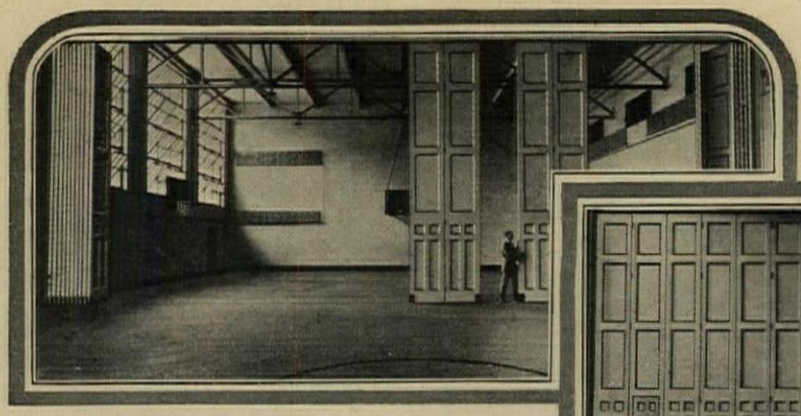
THE ARCHITECTURAL FORUM

IN TWO PARTS

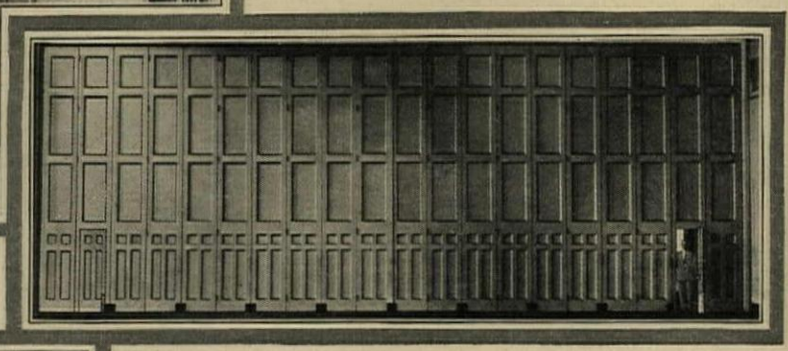
ENGINEERING & BUSINESS

PART TWO

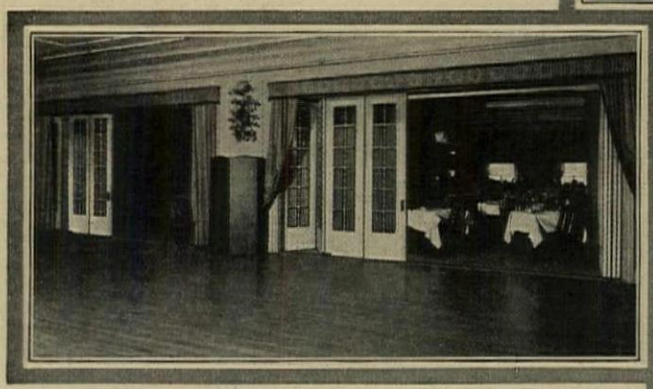
APRIL 1928



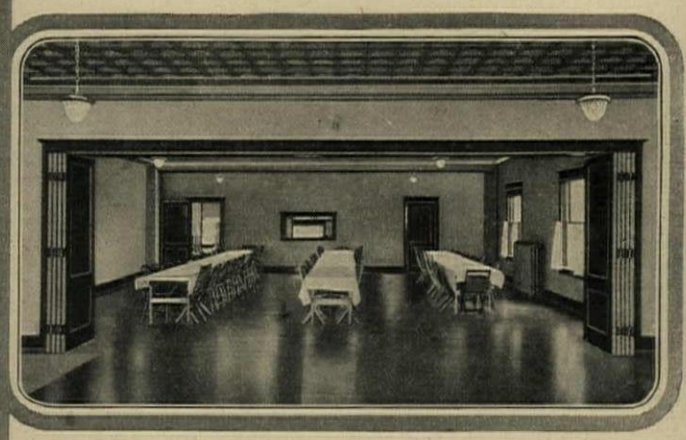
Left and Below: FoldeR-Way Hardware as used on very high and heavy partition doors. The weight is carried on floor track.



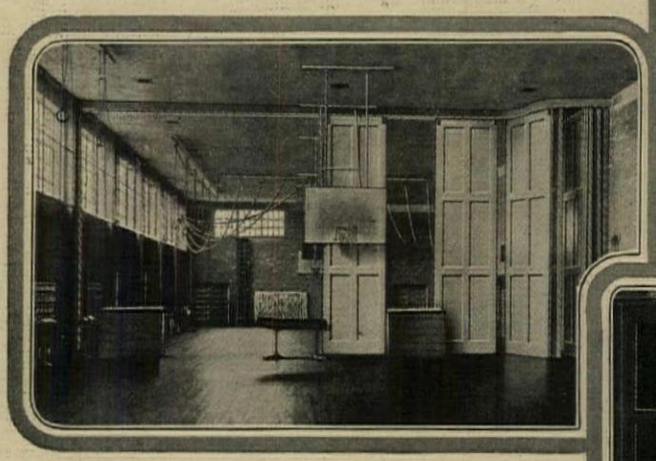
With this type of FoldeR-Way the doors operate in pairs—easily handled by one man.



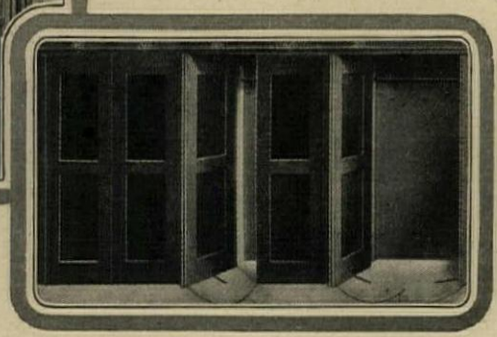
Below: With FoldeR-Way hardware as used on smaller size doors, the weight is carried on track at top.



The dining room and ballroom *shown above* can be separated or quickly made into one room.



Left: This type of FoldeR-Way is particularly adaptable for very wide doors, each handled as a separate unit.



The type of FoldeR-Way *at the left* is most desirable for school wardrobes, telephone booths, etc.

FoldeR-Way METHODS

DESIGNING hardware for partition doors that slide or fold away requires expert engineering skill. *Installing* partition doors, however, becomes *a simple matter* when FoldeR-Way methods are used.

No line is more complete, offers more variety, than FoldeR-Way partition door hardware. Whatever your problem is, from telephone booths to churches, gymnasiums and auditoriums, you are certain of finding FoldeR-Way hardware specially designed for any size or style of sliding or folding partition doors you wish to install. Feel free at any time to consult R-W engineers about any kind of door problems.

The R-W book "Sliding and Folding Partition Door Hardware" contains *over 100* photographs, drawings and diagrams illustrating FoldeR-Way Methods and uses. Details of design and engineering are fully explained. Let us send you this book. You will want to retain it in your files for ready reference.

Richards-Wilcox Mfg. Co.

"A Hanger for any Door that Slides."

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NATCO SHIELDS FROM RUST'S DESTRUCTIVE SCARS

SIR Edwin Lutyens, eminent English Architect, claims that Americans build sketchily—fail to protect their steel work properly

If that is the case, where is all the Natco Beam, Girder, and Column Covering being used, that architects all over the country are specifying?

If there is any better protection than Natco Hollow Tile, we'd like to know about it.

Natco Beam, Girder, and Column Covering that shields steel from rust and corrosion also protects it from flame And this is only one class of product. from the Complete Natco Line of Hollow Building Tile. Natco provides a tile for every building need that will do the job you want it to do, will fill the place it is destined to fill, dependably, economically, permanently.

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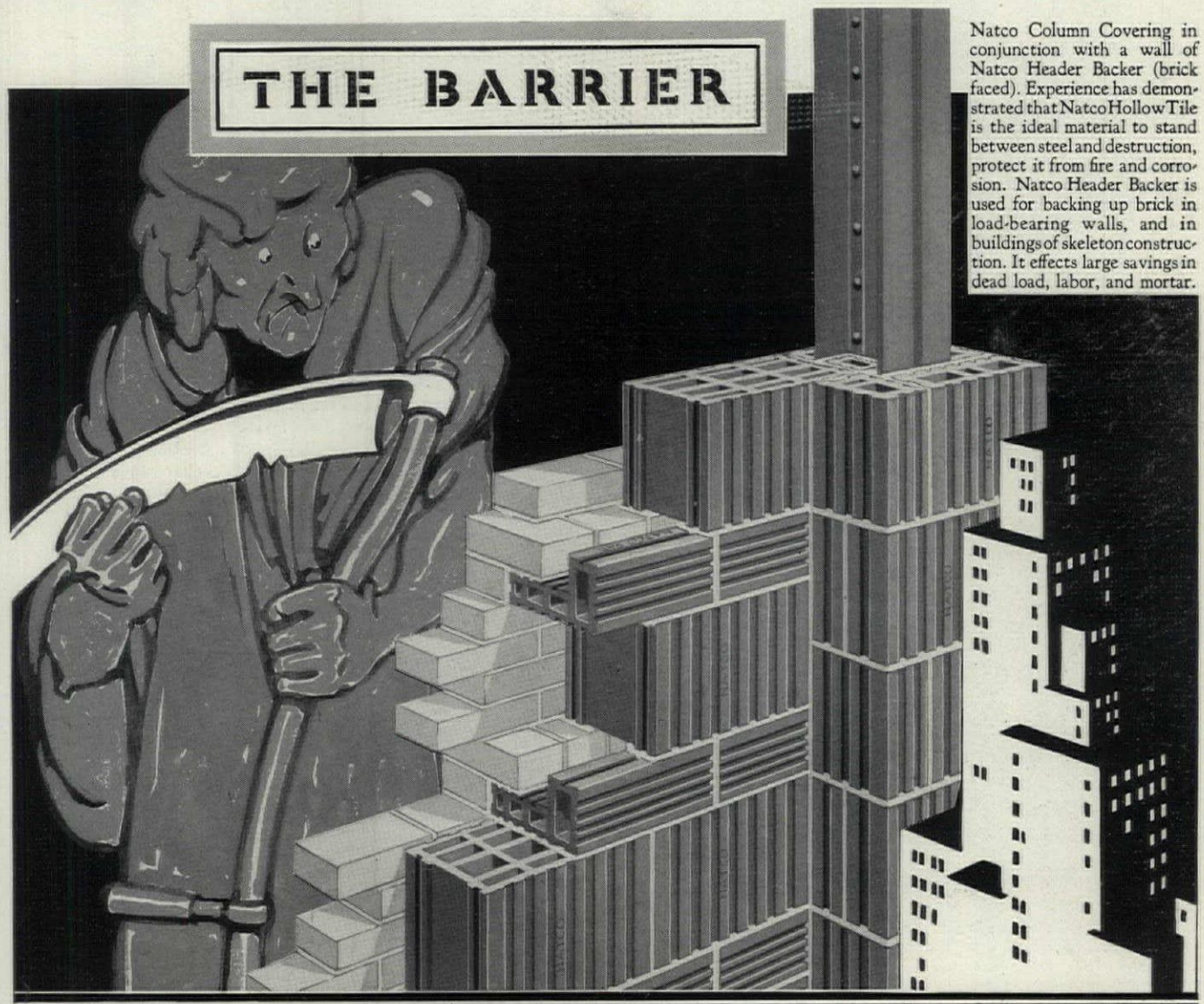

Natco Column Covering in conjunction with a wall of Natco Header Backer (brick faced). Experience has demonstrated that Natco Hollow Tile is the ideal material to stand between steel and destruction, protect it from fire and corrosion. Natco Header Backer is used for backing up brick in load-bearing walls, and in buildings of skeleton construction. It effects large savings in dead load, labor, and mortar.

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NATCO
THE *COMPLETE* LINE *of*
HOLLOW BUILDING TILE

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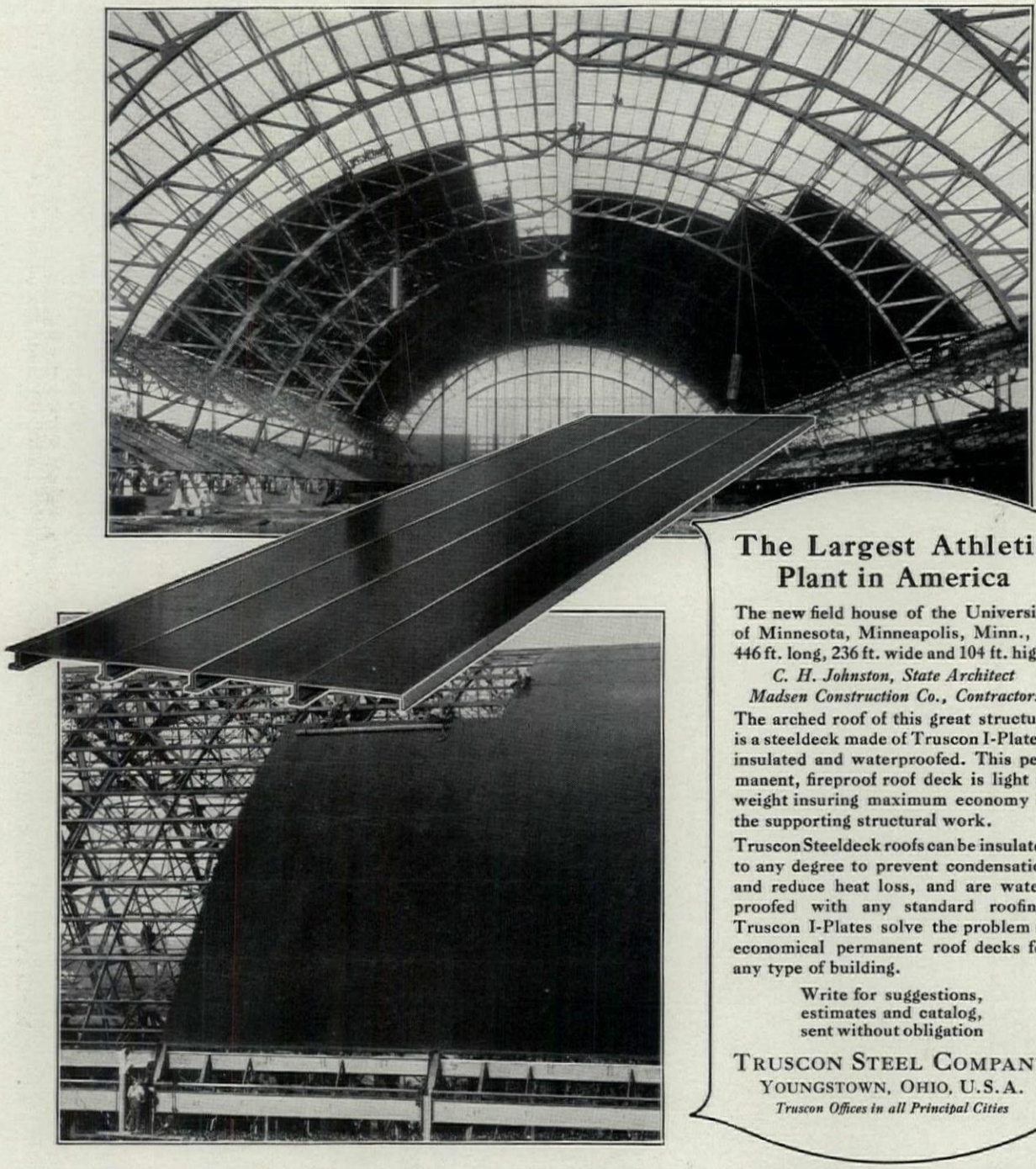
INSULATED AND WATERPROOFED



The Largest Athletic Plant in America

The new field house of the University of Minnesota, Minneapolis, Minn., is 446 ft. long, 236 ft. wide and 104 ft. high.

C. H. Johnston, State Architect
Madsen Construction Co., Contractors

The arched roof of this great structure is a steeldeck made of Truscon I-Plates, insulated and waterproofed. This permanent, fireproof roof deck is light in weight insuring maximum economy in the supporting structural work.

Truscon Steeldeck roofs can be insulated to any degree to prevent condensation and reduce heat loss, and are waterproofed with any standard roofing. Truscon I-Plates solve the problem of economical permanent roof decks for any type of building.

Write for suggestions, estimates and catalog, sent without obligation

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YOUNGSTOWN, OHIO, U.S.A.
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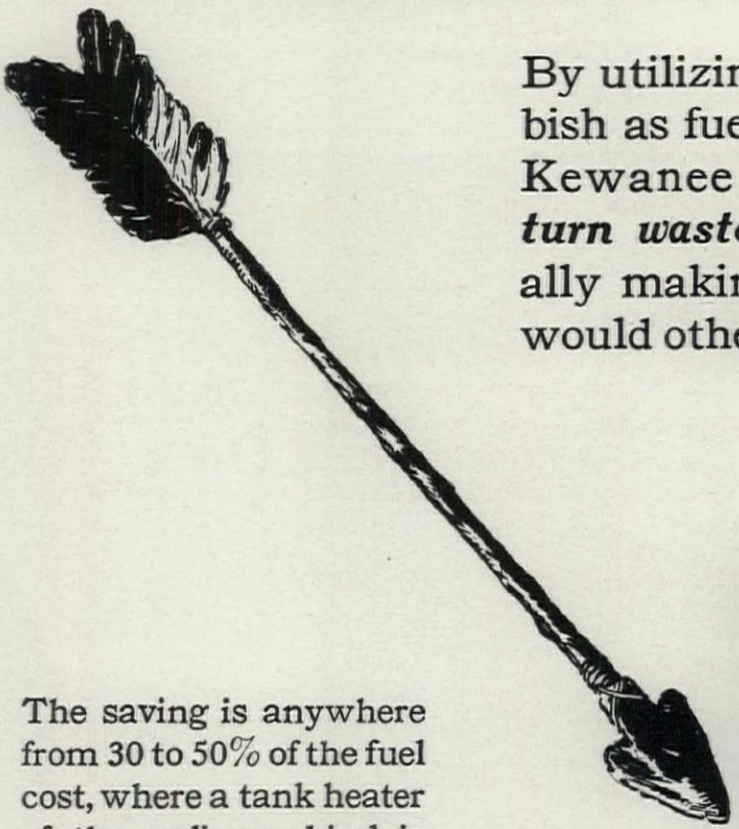
Water Heating

GARBAGE BURNERS



By utilizing garbage and rubbish as fuel for heating water, Kewanee Garbage Burners ***turn waste into profit***—actually making an asset of what would otherwise be a nuisance.

The saving is anywhere from 30 to 50% of the fuel cost, where a tank heater of the ordinary kind is used for heating water.

Made in three types and fourteen sizes to heat 200 to 2600 gallons of water per hour

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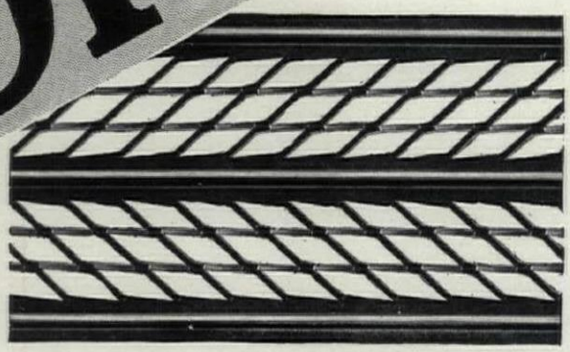
-and now NORWEST



A Steel Plastering Base for Low Cost Work

THIS new three pound 1/8" flat rib NORWEST metal plastering lath is designed for extreme economy. We recommend it for the class of residence work, etc., for which you would otherwise find it necessary to specify less good and combustible materials—wood lath or plaster board.

[The use of NORWEST assures a better grade of plastering and a greater degree of fire safety. Samples and Specifications gladly sent]

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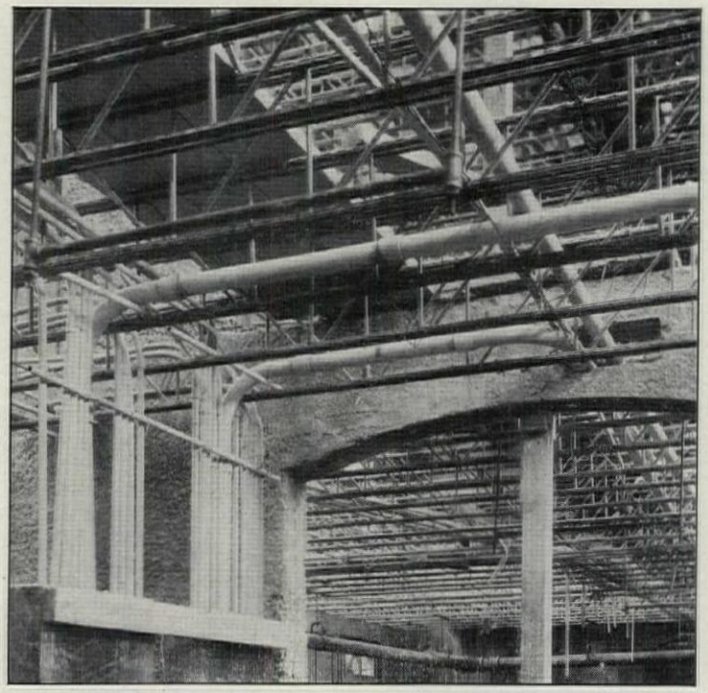
YOU MAY SEND US

Samples, Circulars and Specifications of the 1/8 inch Flat Rib NORWEST Lath

NAME..... STREET..... CITY and STATE.....

New York State Hospital program adopts



At top, Rockland State Hospital, Orangeburg, Rockland County, N. Y. Architect, State of New York, Sullivan W. Jones, State Architect, Builder, Niewenhous Co., Inc., New York. Constructed of concrete with exterior of stucco. Interior walls and supporting columns of reinforced concrete with Havemeyer Truss Floor Framing 2½" concrete structural slab on metal lath. Finished with 1" cement. Above, shows how the open webbing of Havemeyer Trusses facilitates the running of many lines of pipe, which are laid within the webs.

Largest hospital program ever undertaken by any state uses 1800 tons of Havemeyer Trusses and 600 tons of Havemeyer Reinforcing Bars, and many other products of the Concrete Steel Co.

The twenty-five buildings constituting the mammoth New York State Hospital at Orangeburg, Rockland County, are of reinforced concrete construction throughout. The floors are of the thin-slab concrete type, constructed with metal lath over standard Havemeyer Trusses. The walls, framing and foundations of concrete are reinforced with 600 tons of Havemeyer Bars. On the opposite page is a brief list of Concrete Steel Products required for this project.

Selection of the Havemeyer Truss Floor System, after extensive investigation of all materials by the New York State Architects Office, is further evidence that this system possesses characteristics of strength, economy and simplicity which must command the thoughtful attention of every architect, engineer and contractor.

A new book, giving complete design and construction data on the Havemeyer Truss floor system, with reference data sheets for use in office and field, is just off the press. The simple, standard specifications for the Havemeyer Truss Floor System are fully described. Write to Concrete Steel Company, 42 Broadway, New York.

An Engineering Service

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

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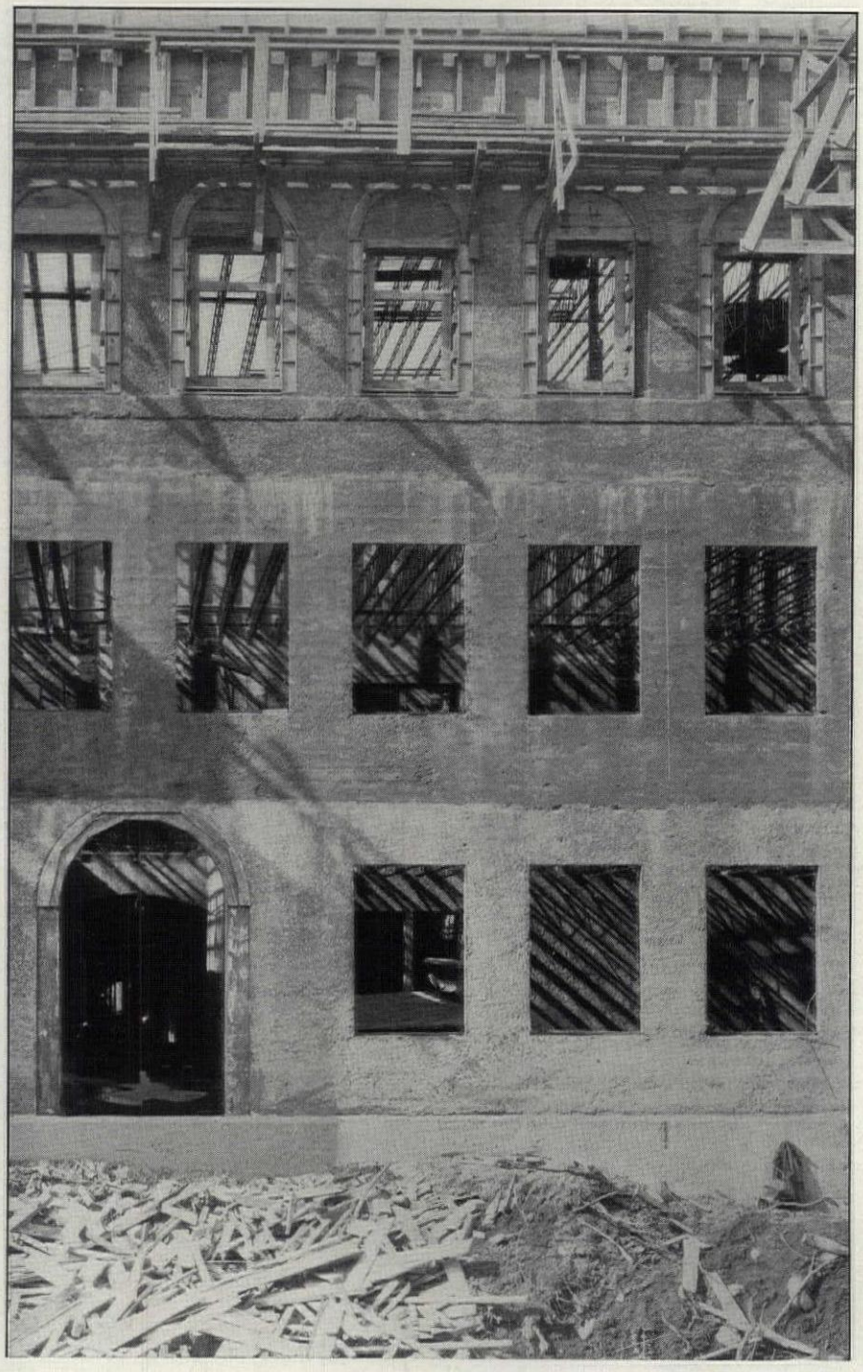
Sales Offices and Warehouses in Principal Cities: Birmingham, Boston, Chicago, Cleveland, Detroit, Kansas City, Milwaukee,

HAVEMEYER TRUSS



Products of the Concrete Steel Company used in this job

1,800 tons Havemeyer Trusses

600 tons Havemeyer Bars

196,000 sq. yds. Havemeyer Copper Bearing Rib Lath

805,000 sq. ft. Havemeyer Wire Mesh

Havemeyer Removable Tile used in the construction of 106,000 sq. ft. of reinforced Concrete Floor

Havemeyer Trusses in this Unit of the Rockland State Hospital have been laid and spaced. After being bridged, they will be covered with metal lath, upon which the concrete will be poured. The process is carried through with amazing ease, rapidity and economy.

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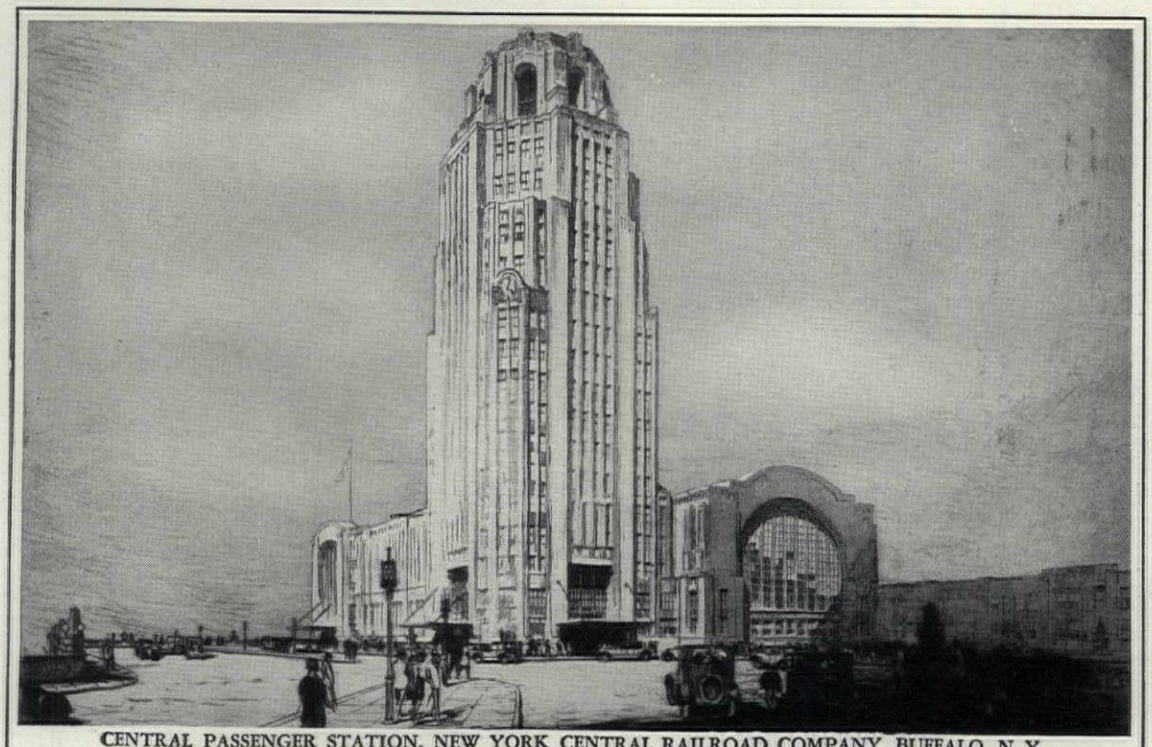

CENTRAL PASSENGER STATION, NEW YORK CENTRAL RAILROAD COMPANY, BUFFALO, N. Y.
Architect and Engineer—Alfred Fellsheimer & Stuart Wagner, New York City; Heating Contractor—William E. Shattuck Co., Buffalo, N. Y.; Fan Equipment—Buffalo Forge Company. 12,022 *square feet of* VENTO.

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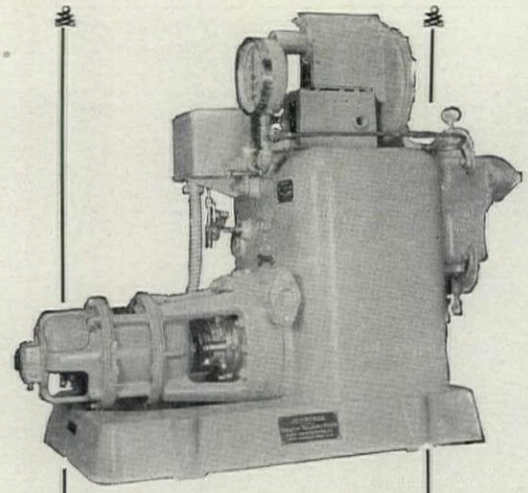
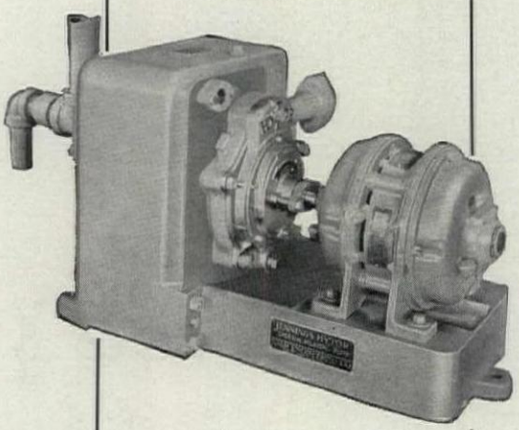
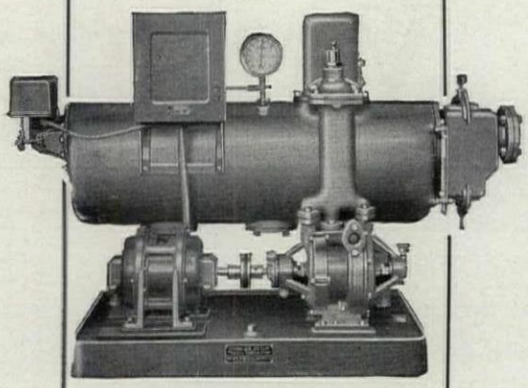


Size T, Jennings Heating Pump, for 2,500 sq. ft. equivalent direct radiation



Jennings Pump, size M, for 5,000 sq. ft. No piping connections between returns tank and pump



Motor-driven Jennings Heating Pump. In standard sizes up to 300,000 sq. ft. radiation

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THE heating boiler plays an important part in the satisfactory operation of any heating system. A wise investment here is justified by good performance season after season; also by the many economies and freedom from upkeep expense which such performance makes possible.

Choose your heating pump just as wisely. For the pump, too, controls the overall efficiency of the system.

By promoting unrestricted steam flow, a Jennings Pump brings to each radiator its share of the heat. Less coal is consumed. Boiler working pressures are lower. Furnace firing is easier—also less frequent. There is no noisy water hammer. Heat supplied can be closely controlled according to weather conditions.

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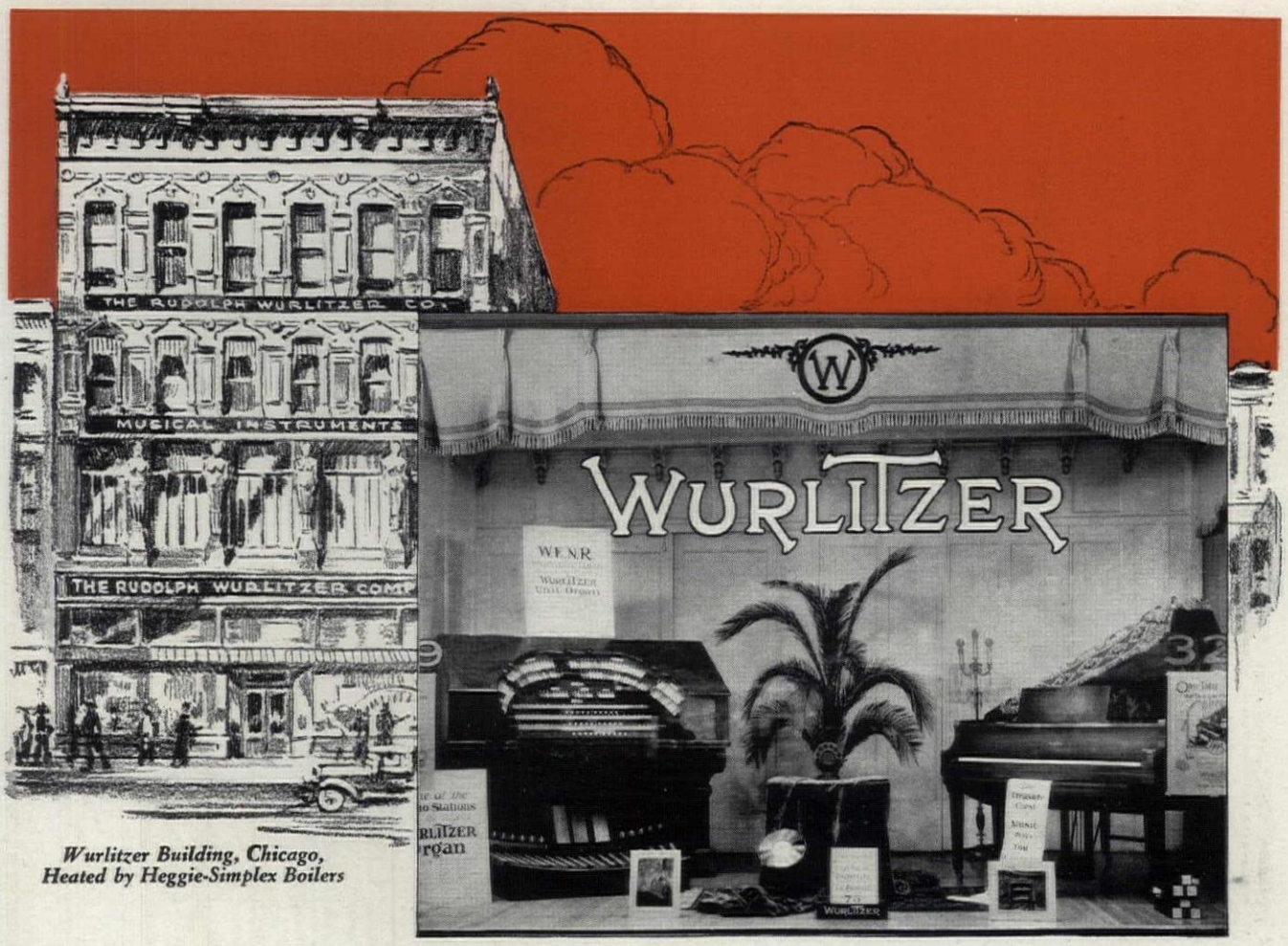
Jennings Pumps



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OUTSTANDING business success is as much a matter of scientific buying as scientific management of production and sales. Among the great corporations who recognize this fact and whose buying is always based on pre-determined standards, Heggie-Simplex Steel Boilers enjoy an ever-increasing preference as the most modern of heating boilers for modern buildings.

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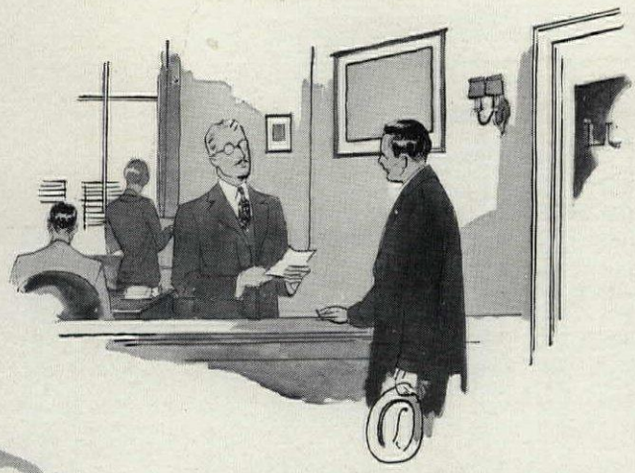

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LIME mortars require two basic ingredients —lime and portland cement. Compared with selling Kosmortar, there is twice the stock to carry, twice the bookkeeping to do, twice the loading and unloading to perform.

Kosmortar simplifies stock-keeping like it simplifies mortar-making. It is handled with half the cost of overhead and service; cuts inventory in two, and combines the turnover and profit of two products with the convenience of one.

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To buildings erected today, Kosmos promises the same long, trouble-free life given to buildings in which it was used twenty years, and more, ago. High-test, uniform, reliable.

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Sweets, Pages B2036-2039

AIA 27c5

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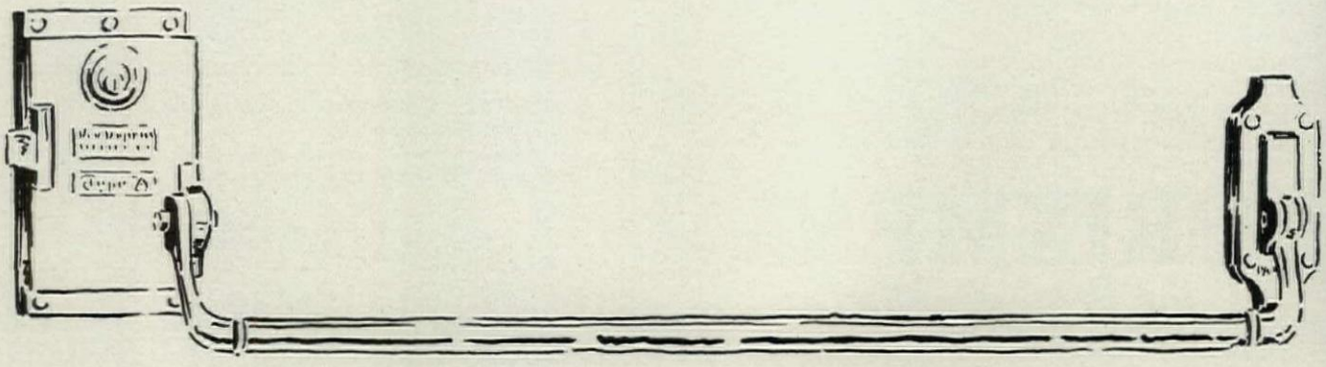

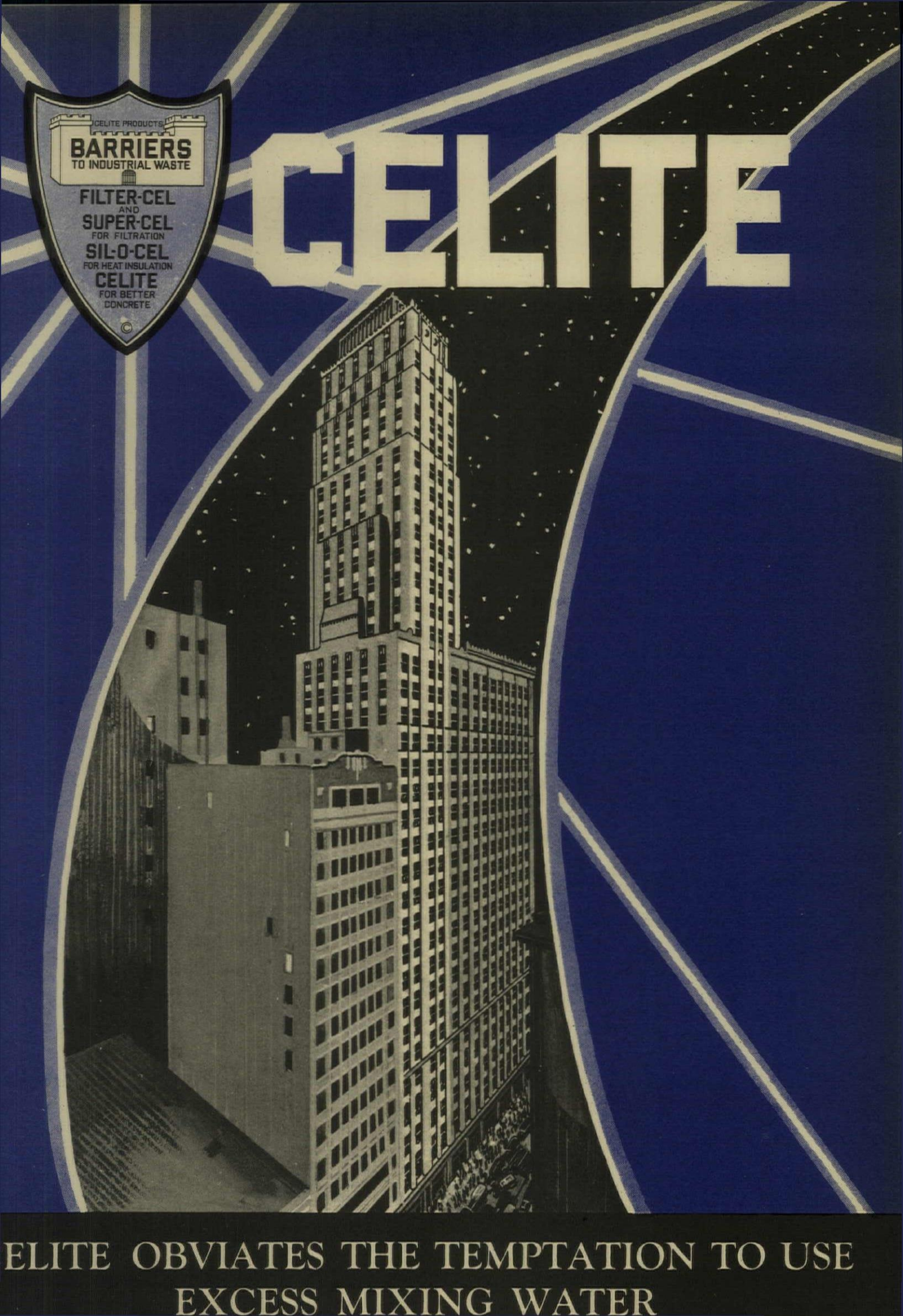
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FOR SUCCESSFUL PERFORMANCE · A.G.C.-A.E.

The architects of the 37-story Roanoke Tower Building, Chicago, are Holabird and Roche. Dahl-Stedman Company, Chicago, builders. All of the concrete placed in this structure, of 1:2:4 proportions, contained 3 pounds of Celite per bag of cement.

How effectively Celite prevented segregration is illustrated in the picture above showing the pouring of the floor slab 35 stories above the mixing plant. Note the freedom from surface water and the uniform dispersion of the ingredients of the mix.

TWO to five pounds of Celite per bag of cement will give you more workability in your concrete than can be obtained by any other means.

Three pounds of this finely powdered material used in the 1:2:4 concrete in the Roanoke Tower Building, Chicago, entirely eliminated segregation even where placing conditions were extremely difficult

Mr. W. J. Hoskins, Superintendent for the Dahl-Stedman Company, Builders, says that Celite on this job more than saved its cost alone in money that would otherwise have gone into patchwork.

Celite also made it possible to place drier concrete. It speeded up the filling and emptying of the hoist buggy which directly controlled the speed of operation on the job. It eliminated surface water evils and "lubricated" placing operations.

Hundreds of well-known contractors are using this approved workability agent to reduce their costs and improve the quality of the concrete they place. May we send you our booklet of facts about workability in Concrete.

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Please send me your bulletin on workability in concrete.

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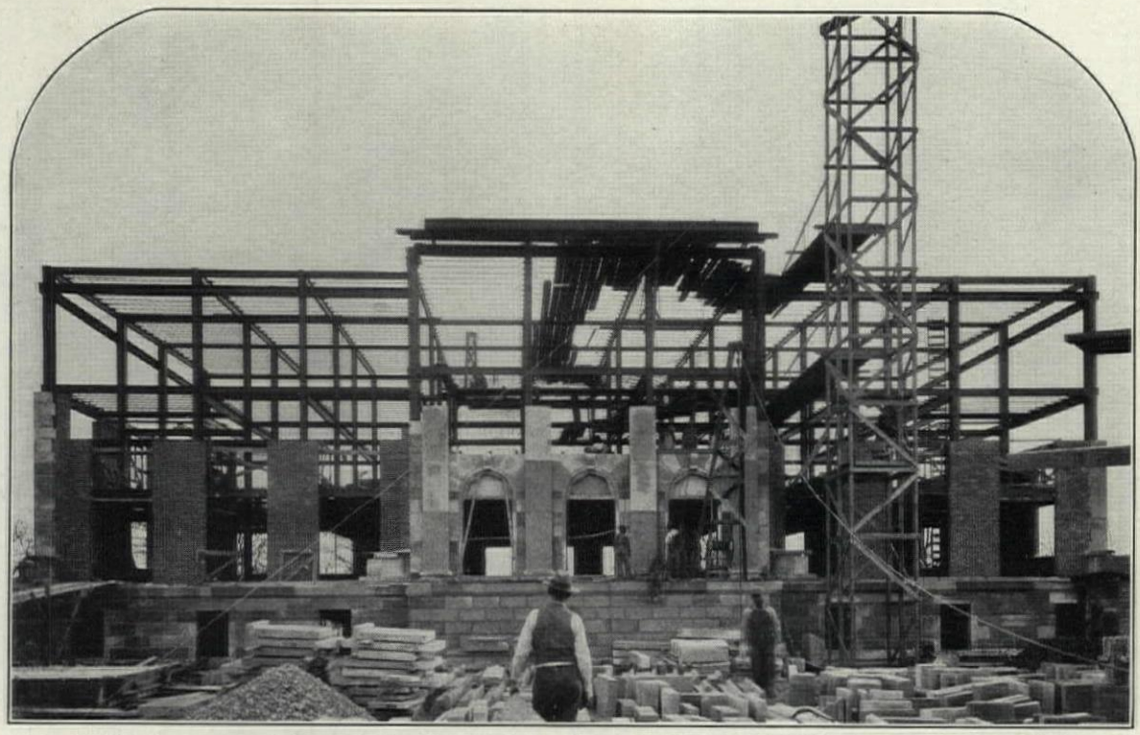
City and State _____

The beams were deep and wrapped with wire mesh. The extremely narrow space between the steel and framework at the corners would have made it almost impossible to get plain concrete well down around the under side of the beams. Here is where the added workability imparted by Celite proved especially valuable.



Munger Memorial Building
Birmingham Southern College
Miller & Martin, Arch.—J. A. Lewis, Engr.

Traced against the sky

INGALLS TRUSSES

The pattern of Ingalls Trusses in place on the bare skeletons of new buildings . . . a tracery of steel and strength outlined against the sky . . . more and more familiar to those who watch with interest new buildings in course of erection.

For fire-proof and sound-proof rapidly erected floor construction nothing quite equals Ingalls Trusses. The open web truss permits economical placing of pipes, wires, etc. Installation is quick and simple—skilled labor is not required. The positive anchorage means positive safety.

Adaptable for all types of buildings—considered by many leading architects and engineers absolutely essential for projects involving sound-proof floors such as for hospitals.

Ingalls Truss Floors represent the most modern trend in building materials. Light in weight, but of great strength, they offer unique advantages from every standpoint—design, economy, speed of erection, strength, minimum weight, fire safety and sound-proof construction.

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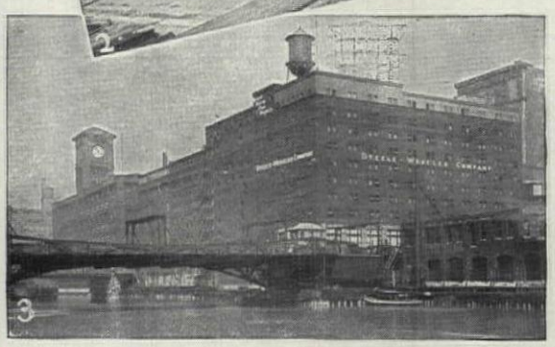
The INGALLS Steel Products CO.

Main Office and Plants, Birmingham, Ala.



1—First National Stores, Inc., Boston. Monks & Johnson, Archts.

2—Great A. & P. Warehouse, New York.

3—Steele-Wedeles Company, Chicago.

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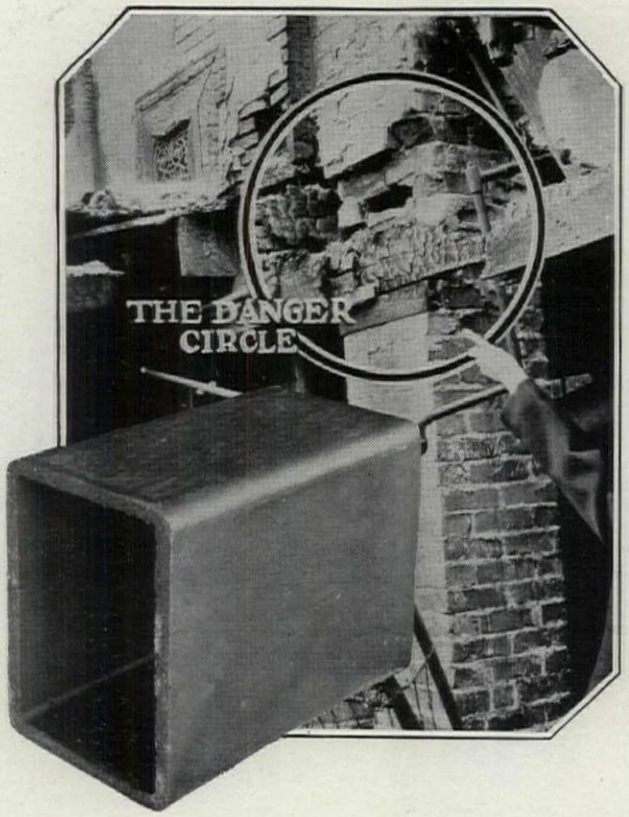

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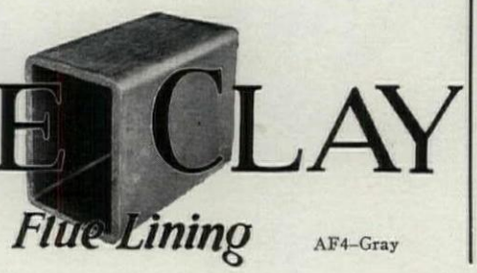

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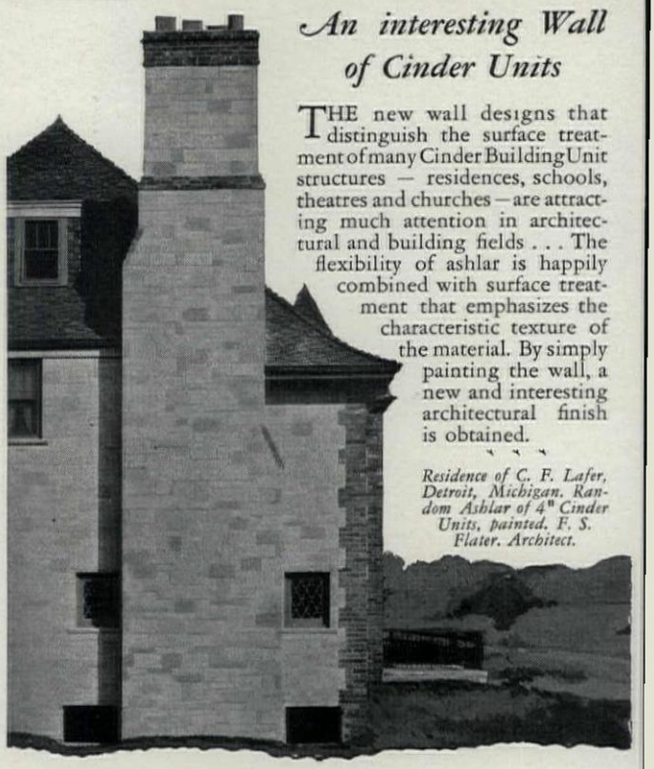

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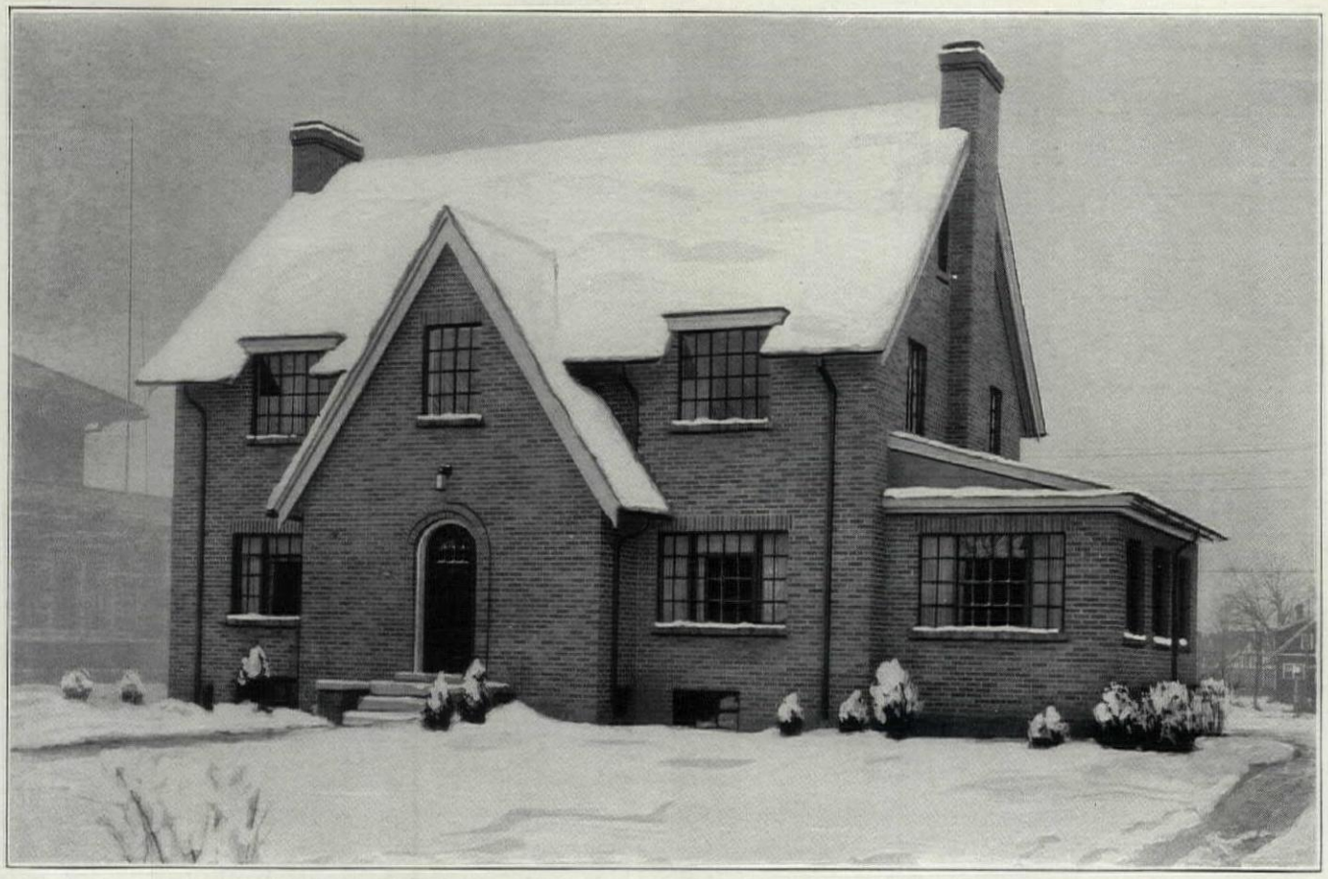

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BOOK DEPARTMENT

THE MECHANICS OF MATERIALS

A Review by
C. W. SPENCER

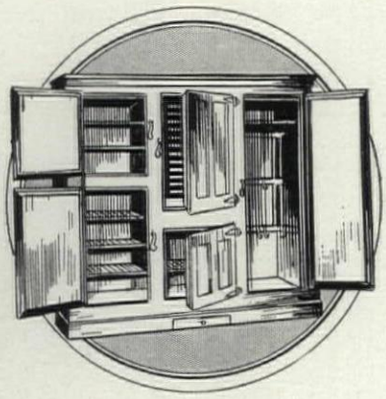
THE great strides which have recently been made by the building industry in this and other countries are due in a very large degree to the methods which are now used in working out the various problems of construction. The buildings of ancient and mediæval eras, marvelous as they were, and even those of comparatively recent times, had very little background of scientific knowledge but were developed along empirical lines,—that is the methods of their builders were based on experience and traditions handed down to them and on precedent found in the work of countless generations of their predecessors. When new departures were made at all, they were undertaken very slowly and cautiously, and new methods or principles were introduced, in most cases, as the results of development through long periods of time. The modern builder, of course, derives immeasurable benefit and inspiration from study of the precedents and recorded experience of all the builders of the past; but he has, in addition to this, the advantage of being able to work out his problems in the rational or scientific manner, using the rational sciences, physics and mathematics, and then checking and testing the results so obtained in the many laboratories and proving grounds maintained for that purpose. He is also able to profit in a great degree from the study, investigation and experience of his fellows, the results of which are now freely circulated by means of innumerable publications, both periodical and standard, in the form of articles and tabulated data covering all phases of construction science.

The successful solution of a problem in construction is had by selecting and combining materials in such a way that the completed structure serves its purpose with the greatest possible efficiency, while more labor and material have not been expended than is absolutely necessary. A simple illustration of the possibility of saving material and labor by a careful study of design from a scientific viewpoint, can be had by comparing the modern practice of constructing frame buildings with a framework of light timbers, usually about 2 inches in thickness, so assembled as to serve all necessary purposes, with the method formerly used whereby the framework was built of massive timbers, usually requiring a "raising bee" to erect them, while at the bearing points they were cut down to comparatively slight tenons, so that a beam 12x12 inches had only the same bearing power as one

2x12, and had in addition to support its own great weight. It is true that the buildings and their builders, as were the "raising bees," were quite picturesque, but the same effects are now obtained with a comparatively slight expenditure of labor and material. When the load which the various portions of a structure will be required to support has been ascertained by means of tables and formulæ, and when the materials have been selected with a view to availability and adaptability to the purposes of the structure, it remains only for the sizes, shapes and disposition of the members to be determined, and it is this phase of the problem in which the employment of the rational scientific method is most useful. It is the study and application of the principles governing this portion of the problem which form the greater part of the subject matter in the book "Mechanics of Materials," by George Young, Jr. and Hubert Eugene Baxter, professor and assistant professor, respectively, of architecture at Cornell University.

The methods of determining loads and the description and discussion of materials are introduced only insofar as necessary to form a basis for the working out of the main theme of the book. The computation of loads is a comparatively simple subject and in actual practice is determined largely by the use of formulæ and data resulting from experience and local conditions. On the other hand, the selecting of materials is a subject for lifelong study, due to the constantly changing sources of supply, methods of manufacture and local conditions governing their availability. There is ample material available on this subject, and a real working knowledge comes only through long experience and study. The main topic of the book consists of a study of force, motion and equilibrium, and forces and stresses including both concurrent and non-concurrent coplanar forces. A chapter is devoted to a discussion of the center of gravity and its location, and another to stress and deformation. Following a rudimentary discussion of safe loads and then a brief description of some of the more common building materials, considerable space is devoted to applying the principles and formulæ developed in the preceding chapters to the various fundamental parts of structure, such as columns and beams, and showing the deforming effects on them of stress and restraint. In the remaining five chapters, covering such subjects as "Eccentric Loads and Combined Stresses," "Combined Materials," "Unsymmetric Bending," and "Problems Involving Work," the subjects are covered in a most rudimentary manner, as it is felt that each of these topics might well be the subject of a complete book, the idea in presenting them being to arouse interest and excite curiosity rather than to offer solutions. Although a few tables and miscellaneous problems are published at the end of the volume, it has not been thought advisable to present a great extent of tabulated data, as many good handbooks are available, and it is assumed that those using this book in actual practice will supplement it with at least one good reference work. When so supplemented and used by one who has had the proper grounding in the rational sciences, it should become a valuable addition to any good architectural or engineering library.

MECHANICS OF MATERIALS. By George Young, Jr., and Hubert Eugene Baxter. 451 pp., ins. Price $4. The Macmillan Company, New York.



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HEATING AND VENTILATION. A Handbook for Architects and Engineers. By Charles W. Brabbee. 332 pp., 6 x 9 ins. Price $4.50. McGraw-Hill Book Company, Inc., New York.

HEATING and Ventilation," for many years the standard textbook of German-reading engineers, has been made available to American architects and engineers by its translation into English. The translator, Dr. Charles W. Brabbee, recently gave up an important position in the University of Berlin to direct research for a large American manufacturer of heating radiators.

Away back in 1893, when house heating systems as we today know them in America were in the process of evolution, Dr. Rietschel, Professor of Heating and Ventilating in the University of Berlin, Charlottenburg, sensing the need for a basic textbook on the subject, prepared his since famous *"Heizungs und Luftungstechnik."* That the architect loomed large in the field for which this treatise was written is evident from the preface of the first edition, in which we find: "I desire not only to inform owners and architects of the true setting of the problems, but also to equip the engineer with rapid means of computation for his designs." One might almost feel that the architect was foremost in the mind of Dr. Rietschel, and the engineer only an afterthought. Five years after the appearance of this first edition, cast iron sectional boilers were introduced into Europe. So the Doctor was before his time, and even at this date the basic conceptions he set forth have required only minor modifications to enable the seventh edition to rank as both fundamental and monumental. Dr. Rietschel died after having seen five editions as well as French translations testify to the intrinsic value of his life's work. His pupil and successor, Dr. Charles W. Brabbee, who also was director of the research laboratory at the university for 15 years, carried on the task of remoulding and republishing the work through two more editions. Then, about two years ago, he was called to the United States to conduct research in a laboratory especially fitted up for him by the American Radiator Company. Far-reaching and valuable were his contributions to knowledge in this field, and Dr. Brabbee has just been made director of the Institute of Thermal Research which was recently dedicated at Yonkers, N. Y.

So enthusiastic has Dr. Brabbee become over the opportunities for development in the heating and ventilation field in the United States, that he has produced an English translation, bringing to American readers this ripened fund of old-world knowledge. For the benefit of his new group of readers, Dr. Brabbee has taken logical liberties in the revision. Portions of the German text which do not apply to American practice have been abridged, and others, adaptable to conditions in the United States, have been amplified. Illustrations of American equipment have mainly replaced those of continental prototypes, but a sufficient number of illustrations of modern German boilers and equipment have been retained to make the volume valuable from a comparative point of view. The scope of the text is evident from the general heads of the four sections into which it is divided: Heating, Ventilation, The Design of Heating Systems, and Ventilation Systems.

In a general discussion of the different kinds of heating systems, Dr. Brabbee thus characterizes gravity hot-water heating: "Installations of this kind have a positive

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action which is dependable. The water temperature in the supply main is readily changed. For average winter conditions the heating surfaces have maximum temperatures of about 150° Fahr., a temperature which is hygienically desirable. Such systems are noiseless. A disadvantage is the fact that such systems are sluggish. As a consequence, hot-water heating is unsuited to rooms which must be heated rapidly or where the demand for heat is very variable. In cases of this kind the steam system is preferable. In general, the disadvantages are compensated for by the many advantages." Dr. Brabbee then proceeds to analyze the factors that must be considered by the architect and engineer in recommending or designing hot-water heating systems for residences. Descriptions and illustrations of equipment produced by leading manufacturers in Europe and America give the reader a vivid picture of what's what in this form of heating. One suggestion, applicable where gas is available, is for a duplex heating plant consisting of a small gas-fired boiler for the fall and spring heating loads and a larger boiler to be fired with coke during the severe months. Where coke is used, it is suggested that it be purchased by volume rather than by weight (one gathers that the fuel retailers in Germany are less hard boiled than in the United States!) because of the relatively high moisture-absorbing character of this fuel. He also suggests a coke bunker above the boiler installation in order that the fuel can be delivered to the boiler in a dry state. Chimneys are discussed, with the injunction that architectural features must be subordinated.

Application of some form of motive force to the water circulating in a heating system enables large, horizontally-disposed buildings and groups of buildings to be heated with ease and certainty, and the possibilities of extension of this practice to even small-house heating is outlined. High-pressure steam heating is accorded comprehensive treatment, for, although admittedly unsuited to residence work, certain applications are admirably suited to this medium. Preparatory to discussing the use of low-pressure steam for general heating, Dr. Brabbee says: "For hygienic reasons it is preferable to use hot-water heating in homes. On the other hand, low pressure steam is to be considered whenever rapid heating or speedy cooling off is desirable. As a result, it is desirable for theaters, assembly and amusement halls, business offices, churches, lecture auditoriums, for schools under certain conditions, and for the operation of steam-heating systems." Boiler types for steam-heating piping layouts are discussed and analyzed, and methods of automatic control are described. Vacuum heating, used only in connection with steam power plants in Germany, has been highly developed for residence heating in the United States, and it offers many advantages. Combination systems, where both steam and hot water are used as media, find use in specialized applications,—hospitals, some tall buildings, and hotels. Warm-air furnace heating is briefly treated, and its merits and disadvantages enumerated. It is recommended that no register temperature above 150° Fahr. be permitted. Combination steam and hot-water air heating systems, commonly known as "unit heaters," are especially adapted to large single rooms, theaters and auditoriums, and are arranged for recirculation or for delivering fresh air, or for any combination of the two. The use of steam and water as heating media in district heating systems is outlined, the former being preferred in the United States and the latter in Germany, where forced circulation is practiced. The first heating system of this type was installed in New York in 1879, and today it has, in its downtown plant, 45,000 boiler horsepower.

Utilizing the exhaust steam from engines or turbines for heating purposes has reached a high stage of development, particularly in large industrial plants where both power and heat are required for many purposes. Dr. Brabbee presents graphic charts giving heat balances for various prime movers, showing that, as an average, 60 per cent of the heat energy in fuel cannot be converted into power, and would be wasted if it were not possible to use it for heating purposes. He outlines the elementary economics of the problem and discusses, in considerable detail, the technique of exhaust steam heating. "Ventilation is necessary." says Dr. Brabbee, "because of the contamination of air in occupied rooms. The degree of the possible contamination of the air supply may be appreciated when it is considered that people assimilate 25 pounds of nourishment in a gaseous form and 6 pounds in the form of solids and liquids in 24 hours." Calling attention to the fact that the ventilation of schools in Europe is not given sufficiently serious attention, Dr. Brabbee maintains that adequate ventilation in such quarters not only reduces sickness but minimizes the effort required of a teacher, and increases student capacity.

Many fundamental data are given on the subject of heat-and-moisture emission from persons and from sources of illumination, leading up to the question of the required changes of air for any given conditions. The synthetic air chart, resulting from the very extensive investigation of the American Society of Heating and Ventilating Engineers, is cited as the foundation of air conditioning knowledge. The essentials are proper temperature, humidity and air motion, with minimum dustiness, odor, bacteriological content, and carbon dioxide content. Each of these is discussed and analyzed. A section is devoted to a study of pressure relations in a closed room, followed by outlines of various non-mechanical and mechanical means of room ventilation. In this chapter is a fund of information on equipment for dust removal, humidifying, moving air and controlling air conditioning. Outlining methods of cooling occupied rooms, Dr. Brabbee says that, in general, inside temperatures should not be maintained at more than 10° to 12° below the outside temperatures, and recommends a decrease in relative humidity and definite air movement to produce comfortable conditions. Of less interest to architects are the portions of the volume devoted to technical analysis of heating plant design, prefaced by a mathematical study of heat transmission and of heating surface computation. The designing of various types of heating systems also is handled with characteristic Teutonic tendency toward mathematics, and with scrupulous thoroughness. Several typical examples are worked out in detail, and this portion is of inestimable value to the heating engineer who cares for accurate and finished predetermination rather than for rule-of-thumb estimates. These examples cover almost every conceivable method of heating with high and low-pressure vacuum steam, hot water and warm air

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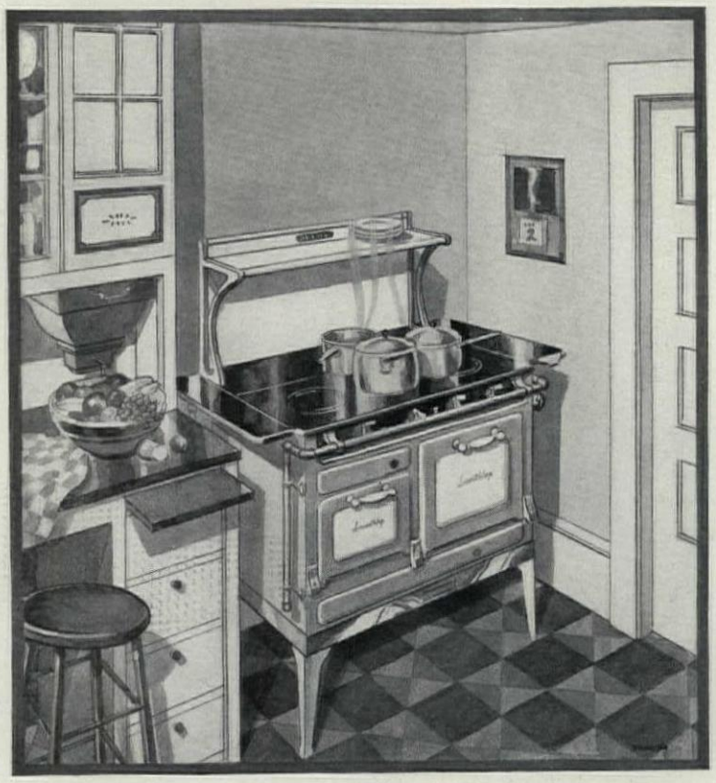

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THE
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VOLUME XLVIII NUMBER FOUR

APRIL 1928

PUBLIC BUILDINGS AND THE ARCHITECT

BY
SULLIVAN W. JONES
FORMER ARCHITECT OF THE STATE OF NEW YORK

THE part architecture should play and the place of the architect in public building progress are questions assuming aspects of vital interest to the architectural profession. At the sixtieth convention of the American Institute of Architects in Washington last May, while discussing these questions, I pointed out that during the next 12 years a minimum of one and one-half billion dollars would have to be spent on institutional and other public buildings by the 48 states collectively. More recent studies of the building needs, which have accumulated and are now accumulating at an increasing rate, seem to indicate a total expenditure far in excess of the previously stated minimum. This substantial increase is reflected not only by the rapidly growing needs for additional prison and mental hospital and other institutional capacity, but also by the growing importance of public works as a field for the permanent investment of the vast accumulations of capital in this country.

The profession's interest in this great program has many roots; but its immediate interest, which must be aroused and sharpened into action, is twofold:—first, as a profession, in seeing that the policy and procedure adopted by the several states are consistent with the fundamental principles underlying professional practice; and second, as well informed citizens, in seeing that conditions created insure against planning which produces abortive architecture, waste of public funds, high maintenance and operating costs, and the intrusion of purely political considerations. The interest of the architect as a citizen and tax-payer who knows how buildings should be designed and constructed, assumes the quality of a real and compelling responsibility. Very generally the profession has recognized and accepted the responsibility with which specialized knowledge automatically clothes itself. The success or failure of representative government depends largely upon the effectiveness of the well informed, articulate minority in preventing blunders and insisting that whatever is done shall be done in the interest of the public, whose money is being spent. Indeed, that purpose is at the very core of the professional idea. This is the time, it seems to me, to design and construct the machinery,—or at least to design it,—for the wise and economical execution of this impressive public building program. The profession must not, by default, permit the designing of this machine by inept, ignorant and selfish hands. If the profession does not seize the opportunity to secure proper legislation, a situation may be expected to develop similar to that which has aroused the indignation and protest of the architects of New York. Often, things done are ridiculously difficult to undo because they get tangled with those imponderables in politics which stubbornly refuse to give way to reason, logic and common sense, but which grow out of and turn upon wholly irrelevant conflicts between personal aims and aspirations, grudges, petty prejudices and struggles for individual advantage.

In 1899, upon the insistence of Theodore Roosevelt, then governor, the state of New York stepped into the van of progress by creating the office of state architect. This happened after the capitol had been 30 years building and not completed. In 1909 the enactment of the public buildings law definitely fixed the state architect's duties, gave him authority over all buildings constructed with state funds except armories, and established supervision of architecture in connection with state buildings as a function of state government by creating the Department of Architecture. Until January 1, 1927, the state architect, like the attorney general, rendered his professional services to the legislature, the governor, and to all departments, boards and commissions to which funds were appropriated for the construction of buildings. These other state agencies were the state architect's clients, and he served them just as an architect in private practice serves his clients. The state architect's practice, however, assumed a scope and proportion far beyond ordinary practice; his planning and budgeting were for the whole state. "Where to build," was a more important question than "what to build." The planning and construction of state hospitals for the insane formed not a problem of one building or a group of buildings, but one of a coördinated state-wide service balanced

against population needs. Architecture as a function of government is, in part, regional planning, and takes on some attributes of statesmanship. Programing and budgeting the building needs of a state as a preliminary to the framing of appropriation bills are work for which the architect is peculiarly well qualified by training, experience and habit of mind.

Until reorganization became effective, the public buildings law in the state of New York clothed the state architect with authority to secure the services of architects in private practice on individual projects. This authority was used in many cases where such services were beneficial to the state, either in expediting work or by bringing to bear upon the solution of special problems specialized knowledge and experience. The law worked well. It provided for tapping the great reservoir of competent architectural service available, and at the same time centralized control in an official who was sympathetic with and understood established procedure and knew how and where to secure the services required. The high standards of design and execution and the low cost of services attest the wisdom and success of the law. But all of this has been cast into the discard to embark upon an experiment in working out a mistaken theory of organization which already has proved disastrous. The Department of Architecture has been abolished, and its duties transferred to a Division of Architecture in the Department of Public Works. The state architect has been stripped of his former responsibility and authority and subordinated to the Superintendent of Public Works. Supervision of construction has been transferred from the state architect to the head of the department's engineering division. The designer no longer controls the execution of his design. As a function of government in New York, the practice of architecture is being ignominiously dragged through the mire. And to complete its prostitution, legislation is now pending which changes the title of state architect to "Commissioner of Architecture" without requiring the appointee to be an architect!

State Office Building, Albany
Sullivan W. Jones, State Architect

I have drawn a somewhat detailed contrast between the past and present conditions in New York with a double purpose:—first, to indicate to the profession what may be expected to happen in other states; and second, to show that before architecture and public building were sacrificed upon the altar of the great god "reorganization," whose feet are of political clay, the procedure was in substantial accord with the policy laid down by the Institute many years ago and reaffirmed by the regional conference held in Albany on February 28: "The public interest is served best when the official architect, federal, state or municipal, may function freely and independently in serving the departments of the government, and provision is made for the employment of competent and experienced architects in private practice in connection with the design and construction of important public buildings."

What has happened in New York may have a long trail of disastrous consequences, because of the state's pioneer work in establishing a wise and economical procedure in the construction of public buildings, and in formulating and financing its unprecedented construction program. Unless the habitual tendency to follow in the footsteps of the leader is checked, we shall have other states using New York's retrogression as full justification for standing pat or following a similar course. Let there be no mistake about it,—New York has relinquished its leadership, lowered its standard, and retreated to the dismal period when architecture in connection with public buildings was counted among the prizes in the patronage grab bag. The issue in New York has now become enmeshed with the political imponderables. New York has made itself the battleground upon which not a local but a national issue is being fought out. The New York profession is making a splendid fight, in which it has the whole-hearted and enthusiastic support of the entire building industry and the civil engineers. The support of the profession everywhere should be thrown behind the architects of New York. If they are defeated, the action will shift to other states, and the profession will be confronted with the necessity of conducting a disheartening defensive campaign. Every effort must be made to reëstablish architecture in its rightful place in state work to insure that the public funds shall be expended in such a way that the buildings will be efficiently planned, properly designed and economically built.

THIN SLAB CONCRETE FLOORS OVER STEEL JOISTS

FLOOR CONSTRUCTION SYSTEMS EMPLOYING LIGHT STEEL STRUCTURAL MEMBERS IN CONJUNCTION WITH A CONCRETE SLAB POURED IN PLACE WITHOUT FORMS

BY

C. STANLEY TAYLOR

SEARCH for improved materials of construction and for better methods of utilizing the materials already at hand has been going on ever since man first undertook to erect shelter. Within comparatively recent years the materials employed for the structural elements in buildings have been the subject of extensive research, directed toward greater economies through the elimination of unnecessary or surplus material and through improved methods of putting the structural members together to form the desired kind of building. Wooden construction has been largely superseded for important structures by the use of steel and concrete because of their fireproof characteristics, and because their greater strength permits their use in buildings of great size.

The use of both steel and concrete for structural floor systems has developed within the lifetime of living architects and engineers. Reinforced concrete has been employed only for about 30 years. Structural steel construction has a history running back approximately a half-century. No better materials have been developed, but the method of utilizing these two basic structural materials has been undergoing constant improvement. Steel and concrete have been used together in practically all modern buildings, especially for the construction of floors. Local market conditions and the availability of materials, together with the size and height of the structure have been the governing factors determining the choice of reinforced concrete or structural steel framing for any given building. In some areas for buildings up to 10 or 12 stories in height reinforced concrete has proved to be very economical. Steel has universally predominated for taller structures, and in certain sections it is cheaper than concrete even for lower buildings. Methods heretofore employed for the use of steel and concrete for structural floor systems have been considerably more expensive than wood joist construction formerly employed, due largely to the need for formwork to support the concrete slabs during the construction process and because the dead load imposed by the resulting floor system has been relatively high.

There has recently come into general use a new system of floor construction employing a relatively thin concrete structural slab supported by light steel joists in which the need for formwork has been eliminated by the use of a reinforcing material which combines the functions of a form and slab reinforcing. In order to acquaint architects and builders with the present state of development of this system, the subject is divided under these different headings:

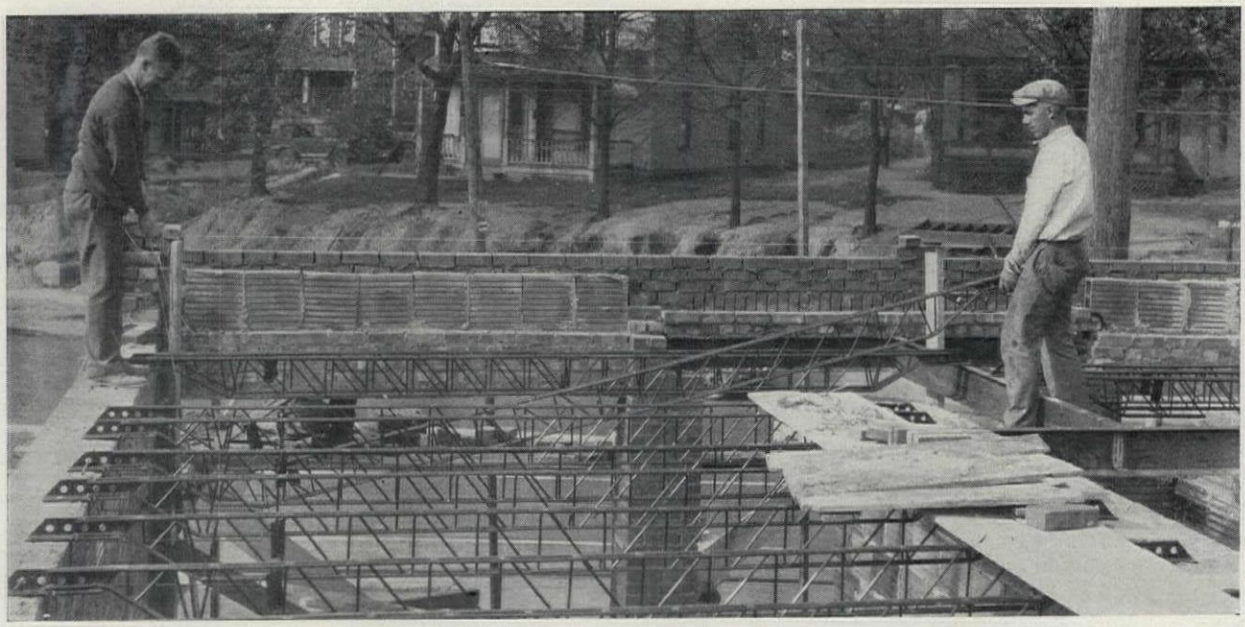
1. Summary of Thin Slab Concrete Floor Systems.
2. Characteristics of the new Floor System.
3. Fireproof Qualities.
4. Insurance Ratings.
5. Building Codes.
6. Types of Steel Structural Members.
7. Typical Load-bearing Capacities.
8. Methods of Installing Steel Members.
9. Slab Reinforcing and Supporting Materials.
10. Methods of Installing the Concrete Slab.
11. Ceiling Construction.
12. Specifications.

The data upon which this article is based have been obtained through engineers, architects and builders who have successfully employed this type of construction; from the manufacturers of the various materials used in the system; and with the coöperation of the American Institute of Steel Construction.

Summary of Thin Slab Concrete Floor Systems

Reduced to its simplest terms, this floor system consists of four elements: the steel joist or structural member; the material used to support and reinforce the slab; the concrete slab with its finished floor surface; and the ceiling beneath. The steel joists are light structural members of which several types are now on the market. These types include rolled steel sections having solid webs and flanges, rolled steel sections with expanded or perforated webs, and various types of built-up members usually of truss form composed of bars, tees and angles welded or riveted together in accordance with various designs. These structural members are placed upon the building framework or walls without riveting or welding and, being entirely fabricated in the shop in standard lengths, require no cutting or fitting at the site. They are held in place by means of wire or metal bridging and bracing and by various types of clips or anchors, as will be seen in several of the accompanying illustrations.

On the tops of the joists, which are usually spaced from 12 to 30 inches apart, metal lath or one of the newer types of welded mesh reinforcing, having a waterproof backing which eliminates use of forms, is spread and attached to the truss by means of clips or wedges. After conduits and pipes are in place, a concrete slab is poured directly over the supporting and reinforcing material. Where a wood top floor is contemplated screed chairs and sleepers are



Steel Joists of Average Length Are Light Enough to Be Handled by Two Men

set before the concrete slab is poured. No temporary forms are required. To the underside of the truss metal lath is wired or attached by various devices designed for the purpose and a plaster ceiling applied in the usual fashion.

Characteristics of the New Floor System

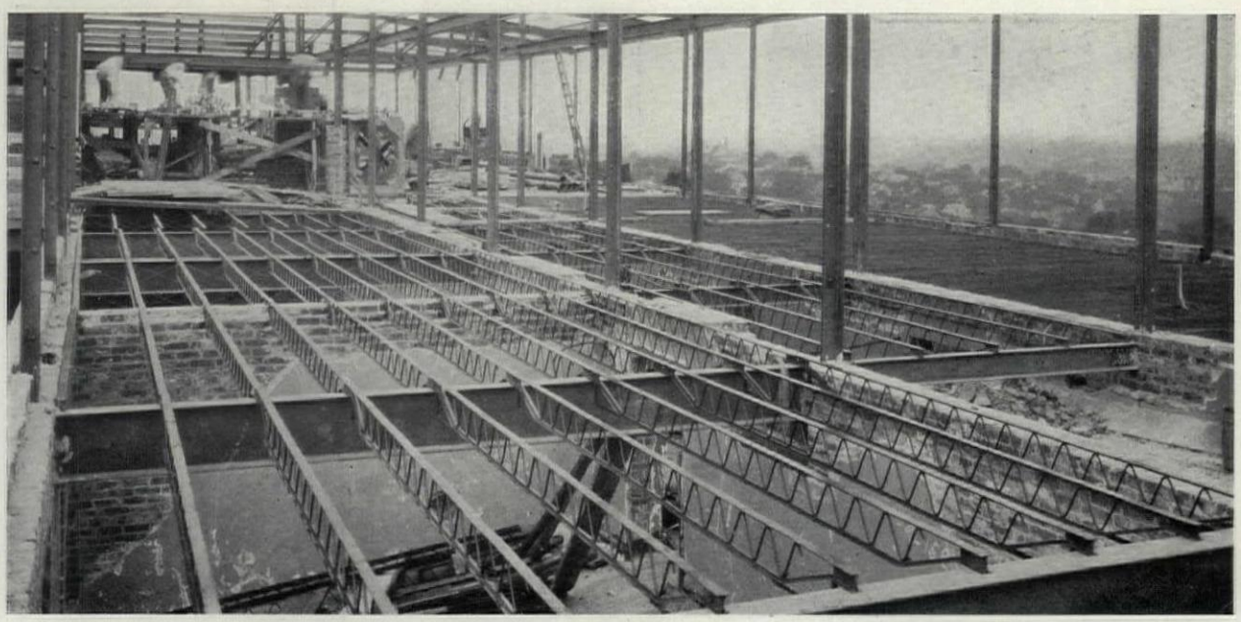
The resulting construction is considerably lighter than a reinforced concrete floor or a floor composed of structural steel shapes encased in concrete with the usual reinforced concrete slab above and between the beams. The average weight of a thin slab concrete floor on steel joists, including the metal lath and plaster ceiling, the weight of joists, the slab and wood top floor, is from 40 to 50 pounds per square foot. This floor system is primarily designed for relatively light live load capacities. For practically all spans possible with standard steel joists or trusses, live load capacities range from 40 pounds to 150 pounds per square foot. This range is obtained largely by the spacing of the steel joists. While joists are provided for any local condition, the system is generally used for light-occupancy buildings.

A number of important economies are inherent in this type of construction. The relatively light dead load lessens the load imposed upon columns, bearing walls and foundations, resulting in a saving in the materials required and in cost of these parts. There is an obvious saving in the amount of material employed, less steel and less concrete being required for this light-weight floor construction than are needed for other standard types of floors, and there is a very marked saving in the amount of labor needed to install these materials. The entire elimination of formwork is perhaps the most important single factor in lowering the cost of this new floor construction system. Forms are expensive to build and to take down, and the material used in the forms has little salvage value. Formwork contributes nothing to the ultimate value of the structure.

Practically all types of steel joists permit conduits and pipes to be run through the floor between the ceiling and the concrete slab, either by carrying the pipes through the open webs, when this type of member is employed, or by carrying them around the ends of the joists when solid web members are used. This opportunity for utilizing waste space within the floor itself eliminates the need for extra slab thickness to conceal conduits and pipes, often necessary in reinforced concrete or fireproofed steel construction. The rapidity with which the floor can be constructed contributes further saving. There is no riveting or fabricating on the site. The elimination of the forms saves time as well as materials. The self-supporting floor permits other operations to be conducted on floors immediately below that under construction, and mechanical installations can be carried on while the floor is under construction. These factors shorten the time required for completing the building, resulting in lower interest charges on the capital tied up during the construction operations and advancing the date when the building begins to produce an income.

Fireproof Qualities

It is not generally realized that thin slab concrete floor construction upon steel joists enjoys the rating of "fire-resisting" construction. The steel joist type of floor has been in use for 20 years. In all this time there has never been a reported instance where fire has structurally damaged a steel joist floor. Fire tests by impartial engineers have proved this fire-resisting quality to be due to the inherent characteristics of the floor system and not to a fortunate lack



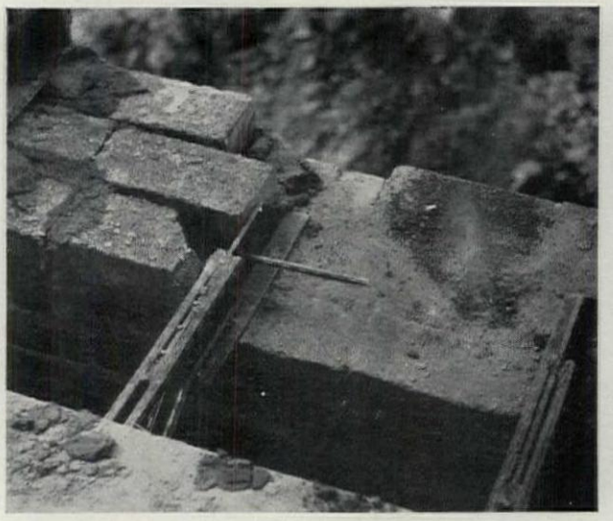
Steel Joists Are Easily Placed Without Field Fabricating or Riveting

of serious fires in buildings employing this construction. The reasons for this characteristic are of considerable interest. Many materials are incombustible at even high temperature, but no material is immune from expansion and contraction with variation in temperature. As an example of the extent of this expansion, a steel beam 20 feet long will expand about 3 inches when raised from 100° to 1600° Fahr. Concrete expands in a similar manner, the rate of expansion varying with the aggregate. When a member such as a steel beam is heated on one side while maintained at ordinary temperatures on the other side, the resulting expansion will cause distortion or buckling toward the heated side. Similarly, if the beam is rigidly fixed at its ends, and heated uniformly or otherwise, the expansion that is bound to take place results in distortion. However, a beam that is loose at one or both ends will simply expand in length without distortion, if uniformly heated. As a result, a beam resting on brick walls will successfully withstand greater temperatures than a beam riveted to columns.

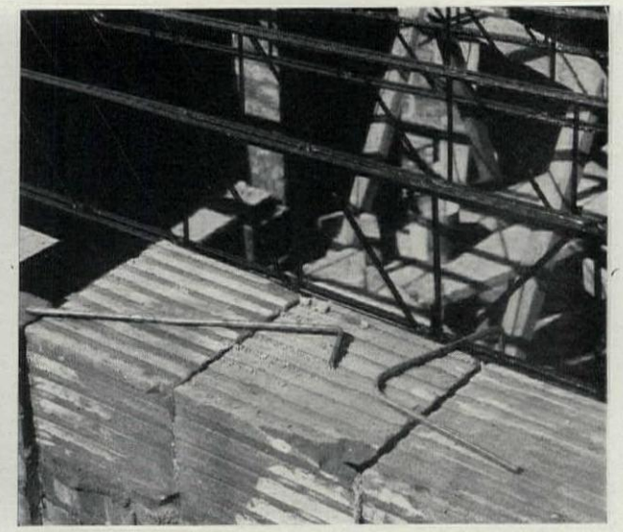
Another effect of heat on building material is on its strength. In general, as the temperature rises the strength decreases slowly to a critical point, after which it drops off rapidly. Structural grade steel, however, is an outstanding exception. Its strength is actually about 15 per cent greater at from 600° to 700° Fahr., than at room temperature. With the temperature raised to nearly 1000° Fahr., a steel member will still safely carry its designed load provided the member has been permitted to expand without distortion. Analyzing this, certain obvious conclusions are drawn as to the proper methods of fireproofing structural members: First; any heat that reaches a structural section in a building should be uniformly distributed over the entire area of the section. Second; the members should be free to expand as heat is applied, or they should be so protected as to permit but a moderate increase in temperature.

It has also been established that fireproofing with plaster on metal lath is highly effective, probably because it employs a principle of surrounding the steel member with a dead air space. Plaster is highly resistant to the transmission of heat, but when applied on relatively smooth surfaces it has no protective value. This is because ordinarily adhesion will not withstand the stresses resulting from high temperatures. However, when applied on metal lath or other reinforcing fabric of suitable design, a mechanical bond is secured. The plaster is not only held to its work, but is reinforced in every direction against temperature stresses. The result is a tenacity or durability beyond most other combinations of materials. Many laboratory tests have been made that have consistently indicated the effectiveness of plaster as a heat resistant and have established plaster on metal lath as a fireproof detail in construction. Experience in actual fires has proved these tests.

For the reasons just indicated, steel joists as employed in this type of floor or roof construction are not fixed at their ends but are free to expand and contract with changes in temperature. The joists are surrounded by a dead air space. If the fire conditions under a floor panel are such that the temperature in this dead air space is not raised above 1000° Fahr. until the fire has burned itself out or been extinguished, the only resulting damage will be a calcined ceiling. Fire tests conducted by the Pittsburgh Testing Laboratories on an actual floor panel constructed with open web steel joists of the truss type and fully loaded, indicate that a temperature of 1800° Fahr. can be maintained for four and one-half hours under the floor without structurally damaging the joists. The floor panel used in this test had a



A Simple Method of Anchoring the Ends of Steel Joists in Masonry



Details Showing One Method of Side Anchoring Open Web Joists

metal lath and plaster ceiling beneath the joists. Both insurance rates and building codes are reflecting an ever-increasing approval of the steel joist floor as giving fire-resisting building construction.

Insurance Ratings

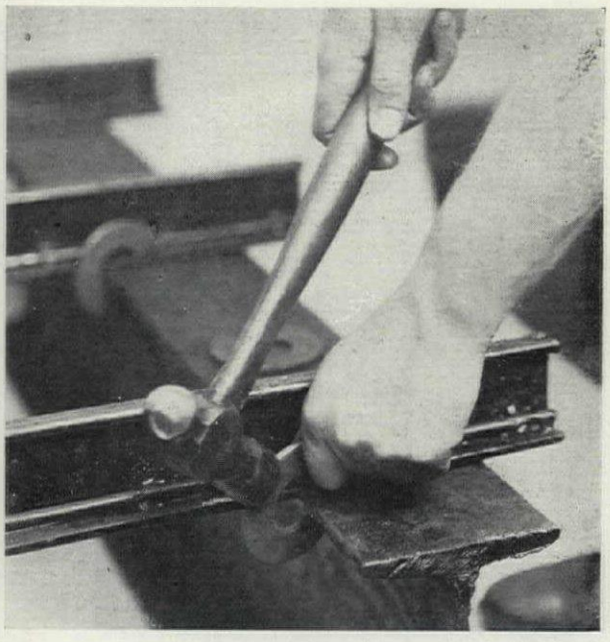
Insurance rates properly influence the architect's choice of structural floor systems. These rates are based on experience. When steel joists were first brought on the market in 1907, there was little to guide the insurance companies. The strip steel joist (sometimes called "metal lumber") came into prominence in 1921 when certain insurance companies recognized and granted steel joist floor construction the minimum basic fireproof rates. This rating is given steel joist floor or roof construction by practically all companies at the present when certain required conditions are met. These conditions involve properly fireproofing the structural portions of the floor. The ceiling plaster should be applied to and form a good mechanical bond with the ceiling lath. The usual practice is to use a 3/8-inch rib lath with ribs turned up or a flat diamond-mesh lath furred to the bottom cords of the joists with furring channels or rods. The joists should be placed on (not riveted or bolted to) the supports to allow the joists to expand or contract without distortion under actual fire conditions. Where wood finish floor is used, wood nailing strips should be blocked up or placed on screed clips to allow at least 1 inch of concrete to come between the wood strips and the joists. This construction takes the minimum basic fireproof rate for the slab thickness used, the same as in concrete joist floor construction. Of course it must be appreciated that this rating applies to the floor system only, and the ultimate insurance rates for any given building are influenced by other factors. The use of non-fireproof partitions or the improper fireproofing of the structural frame may penalize a building and increase its rates.

Building Codes

The architect is also largely guided in his choice of structural systems by local building code limitations. Building codes are constantly undergoing evolution and change, and no definite statement can be made with reference to the acceptance of this type of construction in all cities. In general, thin slab concrete floors on steel joists are recognized as fireproof floor construction in all but a few of the important building centers. It must be appreciated that the method of handling approvals of new materials and construction methods by building departments varies. In most cases no mention is made of steel joist construction in printed codes. The usual recognition consists of an interpretation of existing sections of the code. In some cities only a few officials in the building department know the rules on this type of construction. Such limitation as may affect a particular building may be easily determined by writing the building commissioner, the American Institute of Steel Construction, or the larger manufacturers of steel joists, outlining the type and location of the building under consideration.

Cities such as Pittsburgh, Cleveland, Rochester, Cincinnati and St. Louis approve this construction for all types of buildings in all fire zones. Philadelphia approves the construction for all types of buildings in all fire zones under existing sections of the code that call for protection of the bottom chords of the joist with 2 inches of concrete or gypsum. The method employed for taking care of this special requirement is discussed later under "Ceiling Construction." The building departments of Washington, Detroit and Buffalo have given their approval of steel joists for all types of buildings within a specified height limitation that confines the use of this floor system to seven- or eight-story buildings. This measure of caution seems unwarranted to many familiar with the performance of these floors. It is obvious that the merit of this construction is not

Most Open Web Type Joists Use a Ceiling Bracket to Extend Lower Chord to Wall for Ceiling Lath



End Anchorage of Steel Joists on Structural Steel Girders by Means of a U-Shaped Wedge

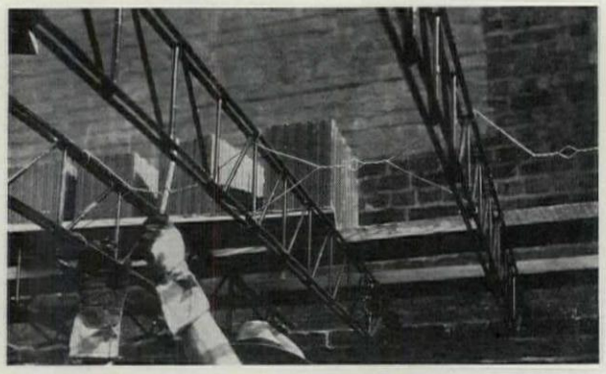
different in the fourth floor from what it is in the thirtieth floor of a building. New York, Chicago and Boston are the large cities that do not at present permit the use of steel joist construction for fireproof buildings in the more rigidly restricted building zones. With the architectural departments of such states as New York, New Jersey and Illinois specifying thin slab concrete floors on steel joists on state projects involving millions of dollars, and with a 35-story building under construction in Pittsburgh employing this floor system, it is only a matter of time until departments will give further recognition to the merits of this system where limitations now exist.

Types of Steel Structural Members

In this article the term "steel joists" is used in a general sense to connote all forms of light steel structural members employed in thin slab concrete floor construction. Steel joists are sold under various names and are sometimes classified as rolled sections, metal lumber (pressed sections), bar joists and trusses. For our purpose here, however, the only general division of these members is into two classes,—those having solid webs similar to ordinary I-beams, and those having open webs more or less resembling inverted bridge trusses. Typical steel joists of these several types are shown in the accompanying pages by means of illustrations from photographs. The reader is referred to these illustrations for a general comparison of the characteristic features of the several types. In later paragraphs there is given a brief summary of the design features of the more important types, but no attempt is made in this article to distinguish between the merits of the various designs. Each type of steel joist has its uses, and the designer contemplating the adoption of steel joist construction should communicate with the manufacturers of these products, obtain their design formulæ, load tables, weights and dimensions. Accompanying this article will be found a typical load table showing the safe loads for various spans and spacings, from one manufacturer's load tables, which has been greatly condensed.

Solid Web Members

This type of steel joist is manufactured in various ways. The simplest to describe is a light-weight rolled section similar in shape to a standard I-beam. These joists may be used as structural steel members riveted to the steel framework, and when so used are not properly classified as steel joists but should be considered as a special type of structural steel framing. They are also manufactured with mitered ends with bearing plates welded or riveted below the top flanges. These members rest on bearing walls or structural framework without riveting and are treated like other types of steel joists. The mitered ends provide transverse pipe spaces and also eliminate metal not required for strength. Another type of solid web section is sometimes called the "five-member" section and resembles a welded plate girder. It is composed of a web made of strip steel with four angles welded to the upper and lower edges forming flanges similar in shape to an ordinary I-beam. These also have end supports welded or riveted below the top flanges and may be mitered or straight at the ends. Metal lumber is manufactured in various ways, generally using cold rolled or pressed strip steel in channel form, or in I-beam form made by welding or riveting angles to the back of a channel.



Cross Bridging of Open Web Joists

The latter type of construction is sometimes referred to as a three-member section.

Open Web Steel Joists

This type of joist is characterized by its truss design which leaves open spaces within the webs. For our purpose these steel joists may be classified into two subdivisions, those having round top chords, usually composed of two bars separated by the web members, and those having solid top flanges. This distinction is of value, inasmuch as the method of attaching metal lath or other types of slab or reinforcing is necessarily different for these two types of joists. Steel joists with round top chords are variously called bar joists or trusses, and are built up of steel bars of structural grade steel with the web members usually arc-welded to the upper and lower chords. The lower chords are usually brought up at an angle near the ends of the joists to be joined to bearing members to which the top chords are also attached. The principal difference between various makes of these so-called bar joists or trusses lies in the design and spacing of the web struts and braces. The end bearings are usually made of I- or T-sections.

Open-web steel joists with solid top flanges are manufactured in several ways. One type employs a special rolled T-section for the chords with webs composed of bent rods in truss form which are welded at the bends to the edge of the stem of the T-sections. Another type employs a special section for the top chord and an L-section for the bottom chord and light angles to form the truss web. A third type is made of a standard rolled I-beam, the web of which is slotted, and then the beam is spread after heating, to expand the web. The resulting member has the appearance of a lattice truss but is actually composed of a single piece of metal except for an inserted center strut and special members which may be used to form end bearings. A feature often stressed by the manufacturers of open web steel joists is the opportunity for carrying pipes and conduits across a floor span through the webs. This feature is often of considerable value, although for long runs it is frequently necessary to utilize the space beneath the mitered ends of the joists either of the open-web or solid-web type because of the difficulty of setting in place long pieces of pipe after the joists have been spaced and bridged. Most of the manufacturers of solid-web joists will perforate the webs where required to accommodate conduits or small pipes. If the designer specifies or so arranges piping as to require the contractor to carry it through the open webs of the truss type joist, the builder should be permitted to get the longer pieces of pipe in place before the joists are firmly anchored and bridged. Cast iron soil lines, of course, may be erected at any time, because the short lengths employed can readily be handled, even when relatively limited joist space is available.

Methods of Installing Steel Structural Members

This sequence of operation is generally employed for all types of steel joists. Manufacturers usually ship the joists with tags indicating their length and type, and sometimes they are specially labeled in accordance with the builders' construction schedule. Unless the building is ready for placing the joists, they are stacked on the ground, preferably on racks which support the ends, permitting the joists to hang in place on the racks without resting one upon the other. If piled on the ground and laid flat, the longer members are subject to some injury due to bending, although they can always be straightened afterwards without difficulty. When the work is ready for placing the joists, they are hoisted to the proper floors and immediately laid in the floor panels with the ends resting on the proper supports. All except the very long members can usually be handled and distributed to the correct spacing by sliding them along to supporting members. The spacing is usually accomplished by means of a wooden block or other template, and is very rapidly accomplished. At this stage a few planks may be laid over the joists as a temporary walking surface while the subsequent operations are being performed. No heavy loads should be wheeled over or carried on this planking until after the joists are anchored and braced.

Anchoring Joists

When the joists rest on masonry walls, it is customary to anchor the ends of every third or fourth joist by means of rods or ties provided by the joist manufacturer for the purpose. The accompanying illustrations indicate several methods for end anchoring. Joists which are parallel to masonry walls should be side-anchored to the walls at intervals corresponding to the specified interval for bridging. The usual anchorage is a bent rod which is embedded in the brick or tile work. With reinforced concrete construction it is customary to provide wire ties carried through the framework, the ends of which are subsequently wrapped around the first parallel joist.

When steel joists rest on structural steel framework, the ends are usually clipped to the upper

flanges of the steel girders by means of C-shaped clips driven over the flanges and the corresponding flange of the end support of the joist. Another method is to use a bent bar hooked into the web of the joist or into the end support and bent over the farther flange of the steel girder.

When the joists are used in conjunction with reinforced concrete beams, they may be set on the upper edges of the forms and bent rod anchors carried down into the spaces to be filled with concrete. If the reinforced concrete beam is cast before the joists are set in place, simple wire or bent rod anchors may be used similar to those employed over steel girders.

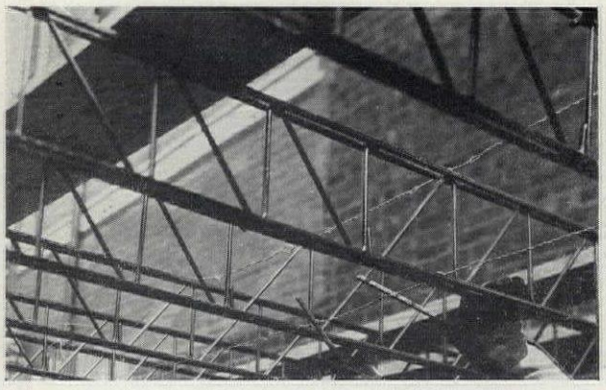
It should be noted that these anchors are not required on all joists, and in no case are they so rigid as to prevent the expansion and contraction of the joists under temperature changes. They simply serve to keep the joists from moving during the construction process, the weight of the finished floor being sufficient to assure their remaining in position after the floor has been completed. Anchorage is very important, however, for the end joists parallel to beams or girders when a reinforcing fabric of the welded mesh type with waterproof backing is employed for the construction of the top slab, as this type of fabric is usually stretched by a mechanical device which has sufficient power to misplace the end joists unless they are firmly anchored.

Bracing and Bridging

The next operation is to run bridging at intervals of not greater than 8 feet across the joists to prevent their movement during the operation of laying the floor slab. The bridging performs no structural function and is not designed to transmit loads from one joist to adjoining joists. Several types of bridging are employed as shown in accompanying illustrations. Some manufacturers provide special forms of metal bridging which are merely clipped or bent in place, but the usual method is to use annealed or stranded wire in one of three ways.

Cross bridging employs two strands of wire wrapped around solid web joists or around the upper or lower chords of open web joists and crossed diagonally between each pair of members. Where the wires meet, a rod is inserted, and they are twisted taut rigidly, holding the joists in place.

Two-wire straight line bridging consists of parallel wires carried above and below the upper and lower cords of open web joists, each pair of wires being twisted at two points between and across to the adjoining joists to take up the slack and form a rigid tie. This system requires four lines of wire instead of two. Single-wire straight line bridging, also used on open web joists, employs a wire for the upper chord and another wire for the lower chord, which is carried through the webs and wrapped once around each chord running horizontally to the next joist, where the operation is repeated. No twisting is employed, hence the operation must be carefully performed to be sure that the wires are entirely taut.



Parallel Bridging by Means of Taut Wires

Attaching Ceiling Brackets

Most types of open-web joists have lower chords which slope up to meet the bearing plates leaving a gap between the horizontal ceiling line of the center part of the joist and the side wall. When metal lath ceilings are to be hung to the joists, this gap must be bridged to permit the firm attachment of the metal lath close to the wall. For this purpose joist manufacturers make various types of ceiling brackets, most of which are of such design that they may be put in place without the use of tools. They function to extend the horizontal line of the lower chords of the joists to the wall line. They bridge the spaces frequently employed for concealing pipes.

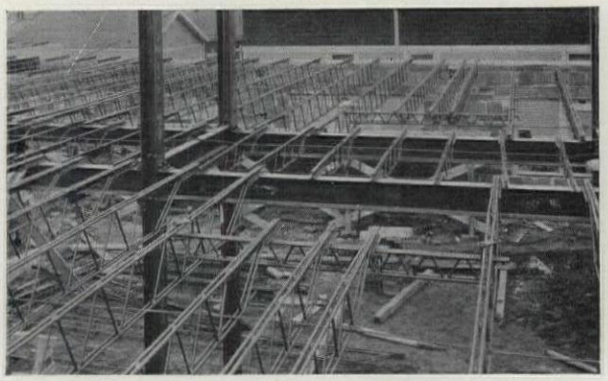
Installing Headers

Most joist manufacturers provide headers for use in framing around small openings. These headers are usually angles of small channels which are attached to the trimmer joists by means of hangers at any desired points, the bearing faces of the headers being dropped below the floor line a sufficient distance to bring the shorter intermediate joists to the level of the others.

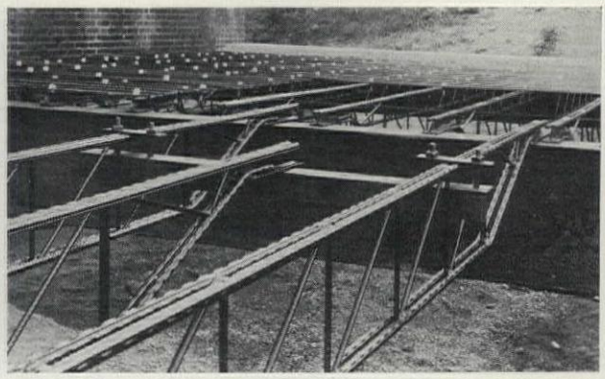
Headers may be employed with single trimmer joists for small openings generally not exceeding 5 feet in length, and with double trimmer joists for larger openings up to 8 feet. Larger openings should be framed with structural steel members.

Installing Pipes and Conduits

Mention has been made of the facility with which pipes and conduits can be concealed between the floor and ceiling with steel joist construction. With the solid-web type of joist, longitudinal lines of pipe are carried between joists, and transverse lines are carried close to the wall in the triangular spaces left under the mitered ends of the joists. Some of the manufacturers of solid-web joists will perforate the members at designated points for the insertion of flexible electrical conduit or small pipes. The open-



Small Open Web Joist Used as Header Beam



Steel Angle Header Beam Bolted to Joists

web type of joist permits the installation of transverse as well as longitudinal lines of piping at practically any point in the floor section. It must be remembered, of course, that long pieces of rigid pipe cannot be inserted through the webs after the joists are firmly fixed in place unless there is an open section at some point large enough to permit the lengthy pipe to be lifted and slid in the desired space. Contractors who neglect to take this matter into consideration are often disappointed in their ability to utilize the web spaces for pipe lines, and thus frequent criticism is heard on this point. By having the mechanical trades carrying on their work while the floor joists are being set, this difficulty can be entirely obviated.

Cast iron soil lines can usually be placed at any point because of the short lengths of pipe employed. Surprisingly large pipe lines of this type can be entirely concealed within the floors. One caution is of the utmost importance. Under no circumstances should any of the web members of the truss type steel joist be cut or bent to permit placing of pipes or for any other purpose. Another caution to note is that the weight of the horizontal lines of piping carried through the steel joist floor must be taken into consideration in designing the load-bearing capacity of the floor section. An installation was recently discovered where a very large water main was carried transversely through the webs of truss type joists along the center line of the floor span for which no provision had been made in the design of the floor. The pipe was run as an after-thought and imposed a dead load which materially reduced the margin of safety and threatened a failure of the floor.

While it is desirable to plan the installation of long runs of pipe while the joists are being installed, it is possible to carry on most of the mechanical installations after the floor slabs have been completed. This permits the contractor to place his joists, pour the slabs and enclose his building without delays and interruptions on the part of the electrical and plumbing trades. This reduces the time required to complete the building, effects a saving in the material and labor required by the mechanical trades, and facilitates winter construction work.

Slab Reinforcing and Supporting Materials

At the present state of development of thin slab concrete floors, only two types of material are employed for the support and reinforcing of the concrete. Metal lath has been the usual material. Recently a new type of welded mesh reinforcing with a waterproof backing has been introduced for this purpose and it has already proved to be excellent.

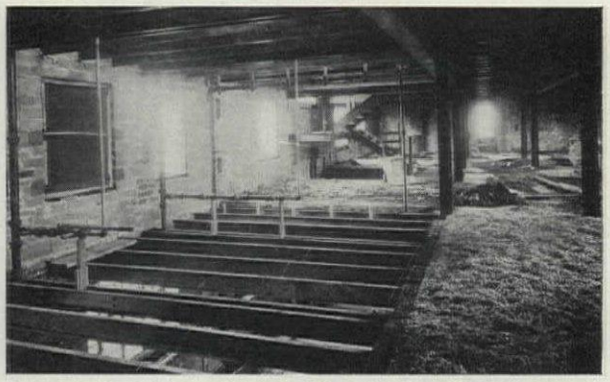
Metal Lath

Ever since the introduction of metal lumber and the earlier types of steel joists, metal lath has been used for reinforcing and supporting the slab. In theory the metal lath functions as a reinforcing material, and it is for this reason primarily that rib lath is invariably employed. The ribs are deeply embedded in the concrete slab; they are solid metal and have approximately the same effect as reinforcing rods of equivalent sectional area. Some designers do not consider the perforated mesh of the lath as effective reinforcing. Others take the contrary stand. Obviously, the perforated mesh largely remains on the under side of the slab and is not wholly enclosed in the concrete, as the latter simply keys through the mesh and gets a grip on the lath without totally surrounding it.

Whatever the design theory may be, experience has developed certain standard practices. The recommended practice is to use ⅜-inch rib lath weighing not less than 4 pounds per square yard for joist spacings up to 25 inches on centers; and to employ ¾-inch rib lathing weighing 4.5 pounds per square yard for joist spacings in excess of 25 inches and up to the permissible maximum of 30 inches to occasionally 36 inches. Some engineers and architects have employed lighter lath weighing 3.5 pounds per square yard for floors in which the joists are spaced not over 16 inches on centers, but this light lath is not normally recommended.

The highest grade lath should invariably be employed, and it should always be painted. Care should be exercised to select a lath having enough openings to effect a good key with the concrete without choosing a mesh that is so large as to permit exces-

Rolled I-Beam Section With the Web Slotted and Expanded Into a Lattice Truss



A Typical Installation of Solid Web Steel Joists Showing Method of Bridging

sive waste of cement and aggregate through the lath when the slab is poured.

Some designers utilize temperature bars in the concrete slab when metal lath is specified, which generally consist of ¼-inch round rods on 18-inch centers. These are sometimes placed parallel to the joists resting on the ribs of the lath on the theory that the ribs take the strains in one direction and the rods take the strains at right angles to the ribs. In other cases the rods are placed at right angles to the joists and parallel to the ribs of the lath and are usually put in place while the concrete is being spread. Another practice is the use of welded mesh reinforcing laid over the ribs of the lath.

Welded Mesh Reinforcing with Waterproof Backing

Within a relatively short time there has been introduced a new type of material especially designed for the construction of thin slab concrete floors over steel joists. It consists of a welded wire mesh made of 12-gauge wire with a spacing approximately 3 inches for the longitudinal wires and 4 inches for the transverse wires. The mesh is heavily galvanized. A typical mesh of this type has a cross sectional steel area of .035 square inches per foot of fabric for the longitudinal wires and a cross sectional area of .026 square inches per foot of fabric for the transverse wires. This reinforcing is ingeniously attached by means of secondary woven wires to a heavy double waterproof backing made of two layers of a special paper stock with a waterproof membrane between the layers. The attachment of the backing to the reinforcing material is so arranged that a space of ½-inch is left between the two which allows the concrete to flow around and securely embed all of the reinforcing members. The backing, which functions purely as a form, is watertight to prevent any leakage of water or fine aggregate and is of ample strength to support the concrete when being placed.

This type of material usually comes in long rolls which permit it to be laid quickly over a large area, reducing wastage, since over-lapping is minimized, and giving continuity of reinforcement. Ease and rapidity of installation are also important considerations.

Installing Metal Floor Lath

The sheets of lath are unpacked from bundles and spread over the joists, the ribs being placed at right angles to the joists. The outside ribs of adjoining sheets are nested and wired to form a continuous surface. The sheets are lapped with a minimum lap of 2 inches over a joist and secured to the joist. Joists are spaced to secure a minimum lath wastage at end laps as well as for the maximum efficiency of the joists. The method of fastening the lath to the joists varies with the different types of joists as is necessary because of the variety of top-members.

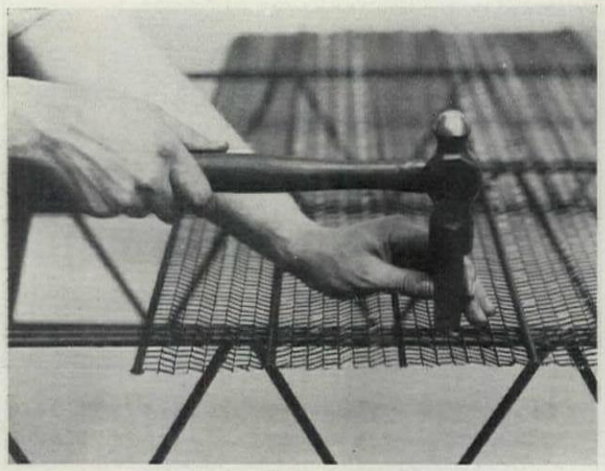
Small wooden wedges are employed with steel joists having round top chords to attach the lath to the joists. The wedges are driven through the open mesh of the lath between the top chords. With steel joists having solid top flanges, special wire clips of various types are provided by the joist manufacturers. These are inserted through the open spaces in the lath mesh and clamped around the joist flanges either with special tools or by means of ordinary pliers. Wedges or clips should be used at not greater than 8-inch intervals along each joist.

When a wooden finish floor is to be used screed chairs are attached to the metal lath or to the upper chords of the joists by clips extending through the lath and sleepers are set in these chairs at least one inch above the lath.

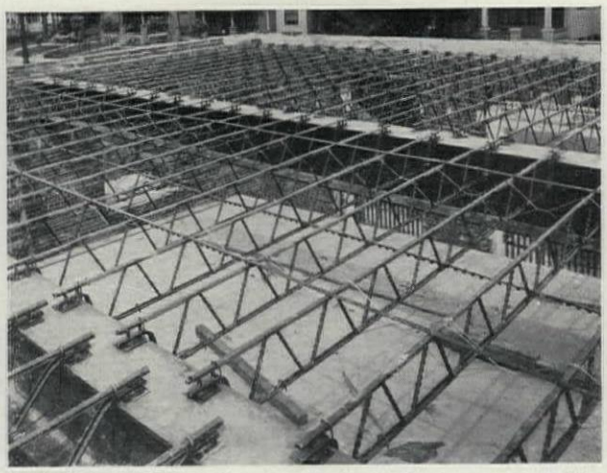
Pouring the Slab on Metal Lath

The concrete slab usually employed is 2 inches thick for short spacings and may run up to 3 inches for wider spacings. The latter thickness is recommended for garage floors and for buildings subject to vibration or heavier live loads. A mix of 1:2:4 is standard. Care must be exercised to keep the mix quite dry in order to minimize wastage.

The concrete is poured over the lath from barrows or dump buckets. Care should be exercised to avoid dumping heavy loads at one spot, although a well-installed lath should not be injured if the load is carefully dumped and immediately spread. The usual methods of finishing concrete slab are followed beyond this point.



Wooden Wedges Are Used to Hold Metal Lath



Notched Spacing Bars Used With Wire Cross Bridging

Installing Welded Mesh Reinforcing with Waterproof Backing

This type of material is usually supplied in long rolls 4 feet wide. As soon as the joists are ready to receive the floor, the reinforcing fabric with its backing is rapidly unrolled across the joists (using temporary planking to support the first sheet) and the roll is cut off at the end of the span. The sheet is then picked up and turned over into place so that the backing is next to the joists and the mesh on top. One end of the sheet is then wedged or clipped to the first joist adjacent to a wall or beam. This joist and that at the opposite end of the span must be strongly braced to the supporting wall or girder as previously described. Steel joists having round top chords provide an attachment of the mesh reinforcing by the use of special metal wedges, supplied by the reinforcing manufacturer, which are driven between two chord members engaging a longitudinal wire in each wedge. An accompanying illustration clearly shows the wedge and its use. With steel joists having solid top flanges, a simple wire clip is hooked over the further flange of the joist under the mesh, and the ends are bent around a transverse wire in the fabric. Four wedges or clips are used on this first anchored joist. To the other end of the sheet of fabric a stretching device provided by the fabric manufacturers is attached by hooking it over a transverse wire, and by carrying a special lug in the stretching mechanism over the flange of the last anchored joist. To facilitate the application of this stretching mechanism, a small piece of the fabric about 6 inches wide is cut from the end of the sheet to prevent the material buckling when the stretcher is used. By means of a lever and screw the entire sheet of fabric is drawn taut, the whole operation requiring but little time.

Wedges or clips of the type just described are then attached to the anchored joist to which the stretcher is applied, four such wedges or clips being used at this end of the sheet in the same manner as they were applied to the starting end. Thereupon wedges or clips are applied to each intervening joist down the length of the sheet, two attachments being made to each joist per width of fabric. As soon as the stretcher has been applied, this type of fabric will safely bear all ordinary loads, and workmen may walk freely over its surface to perform the wedging or clipping operations.

The adjoining sheet of fabric is then laid and stretched. Side joints should be lapped at least 2 inches; other, or end joints, at least 1 foot.

After the floor is covered screed chairs and sleepers are set in place where a wood finish floor is desired.

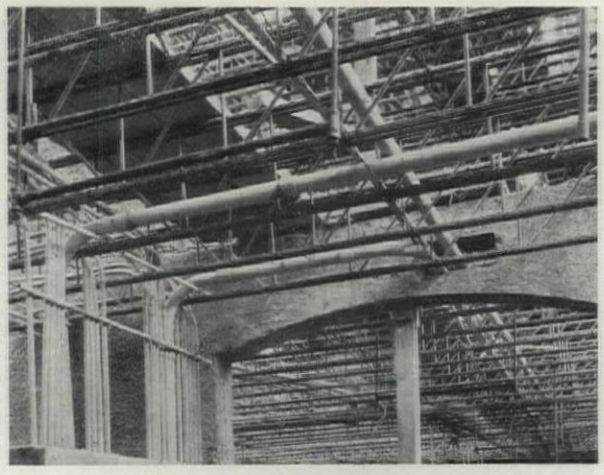
Pouring Concrete Slab Over Welded Mesh

With this type of reinforcing material the necessity for a carefully proportioned dry mix of concrete is removed, and the designer is free to specify whatever mix is desired and in accordance with any selected water-cement ratio. No material is lost through the fabric, hence there is some economy in the amount of concrete required. The waterproof backing has some insulating as well as dampproofing value and assists in the curing of the concrete by preventing its drying out too rapidly. The under side of the finished floor is clean and neat.

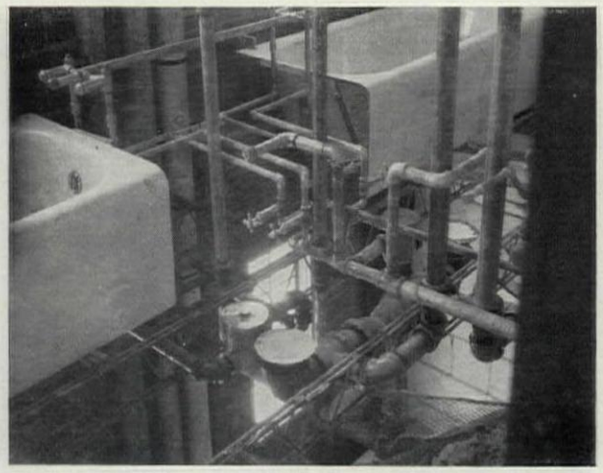
Ceiling Construction

The usual practice in the construction of ceilings under steel joist floors is to attach metal lath to the lower chords or flanges of the joists by means of wire clasps manufactured for the purpose, or by using short lengths of annealed wire carried over the lower flanges of open-web joists and twisted on the under side of the lath. Furring channels are sometimes used. The ceiling is then ready for plastering.

The building code of Philadelphia permits the use of steel joist construction in fireproof buildings providing the steel is protected by a 2-inch layer of concrete or gypsum. To meet this requirement local contractors usually hang the metal lath ceiling on light channels suspended 2 inches below the lower chords or flanges of the joists, placing the ceiling



Open Web Steel Joists Permit Placing of Pipes and Conduits Through the Webs



The Installation of Plumbing Pipes and Fixtures is Facilitated

before the floor lath or fabric is laid. Gypsum is usually employed for the fireproofing because of its lighter weight, and a layer is poured on the ceiling lath from above to the required depth, completely encasing the lower flanges of the joists. The gypsum (or concrete) penetrates the lath and forms an excellent key on the lower side.

SPECIFICATIONS

Standard specifications are published by all steel joist manufacturers and the makers of metal lath and welded mesh reinforcing material, covering the proper use of these particular products. Some are rather closely written, incorporating special features of the manufacturer's particular material; others are more general in their nature and permit competitive bidding. Where the architect feels that his client's best interests will be served by an outright specification, he should write the manufacturer's wording into his specifications. Where competitive bidding is desired, the specifications should be written with a view to placing all bids on a fair competitive basis as well as to insure proper construction.

The comments given here will supplement the information given in this article and will assist in developing a comprehensive specification.

Live Loads

The live loads should be specified for each floor or roof panel, rather than leaving this to the option of the manufacturer.

Partition Loads

Lighter partitions can be ignored or included as part of the specified live load. The weight per lineal foot of heavier partitions should be specified. Where heavier partitions are over and paralleled to the joists, good practice calls for extra joists to carry the partition load.

Floor Dead Loads

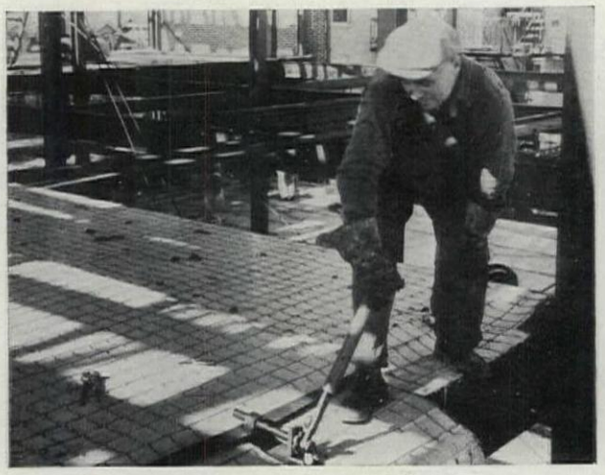
The floor dead load will vary with the floor slab thickness and type of finish floor used and can be obtained from any of the manufacturers. The steel joists themselves represent only about 10 per cent of the floor dead load, with little variation between different makes of joists. For this reason the floor dead load should be specified.

Basis of Design

If the A. I. S. C. specifications are to govern, the specifications should clearly state that, "the joists are to be designed in accordance with the American Institute of Steel Construction specifications for the specified floor loads." If other specifications are to govern, the specifications should clearly state the basis of design.

Spacing of Joists

Tie beams may or may not be used as joists. It is good practice to use a tie beam as a joist only where its deflection under full load approximates that of the joist. Joists may or may not be placed alongside of and parallel to the end walls in each panel. Good practice calls for these joists. The specifications should clearly state where tie beams are to be figured as joists and where joists are to be placed alongside of and parallel to end walls as well as the maximum center spacing of intervening joists. Under ordinary practice the maximum spacing of joists is 25 inches for floors and 32 inches for roofs. The solid web members of I-beam sections are not limited to this spacing when used as structural members, but practical experience with metal lath seems to establish these limits for best construction. Welded mesh reinforcing seems to permit wider spacings than are customary with metal lath, and 30 inches may be considered the maximum spacing for good practice with this material. In some types of buildings



Stretching Welded Mesh Reinforcing Fabric

Pouring Concrete Over Welded Reinforcing Fabric

and for certain loading conditions a closer spacing of joists should be specified. For example, good practice calls for a maximum spacing of 16 inches for garage floors.

Steel Joists

The specifications should require the manufacturer to furnish joists in accordance with his published dimensions to allow the architect or his engineer to check the correctness of the design. Where these data are not published, the architect should insist on the manufacturer furnishing complete detailed dimensions before allowing the contractor to quote on his material. This will allow the architect to intelligently compare and approve the particular makes of joists to be considered before the contract is awarded. The usual specifications that full facilities are to be provided by the manufacturer at all times for the proper inspection, chemical or physical, of the material and the workmanship used in the manufacture of the material, should be included.

Bracing

The steel joist has its center of gravity below the line of bearing and assumes its natural position when placed. The specifications should require that the end joists in every panel be anchored to the parallel wall or beam and intervening joists securely braced with bridging wire, bridging to be placed at least 8 feet on centers and drawn taut. This insures the joists holding their proper position during the erection period. The concrete floor slab and ceiling effectively brace the construction after they are in place.

Ceiling Lath

The ceiling lath and ceiling extensions are usually handled by the lather and should be specified as a part of his contract. The usual practice is to use a 3/8-inch rib lath with the rib turned up or a flat diamond mesh lath furred to the bottom chords of the joists with furring channels or rods. The lath specified should provide a good key for furnishing a mechanical bond.

TOTAL SAFE LOADING IN POUNDS PER SQUARE FOOT UNIFORMLY DISTRIBUTED

(Abstract of Table as published by one Open Web Type Joist Manufacturer)

This loading table is standard, and joists as shown in tables of dimension for both the American Institute of Steel Construction Specifications and the American Bridge Company specifications have been designed to meet these loading conditions.

(Under column headed Joist, first number gives depth in inches, second number in length of joists in feet.)

		SPACING C-C OF JOISTS IN INCHES																
Span	Total Load	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	28	30
4′-0″	2528	632	584	542	506	475	446	422	400	379	361	345	330	316	303	292	271	253
6′-0″	1686	281	260	241	225	211	197	187	178	169	161	153	147	141	135	130	120	112
8′-0″	1856	232	214	199	186	174	164	155	147	139	133	127	121	116	111	107	99	93
10′-0″	2160	216	200	185	173	162	153	144	136	130	123	118	113	108	104	100	93	86
12′-0″	2928	244	226	209	195	183	172	163	154	146	140	133	127	122	117	113	105	98
14′-0″	2506	179	166	153	143	134	126	120	113	107	102	98	93	90	86	83	77	72
16′-0″	2784	174	160	149	139	131	123	116	110	104	99	95	91	87	83	80	75	70
18′-0″	3816	212	196	182	170	159	150	141	134	127	121	116	111	106	102	98	91	85
20′-0″	4160	208	192	178	166	156	147	139	131	125	119	114	109	104	100	96	89	83
22′-0″	4510	205	190	176	164	154	145	137	130	123	117	112	107	103	98	95	88	82
24′-0″	4872	203	188	174	162	152	143	135	128	122	116	111	106	102	98	94	87	81
26′-0″	5250	202	186	173	162	152	143	135	128	121	115	110	105	101	97	93	87	81
28′-0″	5630	201	186	172	161	151	142	134	127	121	115	110	105	101	97	93	86	80
30′-0″	6060	202	186	173	162	152	143	135	128	121	115	110	105	101	97	93	87	81

INSTRUCTIONS FOR USE OF TABLES—

All loads are computed for the clear span.

Deduct width of beam flange to determine clear span.

Opposite the clear span in the first column, follow the table to the right until the proper figure for total dead and live load is reached. At the head of this column will be found the proper joist spacing.

HEATING AND VENTILATING FOR THE ARCHITECT

BY
PERRY WEST
CONSULTING HEATING AND VENTILATING ENGINEER

SOME feel that it is not necessary, in this age of highly specialized practice, for the architect to know very much about heating and ventilating. The architect finds, however, that there are a great many things which he must know about them in order to be successful in his own business. The problem is to differentiate between that which he does and does not need to know, so that he will not be burdened with any of the latter that can best be left to those who are especially trained and experienced in these particular branches of engineering.

The practice of architecture covers a broad and varied field, pertaining to art, science and business. The architect is generally the individual who pieces all of the various components of the building together, and it is he who must bring each of them into proper scale and keeping with the character, the cost and the purpose of any particular operation. In order to do this successfully he must have most accurate general knowledge about certain phases of each of these branches, but he is hardly expected to know all of the technical details, as a complete knowledge of any one is, at the present time, as much as anyone may hope to attain. Believing, therefore, that it is the part of wisdom for the architect to decide just what he should know about heating and ventilating, we shall endeavor to give an outline of the kind of information which may be considered most useful, and to name some of the reasons why and suggest some of the ways how this may be used.

Some of the Architect's Considerations

Residences. The kind of heating? Shall it be steam, hot water, warm air, gas, electric or some combination of these? If steam, shall it be one-pipe gravity, two-pipe gravity, closed or open, vapor or vacuum? If hot water, shall it be one-pipe, two-pipe, open or closed? If a warm air furnace, shall it be piped, pipeless, with or without a fan?

Office Buildings. Heating for the office or commercial type of building may be by any of the systems mentioned, and the points of particular interest to the architect are the same; but in addition he must know something about coördinating the heating and the hot water service; vacuum systems, forced circulation hot water systems, the relative merits of basement supply systems with up-feed risers, overhead supply systems with down-feed risers, balanced systems, and special automatic or manually controlled systems for meeting different outside weather conditions; divisions of systems into sections with controls for meeting the varying sunshine and wind conditions on the different sides of the building and separate systems for restaurants, assembly rooms, etc.

Hotels and Apartments. Heating in this class of buildings involves also the coördinating of the heating with the kitchen and laundry equipment, with electric or power plants, and with the refrigeration in certain instances. In hotels there is usually considerable ventilation also to be considered.

Hospitals and Institutions. In these structures there are usually added the problems of long transmission systems and summer heating for operating rooms, bathrooms, defective patients' rooms, etc.

Industrial Buildings. Heating these buildings involves the additional problems of space and light obstruction, coördination with ventilation and air conditioning and with the processes of manufacture.

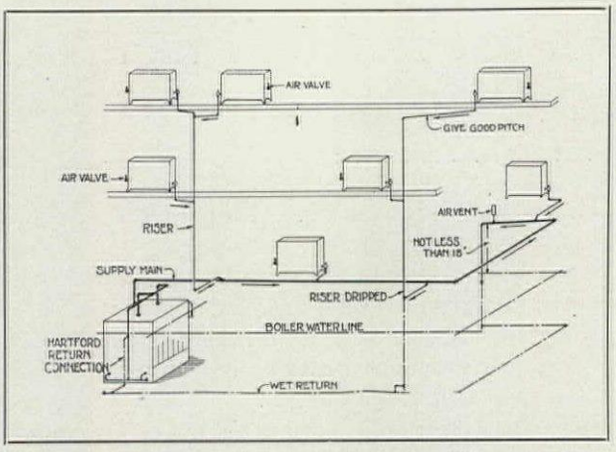
The Kind of Heating Apparatus

The kind of boiler to be used must be decided. Shall it be coal-, oil- or gas-fired? The kind of radiation must be chosen, whether the column type set on the floor; legless type hung on the walls; concealed in recesses or covered by cabinets; wall type; one of the newer types of concealed or cabinet radiators; or some of the latest tubular or radiant types. The problems of choice are often puzzling to the architect. Many are dependent on the owner's preference and on the proper relation of the heating system to the design and to the cost of the structure.

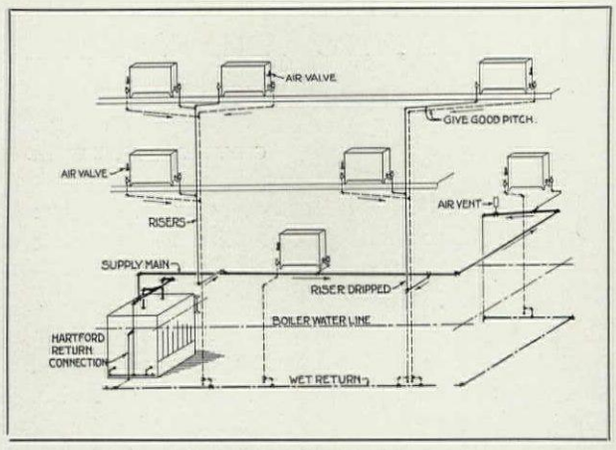
Ventilation. The architect desires to know under what circumstances ventilation is desirable or necessary; the type of ventilation to use; the kind of ventilation apparatus to use; the space requirements; the advantage of ventilation; the cost to install and operate ventilating apparatus; and how to go about securing the designing and operation of the system.

Answers to the Architect's Questions

Going back now to our list of considerations, we shall endeavor to give definite information, not expecting the architect to become an engineer, but in an endeavor to give such general information as may enable him to better visualize the kind of heating and ventilating apparatus best suited to the various kinds of buildings, so that he can discuss them with clients, have some idea of their relative merits and of the space, chimney, fuel storage and other such requirements, together with a better understanding of costs to install, costs to operate and the general results to be expected. We shall not attempt in this article to go into details, but to cover primary factors. The detailed standards to be employed, particular kinds of apparatus to be used, exact space and other building requirements and provisions, and human relationships will be more fully treated later.



Typical Gravity One Pipe Steam System



Typical Two Pipe Gravity Steam System

Heating Systems for Residences

Warm Air Furnace Systems. The pipeless warm air furnace is the cheapest to install, and for a small residence of not more than two stories, where all first floor rooms open off of a central room or hall and the upper rooms open off of the stair hall, it is very successful.

The piped warm air furnace is the next higher in price and may be made very successful for any residence, provided the apparatus and piping are of proper design and capacity. Warm air furnaces with fans are more positive in their performance, but they generally cost more than the others to install and to operate. Warm air furnaces are usually coal- or coke-fired, may be very successfully gas-fired, and are sometimes oil-fired. Oil-firing is rarely successful with old style cast iron, built-up warm air furnaces on account of the burning or warping of the furnace and the leakage of oily fumes and dirt into the rooms. The newer type of all-steel welded furnace does not present these difficulties. Warm air furnaces require on an average of from one to one-and-a-half tons of coal or coke per average sized room of residences per season in the colder climates of this country, which corresponds to from 25,000 to 35,000 cubic feet of 500 B.t.u. gas and from 140 to 210 gallons of furnace oil. Some recent developments in gas-fired, copper-tube, fan, warm air heaters seem to have materially increased this efficiency, so that the consumption of gas may run as low as 20,000 cubic feet per room per season. Warm air furnaces have these advantages:

(a) Low first cost.
(b) Combining heating with ventilating.
(c) Quick response; heating rooms rapidly.
(d) Absence of unsightly, inconvenient radiators.
(e) Absence of escaping steam or air from air valves in the room.
(f) Humidity as well as heat, in best types.

They also have certain disadvantages:

(a) Lack of uniformity in the distribution of heat, due to the action of the wind, or other weather conditions against any particular room or side of the house. Such conditions may retard the flow of warm air from the furnace to the particular rooms by preventing the outward leakage through the cracks of windows and doors, or by unduly chilling certain walls so that the warm air cannot properly overcome this chilling effect, especially during heating up periods.

(b) Leaks between the fire pot and the heated air chambers in the old style cast iron, causing fuel gas and dust to pass to the rooms being heated.

(c) Susceptibility of the fire pot to warping, cracking and the opening of joints, due to the uneven and sometimes excessive temperature, resulting in increased leakage of gas and dust into the rooms.

(d) Rapid deterioration of the furnace, due to the overheating with air only, with no water on the outside of the fire pot surfaces.

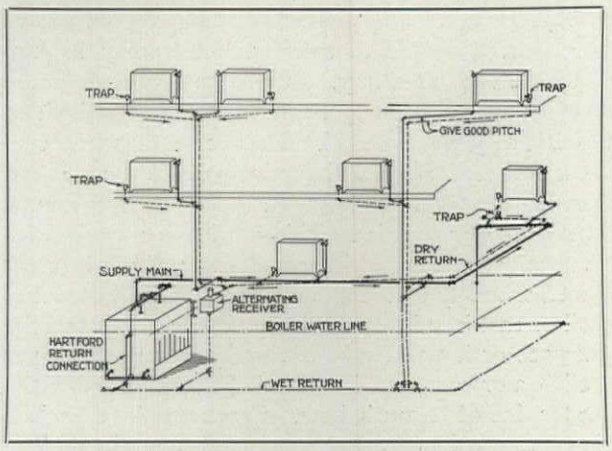
(e) Difficulty of changing or extending the system to accommodate additional rooms.

(f) Low relative humidity and drying effect of the heated air, especially in close proximity to the warm air inlets.

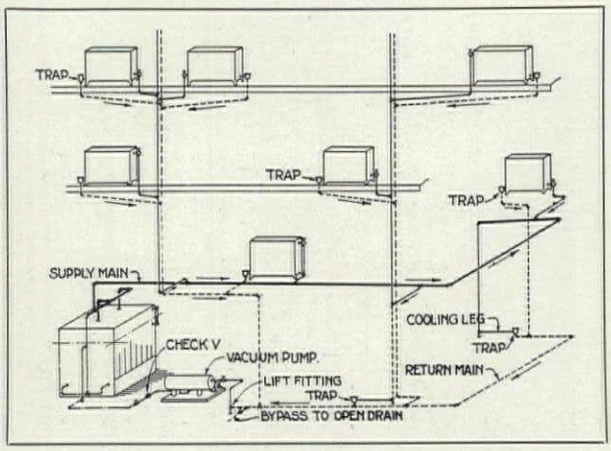
It should be noted that most of the difficulties under (a) may be eliminated by proper design and the use of indoor recirculation or fan-equipped heaters. Also that most of the difficulties under (b), (c) and (d) have been eliminated in some of the latest and best designed types of heaters.

For general data as to building, chimney and wall stack requirements, it is well to refer to pages 207, 208, 211, 212, 216 and 217, of the American Society of Heating & Ventilating Engineers' Guide, 1928. Warm air heating should conform with the Standard Code of the National Warm Air Heating and Ventilating Association, Cleveland.

Steam Heating Systems. The one-pipe gravity steam system is the next higher in first cost to the warm air furnace and is the cheapest and simplest type of steam heating system to install. Its operation is very satisfactory when it is properly designed and installed, but it is susceptible to many difficulties of poor circulation and noisy operation due to the steam's flowing *to* and the condensate *from* the



Typical Gravity Vapor System With Receiver



Typical Installation Using Vacuum Pump

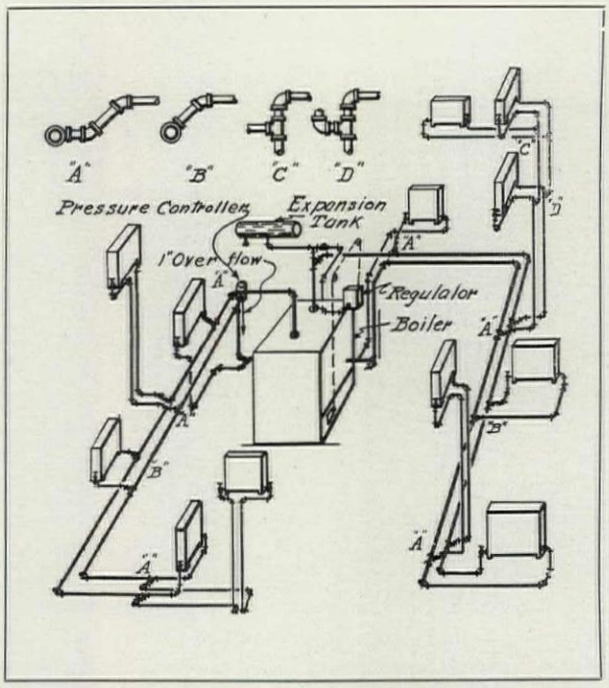
radiators through the same pipes. Air valves must be used on radiators and mains with this system, and they may give trouble and annoyance from leakage of steam and water and the discharge of odoriferous air into the rooms. This system is not adaptable to fractional control of heat and must be run with the radiator supply valves either wide open or tightly closed to prevent the retention of water and consequent noise due to intermittent flow of water and steam, which occurs when a valve is partly open. It is also slow to respond to irregularities in the steam supply, since the system tends to fill with air every time the steam drops below atmospheric pressure, and much time is lost in expelling this air through the small air valve ports as the steam is again raised. Some relief can be had from this difficulty by using a non-return type of air valve on radiators and mains.

Two-pipe gravity systems circulate more freely, but are susceptible to the backing up of steam through the returns from one radiator to another unless each return is connected separately to the return mains below the water line, which greatly increases the cost and multiplicity of pipes. Air valves must be used with this system, and it is susceptible to all of the difficulties of the one-pipe system not covered here, and is fast going out of use. Non-return air valves cannot be successfully used where the returns are connected below the water line.

Vapor systems are the latest of two-pipe gravity steam systems and are generally the most satisfactory steam heating systems for residence work. They differ from the gravity two-pipe systems in four important particulars: (1) by means of thermostatic or other forms of automatic traps on the return ends of all radiators the steam is prevented from entering and building up pressure in the return systems; (2) the air is eliminated from the radiator with the condensation through the radiator returns into the return system and thence to the atmosphere through automatic vent valves or other forms of automatic air-venting apparatus near the boiler instead of through individual air valves on the radiators in the rooms; (3) the backing up of water in returns may be prevented by the carrying of exceedingly low supply pressures; (4) real fractional control of the amount of heat is possible. In vapor systems, boiler protection is given by devices supplementing the damper regulator and may be in the form of an alternating receiver, return trap, equalizing or differential unit. An approved return connection is quite extensively used in place of a check valve for partially preventing water from leaving the boiler. Vapor systems usually are provided with vacuum venting valves at the boilers, which prevent air from returning through the vent ports, thus permitting the formation of a partial vacuum when the generation of steam pressure above atmospheric ceases. The cost of a vapor system is from 10 to 20 per cent more than the cost of a one-pipe system.

Vacuum return-line systems are not used in residence work except for unusually large houses. They are similar to vapor systems in every way, except that a pump is used to produce a vacuum in the return system by removing air and water. They permit wider variation in pressure differences between steam and return mains. They are installed in buildings where it is required to operate at low initial pressures or where, by reason of the layout, radiators must be located below the water line of the boiler. This type of system is also well adapted to large groups of widely separated buildings. It is generally used where exhaust steam is available, as it can be operated on a low back pressure without appreciably decreasing the capacity or economy of steam engines. A vacuum pump is used to accelerate circulation by discharging both water and air, the water being returned to the boiler and the air vented to the atmosphere. Because of the greater pressure differential of vacuum systems, the result of faulty grading of piping connections is less serious than in the other systems mentioned, and the returns can be smaller. Refer to American Society of Heating and Ventilating Engineers' 1928 Guide, page 86, for diagram of this system.

Hot Water Heating Systems. Hot water systems are generally the most satisfactory and economical for residences where the operation is continuous and when it is not intended to leave the system without



Closed Hot Water Heating System, Showing Connections

attention for long periods during cold weather, when the water might freeze. They are slow to respond to irregularities in the condition of the fire or to compensate for sudden changes in weather conditions. They are very adaptable to either hand or automatic temperature control, and with automatic control and continuous operation give little or no difficulty on account of slow response or in compensating for varying weather conditions. Gravity hot water systems are susceptible to difficulties arising from faulty design or workmanship, since the motive power for circulation is very small and the flow currents are easily diverted or short circuited. Forced circulation systems are positive, but they are generally too costly to install and operate for residence work. The one-pipe gravity hot water system is the cheapest to install, but is not much used because of its comparative sluggish and uncertain operation. The two-pipe system costs about the same to install as a vapor steam system and should show some saving in fuel. One-pipe systems are somewhat cheaper, as they require no special accessories, but they do require larger pipes and more radiation than the closed systems. They are also limited to a water temperature of about 180° Fahr., and are therefore not so flexible in capacity or control. The closed type may have the tank in the basement or be of the pressure-reducing valve and relief valve type of system, and is perhaps the best type of hot water heating for residences.

Gas heating may be used in the form of gas space-heaters or gas-steam radiators as auxiliaries for breakfast rooms, bathrooms or other special rooms where heat is required when the regular system is not in operation, or for early morning heating. Gas may also be used for gas-fired boilers or furnaces.

Electric heating at present is usually too expensive for general residence heating, but it may be employed as an auxiliary. In certain locations where water-power electricity is cheap and fuel is high in cost, it may well be used. Electric heating with current at 5 cents per k.w. hour is about 15 times as expensive as steam heating with coal at $15 per ton.

Hot Water Service. This service for a residence is usually a comparatively small load and can be combined with any of the systems mentioned by a copper coil or cast iron heating element in the fire pot of the furnace or hot water boiler, or by iron shell copper coil heaters connected in local circulation below the water line of steam boilers. Care must be exercised in placing coils or other heating elements in the fire pot to keep them out of the way of firing or the cleaning of grates, so as not to interfere with the efficiency of the boiler or furnace. The heating of water in summer is usually taken care of by gas-, oil- or coal-fired heaters connected in parallel with the winter heaters.

Office Building Heating. The hot water requirement of office and other commercial buildings is generally an appreciable load and is usually taken care of by a separate boiler or heater. If exhaust steam is available, a separate steam heater may be used; otherwise a separate steam boiler with a tank coil heater attached, or a coal-burning heater or combined refuse burner and water heater may be used. Care should be taken to have a heater capable of withstanding the water pressure in tall buildings. Forced circulation hot water is a most satisfactory and economical system for this class of building, but it costs more to install and must be arranged so that there will not be excessive static pressure on the radiators. The obstruction and unsightliness of basement supply mains can be avoided if space is available for overhead mains above the top story. Overhead mains allow the use of smaller down-feed "risers," produce better circulation, and by running the returns in trenches in the basement, all exposed piping may be done away with. By dividing the system into sections corresponding to the varying requirements for heating due to changes in the sunshine, wind and exposures on the various sides or wings of a building, either automatic or hand control may be applied for equalizing the heat so as to save fuel and prevent overheating. By the application of some form of automatic vacuum or pressure control and balancing features, the heating may be kept in step with variations in the outside temperatures.

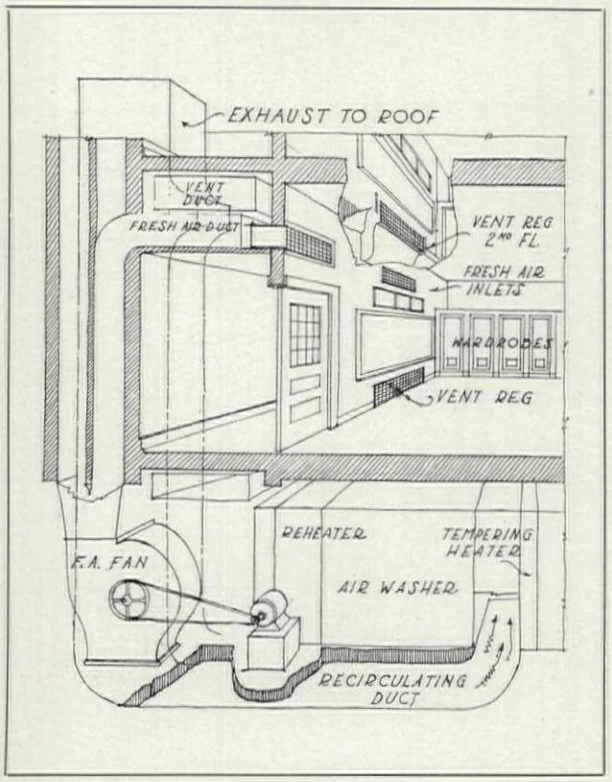
Hotel and Apartment House Heating. The domestic hot water requirements are relatively heavy in these types of buildings, and frequently run as high as 25 per cent of the total heating load. It is not generally advisable to heat this volume of water with coils or surfaces either in the fire box or in the water circulation of the house heaters. If the water heating is to be done from the house heaters, these should be divided into units so that one or more may be used on this service alone in the summer, when other

heating is not required, without being too large and therefore uneconomical for operation on this load.

In hotels where kitchen equipment is to be supplied with steam at about 30 pounds pressure, or laundry equipment at about 80 pounds pressure, it is general practice to generate all steam at about 100 pounds pressure and supply the heating system, the domestic water heaters, the kitchen equipment and the laundry equipment through separate pressure-reducing valves set for the respective purposes. Where refrigerating apparatus is employed, it will generally be found that the steam required to operate this will produce exhaust about sufficient to heat the domestic hot water. A very economical arrangement is to have steam-driven refrigerating units with tank heaters using this exhaust steam for heating water. Care must be exercised to have the hot water storage tanks of ample capacity, as the refrigeration load is practically constant while the hot water demand fluctuates from 10 to 300 per cent of the average hourly load, and unless the storage tanks have a capacity of from one and one-half to twice the maximum hourly demand, much of the exhaust may be wasted, especially in the summer months. Separate water heating apparatus consisting of tank heaters connected directly to storage tanks by means of local water circulating pipes, or of steam or water boilers connected to coil tank heaters, are sometimes used, but it is generally found best to do all of the heating from one central boiler plant.

Hotel and apartment house ventilation is generally employed in kitchens and public toilets; frequently in dining rooms, ball rooms, assembly rooms, public spaces, laundries, boiler rooms, engine rooms, store rooms, and all interior bathrooms. Exhaust ventilation without fresh air supply from other than adjacent spaces is sometimes employed for kitchens, toilets, laundries, boiler rooms, engine rooms, store rooms, and interior bathrooms, but care must be exercised, in using exhaust ventilation alone, to prevent disagreeable drafts through doors and other openings, to prevent interference with the draft in the boiler room, and to prevent interference with proper heating due to the increased inleakage of cold air from the outside. A properly heated or cooled, cleaned and moistened supply of fresh air should be used in conjunction with exhaust ventilation for dining rooms, ball rooms, assembly rooms, public spaces, boiler rooms and all other spaces where the supply cannot be properly taken care of from adjacent rooms. This requires heating in winter and, for the better classes of ventilating, cooling in summer. The heating of air for ventilation in colder climates requires from 3 to 5 tons of coal per season, per 1000 cubic feet of air per minute delivered; cost of power is from $25 to $40 for that amount of air.

The cost to install good ventilation may range from 1 to 3 per cent of the cost of the building, depending upon the relative amount of space to be ventilated. The cost to operate can be very materially reduced where a generating plant is used, from



Central Fan Split System for School Use

which the power and exhaust steam may be taken, or where recirculation is employed, and in many such cases it may be reduced to practically no additional cost for the operation of the best kind of ventilation. In many localities the ventilation of interior toilets is compulsory under certain laws prescribing gravity or mechanical systems.

School and Public Building Heating. School heating is either by gravity warm air furnace, fan furnace, steam or hot water, and is usually combined with some form of ventilation. In furnace installations the ventilation is an integral part of the system. In steam or hot water installations, the heating may be by direct radiation with either a central fan system, individual ventilating units or a gravity system for ventilation, or by a combination system of heating and ventilating using a central fan or units. Steam or hot water with direct radiation in the rooms and fans or units for ventilation is a generally accepted standard for colder climates, while the combination system of heating and ventilating with warm air by central fans or units is employed for milder climates. The former is commonly known as the "split" system, while the latter is termed the "hot blast" system. The hot blast system is simpler and cheaper, but it requires the delivery of the air in cold climates at from 15 to 25 degrees Fahr. above the temperature of the room, with consequent excessive dryness of this air before it is cooled to room temperature. In the absence of any direct radiation, the chilling effect of exposed walls is hard to overcome with warm air alone, so that in some cases the temperature adjacent to these walls will remain quite low for con-

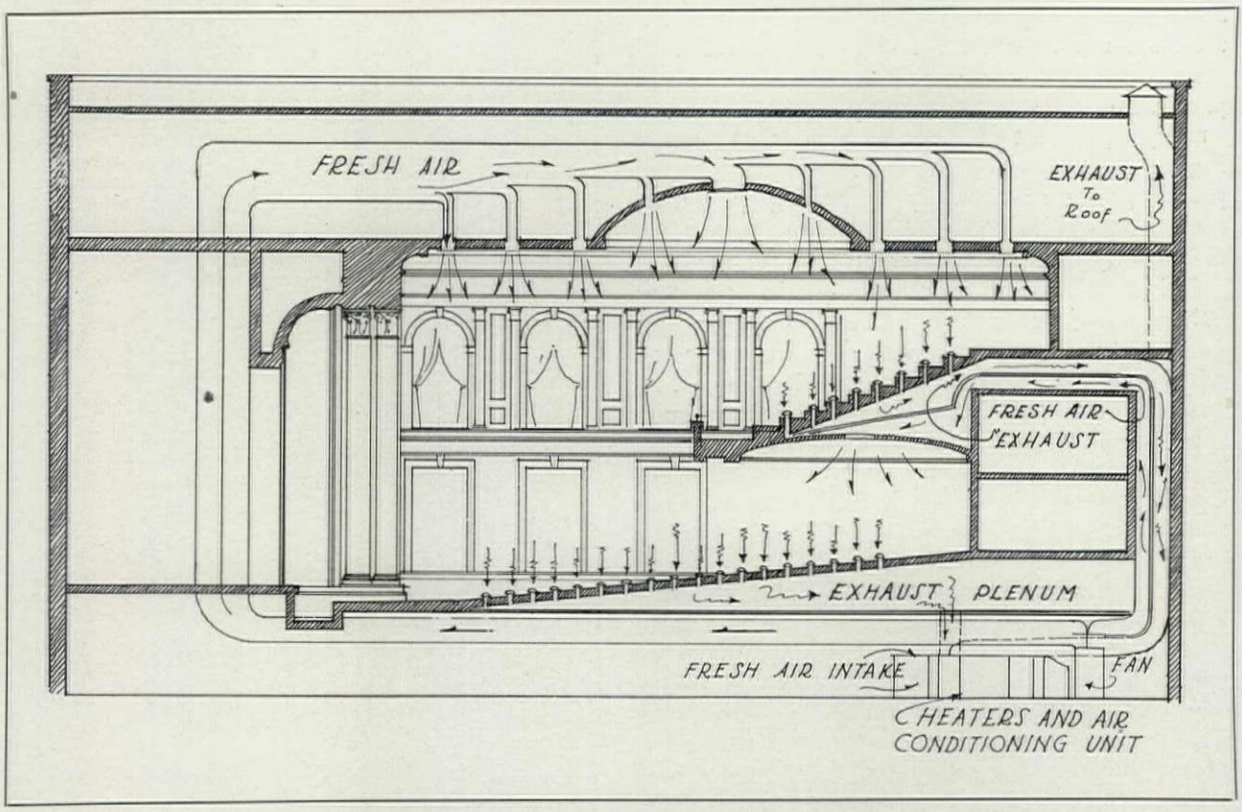


Fig. A. Downward System of Ventilation for Theaters

siderable periods in the mornings in cold weather.

Steam or hot water systems with direct radiation in the rooms may employ gravity ventilation either in the form of fresh air supply ducts, with warming stacks at their bases and exhaust flues running to ventilators above the roofs, or the fresh air may be taken in through the windows and be exhausted in the same way. These systems are not positive or under control in their action, and are subject to all of the vagaries of wind and weather conditions. The former is one of the old and practically obsolete forms of schoolhouse ventilation, while the latter though much older is one of the latest to be advocated by some and as thoroughly condemned by others. These systems conform to no particular standard, produce no definite results, and save nothing either in the cost to install or to operate. Upon first thought it would appear that the so-called open window system would require less space and cost less than almost any other system, but when thoroughly analyzed, and if installed in accordance with the requirements laid down by those who have experimented with it most, it not only costs more to install but requires a greater building cost and greatly increases the costs not only to operate the heating and ventilating system but for the general school administration as well, and there is decreased pupil capacity.

Recently several schemes have been suggested for supplying unheated or very slightly tempered air, by mechanical means, through a narrow opening all along the window stools of classrooms to take the place of the natural air supply through the open window, and for dividing the radiators under windows into two or more horizontal sections for better temperature control. The June, 1926 and March, 1928 A. S. H. V. E. *Journals* give descriptions of these suggestions. Unit systems generally employ vertical gravity exhaust ducts running up from each room to ventilators above the roofs, but the exhaust may be into corridors, thence through ducts to the roof or into horizontal ducts furred down over corridors and thence into main vertical ducts discharging above the roofs. Where vertical ducts in the rooms are eliminated, this system requires the least space of any. The piping system to and from the units and the electric supply to unit motors are increased over the requirements for central systems.

The central fan system may employ vertical supply and exhaust ducts for each room, or the supply and exhaust ducts or either may be furred down over corridors and connect into main vertical ducts to eliminate all vertical ducts in rooms. There can be fan supply and gravity exhaust, gravity supply and fan exhaust, fan supply and fan exhaust or one fan for supply and partial exhaust recirculation with gravity exhaust relief for the portion of the air not recirculated. This latter system, when properly designed, is one of the cheapest to install and to operate and can be controlled to uniformly give any results desired. An accompanying diagram illustrates a central fan, split system, where both the fresh air and vent ducts are furred down over the corridor ceilings and where one fan is used with partial recirculation. The fan and other apparatus

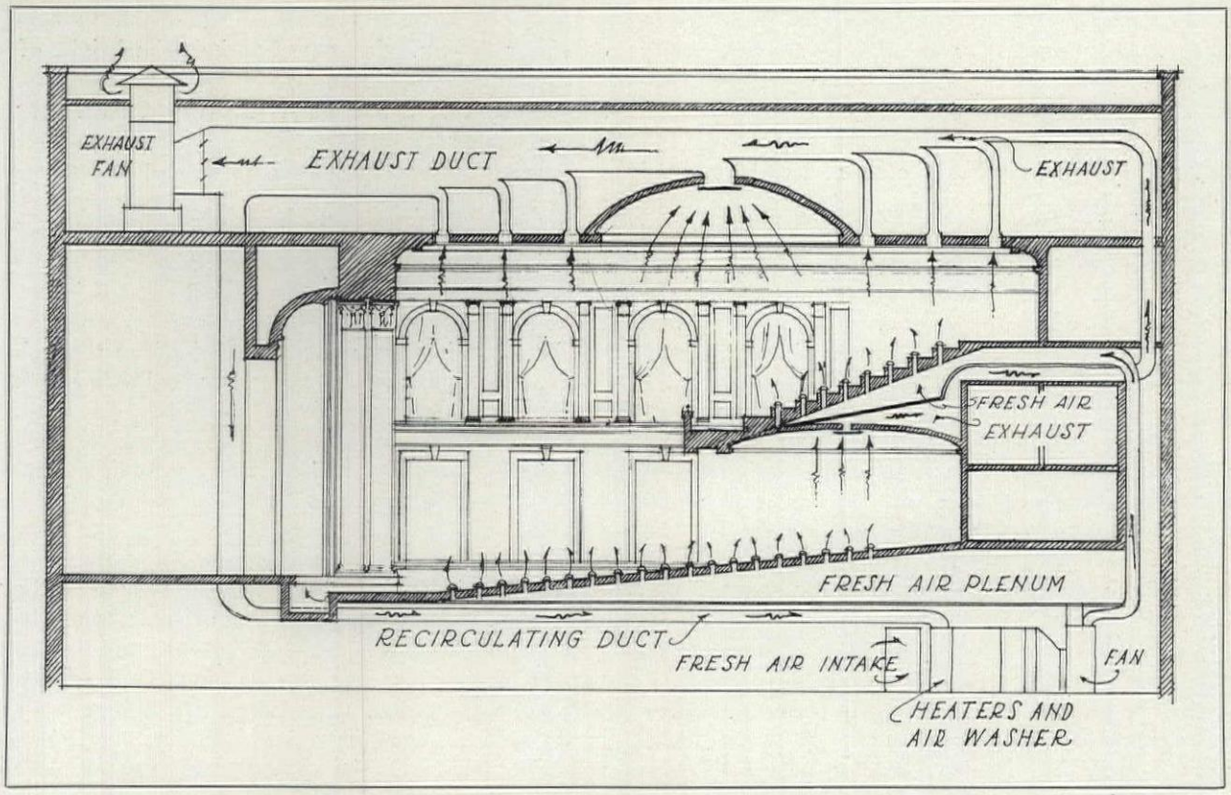


Fig. B. Upward System of Ventilation for Theaters

may be placed in a pent house on the roof in this type of system, instead of as shown, thus eliminating these and the large piping in the basement. In any of these systems ventilating units may be used to take the place of the supply fans, heaters, air washers, and air filters, in which case the fresh air ducts are also eliminated; but the piping must be increased to take care of the steam and returns to the units. The removal of foul air from the rooms may be either by gravity vents or by means of exhaust fans.

The opinions and convictions of the school authorities, especially of those who are to use and operate the apparatus, should always be given due consideration in connection with the heating and ventilating of any school building. There is a deepseated conviction in the minds of some school people at the present time that the apparatus should be controlled by the teachers and not by the janitor. Some principals and teachers support this idea and assume its responsibilities and, where they cannot be convinced to the contrary, it is my experience that they are better pleased with the results produced under their own control than they would be with any results the janitor could deliver, even with the best apparatus and automatic control. This idea has done more perhaps than any other one thing to popularize unit and open window ventilation, and while these methods have such advantages as making it possible to do away with the fresh air distribution systems and otherwise simplify the installation work so that more of the apparatus can be fabricated in responsible factories instead of on the site by less skilled contractors, they have disadvantages such as not being susceptible to as satisfactory an arrangement for air cleaning, humidifying and other proper conditioning and control as has the central system. It is also a fact that a properly designed central system arranged for automatic control and partial recirculation can usually be operated more economically than most other systems producing equal results.

The proper care and operation of any system is a most important factor, and for this reason those who are to use and operate the particular system must have confidence and interest in it; otherwise it is doomed to failure from the start. In all public schoolhouse heating and ventilating, the requirements of the local laws must be complied with. These laws generally provide that the heating apparatus shall be capable of heating to 70° Fahr. inside with an outside temperature of 0° Fahr., and that the ventilating apparatus shall be capable of supplying not less than 30 cubic feet of properly heated fresh air per minute per pupil, in all classrooms. Assembly rooms, gymnasiums, social service rooms, cafeterias and such other spaces as are used at times when other parts of the building are not in use, should have separately controlled heating and ventilating systems. School toilets should be ventilated independently of the remainder of the building.

Public Buildings. Other public buildings present various problems, but are generally heated with steam or hot water and ventilated by one of the methods referred to here. Assembly halls, court rooms, large work rooms, public toilets, engine

rooms, boiler rooms and store rooms are usually ventilated. Good exhaust ventilation of ample capacity proves very satisfactory, except for theaters and public auditoriums where both fresh air and exhaust should be used with arrangements for cooling and dehumidifying in the better class of well patronized theaters. The problem in these is generally that of cooling and ventilating rather than of heating and ventilation, even in winter. This is due to the fact that in this class of building, where exposure is relatively small and the heat given off by the audience, and by the lighting and the power equipment is relatively large, the amount of heat thus liberated in the building is greater than that lost to the outside.

Downward ventilation with fresh air and partial recirculation admitted through numerous grilles at the ceilings and exhausted through numerous mushrooms under the seats, is the best system for this type of building, provided refrigeration and dehumidifying apparatus are provided for summer use, but the upward system with fresh air admitted through numerous mushrooms under the seats and exhausted through grilles in the ceilings, and especially under and over galleries, is better if cooling and dehumidification are not used. With the downward system and cooling, smaller fans and ducts may be used, and an average of about 8 cubic feet of fresh air with 24 cubic feet of total air circulated per person per minute may be used, while from 30 to 75 cubic feet per minute per person is required with the upward system and no cooling. Fig. A illustrates a downward system of theater ventilation, while Fig. B illustrates an upward system. Smaller auditoriums may be ventilated very successfully by separate units or by central fan systems delivering air on each side of, or over the proscenium arch,—or sometimes from the rear toward the stage, with either gravity or fan exhaust from near the floor in front of the stage and through the ceiling under and over the galleries. It is always preferable to have the flow of air from the stage toward the audience as an aid to acoustics. Such systems should handle about 30 cubic feet of air per person per minute, and may be partially recirculating. They are very much less expensive than the more elaborate systems.

Hospital and Institutional Heating. Hot water is one of the most satisfactory and economical systems to operate for this type of heating, but because the boiler plant is usually located at some distance from the buildings, long and large transmission systems with forced circulation and a considerable amount of water heating equipment are required, which increases the first cost to from 15 to 20 per cent above that for a steam system. Cost of equipment may be reduced by employing direct-fired hot water heaters or boilers, but inasmuch as steam is required throughout for kitchen, laundry, sterilizers, warmers, etc., steam boilers are also required, which in turn increase the number and cost of "stand-by" units and prevents the alternate use of the boilers on either system. In some hospitals the height of the building would cause excessive static pressure, and in any case a hot water leak would be a very serious matter in this kind of building. Space requirements are also increased, so that in many hospitals and institutions steam is the heating medium used. Direct radiation is usually employed and should be of an open type easily cleaned and hung on the walls 6 to 8 inches above the floor, 2½ inches from finished walls and with supply and return connections running from walls instead of up through floors. Air supply is sometimes provided either back of or over the radiators for ventilation.

Radiators in operating rooms should be set back of a shield (usually of glass) with access doors and grilles for circulating the heated air to the room. The domestic hot water requirements are much the same as for hotels, and the coördination of this with the heating and refrigeration may be treated in the same way. Operating rooms, bathrooms, examination rooms, defective patients' rooms, etc., often require heat in the summer and should be equipped with auxiliary radiation fed from the high-pressure steam system through pressure-reducing valves and returning separately or through the high-pressure returns to the boiler plant. Ventilation should be employed in sink rooms, food service rooms, wards, corridors, laboratories and nurses' stations, in operating rooms when desired, and in other parts as was recommended for hotels. Private rooms may be ventilated, but present custom is to rely on windows with some good type of ventilation sash, window deflectors or special window intakes with enough radiation under windows to compensate for the incoming air. Ventilation elsewhere usually requires only exhaust fans, but where clean air cannot be taken in through windows, supply systems should also be used with air cleaners and washers.

Industrial Heating. Industrial heating may be by direct radiation, but this is fast giving way to unit heating, especially for rooms with high ceilings, as units are cheaper to install, cost less to operate and obstruct less of the side wall and window space. Unit heating and air conditioning apparatus is available. Central fan-blast systems are also used and are advantageous where air conditioning is required, as the control and distribution can usually be well worked out. Overhead ducts are sometimes undesirable as they obstruct light, but at other times "units" are sometimes undesirable, as they may constitute a floor or overhead obstruction.

The illustrations on pages 592, 593 and 594 are from the A. S. H. & V. E. Guide.

Editor's Note. Mr. Perry West's next article will continue the consideration of Heating and Ventilating for the Architect, taking up the theoretical and practical standards of heating, ventilating and air conditioning for various types of buildings.

RAMP PROBLEMS IN GARAGES

BY

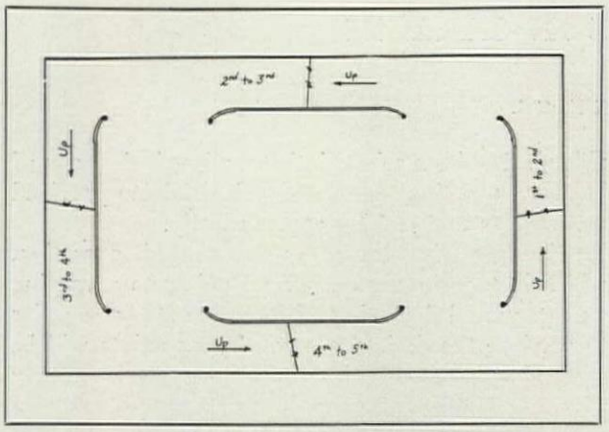
K. F. JACKSON, C.E.

HAD one stood for say two minutes just before nine in the morning, and again during mid-afternoon at a prominent intersection of streets in any American city a dozen years ago, and should he repeat the experience today, he would immediately appreciate the *raison d'etre* of the large metropolitan garage. I am doubtful whether he would require the two minutes. A glance would almost be sufficient for him to make three observations,—he would surely be impressed by the large and increasing number of business people who are "commuting" by automobile; by the many cars which are bringing the great army of shoppers to the stores; and finally by the vast number of cars and trucks of every description, which are employed in the transaction of modern business. Given these conditions, the inevitable result is two-fold: a dearth of space for standing vehicles in the streets and squares during daylight hours, reflected in ever more stringent parking regulations, and a tremendous need of housing accommodations for fleets of trucks at night. Thus there has been created a distinct construction necessity which is engaging the attention of promoters and builders, and through them, of capital,—namely, the city garage.

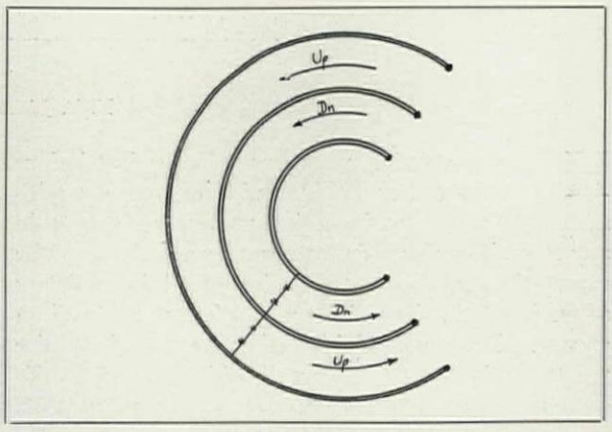
For several reasons these buildings must all take the same general form. The high value of property within city limits necessitates a large amount of floor space in proportion to the area of ground covered, which means that they must be multi-storied. Similarly, economy of operation, requiring a small staff for management, allows but a minimum number of entrances and exits. These features, together with other limitations as to size and speed, render elevators impracticable and make imperative some system of ramps from street level to top floor. Before taking up consideration of the various types of ramps which have been evolved and applied, it might be well to note certain typical requirements to be met in all city garages, for the more perfectly and completely met, the more successful the garage as a business venture. Since the primary requisite of any building erected on a commercial basis is that it shall yield at least the usual return on the capital invested, those financially interested are concerned with a few of the broader, more comprehensive essentials. First among these is the location, upon which depend several important considerations. Are its potentialities sufficient, provided the business can be secured? Are the expected patrons likely to use the garage facilities if presented to them? What about competition, present and future? Is the district over-garaged? Is it likely to be? All of the foregoing is in fact beyond the scope of this writing, and is touched upon here merely for the sake of completeness. Henceforth it will be assumed that a suitable site has been selected, that a client is desirous of building, and that the financing is available provided a profitable undertaking appears likely.

Of large significance is economical operation, which in turn hinges on several points to a varying extent, yet all deserving of intensive study in order to produce the desired result. These points will be covered subsequently in detail. Summarized, they are: (1) minimum personnel for management, (2) rapid movement of car traffic, (3) provision for efficient classification, and (4) maximum accessibility of cars. Another aim of scarcely less importance is to so arrange plans as to derive the best use of the allotted floor space; the maximum parking capacity must be realized. This is a broad statement, however, and should be amplified. The reaction of the patron to the entire plant is paramount. A 500-car capacity garage which, on account of its physical characteristics, can only maintain a steady patronage of 300 is much less to be desired than a 400-capacity building so attractive in its appointments that it can command 350, except under extraordinary circumstances of weather or whatnot. The number of vehicles accommodated and actually yielding revenue determines the soundness of the investment. Lastly in this category of considerations is convertibility. All cities are to a certain extent mobile. The character of a locality is subject to change. Business is not sufficiently stabilized to maintain centers, and this shifting process may so alter conditions that the garage building must be adapted to new uses. This is a matter of perspective, however. The true purpose of the project should not be eclipsed by a lesser possibility considered too closely. A garage is to be built, and the most efficient arrangement for such should be accorded greater weight than remote futurities. Yet some exercise of thought is needed, and if a strong doubt exists as to the continued fitness of a site for garage purposes, it would be better to select another site.

An analysis based on these considerations will, as already said, fix the status of the projected garage,—whether or not it is likely to be successful. The succeeding elements will determine to a large extent the degree of success which may be attained. In a garage such as has been outlined, of several motors and probably with a single entrance and exit, one of the important problems for solution is that of securing rapid movement of cars. This is particularly the case in an establishment catering to drivers who leave their cars in the morning and remove them in the evening. All arrive and all leave at approximately the same hours, which creates twice daily peak conditions. Nothing is more annoying to the average motorist than to be held stationary with motor running, breathing exhaust fumes with in-



Straight Run Ramps; No Sharp Turns; Good Visibility



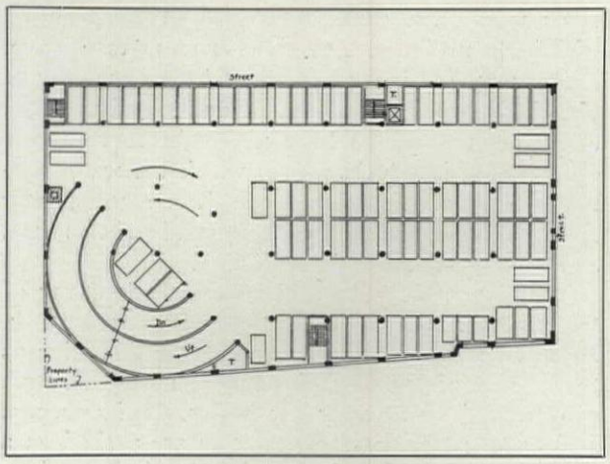
Ingenious Variation of Spiral Ramp; Outside Spiral Up; Inside Spiral Down

creasing impatience. It does not require many experiences of this sort to effect a change in patronage. The next time he will park his car somewhere else.

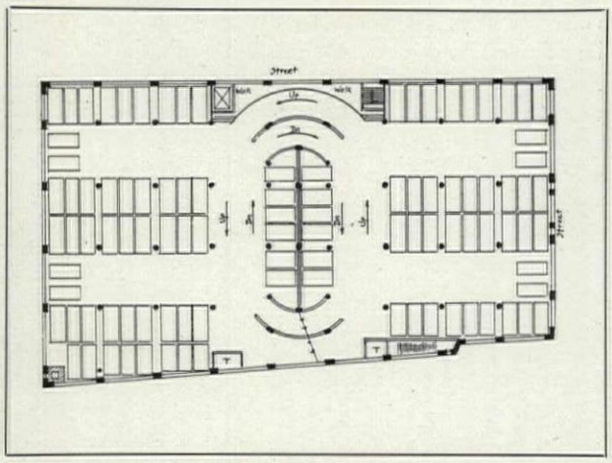
Obviously the fast movement so necessary can be accomplished by eliminating all causes of delays, notably by facilitating entrance and exit with level or nearly level driveways, with no blind corners; by affording ample magazine space, that is to say, a sufficiently long run on the ground floor to permit of classification of a car at entrance and checking off at exit without actually stopping the car; by an easily negotiated ramp, about which more will be said later; and by arranging the parking off the traffic lanes. A certain amount of jockeying to get in or out of a stall cannot be avoided, but this maneuvering should not interfere with other cars. To accomplish this, there will necessarily be sacrificed some floor space, which is utilized for subsidiary parking aisles leading away from the main driving aisles. It will be found well worth while, nevertheless, to get rid of any clogging moving traffic from this cause. It should be noted in the typical floor plans reproduced a little further on that due attention has been accorded all these points. The start of the ramp is placed at a comfortable distance from the street entrance, thus allowing for proper classification of entering vehicles, and similarly for checking them out. Likewise, virtually all car stalls are facing on parking aisles. The necessity of having maximum parking space comes next after these. Cars should be readily accessible to avoid delay to drivers. Much time and effort can be expended needlessly in moving one or more cars to release another. Some cars are known quantities in respect to the time they will be called for, and consequently may be blocked temporarily, but for the most part, cars must be free to be moved at any and all times. The sketches included here illustrate this point also. Above all, it should be possible for any driver to ascend the ramp and maneuver his own car. A ramp which requires the services of an experienced attendant is a liability and will never wear out from use. Another refinement too frequently forgotten is the minimizing of the amount of walking which must be done to and from the car stall to the stair or elevator, and the provision of a place to walk without dodging between moving cars and having a slowing effect upon them. Every stall cannot be adjacent to a means of ascent and descent, but no stall need be very far away, and the majority can be comfortably near.

Turning now to a contemplation of the features for which to strive in the ramps themselves, it is quite natural to find them dovetailing to a large extent with the previously mentioned requirements applicable to garages in general. All of the advantages to be enumerated here cannot be obtained, inasmuch as some are in opposition to others. They will be commented upon separately for clearness, and it is to be realized that in any particular garage, all are worthy of consideration, and where conflict exists, the conditions pertaining must determine their relative merits. In most cases, a nice adjustment is the solution, and a compromise giving the best ultimate result will have to be worked out. Insofar as possible, a ramp should have an easy and not too varied percentage of grade, ample turning radius for the largest cars, width enough for comfortable driving, and good visibility. The reasons are apparent. All contribute to the speed of traffic, to the satisfaction of patrons, to minimum wear and tear on cars, and hence to economical operation and increased patronage, the two greatest virtues of any garage. These various points will enter the later examination of the types of ramps and what advantages each offers.

Some additional thought should be devoted to reducing the amount of valuable space sacrificed to the ramp, and also to the ramp's flexibility. By this is meant the quality which will permit of varying story heights without resulting in too steep grades or too great variations in grades. It is frequently advantageous to plan a garage for the accommodation of trucks on the lower floors and passenger cars above. The trucks will require somewhat more headroom, yet the arrangement of the ramps would preferably be typical in the several runs. Otherwise, drivers will become confused and cautious, with a general



Circular Spiral Ramp



Elliptical Spiral Ramp

slowing down of traffic resulting. Sudden changes of grade will produce a like effect, and must accordingly be guarded against. A ramp with a low grade is the only kind which can satisfactorily meet this condition, and such a ramp, unless ingeniously planned, will be prodigal of space occupied. There is a way to avoid this disadvantage, as will be shown. The cost of constructing the ramp is also of some moment, though it can scarcely be called important except in the case of a small structure. A fairly safe rule to adopt is this,—select the type of ramp which will satisfy the conditions and afford the greatest number of physical advantages, and its cost will be taken care of in the service rendered.

Ramps at their worst are not exceedingly difficult of erection, although the work requires a skilled and experienced building superintendent. Some are more difficult than others,—much more,—and all should have better than ordinary attention. The most involved part of the work is completed with the construction of the forms. Excellent ramps have been and will continue to be built. A little more perplexing than in the usual construction is the placing of the reinforcement, yet similar problems are encountered every day in variously pitched roofs. Needless to say, a little extra care in mixing and pouring the concrete is desirable. This is merely to offset the human equation, to compensate for the slightly greater chance of a flaw in the work due to its complicated nature.

There is a further item of cost in connection with ramps which must be noted, and the reference is made to royalties. Many patents have been taken out on ramp systems and ramp features, the large majority of which mean little or nothing. Some there are, on the contrary, seemingly good and functioning. In the interests of impartiality, none of the names will be used here, since the writer might inadvertently neglect to mention some deserving type. The justification of patenting such a thing as a ramp system might appear, at first blush, questionable. The fact remains that such patents do exist, and when it is realized that they represent a tremendous amount of time and experimenting, as well as the expenditure of much money, one finds scant excuse for protest. Furthermore, their sponsors offer the results of their experience in advice and service, and there is no doubt but that their use results in savings which far outweigh the patent fees. Ramp royalties are generally figured on the base price of 10 cents per square foot of the entire area, and with a sliding scale of discounts depending upon the size of the building. The price of the royalty for a ramp for a garage with a capacity for 500 cars would be say $10,000.

The several forms of ramps may be now enumerated and the characteristics peculiar to each presented and discussed. Beginning with the simplest, there is the plain, ordinary incline, a straight run from one level to the next, obviously excellent when circumstances make its use feasible. It requires either a very large or very long building, since upwards of 80 feet in horizontal projection is necessary to rise the normal story height without excessive grade. Such a combination of conditions is rarely found, although in passing, there might be mentioned the Motor Mart Garage in Boston, said to be the largest in the world, where ramps of this kind are employed. In this instance the ramps are laid out in such a way that the travel of cars is around the building, succeeding ramps being located on succeeding sides. This arrangement proves very effective, since the driving is made easy, there are no sharp turns, and visibility is good. All parking is away from traffic, and hence there is little chance for delays. The capacity requirement is likewise well met.

The most common type of ramp found in present-day city garages of more than three stories is the curved or spiral type. This classification may in turn be sub-divided into those which are circular in plan, and those approximately elliptical. Both are applicable to the ordinary lot, the shape of which is of no consequence. Commenting on the circular spiral, the outstanding merits are easily summarized. It occupies the least amount of space, thus contributing to one of the principal aims,—maximum capacity. For the same reason, it caters to the feature of

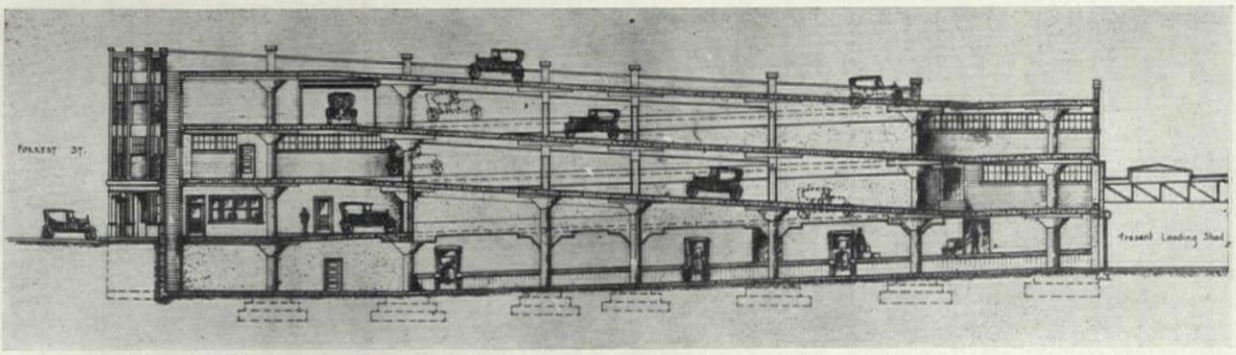
convertibility, inasmuch as the building can readily be adapted to a different use with minimum loss of floor space; or, if alterations are made, small amount of demolition and replacement is necessary. Further, because of the shape and small space necessary, a circular ramp can be tucked into a semi-useless corner or jog. The disadvantages of this kind of ramp are that it is one of the most difficult to build, and hence costly; it is likely to be reduced in size with sharp turning and steep slopes; the visibility is very poor, a driver being able to see only a few feet in front of him; and it is hard to negotiate, especially with a long car. These undesirable characteristics slow up traffic with consequent bad effect, induce strain on the drivers, and cause wear and tear on the cars. At present some modification of this type is most generally in use, and there are doubtless examples of it in almost every city which boasts a large garage. A typical layout for a circular spiral ramp is shown in one of these diagrams. Before completing consideration of ramps of circular plan, mention should be made of an ingenious variation wherein one spiral is within another. The inner spiral is for down traffic, the outer for that moving up. Yet all traffic is traveling in the same direction. The interesting point to be noted is the clever method by which the meeting and crossing of cars going up and down are eliminated. The only other method of accomplishing this happy condition is to supply two distinct ramps in different parts of the garage. An example of this is in the Eliot Street Garage, Boston. The spiral ramp of elliptical plan may be similar to the circular, differing only in that the longer run requires more space, but allows lower grades.

Many buildings are split vertically with the floor levels of one portion staggered with relation to those of the other. The floors themselves are usually level and are connected by half-story ramps. This type is very efficient in car-storage capacity and has been widely used. In this category fall several ramp garages in Detroit, and many examples are found in other cities, such as the Bowdoin Square in Boston. They have proved very successful.

The floors may be slightly pitched upward in a counter clockwise direction and the two parts connected at the ends by short ramps. These short ramps have slightly steeper grades than the floors, but are comparatively gentle. The accompanying sketch will serve to illustrate the plan. Various refinements may be made in the basic type, such as warping of floors; banking of curves; banking of entire driving aisles, since considerable speed can be developed; and location of drainage connections at lowest points. Probably the latest modification of a ramp system on this principle is described in this manner. A continuous ramp, banked at all points, the plan and pitches described from two points, making a ramp of somewhat the nature of a spiral or helix, yet not a true helix; and while this term would indicate a circular plan, this plan is more of an ellipse, with the centers as drain points. In other words, the entire floor area of the building goes in to make up a continuous ramp to the top, the driving aisle being banked, and the remainder of the floor warped away from it and slightly pitched to the point or points from which the curve of the driving aisle is struck, and to which the water naturally flows and is drained off. The recently built Fourth Avenue Garage in Pittsburgh is of this type, and another is located in Baltimore.

There is much to be said apparently in favor of this system, and little of significance against it. Briefly, its disadvantages are: (1) the limitation as to the size of building, since there must be length enough to give extremely low grades, else its purpose is defeated; (2) the fact that cars are parked on a surface which is sloped, though very slightly,—less, in fact, than the crown of the ordinary street; (3) the lack of general convertibility. A building constructed in this fashion might be used as a warehouse, but there are few other uses to which it could be adapted. The benefits credited to this variety of ramp might be summarized as all that could be desired,—low grades; good visibility; easy, fast driving; economy of space, for nothing is lost to parking; easy turning radius; great flexibility; all are combined in one ramp. At first glance, a ramp of this system, which is rather hard to grasp and visualize, might seem expensive to build. On the contrary, because of the fact that grades are low, floors, though pitched, are parallel, and there are no sharp curves, it costs little more than ordinary floor construction when once under way. It is possible also to contrive very creditable elevations for such a building in spite of staggered and pitched floors. This, then, outlines the present development of garage ramp systems. It is not meant that any one system is advocated for general use everywhere. Each individual building is a problem in itself, which must be studied and analyzed to determine what type will best fulfill the requirements under the conditions.

As a matter of interest, authentic cost figures are herewith presented, based upon a garage recently built using this last described system. The structure is 90 feet by 172 feet, five stories high, but figured for four more; it has face brick on three sides, and was designed for a net live load of 150 pounds. The cost complete, including heating plant, plumbing, push-button passenger elevator, wiring, fixtures, air compressors, architect's and patent fees, was $220,000. This figure includes a cost of $32,000 for concrete piling. This is extraordinarily low, especially in view of the prevailing rates of wages,—common labor 80 cents; carpenter labor, $1.50; brick masons, $1.75. It will be observed that the cost per square foot was under $3. It should be noted that the cost per square foot was thus moderate, or, expressed in terms of cubage, was 22 cents per cubic foot. Located in the business district of a large city in the eastern section of the country, this garage is rated at 430-car capacity. Cars can easily be driven at a speed of 30 miles per hour on grades varying

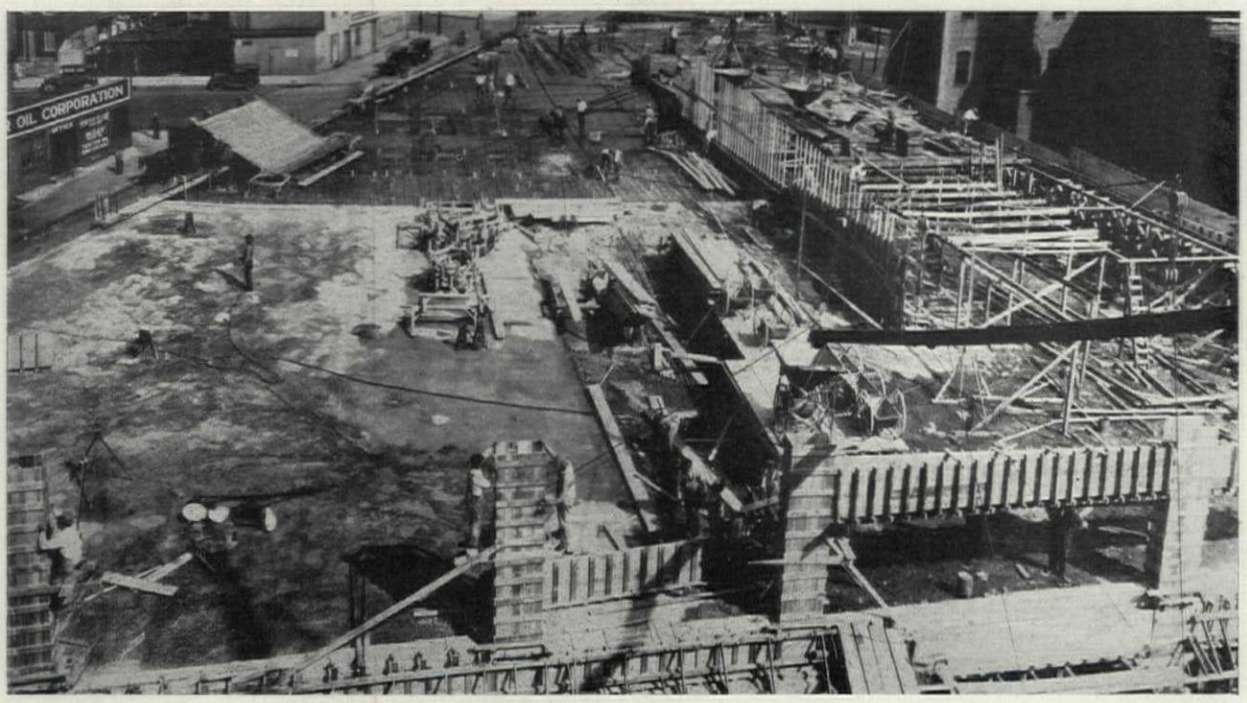


Section Through a Warped Floor Garage

from about 4 to 11 per cent. The lower two story heights are 12 feet, 8 inches, being designed for the accommodation of trucks, while the upper three stories for the parking of passenger vehicles, are 10 feet, 8 inches high. The total area available for parking on the five floors and roof is approximately 77,400 square feet. The basement is utilized as a repair shop, washrack, etc., and for the heating plant. At the present time this garage is operating successfully with a charge of 50 cents a day for transients and proportionate weekly and monthly rates.

There is a third classification of ramps, worthy of mention,—namely, the combination of the straight run with some form of the curved. This kind is used where insufficient distance is available for a plain straight ramp, and most commonly found in garages of two or three stories only. All of the types here described may be further sub-divided into single or double ramps, that is to say, ramps carrying traffic up or down, or both up and down. The majority of ramps are to carry the double traffic, this in the interest of economy; yet there are single-traffic ramps, and there are advantages to be derived from their use. Generally speaking, their place is in a garage of very large proportions, having separate entrances and exits in different parts of the building.

Before making final selection of the ramp for any garage, some consideration must be directed to the physical character of the building itself, as dictated by conditions or by the owner. For example, the desired story heights must be decided, generally from 10 feet up; the spacing of supporting columns; the width of driving aisles, 18 to 22 feet suggested; the kind of construction, whether beam and girder or flat-slab; and the treatment of the exteriors. All have some bearing on the ramp problem, as can be readily appreciated. Hence it is that the planning of a modern reinforced concrete ramp garage is something more than just another commission. The need of buildings for this purpose is very real, and many must be built in the next years. Their designing and planning constitute an interesting problem worthy of the best thought and effort, and the attempt has been made in this article to indicate the extent of the available material from which a happy solution can be worked out.



Building a Warped Floor Garage

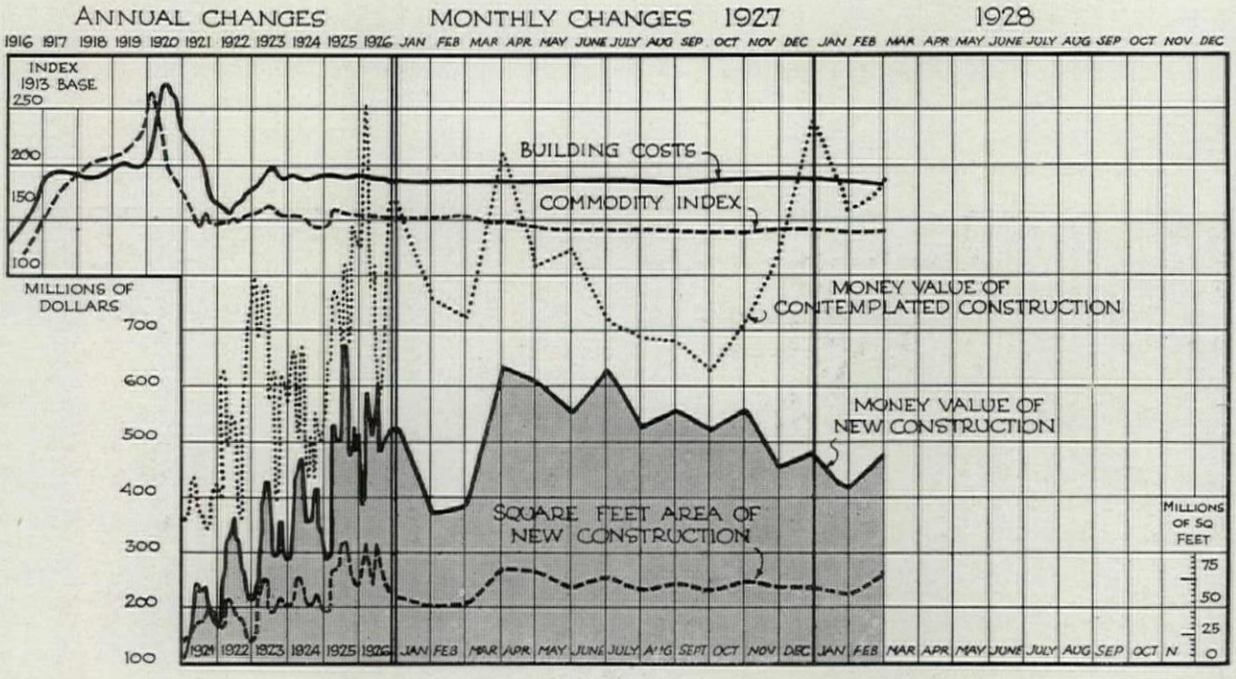
THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

THE construction figures recorded for the month of February are unusually interesting, because once again all records are broken. According to the figures of the F. W. Dodge Corporation, the value of building and engineering contracts awarded during the month of February in the 37 states east of the Rocky Mountains amounted to $465,331,300. The figure was the highest February contract total ever recorded for the 37 states. It was 9 per cent ahead of the January, 1928 total and was 18 per cent over the record for February of last year. The territory covered by this record includes approximately 91 per cent of the active building district of the country. Four districts made new high totals for the month of February, the new records being reached by New York state and northern New Jersey, the Middle Atlantic States, the Central West, and Texas. The New England States had a total which was next to the largest February on record.

Last month's contract total for the 37 states included these items of note: $238,985,100, or 51 per cent of all construction, for residential structures; $59,980,200, or 13 per cent, for public works and utilities; $57,695,400, or 12 per cent, for commercial buildings; $35,413,700, or 8 per cent, for social and recreational projects; and $34,881,300, or 7 per cent, for industrial buildings. The February contract total brought the amount of work started since the first of this year up to $892,500,000, this being a gain of 15 per cent over the amount started in the first two months of 1927. New work contemplated during the past month in these states amounted in value to $947,003,400. This figure shows an increase of 5 per cent over the amount reported in the preceding month and was 50 per cent ahead of the amount reported in February, 1927. In New York state and northern New Jersey, the value of building and engineering contracts awarded in the month of February reached the highest February contract total ever recorded, the amount being $139,071,700. This amount is 34 per cent higher than that reported in February of last year and 6 per cent higher than the figure of the previous month. It is to be noted, however, that one hotel project alone, costing $22,000,000, helped considerably to swell this total.

Of the total amount of construction recorded for February, approximately 51 per cent was for residential structures, which include houses, apartment buildings, hotels, etc. An unusual amount of residential building seems to be under way.



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.

QUESTIONS THE ARCHITECT MUST ANSWER ABOUT OIL BURNING

BY

P. E. FANSLER

ASSOCIATE EDITOR, THE HEATING AND VENTILATING MAGAZINE

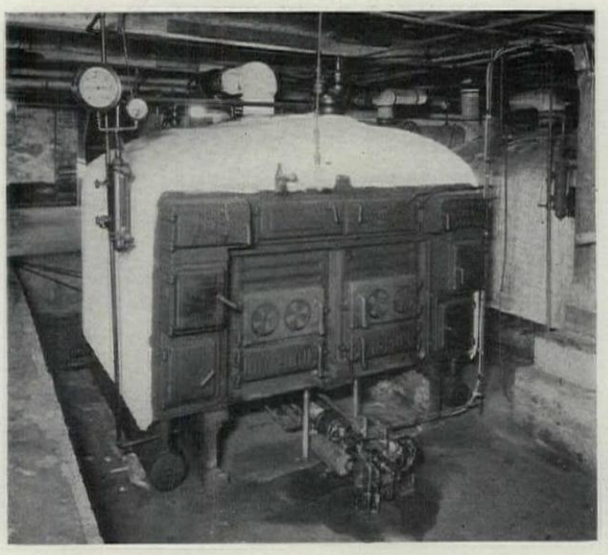
NO fewer than 700,000 domestic oil burners would have been sold during the last 24 months had one been installed in each new house built during that period. It might fairly be assumed that, indirectly at least, architects, through the heating engineers who are responsible for laying out heating plants, exercise a large degree of control over the possible expenditure of some $150,000,000 a year for oil burners. Having in mind these significant figures, it would seem highly desirable that the architect be well informed regarding domestic oil burners, in order that he may answer intelligently the questions asked by his clients. In a previous article the essential technical features of modern oil burners were described. It is now in order to deal with the most commonly asked questions, and to suggest logical and comprehensive replies.

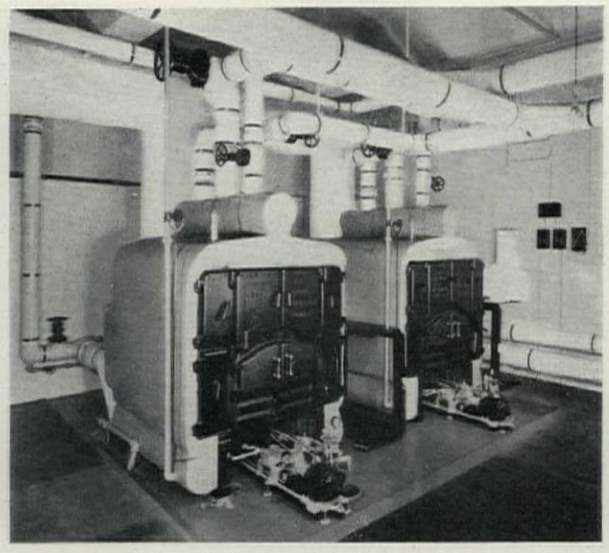
First of all the architect probably will be asked for his opinion of the value of oil burners as a generic class of equipment. Personal feeling, even if it be strongly for or against, should here be subordinated to facts based on nation-wide performance. As a general thing, architects are lukewarm on this subject, but with a leaning toward giving qualified recommendation. So many burners have been installed in almost every community, and the average results have been so satisfactory, that the architect usually has many more friends who are delighted with the operation of their oil burners than friends who are not satisfied. The aggregate opinion of 25 or more users in any community may be a safe basis of judgment, but if the opinions are based on the performance of only two or three makes of burners, certain reservations may be necessary. So much depends upon the care with which an oil burner is installed that a careless agent can easily ruin the reputation of a first class burner in his territory. I know of a case where a prominent western architect was involved in a very disagreeable situation by the installation of two burners in a single boiler. The agent realized that he did not have a suitable burner for this installation, but, rather than let a competitor get the business, he resorted to the subterfuge of putting in two burners where one of greater capacity should have been used. Throughout a winter season the owner, the architect and the agent formed a constantly wrangling trio. Finally the two burners were removed by a competing agent, a larger and more suitable type of burner was put in, and, immediately, peace reigned. The architect was justified in his recommendation of oil burning, and the owner was converted into an enthusiastic booster. In this case, had the architect been better informed on the technique of oil burning, he would not have approved the proposal of the original agent.

In my contacts with the heating industry, I have found rather more reluctance to accept the oil burner than I have among architects. One man, prominent in the industry, was vehement in denouncing "the oil-burner business" because two of his friends, heating contractors, had lost considerable money through taking on an oil-burner agency. It would seem logical to suggest that the difficulty might have come as the result of bad merchandising rather than of defective or unsatisfactory merchandise. The architect, in reading advertising, and in discussing such advertisements with his client, should strip the superlatives and exaggerations from the meat, and assure his listener that no burner is "absolutely" safe, any more than a coal-heating plant or a gas-heating plant, or an automobile is "absolutely" safe. He must admit that every burner using an electric motor, and many of the atmospheric burners, make some noise, although properly installed burners should not be audible in the living portions of the home. He might quizzically raise the question, where burners are claimed to be "perfected," as to the necessity for spending money in laboratory work if the burner is already perfect.

But the conscientious architect is bound to tell his client that oil burning in the home is, broadly speaking, entirely successful, and that every factor militating against universal satisfaction is being studied and remedied as rapidly as possible. One of the most general causes for trouble in domestic burner operation has been unsuitable or non-uniform fuel. This situation is rapidly being cleared up by the oil refiners, who see a tremendous market for partially refined products. A great many bitter experiences during the last few years have proved the necessity for close adherence to definite specifications, and all interested parties are now working on a formulation of such specifications as will remove this serious cause of trouble.

Assuming that the architect is ready to recommend oil burning, he probably will be faced with the question: "What is the best burner?" This can be answered with entire fairness and satisfaction to all concerned by recommending the three or four burners that have given the greatest general satisfaction in the neighborhood. Suggest to the client that he call on owners and get first-hand data on a few of the burners most popular in his locality. Burner performance being a combined function of the burner and of the operations of the agent, this method of selection helps to build up the business of the most conscientious burner agents and automatically assists in the decline of the fly-by-night. The selection of a burner is usually determined to some extent by the amount the client is willing to spend for it. The





Cleanliness of Boiler Rooms is Evidenced in These Workmanlike Oil Burning Installations

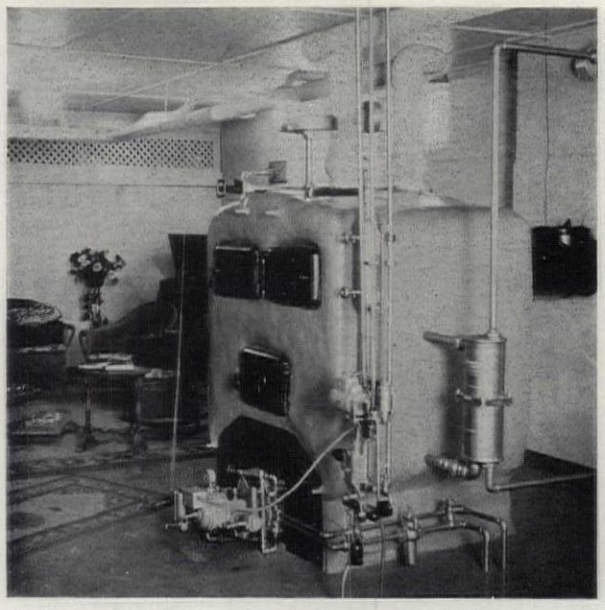
range in price of burners to supply heat for an eight- to ten-room house is just about what it is for an automobile to transport two persons. One can buy the new Elizabeth, or, by spending 20 times as much, acquire an English-built Rolls-Royce. In general, the trend of prices is downward,—that is, new makes and small and simplified burners made by older manufacturers are now on the market at $300 to $400 installed, with 275-gallon inside tanks. Burners suitable for larger houses, installed in cities with extremely rigorous installation regulations, cost up to $1200.

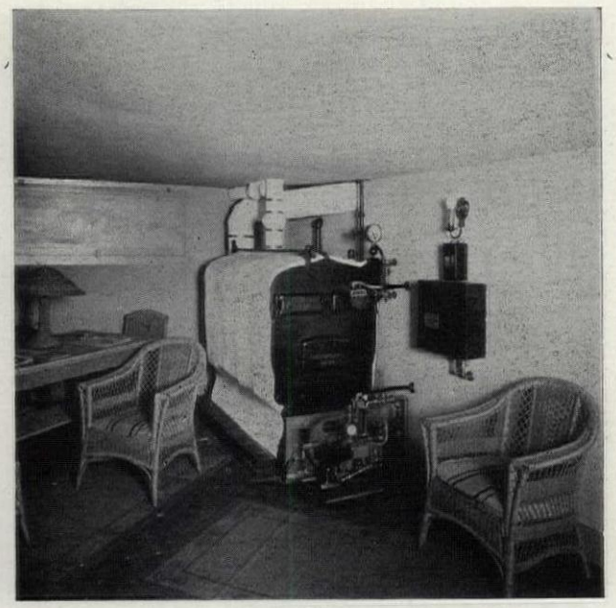
Many clients, in certain sections, and owners of small houses in other sections, will ask: "Will an oil burner be satisfactory in a warm-air heating system?" As a usual thing, extreme care must be taken in installing an oil burner in a warm-air furnace, because this type of heating plant is likely to act as a resonator and amplify and pass on any noise of combustion or mechanical noise of the burner. The air ducts offer an excellent means of transmitting this noise throughout the house. So the burner should be set on a cork or similar foundation, and if possible kept from metallic contact with the furnace. In some cases it may even be necessary to encase the burner unit with sheets of cork or other sound-deadening material; except in extreme cases, a burner can be so installed in a warm-air furnace as to be entirely satisfactory from the standpoint of noiselessness. I would suggest, however, that oil burners should be used only with the new type of all-steel furnaces having welded seams. In the old fashioned kinds, the fire pot is made up from several cast iron sections, the joints being cemented. The intense heat from the burner flame is likely to cause the cement to disintegrate, with the result that products of combustion are drawn into the jacket and spread through the house.

An oil burner should work well with any kind of a heating plant, but there are many factors that may cause its functioning to be "jumpy" or erratic. For instance, the ratio of the quantity of water in a boiler to the quantity in the radiators and piping can vary within wide limits, and likewise the action of the burner, in response to the thermostat, may vary. Again, the fact that there is liberal radiation in a house, or that it is deficient in radiation, or that it has excessive infiltration may have a noticeable effect on the proper setting of a burner, and on its working. And to these variables must be added those based upon the variations in steam and vacuum systems, with different degrees of "acceleration" in passing heat from the boiler to the air in the rooms. Any of the reliable burners can be so installed as to give entire satisfaction in any kind of a system, but the setting of the burner must be intelligently determined to best suit the specific conditions encountered.

There is one tremendous advantage offered through the use of either oil or gas fuel,—the ability to utilize a large portion of the basement for living or recreation purposes. This is not a fictitious advantage, for houses are now being designed and built in which all but a tiny portion of the excavated portion is to be play room, billiard room, study, or other useful adjunct to the up-stairs portion. Sixty square feet of floor space is sufficient to allow for a boiler and burner, and this is but a fraction of the area of an ordinary basement. The space gained through burning fluid fuel is not merely that saved from the no-longer-needed coal bin; it results from the cleanliness inherent in the basement where fuel is fed automatically through a pipe. A growing number of plans have taken full advantage of this situation, and added approximately 30 per cent of usable space to the houses at no cost but that of decoration.

One question that the architect can count on being asked is "Is there enough oil in sight to justify the investment in a burner?" A near-panic was precipitated by the report of a federal commission about a





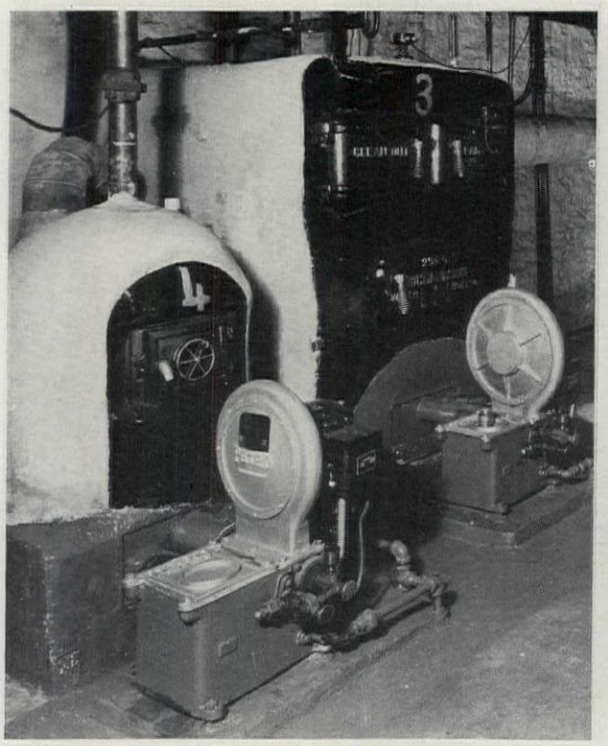
Boiler Rooms Equipped with Oil Burners Can Become Part of the Living Quarters of the House

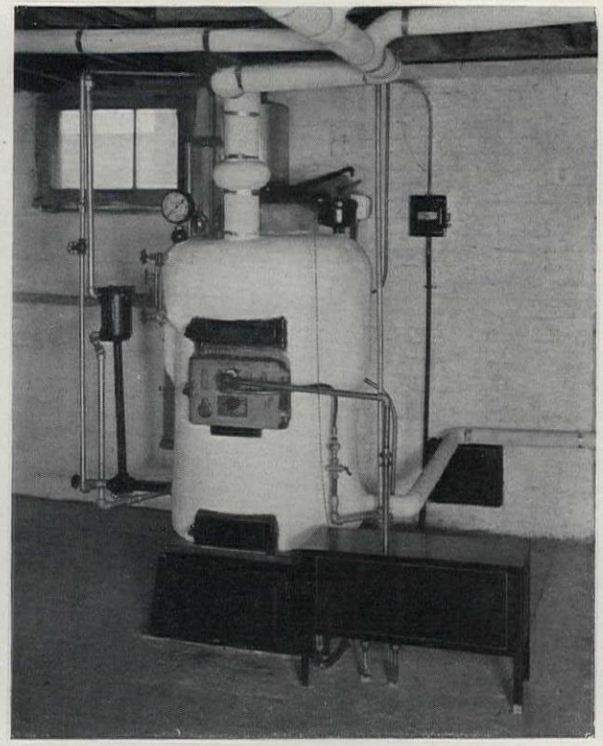
year ago, indicating a shortage of oil, and a great deal of "explaining" followed. As a matter of fact, no one has any conception of the aggregate crude oil resources of the United States, or any other country. Several years ago experts announced what the oil reserve was supposed to be. In the interim more oil than this estimated reserve contemplated has been brought to the surface, and the known bulk of oil is now greater than it was at the time when this statement was issued. Only last month a report was given out leading us to believe that the hidden supply of oil is much greater than ever has been dreamed of, and certainly it is not likely to be consumed for many years to come.

It is my feeling that the consumption of gasolene by automobiles will not materially increase. The ton-mileage of trucking is bound to grow enormously, but the truck of the near future will not burn gasolene,—it will be powered with a Diesel engine using distillates ranging between 24° and 36° A.P.I. The change from use of gasolene engines to heavy-oil engines for marine purposes has already gone a long way toward the ultimate, and except for engines of small power and those of high speed used for special purposes, the marine gasolene business is on the down grade. All this means that gasolene consumption will not grow in proportion to the increase in aggregate automobile horsepower, and that the increased need for "cracking," so marked during the last few years, will not be felt in the future. "Cracking" is the term used in the oil industry to designate the refining of crude oil into lighter oils or gasolene. These cracking stocks will then become available as domestic fuel, adding enormously to our present stocks.

"How much oil capacity should be installed with an oil burner?" is a frequently asked question. This is largely a matter of local conditions,—proximity to oil stations, promptness of service rendered, condition of roads, and normal character of the winter weather. Usually there is such a small difference between the cost of an installation with a 275-gallon basement tank and one with a 1000-gallon outside tank, that it would be good insurance to put in the latter. In many sections of the country it is common practice to install tanks above the surface of the ground and to cover them with neat housing, or to allow vines to run over them. This reduces the cost of installation, but this practice would not be tolerated east of the Mississippi River. If a burner is installed in a house where oil trucks constantly pass within a few blocks, a small tank will suffice, particularly if the service is good. I would recommend, however, getting away from basement tanks and using only 1000-gallon and larger buried tanks, merely as a good investment in fuel storage and reserve. The average house may require 200 gallons of fuel per heating season, and for such a building a 1000-gallon tank would be about right.

There is one question that is always asked in a discussion of oil burning: "How does oil heat compare in cost with heat from a coal-fired plant?" The only proper answer to this query is that there is no proper comparison. Solid fuel gives one kind of a result; fluid fuels,—oil, gas or district steam,—give an entirely different kind of "heat comfort." Logically, the costs should not be compared. No one, after having used a decent oil burner, or a gas-fired heating plant, or "street steam" would attempt to compare them with a coal-fired plant. He would say: "I'm getting real heating comfort of a kind I had never known. My fuel is automatically fed, thermostatically controlled, so that the temperature in my house is always just what I want it, and there is no dirt, no dust and no residue to remove. Cost comparison is out of the question." Two years ago I sent a circular letter to a number of persons who had





Methods of Heating Domestic Hot Water Supply with Oil Fuel

A Separate Oil Fired Hot Water Heater

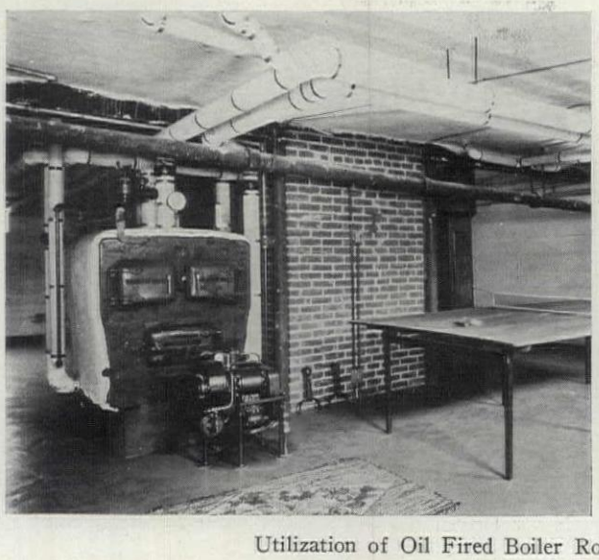
An Indirect Hot Water Heater

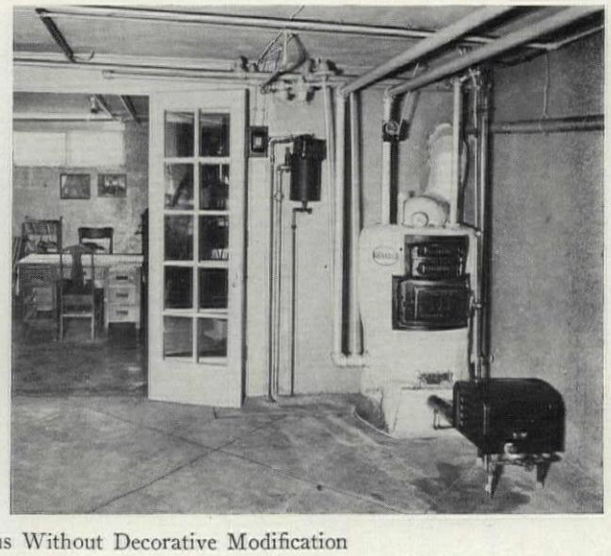
used oil burners for two or more years,—they had had experience. I asked them, among other questions, how much more they would pay for oil fuel than for coal before they would revert to coal. The figures given in the replies varied between 25 and 200 per cent, and the mean was almost exactly 100 per cent. In other words, the average man was willing to pay twice as much for oil heat as for coal heat.

In a recent article, Dr. R. T. Haslam, of the Standard Oil Development Co., a leading technician on the subject of the utilization of fuels, said that a high class burner of the present day, properly installed and adjusted, should produce heat at a cost not exceeding that of equivalent heat produced by burning anthracite coal. Of course, this is a general statement, but it is unbiased and authoritative. I would say that equivalent heating should be produced by oil fuel at costs varying between 10 per cent less than and 25 per cent more than those for coal in the same territory. As a general thing oil burners are not removed. Once in a while we learn of a locality where burner removals cause considerable comment. Two causes usually explain the situation. Either a salesman has "cleaned up" in a given locality, with a cheap burner that is not worthy of the name, or a really good burner has been damned through the high-pressure, careless installation policy of a "get-rich-quick" type of agent.

The life of a good burner is not known. Burners built on the Pacific coast and installed more than 20 years ago are still in service. Some of these are about as efficient as the modern units, although not automatic in operation. A high class burner heating a house for the first time this winter should give ten years of heating comfort without major repairs. It might be well to overhaul twice during that period. If kept free from dirt and dust and properly lubricated, there is little to wear out and require replacing. I should expect any one of the dozen burners that I might select for my own house to serve me well for at least 15 years, and I am certain that any one of them would be able, mechanically, to do so. The life of underground tanks is not known, but, based on installations made 15 years and more ago, the tanks installed today should last for at least 20 years. Cinders should never be used to fill in around oil-storage tanks, as water seeping through the cinders causes the formation of destructive acids. Special attention should be given to tank installation in those rare locations where corrosion follows the placing of iron in the earth. None of the oil fuels in common use for domestic heating will freeze in the coldest winter weather, either in buried or in exposed tanks. Some oils will congeal to such an extent as to cause faulty operation of the oil pumps, but where a reputable agent advocates the use of heavy fuel, provision always is made for maintaining the temperature of the oil in the tank and pipe line at such a point that proper viscosity is insured. This is usually done through the medium of a steam or hot water coil connected to the heating plant.

The two problems that loom before the oil-burner manufacturers today are those of proper installation and service. We have discussed the former; the latter is not yet settled. The oil burner is a simple, rugged, yet at the same time delicate mechanism. It





Utilization of Oil Fired Boiler Rooms Without Decorative Modification

Boiler Room as Children's Play Room

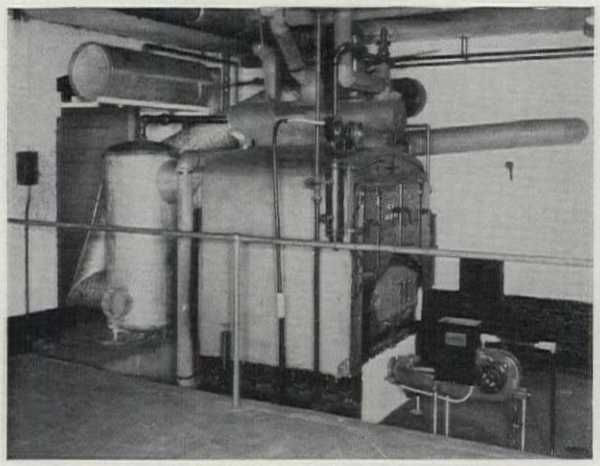
Boiler Room as Adjunct to Study

should not, as a general thing, be played with or adjusted by the average servant. Service should be available at all times, although it may never be needed. To meet this requirement some dealers are providing service free for the first month, or two, or three, and then charging for service at a definite fee per call, by the hour, or for a fixed charge per heating season. In the last case there is included a general overhaul of the burner in the spring, its storage or proper protection from dust during the summer, and a check-inspection at the beginning of the heating season. If a home owner has an appreciation of high class machinery and its abilities and limitations, he may go through an entire heating season without requiring a service call;—many do. On the other hand, if he or the servants are careless and unappreciative, allowing dust and dirt to get to the burner and giving no heed to its operation, such a plant may need cleaning and oiling by a service man once a month. Twenty dollars a year should provide service for the typical good burner in average hands. Present-day charges may exceed this by $5 or $10, largely on account of lack of density of population in any community. When there are more burners in use, service charges will naturally drop.

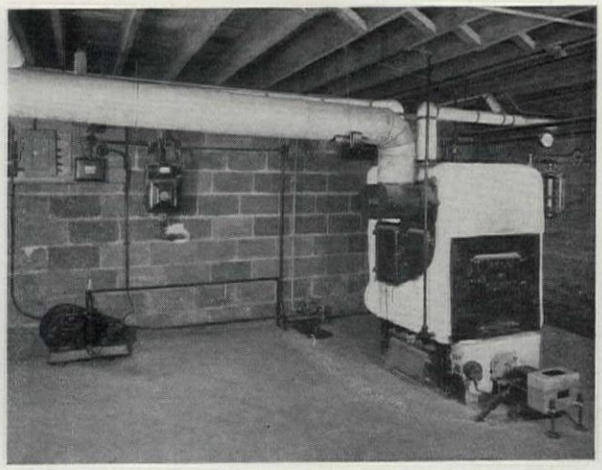
Oil burners are, as a usual thing, delicate in adjustment; that is, a slight variation from a certain setting will materially decrease the efficiency of the burner. This does not mean, however, that burners are unstable. The usual practice is to have air and oil adjustments so made that special keys are required. This prevents tampering with the setting by any other than the authorized and qualified agent. It is not impossible to so adjust a given burner that it will produce heat at a given rate and then make another adjustment that will double the quantity of oil required to generate the same amount of heat at the boiler outlet. This is because it is very easy, when setting the burner by eye, to so adjust it that a tremendous amount of excess air goes through the combustion chamber.

It would be of great benefit to the house owner if every architect required that burners be set on the basis of a gas analysis made with an Orsat apparatus. This might well be made an item in the architect's specifications. This apparatus furnishes exact data on the character of the flue gases, and, with a thermometer giving the flue-gas temperature, it is a simple matter to adjust the burner for maximum efficiency. The cost of making the final adjustment in this exact way would be only a dollar or two more than leaving it to the eye of the installation man, and the results certainly would justify the requirement.

The matter of safety, where oil is the fuel, I have left to the last. Two years and more ago this was a pertinent and often-asked question. Today there is a pretty general understanding of the facts. In this interim the National Board of Fire Underwriters has made a careful study and analysis of oil-burner fires, and the data accumulated indicate that the risk in a house burning oil fuel is no greater than in a house burning anthracite coal, and much less than where soft coal is used. The fact that no additional premium is charged for domestic fire insurance should be conclusive evidence on this point. It is unfortunate that a great many people interested in the sale of coal have undertaken to carry on a terrorist campaign through advertising in local newspapers, using articles about oil-burner fires, set up to resemble news items. One such, in a New Jersey paper, I traced through 14 offices and "news" agencies. Finally the fire chief in the city where the "fire" happened branded the story as a gross exaggeration. Careful installation in accordance with the regulations of the National Board of Fire Underwriters is the best guarantee of safety. Nearly every manufacturer requires that his burners be so installed, and these standards are being adhered to by members of the oil-burner industry, who realize the importance of this phase of their work. The Underwriters' regulations are not in any way overstrict or objectionable, but in some cities the author-



Two Radically Different Types of Oil Burners
Motor, Blower and Nozzle in Single Unit



Motor Driven Blower Separate from Nozzle Element

ities pass regulations that are unnecessarily harsh. The extra costs involved are always passed on to the purchaser. In New York, for example, it costs about $200 more to install a high class burner than it does in nearby cities, or even in the other large cities in the country. This premium of 20 per cent does not seem to be offset by evidences of greater immunity from fire.

Finally, there is the question, never omitted: "What burner would you recommend?" First, as to type, there are no data to show that any one type is generally superior to others. There are no data to prove that any shape of flame is more efficient or desirable in all types of boilers than are other shapes. The installation man who knows his business can adapt almost any type of burner to give excellent results in any boiler or furnace that is fit for an oil-burner installation. The long fox-tail flame produced by some burners seems particularly adapted to the long, narrow combustion chambers of sectional cast iron boilers. The same long flame can be utilized in round-type boilers through the proper use of refractory materials. And in the steel boilers that are available for house heating, such a flame fits beautifully;—but the same thing is true of the other shapes of flame, with few exceptions. Proper installation will make any shape show excellent performance in any shape of combustion chamber, provided always that the burner will handle oil at the necessary rate to carry the boiler at the maximum load required. It has been amply demonstrated that the average boiler, particularly the larger steel types, will carry more of an overload with oil fuel than when fired with coal. This is largely because higher temperatures can be maintained in the combustion chamber without variation, and because there is no "firing period." The burner can be set to burn continuously, and the output of the boiler maintained at 150 to 200 per cent of its normal rating. This is one reason why the installation of an oil burner is frequently followed by more satisfactory heating,—the boiler ability is increased with the change in fuel.

A definite warning should be sounded, however, against attempting to bolster up the operation of a "sick" heating plant by installing an oil burner. Many and many a burner has been sold on the promise that it would heat rooms that never had been comfortable when coal was used. This situation, of course, does not arise in connection with new houses. It is obvious that insufficient heat in any portion of a house is the result of too little radiation, too small piping, improperly run lines, or similar defects. These should be corrected, if it is desired to improve results; the remedy is not merely in a change of fuel.

From a constant and careful study of the development of heating with gas, oil and coal, I feel certain that we are at the beginning of a nation-wide trend toward the use of fluid fuels. Gas and oil are the domestic fuels of the future,—the former where it is available at a reasonable price, and the latter in the tremendous areas where gas is not to be had, or is excessive in cost. Fundamental economic laws will provide for a balancing of unit fuel costs against the relative benefits accruing from the use of each kind. One trait is characteristic of Americans, and it is daily growing more pronounced,—the readiness to pay generously for bodily comfort and for any desired attainment at a minimum expenditure of effort, physical or mental. This explains, in large measure, the ready acceptance of gas and oil as domestic fuels, and the possibility of a complete change from solid to fluid fuels within the space of a dozen or more years. The architect who will best advise his client in this matter will follow the present developments in the burner and fuel industries and judge with unbiased attitude the merits of the case from data gathered in nation-wide studies. Oil-burner manufacturers are banded together in an honest and earnest endeavor to improve their respective mechanisms, to raise the standards of merchandising, installation and servicing, and the oil producing and distributing interests are striving to standardize oil fuels and provide for delivery with minimum effort on the part of the home owner. These activities are so sincere that there is no doubt of early attainment of their aims.

BUSINESS AND FINANCE

THE ARCHITECT AND REALTY DEVELOPMENT

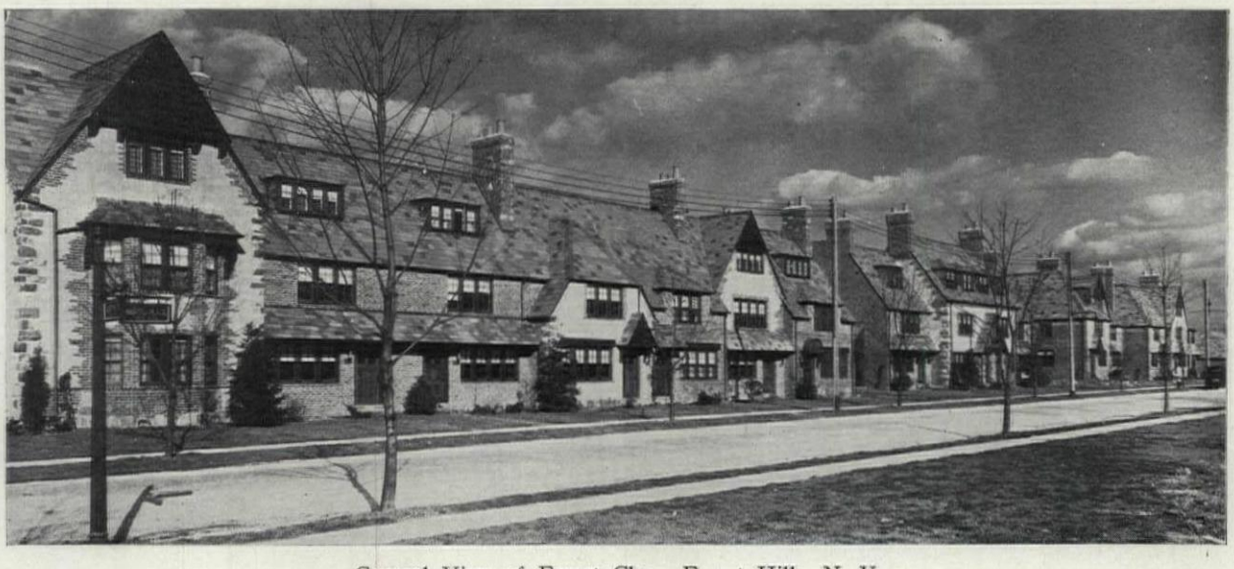
AN INTERVIEW WITH ROBERT TAPPAN, ARCHITECT

BY KENNETH KINGSLEY STOWELL

THE field of speculative building is one which architects seem to have neglected, and yet, when we stop to consider that over a billion dollars are spent each year in the construction of small houses costing less than $25,000, it would seem to be fertile for the architect's activities. Probably less than 10 per cent of the small houses built in the United States last year were designed by architects. It would hardly do for the architect to merely shake his head and condemn the ugliness of the speculative houses, without making a serious attempt to improve their quality. Is it not a civic duty for the architect as well as an opportunity? The speculative builder needs the services of the architect, and arrangements can be made that will be mutually advantageous, and there will be a large unearned increment for the public at large in more sightly suburbs and in more agreeable and efficient living conditions. Perhaps the situation will be clearer if we draw the analogy between custom tailoring and ready-made. Most people would be glad to wear custom-made clothes if they could afford it, but the large majority, for economic reasons, are forced to use the ready-to-wear. The same is true in housing as in clothing. Most people would prefer to have their houses designed individually for themselves, but the lack of cash forces over 90 per cent to live in "ready-made" houses. Here the analogy falls down, perhaps, as we find the ready-made clothing approaches closely in design the custom-made. The speculative house seldom has the advantage of good design.

The Attitude of the Architect. It may be better to consider the ways and means by which the architect can help to remedy existing conditions rather than to try to fix blame on either the speculative builder or the architect. The architect cannot hope to coöperate with the speculative builder unless he is willing to analyze the builder's position and to grasp the economic considerations that are always uppermost in the builder's mind. He must realize that the builder is investing a comparatively large amount of money, and that his risk is great. The architect, in connection with a project of this kind, is risking a few hundred dollars, whereas the builder is investing thousands. The architect must be able and willing to consider the whole project from the builder's viewpoint. He must often ask himself the questions, "What would I do if I were in the builder's position?" "What would my reaction be to this if it were put up to me as the builder?" This sympathetic understanding can only be the result of a conscious effort on the part of the architect,—an effort, perhaps, which many architects are unwilling to make. It will mean a sloughing off of any over-bearing propensities or superiority complexes, with which most builders feel that the architect is endowed. It means "playing the game" with the builder. It means the elimination of much that is, to use the vernacular, "high hat." The architect must learn to talk in the language of the builder, in the beginning, and to educate him, as things develop, to the advantages of good design.

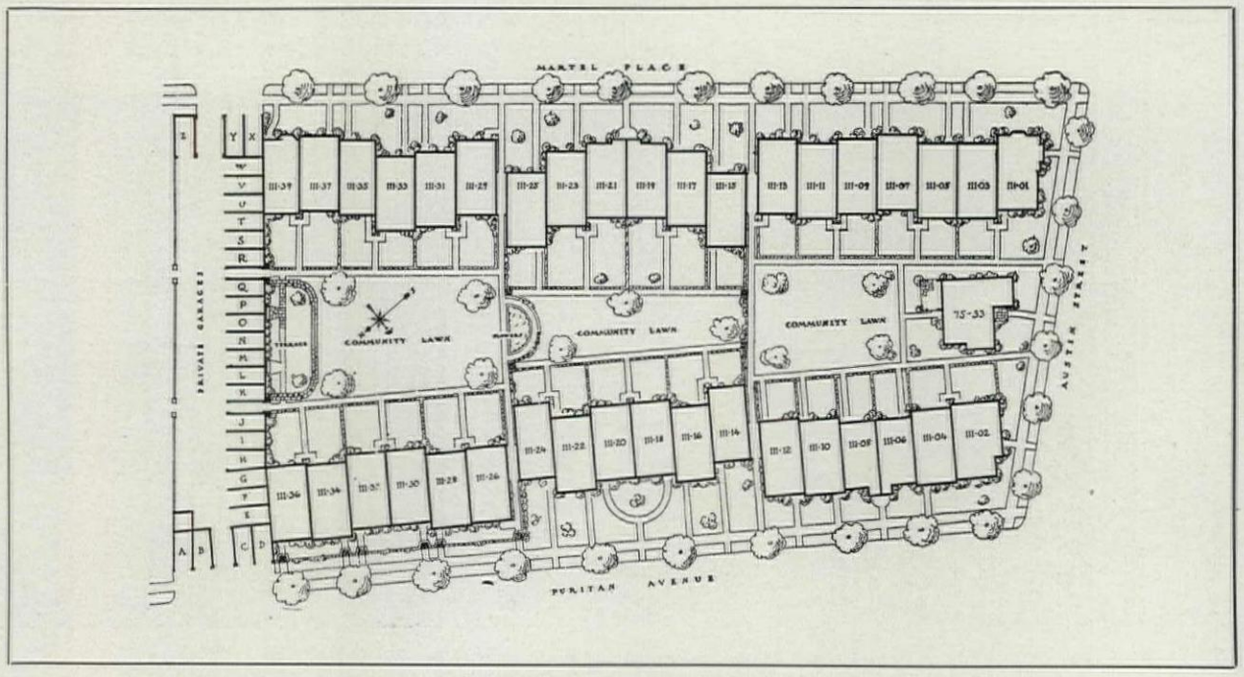
The speculative builder rarely considers consulting an architect of merit because he feels that the archi-



General View of Forest Close, Forest Hills, N. Y.
Robert Tappan, Architect

Interesting Grouping and Texture at Forest Close
Robert Tappan, Architect

tect's fee is out of proportion to the service he renders; and he also feels that the architect will, through failure to fully understand the economic aspects of the problem, incorporate expensive features in the designs for speculative houses. Nothing can be done unless the architect is able to convince the speculative builder that he will be able to make his services pay, or more than pay, for themselves, when considering the project as a whole. In other words, the architect's argument must be that he can help the speculative builder to sell his houses faster and for more money because of their good design than would

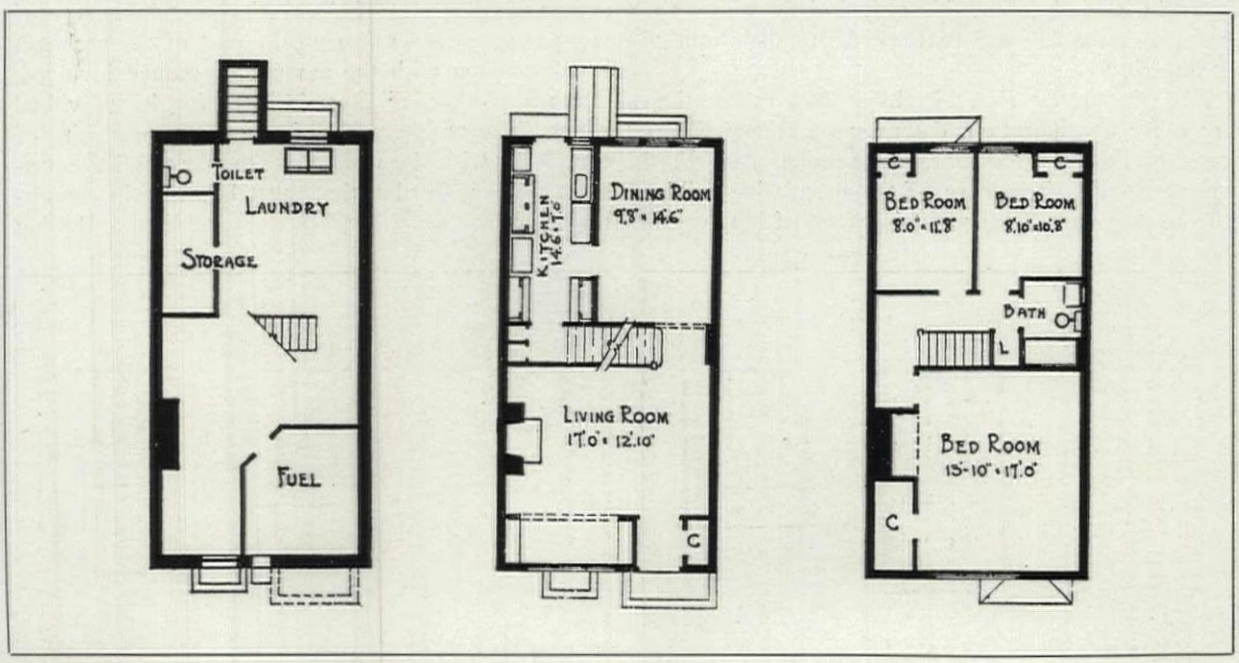


General Plan of the Development

View in the Garden of the "Close"
Robert Tappan, Architect

otherwise be the case. He must also convince the builder that the houses he designs will be no more expensive to build than those produced by someone with less training and experience in architectural design. The architect can help the builder to get larger loans proportionally from the bank for his project because the designs are attractive to buyers and the materials and workmanship specified by the architect are of a quality that will insure the safety of the investment.

The question for the architect is "How can I convince the speculative builder of the facts just men-



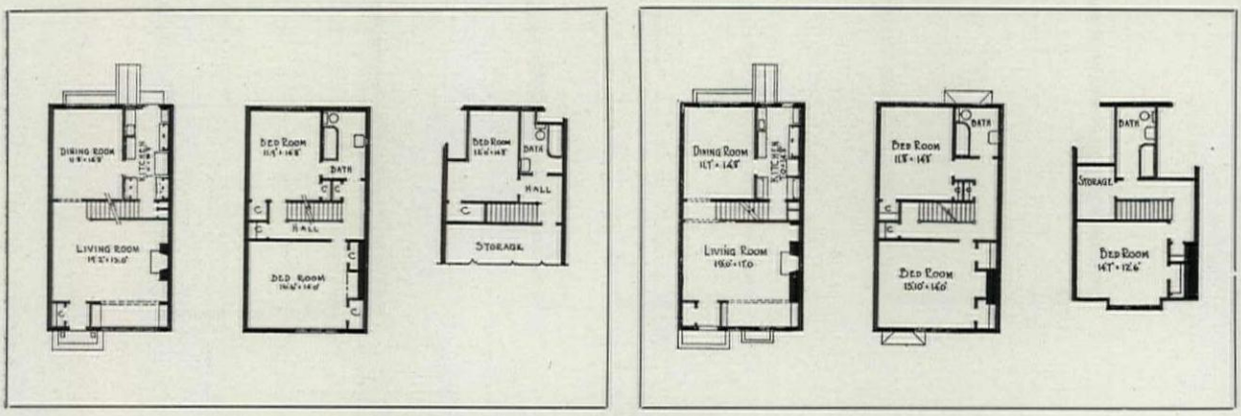
Plan of Houses Each Having Six Rooms and One Bath

Variations in Exterior Design Add to Attractiveness

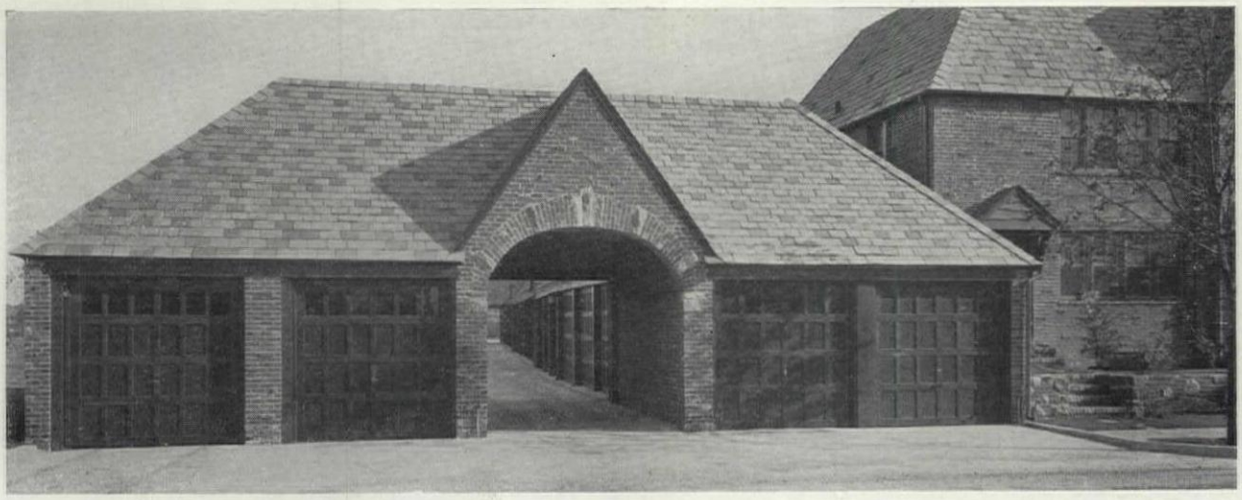
tioned?" In the first place, results accomplished are usually the most convincing argument. For that reason, the Forest Close development, at Forest Hills, New York, is given here as one such instance.

In the second place, the architect must be willing to prove his point graphically. He can do this by offering to take the plans that the speculative builder has used on former projects and to make sketches showing how these plans can be altered for greater efficiency, for saving of labor and materials, and, especially, to make the houses more readily salable by excellence and attractiveness in design. This latter method has proved convincing in many cases, and it is satisfying to know that this demonstration of ability has convinced the speculative builder, and he has invariably come back to the architect for each new project. The making of contacts with speculative builders should not be difficult. It would be wise for the architect to consult first the one or two leaders in this field in his locality. He may find these men the most receptive to ideas that will be to their mutual advantage.

The Architect's Fee. Perhaps this, rather than any other consideration, deters speculative builders from employing architects. The much advertised 6 per cent will often scare off the speculative builder who usually pays $40 or $50 for a set of blue prints which he "buys." The flat fee of a certain stipulated sum, based on the architect's past experience, is the best basis on which to charge the speculative builder for architectural service. The percentage and the "cost plus" systems of charges have not been found advantageous for use in this type of work. The architect should insist on supervising the work. Only in this way can he make sure that the results will warrant his employment. He will not be able to make good his claims of greater salability because of attractiveness and quality if he does not have control of the execution of his designs. The supervision is as much a part of his helpful service to the prospective builder as his original design. The architect must be prepared to meet the builder halfway on the question of fee. He must not expect the same size fee for this sort of work as he would expect in working for the client building an individual house. This is entirely compatible with his own business judgment and the ethics of the profession. This type of work requires less effort on the part of the architect in comparison with the amount of money involved, than many other buildings designed for the individual client. The architect is relieved of the necessity of complying with the whims of the client and the constant changes in plan that must be made in connection with the usual small house problems. Having



Plans, Six Room Houses, Each with Two Baths



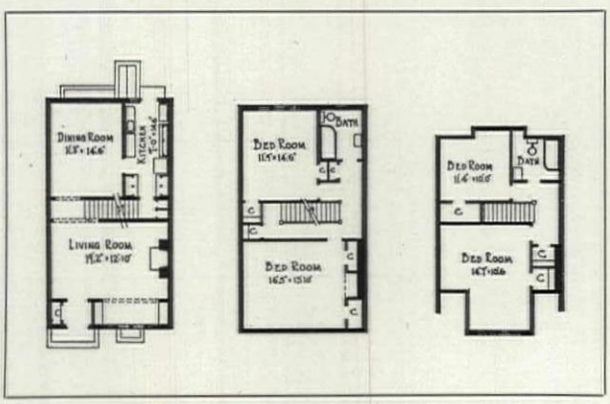
The Garages are Placed at One End of the "Close"

worked out one or two plans for the speculative builder, variation is obtained by alternating these plans and by grouping standard facades in order to make an attractive ensemble.

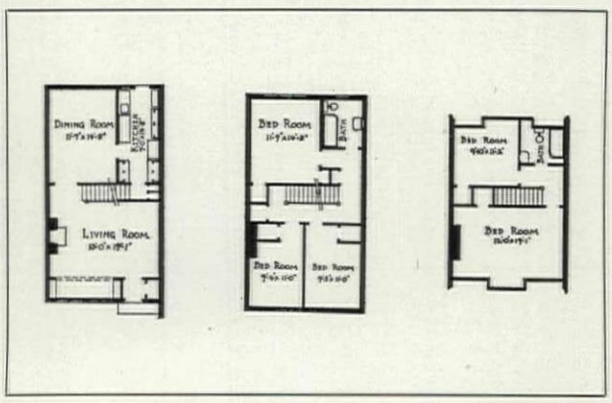
In determining the requirements of the project, the builder usually has a fairly definite idea of the practical requirements in regard to the number of rooms and the selling price, which largely determines the plan and character of the development. The builder is usually in a better position to set forth these requirements, because he is in direct touch with the buying public, and the architect as a rule has very little knowledge of real estate selling conditions in the locality of the development. The builder's ideas will usually be found sound on these subjects. The architect can, by modifying and rearranging the plan ideas of the builder, produce more attractive and more efficient houses. This is especially true in regard to the grouping and group arrangement. In this connection composition, relation of masses, relation of wall to fenestration, and considerations of texture are much more important than small details. The position of the window in the facade and its relation to the whole composition are much more important than the actual detailing of the window itself and its trim. The architect should take advantage of the builder's knowledge of the most economical detailing and not be too insistent on special moulding profiles. The architect can select the best of stock designs for their architectural effect without adding to the cost of the building. The builder is usually unable to make as wise a selection, and consequently would produce a poorer looking building if the choice were left to him alone, without the benefit of the training and taste of the architect.

Throughout the entire project every consideration must be given to economy of materials and labor. The builder and architect, working together, can produce buildings worth while architecturally for no greater cost than buildings of like accommodations and size that are lacking in the essentials of good design.

The "community garden" type of development has proved an excellent form of housing venture for the speculative builder. There seems to be an instinctive desire to own a small plot of ground and a single house of one's own. The "community garden" development meets this instinctive desire and yet makes possible the building of homes at a smaller cost than would be involved if each house were separate. The party walls effect a great saving, and the small houses gain in appearance by being incorporated in the design with their neighbors. The houses, though they may be small, do not appear as tiny or as tall as they would if they were constructed separately.



Seven Room House with Two Baths



Eight Room House with Two Baths

As an indication of the quality of construction that the enlightened real estate developer is adopting, we quote here the essentials of the specifications of Forest Close.

FOOTINGS: Solid concrete 12″ x 24″ under all walls.
FOUNDATIONS: Solid concrete 12″ thick.
CELLAR FLOOR: Solid concrete 3″ thick.
EXTERIOR WALLS: Brick, laid in Portland cement mortar. Metal pans are set under and over all windows.
STUCCO: Portland cement, troweled finish.
STEEP ROOFS: Graduated slate laid over 30-pound roofing felt and fastened with copper nails.
ROOF DECKS: Ten-year guaranteed tar and gravel roof.
FLOOR JOISTS: 3″ x 10″ Douglas fir.
RAFTERS: 3″ x 8″ and 2″ x 6″ Douglas fir.
PARTITIONS: 2″ x 4″ spruce, 16″ on centers, non-bearing.
PARTY WALL: Concrete block, 8″ thick.
CELLAR WINDOWS: Steel sash and frames.
DOUBLE HUNG WINDOWS: White pine.
EXTERIOR TRIM: Selected white pine.
LEADERS: 16-ounce copper.
GUTTERS: 16-ounce copper.
FLASHING: 16-ounce copper.
FURRING: All exterior walls furred, for air space.
LATHING: 24-gauge metal lath throughout.
PLASTER: Patent plaster, troweled and smooth finish.
WATER PIPE: Solid brass throughout.
STEAM BOILER: Latest model round boiler.
WATER HEATER: Automatic gas storage system, with heater connected to furnace.
PIPE COVERING: Asbestos air cell.
RADIATORS: Cast iron of approved design.
AIR VALVES: On all radiators.
BATH ROOM FIXTURES: Of best quality.
BATH ROOM WALLS: Tiled to ceiling.
BATH ROOM FLOOR: Ceramic mosaic tile.
KITCHEN FLOOR: Cork composition.
ALL OTHER FLOORS: Select grade oak ⅞″ thick, laid over sub-floor.
INTERIOR TRIM: Selected white pine.
STAIRS: Oak treads, wedged and glued.
DOORS: Single-panel—1¾″ birch.
HARDWARE: First quality throughout.
ELECTRIC WORK: B/X cable for wiring.
ELECTRIC FIXTURES: Ample base plugs and distinctive selected fixtures.
PAINTING: All painting is lacquer applied with air brush.
SHADES: Non-fading linen.
SCREENS: Copper bronze throughout.
WEATHER STRIPS: Copper bronze friction strips on all windows and exterior doors.
GAS RANGE: Furnished with the house.
KITCHEN CABINET: Steel of most convenient pattern.

The sales policy for houses of this type is also of interest to architect, builder and prospective owner. A part of the purchase plan of the Cord Meyer Development Company for this group is given here.

SIX-ROOM HOUSES						SEVEN-AND EIGHT-ROOM HOUSES			
$16,100	$17,100	$18,200	$18,800	$19,600	PRICES	$20,000	$20,500	$21,000	$22,500
1,610	1,710	1,820	1,880	1,960	Cash	2,000	2,050	2,100	2,250
8,000	8,500	9,100	9,400	9,800	First Mortgage	10,000	10,000	10,500	11,500
6,490	6,890	7,280	7,520	7,840	Second Mortgage	8,000	8,450	8,400	8,750
Estimated Yearly Carrying Charges									
480	510	546	564	588	First Mortgage Interest at 6 Per Cent, Payable Semi-annually	600	600	630	690
					Second Mortgage Installment which pays off this Non-callable Mortgage in Ten Years				
888					$74 per month on $6,490				
	936				78 " " " 6,890				
		984			82 " " " 7,280				
			1,020		85 " " " 7,520				
				1,056	88 " " " 7,840				
					91 " " " 8,000	1,092			
					95 " " " 8,450		1,140		
					95 " " " 8,400			1,140	
					99 " " " 8,750				1,188
245	254	270	278	289	Taxes, Approximate	297	302	311	332
8	8	9	15	15	Water, Approximate	15	15	15	15
11	12	13	13	13	Fire Insurance, Approximate	14	15	15	16
$1,632	$1,720	$1,822	$1,890	$1,961	Total Carrying Charges	$2,018	$2,072	$2,111	$2,241
649	689	728	752	784	Included in these totals are the average annual reductions of the second mortgage principal; therefore deduct	800	845	840	875
983	1,031	1,094	1,138	1,177	Leaving Total Yearly Net Charges of	1,218	1,227	1,271	1,366
Yearly Charges on a Monthly Basis									
136	143	152	158	164	Total Monthly Cost	168	173	176	187
54	57	61	63	65	The Average Reduction of the Second Mortgage Per Month	67	70	70	73
$82	$86	$91	$95	$99	Leaving Net Cost Per Month of	$101	$103	$106	$114

To purchase a $1,400 garage adds $140 to initial cash payment; $700 to first mortgage; $560 to second mortgage. Second mortgage monthly payment is thereby increased $7.

Purchase Plan for Forest Close

ESTIMATING CONSTRUCTION COSTS

CONCERNING METHODS ESPECIALLY ADAPTED TO THE ARCHITECT

BY

CLAYTON W. MAYERS

VICE-PRESIDENT, MORTON C. TUTTLE CO.

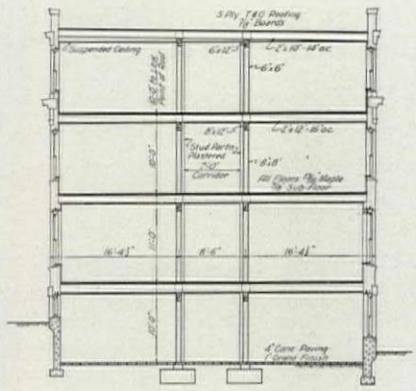
NEARLY every architect is acquainted all too well with the unpleasantness experienced in completely revising a set of plans and specifications on which bids have been taken and costs found to be prohibitively high. Such an experience is, however, very much more disagreeable when the procedure is necessary in order that the cost of the finished project be kept within a set limit which heretofore the architect had felt certain would be met by the requirements of his design. The fact remains, however, that he has either been too liberal in refinements and ornamental details or,—what is more unfortunate,—embarked on a project the size of which was too large in the first place. Whatever may be the reason for the necessity of cutting down the design, the work which must be done is not only irritating and disagreeable but expensive, in that the process calls for seemingly endless changes to drawings and specifications.

Frequently the result of all this work of revision produces an unbalanced design not at all in keeping with what the architect had originally intended or what the client had expected. Were it not for the pressure of time, making a fresh start might be the wisest way out, but generally the client has already become impatient to begin operations, and now being obliged to forego many of the features incorporated in the original design, becomes more and more disgruntled. Thus the architect is placed in an exceedingly embarrassing position. It is expected that he will be able to make changes quickly which will result in a lowered cost, all without impairing seriously the attractiveness or usefulness of the structure. Eventually the changes in plans and specifications are completed, and as a result, the architect becomes involved with the design and construction of a building very different from his original conception, one in which he can take but small if any pride; in fact, it may be that he would much prefer that he had been disassociated with the project altogether. Perhaps, too, on account of the many hours spent in revising the drawings, the architect finds that he is actually out of pocket, a condition which cannot help but add to the keenness of his disappointment. Much better had he planned a somewhat smaller or more simple structure, a building development in which he could take justifiable pride.

There is a reason for such a state of affairs, and an avoidable reason. A wrong start has been made, and when the start is wrong the course is also wrong, and the result correspondingly unsatisfactory. It may be that the size of the project as originally visualized did not correspond with the amount of funds available for its development. It may be that the size was correctly established, but that the character of the structure and materials and the elaborateness of the developed details were to blame for the disappointingly high figures submitted by the contractors. Whatever the reason, this unhappy condition could have been averted had the architect given proper consideration to "cost" at the critical time,—namely, during the early stages of the development of the plans.

On this point of cost, the architect, having obtained some generalizations as to what the client could spend, might have made certain mental reservations as a safeguard against surprise, and prepared sketches accordingly. The estimate of cost perhaps consisted of a simple calculation in which the cubic contents of the proposed structure were multiplied by a cost per cubic foot, which represented the best guess of which, at the moment, the designer was capable. Making such an estimate frequently constitutes the sole means of judging cost of the building until the designer's plans have been fully elaborated, his specifications written, and the whole put to the test of competitive bids from a number of contractors. All through this period of designing, there is no certainty that the design will prove capable of development within the limits of cost previously set. There is always a chance, however, that the design may have sufficient appeal to permit an expansion of the limits of cost as set by the client. In such a case, the architect may be more fortunate than skillful!

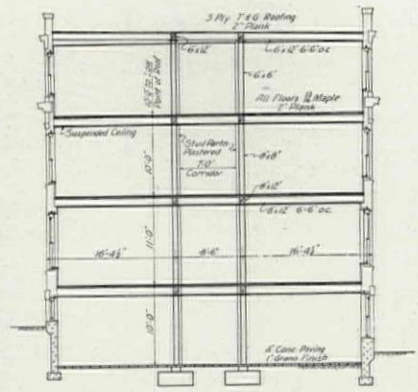
So many factors enter into the cost of construction work that it is only by making preliminary estimates during the early stages of design that an architect can be reasonably certain that he is on the right road. Such estimates should be the product of a building cost expert working closely with the architect. It is only by such a procedure that the architect is assuring his client of skillful and competent service. Where a building,—whether it is an office structure, a factory, a hotel or a large apartment house,—must return income proportioned to the capital investment which it represents, such procedure alone is intelligent and fair. This cost expert should be a man in close touch with the actual cost of work done in the construction field. He should be working not merely from records, in many instances established by persons and under conditions unfamiliar to him, but from information gained at first hand, which should be extensive enough to permit his qualifying to speak with a certain degree of authority. The architect can depend upon the information so furnished in working out the design of the entire building, from footings to parapet cap. By the judi-



SECTION A
"JOIST CONSTRUCTION"

Floor Area 2,145 square feet
Cube 22,255 cubic feet

	Quantity	Price per Unit	Cost $
Concrete Work—			
Interior and exterior footings, including material and labor and plant costs	4-1/5 c.y.	15.00	63
Basement walls	10 c.y.	15.50	155
Paving (floor on ground)	6 c.y.	13.25	80
Granolithic finish on paving concrete	502 s.f.	.12	60
Steel caps on interior footings	No. 2		10
Formwork—			
Forms for interior and exterior footings, including labor, material and plant	112 s.f.	.30	34
Forms for basement walls including labor, material and plant	460 s.f.	.35	161
Reinforcement Steel, including material and labor	6/10 tons	92.00	55
Structural Steel lintels, including material and labor	1000 lbs.	.06	60
Masonry—			
Brick walls	623 c.f.	1.40	872
Hung ceiling of metal lath and plaster	225 s.y.	2.50	562
Plaster on exterior walls, partitions, interior wood columns and girders	300 s.y.	1.40	420
Metal lath on stud partitions	194 s.y.	.40	78
Carpentry Work—			
Wood furring and grounds in place for metal lath work			100
Stud partitions (ready for metal lath work)	872 s.f.	.078	68
Hard pine framing (LLYP) Material and labor of erection	1-2/10 M	103.50	124
Spruce beams, material and labor of erection	3-6/10 M	67.00	241
7/8" sub-flooring and roof boarding, material and labor of erection	2-3/10 M	50.00	115
7/8" maple top floors (material delivered at site)	2 M	90.00	180
Lay maple top floors, including nails and paper	15-1/3 sqs.	6.00	92
Cast iron work for framing (bases, caps and anchors)			50
Nails, spikes, etc., for plank and spruce framing work			10
Painting walls and ceilings (2 coats)	246 s.y.	.35	86
5-ply tar and gravel roofing (on wood roof)	5-1/10 sqs.	15.50	79
Net estimated cost of one bay only			$3,755

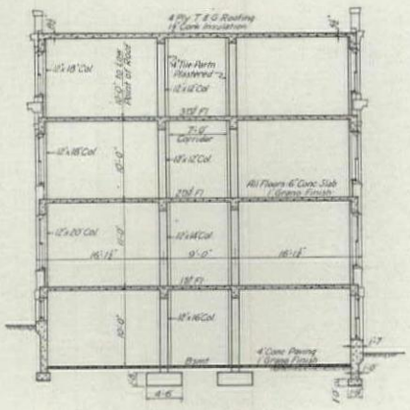


SECTION B
"MILL CONSTRUCTION"

Floor Area 2,145 square feet
Cube 22,255 cubic feet

	Quantity	Cost per Unit	Cost $
Concrete Work—			
Interior and exterior footings including material, labor and plant costs	4-1/5 c.y.	15.00	63
Basement walls, including material, labor and plant costs	10 c.y.	15.50	155
Paving (floor on ground)	6 c.y.	13.25	80
Granolithic finish on paving concrete	502 s.f.	.12	60
Steel caps for footings	No. 2		10
Formwork—			
Forms for interior and exterior footings including labor, materials and plant costs	112 s.f.	.30	34
Forms for basement walls	460 s.f.	.35	161
Reinforcement Steel	6/10 ton	92.00	55
Structural Steel lintels	1000 lbs.	.06	60
Masonry—			
Brick walls	623 c.f.	1.40	872
Hung ceilings of metal lath and plaster (metal hangers)	225 s.y.	2.80	630
Plastering on exterior walls, partitions, wood columns and girders	277 s.y.	1.40	388
Metal lath on stud partitions	194 s.y.	.40	78
Carpentry Work—			
Wood furring and grounds in place for metal lath work			100
Stud partitions ready for metal lath	872 s.f.	.078	68
Hard pine framing (LLYP)	2-6/10 M	103.50	269
Short leaf spruce plank for subfloors and roof	4-7/10 M	53.00	249
Maple top floors (material delivered at site)	2 M	90.00	180
Lay maple top floor, including nails and paper	15-1/3 sqs.	6.00	92
Cast iron work for mill construction framing			100
Nails and spikes for plank			15
Painting walls and ceilings (2 coats)	223 s.y.	.35	78
5-ply tar and gravel roofing	5-1/10 sqs.	15.50	79
Net estimated cost of one bay only			$3,876

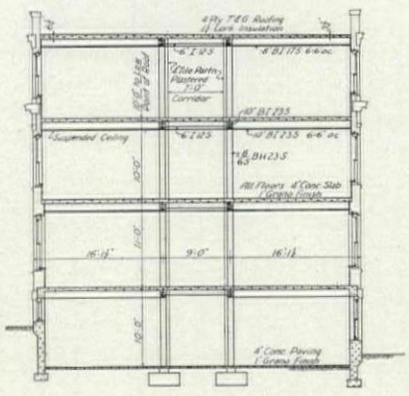
cious use of such information he should at no time be ignorant of the proper cost of the structure being developed. A budget estimate of cost should be made, which,—instead of being a guess predicated on a hasty calculation of probable cubic contents,— represents a reasonably careful computation of the cost of each major element in the proposed structure and a totaling of them all. An alteration in the character or form of any one of these elements will, obviously, alter the total cost. Hence, with his building problem thus broken up into logical and understandable elements, the architect is in a position to view his alternatives on the basis of good reason and to determine whether additional expense is in any way or at any time justified, or whether exactly the opposite viewpoint must be taken in safeguarding the client's interests. Uncertainty of cost should be as far as possible eliminated, thereby saving the architect the unhappy experience previously described, and this can be done by the construction cost expert.



SECTION C
"ALL REINFORCED CONCRETE"

Floor Area 2,145 square feet
Cube 22,255 cubic feet

	Quantity	Cost per Unit	Cost $
Concrete Work—			
Concrete interior and exterior footings (including materials, labor and plant expense)..	4-2/10 c.y.	14.00	59
Basement walls (including materials, labor and plant expense)	10 c.y.	14.50	145
Paving on the ground (1-2½-5 mix)	6 c.y.	12.25	74
Floor slabs and beams	54-2/10 c.y.	15.00	813
Granolithic finish	2022 s.f.	.10	202
Formwork—			
Interior and exterior footings..	112 s.f.	.30	34
Basement walls	460 s.f.	.35	161
Floor slabs and beams	2555 s.f.	.25	639
Exterior and interior columns (very small)	625 s.f.	.40	250
Reinforcement (steel)	6-8/10 tons	90.00	612
Steel Lintels (angles)	75 ft.	.70	52
Masonry—			
Brickwork (walls & face work)	369 c.f.	1.50	554
4" t.c. partitions at corridors	847 s.f.	.25	212
Plastering walls and ceilings (on masonry)	272 s.y.	1.40	381
Wood furring and grounds (in masonry)			160
Painting walls and ceilings (2 coats)	272 s.y.	.35	95
4-ply tar and gravel roofing (on concrete slab)	5-1/10 sqs.	14.00	71
1½" cork insulation on roof..			92
Net estimated cost of one bay			$4,606



SECTION D
"STEEL FRAME FIREPROOFED WITH CONCRETE SLABS"

Floor Area 2,145 square feet
Cube 22,255 cubic feet

	Quantity	Cost per Unit	Cost $
Concrete Work—			
Concrete interior and exterior footings	4-2/10 c.y.	14.00	59
Basement walls	10 c.y.	14.50	145
Paving on the ground	6 c.y.	12.25	74
Concrete slabs and fireproofing beams and columns	39-5/6 c.y.	15.00	598
Granolithic finish	2020 s.f.	.10	202
Formwork—			
Interior and exterior footings..	112 s.f.	.30	34
Basement walls	460 s.f.	.35	161
Slabs and beams	2802 s.f.	.22	616
Walls beams	91 s.f.	.30	27
Columns (small)	278 s.f.	.40	111
Reinforcement Steel including material and labor	4140 lbs.	.04½	186
Steel lintels (angles)	707 lbs.	.06	42
Masonry—			
Brick walls and facing	534 c.f.	1.50	801
4" terra cotta partitions at corridors	867 s.f.	.25	217
Plastering on masonry walls and columns	98 s.y.	1.40	137
Hung ceilings of metal lath and plaster with hangers	169 s.y.	3.50	592
Wood furring and grounds (in masonry)			160
Structural steel framing including labor and materials	6 tons	100.00	600
Allow for labor and materials to support outside ends of steel beams until brick piers are in place			50
Mesh for wrapping steel beams before concrete is placed around flanges	1678 s.f.	.04	67
Painting walls and ceilings (2 coats)	267 s.y.	.35	94
4-ply tar and gravel roofing on concrete slab	5-1/10 sqs.	14.00	71
1½" cork insulation on roof....			92
Net estimated cost of one bay only			$5,136

Answering the question as to why the architect cannot get his good friend Mason, the contractor, to give him estimates such as we have furnished here, I believe in the majority of cases where architects ask builders for estimates of this sort that the builder is more interested in making an impression upon the architect than he is in giving the architect his unbiased judgment. To most builders an opportunity to make such an estimate for an architect offers an opportunity to sell the architect the idea that he, the builder, must be tremendously economical in his work. To drive this idea home he is often likely to make very low approximate estimates which, of course, are misleading. Again, few builders have gone to the trouble and expense of compiling statistics on the efficiency of men on various operations. To make such a compilation requires, first, a large volume of construction work, and also a very efficient cost keeping system on the site in order that such data be available. We believe it is quite customary for concerns who have a large amount of estimating data to guard it very carefully. Free estimates are usually looked upon by architects as being nearly worthless and very likely to be confusing on account of their lack of frankness.

An actual example of the successful results obtained by coöperation between the cost expert and the architect is the best proof of the advisability and feasibility of adopting this arrangement. Therefore, we here describe the working out of an actual case that was most gratifying to all concerned. The construction of the building was carried out at a cost

well within the appropriation made by the client after a study of the preliminary sketches. Preferences, which could be classed as generalities, were expressed by the client, who also furnished the architect a minute description of the utilitarian characteristics expected of the building. Beyond this, the architect was left a wide latitude in the working out of the preliminary sketches of the structure. Fireproof building by no means prevailed in the community where this structure was to be erected. Consequently, the question of second-class construction was brought up. The value of a fireproof building was unquestionably recognized, but at the same time, the client, operating well within his rights, wished to know how much more he would be paying for this more modern type of construction. It was possible indeed that this added cost might have considerable bearing on the enterprise from an investment standpoint. In order that the architect might answer this question correctly, it was necessary to prepare brief comparative estimates, which in turn demanded comparative sketches of the typical cross-sections of the several types of construction available.

Accordingly, outline drawings of these cross-sections were made to which the dimensions and sizes of the major elements were added. Facsimiles of these cross-sections are reproduced here. Comparative estimates of cost based on each of these cross-sections were made, and in doing so items of work common to all schemes were purposely omitted. The tabulated result indicated the comparative costs of one bay of the building, 13 feet in length, consideration being given only to elements which underwent change in the various schemes. From these comparative estimates there was determined the total cost for each type of construction, and the architect and the client were able to select intelligently the scheme which should be incorporated in the plans.

The sketches which show cross-sections A, B, C and D were estimated in detail, considering only those items which were changed on account of the change in type of design. For instance, as these estimates were prepared for the purpose of making comparisons, it was not necessary to consider window sash, as the window sash would be the same in all four schemes. The roof, however, was considered, inasmuch as on a concrete roof only four plies of felt were required, whereas on a wood roof, five plies would be required to make an equally satisfactory roof covering. Painting was considered in all four schemes, as the areas to be painted increased where girders dropped below the ceiling line. It will be understood from this description that in preparing these comparative estimates, as they are called, it was not necessary to go into the items which we consider as common to all schemes.

The architect next produced sketch plans, showing a side elevation, and floor plans indicating partition layouts, and other preliminaries necessary to the compilation of a complete preliminary estimate in which all items of work should be assigned a proper probable cost, and which at the same time would furnish the client with sufficient and satisfactory assurance regarding the appearance and utility of the building. The estimate made from these last sketches (in which the reinforced concrete frame shown by cross-section "C" was used) has been produced here in detail, and clearly indicates what might be expected as a proper cost of the building carried out on the basis of the preliminary sketches and specifications. With an estimate at hand made in this manner, during the early stages of the work, appropriations may be more intelligently reviewed with a feeling of security to both architect and client.

Description of Office Building

The building on which this estimate is based is an office structure of modified Georgian architecture, of brick, three stories high, with a basement in which an assembly hall is located. The foundation walls of the building are of concrete carried up to the level of the first floor. The brick are of a deep red color, laid up in a manner to present the appearance of an early American bond in which alternate courses of headers and stretchers are used, laid more or less irregularly. Double-hung wood sash about 4 feet wide of Colonial design are used in all the window openings, there being two windows to a bay. The entire structural frame of the building is of reinforced concrete, with no beams spanning across the building except those in the end walls. Reinforced concrete slabs span across the building extending from the side walls to the longitudinal beams which run lengthwise of the building and are located over the main corridor walls. The ceilings in the offices are, therefore, entirely free from beam construction, making it possible to re-locate partitions at any time without considering ceiling beams or suspended plastered ceilings. The inside of the brick walls, except in the basement, were first waterproofed with an asphalt compound, then furred with 2-inch terra cotta split furring. The plaster was applied directly to the terra cotta furring and to the concrete ceilings, the latter requiring the usual bonding coat. The jambs around all window openings were plastered, wood trim being omitted entirely in connection with these openings. The doors, generally, were wood of Colonial design, set in pressed steel door frames and trim. Wood baseboards and picture mouldings were installed in most of the rooms.

The floors were surfaced with a granolithic finish, except in the assembly hall, where a maple top floor was laid on screeds and cinder fill, all of which was placed on a concrete base. Linoleum floor coverings are used in all the private offices in the first story. Slate thresholds were placed at the corridor doors leading into the offices. The corridors are lighted through transoms. Inside stairways are of steel construction with blue stone treads, fitted with wrought iron rails and wood handrails. The roofing is of tar and gravel, together with 1½ inches

Preliminary Estimate of Cost of Fireproof Office Building

Floor areas: 28,676 square feet
Cubic contents: 328,990 feet

Earth Work—			
Clear site of old buildings (now being done by owner).			
Steam shovel work, including teaming away to dump, about half-mile haul one way. Soil of hard gravelly material with some stones	2600 c.y.	$1.00	$2,600
Wood sheeting at ends of excavated area; (drive and pull including lumber)	1120 s.f.		500
Cut trees on the lot, backfill and grade at completion	(allow)		800
Hand excavation and backfill for footing holes	254 c.y.	2.25	572
Hand excavation in connection with operation of steam shovel	(allow)		300
Hand excavation for entrance steps and entrance platform (shallow)	73 c.y.	1.50	110
Reinforced Concrete Work; (all 1:2:4 mix unless otherwise noted)			
Concrete of mass type at entrance	32½ c.y.	13.00	423
Concrete for exterior and interior footings (including rental costs of all plant and fuel costs)	111 c.y.	14.00	1,554
Concrete work in small elevator pit (complete)			250
Concrete for foundation walls and pilasters on these walls	148½ c.y.	14.50	2,153
Concrete floor laid on the ground; (1:2½:5 mix)	104 c.y.	12.25	1,274
Concrete for exterior and interior columns; (very small columns)	80½ c.y.	15.00	1,208
Concrete slabs, including all beams and girders	598 c.y.	15.00	8,970
Granolithic finish on all floors except assembly hall	24510 s.f.	.10	2,451
Cement sanitary base for toilet rooms, colored black	296 l.f.	.45	133
Extra allowance for heavy concrete work in boiler room, foundations for boilers, etc.	(allow)		1,000
Concrete platform at entrance (complete)	216 s.f.	.75	162
Concrete buttresses for steps; (about 4 c.y. concrete each)	No. 2	100.00	200
Concrete steps at entrance; (linear feet of nosings)	154 l.f.	2.00	308
Concrete steps in side building in basement; (nosings)	99 l.f.	2.00	198
Concrete emergency exit at rear including walls and foundations	(allow)		400
Formwork, (contact surface measured) including material and labor			
Foundations under entrance	1752 s.f.	.25	438
Footings; (mostly piers of small dimensions)	2262 s.f.	.30	679
Foundation walls and pilasters	6888 s.f.	.35	2,411
Exterior and interior columns; (very small in section)	8228 s.f.	.40	3,291
Slabs, beams and girders	34595 s.f.	.25	8,649
Reinforcement; for all concrete work (including material and labor).			
Assume quantity at an average of 1½ per cent of all concrete (excluding concrete on ground and mass concrete)	93 tons	90.00	8,370
Carborundum Rubbing of exterior face of foundation walls			....
(Allow for especially good work)	1910 s.f.	.20	382
Masonry—			
Brickwork (labor, material, plant, etc.)			
Special bond to give the appearance of old brickwork, using a good hard-burned selected sand-struck brick costing about $20. M. at the site; (labor and material)	11060 c.f.	1.50	16,590
Two-inch split tile wall furring	6650 s.f.	.18	1,197
Extra for arches and lintel work over opening	905 l.f.	1.50	1,358
Boiler flue lining			100
Cast stone trim (plain belt courses and caps); labor and material and hoisting gear)	3135 c.f.	4.50	14,108
Eight-inch terra cotta walls (plastered one side) around flue and freight elevator well	440 s.f.	.80	352
Four-inch terra cotta block partitions (plastered both sides); (measured over all openings)	18540 s.f.	.55	10,197
Doors—			
Extra cost of doors and door frames, complete in place with thresholds:			
3 feet x 7 feet	No. 86	25.00	2,150
6 feet x 8 feet	No. 3	90.00	270
Small elevator doors (freight); (special type)	No. 5	$200.00	$1,000
Exterior doorway at end (complete)			250
Entrance doorway (complete)			600
Other exits (complete)	No. 3	150.00	450
Sash and Glass—			
Exterior wood sash and glass. Double-hung sash including trim erected complete and including attaching hardware	3289 s.f.	1.20	3,947
Weather strips			800
Plastering on brick walls and concrete work, ceilings and on furring (including preparation cost)	5100 s.y.	1.40	7,140
Extra cost of ornamental work in assembly hall	(allow)		500
Painting; 2 coats on all plastered surfaces	8740 s.y.	.35	3,059
Painting; on basement concrete ceiling when required			250
Painting on sash and doors	900 s.y.	.60	540
Plaster grounds for entire building			2,000
General millwork and hand dumbwaiters for entire building	(allow)		3,000
Ceramic floors in toilets	1246 s.f.	1.00	1,246
Marble w. c. enclosures and doors (complete with back)	No. 19	100.00	1,900
One-quarter-inch linoleum floors in private offices	150 s.y.	2.75	412
Maple top floor of screeds, sub-floor paper and top floor in assembly hall	2080 s.f.	.60	1,248
Baseboards of wood, chair rails and picture mouldings in all offices			3,000
Iron stairs, blue stone treads, w. i. rails and wood handrails	No. 4 flights	750.00	3,000
General miscellaneous iron and ornamental iron for entire work	(allow)		1,500
Hand ash hoist to street from boiler room			275
Tar and gravel roofing; (4-ply on concrete)	69 sqs.	14.00	966
Copper cap and base flashing	422 l.f.	1.10	464
Lead flashing for cornice and belt course			750
Conductor boxes	No. 6	15.00	90
One and one-half-inch cork on roof under roofing (laid complete)	6850 s.f.	.18	1,233
Hardware allowance			2,000
Clean up site at completion			650
Liability and public insurance; (fire insurance by owner); (about 1½ per cent)			2,100
Site superintendent, chief clerk, travel to and from site, supplies, site office, telephone, etc., etc.			8,000
Watchman			650
Allowance for cold weather protection during winter, as work was started in fall and would run right through the winter in a northern climate			10,000
Total for Building Proper			$159,128

Permanent Equipment

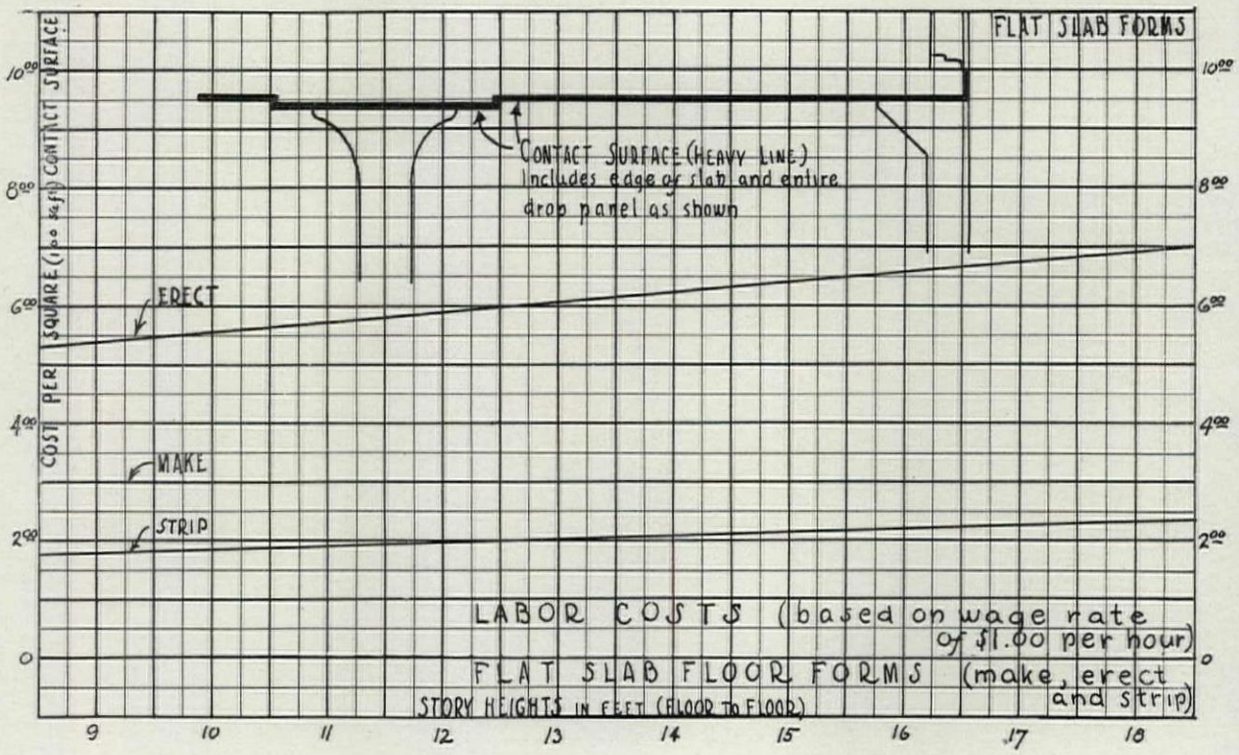
Steam heating and vent ducts:			
6150 s.f. rad. at $2 (small radiators)	12,300		
Boilers and stack complete	3,500	15,800	
Plumbing:			
Six conductors at $100 each	600		
Underground drains and sewers (allow)	1,000		
Water closets and urinals; 25 at $200	5,000		
Lavatories, 20 at $75	1,500	8,100	
Gas line to building		350	
Small capacity elevator for freight only,—of low speed		2,500	
Electric wiring (fixtures furnished by owner)			
570 outlets at $8 each	4,550		
Electric wiring	450	5,000	
Total for Equipment			31,750
Net Estimated Cost of the Building and Equipment			190,878
Builder's Fee (fixed at about 8 per cent)			15,000
			205,878
Architect's Fee (at 6 per cent)			12,352
Total Estimated Cost of Building			$218,230

Note—This is equal to about 65½ cents per cubic foot.

of cork insulation, which was placed on top of the concrete roof slab. All flashings are of copper and lead. The entire interior is painted, and the concrete floors are finished with a wax treatment. The building is heated with a low-pressure steam system using cast iron radiators, the system being supplied by boilers located in the basement of the building. All electric wires for light and other electrical apparatus are encased in steel conduit placed in the concrete slabs. The toilet rooms are spacious and fitted with a good grade of plumbing fixtures. One small slow-speed freight elevator was installed, the use of which is confined principally to the janitor and for the purpose of moving furniture from floor to floor. No sprinkler system was installed in the building. Construction work on this structure was begun about the middle of September and was finished the latter part of May. Work progressed continuously throughout the winter months.

Unfortunately, the unit cost data for a building of this type calls for considerable experience on the part of the estimator. There are a few items, such as timber and plank work, where data can be used without very much change. The brickwork of this building was of special bond, and the experience of the estimator was drawn upon to price this correctly. The items used in connection with the estimate of the scheme adopted were worked out from data which had been compiled for a number of years. In order to give an idea of how the data were compiled, the accompanying chart indicates the labor cost in connection with the erection of formwork for flat slab concrete floors. There are three lines drawn horizontally across this chart. The lower line represents the cost of stripping, the next line above the cost of making in the yard, and the top line the cost of erecting the forms in the field. At the bottom are indicated the story heights, and at the left-hand margin the cost per hundred feet, based on a labor wage of $1 per hour.

Charts of this kind are prepared for many different items of work. The placing of the lines on the chart is done only after exhaustive study of the efficiency of men on like operations, all of which is reduced to the basis of $1 per hour. Should the labor cost be $1.50 per hour, 50 per cent should be added to the indicated cost chosen from this chart. One will, of course, understand that the costs shown on this chart will vary with the amount of labor required in the formwork, even though the material is not considered in these costs. If a very heavy live load is required, which would call for 12 inches of concrete in the slab, the erection of the formwork would necessarily cost more on account of the additional lumber to be handled and additional posts to be placed. There have been tabulated in connection with this chart the percentages to be added or deducted, as the case may be, for form costs where the requirements vary from four posts per hundred square feet of contact surface. The chart is included simply to illustrate what pains have been taken by the cost estimator in order to compile a vast amount of data, all of which has been tabulated and is drawn upon in the making of estimates. There are many items, of course, where no data are available; it is in such cases that the estimator's experience becomes doubly valuable. As a rule the architect lacks the requisite intimate knowledge of costs which are supplied by the cost expert, but through collaboration he may obtain accurate estimates of construction costs.



PUBLICITY AND ITS VALUE TO THE ARCHITECT

BY
C. STANLEY TAYLOR

IT is perhaps unnecessary to develop any lengthy series of arguments as to the value of publicity from the architect's point of view. At least a large proportion of practicing architects recognize the direct benefits which accrue from the publication of their work in proper media, but it is surprising how few take advantage of the opportunities which are offered. Publicity is probably the most powerful factor in the development of background, which in turn tends to improve the quality and increase the size of the architect's practice. It is quite obvious that good work is slow to build up a practice unless it is made known to many people, and particularly to the types who might be prospective clients.

There are three major channels through which the architect can make known the good work which he has done, without lowering his professional standing and standards. These are, first, through the architectural press,—the publications of his own profession; second, through business papers and class publications, which penetrate into all divisions of the field of building construction; and, third, through newspapers, particularly local publications. The value of publication of an architect's work in an architectural journal is almost incalculable from the point of view of building professional standing. It seems strange indeed that this fact is not more clearly recognized, and that so few architects,—relatively speaking,—submit photographs, plans and descriptions to publications in their own field. We have heard a number of arguments on this subject, many of which were extremely shortsighted. Perhaps the most common negative is based on the fact that an architect does not see the value of placing his work before his professional brethren.

Here is the exact value of having work presented in the architectural publications. In the first place, such publication constitutes a definite recognition of the quality of the work, and represents a type of editorial approval which should be of considerable influence in discussing future projects with prospective clients. In the second place, it is of great benefit to the architect to be known throughout the profession. There are many times when prospective clients make inquiries through other architects as to the standing of those with whom they may expect to do business. It may almost be said that the original development of prestige in this field begins with comments of other architects, and it spreads gradually through interrelated contacts until suddenly there is a strong local following established and perhaps a national following. A third reason, which applies particularly to architects who are interested in having work published in the magazines of the home-building field or the publications of various commercial types, is that the editors of these publications study the architectural journals with great care, using them as sources of information for obtaining the names of architects whose work is thus recognized and in turn is of editorial interest in their own fields. There is another point involved, known to the publishing field as "indirect circulation." It is quite possible that an issue of an architectural journal which circulates to 7,000 architects is seen by two or three times as many persons, who for one reason or another are interested in architectural work. It is often the case that the prospective builder of a house or other type of building will study these publications for a time in order to gain familiarity with the work of active architects.

The second major channel of publicity, to which we have already referred, is that of the so-called business papers and class publications which circulate to various groups of people who are interested in the question of constructing new buildings. In the home-building field, there are eight or ten powerful magazines established, perhaps for different classes of people, but having primarily to do with the problems of home-building, furnishing and decoration. Most architects are interested in having their work published in magazines of this nature, but many fail to realize the great value of such publicity and do not coöperate intelligently with editors to secure this valuable form of recognition. Almost every type of building forms the background for editorial publicity to those who are interested in the building and operation of the particular type in question. For instance, there are important journals devoted exclusively to the hotel field, hospital field, school field, industrial field, public buildings, and others. These publications almost invariably take a definite editorial interest in the building problems of the particular industry they serve. They are constantly seeking good new projects for publication, and here the architect is offered an unusual opportunity. It may be said that good architectural work, regardless of the type of building, almost invariably can find its way into the printed pages which go before an interested audience. But obviously the architect himself must help this situation along. Editors do not always know where these buildings are, and the fact that an editor has not written to obtain work for publication is certainly no indication that he is not interested. Editors are constantly seeking good material of this nature, although they cannot take everything that may be submitted; this is logical, because they are restricted in their choice to subjects which interest their particular group of readers, and restricted by definite limitations of space, and often by general policies governing the type of material which is used editorially. Architects desiring this form of publicity should carefully study the publications which reach the type of people from among whom they draw their

clients or would like to draw them. If, for instance, an architect has completed a good hotel building, regardless of how small it may be, he should study the publications of the hotel field and send his material to that which seems to him most logical and most interesting. The best procedure is to write first to the editor enclosing a good photograph of the building with a general description of the work and asking him if he is interested in other photographs, plans and data.

Good photographs are the real backbone of modern publicity. This applies particularly to architectural work. It may be said that almost without exception good photographs will insure publication, because these are being sought constantly by editors, and there are not too many of them available. While it is true that the policies of most modern publications involve the obtaining of photographs with the help of good photographers, it is also obvious that if the material is supplied to them, they are more likely to use it than if it becomes necessary for them to examine the building before deciding to obtain photographs. The architect should employ the most expert photographer available, not only to properly record his work in order to be able to show it to prospective clients, but also to place himself in the position of supplying photographs for publication purposes. In this matter of obtaining publicity, ethics are involved, and editors soon learn to recognize architects who observe them. Usually any unethical procedure on the part of an architect in his relationship with editors is due to ignorance, and for this reason it may be well to mention certain common infractions of which architects are sometimes guilty.

In the first place, competing publications in any field discourage the sending of photographs to several magazines concurrently, because they are earnestly striving to prevent duplication. Editors prefer what are termed "exclusive releases," and if the architect will say to the editor that he is submitting his material exclusively to the particular publication in question, this immediately becomes a great inducement to publish it. This situation does not mean that buildings cannot or should not be published in an architectural publication and concurrently in magazines devoted to home-building interests or in trade journals. The publication in different fields and before audiences of entirely different character is generally acceptable to all editors. Thus, if an architect has designed an attractive residence, church, or other type of building which is being published in the architectural press, there is no particular reason why it should not appear in a home-building publication, church publication, or wherever its type may direct. There is also no reason why it should not appear in newspapers. Only a few magazines demand exclusive rights covering all the many types of publications.

Editors of practically all publications which have an editorial interest in the building field have learned to give the architect full credit in connection with the publication of his photographs and plans. Newspapers are not as universally satisfactory in this respect, and the architect should protect himself by definitely releasing the photographs or giving permission for publication only with the provision that credit is to be given to him for designing the building. This question of publicity in newspapers is one which is becoming important. Newspapers very often have home-building and real estate pages on which they are glad to present recent structures, particularly if descriptive editorial material is provided. This is, of course, the most direct manner in which to bring an architect's work before the public, and in turn to build up his prestige. Here the best procedure is to submit the material directly to the editor without writing beforehand. The newspaper editor is very busy and will often not indicate any interest until he sees the material and recognizes its value.

For those who are interested in this subject of publicity, it may be noted in more detail that aside from architectural journals and newspapers, there are important publications in several fields, which take a definite editorial interest in current architectural work. These fields include hotels, theaters, hospitals, schools, clubs, apartment buildings, office buildings, banks, industrial plants, real estate, building management, dwellings of all types,—in fact any type of building which an architect designs can find its special type of publication. One prominent architect now enjoying international reputation has for years made it a definite practice to provide editors with photographs of his work upon request, often submitting the material as soon as it was ready. This same architect has written many articles for newspapers and magazines, and according to his own statement he has largely built up his national and international practice and prestige through the results of this widespread public knowledge of his work. He tells the interesting story of one article illustrating a particularly attractive house which brought 129 letters definitely referring to the house illustrated, and resulting ultimately in a number of important commissions.

There are, in fact, a fairly large number of architects, most of whom are known throughout the profession, who have built up their practices partially through the force of publicity. After all is said, it is still evident that the architectural light which remains hidden under a bushel is not likely to be seen, and it is also true that even the architect's friends forget him if his activity is not occasionally brought to their attention.

PERSONALITY AND PROSPECTIVE CLIENTS

BY
WILLIAM A. EDWARDS
EDWARDS & SAYWARD, ARCHITECTS

IN this era, the greatest of all ages for building, the practice of the profession of architecture has become the work of an organization of well trained and scholarly men, going out after business, rather than of the dignified and reserved individuals of the past sitting waiting for clients. The success of the practitioner of today is measured by his capacity for getting business and his capacity for executing it well. The first shows his capacity as a salesman; the second his capacity at keeping it "sold." Both are of the greatest importance. Think of the woeful plight of the most wonderful potential organization at carrying out a commission without a commission to carry out! Too much cannot be said, therefore, of the importance of expert salesmanship legitimately exercised in the profession. This salesmanship is not trivial, like selling a peck of potatoes, a yard of cloth or other such tangible things. It is the adroit placement of personality that persuades the prospective client to actually retain the architect to take over and expend his money in transforming his dream into the reality of a building. This is a very delicate matter, as it is equally a responsibility. To assume it, the architect must be amply prepared to carry out the obligation. It is very fine, too, for the architect to have good equipment and organization back of him to give zest and confidence to his advocacy.

The fundamental basis of successful salesmanship is psychology, with the use of diplomacy in its exercise. No two human minds that may be pitted against each other are alike, and each personality must be analyzed from points of environment. Kinships, school life, college and club life and other relationships among men must be studied and understood. After so informing himself, the architect may approach his committee or individual with confidence, at least of leaving a good impression even if a sale cannot be made. It must not be forgotten that the greatest of sales are often made even when the objective commission is lost. Winning the way to a man's mind and to his consent is for the salesman to agree with him and speak pleasingly of his vanities. There is plenty of time to persuade him to different views and convictions after he has been won. The successful salesman must think very little of the commission he is after, but mostly of the man or set of men who have the commission to give out. What he or they want must be the salesman's chief consideration. On one occasion a board advertised in current papers and technical magazines that it was charged with the duty of erecting a new university, and would meet on a certain day for the purpose of hearing architects on the subjects of how best to proceed to the employment of an architect and how best to proceed with the building of a university on 500 acres of ground. Seventeen architects met this appointment, and each in turn was given a private interview. From back room comments, the vast majority presented themselves before the board with only one thing in mind, viz: getting the work. Others, more familiar with the situation, were of the firm conviction that the board had already been instructed politically as to the architect to whom the award must be made, and that it was therefore useless to treat the meeting as more than simply a gesture.

The architect ultimately chosen, however, complied directly with the request that was advertised, and seized the opportunity to represent the profession with dignity, and to present truthfully his belief as to the best method of selecting an architect and to set forth with his best knowledge the proper way to proceed with building their university. He took occasion, as he advocated the employment of an architect on account of his personality, office equipment and experience, to advocate their employment of an architect on that very day, if there were one that met their approval. He only said in his personal behalf that if they were not prepared on that day to make such employment, he would be entirely satisfied with his efforts if they would make a full investigation of his firm, looking to employment. The result of this meeting was that 15 architects were promptly eliminated, leaving only the political favorite and this one other architect to make presentations of preliminary studies illustrating an administration building, a dormitory and a general prospectus plan, as a criterion for aiding them in making a selection of one of the two as architect. The final result was that the political favorite failed of success, the other was employed, and his firm remained over 30 years the architect of this board for all work it did, receiving many other similar awards of work elsewhere, due to this success, besides much attendant private work, making a healthy nucleus for a permanently successful practice.

One of the hard problems the competitor for business has is the tendency eternally of a prospective client to consider the financial basis in connection with the employment of his architectural talent. Howsoever erroneous this may be, it is a problem that the architect in approaching his prospect has to contend with, and for success he must have his mind made up and be willing to lose rather than reduce his fee. One thing may truthfully be said in favor of holding to the regular professional fee, and that is that no client wishes his architect to cheapen himself. In public service, however, a board is wary about paying to its favorite architect a higher fee than any other good architect offers his services for, fearing the reprimand of the public.

It was the experience of an architect upon one occasion to meet a school board by appointment, at

which meeting there were ten other architects, each to present himself in turn, giving credentials, presenting illustrations of work that he had done, and giving every good reason that each had in self-advocacy, justifying his employment. The difficulty encountered in final conversations between the preferred architect and the board was that the vast majority of those presenting themselves had offered to do the work for 1 per cent less; otherwise, the board desired to have the services of this architect. The prompt response was that the price of services was not a proper criterion to be used in selecting an architect, so long as a standard fee was not exceeded, for in the end a cheap man would likely cost the most. Also, if the price to be paid were a consideration, their preferred architect should receive a higher fee in equal proportion to such preference. In other words, they were asked how many dollars they preferred to the man of their choice. The difficulty still remained after all argument, and finally a written contract of employment was prepared and presented. This contract was accepted and contained a clause permitting the board to hold back 1 per cent of fees until final completion of the work, and if, at that time, the members were satisfied entirely with the type of services rendered and were satisfied that the architect had duly and properly earned the fee claimed, they were on their own election and volition to pay over the 1 per cent to the architect. If not so satisfied, they were to retain the 1 per cent, and that they themselves were to be the judges. The result of this transaction was a happy ending, with all persons more than pleased, and the architect without comment received his full fee.

Many failures of an architect in the matter of salesmanship come in meeting a prospect in the form of an individual who is a supreme dictator of his community and board, and who abruptly and rudely dismisses him and turns him away because the architect himself has failed to get hold of the idiosyncrasies of the man he approaches. On one occasion, an architect went to the town where a school building was to be erected. It was promptly learned that this was a "one-man" proposition, and if one could gain audience and win him, the work would easily be awarded according to his choice. Many architects had been individually to see this man, and all spoke of him as "an old crab" and impossible to interview. Our architect, undaunted by these advices, proceeded to the town to try out his cunning. Arriving at an early hour, he immediately proceeded to become acquainted with the people of the town and soon found the friends of this man, who spoke in the greatest of confidence and praise of him and his useful citizenship, his cordial ways of dealing with people, etc. Our architect was told that others of the town, however, considered him a very stern character, hard to approach and get close to. So our architect proceeded immediately to consult with them. Out of the conversations with both factions, all of the weaknesses and vanities of the objective man were discovered and digested. It was found that he took great pride in the little town, and that he, at his own personal expense and time, had created a beautiful avenue with beautiful shade trees, and that this avenue was his pet hobby. Thus armed, our architect, after the morning mail was disposed of, proceeded to test his mettle before this exacting small town ruler. Here is where the private secretary came in, for he (or she) who is the buffer must also be successfully sold in order to gain audience. This process being gone through with, the architect was admitted, and the man reposefully greeted him.

After making a few preliminary remarks in the hope that his coming in was not an encroachment on his valuable time, the architect was asked to be seated. Upon being thus seated, he immediately spoke of his coming to town early in the morning and what a privilege it was while waiting, to walk over the principal streets of the town and to find it a beautiful and well kept little place, and particularly was it his delight to visit the beautiful sycamore drive in the suburbs of the town. The tender spot was found, and the great man grew chesty, pulled out his cigars, leaned back in his chair and told the architect the history of the little town and his doings about it,—which was listened to with interest. After spending more than an hour without indicating his business, our architect arose with apologies for over-staying his time, and while standing mentioned the object of his visit. Very few additional remarks were necessary, for our architect was told that his firm was well known and particularly in connection with school work. He said, however, that the matter would necessarily have to be taken up in board meeting. A few days elapsed, and in came notice that the board had made selection of our architect's firm to do the work.

A situation in one of our states had developed very much to the embarrassment of the architectural profession by reason of the unsuccessful dealings of an architect in the execution of a piece of state work, in which instance even charges of corruption were intimated. In an atmosphere of this kind, an architect approached a board of trustees whose chairman was a United States senator, a successful politician and very much a browbeater to those who approached him for consideration. He, however, loved the combat of minds and despised persons approaching him who did not give him back in kind equally as he dealt. The method of handling him, therefore, was necessarily with gloves off. Convincing retort handed back with courage but kindliness is what it took to win him. He and the architect talked on the campus alone together after a number of sessions before the committee, and the senator proceeded at once to explain the disrepute in which the profession happened to be held at that moment. The quick retort was to remind him of the many United States senators who had brought reproach upon our country, and that United States senators after all, are human beings, subject to all the infirmities of other human kind,

and that it was greatly to the benefit of the United States senate and the profession of architecture, that a vast majority of both were men of noble character, and there was no reason why a good United States senator and a good architect could not yet relate themselves with each other in perfect confidence.

It was soon discovered that the distinct object on the part of the senator was to tell the architect of his excessive fees. The senator said that for one building he was asking more compensation than had been paid for similar services for other buildings on the campus. Readily the retort was that the buildings on the campus were a just demonstration of the wisdom of his statement, and, that had a decent architect been employed in the first place, there would not be felt the same necessity for a consuming fire, as existed; and that it was high time to turn over a new leaf in the affairs of the institution. Furthermore, he was reminded that he had just discussed the profession of architecture in a derogatory way, speaking of its low ebb, and that the proposition that the architect should render his services for less, coming from a state official in such a high position as he, was itself a corrupting proposition. The profession, he was told, must have sufficient compensation to do services properly, and that an established fee legally recognized before any court as equitable should be adopted and accorded to the architect, and that it would be very much against the state's interest if he employed any architect who would cheapen himself by taking a piece of state work for less than such a fee,—that the result would be lax service, which was as bad in consequence as bad manners.

After many arguments the senator went away fully convinced, made report to his board, and the award was made to the architect with full fee. More than that, the entire board of trustees then in session felt that the services of the architect during the several days of the session deserved their consideration, and a handsome check was sent him in addition to the award of the full fee. When the services were ended and the final check for services was given, the senator stood up like a man before the architect and said: "In handing you this final payment, I wish to add that your services have been of a high order, greatly to the gratification of our board, and I personally wish to say to you that the state has not paid a cent too much for your services."

In the era of plan-juggling of 20 years ago when highly colored drawings of court houses and schools greatly factored and flourished, the impostor in the profession of architecture had his greatest day. This practice is sometimes encountered yet, and has to be dealt with by the practitioner. On one occasion, architects were invited to present sketches in competition to a school board. It happened that a wealthy and prominent citizen of his state and community lived in this district, and the board in charge desired his approval of its operations, since this man paid a major proportion of the taxes of the district. The sketches, therefore, were required to be sent to his home town on a certain date and then to be carried to the county seat for final discussion before the assembled school board.

Incidentally, the architect of this tale followed his sketches and acquainted himself with the chairman, who was the strong man of the board, before the meeting for the submission of drawings. A number of architects met on this day of final submission, many of whom violated the instructions to send drawings in as already explained for preliminary consideration. In its deliberations the board, however, made no discrimination against those who did not comply strictly with the advertisement. The impostor architect was there and showed the board drawings for a building two or three times larger than those of any other competitor, guaranteeing its cost to be within the stipulated price. The chairman of the board, happening to be a builder, knew that this building could not be built within the amount of appropriated funds, but believed the others could. Consequently, the first days' deliberations of the board reached no conclusion and were held over for further consideration the next day. In the evening, the chairman of the board was called to the hotel room of the impostor-architect, and adroit overtures of all kinds were made to him to accept a fee to supervise the construction of the building, receiving the compensation from him,—the impostor. This was listened to with interest and declined, and finally the impostor-architect made the proposition to pay him the entire fee accruing from the commission for the award of the work to him, claiming it to be an advertisement to design this building which would justify this business action.

The chairman, wise and honorable, came to the architect who ultimately secured the work, setting forth all the facts, including that there must be a guarantee that the building would be built within the funds appropriated, with the contract awarded to a responsible contractor and with a surety bond for 100 per cent of the contract price given. The chairman's statement was that—"I know there is a nigger in the wood pile somewhere, but tell me where it is. I know he cannot do what he says he can do." In the first place, this chairman was told that he would have to make a check for services payable to the impostor-architect, which he would pocket and carry away, and that he would not be able to get it back if he wanted to. In the second place, the impostor-architect would award the contract within the contract price, deliver the bond, as agreed and proceed with the work. Over the impostor-architect's signature, his board would be compelled to make payment to the contractor. A certificate in excess of a just proportionate amount paid to the contractor would be a violation of the bond, and by collusion between the impostor-architect, the contractor and the bond salesman, they could secure the first payment with all apparent legitimacy, then walk out of town leaving them with the "bag to hold" without any legal recourse whatsoever. He was also told that many

things as infamous as that had happened. The result of the deliberations of this board was a complete turn down of the proposition and the award of the work to an architect in whose judgment and plain statements this chairman had implicit confidence, and whose design was preferred by the millionaire citizen.

The only times we know of the infamy of the impostor-architect is when he is unsuccessful, and only then the true story is related. Many such things happen in our professional business, but those involved either by ignorance or infamy will decline to tell the story for the same reason that the victim will not relate the story of the rape of the confidence man if he is "picked up." The beauty of the long run, however, eliminates and abates crime and ignorance, and wonderful is the waiting that in the end finds virtue and success eternal. Enlightenment, of course, eliminates the impostor, who is only a time server. The reader must bear in mind that successes are attended with many failures. Failure defines the meaning of success, and by that we know and appreciate it. No one loves to hear the stories of failure, which are seldom told.

Personality plays a most important part in all dealings with prospective clients and no less in one's contacts after the contract is signed. Each client differs in attitude, taste and prejudices from every other, and the architect who takes the particular characteristics of each client into account and governs his own conduct and conversation accordingly, is the most likely to be successful.

It is hoped that the potential architect may find food for his imagination in the actual incidents related here, and proceed with courage to his trust to make good and advance his profession in the dignified ministration it truly gives to the building world.

Entrance, Girls' High School, Atlanta
Edwards & Sayward, Architects

FEE PLUS COST SYSTEM FOR ARCHITECTS

BY
WILLIAM STANLEY PARKER
OF THE OFFICE OF R. CLIPSTON STURGIS

THERE is more than one way to skin a cat, and I suspect the same to be true regarding the use of the fee plus cost system in architectural practice. Its two elements, fee and cost, are both variable at will. The fee may be made to cover the entire services of the members of the firm, or it may be in addition to other charges based upon the time they actually spend on the work. The items of cost may or may not include the just mentioned items for time spent by members of the firm, and may well vary in minor items charged by some as cost, by others as overhead. In writing on this subject it should be understood that I am not describing the only method or even the best method of charging on this basis, but merely the way in which the office with which I am associated has been using the system for practically 25 years.

It will be well first to state just what our fee covers, what items are charged at cost, and what items are covered by overhead and how they are charged for.

The fee is the profit item for the office as a whole, in which Mr. Sturgis and his associates have variable percentage interests. Mr. Sturgis' interest in the fees constitutes his whole interest in the earnings of the office, no other charges being made for any time spent by him. Apart from the fee our charges fall under these various headings: "Drafting and Overhead," "Engineers," "Clerk of the Works," and "Miscellaneous."

Under *Drafting* is entered, at their various hourly rates, all time spent by members of the office other than Mr. Sturgis, whether that time is spent on drafting, specifications, conferences, or inspection. The total of these drafting charges is doubled to cover overhead. In our case *"Overhead"* includes rent, stenographers, office boy, telephone, postage, supplies, cleaning and time spent by members of the organization on office work, such as office conferences and general office problems not related to any particular project. We have found that with an average volume of work the total drafting charge is substantially the same as our overhead items. In busy times it is more, in slack times it is less, but these two equalize each other in the long run.

Under the heading of *"Engineers"* we include, at cost, the fees of structural and domestic engineers, and any other specialists that may be engaged on the work.

Under *"Clerk of the Works"* we charge at cost the salary of the clerk of the works if one is employed. Occasionally, when a clerk of the works ought to be but is not employed, we estimate the additional office supervision that will be required and charge it under this item instead of under drafting. This means charging the time spent in such supervision as single time, not doubled to cover overhead as for other drafting time. This is fair to the owner, as it charges that time singly, as the time of a clerk of the works is always charged. It is a burden to the office, however, as it reduces the drafting time with which to cover the overhead.

Under the heading *"Miscellaneous"* are charged up net for reimbursement the various minor expense items directly connected with the particular commission, such as traveling expense, long distance telephone and telegraph, blue prints, models and similar items.

Perhaps the best way to illustrate the system is by a copy of one of our "Monthly Statements." Our bills are properly so captioned, because all our accounts are based on monthly payments on all our cost items and also on our fees. In the case of the latter about 20 per cent is withheld for payment upon completion of the work, the balance being divided into monthly payments during the estimated duration of the project. Thus the statement herewith reproduced is the third statement issued, the fee item (entitled "Professional Services") being the third of nine monthly payments of $130 each, a total of $1170, the balance, $130 (in this case 10 per cent of the $1300 fee) being held for payment on completion. The first column, "This Statement," is the current account payable. The second column, "Previous Total," is the accumulated total of all previous statements. The third column is the estimated or guaranteed cost of each item.

At the right the current summary is repeated, but these spaces are primarily intended for use when a guaranteed limit of cost for certain items has been agreed to. When this is true the items guaranteed are generally limited to the fee, drafting and overhead, possibly also including engineers, but generally not including the other items. This final right hand summary can show the condition of the guaranteed amount,—already paid, current charges, balance remaining. In such a case the items in the third column that are not included in the guaranteed limit are marked with an asterisk.

In an effort to reduce to a minimum the time required for entering the drafting charges of the various projects, we developed a monthly time sheet for each man as here reproduced. This is 9 x 12 inches and vertically is divided into five weeks of six days each, some months for accounting purposes being "five-week" months.

The three final columns are for the totaling of hours spent each day and each week, and the daily record and accumulated total of "due" and "ex"-cess hours, or in other words, the number of hours a man

is behind or ahead of the normal number of hours covered by his weekly salary, showing whether he owes the office or the office owes him a balance.

The right hand totals adjust each man's time and money in relation to the office. The totals at the bottoms of the columns show the total hours spent on each project and the total charge against the project.

This monthly time sheet has saved a great deal of time previously spent in making entries on weekly time sheets from which the various subdivided entries were drawn off and entered in ledgers. This one sheet now gives each man's complete record for the month. The totals are of course entered in the ledgers against the appropriate projects and the office accounts.

All this indicates briefly how accounts are kept and charged.

The exact amounts indicated in this Statement are of no significance, nor would any reproduction of exact charges rendered on different kinds of work be illuminating. No two offices would arrive at the same amount, either estimated or actual. The Fee, Drafting and other items would all vary, for a given piece of work, due to different office practices. This typical statement form is reproduced merely to indicate the way in which the few items involved are recorded from month to month, each statement conveying to the client a complete account to date.

Our form of agreement with the client, after defining the work and the service to be rendered, recites the given items and how each is charged for. It also arranges for the adjustment of the contract in case it is terminated, and we feel it does this in a simpler way than that contained in the Institute Fee Plus Cost form. In our form the owner, if he terminates our employment, pays all charges provided for up to the date of such termination and the portion of the fee, usually about 20 per cent, that is due upon completion of the work. This is definite, without any items to be settled by agreement, no discussion is involved, and the withheld balance of the fee will be found to adjust the matter of fee with substantial fairness, no matter at what stage of the work the break may come.

It of course is but seldom brought into play, but when it is there is hardly a possibility of strained relationships under which amicable adjustment of any uncertain financial settlement might be difficult. Our method is simple and positive and obviates any discussion.

We have used this system of charging with many different types of clients. Frequently in talking about the system with architects they have said that it was logical enough, but it meant explaining the system to each client who wouldn't understand it and who would be familiar with the percentage fee, and so it was simpler to stick to the older method. This bugaboo of what the client will think is largely in the mind of the architect rather than in that of the client. The number of clients, in our practice, that have disliked the system or found it difficult to understand has been negligible.

Generally they feel it is sound and reasonable. Sometimes they want to translate the result into terms of percentage, but while they may do this in their own minds, there is seldom any particular comparison. They rather like the basic idea that our fee is a fixed amount, regardless of any fluctuation in the final cost of the work. If the work is increased or diminished to any substantial degree, after the agreement is settled the amount of the fee is adjusted accordingly. This is seldom necessary and never a source of difficulty. Apart from such cases the fee is a fixed amount.

All the other items, however, are stated as mere estimates and not guaranteed, and so they will vary according to the conditions as they actually develop. If sketches are promptly approved, if frequent changes are not made in the drawings at various stages of the work, if the construction is carried through quickly and competently by the contractor, most of which matters are beyond the definite control of the architect, then the drafting and overhead charges will be kept at a minimum. If reverse conditions develop, such charges will doubtless increase.

Some clients of course, for varied reasons, prefer some kind of agreed limit, but they have been rare in our practice. In one case it may be that they will want the total of the fee, drafting and overhead, and structural engineers, to be not in excess of some named percentage because these items comprise the services generally covered by a percentage fee. In another case they may prefer a guaranteed limit for all services, even including the clerk of the works. These varying desires should be met by the architect in an accommodating spirit, and a clear knowledge of past office experience on similar projects makes it relatively easy to determine fair amounts in any such case. Certainly it requires no greater degree of acumen and prescience than is required in many cases to determine what percentage will be appropriate and just what that percentage will cover.

Of course the simplest mental operation is with a hard and fast schedule, say 6 per cent, for all kinds of work. But it is neither very scientific nor fair. One architect said to me once that he had always done all his work on a 6 per cent basis, but always lost money on his houses and helped cover this loss with his commercial buildings. Now it seems to me unfair, both to himself and perhaps in many cases to his fellow architects, to take, for instance, houses at a percentage below actual cost. It is an economic absurdity to design and supervise an owner's dwelling for less than the service costs one. And it is quite likely that some other architect who perhaps doesn't have much commercial work and who charges for house work at a rate that will produce a profit, may be told, "But so and so does houses at 6 per cent.

THE OFFICE OF
R. CLIPSTON STURGIS, Architect, 120 Boylston Street, Boston

MONTHLY STATEMENT December 1, 1927.

John Doe Esq., *To Office of R. CLIPSTON STURGIS, Dr.*

For Work on House *at* Blank, Mass.

SERVICE	THIS STATEMENT	PREVIOUS TOTAL	ESTIMATED OR GUARANTEED COST	DATE OF AGREEMENT
Professional Services 3 of 9	$130.00	260.00	$1300.00	Oct. 1, 1927
Draughting and Overhead	554.14	1090.84	2000.00	
Engineers		29.44	50.00	*Previous Charges* $1397.78
Clerk of Works at				*This Charge* $698.31
Printing Specifications				
Incidentals	14.17	17.50	100.00	*Total Charges* $2096.09
Total		$1397.78	$3450.00	*Balance*

APPROVED

Account Rend.

TOTAL DUE $698.31

Received Payment,

Note: Items starred are not chargeable against limit.

A Complete Statement is Sent to the Owner

Why do you charge more than he would charge?"

If an architect uses a percentage system, he certainly must adjust the percentage to suit different types of work, and in each case there will be additional items to be charged at cost. These items will always involve miscellaneous expenses such as travel, etc., and I suspect with most architects the cost of domestic engineers will also be charged for apart from this percentage, though doubtless many now include them in their fee.

The difference between the systems is therefore not so great as it sometimes seems. It is a case of a "profit fee" plus costs or a "percentage fee" plus costs. In either case an appropriate total can be arranged with no difference in the amount of judgment involved. The main difference is that the so-called "fee plus cost" system is based upon each project, carrying a stated professional fee that is guaranteed, in addition to reimbursement of all costs, and that this fee when once established ceases to be affected in any way by the cost of the work. It goes without saying that I am speaking primarily of operations of definite extent and not those that are indefinite in all their major factors of size, time and cost. But even to such enterprises the system is equally applicable.

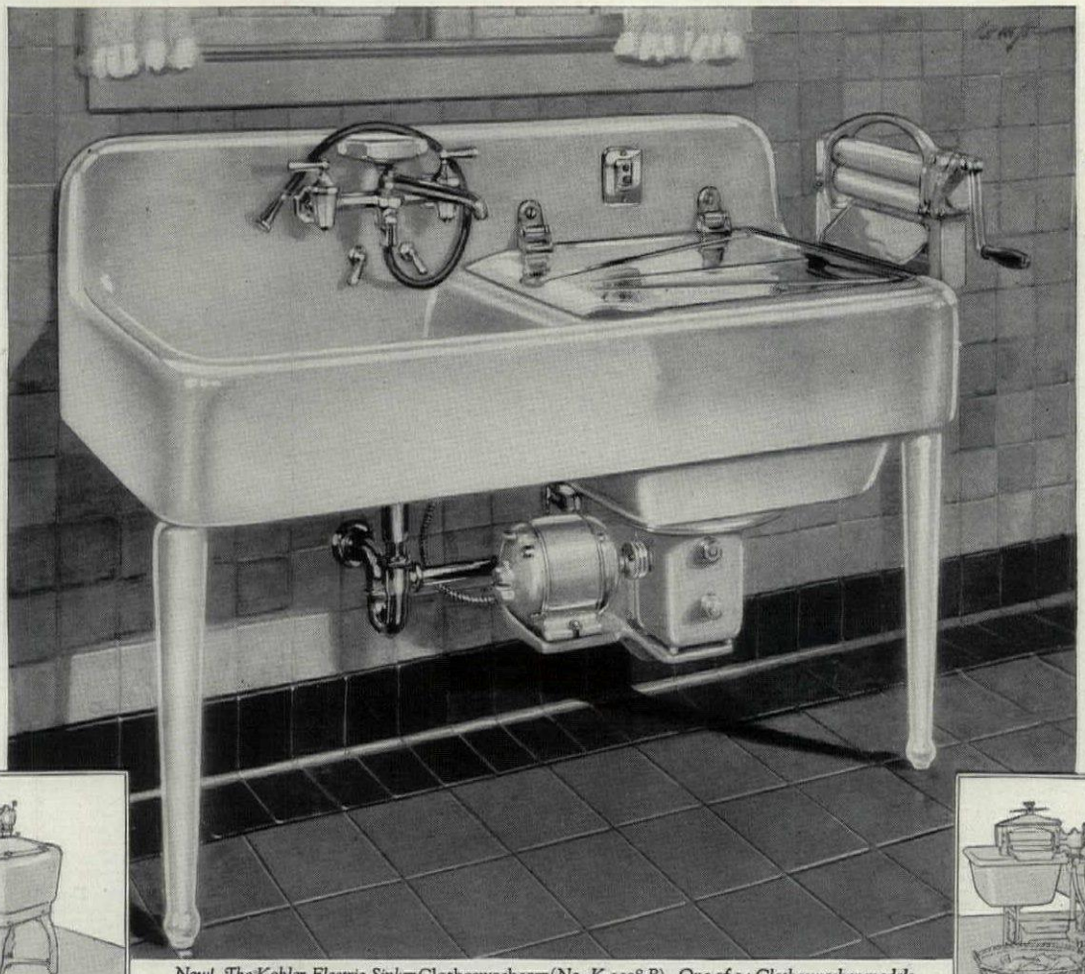
This method of charging is so flexible as also to fit quite easily those operations involving repeated units, like housing developments, to which the standard percentage fees cannot be applied without adjustment. Obviously the character of the service, its duration and the approximate total cost of the work must all be considered in either case. In the fee plus cost method the resulting estimates of profit and cost can be set down direct. In the percentage method they are translated into terms of a percentage, and that is set down. Which is the simpler method?

The advantages of the fee plus cost system from the point of view of the architect are therefore, (1) a known fee or profit for the architect; (2) an assured sum each month from the owner, covering the actual cost of the office work and the proportional amount for overhead, which simplifies the financing of the architect's office; (3) more prompt and definite decisions on the owner's part and freedom from annoying changes in the work, since he realizes he must pay the additional costs of drafting involved each time he changes his mind about this or that. Under the percentage system the architect is often imposed upon in the matter of changes due to whims of the owner, and an unfair burden of cost is placed on the architect through no fault of his own. With the fee plus cost system the owner pays for all work.

MO. OCT. YEAR 1927 — OFFICE OF R. CLIPSTON STURGIS ARCHITECT — MONTHLY TIME SHEET OF JOHN DOE

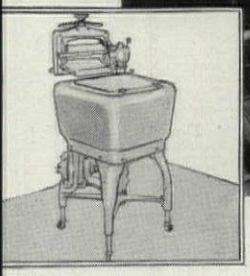
DAY	THOMAS		LANE		CHANDLER		FRENCH		MC'ARTHUR						PROSPECTIVE		OFFICE		S-H-&-V		TOTALS DAY	TOTALS WK	TIME DUE	TIME EX	TOTAL DUE	TOTAL EX
Sept 27																			ill	7	7					
28																			"	7	7					
29																			"	7	7					
30		4		3														1			8					
31		4		1														2			8					
1		3																			3	40				1
3		4		1											DR. P.	2		1			8					
4	at job.	6																2			8					
5		4						2										2			8					
6		3½		2		1½												1			8					
7		J		1														1			7					
8																						39				
10																							8			
11		4		3																	7					
12																			Hol.	7	7					
13		4		1		1												2			8					
14		J		2														1			8					
15																		1			1	31			8	
17		6																1			7					
18	at job	6																1			7					
19		6																1			7					
20		6																1			7					
21		J													MRS S GARAGE.	2					7					
22																						35	4		4	
24									7												7					
25									7												7					
26									7												7					
27									7												7					
28									7												7					
29									4												4	39				
JOB H'RS.		75½		14		2½		2		39						4		18		7 21	184				11	
JOB CHGE	154	77	28	70	J	13	4	10	79	95					8	20	36	90	14 43	J J	377.20				22.JJ	

The Monthly Time Sheet of Each Draftsman Facilitates the Apportioning of Charges to Each Project



The wringer is easily removable

New! The Kohler Electric Sink—Clotheswasher—(No. K-1128-R). One of 14 Clotheswasher models



Kohler also makes this portable washer, in colored enamel inside and out—an admirably capable machine

"Free-standing" Kohler laundry trays and the new Kohler washer make a most efficient combination in the laundry

The Kohler Electric Sink —Clotheswasher—

for light laundering

HERE is a fixture which presents a new opportunity to the architect who specializes on designing for maximum efficiency in housekeeping. It is a Kohler Electric Sink for clotheswashing, a fixture to be permanently installed in the kitchen, where it is most convenient for immediate and constant use.

Countless homes need it for doing the *everyday* washing—of tea napkins and luncheon sets, children's clothes, golf stockings, silk sweaters and underthings—all those articles that are too easily ruined or too immediately needed to be left for the regular washing.

You will realize, too, what a useful place this fixture will fill in apartments where the basement laundry is inconvenient to use and only available for a limited time each week for each individual tenant.

This *two-in-one* fixture is, in addition, a splendid regular sink. The wringer is easily removable and the metal clotheswasher cover forms a capacious drainboard. The sink is 8 inches deep, fitted with the Kohler Duostrainer, the new cup strainer and drain control for Kohler Sinks. It holds the water in the sink. No need to bother with pans. And the removable strainer cup catches the debris. It may be lifted out by the convenient handle and emptied with ease.

* * *

Kohler Electric Sinks for clotheswashing and dishwashing, the recently announced *Efficiency* sinks, and Kohler Color Ware, are combining to revolutionize the plumbing-fixture equipment of the modern home. You should make it a point to see these new fixtures in Kohler show-rooms and to write for descriptive literature.

KOHLER CO., *Founded 1873*, KOHLER, WIS. · *Shipping Point*, Sheboygan, Wis. · *Branches in Principal Cities*

KOHLER OF KOHLER

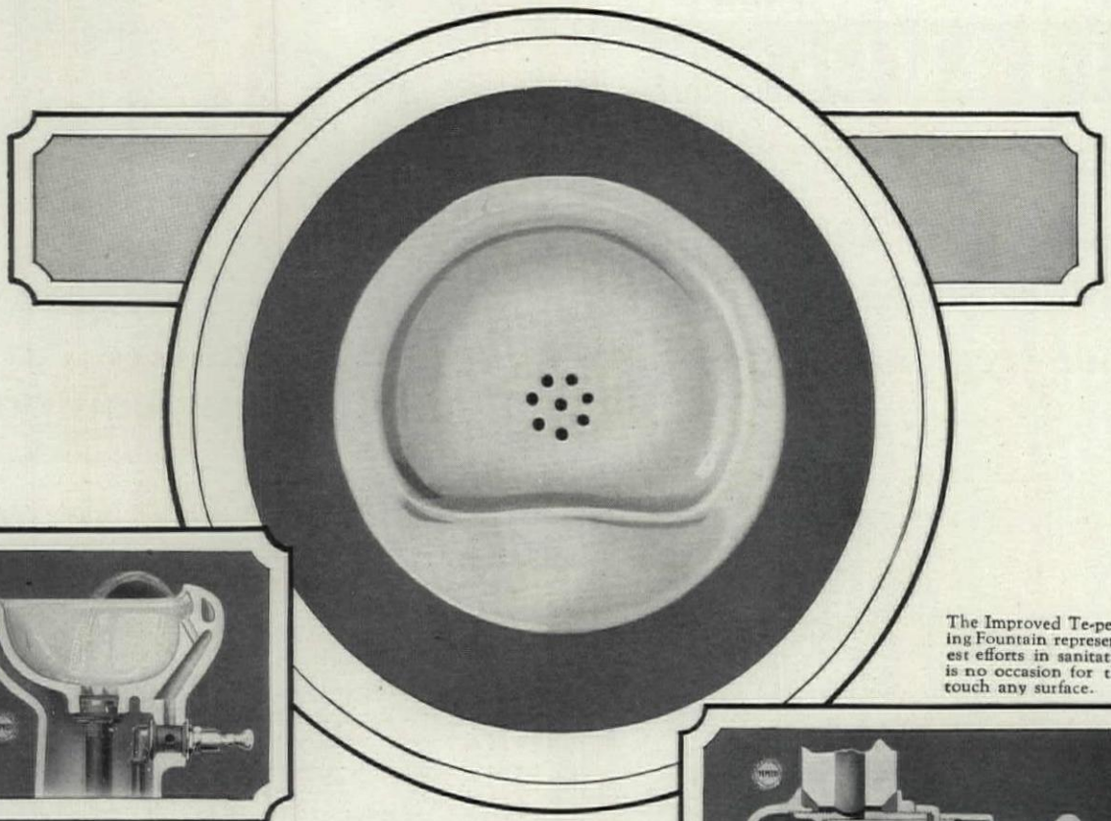
Plumbing Fixtures

INFORMED home owners prefer the Improved Madera for its long, soil-proof seat which permits a correct, natural position; for its sparkling, glass-hard, easily-cleaned surfaces; for its quiet, forceful siphonic flushing, carrying all waste through its greater trapway; and for its rugged construction and splendid fittings—good for a lifetime.

THOMAS MADDOCK'S SONS COMPANY
DUROCK *Bathroom Equipment*
TRENTON, N.J.

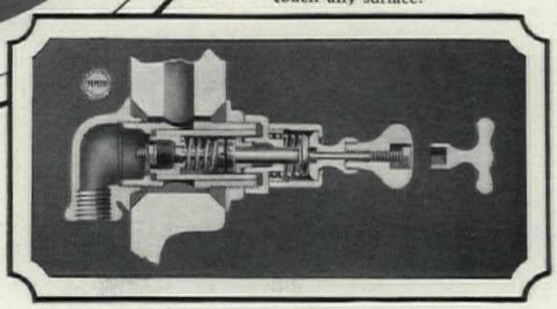
MADDOCK

Since 1859 — No Name has stood for higher quality



The Improved Te-pe-co Drinking Fountain represents the latest efforts in sanitation. There is no occasion for the user to touch any surface.

The Te-pe-co Duplex Valve can be used for either manual operation or constant stream. Note that stream is regulated by turning a spindle through the oscillating, self-closing valve handle.



The Drinking Fountain at its Best

HERE is the fountain that affords exactly what the most discriminating sanitarians demand of such a fixture — a device that ejects a thick, splashless stream of water, absolutely free from any possible contamination.

This we have accomplished by replacing the ordinary bubbler with an integral angle stream nozzle under an elevated cowl, operated by our special Duplex Valve especially designed for the purpose.

The construction of the supply chamber tends to check any variation in pressure, thus keeping the arch of the stream constant. Note that the glassy, two-fire vitreous china bowl contains no exposed metal to tarnish, no crevices to carry germs or dirt.

In a word, Te-pe-co Integral Nozzle Drinking Fountains offer so much in sanitation, durability and ease of installation that they are specified as a matter of course by leading architects everywhere.

THE TRENTON POTTERIES COMPANY

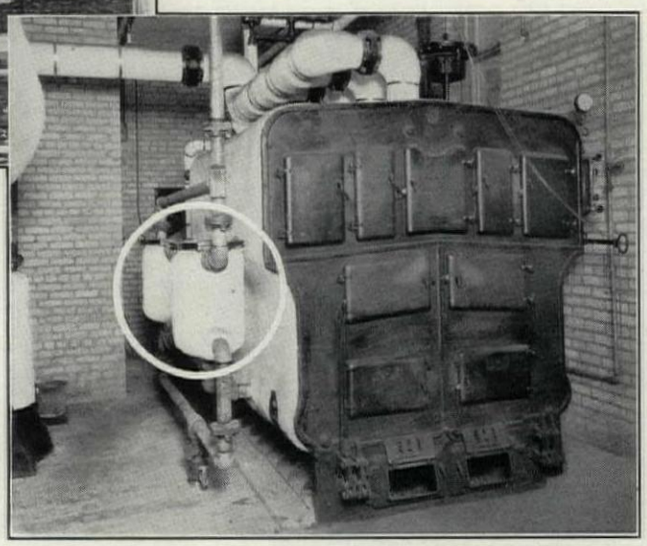
NEW YORK — PHILADELPHIA TRENTON, NEW JERSEY, U. S. A. BOSTON — SAN FRANCISCO

World's Largest Manufacturers of All-Clay Plumbing Fixtures

TE-PE-CO

ALL-CLAY PLUMBING FIXTURES

Two Triple Copper Coil Excelsos furnish an abundance of low-cost hot water to seventy-two families in this Detroit Apartment of Glasser and Hoffman, owners.
Architect—J. I. Weinberg



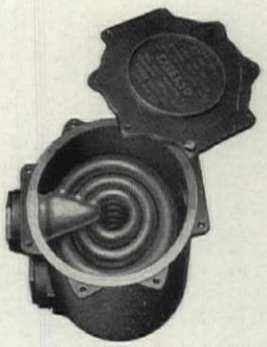
Excelso Triple Copper Coil Heater shown here will save Hot Water costs for your clients.

Detroiters Also Know the Lowest Cost for HOT WATER

TO THE QUERY "What is the one lowest-cost method of assuring a clean and pure supply of hot water, abundant at all hours for tenants of apartments, hotels and other large residential and commercial buildings?" the best answer is—"Excelso *Indirect* Water Heaters!"

Connected between steam or vapor heating boiler and domestic hot water storage tank, eliminating separate fire-care and fuel-cost, Excelsos give perfect and permanent satisfaction.

Write for (standard A. I. A. file-size) catalog showing fourteen typical installations. An invaluable guide for architects' offices.



Open View of Triple Copper Coil Excelso Heater

Excelso Products Corporation
DIVISION OF AMERICAN RADIATOR COMPANY
69 CLYDE AVE. BUFFALO, N. Y.

EXCELSO WATER HEATERS

Sold and Installed by All Plumbing and Heating Contractors

Sizes for One Family or One Hundred Families

The MASTER of ACID

The Shaw & Marchant Co.
Designers-Illustrators-Engravers

Dayton Ohio

July 1, 1927.

The Duriron Company,
Dayton, Ohio.

Gentlemen:

The photograph attached shows a part of the Duriron drain pipe and fittings that carry the acid waste from our etching tubs and machines.

Inasmuch as this installation was made in 1916 and has constantly carried nitric acid and other corrosives, we think the picture interesting, as it demonstrates the wonderful acid resistance Duriron possesses.

The strength of the solutions is such that the fumes from the vents of our etching machines corrode ordinary iron pipe some distance away and damage the metal roof of an adjoining building.

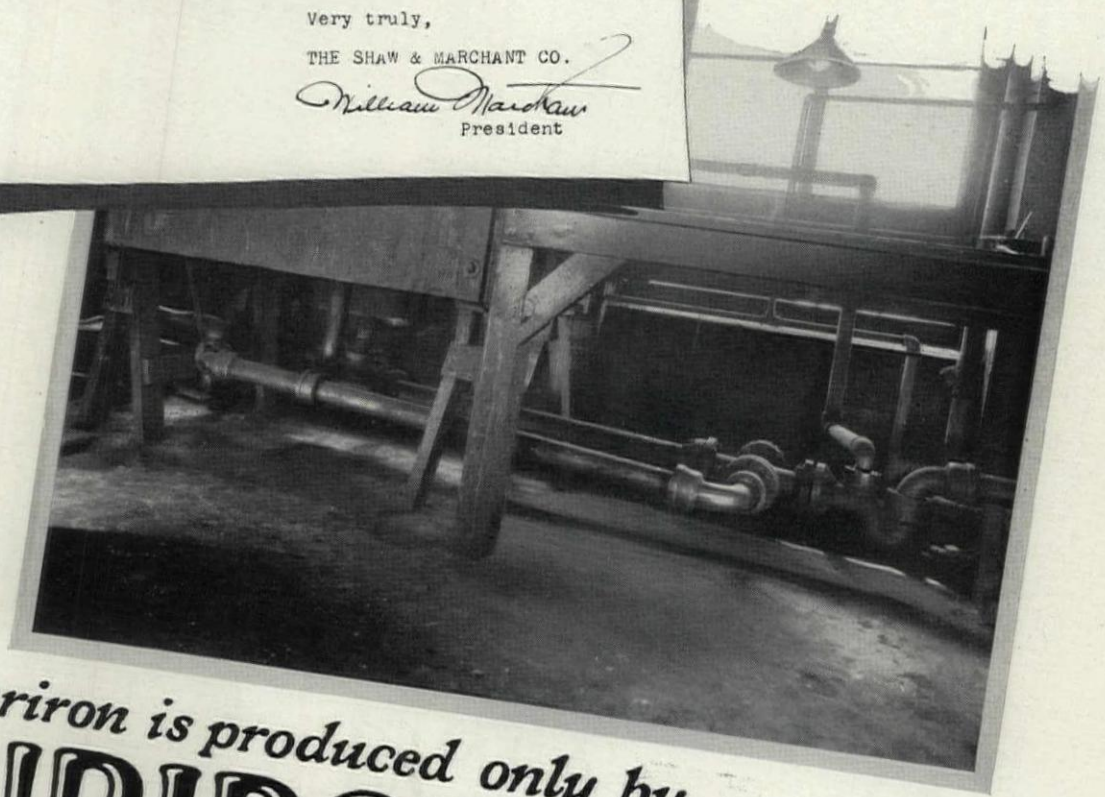
We have from time to time added more Duriron as we have increased our equipment, but we have had no failure in our years of use of Duriron.

We are convinced that no other material would give us anything like an equal service.

Very truly,

THE SHAW & MARCHANT CO.

William Marchant
President



Duriron is produced only by

The DURIRON COMPANY
DAYTON · OHIO

KANSAS CITY UNION STATION
Mr. Jarvis Hunt, Architect
Mr. E. D. Hornbrook, Sheet Metal Contractor

Were these "arteries" wisely chosen?

THE Kansas City Union Station houses a heating and ventilating system that is still paying dividends to its owners fourteen years after installation. Its original cost dwindled year by year because the ducts and other sheet metal parts are ARMCO Ingot Iron.

Heating and ventilating ducts—life-giving arteries of public buildings—must go in to stay. They must be virtually as permanent as the very foundations. Else costly replacements follow.

When you select rust-resisting ARMCO Ingot Iron for heating and ventilating systems you are giving your clients the ultimate in low-cost protection . . . . Protection from the insidious Rust-Fire* that quickly consumes impure irons and steels—protection to their pocketbooks.

THE AMERICAN ROLLING MILL COMPANY

Executive Offices, Middletown, (O.)

Export: The ARMCO International Corporation
Cable Address—ARMCO, Middletown, (O.)

District Offices at Chicago, Cincinnati, Cleveland, Detroit, Philadelphia, Pittsburgh, New York, San Francisco, St. Louis

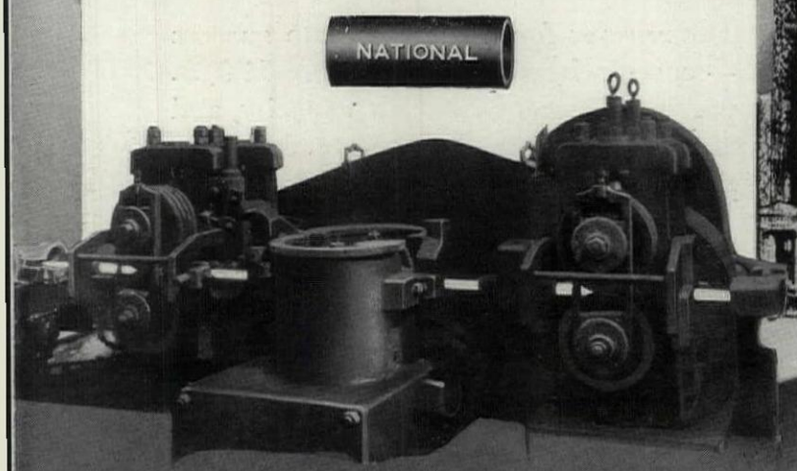
ARMCO
INGOT IRON
RESISTS RUST

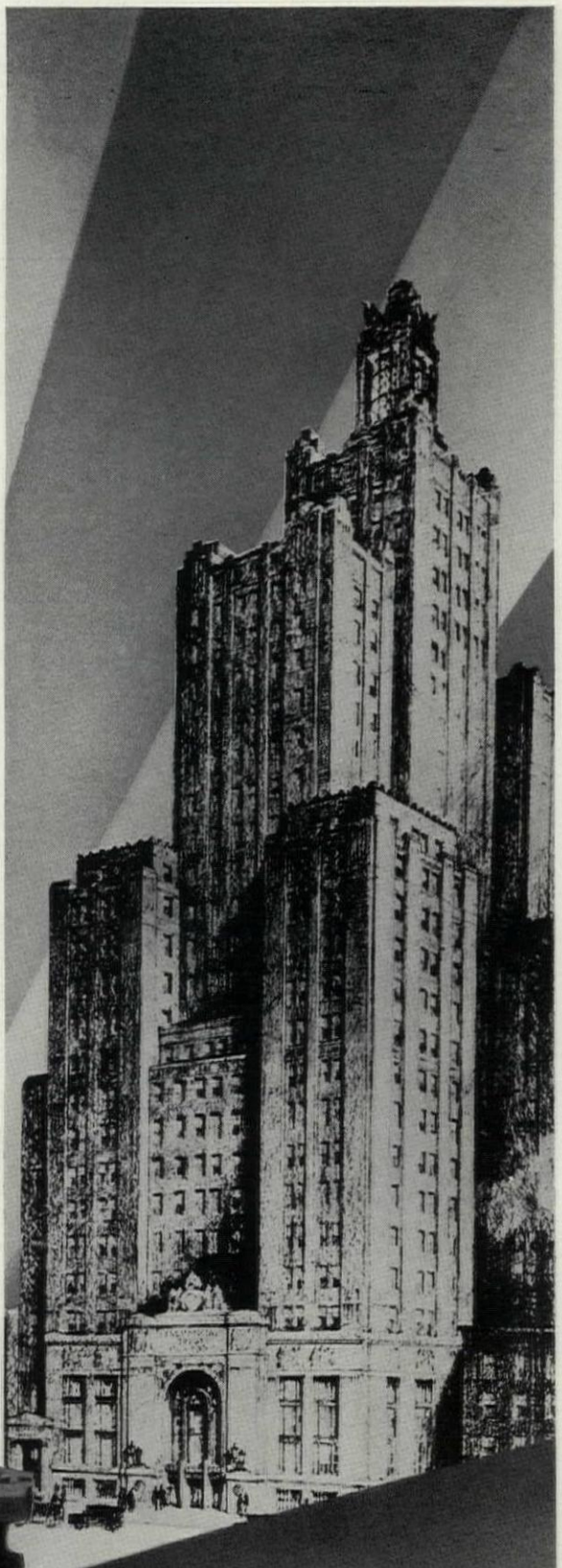
* *Here RUST-FIRE is retarded. The only difference between rusting and burning is time—both are oxidation. You can feel and see the fire produced by rapid burning. But when metal rusts, the process is too slow to see. Rust is the "ash" of this fire.*

In the YEARS *to* COME

ON Fifth Avenue, Michigan Boulevard, Market Street and on the thoroughfares of many of America's great cities, one may stand today and gaze in amazement at the number of great buildings. Here one sees, materially, that typical American spirit, ever striding quickly forward—reaching, climbing, planning for the years to come. And, in keeping with the architectural achievement, engineering skill has been diligently applied—the specifications for the various materials were written by far-famed architects and engineers, cooperating with industrial leaders in establishing quality. Included with other dependable equipment are vast networks of pipe lines, behind the walls and beneath the floors. Here, in particular, there could be no compromise with the principle of high quality. Buildings constructed to stand for years to come and to give uninterrupted service through their pipe lines must contain pipe which offers the basic advantage of long life. Thus, in the selection of the tubular equipment for the Industrial Trust Company Building, one of the newest and largest of New England's skyscrapers, "NATIONAL" Pipe was specified for the major pipe tonnage.

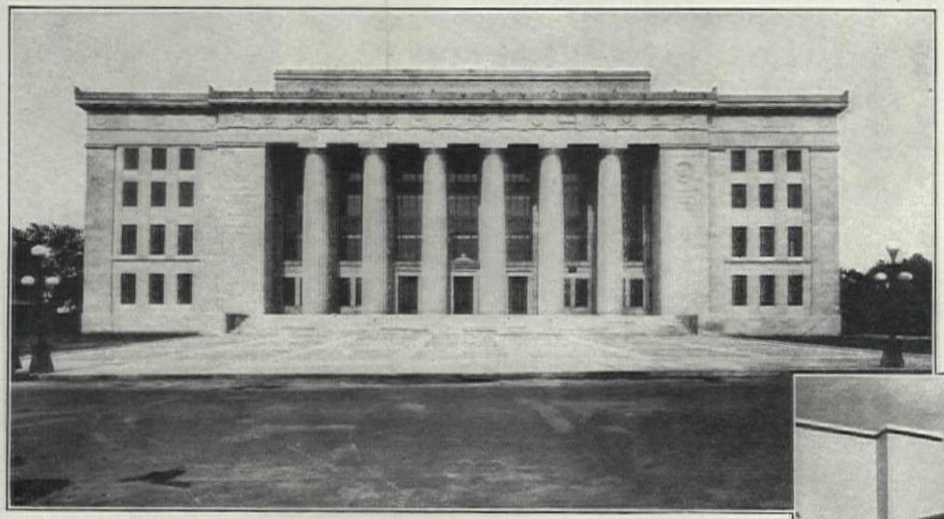
The name "NATIONAL" on the specifications means that future service has the added protection of the "NATIONAL" Scale Free Process (partly illustrated below). This process is applied to butt-weld sizes ½ to 3-inch, and the Spellerizing Process to all sizes 4-inch and under. Both processes are designed to make this pipe more resistant to corrosive influences and give added life in the years to come.



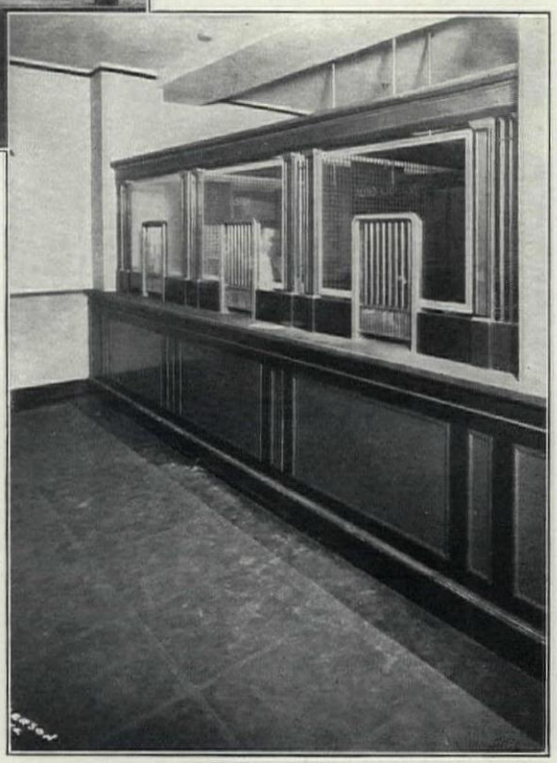


INDUSTRIAL TRUST COMPANY BUILDING
PROVIDENCE, RHODE ISLAND
Architects: Walker & Gillette; *Associate,* George Frederic Hall: New York City
Engineers: J. F. Musselman Associates, New York City
General Contractors: Starrett Brothers, New York City
Heating Contractors: General Fire Extinguisher Co., Providence, R.I.
Plumbing Contractor: James McMillan, New York City

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
District Sales Offices in The Larger Cities



Wyandotte County Court House, Kansas City, Kansas. Architects—Wight and Wight; General Contractor—Swenson Construction Co.; Plumbers installing Youngstown Pipe—Interstate Heating & Plumbing Co., all of Kansas City, Mo.



One of The Finest

Wyandotte County Court House at Kansas City, Kansas

While not the largest, the new Wyandotte County Court House at Kansas City, Kansas, is nevertheless looked upon as one of the finest structures of its kind erected within the last year. All materials used were of the best that could be obtained including the use of Youngstown Steel Pipe for all plumbing and heating lines and the use of Youngstown Sheet Steel for partitions, cabinets, shelving, etc.

"Youngstown" Products are regularly specified by the best architects in America for perhaps the large majority of the better and most modern buildings today. Information regarding Youngstown Steel Pipe and Youngstown-Buckeye Rigid Steel Conduit will gladly be sent to Architects on request.

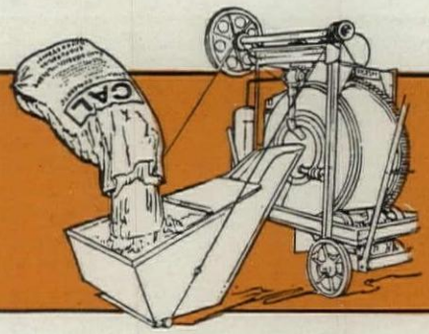
All partitions, filing cabinets, and shelving in the new Wyandotte County Court House were fabricated of Youngstown Steel Sheets by The Steel Fixture Company of Topeka, Kansas, and reflect only the finest workmanship in following the new trend of using sheet steel throughout for installations of this nature.

THE YOUNGSTOWN SHEET AND TUBE CO.
YOUNGSTOWN, OHIO

District Sales Offices:

ATLANTA—Healy Bldg.
BOSTON—Chamber of Commerce Bldg.
BUFFALO—Liberty Bank Bldg.
CHICAGO—Conway Bldg.
CINCINNATI—Union Trust Bldg.
CLEVELAND—Union Trust Bldg.
DALLAS—Magnolia Bldg.
DENVER—Continental Oil Bldg.
DETROIT—First National Bank Bldg.
KANSAS CITY, MO.—Commerce Bldg.
MINNEAPOLIS—Andrus Bldg.
NEW ORLEANS—Hibernia Bank Bldg.
NEW YORK—30 Church St., Hudson Terminal Bldg.
PHILADELPHIA—Franklin Trust Bldg.
PITTSBURGH—Oliver Bldg.
SAN FRANCISCO—Sharon Bldg.
SEATTLE—Central Bldg.
ST. LOUIS—Mo. State Life Bldg.
YOUNGSTOWN—Stambaugh Bldg.

LONDON REPRESENTATIVE—The Youngstown Steel Products Co., Dashwood House, Old Broad Street, London, E. C. England.



~ just put it in the mix

CAL

Specify CAL to improve the density of concrete. Dense concrete is watertight. ¶CAL is Oxychloride of Calcium, a white powder packed in bags, to be added dry to any Portland Cement mixture. ¶In addition to densifying, CAL accelerates the hardening, fattens and cures Portland Cement concrete, stucco and mortar. ¶The use of CAL in place of other materials is a safeguard on rigid adherence to architectural specifications. ¶The CAL Book will be sent upon request. ¶ See our Catalog in Sweet's.

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General Offices
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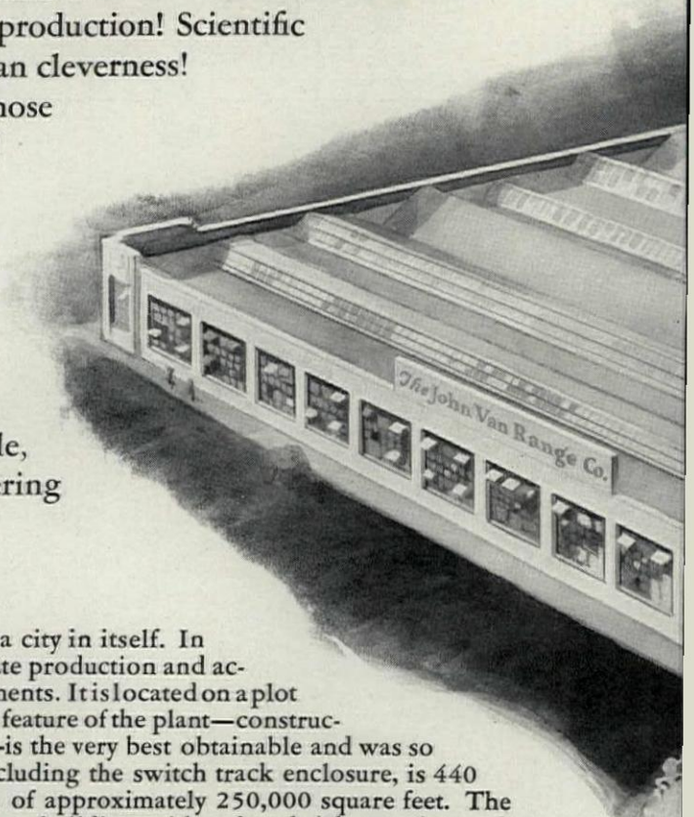
Announcing th
World's Greatest Kitche

A MANUFACTURING organization famous for over seventy years as producers of matchless quality products—now installed in new quarters with vastly increased capacity and with scientific manufacturing facilities many years in advance of any ever used in the kitchen equipment industry!

The John Van Range Company now manufacturing Kitchen and Restaurant Equipment for all The ALBERT PICK-BARTH Companies is operating on a scale that dwarfs anything ever done before in this line of business. Their new building, located in the heart of the Oakley manufacturing district in Cincinnati, contains over a quarter of a million square feet of floor area—a masterful piece of industrial engineering organized to make use of machines and methods of the most advanced character known today. Mass production! Scientific precision! Machines with uncanny human cleverness! Laboratories for research! Workmen whose craftsmanship is a tradition of generations!

All of these are devoted to raising the famous Van Standard of Quality to even greater heights than ever before. And now, in addition, Van Equipment is sold and engineered by The ALBERT PICK-BARTH Companies—sponsored by the most able, widespread and authoritative engineering organization in the country.



A Vast Industrial City Under One Roof

The new Van Range Company plant is practically a city in itself. In fact, it is divided into streets and avenues to facilitate production and accommodate the tremendous traffic between departments. It is located on a plot of land containing just under 15 acres. Every single feature of the plant—construction, machinery, lighting, heating and ventilating—is the very best obtainable and was so proved by exhaustive tests. The main building, including the switch track enclosure, is 440 feet long and 370 wide and has a total floor area of approximately 250,000 square feet. The manufacturing section is a single story steel frame building with a face brick exterior, a daylight factory with maximum window space and skylights of special design. Adjoining this is a four-story section of reinforced concrete construction, containing the offices, warehouse space, display rooms, laboratories, employes' restaurant and operating departments.

THE ALBERT PICK-BARTH COMPANIES

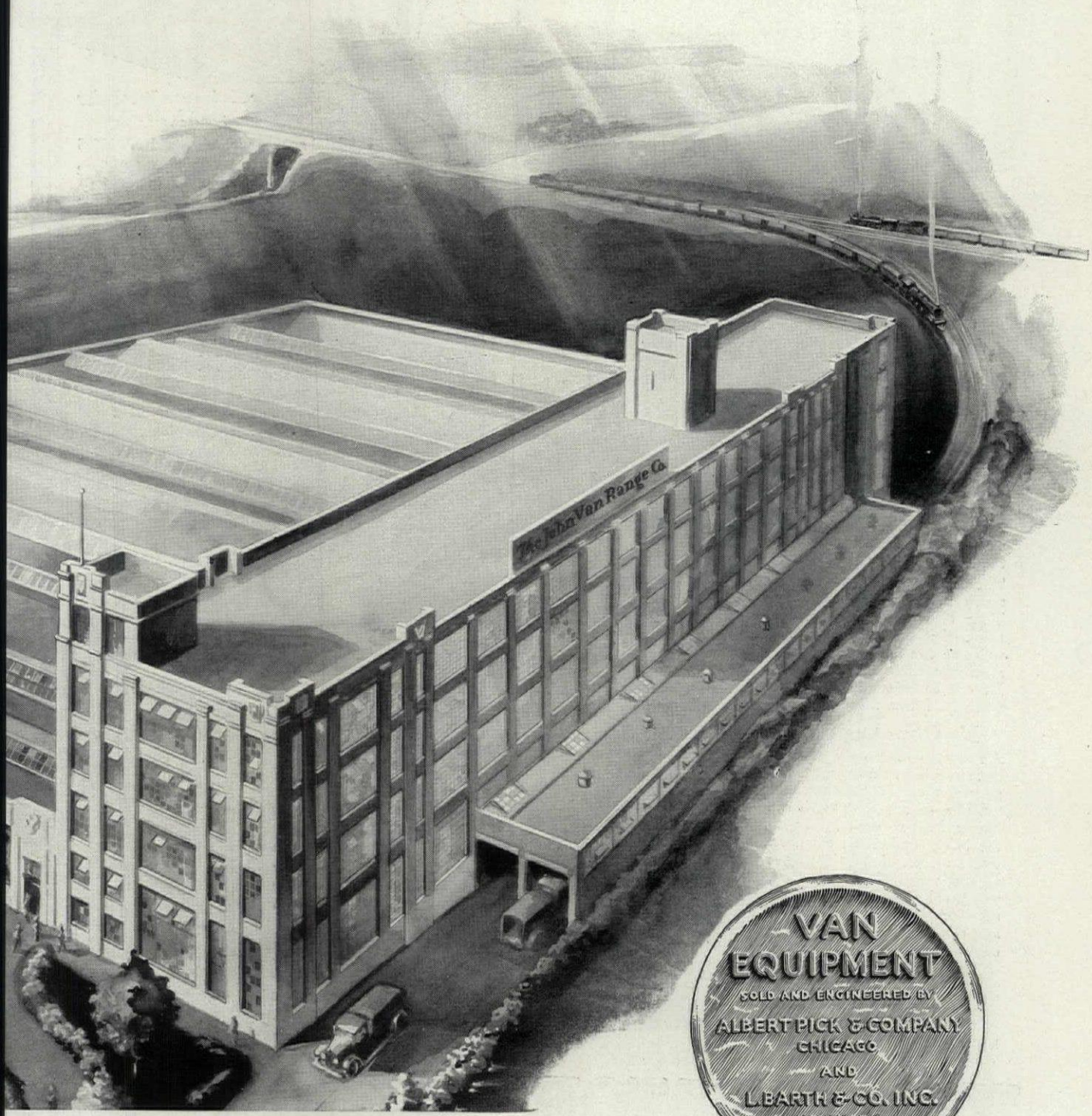
ALBERT PICK & COMPANY
208-224 W. Randolph St., Chicago, Ill.

L. BARTH & CO., Inc.
32 Cooper Square, New York, N. Y.

THE JOHN VAN RANGE CO., Cincinnati, Ohio, *Manufacturing Division*

VAN FOOD SERVICE EQUIPMENT IS THE NATIO

Opening of the Equipment Factory . . .



The New Factory of The John Van Range Co.
Oakley, Cincinnati, Ohio

VAN EQUIPMENT
SOLD AND ENGINEERED BY
ALBERT PICK & COMPANY
CHICAGO
AND
L. BARTH & CO., INC.
NEW YORK

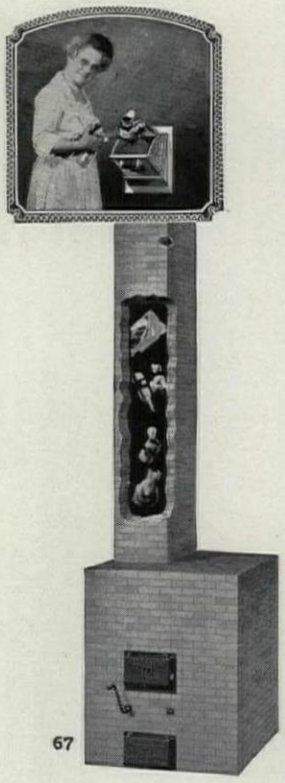
ANDARD FOR ECONOMY—DEPENDABILITY—LONG LIFE

Residence Models as Low as $95.00

— and the masonry adds but little more when regular chimney is used.

THE better a client is satisfied with his new home the more he will add to your reputation as an architect when he talks to his friends. It is just such outstanding conveniences as the Kernerator that assure you valuable returns in the form of good will.

The Kernerator is the finishing touch to the modern kitchen. Your client will not always think of it in time but he will welcome the suggestion enthusiastically when you mention it. He will be especially interested when he learns there's—



No Operating Cost

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

See Sweet's, write for Kernerator catalogs in ready-to-file A. I. A. Folder 35 J 41 or phone your local Kernerator representative. Offices in 89 cities.

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

KERNERATOR
REG U S PAT OFF.
THE CHIMNEY-FED INCINERATOR

"Garbage and Waste Disposal without Leaving the Kitchen"

VENUS Pencils

The largest selling Quality pencil in the world

THE accuracy with which VENUS Pencils are made—the smooth, durable, dependable lead, in 17 degrees of hardness—each degree running true and uniform always—has made VENUS the ultimate choice of the technical men and all others who desire the utmost in pencil quality and service.

17 Black Degrees—3 Copying

For bold, heavy lines . .	6B-5B-4B-3B
For writing, sketching . .	2B-B-HB-F-H
For clean, fine lines .	2H-3H-4H-5H-6H
For delicate, thin lines . . .	7H-8H-9H
Plain Ends, per doz. . .	$1.00
Rubber Ends, per doz. .	1.20

At Stationers and Stores throughout the World

AMERICAN LEAD PENCIL COMPANY
229 Fifth Avenue, New York

Make fine lines in Color

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

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

Can be sharpened in a pencil sharpener and easily erased.

The 12 colors are ideal as symbols for executives

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

At all dealers or write direct

American Pencil Co., 229 Fifth Ave., N.Y.
Makers of the famous VENUS Pencils

EXIT

ROOF REPAIR EXPENSE FOR 20 YEARS

HOW often does the owner of a Barrett Specification Roof think bout that roof?

He forgets it. His roof is so trouble-ee that he never has to give it a thought.

Once in a while—hearing that some her man's buildings are in the throes roof repairs or replacements—he members that his Barrett Roof has en up there for years without costing m one cent.

When a Barrett Specification Roof laid, a Surety Bond is issued guar-nteeing the building owner against pair or maintenance expense for the xt 20 years*.

That definitely guaranteed period mps us up to the year 1948. After 48, what?

That question is answered by scores old roofs of Barrett Pitch and Felt id in the 70's, 80's and 90's. (You member the pictures of a number of ese old-timers featured in our advertising during the past year.) Not once, but again and again we were able to point to veteran Barrett Roofs —30, 40 and even 50 years old—that had never cost their owners one cent for repairs or maintenance.

The architects, engineers and contractors of America are thoroughly familiar with these notable Barrett records. They know that no other type of built-up roof offers such irrefutable proofs of durability. That's why a majority of our finest modern buildings are covered with the Barrett Specification Roof.

For complete information about these trouble-free roofs, dictate a brief note to us.

*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.

Depend on the Barrett Approved Roofer

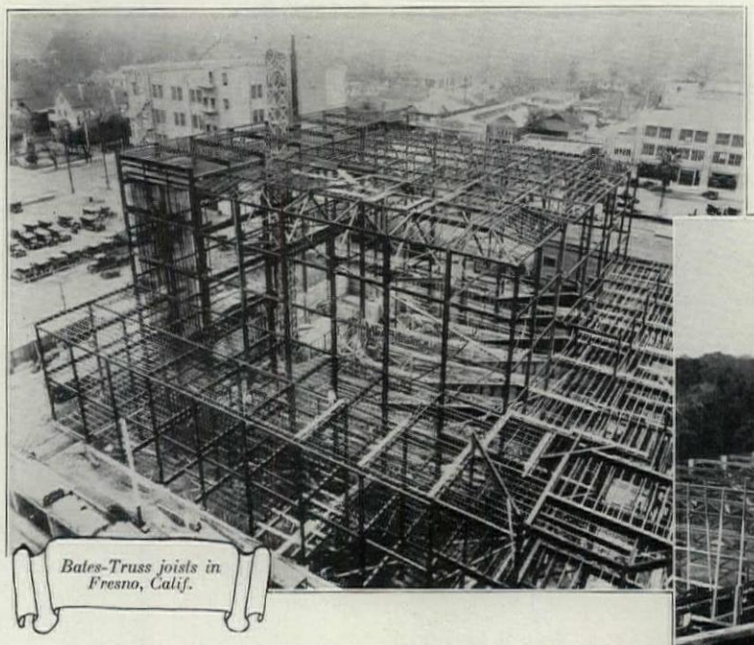
Throughout the United States and Canada a limited number of roofing contractors have been approved by Barrett to lay the Barrett Specification Bonded Roof. These men have earned a reputation for doing efficient work—a name for absolute dependability.

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

THE BARRETT COMPANY
40 Rector Street, New York City

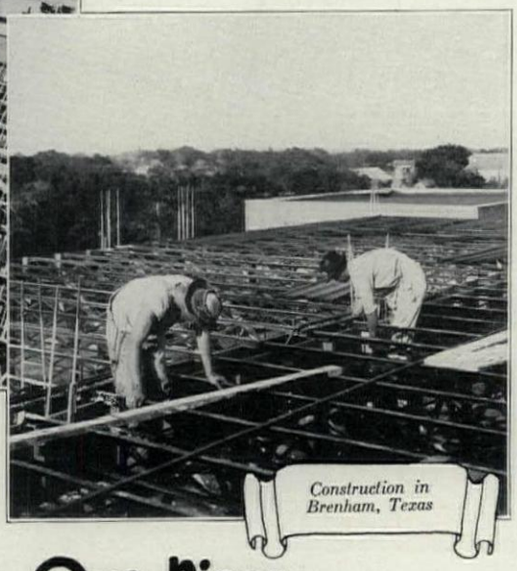
IN CANADA:
The Barrett Company, Limited
5551 St. Hubert Street, Montreal, Quebec

Barrett Specification Roofs

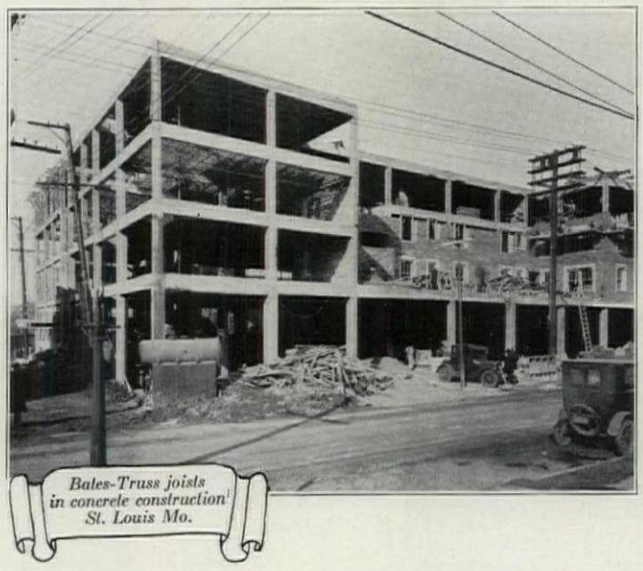


Bates-Truss joists in Fresno, Calif.

BATES-TRUSS JOISTS
Throughout the Country!



Construction in Brenham, Texas



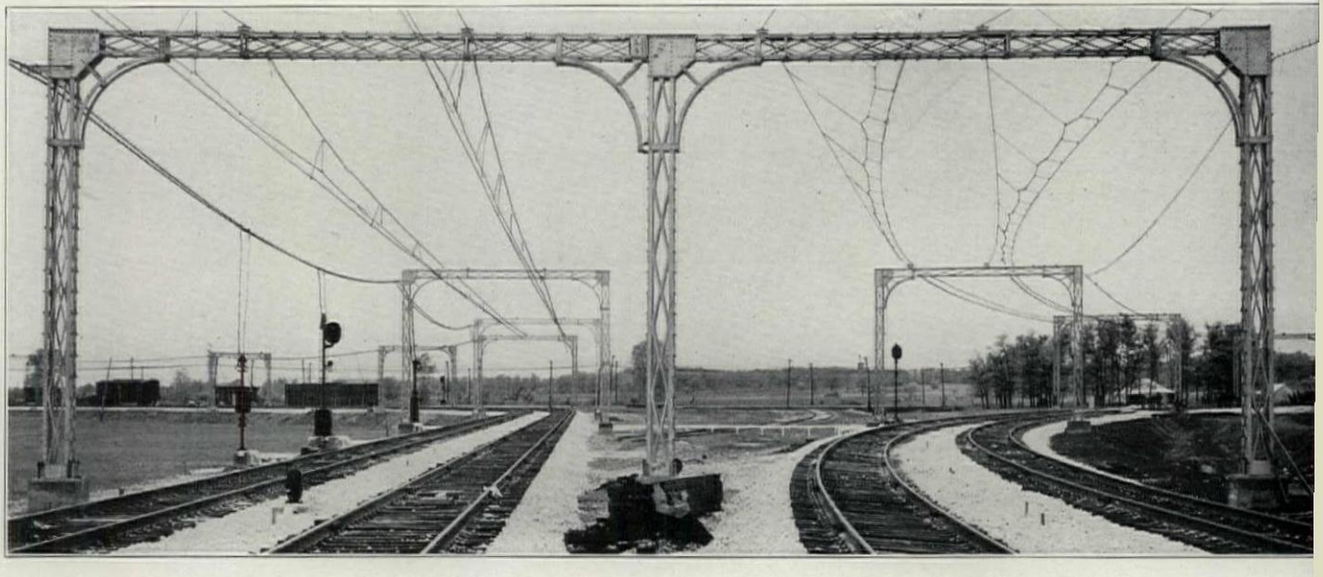
Bates-Truss joists in concrete construction St. Louis Mo.

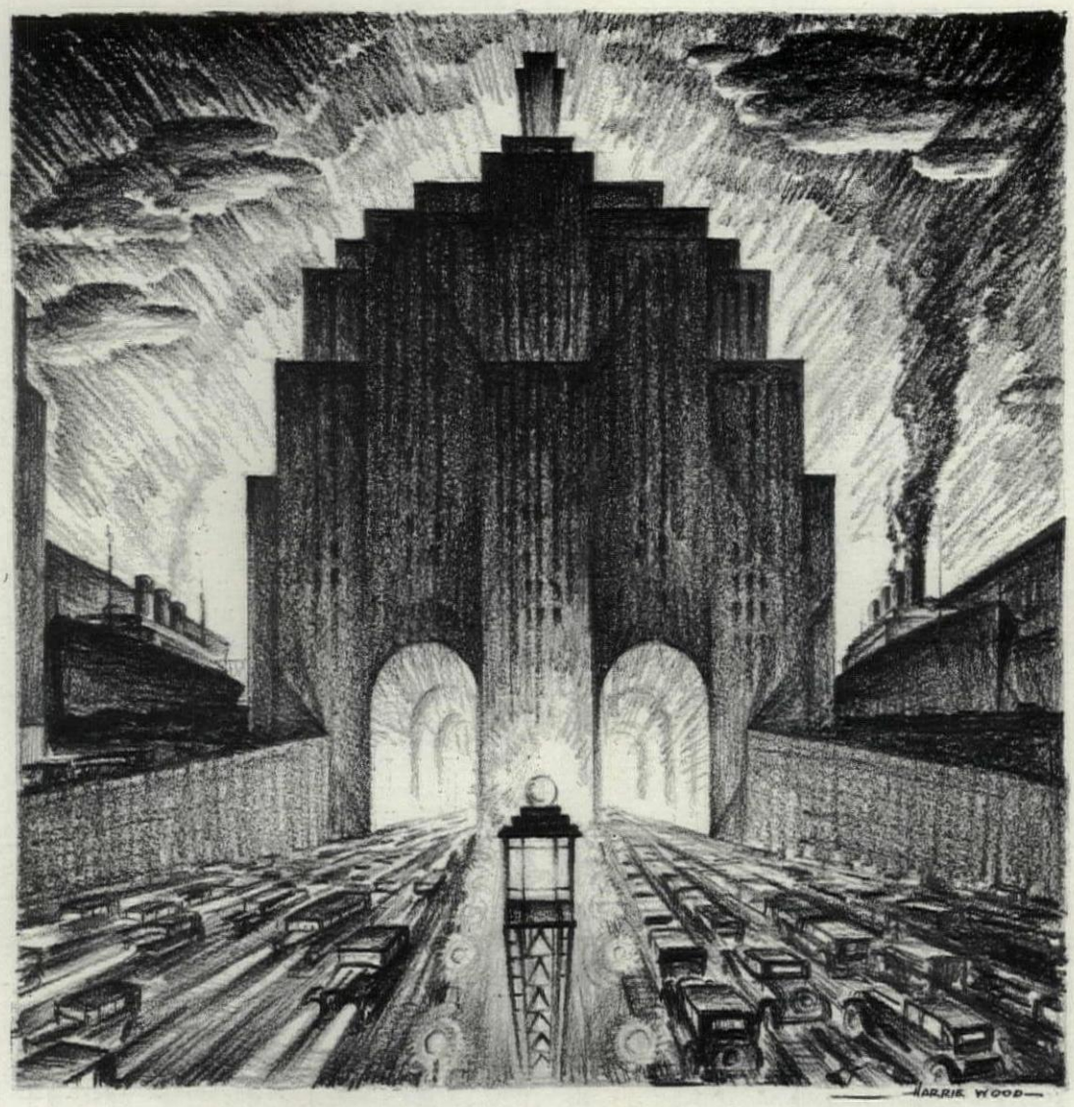
One-piece Dependability!

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

BEST Bates Expanded Steel Truss Co.

EAST CHICAGO, IND.

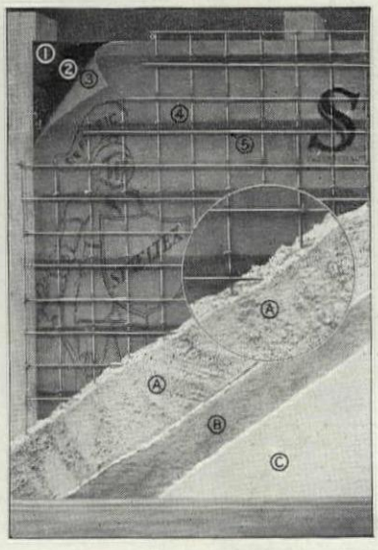




Like concrete—today plaster is reinforced

Years of experience in the manufacture of reinforcing for concrete has developed a product that brings the tested reinforcing principle to plaster construction. Replacing lath, **STEELTEX** builds into plaster a network of fabricated steel—completely embedded.

More than this—the specially processed **STEELTEX** backing insulates, damp-proofs, deadens sound, and assures automatic "back-plastering." We invite your attention to the sectional illustration. Send the coupon for complete information.



Section showing STEELTEX and how it is used

① Waterproof backing. ② Waterproof compound. ③ Second tough backing. ④ Furring device. ⑤ Rust-proofed steel reinforcing fabric. **A.** Scratch coat of plaster. **B.** Straightening coat. **C.** Finishing coat.

National Steel Fabric Company

DIVISION OF Pittsburgh Steel Co.

604 Union Trust Bldg. Pittsburgh, Penna.

The world's largest manufacturers of welded steel fabric for reinforcing concrete construction of all kinds.

National Steel Fabric Company,
604 Union Trust Bldg., Pittsburgh, Pa.

Please send me without charge a copy of *Better Walls for Better Homes.*

Name_____

Street_____

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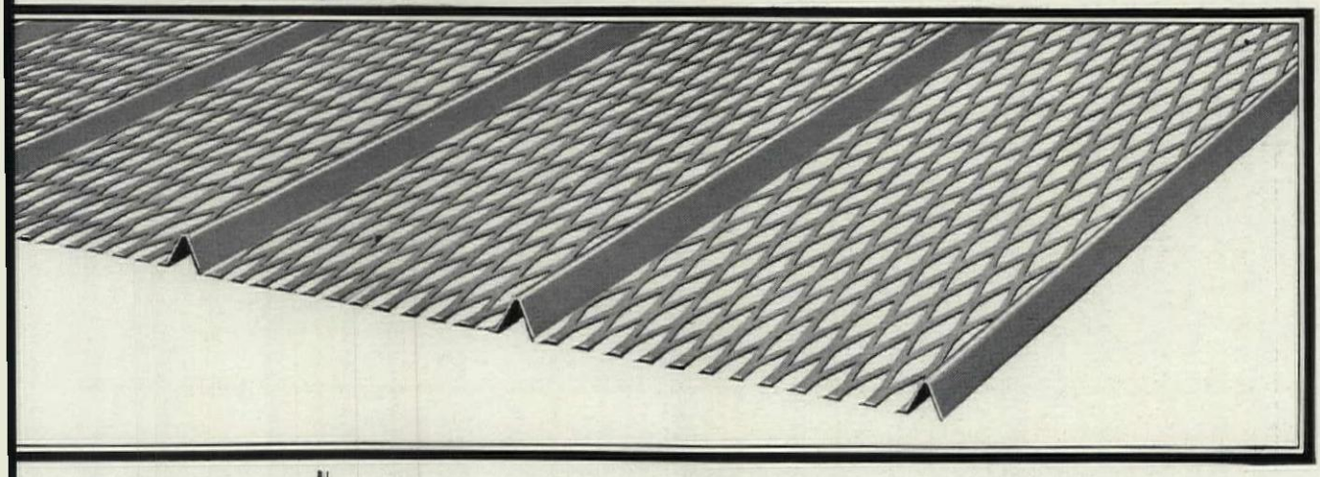
Providing New Strength, Beauty and Economy In Interior Construction



THE COMPLETE KALMAN LINE

For Buildings

Rib Lath
Diamond Lath
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Wing Corner Bead
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Base Bead
Picture Moulding
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Metal Trim
Channels
Dome Dampers
Coal Chute Doors
Ash Pit Doors
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Wire Fabric
Sleeper Anchors
Inserts
Screed Chairs
High Chairs
Beam Bolsters
Slab Spacers
Column Spirals
Corrugated Bars
Removable Steel Tile
Permanent Steel Tile
Column Forms

THIS new 3/8" Rib Kalmanlath lends new strength, new beauty and new economy to interior construction.

Strength because it acts as reinforcing. The new mesh gives a perfect key to plaster. Notice the illustration which shows the flat strands of the mesh. This mesh imbeds itself completely in the plaster.

It lends permanent beauty to interior construction because of its new perfect keying and plaster reinforcing qualities. These qualities preserve the beauty of the architectural finish.

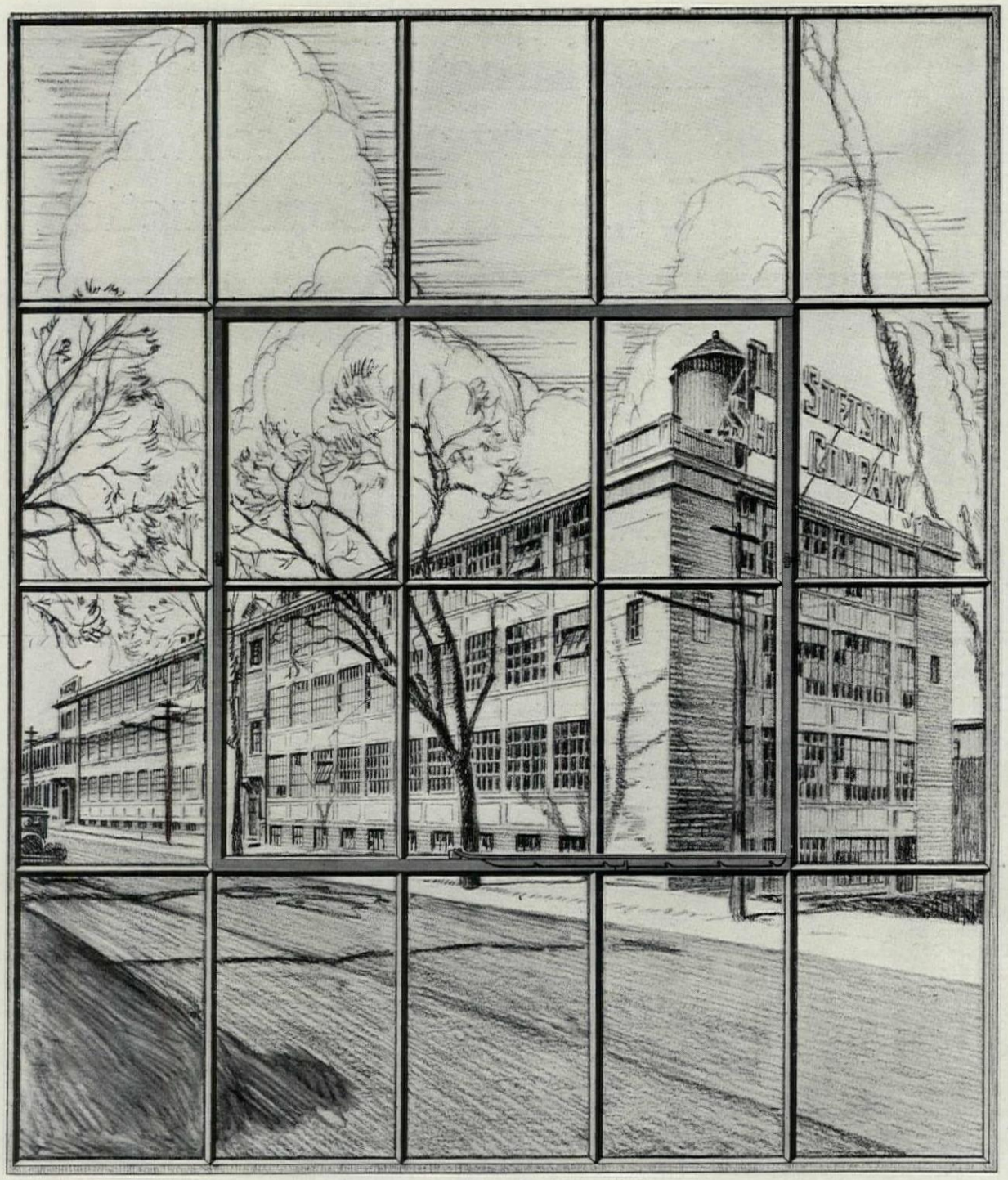
In addition it provides a new means of economy because it is easily and accurately installed. It makes possible faster work both in the lathing and plastering—thereby giving the contractor a lower cost on which to base his bid.

KALMAN STEEL COMPANY

Plants or Offices at

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

KALMANLATH



LUPTON Pivoted Windows, accepted for many years as the standard steel windows for every type of industrial building, provide natural lighting and ventilation at lowest cost. Rigidly built of rolled steel sections, their easy operation, large glass space and durability give them high investment value. When specified, these windows can be furnished with Underwriters' Label. Consult Lupton on your window problems.

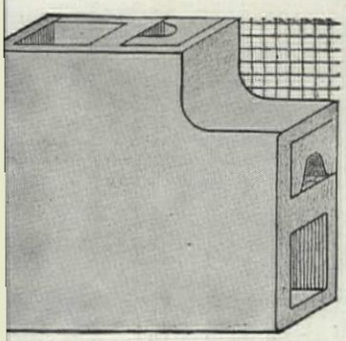
DAVID LUPTON'S SONS CO. 2207 E. Allegheny Ave., Philadelphia

Lupton STEEL Windows

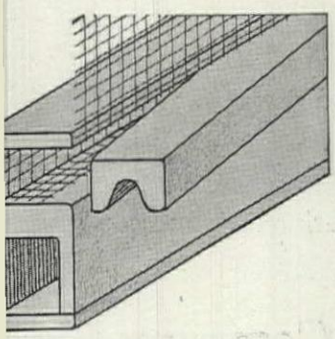
ORANGE SCREENS

MAYFLOWER PLYMOUTH HOTEL
NEW YORK
Emory Roth, *Architect*
Henry S. Lion, *Associate Archt.*
Joseph E. Gilbert, *Builder*

This residential hotel is screened with Orange Aluminum Frame Screens. Light frame means easy removal in the fall. Thin frame means compact storage



lded corners are stronger and neater than the style reinforced and riveted corners. Firm ded corners make the whole frame into one piece.



il section of extruded Aluminum Frame with screen in place showing lock moulding which, when ped into place, holds screen cloth in vice like grip.

Orange ALUMINUM FRAME *Screens*

These aluminum frame screens with their perfect welded corners have the tensile strength and stiffness of structural steel. Even under a severe "wrack test" neither fracture nor distortion occurred at the corners.

. . . . . .

Advantages of Aluminum Frames:

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

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

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

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

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

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

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

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

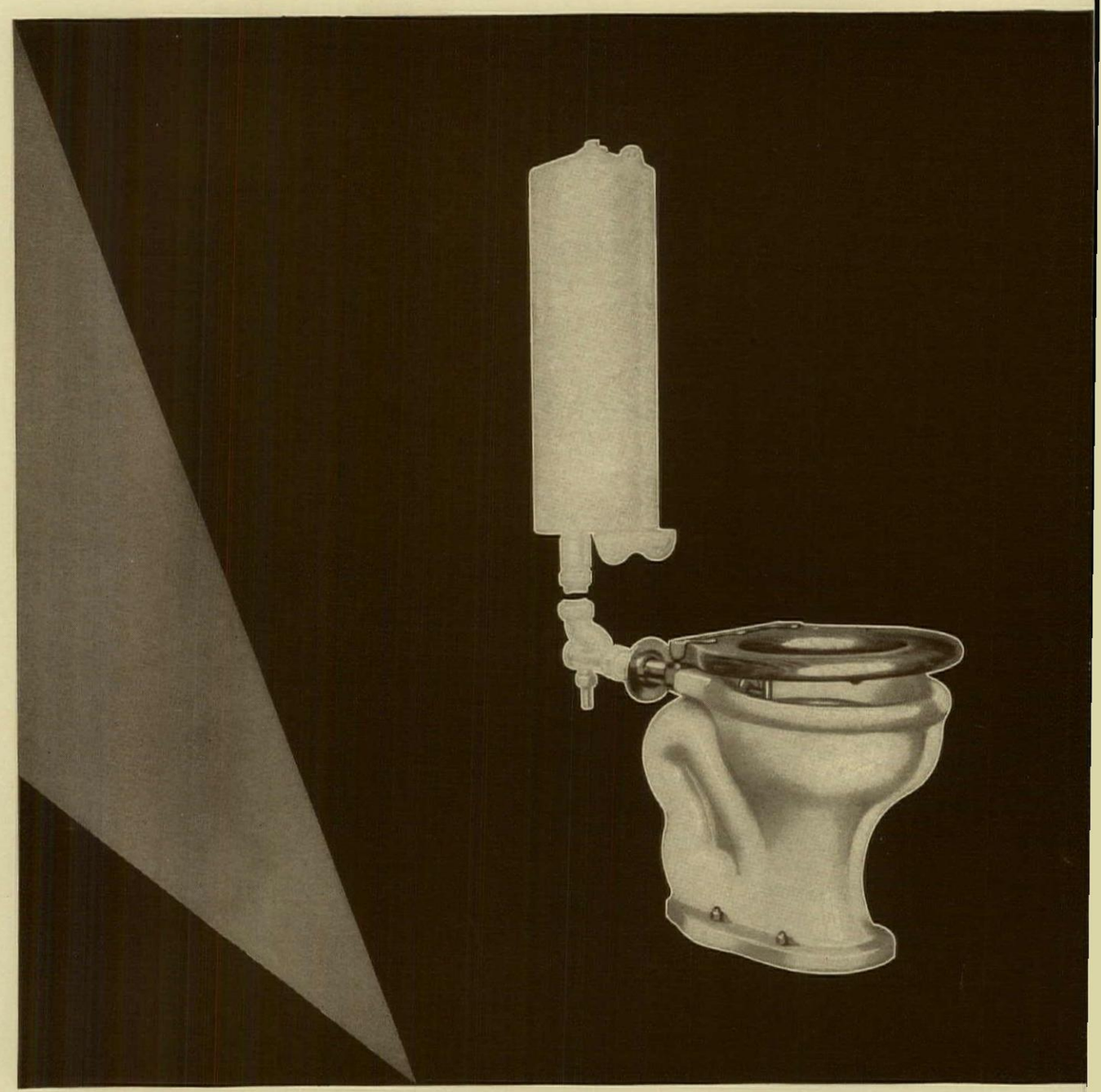
Service and Dependability

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

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

ORANGE SCREEN COMPANY

Maplewood . . . . . New Jersey



Record No. 101
1902 — 29 Clow Automatics installed. 1928 — after 26 years of school service, Automatics look ready for as many more. *High School, Rock Island, Illinois.*

Never, Never, *Never* . . .

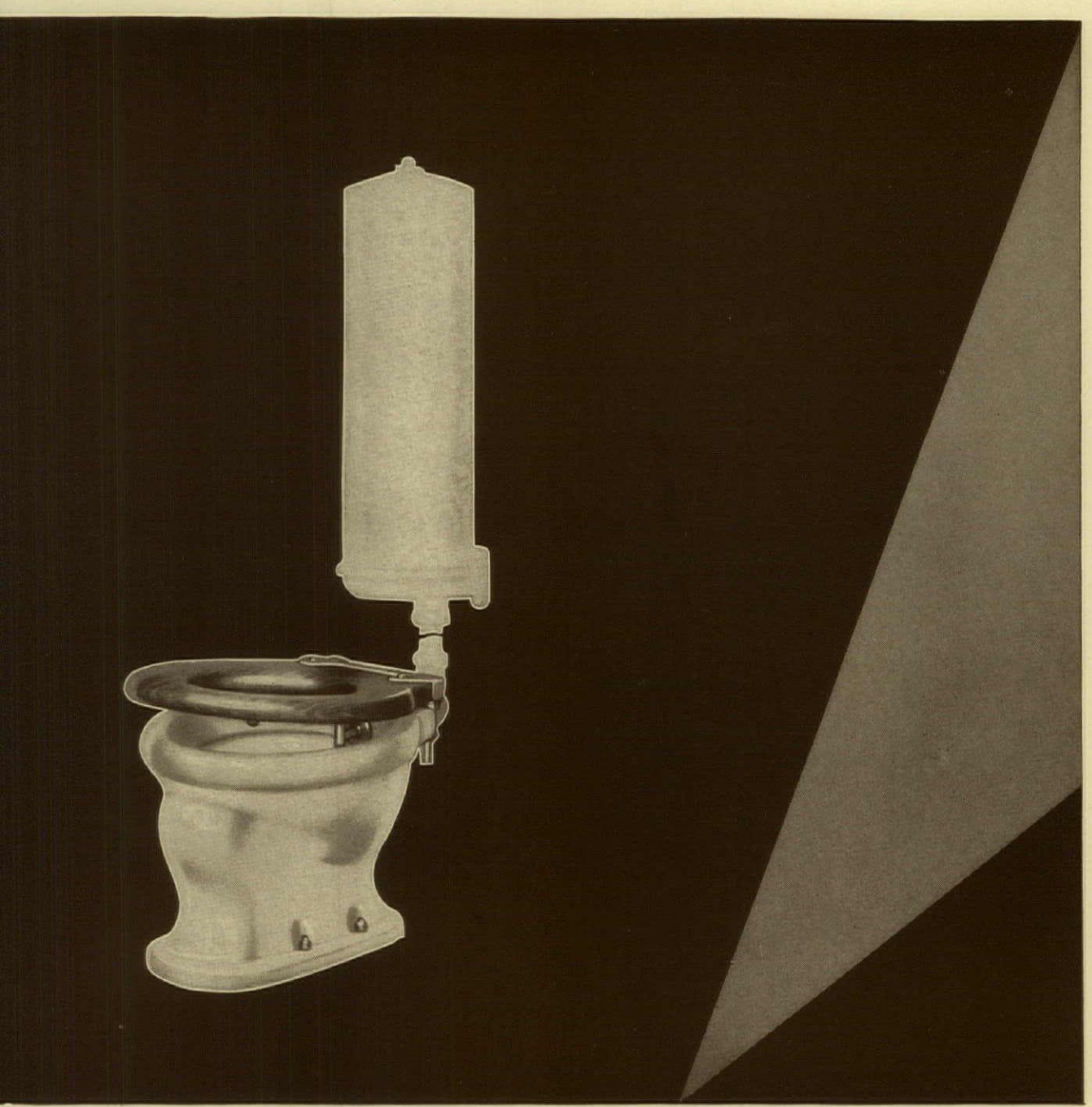
No one, *no one* can use a Clow Madden Automatic and let it stand unflushed. Clow Madden Automatics flush themselves . . . more *swiftly* than human hands can operate . . . more *surely* than human minds can function.

With Clow Madden Automatics, sanitation does not wait on the hurried workman, the play-thoughtful child, the heedless transient closet user.

Swiftly, surely, all residue is whisked away in an engulfing torrent of water. Bad odors, flies, lice

CLOW MADDEN

Forty-Eight Styles, Heights and Types to Meet Your Requirements



Will They Stand Unflushed

germs, can't exist in Clow Madden Automatics. A simple valve . . . a closed top tank . . . a bowl with no eddy or backwash hollows . . . these insure a perfect flush each time the seat is used.

One word more . . . the Clow Plumbing Booklet tells how toilet rooms are kept sanitary, and how sanitation costs are cut by smaller water, repair and replacement bills. (Read records No. 101 and No. 102.) Send for it today.

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

Record No. 102
1904 — 24 Clow Automatics installed. 1928 — repair bill after 24 years is $5.00, or less than 1c per closet per year. *Bingham School, Lansing, Michigan.*

AUTOMATIC

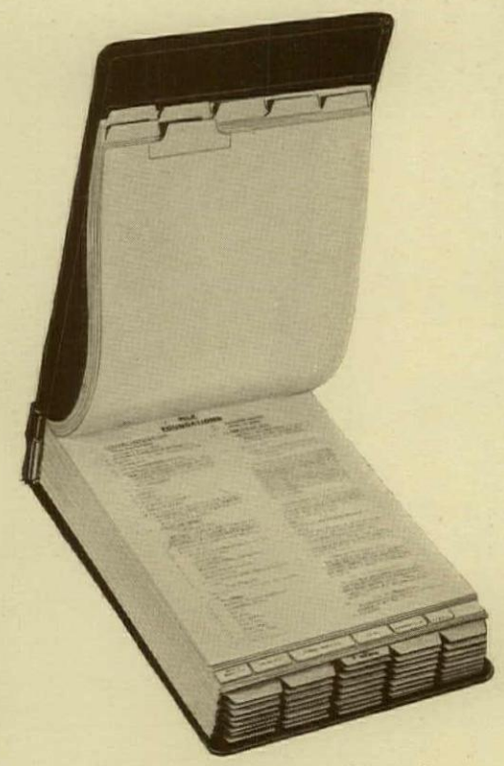
Forty-Eight Styles, Heights and Types to Meet Your Requirements

Specification writers will find work easier —effective July 1st

The news has leaked out about Stevens' Master Specifications. Architects and Engineers from many cities have written us to find out when they can get a complete copy. One prominent Architect who saw only the manuscript offered us a thousand dollar fee for the use of it so he could write, quickly and correctly, the specifications for a four million dollar job he had just secured. Other Architects, hearing this, also want to "borrow" the manuscript. Hence this advertisement.

What it is

A leather bound manual containing an exhaustive compilation of open-competitive master specifications for every type of building, every detail of construction. Compiled and edited by Frank B. Stevens Jr. who has specified for over $60,000,000 worth of construction. Every paragraph thoroughly tested and approved by eminent specialists.



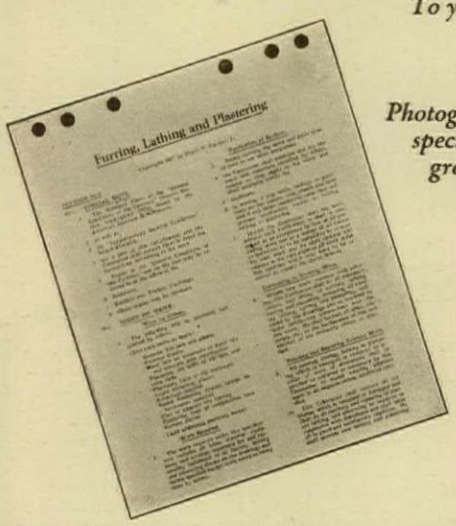
To you—with our compliments!

Why you will use it

No more thumbing through file for printed matter. No need to consult A. I. A. folder data. Simply mark certain paragraphs for typist to copy and the job is done. And following the model specifications under each heading—a limited number of selected manufacturers' data sheets—so you can name the exact product or material you want used.

Who will get it

This *first year only* with our compliments one copy to each firm of licensed, recognized Architects or Engineers. (Next year $7.50.) A suggestion: To make *sure* the right man in *your* office receives your copy, fill in and mail the coupon below. No obligation whatsoever.



Photograph of a typical specification page, greatly reduced

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Artificial Stone
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INCORPORATED

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Attention Mr. Graham

The right man in our office to send the book to is

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Selected List of Manufacturers' Publications

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

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

ACOUSTICS

R. Guastavino Co., 40 Court St., Boston
Akoustolith Plaster. Brochure, 6 pp., 10 x 12½ ins. Important data on a valuable material.

U. S. Gypsum Co., 205 W. Monroe St., Chicago, Ill.
A Scientific Solution of an Old Architectural Problem. Folder 6 pp., 8½ x 11 in. Describes Sabinite Acoustical Plaster.

ASH HOISTS—ELECTRIC AND HAND POWER

Gillis & Geohegan, 535 West Broadway, New York, N. Y.
General Catalog. 8½ x 11 in. 20 pp. Fully illustrated. Contains specifications in two forms (with manufacturers' name and without). Detail ¼ in. scale for each telescopic model and special material-handling section.
G. & G. Telescopic Hoist. Brochure, 24 pp., 8½ x 11 ins. Illustrated. Electric and hand power models; watertight sidewalk doors; automatic opening, closing, and locking devices.

BASEMENT WINDOWS

Genfire Steel Company, Youngstown, Ohio.
Architectural Details. Booklet, 62 pp., 8½ x 11 ins. Details on steel windows.

Truscon Steel Co., Youngstown, Ohio.
Truscon Copper-Steel Basement Windows. Booklet, 8 pp., 8½ x 11 in. Illustrated with installation details. Specifications and construction details.

BATHROOM FITTINGS

A. P. W. Paper Co., Albany, N. Y.
Onliwon for Fine Buildings. Folder, 8 pp. 3¾ x 6 in. Illustrated. Deals with toilet paper fittings of metal and porcelain.
Architects' File Card. 8½ x 11 in. Illustrated. Filing card on toilet paper and paper towel cabinets.
A Towel Built for Its Job. Booklet, 8 pp. 4¼ x 9⅝ in. Illustrated. Paper Towel System and Cabinets.
Cabinets and Fixtures. Booklet, 31 pp. 5¾ x 4¾ in. Illustrated. Catalog and price list of fixtures and cabinets.

BRICK

American Face Brick Association, 1751 Peoples Life Building, Chicago, Ill.
Brickwork in Italy. 298 pages, size 7½ x 10½ in., an attractive and useful volume on the history and use of brick in Italy from ancient to modern times, profusely illustrated with 69 line drawings, 300 half-tones, and 20 colored plates with a map of modern and XII century Italy. Bound in linen, will be sent postpaid upon receipt of $6.00. Half Morocco, $7.00.
Industrial Buildings and Housing. Bound Volume, 112 pp. 8½ x 11 in. Profusely illustrated. Deals with the planning of factories and employes' housing in detail. Suggestions are given for interior arrangements, including restaurants and rest rooms. Price $2.

Common Brick Mfrs. Assn. of America, 2134 Guarantee Title Bldg., Cleveland.
Brick; How to Build and Estimate. Brochure, 96 pp., 8½ x 11 ins. Illustrated. Complete data on use of brick.
The Heart of the Home. Booklet, 24 pp., 8½ x 11 ins. Illustrated. Price 25 cents. Deals with construction of fireplaces and chimneys.
Skintled Brickwork. Brochure, 15 pp., 8½ x 11 ins. Illustrated. Tells how to secure interesting effects with common brick.
Building Economy. Monthly magazine, 22 pp., 8½ x 11 ins. Illustrated. $1 per year, 10 cents a copy. For architects, builders and contractors.

BUILDING, STEEL PRODUCTS FOR

Truscon Steel Company, Youngstown, Ohio.
Truscon Data Book. Catalog. 3½ x 6 in. 128 pp. Illustrated. Contains complete information with illustrations on Tuscon reinforcing steel, steel windows, metal lath, standard buildings, concrete inserts, steel joists, pressed stamping and chemical products.

CEMENT

Carney Company, The, Mankato, Minn.
What Twelve Men Said About Carney. Booklet. 8½ x 11 ins., Illustrated. Opinions of well known architects and builders of Carney Cement used for mortar.

Cement Gun Company, Inc., Allentown, Pa.
Gunite Bulletins. Sheet 6 x 9 in. Illustrated. Bulletins on adaptability of "Gunite," a sand and cement product, to construction work.

Kosmos Portland Cement Company, Louisville, Ky.
Kosmotar for Enduring Masonry. Folder, 6 pp., 3½ x 6½ in. Data on strength and working qualities of Kosmortar.
Kosmortar, the Mortar for Cold Weather. Folder, 4 pp., 3⅜ x 6½ in. Tells why Kosmortar should be used in cold weather.

Lawrence Cement Co., New York, Boston and Philadelphia.
Dragon Super Cement. Booklet, 20 pp., 8½ x 11 ins. Illustrated. Data on a vaduable waterproof material.

Louisville Cement Co., 315 Guthrie St., Louisville, Ky.
BRIXMENT for Perfect Mortar. Self-filing handbook 8½ x 11 inches. 16 pp. Illustrated. Contains complete technical description of BRIXMENT for brick, tile and stone masonry, specifications, data and tests.

North American Cement Corporation, 285 Madison Ave., New York.
The Cal Boon. Brochure. 32 p. 6 x 9 ins. Illustrated. Use of Cal in Portland Cement mixtures.

CEMENT—Continued

Pennsylvania-Dixie Cement Corp'n., 131 East 46th St., New York.
Celluloid Computing Scale for Concrete and Lumber, 4⅝ x 2½ ins. Useful for securing accurate computations of aggregates and cement; also for measuring lumber of different sizes.

CONCRETE BUILDING MATERIALS

Celite Products Company, Chicago, New York, Los Angeles. Designing Concrete for Workability as Well as Strength. Brochure. 8 pp. Illustrated. Data on an important material for drying concrete.
Better Concrete; Engineering Service Bulletin X-325. Booklet, 16 pp., 8½ x 11 ins. Illustrated. On use of Celite to secure workability in concrete, to prevent segregation and to secure water-tightness.
Economic Value of Admixtures. Booklet, 32 pp., 6⅛ x 9⅛ ins. Reprint of papers by J. C. Pearson and Frank A. Hitchcock before 1924 American Concrete Institute.

Concrete Surface Corporation, 342 Madison Ave., New York.
Bonding Surfaces on Concrete. Booklet, 12 pp., 8 x 11 in., illustrated. Deals with an important detail of building.

Dovetail Anchor Slot Co., 149 West Ohio St., Chicago.
Dovetail Masonry Anchoring System. Folder, 4 pp., 8½ x 11 ins. Illustrated. Data on a system of anchoring masonry to concrete.

National Building Units Corporation, 1600 Arch St., Philadelphia.
Durability and Utility of Straub Cinder Building Blocks. Brochure, 14 pp., 8 x 11 ins. Report on this material by Pittsburgh Testing Laboratories.
Sound Absorption of Cinder Concrete Building Units. Booklet. 8 pp., 8 x 11 ins. Illustrated. Results of tests of absorption and transmission of sound through Straub building blocks.
Philadelphia. Cinder Concrete Building Units. Brochure, 36 pp., 8¼ x 10¾ ins. Illustrated. Full data on an important building material.

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

CONCRETE COLORINGS

The Master Builders Co., 7016 Euclid Ave., Cleveland.
Color Mix, Colored Hardened Concrete Floors (Integral). Brochure. 16 pp. 8½ x 11 in. Illustrated. Data on coloring for floors.
Dychrome, Concrete Surface Hardener in Colors. Folder. 4 pp. 8 x 11 in. Illustrated. Data on a new treatment.

CONSTRUCTION, FIREPROOF

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

National Fire Proofing Co., 250 Federal St., Pittsburgh, Pa.
Standard Fire Proofing Bulletin 171. 8½ x 11 in. 32 pp. Illustrated. A treatise on fireproof floor construction.

Northwestern Expended Metal Co., 1234 Old Colony Building, Chicago, Ill.
Northwestern Expanded Metal Products. Booklet. 8½ x 10¾ in. 16 pp. Fully illustrated, and describes different products of this company, such as Kno-burn metal lath, 20th Century Corrugated. Plaster-Sava and Longspan lath channels, etc.
A. I. A. Sample Book. Bound volume, 8½ x 11 ins., contains actual samples of several materials and complete data regarding their use.

DAMPPROOFING

Philip Carey Co., Lockland, Cincinnati, Ohio.
Architects' Specifications for Carey Built-Up Roofing. Booklet. 8 x 10¾ in. 24 pp. Illustrated. Complete data to aid in specifying the different types of built-up roofing to suit the kind of roof construction to be covered.
Carey Built-Up Roofing for Modern School Buildings. Booklet 8 x 10¾ in. 32 pp. Illustrated. A study of school buildings of a number of different kinds and the roofing materials adapted for each.

Genfire Steel Company, Youngstown, Ohio.
Waterproofing Handbook. Booklet. 8½ x 11 in. 72 pp. Illustrated. Thoroughly covers subject of waterproofing concrete, wood and steel preservatives, dusting and hardening concrete floors, and accelerating the setting of concrete. Free distribution.

The Master Builders Co., 7016 Euclid Ave., Cleveland.
Waterproofing and Damp Proofing Specification Manual Booklet. 18 pp. 8½ x 11 in. Deals with methods and materials used.
Waterproofing and Damp Proofing. File. 36 pp. Complete descriptions and detailed specifications for materials used in building with concrete.

Sonneborn Sons, Inc., L., 116 Fifth Ave., New York.
Specification Sheet, 8½ x 11 in. Descriptions and specifications of compounds for dampproofing interior and exterior surfaces.

The Vortex Mfg. Co., Cleveland, Ohio.
Par-Lock Specification "Forms A and B" for dampproofing and plaster key over concrete and masonry surfaces.
Par-Lock Specification "Form J" for dampproofing tile wall surfaces that are to be plastered.
Par-Lock Dampproofing. Specification Forms C, F, I and J. Sheets 8½ x 11 ins. Data on gun-applied asphalt dampproofing for floors and walls.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 179*

DOORS AND TRIM, METAL

The American Brass Company, Waterbury, Conn.

Anaconda Architectural Bronze Extruded Shapes. Brochure, 180 pp., 8½ x 11 in., illustrating and describing more than 2,000 standard bronze shapes of cornices, jamb casings, mouldings, etc.

Richards-Wilcox Mfg. Co., Aurora, Ill.

Fire-Doors and Hardware, Booklet. 8½ x 11 in. 64 pp. Illustrated. Describes entire line of tin-clad and corrugated fire doors, complete with automatic closers, track hangers and all the latest equipment—all approved and labeled by Underwriters' Laboratories.

DUMBWAITERS

Sedgwick Machine Works, 151 West 15th St., New York.

Catalog and Service Sheets. Standard specifications, plans and prices for various types, etc. 4¼ x 8¼ in. 60 pp. Illustrated.

Catalog and pamphlets, 8½ x 11 in. Illustrated. Valuable data on dumbwaiters.

ELECTRICAL EQUIPMENT

Benjamin Electric Mfg. Co., 120 So. Sarigamore St., Chicago.

Reference Wall Chart, 22 x 28½ ins. "Enables one to select at a glance the right type of reflector or other lighting equipment."

Benjamin-Starrett Panelboards and Steel Cabinets. Booklet, 80 pp. 8½ x 10½ ins. Full data on these details for light and power.

Benjamin-Starrett Panelboards for Light and Power. Booklet, 80 pp., 8½ x 11 ins. Illustrated. Full data on company's line of panelboards, steel cabinets, etc.

General Electric Co., Schenectady, N. Y.

"Electrical Specification Data for Architects. Brochure, 36 pp., 8 x 10½ ins., illustrated. Data regarding G. E. wiring materials and their use.

"The House of a Hundred Comforts." Booklet, 40 pp., 8 x 10½ ins. Illustrated. Dwells on importance of adequate wiring.

Pick & Company, Albert, 208 West Randolph St., Chicago, Ill.

School Cafeterias. Booklet. 9 x 6 in. Illustrated. The design and equipment of school cafeterias with photographs of installation and plans for standardized outfits.

Signal Engineering & Mfg. Co., 154 W. 14th St., New York.

Signal Call Code System. Booklet, 16 pp., 8½ x 10 ins. Illustrated. Important telephone accessories.

Fire Alarm Systems,—Bulletin A-35. 12 pp., 8½ x 9½ ins. Illustrated. Data on fire alarn equipment.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Electric Power for Buildings. Brochure, 14 pp., 8½ x 11 ins. Illustrated. A publication important to architects and engineers.

Variable-Voltage Central Systems as applied to Electric Elevators. Booklet, 13 pp., 8½ x 11 ins. Illustrated. Deals with an important detail of elevator mechanism.

Modern Electrical Equipment for Buildings. Booklet, 8½ x 11 ins. Illustrated. Lists many useful appliances.

Electrical Equipment for Heating and Ventilating Systems. Booklet, 24 pp., 8½ x 11 ins. Illustrated. This is "Motor Application Circular 7379."

Westinghouse Panelboards and Cabinets (Catalog 42-A). Booklet, 32 pp., 8½ x 11 ins. Illustrated. Important data on these details of equipment.

Beauty; Power; Silence; Westinghouse Fans (Dealer Catalog 45). Brochure, 16 pp., 8½ x 11 ins. Illustrated. Valuable information on fans and their uses.

Electric Range Book for Architects (A. I. A. Standard Classification 31 G-4). Booklet, 24 pp., 8½ x 11 ins. Illustrated. Cooking apparatus for buildings of various types.

Westinghouse Commercial Cooking Equipment (Catalog 280). Booklet, 32 pp., 8½ x 11 ins. Illustrated. Equipment for cooking on a large scale.

Electric Appliances (Catalog 44-A). 32 pp., 8½ x 11 ins. Deals with accessories for home use.

ELEVATORS

Otis Elevator Company, 260 Eleventh Ave., New York, N. Y.

Otis Push Button Controlled Elevators. Descriptive leaflets. 8½ x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.

Otis Geared and Gearless Traction Elevators of All Types. Descriptive leaflets. 8½ x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.

Escalators. Booklet. 8½ x 11 ins. 22 pp. Illustrated. Describes use of escalators in subways, department stores, theaters and industrial buildings. Also includes elevators and dock elevators.

Richards-Wilcox Mfg. Co., Aurora, Ill.

Elevators. Booklet. 8½ x 11 ins. 24 pp. Illustrated. Describes complete line of "Ideal" elevator door hardware and checking devices, also automatic safety devices.

Sedgwick Machine Works, 151 West 15th St., New York, N. Y. ..

Catalog and descriptive pamphlets, 4¼ x 8¼ ins. 70 pp. Illustrated. Descriptive pamphlets on hand power freight elevators, sidewalk elevators, automobile elevators, etc.

Catalog and pamphlets. 8½ x 11 ins. Illustrated. Important data on different types of elevators.

Concrete Engineering Co., Omaha, Nebr.

"Handbook of Fireproof Construction." Booklet, 53 pp., 8½ x 11 in. Valuable work on methods of fireproofing.

FIREPROOFING—See also Construction, Fireproof

Genfire Steel Company, Youngstown, Ohio.

Fireproofing Handbook, 8½ x 11 in. 64 pp. Illustrated. Gives methods of construction, specifications, data on Herringbone metal lath, steel tile, Trussit solid partitions, steel, lumber, self-centering formless concrete construction.

North Western Expanded Metal Co., 407 South Dearborn St., Chicago.

A. I. A. Sample Book. Bound volume, 8½ x 11 ins. Contains actual samples of several materials and complete data regarding their use.

FLOOR HARDENERS (CHEMICAL)

Master Builders Co., Cleveland Ohio.

Concrete Floor Treatment. File, 50 pp. Data on Securing hardened dustproof concrete.

Concrete Floor Treatments—Specification Manual. Booklet. 23 pp. 8½ x 11 in. Illustrated. Valuable work on an important subject.

Sonneborn Sons, Inc., L., 116 Fifth Ave., New York, N. Y.

Lapidolith, the liquid chemical hardener. Complete sets of specifications for every building type in which concrete floors are used, with descriptions and results of tests.

FLOORS—STRUCTURAL

Truscon Steel Co., Youngstown, Ohio.

Truscon Locktyle. Booklet, 8½ x 11 in., 8 pp. Illustrations of material and showing methods of application.

Truscon Floretyle Construction. Booklet, 8½ x 11 in., 16 pp. Illustrations of actual jobs under construction. Lists of properties and information on proper construction. Proper method of handling and tables of safe loads.

FLOORING

Armstrong Cork & Insulation Co., Pittsburgh, Pa.

Armstrong's Cork Tile Floors. Booklet, 7¾ x 10½ in. 30 pp. An illustrated work on cork flooring.

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

Armstrong Cork Co. (Linoleum Division), Lancaster, Pa.

Armstrong's Linoleum Floors. Catalog. 8½ x 11 in. 40 pp. Color plates. A technical treatise on linoleum, including table of gauges and weights and specifications for installing linoleum floors.

Armstrong's Linoleum Pattern Book, 1927. Catalog. 3½ x 6 in. 272 pp. Color Plates. Reproduction in color of all patterns of linoleum and cork carpet in the Armstrong line.

Quality Sample Book. 3½ x 5¾ in. Showing all gauges and thicknesses in the Armstrong line of linoleums.

Linoleum Layer's Handbook. 5 x 7 in. 32 pp. Instructions for linoleum layers and others interested in learning most satisfactory methods of laying and taking care of linoleum.

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

Barber Asphalt Co., Philadelphia.

Specifications for Applying Genasco Asphalt Mastic. Booklet. 8 x 10½ in. Directions for using Asphalt Mastic for flooring.

Blabon Company, Geo. W., Nicetown, Philadelphia, Pa.

Planning the Color Schemes for Your Home. Brochure illustrated in color; 36 pp., 7½ x 10½ in. Gives excellent suggestions for use of color in flooring for houses and apartments.

Handy Quality Sample Folder of Linoleums. Gives actual samples of "Battleship Linoleum," cork carpet, "Feltex," etc.

Blabon's Linoleum. Booklet illustrated in color; 128 pp., 3½ x 8½ in. Gives patterns of a large number of linoleums.

Blabon's Plain Linoleum and Cork Carpet. Gives quality samples, 3 x 6 in. of various types of floor coverings.

Bonded Floors Company, Inc., 1421 Chestnut St., Philadelphia, Pa.

A series of booklets, with full color inserts showing standard colors and designs. Each booklet describes a resilient floor material as follows:

Battleship Linoleum. Explains the advantages and uses of this durable, economical material.

Marble-ized (Cork Composition) Tile. Complete information on cork-composition marble-ized tile and the many artistic effects obtainable with it.

Treadlite (Cork Composition) Tile. Shows a variety of colors and patterns of this adaptable cork composition flooring.

Natural Cork Tile. Description and color plates of this superquiet, resilient floor.

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

Carter Bloxonend Flooring Co., Keith & Perry Bldg., Kansas City, Mo.

Bloxonend Flooring. Booklet 3¼ x 6¼ in. 20 pp. Illustrated. Describes uses and adaptability of Bloxonend Flooring to concrete, wood or steel construction, and advantages over loose wood blocks.

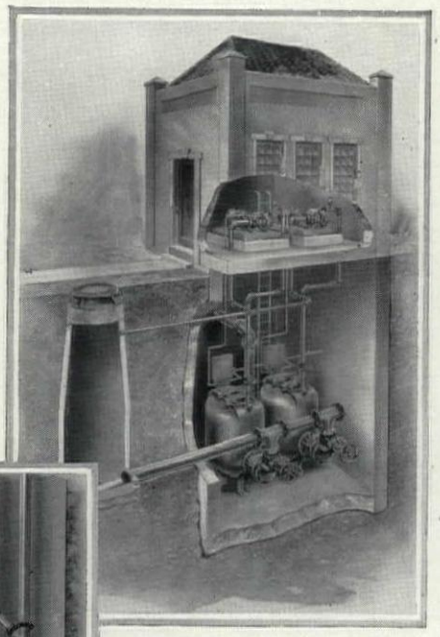
File Folder, 9⅜ x 11¾ in. For use in connection with A. I. A. system of filing. Contains detailed information on Bloxonend Flooring in condensed, loose-leaf form for specification writer and drafting room. Literature embodied in folder includes standard Specification Sheet covering the use of Bloxonend in general industrial service and Supplementary Specification Sheet No. 1, which gives detailed description and explanation of an approved method for installing Bloxonend in gymnasiums, armories, drill rooms and similar locations where maximum resiliency is required.

No intricate air valves in these sewage plants

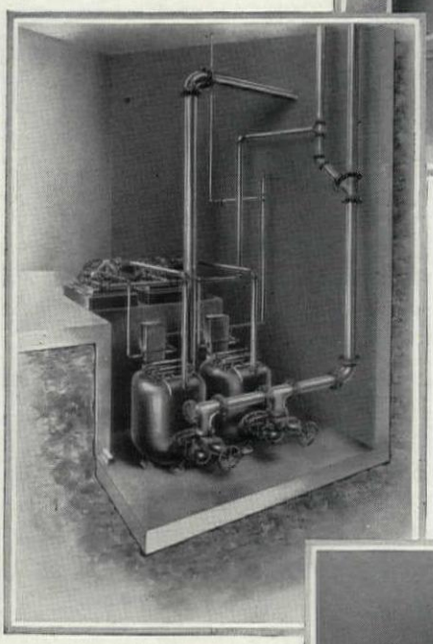
THROUGHOUT the Jennings Sewage Ejector you will notice a simplicity and sturdiness in construction that make possible two outstanding advantages in pneumatic equipment of this kind—trustworthy performance, at the least cost.

Intricate air valves and similar complicated mechanisms have been avoided. There are no inaccessible parts. Nor any devices likely to get out of order and require attention.

Let us send you further details before you lay out your next sewage ejector plant.

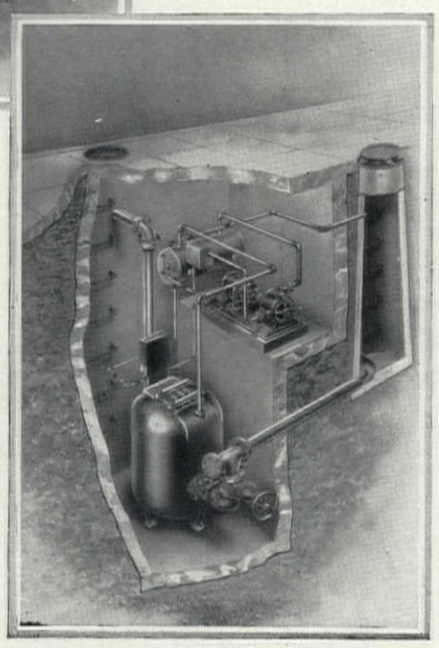


A duplex installation. Widely used in municipal work for pumping sewage from low areas into gravity sewer.



Installation for office building, apartment house, hotel or hospital. Discharge is into street sewer.

This 16-page bulletin gives specifications, capacities, dimensions, etc. Sent on request.



Underground installation for municipal work.

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

Jennings Pumps

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 180*

FLOORING—Continued

Albert Grauer & Co., 1408 Seventeenth St., Detroit, Mich.
Grauer-Watkins Red Asphalt Flooring. Folder, 4 pp., 8½ x 11 in. Data on a valuable form of flooring.

U. S. Gypsum Co., Chicago.
Pyrobar Floor Tile. Folder. 8½ x 11 in. Illustrated. Data on building floors of hollow tile and tables on floor loading.

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.

U. S. Rubber Co., 1790 Broadway, New York.
Period Adaptations for Modern Floors. Brochure. 8 x 11 in. 60 pp. Richly illustrated. A valuable work on the use of rubber tile for flooring in interiors of different historic styles.

FURNITURE

American Seating Co., 14 E. Jackson Blvd., Chicago, Ill.
Ars Ecclesiastica Booklet. 6 x 9 in. 48 pp. Illustrations of church fitments in carved wood.
Theatre Chairs. Booklet. 6 x 9 in. 48 pp. Illustrations of theater chairs.

Kensington Mfg. Company, Showrooms, 41 West 45th St., New York.
Illustrated booklet indicative of the scope, character and decorative quality of Kensington Furniture, with plan of co-operation with architects, sent on request.
Photographs and full description of hand-made furniture in all the period styles, furnished in response to a specific inquiry.

Kittinger Co., 1893 Elmwood Ave., Buffalo, N. Y.
Kittinger Club & Hotel Furniture. Booklet. 20 pp. 6¼ x 9½ ins. Illustrated. Deals with fine line of furniture for hotels, clubs, institutions, schools, etc.
Kittinger Club and Hotel Furniture. Booklet. 20 pp. 6 x 9 ins. Illustrated. Data on furniture for hotels and clubs.

McKinney Mfg. Co., Pittsburgh.
Forethought Furniture Plans. Sheets, 6¼ x 9 ins., drawn to ¼-inch scale. An ingenious device for determining furniture arrangement.

White Door Bed Company, The, 130 North Wells Street, Chicago, Ill.
Booklet. 8½ x 11 in. 20 pp. Illustrated. Describes and illustrates the use of "White" Door Bed and other space-saving devices.

GARAGES

Ramp Buildings Corporation, 21 East 40th St., New York.
Building Garages for Profitable Operation. Booklet. 8½ x 11 in. 16 pp. Illustrated. Discusses the need for modern mid-city parking garages, and describes the d'Humy Motoramp system of design, on the basis of its superior space economy and features of operating convenience. Gives cost analyses of garages of different sizes, and calculates probable earnings.
Garage Design Data. Series of informal bulletins issued in loose-leaf form, with monthly supplements.

GLASS CONSTRUCTION

Adamson Flat Glass Co., Clarksburg, W. Va.
Quality and Dependability. Folder, 2 pp., 8½ x 11 ins. Illustrated. Data in the company's product.

Libbey-Owens Sheet Glass Co., Toledo, O.
Flat Glass. Brochure, 11 pp., 5⅞ x 7¾ ins. Illustrated. History of manufacture of flat, clear, sheet glass.

Mississippi Wire Glass Co., 220 Fifth Ave., New York.
Mississippi Wire Glass. Catalog. 3⅞ x 8½ in. 32 pp. Illustrated. Covers the complete line.

HARDWARE

P. & F. Corbin, New Britain, Conn.
Early English and Colonial Hardware. Brochure, 8½ x 11 in. An important illustrated work on this type of hardware.
Locks and Builders' Hardware. Bound Volume, 486 pp., 8½ x 11 ins. An exhaustive, splendidly prepared volume.
Brochure, 61 plates, 8½ x 11 ins. Illustrated. Locks nad builders' hardware as presented in 22nd edition of Sweet's.

Cutler Mail Chute Company, Rochester, N. Y.
Cutler Mail Chute Model F. Booklet. 4 x 9¼ in. 8 pp. Illustrated.

McKinney Mfg. Co., Pittsburgh.
Forged Iron by McKinney. Booklet, 6 x 9 ins. Illustrated. Deals with an excellent line of builders' hardware.
Forged Lanterns by McKinney. Brochure, 6 x 9 ins. Illustrated. Describes a fine assortment of lanterns for various uses.

Richard-Wilcox Mfg. Co., Aurora, Ill.
Distinctive Garage Door Hardware. Booklet. 8½ x 11 in. 65 pp. Illustrated. Complete information accompanied by data and illustrations on different kinds of garage door hardware.

Russell & Erwin Mfg. Co., New Britain, Conn.
Hardware for the Home. Booklet, 24 pp., 3½ x 6 ins. Deals with residence hardware.
Door Closer Booklet. Brochure, 16 pp., 3½ x 6 ins. Data on a valuable detail. Garage Hardware Booklet, 12 pp., 3½ x 6 in. Hardware intended for garage use.
Famous Homes of New England. Series of folders on old homes and hardware in style of each.

American Blower Co., 6004 Russell Street, Detroit.
Heating and Ventilating Utilities. A binder containing a large number of valuable publications, each 8½ x 11 in., on these important subjects.

HEATING EQUIPMENT

American Radiator Company, The, 40 West 40th St., N. Y. C.
Ideal Type "A" Heat Machine. Catalog 7¾ x 10½ in. 32 pp. Illustrated in 4 colors. A brochure of high-efficiency heating apparatus for residences and commercial buildings.
Ideal Water Tube Boilers. Catalog 7¾ x 10⅝. 32 pp. Illustrated in 4 colors. Data on a complete line of Heating Boilers of the Water Tube type.
Ideal Smokeless Boilers. Catalog 7¾ x 10½ in. 32 pp. Illustrated in 4 colors. Fully explains a boiler free from the objection of causing smoke.
Ideal Boilers for Oil Burning. Catalog 5½ x 8½ in. 36 pp. Illustrated in 4 colors. Describing a line of Heating Boilers especially adapted to use with Oil Burners.
Corto—The Radiator Classic. Brochure 5½ x 8½ in. 16 pp. Illustrated. A brochure on a space-saving radiator of beauty and high efficiency.
Ideal Arcola Radiator Warmth. Brochure 6¼ x 9¼. Illustrated. Describes a central all-on-one-floor heating plant with radiators for small residences, stores, and offices.

James B. Clow & Sons, 534 S. Franklin St., Chicago.
Clow Gasteam Vented Heating System. Brochure, 24 pp., 8½ x 11 ins. Illustrated. Deals with a valuable form of heating equipment for using gas.

C. A. Dunham Company, 450 East Ohio Street, Chicago, Ill.
Dunham Radiator Trap. Bulletin 101. 8 x 11 in. 12 pp. Illustrated. Explains working of this detail of heating apparatus.
Dunham Packless Radiator Valves. Bulletin 104. 8 x 11 in. 8 pp. Illustrated. A valuable brochure on valves.
Dunham Return Heating System. Bulletin 109. 8 x 11 in. Illustrated. Covers the use of heating apparatus of this kind.
Dunham Vacuum Heating System. Bulletin 110. 8 x 11 in. 12 pp. Illustrated.
The Dunham Differential Vacuum Heating System. Bulletin 114. Brochure, 8 pp., 8 x 11 ins. Illustrated. Deals with heating for small buildings.
The Dunham Differential Vacuum Heating System. Bulletin 115. Brochure, 12 pp., 8 x 11 ins. Illustrated. Deals with heating for large buildings.

Excelso Products Corporation, 119 Clinton St., Buffalo, N. Y.
Excelso Water Heater. Booklet. 12 pp. 3 x 6 in. Illustrated. Describing the new Excelso method of generating domestic hot water in connection with heating boilers. (Firepot Coil eliminated.)

The Fulton Sylphon Company, Knoxville, Tenn.
Sylphon Temperature Regulators. Illustrated brochures, 8½ x 11 ins., dealing with general architectural and industrial applications; also specifically with applications of special instruments.
Sylphon Heating Specialties. Catalog No. 200, 192 pp., 3½ x 6¾ ins. Important data on heating.

Illinois Engineering Co., Racine Ave., at 21st St., Chicago, Ill.
Vapor Heat Bulletin 21. 8½ x 11 in. 32 pp. Illustrated. Contains new and original data on Vapor Heating. Rules for computing radiation, pipe sizes, radiator tappings. Steam table showing temperature of steam and vapor at various pressures, also description of Illinois Vapor Specialties.

S. T. Johnson Co., Oakland, Calif.
Bulletin No. 4A. Brochure, 8 pp., 8½ x 11 in. Illustrated. Data on different kinds of oil-burning apparatus.
Bulletin No. 31. Brochure, 8 pp., 8½ x 11 in. Illustrated. Deals with Johnson Rotary Burner With Full Automatic Control.

Kewanee Boiler Co., Kewanee, Ill.
Kewanee on the Job. Catalog. 8½ x 11 in. 80 pp. Illustrated. Showing installations of Kewanee boilers, water heaters, radiators, etc.
Catalog No. 78, 6 x 9 in. Illustrated. Describes Kewanee Firebox Boilers with specifications and setting plans.
Catalog No. 79. 6 x 9 in. Illustrated. Describes Kewanee power boilers and smokeless tubular boilers with specifications.

May Oil Burner Corp., Baltimore.
Adventures in Comfort. Booklet, 24 pp., 6 x 9 ins. Illustrated. Non-technical data on oil as fuel.
Taking the Quest out of the Question. Brochure, 16 pp., 6 x 9 ins. Illustrated. For home owners interested in oil as fuel.

Milwaukee Valve Co., Milwaukee.
MILVACO Vacuum & Vapor Heating System. Nine 4-p. bulletins, 8½ x 11 ins. Illustrated. Important data on heating.
MILVACO Vacuum & Vapor Heating Specialties. Nine 4-p. bulletins, 8½ x 11 ins. Illustrated. Deal with a valuable line of specialties used in heating.

Modine Mfg. Company, Racine, Wis.
Thermodine Unit Heater. Brochure, 24 pp., 8½ x 1 ins. Illustrated. Apparatus for industrial heating and drying.
Thermodine Cabinet Heater. Booklet, 12 pp., 8½ x 11 ins. Illustrated. Cabinet heaters to buildings of different kinds.

Nash Engineering Company, South Norwalk, Conn.
No. 37. Devoted to Jennings Hytor Return Line Vacuum Heating Pumps, electrically driven, and supplied in standard sizes up to 300,000 square feet equivalent direct radiation.
No. 16. Dealing with Jennings Hytor Air Line Heating Pumps.
No. 17. Describing Jennings Hytor Condensation Pumps, sizes up to 70,000 square feet equivalent direct radiation.
No. 25. Illustrating Jennings Return Line Vacuum Heating Pumps. Size M, for equivalent direct radiation up to 5,000 square feet.

National Radiator Corporation, Johnstown, Pa.
Aero Radiators; Beauty and Worth. Catalog 34. Booklet 6 x 9 in., 20 pp., describing and illustrating radiators and accessories.

Petroleum Heat & Power Co., 511 Fifth Avenue, New York.
Heating Homes the Modern Way. Booklet, 8½ x 11¾ ins. Illustrated. Data on the Petro Burner.
Residence Oil Burning Equipment. Brochure, 6 pp., 8½ x 11 ins. Illustrated. Data regarding Petro Burner in a bulletin approved by Investigating Committee of Architects and Engineers.

In Thousands of Buildings

Office Buildings, Hotels, Theatres, Hospitals and Schools, the Original Genuine Sylphon Bellows controls the temperature of service hot water, of air duct systems, of heating and ventilating of feed water and of brine cooled refrigerating systems.

In Most Industrial Plants

Sylphon Instruments find extensive application in temperature control in Textile Mills, Chemical and Leather Plants, Food and Meat Packing Plants and Laundries.

In Great Power Plants

Sylphon Instruments maintain constant temperatures of feed water to boilers, the cooling water for Diesel Engines, maintain correct temperature of fuel oils and cut off the oil supply when the atomizing pressure drops below a safe minimum.

In Homes of the People

Sylphon Damper Regulators, now factory equipment on 35 of the leading makes of boilers, afford comfort and positive fuel economy.

In Your Service let us send you complete detailed information and let our engineers assist in solving your particular problem, all without obligation to you. Just send coupon or write if you prefer.

The ORIGINAL GENUINE
SYLPHON BELLOWS

The motor element in all Sylphon Instruments is the most accurate, durable and flexible temperature control unit known to science.

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

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

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We are interested in the application of Sylphon Bellows to

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THE FULTON SYLPHON COMPANY
Sylphon
AUTOMATIC TEMPERATURE CONTROL

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 182*

HEATING EQUIPMENT—Continued

Petro Mechanical Oil Burner & Air Register. Booklet, 23 pp., 8½ x 11 ins. Illustrated. Data on industrial installations of Petro Burners.

Present Accepted Practice in Domestic Oil Burners. Folder, 4 pp., 8½ x 11 ins. Illustrated. A reprint from Heating and Ventilating Magazine.

Trane Co., The, La Crosse, Wis.

Bulletin 14. 16 pp. 8½ x 10⅝ in. Covers the complete line of Trane Heating Specialties, including Trane Bellows Traps, and Trane Bellows Packless Valves.

Bulletin 20. 24 pp., 8½ x 10⅝ in. Explains in detail the operation and construction of Trane Condensation. Vacuum, Booster, Circulating, and similar pumps.

HOSPITAL EQUIPMENT

The Frink Co., Inc., 24th St. and Tenth Ave., New York City.

Catalog 426. 7 x 10 in., 16 pp. A booklet illustrated with photographs and drawings, showing the types of light for use in hospitals, as operating table reflectors, linolite and multilite concentrators, ward reflectors, bed lights and microscopic reflectors, giving sizes and dimensions, explaining their particular fitness for special uses.

The International Nickel Company, 67 Wall St., New York, N. Y.

Hospital Applications of Monel Metal. Booklet. 8½ x 11½ in. 16 pp. Illustrated. Gives types of equipment in which Monel Metal is used, reasons for its adoption, with sources of such equipment.

The Pick-Barth Companies, Chicago and New York.

Some Thoughts About Hospital Food Service Equipment. Booklet, 21 pp., 7½ x 9¼ ins. Valuable data on an important subject.

Wilmot Castle Company, Rochester, N. Y.

Sterilizer Equipment for Hospitals. Book, 76 pp. 8½ x 11 in. Illustrated. Gives important and complete data on sterilization of utensils and water, information on dressings, etc.

Sterilizer Specifications. Brochure, 12 pp. 8½ x 11 in. Practical specifications for use of architects and contractors.

Architects' Data Sheets. Booklet, 16 pp. 8½ x 11 in. Illustrated. Information on piping, venting, valving and wiring for hospital sterilizer installations.

Hospital Sterilizing Technique. Five booklets, 8 to 16 pp. 6 x 9 in. Illustrated. Deals specifically with sterilizing instruments, dressings, utensils, water, and rubber gloves.

HOTEL EQUIPMENT

Pick & Company, Albert, 208 West Randolph Street, Chicago, Ill.

Some Thoughts on Furnishing a Hotel. Booklet, 7½ x 9 ins. Data on complete outfitting of hotels.

INCINERATORS

Kerner Incinerator Company, 715 E. Water St., Milwaukee, Wis.

Incinerators (Chimney-fed). Catalog No. 15 (Architect and Builders' Edition). Size 8½ x 11 ins. 16 pp. Illustrated. Describes principles and design of Kernerator Chimney-fed Incinerators for residences, apartments, hospitals, schools, apartment hotels, clubs and other buildings. Shows all standard models and gives general information and working data.

Sanitary Elimination of Household Waste, booklet, 4 x 9 ins. 16 pp. Illustrated. Gives complete information on the Kernerator for residences.

Garbage and Waste Disposal for Apartment Buildings, folder, 8½ x 11 ins. 8 pp. Illustrated. Describes principle and design of Kernerator-Chimney-fed Incinerator for apartments and gives list of buildings where it ahs been installed.

Sanitary Disposal of Waste in Hospitals. Booklet. 4 x 9 ins. 12 pp. Illustrated. Shows how this necessary part of hospital service is taken care of with the Gernerator. Gives list of hospitals where installed.

INSULATING LUMBER

Mason Fibre Co., 111 West Washington St., Chicago, Ill.

Booklet, 12 pp., 8½ x 11 in. Illustrated. Gives complete specifications for use of insulating lumber and details of construction involving its use.

INSULATION

Armstrong Cork & Insulation Co., Pittsburgh, Pa.

The Insulation of Roofs with Armstrong's Corkboard. Booklet. Illustrated. 7½ x 10½ in. 32 pp. Discusses means of insulating roofs of manufacturing or commercial structures.

Insulation of Roofs to Prevent Condensation. Illustrated booklet. 7½ x 10½ in. 36 pp. Gives full data on valuable line of roof insulation.

Filing Folder for Pipe Covering Data. Made in accordance with A. I. A. rules.

"The Cork Lined House Makes a Comfortable Home." 5 x 7 in. 32 pp. Illustrated.

Armstrong's Corkboard. Insulation for Walls and Roofs of Buildings. Booklet, 66 pp., 9½ x 11¾ ins. Illustrates and describes use of insulation for structural purposes.

Cabot, Inc., Samuel, Boston, Mass.

Cabot's Insulating Quilt. Booklet, 7½ x 10½ ins., 24 pp. Illustrated. Deals with a valuable type of insulation.

Celite Products Co., 1320 South Hope St., Los Angeles.

The Insulation of Boilers. Booklet. 8 pp., 8½ x 11 ins. Illustrated. On insulating boiler walls, breechings, and stacks to reduce amount of radiation.

Heat Insulation Specifications and Blue Prints. Booklet, 20 pp., 8½ x 11 ins. Illustrated. On approved types of insulation.

Flax-li-num Insulating Company, St. Paul, Minn.

"Heat Insulation for Houses." Booklet, 64 pp., 9¾ x 11¼ ins. Illustrated. Authoritative information on thermal insulation with complete specifications for all types of buildings.

Philip Carey Co., The, Cincinnati, Ohio.

Carey Asbestos and Magnesia Products. Catalog. 6 x 9 in. 72 pp. Illustrated.

JOISTS

Bates Expanded Steel Truss Co., East Chicago, Ind.

Catalog No. 4. Booklet, 32 pp., 8½ x 11 ins. Illustrated. Gives details of truss construction with loading tables and specifications.

Truscon Steel Co., Youngstown, Ohio

Truscon Steel Joists. Booklet, 8½ x 11 in., 16 pp. Illustrated with typical buildings and showing details of construction. Tables of sizes and safe loads.

Truscon Steel Joist Buildings. Illustrated 32-page brochure, attractively illustrated, showing types of buildings equipped with Truscon Steel Joist.

Strip Steel Joist Construction. 14-page booklet, with illustrations. Reprint of paper presented to Building Officials' Conference, Madison, Wis., 1925, by J. J. Calvin, Secretary, Strip Steel Joist Association.

KITCHEN EQUIPMENT

The International Nickel Company, 67 Wall St., New York, N. Y.

Hotels, Restaurants and Cafeteria Applications of Monel Metal. Booklet. 8½ x 11 in. 32 pp. Illustrated. Gives types of equipment in which Monel Metal is used, with service data and sources of equipment.

McDougall Company, Frankfort, Ind.

Kitchens for Homes and Apartments. Booklet, 32 pp., 8½ x 11 ins. Illustrated. Views and plans of conveniently equipped kitchens.

File Folder. Service sheets and specifications useful in preparing kitchen layouts.

Domestic Science Kitchen Units. Brochure, 8 pp., 8½ x 11 ins. Illustrated. Deals with flexible line of kitchen equipment.

Pick & Company, Albert, 208 W. Randolph St., Chicago, Ill.

School Cafeteria. Portfolio. 17 x 11 in. 44 pp. Illustrated. An exhaustive study of the problems of school feeding, with copious illustrations and blue prints. Very valuable to the architect.

School Cafeterias. Booklet. 9 x 6 in. Illustrated. The design and equipment of school cafeterias with photographs of installation and plans for standardized outfits.

LABORATORY EQUIPMENT

Alberene Stone Co., 153 West 23rd Street, New York City

Booklet 8¾ x 11¼ in., 26 pp. Stone for laboratory equipment, shower partitions, stair treads, etc.

Duriron Company, Dayton, Ohio.

Duriron Acid, Alkali and Rust-proof Drain Pipe and Fittings. Booklet, 8½ x 11 ins., 20 pp. Full details regarding a valuable form of piping.

LANTERNS

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

Hand Wrought Lanterns. Booklet, 5¼ x 6¼ in. 20 pp. Illustrated in Black and White. With price list. Lanterns appropriate for exterior and interior use, designed from old models and meeting the requirements of modern lighting.

LATH, METAL AND REINFORCING

Genfire Steel Company, Youngstown, Ohio.

Herringbone Metal Lath Handbook. 8½ x 11 in. 32 pp. Illustrated. Standard specifications for Cement Stucco on Herringbone. Rigid Metal Lath and interior plastering.

National Steel Fabric Co., Pittsburgh.

Better Walls for Better Homes. Brochure. 16 pp. 7¾ x 10¾ ins. Illustrated. Metal lath, particularly for residences.

Steeltex for Floors. Booklet. 24 pp. 8½ x 11 ins. Illustrated. Combined reinforcing and form for concrete or gypsum floors and roofs.

Steeltex Data Sheet No. 1. Folder. 8 pp. 8½ x 11 ins. Illustrated. Steeltex for floors on steel joists with round top chords.

Steeltex Data Sheet No. 2. Folder. 8 pp. 8½ x 11 ins. Illustrated. Steeltex for floors on steel joists with flat top flanges.

Steeltex Data Sheet No. 3. Folder. 8 pp. 8½ x 11 ins. Illustrated. Steeltex for folders on wood joists.

Northwestern Expanded Metal Co., 1234 Old Colony Building, Chicago, Ill.

Northwestern Expanded Metal Products. Booklet, 8½ x 10¾ in., 20 pp. Fully illustrated, and describes different products of this company, such as Kno-burn metal lath, 20th Century Corrugated. Plasta-saver and Longspan lath channels, etc.

Longspan ¾-inch Rib Lath. Folder 4 pp., 8½ x 11 ins. Illustrated. Deals with a new type of V-rit expanded metal.

A. I. A. Sample Book. Bound volume, 8½ x 11 ins. Contains actual samples of several materials and complete data regarding their use.

Northwest Metal Lath. Folder. 8½ x 11 ins. Illustrated. Data on Flat Rib Lath.

Truscon Steel Company, Youngstown, Ohio.

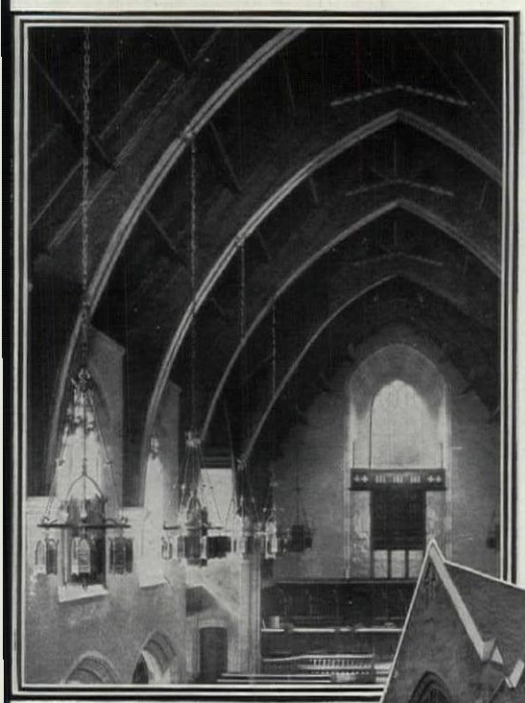
Truscon 1-A Metal Lath. 12-page booklet, 8½ x 11 in., beautifully printed, with illustrations of details of lath and method of application.

Truscon ¾-inch Hy-Rib for Roofs, Floors and Walls. Booklet, ½ x 11 in., illustrating Truscon ¾-inch Hy-Rib as used in industrial buildings. Plates of typical construction. Progressive steps of construction. Specification and load tables.

LAUNDRY CHUTES

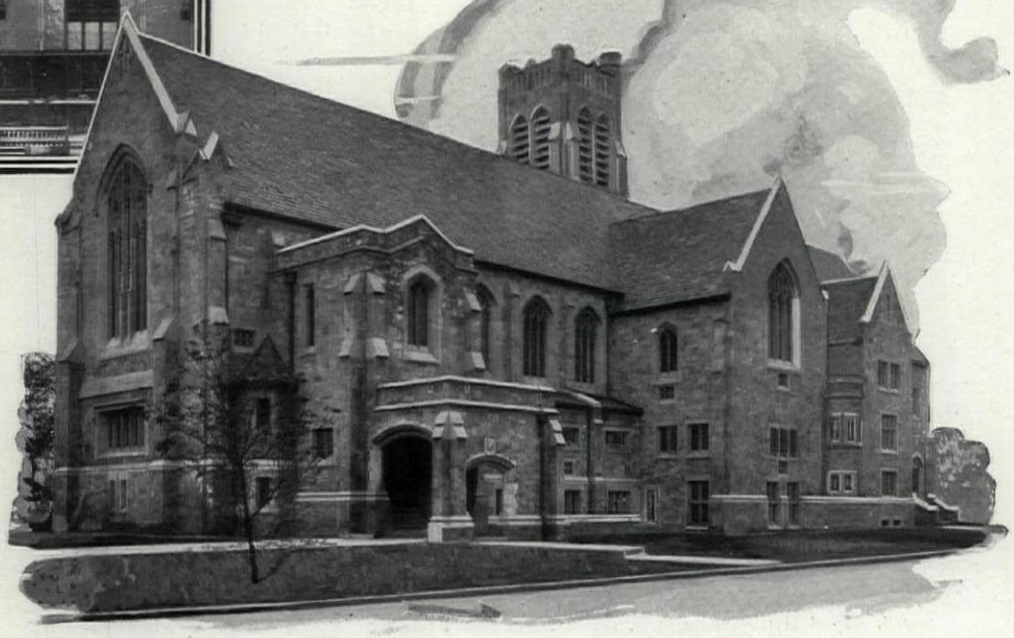
The Pfaudler Company, 217 Cutler Building, Rochester, N. Y.

Pfaudler Glass-Lined Steel Laundry Chutes. Booklet, 5⅜ x 7⅜ in. 16 pp. Illustrated. A beautifully printed brochure describing in detail with architects' specifications THE PFAUDLER GLASS LINED STEEL LAUNDRY CHUTES. Contains views of installations and list of representative examples.



Broadway Methodist Episcopal Church, Indianapolis, Ind. Foltz, Osler & Thompson, architects. Armstrong's Corkboard, one inch thick, applied on the ceiling for heat insulation and acoustic effect

Cork Serves Double Purpose in this Church Installation



THE installation of Armstrong's Corkboard on the roof of the Broadway M. E. Church, Indianapolis, is an excellent example of the two-fold value of corkboard for the insulation of church roofs. It materially reduces the heat loss, which for such large areas is very great, and it serves the valuable acoustic purpose of correcting reverberation and echo.

In the Broadway M. E. Church, Armstrong's Corkboard was applied to the under side of the roof, and left exposed, the color and texture of the corkboard being admirably adapted to the interior decorative treatment.

Because of the intermittent use of church buildings and their high ceilings, heating is difficult and costly. The use of even one inch of Armstrong's Corkboard, as in this case, lessens the heat loss materially, making it possible to bring up the temperature in less time and to maintain it comfortably and uniformly with less fuel.

Armstrong's Corkboard has sound absorbing qualities that produce excellent acoustic effect, reducing reverberation and echo without deadening the intensity of the sound.

Armstrong's Corkboard is pure cork, non-absorbent and non-deteriorating. It does not decay or disintegrate, nor does it shrink, swell, warp or buckle. It is slow-burning, and will not ignite from sparks or embers. It is easily applied at a low cost for labor.

The counsel of Armstrong Engineers on the use of corkboard for either insulation or acoustic purposes is offered without charge to architects. Armstrong Cork & Insulation Company, 132 Twenty-fourth Street, Pittsburgh, Pa.; McGill Building, Montreal, Quebec; 11 Brant Street, Toronto 2, Ontario.

Armstrong's Corkboard Insulation

for the Roofs of All Kinds of Buildings

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 184*

LAUNDRY MACHINERY

American Laundry Machinery Co., Norwood Station, Cincinnati, Ohio.
Functions of the Hotel and Hospital Laundry. Brochure, 8 pp., 8½ x 11 ins. Valuable data regarding an important subject.

LIBRARY EQUIPMENT

Art Metal Construction Co., Jamestown, N. Y.
Planning the Library for Protection and Service. Brochure, 52 pp. 8½ x 11 in. Illustrated. Deals with library fittings of different kinds.
Library Bureau Division, Remington Rand, N. Tonawanda, N. Y.
Like Stepping into a Story Book. Booklet. 24 pp. 9 x 12 in. Deals with equipment of Los Angeles Public Library.

LIGHTING EQUIPMENT

The Frink Co., Inc., 24th St. and 10th Ave., New York City.
Catalog 415. 8½ x 11 in. 46 pp. Photographs and scaled cross-sections. Specialized bank lighting, screen and partition reflectors, double and single desk reflectors and Polaralite Signs.
Gleason-Tiebout Glass Co. (Celestialite Division), 200 Fifth Avenue, New York.
Next to Daylight Brochure, 19 pp., 4 x 8½ ins. Illustrated. Deals with a valuable type of lighting fixture.
Celestialite Circular No. 40. Folder, 4 pp., 3½ x 6 ins. "What Nature does to the Sun, Celestialite does to the Mazda lamp."
Attractive Units in Celestialite. Folder, 12 pp., 3¼ x 6½ ins. Illustrates Decorated Celestialite Units.
It Has Been Imitated. Folder, 4 pp., 10 x 13 ins. Data in an important detail of lighting equipment.
Smyser-Royer Co., 1700 Walnut Street, Philadelphia.
Catalog "J" on Exterior Lighting Fixtures. Brochure, illustrated, giving data on over 300 designs of standards, lanterns and brackets of bronze or cast iron.

MAIL CHUTES

Cutler Mail Chute Company, Rochester, N. Y.
Cutler Mail Chute Model F. Booklet. 4 x 9¼ in. 8 pp. Illustrated.

MANTELS

Arthur Todhunter, 119 E. 57th St., New York, N. Y.
Georgian Mantels. New Booklet. 24 pp. 5¼ x 6¼ in. A fully illustrated brochure on eighteenth century mantels. Folders give prices of mantels and illustrations and prices of fireplace equipment.

MARBLE

The Georgia Marble Company, Tate, Ga. New York Office, 1328 Broadway.
Why Georgia Marble is Better. Booklet. 3⅜ x 6 in. Gives analysis, physical qualities, comparison of absorption with granite, opinions of authorities, etc.
Convincing Proof. 3⅜ x 6 in. 8 pp. Classified list of buildings and memorials in which Georgia Marble has been used, with names of Architects and Sculptors.

METALS

The International Nickel Company, 67 Wall St., New York, N. Y.
The Choice of a Metal. Booklet, 6¼ x 3 in. 166 pp. Illustrated. Monel Metal—its qualities, use and commercial forms, briefly described.

MILL WORK—See also Wood

Curtis Companies Service Bureau, Clinton, Iowa.
Architectural Interior and Exterior Woodword. Standardized Book. 9 x 11½ in. 240 pp. Illustrated. This is an Architects' Edition of the complete catalog of Curtis Woodwork, as designed by Trowbridge & Ackerman. Contains many color plates.
Better Built Homes. Vols. XV-XVIII incl. Booklet. 9 x 12 in. 40 pp. Illustrated. Designs for houses of five to eight rooms, respectively, in several authentic types, by Trowbridge & Ackerman, architects for the Curtis Companies.
Curtis Details. Booklet, 19½ x 23½ in. 20 pp. Illustrated. Complete details of all items of Curtis woodwork, for the use of architects.
Hartmann-Sanders Company, 2155 Elston Ave., Chicago, Ill.
Column Catalog, 7½ x 10 in. 48 pp. Illustrated. Contains prices on columns 6 to 36 in. diameter, various designs and illustrations of columns and installations.
The Pergola Catalog. 7½ x 10 in. 64 pp. Illustrated. Contains illustrations of pergola lattices, garden furniture in wood and cement, garden accessories.
Roddis Lumber and Veneer Co., Marshfield, Wis.
Roddis Doors. Brochure, 24 pp., 5¼ x 8½ in. Illustrated price list of doors for various types of buildings.
Roddis Doors, Catalog G. Booklet, 183 pp., 8½ x 11 in. Completely covers the subject of doors for interior use.
Roddis Doors for Hospitals. Brochure, 15 pp., 8½ x 11 in. Illustrated work on hospital doors.
Roddis Doors for Hotels. Brochure, 15 pp., 8½ x 11 in. Illustrated work on doors for hotel and apartment buildings.

MORTAR COLORS

Clinton Metallic Paint Co., Clinton, N. Y.
Clinton Mortar Colors. Folder, 8½ x 11 in. 4 pp. Illustrated in color, gives full information concerning Clinton Mortar Colors with specific instructions for using them.
Color Card. 6½ x 3¼ in. Illustrates in color the ten shades in which Clinton Mortar Colors are manufactured.
Something new in Stucco. Folder, 3½ x 6 ins. An interesting folder on the use of coloring matter for stucco-coated walls.

OFFICE SUPPLIES

Eugene Dietzgen Co., 166 W. Monroe St., Chicago.
General Catalog. 500 pp. 6 x 9 ins. Illustrated. Complete line of drafting and surveying supplies.
Use and care of Drawing Instruments. Booklet. 18 pp. 6 x 9 ins. Illustrated. Discusses proper care of equipment.
Sample Book of Drawing and Tracing Papers. Brochure. 23 pp. 3½ x 7 ins. Illustrated. Papers recommended for these uses.
Ozalid Booklet. 16 pp. 4 x 8½ ins. Illustrated. Data on a positive reproduction paper.

PAINTS, STAINS, VARNISHES AND WOOD FINISHES

Cabot, Inc., Samuel, Boston, Mass.
Cabot's Creosote Stains. Booklet. 4 x 8½ in. 16 pp. Illustrated.

ORNAMENTAL PLASTER

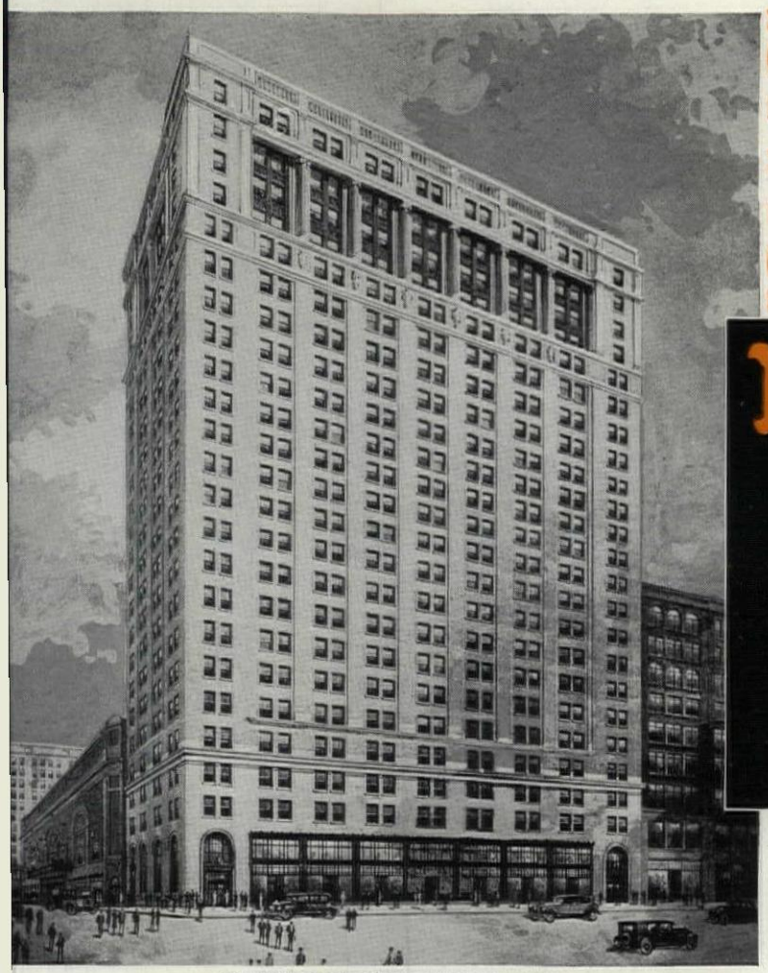
Jacobson & Co., 241 East 44th St., New York.
A book of Old English Designs. Brochure. 47 plates. 12 x 9 ins. Deals with a fine line of decorative plaster work.
Architectural and Decorative Ornaments. Cloth bound volume. 183 plates. 9 x 12 ins. 18 plates. Price, $3.00. A general catalog of fine plaster ornaments.
Geometrical ceilings. Booklet. 23 plates. 7 x 9 ins. An important work on decorative plaster ceilings.
National Lead Company, 111 Broadway, New York, N. Y.
Handy Book on Painting. Book. 5½ x 3¾ in. 100 pp. Gives directions and formulae for painting various surfaces of wood, plaster, metals, etc., both interior and exterior.
Red Lead in Paste Form. Booklet, 6¼ x 3½ in. 16 pp. Illustrated. Directions and formulae for painting metals.
Came Lead. Booklet, 8¾ x 6 in. 12 pp. Illustrated. Describes various styles of lead cames.
Cinch Anchoring Specialties. Booklet. 6 x 3½ in. 20 pp. Illustrated. Describes complete line of expansion bolts.
Pratt & Lambert, Inc., Buffalo, N. Y.
Specification Manual for Paint, Varnishing and Enameling. Booklet, 38 pp., 7½ x 10⅝ ins. Complete specifications for painting, varnishing and enameling interior and exterior wood, plaster, and metal work.
Sherwin-Williams Company, 601 Canal Rd., Cleveland, Ohio.
Painting Concrete and Stucco Surfaces. Bulletin No. 1. 8½ x 11 in. 8 pp. Illustrated. A complete treatise with complete specifications on the subject of Painting of Concrete and Stucco Surfaces. Color chips of paint shown in bulletin.
Enamel Finish for Interior and Exterior Surfaces. Bulletin No. 2, 8½ x 11 in. 12 p. Illustrated. Thorough discussion, including complete specifications for securing the most satisfactory enamel finish on interior and exterior walls and trim.
Painting and Decorating of Interior Walls. Bulletin No. 3. 8½ x 11 in. 20 pp. Illustrated. An excellent reference book on Flat Wall Finish, including texture effects, which are taking the country by storm. Every architect should have one on file.
Protective Paints for Metal Surfaces. Bulletin No. 4. 8½ x 11 in. 12 pp. Illustrated. A highly technical subject treated in a simple, understandable manner.
Sonneborn Sons, Inc., L., Dept. 4, 116 Fifth Ave., New York. Paint Specifications. Booklet. 8½ x 10¾ in. 4 pp.
U. S. Gutta Percha Paint Co., Providence, R. I.
Barreled Sunlight. Booklet, 8½ x 11 in. Data on "Barreled Sunlight" with specifications for its use.
Valentine & Co., 456 Fourth Ave., New York.
How to Use Valspar. Illustrated booklet, 32 pp., 3¾ x 8 in. Deals with domestic uses for Valspar.
How to Keep Your House Young. Illustrated brochure, 23 pp., 7 x 8½ in. A useful work on the upkeep of residences.
Zapon Co., The, 247 Park Ave., New York City.
Zapon Architectural Specifications. Booklet, 28 pp., 8½ x 11 in. Describes odorless brushing and spraying lacquers and lacquer enamels.

PAPER

A. P. W. Paper Co., Albany, N. Y.
"Here's a Towel Built for Its Job." Folder, 8 pp., 4 x 9 in. Deals with "Onliwon" paper towels.

PARTITIONS

Circle A Products Corporations, New Castle, Ind.
Circle A Partitions Sectional and Movable. Brochure. Illustrated. 8½ x 11¼ in. 32 pp. Full data regarding an important line of partitions, along with Erection Instructions for partitions of three different types.
Hauserman Company, E. F., Cleveland, Ohio.
Hollow Steel Standard Partitions. Various folders, 8½ x 11. Illustrated. Give full data on different types of steel partitions, together with details, elevations and specifications.
Improved Office Partition Company, 25 Grand St., Elmhurst, L. I.
Telesco Partition. Catalog. 8¼ x 11 in. 14 pp. Illustrated. Shows typical offices laid out with Telesco partitions, cuts of finished partition units in various woods. Gives specifications and cuts of buildings using Telesco.
Detailed Instructions for erecting Telesco Partitions. Booklet. 24 pp. 8½ x 11 in. Illustrated. Complete instructions, with cuts and drawings, showing how easily Telesco Partition can be erected.
Richards-Wilcox Mfg. Co., Aurora, Ill.
Partitions. Booklet. 7 x 10 in. 32 pp. Illustrated. Describes complete line of track and hangers for all styles of sliding, parallel, accordion and flush door partitions.
U. S. Gypsum Co., Chicago.
Pyrobar Partition and Furring Tile. Booklet. 8½ x 11 in. 24 pp. Illustrated. Describes use and advantages of hollow tile for inner partitions.



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Arch. and Eng., Hoffman-Henon Co. Htg. Cont., Geo. H. Soffel Co. {Aero Radiation}

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ou want a responsibility that does not quibble or compromise. ational accepts it. National, today, offers the resources of six ng-established boiler and radiator companies—individually and combination. It is NOW a united responsibility.

he three things you need most are all assured when your heating quirements are left to the National.

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ltimore, Md.—2622 Frisby Street; Boston, Mass.—93-97 Oliver Street; Buffalo, N. Y. McKinley Building, Delaware Avenue; Chicago, Ill.—2445 N. Keeler Avenue; Cleve- id, Ohio—935 E. 63rd Street; Cincinnati, Ohio—Spring Grove and Elmira Avenue; lianapolis, Ind.—57 S. Bolton Avenue; New York, N. Y.—55 W. 42nd Street; Johns- vn, Pa.—221 Central Avenue; Philadelphia, Pa.—121 N. Broad Street; Pittsburgh, .—1509 Arrott Building; Richmond, Va.—3032 Norfolk Street; Washington, D. C. 1205 Fifth Street, N. E.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 186*

PIPE

American Brass Company, Waterbury, Conn.
Bulletin B-1. Brass Pipe for Water Service. 8½ x 11 in. 28 pp. Illustrated. Gives schedule of weights and sizes (I.P.S.) of seamless brass and copper pipe, shows typical installations of brass pipe, and gives general discussion of the corrosive effect of water on iron, steel and brass pipe.

American Rolling Mill Company, Middletown, Ohio.
How ARMCO Dredging Products Cut Costs. Booklet, 16 pp., 6 x 9 in. Data on dredge pipe.

Clow & Sons, James B., 534 S. Franklin St., Chicago, Ill.
Catalog "A". 4 x 6½ in. 700 pp. Illustrated. Shows a full line of steam, gas and water works supplies.

Cohoes Rolling Mill Company, Cohoes, N. Y.
Cohoes Pipe Handbook. Booklet, 40 pp., 5 x 7½ in. Data on wrought iron pipe.

Duriron Company, Inc., Dayton, Ohio.
Duriron Acid, Alkali, Rust-proof Drain Pipe and Fillings. Booklet, 20 pp., 8½ x 11 in., illustrated. Important data on a valuable line of pipe.

National Tube Co., Frick Building, Pittsburgh, Pa.
"National" Bulletin No. 2. Corrosion of Hot Water Pipe, 8½ x 11 in. 24 pp. Illustrated. In this bulletin is summed up the most important research dealing with hot water systems. The text matter consists of seven investigations by authorities on this subject.
"National" Bulletin No. 3. The Protection of Pipe Against Internal Corrosion, 8½ x 11 in. 20 pp. Illustrated. Discusses various causes of corrosion, and details are given of the deactivating and deaerating systems for eliminating or retarding corrosion in hot water supply lines.
"National" Bulletin No. 25. "National" Pipe in Large Buildings. 8½ x 11 in. 88 pp. This bulletin contains 254 illustrations of prominent buildings of all types, containing "National" Pipe, and considerable engineering data of value to architects, engineers, etc.
Modern Welded Pipe. Book of 88 pp. 8½ x 11 in., profusely illustrated with halftone and line engravings of the important operations in the manufacture of pipe.

PLASTER

Best Bros. Keene's Cement Co., Medicine Lodge, Kans.
Information Book. Brochure, 24 pp., 5 x 9 ins. Lists grades of plaster manufactured; gives specifications and uses for plaster.
Plasterers' Handbook. Booklet, 16 pp., 3½ x 5½ ins. A small manual for use of plasterers.
Interior Walls Everlasting. Brochure, 20 pp., 6¼ x 9¼ ins. Illustrated. Describes origin of Keene's Cement and views of buildings in which it is used.

PLUMBING EQUIPMENT

C. F. Church Mfg. Co., Holyoke, Mass.
Catalog S. W.-3. Booklet, 95 pp., 7¾ x 10½ in. Illustrated. Data on Sani-White and Sani-Black toilet seats.

Clow & Sons, James B., 534 S. Franklin St., Chicago, Ill.
Catalog "M." 9¼ x 12 in. 184 pp. Illustrated. Shows complete line of plumbing fixtures for Schools, Railroads and Industrial Plants.

Crane Company, 836 S. Michigan Ave., Chicago, Ill.
Plumbing Suggestions for Home Builders. Catalog. 3 x 6 in. 80 pp. Illustrated.
Plumbing Suggestions for Industrial Plants. Catalog. 4 x 6½ in. 34 pp. Illustrated.
Planning the Small Bathroom. Booklet. 5 x 8 in. Discusses planning bathrooms of small dimensions.

John Douglas Co., Cincinnati, Ohio.
Douglas Plumbing Fixtures. Bound Volume. 200 pp. 8½ x 11 ins. Illustrated. General catalog.
Another Douglas Achievement. Folder. 4 pp. 8½ x 11 ins. Illustrated. Data on new type of stall.
Hospital. Brochure. 60 pp. 8½ x 11 ins. Illustrated. Deals with fixtures for hospitals.

Duriron Company, Dayton, Ohio.
Duriron Acid, Alkali and Rust-Proof Drain Pipe and Fittings. Booklet, 8½ x 11 ins., 20 pp. Full details regarding a valuable form of piping.

Eljer Company, Ford City, Pa.
Complete Catalog. 3¾ x 6¾ in. 104 pp. Illustrated. Describes fully the complete Eljer line of standardized vitreous china plumbing fixtures, with diagrams, weights and measurements.

Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Watrous Patent Flush Valves, Duojet Water Closets, Liquid Soap Fixtures, etc. 8½ x 11 ins., 136 pp., loose-leaf catalog, showing roughing-in measurements, etc.

Maddock's Sons Company, Thomas, Trenton, N. J.
Catalog K. 10⅞ x 7⅞ in. 242 pp. Illustrated. Complete data on vitreous china plumbing fixtures with brief history of Sanitary Pottery.

PUMPS

Chicago Pump Company, 2300 Wolfram St., Chicago, Ill.
The Correct Pump to Use. Portfolio containing handy data. Individual bulletins, 8½ x 11 ins., on bilge, sewage, condensation, circulating, house, boiler feed and fire pumps.

Kewanee Private Utilities Co., 442 Franklin St., Kewanee, Ill.
Bulletin E. 7¾ x 10¼ in. 32 pp. Illustrated. Catalog. Complete descriptions, with all necessary data, on Standard Service Pumps, Indian Brand Pneumatic Tanks, and Complete Water Systems, as installed by Kenwanee Private Utilities Co.

RAMPS

Ramp Buildings Corporation, 21 East 40th St., New York.
Building Garages for Profitable Operation. Booklet. 8½ x 11 in. 16 pp. Illustrated. Discusses the need for modern mid-city parking garages, and describes the d'Humy Motoramp system of design, on the basis of its superior space economy and features of operating convenience. Gives cost analyses of garages of different sizes, and calculates probable earnings.
Garage Design Data. Series of informal bulletins issued in loose-leaf form, with monthly supplements.

The Trane Co., LaCrosse, Wis.
Trane Small Centrifugal Pumps. Booklet. 3¾ x 8 in., 16 pp. Complete data on an important type of pump.

REFRIGERATION

The Fulton Sylphon Company, Knoxville, Tenn.
Temperature Control of Refrigeration Systems. Booklet, 8 pp., 8½ x 11 ins. Illustrated. Deals with cold storage, chilling of water, etc.

REFRIGERATORS

Lorillard Refrigerator Company, Kingston, N. Y.
Lorillard Refrigerator, for hotels, restaurants, hospitals and clubs. Brochure. 43 pp. 8 x 10 ins. Illustrated. Data on fine line of refrigerators.

REINFORCED CONCRETE—See also Construction, Concrete

Genfire Steel Company, Youngstown, Ohio.
Self-Sentering Handbook. 8½ 11 in. 36 pp. Illustrated. Methods and specifications on reinforced concrete floors, roofs and floors with a combined form and reinforced material.

Truscon Steel Company, Youngstown, Ohio.
Shearing Stresses in Reinforced Concrete Beams. Booklet, 8½ x 11 in. 12 pp.

North Western Expanded Metal Company, Chicago, Ill.
Designing Data. Book. 6 x 9 in. 96 pp. Illustrated. Covers the use of Econo Expanded Metal for various types of reinforced concrete construction.
Longspan ¾-inch Rib Lath. Folder 4 pp., 8½ x 11 in. Illustrated. Deals with a new type of V-rit expanded metal.

ROOFING

Barber Asphalt Co., Philadelphia, Pa.
Specifications, Genasco Standard Trinidad Lake Asphalt Built-up Roofing. Booklet. 8 x 10½ in. Gives specifications for use of several valuable roofing and waterproofing materials.

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.

Philip Carey Co., Lockland, Cincinnati, Ohio.
Architects Specifications for Carey Built-up Roofing. Booklet. 8 x 10¾ in. 24 pp. Illustrated. Complete data to aid in specifying the different types of built-up roofing to suit the kind of roof construction to be covered.
Carey Built-up Roofing for Modern School Buildings. Booklet. 8 x 10¾ in. 32 pp. Illustrated. A study of school buildings of a number of different kinds and the roofing materials adapted for each.

Heinz Roofing Tile Co., 1750 Champa St., Denver.
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 in. 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 in. 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.

U. S. Gypsum Co., Chicago.
Pyrobar Roof Construction. Booklet. 8 x 11 in. 48 pp. Illustrated. Gives valuable data on the use of tile in roof construction.
Sheetrock Pyrofill Roof Construction. Folder. 8½ x 11 in. Illustrated. Covers use of roof surfacing which is poured in place.

SASH CHAIN

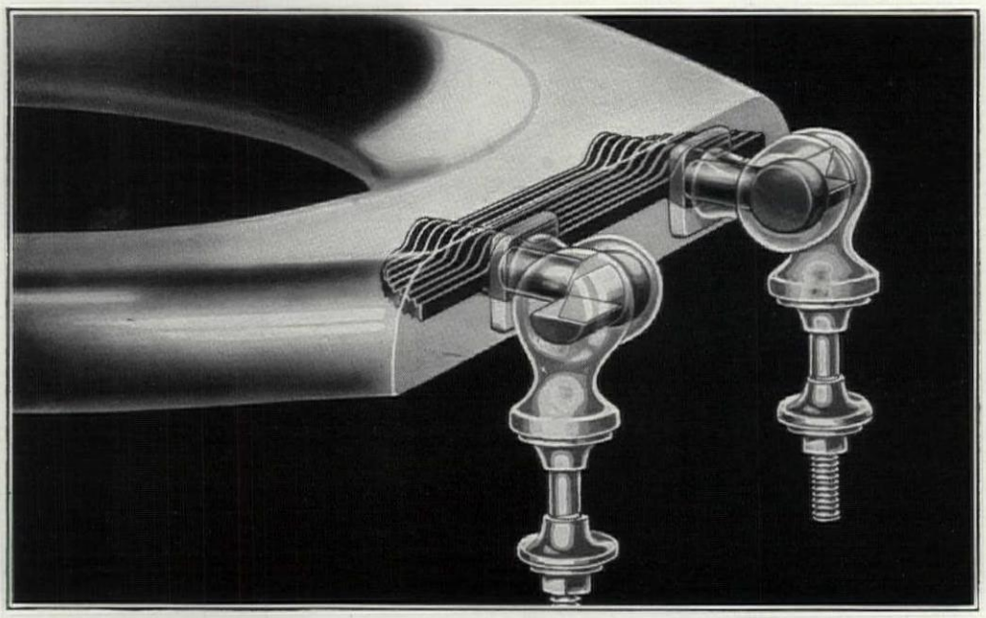
Smith & Egge Mfg. Co., The, Bridgeport, Conn.
Chain Catalog. 6 x 8½ in. 24 pp. Illustrated. Covers complete line of chains.

SEWAGE DISPOSAL

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

This New Hinge is *molded* into the seat itself

Whale-bone-ite's supremacy clearly maintained by this new feature



Seat shown is Model 23-968. Phantom view gives details of construction.

ON the union between hinge and seat depends the permanence of your seat installation. Realizing that the unsanitary metal hinge with its cleaning problem and loosely connected parts was a weakness in closet seats, the makers of the Whale-bone-ite Seat have perfected a new-type hinge which is actually part of the seat itself.

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The makers of the Whale-bone-ite Seat offer this newest feature on all models of both closed and open-back seats. Whale-bone-ite is the only seat having the hinge you see pictured here. It is one more reason why you should specify this finest of seats for your building.

WHALE-BONE-ITE TOILET SEAT

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Birmingham	Charlotte	Cleveland	Des Moines	Houston	El Paso	New York	Richmond	St. Louis	Montreal	Havana

For free cross-section of a Whale-bone-ite Seat, address Dept. 189 Seat Division, The Brunswick-Balke-Collender Co., 623 South Wabash Avenue, Chicago

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 188*

SCREENS

American Brass Co., The, Waterbury, Conn.

Facts for Architects About Screening. Illustrated folder, 9½ x 11¾ in., 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.

The Higgin Manufacturing Co., Newport, Ky.

Your Home Screened the Higgin Way. Booklet. 8½ x 11½ in. 13 pp. Illustrated in colors. Complete description of Higgin Screens, designed to meet every need.

SHELVING-STEEL

David Lupton's Sons Company, Philadelphia, Pa.

Lupton Steel Shelving. Catalog D. Illustrated brochure, 40 pp., 8⅝ x 11 in. Deals with steel cabinets, shelving, racks, doors, partitions, etc.

SKYLIGHTS

Albert Grauer & Co., 1408 Seventeenth St., Detroit, Mich.

Grauer Wire Glass Skylights. Folder, 4 pp., 8½ x 11 in. Illustrated. Data on an important line of wire glass lights.

The Effectiveness of Sidewalk Lights. Folder, 4 pp., 8½ x 11 in. Illustrated. Sidewalk or vault lights.

Let in the Light—The Light That's Free. Folder, 4 pp., 8½ x 11 in. Illustrated. Data on securing good lighting.

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 protectection against sound.

STAIRWAYS

Woodbridge Ornamental Iron Co., 1515 Altgeld St., Chicago.

Presteel Tested for Strength—stairways, catalog, 92 pp., 8½ x 11 ins. Illustrated. Important data on stairways.

STEEL PRODUCTS FOR BUILDING

Genfire Steel Company, Youngstown, Ohio.

Herringbone Metal Lath Handbook. 8½ x 11 in. 32 pp. Illustrated. Standard specifications for Cement Stucco on Herringbone.

Rigid Metal Lath and interior plastering.

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 in. 56 pp. Containing specifications and supplementary data relating to the best methods of specifying and using this stone for all building purposes.

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

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

Volume 5. Series B. Indiana Limestone Library. Portfolio. 11⅜ x 8¾ in. 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 in., 80 pages, illustrated.

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

Old Gothic Random Ashlar. 8½ x 11 in., 16 pages, illustrated.

STORE FRONTS

Brasco Manufacturing Co., 5025-35 South Wabash Avenue, Chicago, Ill.

Catalog No. 31. Series 500. All-Copper Construction. Illustrated brochure. 20 pp. 8½ x 11 ins. Deals with store fronts of a high class.

Brasco Copper Store Front. Catalog No. 32. Series 202. Brasco Standard Construction. Illustrated brochure. 16 pp. 8½ x 11 ins. Complete data on an important type of building.

Detail Sheets. Set of seven sheets; printed on tracing paper, showing full sized details and suggestions for store front designing, enclosed in envelope suitable for filing. Folds to 8½ x 11 ins.

Davis Solid Architectural Bronze Sash. Set of five sheets, printed on tracing paper, giving full sized details and suggestions for designing of special bronze store front construction, enclosed in envelope suitable for filing. Folds to 2½ x 11 ins.

SWIMMING POOL EQUIPMENT & STERILIZATION

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.

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 in. 60 pp. Illustrated. Complete information with detailed sheets and installation instructions convenient for architects' files.

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

R. U. V. Company, Inc., 383 Madison Ave., New York City.

Water Sterilization by Means of Ultra Violet Rays. Booklet 8½ x 11 in. 16 pp. Full data on a system of purifying water.

Swimming Pool Sterilization. Booklet 8½ x 11 in. 24 pp. Describes a method of purifying water in bathing pools.

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 in. 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 12¼ in., 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 in. 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 in. 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 in. 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 in. 6 pp. Illustrated.
Natco Face Tile for the Up-to-Date Farm Bulletin, 8½ x 11 ins.

TILES

Kraftile Company, 55 New Montgomery St., San Francisco. High Fired Faience Tile. Booklet. 32 pp. 8½ x 11 ins. Illustrated. Presents a fine line of tiles for different purposes.

Unites 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.

The Dunham Packless Radiator Valve Brochure, 12 pp., 8 x 11. Illustrated. Data on an important type of valve.

Illinois Engineering Co., Racine Ave., at 21st St., Chicago, Ill.

Catalog. 8½ x 11 in. 88 pp. Illustrated.

Jenkins Bros., 80 White St., New York.

The Valve Behind a Good Heating System. Booklet 4½ x 7¼ in. 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 in. 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.

The Roosevelt Hotel, St. Louis, Missouri, a magnificent new hostelry, given the permanent protection of a Carey Built-up Roof.
Widmer Engineering Company, Architects and Engineers, St. Louis, Missouri.

Inside, outside—and *overhead*—one of St. Louis' finest...

"FROM the time we made our very first drawing for the Roosevelt Hotel," said A. J. Widmer, President of Widmer Engineering Company, Architects and Engineers, St. Louis, "we spared no pains to make this hotel one of the very finest structures in St. Louis.

"We used the utmost care in the selection of materials for the building itself," continued Mr. Widmer, "and we used the same care in choosing the furnishings and interior appointments, too. We believe we have done everything humanly possible, to insure the comfort of The Roosevelt's guests."

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For the overhead protection of the splendid Roosevelt Hotel, the Widmer Engineering Company specified a Carey Built-up Roof, which was a real tribute to Carey quality. Architects and engineers everywhere know that Carey Roofs can be depended on for many years of low-maintenance, attention-free service. Out of sight—out of mind—a lasting roof that the years cannot touch. Write for our Architects' Specification Book.

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Lockland, Cincinnati, Ohio

"A ROOF FOR *EVERY* BUILDING"

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

VENETIAN BLINDS

Burlington Venetian Blind Co., Burlington, Vt.
Venetian Blinds. Booklet, 7 in. x 10 in., 24 pages. 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 in. 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.

Globe Ventilator Company, 205 River St., Troy, N. Y.
Globe Ventilators Catalog. 6 x 9 in. 32 pp. Illustrated profusely. Catalog gives complete data on "Globe" ventilators as to sizes, dimensions, gauges of material and table of capacities. It illustrates many different types of buildings on which "Globe" ventilators are in successful service, showing their adaptability to meet varying requirements.

Van Zile Ventilating Corporation, 155 East 42nd St., New York, N. Y.
The Ventadoor Booklet. 6½ x 3½ in. 16 pp. Illustrated. Describes and illustrates the use of the Ventadoor for Hotels, Clubs, Offices, etc.

WATERPROOFING

Carey Company, The Philip, Lockland, Cincinnati, Ohio.
Waterproofing Specification Book. 8½ x 11 in. 52 pp.

Genfire Steel Company, Youngstown, Ohio.
Waterproofing Handbook. Booklet. 8½ x 11 in. 72 pp. Illustrated. Thoroughly covers subject of waterproofing concrete, wood and steel preservatives, dustproofing and hardening concrete floors, and accelerating the setting of concrete. Free distribution.

Master Builders Company, Cleveland, Ohio.
Waterproofing and Dampproofing and Allied Products. Sheets in loose index file, 9 x 12 in. 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 mortar 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, 8¼ x 11 in.

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

Toch Brothers, 110 East 42nd St., New York City.
Specifications for Dampproofing, Waterproofing, Enameling and Technical Painting. Complete and authoritative directions for use of an important line of materials.

The Vortex Mfg. Co., 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.
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.

The Higgin Manufacturing Co., Newport, Ky.
Higgin All-Metal Weather Strips. Booklet. 6 x 9 in. 21 pp. Illustrated in colors. Describes various types of Higgin Weather Strips for sealing windows and doors against cold and dust.

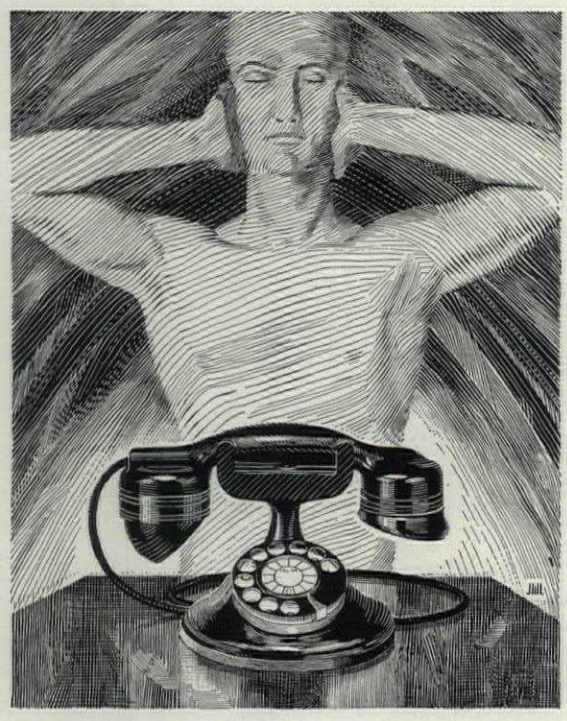
WINDOWS

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. 8½ x 11 in. 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 in. 76 pp. Illustrated. Photographs of actual work accompanied by scale details for casements and composite steel windows for banks, office buildings, hospitals and residences.



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Dallas, Tex.	New York, N. Y.	Pittsburgh, Pa.	Seattle, Wash.

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

WINDOWS, CASEMENT—Continued

Genfire Steel Company, Youngstown, Ohio.
G F Steel Standard Casement Windows, Booklet, 16 pp., 8½ x 11 ins. Data and architectural details of casements.

Hope & Sons, Henry, 103 Park Ave., New York, N. Y.
Catalog. 12¼ x 18½ in. 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-122. Booklet 16 pp. 8⅝ x 11 in. Illustrated brochure on casements, particularly for residences.

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

Truscon Steel Co., Youngstown, Ohio.
Truscon Steel Casements. Booklet, 8½ x 11 in., 24 pp. Handsomely printed with illustrations of houses equipped with Truscon Casement Windows. Illustrations of various units and combinations. Specifications, types and sizes and details of construction.
Architectural Details. Booklet, 8½ x 11 in. 16 pp. Tables of specifications and typical details of different types of construction.
List of Parts for Assembly. Booklet, 8½ x 11 ins., 16 pp. Full lists of parts for different units.

WINDOWS, STEEL AND BRONZE

David Lupton's Sons Company, Phiiadelphia, Pa.
A Rain-shed and Ventilator of Glass and Steel. Pamphlet, 4 pp. 8⅝ x 11 in. Deals with Pond Continuous Sash, Sawtooth Roofs, etc.
How Windows Can Make Better Homes. Booklet. 3⅞ x 7 in. 12 pp. An attractive and helpful illustrated publication on use of steel casements for domestic buildings.

Truscon Steel Company, Youngstown, Ohio.
Truscon Mechanical Operators for Steel Windows. Brochure, 8½ x 11 in., 65 pp. Complete description of various kinds of installations with drawings of details.
Drafting Room Standards. Book, 8½ x 11 in., 120 pages of mechanical drawings showing drafting room standards, specifications and construction details of Truscon Steel Windows, Steel Lintels, Steel Doors and Mechanical Operators.

WINDOWS, STEEL AND BRONZE—Continued

Daylighting and Ventilating Power Houses. 32-pp. booklet, 8½ x 11 in., illustrating the economical application of Truscon Windows in modern power house design.
Truscon Solid Steel Double-Hung Windows. 24--pp booklet, 8½ x 11 in., containing illustrations of buildings using this type of window. Designs and drawings of mechanical details.
Truscon Donovan Awning Type Steel Windows. 12-pp. booklet, 8½ x 11 in., illustrating typical installation and giving construction details.

WOOD—See also Millwork

American Walnut Mfrs. Association, 618 So. Michigan Blvd., Chicago, Ill.
American Walnut. Booklet. 7 x 9 in. 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.
"American Walnut for Interior Woodwork and Paneling." 7 x 9 in. pages, illustrated. Discusses interior woodwork, giving costs, specifications of a specimen room, the different figures in Walnut wood, Walnut floors, finishes, comparative tests of physical properties and the advantages of American Walnut for woodwork.

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

Long-Bell Lumber Co., Kansas City, Mo.
The Perfect Floor. Booklet 5¼ x 7¾ in. 16 pp. Illustrated. Valuable for the data given on the use of wood for floors.
Saving Home Construction Costs. Booklet 4⅛ x 7½ in. 24 pp. Discusses economy and value in domestic building.
Experiences in Home Building. Booklet 6 x 9 in. 16 pp. Records the testimony of a number of builders and contractors as to the value of certain materials.
The Post Everlasting. Booklet 8 x 11 in. 32 pp. Illustrated. Describes the production of posts and their use in various ways.

West Coast Lumber Trade Extension Bureau, Seattle, Wash.
"Durable Douglas Fir; America's Permanent Lumber Supply." Booklet, 32 pp., 7 x 11 ins. Illustrated. Complete data on this valuable wood.
"Douglas Fir Wall Hanger." Metal-bound hanger, 31 x 32 ins. An attractive advertisement for Douglas fir.
"Where to Use Douglas Fir in Your Farm." Brochure, 32 pp., 6 x 9 ins. Data on use of this wood for farm buildings.

In the RITZ TOWER

TOWERING in majestic grandeur, and intensely impressive in every detail, the Ritz Tower in New York is another tribute to American architectural genius. One views the character of the building with instinctive respect because it attests to the broadness of vision and thoroughness of detail with which it was planned and constructed.

It is significant, therefore, that Westinghouse Equipment was selected for the heating and ventilating systems, the pumps and compressors. It is almost obvious, too, because this equipment assures years of steady, consistent performance—performance brought about only by properly designed and applied motors.

Equipped with Sealed Sleeve Bearings—an exclusive Westinghouse feature—these motors offer unusual operating and maintenance economies. They add to the life of the motor through perfect lubrication, and positive protection against insulation troubles that come from oil soaked windings. The oil stays where it belongs—in the Sealed Sleeve Bearing, the insulation remains where it should—free from oil. Dust or grit cannot get in to shorten the life of the bearings.

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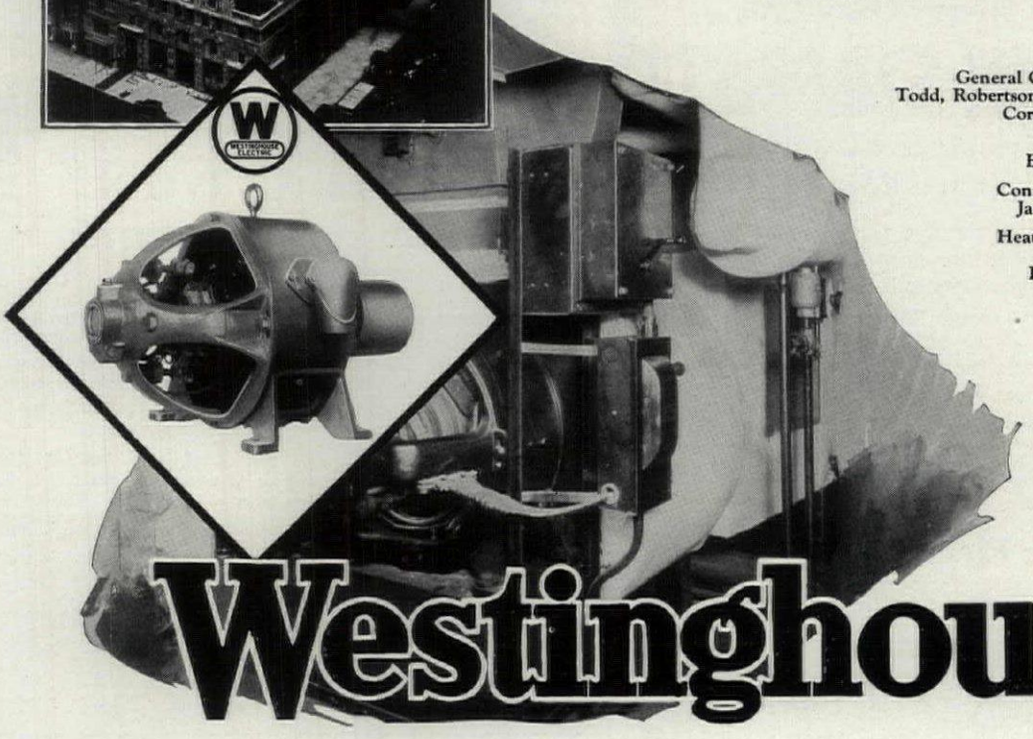

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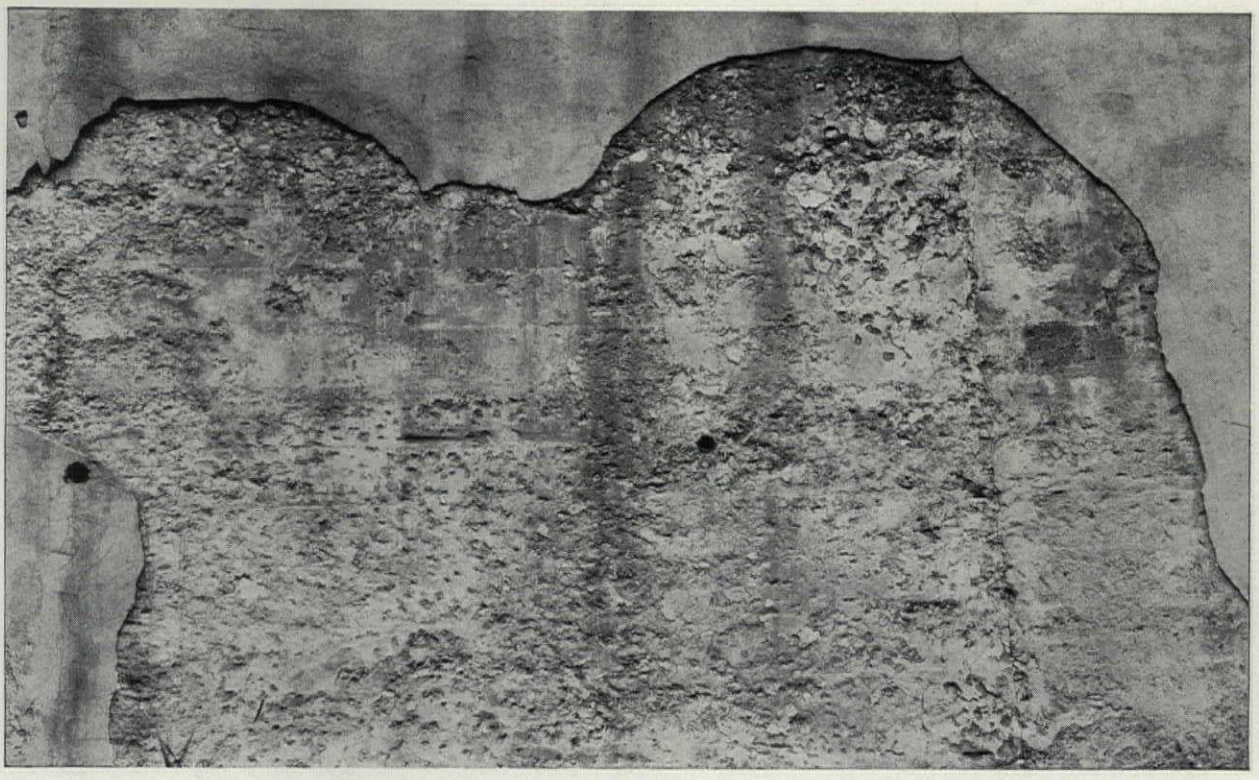

THE BOND THAT FAILS—A "Thoroly Hacked" Concrete

THE BOND EVERLASTING—
Detail of Full Rough Area of Clean Stone on Concrete Exposed for Bond by Bonding Con-Tex

HACKING concrete for bond is an obsolete, costly and ineffective way of preparing concrete surfaces for plaster or waterproofings or stucco or other finish coats.

But, by specifying: "BONDING CON-TEX shall be coated on all forms before concrete is cast" the clean-stone fully roughened Con-Tex bond surface will be obtained *over the entire area and without an argument.*

The Con-Tex clean-stone bond surface is unequalled for Plaster Bond, Waterproofing Bond, Stucco Bond, Top Floor Bond and other bond surfaces on concrete because the Con-Tex Bond Surface is *an integral part of the concrete itself.*

The new Con-Tex Brochures on Concrete are now ready. Have you received your copies? If not, ask by number for those you desire.

No. 1—Producing Texture and Color in Concrete Construction.
No. 2—Producing Bonding Surfaces on Concrete.
No. 3—The Con-Tex System of All-Concrete Construction for Buildings (in Preparation).
No. 4—Surfacing Concrete Roads and Pavements with Con-Tex.
No. 5—Producing Permanent Stucco Work on Concrete.
No. 6—Producing Locked-on Waterproofing Surfaces on Concrete.

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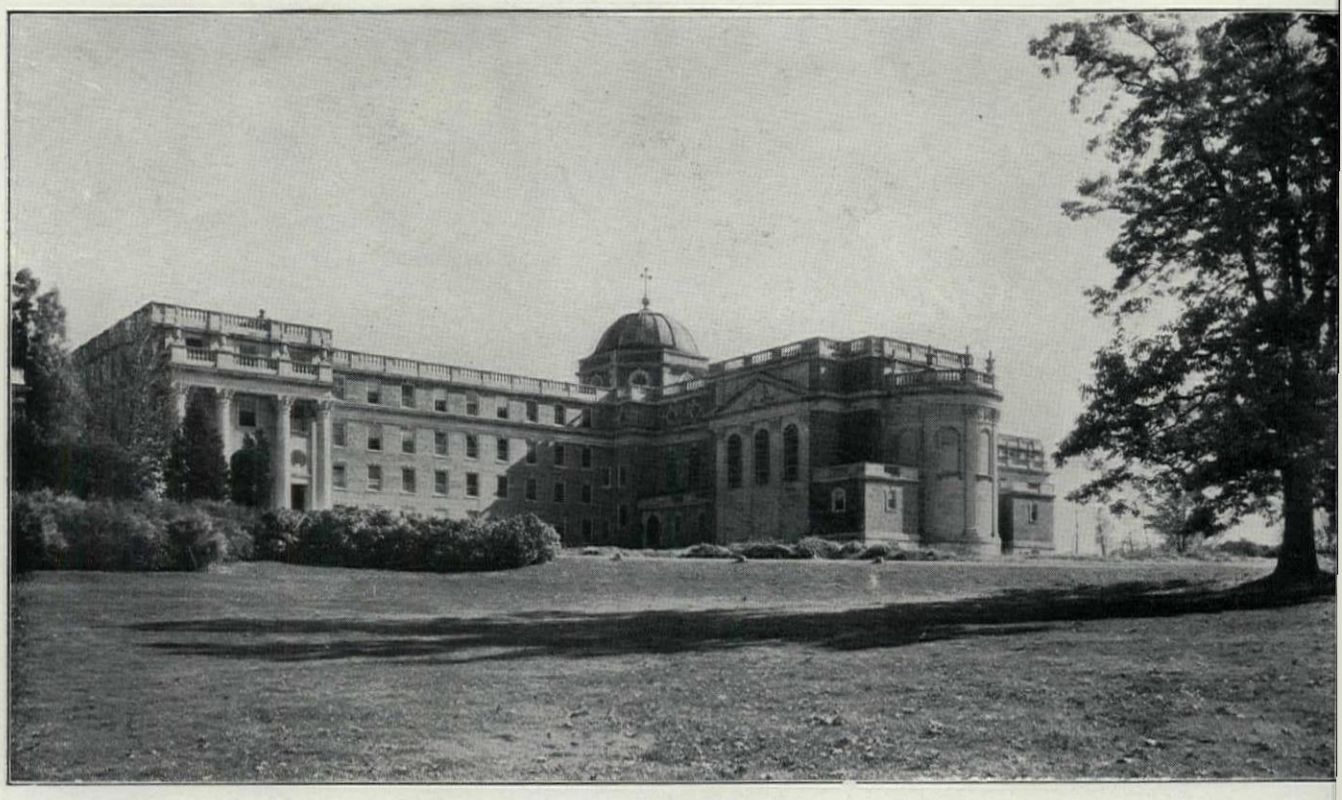

Par-Lock Protects House of Studies

THE serene beauty of this stately House of Studies, at Weston is but a counter-part of its innate worth. The plastered inner surface of its outer walls is effectually damp-proofed and keyed by a preliminary application of Par-Lock.

Par-Lock also keys the plaster of ceilings, soffits, beams and columns throughout the building.

This splendid building is the work of Architects Maginnis and Walsh of Boston. The General Contractor was J. P. Keating and the Plastering Contractors Nicholson, Ferris & Sheehy. Par-Lock applied by the Par-Lock Appliers of New England, 45 Commercial Wharf, Boston. One of the most impressive educational buildings in America its construction and equipment is reputed to have cost $15,000,000.

There is a Par-Lock Applier near you ready to advise on questions of damp-proofing and Plaster Key.

THE VORTEX MANUFACTURING COMPANY
1984 West 77th Street · · Cleveland, Ohio

Par-Lock
PLASTER KEY

Par-Lock Appliers

ALBANY,
425 Orange Street
BALTIMORE,
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BUFFALO,
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CHICAGO,
111 West Monroe Street
CLEVELAND,
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Cedar Avenue
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TORONTO,
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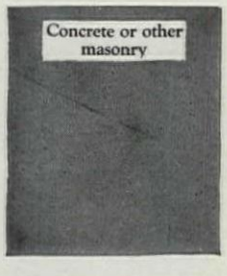

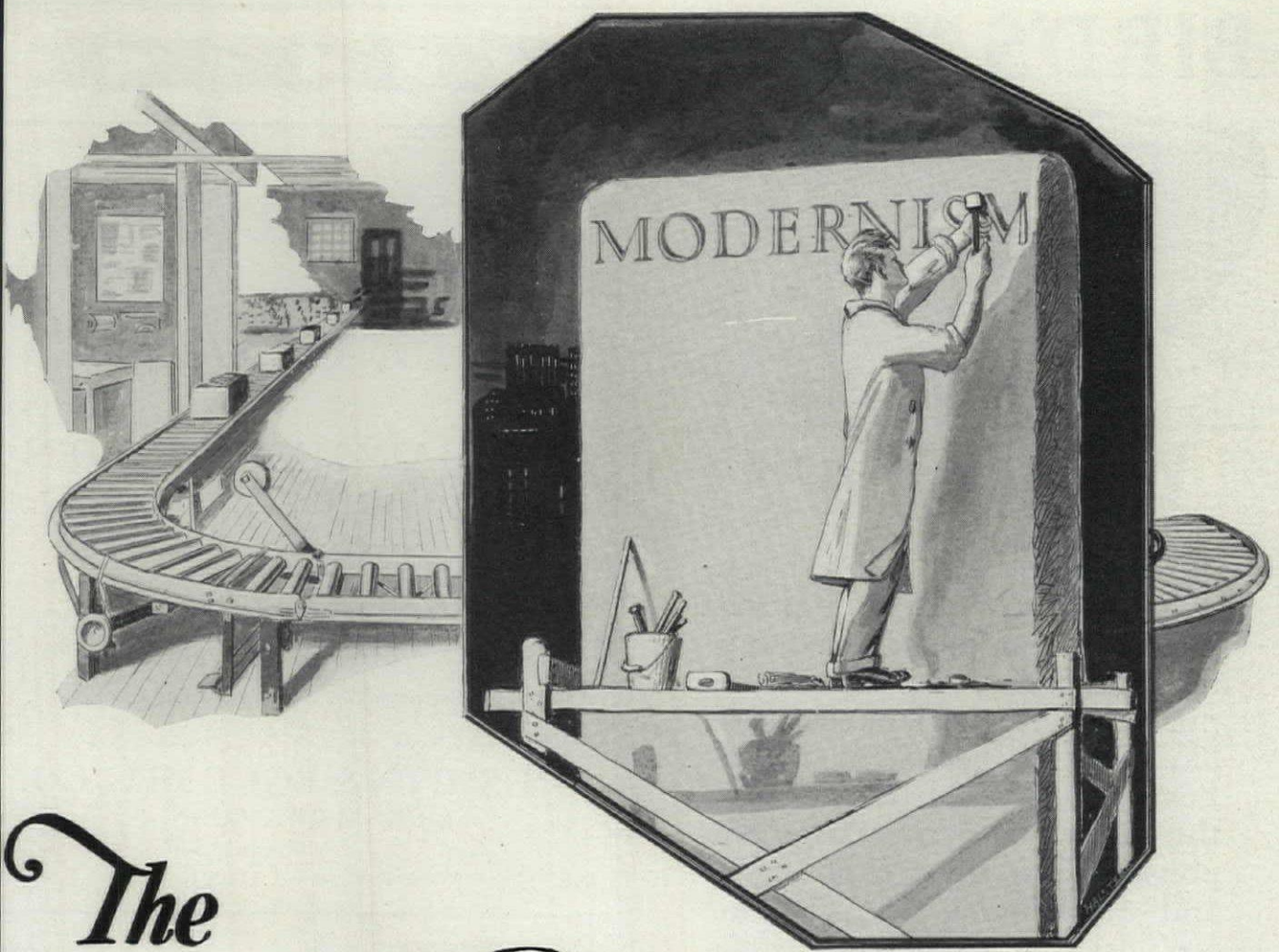

The Industrial Builders' Code

The code of the true architect or engineer is not simply to design a building, but to build for his client a sound background for tomorrow's profits. That means attention to space and money saving developments—it means consideration of built-in conveying systems.

Utilizing gravity where possible, Standard Conveying Systems are built to order and to measure—special chutes, gravity rollers, slat conveyors, inclines, belts, straight slides, or pneumatic conveyors.

If our engineering consultants can be of assistance to you in any of your building plans, call on them. Each man of this corps has spent years in studying and solving material handling problems.

Request for any information or Bulletin E—will receive prompt attention.

STANDARD CONVEYOR COMPANY

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MEYER Service Puts Reinforced Concrete Floors for Residences on a New Low-Cost Basis

REINFORCED Concrete Floors for residences can now be constructed at surprisingly low cost. At an additional expense of only 1½ to 2%, homes costing $10,000 and upwards may now have the same fire-safe, everlasting floors as modern hotels and other large structures.

Meyer Service in connection with residences covers these important steps—

1 Prepares structural working drawings.

2 Erects Meyer Steelforms, Meyer Adjustable Shores, and joist soffits complete, ready to receive the concrete.

3 Sets the reinforcing steel accurately in place.

This service not only cuts construction costs but insures a better, quicker job.

***Many Advantages*—Concrete floors in residences meet today's demand for safety, permanence, attractiveness.**

Concrete floors are fire-safe; they give stability to the structure, insure against cracked walls and other ills caused by shrinkage and settling; they are vermin-proof, resist decay, and are readily adapted to all types of floor covering.

Interior of Omaha Residence in which Meyer Steelform Concrete Floor Construction was used. There are no cracks in the walls, floors, or ceilings of this residence. Geo. B. Prinz, Architect. Gilmore Co., Contractor.

***Write* for illustrated literature giving other interesting facts on Concrete Floors for residences, or call our nearest office and ask our representative for facts and figures. In writing, kindly address 401 North 11th St., Omaha.**

CONCRETE ENGINEERING CO.

General Offices: OMAHA, NEBR.

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A Ceco Product

MEYER STEELFORMS

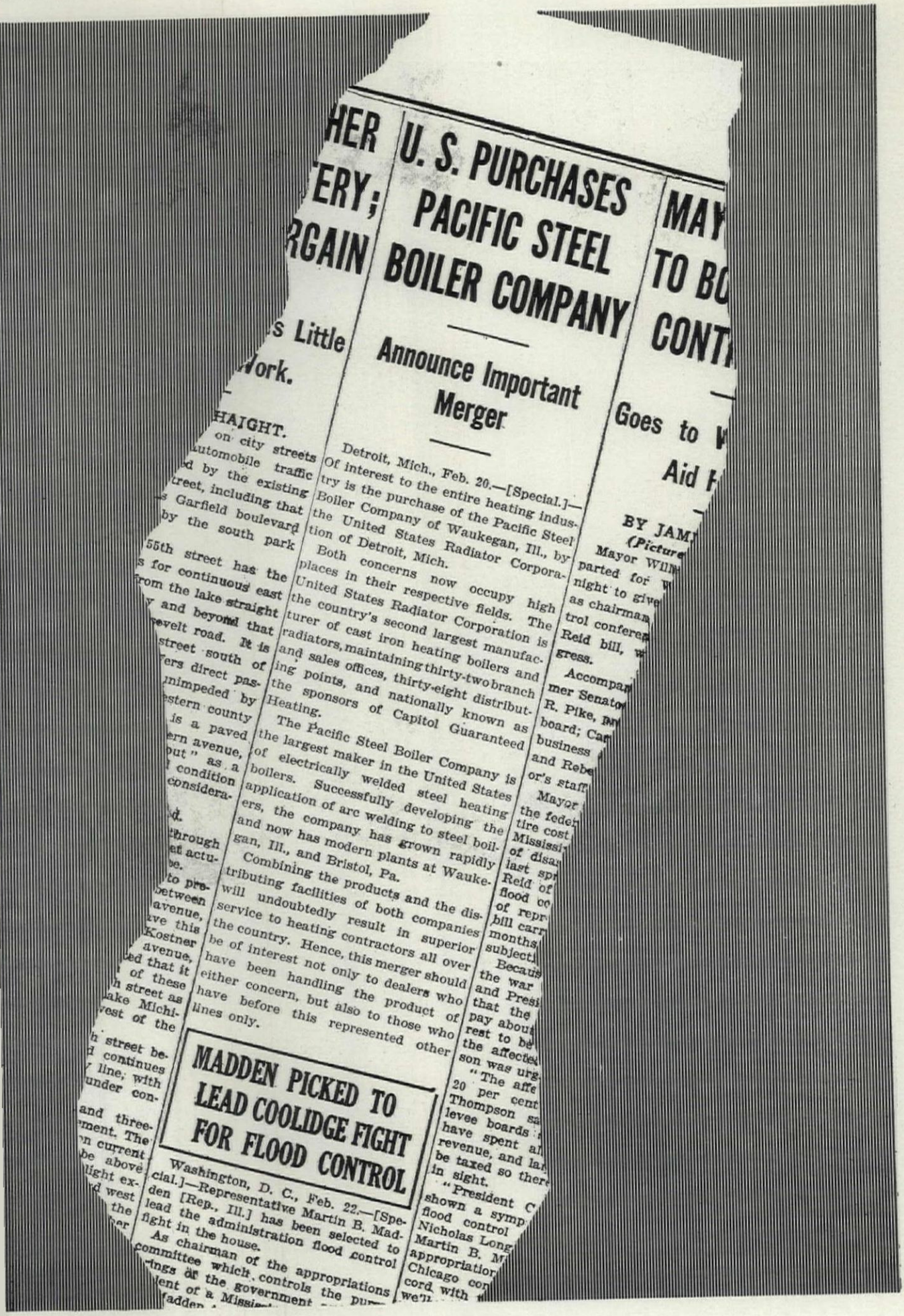
Other Ceco Products

Meyer Adjustable Shores
Meyer Adjustable Column Clamps

Ceco Reinforcing Bars and Bar Chairs
Ceco Triangle and Welded Fabric
Ceco Column Spirals

Ceco Metal Lath and Hook Hangers
Ceco Hot and Cold Rolled Channels
Ceco Corner, Base Bead and Mouldings

Ceco Metal Weather Strips and Screens



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U. S. PURCHASES PACIFIC STEEL BOILER COMPANY

Announce Important Merger

Detroit, Mich., Feb. 20.—[Special.]—Of interest to the entire heating industry is the purchase of the Pacific Steel Boiler Company of Waukegan, Ill., by the United States Radiator Corporation of Detroit, Mich.

Both concerns now occupy high places in their respective fields. The United States Radiator Corporation is the country's second largest manufacturer of cast iron heating boilers and radiators, maintaining thirty-two branch and sales offices, thirty-eight distributing points, and nationally known as the sponsors of Capitol Guaranteed Heating.

The Pacific Steel Boiler Company is the largest maker in the United States of electrically welded steel heating boilers. Successfully developing the application of arc welding to steel boilers, the company has grown rapidly and now has modern plants at Waukegan, Ill., and Bristol, Pa.

Combining the products and the distributing facilities of both companies will undoubtedly result in superior service to heating contractors all over the country. Hence, this merger should be of interest not only to dealers who have been handling the product of either concern, but also to those who have before this represented other lines only.

MADDEN PICKED TO LEAD COOLIDGE FIGHT FOR FLOOD CONTROL

Washington, D. C., Feb. 22.—[Special.]—Representative Martin B. Madden [Rep., Ill.] has been selected to lead the administration flood control fight in the house.

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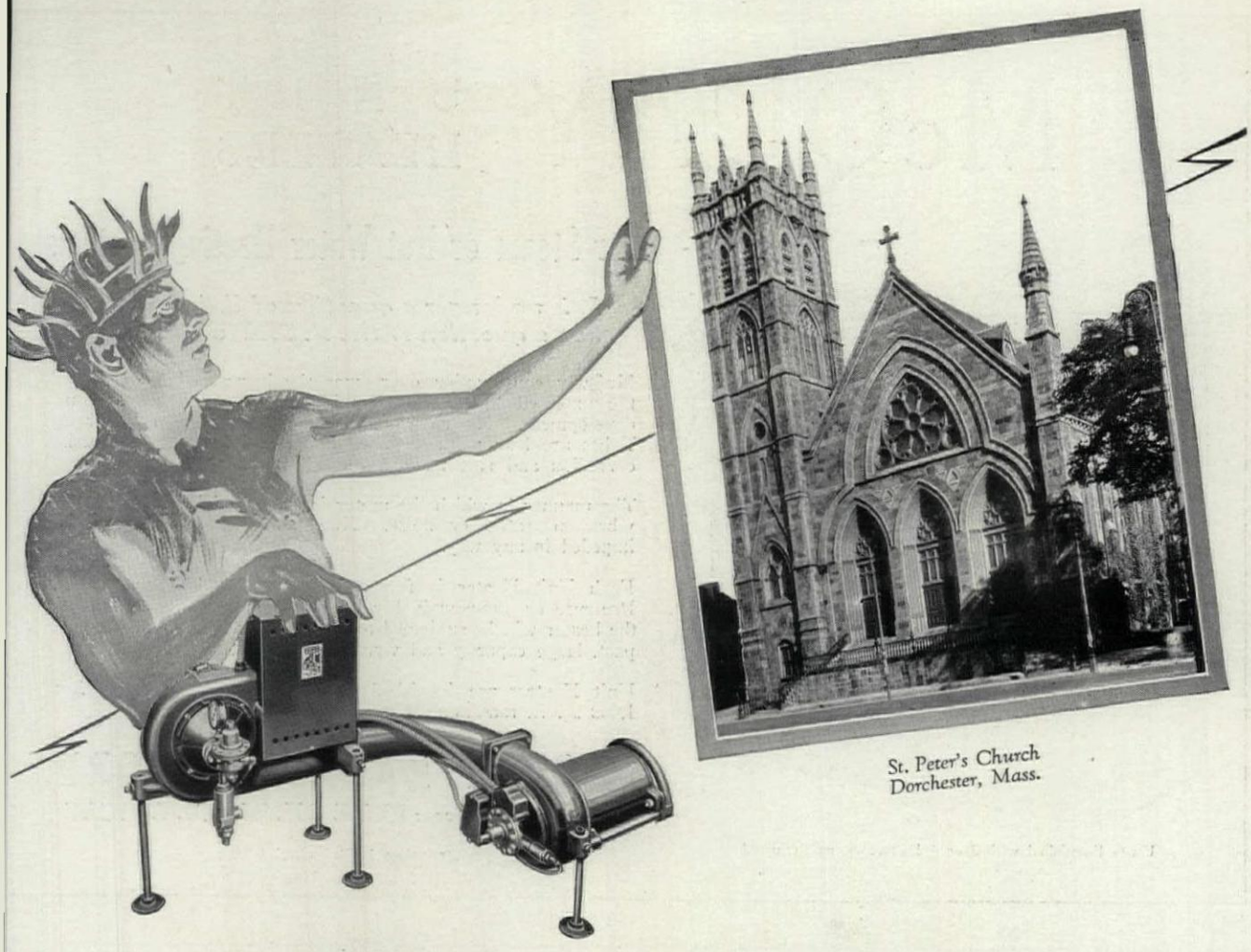

St. Peter's Church
Dorchester, Mass.

Successfully Heating Buildings —*of All Types and Sizes*

It is highly significant that Electrol has been chosen by leading architects for many of the outstanding church edifices of the country.

—Significant but not unusual, for in the past decade, Electrol has built a reputation for successfully heating buildings of all types and sizes.

All-Electric and Entirely-Automatic, Electrol, The Oil Burner with the Master Control, is self-regulating beyond belief, providing quick comfort at a constant temperature through the coldest weather.

For instance, in Dorchester, Mass., where the church illustrated above is located, the winters are noted for their severity. Installed in one boiler which carries about 4500 feet of direct steam radiation, Electrol supplies more than ample heat.

May we send you further information about Electrol, The Oil Burner with The Master Control? A request will bring our regulation A. I. A. folder, describing specific installations, special features, and containing helpful specification data.

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and by the Common-
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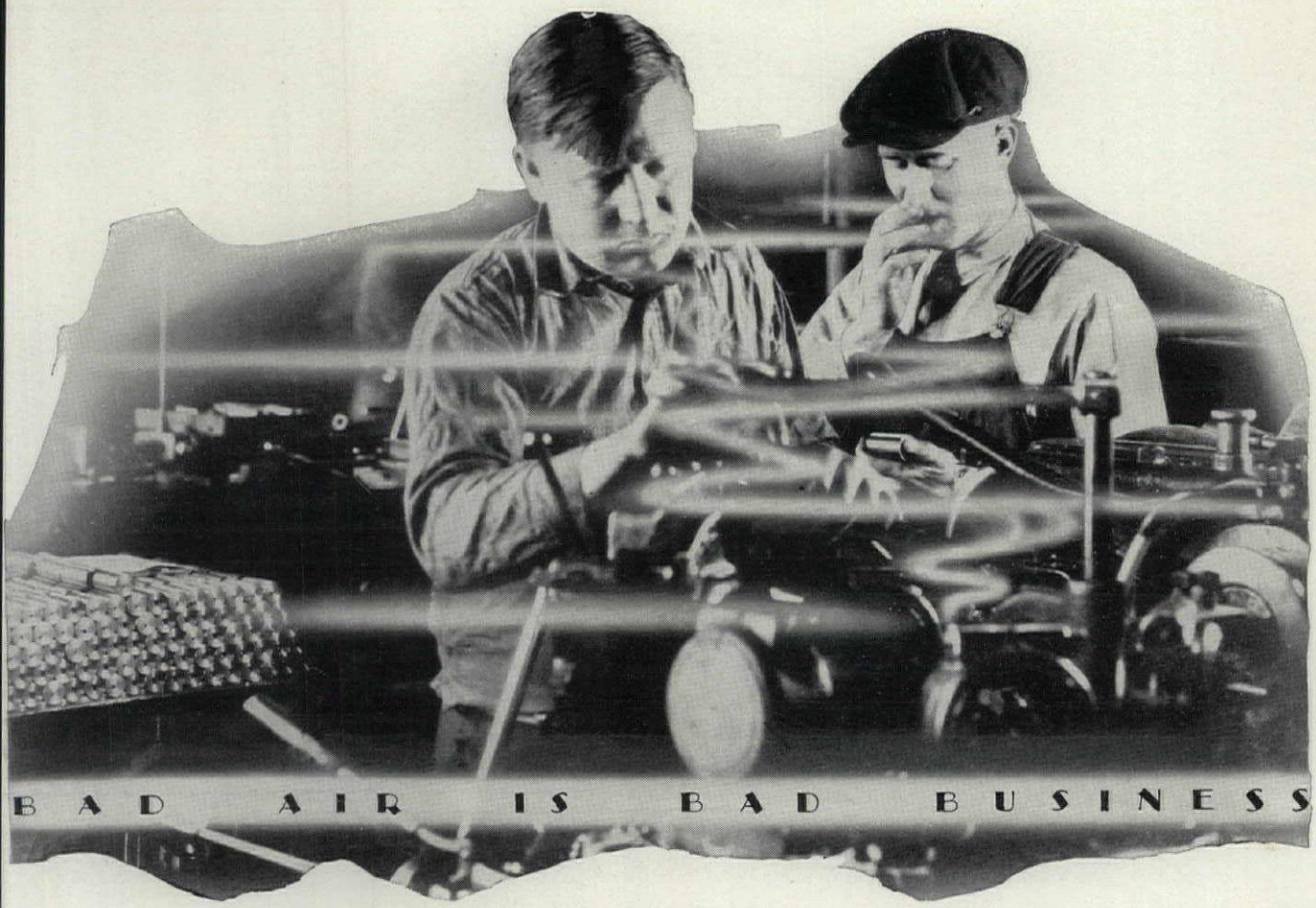
ELECTROL

The OIL BURNER with *The Master Control*

MADE IN ST. LOUIS AT 179 DORCAS STREET BY ELECTROL, INC. OF MISSOURI



...IN EVERY FACTORY

"Air" — the freest thing on earth — yet the most expensive! Men die from the want of it—countless thousands of dollars are wasted—millions of costly mistakes committed — because of the lack of pure, correctly tempered, exhilarating air in industry.

American Blower has declared war on bad air in business. Users of American Blower air conditioning equipment — electric ventilating, heating and air washing devices — are freed from one of the major causes of inefficiency, inaccuracy and under-production.

Actual savings, far out of proportion to the cost, stand to the credit of American Blower equipment.

For industrial work where duct systems of ventilation are required or advisable, Sirocco Blowers delivering as high as 200,000 cubic feet of air per minute are being specified.

For working areas that do not require a duct system, Ventura Ventilators are installed in walls, windows or transoms, which bring in or carry away as much as 70,000 cubic feet of air per minute.

For areas that require heated air as well as fresh air, the Venturafin Method of Unit Heating ventilates as it heats at a lower cost than just the price of heating equipment alone.

Write today for your copy of Ventilation News, the American Blower Corporation's new rotogravure magazine illustrating the many benefits of proper air conditioning.

AMERICAN BLOWER CORP., DETROIT, MICH.
CANADIAN SIROCCO CO., LTD., WINDSOR, ONT.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

Proper Ventilation Demands the Following Air Changes*

Offices	5 to 10 minutes
Bakeries	3 minutes
Laboratories	3 to 10 minutes
Ship Holds	10 minutes
Kitchens (Home)	2 to 3 minutes
Laundries	5 minutes
Theatres	5 to 10 minutes
Garages	5 minutes
Dining Rooms	5 to 15 minutes
Machine Shops	15 minutes
Lodge Rooms	10 minutes
Foundries	5 to 10 minutes
Retail Stores	5 to 15 minutes

*This table is based on climatic conditions in Central United States. Other tables for specific localities are available.

The American Blower Office Ventilator

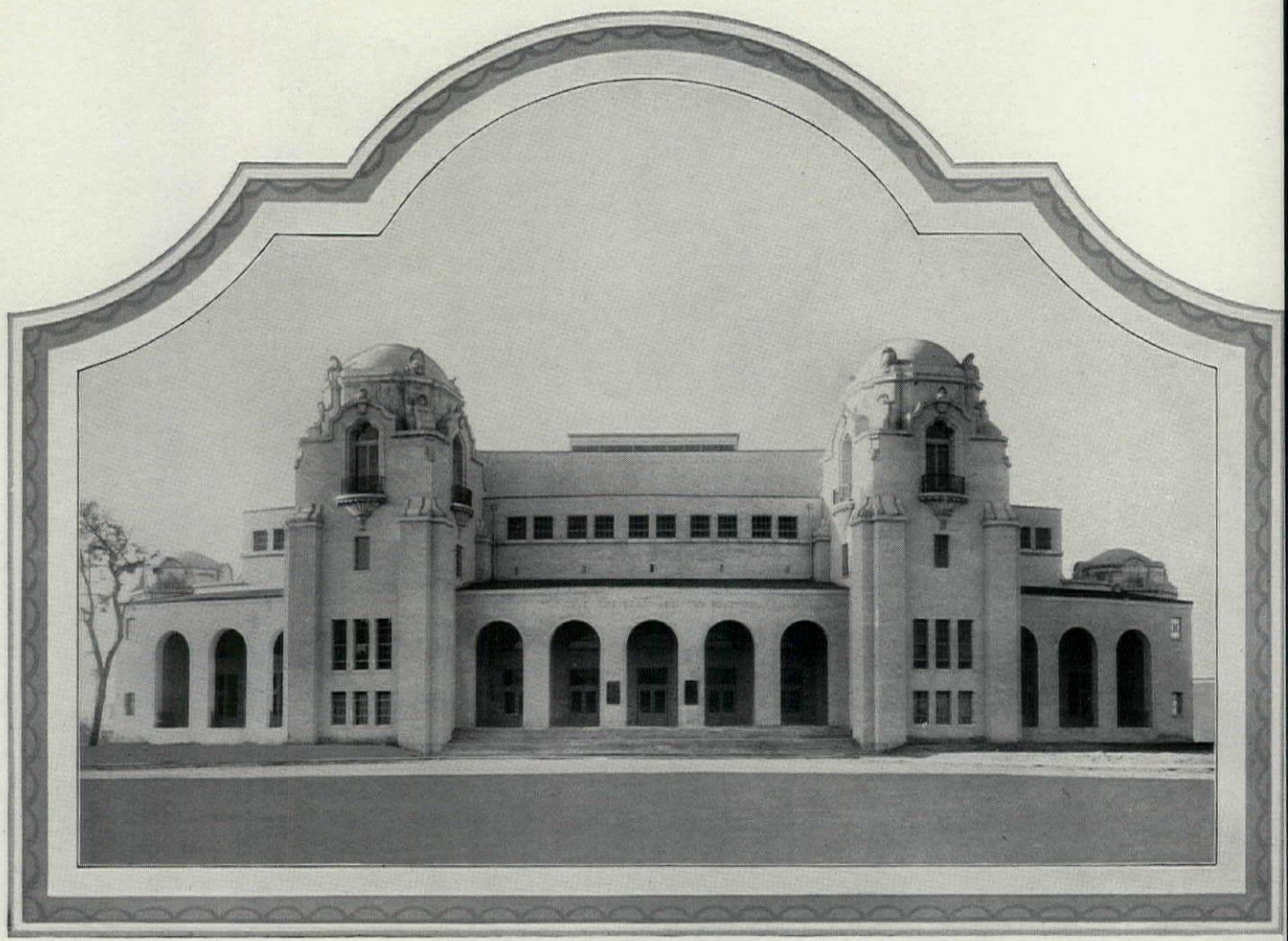
A noiseless, compact ventilator that carries away the tobacco smoke, impure air and odors; brings in the pure fresh air from outdoors. Equipped with reversible motor—fits any window—no alterations or cutting of glass to install—ventilates without draughts.

(725)

American Blower

"Sirocco" VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT

MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881



FAIR PARK AUDITORIUM, DALLAS, TEXAS . . . . LANG & WITCHELL, ARCHITECTS . . . . EQUIPPED WITH JOHNSON HEAT CONTROL

The architect's attitude toward Johnson Heat Control is one of confirmed acceptance. Johnson Heat Control is readily specified for every type of building. The Johnson System's forty-three years of constancy substantiates its merit. Johnson all-metal construction has advanced temperature regulation to a permanent accuracy and practicability. Its Dual Thermostat (night and day regulation) completes heat control service and value. The conveniences and comforts and correct temperature evenness furnished, and the fuel economy of twenty-five to forty per cent obtained . . . . . are advantages and results every building today requires.

The Perfect Graduated, Intermediate Night And Day Heat Regulation . . .

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MILWAUKEE, . . WISCONSIN, . . U. S. A.
BRANCHES IN ALL PRINCIPAL CITIES

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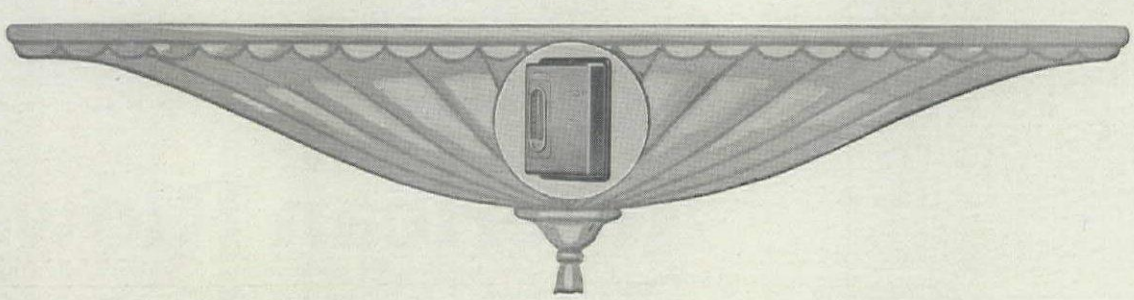
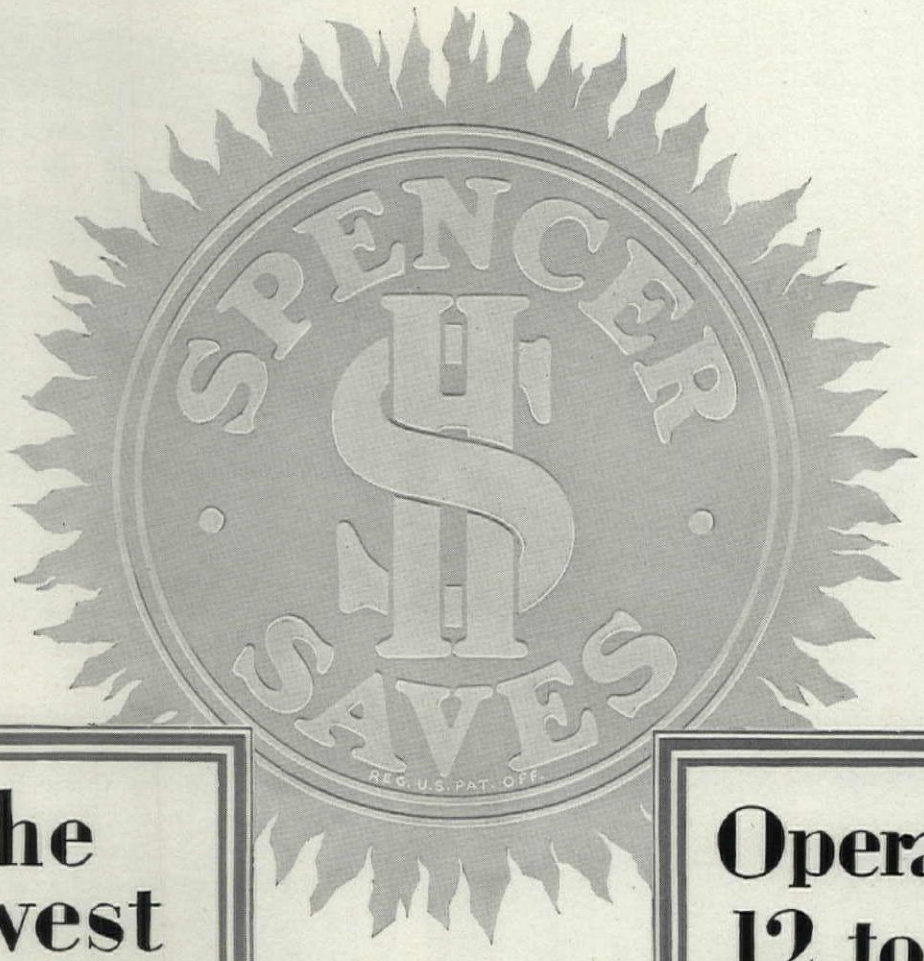




The Lowest cost heat you can buy

The advantages of this economy and convenience are what the architect offers his client when he recommends

Operates 12 to 24 hours without attention

Spencer

steam . vapor or hot water

Heaters

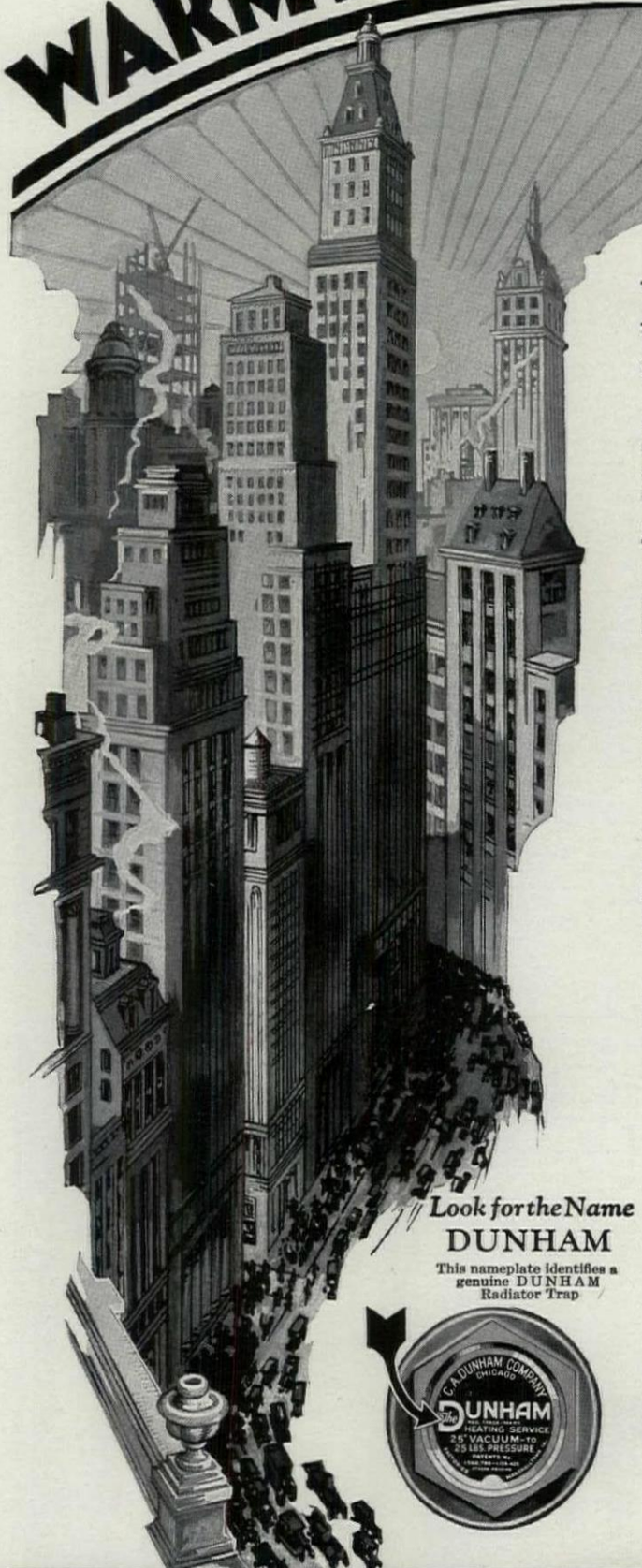
SPENCER HEATER COMPANY *General Offices:* WILLIAMSPORT, PA.

New York City Boston Philadelphia Baltimore Buffalo Rochester Hartford Albany Syracuse Scranton

Division of Lycoming Manufacturing Company

STEAM CAPACITIES: Cast Iron Sectional *from 600 feet to 3,200 feet.* Steel Tubular *from 2,000 feet to 16,000 feet*

WARMTH WITHOUT WASTE



ENGINEERS have pronounced the invention and successful application of the Dunham Differential Vacuum Heating System utilizing Sub-Atmospheric Steam as the outstanding heating achievement of the decade.

It has long been a matter of common knowledge among Engineers that the amount of radiation estimated for the coldest weather of a heating season was excessive for the requirements of the mild temperatures which prevail through 95% of the usual heating season.

Sub-Atmospheric Steam Overcomes These Conditions

It prevents costly overheating with excessive window opening. It provides healthier indoor temperature of buildings.

With the widespread installation of the Dunham Differential System has come a new appreciation of the comforting agent we know heat to be. And also a new understanding of heating economy. For with the removal of overheating the Dunham System cuts fuel costs at least 25%.

A fundamental point about this new system of heating is the degree of heat given off by the radiators. It permits circulation of steam in the radiators on as low as 133 degrees (for mild weather) with increasing temperatures (in extreme weather) to correspond to heat lost from the building.

These are facts that should challenge the attention and closest investigation of Engineers, Architects and Heating Contractors.

Over seventy branch and local sales offices in the United States, 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.

The DUNHAM
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A FIXED DIFFERENTIAL IN PRESSURE — Heating System — A VARIABLE DEGREE OF VACUUM

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

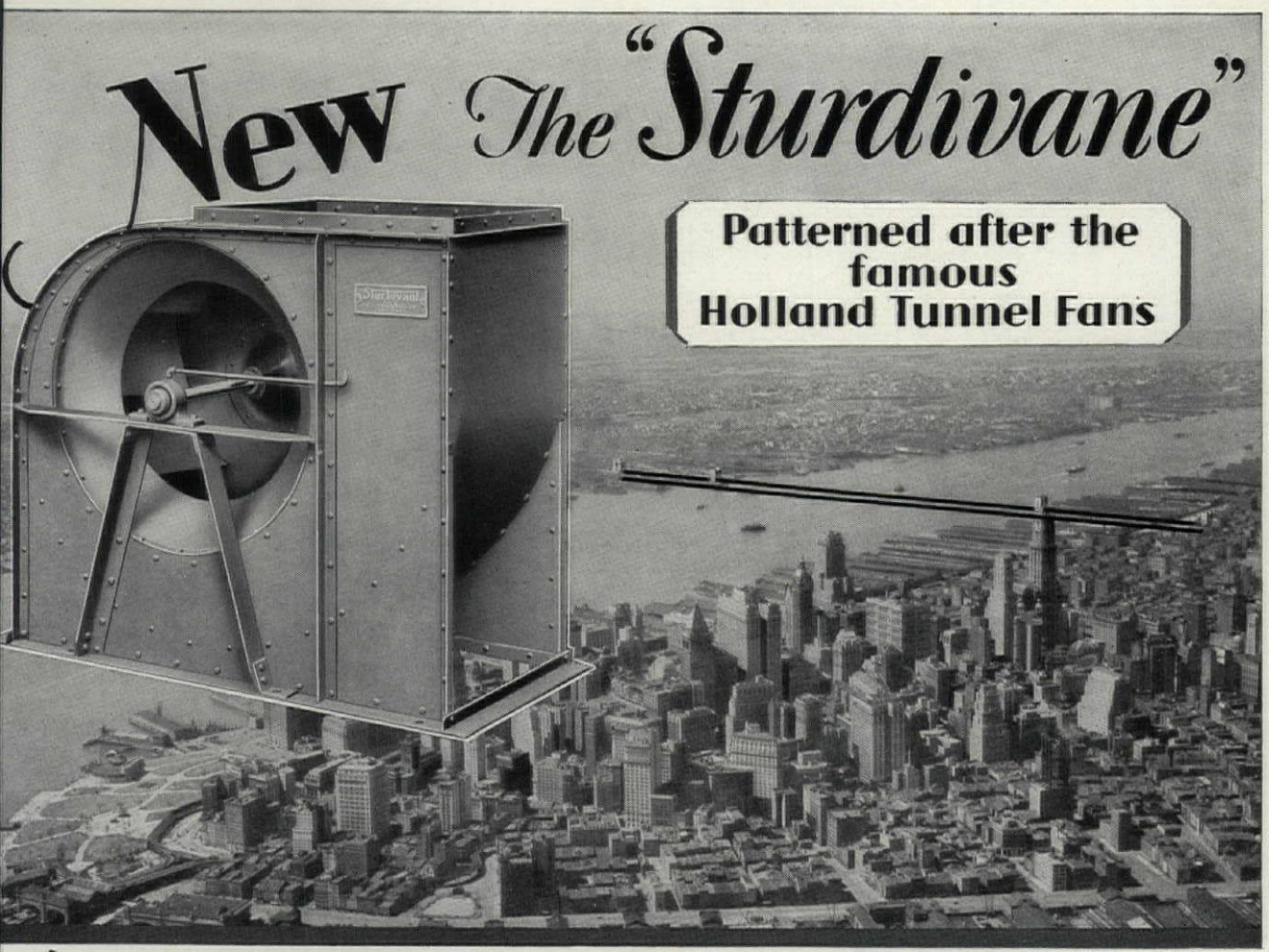
C. A. DUNHAM CO.

DUNHAM BUILDING

450 East Ohio Street, Chicago

SUB-ATMOSPHERIC STEAM

New The "Sturdivane"



A sturdy, high speed ventilating fan for general use . . . *with the same superior operating characteristics . . . the same low power consumption of the Holland Tunnel Fans*

MANY months of designing, building and testing—all the facilities of the Sturtevant Research Laboratories—went into the making of the giant Sturtevant fans which ventilate the Holland Vehicular Tunnels.

The result of these months of effort stands as one of the most important achievements in air engineering. Sturtevant not only met the exacting specifications of the tunnel engineers, but met them with a power consumption 15% less than that required by any other competitor.

A new fan, for general use, the "Sturdivane," is now offered by Sturtevant. It is patterned after the Holland Tunnel fans . . . possesses the same superior operating characteristics . . . the same low power consumption.

The "Sturdivane" brings new efficiency and economy to ventilating fan operation. Here are some of its outstanding features:

1. *Quiet as a slow speed fan.*
2. *Extremely low cut-off velocity.* A larger air outlet allows the air to move quietly at a lower velocity.
3. *Objectionable motor noise avoided*—Wheels can be over-hung on extended motor shaft, making a self-contained motor-driven unit which may be set on a silencing frame.
4. *Has a self-limiting horse power characteristic*—Prevents motor overload, and permits use of smaller motors.
5. *Cuts operating costs 25 to 30%*—
6. *Low initial cost.*
7. *Low transportation cost.*
8. *Low installation cost*—No pulley, belting or chain drive to install when direct connected.
9. *Ball bearing equipped*—Smooth operation—practically no bearing wear.
10. *Cuts motor costs*—Saves 20% or more on direct connected motor costs.

Write for complete information about this important development. The nearest Sturtevant office will give prompt attention to your inquiry

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

Atlanta	Buffalo	Chicago	Dallas	Hartford	Kansas City	New York	Rochester	San Francisco
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Sturtevant

REG. U. S. PAT. OFF.

ENTILATING, HEATING, AND POWER PLANT EQUIPMENT

REVIEWS OF MANUFACTURERS' PUBLICATIONS

THE ELEVATOR SUPPLIES COMPANY, INC., Hoboken. "E. S. Bulletin." A monthly publication about elevators.

As has been often said, the modern tall building could never have become even a possibility had not the elevator been developed to render it practical. It might be supposed that the elevator had some time ago reached the height of development to which it could be brought, but such can scarcely be said to be true, since there frequently appear improvements or refinements to render the elevator even more useful for passenger or freight service. Architects and engineers who are interested in keeping abreast of the times in regard to improvements in elevators would do well to receive this little monthly magazine, which is devoted to spreading information concerning such improvements.

NATIONAL LAMP WORKS OF THE GENERAL ELECTRIC CO., Cleveland. "Office Lighting."

The importance of proper artificial lighting is not recognized as it should be as a very important part of the working equipment of an office, and today we find the majority of offices equipped with poor or inadequate illumination. Two essentials for office lighting, in relation to vision, are adequate quantity and good quality to permit clear, quick sight, and to prevent eye strain. This interesting booklet presents half-tones of well lighted offices together with their approximate dimensions and information regarding the lighting equipment used. Under each illustration data are given showing the size of the office, the ceiling height, the type of lighting unit and the number of lighting fixtures according to the floor area. Four tables given at the back of the brochure present detailed lighting recommendations for offices of any dimensions, together with the type of lighting unit to be used, first for interiors with light colored ceilings, and second for offices with dark colored ceilings.

THE ATLAS PORTLAND CEMENT COMPANY, New York. "Stucco; Interior Plastering; Sgraffito."

No booklets issued by manufacturing concerns to keep architects and builders informed as to their output are more interesting or more valuable than the numerous publications which come from the Atlas Portland Cement Company. This particular booklet deals with a number of subjects which concern builders doing domestic work, covering as it does the clothing of buildings of brick, concrete or building blocks with stucco, the use of stucco or plaster for interiors or as covering for old frame structures being remodeled, and the use of sgraffito, this last being of course a matter of decoration rather than of building. The subjects which require illustrations are made quite plain by means of diagrams and cuts (many in color) showing work in various stages of progress, and the important details of mixing stucco and figuring quantities of material needed are covered by carefully prepared, authoritative tables.

THE NATIONAL LEAD COMPANY, New York. "Standard Specifications for Use of Red Lead Paint."

With nearly all important building in American cities being done with steel, there attaches particular importance to whatever protects the steel and renders its durability secure. Red lead is perhaps the most widely used of all steel preservatives, often being applied at the foundry before the steel is delivered at the building site. So important to the durability of steel are the preparation and application of red lead that these large manufacturers of the material issue this brochure to promote its better use and also the use of red lead paints. Extreme care has been taken in the preparation of these specifications to make them complete and absolutely reliable, and to present them in the most readily understood form possible. They are based on approved modern painting practice and are authoritative in every detail, and as supplementary matter there are included the specifications of the American Society of Testing Materials and the United States government for the use of red lead, turpentine, and for linseed oil both raw and boiled, made from North American and South American seed.

AMERICAN DISTRICT STEAM CO., North Tonawanda, N. Y. "The Adsco System of Atmospheric Steam Heating."

Manufacturers of heating apparatus have brought to bear upon the designing and manufacturing of their product the most careful attention and study of highly trained engineers, the result being that the utmost in heat and heat circulation is had from the generators of heat and from the radiators or other units by means of which it is distributed or diffused. This booklet describes and illustrates the Adsco System of Atmospheric Steam Heating, a vapor system adaptable to buildings of any size or type. Of particular interest are the pages devoted to the Adsco Graduated Valve, placed at the top of each radiator and opened to any extent necessary to control the quantity of steam entering the radiator.

THE AMERICAN BRASS CO., Waterbury, Conn. "Anaconda Architectural Bronze Extruded Shapes."

For building entrances, windows, show windows and other similar purposes extensive use is being made of bronze in different forms. This highly successful use is of course made simpler and vastly less costly than would otherwise be the case by use to a large extent of bronze supplied in stock forms instead of forms which must be made to order from an architect's detailed drawing. This is exactly what is made possible by use of the stock details illustrated and described in this valuable booklet,—cornice sections in wide variety; pilaster casings of different kinds; jamb casings and sash sections; base mouldings, bar sections, and all the many details which enter into building of this exacting character. While it is sometimes impossible to extrude complicated sections in one piece, various independent shapes can be used in assembly to execute almost any design required for cornices, pilasters, casings or other items needed. The value of the brochure should give it wide circulation.

CELESTIALITE DIVISION, Gleason-Tiebout Glass Co., 200 Fifth Avenue, New York. "A. I. A. File."

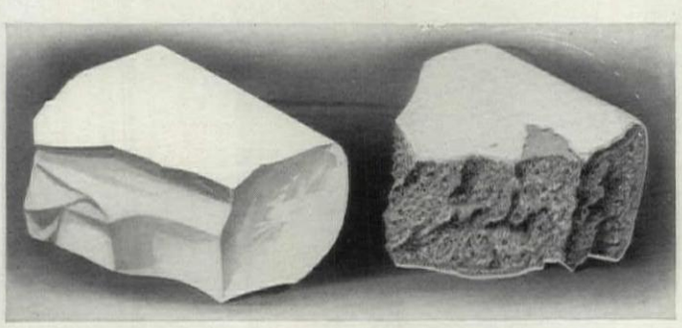
Vast indeed must be the amount of electrical current wasted daily in the United States because of its being improperly used, and care and study at the hands of architects and engineers would do much to advance the economical use of this marvelous source of power, if the valuable publications issued by certain manufacturers were properly made use of. To make easy the preservation of the bulletins and other sources of data regarding lighting issued by its staff, the Gleason-Tiebout Glass Co. will mail to any architect or engineer a folder, made in accordance with the directions of the A. I. A., in which to file its highly important data of different kinds. On one inside page of the folder there are given certain details of data which are probably of general importance,—data having to do with Wattage of Mazda Lamps; Location of Lamp Filament; Low Intrinsic Brilliancy. The "file" should be had by every architect.

THE BARBER ASPHALT COMPANY, Philadelphia. "Genasco Trinidad Lake Asphalt Mastic." A work on its use.

In the asphalt industry the term "mastic" signifies a bituminous mixture which is sufficiently plastic when hot to spread and compress by hand with a wooden trowel or float, as distinguished from mixtures of a somewhat similar nature that are spread with rakes and compressed by means of tamping irons or a mechanically-operated roller. It is especially adapted for the construction of floors and sidewalks, the foundations of which are not sufficiently strong to support the weight of a heavy roller or the location of which will not permit use of the latter type of manipulation. As a material of which to construct sidewalks and roadways and for use upon platforms in train sheds, large manufacturing plants, etc., mastic has an importance to architects and engineers which is fully explained in this brochure. Mastic when used for flooring is easily laid over a pre-existing floor of wood, concrete, brick or in fact of any material, provided the floor be sufficiently solid and has no excessive vibration. A floor of mastic forms a continuous sheet and therefore has no crevices where dirt may collect.

An Approved School Fixture of Highest Sanitary Quality and Design—

More than twelve hundred Douglas Vitreous China Urinal Stalls were used during 1926 and 1927 in Chicago Schools alone. Sixty-three were installed in the Roosevelt High School, America's largest and most modern High School building. Made of genuine vitreous china, the same material as is used in the manufacture of water closet bowls and china lavatories.



A Sectional Piece of Douglas Vitreous China Urinal

A Sectional Piece of the Ordinary Urinal

The John Douglas Co.

Cincinnati, Ohio

Manufacturers of School Plumbing Fixtures Since 1887

REVIEWS AND ANNOUNCEMENTS

WEST COAST LUMBERMEN'S ASSOCIATION. Seattle. "Douglas Fir and Southern Pine." A booklet on their use.

Even within the same material there are wide ranges of strength, toughness, and many other qualities which procure for those materials extensive use for one purpose or another. This is particularly true of wood, and various woods and even different kinds of the same wood present such differences that an architect or engineer, if he is to use wood intelligently, should be familiar with the qualities which often render a particular wood much more serviceable than any other. This brochure or booklet, issued by the West Coast Lumbermen's Association, has to do with comparing the physical and mechanical properties of Douglas Fir and Southern Pine. The booklet says: "It is the policy of the manufacturers of Douglas Fir to present the merits of their own species, without comparison with others. Inquiry is so frequently made, however, as to the comparability of Douglas Fir and the Southern Pines, that this analysis has been prepared in order that the questions may be answered by a carefully considered, fair statement.

THE UNITED STATES GYPSUM COMPANY, Chicago. "Sheetrock-Pyrofill Construction; Floors and Roofs."

This booklet says that during the past 15 years the U. S. Gypsum Co. has installed more than 50,000,000 square feet of gypsum roofs on buildings of different kinds throughout the United States. The brochure deals quite fully with the use of gypsum and describes the use of the Sheetrock-Pyrofill system, which as the name implies "consists of permanent Sheetrock forms and Pyrofill reinforced with an electrically-welded galvanized steel fabric. Sub-purlins, either tee irons or light rail sections, are spaced 32½ inches on centers, and clipped to the main roof purlins. This spacing will vary slightly, depending on weight of rail and method of fastening used. Construction details show spacing for 12-pound rails. On the bottom flanges of these sub-purlins are laid panels of Sheetrock, mill-made in lengths equal to the main purlin spacing, so that all joints on the undersurface are hidden from view, and a neat, smooth ceiling results. A reinforcement consisting of electrically-welded galvanized steel fabric with No. 11 longitudinal wires on 4-inch centers and No. 12 cross wires on 8-inch centers having a sectional area of .034 square inch is then laid on top of the Sheetrock with the main wires running at right angles to the sub-purlins, and the Pyrofill mix is then poured to the desired thickness. Screeding to a smooth finish leaves this monolithic deck ready for the waterproof covering, with no sharp points or edges."

MOLBY BOILER COMPANY, New York, and Lansdale, Pa. "The New Molby Heating Boiler."

In connection with its description of the "Molby Magazine Feed Boiler" and the "Molby Magazine Feed Tank Heater," this booklet gives certain data likely to interest architects and builders as well as house owners. "The annual cost of coal plus how efficiently it operates and how little labor and attention it requires, and not the first cost, determine the investment features of a heating boiler. A Molby magazine-feed boiler or a Molby magazine-feed tank heater is an investment that pays perpetual dividends not alone because of its labor-saving features and its superior heating efficiency, but because of its ability to burn the cheaper No. 1 buckwheat size of anthracite. Say, for example, 20 tons of coal are required for a season's heating. The price of egg, stove and nut in New York and vicinity is often as low as $13.50 a ton; 20 tons at this price would be $270. No. 1 buckwheat can be purchased for $7.70 a ton (often less). At this price 20 tons cost only $154. By using No. 1 buckwheat, the owner of a New Molby saves as much as $100 on a single season's supply of coal. When one stops to consider that $100 is the equivalent of 6 per cent interest on an investment of almost $2,000, the owner of an ordinary heating plant, alive to his best interests, will readily see that he is spending far too much for coal. The owner knows, too, that without an efficient, economical heating system, his residence, apartment house, or other building soon loses in re-sale and rental values."

IRON FIREMAN MANUFACTURING CO., Cleveland. "The Iron Fireman Automatic Coal Burner."

The efficiency of a heating apparatus is often increased by using the adjuncts or devices which modern ingenuity and inventive skill are producing. Such, for example, is the "Iron Fireman Automatic Coal Burner," described and illustrated in this brochure. It is a practical firing device, strong, and scientifically designed. It burns the lowest priced coal which can be had—anthracite buckwheat, bituminous or lignite screenings—and these cheap fuels are handled with far greater efficiency than could be had were higher priced fuels fired in the old fashioned way. The relation of the "Iron Fireman" to the boiler is very much the same as that of the carburetor to the automobile. It feeds just the right amount of coal with exactly the quantity of air to give the proper mixture. Because it is automatic, it saves labor; owing to its construction the smoke nuisance is wholly eliminated, and by setting its automatic control at the maximum and minimum desired, the temperature degree may be maintained within the determined ranges.

ARMSTRONG CORK & INSULATION CO., Pittsburgh. "The Contractor's Book on Armstrong's Corkboard."

Among the various problems connected with building which have been successfully solved are those having to do with insulation,—the confining of heat or else the preventing of penetration of heat into certain areas. Scientific research and the ingenuity of manufacturers have here worked hand in hand, and the result is that architects and builders have at their service means of insulation which seem to express the final word in efficiency. This booklet explains and illustrates the uses of Armstrong's Corkboard as applied to residence structures. Every aspect of such use of an insulating substance is discussed, and the correct methods of using the material are made plain by diagrams and halftones from actual photographs of houses in many localities.

Lionel H. Pries announces the formation of the firm of Bain & Pries, with offices in the Liggett Building, Seattle.

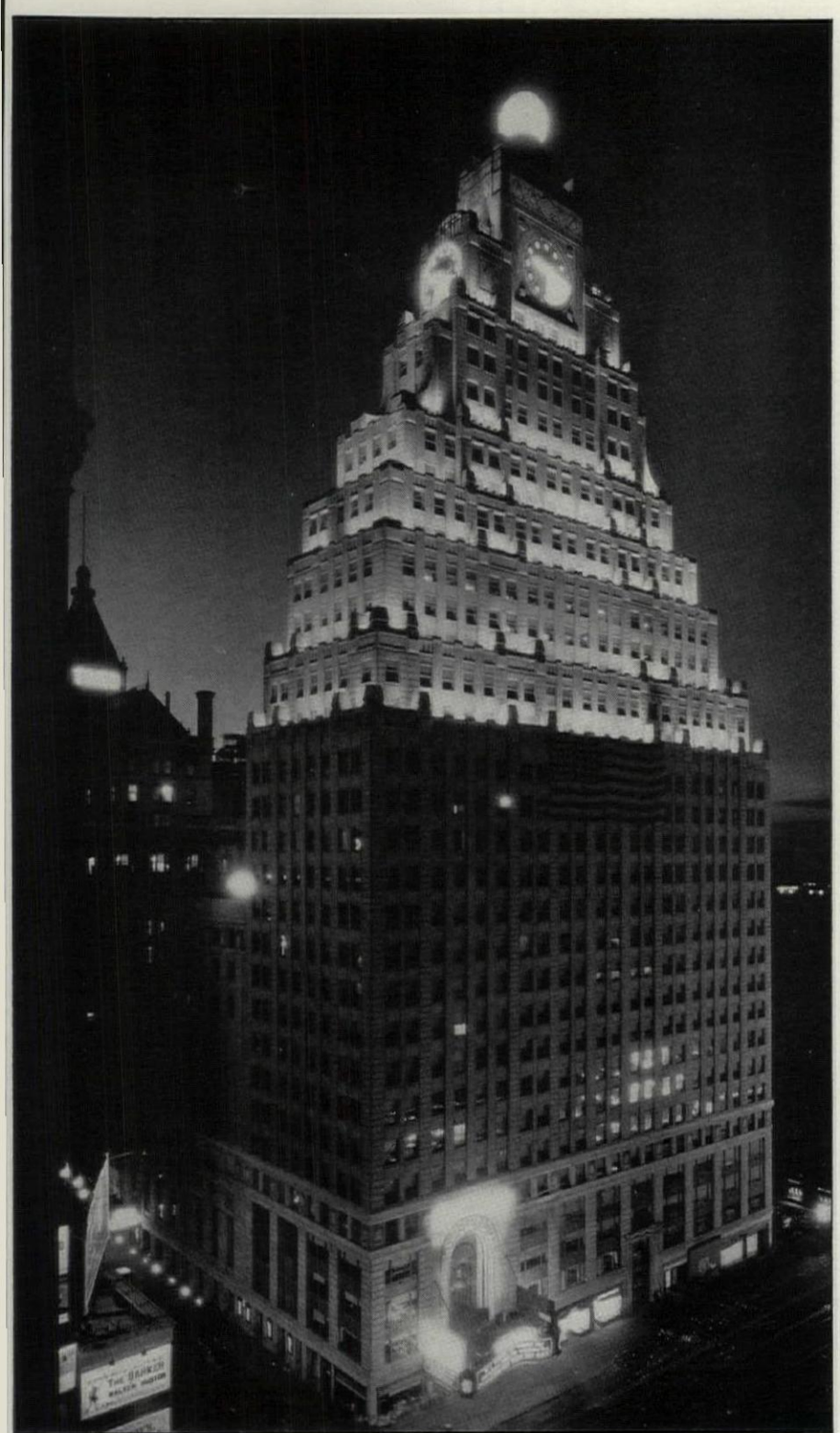
Clarence J. Veillette, formerly of 1562 East Main Street, Bridgeport, Conn., is occupying offices at 1044 Noble Avenue.

John Hunter, Jr., and William H. Caldwell announce formation of the firm of Hunter & Caldwell, with offices in the Central Trust Building, Altoona, Pa.

E. T. Hutchings announces his removal from 418 South Fifth Street to 1709 Heyburn Building, Louisville. G. M. Grimes and E. R. Gregg will be associated with him.

R. E. Raseman and R. P. Raseman announce the withdrawal from the firm of Raseman & Freier of Henry M. Freier, and the formation of the firm of Raseman & Raseman, with offices in the Murphy Building, Detroit.

Thomas R. Kimball, William L. Steele, and J. Dorr Sandham announce the formation of the firm of Kimball, Steele & Sandham, with offices at 836 World-Herald Building, Omaha, and 502 United Bank Building, Sioux City, Ia.



All concrete floors in the Paramount Building are protected by LAPIDOLITH TRADE MARK

OVER one-quarter million feet of cement surface—thirty-one floors in this great structure—are treated with Lapidolith, the original concrete floor hardener.

The steadily growing list of such Sonneborn jobs is definite evidence of the leadership of Sonneborn Products.

The cost of Lapidolith per gallon may be higher, but *the cost per year of service is lower than that of any other hardener.*

Every set of plans in your office involves floors. Remember that Sonneborn experts are at your service to give the cooperation that produces successful work.

The Sonneborn Policy is that the architect must always be satisfied. Sonneborn always makes good.

Architect, C. W. & G. L. Rapp
Builders, Thompson, Starrett Company

L. SONNEBORN SONS, Inc.

114 FIFTH AVENUE, NEW YORK

Some Other SONNEBORN *Products*

LIGNOPHOL—Wood floor preservative prevents floors from splintering or drying out. Gives a hard, smooth, sanitary floor.

HYDROCIDE COLORLESS—A waterproofing for exposed exterior walls, which does not form a film that can be abraded, but carries waterproofing material into brick, stone or cement, caulking the pores against the elements.

CEMCOAT—A paint that stays white after others turn yellow. Can be washed over endlessly. Adheres to brick or concrete as easily as to wood.

COUPON

L. SONNEBORN SONS, Inc., 114 Fifth Ave., New York

Please send me, without obligation, demonstration samples and literature on: —Lapidolith.....; Lignophol.....; Cemcoat.....; Hydrocide Colorless..... (Check products that interest you.)

Name.....

Address.....

Company.....

Position..... A.F.-4

INDEX TO ADVERTISING ANNOUNCEMENTS

PART 1—ARCHITECTURAL DESIGN

PART 2—ENGINEERING AND BUSINESS

City of Onalaska, Washington. J. W. Luke, Portland, Oregon; *Consulting Engineer*

Heating the whole town *from one central power plant!*

Minimizes fire risk, eliminates firing of boilers and stoves, and affords a remarkable fuel economy

Miles of steam mains, operating with positive circulation and maximum economy, from one central power plant, heat entirely the Carlisle Lumber Company's model city of Onalaska, Washington, comprising office buildings, churches, schools, stores, and hundreds of residences.

These successful results are possible because all Valves, Thermo Radiator Traps, Steam Traps, Reducing Valves, Back Pressure Valves, etc., are of one manufacture —ILLINOIS ENGINEERING COMPANY—giving unified operation and undivided responsibility.

Consult us on your central heating problems!

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REPRESENTATIVES IN 40 CITIES OF U.S.A.

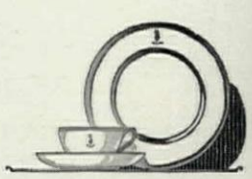
ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD President INCORPORATED 1900

CHICAGO

All these things in one

1. *Compact*—Valve housed in bowl at back making one compact and complete unit.
2. *Design*—A graceful syphon jet bowl with square base and extended lip, having a deep seal, large water surface and long rim opening.
3. *Quiet*—Very much quieter in operation than the usual flush valve bowl.
4. *Metal Concealed*—The valve and most of the nickeled work is concealed, saving the usual cleaning and polishing upkeep.
5. *Valve*—A stock type valve especially adapted to the bowl. A valve of proven merit with national distribution and reputation. A cap above the valve permits ready access for attention to the valve.



Plumbing fixtures of Eljer China are similar in texture to the finest French Table China—but with the added toughness necessary to withstand rough usage. Acid-proof and rust-proof.

THE following perfect description of the Eljer Carlton fixture, No. 545, was coined at some time before William the Conqueror forsook short pants in favor of a suit of armor and a battle axe: *"Multum In Parvo"—much in little space.* That's the Carlton, with all the good points of a hundred types and designs rolled into one and produced by Eljer in vitreous china, as white and hard and impervious to stains as the finest French Table China. Everything you want is here: remarkably quiet; efficient action; grace of line; ample size—everything!

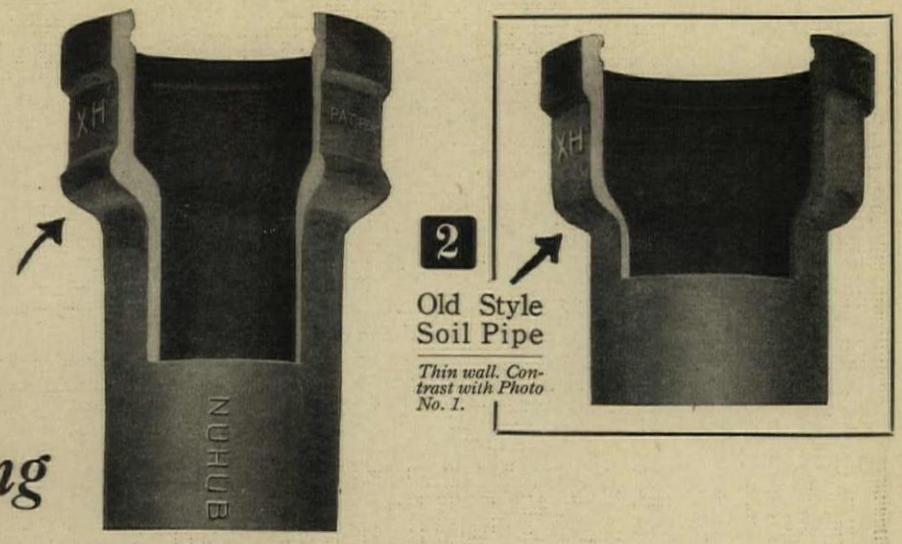
And it's backed by willing service that fills orders right on the dot, thus saving costly delays and temper-trying uncertainties.

Send for the Eljer catalog, with the Carlton and scores of other Eljer designs, regular and special, fully described. Eljer Company, Ford City, Pa. Plants at Ford City, Pa. and Cameron, W. Va.

ELJER

VITREOUS CHINA PLUMBING FIXTURES

An Announcement of Nation-Wide Importance



Introducing NUHUB

TRADE MARK

SOIL PIPE

The Biggest Step Forward in Soil Pipe Design and Manufacture . . .

STRENGTH WHERE STRENGTH IS NEEDED MOST

THE Central Foundry Company's engineers, ever alert and resourceful and backed by one of the largest foundry organizations in the world, has again scored a triumph in perfecting what has been acclaimed by prominent architects, engineers, builders and plumbing contractors as a stronger, better soil pipe.

Pioneers in formulating standard specifications for soil pipe and first to perfect the lead groove type of joint, The Central Foundry Company is now manufacturing and furnishing the trade, in extra heavy weight, NUHUB cast iron soil pipe.

NUHUB sweeps away all former conceptions of what soil pipe should be.

Look at the accompanying photographs. Number 2 shows the recognized weakness of old style soil pipe, namely a thin wall at the base of the hub. A thin wall means breakage and replacement.

Number 1 shows how The Central Foundry Company has overcome this glaring weakness. Note the bead at the base of the hub. The bead assures double strength where the hub and the barrel of the pipe meet—strength where strength is needed most. The hub on NUHUB pipe meets the requirements of proper pipe hanging in steel and reinforced concrete buildings.

Led-LoK Groove, too

The "Led-LoK" superior groove inside of the hub—the first successful lead groove on soil pipe and originated by The Central Foundry Company fifteen years ago—is retained in NUHUB pipe.

Poured in the usual manner, the lead immediately upon cooling, becomes locked in this groove. The lead locked in the groove *can't* work loose.

For vertical and horizontal lines, in the building and under the ground—soil lines, waste lines, leader lines, vent lines, house drains and house sewers.

Sold by jobbers of plumbing supplies.

Specify NUHUB
Use NUHUB
for the Tallest uildings

NUHUB, tight, flexible, dependable, meets the most exacting demands of contraction and expansion, no matter how high the building.

Architects and Engineers can specify NUHUB soil pipe without danger of error or substitution. The "bead at the base of the hub" is a permanent and a distinctive mark of identification and can be always seen after the pipe is installed.

Plumbing Inspectors and Plumbing Contractors find the problem of calking for water or air test reduced to a minimum. NUHUB permits lead joints to be thoroughly calked without splitting hubs.

Jobbers are assured of less breakage in handling because NUHUB is stronger, better.

Look for the Bead at the Base of the Hub
. . Strength where strength is needed most .

THE CENTRAL FOUNDRY COMPANY

AND ASSOCIATE COMPANIES: ESSEX FOUNDRY, CENTRAL RADIATOR COMPANY
MOLBY BOILER COMPANY, INC. AND CENTRAL IRON AND COAL COMPANY
SUBSIDIARIES OF THE UNIVERSAL PIPE AND RADIATOR COMPANY

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Also manufactured under special agreement by ESSEX FOUNDRY, NEWARK, N. J.

BELL TELEPHONE COMPANY BUILDING
KANSAS CITY, MO.

Architects—Messrs. Hoit, Price and Barnes
Associate Architect—I. R. Timlin
Contractors—Swenson Construction Co.

Ask Messrs. Hoit, Price & Barnes about Carney Cement Mortar

CARNEY Cement was used for all of the mortar on the first section of the Bell Telephone Company Building. When the addition was made, Messrs. Hoit, Price and Barnes again specified and used Carney Cement.

Ask them, or any other architect why they prefer Carney Cement for their mortar, and you'll find—first, that it produces a bonded wall of exceptional strength—and second, that through the simple method of preparing it for use, and its extreme plasticity, a really sizeable saving in masonry, mixing and material is made possible.

THE CARNEY COMPANY

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CLEVELAND	CHICAGO	DETROIT	ST. LOUIS	MINNEAPOLIS
Leader Building	Builders Building	Book Tower	Louderman Building	Builders Exchange

Cement Makers Since 1883

CARNEY CEMENT
for Brick and Tile Mortar

Specifications
1 part Carney Cement to 3 or 4 parts sand depending upon quality of sand.