale is not the same as the physical scale. As the intensity of sound increases steadily on the physical scale, the response of the ear fails to keep pace with the increasing energy of the sound waves, but is in fact proportional to the logarithm of that intensity. For example, two sounds of intensity, 10 and 100, as measured on the physical scale, would seem to the ear to have the ratio of 1 to 2, the common logarithms of 10 and 100. And because of the almost universal use of the ear as a means of detecting sound, it is advisable to express the results of the experiment on the ear scale.

This method of expressing results presents some difficulties. While the relative sound transmission of two panels is always the same on the physical scale, no matter how loud the sound which seeks transmission, this is apparently not the case on the ear scale. A numerical example, given in this table, will illustrate this point. We consider two walls, A and B, of which A transmits 1/1000 and B 1/100 of the incident sound energy, measured on the physical scale:

Intensity of Sound on Far Side of Wall: Physical Scale	Wall	Intensity of Sound Transmitted: Physical Scale	Ear Scale
1,000,000	A	1,000	3 (=log. 1,000)
	B	10,000	4 (=log. 10,000)
10,000	A	10	1 (=log. 10)
	B	100	2 (=log. 100)

From this it may be seen that while A is 10 times as good as B (in the physical scale), no matter what the original intensity of the sound may be, the ear estimates A as twice as good as B for a faint sound, and both A and B as nearly the same (ratio 4/3) for a louder sound.

We should therefore be cautious about the use of such phrases as "twice as good a sound insulator"; the point that should be emphasized (in advertising or otherwise) is not whether one material is twice as good as another under some special condition but whether it gives sufficient sound insulation under conditions as are usually prevailing to reduce the sound to a point where it will not be annoying. This means that to make a satisfactory installation one should know approximately the intensity of the noise he is trying to insulate against and approximately how good a sound insulator is the type of structure that he proposes to build. It is hoped that these suggestions will be of benefit, and that they will aid in the building of better apartment houses.

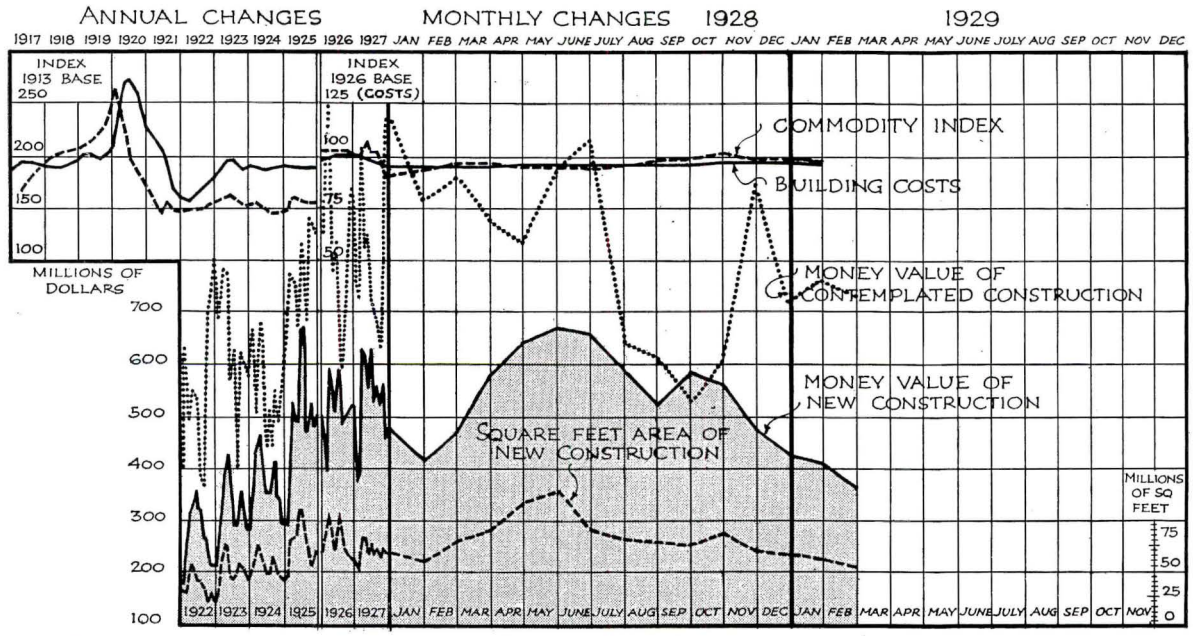
THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

FEBRUARY construction contracts awarded in the 37 states east of the Rocky Mountains show a 12 per cent decline from January of this year and a 22 per cent decline from February, 1928, according to figures provided by the F. W. Dodge Corporation. The total valuation of this February construction,—$361,273,900,—covers a period of four days less than the January totals, but there seems to have been approximately the same daily construction volume as that existing since the beginning of 1929. Combining the figures for January and February, 1929 gives a total of $771,241,800 and represents a decrease of 14 per cent from the 1928 construction for that period.

The district consisting of New York state and northern New Jersey, with a February total of $74,985,900, showed a falling off of 26 per cent from January of this year and 46 per cent from February, 1928. In the central west the total construction for February of $99,321,000, here again, was below the figure of the previous month by 12 per cent and below that of February, 1928 by 35 per cent. The only other district which showed a decrease for February, 1929 was that including the southeastern states, which had a total of $34,266,700, which is 12 per cent below the figures for February, 1928, and 9 per cent below the January, 1929 total. In the New England states construction was the highest ever recorded for this month. The total for the month of February was $26,430,700.

In the middle Atlantic states the value of construction started during February amounted to $50,689,700, an increase of 3 per cent over that of the preceding month and 9 per cent above the total for February, 1928. The Pittsburgh district showed an increase of 22 per cent over February, 1928, but its total of $50,298,500 was 12 per cent below the figures for January, 1929. This same condition existed in the northwestern states where the February contracts, $3,746,500, were 70 per cent higher than for February, 1928, but 40 per cent below the January, 1929 figure. The February contract total for the 37 states show that 36 per cent of all construction represented residential buildings, 19 per cent commercial buildings, 16 per cent public works and utilities, and 16 per cent industrial projects. Contemplated projects reported during February reached the total of $772,621,600 for the 37 states. This is 6 per cent less than the amount of contemplated work reported during January of this year and 18 per cent less than that reported for month of February, 1928.



THESE various important factors of change in the building situation are recorded in the chart given here: (1) *Building Costs.* This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) *Commodity Index.* Index figure determined by the United States Department of Labor. (3) *Money Value of Contemplated Construction.* Value of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corp. and *Engineering News-Record.* (4) *Money Value of New Construction.* Total valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) *Square Foot Area of New Construction.* The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.

THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

THE FIRST DAY ON THE JOB—*(Continued)*

Editor's Note. Mr. Beach here continues the consideration of "The First Day on the Job," Chapter 4 of which appeared in the February issue of THE ARCHITECTURAL FORUM.

Regarding saving by the waiving of a bond, the architect was known to be greatly in favor of so doing, as he regarded the unnecessary addition of 1½ per cent to the cost of a building to be quite unwarranted, except only as a pure matter of insurance. If it had been a private owner, the superintendent was quite sure that, with such a high class contractor, the architect would approve the saving, but, this being public work, the question was entirely one for the board to decide. It was obvious that the architect could not in any way be held for any of the contractor's defections, although the architect and superintendent would do their best to see that the contractor fulfilled the terms of his contract and met all his obligations pertaining thereto. It was thereupon decided that if a surety company could be found that would underwrite the architect's form of bond, such bond would be accepted; otherwise the board would consider doing without one. The agent was persuaded to send a night letter to his company, with the result that a bond in acceptable form was promptly forthcoming and all was well in that particular.

Returning to the site after lunch, the contractor was found directing his new foreman, starting work on temporary buildings, but it was apparent that neither had thought to consult the specifications on the subject:

"TEMPORARY OFFICE BUILDING. The Contractor shall, immediately after award of contract, provide a substantial, weatherproof building at the site, containing an office for the Superintendent, of at least 120 sq. ft. of floor area and fitted with movable sash on each open side, substantial door (with butts, latch and cylinder lock), table for blueprints, desk with drawers, locker, stool and two chairs, all as directed by the Superintendent and at the expense of the Contractor, who shall provide heat and light for same.

"CONTRACTOR'S OFFICE at the site shall be a substantial, weatherproof building, properly heated and lighted and appropriately furnished. It may be under same roof with Superintendent's office, with partition separating. The Contractor's office shall be the proper place of deposit for all copies of all drawings and specifications and for all his file records pertaining to the work. It shall also be the proper place for delivery of all orders and instructions to the Contractor. The Contractor or his Foreman shall be constantly in charge of same during working hours and shall maintain (on shelf accessible to the Superintendent) a telephone, served and listed by the local exchange, all at the Contractor's expense. Free use of the telephone shall be granted to Representatives of Contractors, Subcontractors, Owner and Architect, except that the Contractor may require reimbursement for tolls on long distance calls. He may also have a pay telephone installed for the use of others. The Contractor's office shall not be used for the storage of equipment or materials nor as a loafing place.

"MATERIAL SHEDS. The Contractor shall provide at least 3 shelter sheds where directed, separate or under one roof, each containing 260 sq. ft. (or more) of floor area, and of substantial weatherproof construction, with hinged door to each shed, and a window on each exposed side. Each door shall be fitted with hasp and staple and brass padlock with necessary keys. The Superintendent will assign space in these sheds according to his best judgment.

"TOILET CONVENIENCES for all persons employed on the work shall be constructed and maintained by the Contractor in accordance with City ordinance and State laws, properly lighted and heated and kept clean and sanitary, satisfactory to Superintendent and local Authorities."

Being set right on these subjects, the contractor and his foreman next proceeded to "stake out" the building in accordance with the plot plan, erecting substantial batterboards at each of the four corners. Fig. 7 illustrates the customary and proper manner of setting batterboards, which should be located far enough back of the edge of the excavation to be out of the way of teams and trucks. The boards are nailed to substantial stakes driven well into the ground and notches are cut in the upper edges as shown. "C" and "H" are on lines of outside surfaces of basement walls; "B" and "I" mark the inside surfaces; "A" and "D," and "G" and "J" are the outside lines of the footings; and "E" and "F" are the limiting lines of the excavation. Cords stretched from these notches to corresponding notches in boards at opposite corners afford lines from which a plumb-bob can be dropped and lines or points in the excavated portion be correctly located. Thus, plumbing down from intersection at point "L," the contractor locates the corner of his excavation at "K." If it is desired to prove the square of the corner at "L," one can use the simple rule of "the square of the hypotenuse is equal to the sum of the squares of the other two sides of a right-angled triangle," measuring 40

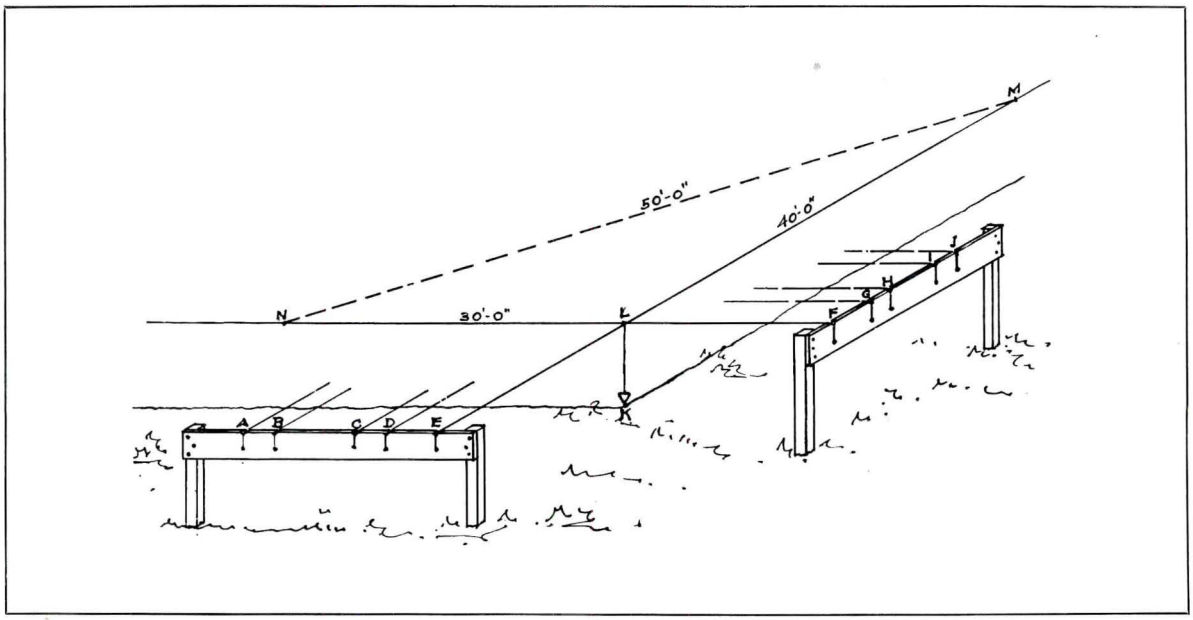


Fig. 7. A Proper Arrangement for Setting Batterboards

feet in one direction from the corner, 30 feet in the other direction and 50 feet across the hypotenuse. This should be done with great care, as the variation should not be more than ½ inch in 100 feet.

Here is the superintendent's report of the first day's activities at the site:—

Work day:—No. 1.
Force worked:—10 hours.
Weather conditions:—Finest.
Temperature:—78° to 82°.
Number and kind of workmen employed:—
General Contractor:—6 carpenters and 1 foreman.
Excavating Contractor:—6 men with teams, 1 foreman, 1 steam shovel man.

Work today consisted of:—Taking out trees and shrubs; protecting trees and walks; starting stripping loam; bringing on steam shovel; starting to stake out the building and put up sheds.

Cause of delays, if any:—Contractor submitted bond on bond company's printed form which was rejected. He was notified he could continue work as trespasser until bond is settled. He is proceeding with that understanding. Board is to meet tonight to consider subject.

Drawings and information needed:—Contractor needs two complete sets of working drawings at once; one on cloth.

Daily letter:—Job started 2 days ahead of schedule without authority, but weather too fine to stop it. Contractor's liability insurance policy is No. 283,576 in ..... Co. Grading subcontractor was ordered to get policy at once; promised for tomorrow. Job telephone, electric and water supply ordered in. Permit applied for; said to be a matter of form on public buildings.

To this, the superintendent added his room address for regular mail and the address of the job for receiving telegrams and special delivery letters.

CHAPTER 5
BEGINNING THE WORK

AFTER the first day's preliminaries at the site, the morning of the second day proved a busy time for the superintendent. First, he found that the subcontractor for grading had changed his mind about getting a liability insurance policy, —simply refused to do so, intimating that he considered the demand for it to be only attempted graft on the part of the member of the board of education who was agent for such insurance. He claimed further that the law did not require such insurance to be carried by employers who were financially responsible. To this the superintendent rejoined that it was not a question of law but of contract requirements, and that the policy must be forthcoming, quite regardless of who might be the agent. Here appeared the chairman of the building committee of the board, accompanied by the principal of the high school. This board member and the general contractor added the weight of their counsel to that of the superintendent, as a result of which the grading contractor finally agreed to secure a policy from an-

other agent, and a copy of the application was handed the superintendent a little later in the day.

In discussing the work with the board member and high school principal, two matters of vital importance developed. One was that the school man had been delegated by the board to act as its representative on matters pertaining to the new building during intervals between board meetings; the other, that another board member, who was also a member of the town planning commission, had an idea that the building, located on a hillside with a fine prospect to the south, would look better and have a still finer view if raised about 3 feet higher than shown by the drawings. Decision on this was deferred, pending the next visit of the architect, due the following Monday, but the other matter was not one that could be either deferred or disposed of. The intervention of such an "agent" in building programs is not unusual and is a fruitful source of friction in too many instances. In the case of private work or that of a corporation, the agent is frequently looking more to his own interests than to those he represents, as a result of which the superintendent finds him presently aligned with one or more of the contractors to the detriment of the work. Even on public work, the agent, with no apparently dishonest intent, may be heard criticizing the architect and his documents as much as he does the performance of the various contractors. His relation to the work is only semi-official, with no definite limitations and, unless he is a very unusual individual, he is much more of a nuisance than a help. Having no real authority, it is nevertheless difficult for him to avoid assuming the semblance of it, especially if he be, as in this case, a school official accustomed to dictating to his subordinates. It is difficult to understand why, after employing an architect to conduct their operations, owners should consider it necessary to inject a personality whose very employment means merely an added problem to be dealt with. If a superintendent is compelled to face it, he had best "cultivate" the incumbent and trust that he will not prove a deliberate trouble maker.

This man had started being officious the preceding day, before the arrival of the superintendent, by directing the grader to have the slip-scrapers dump the top soil into a small ravine that required filling. This error was corrected, and the loam was ordered piled on high ground where it would be subject to minimum wash from storm water, as provided in the specifications:

"TOP SOIL. At beginning of excavating, the black earth at surface shall be removed to a depth of 9″ to 12″ over the building site and piled on premises where directed by the Superintendent, to be distributed as required before completion of the work."

Neither the school man nor the grader had thought to consult the specifications on such a minor matter, but the incident was of value as initial proof that there should be but one head to the work.

The superintendent and the principal also reviewed other specification paragraphs especially applicable at the beginning of the work:

"PERMITS for building construction, street obstruction and water connection shall be taken out by the Contractor before operations are started. He shall pay all fees for same, including inspection fees and cost of all water used for the work of others, as well as for his own operations."

"PROGRESS PHOTOGRAPHS shall be taken by a professional photographer at the expense of the Contractor at intervals designated by the Architect, 12 negatives in all, on 8″ x 10″ plates. Three prints from each negative, mounted on linen with binding margins, together with the negative, shall be delivered promptly to the Superintendent by the Contractor, in each case."

"LINES AND LEVELS. The Owner will have lot lines and restrictions established and a copy of survey provided on which same are indicated, also stakes and marks evidencing same, together with a permanent bench mark conveniently located. The responsibility for all other lines and levels necessary for proper location and erection of the building and appurtenances rests with the Contractor who shall employ a competent instrument man."

"USE OF PREMISES. (From Art. 42 of A. I. A. General Conditions.) The Contractor shall confine his apparatus, the storage of his materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the Architect and shall not unreasonably encumber the premises with his materials."

"PROPERTY CONFINES. The Contractor shall limit the storage of his materials and the operations of his employes as prescribed in Art. 42 of the General Conditions and shall not infringe upon storage and operating space assigned to others. The Contractor has no authority to permit the use of any portion of the premises by anyone, except for business connected with the construction in which this contract is concerned."

"EXCAVATING IN GENERAL. The Contractor shall provide all excavating for basement, areas, etc., all to the various depths required. Hand excavating for pits and footing

trenches is included with foundation work. Excavations shall extend 2′ 0″ outside of all basement wall planes and to 9″ below finished planes of various basement floor levels. Work shall start at one end of the building, as directed by the Superintendent, and shall proceed uniformly to the opposite end, completing as it progresses, so that the first end can be turned over to concrete workers without waiting for entire excavating to be completed. The work shall be so laid out and conducted as to produce no conflict between concrete workers, trench diggers and those working on remaining excavating."

Taking stock of these matters in the order quoted, the superintendent learned that application had been made for a building permit and that a set of prints had been filed with the local building department, that the issuance of a permit in due time was to be expected as a matter of course, but that nothing had been done about water supply or the first progress photograph. He insisted that the contractor give these subjects immediate attention and that he also arrange at once for the requisite telephone service.

The foreman and an assistant were continuing the work of staking out the building, the former making use of a surveying instrument. The contractor satisfied the superintendent that he, the foreman, could qualify as the "competent instrument man" demanded by the specifications. The superintendent later verified this, as well as the accuracy of the instrument and the work done by it.

Meanwhile, a carload of cement had arrived on the tracks, and the contractor was anxious to unload it, to avoid paying demurrage. He asked permission to have it stacked on the shed floor and have it covered with tarpaulins. Reference was made to the specifications, wherein clauses were found pertinent:

"ALL CEMENT, except where otherwise specifically stated, shall be approved Portland, properly tested before using. It shall conform in all particulars to the latest standards and tests of the American Society for Testing Materials. Samples shall be taken as directed. Each car lot shall be stored separately and plainly marked for identification.

"Cement shall be stored in the water- and weather-proof shed, provided by the Contractor (as elsewhere specified), with floor well up from the ground. None may be used that has been exposed to weather nor from bags showing water marks or caking."

The contractor, in view of these restrictions, was directed to leave the cement on the tracks while the shed was rushed to completion. Four samples were taken from the car lot and sent to the architect's office for testing, the brand being one known to be acceptable to him. The manufacture of Portland cement has reached such a degree of standardization and excellence that metropolitan architects and contractors seldom have cause to reject more than an occasional sack that has met with accident. Cement for use in cities is always subject to testing, and hence it is safest and most economical for the manufacturers of this commodity to ship none that might fail to meet requirements. This is not so in rural districts, where most of the cement sold (other than that shipped in car lots for road work or large buildings) is first stored in lumber yards, then distributed in small parcels to local builders who have no desire to test and no convenient facilities for so doing. Such cement should be carefully watched, as it is not unusual for it to fail under test. It may have been originally bought at a bargain because of its inferiority. There is always a chance that a country dealer will try to unload some of it on such work as this school, in a real or pretended emergency, hence the wide awake superintendent will keep an eye on it and should warn both the dealer and contractor that no such old or stored cement is to be used under any circumstances; and it would therefore be expedient for the dealer to make sure that he has enough of the right material on hand at all times.

The location of sheds and the dumping of top soil led to a general discussion of the contractor's yard layout. Together, he and the superintendent evolved a working plan for all temporary storage and facilities, as shown by the plot plan, Fig. 8. The superintendent's interest in this phase of the work has to do only with seeing that provision is made for storage space for minor contractors' materials, and that temporary buildings and heavy materials are not so placed as to be in the way of trenching for sewer and other piping. In this case, the available space was ample for all purposes, but in a more confined location, considerable ingenuity must be exercised in designing a temporary layout of maximum efficiency and in avoiding friction between all contractors demanding accommodation. It will be noted that this contractor arranged to have his sand and gravel dumped on the paving, to avoid the expense of building a floor, as would have been his alternative under the specifications. Materials to be first used from storage piles, such as floor tile and common brick, were piled as close in as possible. Floor tile (for first floor only) would be all used before the hoist would be placed in service. Thereafter, brick and wall tile, in limited quantities, could be unloaded close to the hoist.

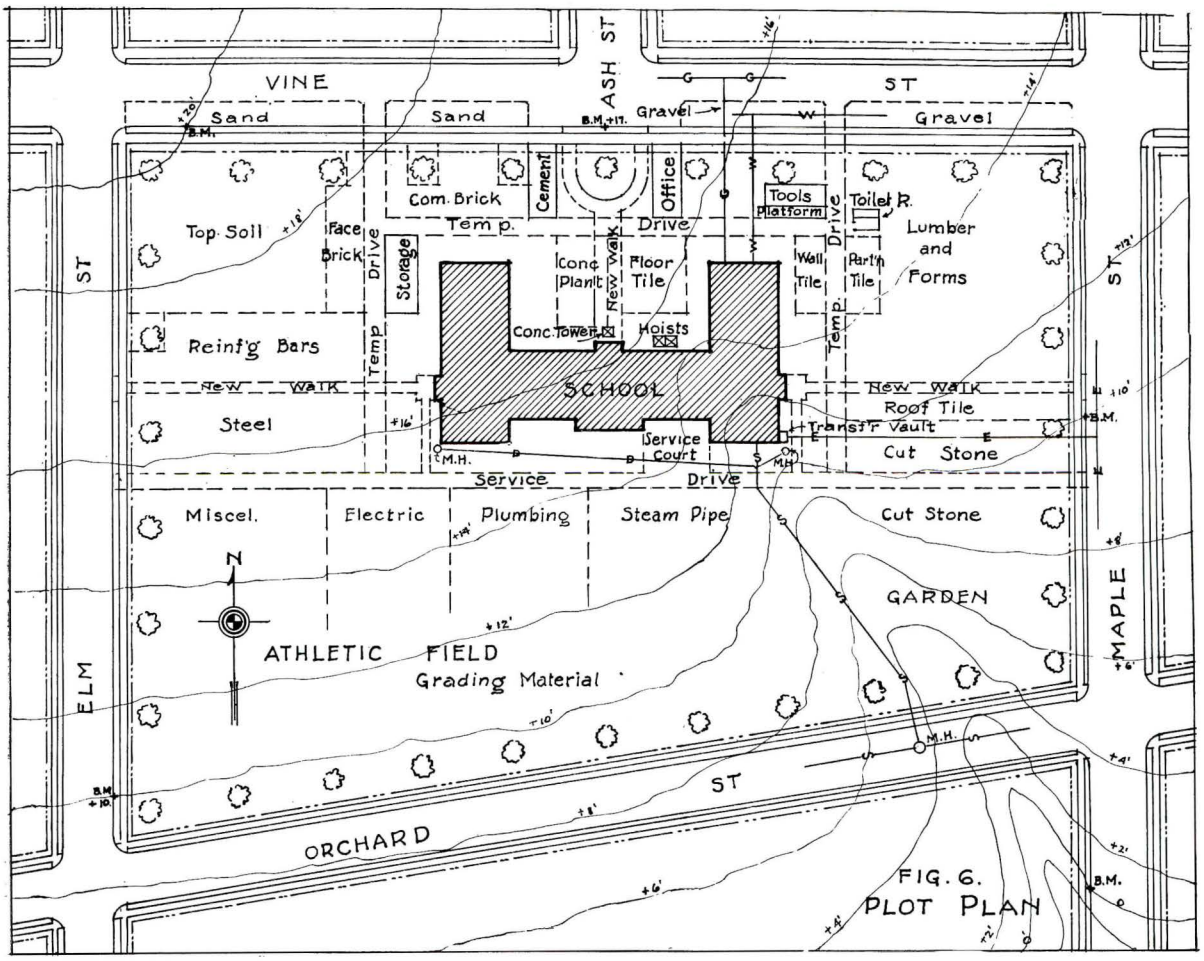


Fig. 8. Plot Plan Showing Disposition of Building Materials on the Site

Larger areas were allotted to items requiring sorting and re-handling, such as lumber, cut stone and reinforcing bars. Temporary drives were combined with the future service driveway to afford maximum communication at minimum distance, inasmuch as these roadways had to be maintained for several months and might be very muddy at times. For this latter reason, the contractor was given permission to start hauling cinders for use as temporary paving for these drives with the understanding that such cinders as were still in fit condition could later be used as underbed for walks and permanent driveway.

In the afternoon of this second day, the contractor suggested a trip to the gravel pit from which he expected to secure both sand and gravel, using the latter "pit-run." In fact, he admitted having gambled on such intent and had reduced his bid several hundred dollars on the chance. Before leaving the premises, the superintendent wrote an order to the contractor to hold his excavating 3 feet higher than shown on drawings, pending arrival of the architect and his decision on the proposed change in the building grade. The necessary instructions on this subject were passed on to the grading contractor who was also informed as to the proper amount of material to be left on the premises for finished grading. Enough stripping of top soil had been done for the steam shovel to get into action, hence it and the auto trucks were already working to capacity.

En route to the gravel pit, the superintendent consulted his specifications and re-read the paragraphs on the subject of aggregates:

"SAND. Fine aggregate shall consist of sand having hard, durable grains, free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances. It shall be well graded in size up to ¼"."

"COARSE AGGREGATE shall consist of crushed rock or gravel having clean, hard, strong, durable particles, free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter. It shall be well graded from ¼" to ¾" for fine concrete and from ¼" to 2" for mass concrete. If gravel is used, it shall be screened to size and

washed if, in the opinion of the Architect, such treatment is indicated." "Occasional pieces larger than 2" will be permitted in mass concrete, provided that same are entirely embedded in wet concrete and have no surface closer than 6" to outside plane of the mass."

"STORAGE. Sand, stone and gravel shall be deposited only on paving or suitable planking; never on bare ground."

The pit was found to be one long disused and recently re-opened, evidently for this particular work. The stripping had disclosed a good bed of gravel lying between the surface stratum and one of fine sand. Both stand and gravel appeared to be of good quality. The chief difficulty was evidently going to be the task of keeping the fine and coarser aggregates separate and at the same time free from droppings and wash from the overlying earth. This latter, the contractor proposed to effect by using hand excavating for the gravel and following with a steam shovel and a portable sifting plant that would deliver sand of proper fineness. The stripping was to be kept well back from the pit, and proper watersheds maintained to fend off storm water. The superintendent appreciated the contractor's effort to hold down costs and expressed himself as being quite willing to coöperate wherever possible, keeping always within the intent of the contract. If pit-run gravel of suitable character could be delivered at the building site at a cost of about $1.75 a yard, and the sorted material at an additional 50 cents, the contractor would be sufficiently under the local price of $4 a yard for crushed rock to have justified his gamble. The gravel would probably contain too high a percentage of sand, the which could be equalized, as he explained, by the admixture of the indicated amount of coarser material.

It is evident that the superintendent was going out of his way to help the contractor and equally evident that he was running the risk of making later trouble for himself by the necessity of closely watching the ratios of sand and gravel. It would have been much easier and safer for him to have pointed out the advisability of having a washing and grading plant installed before beginning to haul material from the pit, but this would have raised the cost of coarse aggregate to about that of the crushed rock. It is likely that the more cautious course would have been that adopted by the majority of superintendents of experience, but this man was imbued with the idea that, if he would go somewhat out of his way in the matter of coöperating with the contractor at this stage of the work, he would find himself repaid later on; so he tacitly approved the contractor's arrangements and took samples of the sand and gravel and expressed them to the home office.

The two then drove to a brickyard to inspect common brick and partition tile for which contract had been made, subject to approval. They found three grades of each, separately piled,—"kiln-runs," "selects" and "culls." Another grade, termed "standards," was not shown. In this grade, only the very poorest and softest had been culled out. The superintendent was told that the material used by local contractors was generally "kiln-run," but that it was then being culled to comply with his strict specifications. The superintendent gave provisional approval of the selects but cautioned the contractor that such approval was made conditional by this paragraph of the specifications:

"'APPROVAL' AND 'ACCEPTANCE' in these specifications, unless otherwise stated, mean approval and acceptance by the Architect; but no acceptance by the Architect shall bind the Owner in case of proven defective work or other clear violation of the contract; nor will approval of material or equipment before same is brought on the premises be held to constitute acceptance, in case such items are found not to comply with specification."

Three samples showing the range of select common brick were also sent to the express office. The next stop was at the lumber yard, merely, as the contractor explained, "to get acquainted." The fact that the lumber dealer was also a member of the board of education appeared to embarrass him not at all as a purveyor of materials to the school building. Both he and the contractor showed considerable surprise, however, when the superintendent expressed a desire to see the stock of No. 1 white pine lath. They thought he was looking a long way ahead. This was admitted, and the stock of various grades of lath inspected. The best grade showed signs of having been on hand a long time, which was explained by there being but little call for it, contractors generally saving the few dollars per thousand difference in price by ordering the cheaper grades (perhaps claiming that the No. 1 grade was not to be had). The superintendent suggested that such extremity be avoided on the school work by ordering well in advance, which the contractor agreed to do, receiving a further hint to the effect that this architect considered metal lath to be the only adequate substitute for No. 1 white pine.

Inspection of wood lath is always a matter for the close scrutiny of the superintendent, when they are called for. No. 1 white pine lath are generally specified by architects where wood lath are indicated, because of the impression that no other wood can back a good plaster surface quite

so well. Obviously, this grade is only carried in yards where the demand warrants buying full car lots, or where possible, part loads of "mixed" cars. Contractors and supply dealers will seemingly exert themselves more to substitute something else for these lath than to effect any other evasion of a given contract. Usually the lath is not delivered until the lathers are on hand to apply it, and the inspector must then either compromise or delay the work. Hence our introduction of the subject thus early in the procedure.

Many instances could be cited to indicate how far contractors and dealers will go in their endeavors to evade the exactions of a No. 1 white pine lath specification. In one such case, a young clerk-of-the-works was induced to pass a carload of other lath because the No. 1 white pine "was not to be had in that market." But that market happened to be in the Black Hills, where such lath are a local product, hence the members of the building committee were up in arms when they saw the lath from outside being unloaded, and wired the architect to set the matter right. This he did by dismissing the superintendent and taking advantage of the specification clause which permitted the owner to refuse "accepted" material that was manifestly not up to requirements.

Another instance was that of a bank building being constructed under a "cost-plus" contract. The builder had purchased his lath as part of his lumber bill from a dealer who happened to be a director in the bank. Three months later, when ready for the lath (this was in 1920, when prices were advancing by leaps and bounds), the builder was informed that he would have to use a cheaper grade, as the No. 1 were not to be had for less than $18 per M. To this the builder demurred as he had bought them for $8.50 per M. But the dealer naïvely contended that he could not be expected to store them indefinitely at the price quoted. So the builder offered to pay storage, but found that the dealer had sold the lath to others at a fat second profit. Later, in the absence of the builder, the dealer told the other directors about the dilemma, omitting to mention that the lath had really been ordered and sold at the lower price. He insisted that he would not cut his prices to favor an "outsider" but, to accommodate his bank, would deliver the lath for $15 per M., if the order were signed then and there, ahead of another threatened rise, which was done. The dealer said nothing further of the matter until the time of final reckoning, when it amused him to divulge the particulars of the deal.

It developed on the school project with which we are dealing that our forehanded superintendent "started something." An immense amount of gossip anent an outstanding construction operation in a small place circulates continually during its progress. It is malicious, disinterested or merely critical,—according to the animus or interest of the vender,—but seldom helpful. Here we may record an accidental exception. The architect had specified tile partitions in the basement and tile or gypsum block (at contractor's option) above the basement, except for certain minor partitions, for which metal-lath-and-plaster, 2 inches thick, was called for. The architect's instructions from the board were to produce a building of the requisite size and appointments, as nearly fireproof as the appropriation would permit. But, as is not unusual, it developed that the requirements far outran the limits of the appropriation; hence, in order to reconcile the two, he had asked the bidders for three major alternatives:

1. The saving to be affected by substituting light-weight steel beams or trussed-metal joists for flat-tile-arch-and-concrete-joist floor construction.

2. The saving to be made by substituting wood rafters and sheathing on steel framing for the concrete roof construction.

3. The having to be made by substituting wood lath and studding for tile-and-metal-lath partitions throughout the building above basement.

The contract had been awarded on the basis of all three savings, except that trussed-metal-joist construction was adopted only for the second and third floors, and not for the first. However, so much criticism was suddenly aroused because of the idea that a building originally intended to be approximately fireproof was falling too far short of the intent if stud partitions were used, that the board members hastily decided to reconsider the third alternative. Hence this subject, and also the question of raising the grade at the building, were made causes of the calling of a special meeting of the board on the afternoon of the day of the architect's visit.

The first work day under the schedule found the job well organized. Trees and walks had been duly protected; scrapers were busily piling the top soil; the steam shovel and its covey of motor-driven dump carts were in systematic action; carpenters were completing the cement shed and starting the office building; and the photographer was on hand to take the first photograph. Inasmuch as 12 of these were included in the contract, it was assumed that only one exposure per month was expected, and therefore the viewpoint was carefully chosen by the superintendent to afford maximum information regarding the activities in progress at each period. The superintendent also intended to make use, from time to time, of his own small camera for such snapshots as would serve to record particular conditions and

illustrate the points discussed in his daily reports.

The end of the first week recorded five and one half work days of excellent progress. Stripping of top soil had been completed, and the excavating was well under way. A concrete plant was being installed at the upper end of the site, and the carload of cement had been stacked in the nearby shed, which was being covered with 1-ply, hard-surfaced roofing felt. The office building was being similarly completed, and a shed was being erected for the shelter of workmen and their tools; a fourth shed had been decided upon by the contractor, for the use of subcontractors, in preference to permitting them to share the space in his tool shed. Another crew of carpenters was constructing forms of a standard size for use in building the basement walls. Two crews of linemen were running wires for telephone and electric supply. The water main had been tapped, and a ¾-inch supply was being run on top of the ground to a point near the concrete plant. Several loads of pit-run gravel had been dumped on the paving above the concrete plant, and the delivery of this material was going forward rapidly, but no sand or graded coarse aggregate had come from the pit. A carload of reinforcing bars had been unloaded in the space assigned for their sorting and storage.

Saturday, weather being fair, the excavating machine and dump trucks continued in operation throughout the afternoon, the other trades "knocking off" at noon. When the shovel reached the level where the contractor had been told to stop, 3 feet above that orginially intended, the shovel man advanced the claim that he would lose money if his machine could not work continuously. This the superintendent admitted, but pointed out that he was merely working overtime to his own advantage, and that the status of the work at Saturday noon was supposed to be identical with that at the beginning of work on Monday morning, when the architect would be on hand to render a decision. The shovel man thereupon continued as directed without further argument, admitting that the remaining three hours would not make much difference.

Before leaving the site that night, the superintendent saw to it that a small diverting trench for storm water was dug in the sod above the excavation. He also inspected the cement shed and found that the carpenters had left without completing the waterproof covering. In spite of the fine weather, he insisted that the covering be completed. This was attended to personally by the general foreman and carpenter foreman. It was well that they did, for a severe storm of rain and wind occurred on Sunday and continued throughout the night and until Monday noon. On Sunday afternoon the architect was advised by telephone to defer his visit until Tuesday, which he did. Meanwhile, stock was taken of the damage done at the site. Fortunately, it was not serious. The cement shed proved tight, but the diverting ditch had been insufficient for the purpose, and the excavation was a sad mudhole. A controversy arose between the general foreman (his employer being absent) and the excavating contractor as to who should provide a power pump. The excavator claimed he had figured only on excavating,—was not in the pumping business. The foreman contended that the subcontract had been awarded for the excavating as specified, to which the other rejoined that he had bid "on the plans" and hadn't seen the specifications.

Both parties had already learned to respect the judgment of the superintendent, but he insisted that it "wasn't his funeral" and referred them to the specification clause directly applicable:

"SPECIFICATION DIVISIONS. For convenience of reference, this specification is divided into various headings and subheadings, but such divisions do not make the Owner or Architect responsible for the limitations of the contract of any subcontractor, each of which contracts shall be dependent upon its own definite confines, regardless of specification divisions."

Many metropolitan architects omit this clause from their specifications and insist that their divisions *do* govern the limitations of a contractor's understandings with his "subs," but it is a custom full of inconsistencies and fraught with much danger. In this case, it would have made an issue out of a matter which was merely a cause of argument. To settle it, the superintendent cited the two paragraphs in the specifications applicable. Under "Supplementary General Conditions," he found:

"STORM WATER and water from springs and pipe leaks shall not be allowed to stand in the excavations or basement or other parts of the building, but shall be adequately guarded against by ditching, draining, pumping or other approved means."

And, under "Excavating":

"PUMPING. All parts of the excavations shall be kept free from standing water from any source (as specified under Supplementary General Conditions), for which purpose the Contractor shall provide hand or power pumps of needed capacity until drainage connection to sewer is made available."

(*To be continued in the May, 1929 issue of* THE ARCHITECTURAL FORUM.)

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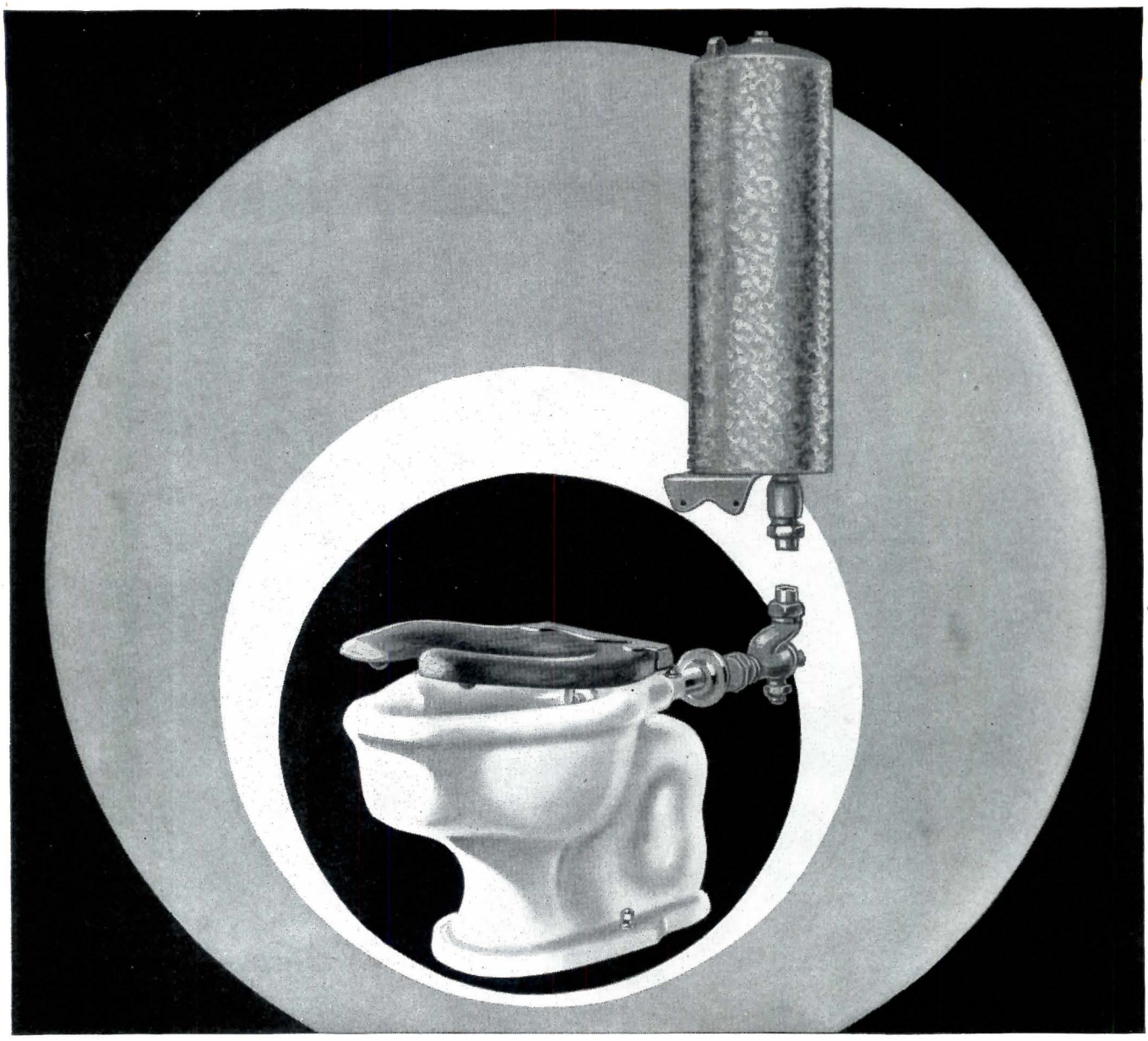

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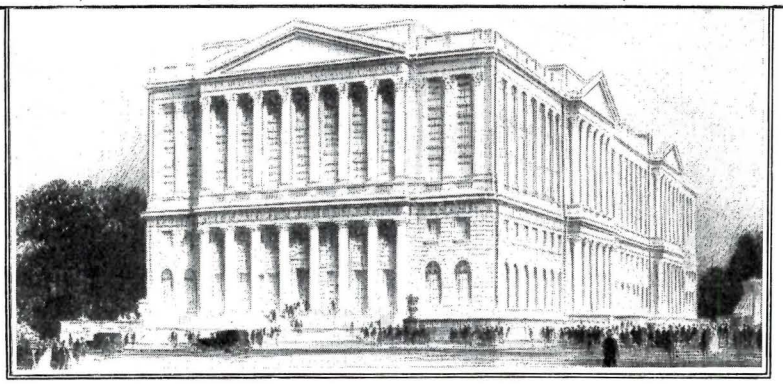
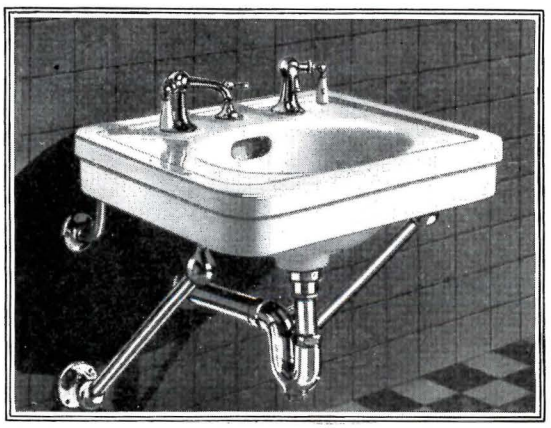


Mutual Benefit Life Insurance Company Building, Newark, N. J., John H. and Wilson C. Ely, Architects. Solid Nickel Silver plumbing fixtures by The Meyer-Sniffen Co., New York.*

MODERN BUILDINGS DESERVE MODERN FIXTURES OF NICKEL SILVER

SEMI-INSTITUTIONAL structures such as the new Mutual Benefit Life Insurance Company Building in Newark, N. J., are built to endure for generations. Every detail in their construction must conform to the highest standards of architectural quality. It is significant, therefore, that the builders selected Solid Nickel Silver* plumbing fixtures manufactured by Meyer-Sniffen... Solid Nickel Silver possesses a characteristic hardness that adds to the wear-resistance of valve seats. Its permanent, silver-like lustre compares favorably with the appearance of Pure Nickel and other high Nickel alloys. It is easy to keep clean and spotless even when subjected to severe use ...The specification of Solid Nickel Silver sanitary equipment is the logical way to insure beauty, permanence and highest quality. For the most modern type buildings, plumbing fixtures of Solid Nickel Silver have no substitute.

18% 22 Nickel SILVER



**Diamond Metal is the name used by The Meyer-Sniffen Co. to identify its Nickel Alloy used in manufacturing Nickel Silver plumbing fixtures. This is a solid white metal and contains a high percentage of Nickel.*

INCO NICKEL THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y. INCO NICKEL

an ARCHITECT'S *daughter* dictates Specifications

PARIS couturieres started it. Women's scanty attire brings the need for more heat in homes than is comfortable for woolen-clothed men. Isn't it time we faced this problem?

"Father," said the daughter of a New York architect, "when the house is warm enough for Mother and me, you compare it with an oven. John opens windows. When it is cool enough for you and John, all I can do is wear a fur coat.

"Why can't there be a heating system that will make an 'oven' of the drawing room, and provide the temperature you wish in your library and in John's room? You ought to know. . . ."

He *did* know, but had never realized how completely this modern problem is overcome by Hoffman Controlled Heat.

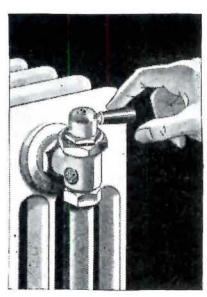
Hoffman Controlled Heat brings comfort to every member of the family. It delivers to each room as much or as little heat as is required, without effect on the temperature of other rooms. In each room, a finger touch commands the radiator to give off full heat, three-quarters heat, half heat, one-quarter heat or none at all. This system automatically adjusts itself to the hour-to-hour need for heat. Only as the call for heat increases does the supply of steam accumulate. There is no waste.

Hoffman Controlled Heat requires only a few ounces of pressure to heat a large home, one pound to heat great buildings, even in zero weather. Owners of buildings, large and small, have kept close check-ups on fuel costs—reported drastic savings.

No matter what standard boiler and radiators you specify, whether the boiler is to be fired by coal, oil or gas, it is a simple matter to add the equipment that makes it Hoffman Controlled Heat. This equipment places automatic controls over boiler and radiators at every necessary point assuring the owner amazingly safe and flexible operation.

This modern system is guaranteed in writing by a long-established, conscientious maker, to operate perfectly for years. Hoffman Specialty Company also offers expert engineering counsel.

This radical time-tested advance in heating methods has aroused the interest of many architects. We shall be glad to mail you without obligation, a copy of our new booklet, describing in detail the operation of Hoffman Controlled Heat. You are cordially invited to write for your copy. Address Hoffman Specialty Company, Inc., Dept. EF-4, Waterbury, Connecticut. You will get it promptly.



HOFFMAN CONTROLLED HEAT

A Mark of Progress

In Lavatory Design

The Wolff Double Faucet

A HOME BUYER quickly recognizes the up-to-date character of bathroom equipment, if it provides facilities for washing *comfortably* in running water. No installation offers this advantage in more efficient form than the Wolff double faucet, shown in detail in the inset below.

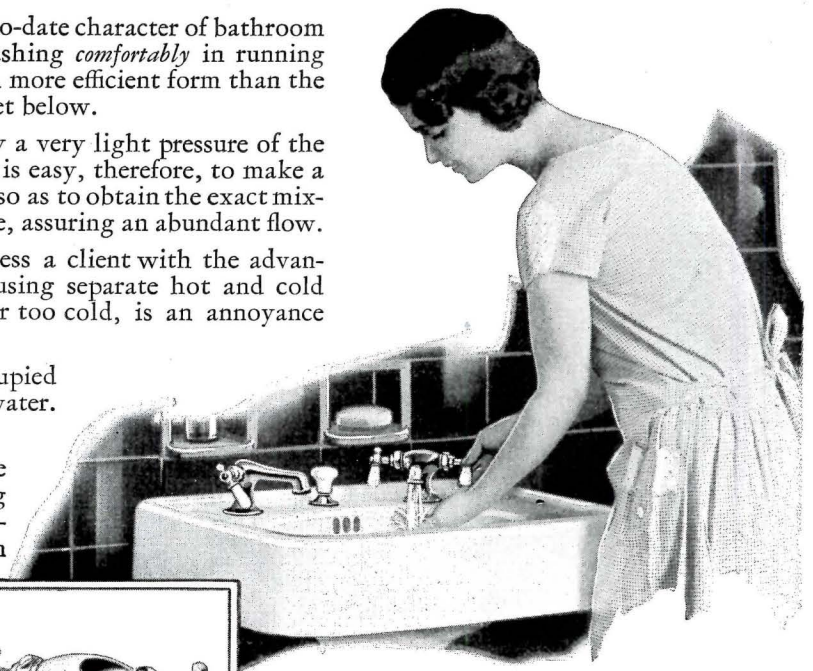
The fittings are so accurately made that only a very light pressure of the fingers is necessary to move the side levers. It is easy, therefore, to make a very fine adjustment of the hot and cold supply so as to obtain the exact mixture desired. The waterways are unusually large, assuring an abundant flow.

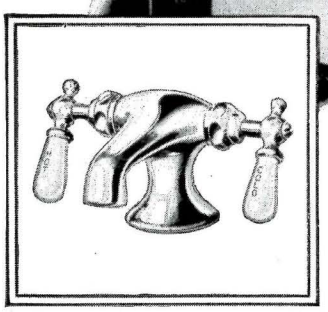
Little or no explanation is needed to impress a client with the advantages of this installation. The discomfort of using separate hot and cold faucets alternately, one too hot and the other too cold, is an annoyance which everyone wishes to escape.

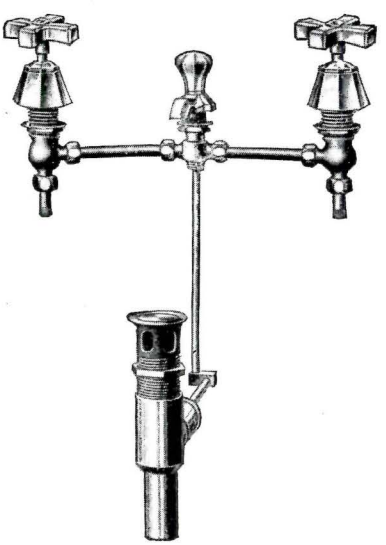
Another advantage. The space usually occupied by the second faucet can be used for drinking water. Three kinds of water with only two faucets.

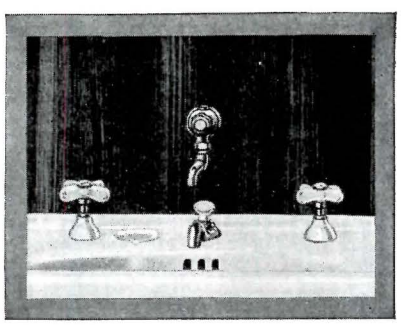
This installation is typical of the up-to-date character of the entire Wolff line of plumbing fixtures—brass, enamel and vitreous. The bathtubs, lavatories and closet bowls are made in a variety of attractively matched tints, and the handsome brassware is exceptionally durable, due to the unusually high percentage of copper in its analysis.

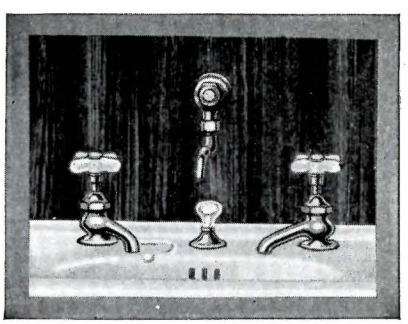
The selection of Wolff lavatory trimmings is extremely wide; three examples are shown below. These and all other Wolff "DURO" brass fixtures are obtainable Durochrome or nickel plated, as desired.











Catalog and full particulars on request

WOLFF

WHY BE ASHAMED OF YOUR BATHROOM?

SUPERIOR PLUMBING FIXTURES

WOLFF CO. • *Established 1855* • General Offices: 2058 W. Fulton Street, CHICAGO • *Branches and Distributors in All Principal Cities*

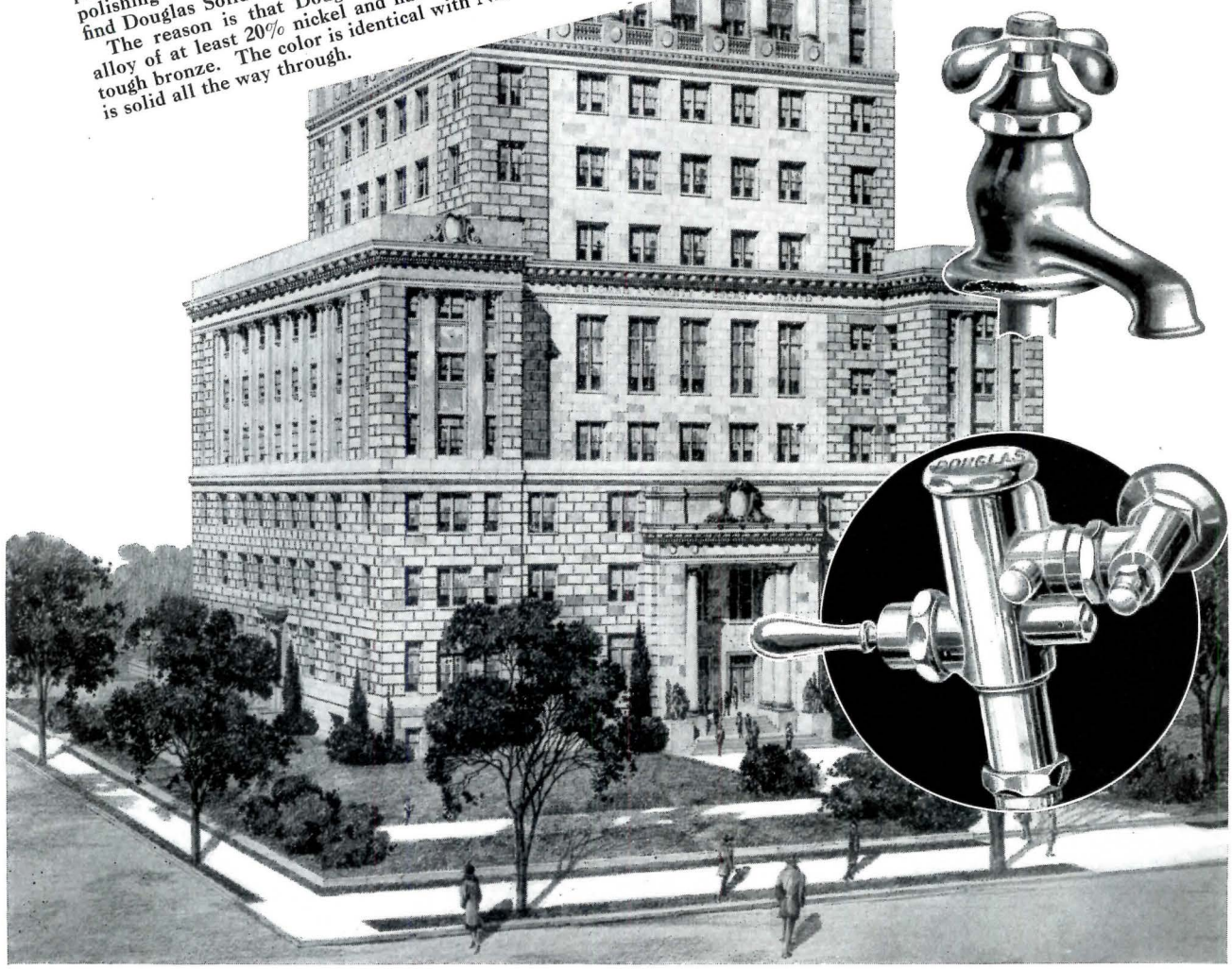
DOUGLAS SOLID NICKEL SILVER FITTINGS - STAND - THE TEST OF TIME

YEARS of public usage mean nothing to Douglas Solid Nickel Silver plumbing fixture fittings. Long after the plating of ordinary fittings has been worn away by constant polishing and after they have become unsightly you will find Douglas Solid Nickel Silver fittings looking like new. The reason is that Douglas Solid Nickel Silver is an alloy of at least 20% nickel and has the tensil strength of tough bronze. The color is identical with Nickel Plate and is solid all the way through.

When architects specify fittings of this kind they may be assured of the best that can be had and that their selection will reflect credit.

Remember that Douglas Solid Nickel Silver fittings are not plated, that they are carefully machined and that each fitting has been tested under water pressure.

A request will bring you descriptive literature by return mail.



Buncombe County Court House
Asheville, N. C.
Milburn-Heister, Washington, D. C.
Architects
Sluder Bros., Asheville, N. C.
Plumbers

DOUGLAS
Plumbing Fixtures

THE JOHN DOUGLAS COMPANY
CINCINNATI, OHIO

Colored fixtures rent apartments

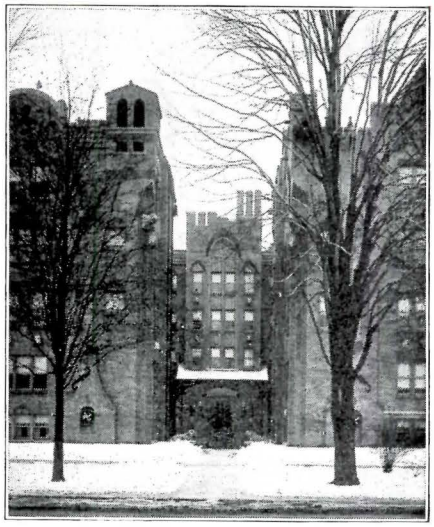
EASIER rentability—that, according to accumulating evidence, is the immediate result of the installation of Kohler colored fixtures in apartments. The new beauty of these fixtures stimulates spoken advertising that travels fast and far.

In the El Tovar apartments, Detroit, more than 90 per cent of the apartments were rented before the building was completed. Mr. Jacob P. Sumeracki, president of the Michigan Land & Home Corporation, the owners, gives much of the credit to the Kohler colored fixtures, which, he says, "have a strong appeal, resulting in quicker rentals."

Moderate Extra Cost

The use of these fixtures brings such a handsome advertising return that even a considerable extra cost would be more than offset. As a matter of fact, however, the added cost is very reasonable and represents only a minor addition to the cost of the complete bathroom.

Kohler colored fixtures are made in patterns covering such a wide price range that they may be included in the plans for almost any apartment, hotel, or private dwelling. This is true of kitchens and laundries as well as bathrooms. Many architects are developing the kitchen as an especially attractive room by the use of Kohler sinks in color.



EL TOVAR APARTMENTS
320 E. Grand Boulevard, Detroit

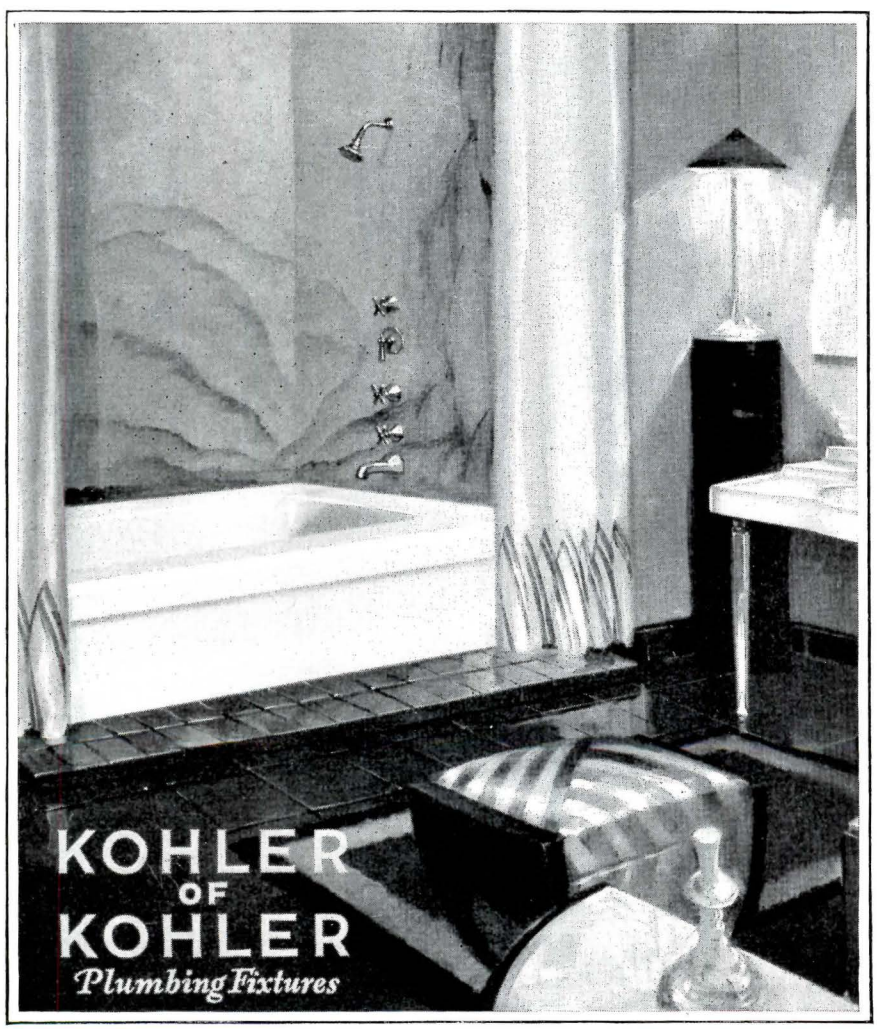
Kohler Colored Fixtures in bathrooms. Michigan Land & Home Corporation, Detroit, Owners; Robert J. West, Detroit, Architect; Ciesliga Co., Detroit, Plumbers; Nelson Co., Detroit, Wholesalers

Seven Colors and White

With seven colors to choose from the architect has free scope for his creative ability. The Kohler colors are noted for their delicacy, so they lend themselves perfectly to the designing of rooms of taste and refinement.

All Kohler fixtures—both vitreous china and enameled ware—are made in one place under admirable conditions of product-control, so the color harmony of a Kohler installation is assured. Kohler brass fittings add the finishing touch of quality to such an installation.

You are invited to visit a Kohler display room and study at your leisure the possibilities of this distinguished ware . . . May we send you the new Kohler book offered in the coupon below?



Distinguished new Kohler fixtures—the paneled Mayfair bath and Bellaires vitreous china lavatory

Kohler Co., *Founded 1873*, Kohler, Wis.
Shipping Point, Sheboygan, Wis.
Branches in Principal Cities

NEW 72-PAGE BOOK FREE

Please mail this coupon to Kohler Co., Kohler, Wis., for

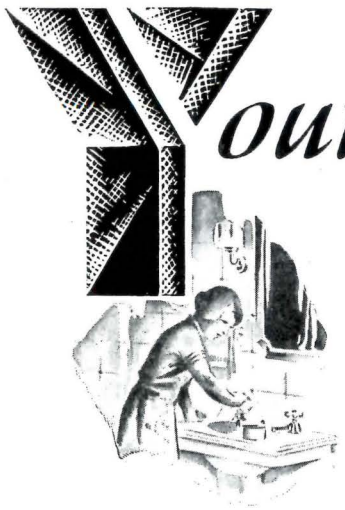
A helpful book for the architect. Illustrated in color. Shows bathrooms, kitchens, laundries; color schemes; floor plans; prices.

Name.....

Street.....

City..... *State*.....

 AF 4-29



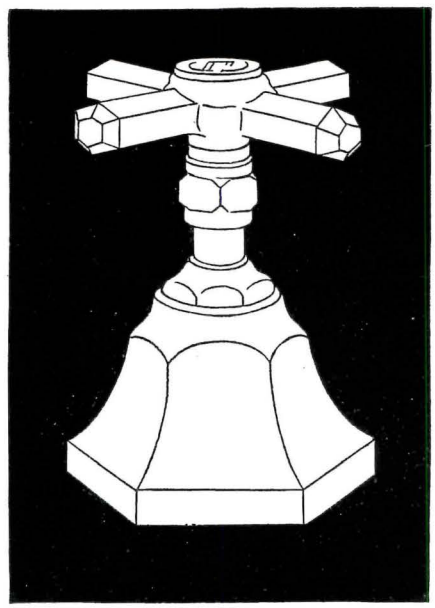
Youth insurance for bathrooms

POLISH.
SHINE.
RUB. And the more elbow-grease goes into keeping ordinary bathroom fixtures shiny, the sooner they go into a decline and begin to show their age.

Not so with the brilliantly beautiful new Speakman fixtures in chromium plate. The finish never wears through. They need absolutely no polishing. They never tarnish. They will be just as young and brilliant in 1939 as they are today. Home owners can be proud of the beauty they give their bathrooms for a long lifetime.

May we suggest that you look into the virtues of the Speakman Artline family—for showers, lavatories, bathtubs and kitchen sinks? They have been called the most beautiful fixtures made today. They are a triumph of graceful design, delicate yet rugged construction, and admirable artistry.

SPEAKMAN COMPANY
Wilmington, Del.



SPEAKMAN
SHOWERS & FIXTURES

Gentlemen of the architectural profession:

may we introduce this golf ball?

This is just a golf ball. It has nestled in sand traps and plopped into water hazards. As far as we are concerned, there is just one significant thing about it—its diameter.

Here we have an ordinary water closet. Every day its like go into homes and buildings by the hundreds. This closet will pass government health requirements.

Ordinary closet

But observe what happens when the golf ball is flushed through the trapway of this water closet. Either it sticks in the trap and stops up the closet, or else it goes through with scarcely a hair's breadth to spare.

The Improved Madera

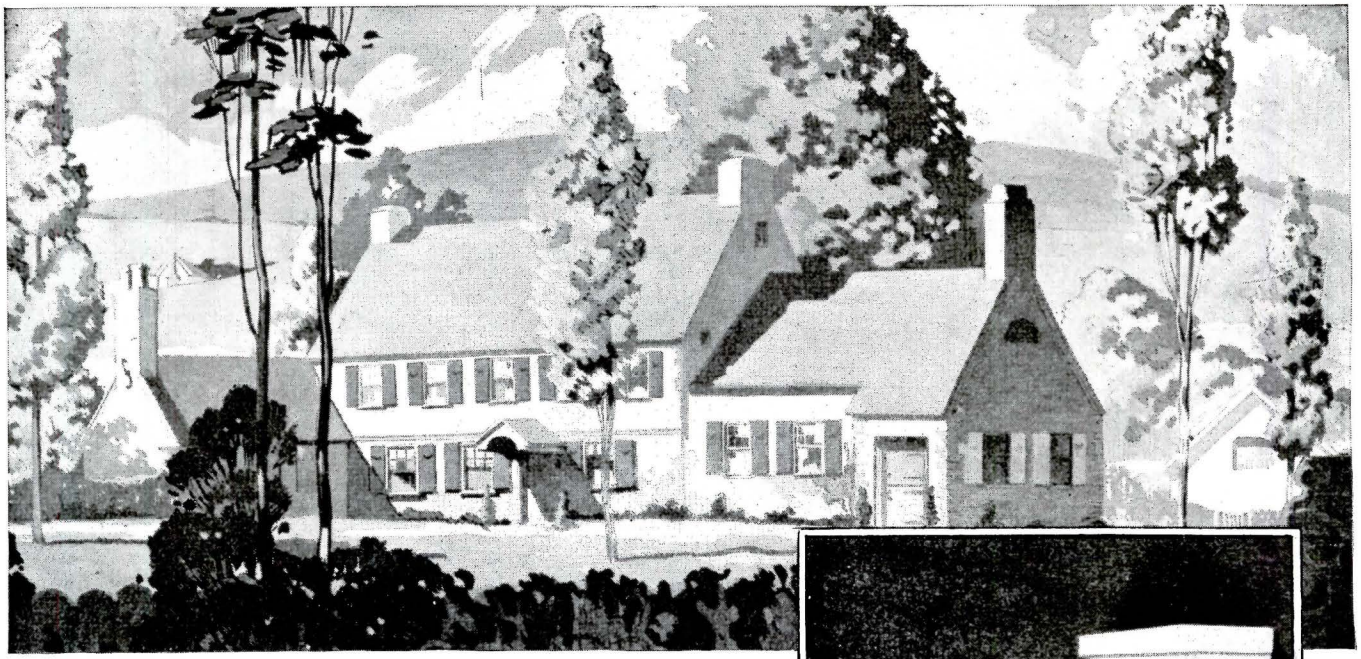
Now see what happens when the golf ball is flushed through Maddock's nationally known toilet, the *Improved Madera*. It comes through with space to spare. It could rattle around in the trapway like an egg in a tea cup. Is this significant?—emphatically yes!

One of the most important functions of today's toilet is to dispose safely of modern sanitary pads. *The toilet whose trapway is so small as to scarcely pass a golf ball is obviously unsuited for the purpose*, and is almost certain to give trouble.

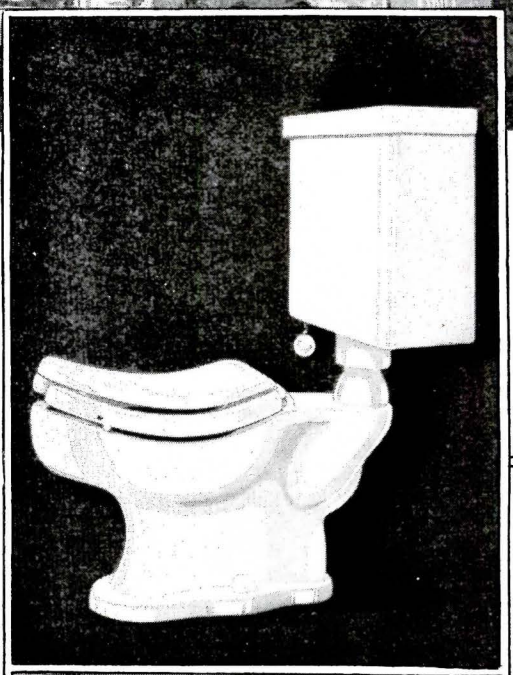
The Improved Madera, with its powerful, quiet flushing and oversize trapway, will dispose quickly, safely of sanitary pads. Judge for yourself whether or not this is of importance to the woman of refinement!★

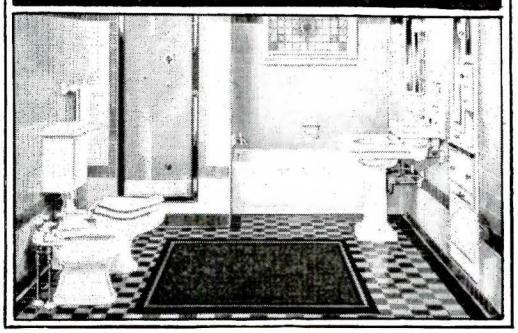
To this outstanding superiority, add: a long soil-proof seat with large opening, complete water coverage below seat opening, the finest fittings, dazzling Durock surface. Thomas Maddock's Sons Co., Trenton, N. J.

★*For homes or buildings in which the sanitary pad is not a problem, Maddock offers the Madbrook, with long bowl and seat, large water area. Also the dependable Maderno.*



The Improved QUIET SI-WEL-CLO





Not Only Sanitary *but* Hygienic

THE Si-wel-clo, like all Te-pe-co closets, has always embodied the latest advances of sanitary engineering. The quietness of its operation has always been an acceptable attribute of this closet de luxe.

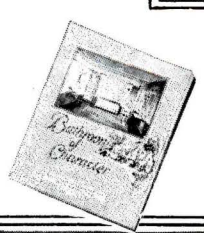
The Improved Si-wel-clo is unquestionably the greatest advance in water closet construction of recent years. It is the most comfortable, hygienic, sanitary and quiet closet that has ever been devised. The decided dip in the rim elevates the front and rear of the bowl opening, minimizing the possibility of soiling.

The Si-wel-clo is typical of the entire line of Te-pe-co All-Clay Plumbing Fixtures—closets, baths, lavatories, etc.—sanitary, durable and of irreproachable distinction.

Folders describing this closet combination in detail will be forwarded on request.

The TRENTON POTTERIES COMPANY

TRENTON, NEW JERSEY, U. S. A.
National Showroom—New York City
101 Park Ave., *Entrance on 41st St.*
Branch Offices: Boston, Philadelphia, Chicago
Export Office: 115 Broad Street, New York City

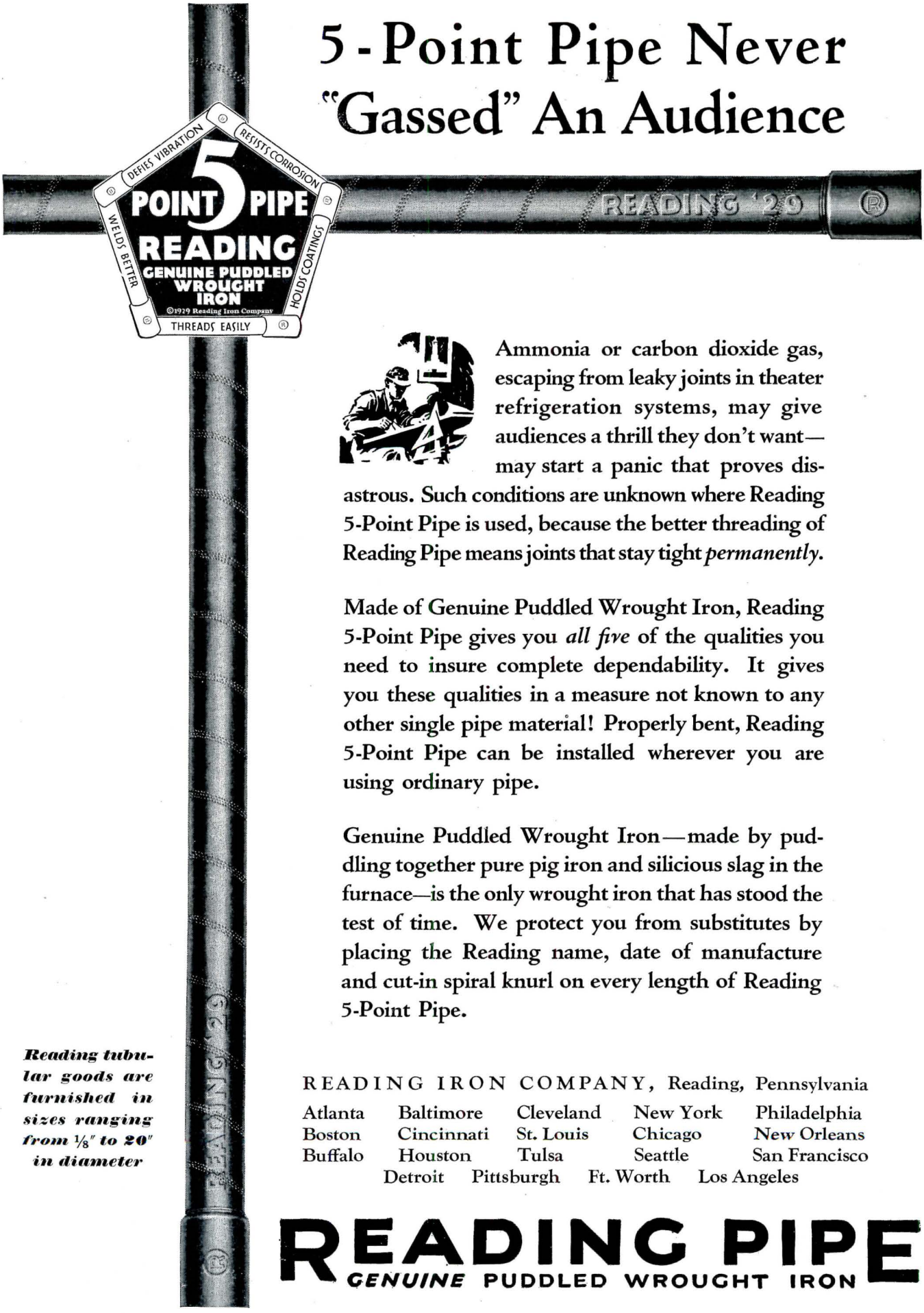


Our Guarantee

We, of The Trenton Potteries Company, make but one grade of ware—the best that we can produce—and sell it at reasonable prices. We sell no seconds or culls. Our ware is guaranteed to be equal in quality and durability to any sanitary ware made in the world. The Te-pe-co Trade Mark is found on all goods manufactured by this company and is your guarantee that you have received what you paid for.

TE-PE-CO
ALL-CLAY PLUMBING FIXTURES

5-Point Pipe Never "Gassed" An Audience



Ammonia or carbon dioxide gas, escaping from leaky joints in theater refrigeration systems, may give audiences a thrill they don't want—may start a panic that proves disastrous. Such conditions are unknown where Reading 5-Point Pipe is used, because the better threading of Reading Pipe means joints that stay tight *permanently*.

Made of Genuine Puddled Wrought Iron, Reading 5-Point Pipe gives you *all five* of the qualities you need to insure complete dependability. It gives you these qualities in a measure not known to any other single pipe material! Properly bent, Reading 5-Point Pipe can be installed wherever you are using ordinary pipe.

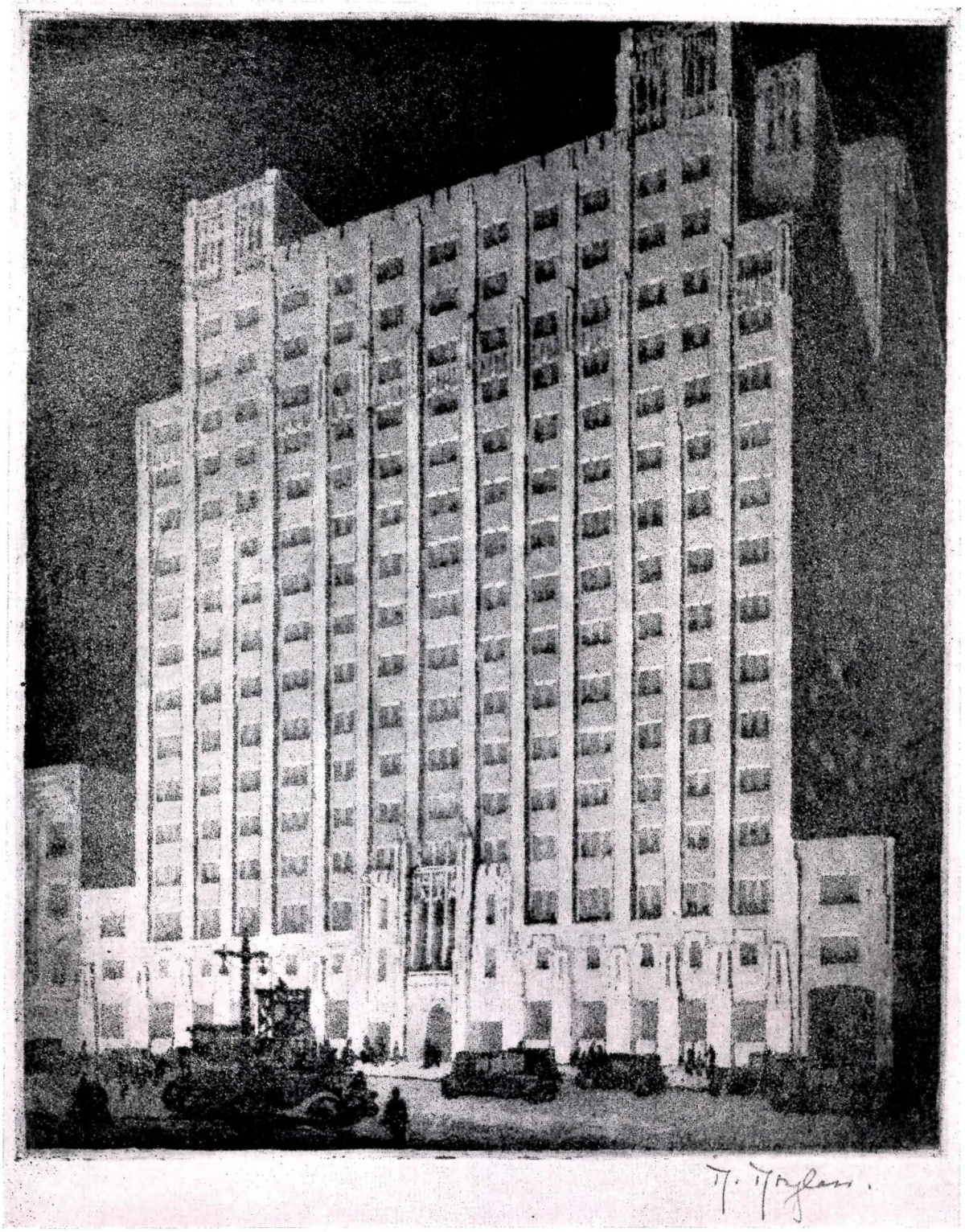
Genuine Puddled Wrought Iron—made by puddling together pure pig iron and silicious slag in the furnace—is the only wrought iron that has stood the test of time. We protect you from substitutes by placing the Reading name, date of manufacture and cut-in spiral knurl on every length of Reading 5-Point Pipe.

Reading tubular goods are furnished in sizes ranging from 1/8" to 20" in diameter

READING IRON COMPANY, Reading, Pennsylvania

Atlanta	Baltimore	Cleveland	New York	Philadelphia
Boston	Cincinnati	St. Louis	Chicago	New Orleans
Buffalo	Houston	Tulsa	Seattle	San Francisco
	Detroit	Pittsburgh	Ft. Worth	Los Angeles

READING PIPE
GENUINE **PUDDLED WROUGHT IRON**



A Donald Douglass Aquatint study of the Hahnemann Hospital, Philadelphia, Pa. ⌒ Pettit and Ferris, New York, Architect ⌒ H. Hall Marshall, New York, Consulting Engineer ⌒ Irwin and Leighton, Philadelphia, General Contractor ⌒ V. N. Welamb Co., Philadelphia, Heating Contractor ⌒ S. Faith & Co., Philadelphia, Plumbing Contractor. Jenkins Valves are used for the entire valve equipment of this modern hospital . . . Jenkins Bros. ⌒ New York ⌒ Boston ⌒ Philadelphia ⌒ Chicago . . . Jenkins Bros. Ltd. ⌒ Montreal ⌒ London.

Owner:

The question is: How much extra can we afford to pay for wrought iron pipe? Suppose we do get double life, but pay almost double for it, what have we gained?

Engineer:

The price of wrought iron pipe may be nearly double that of cheaper pipe, but *installed* in the system, ready for service, it costs only about 5% extra. That's the important thing to look at.

"Why do we have to look at the installation cost rather than the pipe cost?"

"Because freight, labor, fittings, and overhead, are all necessary elements in the cost of a pipe system. They are not lessened by using cheap pipe. Some of them, on the contrary, may be increased.

"Replacements are usually more expensive than new work. Freight, hauling, and overhead enter, just as they did in the first place. Labor often is doubled and trebled. And besides that, walls, floors and partitions may have to be torn out, and repaired after the job is finished. Carpenters, plasterers, painters, and decorators have to be reckoned with, as well as pipe fitters.

"In a factory, if some of these troubles are absent, there are others equally severe. Difficulty in getting at the leaky pipes, overtime charges, interrupted operation, idle time of machines and men, delayed production—these are common experiences. Pipe failures are extremely costly."

"But the whole system would not fail all at once!"

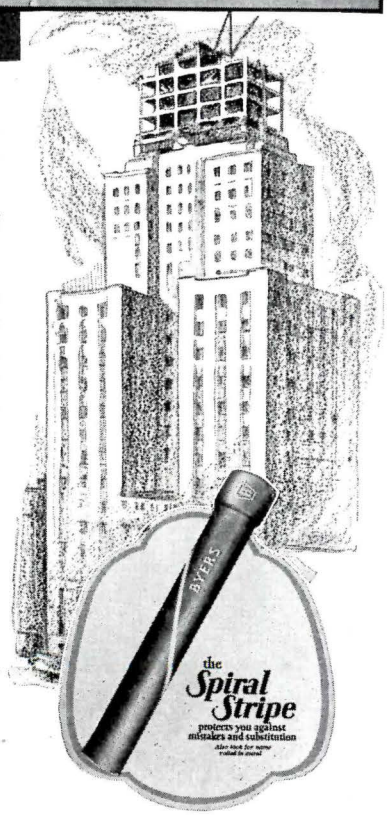
"True, it would not go to pieces all at once, like the 'one hoss shay'. But whether all at once, or little by little, when pipes break down they have to be replaced, and it certainly doesn't cost any less to do a thing piecemeal than all at one time. We are discussing, not the exceptional utter collapse, but the usual, disheartening expense of continual replacements when short-lived pipe is used."

* * * * * *

Thorough studies have been made, covering the experience of many pipe users, in different places, through a long term of years. A Byers bulletin on the Installation Cost of Pipe gives facts and figures. Send for a copy.

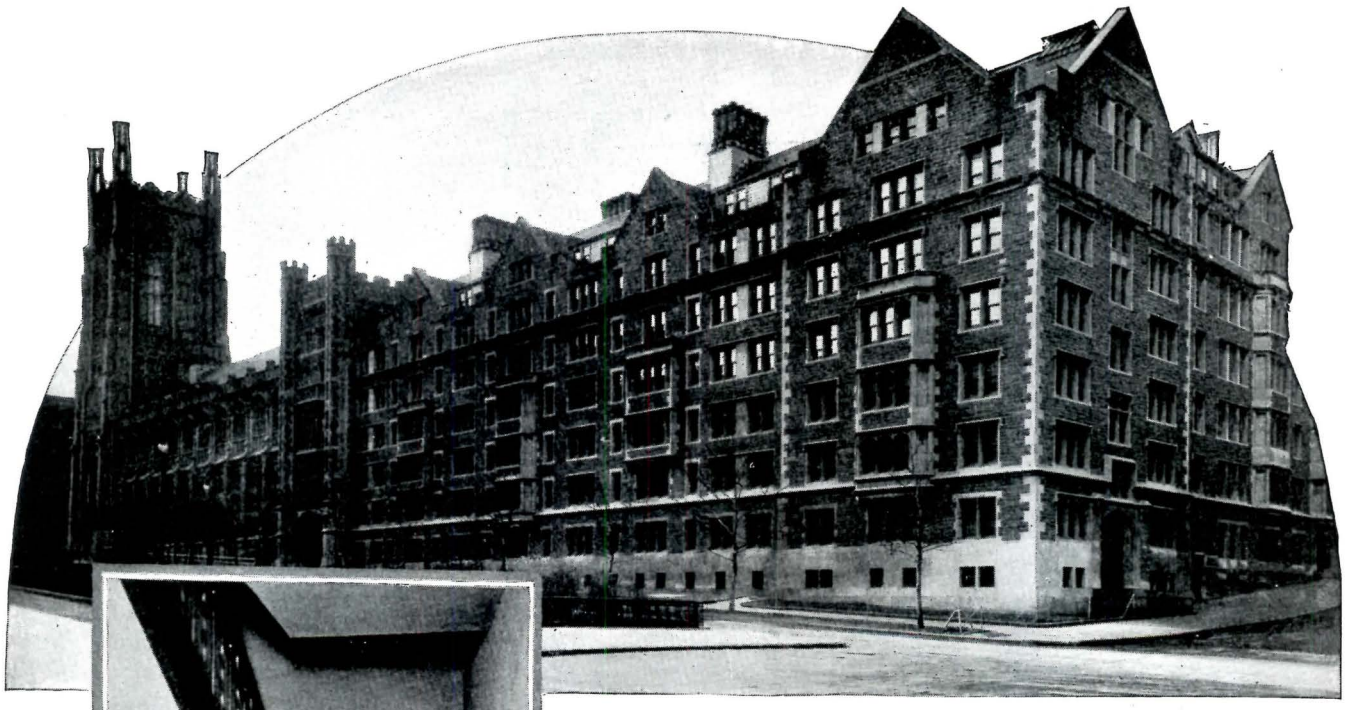
A. M. BYERS COMPANY

Established 1864 Pittsburgh, Pa.



BYERS PIPE

GENUINE WROUGHT IRON



Stairway, hall and stair landings of Alberene Stone at Union Theological Seminary, New York, N. Y. ALLEN N. COLLINS, Boston, *Architect*

STAIRS
THAT ARE PLANNED FOR TRAFFIC

The treads of such stairway installations must combine durability and an abrasive surface-grip with pleasing appearance and comfortable use. Those of Alberene Stone qualify with a plus rating on each of the four counts.

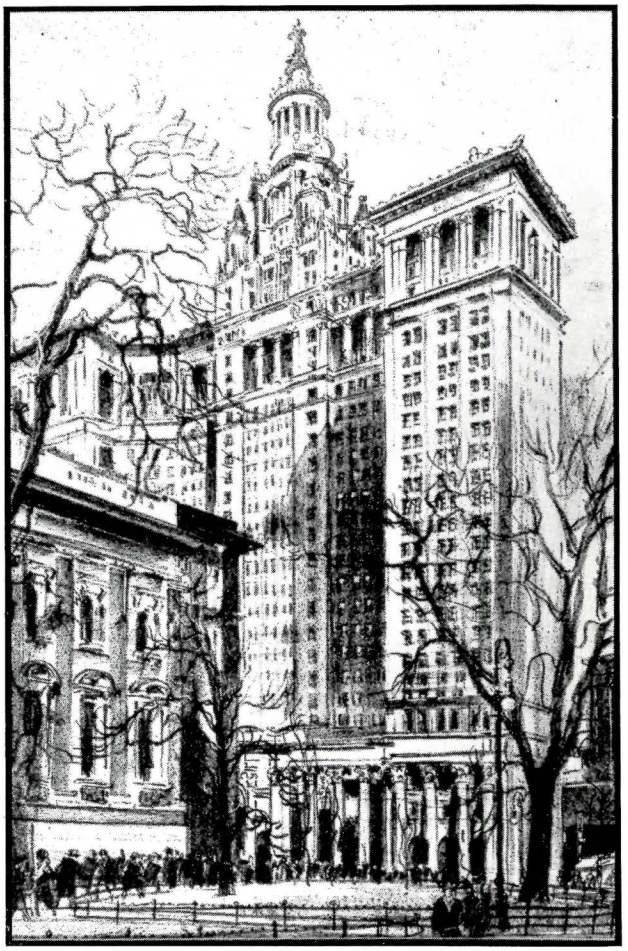
A special quarry-selected hard stone is used. It has the workability which characterizes soapstone, and a hardness and abrasive content which give it definite advantages.

Tiles of the same character, either of regular dimension or ashlar pattern laid are admirable for hallways and landings.

The Company's new brochure, Architectural Alberene, has a series of illustrations which are full of practical suggestions.

ALBERENE STONE COMPANY
153 West 23rd Street, New York City
Branch Offices—BOSTON, CHICAGO, PHILADELPHIA, NEWARK, N. J., PITTSBURGH, CLEVELAND, RICHMOND
Quarries and Mills at Schuyler, Va.

ALBERENE STONE



Courtesy of The New York Edison Company

The New York Municipal Building exemplifies the art, craftsmanship, and excellent materials that went into its construction . . . Among which was rust-resisting ARMCO Ingot Iron, used in the form of Herringbone Metal Lath. Architects: McKim, Mead, and White.

Design Freely...

and know it will conform

WITH pure ARMCO Ingot Iron as the sheet metal to be used, you can design the most complex motifs . . . with the satisfaction of knowing that every line can be faithfully reproduced.

ARMCO Ingot Iron is made pure to endure. Yet from this same purity comes remarkable ductility; the ductility that enables you to trust your designs to a competent sheet metal craftsman with the assurance that they will be reproduced faithfully.

From simple gutter to ornate cornice or marquise, there is a gratifying measure of beauty and protection when you specify ARMCO Ingot Iron.

If you have a sheet metal problem, our Development Engineers can tell you just what you can achieve with ARMCO Ingot Iron. Ask the office nearest you for this cooperation. There is no obligation.

The First Church of Christ Scientist, Atlanta, Georgia, is a typical example of the adaptability of ARMCO Ingot Iron for architectural sheet metal construction. This pure iron expresses freely the artistic cornice design of Architects Robinson and Dougherty, while its durability has protected their specification for 16 years without repair or replacement. The dome is also covered with rust-resisting ARMCO Ingot Iron, installed in 1913.

THE AMERICAN ROLLING MILL COMPANY

Executive Offices, Middletown, Ohio

Export: **The ARMCO International Corporation**

Cable Address—**ARMCO, Middletown (O.)**

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Chicago
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San Francisco

ARMCO

ARMCO INGOT IRON RESISTS RUST

HOFFMAN SPEC
ANNO
TWO NEW

HOFFMAN MOTO-HEATERS...

Hoffman Moto-Heaters are an improved type of unit heaters, scientifically designed and made in accordance with the highest engineering standards.

Architects and heating engineers will find in Hoffman Moto-Heaters a product that insures maximum efficiency at lowest cost per B. T. U.

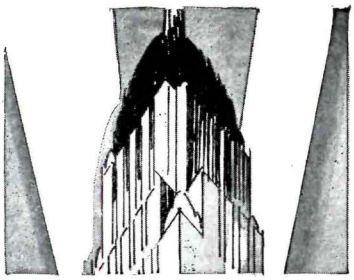
Hoffman Moto-Heaters can be specified with the assurance that they will fully measure up to rated capacities and will give years of satisfactory service without leakage or other mechanical troubles.

Made in both suspended and floor mounted styles, in a complete range of sizes for all industrial and commercial heating requirements.

Every heater tested at 1,000 pounds hydrostatic pressure and guaranteed for 200 pounds operating pressure. Furnished with Super-Fin heating surface. Copper tubes are united to header by fusion of metal, to prevent danger of leakage.

HOFFMAN HEATING SPECIALTIES FOR ALL TYPES OF STEAM INSTALLATIONS

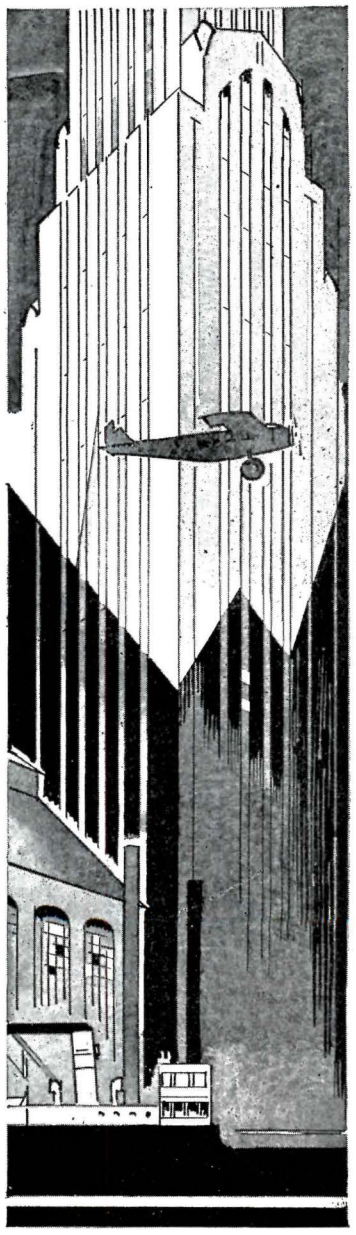
The addition of these two new products marks another forward step in making the Hoffman line more complete. In Hoffman Valves, Hoffman Controlled Heat Equipment, Hoffman Moto-Heaters and Hoffman-Economy Pumps, architects and heating engineers are now offered a reliable line of heating specialties for residences and all types of commercial and industrial buildings. The selection of complete Hoffman equipment simplifies specifications, insures complete engineering counsel and avoids divided responsibility.



IALTY COMPANY

UNCES

PRODUCTS



HOFFMAN-ECONOMY PUMPS . .

Condensation Pumps — Compactly designed and sturdily constructed, Hoffman-Economy Condensation Pumps meet every requirement of efficiency and dependability. Mounted on heavy cast iron base and driven by a powerful motor of standard make and size. Removable cover gives access to all working parts without breaking pipe connections.

Vacuum Pumps—The Hoffman-Economy Vacuum Pump is a highly efficient and reliable unit for the rapid removal of air and condensate from heating systems.

Vacuum producer is of the jet type—the simplest and best known method. No close clearances on pump; no danger of water overflowing to floor in event of electrical failure. Pump operates efficiently even in handling very hot water, and can "pull" high vacuum.

There is a Hoffman-Economy Pump for every type of heating job.

Send Coupon for New Catalogues

Catalogues and engineering data on Hoffman Moto-Heaters and Hoffman-Economy Pumps will gladly be sent upon request. Fill out attached coupon and mail today.

HOFFMAN SPECIALTY COMPANY, INC., Dept. EF13, Waterbury, Conn.
Please send catalogue on

_____Hoffman Moto-Heaters
_____Hoffman-Economy Pumps

Name .....

Street .....

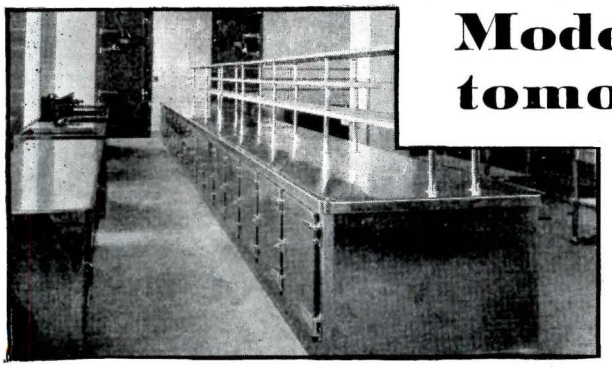
City and State .....

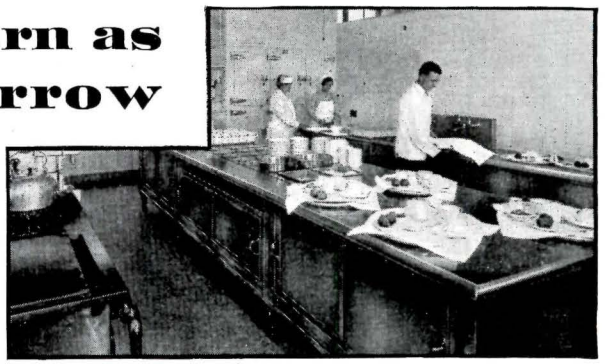
By .....

BATTLE CREEK Sanitarium

Another Monel Metal Installation

Modern as tomorrow





Photograph above at left shows Service Kitchen, Battle Creek Sanitarium, with Monel Metal refrigerator counter, service table, cube ice bin, tray tables, roll warmers and plate warmers mfd. and installed by Duparquet, Huot & Moneuse Company, Chicago. Photograph at right shows one of the diet kitchens in the Battle Creek Sanitarium—Monel Metal equipped—equipment mfd. and installed by The John Van Range Co.

The following companies furnished Monel Metal equipment for the Battle Creek Sanitarium:

COLT'S PATENT FIRE-ARMS MFG. CO.
Hartford, Conn.
DETROIT-MICHIGAN STOVE CO.
Detroit, Mich.
DUPARQUET, HUOT & MONEUSE CO.
Chicago, Ill.
EDISON ELECTRIC APPLIANCE CO.
Chicago, Ill.
D. A. MATOT CO., Chicago, Ill.
THE JOHN VAN RANGE CO.
Cincinnati, Chicago, Detroit, New York

THE world-wide reputation of the Battle Creek Sanitarium is at the same time a benefit and an obligation.

It is a benefit because it draws patients from the four quarters of the globe. It is an obligation because an institution with such a reputation must employ only the finest and most modern equipment.

It is natural, therefore, that the major departments of the Battle Creek Sanitarium should be Monel Metal equipped.

Monel Metal is the preferred material among MODERN hospitals. It has received the endorsement of hospital executives because it offers a combination of properties available in no other material—it is rust-proof, corrosion-resisting, durable. It has no coating to chip, crack or wear off. Its beautiful, silvery lustre is permanent.

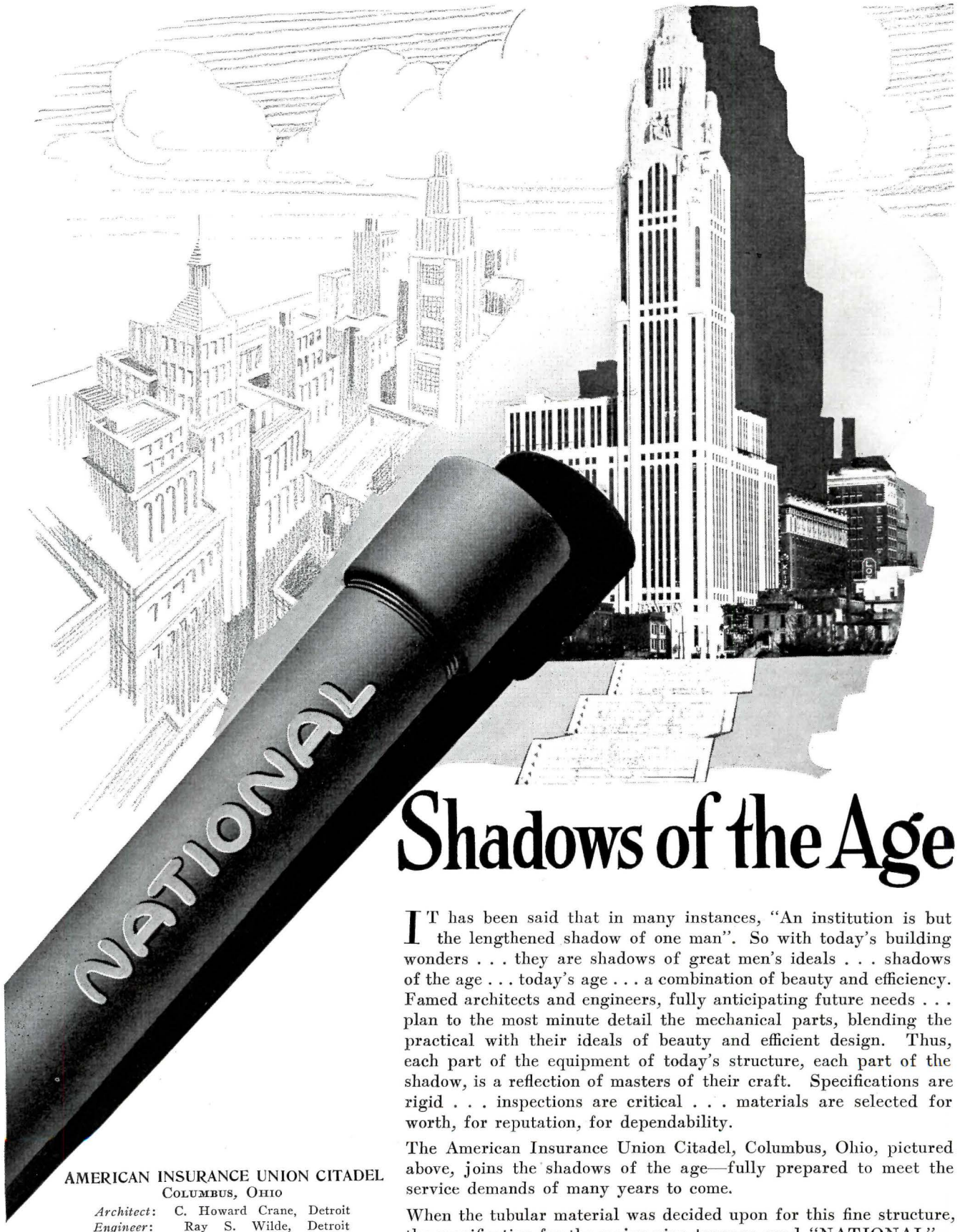
In advising hospitals regarding their equipment requirements, you are absolutely safe in recommending Monel Metal. Its dependable high quality has been demonstrated by its many years of economical service in well-known institutions.

SEND FOR ARCHITECTURAL FOLDERS ON HOSPITALS

See our exhibit at the Architectural and Allied Arts Exposition, Grand Central Palace, New York City, April 15th to 27th.

MONEL METAL

THE INTERNATIONAL NICKEL COMPANY, INC. — INCO MONEL METAL TRADE MARK — 67 WALL STREET, NEW YORK N. Y.



Shadows of the Age

IT has been said that in many instances, "An institution is but the lengthened shadow of one man". So with today's building wonders . . . they are shadows of great men's ideals . . . shadows of the age . . . today's age . . . a combination of beauty and efficiency. Famed architects and engineers, fully anticipating future needs . . . plan to the most minute detail the mechanical parts, blending the practical with their ideals of beauty and efficient design. Thus, each part of the equipment of today's structure, each part of the shadow, is a reflection of masters of their craft. Specifications are rigid . . . inspections are critical . . . materials are selected for worth, for reputation, for dependability.

The American Insurance Union Citadel, Columbus, Ohio, pictured above, joins the shadows of the age—fully prepared to meet the service demands of many years to come.

When the tubular material was decided upon for this fine structure, the specification for the major pipe tonnage read "NATIONAL"—

America's Standard Wrought Pipe

(Butt-weld sizes ½ to 3-inch, made Scale Free)

AMERICAN INSURANCE UNION CITADEL
COLUMBUS, OHIO
Architect: C. Howard Crane, Detroit
Engineer: Ray S. Wilde, Detroit
General Contractors:
John Gill & Sons Co., Cleveland
Plumbing & Heating Contractors:
Hoffman Wolfe Company, Columbus

ATIONAL TUBE COMPANY • Pittsburgh, Pa.

***Subsidiary of* United States Steel Corporation**

No. 55 of a series of advertisements featuring prominent laundry installations

The Laundry Problem *simplified*

... *by this* SPECIALIZED *cooperation*

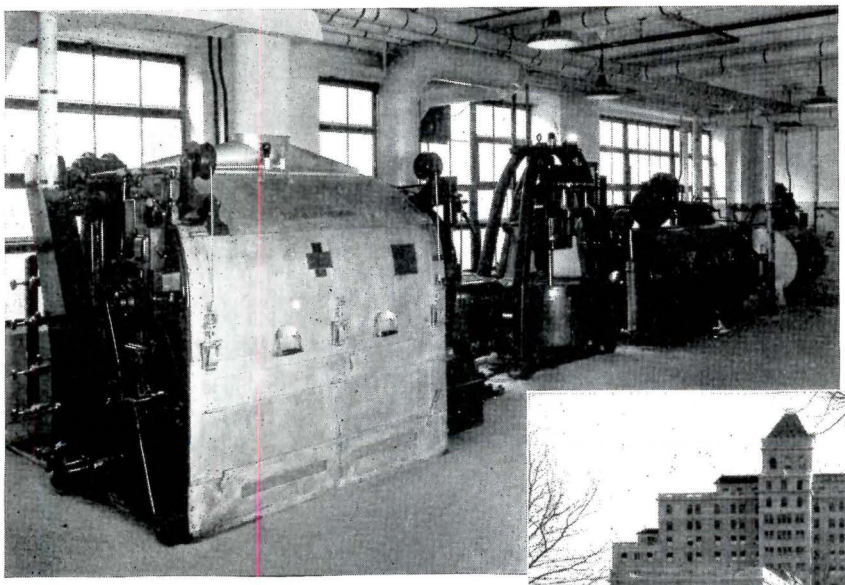
THE experience of The American Laundry Machinery Company covers laundry installations in practically every type of building. For, nowadays, the institutional laundry, as you know, is a planned-from-the-start department — in hospitals, hotels, clubs and apartment structures, even factories.

When it comes to any kind of laundry problem—commercial or institutional—you will find "American" counsel valuable. Take, for example, the laundry at Beth Israel Hospital. Location, floor space, power requirements, troughings for the washers, weight of the equipment were problems which "American" specialists helped to work out.

The services of these engineers are at your disposal—a letter will bring one of them to your office.

THE AMERICAN LAUNDRY MACHINERY COMPANY
Norwood Station, CINCINNATI, OHIO

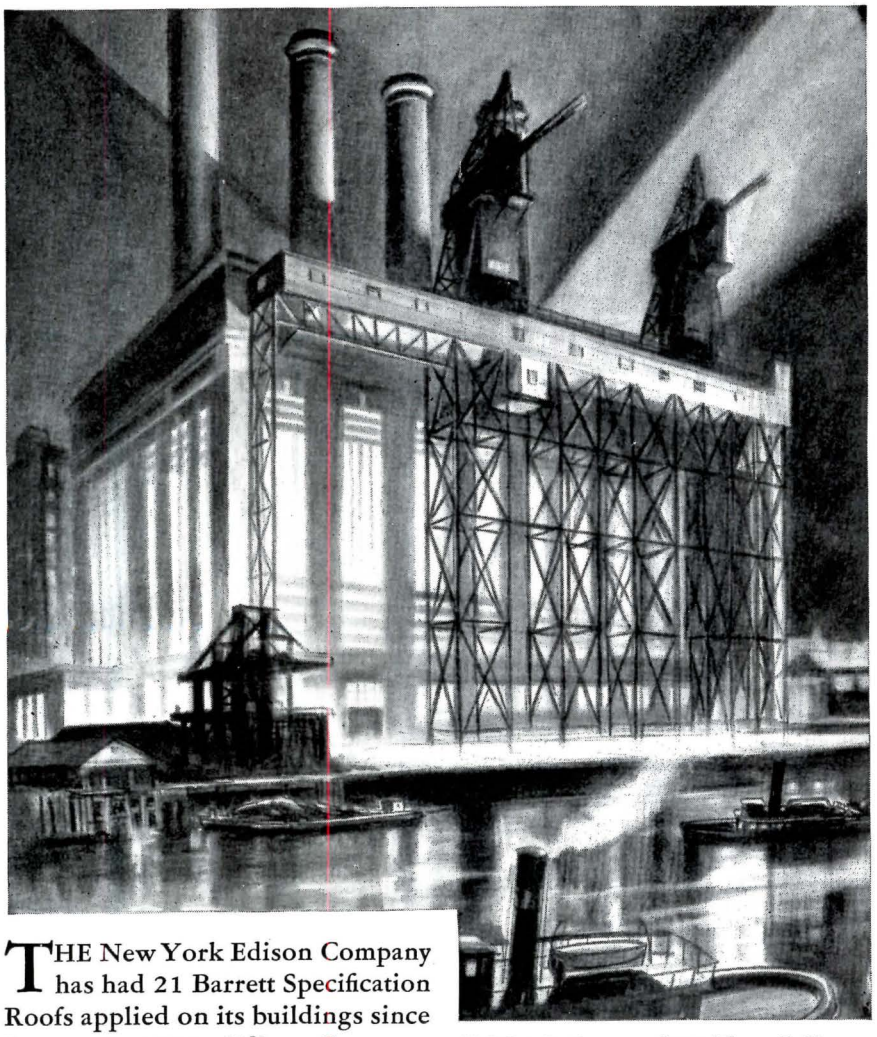
The Canadian Laundry Machinery Co., Ltd., 47-93 Sterling Road, Toronto 3, Ont., Canada.
Agents: British-American Laundry Machinery Co., Ltd., Underhill St., Camden Town, London, N. W. 1, England.



The modern laundry department at Beth Israel Hospital, Newark, N. J., planned and installed with the collaboration of American Laundry Machinery Company engineers.

STARRETT BROTHERS, 292 Madison Avenue, New York City—*Builders.*

21 NEW YORK EDISON BUILDINGS under Barrett Specification Roofs



Hell Gate Station, erected 1922, Thomas E. Murray, Inc., New York City, engineers and architects. Covered with Barrett Specification Coal-tar Pitch and Felt and surfaced with tile. T. New Construction Co., New York City, Roofer.

THE New York Edison Company has had 21 Barrett Specification Roofs applied on its buildings since January 1, 1921. Edison Company engineers demand roofs that will not leak, burn, crack or rot. The few cents more per square foot, between the Barrett Specification and ordinary roofs, doesn't enter into their consideration. Trouble-free, expense-free service is their objective... their method of economizing.

Engineers and architects know that Barrett Specification Roofs of Coal-tar Pitch and Felt, surfaced with gravel, slag or tile, and bonded for 20 years* against repair or maintenance expense, far outlive even the liberal provisions of the bond.

Ten-, twenty-, thirty-, forty-, fifty-year performance sets forth the value of Barrett Roofs. A roof that comes through decades of withering summer heat, decades of blighting winter cold, *unscathed,* proves itself. What more could be demanded of *any* roof?

Coal-tar pitch literally thrives on that element which nature uses so destructively on ordinary roofs. Water is actually a pitch *preservative!* Misuse may injure the surface—but self-healing properties of pitch mend it automatically. The surface-imbedded gravel, slag or tile provides a practically imperishable wearing surface that defies fire, time and tempest.

Fifty-year repair-free service records are a common occurrence with Barrett Coal-tar Pitch, Felt and Gravel Roofs. "Tar and gravel" roof protection . . . by Barrett . . . was standard practice when the four-story "red brick" enjoyed its first fling in commercial building fashion. And it is standard practice today.

Architects, engineers and builders turn consistently to the Barrett Specification Roof. Not merely because they know of these records, know of the high character of Barrett Approved Roofers and of Barrett's "on-the-spot" inspection service—or yet, entirely, because the Barrett Specification Roof carries a Surety Bond. But because the Barrett Specification Roof keeps the owner totally free of annoyance and interruption to business. And that's sound business!

Let us put you in touch with the Barrett Approved Roofer located in your city.

*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.

Barrett Specification Roofs are constructed of alternate layers of prime quality tarred felt and the finest coal-tar pitch, armored and fire-safed with surface-imbedded gravel, slag or tile. They are laid by Barrett Approved Roofers according to the Barrett Specification and bonded by Barrett against repair or maintenance expense.

Barrett Specification Roofs

Inspected and Bonded by Barrett

THE BARRETT COMPANY, 40 Rector St., New York ~ *In Canada* ~ THE BARRETT COMPANY, Ltd., 5551 St. Hubert St., Montreal, P. Q.

VALUABLE MANUAL *on* Modern Concrete Reinforcement *now ready for Distribution*

"A practical manual for architects and builders on concrete reinforcement and economical methods and materials for placing, supporting, spacing and holding reinforcement in concrete structures;—including notes on specifications and inspection methods."

* * *

A few of the subjects covered:

Correct Placement of Steel Reinforcement . . .

* * *

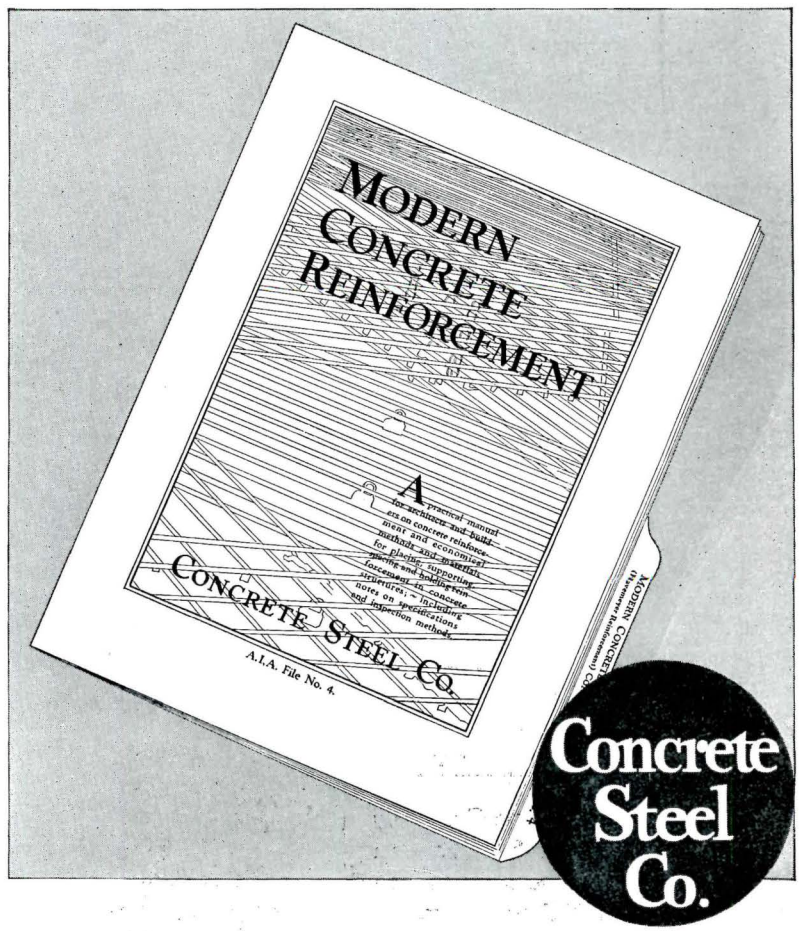
Economies possible Through Correct Field Practice . . .

* * *

Supporting, Spacing and Holding Devices . . .

* * *

Practical considerations governing Placing and Protection of Steel in the Concrete Mass . . .



This new manual of 32 fully illustrated pages, plus two "Standard Practice" folders of eight pages each, brings up-to-date and makes available in one place a vast amount of accurate, practical information on reinforcing. It simplifies and makes clear the entire subject. Without question it deserves—and will receive—a prominent place in the offices of architects, engineers, contractors and builders.

Copies of this valuable manual will be gladly sent to responsible firms and individuals without cost. Use the coupon below, or send special request to the *Concrete Steel Company, 42 Broadway, New York.*

Concrete Steel Co.

Executive Offices: 42 Broadway, New York

District Offices—Birmingham, Boston, Chicago, Detroit, Minneapolis, Philadelphia, Pittsburgh, St. Paul, Syracuse, Washington, Youngstown

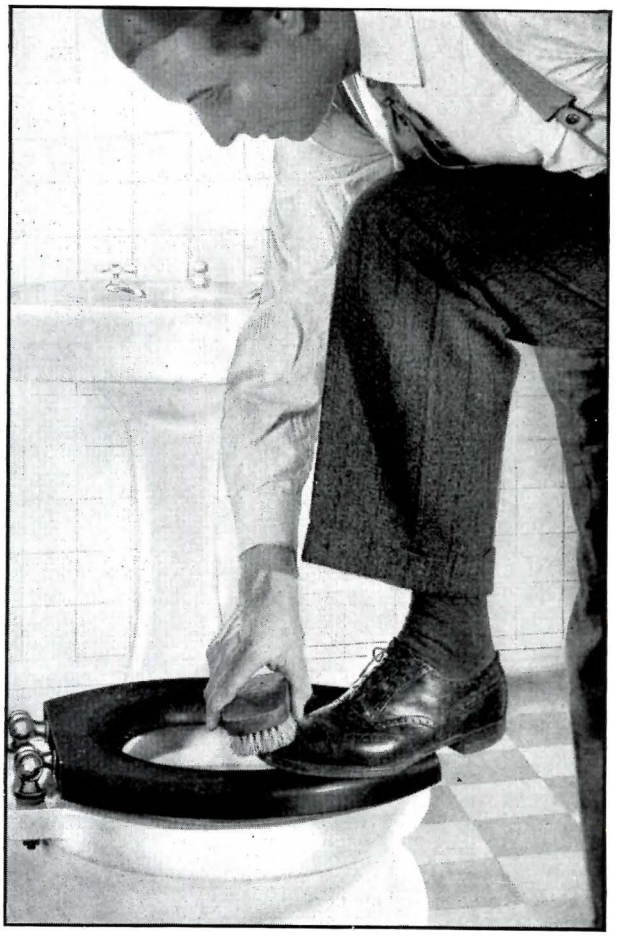
CONCRETE STEEL CO., 42 Broadway, New York A.F.4-29

Gentlemen: Please send me, without obligation, a copy of your new Manual on Concrete Reinforcement.

Name .....

Firm Name .....

Address .....



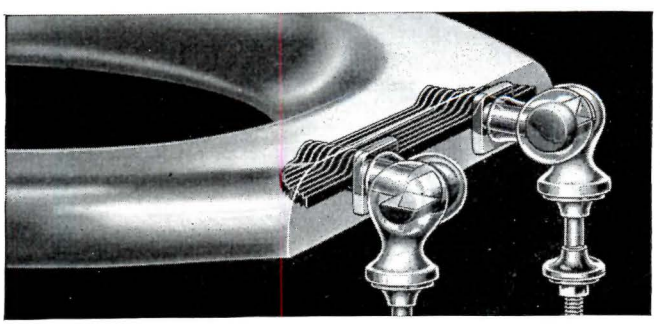
It takes a WHALE *of a seat to stand public toilet abuse!*

There is absolutely only one way to guard against the vandalism of the public. Install seats of such super-strength construction, that the worst treatment in the world cannot smash them.

Whale-bone-ite is such a seat. Though it costs no more than the cheapest composition closet seat made, its unbreakable construction—guaranteed for the life of the building—immediately ends all replacement expense.

Its handsome polished Whale-bone-ite surface will last a life-time. It is easy to clean and non-inflammable. Its hinge also is covered with Whale-bone-ite, giving it the same strong, polished surface as the seat, and making it non-corrosive.

The use of Whale-bone-ite Seats is spreading to the guest bathrooms of fine hotels. Many new apartment houses are equipping all toilets with it.



THE WHALE-BONE-ITE Seat and Hinge form an unbreakable unit. The seat is molded around a laminated core of alternating-grain layers of hardwood, making it proof against warping, cracking and splitting. The die-cast hinge is molded integral with the seat.

Send for free cross-section —see its strength yourself

Figures show that on the average ordinary seats have to be replaced about every three years. If you want to end this needless expense, just as it already has been ended in more than a million public toilets in modern and remodelled buildings, simply install Whale-bone-ite Seats as fast as other seats wear out. Not only will the replacement expense end, but the toilets will be cleaner as Whale-bone-ite is easier to keep clean. Without obligation send for a free Whale-bone-ite cross-section. Simply address Dept. A-2, Seat Division, The Brunswick-Balke-Collender Co., 623 South Wabash Avenue, Chicago.

THE BRUNSWICK-BALKE-COLLENDER CO. Chicago

Atlanta	Chicago	Detroit	Memphis	New York	Seattle
Birmingham	Cincinnati	El Paso	Minneapolis	Philadelphia	St. Louis
Boston	Cleveland	Harrisburg	Nashville	Pittsburgh	Tampa
Buffalo	Dallas	Houston	Newark	Richmond	Washington
Charlotte	Denver	Kansas City	New Haven	San Antonio	Montreal
Chattanooga	Des Moines	Los Angeles	New Orleans	San Francisco	Ottawa
	Toronto			Havana	

BRUNSWICK

WHALE-BONE-ITE

TOILET SEATS

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 190*

ROOFING

The Barrett Company, 40 Rector St., New York City.
Architects' and Engineers' Built-up Roofing Reference Series; Volume IV Roof Drainage System. Brochure. 63 pp. 8½ x 11¼ ins. Gives complete data and specifications for many details of roofing.

Heinz Roofing Tile Co., 1925 West Third Avenue, Denver, Colo.
Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8½ x 11 ins. Illustrated. Shows use of English shingle tile with special hips.

Italian Promenade Floor Tile. Folder, 2 pp., 8½ x 11 ins. Illustrated. Floor tiling adapted from that of Davanzati Palace.
Mission Tile. Leaflet, 8½ x 11 ins. Illustrated. Tile such as are used in Italy and southern California.

Georgian Tile. Leaflet, 8½ x 11 ins. Illustrated. Tiling as used in old English and French farmhouses.

Ludowici-Celadon Company, 104 So. Michigan Ave., Chicago, Ill.
"Ancient" Tapered Mission Tiles. Leaflet. 8½ x 11 ins. 4 pp. Illustrated. For architects who desire something out of the ordinary, this leaflet has been prepared. Describes briefly the "Ancient" Tapered Mission Tiles, hand-made with full corners and designed to be applied with irregular exposures.

Structural Gypsum Corporation, Linden, N. J.
Relative Effectiveness of Various Types of Roofing Construction in Preventing Condensation of the Under Surface. Folder, 4 pp., 8¾ x 11 ins. Important data on the subject.

Gypsteel Pre-cast Fireproof Roofs. Booklet, 48 pp., 8½ x 11 ins. Illustrated. Information regarding a valuable type of roofing.

U. S. Gypsum Co., Chicago, Ill.
Pyrobar Roof Construction. Booklet. 8 x 11 ins. 48 pp. Illustrated. Gives valuable data on the use of tile in roof construction.

Sheetrock Pyrofill Roof Construction. Folder, 8½ x 11 ins. Illustrated. Covers use of roof surfacing which is poured in place.

SEWAGE DISPOSAL

Kewanee Private Utilities, 442 Franklin St., Kewanee, Ill.
Specification Sheets. 7¾ x 10¼ ins. 40 pp. Illustrated. Detailed drawings and specifications covering water supply and sewage disposal systems.

SCREENS

American Brass Co., The, Waterbury, Conn.
Facts for Architects About Screening. Illustrated folder, 9½ x 11¾ ins., giving actual samples of metal screen cloth and data on fly screens and screen doors.

Athey Company, 6015 West 65th St., Chicago, Ill.
The Athey Perennial Window Shade. An accordion pleated window shade, made from translucent Herringbone woven Coutil cloth, which raises from the bottom and lowers from the top. It eliminates awnings, affords ventilation, can be dry-cleaned and will wear indefinitely.

Orange Screen Co., Maplewood, N. J.
Orsco Aluminum Screens. Booklet, 8 pp., 8 x 11 ins. Illustrated. Data on a valuable line of screens.

Orsco Screens and Other Products. Brochure, 20 pp., 8 x 11 ins. Illustrated. Door and window screens and other hardware.

SHADE CLOTH AND ROLLERS

Columbia Mills, Inc., 225 Fifth Avenue, New York, N. Y.
Window Shade Data Book. Folder, 28 pp., 8½ x 11 ins. Illustrated.

SHELVING-STEEL

David Lupton's Sons Company, Philadelphia, Pa.
Lupton Steel Shelving. Catalog E. Illustrated brochure, 40 pp., 8⅝ x 11 ins. Deals with steel cabinets, shelving, racks, doors, partitions, etc.

SOUND DEADENER

Cabot, Inc., Samuel, Boston, Mass.
Cabot's Deadening Quilt. Brochure, 7½ x 10½ ins., 28 pp. Illustrated. Gives complete data regarding a well-known protection against sound.

STEEL PRODUCTS FOR BUILDING

Bethlehem Steel Company, Bethlehem, Pa.
Steel Joists and Stanchions. Booklet, 72 pp., 4 x 6¾ ins. Data for steel for dwellings, apartment houses, etc.

Steel Frame House Company, Pittsburgh, Pa. (Subsidiary of McClintic-Marshall Corp.)
Steel Framing for Dwellings. Booklet, 16 pp. 8½ x 11 ins. Illustrated.
Steel Framing for Gasoline Service Stations. Brochure, 8 pp. 8½ x 11 ins. Illustrated.
Steel Frame Standard Gasoline Service Stations. Booklet, 8 pp. 8½ x 11 ins. Illustrated. Three standard designs of stations.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
The Arc Welding of Structural Steel. Brochure, 32 pp., 8½ x 11 ins. Illustrated. Deals with an important structural process.

STONE, BUILDING

Indiana Limestone Company, Bedford, Ind.
Volume 3, Series A-3. Standard Specifications for Cut Indiana Limestone work, 8½ x 11 ins. 56 pp. Containing specifications and supplementary data relating to the best methods of specifying and using this stone for all building purposes.

Volume 1. Series B. Indiana Limestone Library, 6 x 9 ins., 36 pp. Illustrated. Giving general information regarding Indiana Limestone, its physical characteristics, etc.

STONE, BUILDING—Continued

Volume 4. Series B. Booklet. New Edition. 8½ x 11 ins., 64 pp. Illustrated. Indiana Limestone as used in Banks.

Volume 5. Series B. Indiana Limestone Library. Portfolio. 8¾ x 11⅛ ins. Illustrated. Describes and illustrates the use of stone for small houses with floor plans of each.

Volume 6, Series B—Indiana Limestone School and College Buildings. 8½ x 11 ins., 80 pages, illustrated.

Volume 12. Series B—Distinctive Homes of Indiana Limestone. 8½ x 11 ins., 48 pages, illustrated.

Old Gothic Random Ashlar. 8½ x 11 ins., 16 pages. Illustrated.

STORE FRONTS

Brasco Manufacturing Co., 5025-35 South Wabash Avenue, Chicago, Ill.
Catalog No. 33. Series 500. All-metal construction. Brochure. 20 pp. 8½ x 11 ins. Illustrated. Deals with store fronts of a high class.

Catalog No. 34. Series 202. Standard construction. Booklet. 16 pp. 8½ x 11 ins. Illustrated, complete data on an important type of building.

Detail Sheets. Set of seven sheets, 8½ x 11 ins., printed on tracing paper, giving full-sized details and suggestions for store front designs.

Davis Solid Architectural Bronze Sash. Set of six sheets, 8½ x 11 ins., printed on tracing paper. Full-sized details and suggestions for designs of special bronze store front construction.

The Kawneer Company, Niles, Mich.
Store Front Suggestions. Booklet, 96 pp., 6 x 8½ ins. Illustrated. Shows different types of Kawneer Solid Copper Store Fronts.

Catalog K. 1927 Edition. Booklet, 32 pp., 8½ x 11 ins. Illustrated. Details of Kawneer Copper Store Fronts.

Detail Sheets for Use in Tracing. Full-sized details on sheets 17 x 22 ins.

Kawneer Construction in Solid Bronze or Copper. Booklet, 64 pp., 8½ x 11 ins. Illustrated. Complete data on the subject.

Modern Bronze Store Front Co., Chicago Heights, Ill.
Introducing Extruded Bronze Store Front Construction. Folder, 4 pp., 8½ x 11 ins. Illustrated. Contains full sized details of metal store fronts.

Zouri Drawn Metals Company, Chicago Heights, Ill.
Zouri Safety Key-Set Store Front Construction. Catalog. 8½ x 10½ ins. 60 pp. Illustrated. Complete information with detailed sheets and installation instructions convenient for architects' files.

International Store Front Construction. Catalog. 8½ x 10 ins. 70 pp. Illustrated. Complete information with detailed sheets and installation instructions convenient for architects' files.

Store Fronts by Zouri. Booklet, 30 pp., 9 x 12 ins. Illustrated.

TELEPHONE SERVICE ARRANGEMENTS

All Bell Telephone Companies. Apply nearest Business Office, or American Telephone and Telegraph Company, 195 Broadway, New York.

Planning for Home Telephone Conveniences. Booklet, 51 pp. 8½ x 11 inches. Illustrated.

Planning for Telephones in Buildings. Brochure, 73 pp. 8½ x 11 inches. Illustrated.

TERRA COTTA

National Terra Cotta Society, 19 West 44th St., New York, N. Y.
Standard Specifications for the Manufacture, Furnishing and Setting of Terra Cotta. Brochure. 8½ x 11 ins. 12 pp. Complete Specification, Glossary of Terms Relating to Terra Cotta and Short Form Specification for incorporating in Architects' Specification.

Color in Architecture. Revised Edition. Permanently bound volume, 9⅛ x 12¾ ins., containing a treatise upon the basic principles of color in architectural design, illustrating early European and modern American examples. Excellent illustrations in color.

Present Day Schools. 8½ x 11 ins. 32 pp. Illustrating 42 examples of school architecture with article upon school building design by James O. Betelle, A. I. A.

Better Banks. 8½ x 11 ins. 32 pp. Illustrating many banking buildings in terra cotta with an article on its use in bank design by Alfred C. Bossom, Architect.

TILE, HOLLOW

National Fire Proofing Co., 250 Federal St., Pittsburgh, Pa.
Standard Wall Construction Bulletin 174. 8½ x 11 ins. 32 pp. Illustrated. A treatise on the subject of hollow tile wall construction.

Standard Fireproofing Bulletin 171. 8½ x 11 ins. 32 pp. Illustrated. A treatise on the subject of hollow tile as used for floors, girder, column and beam covering and similar construction.

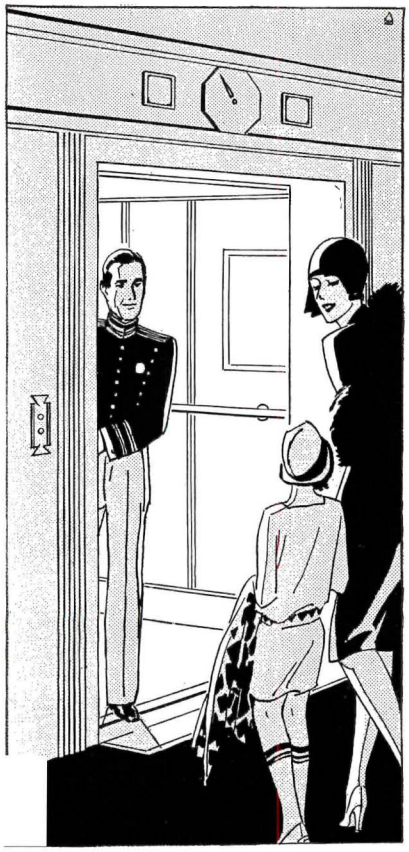
Natco Double Shell Load Bearing Tile Bulletin. 8½ x 11 ins. 6 pp. Illustrated.

Natco Unibacker Tile Bulletin. 8½ x 11 ins., 4 pp. Illustrated.

Natco Header Backer Tile Bulletin. 8½ x 11 ins. 4 pp. Illustrated.

Natcoflor Bulletin. 8½ x 11 ins. 6 pp. Illustrated.

Natco Face Tile for the Up-to-Date. Farm Bulletin. 8½ x 11 ins.



Elevator performance reflects building perfection . . . .

The tenants' and their visitors' appraisal of a building is determined by its facilities and furnishings. Performing with precision, the up-to-date elevator affords remarkable convenience. The public voices its appreciation of such dispatch, comfort and safety in terms reflecting its admiration of the building as a whole.

The Automatic Inductor Control, as designed by Westinghouse, affords distinctive elevator operation. The control is automatic—good service does not depend upon the skill of the operator. Westinghouse elevators move swiftly, safely and surely. Passengers are never required to step up or down as the car is always stopped at the exact level of the floor. Patrons readily realize and appreciate such exacting elevator performance.

Westinghouse Equipment for buildings includes:

Circuit-Breakers
Elevators
Fans
Fuses
Insulating Materials
Lamps
Lighting Fixtures
Motors and Control for Ventilating Systems, Pumps, etc.
Panelboards
Ranges
Safety Switches
Solar Glow Heaters
Switchboards
Turbines
Transformers
Watthour Meters
Water Heaters

WESTINGHOUSE ELECTRIC & MFG. COMPANY
EAST PITTSBURGH PENNSYLVANIA
SALES OFFICES IN ALL PRINCIPAL CITIES OF THE UNITED STATES AND FOREIGN COUNTRIES

Westinghouse

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Complete electrification for modern buildings

Westinghouse Electrification
Appliances Apparatus
Wiring
THIS SIGN YOUR GUARANTEE
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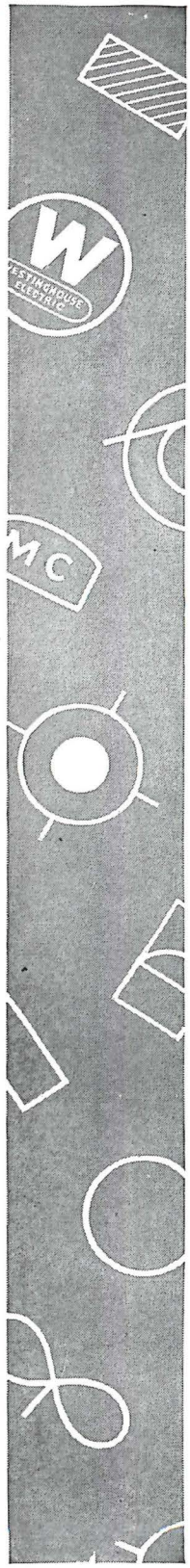
WESTINGHOUSE ELECTRIC

The Sign of a Westinghouse Dealer



SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 192*

TILES

Kraftile Company, Niles, Calif.
High Fired Faience Tile. Booklet. 32 pp. 8½ x 11 ins. Illustrated. Presents a fine line of tiles for different purposes.

C. Pardee Works, 9 East 45th St., New York, N. Y., and 1600 Walnut St., Philadelphia, Pa.
Pardee Tiles. Bound Volume, 48 pp., 8½ x 11 ins. Illustrated.

United States Quarry Tile Co., Parkersburg, W. Va.
Quarry Tiles for Floors. Booklet, 119 pp., 8½ x 11 ins. Illustrated. General catalog. Details of patterns and trim for floors.

Art Portfolio of Floor Designs. 9¼ x 12¼ ins. Illustrated in colors. Patterns of quarry tiles for floors.

VALVES

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
No. 51. General Catalog. Illustrated. Describes the complete line of the Crane Co.

C. A. Dunham Co., 450 East Ohio St., Chicago, Ill.
The Dunham Packless Radiator Valve Brochure, 12 pp., 8 x 11 ins. Illustrated. Data on an important type of valve.

Jenkins Bros., 80 White St., New York, N. Y.
The Valve Behind a Good Heating System. Booklet. 4½ x 7¼ ins. 16 pp. Color plates. Description of Jenkins Radiator Valves for steam and hot water, and brass valves used as boiler connections.

Jenkins Valves for Plumbing Service. Booklet. 4½ x 7¼ ins. 16 pp. Illustrated. Description of Jenkins Brass Globe, Angle Check and Gate Valves commonly used in home plumbing, and Iron Body Valves used for larger plumbing installations.

VENETIAN BLINDS

Burlington Venetian Blind Co., Burlington, Vt.
Venetian Blinds. Booklet. 7 x 10 ins., 24 pp. Illustrated. Describes the "Burlington" Venetian blinds, method of operation, advantages of installation to obtain perfect control of light in the room.

VENTILATION

American Blower Co., Detroit, Mich.
American H. S. Fans. Brochure, 28 pp., 8½ x 11 ins. Data on an important line of blowers.

Duriron Company, Dayton, Ohio.
Acid-proof Exhaust Fans. Folder. 8 x 10½ ins. 8 pp. Data regarding fans for ventilation of laboratory fume hoods.

Specification Form for Acid-proof Exhaust Fans. Folder, 8 x 10½ ins.

Staynew Filter Corporation, Rochester, N. Y.
Protectomotor High Efficiency Industrial Air Filters. Booklet. 20 pp., 8½ x 11 ins. Illustrated. Data on valuable detail of apparatus.

WATERPOOFING

Master Builders Company, Cleveland, Ohio.
Waterproofing and Dampproofing and Allied Products. Sheets in loose index file, 9 x 12 ins. Valuable data on different types of materials for protection against dampness.

Waterproofing and Dampproofing File. 36 pp. Complete descriptions and detailed specifications for materials used in building with concrete.

Sommers & Co., Ltd., 342 Madison Ave., New York City.
"Permantile Liquid Waterproofing" for making concrete and cement morar permanently impervious to water. Also circulars on floor treatments and cement colors. Complete data and specifications. Sent upon request to architects using business stationery. Circular size, 8½ x 11 ins.

Sonneborn Sons, Inc., L., 116 Fifth Ave., New York, N. Y.
Pamphlet. 3¾ x 8¾ ins. 8 pp. Explanation of waterproofing principles. Specifications for waterproofing walls, floors, swimming pools and treatment of concrete, stucco and mortar.

The Vortex Mfg. Co., 1978 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 Waterproofing. Specification Forms D, E, F and G. Sheets, 8½ x 11 ins. Data on combinations of gun-applied asphalt and cotton or felt membrane, built up to suit requirements.

Par-Lock Method of Bonding Plaster to Structural Surfaces. Folder, 6 pp. 8½ x 11 ins. Official Bulletin of Approved Products—Investigating Committees of Architects and Engineers.

WEATHER STRIPS

Athey Company, 6035 West 65th St., Chicago, Ill.
The Only Weatherstrip with a Cloth to Metal Contact. Booklet. 16 pp., 8½ x 11 ins. Illustrated. Data on an important type of weather stripping.

WINDOWS

The Kawneer Company, Niles, Mich.
Kawneer Solid Nickel Silver Windows. In casement and weight-hung types and in drop-down transom type. Portfolio, 12 pp., 9 x 11½ ins. Illustrated, and with demonstrator.

David Lupton's Sons Company, Philadelphia, Pa.
Lupton Pivoted Sash. Catalog 12-A. Booklet, 48 pp., 8⅝ x 11 ins. Illustrates and describes windows suitable for manufacturing buildings.

WINDOWS, CASEMENT

Crittall Casement Window Co., 10951 Hearn Ave., Detroit, Mich.
Catalog No. 22. 9 x 12 ins. 76 pp. Illustrated. Photographs of actual work accompanied by scale details for casements and composite steel windows for banks, office buildings, hospitals and residences.

Hope & Sons, Henry, 103 Park Ave., New York, N. Y.
Catalog. 12¾ x 18½ ins. 30 pp. Illustrated. Full size details of outward and inward opening casements.

The Kawneer Company, Niles, Mich.
Kawneer Solid Nickel Silver Windows. In casement and weight-hung types and in drop-down transom type. Portfolio, 12 pp., 9 x 11½ ins. Illustrated, and with demonstrator.

David Lupton's Sons Company, Philadelphia, Pa.
Lupton Casement of Copper Steel. Catalog C-217. Booklet, 24 pp. 8⅝ x 11 ins. Illustrated brochure on casements, particularly for residences.

Lupton Heavy Casements. Detail Sheet No. 101, 4 pp., 8½ x 11 ins. Details and specifications only.

Richards-Wilcox Mfg. Co., Aurora, Ill.
Casement Window Hardware. Booklet, 24 pp., 8½ x 11 ins. Illustrated. Shows typical installations, detail drawings, construction details, blue-prints if desired. Describes AIR-way Multifold Window Hardware.

Architectural Details. Booklet. 8½ x 11 ins. 16 pp. Tables of specifications and typical details of different types of construction.

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WINDOW SHADES AND ROLLERS

Columbia Mills, Inc., 225 Fifth Avenue, New York, N. Y.
Window Shade Data Book. Folder, 28 pp., 8½ x 11 ins. Illustrated.

WINDOWS, STEEL AND BRONZE

David Lupton's Sons Company, Philadelphia, Pa.
A Rain-shed and Ventilator of Glass and Steel. Pamphlet, 4 pp., 8⅝ x 11 ins. Deals with Pond Continuous Sash. Sawtooth Roofs, etc.

How Windows Can Make Better Homes. Booklet. 3⅞ x 7 ins. 12 pp. An attractive and helpful illustrated publication on use of steel casements for domestic buildings.

Truscon Steel Company, Youngstown, Ohio.
Drafting Room Standards. Book. 8½ x 11 ins. 120 pages of mechanical drawings showing drafting room standards, specifications and construction details of Truscon Steel Windows, Steel Lintels, Steel Doors and Mechanical Operators.

Truscon Solid Steel Double-Hung Windows. 24 pp. Booklet. 8½ x 11 ins. Containing illustrations of buildings using this type of window. Designs and drawings of mechanical details.

Continuous Steel windows and Mechanical Operators. Catalog 126. Booklet, 32 pp., 8½ x 11 ins. Illustrated.

WOOD—See also Millwork

American Walnut Mfrs. Association, 618 So. Michigan Blvd., Chicago, Ill.

American Walnut. Booklet. 7 x 9 ins. 45 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.

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

National Lumber Mfrs. Assn., Washington, D. C.
Airplane Hangar Construction. Booklet, 24 pp., 8½ x 11 ins. Use of lumber for hangars.

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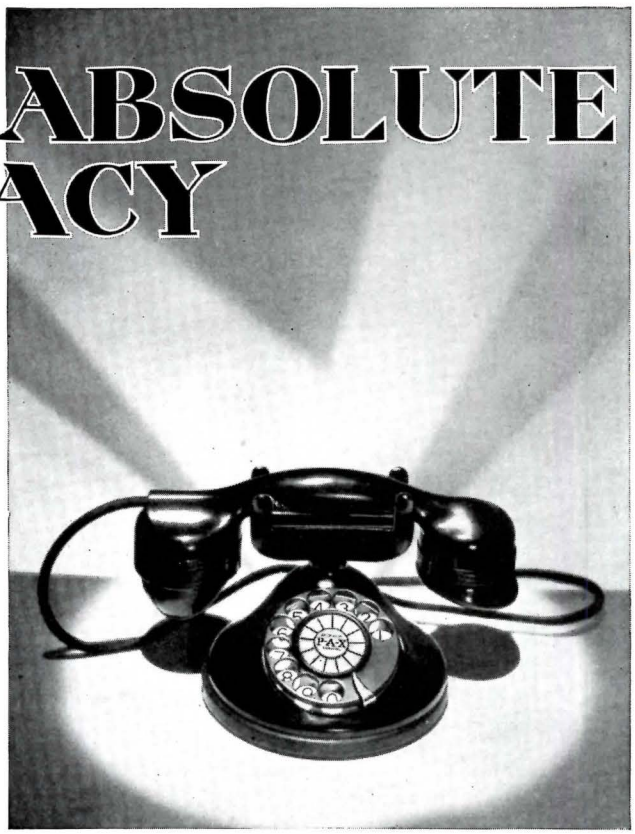

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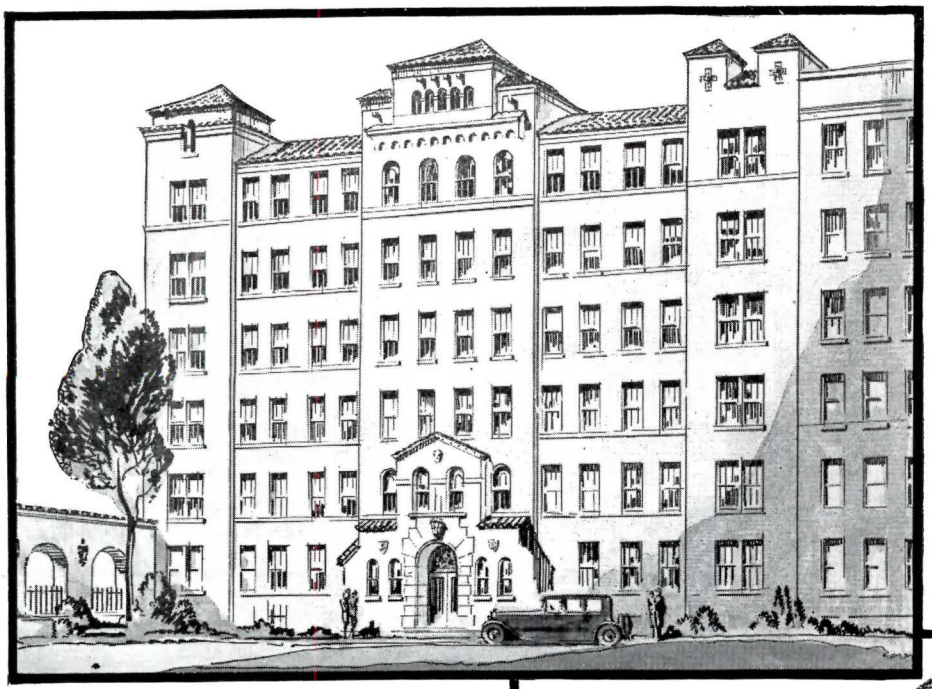

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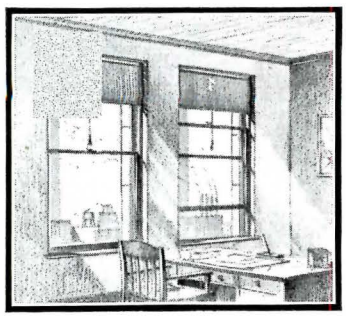

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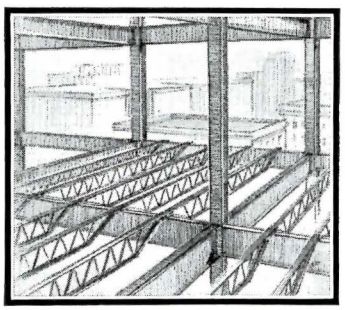
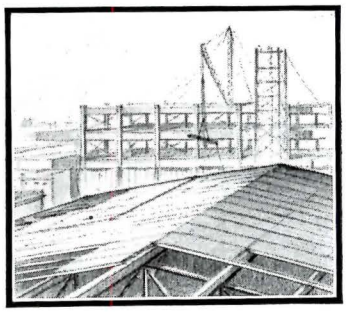


Steel Joists—economical fireproof floor construction, quickly erected without centering. Open Truss and Plate Girder types.



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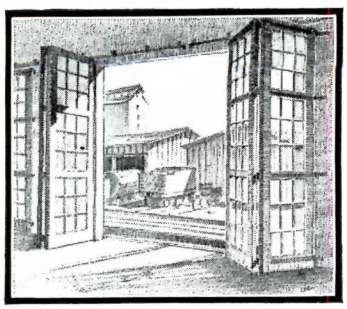
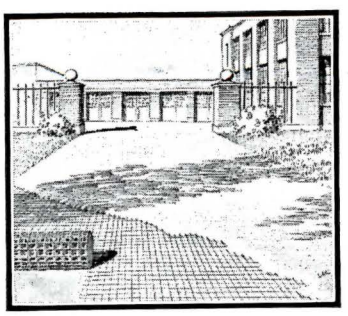


Steel Doors—sturdy, durable and fireproof, stock and special types. Swing Slide, Folding, Lift and Lift-Swing.



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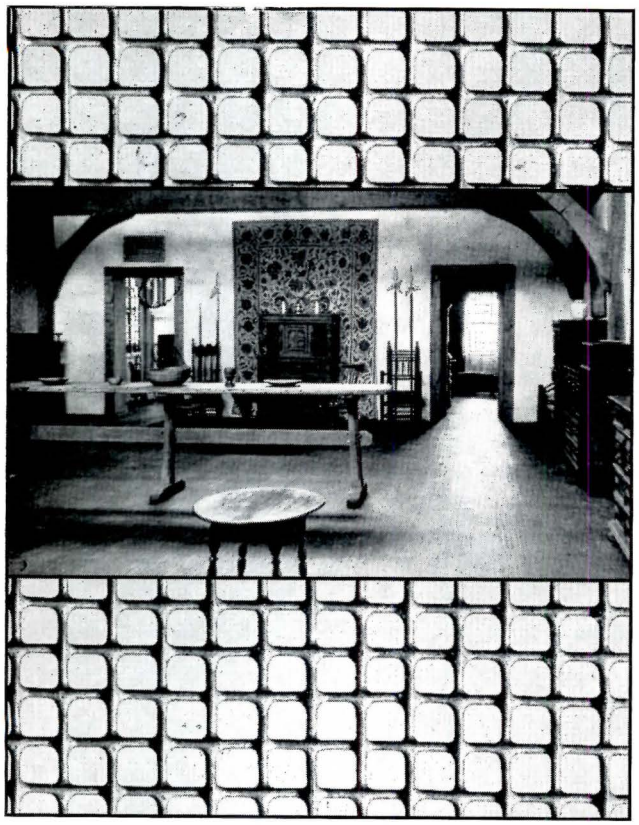

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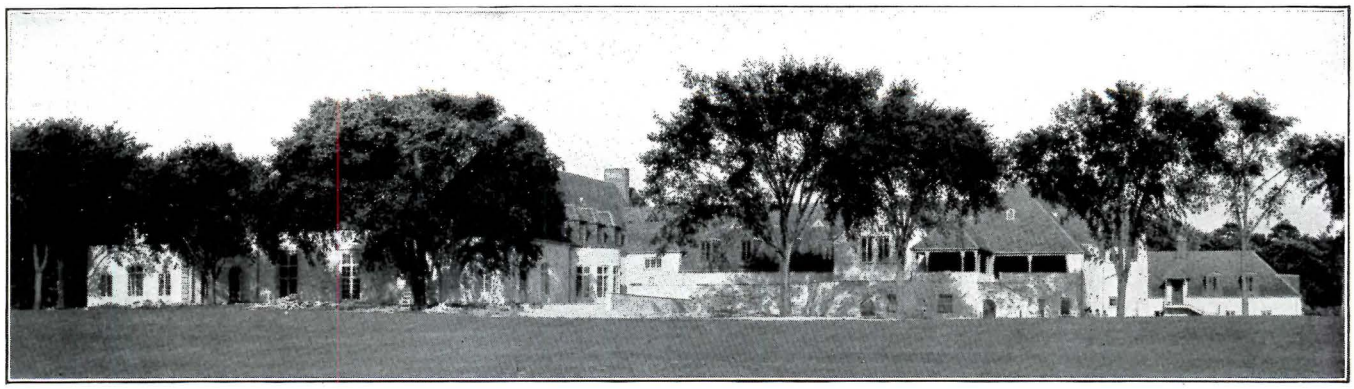

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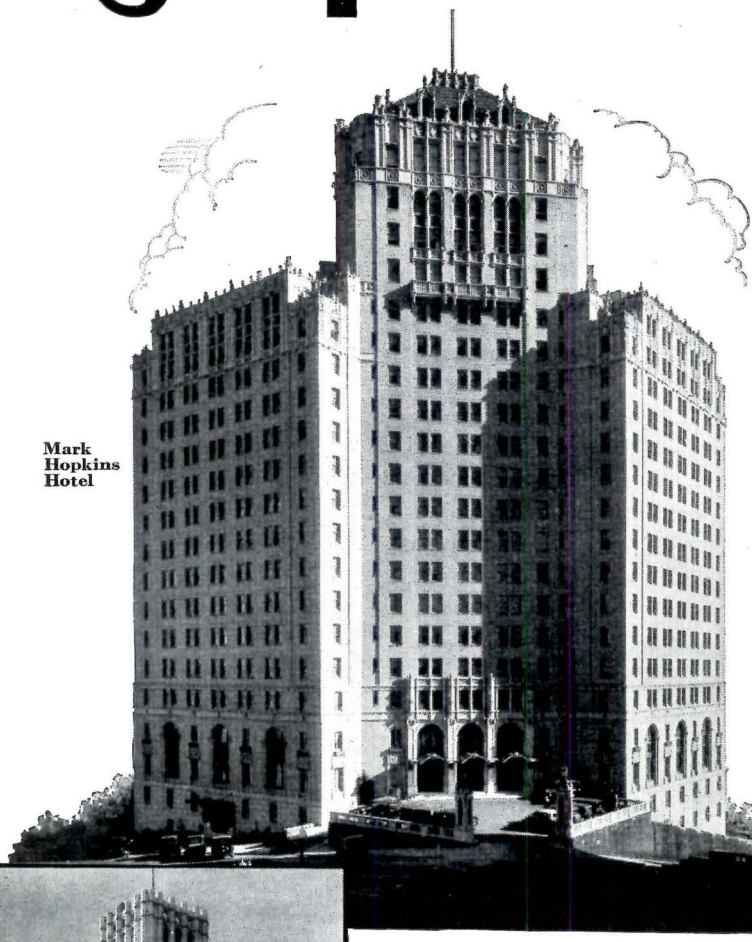
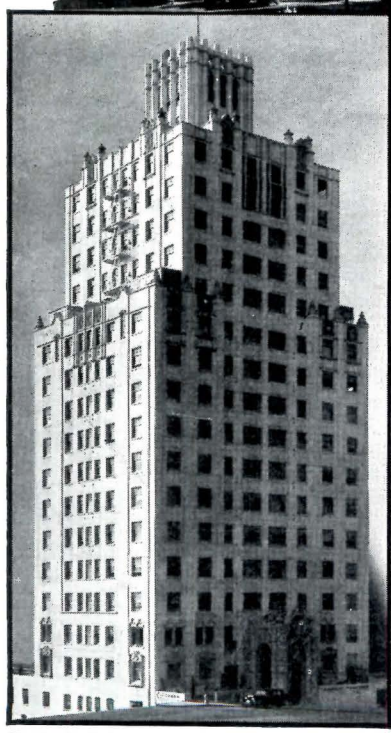
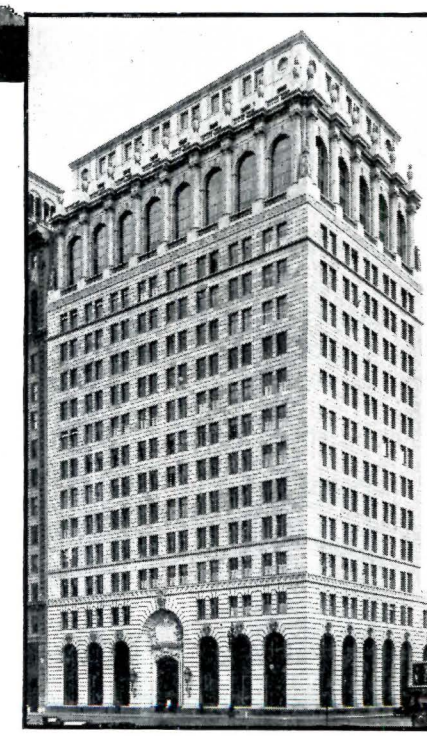


Mark Hopkins Hotel

Pacific States Telephone and Telegraph Building



Cathedral Apartments



Pacific Gas and Electric Company Building

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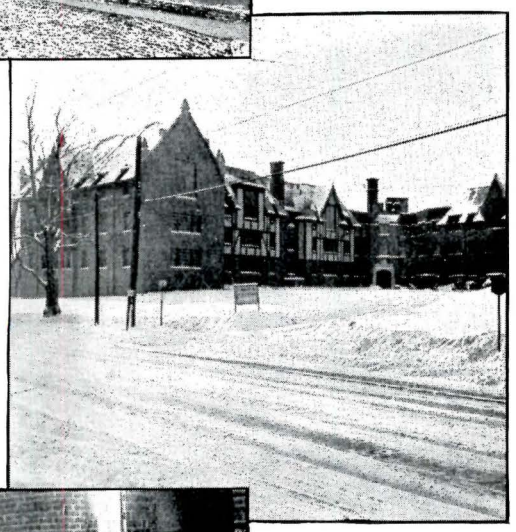
Wide-Flange STRUCTURAL SHAP

(above) The floors of the attractive Hampton Hall Apartment, Pittsburgh, Pa., Herman Kamin, owner, are concrete reinforced with STEELTEX supported on steel joists.



(right) *Beautiful Oakwood* Manor Apartment House, Dayton, Ohio. Approximately 52.000 square feet of concrete floors supported by steel joists. STEELTEX reinforces the floors, and acted as the concrete form.

(left) STEELTEX for Floors is a combined steel reinforcing mesh and concrete form. It is quickly unrolled and cut to any desired length. It can be placed over any type of beam or joist by means of STEELTEX for Floors clips or wedges.

(right) Placing concrete on STEELTEX—water-tight form, correct reinforcing.

"Complies with architects' specifications—

water-tight concrete form. correct reinforcing"

they say about STEELTEX for Floors

ARCHITECTS, engineers, and contractors are welcoming a new concrete floor method that saves materials, time, labor, and money, and gives a cleaner, stronger completed job.

STEELTEX complies with architects' specifications—*water-tight concrete form—correct reinforcing.* Save annoyance, time and—expense. *Build for safety* by rigidly following architects' and material manufacturers' specifications.

Although STEELTEX was announced to the construction industry barely a year ago it is already reinforcing the concrete floors of hundreds of buildings—hotels, apartments, churches, hospitals, schools, theatres, and office buildings.

The pictures show the outstanding adaptability of STEELTEX but you will want complete information. Send for our free book, STEELTEX *for Floors.* The coupon brings it promptly.

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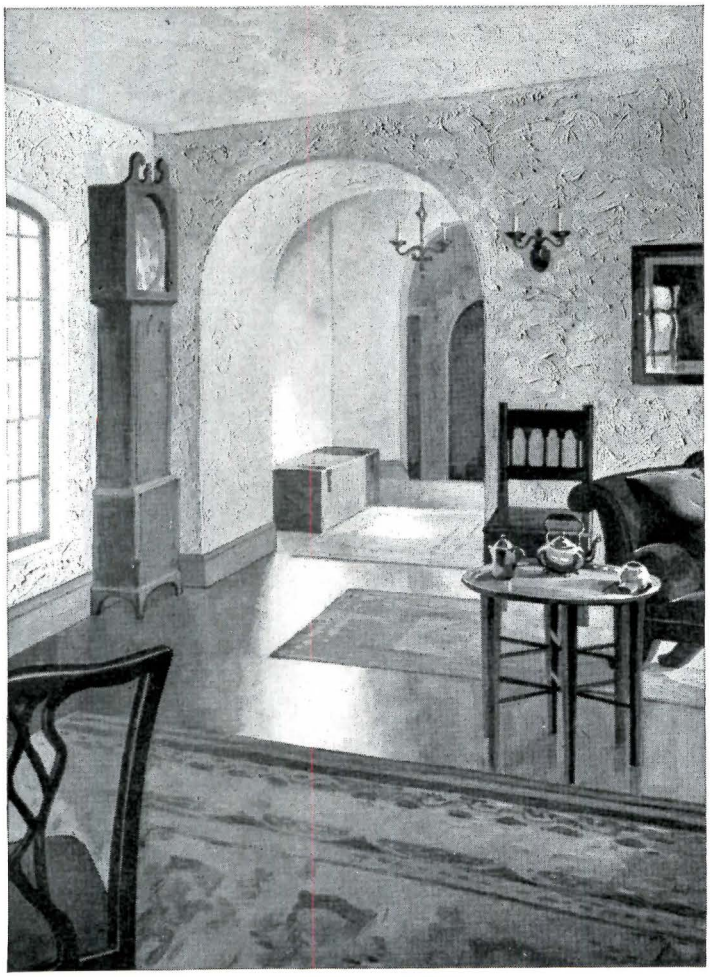

GRACEFUL interiors are among the loveliest charms of today's homes. And the architect plays an artist's part in achieving them. For beautiful walls are commonly a matter of construction.

Decorative interiors require a wall and ceiling construction that will last the life of the building without cracking. STAY-RIB metal lath assures this permanence.

The modern architect completes the interior ensemble with *Milcor Expansion* Metal Casings for door and window openings, and with *Milcor Expansion* Corner Beads for exposed corners and inside angles.

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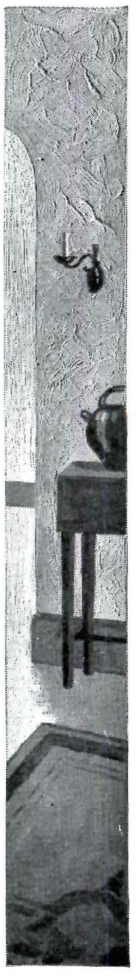
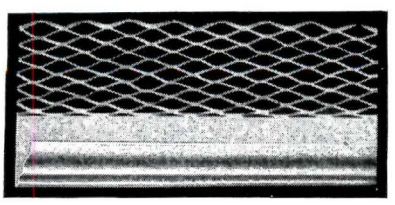
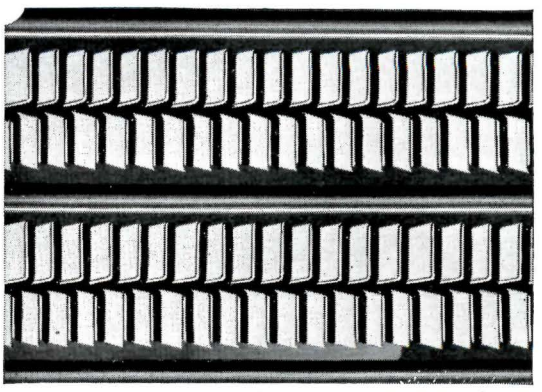
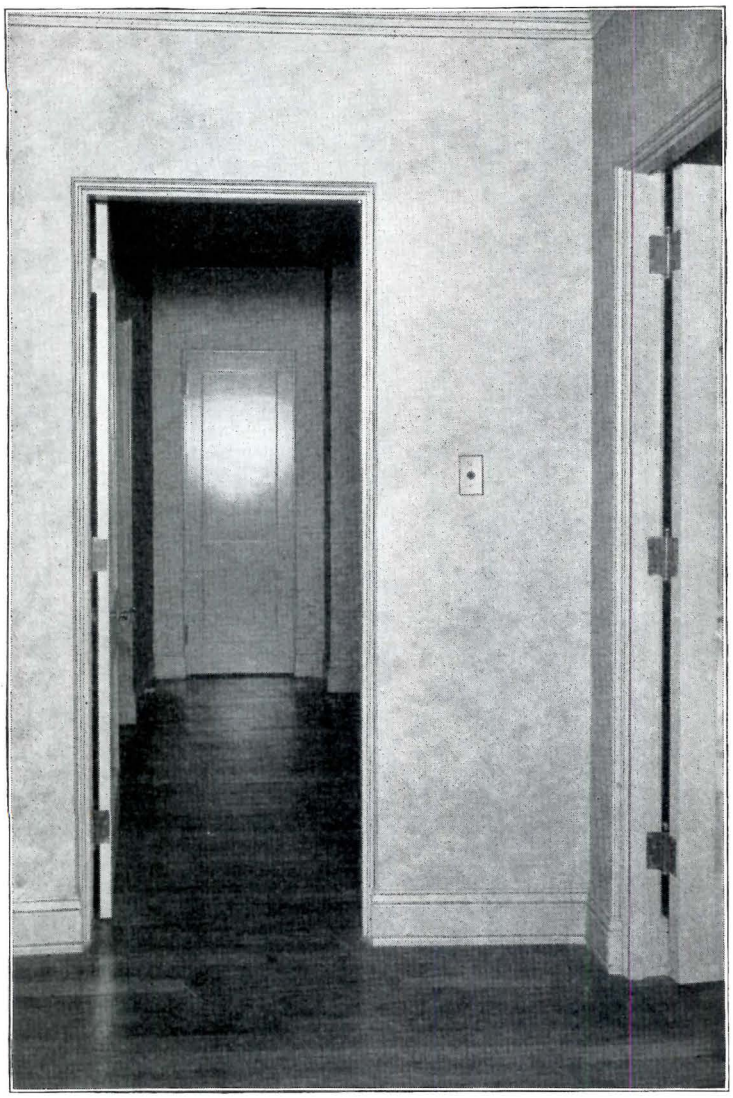


MILCOR PRODUCTS
FOR BETTER PLASTERING



The architectural effects possible with Milcor Expansion Casings are accepted as artistically correct. The old-fashioned wooden casing is eliminated allowing the plastered wall to come flush with the casing. Expansion Casings are made from Tight Coat Galvanized Open-Hearth Steel or Armco Ingot Iron also Zinc and Copper.





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Kalman Steel Buck takes the place of wood buck, ground and standing trim. It eliminates the plaster cracks common to the warping and shrinking of wood buck and definitely increases the amount of wall space. It permits the close interpretation of any profile—provides a positive finish and edge for plaster around openings—and gives the wall a clean-cut, modern beauty. In addition, it does not limit you to the use of stock mouldings. By the use of Kalman-trim, the same effect can be secured for windows. If you haven't received the booklet outlining the 16 advantages of Kalman Steel Buck for enhancing interior beauty, we will mail it to you. Write us.

Kalman Steel Buck

KALMAN STEEL COMPANY

KALMAN STEEL

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Sir Francis Drake Hotel
San Francisco

Weeks & Day—*Architects and Engineers*
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From Coast to Coast—

The beautiful Sir Francis Drake Hotel in San Francisco is indeed an honor to the famed navigator of the sixteenth century for whom it is named. Carnegie Steel Company is also honored that Carnegie Beams were selected to form the steel framework. From coast to coast, architects, engineers and builders have enthusiastically welcomed these new sections and their contribution to steel construction.

In garages, factories, bridges, subways, schools, churches, apartments, hotels and great towering skyscrapers, Carnegie Beams are imparting to structural steel a new efficiency. Their parallel flanges simplify fabrication and erection. Their great strength permits the use of lighter sections, resulting in considerable economy in steel tonnage. Their constant-depth columns present opportunities for substantial savings, both in the drafting room and on the job.

Those contemplating the erection of any type of building involving structural steel, would do well to investigate the advantages of these beams. A handbook, "Carnegie Beam Sections," containing detailed information, will be sent at your request.

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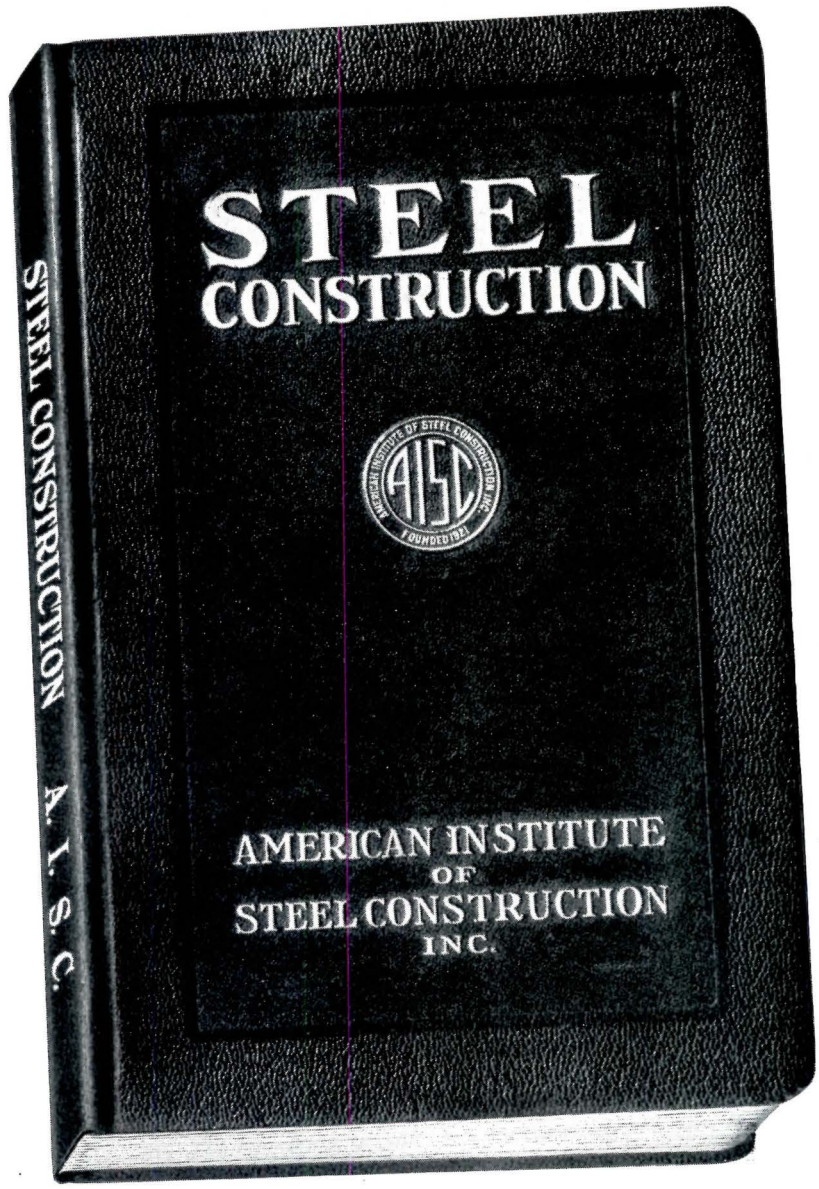

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HERE is a handbook that should be on the desk of every engineer . . . that should be within reaching distance of every architect . . . that should be the first thought of everyone who works with steel. A new kind of steel handbook . . . more usable . . . with all essential data instantly available . . . comprehensive, complete, compact. Forty thousand copies have gone into circulation since its publication a year ago. It is used as a text in 143 technical schools and colleges.

This indispensable book is published by the American Institute of Steel Construction and contains, besides its immensely valuable technical data, other contributions that the Institute has made toward standardization and betterment of structural steel construction. These are The Standard Specification for Structural Steel for Buildings, The Code of Standard Practice and The Standard Specification for Fire-proofing.

No one working with steel can afford to be without this important handbook. It is available from members of the Institute or may be had by sending $1.50 to the American Institute of Steel Construction, 200 Madison Avenue, New York. A coupon is attached for convenience in ordering. Mail it today and a copy of the handbook will be sent to you at once.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

The co-operative non-profit service organization of the structural steel industry of the United States and Canada. Correspondence is invited. 200 Madison Avenue, New York City. District offices in New York, Worcester, Philadelphia, Birmingham, Cleveland, Chicago, Milwaukee, St. Louis, Topeka, Dallas and San Francisco.

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The varying types of construction, the diversified needs of the lather and plasterer all find an adequate solution in the Berloy Metal Lath Family. Every modern trend in building design points to new and different plastered effects and whether the plans call for broad planes of formed surfaces, there is a reciprocal advantage to be found in the right Berloy lath for each need.

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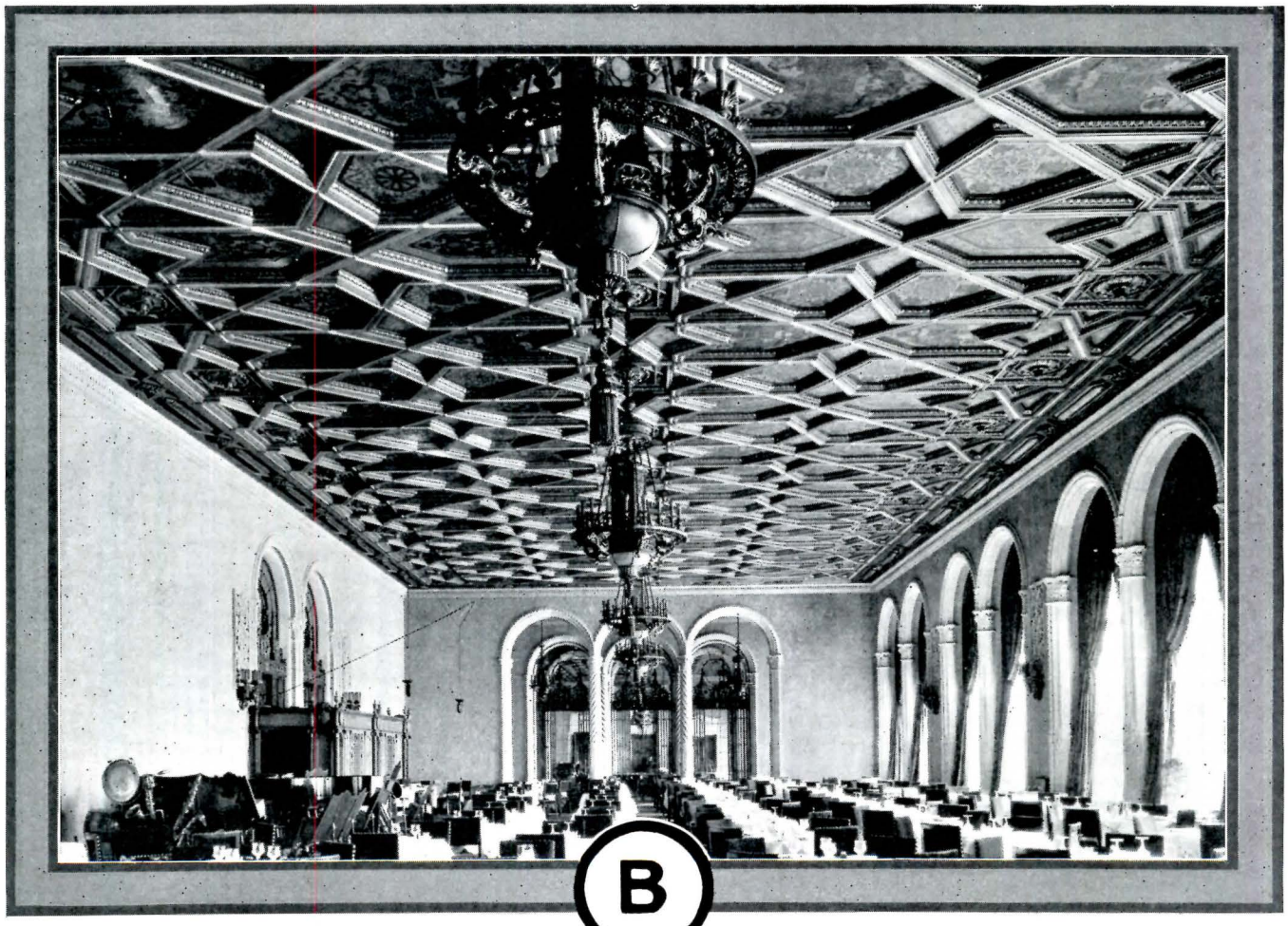

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Concrete Rib Floor Construction

Builders of the City Beautiful

Beauty that is strength, and strength that is beauty is the goal of the architect. Thus he has ever been the inspiration to building progress.

To materialize the architect's forward looking plans, special methods of construction have been developed.

A notable example of this is the Meyer Steelform method of concrete rib floor construction. It meets the modern need for high speed building operation—it makes concrete rib floors the most economical and most practical type of construction.

Meyer Steelforms are installed and removed by an organization especially trained to render the greatest possible cooperation to both architect and contractor. The service of this organization starts with the architect's plans and continues right on through to the successful completion of the concrete floor.

Meyer Steelforms are handled on a rental basis. Warehouses at strategic centers make immediate shipments to the job.

You are invited to ask a representative to call and show you how Meyer Steelforms will help you realize a construction that does full justice to your plans.

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and
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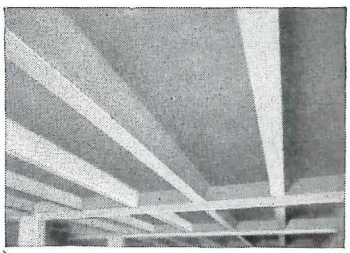
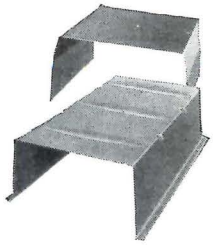


Note the clean-cut, good-looking joists when Meyer Steelforms are used.

Meyer Steelforms are furnished in 1, 2 and 3 ft. lengths.

Standard widths are 20 in. and 30 in. Special widths, 10 in. and 15 in.



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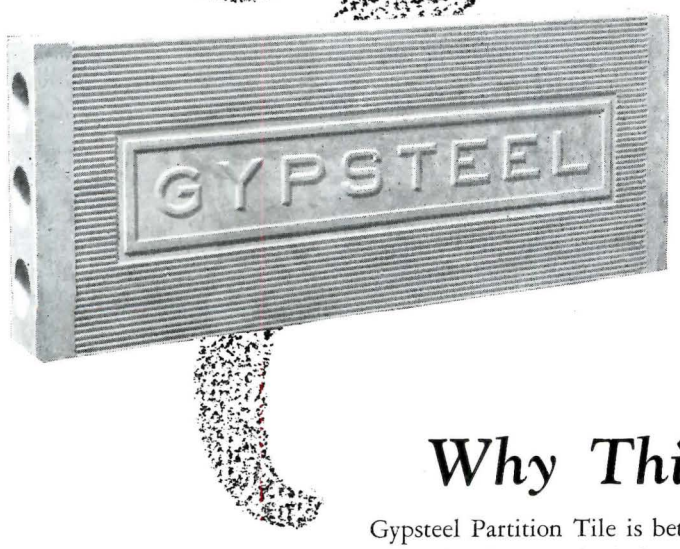
THE ORIGINAL REMOVABLE STEEL FORMS FOR CONCRETE RIB FLOOR CONSTRUCTION

GYPSTEEL

Partition Tile



This Answers The Question

Why This Tile Is Better

Gypsteel Partition Tile is better because the Gypsum in it is stronger and tougher.

The Gypsum in it is stronger and tougher because it is pure and, because the crystals in it are of uniform shape and size, they *bind together like bricks in a wall.*

The crystals are uniform, because our Gypsteel Process gives chemical absolute control each step of the way from its derivation from phosphate rock to the calcined Gypsum. (Oh yes, the Gypsteel Process, by the addition of certain elements and the subtraction of others, makes it possible to derive the purest of Gypsum from phosphate rock.)

Thus, with a perfect crystal formation in the Gypsum, you get a tile that has an added strength and toughness. One subject to far less breakage in shipping, handling and erection.

Wouldn't you say that such a tile would also have greater fire resistance? Likewise, be less absorbent of moisture?

This better tile costs no more than those not as good.

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Strength

all the way through

NATURALLY the purpose of a conveying system is to speed up production and increase the net earnings. Standard Conveyors, all types, because of proper construction, stand up under the grind of daily service, thereby fulfilling, in every sense, the purpose for which they were installed.

Whether it is belt, slat, or roller conveyors; power or gravity; spiral chutes, piling, and tiering machinery; lift elevators or pneumatic tubes, there are Standard features that are the positive assurance of dependable conveyor service with economy.

Architects who wish to furnish the most highly efficient plans will do well to get more information about Standard Conveyors.

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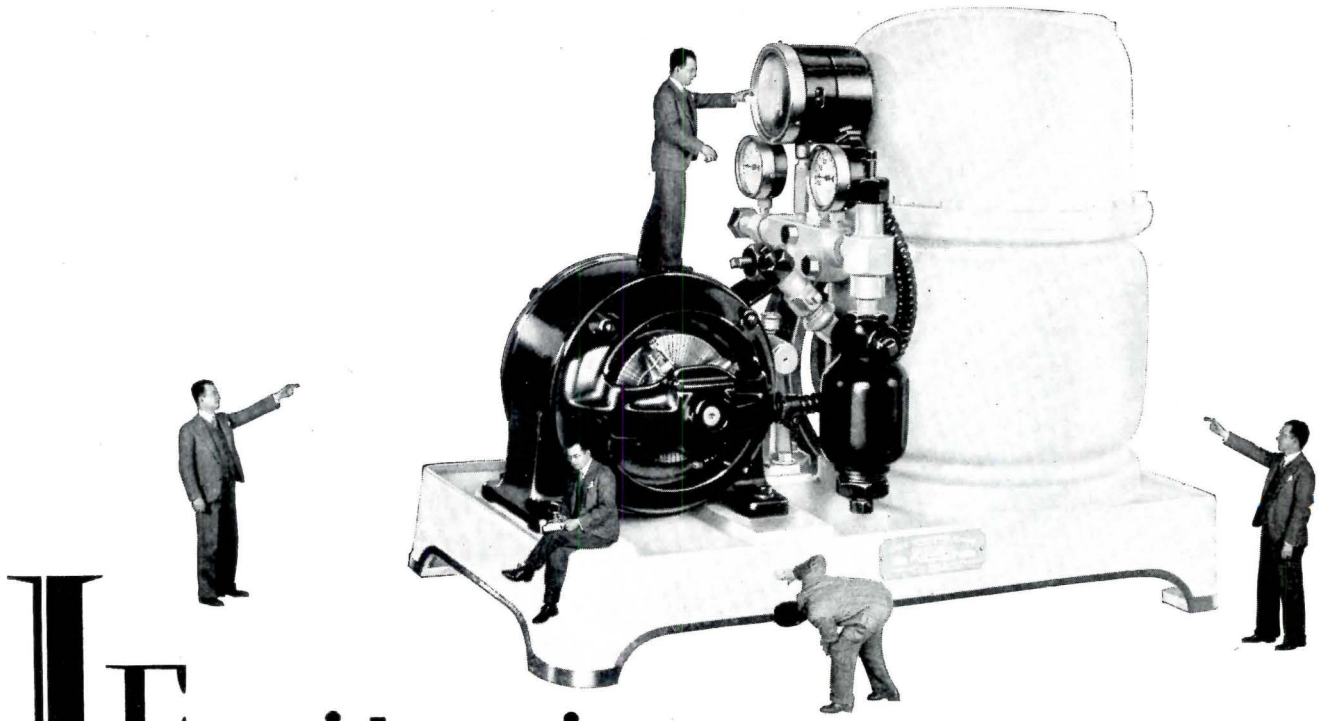

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You wouldn't have room enough for a Lipman if its size were as big as its value. But fortunately mere size is not a measure of value. A two-carat diamond is worth a train load of sand.

The Lipman is almost invaluable to the user of commercial refrigeration. And it is the cheapest machine he can buy—not because of its first cost, but because of its ultimate cost. The true measure of value is always *the cost of ownership.*

The cost of ownership of a Lipman, meaning the cost of depreciation *plus* the cost of service *plus* the cost of operation, is extremely low. Judged on this accurate basis, the Lipman offers unmistakably the biggest value.

Write today for full information. Or, if you wish, let us send a Lipman engineer to make a free analysis of your refrigeration problem. There's no obligation whatsoever.

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1 STRENGTH—The great strength of steel provides the most rigid framework known in building construction—no sagging or settling, no expansion or contraction to cause plaster cracks in walls and ceilings. Here is solid, skyscraper construction for residences.

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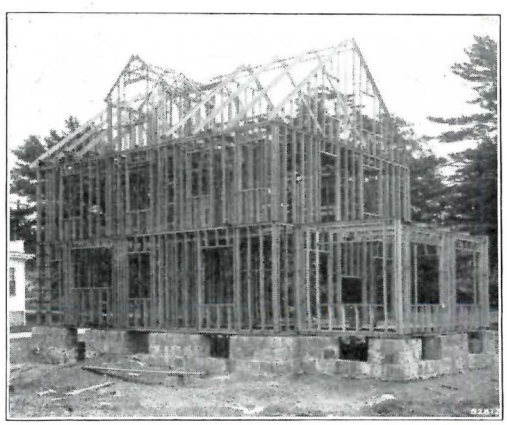
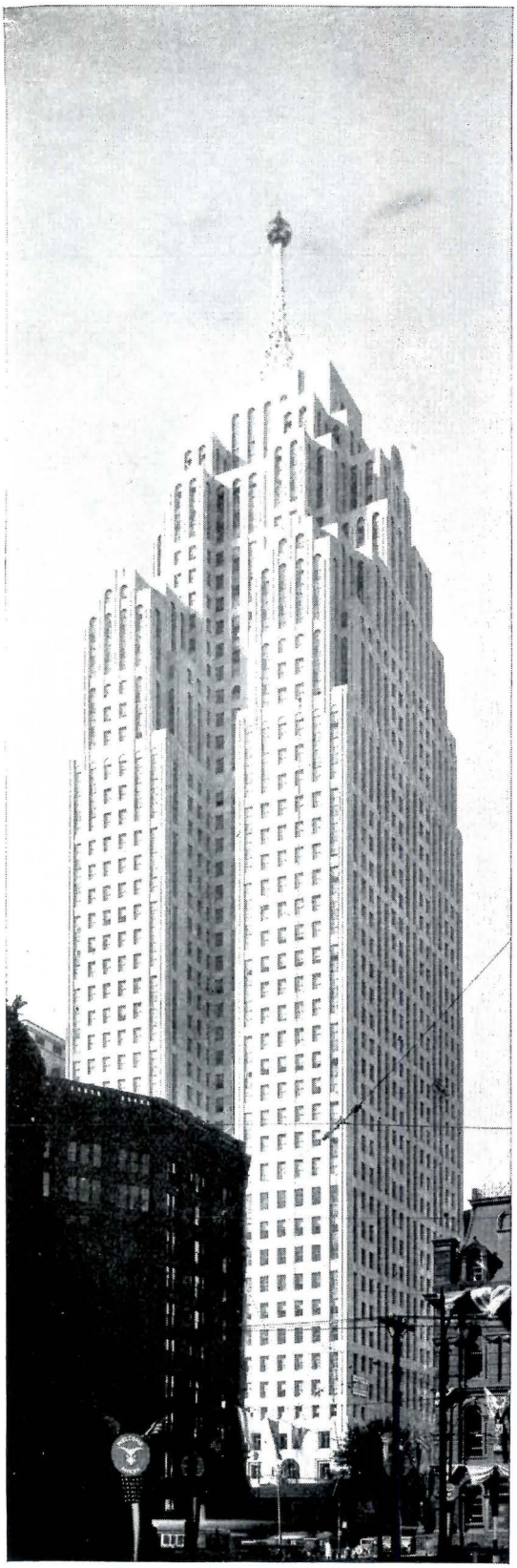


STEEL FRAMING
THE MODERN METHOD OF HOUSE CONSTRUCTION



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TWENTY expert, responsible, well established concerns, whose addresses are listed below, offer you the fruit of intensive experience in the problems of damp-proofing and plaster key.

Par-Lock Plaster Key, long recognized as the maximum specification for protected plastering was applied on the interior of all exterior walls of the New Penobscot Building, Detroit, by the Par-Lock Appliers of Michigan—a symbol of interior worth to match its magnificent exterior.

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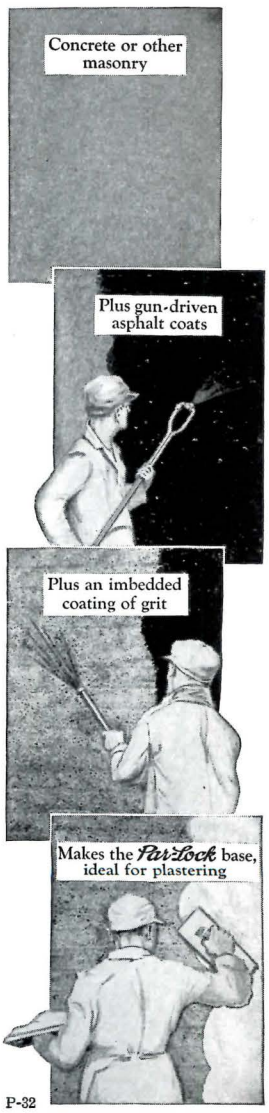
The nearest Par-Lock Applier is your logical resource in assuring walls and ceilings that are permanently fine.



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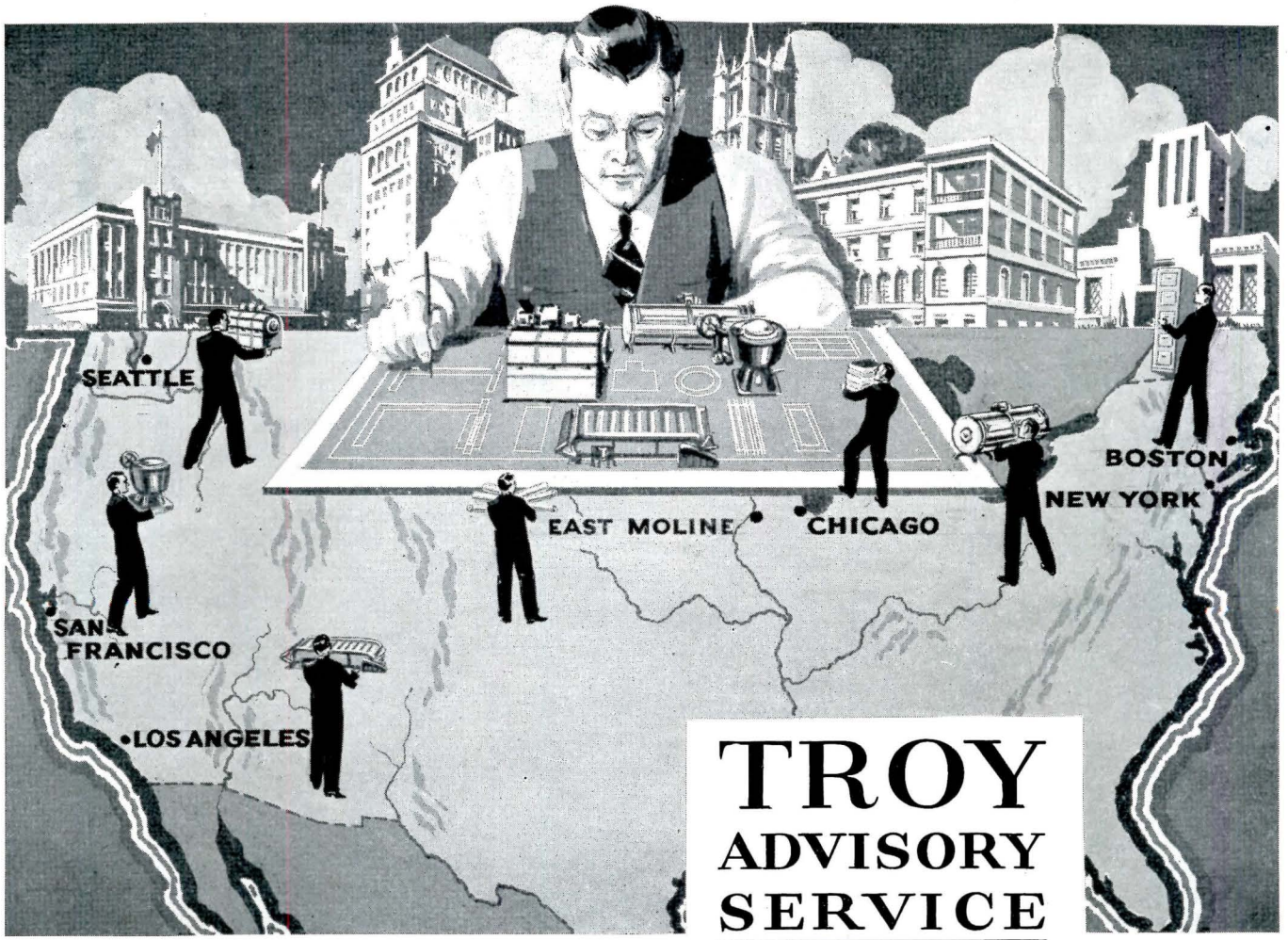

Sound Institutional Laundry Ideas... Whenever and Wherever You Want Them

IN order to cooperate with you promptly, Troy engineers comprising the TROY ARCHITECTS' ADVISORY SERVICE are located in the principal centers throughout the country. ¶ Consult these specialists whenever you are planning a laundry for a hospital, hotel, school, or similar institution. Take advantage of their seasoned experience in layout, equipment and specifications. Let them cooperate with you on matters of machinery placement, routing without crossing traffic lanes, power conservation, provision for future expansion. ¶ This service is rendered to responsible individuals and firms...without cost, without obligation. TROY LAUNDRY MACHINERY CO., INC., Chicago, New York City, San Francisco, Seattle, Boston, Los Angeles. *James Armstrong & Co., Ltd., European Agents: London, Paris, Amsterdam, Oslo.* Factories: East Moline, Ill., U. S. A.

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AN ANNOUNCEMENT—

delayed 10 years

FOR 26 years we have pioneered, developed, and built oil heating equipment. In that time we have become the largest manufacturer of oil burners in the East, where we are also one of the foremost distributors of light and heavy Fuel Oil.

After a quarter century, this announcement to the architectural profession may be said to be a bit tardy.

But it has been held back because Petro was ahead of its time. Ten years ago, even five years ago, the story of this burner would have been accepted as the story of just another oil burner. Few indeed recognized then the urgent need for equipment so well engineered, so perfectly built. And even more serious, the number of dealer organizations sufficiently skilled in proper installation practice, might have been counted on the fingers of two hands.

Under these circumstances, widespread distribution and general publicity would have been rather premature. It would have jeopardized the good name of Petro, for no oil burner is any better than its installation.

But now, Petro has come into its own. With a wealth of engineering background, with nation-wide acceptance, with highly skilled Petro distributors in all important cities, we offer to the builders of America, the finest and most complete line of fully engineered oil burners the industry has produced.

Architects will be prompt to secure detailed information of this unusual line. Your local Petro dealer will gladly cooperate with you, or write us direct.

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PETROLEUM HEAT & POWER COMPANY
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PETRO

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DOMESTIC OIL BURNERS

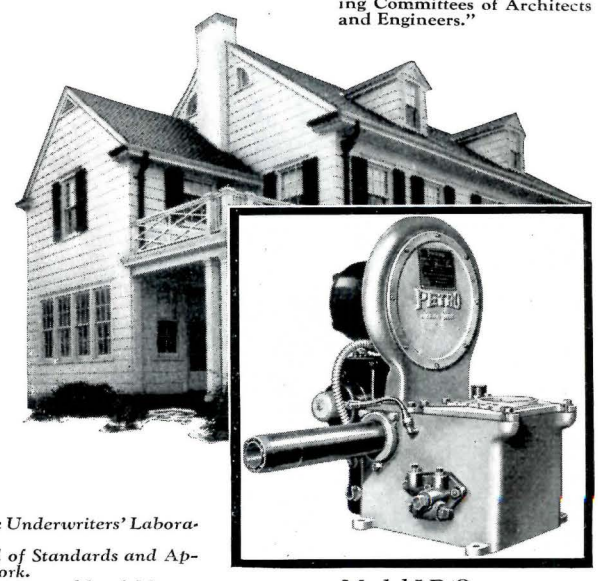
ALL Petro Burners are of the mechanical atomizing type, and are built in such a number of sizes and models as to cover the entire heating and power field. Capacities range from 200 sq. ft. of radiation to 375 H. P. per burner.

Models are built for either fully automatic, semi-automatic or straight manual control.

All Petro Domestic Oil Burners are fully automatic in operation. Ignition is either straight spark or combination spark and gas. American Oil Burner Association No. 3 Specification Oils, or lighter, are appropriate.

Service hot water may be heated from the main heating boiler through standard indirect heaters during both summer and winter.

All Petro burners have been approved by "The Investigating Committees of Architects and Engineers."



Model LD-O

The Petro line of fully automatic domestic burners consists of five models, all allied in design and method of operation. They use the intermittent principle of firing, and when inoperative entail no standby oil, gas or electric current losses.

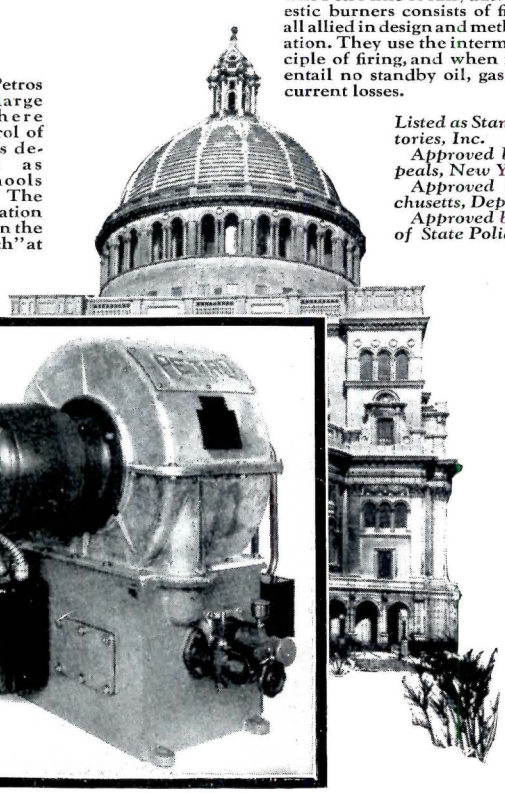
Listed as Standard by The Underwriters' Laboratories, Inc.

Approved by the Board of Standards and Appeals, New York, New York.

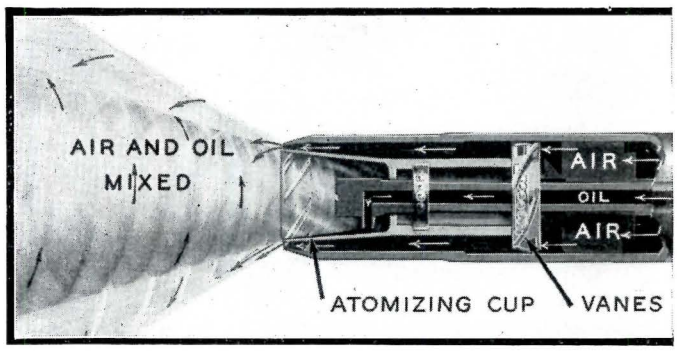
Approved by the Commonwealth of Massachusetts, Dept. of Public Safety.

Approved by State of Connecticut, Department of State Police.

High capacity Petros are found in large structures where automatic control of temperature is desired, such as churches, schools and hospitals. The first Petro installation in the East was in the "Mother Church" at Boston.



Model LD-4



This is the heart of all Petro Turbine Atomizing Burners —the basic feature that has made possible the extraordinary records established by Petro.
It is the Air Turbine Driven Atomizing Cup!
It has long been admitted that the best and easiest manner by which fuel oil could be atomized is that of centrifugal force, and Centrifugal Atomization has been Petro's for over a quarter of a century!

A GREAT OIL COMPANY IS BEHIND PETRO

The experience gained in over a quarter century's specialized application to the design of efficient equipment for the combustion of fuel oils, and over thirteen years of actual experience in delivering the oils themselves, proved the need for a complete line of oil burners to cover the industry's entire needs.

Part of the great fleet of Petro oil delivery trucks operating in the Boston territory, on parade.

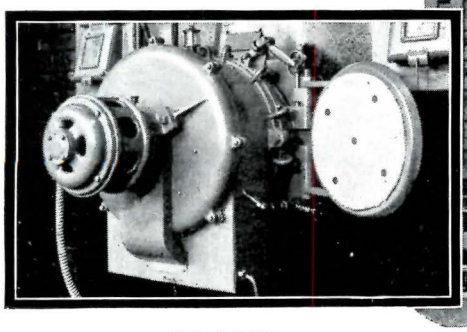
PETRO

REG. U.S. PAT. OFF

INDUSTRIAL OIL BURNERS

The average one and two boiler low pressure heating plant is excellently handled by the unit type "B" Burners.

The Medical Tower, Newark, N. J., a modern professional building is Petro equipped.



Model B2

ALL Petro Industrial Turbine Burners are designed to handle oils as heavy as 10° Baume, preheated. Ignition is manual, but automatic high and low flame operation is obtained by means of the PETRO pressure regulators.

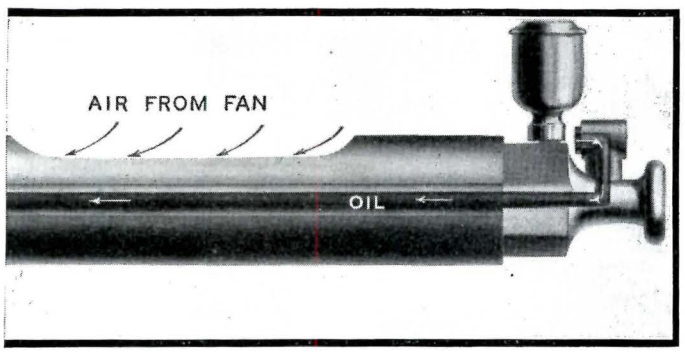
The Petro Type "LA" Burner consists of a Petro gun assembly and a Petro Air Register, which controls the volume and distribution of the secondary air for combustion.

In the Petro combination fan and pump set both air fan and oil pump are operated as one unit driven by a single motor. These sets are commonly installed in duplicate and insure continuity of operation.

The Petro Type "B" Burner in general design and operation is the same as the "A" Line.

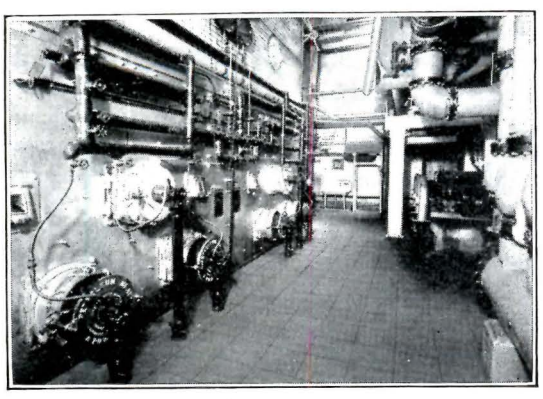
Petro Type "LA" Equipment is:
Listed by the Underwriters' Laboratories, Inc.

Approved by the Board of Standards of Appeals, New York, New York.

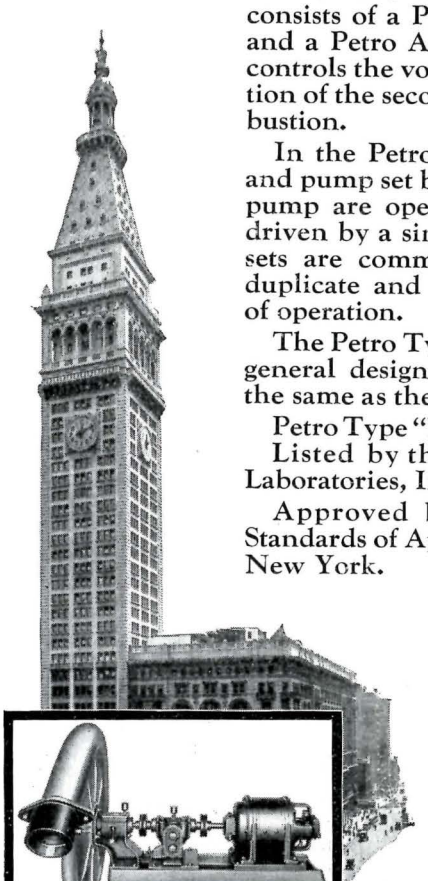


Petro's engineers simply took the cup off the motor shaft, put a highly efficient air turbine wheel on the cup and used the air discharge from the fan to spin the turbine wheel. Result—a 50% increase in cup speed with no increase in motor r.p.m.

Petro's high cup speed and high efficiency is one of the many reasons for its favor among the leading architects and engineers of the country.



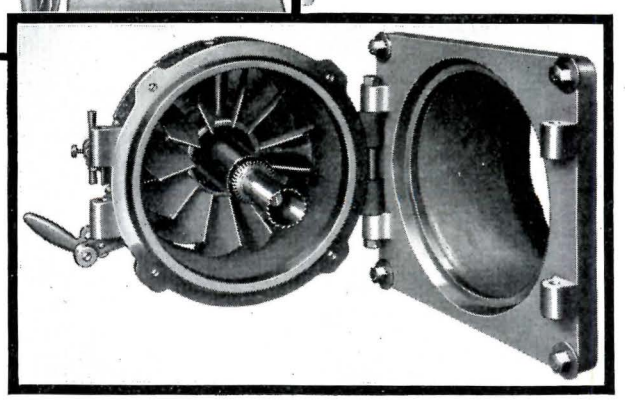
The modern power plant of the Cascade Laundry, New York. The cleanliness, ease of operation and inherent ability of Petro equipment to meet a widely fluctuating load is best exemplified by this modern power plant equipped by Petro.



PETRO "LA" BURNERS

The engineered perfection of Petro burners warrant their selection for use in many of the world-famous buildings of the United States.

The Metropolitan Life Insurance Company Building, New York, is a noteworthy Petro installation.

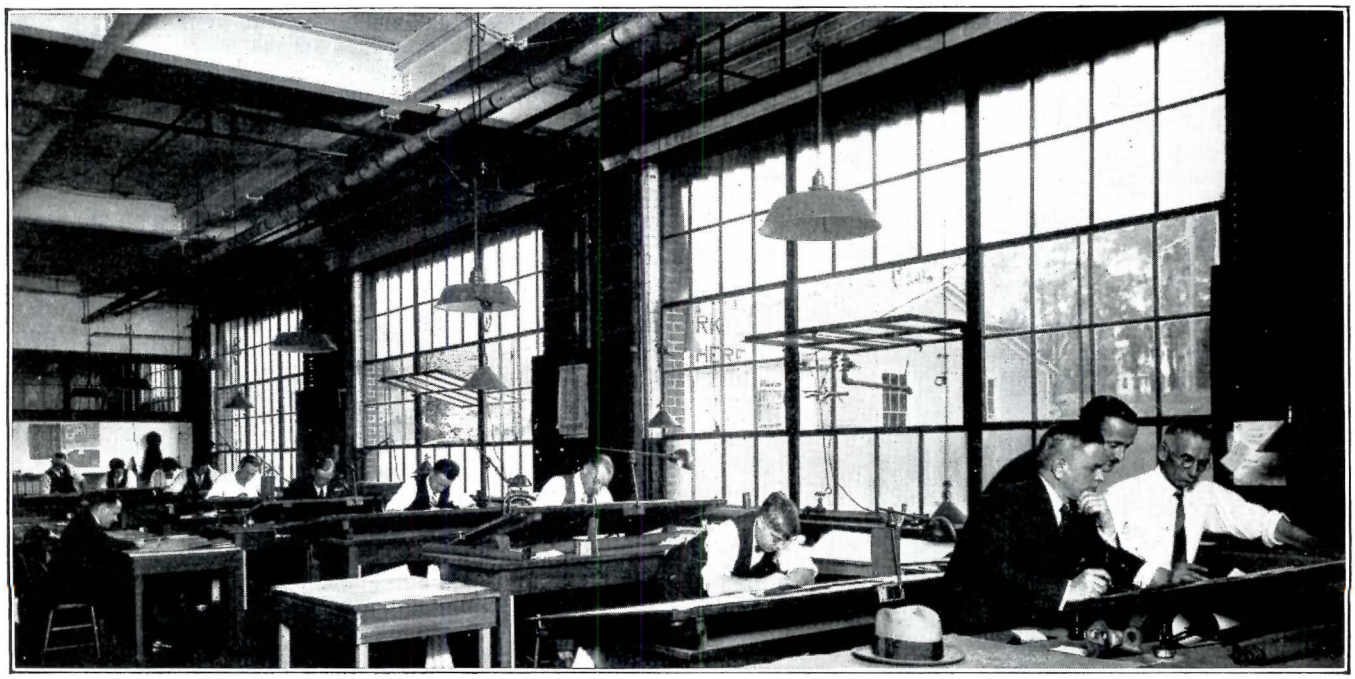


A Petro "LA" Burner swung open, with "gun" casing removed, showing the Adjustable Air Register Vanes, the Atomizing cup with its air turbine wheel, and the distributor tip at the end of the fuel tube.

Upper left: A Petro Motor Driven Combination Fan and Pump Set.

PETRO

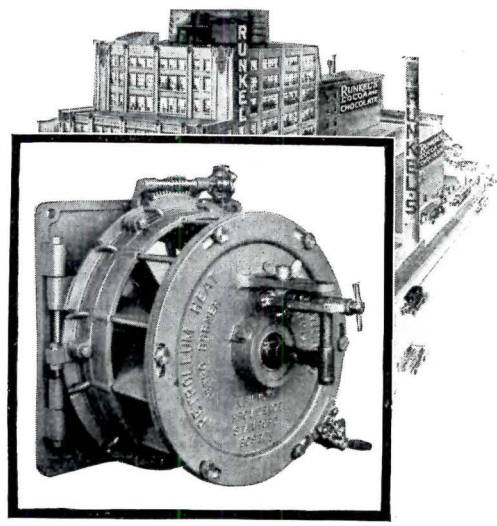
REG. U.S. PAT. OFF



The Petroleum Heat & Power Company *is a Great Engineering Organization*

TWENTY-FIVE years ago, W. C. McTarnahan recognized the value of engineering in oil burner design and construction. He associated himself with M. A. Fessler, one of the real pioneers in oil burning. Fessler was an engineer of signal ability. Together they developed the burner now known as Petro.

Today Mr. McTarnahan has surrounded himself with skilled engineers. These men come from 18 different colleges and universities, such as Massachusetts Tech., Stevens, Brown, Yale, Columbia, Penn U., and New York U.



The PETRO Mechanical Atomizing Oil Burner and Air Register finds application in the large central station and power plant field. For nearly ten years this type of equipment has met with great favor among the leading architects and engineers.

(Above) Runkel Bros. Chocolate Works, New York, one of the modern power plants equipped with Petro Mechanical Atomizing Oil Burners.

An actual count in the factory shows a trained engineer —electrical, mechanical, combustion and heating—for every 7 mechanics on the payroll. Small chance indeed, for a Petro to ever reach the field without measuring up 100%.

And with 6 times as many engineers as salesmen, Petro sales increased 400% in 1928 and 1224.2— in January, 1929!

Architects are urged to avail themselves of the services of this staff on any heating problem. For detailed information confer with the local Petro dealer or we invite you to direct your inquiry to the

PETROLEUM HEAT & POWER COMPANY, STAMFORD, CONNECTICUT.

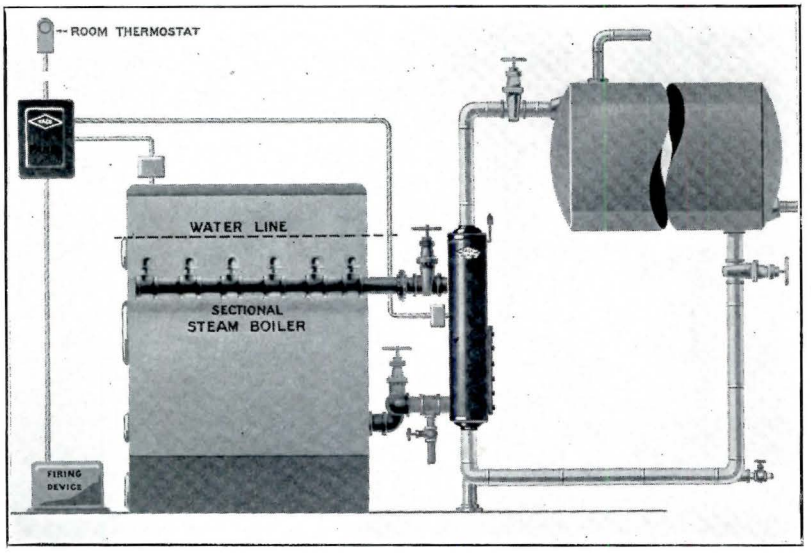
Low-cost Year-round
AUTOMATIC HOT WATER SUPPLY..
for the Oil-heated Building

THE Taco water heater heats the water supply from the same flame that heats the home or building. The cost of maintaining this *automatic* hot water supply during the heating season is next to nothing. During non-heating months the cost is lower (in most parts of the country) than that of any type of automatic water heater.

The Taco water heater can be hooked up with any standard heating boiler and oil burner. The entire operation is automatically controlled, winter and summer, by means of the patented Taco Abbott system.

Endorsed by heating engineers. Taco heaters supply ample, clean hot water in buildings large and small, with oil, gas or coal-fired heating boilers.

We will be glad to furnish full information and engineering data in connection with specific jobs, or for general reference. Write Taco Heaters, Inc., Dept. D-2, 342 Madison Avenue, New York City.



WATER from the steam or hot water boiler of the furnace passes through the Taco shell and back to the boiler. In passing through the shell this boiler water surrounds a copper coil through which the domestic water supply flows. The domestic water, heated by the boiler water, flows automatically up to the domestic water supply tank. Even during non-heating months hot water is supplied continuously and automatically, by the oil burner at trifling cost. Control of the entire system is coordinated, simplified, and made automatic by the patented Taco Abbott system.

TACO

AUTOMATIC *FUEL-LESS* WATER HEATERS

The Dunham Differential Vacuum Heating System

Baltimore Trust Co. Building
Baltimore, Md.

TO the rapidly growing list of outstanding skyscrapers to be heated by a Dunham Differential Vacuum Heating System is added Baltimore's new 34-story banking house.

The structure will be the tallest in the city and the highest building south of the Mason-Dixon Line. Indeed it is said that its height of 484 feet is exceeded in the South only by the Washington Monument. The rentable floor space of more than 200,000 square feet exceeds that of any other building in the city.

The first floor will be given over to the Bank and stores. Three mezzanine floors will also be devoted to banking. Seventeen typical office floors will rise above the banking section. At this point there will be a set-back where the thirteen additional floors of the tower begin. The exterior of the first four floors will be of stone, the remainder of the structure to be of brick decorated with stone.

Associated Architects:
Taylor & Fisher
Smith & May

Consulting Engineer:
Chas. L. Reeder

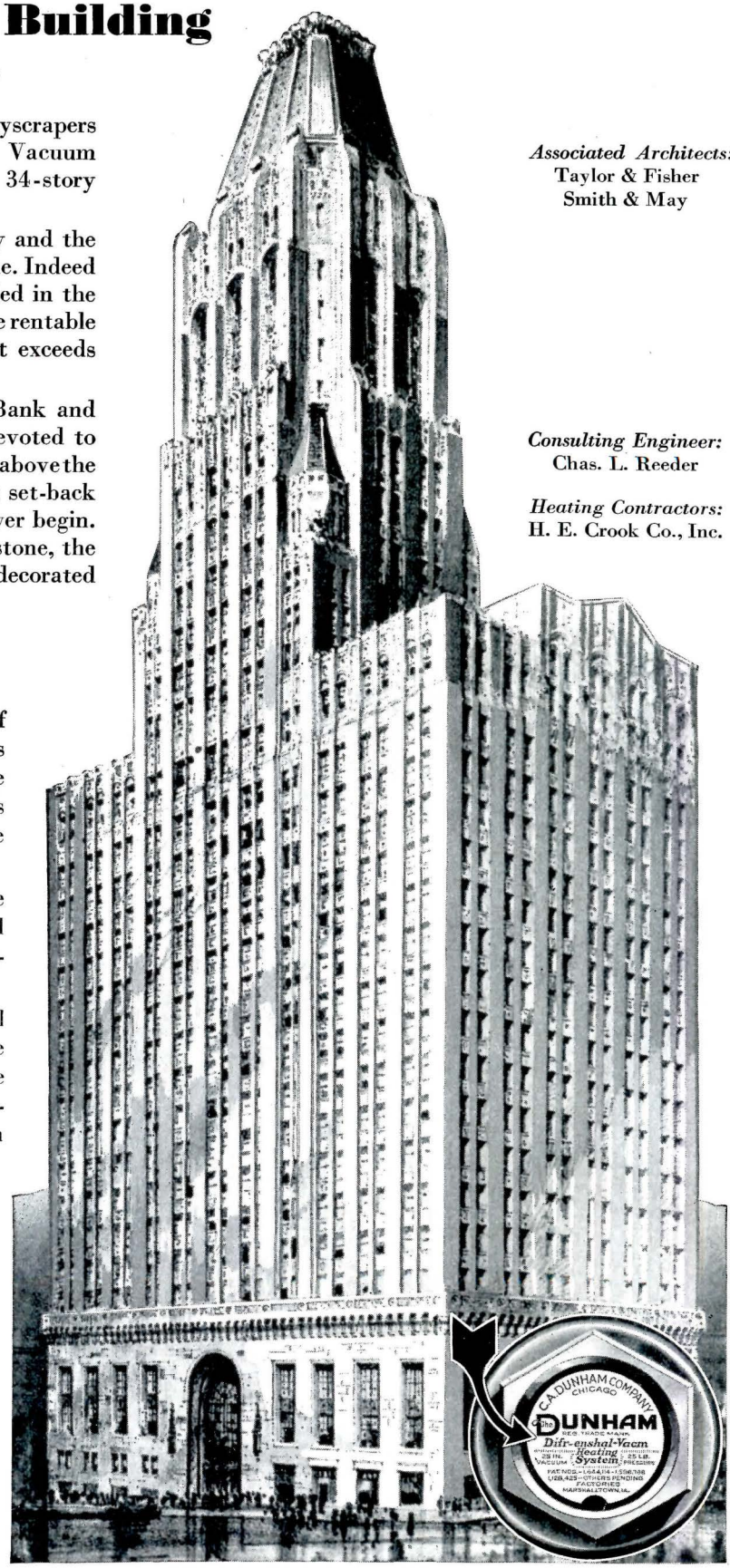
Heating Contractors:
H. E. Crook Co., Inc.

Dunham Differential Vacuum Heating System to be Installed

Steam will be generated in the central portion of the basement. The distributing system provides separate mains for feeding the hot water storage equipment and blast radiation. It also provides separate mains for feeding direct radiation in the several zones.

The main riser will run to a pipe space above the fifteenth floor and on to the thirty-second floor. The main in these spaces will feed downward to all floors.

Each of these main distribution systems will have its individual return lines connecting to the Dunham Differential Vacuum Pumps in the basement. The returns from the blast radiation and hot water systems will run to a Dunham Duplex Vacuum Return Line Pump which will return condensation from these to the boiler.



U. S. Patent No. 1644114. Additional patents in the United States, Canada and Foreign Countries now pending.

Over eighty sales offices in the United States and Canada and the United Kingdom bring Dunham Heating Service as close to you as your telephone. Consult your telephone directory for the address of our office in your city. An engineer will counsel with you on any project.

C. A. DUNHAM CO.
DUNHAM BUILDING
450 East Ohio Street, Chicago

—further evidence that AEROFIN (The Standardized Light-Weight Fan System Heat-Surface) is used by the best for the best

New York Athletic Club

Photos, Brown Bros.

YORK & SAWYER
Architects

CLYDE R. PLACE
Consulting Engineer

CHAS. T. WILLS, INC.
General Contractor

ALMIRALL & Co.
Heating Contractors

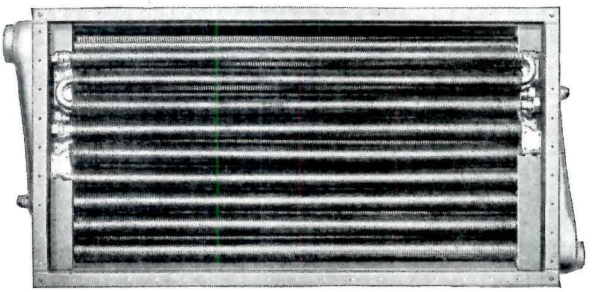
AMERICAN BLOWER CO.
Fan System Apparatus

AEROFIN's standardized encased unit construction, light-weight, and extraordinary compactness not only make possible, but inspire a finished installation in keeping with the finest modern Architecture and Engineering. The fact that AEROFIN's installed cost is less than heavier, bulkier, corrosive surface is fortunate but far less important.

Write to Our Newark Office for Piping Diagrams and Detail Information on any or all Types.

LOW PRESSURE AEROFIN, Tube-Plate Construction, for pressures up to 50 lbs. gauge.

UNIVERSAL AEROFIN, continuous seamless tubes, multiple-coil construction, for pressures from 2½ to 150 lbs. gauge. (Illustrated.)



HIGH PRESSURE AEROFIN, continuous seamless tubes, for pressures from 25 to 350 lbs. gauge (Temp. 500° F.)

All Units in standardized steel Casings, ready for Pipe and Duct connections

Manufactured by

AEROFIN CORPORATION

850 Frelinghuysen Avenue, NEWARK, N. J.
39 Cortlandt Street, NEW YORK
United Artists Building
DETROIT

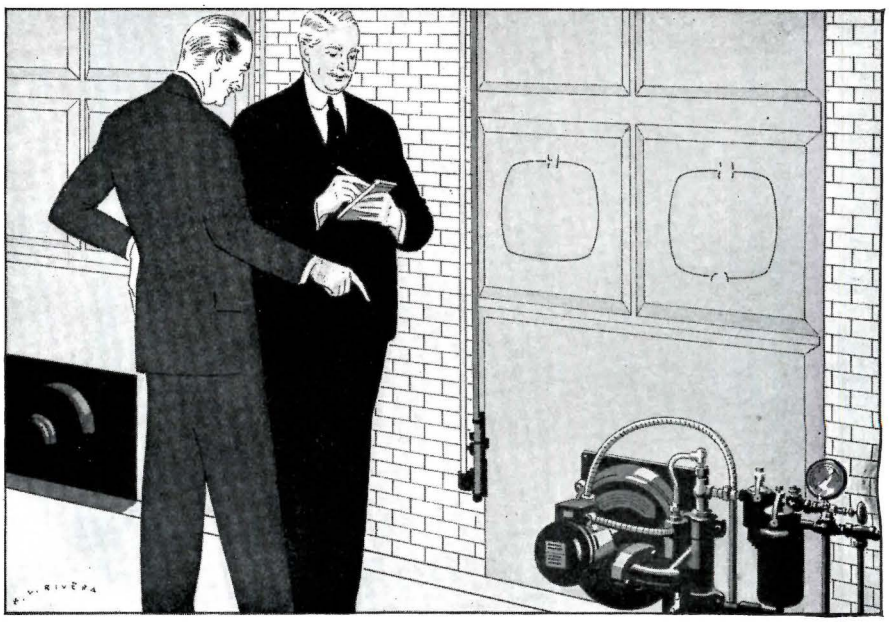
Burnham Building
CHICAGO
Land Title Building
PHILADELPHIA

Oliver Building
PITTSBURGH
Paul Brown Building
ST. LOUIS

AEROFIN is sold only by Manufacturers of nationally advertised Fan Heating Apparatus

"These Oil Burners paid for themselves" ~ ~

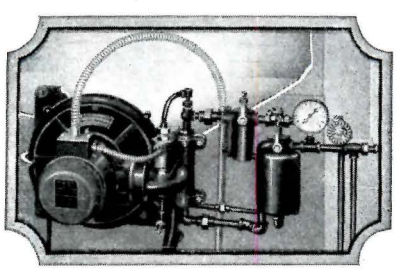
Vick's Chemical Company gets "perfect satisfaction" with Johnson automatic oil burning equipment



A high standard of efficiency has been set at the Philadelphia plant of the Vick Chemical Company, where exacting temperature control is essential in the manufacture of Vick's VapoRub. The superintendent of this factory writes:

"We have used the equipment for about two years with perfect satisfaction, during which time the saving in fuel and labor alone has been more than enough to pay for our two installations, aside from eliminating all the dust and also the storage space for coal."

There is no longer any necessity for boiler room extravagance. Heat supplied by Johnson Oil Burners is efficient because there is no waste in banking fires; no unburned fuel to fall into the ash box. Fuel is burned only when heat is needed. Labor costs are reduced because one man can easily take care of an entire battery of boilers. Ash removal expense is entirely eliminated.



Awarded Gold Medal, Sesqui-Centennial Exposition, Philadelphia, 1926, for "Excellence of workmanship and completeness of design"

For Every Heating and Power Purpose

In homes, large buildings, factories and industrial plants Johnson oil burning equipment is receiving enthusiastic endorsement from coast to coast. Johnson Rotary Burners, with either manual, semi-automatic or full automatic control, are made in three styles and six sizes—giving a range of from 250 to 27,800 square feet of steam radiation or the equivalent. We also manufacture natural draft, whirlwind, low pressure air and steam atomizing oil burners; also electric and steam driven oil pumping and preheating equipment.

And each product, fully guaranteed, is the result of more than 23 years experience in the exclusive manufacture of oil burning equipment. Our Engineering Department will be glad to help you in the solution of your heating or power problems.

Separately Bound Copies of our Catalogue in Sweet's for drafting room use will be mailed on request.

JOHNSON OIL BURNERS

Listed as Standard by the Underwriters' Laboratories

S. T. JOHNSON CO.

Main Office and Factory, 940-950 Arlington Street, Oakland, California

Factory Branches

SAN FRANCISCO, SACRAMENTO, STOCKTON, PHILADELPHIA

YOU WILL FIND OUR LOCAL REPRESENTATIVE'S ADDRESS IN YOUR TELEPHONE DIRECTORY

The Traveler's Insurance Building, Hartford, Conn.

Architects: Voorhies, Gmelin and Walker, New York City. *Engineers*: Meyer, Strong and Jones, New York City. *Heating & Ventilating Contractors*: Baker, Smith & Company, New York City.

Setting a good example of "*Life Insurance*"....

THE Traveler's Insurance Building in Hartford provides ideal indoor working conditions—because it has an ideal system of ventilation. Good ventilation is life insurance—without premiums! The "Traveler's" sets a good example.

In this beautiful building the health of outdoors is brought to the indoor worker. 385,333 cubic feet—over 14 tons—of outdoor air is circulated every minute . . . air that has been filtered clean . . . *controlled* air . . . warmed to precise temperatures.

Twelve Sturtevant "Silentvane" Fans are used . . . five "blowers" and seven "exhausters"—with capacities from 9,800 to 52,000 C.F.M.

Sturtevant Ventilating Equipment has enjoyed the endorsement of architects and engineers for many of the most outstanding building achievements.

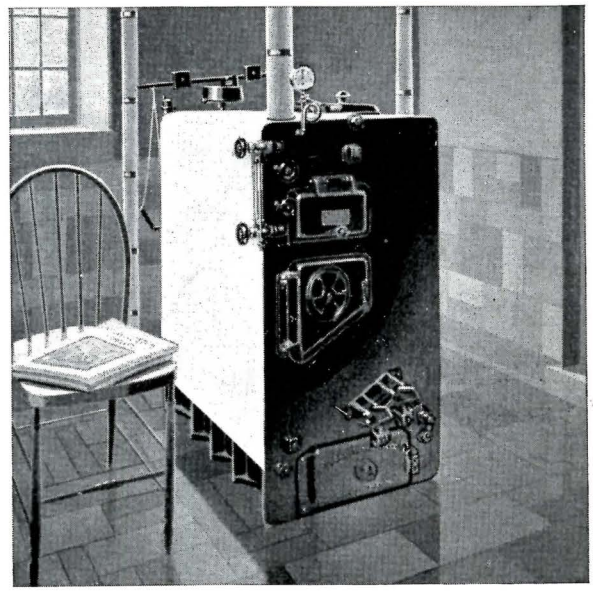
B. F. STURTEVANT CO., *Hyde Park,* BOSTON, MASS.

Plants at: Berkeley, Cal.—Camden, N. J.—Framingham, Mass.—Galt, Ontario Hyde Park, Mass.—Sturtevant, Wis. Offices in Principal Cities

Sturtevant

REG. U.S. PAT. OFF.

HEATING-VENTILATING AND POWER PLANT EQUIPMENT



This new small Spencer, with Magazine Feed and Sloping Gable-Grate, is made in three, four or five sections, to supply in direct cast iron column radiation 175 to 375 sq. ft. steam, and 290 to 620 sq. ft. hot water. It is made either with or without the enameled steel jacket. Write for specifications and guaranteed capacities.

New aid to help you make the modern small home perfect

Just announced—ready for delivery May 1st—is this newest member of the Spencer family.

It is the smallest of all Spencers, designed and made as a result of a steady and increasing demand for a heater that would supply the luxury of low cost steam, vapor or hot water heat to homes that now use less efficient heating systems; and those are the small homes of America.

This new beauty that dots our towns and suburbs flows from the architect's pen. The small home of today is modern in conception, beautiful in design, and as practical as skill and art can make it. One thing has been lacking to make these new small homes perfect—and that was modern heat *at low cost.*

Now comes this newest Spencer Heater to add that last practical touch which your small homes need to make them perfect. Like all Spencers, this newest heater is made with the Magazine Feed first introduced by Spencer, and with the Gable-Grate that is sloped to let fire burn up-hill. Now your clients—those who buy and build the small homes you design—may have automatic steam or hot water heat at a maintenance cost even lower than the heating systems of the past.

All Spencer Heaters burn the small size fuels that are so low in cost, such as No. 1 Buckwheat anthracite, coke, semi-bituminous and graded bituminous coal. For even the smallest home, this new Spencer Heater will provide steam heat in a guaranteed amount at the lowest possible cost for fuel.

Spencer Heaters, as you no doubt know, are made both in cast iron sectional and steel tubular types for homes and buildings of any size or character. Write for illustrations, specifications and guaranteed ratings. Spencer Heater Company, Williamsport, Pa.

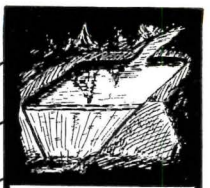
SPENCER SAVES

SPENCER
steam, vapor or hot water
HEATERS

Man learned to kindle and control fire

Man learned to confine fire within four walls

Man learned to conduct heat from one place to another



Man learned to keep impurity from the water he drinks

Man learned to keep impurity from the food he eats

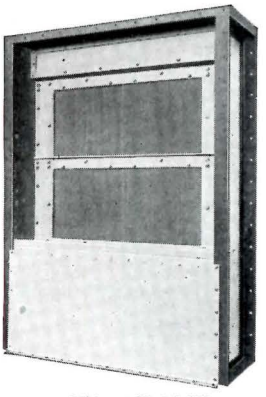
Man learned to keep impurity from the air he breathes

Now that the Cost of clean Air has been brought so low the Use of forced Air Ventilation without Filtration is economic WASTE!

THERE was a time—only a few years ago—when filtered air for building ventilation was considered impractical because of its cost. Then came the manually cleaned unit filters, first introduced by Midwest, showing definite savings in redecoration and maintenance as applied to buildings of the finer sort.

Following this came the automatic, self-cleaning filters and a swiftly expanding field of application.

But it remained for Midwest and the discovery of "Controlled Air Flow" to make filtered air available to *all* types of buildings using forced air ventilation. Today filtered air represents the last word in heating and ventilating progress and is as much a part of our modern civilization as filtered water and refrigerated foods.



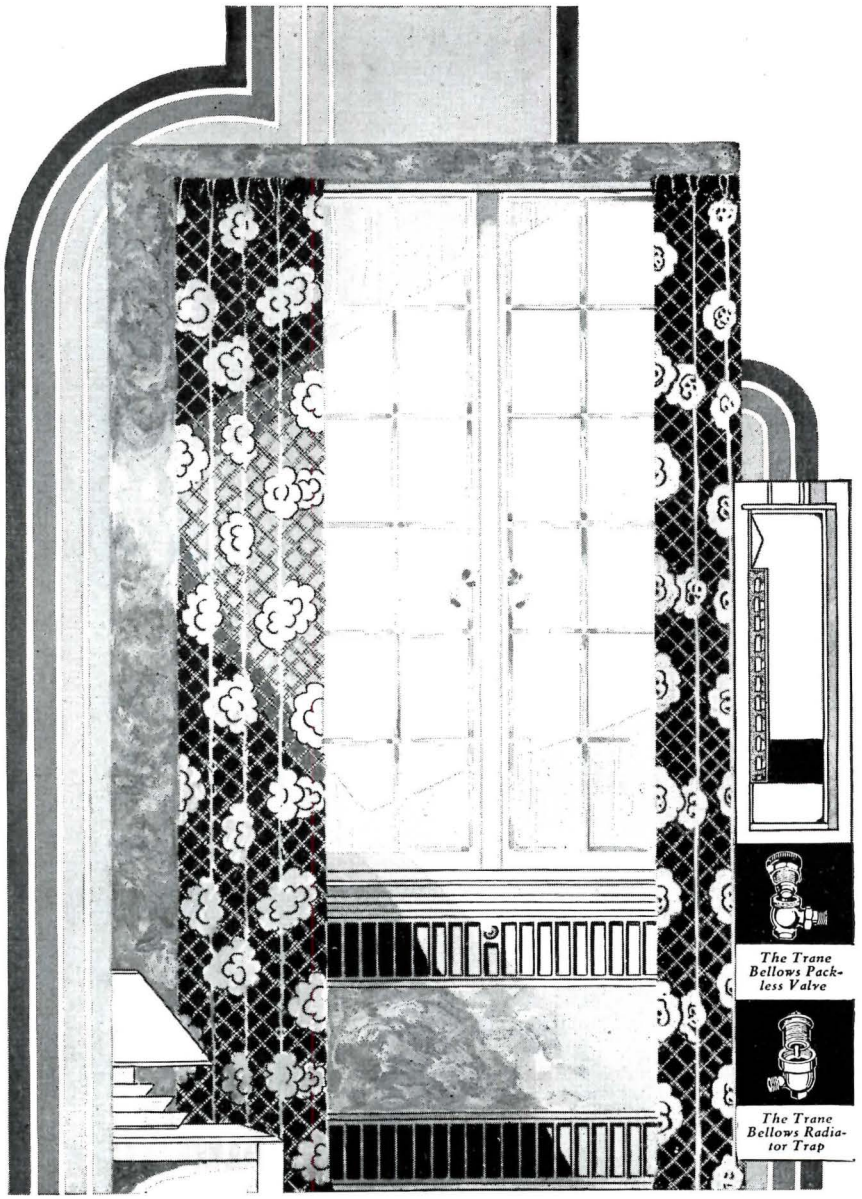
Midwest Model SV

MIDWEST AIR FILTERS

INCORPORATED

BRADFORD, PA.

Offices in Principal Cities



Should your client be satisfied with 1919 heating

in 1929?

You can't blame him for wanting the latest style—the Trane Under-Window Concealed Heater

—nor can you justly discourage him on the ground of the old-fashioned "experimental period." For underlying the style element in the arrangement of rooms is a modern heating principle which makes Trane concealed heating a genuine engineering achievement. With this equipment, the owner obtains a heating efficiency and a flexibility of control never possible before.

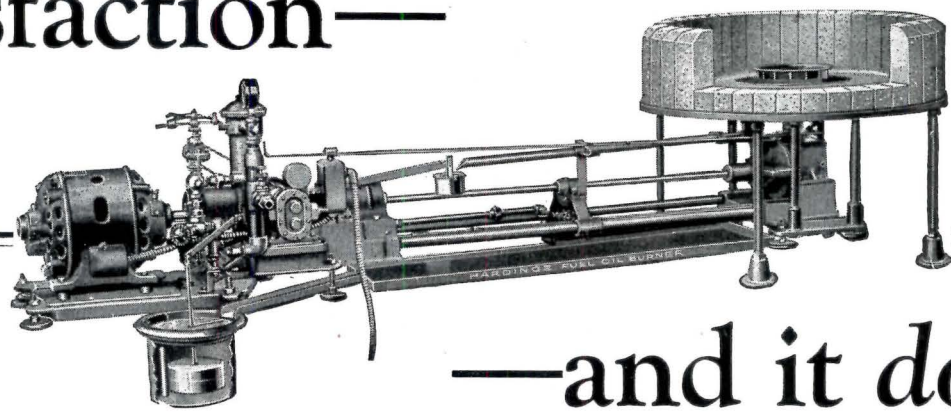
These advantages were inherent in the design of the original Trane Concealed Heater. Today the latest Under-Window model also arouses the enthusiasm of the trade as a practical heating unit for universal application. Contractors wanted a complete unit, with nothing extra to buy. Here they have it! Here is a one-man installation, from unloading the truck to screwing on the front panel. And the entire front panel comes off at the turn of a few screws, so they can have access to "the works" at any time.

You can look to Trane for the same progressive leadership in concealed heating which has built the reputation of Trane Heating Specialties and other Trane products. The same sort of practical, common-sense improvements have recently been made in the Trane Bellows Packless Valve. Tension arrangement to hold valve in position, regardless of vibration—non-rising stem—interchangeable wheel and lever handle—improved appearance—guide to relieve strain on the bellows when opening or closing. Before you recommend any part of a heating system except the boiler and piping, investigate Trane's recent developments.

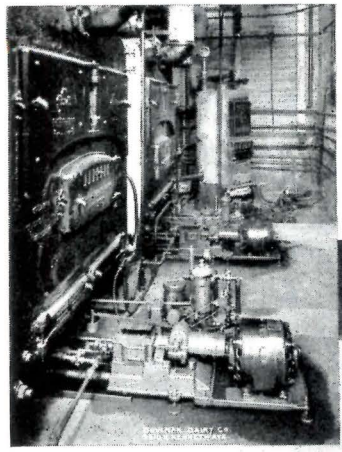
HEAT CABINETS **TRANE** CONCEALED HEATERS
PUMPS, UNIT HEATERS, AND HEATING SPECIALTIES

THE TRANE COMPANY, (*Est. 1885*)
Dept. 4—220 Cameron Ave., La Crosse, Wis.
Send complete information on modern style in heating.
Name _____
Address _____

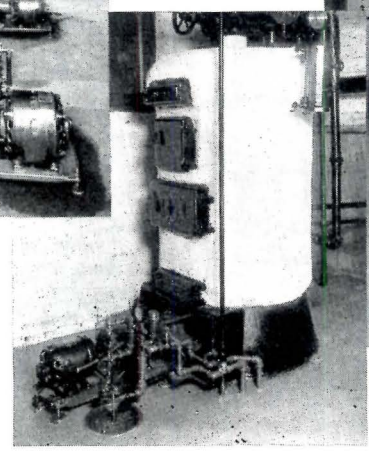
Designed to give permanent satisfaction—



—and it *does!*



Above—
Bowman Dairy Co.
4310 Kenneth Avenue
Chicago

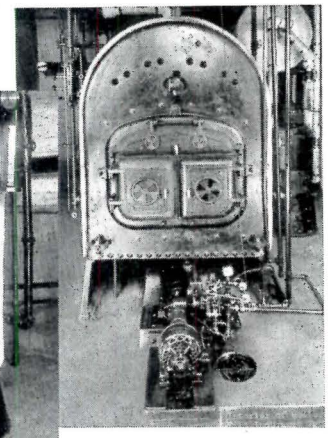


Right—
George Smart
Residence
1315 Elmdale Ave.,
Chicago

Hardinge installations, whether large or small, domestic or industrial, give perfect service and satisfaction year after year.

Precision-built in two distinct models — both Domestic and Industrial —in 9 different sizes and combinations, enable specific treatment for any heating problem.

Dependable, economical, quiet, carefree — you can safely specify Hardinge Fuel Oil Heat for any building "from bungalow to skyscraper."



Above—
Fire Insurance Patrol
No. 5 Boiler Room
1044 Orleans St., Chicago

HARDINGE FUEL OIL HEAT

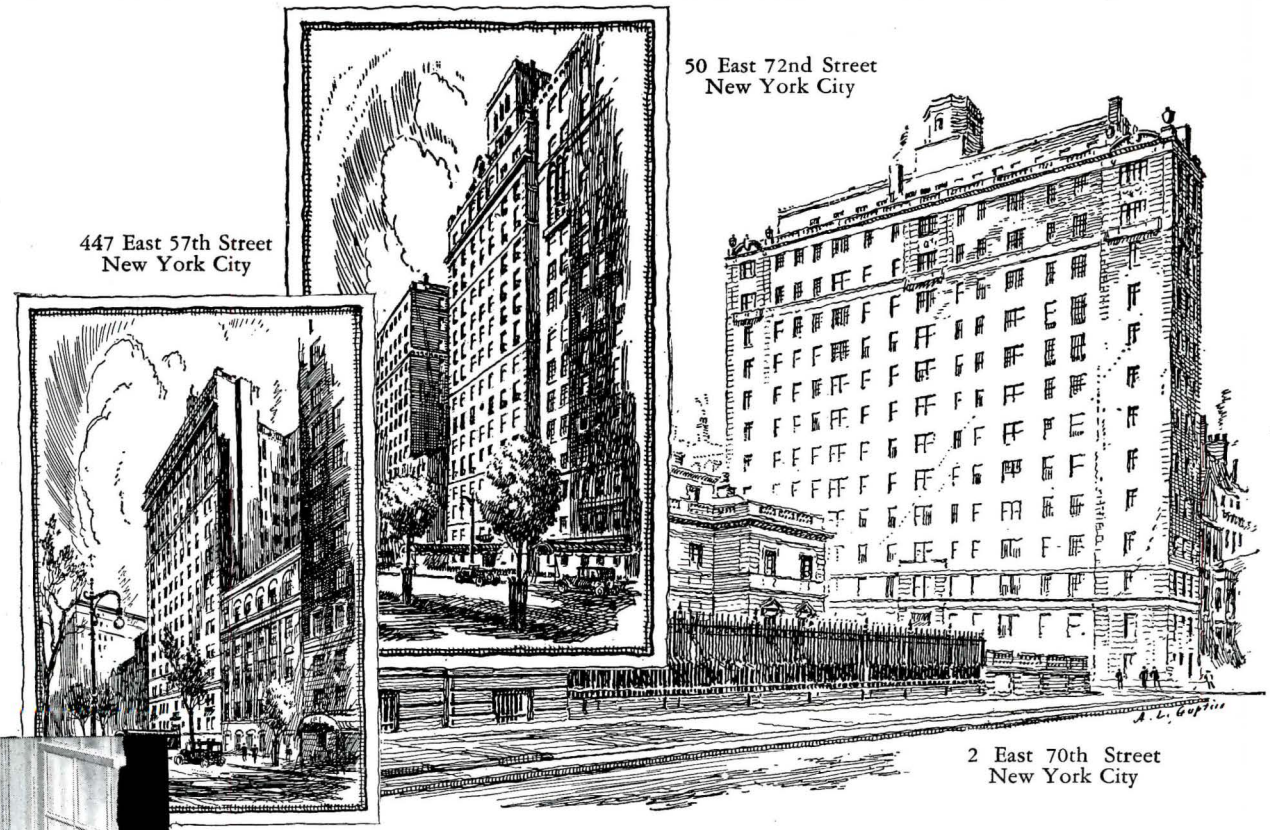
Hardinge Brothers, Inc.

Manufacturers of Precision-Built Machines for 38 Years

FACTORY BRANCH:
CHICAGO
Michigan Ave., at Chio St.

Factory and General Offices:
4149 Ravenswood Avenue
CHICAGO

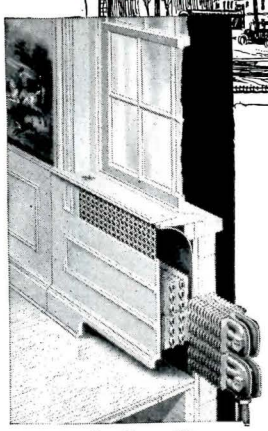
FACTORY BRANCH:
BOSTON
843 Beacon Street



447 East 57th Street
New York City

50 East 72nd Street
New York City

2 East 70th Street
New York City



Method of installing ROBRAS 20-20's in-the-wall, under-a-window

These *Extras* Eliminated If Original Equipment Had Been ROBRAS 20-20 THROUGHOUT

IN each of these New York apartments, ROBRAS 20-20 Radiators were concealed in the walls of the principal rooms. In less important rooms old-fashioned radiators were used, under the mistaken impression that they might bring about possible economies.

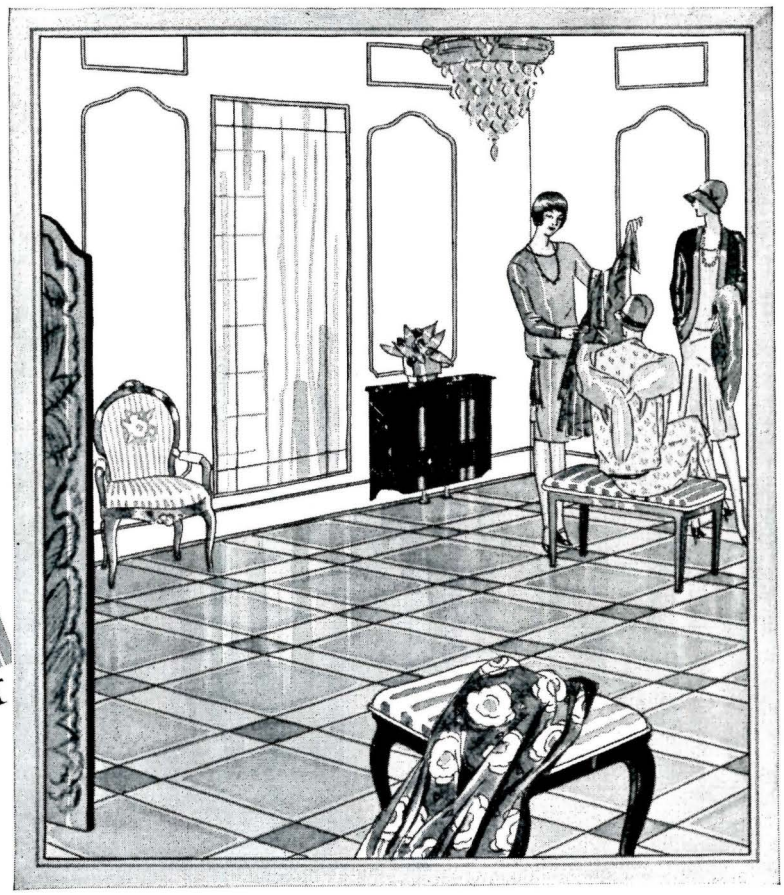
The error of this conclusion was discovered as soon as the apartments were sold or rented. Practically all of the new owners or lessees *demanded* ROBRAS 20-20 Radiators, out-of-sight, and out-of-the-way, in the balance of their rooms.

You can well imagine the trouble and extra cost this entailed. If ROBRAS 20-20's had been installed throughout originally, both owners and tenants would have been saved the expense and exasperation of changing the existing radiators.

Again, suppose a case where tenants, educated to ROBRAS 20-20 Radiators, discovered the old-fashioned radiators throughout. Think of the complication entailed in changing the existing radiators on the *entire* job!

The safest course today is, at the start, to install ROBRAS 20-20 Radiators in-the-wall, out-of-sight and out-of-the way. Then every one is satisfied.

ROME BRASS RADIATOR
CORPORATION
ONE EAST FORTY-SECOND STREET NEW YORK CITY



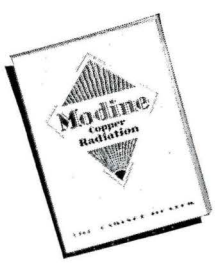
An Exclusive Modine PRODUCT

The Wall Cabinet Heater

THE Wall Cabinet Heater — built only by Modine—conforms to the most exacting demands of modern room decoration, but its cost makes it the most economical installation where utility is the prime consideration.

Because of the inclined position of its enclosed copper radiator, it extends only a few inches from the wall and is particularly desirable where space economy is necessary. It is the ideal radiation for smart shops, department stores, offices, hospitals, apartments and homes.

Complete information on Modine Cabinet Heaters and Modine Wall Type Cabinet Heaters will be sent on request.



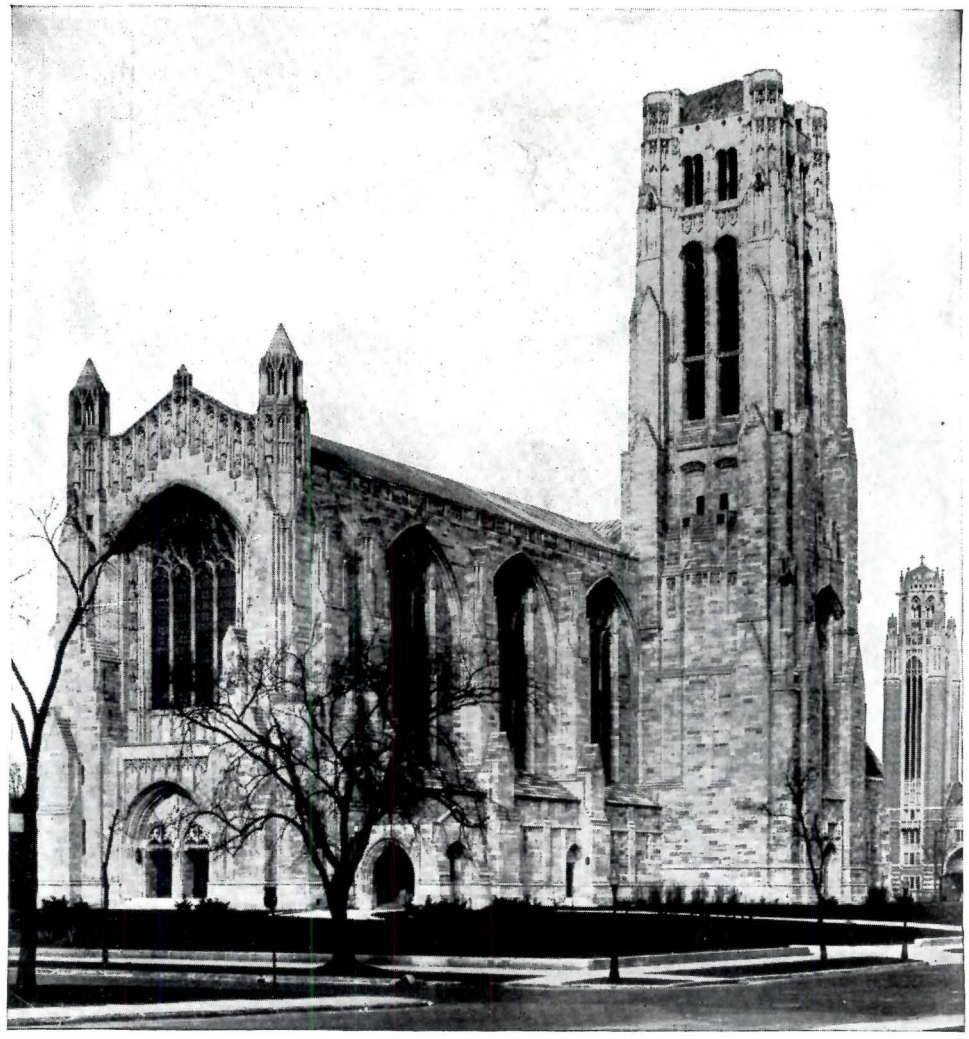
Send for your copy of our new 4-color Booklet "Modine Cabinet Heaters". In addition to construction details and capacity details, it has numerous suggestions for Modine Cabinet Heaters in the decorative scheme.

MODINE MANUFACTURING COMPANY
1718 Racine Street RACINE, WISCONSIN

Originators of
COPPER RADIATION

USED IN PLACE OF CAST IRON RADIATION SINCE 1922

Manufacturers of
MODINE UNIT HEATERS



UNIVERSITY OF CHICAGO CHAPEL

BERTRAM G. GOODHUE and BERTRAM G. GOODHUE ASSOCIATES—Architects

—a Rockefeller Foundation contribution to the University of Chicago, which realizes the original intention of including for this institution a building devoted solely to religion and its exercises.

In 1918, Mr. Bertram Grosvenor Goodhue of New York was commissioned as the architect to design the Chapel. Mr. Goodhue's design for the Chapel placed the tower over the crossing, and after his death in April 1924 before any construction had been started, the University conferred with the Bertram Grosvenor Goodhue Associates, the firm who had undertaken to carry on and complete Mr. Goodhue's work.

The building as built is from the drawings of the Bertram Grosvenor Goodhue Associates which they consider as a modification of Mr. Goodhue's original conception; the tower being entirely redesigned and placed over the transept, and the front elevation and divisioning of windows being considerably modified.

All of the craftsmanship in this building, including the Skinner organ, is of American artisanship, and breathes the spirit of the craftsmanship of the Old World.

The design of the Chapel displays the progressive spirit of the architects—the Bertram Grosvenor Goodhue Associates—imbued with the spirit of the master—Bertram G. Goodhue—and portrays in New World fashion, the Gothic tradition of the Old World.

Visitors are permitted each day to enter and view the imposing interior; likewise at services on Sunday and evenings during the week when it is especially impressing and soul inspiring.

A monument indeed to *endowment* kindness, and the consummate of church thought and architecture . . . . . .

JOHNSON SERVICE CO., MILWAUKEE, WIS.

The design *of* every building *is influenced by* FUEL...

. . . Even the *basement plan* cannot be completed until the fuel to be used in the building is determined.

If it is Coal—You know what to figure on—receiving the coal, storing the coal, moving the coal to the heating plant, removing the ashes, disposing of the ashes.

If it is Gas—There is nothing to do but to bring a pipe into the Basement from the gas main—*but* the *cost* is *high.*

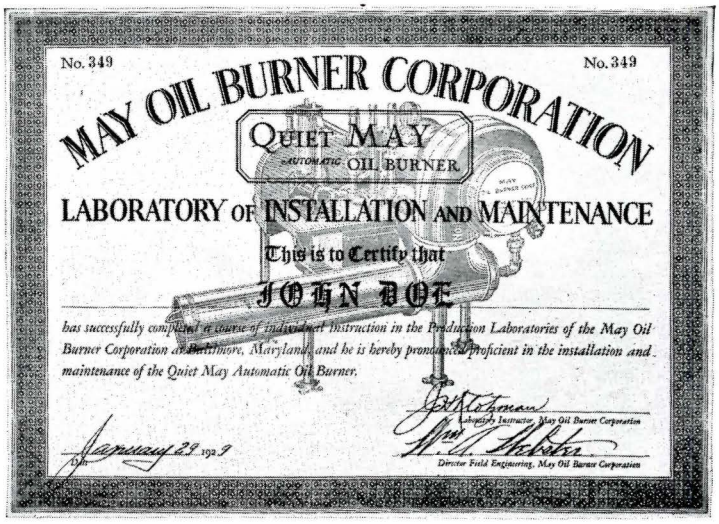
If it is Oil—The basement plant is much the same as when gas is used. You do not have to provide space for *coal and ashes activities.* A tank, either in the basement, or underground, outside the building contains the fuel supply.

Architects' Manual on Automatic Oil Burners

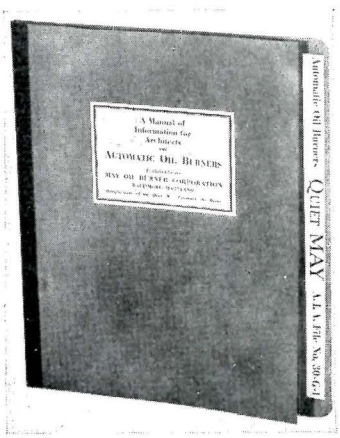
The use of this manual as a guide makes the preparation of the *heating plans* and *heating specifications* a simple task.

Installation and Maintenance

The May Oil Burner, the tank, and all necessary pipes and automatic controls are installed by authorized May Oil Burner Corporation dealers.



Here is the certificate which we present to each individual who has successfully completed a course of instruction in the production laboratories of the May Oil Burner Corporation, at Baltimore, Maryland.



This 68-page *manual of information for architects* on Oil Burners contains text matter, floor plans, sections, and photographs, as well as the *complete regulations of the National Board of Fire Underwriters* for the installation of Oil Burner equipments.

MAY OIL BURNER CORPORATION
3500 E. BIDDLE ST., BALTIMORE, MD.

MAY OIL BURNER CORPORATION F-4
3500 E. BIDDLE ST., BALTIMORE, MD.

Please send your manual of information for architects to

Individual_____

c/o Firm_____

Street_____

City_____ State_____

MEMBER OIL HEATING INSTITUTE OIL HEAT

REVIEWS OF MANUFACTURERS' PUBLICATIONS

THE FIREBRAND KITCHEN EQUIPMENT CO., Chicago. "Firebrand Kitchen Equipment." Its importance and value.

The majority of modern hotels, hospitals, clubs, restaurants, cafeterias, lunch rooms, etc., possess a highly efficient kitchen equipment, the latest in scientific methods of cooking apparatus, which is first in sanitation, neat in its appearance, efficient and satisfactory in operation. The Firebrand Kitchen Equipment Company of Chicago has manufactured a gas steamer which produces amazing new cooking results, improved flavor, tenderer food, with less food waste and less gas consumption. Really, it is one of the finest steamers on the market. It quickly saves its cost in fuel economy, and is supreme in cooking quality. This catalog issued by the Firebrand Kitchen Equipment Company fully illustrates Firebrand standardized kitchen equipment, such as, coffee urns, steam tables, urn stands, dish warmers, work tables, coolers, dish tables,—in other words, a fine line of all cafeteria, lunch room, restaurant and hotel equipment.

MACOUSTIC ENGINEERING CO, Cleveland. "Macoustic Sound Control." Dependable data on acoustics.

Good acoustics, providing clear and distinct hearing in every section of an interior, is of prime importance. The modern theater, with its large spans, high ceilings, distant reflecting surfaces, extensive use of hard plaster ornamentation, large orchestra, powerful organs and varied programs demands a positive and uniform degree of good hearing under all audience conditions. Many interiors of modern office buildings are acoustically treated, at great expense, after occupancy because tenants demand quiet, workable offices, free from distracting noises. The clatter of typewriters, adding machines and other mechanical equipment, is not only distracting to employes but offensive to patrons. This booklet will explain Macoustic, its engineering service, its application, and its decorative possibilities and will give other data.

CHICAGO PUMP COMPANY, Chicago. "Fire Pumps." An excellent brochure on the important subject of pumps.

Because of the heavy responsibility placed upon a fire pump, each part in its makeup must necessarily be of the best. Insurance Underwriters' tests are so severe that only a truly reliable pump will pass examination. Fire pumps are used for reducing fire hazard in office buildings, theaters, hotels, clubs, factories and many other types of buildings. They are also used by municipalities and subdivisions. The primary reasons for installing fire pumps are the protection of life and property; a reduction in insurance rates because of reduced fire hazard. Chicago Pump Company Fire Pumps have met the Underwriters' severe tests, and in fact the "Chicago" Fire Pump was the first ball-bearing fire pump to pass Underwriters' tests. Typical layout diagrams are shown in this booklet, and a short description of the "Chicago" Fire Pumps will quickly show why they are desirable for fire protection work, and why they are so widely used.

FLAX-LI-NUM INSULATING COMPANY, Minnesota. "Flax-li-num Insulation." Data on heat conservation.

Because of poor or unscientific construction of buildings' walls and roofs, it has been conservatively estimated that the fabulous sum of $450,000,000 is wasted in fuel every year in the United States. Our present structures are causing annual leakage costs of literally millions of dollars' worth of heat. The house of the future will be scientifically built from the standpoint of heating. The idea of heat insulation from the standpoint of comfort is primitive, perhaps the most notable of early methods of securing it being use of the "wattle and daub" construction of the New England colonists, who filled the open spaces between uprights in their houses with a mixture of straw and mud. Primitive methods are still used today, and a degree of comfort is secured by both the Eskimo and the South Sea Islanders by the application of natural insulation principles. In this bulletin one will find data on correct and efficient insulation, and the advantages of using Flax-li-num insulation.

WALLPAPER MANUFACTURERS' ASSOCIATION OF THE UNITED STATES. "Wallpaper."

Dr. Faber Birren of Chicago, in a recent article in "The Modern Hospital," has said that it has been demonstrated that color has a definite psychological effect on the sick. The successful application of color demands more than an average amount of attention, particularly as regards its emotional demonstrations. There are, according to Dr. Birren, two purposes to be served by the use of color in the hospitals. One of these is to effect a positive reaction on the part of the patient and the other is to create a general atmosphere of cheerfulness for its æsthetic and visual appeal. Wallpaper is entering its own as a hospital decorative medium and has been utilized in a number of institutions of this character with thoroughly satisfactory results; and there is every reason to believe that its use will increase. This valuable publication is issued monthly by the Wallpaper Manufacturers' Association. It is the latest thing in color printing.

THE CORCORAN MANUFACTURING CO., Cincinnati. "Corcoran One-Piece Steel Bathroom Cabinets."

It is needless to say that the bathroom is a place of cleanliness and sanitation. Every one of its fixtures should be of the highest and most perfect sanitation and cleanliness. "Corcoran One-Piece Steel Cabinets" are completely described in this brochure. The primary motive of the manufacturer has been to provide a line of cabinets radically improved and of outstanding superiority over any product of its kind on the market today. These cabinets are drawn in one integral piece of steel,—no cracks, no seams, no welded joints, no raw edges. The beautiful lustrous finish can be kept spotlessly clean with soap and water. Round corners inside and out are first aids to sanitation and cleanliness. The booklet will give all details of the Corcoran One-Piece Steel Bathroom Cabinets, details which interest architects.

THE MACOMBER STEEL COMPANY, Canton, O. "Hangar Design for Airports." A booklet on the subject.

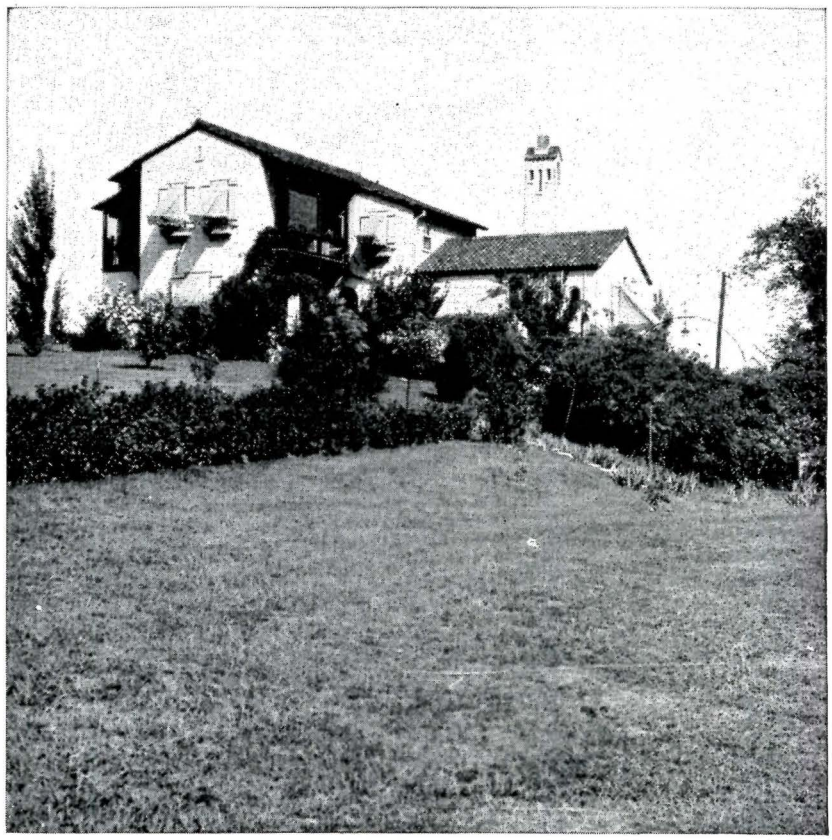
The development of aviation and air transportation has been so extremely rapid for the past few years that it has introduced new problems to the building industry. Now airport owners, cities, towns, transportation companies and private owners are greatly interested in hangars, especially hangar designs for airports. This booklet, which is based upon the economic and efficient use of Massillon Standardized Steel Building Products, to meet the individual requirements of all projects, describes how hangars can be built economically. The Macomber Steel Company, with its standardized "Massillon" products has adapted itself to furnishing a prompt and efficient service in the complete steel requirements for hangars. To fill the need of hangar construction design and to offer its efficiency to airship owners, this "Hangar Design" booklet has been made available and should have wide circulation among architects.

WOLFF CO., Chicago. "Modern and Ancient Luxury." An excellent brochure on fittings for bathrooms.

"To such a pitch of luxury have we come that, unless we tread on gems in our bath, we are dissatisfied." Thus spoke Seneca in commenting on the magnificence and luxurious appointments of the palaces of cleanliness and pleasure that were a part of ancient Rome. As a matter of fact, in the early years, while America was struggling, a bath was a rare treat. In the first place, there was no water in the house, and the preparation of the bath was a task that took a long time. The smaller children could sit in the tub, but poor father had to stand up, dip a sponge in the water, which was taken from the backyard pump, and then squeeze it out on his chest. That was a primitive form of shower. Then someone, who was regarded as eccentric, suggested a bath a day. "Impossible," said someone; "shocking," said others; and "it ain't healthy," said some. So even legislators passed a law against so absurd a practice. But it came anyway. This booklet will ask one: "Why be ashamed of your bathroom?" and will describe many ways to beautify it.

Home builders are now asking WHICH IS THE BEST OIL BURNER?

—*instead of* SHALL WE INSTALL OIL HEAT?



KNOW ELECTROL BY THE HOMES IT HEATS
Residence of Mr. Norman B. Comfort, St. Louis County, Missouri

It has come to be the exception, rather than the rule, for an architect's client to debate the advisability of heating his home with oil.

His only question now is, "*Which is the best oil burner to install?*"

We know of no better answer than Electrol's record of satisfactory service in many of the country's finest homes . . . A fine product serving a fine clientele.

Electrol owners know the meaning of "oil heat at its best." They know, for the first time, the satisfying comfort of *automatic* oil heat, *electrically* controlled. They have found an oil burner which keeps on operating year after year, with practically no attention whatever. Heating troubles are a thing of the past.

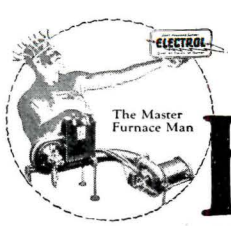
Such dependability of operation and performance can only come from a combination of engineering principles, materials and construction that are *right*, and from proper installation by dealers who have proven their ability to fit Electrol to each type of heating plant and to service the burner throughout its life.

Electrol is All-Electric—Entirely Automatic—and exceptionally Quiet. There is no gas pilot light. None is needed. The entire operation of the burner is under the automatic supervision of *The Master Control* which stands watch night and day, like a living sentinel, regulating the flow of oil, timing the ignition and governing combustion.

Electrol is made in models for homes and buildings of all types and sizes. Wherever it is sold, you will find complete oil heating service backed by a sound, large and growing manufacturing organization.

We shall be glad to mail description and complete details of this finer oil burner, on request.

ELECTROL INCORPORATED
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 ✓ ✓ MEMBER OF THE OIL HEATING INSTITUTE

REVIEWS AND ANNOUNCEMENTS

GILLIS & GEOGHEAGAN, 535 West Broadway, New York. "G & G Atlas Method of Handling Sales Transactions."

Appreciation of the value of orderly and architectural appearance in business quarters has brought about quite a number of changes in equipment of department stores. Some years ago the most complete equipment included overhead "carriers" or "conveyors" from sale counters to cashiers' cages, this system having supplanted use of messengers,—cash boys or cash girls. But this system of carriers, with its overhead wires wholly visible, is now regarded with little favor, and there has come into use the system by which transactions with cashiers are conducted by means of tubes. This large folder explains and illustrates the planning of the cashier's receiving station of a large establishment. It shows the arrangement of files for quick reference to important data; the locations of those who authorize charges to individual accounts; the receiving and dispatching stations; and the stations of the supervisors of different sections. Halftones from actual photographs show the appearance of these individual departments with their operators at their posts.

SHANKLIN MANUFACTURING CO., INC., Springfield, Ill. "Better Awnings." Their effect on a building's appearance.

A building seen from the outside, most of the time gives an appearance of bareness and seems to be rather dull, while the interior is well ornamented. All this could be easily overcome by giving a small distinctive and colorful touch to that building or home by adding awnings to windows. That home shall have personality and distinctiveness of character. They will keep the house cool in summer and well ventilated. The "Shady-way" awning, which is manufactured by the Shanklin Manufacturing Co., is a new type of double-purpose awning that operates easily from the inside, serving as a shade and an awning,—cheerful, beautiful colored awning, that make the home, apartment, hotel or public building sparkle with life and attractiveness and insures cool, comfortable well ventilated rooms. Awnings all a modern necessity, especially now when it's so easy and inexpensive to equip the home or buildings with smart serviceable roller "Shady-way" awnings. This illustrated booklet will tell all about it, and prove that it is a great utility for office structures, hotels, public buildings and homes.

NATIONAL LAMP WORKS, Cleveland. "Picture Projection with Mazda Lamps." Their use for motion pictures.

The use of motion pictures in fields outside of the photoplay house, is becoming widespread. So popular is this form of presentation that, together with slide projection, it has brought about a new technique in education and has become a valuable aid in selling and in home recreation. In the business field, motion pictures of a manufactured product have proved of great benefit in selling, with the result that firms are providing their representatives with motion picture films and projectors. Projectors of the portable type, using either the 35 mm. film or the 16 mm. film, are light in weight and give screen illumination sufficient for this service. Much fascination of home motion picture entertainment is experienced from showing pictures of one's family, friends or children at play and so on. The 35 mm. film is sometimes used for this purpose. To meet the needs of the various fields of motion pictures and stereopticon projection, there has been made a group of lamps especially adapted for these services. Maximum satisfaction is realized when each element in the projection system is designed and adjusted for the incandescent light source. In this bulletin these subjects are therefore discussed: (1) The optical principles in the projection of pictures by means of Mazda lamps. (2) The properties of the component optical elements. (3) Projector equipment. The use of Mazda lamps for the projection of motion pictures is attended by numerous advantages. They are simple and economical in operation; they consume a minimum amount of electrical energy, and they produce neither fumes nor gases, all being important advantages.

John Stafford White is to be addressed at 521 Irving Avenue, Glendale, Cal.

Carl C. Tallman has opened new offices at 733 West Edwin Street, Williamsport, Pa.

H. Silverstein announces the opening of new offices at 191 Joralemon Street, Brooklyn.

Frank O. Barber is occupying new offices in the Deadrick Building, Knoxville, Tenn.

Elmer Grey announces the resumption of his practice at 832 West Fifth Street, Los Angeles.

Arthur J. Widmer & Associates, Inc., announce the opening of offices at 4903 Delmar Avenue, St. Louis.

William C. Halbert, Jr., announces his removal from 11 North Avenue to 202 North Avenue, New Rochelle, N. Y.

Clarence J. Veillette, 1044 Noble Avenue, Bridgeport, Conn., desires the publications and samples of manufacturers.

Leonard J. Toole, Builders' Building, Charlotte, N. C., desires the samples and publications issued by manufacturers.

Announcement is made of the dissolution on January 31, 1929, of the firm of Purdy & Davis, 350 Madison Avenue, New York.

The Associates of A. L. Pillsbury announce the change of the firm's name to Lundeen, Hooton, Roozen & Schaeffer, with offices in the People's Bank Building, Bloomington, Ill.

On January 1, 1929, Oren Thomas joined the firm of Proudfoot, Rawson & Souers. The new firm name is Proudfoot, Rawson, Souers & Thomas, and its offices are at 810 Hubbell Building, Des Moines, Iowa.

Announcement is made of the dissolution of the firm of Purdy & Davis. Raymond J. Purdy will continue the practice of architecture at 350 Madison Avenue, New York, and Willam H. Davis has opened offices at the same address.

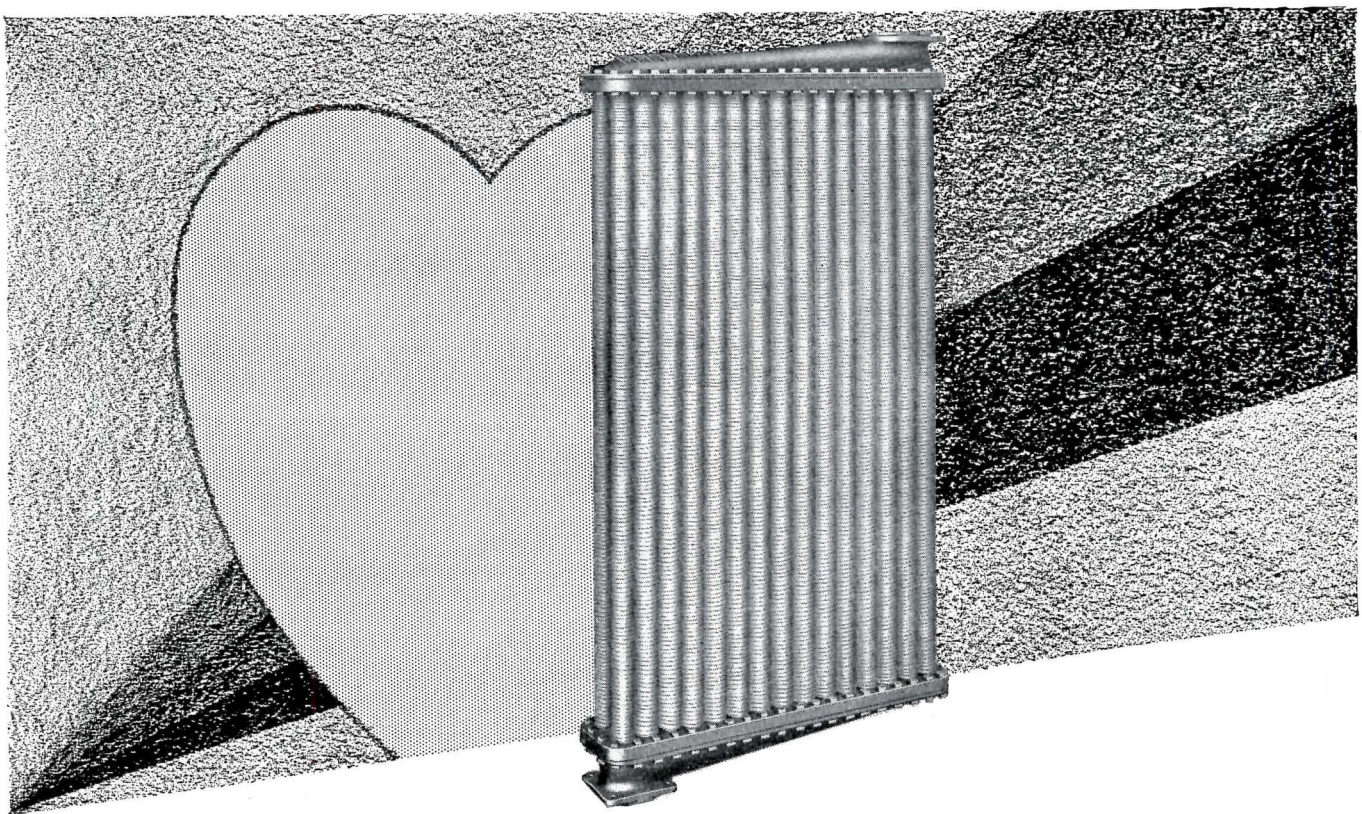
Corrections. Page 210 of the advertising section of THE ARCHITECTURAL FORUM for February, 1929, carried an illustration of the exterior of the chapel recently completed for the University of Chicago. Credit for the designing of the chapel should have been given to Bertram Grosvenor Goodhue and the Goodhue Associates as architects.

In the article entitled "Church Organ Installations," by Emil Praeger, of the Office of Mayers, Murray & Phillip, Architects, the illustration on page 449 should have been entitled "Organ Case, Pipes Not Exposed, Chancel Wall, Trinity English Evangelical Lutheran Church, B. G. Goodhue and B. G. Goodhue Associates, Architects." Also, the illustration shown on page 450 should have been entitled "Organ Screen, Pipes Not Exposed, At Rear of Altar, Epworth-Euclid M. E. Church, Cleveland, Mayers, Murray & Phillip and Walker & Weeks, Associate Architects". These captions were transposed through a typographical error in making up the March issue of THE FORUM.

INDEX TO ADVERTISING ANNOUNCEMENTS

PART 1—ARCHITECTURAL DESIGN

PART 2—ARCHITECTURAL ENGINEERING AND BUSINESS



The Vital part of the UNIT HEATER

THE success of the Unit Heater depends almost entirely upon its heating surface—and it is for this reason that the leading engineers are selecting Arcoblast Heaters. From a careful study of its wide variety of applications, both Unit Heater manufacturers and Heating engineers have found Arcoblast meeting the most exacting demands.

These five outstanding features recommend Arcoblast for all types of Unit Heater work:

1.—Rugged Unit Design.
2.—No Soldered Steam Backed Joints.
3.—Non-Corrosive.
4.—Ample Tube Steam Carrying Capacity.
5.—Minimum Weight Without Impairing Strength.

The heater is composed of staggered rows of metallicly attached fin-wound copper tubes expanded into two cast-iron tube sheets which, with the tapered design cast-iron header bodies flange-connected to the tube sheets, form the supply and return headers.

The copper tubes are three-quarters inch outside diameter with a copper, helical-wound, flat, continuous fin three-eighths inch in depth, metallicly attached to each tube. The materials of construction, copper for tubes and fin and cast-iron for headers, offer a product which is non-corrosive.

Heaters are furnished in two types as follows:

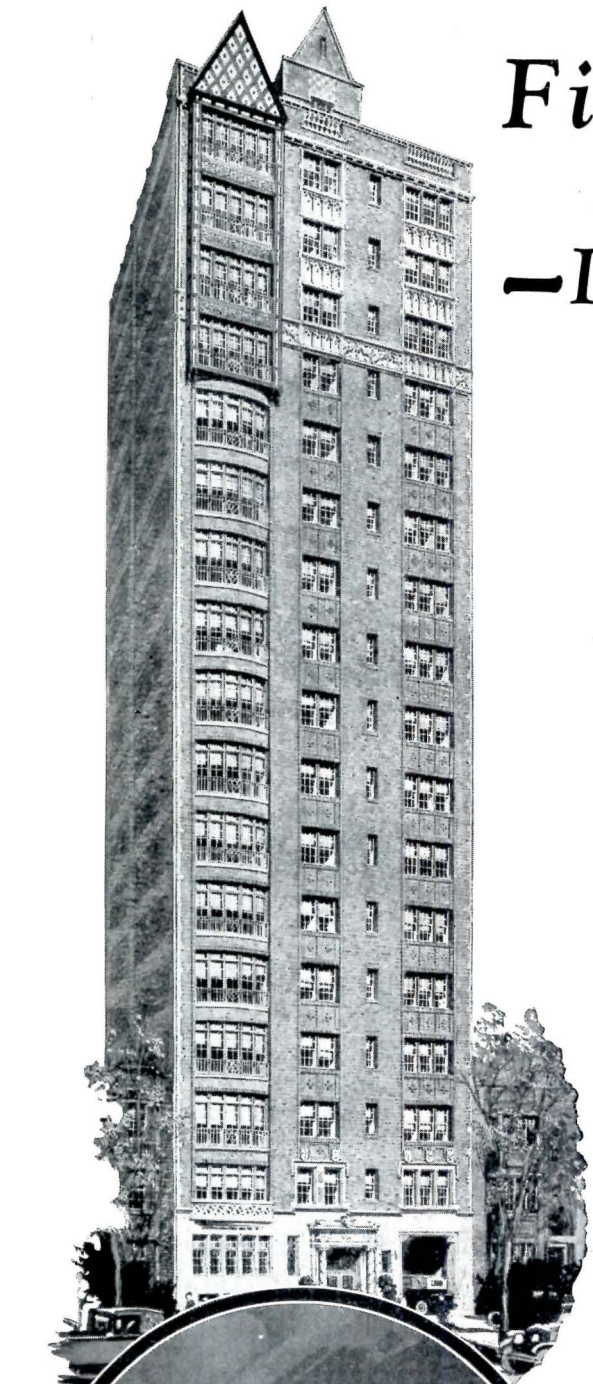
Standard Type for steam pressure to 50 pounds.
High pressure Type for steam pressures to 200 pounds.

Write today for complete engineering data on this remarkable Unit Heater heating surface.

AMERICAN RADIATOR COMPANY

816 So. Michigan Avenue, Chicago

40 West 40th Street New York



Fine Enough for Luxurious Apartments —Inexpensive Enough for Modest Homes

Among the newer, fine buildings for which McQuay Cabinet Radiators have been selected, is this luxurious "Co-Op," designed by Reichert & Finck for 5421 Cornell Ave., Chicago. Yet you will find McQuay Cabinet Radiators equally as popular for heating modest homes.

Owners of buildings have discovered that their unobtrusive beauty immediately appeals to buyers and tenants *actually helping to sell or rent apartments and houses.*

Yet their cost is seldom more, and often less, than for ordinary radiators with their necessary separate covers or shields.

Because they send the heated air out into rooms in a horizontal direction, they provide the circulation so necessary to quick, effective heating.

This helps to reduce heating costs.

A humidifying pan (inside the cabinet) gives the heated air the moisture needed for health and comfort.

On your next job—figure McQuay

McQUAY RADIATOR CORPORATION

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Newark, N. J.: J. F. McLaughlin Co., 738 Broad St.
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A Complete Radiator Not just a cover

McQUAY *Cabinet* RADIATOR

Announcing....

100 YEAR GUARANTEE *on* CAST IRON SOIL PIPE *and Fittings*

BASED upon reliable data covering the service record of cast iron soil pipe over a period of five centuries, together with all scientific information available regarding its longevity, and to demonstrate their unlimited faith in its almost everlasting qualities, the manufacturers announce their willingness to guarantee it for *one hundred years, or for the life of any building in which it is used.*

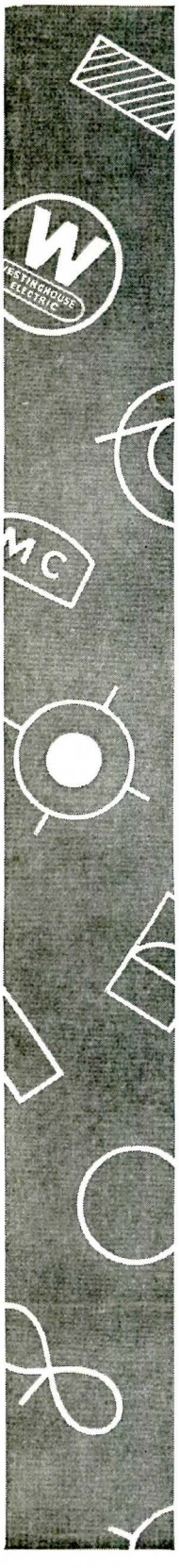
Cast iron soil pipe is recommended in connection with buildings and guaranteed for the following definite purposes:

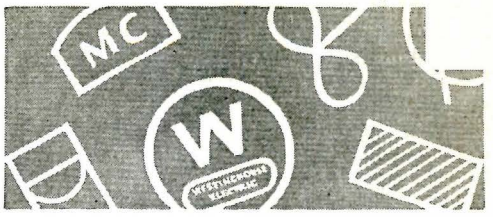
SOIL LINES — WASTE LINES
VENT LINES — LEADER LINES
HOUSE DRAINS — HOUSE SEWERS
ROOF DRAINS

Guarantees will be made between manufacturers and building owners direct, and will cover specific installations.

The SOIL PIPE ASSOCIATION
BIRMINGHAM, ALABAMA

THE GREATEST TRIBUTE EVER PAID ANY PIPE





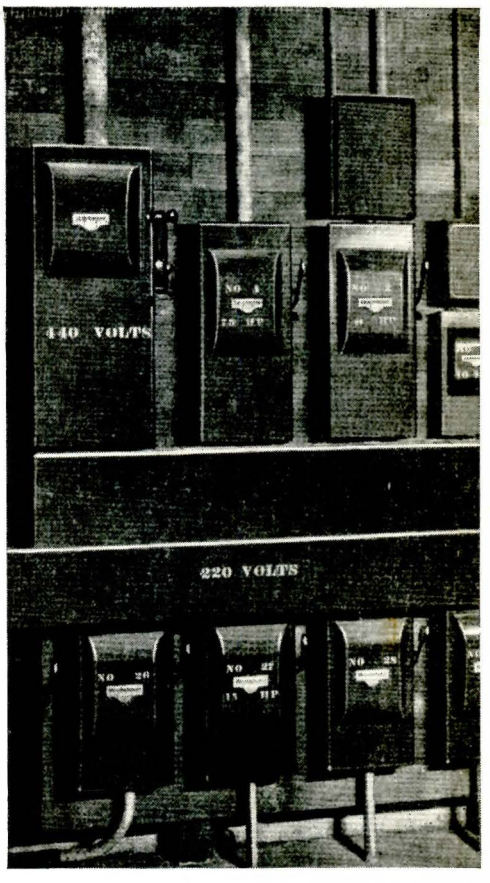
Safety Switches

. . . the point of entry for complete electrification

The future holds a promise of greater usefulness, greater return on investment, for the building that is electrified for today and for tomorrow. And electrification should start where your electrical service enters the building. There—at the point of entry—Westinghouse Safety Switches give you control, give you protection, give you capacity for every electrical requirement.

Protect the equipment you install, and those who use it, with Westinghouse Safety Switches. For every building requirement there is a Westinghouse Safety Switch, backed by Westinghouse skill in designing electrical equipment; staunchly built to take care of the job for which it was designed. Write for a copy of Catalog 282, listing the complete Westinghouse Safety Switch line.

WESTINGHOUSE ELECTRIC & MFG. COMPANY
SAFETY SWITCH SECTION
MANSFIELD WORKS MANSFIELD, OHIO



Westinghouse equipment for buildings includes:

Circuit Breakers
Elevators
Fans
Fuses
Insulating Materials
Lamps
Lighting Fixtures
Motors and Control for Ventilating Systems, Pumps, etc.
Panelboards
Safety Switches
Solar Glow Heaters
Ranges
Switchboards
Turbines
Transformers
Watthour Meters
Water Heaters

Westinghouse

Complete electrification for modern buildings

Westinghouse Electrification
Appliances Apparatus Wiring
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