Positive and unfailing control of large, heavy doors! That's the certain sure result of using R-W doorway equipment and Aut-O-Dor, the electric operator that always works.

R-W engineers can handle any and all problems of door hanging or control. In St. Louis, when the new Police Headquarters garage was completed, R-W engineers were called upon to solve the doorway problem.

R-W engineers installed R-W industrial doorway equipment for four 9-foot high, 800-pound doors. Each door operates separately on ball bearing hangers. They are controlled electrically from three points and can be stopped instantly at any point. Delays and accidents are thus prevented.

Call upon R-W engineers at any time to help you solve difficult doorway problems. No door is too high, no opening is too wide, to be met by R-W equipment.
EVER since the first sky-scraper went up, pessimistic tongues have been busy with doleful predictions. "What's happening to the steel?" they ask. "Some day there'll be nothing left of the skeleton but criss-cross streaks of rust."

The doubters have been answered, with the dismantling in Chicago of the Tacoma Building, erected in 1887 for the World's Fair. Natco Fire Proofing was used throughout; floors were the old reliable Natco Flat-Arch (still a favorite today).

After 42 years, the steel work in this building was as perfect as the day it was installed. The steel corroded more in two weeks when the steel was exposed during the wrecking than it had in the preceding 42 years.

There is only one interpretation; when steel work is properly protected by Natco Girdler and Column Covering, the building should stand indefinitely. Obsolescence, and not depreciation, will determine its span of life.

In the floors of this old building is a tribute to Natco Flat Arch, too. The passing of the years have left their strength unimpaired. It is a comforting thought that the Natco Flat Arch Floors you install will still be rendering flawless service in 1970.

Each member of the Complete Natco Line of Structural Clay Tile has its own outstanding advantages to recommend it. The Line provides a size and shape for every building need—and the building gains in strength, safety, and service, through Natco.

NATIONAL FIRE PROOFING COMPANY


Branch Offices: New York, Chanin Bldg; Chicago, Builders Bldg; Philadelphia, Land Title Bldg; Boston, Textile Bldg.

In Canada: National Fire Proofing Co. of Canada, Ltd., Toronto, Ontario

TURN TO "SWEET'S"
Worthy of the Finest Buildings—
Quality Windows at Moderate Cost

Refinements in design and workmanship give to Truscon Double-Hung Steel Windows a distinctive appearance and superior quality in keeping with the finest buildings. Enhancing the value of any building and adding to its attractiveness, these windows are fireproof and permanent, always operate easily and have bronze weatherstripping. Due to efficient manufacture and large scale production, Truscon Double-Hung Windows are moderately priced.

Write for complete information, literature and quotations.

TRUSCON STEEL COMPANY, YOUNGSTOWN, O.
STEEL WINDOW DIVISION
Truscon Steel Company of Canada, Limited, Walkerville, Ontario
Warehouses and Offices in Principal Cities

TRUSCON
DOUBLE-HUNG STEEL WINDOWS
COUNTERWEIGHTED
MODEL NO 28
Here you see
what the Engineer and Contractor sees of a finished Raymond Concrete Pile, after installation—simply the top of the spirally reinforced steel shell filled with concrete.

and below you see
the sections of the shell itself before they are put together—and driven—and left in the ground as a solid, substantial, pressure-resisting hollow steel "form" (whose interior can be inspected). This is the famous Raymond Method of installing tapering concrete piles . . . every pile poured into a spirally reinforced steel shell that is left in the ground.
Look at a Kewanee from any angle and its greater strength and dependability is quickly apparent. We could build and sell them for less. But to do so we would have to leave out some of that extra strength, dependability and efficiency which makes Kewanee today's best boiler investment.

Kewanee Boiler Corporation
division of American Radiator and Standard Sanitary Corporation
Kewanee, Illinois
Branches in 40 Principal Cities
Picking the Right Concrete Floor

... For the World's Largest Auditorium

At Atlantic City is the world's largest auditorium, showplace of the world's merchandise—meeting place of world conventions. Here floor beauty is imperative. Color is more than desirable—it is a necessity.

And whatever the requisites for beauty the surface must be highly resistant to wear. Thousands of feet tramp over the floors night and day, the year 'round—no time nor budget for frequent redecorating and repairs.

Colored Masterbuilt Concrete Floors, because of their smooth, hard surface, their resistance to the wear of foot traffic, their "built-in" color, supply the answer to floor requirements such as this. They offer a wide selection of colors in treatments that strengthen the concrete as they color it.

Colored Masterbuilt floors are obtained by the application of Colormix, Dycrome, or Colored Metalicron, whichever is most adaptable to the specific installation. Ask the Master Builders' representative to explain the advantages of each.

THE MASTER BUILDERS COMPANY, Cleveland, Ohio
Factories in Cleveland, Ohio
Buffalo, N.Y. and Irvington, N.J.

Colored Masterbuilt Floors
HAR DENED DUST-PROOF CONCRETE
S P E C I F I C A T I O N S

T H E S E Aluminum Spandrels shall be made of No. 43 alloy, having a silicon content of 5%. The weight shall not exceed .097 pounds per cubic inch and the average tensile strength shall be not less than 17,000 pounds per square inch.

The surface shall be free from imperfections and equal in all respects to the smoothness and color of the sample submitted.

A L U M I N U M  C O M P A N Y
O F  A M E R I C A

24993 Oliver Building
Pittsburgh, Pa.

Offices in 19 Principal American Cities

A R C H I T E C T U R A L  A L U M I N U M
No sounder plastering specification could be written than that which calls for North Western Metal Lath—of any type—cut from KEYSTONE Copper Steel.

Years of use have shown that its resistance to corrosive effects is not equalled—that its stiffness and tensile strength are superior to lath cut from other alloys or special analysis steel.

Yet thanks to large-scale buying and high production efficiency, the cost is surprisingly small.

Send Samples and Circulars of North Western KEYSTONE Copper Steel—

Kno-Burn, Jr.  □ Longspan
Plasta-Saver  □ Steelhart Stucco Base

NORTH WESTERN EXPANDED METAL CO.
1234 OLD COLONY BLDG.
CHICAGO
Their beauty *alone* is sufficient reason for installing McQuays but they are far more than attractive radiators. Actually they heat rooms quicker and more thoroughly, with a decided fuel saving.

McQuay radiators impel the heated air out into rooms in a horizontal direction, with sufficient initial velocity to drive it all around and provide the complete circulation so essential to effective heating.

The heating units of tube and copper fin construction are the most efficient means known for transferring heat. Cabinets are now built of rust-defying copper alloy steel, so that the entire radiator is rust proof and practically indestructible.

They weigh about one quarter as much as cast iron, and occupy far less space—saving considerably in freight, handling and installation costs. Each radiator is guaranteed to heat the full amount of capacity shown by its catalog rating.

Sold by any recognized heating contractor, McQuay Radiators are made in dimensions and capacities for every heating need—in both cabinet and concealed types.
EXIDES PROTECT

Administration building of locomotive plant

AGAINST CURRENT FAILURE

Architects specified Exide Batteries to guard Baldwin building against sudden darkness.

Sudden current failure will not endanger the occupants of the administration building of the Baldwin Locomotive Works' Eddystone plant. Reliable Exide Batteries stand guard.

Should normal power fail, important lights are switched to Exides ... instantly and automatically ... without a hand touching a switch. In the building shown here, main stairway, fire towers, executive offices, transformer, battery and engine rooms are safeguarded against sudden darkness. The architects realized that interruption of electric current might result in confusion and danger. That's why they chose absolutely reliable Exide Emergency Lighting Batteries for protection.

Exide engineers have combined in these batteries the following important qualities: (1) moderate initial cost, (2) exceptionally long life, (3) low operating cost, (4) simple, foolproof operation and charging, requiring no expert knowledge, (5) absolute power dependability. Architects all over the country are specifying this never-failing system of protection for hospitals, auditoriums, stores, theatres, offices and any buildings where the public gathers. Write for information.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

Exide Batteries of Canada, Limited, Toronto
Telephone Convenience for Larger Residences

In planning the telephone arrangements for larger residences, it is especially desirable that architects consult freely with the telephone company.

Most important, of course, is the placing of the outlets so that the telephones, when installed, will bring greatest convenience and comfort in the use of the service . . . and providing conduit to conceal and protect the telephone wiring.

Bell Company representatives will gladly aid in working out the telephone convenience which may be needed, both now and in the future. They will suggest such service features as seem appropriate to particular houses . . . a second telephone line . . . push buttons and switches for intercommunication among the house telephones . . . additional bells so incoming calls can be easily heard and promptly answered . . . portable telephones for plugging into jacks at appropriate places . . . and many other modern telephone conveniences.

Your local Bell Company is constantly studying ways to improve its service. It has much information of interest to you as an architect. Without charge, it will help you in planning the facilities for telephone service for all of your houses, small as well as large. Just telephone the Business Office.
If your control of efficiency depends on exact and economical control of temperature, YORK engineers can help you as they have many in like situations.

One consultation may point the way to refrigeration efficiency

YORK ICE MACHINERY CORPORATION
YORK PENNA
BRIXMENT protects winter masonry...

BRIXMENT mortar, like any other mortar containing water, is not freeze-proof. Nevertheless it is used regularly for mid-winter masonry even in the severest northern climates. In fact during the winter months more BRIXMENT is sold in proportion to the volume of building construction than at any other time. BRIXMENT mortar sets up faster than portland-cement-and-lime mortar in which a large quantity of lime is used and this set can be made to take place at any temperature before freezing occurs by heating the sand and water. Once BRIXMENT mortar has set, it remains sound and unimpaired no matter how long and severe the freezing period may be.

The oily content of BRIXMENT which reduces the freezing point of the mortar gives further protection in freezing weather. Send for architect's handbook. Louisville Cement Company, Incorporated, Louisville, Ky.

BRIXMENT for Mortar and Stucco

When a concrete mixer is used, the mortar can be heated by means of a torch attached to the mixer so that the flame is thrown inside the drum. If the weather is not too severe, this method alone will suffice.
THERE'S A NATIONAL HEATING SYSTEM
FOR EVERY BUILDING NEED

The Crimson Flame
A Vivid Promise of Friendly Warmth

The "Crimson Flame" is styled for maximum beauty, engineered for outstanding efficiency. It performs efficiently with all types of fuel: domestic sizes of anthracite and bituminous coal, oil, gas, and coke. It can be converted on the job to meet the individual requirements of the fuel selected. The design of the grate and heating surface; the scientific size and shape of its combustion chamber; the serpentine fire travel; the properly proportioned waterways, and the balanced system of air intake and damper control all unite to set up a condition resulting in extremely low fuel consumption and absolutely satisfactory heating performance.

National Heating Systems are Made-to-Measure: that means that the heating requirements of each room are scientifically determined. Then the boiler, the radiators, and the accessories required to establish a balanced system, proportioned in every respect to the need, are selected and installed by the National Heating Specialist. Each National Boiler is guaranteed—and the guarantee is endorsed by a Surety Bond, issued by The Fidelity and Casualty Company of New York. It covers three distinct guaranteed stipulations as to performance, manufacture, design, and replacement of any defective part. It assures customer satisfaction, protects against criticism or complaint. A line to us will bring complete and helpful information.

NATIONAL RADIATOR CORPORATION
Executive Offices: 55 West 42nd Street, New York, N. Y.

NATIONAL
Made-to-Measure
HEATING SYSTEMS
They found new in these two major forms

This attractive home was designed for Mr. Elmer Wible, Brookside Farms, Pittsburgh, Pa., by George M. Rowland, architect, Pittsburgh. The permanence of its beautiful walls and ceilings is assured by reinforcing plaster with RIBBED STEELTEX.

In beautiful Edgemere Manor Apartments, Oakland, Cal., D. D. Stone, architect. STEELTEX puts welded steel fabric on guard in walls and ceilings. STEELTEX for Floors was also used (see right-hand page).

Permanently Beautiful Walls of plaster reinforced with Ribbed STEELTEX

The NEW RIBBED STEELTEX takes plaster out of the "Replacement group"—furnishings, wall paper, paint, ordinary plaster—and puts it into the "Single-Cost group"—concrete, brick, stone, steel, reinforced plaster.

It makes plaster a permanent building material.

And it protects the architect's skilled design, because it reinforces walls and ceilings with steel.

This lasting reinforced construction — which STEELTEX alone can provide — is today safeguarding plaster walls and ceilings in over a quarter of a million homes and buildings, including many of America's most beautiful residences.

Now the NEW RIBBED STEELTEX brings reinforced plaster within easy reach of even the modest home. Its new features which lower construction costs include a V-rib stiffener that produces a lathing job of board-like rigidity, and a heavier, absorptive backing to which the plaster clings tight. Write for detailed information and booklet.

National Steel Fabric Company

2610 Union Trust Bldg. Pittsburgh, Pa.

the New Ribbed STEELTEX

"BUILDS LIFETIME WALLS AND CEILINGS"
economy and strength
of plastic construction

STEELTEX for Floors comes in rolls and is attached to the joists in continuous strips from one side of the building to the other. Fits any type of wood or metal beam or truss. The picture shows the Riverside California Hospital, Riverside, California, S. L. Pillar, architect—a recent installation.

69th St. Center Building, Philadelphia, Pa., Tunis and Baker, architects. STEELTEX for Floors, used in this modern business building, acts as combined reinforcing and concrete form and saves time, labor, material, and money.

Adaptability and Speed
in concrete floor construction

with STEELTEX for Floors

STEELTEX for Floors offers the logical method for all light steel joist construction. A STEELTEX-for-Floors job is a strong, clean job at low cost, whether you are building concrete floors for apartments, hotels, hospitals, schools, churches, theatres, or office buildings.

Today’s leading architects, engineers, and contractors are turning increasingly to STEELTEX for Floors because of its economy, strength, speed, adaptability, and eminently satisfactory finished results.

The photographs on this page of a few typical STEELTEX jobs among hundreds of installations tell the story, but we would like to send you complete information. Please write us for it.

10 advantages of Steeltex for Floors

1. Eliminates wood or metal forms.
2. Steel properly embedded automatically—full strength developed as true reinforcing.
3. Time and labor saved—quickly cut from roll and easily attached, to any type beam.
6. Proper curing assured.
7. Eliminates clean-up expense.
8. Sound deadening factor especially desirable in hotels, schools, hospitals, and apartments.
9. Permanence of reinforcing guaranteed by heavily galvanized mesh.
10. Temperature stresses resisted and reinforcing correctly spaced, without necessity of inspection or special handling to cover these points.

Other products of the National Steel Fabric Company
Ribbed Steeltex for Plaster, Steeltex for Stucco, Steeltex for Brick and Stone Facing, Steeltex for Floors and Roofs (concrete or gypsum)—same principle, same protection. National Reinforcing for all other types of concrete construction—buildings, roads, streets, sidewalks, dams, canals, concrete pipe, cement gun work. Made by the world’s largest manufacturers of welded steel fabric.

STEELTEX
FOR FLOORS AND ROOFS
ON the most durable building construction the marks of Time's destructive scythe will slowly but inevitably become apparent.

The best protection against the effects of time on masonry is a mortar bond that will endure the disintegrating attacks of passing years as sturdily as the brick or stone it bonds together. Such a lasting bond is produced with Kosmortar. Its strength and endurance result in a mortar bond that will remain, without the need of patching or repairing, an integral part of the masonry. Merely the mixture of sand and water with Kosmortar produces this strong, hard mortar, consistently as strong as 50-50 cement and lime mortar. Because of its skilful chemical composition and laboratory-controlled manufacture, Kosmortar eliminates hit-or-miss methods of mixing boxes.

Kosmortar is exceedingly plastic; non-staining, and water-resistant. Write for complete information. The Ideal Cement for Masonry. KOSMOS PORTLAND CEMENT CO., Incorporated, Mill, Kosmosdale, Kentucky; Sales Offices, Louisville, Kentucky.

**KOSMORTAR**

A MASON'S CEMENT—EASY TO SPREAD

...bonds walls to stay

*Made in the same mills as Kosmos Portland Cement, a brand that has been distinguished for high-test, uniform and reliable quality for over twenty years.*
The Baptist Memorial Hospital modern to the last detail—is ENTIRELY GENERAL ELECTRIC WIRED

Hospitals and hotels, office buildings and universities—clubs and apartments... every type of building where efficiency counts is now being wired with General Electric materials.

For it is important that every foot of wiring hidden behind the walls should be completely dependable... too much is at stake to take any chances. And, of course, the question of maintenance is always vitally important. General Electric wiring materials reduce it to a minimum.

The architects, contractors, engineers and builders who are most particular to choose all their materials to meet the exacting standards of modern business and modern living, are those who guarantee electrical efficiency for their buildings by using only General Electric wiring.

GENERAL ELECTRIC WIRING SYSTEM
THE four essentials of a modern kitchen are found in this Crane room. Restful color, in the sun-tan walls, brown and black linoleum, Lucerne blue Corwith sink. Good lighting, from the window at the right of the Corwith, flooding its roomy beauty. Correct arrangement, in the placement of the Corwith, the table, and stove, only a step apart. And lastly, convenient, sanitary equipment in the Corwith itself. ... This new sink of acid-resisting or regular enamel has many points of real convenience not found in ordinary fixtures. Fittings out of the way in a recess eliminate obstruction and breakage. A lever-operated outlet stopper permits use of the sink as a dishpan. A hose and spray rinses vegetables and dishes. ... At nearby Crane Exhibit Rooms, architects will find many other new ideas for kitchen decoration and equipment. Visits will be welcomed.
The Largest Firm of its kind in the South uses Frigidaire

The Jemison Companies, Birmingham, Ala., use Frigidaire in 90% of the apartments they handle and also have Frigidaire Water Coolers in their own office building.

The Jemison Companies and subsidiaries deal in investment banking, real estate, mortgage loans, and insurance. This is the largest firm of its kind in the South. Read what Mr. Chas. P. Marks, Vice-President, says about Frigidaire.

"I am pleased to advise that the Frigidaire installation in our office has proven most satisfactory, supplying drinking water at the proper temperature at all times. We formerly cooled our drinking water by an old ice cooler with coils throughout, but have found the Frigidaire service to be more satisfactory and more economical. We also use Frigidaire in about 90% of the apartments handled by this office ... quite an asset in renting the apartments."

In any type of building, Frigidaire Water Coolers offer distinct advantages ... effect important money savings as well as pay big dividends in better health and higher efficiency. And in apartment houses, both old and new, Frigidaire provides quiet, dependable, automatic refrigeration ... keeps profitable tenants better satisfied ... reduces vacancies ... increases net income.

We'd like you to have complete information about Frigidaire. We'd like you to have the facts that show why business leaders are turning more and more to the use of this equipment. For descriptive booklets, write to Frigidaire Corporation, Subsidiary of General Motors Corporation, Dayton, Ohio.
Remodeling Campaigns—Non-Metallic Sheathed Cable cuts the cost of rewiring.

An old house can be thoroughly modernized only by installing a complete wiring system...plenty of outlets for the toaster, the vacuum cleaner, the heater, radio and floor lamps. But to do so economically
Non-Metallic Sheathed Cable should be used... for Non-Metallic Sheathed Cable costs much less to install in old walls. It is flexible and easily handled... making a quick clean job.

A Non-Metallic Sheathed Cable job will last as long as the house itself.

For complete information, ask your electrical contractor — or write to any of the Licensed Manufacturers listed below for the booklet — "Where and How to Use Non-Metallic Sheathed Cable".

American Circular Loom Company
Anaconda Wire and Cable Company
Collyer Insulated Wire Company
Eastern Tube and Tool Company
General Electric Company
Marion Insulated Wire and Rubber Company
National Metal Molding Division
National Electric Products Corporation
Rome Wire Company
Division of General Cable Corporation
The Wiremold Company
Triangle Conduit Company, Inc.

The above Manufacturers are Licensed under Non-metallic Sheathed Cable Patents number 1439325; 1520620; 1203758; 1673732.
Ten large railroads and twenty of America's largest chain store organizations have recently chosen Lipman Electric Refrigeration. Interesting news—but of what importance is it to you?

Just this: These purchases were made by trained and fully informed purchasing departments. If machinery just as good were obtainable at a lower cost, Lipman would not have been chosen!

"Lowest cost of ownership"—not price—is Lipman's claim to leadership. Wise buyers of electric refrigeration recognize the accuracy of this revealing measure of value.

Won't you let us send you the facts—today? Use the coupon now. There will be no obligation. Specify booklet "K-27," please.
The selection of 22,000 feet of Arco Metal pipe for the mausoleum pictured above clearly shows that the builders of this structure recognized the qualities of this pipe that insure permanence. This memorial and its piping will last through the ages. It was built for permanence.

Arco Metal Pipe is made from a special analysis ni-chrome alloy cast iron and cast by a process which gives it greater tensil strength, greater flexibility and far greater corrosion-resisting qualities than ordinary gray cast iron. Yet this cast iron pipe has overcome a heretofore great disadvantage—Arco Metal Pipe can be cut and threaded on the job with the same tools used to work wrought steel and iron.
Economical Maintenance

The new series Von Duprin latches are proving so economical in upkeep that the higher first cost of Von Duprin devices is now more than offset, over a period of years, by the negligible cost of maintaining them.

These devices of the new series are so sturdy, so simple and so nearly trouble-proof that they set a standard high above even the best Von Duprins of previous years.

To make sure that you get the genuine new series Von Duprin latches we suggest that you make panic devices a separate item of the specifications, rather than as a part of the finishing hardware, and—of course—that you specify Von Duprins by name.

VONNEGUT HARDWARE CO.
Indianapolis, Ind.

Listed as Standard by Underwriters Laboratories
THE sole limitation to structural extent in architecture has always been the strength of the materials used in construction, although legend implies that the Tower of Babel would surely have reached the heavens had it not been for the confusion of tongues. We of the present day, however much we may marvel at the skill of the ancient builders and the sizes and staunchness of their structures, know that the materials with which they had to work imposed a very definite limitation on the height to which their structures could be carried. Man in his building has always striven for greater height, and in the effort to attain it he has gradually worked out new methods of disposing the materials at hand in such a way that their strength be utilized to the greatest possible advantage. The Romans by developing the arch accomplished much in this direction, but even with use of this clever device the utmost limit to which stone and wood could arise was attained in the Gothic cathedrals of the middle ages, and it was not until the latter part of the nineteenth century that any further progress in this direction was made,—the beginning of what we call “steel construction.”

During the period just preceding the invention of the skyscraper, the tendency of people, especially in America, to congregate in limited areas gave a fresh impetus to the attempts to build larger and taller structures. In these attempts it was found that the old materials were quite inadequate. If a structure of more than ten stories were built of masonry, it was found necessary to make the lower walls so massive as to cause them to occupy nearly the whole floor area, and though several such structures were actually built, it soon became evident that they were quite unsatisfactory from an economic point of view. It was at this point that the introduction of the new materials,—structural steel and concrete,—made possible the development of the skyscraper as we know it today. As our modern materials are superior to those of the ancients in strength and utility, so is our
"International Airports"

By STEDMAN S. HANKS
Lieutenant-Colonel Air Corps Reserve

The rapid development of commercial aeronautics is presenting to American architects what hitherto has been no small problem in designing, constructing and equipping airports. The subject has hitherto received but little attention, and few works on the subject have been published. In this volume a highly trained and experienced aeronaut reviews the subject. He considers the problems of American airport development from a study of what has been done abroad against the background of the author's intimate knowledge of airport conditions here. In its preparation, Colonel Hanks made a prolonged tour of European airports for the purpose of learning in what ways their experience can serve as a guide for airport construction in the United States.

In making his study he received the assistance of many leaders in European aeronautics and enjoyed exceptional facilities for thorough investigation. Much information on the details of foreign airport operation is available in published form. The design, construction, and management of the outstanding airports is described and compared with that of the airports in America. Up to the present time, Europe has led the world in air passenger traffic. Colonel Hanks discusses passenger facilities at airports, tickets, baggage regulations, transportation of passengers to and from airports, and other details of European passenger practice. He considers also the problem of developing the transportation of freight by air and tells what has been done in Germany in the inauguration of combination air and rail service for express shipments.

The opportunities for substantial additional revenue to the airport from supplying recreational facilities and other adjuncts of the modern resort; an outline of an ideal airport combining the best features of successful American and European practice; a typical airport profit and loss statement; airport regulations; are other valuable features of this book.

195 pp., 5½ x 8½ ins. Price $5.

THE ARCHITECTURAL FORUM
521 Fifth Avenue New York

knowledge of the principles underlying their use superior to the science available to the ancient builders, and as our structures become larger and more and more complicated, a greater degree of scientific knowledge is necessary for their safe construction. In the designing of steel framework, modern engineers have attained an amazing proficiency which has been manifested in great buildings and bridges everywhere.

Although it is of course purely a matter of opinion, there is every reason to suppose that the outstanding building material of the future will be ferro-concrete, and one has but to study some of the great modern churches and public structures which have been built of this material to realize how great is the potentiality for beauty and strength latent therein. The possibility of spanning enormous spaces with great parabolic arches in reinforced concrete is being utilized extensively, especially in Europe, and it is difficult to predict to what undreamed of proportions the buildings of the future may attain. At all events, it is quite safe to say that the successful architect of the future will be the man who knows his concrete. As the use of concrete has developed, there has grown up a considerable volume of published material on the subject, there being many excellent works dealing with all phases of the science of building in concrete. One of the recognized standard works in this field is "Concrete, Plain and Reinforced," written by Frederick W. Taylor and Sanford E. Thompson, but as is the case with all new and rapidly developing sciences, new theories and facts are constantly being discovered and applied, and the work has recently been brought up-to-date and rewritten by these authors and by Edward Smulski. The new edition, which is the fourth, is in four volumes, the second volume being the subject of this review. Volume I, already issued, deals with concrete and reinforced concrete structures from the standpoint of design, while Volume II goes still more deeply into the technical and practical aspects of the subject and covers the theory and design of continuous beams, frames, building frames and arches. Taken altogether, the two volumes comprise one of the best and most comprehensive treatises ever published on the subject. Data on continuous beams as specified in the findings of joint committees and in various building codes are given for ideal conditions where the spans of the beams are equal and the loading uniformly distributed. In all other cases, understanding of the action of continuous beams and of the principles upon which formulae can be based is essential for the intelligent designing of concrete structures. In the chapter on continuous beams, formulae and explanations governing a large variety of possible cases are given, and the findings are carefully tabulated. Maximum shears and bending moments for continuous beams up to four spans, with or without fixed ends, are given, and the influence of cantilevers on continuous beams is investigated. Also moments of inertia and their effect on continuous beams will supply much data of practical value to bridge engineers and others interested in the designing of beams with straight or parabolic haunches.

The practical application of the formulae and principle presented is demonstrated by five actual problems worked out for various arrangements of continuous beams. This chapter may be considered the most complete treatment in any language of continuous beams.
In the Nation's Schools

FORTY-FOUR states are now represented in the list of schools using G&G Ash Removal Equipment—practically every state where coal heating apparatus is employed in the schools. Heading the list this year we find the following totals:

- NEW YORK 423 Schools
- PENNSYLVANIA 190 Schools
- OHIO 180 Schools
- NEW JERSEY 150 Schools
- MICHIGAN 113 Schools
- MASSACHUSETTS 106 Schools
- ILLINOIS 74 Schools
- IOWA 68 Schools
- CONNECTICUT 65 Schools
- KANSAS 59 Schools
- MINNESOTA 54 Schools
- MISSOURI 49 Schools
- MARYLAND 36 Schools
- NEBRASKA 26 Schools
- WISCONSIN 26 Schools
- DIST. COLUMBIA 23 Schools
- IOWA 23 Schools
- KENTUCKY 15 Schools

G&G Ash Removal Equipment is now standard equipment with Boards of Education in Pittsburgh, Des Moines, Seattle, Louisville, Kansas City, Mo., Kansas City, Kans., Cleveland, Balti-

more, Jersey City, Newark, Boston and New York. Available in hand and electric models, with and without overhead crane. The electric models are particularly favored in schools. G&G Ash Removal Equipment insures complete safety at all times because sidewalk opening is fully protected by rigid doors. This safety feature, plus unequalled economy in operation and long life, has resulted in the selection of this equipment for school after school throughout the Nation, and it is being repeatedly specified by leading architects. Write for catalog.

G&G Ash Removal Equipment is also widely used in Banks, Churches, Hospitals, Hotels, Office Buildings, Theatres, Telephone Buildings, Stores, Factories, Garages, etc. Also electric and hand-power Hoists for special uses.
College Architecture in America
Its Part in the Development of the Campus

By
CHARLES Z. KLAUDER and HERBERT C. WISE

A NEW and ever higher standard is being established for the architecture of educational structures of all kinds. Some of the most beautiful buildings in all America are those venerable halls in academic groves in Charlottesville, Cambridge, Princeton and elsewhere built by early American architects, and now after long decades of indifferent designing and careless planning American architects are rising anew to the situation and are designing educational buildings of every type which closely rival even the best work of a century ago, while in planning and equipment they establish a standard which is wholly new.

In this valuable and important work two widely known architects of educational buildings collaborate in reviewing the entire situation as it applies to college and collegiate architecture. They have carefully studied practically every important institution in the country, and in their text they discuss administration buildings; dormitories; recitation halls; chapels and auditoriums; gymnasiums; libraries; and structures intended for certain definite and specific purposes, such as the teaching of music, all this being well illustrated with views of existing buildings and in many instances with floor plans and other drawings. A valuable and extremely practical work to add to the equipment of any architect's office.

301 pp., 7½ x 10 ins.
Price $5, Special Net

THE ARCHITECTURAL FORUM
521 FIFTH AVENUE
NEW YORK

with uniform moment of inertia, which are freely supported at intermediate points and either freely supported or fixed at the two end supports. The care of unequal spans for such beams is handled in usable form. The formulæ given in the book are applied to the designing of concrete slabs, joists or beams upon a steel framework. They may not be properly applied to rectangular slabs, joists or beams built monolithically with concrete columns and girders as their intermediate supports, which is by far the more common practice in modern construction. The solutions also do not apply to T-beams where the moment of inertia at the center is often twice that at the support, but within the limited range in which they do apply, the solutions are exceptionally complete and usable. The treatment of the effect of varying moments of inertia starts with cases in which the I at the center of span is one fiftieth of that at the support and stops when they are equal. In actual building it is far more common that the I at the center of the span exceeds that at the support, since T-beams and T-joists are the usual flexural members employed in design.

The authors seem to have had the rectangular beam and the one-way slab, with or without brackets, chiefly in mind in this whole treatment. They have omitted the concept of the reinforced concrete member of flexure, as given, is satisfactory for preliminary design, but the final design should be more carefully worked out. The analysis of bending and direct compression is exceptionally complete for rectangular sections, though here, as in other parts of the work, departures from standard notation result in unnecessary confusion and delay to the reader. Many diagrams are saved by giving only those for N-15 and by supplying two simple conversion tables for other values of N. Circular sections are not discussed. Detailed solutions of many cases in the treatment of rigid frames are given and present much data that have heretofore been available chiefly in European texts. These are limited largely to structures of one or two panels in width, leaving the more common multi-bay building to be worked out by the general slope-deflection equations which are given. This portion of the book is very usable in both concrete and steel design, but it is a matter of regret that the great possibilities for a condensed treatment, more applicable to rapid design, have not been utilized. Four chapters are devoted to the treatment of rigid arches with simple, effective analysis and clear exposition of the basic structural action. Both approximate and exact methods are given.

The authors have planned the text so as to make it useful to the greatest possible number of persons, including students and professionals. For the student the theory and derivation of formulæ are given, while final formulæ are furnished for practical use. To take care of unusual cases, general formulæ are given, the more common cases being covered by simple final formulæ supplemented in many cases by constants and diagrams, the use of the formulæ being made clear in all cases by giving practical examples as illustrations.

Although the volume is a new edition of an already well known work, the material contained in the second volume is entirely new and is not contained in any of the previous issues. The authors believe that, "this is the first book in any language in which the subject of statically indeterminate structures has been fully treated.

Unless otherwise noted, books reviewed or advertised in THE ARCHITECTURAL FORUM will be supplied at published prices. A remittance must accompany each order. Books so ordered are not returnable.
Easily Applied!

Whether sprayed on or applied with brush, Dixon's Industrial Paints flow easily and cover thoroughly — reducing labor costs to a minimum.

Known to industry for more than 65 years as Dixon's Silica Graphite Paints, they are composed (except Bright Aluminum and Standard Red Oxide) of pure boiled linseed oil combined with flake silica graphite. This combination has been proved — over many years, and under various conditions of service — to give superior paint protection at lowest cost per gallon, when measured by years of service.

Dixon's Industrial Paints are now offered in 14 colors, including Bright Aluminum and Standard Red Oxide.

Write for Color Card No. 224-BI.

Paint Sales Division
Joseph Dixon Crucible Company, Jersey City, N. J.

DIXON'S MAINTENANCE FLOOR PAINTS

Give maximum protection to wood, composition, concrete and cement floors. Suitable for use either indoors or outside. Eight standard colors — write for color card No. 224-BF.
from both theoretical and practical standpoints." In all cases easily understood explanations are furnished for the action of statically indeterminate structures. The relation between statically indeterminate and simple structures is given, and the causes for the difference in action are explained. Bending moment diagrams for rigid frames show in all cases the type of bending moments to which the various frames are subjected for different types of loading. When used intelligently, these alone may form a basis for approximate solutions of problems in cases where accuracy is not of prime importance. The chapter on building frameworks contains material and formulae never before published. The treatment of arches is of great importance, and the causes for the difference in the design of large modern buildings, are the formulae for this type of arch.

MEDITERRANEAN DOMESTIC ARCHITECTURE IN THE UNITED STATES
A REVIEW BY
WILLIAM P. SPRATLING

Using the phrase, "Mediterranean Domestic Architecture," Rexford Newcomb has gathered under that colorful title a more than interesting collection of illustrations showing distinguished present-day adaptations of Latin-Moorish architecture in America. Architects of almost any part of the country, though particularly those practicing in climates where such things are practical, will find this material sound, well selected and probably extremely valuable. Mr. Newcomb has already brilliantly distinguished himself in the profession as one of those few who are willing and able to take upon themselves the selective-critical duties of the true architectural educator. Of minds such as his there are all too few in the profession. His has been a work not only of explanation, but of true interpretation,—and stimulation. In the brief text he has tied his theme in well with tradition without being tiresomely specific historically. But at times one suspects Mr. Newcomb of painting an almost too alluring picture of his medium; or is it merely his literary phraseology? At that, he has said many things which will doubtless open the eyes of some of the more conservative members of the profession to certain possibilities of color and the like. He casually explains a certain electicism in the use of these "Mediterranean" styles by the variety of our climatic conditions in America, though neglecting to add that a comparatively unsophisticated America is likely to indulge in what may be termed nothing less than "stage stuff."

For one who likes to see the "stylistic sources" of these things inquired into more searchingly, Mr. Newcomb's remarks about derivations from what he calls the "Mexican Colonial" are perhaps inadequate. Speaking of Santa Fe and Mexico, he remarks: "This many-terraced type, fine examples of which are still to be seen in Taos, Laguna, San Ildefonso and other places, generally passes under the name 'pueblo,'—pueblo of course referring to a peopled place, or village, the generic Spanish term in Latin America"; and: "When the Spaniards employed these Indians to build structures with European plans and utilities, of the materials and upon the lines of the native work, there resulted a new type, half-Spanish, half-Indian, the like of which has nowhere else been developed." In this, of course, Mr. Newcomb is either entirely ignoring or merely neglecting to mention the vast accumulation of Spanish Colonial things in Mexico, where there are more than 15,000 early domed structures, most of which have received the definite impress of the hand of the native Mexican,—the Indian. However, he makes some acknowledgment in closing, saying that, "... by relying upon the early local expression in each community, and by the judicious selection of forms from the varied parent styles of Spain, Mexico, Italy or north Africa, the architect of our time may find a grammar sufficiently broad. . . ."

Mr. Newcomb's examples are well selected and run the whole gamut as to types. There are a few which are pretentious and frankly expensive; some of the simple utilitarian and intensely domestic types, and there are many, are not only very beautiful but also very distinguished. None of them are commonplace, and all show that ingenuity of design which gives evidence of the real fertility of imagination among the architects of America. And all of these examples, being related to the conditions out of which they have sprung, are certainly integral with the life of America today. The material for this book has not only been well selected, but fully illustrated. For each of the 70 examples shown there are probably an average number of six to eight illustrations from well taken photographs, and beautifully and consistently well drawn plot plans. As an example of bookmaking, Mr. Jansen has made a splendid thing of it. It is a volume which will make a distinguished addition to the shelves of an architect's library.

This radically different
Switch contact
assures unfailing life
for Hubbell Switches

This new form of contact spring, combined with the other Hubbell improvements in switch construction assures unfailing, trouble-free life for the new Hubbell Shallow Flush Toggle Switches. In the Hubbell Laboratory these new switches refused to break down or develop trouble, even after being subjected to a lifetime of severest possible use.

After you have checked over the features of the new Hubbell Switches—clip the lower right hand corner of this page to your letterhead for a complete description.

Electrically and Mechanically Perfect in Design—"Approved"
A radically new form of contact spring scientifically designed so that two different rates of vibration are set up in the spring; one tending to counteract the other. Thus recoil is practically eliminated in the ends of the contact spring when the solid metal contact blade strikes between them. As a result, burning and pitting of the spring is prevented—even when in circuit with type "C" lamps. An automatic "kick off" prevents sticking of blades in contact.

Harvey Hubbell, Incorporated, Bridgeport, Connecticut
Boston Mass., 176 Federal Street; Atlanta, Ga., H. C. Biglin, 138 Marietta Street; New York, N. Y., 122 E. 42nd Street; Chicago, Ill., 318 West Washington Street; Denver, Colo., T. H. Bodfish, 1109 Broadway; Philadelphia, Pa., Fifth Street, Phila. Bourse (Exhibition Dept.)

Commutator support is perfectly insulated.
Commutator blades are rigidly riveted to carrier, insuring positive alinement.
Spring arm is pivoted on a round shaft, seated in a symmetrical bearing, facilitating faster, smoother action without wear.
Operating mechanism is separate from the bridge and perfectly insulated.
A solid bridge with ears lies in a recess across Bakelite cover—entirely insulated; perfect alinement and rigidity insured.
Each wiring terminal is held by two screws. Bakelite case completely encloses mechanism.

A complete line to meet any need—
9801—S. P., 5 amps. 250 volts; 10 amps. 125 volts
9802—D. P., 10 amps. 250 volts
9803—3-way, 5 amps. 250 volts; 10 amps. 125 volts
9804—4-way, 2 amps. 250 volts; 5 amps. 125 volts
9805—S. P., 20 amps. 250 volts
9806—D. P., 20 amps. 250 volts

Hubbell Screwless Plates of Bakelite
Ask for a description of these self-alining switch and outlet plates. You can obtain them in any color or finish to exactly match any background.

HUBBELL Toggle Switches
The Wardman Park Hotel Cuts Heating Costs with Heggie-Simplex

Among the prominent building operators who have turned to Heggie-Simplex for lower heating costs is the management of the Wardman Park Hotel, Washington, D. C.

Thoroughly convinced of the greater economy of Heggie-Simplex Boilers by their performance in other installations, the management is replacing the nine boilers previously used with four Heggie-Simplex Steel Heating Units. The management is confident that the new boilers, in fuel saving alone, will pay for themselves in a couple of years or less.

The huge combustion chamber, extra large direct heating surface, unrestricted circulation and rear-front-rear flue passage of Heggie-Simplex design assure maximum utilization of heat units and unparalleled fuel economy. Of crack-proof, electric-welded steel construction, Heggie-Simplex Boilers also effect substantial savings by eliminating repair expense and reducing insurance premiums.

Talk to Heggie-Simplex users. Learn first hand about the greater economy and dependability of these modern heating units. Names upon request.

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

The internationally famed Wardman Park Hotel, Washington, D. C., and its annex will be heated, at vast savings to the owners, with Heggie-Simplex Steel Heating Boilers.
PART ONE—ARCHITECTURAL DESIGN

Cover Design: A Modern House on the Rue Nan-souty, Paris
*From a Water Color by Edward A. Batt*

The Editor's Forum

Building for N. W. Ayer & Son, Inc., Philadelphia
*Frontispiece
From a Water Color by Norman C. Reeves*

PLATE ILLUSTRATIONS

Building for N. W. Ayer & Son, Inc., Philadelphia
*Ralph B. Bencker 97-112*

Third Church of Christ, Scientist, Detroit
*George D. Mason & Co. 113, 114*

Presbyterian Church of the Redeemer, Detroit
*George D. Mason & Co. 115-117*

PART TWO—ARCHITECTURAL ENGINEERING AND BUSINESS

Stone, Steel and Scaffold
*Frontispiece
From a Photograph by George H. Van Anda*

LETTERPRESS

Cold Storage Warehouses
*Carl de Moll 529*

Infiltration and the Heating Problem
*P. E. Fautler 535*

Lincoln School for Nurses, New York
*Pennington & Lewis 118-120*

LETTERPRESS

The Ayer Building, Philadelphia
*Ralph B. Bencker 433*

Rockland County Court House, New City, N. Y.
*Milton D. Lownes 473*

Some Priorities of the Eleventh and Twelfth Centuries

Three Norwegian Log Houses
*481*

Three Gardens at Grosse Pointe, Mich.
*Anne Lee 505*

Baldwin Locomotive Works Office Building
*513*

Restoration of “Kenwood,” A Regency House
*519*

PART TWO—ARCHITECTURAL ENGINEERING AND BUSINESS

The Building Situation
*542*

Electrical Wiring Layouts for Office Buildings
*Nelson C. Ross 543*

Modern Tendencies in the Use of Marble
*Clifford Wayne Spencer 551*

The Supervision of Construction Operations
*W. Wilfred W. Beach 559*

PARKER MORSE HOOPER, A.I.A., Editor
KENNETH K. STOWELL, A.I.A., Associate Editor

Contributing Editors:
Harvey Wiley Corbett; Aymar Embury II; Charles G. Loring; Rexford Newcomb; C. Stanley Taylor; Alexander B. Trowbridge

STEEL BRINGS IMMEDIATE AND CONTINUED ECONOMIES

Build with structural steel and savings begin at once . . . in less time, less labor and less material required. Steel so speeds construction that a steel bridge or building is in service often weeks earlier.

Not only is steel so quickly and readily adapted to its use, but it is so strong that less bulk of it is required than of any other material. Steel can be handled readily . . . very quickly moved into place. It occupies less space and provides larger interiors. Steel minimizes the human element in building . . . it is proved right at the mills . . . and it comes to the job ready to go into place prepared to do its duty with efficiency, and at once.

You can build, alter, extend, remodel or remove a steel building more quickly than any other type of fire-resistive building—again a saving. Whatever type of structure steel is used for—building, bridge or residence—it brings not only permanent strength and security—but immediate and continued economies.

A Technical Service Bureau is at the disposal of architects, engineers, owners and others who have need of any information which can be supplied through the American Institute of Steel Construction, Inc.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

The co-operative non-profit service organization of the structural steel industry of the United States and Canada. Correspondence is invited. 200 Madison Avenue, New York City. District offices in New York, Worcester, Philadelphia, Birmingham, Cleveland, Chicago, Milwaukee, St. Louis, Topeka, Dallas and San Francisco. The Institute publishes twelve booklets, one on practically every type of steel structure, and provides also in one volume, "The Standard Specification for Structural Steel for Buildings," "The Standard Specification for Fireproofing Structural Steel Buildings," and "The Code of Standard Practice." Any or all of these may be had without charge, simply by addressing the Institute at any of its offices.
STONE, STEEL AND SCAFFOLD

RIVERSIDE CHURCH, NEW YORK

HENRY C. PELTON AND ALLEN & COLLENS, ASSOCIATED, ARCHITECTS

From a Photograph by George H. Van Anda

The Architectural Forum
THE preservation of food has always been an important factor in the comfort, health, and existence of the race. In early times food was preserved either by burying it in the earth or by drying it in the sun. One of the steps in the progress of food preservation was the recognition of the fact that a low temperature would retard the progress of decay. A cellar or cave maintained a relatively low temperature throughout the year, being somewhat warmer than the outdoors in winter and much cooler in summer. Of course the smoking of meats was an early way of preserving them, and spices played an important part in food preservation. The search for short routes by water to the spice-producing countries of the East brought about many of the discoveries of the New World. Pickling is also one of the early forms of preservation, and alcohol still has its uses in this connection. All of the preservatives, however, change the nature or at least the taste of foods, and it remained for artificially produced conditions of cold and controlled relative humidity to keep foods for long periods without appreciable change from their fresh condition. The last 40 years have brought a tremendous development in the science of refrigeration and the storage of foodstuffs and other perishables.

Chemists and physicists had known for many years that it was possible to extract heat from almost any substance, but it was not until the latter part of the nineteenth century that machines were devised to do this on a relatively large scale. Fundamentally, a refrigerating machine is merely an appliance to extract heat from one place and put it into another. Any refrigerating machine must be equipped with water, air or some other substance to take the heat extracted by the machine away from the material or space to be cooled. Refrigerating machines were in early days used in breweries, and later in slaughter houses and meat packing houses. Probably their most rapid development began with the erection of great numbers of cold storage warehouses all over the country. With the increased use of cold storage warehouses there came the realization of the extreme importance of securing relative humidity as well as accurate temperature control. As the designing of a modern cold storage warehouse for the preservation of food products is a very complex problem, it is imperative that the best specialized engineering service be obtained. Only by the employment of experienced experts is it possible to obtain the best and most efficient building for the least expenditure of money.

In general, cold storage warehouses can be roughly divided into two general classes,—one, buildings designed for the preservation of a particular substance at one temperature; the other, buildings which must be capable of taking care of a large variety of substances, each at a different temperature. In the first class are buildings for the storage of citrus fruits, apples, or meats. It is important, in the storage of fruit, to recognize the fact that the general tendency of a cold storage warehouse is to reduce the relative humidity of the air. This is deleterious to the product, as it extracts a large amount of water from the fruit, thus drying it and reducing its size and quality. It is, therefore, imperative that a properly high relative humidity be maintained at all times. This is complicated by the great danger of there being fungus growths and mould, which will always appear if the humidity is too high. This has led to the adoption of elaborate systems of ventilation, and it has also led to the introduction of use of chlorine fumes for the prevention of mould.

Where a building is for the general storage of a great variety of foods, it is necessary to divide it into a number of separate rooms. There are many foods, including meat and fish, that it is frequently desirable to receive and place in rooms with a temperature at or below zero, known as
control, so that the temperature of the room may be changed to suit the various seasonable commodities as they are stored at various times during the year. Over a period of years, through scientific research, there have been established ideal temperatures and relative humidities for practically all the food products which are usually carried in cold storage warehouses.

Important factors in the design of a warehouse are the arrangements for receiving, distribution, checking and delivery of goods. Most warehouses of any size are, of course, equipped with railroad sidings, most of the goods coming in by railroad in carload quantities, and after the period of storage distributed to trucks or wagons from an adequate shipping platform. This necessitates very careful checking, so that not only the packages belonging to various owners, but various brands can be so segregated that they can be taken out of storage as the demand warrants. It is found that certain manufacturers are packing the same or similar goods with a number of different brands or labels. These must, of course, be segregated, so that they are obtainable with a minimum amount of handling. There are some houses where the goods are received by trucks or wagons, and after a period of storage, are shipped by railroad. This is more often true in houses built for a single commodity, which is received from the growers at the ripening time and carried in storage and shipped by carloads as the demand warrants. The design of the mechanical equip-

“sharp freezing rooms,” where the material is frozen, then transferred to a room slightly below the freezing point where it can be carried in a frozen condition almost indefinitely. This of course leads to serious complications in insulation, as goods piled close to the wall next to a sharp freezing room are likely to freeze unless there is proper air circulation in the room. A room over a freezing room must have the material stored on high dunnage and air circulation maintained across the floor. The building must, of course, be designed with the various coils under separate control, so that the temperature of the room may be changed to suit the various seasonable commodities as they are stored at various times during the year. Over a period of years, through scientific research, there have been established ideal temperatures and relative humidities for practically all the food products which are usually carried in cold storage warehouses.

Important factors in the design of a warehouse are the arrangements for receiving, distribution, checking and delivery of goods. Most warehouses of any size are, of course, equipped with railroad sidings, most of the goods coming in by railroad in carload quantities, and after the period of storage distributed to trucks or wagons from an adequate shipping platform. This necessitates very careful checking, so that not only the packages belonging to various owners, but various brands can be so segregated that they can be taken out of storage as the demand warrants. It is found that certain manufacturers are packing the same or similar goods with a number of different brands or labels. These must, of course, be segregated, so that they are obtainable with a minimum amount of handling. There are some houses where the goods are received by trucks or wagons, and after a period of storage, are shipped by railroad. This is more often true in houses built for a single commodity, which is received from the growers at the ripening time and carried in storage and shipped by carloads as the demand warrants. The design of the mechanical equip-
ment of a storage house is very important, due to the large expenditure of power which is involved. Slight losses become extremely serious in additional cost. The availability of a large supply of water is imperative, and if it is possible to obtain this water from deep wells, giving a low temperature water at all times in the year, great economy can be obtained. It is also usually advisable to use outside current wherever possible, as, there being no use for the heat, the public service current is usually cheaper than that of an individual power plant. Many cold storage houses have, as an auxiliary business, the manufacture of ice, in some cases installing large rooms for ice storage, so that a relatively small plant working every day in the year can store ice during the colder weather to be available at the time of greatest demand. The owner can thus supply a very large demand at certain seasons with a relatively small expenditure for ice-making equipment.

The building should be of fireproof construction, with adequate insulation, the best material being compressed cork slabs, 4, 6 or 8 inches in thickness. In general, there are two systems of insulation; one known as the “envelope” system, in which the entire storage area is enclosed in a continuous envelope of cork,—that is, a multiple-story building of 10 or 12 floors would have the first floor used for receiving and shipping; the second floor would have a thick cork insulation. The roof and four walls would also be insulated. The intervening floors would simply be of concrete or steel construction. This system is usually recommended only for a large building and for storing one kind of goods, where the same temperature is carried through the entire house, since it would be impossible to carry different temperatures on the various floors without insulation between. It also has the disadvantage of being extremely difficult to avoid there being settlement cracks in the insulation, especially in the upper part. In some buildings which have been built under this system, it is necessary to have periodical inspections made of the insulation, carefully calking any cracks which develop. Where rooms of different temperatures are needed in the building, it is much more advantageous to segregate each of
these rooms with heavy insulation, sometimes placing insulation on every floor. The building for the Quaker City Cold Storage Company in Philadelphia, illustrated here, is designed to contain rooms of all temperatures from below freezing to rooms held slightly above freezing, for the storage of vegetables, candy, etc. The apple storage warehouse for the Arrington Cold Storage Company at Arrington, Va., is designed for the storage of apples in barrels, solely. An interesting feature of this building is that only the alternate floors are solid. The intervening floors are of slat construction, so that the bunker containing the refrigerating pipes and ventilating system is available for two stories of storage.

The question of insurance is important, due to the fact that this cost must be added to the storage charges, so that any saving is directly reflected in profits. It is, therefore, imperative that every effort be made in the design of the building to obtain the minimum rate both on building and contents. There should be the proper division of areas by fire walls, segregation with fire doors, automatic sprinklers, fire hydrants and hose reels through the building, adequate water supply and pumping equipment. The sprinkler equipment will necessarily be of the dry pipe type, and special precautions should be exercised so that there shall be no condensation to freeze in the pipes or around the heads. The electric lighting equipment must be entirely open wiring, as it has been shown that an installation of conduits is impracticable, due to accumulation of moisture in the pipes. The elevators should be of a large size, and of high speed, with an automatic leveling system. The size of elevators should be adapted to the size and number of trucks which it is decided to use, selecting a standard truck which will hold the largest amount it is possible for one man to handle. It is also desirable to consider the use of platforms for lift trucks. In a tall building, the elevator should run at as high a speed as it is possible to obtain. As there is a great deal of leakage of cold air down the elevator shafts when the doors are open, most houses are equipped with vestibules on each floor. It is much better, however, to in-
sulate the floor, roof and three sides of the elevator car with heavy cork, installing a rubbing strip around the door and installing weather strips of heavy soft rubber bearing on these rubbing strips, so that when the elevator car is level with the floor, the door can be opened and no air can escape down the shaft around the door opening. It is also desirable to use heavy insulation around the door frame to avoid condensation at the sill, there being a great deal of trouble due to condensation forming around the sill and freezing where rooms are closed for a long period of time.

Section and Plan Showing Method of Insulating a Cold Storage Building
The matter of handling goods by conveyors is still a debatable point among cold storage building operators. Some things, such as sides of beef and material of similar character, are now handled on overhead tracks. There have been some houses where belt and live roll conveyors can be used. There are also some installations of vertical conveyors, for both loading and unloading the room. Where wages are high, it is economical to use the largest amount of conveying machinery possible. As this equipment is relatively expensive, however, it requires a very careful analysis of the entire problem, as it is never economical to use expensive machinery unless it can be kept moving a large part of the time. There are many and varied interests to be satisfied in an intricate building of this kind. The heads of the shipping and receiving departments, the storage departments, the accounting department and the general manager frequently have very different ideas as to the proper design and layout of the building. It is usually the major problem of the designing engineer to analyze the opinions of the various executives, giving due weight to the ideas of the men who have to do the work, but being careful not to sacrifice the efficiency of the complete unit for slight additional gains of a single department. Whether or not the proper solution of these various factors is obtained frequently makes the difference between a good and economical, or very bad and inefficient design in the completed building, and a pleased or a displeased client.
INfiltration AND THE HEATING PROBLEM

BY

P. E. FANSLER

Infiltration and exfiltration combine to make a formidable problem for the architect; that is, if he has consideration for the comfort and for the pocketbook of his client. Consider a house of ordinary construction, an outdoor temperature of zero, and a high north wind. Air at zero temperature infiltrates through the north side of the house, is heated, and exfiltrates through the southern walls, windows and doors. Until recently very little reliable information has been available as to the demand on the heating plant due to infiltration. Indeed, it is hard to believe the actual facts, now that they are known, because they seem to be out of all reason.

About two years ago the research committee of the American Society of Heating and Ventilating Engineers determined to solve the infiltration riddle and replace, with the results of actual tests, figures that were little more than guesses. The Bell Telephone Company of Missouri had erected a new and high building in St. Louis and offered the use of one of its upper floors to the Society. The elaborate equipment developed in the research laboratory of the Society was set up in St. Louis so that actual infiltration could be determined. One reason for accepting this offer was that steel windows of the latest type had been used, and infiltration data on them were of great value because of the increasing use of this type of window. The testing apparatus installed consisted of a large rectangular metal box, open on one side with a device fixed at the center of the opposite side so that orifices of desired diameters could be used. The box was fastened to a wall area containing the window to be tested, and the periphery carefully sealed so that the contact was airtight. An arrangement of a very delicate pressure gauge permitted the taking of readings that determined the flow of air through the orifices, so that air infiltrated through the window cracks passed through the orifices and was quantitatively determined.

One of the interesting stories of practical research is that of these investigators who waited, day after day, for wind of desired velocities and directions, so that practical determinations could be made. But the wind blew from every direction but that desired. Finally, exasperated, they exercised typical ingenuity by fitting a casing to the window, with a pipe to which a blower was attached. Thus it was possible artificially to simulate wind pressure of any desired velocity, regardless of the caprices of nature. Valuable data were obtained, showing the extent to which these metal windows could be expected to limit infiltration. From the knowledge we have on this subject, it is evident that a building may require more heat when the thermometer is well above zero and with a high-velocity wind blowing than for a condition where the temperature is below zero and the air at rest. For this reason the average wind velocities of the three months of greatest heating load,—December, January and February,—must be taken into consideration when determining heating requirements. Not only velocity, but direction, is a factor in figuring infiltration as well as heat loss. Obviously, it is impossible to set up test equipment that will exactly simulate natural conditions of "wind and weather." A controllable pressure that is equivalent to a known wind velocity at right angles to the plane of the window can be provided, but windage against a window is seldom uniform and fixed in direction.

In order to picture the situation and to show how the architect can control it to the lasting benefit of his client, let us consider a living room, as shown in Fig. 5, extending across one end of a house. Essential data are given on the sketch. From values actually determined by tests made in the research laboratory of the American Society of Heating and Ventilating Engineers, let us build up a tabulation for various wind velocities, showing: (a) the infiltration through the uncalked crack around the frame of the north windows only; (b) the radiation required to heat this inflowing air to 70°; (c) the infiltration through the crack around the sash, including the meeting rail crack; (d) the radiation necessary to heat this volume of air; (e) the total infiltration on account of these windows; (f) the total radiation necessary because of infiltration around this group of windows and its frame. Bear in mind that we are not considering the loss of heat through the window glass. The results, Table I, are startling.

With an assumed wind velocity of 5 miles an hour,—a wind condition hardly noticeable,—there will blow into this room, through the north windows alone, in one hour, almost enough air, at zero temperature, to entirely fill the room. At least 15 square feet of radiation will be necessary to heat this air to 70°. With a 10-mile wind the infiltration will be 6,535 cubic feet, and 35 square feet of radiation will be needed. Increasing the wind velocity to 20 miles an hour brings the infiltration to almost four times the volume of the

935
room, and the radiation to 61 square feet, and if we consider a 30-mile wind,—no stranger during the bitter cold of December and January,—the leakage through this window will change the air in the living room every 11 minutes. Under this condition heat must flow continuously from a huge radiator,—100 square feet,—to heat the incoming air, and coal must be burned at the rate of 3 pounds per hour, or nearly 75 pounds per day, just because of this "leaky" window. To show what can be saved by carefully installed stripping, another portion of the table has been computed. It is evident that the reduction in radiation requirement,—100 square feet with no weatherstripping and a 30-mile wind, reduced to 33.8 square feet,—is so material as to warrant serious attention to the problem. This example admitted is extreme, as a 30-mile wind is considerably in excess of normal winter winds, but such a wind is not uncommon, and should be taken into consideration.

It must be remembered that one part of this so-called loss is entirely unnecessary where attention is paid to details in construction. Practically all leakage around window frames can be stopped by proper calking. This is true whether wood or metal windows are considered. Taking the case of the room and windows under discussion, we have found a radiation requirement of 100 square feet for the four windows, with a 30-mile wind. Of this, 10.4 square feet represents frame leakage, and all of this 10 per cent of the whole can be prevented if the frame is well calked. By proper weatherstripping, the
radiation, as we have seen, can be reduced to 33.8 square feet,—a gross saving of 76 per cent. Surely economies of this order demand, in every case, attention and analysis by the architect.

Essential data developed through the tests at St. Louis¹ are presented here in tabular form in Table 2. The values have been reduced by 20 per cent from the figures shown by the tests because, while they are derived from actual tests, they do not represent ordinary conditions, where pressure is built up in rooms, reducing the infiltration rate by about one fifth. Of course, all the air that blows into the windward side of a house exits from the leeward openings and cracks, frequently accelerated by suction created as the result of the wind. Consequently, when arriving at the total demand, only one half of the radiation due to infiltration loss (as computed for all exposed walls of a building) need be added to the radiation required to offset the direct heat loss.

In studying infiltration losses, research engineers have differentiated between "crack" and "clearance." The drawing, Fig. 6, will make this clear. The crack is taken as one half the difference between the width of the frame and the width of the sash. The clearance is the difference between the width of the stile and the thickness of the sash. One of the interesting findings, in research², is the fact that increasing the crack around the perimeter of a plain sash did not materially increase the leakage, and that weatherstrapped sash, while permitting much less leakage, showed a small increase in leakage with increase in crack. Tests on a plain wood window, with various clearances, brought out the curious fact that the size of the crack around the perimeter has no appreciable effect on the leakage. Consequently the data developed can be applied to any window of the type tested with a crack of from 1/16 of an inch to 1/4 of an inch. It has not been found practical to install wooden windows with cracks of less than 1/16 of an inch, and as the windows age and dry, the cracks increase in width. A typical set of test curves for a plain double-hung window...
the economies of weatherstripping. For New York and vicinity the average wind velocity during the three months of December, January and February is 13.3 miles. The nearest to this figure, is no question as to the economy. Turning to the question of annual saving, we get another angle of the problem. If we assume 5,300 degree-days heating load, we will find a requirement of about 70 pounds of coal per square foot of radiation, and the saving effected through weatherstripping can safely be taken as one half of this, or $1. As the weatherstrip probably could be put on for less than 50 cents a foot, there

TABLE 1.—CALCULATIONS OF INFILTRATION AND CONSEQUENT RADIATION REQUIREMENTS OF WINDOWS SHOWN IN FIG. 5

<table>
<thead>
<tr>
<th>Wind Velocity</th>
<th>Crack Around Frame</th>
<th>Window Cracks (No Weatherstripping)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>5</td>
<td>1.41</td>
<td>0.007</td>
</tr>
<tr>
<td>10</td>
<td>11.3</td>
<td>0.06</td>
</tr>
<tr>
<td>20</td>
<td>31.1</td>
<td>0.16</td>
</tr>
<tr>
<td>30</td>
<td>53.6</td>
<td>0.28</td>
</tr>
<tr>
<td>Wind Velocity</td>
<td>Window Cracks (Weatherstripped Window) Quantities same as (6), (7), (8) and (9)</td>
<td></td>
</tr>
<tr>
<td>(10)</td>
<td>(11)</td>
<td>(12)</td>
</tr>
<tr>
<td>5</td>
<td>3.00</td>
<td>0.016</td>
</tr>
<tr>
<td>10</td>
<td>11.7</td>
<td>0.062</td>
</tr>
<tr>
<td>20</td>
<td>34.9</td>
<td>0.19</td>
</tr>
<tr>
<td>30</td>
<td>59.6</td>
<td>0.32</td>
</tr>
</tbody>
</table>

*Including meeting rail. Allowing for 1/16-inch crack and 1/16-inch clearance.
The architect can determine the saving effected for his client by calking window frames, providing for tight windows, and by having weatherstripping installed. Attention should be directed to the fact that the best types of weatherstripping carelessly applied may fall far short of providing the immunity from infiltration claimed in the printed matter of the manufacturer. The technique of application is of as great importance as the excellence of design or quality of manufacture. Again, some defect quite apart from the weatherstripping may defeat its purpose. A certain living room, for example, had two French doors in the west wall. The leakage was so great that it was impossible to maintain a 65° temperature when a wind was blowing from the north or west. When a real "norther" was blowing, a candle flame was frequently blown out at a distance of 3 feet from the crack between the door edges. Metal weatherstripping was applied, and, as the house was rented, the owner tried to economize by awarding the contract on a price basis. When the next "norther" came, it was found that the infiltration had materially been reduced, but that the candle flame was in danger 1 foot from the tops of the doors! Investigation proved that the doors were warped to such an extent that tight weatherstripping was impossible. It all goes to show the dependent character of the various component parts of a building, and that it does not pay to skimp in any particular.

In many parts of the country storm sash are in common use, and it is interesting to read the conclusions drawn by W. M. Richtmann and C. Braatz, of the faculty of the University of Wisconsin on an exhaustive study of frame calking and storm window application. They say that: "The infiltration through the crack between a brick wall and window frame is a very important factor in calculating the infiltration into a room. However, this source of leakage can be practically eliminated by the application of some type of calking compound to the crack. The application of storm sash does not materially decrease the infiltration of a tight-fitting window, but it does give a large saving if the crack and clearance of the window are large. The application of a wool strip between the frame and storm sash reduced the infiltration appreciably. The storm sash applied by means of four turn-buttons reduced infiltration much more than those applied by means of a hook-and-eye suspension arrangement. The infiltration through the crack between a brick wall and window frame for a plastered wall is about 40 per cent of that through the same crack on a plain wall. This leakage may be as great as the leakage through the sash perimeter of the window."

Turning, now, to the modern steel window, much used in industrial buildings and residences, we find some valuable data resulting from a series of tests made at the University of Michigan by Professor J. E. Emshwiler and W. C.

![Fig. 6. Sketch Showing the Distinction Between "Crack" and "Clearance"](image)

**TABLE 2—INFILTRATION THROUGH DOUBLE-HUNG METAL SASH WINDOWS PER FOOT OF CRACK**

<table>
<thead>
<tr>
<th>Wind Velocity Miles per Hour</th>
<th>Non-Weatherstripped Locked Window, Cu. Ft. per Hr.</th>
<th>Non-Weatherstripped Window, Locked Window, Cu. Ft. per Hr.</th>
<th>Weatherstripped Window, Locked Window, Cu. Ft. per Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat Loss, B.t.u. per Hr. 0-70° Fahr.</td>
<td>Heat Loss, B.t.u. per Hr. 0-70° Fahr.</td>
<td>Heat Loss, B.t.u. per Hr. 0-70° Fahr.</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>0.24</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>0.37</td>
<td>0.39</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>0.51</td>
<td>0.55</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>0.66</td>
<td>0.72</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>0.81</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>0.98</td>
<td>1.11</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Values for pressure for 200 mph at 1000 ft. and 2000 ft. at 8000 ft.
In figuring wood windows, the frame and the other leakage are to be added to the crack leakage to obtain the total. In the steel window there will be little or none of the frame leakage often found in wood windows, because the steel framing is usually installed in the opening with grout or mastic, and the co-efficient of expansion of steel is so near that of building construction that the bond is maintained intact. Cracks at mullions and at contacts where the windows are attached to the steel framework are found to give negligible leakage if care is exercised in installation.

Professor Emswiler brings out an interesting and important point in connection with high buildings. He says: "Even without any wind, a difference of temperature inside and outside will cause the pressure state inside to be less than that outside at the ground, and greater near the roof, and inflow will occur at lower windows and outflow at upper windows. If the building is tall and open throughout from bottom to top, or if arranged in stories in free communication from one to another, and if the temperature difference is great, the pressure difference created at a point near the ground and also at a point near the roof may be considerable. Thus in a building 200 feet high with 70° Fahr. difference in temperature, this force alone, causing inflow at the ground and outflow at the top, may easily exceed 0.2 inches of water, which is the equivalent of a 20-mile wind. If the building is multiple-storied, and if there is absolutely no communication between stories, then the force of temperature difference is effectually nullified, or rather reduced.

---

**Fig. 7. Graph Showing Leakage Through Plain Wood Window with Various Clearances**

Randall. In addition to carrying out a study of leakage through the cracks of rolled steel windows, a field study was made to determine the crack widths found in practice. Measurements of more than 1,600 steel windows are tabulated in Table 4, from which it will be seen that much less air can pass through the cracks of steel windows than through corresponding openings around conventional unweatherstripped wood sash. The tests indicated that when steel windows are pivoted or mastic, as is the common practice with industrial projected, or grouted with cement, as is the common practice with residential casements, heavy section casements, heavy casement-section projected, and possibly architectural projected, or grouted with cement, the frame leakage is negligible.

**TABLE 3—INFILTRATION THROUGH DOUBLE HUNG WOOD SASH WINDOWS**

<table>
<thead>
<tr>
<th>Wind Velocity Miles per Hour</th>
<th>Per Foot of Uncalked Crack Around Frame*</th>
<th>Per Foot of Crack around the Sash including Meeting Rail for Cracks of 1/16-in. and 1/8-in. Clearance, Window Unlocked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leakage, Cu. Ft. per Hr.</td>
<td>Heat Loss, B.t.u. per Hr. 0-70° Fahr.</td>
</tr>
<tr>
<td></td>
<td>Plain Non-stripped Wood Window</td>
<td>Aver. Weatherstripped Window</td>
</tr>
<tr>
<td></td>
<td>Leakage, Cu. Ft. per Hr.</td>
<td>Heat Loss, B.t.u. per Hr. 0-70° Fahr.</td>
</tr>
<tr>
<td></td>
<td>5.0</td>
<td>1.41</td>
</tr>
<tr>
<td></td>
<td>10.0</td>
<td>6.36</td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td>11.2</td>
</tr>
<tr>
<td></td>
<td>20.0</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>30.0</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td>40.0</td>
<td>53.6</td>
</tr>
<tr>
<td></td>
<td>50.0</td>
<td>76.0</td>
</tr>
</tbody>
</table>

Notes.—A. This table is approximately correct for cracks up to 1/4-in.

B. The values given for the plain non-stripped wood window and for the weatherstripped window include the "elsewhere" leakage through the frame, but not the leakage through the uncalked crack around the frame. If the frame is to be left uncalked, the loss under that heading should be included in the heat loss calculations.

*Practically all leakage around frames can be stopped by proper calking.
to an amount proportional to the height of a single story. However, there is always some communication by means of stairs and otherwise, so that the force of temperature difference is always operative in some degree."

It is worth comment that the quantity of infiltration is dependent upon things other than wind velocities and cracks. It is obvious that the outer air cannot be forced through the cracks of a building on the pressure or windward side unless the same volume of air passes out through the leeward side. Therefore the interior layout of the building and the character of its occupancy must enter into the problem. If a room on the side of excessive winter exposure is seldom used, and if the communicating doors are generally kept shut, the infiltration will be slight regardless of the weather-tightness of its walls and windows. For this reason, it might be in order to weatherstrip interior doors as a means of decreasing infiltration. By the same token, open transoms tend to increase infiltration, as do chimneys from fireplaces and kitchen vents, especially if supplemented by electric fans. An interesting example came up in connection with a large house where the kitchen was vented with draft produced by an electric fan. The ventilation was entirely adequate, but it was not realized that the infiltration, some 400 cubic feet an hour, required the use of more than 1,000 gallons of oil per heating season.

An interesting point came to light recently when calculations were made of heat losses and infiltration for a house located near New York. Three rooms, forming one long and one short adjoining wall, were considered (Fig. 8). The radiation requirements were computed for the condition where the long wall faced north and the short wall, east. The house then was assumed to be rotated clockwise, so that the long wall faced northeast and the short wall, south-east, and the amount of radiation was determined. This process was repeated, with 45° steps throughout the circle. It was found that the requirements varied 50 per cent.

There is a growing tendency on the part of the builders to install insulation, weatherstripping, and the other elements that may add to the first cost of a house but which reduce the annual cost of operation, and which frequently provide for more comfortable occupancy. As has been suggested, these refinements may bring about savings in other elements that completely offset their cost. It is entirely possible, in the construction of a small house, to spend $500 for insulation and weatherstripping and save $300 or $400 in the cost of the heating plant. At the same time, a more comfortable house is insured for summer occupancy, and a more salable property is produced.

<table>
<thead>
<tr>
<th>Building Designated by Letter</th>
<th>Type of Window</th>
<th>Number of Ventilators Having Crack Width Indicated</th>
<th>Total No.</th>
<th>Aver. Crack</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (U. of M.)</td>
<td>Heavy section casement</td>
<td>7 28 25 4 4</td>
<td>68</td>
<td>1/16&quot;-</td>
</tr>
<tr>
<td>B (Detroit)</td>
<td>Residential casement</td>
<td>36 39 6 1</td>
<td>102</td>
<td>1/16&quot;-</td>
</tr>
<tr>
<td>C (U. of M.)</td>
<td>Heavy casement section projected</td>
<td>8 12 9 7</td>
<td>36</td>
<td>1/16&quot;+</td>
</tr>
<tr>
<td>D (U. of M.)</td>
<td>Heavy casement section projected</td>
<td>214 M 6 10 2</td>
<td>290</td>
<td>1/16&quot;</td>
</tr>
<tr>
<td>E (U. of M.)</td>
<td>Heavy casement section projected</td>
<td>77 127 10</td>
<td>214</td>
<td>1/16&quot;</td>
</tr>
<tr>
<td>F (U. of M.)</td>
<td>Industrial pivoted</td>
<td>7 19 30 35</td>
<td>6 97</td>
<td>1/16&quot;</td>
</tr>
<tr>
<td>G (Detroit)</td>
<td>Industrial pivoted</td>
<td>45 46 27 11</td>
<td>15 160</td>
<td>3/8&quot;-</td>
</tr>
<tr>
<td>H (U. of M.)</td>
<td>Commercial projected</td>
<td>180 123 103</td>
<td>234</td>
<td>3/8&quot;-</td>
</tr>
<tr>
<td>I (U. of M.)</td>
<td>Architectural projected</td>
<td>43 41 5 21</td>
<td>110</td>
<td>1/8&quot;+</td>
</tr>
<tr>
<td>J (U. of M.)</td>
<td>Architectural projected</td>
<td>95 13 10</td>
<td>78</td>
<td>1/8&quot;</td>
</tr>
<tr>
<td>K (U. of M.)</td>
<td>Architectural projected</td>
<td>76 90 13</td>
<td>180</td>
<td>1/8&quot;-</td>
</tr>
</tbody>
</table>
IN view of the fact that contracts awarded for construction during the month of July represented the second highest monthly total recorded to date, it is not surprising that August construction shows a decided falling off in several of the areas of the United States. The August contract total for the 37 states east of the Rocky Mountains amounted to $488,882,400, according to the F. W. Dodge Corporation, a decline of 25 per cent from the July total and a decline of 5 per cent when compared with that of August of last year. This brings the total of the first eight months of this year up to $4,156,825,300, a decrease of 9 per cent from the corresponding figures of 1928.

Construction work started in the New England states totaled $33,459,900 during August, a figure 21 per cent below that of the preceding month and 14 per cent below that of August, 1928. For the first eight months of the year this district showed total contracts awarded amounting to $1,001,911,700, a decrease of 16 per cent.

Construction total for August was $94,506,000 in the New York state and northern New Jersey district, 57 per cent below the July figures and 26 per cent below those of August, 1928. The total of $1,001,911,700 for the first eight months of this year was 16 per cent below that of 1928.

In the middle Atlantic states construction fell off 39 per cent compared with July. The August total was $45,559,600. This also represents a decrease of 11 per cent from that of August a year ago. For the eight months of this year the total of $508,393,700 was 5 per cent below that of 1928.

The central western and northwestern states showed a comparatively small decline in August. In the central west, with contracts awarded amounting to $153,170,800, the decrease was 4 per cent from the July figures and 8 per cent from the August, 1928 total. For the eight-month period this district showed new construction started to the amount of $1,225,572,900, a decrease of 11 per cent from that of the first eight months of last year. The total of $8,303,100 for August construction in the northwestern states was 6 per cent below the preceding month and 20 per cent below August of last year. However, construction for the first eight months of 1929, with a total of $65,734,500, was 21 per cent ahead of the corresponding period of 1928.

THESE various important factors of change in the building situation are recorded in the chart given here: (1) Building Costs. This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) Commodity Index. Index figure determined by the United States Department of Labor. (3) Money Value of Contemplated Construction. Values 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.
ELECTRICAL WIRING LAYOUTS FOR OFFICE BUILDINGS

BY NELSON C. ROSS
ELECTRICAL ENGINEERS, RICHARD D. KIMBALL CO.

THE electrical wiring layout for an office building will be necessarily influenced by the size and location of the building, the type of construction, and the completeness of the equipment desired, and also upon whether the building is to be occupied wholly by the owner or is to be wholly or partially for rental.

In general, the wiring layout will include separate wiring systems for the control of lighting and power services; conduit raceways for the development of the telephone and miscellaneous low tension office equipment; protective wiring, including fire alarm and watchman's clocks, together with the required distributing Switchboards, panelboards, wire closets, motor, equipment, and lighting fixtures, etc.; and the final connection with the service mains.

Construction. With the smaller office buildings of second class construction, and where it is unlikely that the walls and partitions will be changed to meet the requirements of new tenants, the use of B X armored wire is permissible where the circuits occur in wood construction. With the use of B X armored wires, however, standard 4-inch conduit outlet boxes should be used on all branch circuits for all outlets. These boxes are fitted with the regular fixture receptacle and switch covers, the armored wires entering the boxes with approved clamp type box connectors and lock nuts. With the use of B X, construction "troubles" will nearly always occur at the "outlets" and are mainly due to the use of too small outlets or ceiling plates, the improper insulation of splices, and the crowding of the wires and splices in the outlet boxes.

Expense permitting, however, rigid conduits should always be used for both high- and low-tension wiring and for all types of building construction, since, with the use of rigid conduit properly installed, there is ample room for the installation of wires without crowding, and the wires may be withdrawn, replaced, or added to, at will without the necessity of cutting walls or construction.

With all buildings of first class construction, or where wires must be installed under cement floors, in masonry, or in damp locations, the use of rigid conduits for all services is obligatory.

Preliminary Information. Upon the commencement of the work, a rough approximation should be made of the connected load for both lighting and power services, and such information, together with the rough plot plan, should be given to the public service company, in order that the company may determine the character of the service available for both lighting and power, and also determine the point at which the service cables will enter the building. A copy of the local installation rules of the public service company should also be obtained, as well as any local ordinances governing the installation of the work, and such rules together with the requirement of the "code" should be also ascertained and this information given the telephone company and like service companies, in order that the point of entrance may be determined and the low tension service conduits proportioned for the maximum requirements of the building.

Circuit Wiring. In planning the circuit wiring throughout the office floors, provision should be made for a meter closet on each of the floors. This closet should be located at some central point, and be accessible from the public stair hall or corridor. Panelboards of the lighting system and connecting cabinets of the low tension systems, as well as the terminal cabinets of the public telephone and A.D.T. services, should be installed in these meter closets, and all circuits of all services on the floor should be run back to the meter closet and connect with the respective cabinets, etc.

To facilitate the installation of risers and feeders, meter closets should, as far as possible, be located one over another on the different floors and connected with a vertical wire shaft. The required dimensions of the meter closet will depend upon the number of offices served from the closets. With the smaller buildings with some 15 or 25 offices on a floor, a closet floor space of approximately 6 x 8 feet or more may be required. With the larger buildings, the closet space should be increased in proportion.

Where, with large floor areas and the use of one meter closet, branch circuits exceed 125 feet in length, two or more meter closets should be considered for each floor, these closets being so spaced that the average length of the branch circuits will not exceed 100 feet. With the use of more than one meter closet on a floor, each closet should be made to serve a definite zone, and all branch circuits of all services within the zone should be run back to, and connected with the respective meter closets. Where a building is to be occupied wholly by one tenant, less space may be required in the meter closets, as individual office meters will not be required.

In planning the circuit wiring throughout the offices and rented spaces, provision must not only
be made for fixed ceiling outlets, and outlets in permanent walls and columns, etc., but a flexible arrangement of conduit outlets, and switches, etc. must be had, these being interconnected to permit of the ready extension of circuits, and the metering of one or any number of offices from a single meter as desired.

In general, the outer building walls, corridor bearing walls, columns, and stair enclosures, being fixed, may be equipped with sub-panels, outlets, switches, etc. Conduits and outlets, however, should, in general, be kept clear of partition walls, permitting the removal and relocation of the partitions without interference with electric conduits and outlets.

The spacing of outlets for ceiling fixtures throughout the offices will be influenced by the height of the ceilings and the location of the exposed beams. In offices with floor areas of approximately 12 x 20 feet, two ceiling outlets will give satisfactory results. Where the office width exceeds 12 feet, it is advisable to use four outlets. In larger areas, spacing of ceiling outlets should not exceed the hanging height of lighting unit.

It is difficult to determine the required lighting intensity for different offices, as this will be influenced by the class of work carried on and the individual desires of the tenants. The code rules call for a definite number of watts per square foot of floor area, but this value will be far exceeded in practice. It is well to provide additional room in the conduits, as well as extra circuits on the panelboards to permit of the extension of additional branch circuits if they are required.

In practice, no office circuit should be fully loaded, and it is seldom that more than two or three ceiling outlets are connected on a circuit from the panelboard. Outlets for the use of wall fans should be wired on separate circuits from the lighting, and convenience outlets should be also wired on separate circuits with not more than two convenience outlets connected to the branch.

In general, an office of approximately 12x24 feet of floor area will require two ceiling outlets connected on one branch circuit, and under local switch control; four convenience receptacles, properly spaced and wired on two circuits, permitting the later extension of additional circuits from the outlets for possible special equipment; and two receptacle outlets on walls or columns, 7 feet, 6 inches above the floor (wired on one circuit) to provide for wall fans.

Where it may be determined that certain office spaces may be rented for barber shops, hair dress-
ing parlors, or beauty parlors, and where high wattage equipment may be required, it is good practice to provide an empty conduit (of not less than 1 3/4 inches) from the panel cabinet in the meter closet to each such office space to provide for possible future loads, the conduit to be capped at a point near ceiling convenient for future extension.

For the development of the lighting circuits throughout larger areas, one method of circuit wiring employs the use of one ceiling outlet in the center of each bay, this outlet fed from two full circuits from the panelboards in the meter closet. With the development of the "space," circuits are extended from the center outlets using a metal moulding to additional ceiling outlets, switches, and convenience receptacles, as may be required. These center outlets may be further cross-connected using empty 3/4-inch conduits forming a conduit network in the ceiling construction through which future circuits may be developed.

A second method employs the use of uniformly spaced outlets throughout each of the bays, at approximately from 8- to 10-foot spacings, (usually four outlets to the bay) and each two outlets fed from a circuit from the meter closet; switch legs are dropped from the outlets to switches on columns or on permanent walls. Receptacle outlets are also provided on columns and permanent walls, setting them 18 inches above the floor for general office use and 7 feet, 6 inches above the floor where used for wall fans. Where an underfloor duct system is not used, the conduits feeding the receptacle outlets should be run in the floor slab. Added flexibility may be secured by the use of junction boxes, one in each bay section, these being set in columns at a point near the ceiling, the feeding conduit passing from the meter closet through the junction boxes to the outlets, the junction boxes in turn being connected together with empty conduits, thus permitting the interconnection of the office circuits.

**Public Circuits.** Public circuits will include all wiring throughout corridors, stair halls, general toilets, elevator lobbies, outside lighting, public rooms, etc. These circuits should be run back to the meter closets on the respective floors and connected to the public service panelboards in the meter closets, these panelboards controlling from the public feeders, and metering from the building meters on the distributing switchboard.

Corridor lighting outlets may be spaced to conform to the ceiling design, and with flat ceilings...
Lighting Fixtures Properly Spaced to Illuminate a Large Open Office Area

will be spaced approximately 20 feet apart. Corridor lighting may be controlled from local switches in the corridors, in group from the meter closets, or from remote control switches in the office of the superintendent, or by means of time switches as desired. With the use of remote control or time switches, however, the corridor and stair lighting should be double-circuited, with the main illumination under the master control, and with the second or emergency circuit controlling part of the illumination from local three-way switches on the stairs and in the corridors. The emergency lighting under the three-way switch control will also act as “watchman’s lights,” permitting the watchman to “light up ahead” as he makes his rounds. Red lamp receptacles, or illuminated exit signs may be located at all their entrances and also at the exits from the building, these being wired to control from the emergency corridor circuits.

Where illuminated direction signs may be required, flush receptacles may be set at the required height and fed from the public circuits under the control of local switches.

With the use of floodlights or large electric signs, branch circuits may be carried back to the nearest meter closet, connected to feed from a separate panelboard in the meter closet and controlled from separate risers and remote control switches on the switchboard with push-button stations in the office of the superintendent.

Provision must be made for the lighting of the elevator cars from outlets in the hoistways to which the flexible lighting cables of the cars may connect with separate circuits feeding these outlets from the nearest meter closet. Two separate circuits should also be run from the nearest meter closet to each pent house or elevator machine room to provide current for floor-indicating equipment.

Stores. Where the building includes stores, all wiring for them must be independent of the building wiring, each store being wired as a unit under separate service switch and meter control. Where possible, a service room accessible from a public corridor should be provided for the service switches and meters, the whole being fed from separate feeders from the distributing switchboard and from the street side of the building meters. This applies to both power and lighting services. Each store must have an approved service switch with meter loop, the service feeder running from the service switch to the panelboard in each of the stores.

Panelboards may be in the basement with the store lighting controlled from local switches, or they may be in the stores and all circuits controlled from switches on the panelboard. Stores will include ceiling outlets over counters usually spaced on not more than 10-foot centers, floor and fan receptacles, show window and entrance lighting, and provision for electric signs.

Circuits for window and sign lighting may pass from the panelboard to a junction box at or above the transom, the circuits developing from the
<table>
<thead>
<tr>
<th>Gage</th>
<th>Size of Wire (Circular Mils)</th>
<th>Area in Circular Mils</th>
<th>Conduit Sizes</th>
<th>Conduit Size, in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>1624</td>
<td>3</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>2, 1/2, 1/2, 1/2, 1/2, 3/4, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>16</td>
<td>2563</td>
<td>3</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>2, 1/2, 1/2, 1/2, 3/4, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>14</td>
<td>4107</td>
<td>15</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>12</td>
<td>6530</td>
<td>20</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>10</td>
<td>10360</td>
<td>25</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>8</td>
<td>16510</td>
<td>35</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>6</td>
<td>26620</td>
<td>50</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>5</td>
<td>31100</td>
<td>65</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>4</td>
<td>41740</td>
<td>85</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>3</td>
<td>52630</td>
<td>100</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>2</td>
<td>66370</td>
<td>110</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>1</td>
<td>83690</td>
<td>120</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>0</td>
<td>105500</td>
<td>140</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>000</td>
<td>135100</td>
<td>160</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>0000</td>
<td>167200</td>
<td>180</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
<tr>
<td>00000</td>
<td>211600</td>
<td>200</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
<td>1/2, 1/2, 1/2, 3/4, 3/4, 1</td>
</tr>
</tbody>
</table>

The location of the motor, an overload and underload protective device must be provided at the motor.

The full load current as well as the permissible size of wires for motor circuits may be obtained from tables in the code; these should be followed in laying out motor wiring. Tables are also given in the code showing the current allowed for the different wire sizes, as well as the conduits allowed for the circuits.

Motors of large capacity should, in general, be connected on single circuits or feeders. Where motors are grouped, a single feeder may be run to a fused junction terminal with tap circuits taken from the cut-outs to the respective motors of the group.

Single-motor circuits should be proportioned for not less than 125 per cent of the full load-running current of the motor. Wires which will be required for motor circuits are:

- Direct current ............ 2 wires each same size
- Single-phase A.C. current 2 wires each same size
- Three-phase A.C. current 3 wires each same size
- Two-phase four-wire A.C. current 4 wires each same size
- Two-phase two-wires A.C. current 2 wires each same size
- The neutral or third wire to be 50 per cent larger than either outside wire.

To be concluded in the November issue.
will be of convenience for control of corridor and stair lighting. Remote control switches may be used when it is required to control a circuit or motor from a distant point, the switch being located at the load with control wires running to and terminating in momentary-contact push-button stations, with a pilot lamp to indicate when the switch is closed. Approved safety switches must be used at all motors to master the circuit, these in addition to remote control switches if they are used.

Convenience receptacles, as a rule, should connect on circuits separate from the lighting outlets. Receptacles may be had in 10-, 20-, 30-, 50-, and 100-ampere capacity and in two- or three-pole type. Single circuits must be run to all receptacles of more than 10-ampere capacity, and also to 10-ampere receptacles where the anticipated load exceeds 300 watts. The carrying capacity of the wires connecting to high capacity receptacles should be not less than the ampere capacity of the receptacle.

**Lighting Fixtures.** The type and design of the lighting fixtures for the building is largely a matter of choice. Lighting fixtures of special design will probably be required in the entrance lobby, for post standards, outside brackets, vestibules, and for special offices, etc., and they may be of the multiple arm, ceiling collar or pendant type, designed for direct, semi-indirect, or wholly indirect illumination.

The standard type of lighting fixture, in general use for office illumination, consists of a pendant or ceiling collar, (depending upon the height of the ceiling,) employing a single lamp of the required wattage, with a partial or wholly enclosing globe. Pendant fixtures may be of the rigid pendant type, the chain hanger type, or the "single link" type, which permits the pendant to always "hang plumb." In general, for good results, the lamp should hang from 8 feet, 6 inches to 10 feet above the floor. In corridors, toilets, etc., and where the ceiling height does not exceed 8 or 9 feet, some type of ceiling collar must be considered. In the design of the wiring layout, the type of lighting fixture need be considered only in a general way, as with proper spacings and with ample wattage at the outlets, any desired type of lighting fixture may be used.

**Power Circuits and Equipment.** All motor circuits (other than for motors of fractional horse power) should be designed to operate from the separate power feeders from the power section of the distributing switchboard. These circuits are independent of the lighting service, even though the characteristics of the power and lighting services (as with a single-phase, or direct-current) are the same. Power and lighting services should be metered separately, to take advantage of the power rate usually offered by the companies.

Motors of fractional horse powers for desk fans and portable office equipment, etc., are standardized to operate at the lighting voltage of from 110 to 125 volts, and as a rule feed from receptacles and from the lighting circuits. Motors of fractional horse power for kitchen equipment, including dishwashers, polishers, grinders, food choppers, and refrigerator boxes, are standardized to operate at the lighting voltage for both direct or single-phase A.C. current, and as such motors are rarely of more than 1 horse power, they may connect from the lighting feeders, or may operate from the power service and at the power voltage, with the motors balanced on the phases. The use of the standard single-phase motors on such equipment is to be preferred, as these motors are carried in stock, and can quickly be replaced in the event of breakdown.

All motor circuits should be run in conduits, terminating in fused safety switches at the motors, the circuit leading from the switches to the motor terminals. Direct current motors will require a controller or starting box connected between the switch and the motor. Alternating current motors of not exceeding 7 1/2 horse power will not require controllers. Motors of more than 7 1/2 horse power will require controllers or starters. This applies to both the constant and variable speed types. Where motors are stopped and started under remote control, or other than from
Typical Column Layout for an Office Building, Showing Dimensions

“grade of insulation on the wires.” In the writer’s experience, the cost of high grade insulation for all wires carrying secondary lighting or power voltage and for code insulation has been offset by the lower maintenance cost in operation.

It is further suggested that all wires and cables for use on primary circuits (2,300 volts and above) be insulated for not less than double the working voltage of the circuits on which they are to be used. Conduits and wires should not be installed in close proximity to steam pipes, or where subjected to high temperatures. Where it becomes necessary to run wires in trenches or elsewhere with steam piping, varnished cloth-insulated wires should be used rather than those of rubber. Cables insulated with varnished cloth may be generally used for feeder cables and mains; they are allowed a greater current-carrying capacity than rubber-insulated cables, and as a rule are cheaper to install.

Where feeder circuits are run under floors of sub-basements or in outside trenches and are subjected to moisture, the wires and cables must be sheathed with lead in addition to the insulation. Where the length of the branch circuits exceeds 80 feet, it is advisable to use nothing smaller than No. 12 wire.

Where vertical feeders or riser circuits are run to the panelboards in the wire closets and in elevator hoistways, etc., provision must be made for supporting the weights of the cables in a way other than from the terminal lugs of the panels and switches. The required clamping methods may be obtained from the code.

All wires used throughout the low tension system for the operation of clocks, bells and like equipment should be of No. 14 gauge as used for the lighting circuits, and should be installed with the same care as the wires of the lighting service. In view of the development of the circuits throughout an office building to meet the requirements of new tenants, as well as the tendency toward the use of high wattage equipment, the mains and feeders should be proportioned for not less than the full connected load of the building.

Outlet Boxes and Fittings. The exact types of the outlet boxes to be used for any installation must necessarily be dependent upon the building conditions at the outlets. In general, however, nothing less than the standard 4-inch galvanized conduit boxes should be considered for both fixture, switch and receptacle outlets. This also applies to both conduit and BX construction in second class buildings. Outlet boxes for use with low tension wiring should, in general, be of the same type as used with the lighting circuits, except where special boxes of cases are required for special equipment.

Local Switches and Receptacles. In general, flush switches will be used for the control of local circuits. The use of the tumbler or push-button switch is a matter of choice, either giving satisfactory service. Switch plates may be of brass, bakelite, or of composition, and either may be had in any standard finish. Where the circuit load is heavy, the use of a double-pole switch “connected single-pole,” (with the two blades in multiple) will provide double capacity and reduce switch maintenance cost. It is good practice to set local switches not less than 58 inches above the floor in order that the switches will not interfere with the installation of a chair rail.

Local switches controlling the lighting in vaults may be set in the outside of the vault wall and adjacent to the entering door, such switches being made up in combination with a receptable, (for use with a portable lamp for the vault,) and with a pilot lamp that will glow when the vault lighting is in use.

Lighting outlets in closets may be controlled from switch combinations with pilot lamps, or door switches may be installed in the door jambs. Similar pilot lamps are of convenience in circuits controlling local electric heating equipment, these being wired to indicate when the circuit is in use, and also for use with small motors in ducts or remote from the point of the control.

Three-way and four-way switch combinations
junction box (in the window construction) to the outlets. Show window reflectors may be of the flush recessed type or of the surface type. They are as a rule set approximately on 12-inch centers and are wired on two or more circuits, with the circuits controlling alternate reflectors. Outlets should be designed for not less than 150-watt lamps. Each window should also be provided with two base receptacles on independent circuits. In view of the store's possibly requiring power service, or service for the use of electric heating devices of high wattage, it is good practice to make the main lighting feeder for the stores "oversize" and to provide also a power feeder from the distributing switchboard to the meter group, in turn carrying an empty conduit from the meter group to the basement of each of the stores, terminating the conduits in pipe caps in readiness for later extension. Provision for public telephones may be made throughout the stores, using conduits and wire mouldings.

Assembly Hall. An assembly hall will require the lighting of the platform, by means of possibly one or more stage border reflectors, a footlight reflector, and a series of floor outlets and receptacles on the platform, and also flush receptacles at the front of the platform for the lighting of the music of an orchestra. Lighting of the hall will be from properly spaced ceiling outlets and from brackets on the side walls. The whole is controlled from a panelboard on the platform, and from a separate feeder from the switchboard.

Provision must be made for illuminated exit signs at all exits, as well as for emergency lighting for the aisles, etc., these circuits being fed from a separate panelboard in the lobby or convenient to the entrance of the hall. This panel should be controlled from a separate emergency feeder from the switchboard.

With the use of a projection booth, the lighting of the booth and adjacent rooms may be controlled from the lobby panelboard. A separate circuit, however, should be carried from the switchboard to the booth for the operation of the projector machines and lanterns, this equipment under the control of a separate panel in the booth. Provision should also be made for the control of the ceiling illumination of the hall from a remote control switch on the platform panelboard, with push-button control stations in the booth, and also for a return call bell system between the booth and the platform.

Cafeteria. A cafeteria will require lighting service, power service for the operation of kitchen motors, as well as electric heating circuits for the control of electric ranges, warming ovens, and miscellaneous electric cooking equipment. The lighting of the cafeteria may be under local switch control or controlled from a special cabinet in the cafeteria. Separate power and heating feeders should be run to the cafeteria from the switchboard, each terminating in a cutout panel in the kitchen, with tap circuits run to the respective kitchen motors and heating outlets. Power and heating feeders for the cafeteria should each be separately metered from the switchboard.

Wires and Cables. All considered, the successful operation of the wiring system is dependent upon the "insulation" of the system as a whole, and this applies not only to the insulation of joints and splices in outlets and junctions, panel and switchboards, etc., but also to the

Typical Wiring Layout for Small Office Building Divided into Small Offices
MODERN TENDENCIES IN THE USE OF MARBLE

BY

CLIFFORD WAYNE SPENCER

MARBLE in various forms and uses has furnished one of the records of the character of the various stages through which civilization has passed. The marble structures of ancient Greece are a true indication of the severe simplicity of Greek taste, while the riotous luxury of the Roman Empire was expressed in terms of richly colored marbles and brilliant mosaics. And so it has progressed through various color cycles to the present time. Within the period of our own history, very marked tendencies along these lines can be discerned. Beginning with the pure white of the Colonial and Greek Revival periods, popular taste gradually developed in favor of more richly colored decorations, and the result was the "Victorian" style which was characterized by the use of richly colored red and black marbles in connection with highly ornamental oak or mahogany woodwork. Again the wave of color subsided, and for the past two or three decades we have had cool white marble with more recently a decided tendency toward the use of the buff monotonies, such as Botticino and Tavernelle. In any town of considerable size, bank interiors and other buildings can be found whose interior treatment is based entirely on the use of buff marble. In fact, buff marble has come to be considered the "bread and butter" of the marble industry, like sugar in a grocery store. The marble yards of the country are stocked with this type of marble, and it can be supplied in large quantities.

But the world moves on, and the pendulum swings rapidly in the opposite direction. There is little doubt that we are now entering upon a new color era, which, stimulated by new discoveries and scientific research, bids fair to go beyond anything we have yet known. Always the builder has loved to work in marble. The effects to be gained by its use are unlimited in number, and its lasting qualities are such that his work will endure. Moreover, no material lends itself in quite the same way to the expression of beauty in color. Its colors are natural, and therefore have unlimited possibilities from the standpoint of harmony. Color is now being used where once it was not even considered, and especially is this true of the modern home. Formerly, little marble was used in domestic architecture except in the most pretentious homes of the very rich. Now, however, it has a very definite place, and lends color to many bathrooms and is being used in mantels, radiator coverings, as well as for many exterior uses. These uses of marble are being very definitely recognized by a new policy which has been adopted by the marble industry as a whole. Marble was formerly sold to dealers by the great producers and distributors in block form only, so that if an architect or his client particularly desired a certain kind of marble for a mantel or lavatory slab, he might find that dealers in that locality did not happen to have a block of that particular variety on hand and could not afford to buy one for such a small order, so that a less desirable variety would have to be substituted or the use of marble abandoned altogether. Now, however, the producers offer to sell marble of any variety in lots of one slab or more, so that the architect can now have much greater freedom in
In Elaborately Decorated Interiors, Plain White Marble May Be Used Effectively

The Carpet-like Pattern in Marbles Relieves the Monotony of Wide Floor Areas making his choice of marbles for such purposes.

In choosing marble for use in a prospective building, there are many points to be considered, and experienced marble men should be consulted in all cases. The choice of marble requires some thought, there being about seven hundred different varieties available in this country at the present time. This does not mean that the choice can be made indiscriminately. For instance, an architect may choose a beautiful marble and base his whole scheme of decoration on it only to find that it cannot be supplied in quantities sufficient for his needs. He may wish to use monolithic columns of such sizes that only a very limited list of marbles can be had with sufficient length to serve the purpose. Again he may find that the physical properties of his chosen variety are such that it is unsuitable for his particular project. All these details should be investigated.

The supply of marble depends not only on the existence of the deposit in large quantities, but on its accessibility and the methods used in quarrying it. There are vast quantities of beautiful stone hidden away in the hills which are so inaccessible that only a very limited supply of them is to be had. The mountains of Colorado have vast deposits which are scarcely touched because of the great difficulty in bringing the marble to market. Some quarries in that state are worked, and we have the beautiful Colorado Yule which is available for fairly large buildings, but which is marketed with great difficulty. Another illustration of this is found in Spain, where there are deposits of the richest marbles, which were so greatly desired by the ancients that they were transported in great quantities to the Italian cities and even to Greece and more distant countries. The retrogression which has taken place in Spain has caused such great confusion in the transportation system that these valuable marbles are quarried only in very limited quantities, and then only for local use. The length of the working season is another factor governing supply. If a quarry can be worked for only three of four months of the year, the supply will naturally be limited. This is the case in many of the quarries located in the Pyrenees and the Alps in Europe, and in Colorado and Alaska and the northern sections of North America. This handicap has been overcome in many cases in this country by using modern quarrying methods, and this is especially true of the Vermont district, where most of the quarries are in the form of tunnels and can be worked throughout the year. The southern districts, such as Georgia, Tennessee, Missouri and Alabama, are of course, not subject to this condition, and quarries there are worked in the form of open pits. Modern quarrying methods are doing much to insure a steady supply of blocks. In this country practically all operations are carried on with mechanically operated channeling and drilling machines, so that a constant supply of blocks can be had with very little waste. In Europe, however, the general procedure has been to blow off the side of a mountain or to split off blocks by means of wedges, and to salvage as much of the debris as possible. There has also been use of wasteful methods in this country, foremost among which are those causing the ruining of the deposits of white marble in New York state, and of the black marble beds in Virginia by blasting. The loss of the Virginia black marble is to be particularly regretted, as it is said to be the most beautiful and uniform black marble found anywhere in the world. These quarries are now being worked for terrazzo chips, and it is possible that solid marble will be reached and that this valuable variety will be made available once more.

The sizes of blocks depend on the formation
Native Utah Marble is Used in this Mantel in the Church Administration Building, Salt Lake City

Domestic Marbles Are Unsurpassed for Giving an Effect of Cleanliness to Shop Interiors

of the strata as well as on the facilities for getting out and transporting the blocks. Many varieties can be had in sound blocks of 5 or 6 feet only, while others are limited in size only by the machinery used to raise them from the quarry. A block of white marble, weighing 63 tons and being 14 feet square and 3 feet thick, was especially quarried for the basin of the Scott Memorial Fountain in Detroit, and monolithic columns can be had as large as 32 feet long by 4 feet in diameter. It is always best to ascertain what sizes are available before planning to use monolithic blocks of large sizes.

Another matter to be carefully considered in choosing marble, is that of the suitability of its physical properties to the conditions to which it will be subjected. Marble is not wholly a scientific classification but a trade name, applied to a certain class of limestone possessing peculiar characteristics. In general, marble is more dense and is said to be "metamorphosed" or "recrystallized" limestone. It is more compact and is generally distinguished from limestone by its ability to take a polish. The line of demarcation between limestone and marble is rather vague, and it is sometimes difficult to tell in just which class to place a stone. In general, marble is divided into three classes according to chemical composition. The calcites are almost pure lime carbonate, while Dolomite marble carries a high percentage of magnesium carbonate, and the serpentine marbles have abundant silicates crystallized with the carbonates. The tensile strength of marble is very great, which fact not only adds greatly to its structural value, but makes it especially adaptable to delicate sculptural ornamentation. The crushing resistance of marble ranges from 11,000 pounds to the square inch to 22,000 pounds per square inch, depending on the variety. Its resistance to heat is especially important in case of fire, and marble is well up in the list of stones in this respect. Under carefully conducted tests, it was found that marble may be subjected to a heat of 12,000° Fahr. without physical change. The freezing of liquids absorbed by stone is very likely to cause disintegration of its structure, but so small is the quantity of moisture that can be taken up by marble (from .06 to .09 by weight) that there is no great danger from this source. This quality of non-absorption is also of great advantage in resisting stains from oils, dyes and other liquids. The quality of hardness is very important, especially where the material is to be subject to constant wear, as in floors and stair treads. Everyone knows how hollows will be worn in stone floors and steps by the passing of countless feet over a long period of time.

Special care should be taken in using stones of different wear resistance in the same floor, as the floor is likely to become hilly or uneven through wear. An example of this is found in the Union Station at Washington, where a very hard red Champlain marble was used in connection with a softer white marble to gain decorative effect, and the heavy traffic has worn away the white marble leaving the red projecting quite noticeably. The United States Bureau of Standards is making tests at the present time to determine the wearing qualities of floors and the possible remedies, if any. An apparatus has been designed, and tests with this are being compared with a series of measurements of similar materials under service conditions. A paper showing the results of these tests is now ready for publication and should be of great interest. It contains the results of abrasion tests on about 90 materials, including marble, slate, limestone, and sandstone.

Perhaps the most important consideration in choosing marble to withstand special conditions is that of soundness. Many of the varieties most
highly prized for their rich color and pattern have, by their very nature, natural fissures and depressions. These defects are successfully remedied by the use of wax and by “sticking” the marble together, and in some extreme cases by cementing it to a “liner” of heavier marble or some other sound stone. It is said that in ancient times it was the custom to specify that marble should be “sine cera,” without wax,—and that it was from this custom that our English word “sincere” was evolved. One should not get the impression, however, that marble that is waxed or “stuck” is not an honest product or that its value or durability is lessened thereby. Whatever may have been the practice in times past, the marble industry, in common with the rest of modern business, has adopted the principle that honesty and frankness are the best policy, and if an architect or his client will consult a reputable marble man as to the soundness of a given brand of marble, the facts will not be misrepresented, no matter how much of that particular variety the dealer has for sale. Of course, there are some instances where the use of a highly waxed marble should be avoided. Wax should never be used on exterior marble. It should not be used where it will be subjected to an unusual amount of heat, such as around radiators or as mantel facings for fireplaces. While the color and veining of marble can be matched perfectly with wax, the wax has not the same wearing qualities as marble, and in time a slight change of color or shade may occur in the wax, due to impurities absorbed from the air. For this reason it is sometimes not advisable to use wax in buff monotonous or white marbles, as the wax which originally matched the color of the marble may change slightly in color and betray itself. An example of this is seen in the Botticino of the Grand Central Building, New York, where the wax veins are quite conspicuous in some places. This as often enhances the beauty as not. The National Association of Marble Dealers has classified the various marbles according to their soundness into these four classes:

**Group A.—** Sound marbles and stones, which require no sticking, waxing, or filling, and which possess characteristically uniform and favorable working qualities.

- Alabama
- Alaska Tooleen
- Blue Vermont
- Caen Stone
- Carthage
- Chassagne
- Clarendon
- Colorado White
- Georgia Cherokee
- Georgia Creede
- Grayma
- Italian English Vein
- Italian White
- Kasota Pink

- Lee
- Logan Missouri Gray
- Mankato Pink
- Napoleon Gray
- Pentilicon
- Red Ark Fossil
- Regina
- Tennessee
- Vermont French Gray
- Vermont Lepanto
- Vermont Pearl Gray
- Vermont Verdeo
- Vermont White Grades
- Wellington Cream

A Large Variety of Colored and Plain Marbles in The Elks’ Memorial, Chicago

Patterned Panels May be Formed of Burlled Marble Slabs
Group B.—Marbles and stones similar in character to those of the preceding group, but having somewhat less favorable working qualities; occasional natural faults; limited amount of waxing and sticking necessary.

<table>
<thead>
<tr>
<th>Marbles</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alta Vein</td>
<td>Marbles</td>
</tr>
<tr>
<td>Batseville</td>
<td>stones</td>
</tr>
<tr>
<td>Belgian Black</td>
<td>similar</td>
</tr>
<tr>
<td>Bianco Statuary</td>
<td>in char-</td>
</tr>
<tr>
<td>Briareo</td>
<td>acter to</td>
</tr>
<tr>
<td>Breche Blanc</td>
<td>those of</td>
</tr>
<tr>
<td>Champlain Black</td>
<td>the pre-</td>
</tr>
<tr>
<td>Champville</td>
<td>ceding</td>
</tr>
<tr>
<td>Colorado Travertine</td>
<td>group</td>
</tr>
<tr>
<td>Eastman Cipollino</td>
<td>(light)</td>
</tr>
<tr>
<td>Eastman Cipollino</td>
<td>(dark)</td>
</tr>
<tr>
<td>Eastman Cream</td>
<td>(light)</td>
</tr>
<tr>
<td>Eastman Cream Statuary</td>
<td></td>
</tr>
<tr>
<td>Eastman Cream Green</td>
<td>(veined)</td>
</tr>
<tr>
<td>Fossgraynel</td>
<td></td>
</tr>
</tbody>
</table>

Another point on which a careful architect should be well informed is in regard to the care that is necessary in maintaining marble in its original state. It might be felt by some that when the building is finished the architect has no further concern. However, if materials which he has selected grow dingy and do not weather well, he will be blamed by many for not having made a wise choice. Then, too, if the owner finds on completion of the work that there is an unusual amount of maintenance cost which he had not expected, he is likely to hold the architect morally responsible. The owner should be warned in advance as to exactly what will be necessary to keep the marble work in good condition. With regard to unpolished exterior marble, it is true of marble as of other stones that “the mellowing influence of time is a great beautifier of architectural work.” In the process of weathering, the cold and dazzling whiteness of freshly cut stone takes on an atmosphere of antiquity and warmth that is greatly to be desired. Buildings may be robbed of a distinct part of their charm and dignity through the laborious process of cleaning. Be sure, therefore, that the building actually needs cleaning and will be improved thereby. Sandblast cleaning should never be resorted to, as it removes

<table>
<thead>
<tr>
<th>Group C.—Marbles of uncertain variation in working qualities; geological flaws; voids, veins and lines of separation common; standard shop practice is to atone for Nature’s shortcomings by sticking, waxing and filling; “liners” and other forms of reinforcement freely employed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
</tr>
<tr>
<td>Basseville</td>
</tr>
<tr>
<td>Bois Jourdan</td>
</tr>
<tr>
<td>Botticino</td>
</tr>
<tr>
<td>Breche Pavonazzo</td>
</tr>
<tr>
<td>Breche Violette</td>
</tr>
<tr>
<td>Breccia Turrina</td>
</tr>
<tr>
<td>Cenere</td>
</tr>
<tr>
<td>Cristaline</td>
</tr>
<tr>
<td>Escalante</td>
</tr>
<tr>
<td>Fumason</td>
</tr>
<tr>
<td>Grey</td>
</tr>
<tr>
<td>Italian Pavonazzo</td>
</tr>
<tr>
<td>Jaune Benou</td>
</tr>
<tr>
<td>Rosato</td>
</tr>
<tr>
<td>Skyros A</td>
</tr>
<tr>
<td>Skyros No. 14</td>
</tr>
<tr>
<td>Tavernelle Fleury</td>
</tr>
<tr>
<td>Times</td>
</tr>
<tr>
<td>Verdello</td>
</tr>
<tr>
<td>Vermont Verde</td>
</tr>
<tr>
<td>Vend d’Estour</td>
</tr>
<tr>
<td>Venosa Yellow</td>
</tr>
<tr>
<td>Westfield Green</td>
</tr>
</tbody>
</table>

Group D.—Marbles and stones similar to those of the preceding group and subject to the same methods of finishing and manufacture, but embracing those materials which contain a larger proportion of natural faults and a maximum variation in working qualities, etc.; this group includes many of the highly colored marbles prized for their decorative qualities.

<table>
<thead>
<tr>
<th>Marbles</th>
<th>Group D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alps Green</td>
<td>Montepulciano</td>
</tr>
<tr>
<td>Biegnelle</td>
<td>Nero Golden Travertine</td>
</tr>
<tr>
<td>Black and Gold</td>
<td>Numidian Pink</td>
</tr>
<tr>
<td>Breche Oriental</td>
<td>Numidian Red</td>
</tr>
<tr>
<td>Breche Rose</td>
<td>Numidian Yellow</td>
</tr>
<tr>
<td>Breccia Turrina</td>
<td>Onyx</td>
</tr>
<tr>
<td>Breche Viollette</td>
<td>Portoro Rose</td>
</tr>
<tr>
<td>Byzantine</td>
<td>Rossa Antico</td>
</tr>
<tr>
<td>Campan Bouge Grisette</td>
<td>Rossa Antico</td>
</tr>
<tr>
<td>Carthage Green</td>
<td>Rossa Antico</td>
</tr>
<tr>
<td>Cipollino Greek</td>
<td>Rouge de Rance</td>
</tr>
<tr>
<td>Cipollino Swiss</td>
<td>Rouge Etruscan</td>
</tr>
<tr>
<td>Echantillon</td>
<td>Rouge Royal</td>
</tr>
<tr>
<td>Fleur de Peche</td>
<td>Royal Jersey Green</td>
</tr>
<tr>
<td>Florelo Rose</td>
<td>Royal Rose</td>
</tr>
<tr>
<td>Forest Green</td>
<td>St. Barne</td>
</tr>
<tr>
<td>Genua Green</td>
<td>Sienna Gray</td>
</tr>
<tr>
<td>Grand Antique</td>
<td>Sienna Yellow</td>
</tr>
<tr>
<td>Grisette</td>
<td>Sienna Yellow</td>
</tr>
<tr>
<td>Jasou Arocabio</td>
<td>Sylvan Green</td>
</tr>
<tr>
<td>Jean De Brignolais</td>
<td>Verde</td>
</tr>
<tr>
<td>Languedoc</td>
<td>Verr Antico</td>
</tr>
<tr>
<td>Lavastone</td>
<td>Verr Cana</td>
</tr>
<tr>
<td>Maurin</td>
<td>Violet de Brignolais</td>
</tr>
</tbody>
</table>

A Carved Doorway of Gray Missouri Marble
Colorado Marble is Especially Suitable for Exterior Work

White Vermont Marble is Used Extensively for Public Buildings

the surface and thus lays the stone open to more easily becoming soiled and stained. Also, the sandblast treatment has a tendency to wear down the sharp edges and arrises of the tooling and carving, sometimes to the extent of obliterating them altogether. If the building must be cleaned, the best method is to scrub it with a good cleaning solution and water, using plenty of "elbow grease." Where highly polished marble is used externally, considerable care is required. There is probably only one marble (Westfield Green) that will hold polish indefinitely when exposed to the elements. In all other cases, marble soon becomes dull and dingy, and there is nothing which tends more to give the front of a building a dilapidated appearance than the presence of marble that has once been polished but has lost its luster. Such marble should be gone over regularly, at least once every four weeks with a mixture of beeswax and turpentine and then polished till the original luster returns. In the case of interior polished marble, this is not necessary, but it should be washed regularly to remove the film of grease and dirt that tends to form on the surface and to dim the polish. Of course, the length of time that a marble will hold its polish varies greatly according to the variety. In general, the harder marbles are harder to polish, and for that very reason are likely to retain their polish much longer. There are many preparations for removing all sorts of stains and discolorations from marble, and these are fully described in a booklet called "Maintenance of Interior Marble," compiled by the National Bureau of Standards and published by the National Association of Marble Dealers, 648 Rockefeller Building, Cleveland.

The many conditions under which marble is manufactured in various parts of the country and the varying costs of transportation and setting make it impossible to give any very definite information as to the cost of marble. This depends on the accessibility and extent of the supply. The difficulty by which it is manufactured and transported to the building site is also an important factor. A price for marble quoted in one locality may be utterly misleading.

Scale Models May be Made of Actual Marble Samples
when applied to an estimate for work to be done in another locality. In general, however, marbles can be said to fall into comparative price classes. The domestic marbles of comparatively slight coloring are in the low price class, along with some grades of white Italian marble. The buff monotonies are in a slightly higher class and include Botticino, Buffneco, Montenelle, Beige Nelle, and Tavernelle. The next class includes buffs carrying some color and bringing a higher price, such as Hauteville, Florido, St. Baume and Jaune Lavatine. The next price class includes the Breccias (Roman, Oriental, Rose and Violette), and other colored marbles. A still more expensive group includes both domestic and foreign varieties of reds and dark greens and other highly colored marbles. Marble for exterior use is somewhat higher in price than most of the other materials used for this purpose, and its general use fluctuates with the prosperity of the country. Its great beauty coupled with its lasting qualities and the low cost of upkeep causes it to be chosen in many cases where securing a low initial cost is not important. Many buildings are built of a very beautiful random aslar which is made of what is practically waste material from the marble mills and can be used at a cost only slightly higher than that of brick.

Exterior marble is most often specified in "sand finish," as this brings out to the greatest degree the natural veining of the stone. It is put on by rubbing the sawed blocks with coarse sea sand. Where a rougher finish is desired, tooling is often specified. The work is done by hand or by a special tool used in a planer. It leaves a slightly corrugated surface, the lines being continuous and evenly spaced. When the lines are irregular and finer than tooled finish, it is known as "axed finish." Rock-face aslar is also very beautiful for exterior marble work, the face of the block being chipped off after the pieces are sawed, leaving a natural stone finish.

Commercially speaking, marble is any stone that is of less hardness than granite; that is sufficiently close-grained to take and retain a polished face; and that can be obtained in quantities sufficient for commercial use. Many stones that are not strictly marble are considered by the trade as such and are handled by marble dealers and included in lists of marble. Among these is travertine, a very important building stone, widely used for interior aslar and trim and very suitable for floors on account of its hardness and non-slipping qualities. This is a limestone formed by the action of water in limestone caves. Another stone not properly marble but often considered as such, is onyx, which is composed largely of lime and is formed by the precipitated lime from the water of hot springs. The various kinds of marble are distinguished from one another by trade names adopted in many cases arbitrarily, but usually being descriptive of the coloring or formation of the veining. Thus the term "Breche Violette" is both descriptive of the broken triangular markings and the rich violet coloring. Cipollino marble, which comes from Greece, and which has been used since the days of the Roman Empire, is so named because of the fact that its layers resemble those of an onion. Other varieties are named from the regions or towns in which they are quarried, and many are named from important buildings in which they were first used, such as "Steinway Green" and "Cunard Pink." One variety, which bears the high sounding name "Loredo Chiaro," derives its first name from a combination of the first two letters of the first name and the first three of the last name of the architect who was instrumental in introducing it in this country,— Eddie Lord. Another case of the arbitrary adoption of a name was when some particularly fine gray and gold marble was shown a German architect and he exclaimed in delight, "famos," so this variety has since been called "Famosa."

These trade names do not refer exclusively to the product of any single producer but are adopted merely for the purpose of distinguishing a particular variety from countless others. The distribution of marble deposits is very wide. Scarcey any section of the country is without some such deposit, although most of them are not worked for one reason or another. Quarrying ventures are regarded with a great deal of uncertainty and are considered a highly speculative investment. It would be impossible in the space of this article to discuss all the different deposits and varieties produced in the country. However, some of the more important, from a commercial point of view, can be treated briefly.

The Vermont region, which has been more thoroughly exploited than any other marble-producing district, furnishes a wide variety of high quality marbles for both exterior and interior uses. The West Rutland deposit alone furnishes over 15 varieties ranging from almost pure white to dark greens, such as Verdosso and Olivo. The quarries along the Otter Creek Valley furnish good varieties, most of which are white or pearly white with blue or gray markings, among which Pittsford Italian and Florence are important commercial varieties. The Vermont Verde Antique is very well known and is quarried in the central region. Its extreme hardness makes special machinery necessary for quarrying and manufacturing this variety of serpentinous marble. The Champlain reds are very rich in coloring and include Jasper, Oriental, Olive, Lyonais and Royal Red. The Georgia...
Deposits of crystalline marble are particularly adaptable for statuary work and exterior building, two notable examples of its use being in the statue of "Civic Virtue," New York, carved from a single 55-ton block 14 feet x 8 feet x 6 feet, and the McKinley Memorial, at Niles, O. The main deposit of Georgia marble is said to be a solid block four miles long, three-eighths of a mile wide and between 185 feet (known depth) to a half mile (estimated possible depth) deep. It ranges from light, slightly clouded gray to dark gray. There are also a very vivid pink variety and a good quality, even veined Verde Antique available in quantities to supply architects' needs. The Tennessee region is also an important producer of marble, most varieties being of the fossil-bearing class. It is used most extensively for interior work, such as walls, floors, stairways and toilet room work. There are three distinct classes designated by various trade names. The grays and pinks usually have a characteristic wavy black line, called "crow-foot" veining, running through them at intervals. The dark brown varieties are known as Dark Cedar or Dark Chocolate and are of a very rich uniform appearance. They have been produced in large quantities and have been very widely used in public buildings throughout the country. Missouri is also an important marble district, most varieties being of a warm uniform gray with or without black pencil-like veining. A variety that is particularly desirable is the Golden Vein, which has a ground mass of silver gray with occasional golden markings. This compares very favorably with the imported Famosa. The Missouri marbles are especially adapted to interior work and have been widely used for floors and walls in washrooms as well as public lobbies, banking rooms and corridors.

The only marble quarried in important quantities in Colorado is the Colorado Yule, which is found near Marble, Colo. This is an extremely beautiful white-to-gray material, suitable for exterior purposes. The main structure of the Lincoln Memorial, at Washington, is built of this beautiful stone, as are also many other fine monumental buildings throughout the country. Colorado travertine is also available in large quantities and compares very favorably with the foreign variety, being somewhat warmer in coloring than Roman travertine. The Alabama varieties are suitable for both exterior and interior use and are very striking in their vivid, dark, contrasting veining; the best known variety is Alabama Madre Vein. From Alaska comes a remarkably beautiful interior marble of light, pearly gray background, the Tokeen variety having light gray, clouded veining, and the Gravina, very definite black markings. Both are extremely beautiful and are widely used, especially on the Pacific coast. Maryland has important marble deposits, and much marble which was used in the national capitol came from this state. Now, however, most of these quarries are inactive. One of these quarries has recently been reopened and is producing a beautiful soft Verde Antique called Cardiff Green. Another deposit of valuable Verde Antique here was ruined by destructive blasting, and what might have been valuable marble is now being used as railroad ballast. Among the Dolomitic marbles, are those of Lee, Mass., used largely for structural purposes. Another important variety produced in Massachusetts is Westfield Green, famous for its ability to retain its polish when exposed to the elements. The white Dolomite marble of South Dover, N. Y., is an important building stone which is widely used, a notable example of its use being for the Savoy-Plaza Hotel, New York.

France, Italy and Belgium are the principal sources of marble in Europe, although other countries are rich in marble deposits. Italy is perhaps best known for its marbles, and among others the white statuary marble of Carrara is well known for sculptural purposes. Among the highly colored varieties from this country are Black and Gold, Alps Green, the various Breccias, Siena marbles of varying yellow tints, Botticino which has had such general use recently, Pavonazzo, Tavernelle, and a long list of other richly veined marbles. The marbles of France are equally as varied and as richly colored. Among the better known are Escalette, Grand Antique, Hauteville, and the various Breche varieties. From Belgium comes Belgian Black, the standard black marble in use today. There are also Blue Belge, Rouge de Rance, and Rouge Fleuri. The Famosas from Germany are also well known as are several other varieties. Other sections of Europe also are rich in marble, and American marblemen are going about prospecting for new and more beautiful marbles to meet the demand that is sure to develop as we learn to use more and more the beautiful colors nature has given us. Marble must be seen to be appreciated, and a visit to some of the marble sample rooms, which are located in all large cities, is best when there is a choice of marble to be made for architectural use.
THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 9. CONCRETE WORK, CONTINUED

The specification clause on measuring reads:

"MEASURING. A systematic method shall be employed for the measurement of all materials, including water. Measurement by shovels or barrows (other than approved measuring barrows) is prohibited. Measurement of aggregates shall be by loose volume, the unit being a 94-pound bag of cement, assumed to be equivalent to 1 cubic foot."

There can be no misunderstanding about measurements of concrete ingredients, but there can be much variation in the accuracy by which this measuring is performed. Contractors, doing their own work, may easily train men to use shovel measurement with fair accuracy and with small economy on minor work, but the method is forbidden on all operations supervised by architects or engineers. Before mixing is started, the barrows should be measured by filling cement sacks with aggregate, then emptying them into the barrows, thus judging the degree of fullness taken up by the required amount; but, inasmuch as a cement sack will contain only about 7/8 cubic foot of sand and slightly less of the coarse aggregate, due allowance should be made for this variation.

The barrow capacity can also be measured by dumping cement into it up to the amount of sand specified; or the contractor can have a box made of 1- or 2-cubic foot capacity, to use for a measuring device. This latter is convenient for hand mixing where a barrow is unnecessary. Having determined the barrow measurement, the inspector must see that it is closely adhered to, that all barrows used are identical, and that, where the mix is varied for plain and reinforced work, the change is made in feeding the mixer.

(3). Cement Must be Fresh, Up to Standard, and Used in Correct Ratio. The character and quality of Portland cement are matters of laboratory determination. The superintendent of the schoolhouse construction sent in samples for test as soon as he could get them from the first car, and from each successive car thereafter. None was permitted to be used until reports upon it were received. If these had been unsatisfactory, there would have been no alternative but to reject the entire car, if the samples were properly representative of the shipment, and a new source of supply would have been necessary. As was set forth in Chapter 5, it is extremely unlikely that any but acceptable cement will be sent to a job where it is supposed to be tested. Manufacturers do their own testing and know their products. In certain localities, it is customary to specify that each bag of cement shall bear a test tag, and this evidence of quality is supplied by the manufacturers at an additional cost of 10 cents a bag. On small work, this is the best procedure but, on large work, such increase of nearly 20 per cent to the cost of the cement is too heavy a tax. Proper storage and care of cement after delivery will guarantee its suitable condition at the time of use. But if any is overtaken by accident and suffers water damage, it should be discarded and thrown aside at once.

(4). All Ingredients Shall be Properly Mixed. On this subject, the specifications say:

"MIXING CONCRETE. All concrete shall be mixed in a rotating batch mixer, except that, under certain conditions, the superintendent may permit small batches to be mixed by hand. Under either method, the materials shall be thoroughly mixed dry, then sufficient water added to produce concrete with required moisture content. A competent foreman shall be in constant attendance at the mixer to see to the correct proportioning and mixing of each batch produced. Mixing drums shall operate at a uniform speed of 200 feet per minute and for a minimum of 1½ minutes after water has been added. Volume of materials per batch shall not exceed the maker's rated capacity of mixer. Machine and hoppers shall be thoroughly cleaned before being allowed to stand idle. For hand mixing, the cement and sand shall first be mixed dry by being turned over three times, then the coarse aggregates added and again turned three times while water is being added to produce the required consistency."

As to the required consistency, this is determined by test, specified thus:

"SLUMP TEST. All concrete mixtures shall be subject to a slump test by the Contractor, once or twice a day during pouring, as requested by the Superintendent and under his direction. For such test, the Contractor shall provide a conical form of No. 20 gauge galvanized iron; also a 3/4-inch pointed metal rod, 21 inches long. The form shall be 8 inches in diameter at bottom, 4 inches at top and 12 inches high. The percentage of water in concrete shall not be in excess of that required to produce a maximum slump of 4 inches for mass concrete and base of floors on earth, and a maximum of 7 inches for reinforced slab, beam and column work."
Greater refinement in slump testing is often met with in specifications, but refinements are not characteristic of such testing, which is merely a rough method of ascertaining in the field whether the concrete is being turned out as moist as desired and whether it reaches the work in that condition. "Inasmuch as the amount of water required will depend upon the dampness of the ingredients, the richness of the mix and the percentage of fine aggregate, it is not expedient to specify any exact quantity of water, and hence the burden is on the superintendent to see that the correct amount is used. Its three-fold purpose should be remembered, viz:

1. To carry cement in suspension and hold it in contact with the surface it is to bind.
2. To produce the proper fluidity of mass for best manipulation.
3. To combine with the cement to bring about crystallization and adhesion.

"The success of concrete work depends upon how well these details have been carried out, to the end that maximum density shall have been achieved."

The first of these conditions results from thorough mixing; the second is demonstrated by the slump test; and the third implies that the water, once mixed with the cement, shall be allowed the proper period of repose and none be permitted to be withdrawn by evaporation, suction or other means. Whereas the specifications permit the superintendent to demand two slump tests a day of the contractor, these are seldom needed except where immense quantities of concrete are being produced. An experienced inspector has learned to judge the output of the mixer by its color and consistency, and hence will not demand frequent tests. While work is under way, other tests may be in order and should receive the attention of the superintendent. Inasmuch as testing during construction can serve no purpose other than to influence greater care in the making of concrete, such tests are not often used, final tests of actual slab construction serving the same end.

There are various methods in use for the regulation of water supply in the mixer, but one finds the "rule of thumb" method most in vogue. With an experienced man in charge, there is no particular objection to this,—but such a man is not always in charge, and hence mechanical regulation is preferable. For large operations, there are on the market mixing devices in which the water supply is regulated by the degree of moisture content in the aggregates as determined by their weights.

Not only is the density of the concrete to be considered in connection with the water ratio, but also the ultimate resistance of the finished product to the forces of disintegration. It is fairly well established that complete crystallization of all the cement in a mass is a very slow process, and hence the importance of keeping concrete moist during curing, as will be brought out more fully later. Concrete improperly hydrated will absorb free moisture to an extent that will cause it to swell. If it freezes in that condition, the swelling is dangerously increased. If it then thaws and later dries out, the mass contracts. As this process is repeated, hair cracks appear, absorbency becomes greater,—and disintegration may set in. But to such a degree as concrete is properly hydrated, to just that degree does it become impermeable to free water and less subject to expansion and contraction and to effects from alternate freezing and thawing. (5-a) Concrete Mix to be Deposited Promptly Without Separation of Ingredients. Concrete mixes are delivered to places of deposit by direct spouting from the mixer, or from a tower and spouting adjoining the mixer, or by wheeled vehicles (barrows, buggies or trucks), or by combinations of these devices. The essential is that the conveyance used shall carry the concrete to its final resting place in time to permit adequate tamping or agitating within the 30-minute limit specified:

"PLACING. Concrete shall be conveyed to point of delivery in watertight carriers and deposited as nearly as possible in final position immediately after mixing. Re-tempering or unnecessary re-working of concrete will not be permitted, and any concrete placed or disturbed after 30 minutes from the time water has been added to the cement will be rejected and must be removed from the premises. Pouring shall be continuous from working joint to working joint. Each column shall be poured in a continuous operation. Overtime labor shall be provided for these purposes, without extra charge, where such continuity cannot be otherwise secured. If spouting is used, the plant shall be of such size (with spouting at such incline) as to

---

1 The Portland Cement Association, in "Design and Control of Concrete Mixtures," publishes this table of Recommended Slump for Concrete.


---

Slump in inches

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass concrete sections, pavements and floors</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Heavy walls, slabs, beams</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Thin walls, columns, etc.</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

(One should note the considerable permissible variation in these slumps and bear in mind that few recommendations as to concrete will have any degree of permanency. The foregoing is from the "Second Edition" of the booklet, "Revised and Enlarged, January, 1927." Later issues may advise changes in these figures.)
secure a practically continuous flow during operation. Equipment shall be located as approved and shall be thoroughly cleaned after each run."

Separation of the ingredients is not likely to occur unless flowability has been induced by the addition of too much water in place of giving the spouting adequate incline. Such separation should be compensated for in the forms by the prompt addition of enough cement and sand to take up the surplus water. The mere fact of water coming in contact with unset concrete is not in itself harmful. The cement already in solution will not suffer, but it is most essential that it shall not be washed from the aggregate it is supposed to cover. Thus, concrete can be successfully deposited under water, provided that no current is permitted to pass against or through the mass and carry away any of the cementing element. This is effected by the use of special vessels (tremies) designed to dump the mix directly in its permanent position where it may be lightly tamped but not otherwise disturbed. Material so deposited should have a slightly excessive cement content to compensate for probable losses, and should be most accurately placed. It is not unusual for an entire job of the kind to be lost through some minor miscalculation.

(5-b) The Newly Deposited Mix to be Adequately Agitated. Whereas the density of concrete is dependent largely upon the proper grading of the ingredients, it is no less important that each atom, duly coated with liquid cement, shall rest in the closest possible juxtaposition to those surrounding it. As stipulated in the specifications:

"DENSITY of all concrete shall be effected by thoroughly puddling, rodding, churning or other-wise agitating the wet mass to remove all air pockets and water holes and prevent honey combing of surfaces; but no concrete shall be agitated after the time limit specified."

This means elimination to the greatest possible degree of all air bubbles and water pockets, to avoid the possibility of there being cavities produced by evaporation. Agitation of the mix for this purpose is done by means of spading, rodding or churning the wet mix as soon as deposited, or by pressing an air hammer against the outside of the forms, or by tapping them with a hand hammer. "Honey combing" or pitting of surfaces is due to failure to surround the larger aggregates resting against the forms with fluid material,—strictly speaking, a defect in the agitation process. Except for mixes deposited under water and for dry mixes deposited on earth, the word "tamping" is no longer found in the best concrete specifications, since flowable mixes deposited in forms require tools other than the tamp. The initial set of Portland cement is assumed to begin about 30 minutes after it comes in contact with water; hence, under no circumstances, should it be disturbed in the slightest degree after that time. Contractors are likely to ignore this and have a way of asserting, with real confidence, that the "second set" of cement is as good as the first,—or practically so. There is no foundation for such belief, and hence the only safe course for the superintendent is to know that all cement is still fresh at the time of deposit and undisturbed after the 30-minute period. The custom in vogue by some mechanics of shoveling stale droppings back into the mix is to be deprecated. The saving attempted is not worth the chance being taken.

Habit is so strong with concrete workers that
tamped, which means rammed,—not rodded. Only upon to follow specifications for reinforced construction. They persist in mixing too dry and in not sufficiently rodding the work, especially in deep forms. They are accustomed to following specifications which call for deposits in layers and tamped, which means rammed,—not rodded. Only recently have the better specifications ceased demanding that concrete in walls and similar masses shall be deposited in tamped layers from 8 to 12 inches thick. Such work is not monolithic, though that is the ideal condition at which we are aiming. When poured at considerable depth, therefore, as in column forms, the inspector must see that long, thin rods are vigorously used all around the reinforcing and other inserts and against the forms, but that such agitation shall not extend beyond the material just deposited. The same is true if compactness is sought by hammering the outside of the forms by hand or power hammers. The new, not the old, must be adequately attacked. The dual importance of properly proportioning and mixing concrete and of correctly placing it implies, on work of any size, an omnipresence on the part of the inspector quite outside the sphere of human ability. One simply cannot watch the mixer and the place of deposit at the same time. This means that by the time the pouring is about to begin, the superintendent must have made up his mind as to the character of the contractor and his workmen,—whether or not they are to be counted upon to try to fulfill the specifications, or if attempted cheating is to be expected. If in doubt, the architect should be notified and an opportunity given to have one or more additional inspectors assigned. The work of inspection starts well ahead of the pouring, as is evidenced by this specification paragraph:

"SUPERVISION. Before starting any pouring, the Superintendent shall be notified and given opportunity to inspect all surfaces which are to be covered and all members intended to be embedded. The Contractor shall also have a capable man (more, if needed), who shall watch the forms just ahead of pouring, see that all reinforcement and other built-in members are rigidly supported in proper position; all tags, chips and other refuse removed; all needed sleeves placed; all pipe and conduit ends plugged and all surfaces ready for the concrete. He shall strengthen all form supports as needed to prevent deflection or spreading.

"CLEANING FORMS. No concrete may be poured until all rubbish has been removed from the forms and they have been brushed clean and drenched just ahead of pouring (except in freezing weather) and the rubbish holes at bottoms of forms properly closed."

Thus are the duties of inspection at this juncture set forth in the specifications, with but one exception, which is treated of in the next section.

(5-d) New Concrete to be Properly Bonded to Previous Work. This is also covered in the specifications quite fully:

"CONSTRUCTION JOINTS. Each run of concrete shall be carried vigorously to completion. All temporary joints in walls or floors shall be at right angles to the run of work. Where reinforced floor work is stopped before an entire area is finished, joints shall be made in beams, joists and slabs under uniform load near middle of span. Where beams receive concentrated loads from connecting beams, the construction joint shall be located not less than twice the width of connecting beams from supporting beams. Beams having loads derived from a single connecting member shall have no construction joints. A 12-hour interval shall be allowed between the pouring of columns and that of beams and slabs. Construction joints in walls and piers shall be horizontal or vertical in all cases and shall not occur within 12 inches of a concentrated bearing. Dowels shall be constructed in all horizontal joints and continuous tongues in all vertical joints."

Then, under "Pouring":

"UNFINISHED CONCRETE, against which new concrete is to be poured, shall first have the dowels removed, then be drenched and treated with thin grout or approved bonding cement."

It is customary to pour footings before wall forms are built, as a matter of convenience, whether or not they are of same ratios, and regardless of whether either is reinforced. Applying the paragraph on "Construction Joints" to those between footings and the superimposed walls, it is apparently necessary to lay dowels in the upper surface of the footing. For this purpose, it is customary to use vitrified brick or pieces of stone of about the same size or larger, laid half their depth in the wet flux at intervals of about 3 feet; or blocks of beveled plank, 2 x 6 x 18 to 30 inches, are pressed into the surface, to be removed when work is resumed. But, if a dampproofing layer is called for on top of the footings, as in the work of which we are writing, it is necessary that the dowel shall form a continuous beveled edge trench (as shown in Fig. 8), and hence planks must be prepared and laid in, to produce such a trench. Similar planks are set vertically in forms to make the tongues continuous.

It is obvious that the natural roughness of the aggregate in an unfinished surface is of assistance to the bonding of the new material laid against it, and yet the time such a surface may stand before being considered "old" and not amenable to bonding is not well established. There is no apparent reason for this other than that it is customary to continue a day's work anywhere that is found convenient on the job, regardless of the time when
The guarding of green concrete from dangers of undue heat or cold is of the utmost importance. Covering and moistening are correct preventives against the former, are easily attended to, and should be insisted upon as essential to proper curing. But protection against cold is much less simple, though no less necessary. “A. I. A. File 4c4” of the Portland Cement Association gives “Specifications for Making, Placing and Curing Concrete in Cold Weather” and also describes “Cold Weather Protection for Reinforced Concrete Works,” particularly stressing the latter. These specifications are preceded by this warning: “Adequate protection of concrete against damage by frost during the making and early curing period is absolutely essential whenever temperatures below 40° Fahr. are likely to occur within that period. The use of a definite and complete specification governing such protection is imperative if real assurance of an undamaged and completely satisfactory structure is to be obtained.” From a perusal of these specifications and directions, it can be readily understood that the carrying on of concrete operations in freezing weather is not a project to be lightly undertaken, —is not warranted, except in cases of extreme emergency and when the contractor is fully equipped for proper procedure. It is to be noted that the Portland Cement Association, in this publication, says that “the use of salts, chemicals or other foreign materials in the mix to lower the freezing point of the concrete is prohibited,” but that “within certain limitations, calcium chloride or calcium oxychloride may be used in Portland cement mixtures to hasten hardening and to increase early strengths.” But this whole subject of cold weather concreting is one for the attention of a superintendent of experience. He must needs be well versed in the specifications and protection methods described and have a working knowledge of their practical application. The less experienced inspector should have recourse to the paper just quoted and other authorities on the subject,—then wait for better weather, if possible to do so. If work must proceed, regardless of weather, he should see that all recommended precautions are taken, as no one can afford taking the chance of a failure of concrete construction.

Recapitulating, our superintendent on the schoolhouse project arranged to be notified just before the first concrete was deposited in the footing trenches in the southeast corner. He inspected the bottom, had some earth droppings removed, and ordered some loose earth above to be shoveled back, to prevent further droppings. He had previously made his final check of dimensions and approved them, after slight corrections. The mix for footings was specified to be 1:2½:5, with a 2-inch maximum aggregate, while that for base-
ment walls was to be 1:2:4, with a 1-inch maximum. Owing to this difference (and for general convenience), the contractor had two mixers on the job, one of fair size in connection with his stationary concrete plant, and a smaller portable mixer which he proposed using for the footings, for mortar and for other minor work. Thus, the concreting was started on the morning of Monday, April 23, just two weeks from the day ground was broken,—and they were still two days ahead of their schedule. Thereafter, for many days, the chief task of the superintendent was in watching the concreting, the formwork and the placing of reinforcement and other built-in members. The experienced inspector, knowing what factors to watch in the manufacture of his concrete, gives them his closest attention. Other materials are brought on the job ready-made, but, during the making of concrete, his building is transformed into a factory, the output of which is its own structural framework or some of its most essential parts. The ease with which some of the vital members of the building may prove defective is indicated by an extract from the report of a committee of the Detroit Engineering Society dated November 2, 1925:

"The character of structural concrete now being obtained in this city is a matter which is causing grave concern to all who are thoroughly informed regarding local conditions.

"Tests made from a number of the large local construction projects have indicated that concrete, as being produced, is, in general, very deficient in strength as compared with its strength assumed in the design calculations."

There is no good reason to suppose that conditions in Detroit were very different from those prevailing elsewhere in the country, or that they have since improved to the extent they should.

"Various reports and papers classify the causes of defective concrete and of failures. They are:

1. Poor cement.
2. Defective aggregate.
3. Impure water.
4. Improper mixture.
   (a) Poor grading of aggregates.
   (b) Excess of water.
   (c) Insufficient mixing.
5. Poor workmanship.
   (a) Segregation.
   (b) Inaccuracy in proportioning and in controlling the quantity of water.
   (c) Carelessness in placing.
6. Improper curing.
7. Insufficient protection or heating in cold weather.
8. Removing forms too soon.
9. Poor design.
10. Shrinkage and expansion after set.
11. Corrosion of the metal.
12. Localized abnormal changes of temperature.
13. Action of alkalies or sea water, or trade wastes or sewage or atmospheric fumes. This is a long list, and there may be other causes."

Another writer on the subject says that the reasons for poor concrete have been thus proportioned: "90 per cent from poor workmanship; 8 per cent from using poor aggregates; 2 per cent from using poor cement." He says that fine aggregates need very careful examination, and cites a case where concrete gave trouble because use was made of water from a stream affected by a factory using chemicals; another where disintegrating stone in a dirty car became mixed with broken stone otherwise all right; another where sand, otherwise usable, contained many grains injuriously coated. Verily, when dealing with concrete, no superintendent can be too alert.

Another writer on the subject says that the reasons for poor concrete have been thus proportioned: "90 per cent from poor workmanship; 8 per cent from using poor aggregates; 2 per cent from using poor cement." He says that fine aggregates need very careful examination, and cites a case where concrete gave trouble because use was made of water from a stream affected by a factory using chemicals; another where disintegrating stone in a dirty car became mixed with broken stone otherwise all right; another where sand, otherwise usable, contained many grains injuriously coated. Verily, when dealing with concrete, no superintendent can be too alert.

CHAPTER 10

THE SUPERVISION OF CONSTRUCTION OPERATIONS

CONCRETE REINFORCEMENTS AND OTHER BUILT-IN MEMBERS

Among the first materials to arrive at the school site were the steel bars intended to be used as concrete reinforcement. Since it is not possible for a superintendent to determine by inspection whether such bars are of the quality specified, the architect must be satisfied in this respect with what is supplied or must have recourse to laboratory tests or their equivalent; or, still another alternative, may specify a proprietary brand or brands of bars which he prefers. Inasmuch as the variation in the quality of reinforcing bars on the market is not great, it is more economical for the designer to base his calculations on the poorest grade of material the market offers, using a commensurate factor of safety. On minor work, such procedure is probably warranted, rather than to subject the owner to the expense of employing an accredited testing laboratory. But on work of any importance, especially on public work such as the school build-
ing we have under consideration, it is common practice in the better offices to specify that such materials shall be tested. Such specifications may call for "new billet stock of structural grade" or "either re-rolled rail or new billet stock," in "rounds or squares" or "deformed bars of approved design and make," all to be "of full length required and accurately bent to details and meeting all requirements of the latest standard specifications for such materials as issued by the American Society for Testing Materials and subject to test (at Owner's expense) by a standard testing laboratory as directed by the Architect." Our school building specification further provided for use of a steel wire fabric of definite description in certain locations, and stipulated generally that "all reinforcing materials and inserts shall be free from paint, oil, dirt, scale or excessive rust." There were also the customary provisions as to the submission and approval of shop drawings, and a specification for placing reinforcement which stipulated, among other things, that it must "be correctly placed, rigidly wired together at each intersection with No. 18-gauge annealed wire, and carefully maintained in exact position and clearance, horizontally and vertically."

Operating under these specifications, the superintendent permitted the unloading and sorting of bars in the space allotted, pending receipt of advice regarding samples sent to the testing laboratory. The following day, he and the foreman received copies of schedules and bending diagrams, and men were at once set to work cutting and bending the members first needed. Bars are purchased by builders, either in accordance with diagrams and lists or in bulk quantities, to be formed on the site. Where bars are of simple shape and do not exceed 1 inch in diameter, there is supposed to be economy in the latter procedure. In either case, the superintendent must carefully check all sizes, shapes and quantities and see that the bars are properly sorted and stored under the direction of a man of sufficient intelligence and authority to prevent improper withdrawal at time of usage. In a location remote from a base of supplies, such as the site of the work we are discussing, the incorrect placing of any structural member in finished work implies a like misplacement of another and may be the cause of much annoyance and delay. This is to be particularly avoided in the case of reinforcement because of the crowding of concrete pourers on the heels of those placing the steel.

The first bars placed were in certain footings where they were supported up from the ground on small concrete blocks prepared for the purpose. The practice of using pieces of stone for this, or that of laying the bars on the ground and permitting the tampers to lift them slightly when concrete is poured is not sanctioned by good usage. Broken stones or pebbles tip easily, and hence are undependable for the purpose; nor should the bars rest upon the tops of small stakes as is sometimes done. Use of chairs, such as are commonly used in form work, is not practicable on soft earth, therefore the recourse to use of blocks of some sort. Bats of hard-burned common brick are permissible as chairs in footings, but in this case the superintendent had recently rejected the local brick, so he cautioned the foreman to have the pieces of concrete cast and in readiness, fearing possible delay in the receipt of better brick.

Since the design of reinforced concrete footings is based upon the location of tension members in certain relation to the encasing slab, it is incumbent upon the superintendent to see that such relationship is adhered to reasonably well. This, of course, applies throughout all reinforced work, but one finds workmen less careful with footings than when dealing with relatively smaller members. An instance of this is the case of an octagonal spread-footing, 18 feet in diameter, with 4-way reinforcement. A drawing of a section through the footing showed the first tier of bars 2 inches up from the bottom, and the others at successive intervals of 1 ½ inches above, making a total of 4 ½ inches between the centers of the first and top tiers. The architect witnessed the laying of the lower tier, then went to another part of the work. Returning a half hour later, he found that the tiers had been placed 6 inches apart, and hence the upper layer was close to the top of the 2-foot-thick slab. The foreman had failed to consult his drawings. When the concrete was promptly ordered out, he appealed to the contractor who, though a man of much experience and good repute, backed up his employee and made an issue of the matter. The work was on a cost-plus basis and, the architect standing by his decision, the owner decided in his own mind that he and the contractor were abused and stood the expense of making the correction. The architect didn't learn, until the owner employed someone else for his next project, that the contractor's contention that the architect was overly particular in matters of minor import caused the owner to believe that this was a foible that tended to make work emanating from his office unduly expensive. Of such slender threads is an architect's standing fabricated! Not only must he, as a superintendent, be most meticulous in discerning use of incorrect materials and placements, but he must anticipate such improprieties, catch them at their inception, if possible, in order to save time, expense and avoidable argument.  

October, 1929 THE ARCHITECTURAL FORUM 565
It is not unusual for a contractor to complain that an architect’s supervision is too intermittent,—that it is not fair to the owner or builder to demand removal of materials, no matter how inferior or badly placed, discovered several days after installation. There is a certain degree of justice in this claim, and hence it is important that an architect, at the time of his employment, should make the point clear to the owner, explaining just what is to be expected as to number and frequency of visits under the terms of the contract; and that too extended intervals between inspections do not enable one to either check up the dishonest contractor or offer adequate assistance to one who is striving to do his best. The architect should urge upon the owner the need of the constant attention of a clerk-of-the-works at certain times during construction or under certain conditions that may be encountered on any construction work, and should reserve the privilege of assigning one (at the expense of the owner) at any time he thinks it advisable to do his best. Some architects, in order to avoid the waste of perfunctory visits at stated intervals, especially on out of town work of lesser importance, arrange their remuneration for supervision on a per-trip or per-diem basis. Then, if the work goes smoothly, the owner is spared all expense of unnecessary supervision.

In connection with the inspection of placement of reinforcing materials, too much stress cannot be laid upon the importance of knowing that every piece is in the exact location intended before pouring begins. Heavy rods are awkward members to handle, and slight inaccuracies in bending will tend to throw them well out of position. Chairs are easily neglected or displaced, wiring carelessly done and not always with the right kind of wire. A bar more than an inch out of place may not be subjected to the stresses computed for it or it may not receive the proper amount of protective covering. No doubt many expensive failures could have been traced to carelessness in such particulars. When one is supervising building a factory . . . engaged in the manufacture of artificial stone in monolithic form, one cannot well afford to permit the slightest detail of production operations to be slighted, but must bear in mind that the “personal equation” of each operative is bound to be reflected in the finished product.

Perhaps too little emphasis is ordinarily given to the considerable difference between supervising an ordinary lump-sum contract and one that is let on a cost-plus basis. In the case of the former, the inspector is concerned only in seeing that the owner gets what he is paying for, but with a cost-plus operation it is necessary also to know that the work is being economically handled as well as being honestly accounted for. Economical handling implies that each employe be suited to his task and produces as nearly to maximum capacity as can reasonably be expected. That there is much waste of labor in building is beyond question, some of it beyond prevention. In this, as in almost everything connected with construction procedure, all depends upon the foreman. And the greatest of labor waste can be found in slipshod concrete operations. An example of this was displayed by a gang of six men engaged with a mixer of small capacity. Two were wheeling the sand and gravel, two were wheeling the flux (four barrows to each charging), the “straw boss” was handling the cement and operating the mixer, and a college youth in rubber boots was agitating the flux in the forms. Having his eyes open, the latter suggested a change which was put into effect, whereby each charge was contained in two full barrow-loads, thus promptly releasing the mixer for recharging and speeding it up 100 per cent. Then the young man undertook to wheel and empty both barrows and do the small amount of necessary tamping as well, and releasing the two loafers who had been lazily wheeling half-full barrows. By the efficiency thus effected, the labor cost was reduced by one-third and the product doubled, turning it out at exactly 33 1-3 per cent of what it had been costing. This is an extreme case but an actual instance, and serves to show the need of watching labor action when one is paid to safeguard the owner’s interest in it.

In addition to inspection of reinforcement placing, the superintendent must concern himself with each of the various members that should be in its correct position and there effectually secured before concrete is poured. He must be advised regarding all trades that will want to install members in or through concrete, ascertain that they have been duly notified, and see that such items are in place or that sleeves or boxes have been set to provide necessary holes for later installation and anchorage. Specification requirements as to who shall provide such sleeves and boxes and who shall place them vary in different offices, but they must, in any case, be most definite, or confusion and protest will result. Some architects stipulate that the concrete (or general) contractor shall provide all needed sleeves and boxes for such purposes and that the contractor for each interested trade shall “direct the placement” of all that are demanded for his work. Others say that each trade shall provide and install its own sleeves or shall provide the sleeves and oversee their placing in the forms. This last is probably the best practice, though the chief requisite is that there shall be no doubt or foundation for argument as to who is to do which.
It's the WATER SUPPLY that writes the Specifications

Depending on their sources and the treatment they undergo, waters vary greatly in their effect on plumbing pipes. Some waters are but normally corrosive while other waters—even those which are purest for drinking—are highly corrosive, and very destructive to pipe.

In writing water pipe specifications, therefore, the character of the local water supply should be carefully considered. Brass pipe will outlast rustable pipe under all water conditions, but not all alloys of brass will give the same satisfactory service everywhere.

To meet all different water conditions, The American Brass Company offers two alloys of Anaconda Brass Pipe.

For normally corrosive waters—Anaconda 67 Brass Pipe. This pipe contains not less than 67% copper. It is guaranteed to be structurally sound and physically perfect. It is semi-annealed and seamless.

For highly corrosive waters—Anaconda 85 Red-Brass Pipe. This pipe contains not less than 85% copper, and is offered as the best corrosion-resisting pipe obtainable. It, too, is fully guaranteed.

Proved by 16 years of testing!

These two alloys will serve all water conditions. This has been proven in 16 years of exhaustive research—when various alloys of brass pipe were tested, to determine which alloys would best resist various degrees of corrosion. The laboratory tests were then checked with tests of actual use—and Anaconda 67 Brass Pipe and 85 Red-Brass Pipe is the result.

An important service to architects

Today, the Technical Department of The American Brass Company is prepared to help determine the character of the local water supply and recommend the best alloy of pipe for use under specific conditions. You are cordially invited to communicate with The American Brass Company, General Offices, Waterbury, Conn.
Unflushed closets are an ever-present danger that can cause sickness, disease, and even worse. And children do forget—sometimes grown-ups. To guard health with a complete flush each time—is the one duty of Clow Madden Automatics. That they can't forget. They operate automatically.

Surely, swiftly, high-pressure water scours the bowl from top through trap. All residue is whisked away—

for Clow Madden bowls are free from those hollows that make ports of safety for germs.

Less than half the usual water consumption. A tiny fraction of the usual for repairs—years and years longer service—that's Clow Madden Automatic. Records on countless closets prove it.

This fixture is only one of the complete line of James B. Clow & Sons—established over half a century.

JAMES B. CLOW & SONS, 201-299 N. TALMAN AVE., CHICAGO

CLOW MADDEN AUTOMATIC

Forty-Eight Styles, Heights and Types to Meet Your Requirements
"Or equal" is a dangerous thing to write into specifications. What goes into a building determines the kind of service it will give to its owner. An architect's reputation depends upon year-after-year satisfaction as well as upon good design. Be sure of your specifications.

For nearly three-quarters of a century architects have specified Mueller Bronze Faucets and Fittings. Not because of sentiment. Not because of price. But because they know that Mueller Fittings will give dependable service for the life of their buildings.


MUeller, G-4760 (illustrated) The Mueller Automatic Diverter for Tub and Shower meets the popular demand for bathroom luxury. It is impossible to get an unexpected shower from this fitting because, after side or control valves have been shut off, the Automatic Diverter Valve directs the flow to the tub when the water is again turned on. Desirable for hotel and apartment installations. Furnished complete with pop-up drain for bath.
"Any Slab will fit. This is Kohler Ware"

WHEN Kohler Vitreous China is specified the plumbing contractor can pick any lavatory slab and know that it will fit any leg or pedestal. Slabs and pedestals never have to be kept together in pairs. No time is wasted hunting up missing partners.

In the Kohler Pottery, one of the largest and most modern in the world, many such improvements have been introduced. For instance, every lavatory slab is prepared at the factory so that it may be leveled up without using plaster of paris. Again the work of installation is expedited.

The whole Kohler line—vitreous china, enameled ware, and brass—is engineered to eliminate causes of delay and complication which might add to the architect’s burdens. An all-Kohler installation brings the full benefit of these betterments.

A Perfect Union
In addition to being interchangeable and easily leveled, Kohler lavatory slabs are designed to blend with the leg or pedestal, making an inconspicuous joint—a perfect union

New 72-Page Book in Color
A helpful book for the architect. Shows bathrooms, kitchens, laundries, color schemes, floor plans, etc. Write for a copy.

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

KOHLER OF KOHLER
PLUMBING FIXTURES
LOOK FOR THE KOHLER TRADE MARK ON EACH FIXTURE
24 YEARS IN SERVICE—STILL IN EXCELLENT CONDITION

SOLID NICKEL SILVER* PLUMBING FIXTURES BY MEYER-SNIFFEN

A recent inspection of the Solid Nickel Silver plumbing fixtures installed in 1905 in the U. S. Senate office building disclosed that they are still in excellent condition. This 24-year service record is proof of the permanent attractiveness and unusual durability of fittings of this material. Since they are comparable in both beauty and physical properties to Pure Nickel and high alloys of Nickel, Solid Nickel Silver fixtures retain their lustre during long years of hard use. They are corrosion-resistant and easily kept clean. With hardness, toughness and strength similar to tough bronze, Nickel Silver provides increased wear-resistance in valve seats and produces fixtures not easily marred in installation or use. For quality installations which must meet highest architectural standards, Nickel Silver is the most satisfactory material now available.

*Diamond Metal* waste trap.
Manufactured by The Meyer-Sniffen Co., New York, N. Y.
HERE is a simple but effective means of reducing losses from atmospheric corrosion in soil, waste, vent lines, rain leaders and other piping exposed to alternate wet and dry conditions. That copper-steel pipe effectively checks atmospheric corrosion has been demonstrated by numerous observations, laboratory and field tests and actual service records extending over a period of nearly twenty years. These tests and service records cover a wide range of pipe installations subjected to alternate wet and dry conditions, and the conclusions drawn from them thoroughly substantiate the judgment of architects and engineers throughout the country who are constantly increasing their specifications for NATIONAL Copper-Steel Pipe in order to resist this type of corrosion.

NATIONAL Copper-Steel Pipe is the same high-grade steel pipe consumers have been using for many years, with the addition of a small percentage of pure copper, which thoroughly alloys with the highly refined steel, making it more resistant to corrosion.

The fact that the protection offered by copper-steel is a part of the pipe itself and causes no inconvenience or extra work after installation, makes the use of this product an ideal method of minimizing losses from atmospheric corrosion, while the saving secured through increased life of the pipe is far in excess of the small additional investment involved. Send for Bulletin No. 11, describing

NATIONAL COPPER-STEEL PIPE
The Original Copper-Steel Pipe

NATIONAL TUBE COMPANY, Pittsburgh, Pa.
Subsidiary of United States Steel Corporation
Another Fine Building Equipped With

DOUGLAS

PLUMBING FIXTURES

and Solid Nickel Silver Trimmings

Douglas China Plumbing Fixtures trimmed with Solid Nickel Silver are noted for their enduring beauty, uniformly high quality, and absolute dependability. They resist the corrosive action of acids—will not chip, craze or discolor—easy to clean and keep clean. That is why they were specified by Simon & Simon, for the new Eaglesville Sanatorium—why they are used in many of the country's finest buildings—hospitals, hotels, schools, office buildings, industrial plants and residences.

Douglas Solid Nickel Silver, used in Douglas finer trimmings, is a hard nickel alloy, tough as bronze, and nickel color, nent. Due to its toughness, valve through and through. Never rusts. seats are highly wear resistant.

There is no plating to chip or wear off. It is easily cleaned. The rich, silvery lustre is permanent and everlasting. For more than forty years, we have specialized in the manufacture of high grade plumbing fixtures and fittings. If you haven't a copy of our catalog, write now!

THE JOHN DOUGLAS CO. Cincinnati, Ohio

MAKERS OF HIGH GRADE PLUMBING FIXTURES SINCE 1887
Never, Never, Never Again Will These Hands Be Needed!

This pipe begins a job lasting for generations. Probably never, never again will the costly hands of a workman be needed to repair or replace it. For this is Reading 5-Point Pipe—the pipe that outlasts the building.

The reason for this remarkable endurance! Reading 5-Point Pipe is Genuine Puddled Wrought Iron! It is born in the puddling furnace, where fire and force mingle the pure iron with rust-defying silicious slag. It has been tested by more than four-score years of actual use. That is why you get proved savings with Reading 5-Point Pipe. There is no substitute for Genuine Puddled Wrought Iron.

READING IRON COMPANY
Reading, Pennsylvania

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

GENUINE PUDDLED WROUGHT IRON
READING PIPE
DIAMETERS RANGING FROM \( \frac{1}{8} \) TO 20 INCHES
MARKS that CERTIFY

CRODON

The mark of
Quality CHROMIUM Plate

Ever since the phrase “By Appointment to His Majesty” was coined by medieval British guilds the world has been at a loss to match its significance as a mark of quality. Those privileged to serve nobility and the discriminating few, offered only merchandise which had been tested and found consistently satisfactory.

The Architects of America have had the opportunity of testing CRODON ... and the constantly increasing number of specifications in which CRODON plays an important part testifies to the satisfaction it has given.

So to all Architects we submit CRODON ... because it signifies a time-tested process ... developed from the pioneering days and perfected through hard-earned experience in laboratory and in actual service. CRODON means, not only good Chromium Plate, but uniformly good Chromium Plate. It is the “By Appointment” mark as far as Chromium Plate is concerned!

Manufacturers of fixtures and fittings who are licensed to use the CRODON Process of Chromium plating and to attach the CRODON tag to their products, are peculiarly representative of the country’s most noteworthy designers and producers. Names of our licensees will gladly be sent to you on request by our Service Department.

CRODON

THE CHROME PLATE
Chromium Corporation of America, 120 Broadway, New York City
Licensees of
UNITED CHROMIUM INCORPORATED
Executive Offices: 51 East 42nd Street, New York City
Branch Offices and Plants: 4645 W. Chicago Ave., Chicago • 114 Sansome St., San Francisco • 1220 Bellevue Ave., Detroit • 3125 Perkins Ave., Cleveland • Waterbury, Conn.
THE NEW
HOTEL MONTELEONE
NEW ORLEANS, LA.

Architects: Wogan & Bernard
Plumbing Contractors: Robinson Bros.
Plumbing Jobbers: Jefferson Supply Co.

Watrous
WALL-HUNG CLOSET BOWLS
USED THROUGHOUT

Write for details to
PLUMBING DIVISION
THE IMPERIAL BRASS MFG. CO.
1238 West Harrison Street  Chicago
BRANCH SALES OFFICES IN ALL PRINCIPAL CITIES

THE CUTLER
MAIL CHUTE

In its perfected form is the outcome of long experience, and is designed to meet the requirements of public use under Postoffice Regulation. It is simple and substantial in design and construction, durable in finish, and has an Architectural quality which is appreciated and much commended by Architects.

Full information, details, and specifications on request.

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

FAMOUS USERS OF
KEWANEe
HIGH PRESSURE WATER SYSTEMS

RINGLING BROTHERS

EVERYWHERE Kewanee leads! At its winter headquarters in Sarasota, Florida, Ringling Brothers Circus depends on Kewanee for its water supply. In each of the winter homes of Mr. John Ringling and Mr. Charles Ringling, also in Sarasota, Florida, are two Kewanee high pressure systems.

Kewanee makes over 200 models of High Pressure Systems, electric light and sewage disposal plants, also a full line of Centrifugal Pumps and Deep Well Turbines from the small $69.50 outfit to those which fit wells from 12" to 36" in diameter. This extensive Kewanee line is designed to meet every possible need.

Kewanee will show you how to save dollars and trouble. Write for data.

KEWANEe PRIVATE UTILITIES COMPANY
442 S. Franklin Street  Kewanee, Illinois

Dealer Correspondence Invited
there is no substitute for

Old Fashioned Puddled
Genuine Wrought Iron Pipe

Architects and contractors must depend on facts;
on experience. Cohoes Pipe has demonstrated in
75 years of every conceivable use that it resists
corrosion and rust, and is leak proof.

Our hand book of "Pipe Facts" contains authori-
tative information of sizes, weights and uses.
Send for it.

COHOES ROLLING MILL CO.
COHOES, NEW YORK

Branches: NEW YORK-CHICAGO-LOS ANGELES-SEATTLE-PORTLAND
BOSTON - CLEVELAND - DETROIT - NORFOLK - MINNEAPOLIS
Republic Steel Pipe continues through the years as a building fundamental undisturbed by to-day's revolutionary discoveries and inventions, and by the rapid changes in modern building methods and materials. Nature herself has never improved on the tubular method for conveying life streams, air, water . . . and for the plumbing system of the human structure.

Man's best is always an imitation of Nature. Good steel pipe is the standard means for transporting power, heat, water, air and other fluids in yesterday's or today's buildings.

Republic Steel Pipe is going into many of the most modern buildings now under construction . . . reliable, lasting installations for the future.
CALL it natural delicacy. Or convention. Or habit. The fact remains that the subject is seldom discussed— even among women.

Yet oddly enough almost any woman—if she were utterly frank—would tell you that the matter is to her of considerable concern; would undoubtedly urge you to make provision for it.

The plain facts are these: The average toilet being made today—even those of high quality—is unable to pass the sanitary pad with certainty. It has a trapway no larger than a golf ball. Stoppage—embarrassment—expense are common.

The Improved Madera was designed to pass sanitary pads without fail. It has a very large trapway. Flushing is powerful—yet quiet.

In every detail the Improved Madera is as fine a toilet as can be built. Nothing whatever can stain its glassy-hard vitreous china surface. It stays spotlessly clean merely by wiping with a cloth. It has a very long, comfortable seat. Entire surface beneath seat is covered with water. It is exceptionally quiet. And every fitting is the very best that money can buy. It is a toilet that will function quietly and efficiently for a lifetime—often without a single repair.

It merits your serious consideration.

THOS. MADDOCK'S SONS POTTERY
Division of Standard Sanitary Mfg. Co.
TRENTON, N.J.
Put your sheet metal work in able hands

When you place the contract for sheet metal work with an Ingot Iron Shop, you may be certain it's in able hands. For the creed of their organization defines every job as an opportunity for service and increased good will for their industry.

These shops are willing to stake their reputation and good will on rust-resisting ARMCO Ingot Iron for your sheet metal work because their experience has shown that it makes possible the kind of service and workmanship you want.

Among the seven thousand Ingot Iron Shops scattered throughout the country there is one or more near you. They will be glad to work with you in producing the kind and quality of sheet metal construction you want. Just look for the blue and white triangle sign shown above.
Equipped with

TE-PE-CO Wall Hung Closets

The term "wall hung" as applied to the Te-pe-co line is used as a matter of convenience only. The Te-pe-co Carrier, upon which our wall closets are supported, actually depends not one whit upon the wall for support. It bears the weight of the closet and applied load independent of the walls or connection to the soil. Your brief examination of the illustrations will cause your immediate appreciation of this statement.

So today the merits of the wall hung closet, which are very apparent and long since recognized, may now be safely employed by architects and engineers who, before the perfecting of this Te-pe-co Product, felt the means of support unsatisfactory.

The Trenton Potteries Company, Trenton, New Jersey, U.S.A.

Phantom view, showing how Te-pe-co Wall Hung Closets are supported.

Diagram of Installation

Our Guarantee. We make but one grade of ware—the best that can be produced—and sell it at reasonable prices. We sell no seconds or culls. Our ware is guaranteed to be equal in quality and durability to any sanitary ware made in the world. The Te-pe-co trade mark is found on all goods manufactured by us and is your guarantee that you have received that for which you have paid.
This new shower head
IS REVISING ALL CONCEPTIONS
of what a shower can be

Because this amazingly ingenious new Speakman Shower sluices out every trace of clogging sediment from the water apertures with a twist of a handle . . .

Because it gives, with slight movements of this same handle, any sort of shower desired — mild, normal, stinging needle spray . . .

Because it will last a lifetime, and never get out of order or need attention . . .

Because it is brilliantly finished in tarnish-proof Speakman chromium plate, giving sparkle and color to the bathroom . . .

Because of all its unquestioned superiorities, architects everywhere are specifying the new Speakman Self-Cleaning Anystream Shower with an enthusiasm seldom shown for any new product. Speakman Company, Wilmington, Del.
"U.S." Rainbow Line

50% Easier Pulling
Circuit Testing in one-third the time

United States Rubber Company

We'll gladly serve you through your jobber 1790 BROADWAY . . . NEW YORK

United States Rubber Company, Room No. 491, 1790 Broadway, New York, N. Y.

☐ Please send me free samples of the 8 colored wires comprising the "U. S." Rainbow Line.
☐ Please send me proof of the above statements.

Name_________________________Address_________________________
Company______________________Title_________________________

THE RAINBOW LINE OF "U. S." PARACORE WIRES AND CABLES
How about the location of that indispensable hospital laundry?

In the basement? Or on the top floor, where gravity can be employed to route the flow of the work? How about power? Lighting and ventilation? Placing of the machines?

Those are problems upon which the architect must have definite information when he begins to plan the building itself. And that is where the laundry-practise knowledge of American Laundry Machinery Company engineers is helpful. These men have been privileged to work with architects in the planning of scores of laundries, of every type and size. Their experience is at your disposal, any time you wish.

A view of one of the splendid laundries "American" engineers have helped to install... the modern, airy department at Hahnemann Hospital, Philadelphia.

J. Hall Marshall, New York City, Architect

The American Laundry Machinery Company
Norwood Station Cincinnati, Ohio

The Canadian Laundry Machinery Co., Ltd.
47-93 Sterling Road, Toronto 3, Ont., Canada

Agents: British-American Laundry Machinery Co., Ltd.
Underhill St., Camden Town, London, N. W. 1, England
How Josam Drains are making it safe for 15,000,000 cars to pass thru the Holland Tunnel yearly

Josam Drains overcome not only the ordinary drain problem but the most difficult one as well. Josam Drains are being installed not only at convenient places in buildings but at all strategic points to pre-

serve their beauty and strength. Architects working with Josam engineers are discovering new uses for Josam Drains—uses that not only add the extra measure of safety but in the end work out more economically for owners and operators.

Whether you are planning a garage or a skyscraper—whether your next structure is a private yacht or a war memorial—Josam Drains will solve every phase of draining.

Josam Catalog “G” shows the adaptability of Josam Drains and other Josam Products. It recommends hundreds of uses, and tells the story of Josam experience. Advise us if you do not have a copy and one will be mailed you promptly.

The Josam Mfg. Company
407 Euclid Building
Cleveland, Ohio

Factory: Michigan City, Indiana
Branches in Principal Cities

Josam Products are sold by all Plumbing and Heating Supply Jobbers.

There are no substitutes for Josam Products
COWING
Pressure Relieving
JOINT
Patented September 1, 1925

Insures Against Occurring Stresses In All Buildings

In stone, terra cotta or marble buildings, regardless of the rigidity of the structural steel or reinforced concrete frame, there are movements which occur that will create an overstressing of the facing material at various points. These movements may be caused by compression of the steel, vibration, wind action or unequalized expansion or contraction between the frame and the facing material due to temperature changes.

Where these movements occur—if there is not some elasticity in the face of the building—there will be some cracked facing blocks due to overstress.

The Cowing Joint, installed in place of one mortar joint at each story height, provides the needed elasticity. It gives exact and automatic compensation for all destructive stresses thrown on the facing material.

It is neat... will not squeeze out... eliminates frequent tuck-pointing... it is everlasting.

Include Cowing Joint in the specifications. Estimates will be furnished promptly.

Cowing Pressure Relieving Joint Co.
160 N. Wells St. - Chicago, Ill.

There are now a total of 1297 Otis Signal Control Elevators in service

Signal Control is an exclusive development of the Otis Elevator Company

LOTS of folks have tried to find a substitute for quality—but thus far all have failed.

SEDGWICK DUMB WAITERS and ELEVATORS for all purposes
WRITE FOR NEW CATALOG

Sedgwick Machine Works, 151 W. 15th St., New York
Representatives in Many Principal Cities
THE GREATEST IMPROVEMENT in soil pipe in 50 years

If railroad tracks were laid without regard to expansion, trains would run as shown above. And expansion is an equally serious problem in soil, waste and vent lines. Yet, until the arrival of EXPAN-HUB there was no real solution.

EXPAN-HUB is the finest soil pipe that can be made. On top of that it has one feature that is actually the greatest improvement in 50 years—the Compressible Gasket—which is revolutionizing the soil pipe industry.

This feature takes care of all contraction and expansion, thereby preventing buckling of the soil stack and assuring permanently gas-tight joints.

In every type and size of building—from Skyscraper to Bungalow—EXPAN-HUB solves every soil pipe problem.

Your wholesaler can supply you.
Meet the Lord Baltimore

There's no danger of the guests of the magnificient Lord Baltimore Hotel not being kept warm and comfortable due to any fault of the radiator traps—not with 1,100 Sarco Radiator Traps on the job.

The architect—W. L. Stoddard—and the heating contractor—Lloyd Mitchell—knew from past experience that Sarco Radiator Traps would not air bind or freeze; that they were noiseless in operation and would not water hammer; that they were self-cleaning and easy to take apart. They knew, too, that Sarco Radiator Traps have a perfectly free discharge at all times and are unusually long lived due to the helical expansion element.

Play safe and specify “Sarco” for your next fine building. Ask for Booklet AK-110.

SARCO CO., Inc.
183 Madison Avenue
New York, N. Y.
Boston Chicago Detroit Pittsburgh
Buffalo Cleveland Philadelphia St. Louis
Sarco (Canada) Limited
1605 Delorimier Ave., Montreal

A saving of 30%

Satisfied for 14 years—wouldn’t consider changing. That’s praise of Onliwon paper towels from a big Chicago hotel.*

And praise deserved. For Onliwon towels save money—and please clients.

There’s minimum waste. Served only one at a time from a special cabinet. Double-folded. One’s large enough—with up to 34% more drying surface to the case.

Long-fibred. They absorb quickly. Strong. They’re almost untearable. Yet comfortably soft.

Install them in your public rooms. They’ll prove they meet all claims for service and cost—as a Los Angeles hotel* says.

Mail the coupon below today—It’ll pay.*Name of hotel on request.

THE ORIGINAL
Onliwon Toilet Paper and Paper Towel Service

A. P. W. PAPER CO.
Albany, N. Y.

Please send full data on economy of using A. P. W. Onliwon towels.

Name: ____________________________________________

Hotel: ____________________________________________

Address: __________________________________________

AF-1029
"The most fire-proof building in the United States"

THE National Board of Fire Underwriters point with pride to their Home Office in New York City as "the most fire-proof building in the United States."

Their opinion holds special interest, for no group of men could be better equipped to pass upon the question of fire-safety in building construction.

Analyzed, the reasons this building affords superlative protection from fire are: Fire-resistive materials in both exposed and concealed locations; automatic sprinklers and automatic fire-doors as well as standpipe and hose throughout; enclosed stairways and elevator shafts; wired glass windows in metal frames—and a Barrett Specification Coal-tar Pitch and Felt Roof surfaced with gravel.

The gravel (or slag) wearing surface of a Barrett Roof is fire-safe and practically indestructible. The waterproofing element is Barrett Specification Coal-tar Pitch—which is preserved, not deteriorated, by moisture and dampness and is virtually immune to climatic variation. Barrett Specification tarred felt serves as a base to hold together the heavy layers of pitch.

Thus there is a permanent "union" of gravel, felt and pitch in a Barrett "Built-up" roof that enables each material to do its work to best advantage. That's why Barrett Specification Roofs resist sun, fire and water and are bonded against repair or maintenance expense for 20 years.*

But 20 years by no means represents their "life-expectancy." Many Barrett Pitch and Felt Roofs with gravel surfaces laid 30, 40, even 50 years ago are still giving staunch, weather-tight service.

Barrett Approved Roofer, each one selected for his experience, ability and integrity, are invariably leaders in their cities. Consult with them or with us on any roofing problem.

BONDED BARRETT FLASHINGS

Flashings are the most sensitive parts of any roof. Barrett Flashing Blocks and Forms are now bonded for 20 or 10 years when used with Barrett Specification Bonded Roofs. Barrett Approved Roofer will gladly tell you about this new feature of Barrett Roofing Service.
Leaks from acid waste lines are destructive, dangerous and insanitary; and such leaks are sure to occur when ordinary drain pipe is used.

Duriron soil pipe alone resists the attack of all corrosives, and provides an approved plumbing material that is as permanent as the structure.

Complete catalogue in "Sweet's," from the 1930 edition if you want it.

The Duriron Company, Dayton, Ohio

BROWNELL
TIME-TESTED BOILERS AND STOKERS

One of the matchless products of Brownell is the MASTER Electric Welded Steel Heating Boiler—a multi-feature boiler that saves dollars on initial boiler room cost. This outstanding boiler provides quick heat, all season domestic hot water, and odorless incineration,—thus saving the cost of outside accessories.

The Duriron Company, Dayton, Ohio

BROWNELL CO.
DAYTON
OHIO

Positive Rapid Circulation on ALL Hot Water Systems

with the
HYDROLATOR

You can assure highest efficiency on every hot water system you plan by specifying a HYDROLATOR. Forces rapid circulation. Positive in action. Overcomes traps and restrictions.

Write for Bulletin 729-H

Janette Mfg. Co., Dept. A
556-58 West Monroe St.
Chicago

Features
Stimulates Circulation.
Reduces Fuel Costs.
Makes Quicker Heat.
Cures Faulty Circulation.
October, 1929

THE ARCHITECTURAL FORUM

SHOWING CROWN MOULD
SET TO PROVIDE CANT
*CORNICE SECTION*

SHOWING USE OF
CANT STRIP
*CORNICE SECTION*

AMERICAN METHOD SHINGLES
APPLIED WITH BUTTS STAGGERED

ACOUSTICAL TREATMENT
RIGID ASBESTOS SHINGLES
ASPHALT SHINGLES
BUILT-UP & READY-TO-LAY ROOFING

Johns-Manville
CORPORATION
NEW YORK - CLEVELAND - CHICAGO - SAN FRANCISCO - TORONTO

ARCHITECTURAL SERIES PLATE Nº 10
*ENTIRE SERIES SENT ON REQUEST*
Planning Restaurants That Make Money. 80 pages of data, plans, tables and photographs. Contains practical information on space requirements of various types of eating places and kitchens; discusses efficient seating arrangements; introduces many questions that the Architect must consider. This is not a catalog—but a practical book written especially for Architects. There is no obligation in writing for it.

Practical Planning for School Food Service. A concise analysis of the requirements of school dining rooms and cafeterias in public and private schools and colleges. Contains much information that has never previously been put in print. Numerous floor plans and photographs make it invaluable to any Architect interested in educational buildings.

Practical Planning for Church Food Service. Help on a difficult problem! Here printed for the first time are facts about church kitchens and serving rooms, illustrated by many examples, with floor plans and photographs. An important monograph for any architectural file.

Published by

THE ARCHITECTS' SERVICE BUREAU

THE JOHN VAN RANGE COMPANY
ALBERT PICK-BARTH COMPANY, INC.

1200 West 35th Street
Oakley
Chicago

Cincinnati, Ohio
Cooper Square
New York
Do workers drop ice-cold tools and breathe warmth into their fingers? Do others mop perspiration off their sweaty brows? Are employees inefficient . . . frequently absent because of colds and similar ailments?

When machines stand idle and production suffers . . . when costly mistakes are made and profits vanish—you'll be convinced that temperature, too, is vital in production.

You can control the temperature throughout any building with the Venturafin Method of Heating . . . force heated air directly into working areas without wastefully heating ceiling areas first. Venturafins put an end to cold corners and heat pockets because they force heated air—where you want it, when you want it and as much as you want.

Call in any of the reliable heating contractors in your city. Ask them about the moderate cost of Venturafin Units . . . their quick adaptability to practically any position in your plant . . . their economy of space . . . their low maintenance costs and the actual savings in fuel that result year after year.

Ask for all the facts about Venturafin Units and how they can be most profitably applied to your business.

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

American Blower Corp.
6000 Russell St., Detroit

Please send me your 24-page Venturafin Book
Heat the Bathroom
Without Fire in Boiler

On cold, damp days, before fire is started in the boiler, the modern bathroom needs a Prometheus Built-in Electric Heater to make it comfortable and to prevent catching cold. It makes buildings easier to rent and to sell.

The Prometheus Heater is built into the wall. Requires no floor space.

This attractive cast-iron heater is finished in various colors of vitreous porcelain to harmonize with the color scheme of the bathroom. It has a three-heat switch. Is approved by the Underwriters.

Write for catalog.

PROMETHEUS ELECTRIC CORP.
358 W. 13th St., New York, N. Y.

Vacuum Cleaning Systems
for Public Buildings

Centralized vacuum cleaning has proven its case, and architects, in an increasingly large number of instances, are specifying TABCO Vacuum Cleaning Systems. There are three principal reasons for this: first, their economy of operation; second, the thoroughness with which they clean, and third, their absolute freedom from repair cost.

TABCO Systems come in a complete range of sizes and capacities from 5 hp. to 100 hp. They operate smoothly, quietly, and without vibration, having but one working part and no wearing parts. They require no attention whatsoever other than the occasional lubrication of bearings and the emptying of the dust collector. Descriptive literature and specifications will be sent gladly on receipt of inquiries.

Allen & Billmyre Co., Inc.
Executive Offices
803 Grand Central Palace
New York City

The Authority of Accomplishment

TOCH BROTHERS, during 80 years of exhaustive research and painstaking manufacturing care, have perfected waterproofing and dampproofing compounds that meet every requirement in every type of structure large or small.

The Toch organization stands ready and willing to cooperate with architects and builders to the fullest extent of their ability. For catalogs, prices and complete information address Toch Brothers, 443 Fourth Avenue, New York.
WRITE lifetime performance into your specifications

Whether it is for pipe, conduit, or steel sheets, there is a one-word specification that assures unfailing lifetime performance—Youngstown.

These Youngstown Sheet & Tube Co. products have stood the tests of time and service during the decades that they have been serving the building industry. Their performance in thousands of installations from coast to coast has definitely proved that no sounder specification can be written.

For unfailing pipe performance in plumbing, heating, sprinkler, or refrigeration systems specify Youngstown steel pipe; for lifetime protection to electrical wiring specify Youngstown Buckeye Conduit; for lasting sheet metal work specify Youngstown Copperoid sheets. Such a specification is the soundest insurance of lifetime performance.

THE YOUNGSTOWN SHEET AND TUBE COMPANY, General Offices, Youngstown, O.

One of the oldest manufacturers of copper-bearing steel, under the well-known and established trade name "Copperoid"

DISTRICT SALES OFFICES:

ATLANTA—Healey Bldg.
BOSTON—40 Federal St.
BUFFALO—Liberty Bank Bldg.
CHICAGO—Crosby Bldg.
CINCINNATI—Union Trust Bldg.
CLEVELAND—Union Trust Bldg.
DALLAS—Magnolia Bldg.
DENVER—Continental Oil Bldg.
DETROIT—Palmer Bldg.
MINNEAPOLIS—Andrus Bldg.
KANSAS CITY, MO.—Commerce Bldg.
NEW ORLEANS—Hibernia Bldg.
NEW YORK—30 Church St.
LONDON REPRESENTATIVE—The Youngstown Steel Products Co., Dashwood House, Old Broad St., London, E. C. England

PHILADELPHIA—Franklin Trust Bldg.
PITTSBURGH—Oliver Bldg.
SAN FRANCISCO—33 New Montgomery St.
SAVANNAH—M and N T Terminals
SEATTLE—Central Bldg.
ST. LOUIS—Shell Bldg., 13th and Locust St.
YOUNGSTOWN—Stambaugh Bldg.

"GALVANIZED SHEETS PROTECT" .. .. "SAVE WITH STEEL"
For more than a half century, the Chicago Daily News has served the mid-western metropolis and its environs, building its tremendous circulation through complete editorial independence and the impartial presentation of news.

In its new building, one sees materially that progressive spirit, ever striding forward, planning for years to come. And in keeping with the architectural achievement, engineering skill has been diligently applied—skill that represents specialized service and dependable motor and control applications that characterize Westinghouse efficiency in buildings.

Westinghouse motors drive the ventilating equipment, assuring a continuous circulation of clean, fresh air to every part of the building. Westinghouse motors also drive the fire pumps and circulating pumps, furnishing an adequate supply of water every minute of the day and night. In fact, throughout the building there is liberal evidence of the part Westinghouse is taking in serving this ultra-modern publishing plant.
Delivered complete... ready to go to work

PLANS and layout drawn... machinery, equipment and accessories specified and installed... provision made for future expansion... laundering processes formulated... operating staff organized...

TROY ARCHITECTS' ADVISORY SERVICE is prepared to take care of every step in the planning and equipping of the institutional laundry. Troy specialists will deliver to your client a plant, complete in every way, set up and ready to work as a going concern.

Let Troy cooperate with you. Without charge or obligation, Troy will handle the entire laundry job from the preliminary stages through to actual operation. Feel free to take advantage of this service.

TROY LAUNDRY MACHINERY CO., INC.
Chicago—New York City—San Francisco—Seattle—Boston—Los Angeles
JAMES ARMSTRONG & CO., Ltd., European Agents: London—Paris—Amsterdam—Oslo
Factories: East Moline, Ill., U. S. A.
IT CAN BE DONE
OTHER WAYS

Some contractors have used plugs—others have gone to the needless expense of putting in blind nipples but these are only clumsy inefficient attempts to solve the problem of venting new water—for steam radiators. The only successful way is the In-Airid way.

The In-Airid shown above was specially designed to vent new water radiators when used on steam. It prevents the short circuiting of steam across the top openings and insures complete venting of all cold air. This valve is the one sure means of avoiding venting troubles on your new one-pipe steam and vacuum jobs.

Thousands of Heating contractors have standardized on In-Airid—There must be a Reason!

IN AIRID
The Invisble AIR VALVE
No. 1 for Steam...No. 2 for Vacuum

Airids No. 500 and Vac-Airids No. 510 are still the best valves to use for replacement on old style steam radiation.

AMERICAN RADIATOR COMPANY
Makers of a complete line of VALVES, VENTS, and REGULATORS
The specifications of the new Chief Apartment Building in Kansas City, Mo., call for the largest installation ever built of the antenna distribution type of RCA Centralized Radio.

In this single building there will be 218 radio outlets connected with the central antenna. Each tenant will be able to plug in conveniently with his own receiving set, and hear the broadcast program he chooses.

The ever growing problem of disfiguring, individual antennae is permanently solved and reception is notably bettered.

All RCA Centralized Radio equipment has been approved by the National Board of Fire Underwriters. Every item has been especially designed and developed for centralized radio use, as "adapted" equipment has not been found suitable by RCA engineers.

Now standard modern equipment

RCA Centralized Radio is being chosen by hotel and apartment house builders as necessary equipment in modern residence construction. It is available in two principal forms:

1. A single antenna connected with a distribution system to radio receivers in rooms throughout the building. As many as 80 radio sets of different makes can be independently operated from this common antenna, by plugging into wall outlets—and far more satisfactorily than by the use of individual antennae. Additional central antennae may be installed, if required, for additional groups of 80 receivers.

2. Centralized Radio receiving equipment to distribute broadcast programs to as many as 5000 rooms throughout a building. Equipment may be installed to transmit a single program, or to make available the choice of programs from two, three or four broadcasting stations.

The first method is ideally adapted for apartment houses, dormitories, office buildings, etc., where tenants desire to have their own receiving sets. It does away with the unsightly multiplicity of individual aerials, and the inconvenience of connecting them with distant rooms.

Where central control is advantageous

The second method is particularly designed for hotels, hospitals, sanitariums, schools, passenger ships, etc., where transient occupants of rooms may enjoy radio programs or phonograph record entertainment from loudspeakers or headsets, all operated from a central control.

Descriptive literature available

Descriptive pamphlets of these two systems, and of the special apparatus designed for them are available for architects, builders and building owners.

The Engineering Products Division, Radio-Victor Corporation of America, at any District Office named below, will answer inquiries, and prepare plans and estimates for installations of any size.
HOTEL GROWS FROM RESTAURANT

Use of GYPSTEEL Pre-Cast Gypsum Floor Construction
Permits Addition of Seven Stories on Original Columns

WHEN the two-storied Hildebrecht Restaurant was built several years ago, it was planned eventually to add six more floors for use as a hotel. The floor construction was to be concrete arch and the columns were designed on this basis.

As time drew near for this completion of the building, it was decided that the addition of one more floor was imperative. To do this with the heavy concrete arch construction necessitated alterations in the original columns. Such alterations would mean that the restaurant must be closed for some time. This would mean, aside from a complete redecoration, a loss of the entire revenue for a period of over three months.

The light weight of the Gypsteel Pre-Cast Gypsum Floor construction made it possible to add seven floors by reinforcing but one of the original columns. It provided practically a fire-proof, sound-proof, floor construction with flush ceilings. One in which the floor and ceiling could go forward as fast as the steel was in place. No workmen were held waiting for material to dry or harden. No forms interfered with their work. The finished floor was laid almost immediately after the Gypsteel floor was in place.

As is usual on jobs where the Gypsteel system is used, the architect, engineer and owner were unusually well satisfied with the speed of construction and the finished product.
October, 1929
THE ARCHITECTURAL FORUM

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, 521 Fifth Avenue, New York, or the manufacturer direct, in which case kindly mention this publication.

ACOUSTICS

R. Guastavino Co., 40 Court St., Boston.

Aston Plaster. Brochure, 6 pp., 85 cents 11 ins. Important data on a valuable material.

Johnston Sound Absorbing Corporation, New York.

Sound-Absorbing Treatment in Banks and Offices. Booklet, 18 pp., 85 cents 11 ins. Illustrated.


U. S. Gyproom Co., 205 W. Monroe St., Chicago, Ill.

A Scientific Solution of an Old Architectural Problem. Folder, 8 1/2 x 11 ins. Describes Sabent Acoustic Plaster.

ASPHALT

Bacher Asphalt Company, New York, Philadelphia, Chicago, Pittsburgh, Kansas City, St. Louis, San Francisco.

Specifications for Applying Genaco Asphalt Mastic. Booklet, 16 pp., 8 1/2 x 11 ins.

Genaco Trinidad Lake Asphalt Mastic. Brochure, 32 pp., 6 x 9 ins.

Specifications for Applying Genaco. Booklet, 16 pp., 8 x 10 1/2 ins.

BRICK

American Face Brick Association, 1751 Peoples Life Building, Chicago, III.

Brickwork in Italy. 298 pp., size 8 1/2 x 11 ins. Profusely illustrated. Contains complete technical description of bricks and clays. Price now $3.00, half Morocco, $7.00.

Industrial Buildings and Housing. Bound Volume, 112 pp., 8 1/2 x 11 ins. Profusely illustrated. Deals with the building of factories and employees' housing in detail. Suggestions are given for layout, plan, and arrangement of industries, including restaurants and rest rooms. Price now $1.00 (formerly $2.00).

Common Brick Mfrs. Assn. of America, 2314 Guarantee Title Bldg., Cleveland, Ohio.


Tells how to secure interesting effects with common brick.

Building Economy, Monthly magazine, 22 pp., 85 cents 11 ins. Illustrated. $1 per year, 10 cents a copy. For architects, builders and contractors.


General Catalog. 16 pp. 85 cents 11 ins. Illustrated.

Bedford Reds. Folder, 8 pp., 3 x 8 ins. Illustrated.

CEMENT

Carney Company, The, Mankato, Minn.

A Four-Color Combination of Quality and Economy. Booklet, 20 pp., 85 cents 11 ins. Illustrated. Important data on valuable material.

Kosmos Portland Cement Company, Louisville, Ky.

Kosmort, the Mortar for Cold Weather. Folder, 4 pp., 85 cents 11 ins. Illustrated. Deals with construction of fireplaces and chimneys.

Leverage Pressure Relieving Joint Company, 100 North Wells St., Chicago, Ill.


Minwax Company, Inc., 11 West 42nd St., New York, N.Y.

Complete Index of all Minwax Products. Folder, 16 pp., 85 cents 11 ins. Illustrated. Complete description and detailed specifications.


Portland Cement Association, Chicago, Ill.

Concrete Masonry Construction. Booklet, 48 pp., 85 cents 11 ins. Illustrated. Deals with various forms of construction.


Concrete in Architecture. Bound Volume, 60 pp., 85 cents 11 ins. Illustrated. An excellent work, giving views of exteriors and interiors.

CONCRETE BUILDING MATERIALS

Concrete Steel Company, 42 Broadway, New York.

Modern Concrete Reinforcement. Booklet, 32 pp., 85 cents 11 ins. Illustrated.

Kosmos Portland Cement Company, Louisville, Ky.

High Early Strength Concrete, Using Standard Kosmos Portland Cement. Folder, 1 page, 85 cents 11 ins. Complete data on securing high strength concrete in short time.

CONCRETE COLORING

The Master Builders Co., 2706 Euclid Ave., Cleveland.

Color Mix, Colored Hardened Concrete Floors (Integral). Brochure, 16 pp., 85 cents 11 ins. Illustrated. Data on coloring for floors.

Dychrome, Concrete Surface Hardener in Color. Folder, 4 pp., 8 x 11 ins. Illustrated. Data on a new treatment.

CONSTRUCTION, FIREPROOF

Master Builders Co., Cleveland, Ohio.


North Western Expanded Metal Co., 1254 Old Colony Building, Chicago, Ill.

North Western Expanded Metal Products. Booklet, 85 cents 104 ins. 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. J. A. Sample Book Bound Volume, 85 cents 11 ins., contains actual samples of several materials and complete data regarding their use.

CONSTRUCTION, STONE AND TERRA COTTA

Cowing Pressure Relieving Joint Co., 100 North Wells St., Chicago, Ill.

Pressure Relieving Joint for Buildings of Stone, Terra Cotta or Marble. Booklet, 16 pp., 85 cents 11 ins. Illustrated. Deals with preventing cracks, spalls and breaks.

CORNICES, METAL

Sheet Metal Trade Extension Committee, Terminal Tower, Cleveland.

This committee will send upon request full data published by its members on sheet steel cornices and specifications for their use.

DAMPPROOFING

The Master Builders Co., 2706 Euclid Ave., Cleveland.


MINWAX COMPANY, INC., 11 WEST 42ND ST., NEW YORK, N.Y.

Complete Index of all Minwax Products. Folder, 6 pp., 85 cents 11 ins. Illustrated. Complete description and detailed specifications.


The Vortex Mfg. Co., Cleveland, Ohio.

Par-Loak Specifications "Forms A and B" for dampproofing and plaster key over concrete and masonry surfaces.

Par-Loak Specification "Form J" for dampproofing the tile wall surfaces that are to be plastered.


DOORS AND TRIM, METAL

The American Brass Company, Waterbury, Conn.

Anacosta Architectural Bronze Extruded Shapes. Brochure, 33 pp., 85 cents 11 ins., illustrating and describing more than 2,000 standard bronze shapes of cornices, jamb casings, mouldings, etc.

The Kawkner Company, Niles, Michigan.

Detail sheet. 85 cents 11 ins., with A.I.A. File No. featuring Heavy Welded Bronze Doors.

REQUEST FOR CATALOGS

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to The Architectural Forum, 521 Fifth Avenue, New York.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 187

ELEVATORS
Ots Elevator Company, 269 Eleventh Ave., New York, N. Y.
Ots Push Button Controlled Elevators. Descriptive leaflets, 8% x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.

Ots Geared and Belt Traction. Elevators of All Types. Descriptive leaflets, 8% x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.

Escalators. Booklet, 8% 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, III.
Elevators, 34% 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, 8% x 8% ins., 70 pp. Illustrated. Descriptive pamphlets on hand power freight elevators, sidewalk elevators, automobile elevators, etc.

Catalog and pamphlets, 8% x 11 ins. Illustrated. Important data on different types of elevators.

ESCALATORS
Ots Elevator Company, 269 Eleventh Ave., New York, N. Y.
Escalators. Booklet, 22 pp., 8% x 11 ins. Illustrated. A valuable work on the latest escalators.

FIREPROOFING
Concrete Engineering Co., Omaha, Neb.
Concrete Handbook of Practical Construction. Booklet, 54 pp., 8% x 11 ins. Valuable work on methods of fireproofing.

Concrete Steel Company, 42 Broadway, New York.
Economical Fireproof Floors for Suburban Buildings. Folder, 4 pp., 8% x 8% ins. Illustrated. Valuable work on various types of floor materials and their use.

Western North American Metal Co., 401 South Dearborn St., Chicago, III.
A. I. A. Sample Book. Bound volume, 8% 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 Hardening and Finishing. Booklet, 44 pp., 8% x 11 ins. Illustrated. A publication important to architects and engineers.

Concrete Floor Treatments—Specification Manual. Booklet, 24 pp., 8% x 11 ins. Illustrated. A valuable work on specifications for every building type in which concrete floors are used, with descriptions and results of tests.

Toch Brothers, New York, Chicago, Los Angeles.
Handbook of R.W. Protective Products. Booklet, 44 pp., 8% x 7% ins.

FLOORS—STRUCTURAL
Concrete Steel Co., 42 Broadway, New York.
Structural Economics for Concrete Floors and Roofs. Brochure, 32 pp., 8% x 11 ins. Illustrated. A valuable publication.

Truscon Steel Co., Youngstown, Ohio.

Truscon Panel Co., Youngstown, Ohio.
Truscon Panel Co., Youngstown, Ohio.
Truscon Panel Co., Youngstown, Ohio.
Truscon Panel Co., Youngstown, Ohio.

Structural Gypsum Corporation, Linden, N. J.

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


Linoleum Layer's Handbook, 5 x 7 ins., 36 pp. Instructions for linoleum layers and others interested in learning most satisfactory methods of laying and taking up of linoleum.


REQUEST FOR CATALOGS
To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to The Architectural Forum, 521 Fifth Avenue, New York.

Name
Address

Part Two
This sewage ejector cannot clog . . .

The Jennings Sewage Ejector readily handles unscreened sewage and drainage. Simplified in design, it operates pneumatically without employing troublesome air valves, air storage tanks or reciprocating compressors. Low pressure air is furnished by a Nash Hytor Compressor only when sewage is being moved. No working parts come in contact with the sewage. Capacity cannot be lowered—as so often happens in other type ejectors when impellers and other parts become clogged or caked with solid matter. The Jennings Ejector retains its original efficiency throughout its entire life.

For pumping unscreened sewage or drainage from basements below street sewer level; raising crude sewage from low lying districts; handling effluent, sludge and other heavy liquids the Jennings Ejector affords an efficient unit that will give years of trouble-free service at low operating cost. Write for Bulletin 67.

Jennings Pumps
THE NASH ENGINEERING CO. 12 WILSON ROAD, SOUTH NORWALK, CONN.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 188

FOILING—Continued
Planning the Color Schemes for Your Home. Booklet, 24 pp., 5 x 7 1/2 ins. Illustrated. Complete information accompanied by data and illustrations on different kinds of garage door hardware.

Famous Homes of New England. Series of folders on old homes and hardware in style of each.

HEATING EQUIPMENT
American Blower Co., 600 Russell St., Detroit, Mich.
Winter and Ventilating Utilities. A booklet containing a large number of valuable publications, each 8 1/4 x 11 ins., on these important subjects.

American Radiator Company, The, 40 West 40th St., N. Y. C.
Ideal Boilers for Oil Burning. Catalog 54 x 8 1/2 ins., 30 pp., illustrated. Described in 4 colors. Describing a line of Heating Boilers especially adapted to use with Oil Burners.


Ideal Arcola Radiator Warmth. Brochure, 6 x 9 1/2 ins. Illustrated. Describes a central all-renewable heating plant with radiators for small residences, stores, and offices.

In-Airid, the Invisible Air Valve. Folder, 8 1/2 x 11 ins., 36 pp. Illustrated. Full data on heating and hot water supply.


Air-In-Air, the Invisible Air Valve. Folder, 8 x 2 1/4 ins. Illustrated. Data on a valuable detail of heating.

The 999 ARCO Packless Radiator Valve. Folder, 8 x 2 1/4 ins. Illustrated.

James H. Clow & Sons, 314 S. Franklin St., Chicago, Ill.

C. A. Dunham Company, 430 East Ohio St., Chicago, Ill.


The Fulton Ryholton Company, Knoxville, Tenn.
Ryholton Temperature Regulators. Illustrated brochure, 8 1/2 x 11 ins., dealing with general architectural and industrial applications; also specifically with applications of special instruments.

Ryholton Heating Specialties. Catalog No. 200, 192 pp., 5 1/4 x 9 1/4 ins. Important data on heating.

Hoffman Specialty Company, Inc., 23 West 68th St., New York, N. Y.
Heat Controlled With the Touch of a Finger. Booklet, 46 pp., 5 1/4 x 8 1/2 ins. Illustrated.

How to Lock Out Air, the Heat Theft. Brochure, 40 pp., 5 x 7 1/4 ins. Illustrated.

Jeannette Manufacturing Company, 556 West Monroe Street, Chicago.
Specified internationally!

The stately Mitsui Bank, Tokyo, Japan—
Atop this great building is a Carey Built-up Roof. Trowbridge & Livingston, Architects

...Carey Built-up Roofs

In Canada, in Mexico, in Cuba and the Philippine Islands, in far-away Japan...
everywhere, Carey Built-up Roofs are safeguarding all types of buildings.

Safeguarding professional reputations, too! For architects and engineers know that this roof of permanent satisfaction goes on to stay. Made of the best of blended asphalts and the toughest-sinewed felts. Multi-layered, multi-sealed. Long-lasting, weather-tight.

And guaranty-bonded, for from five to twenty years, by a forty-million-dollar surety company!

We shall be glad to send you our Architects' Specification Book.

“A roof for every building”

THE PHILIP CAREY COMPANY, Lockland, CINCINNATI, OHIO
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 190

HOSPITAL EQUIPMENT

The Fink Co., Inc., 389 Lexington Ave., New York City. Catalog 436. 7 x 10 ins., 16 pp. A booklet illustrated with photographs and drawings, showing the types of light for use in hospitals, as well as the accessories, lino-lite and multilight concentrators, ward reflectors, bed lights and microscopic reflectors, giving full data on dimensions, explaining their particular fitness for special uses.

Hoskins Company, 427 Madison Avenue, New York.

Lighting Specific for Hospitals. Booklet, 30 pp., 854 x 11 ins. Illustrated.

The International Nickel Company, 47 Wall St., New York, N. Y. Hospital Applications of Monel Metal. Booklet, 854 x 11 ins., 16 pp. Illustrated. Gives types of equipment in which Monel Metal is used, reasons for its adoption, with sources of such equipment.

Pick-Bart Company, Inc., Albert, 1203 West 35th St., Chicago, and Cooper Square. Some Thoughts About Hospital Food Service Equipment. Booklet, 22 pp., 754 x 754 ins. Illustrated. Valuable data on an important subject.

Prometheus Electric Corporation, 360 West 13th St., New York.


HOTEL EQUIPMENT


INCINERATORS

Home Incinerator Co., Milwaukee, Wis.


A. I. A. File, 12 pp., 854 x 10 ins., inside. Suggestions for architect on incineration, with equipment and installation.

Specialized Home Comforts Service Plan Book. 40 pp., 854 x 11 ins., inside. Illustrated. A complete outline of the many advantages of incineration.

Blue Star Standards in Home Building. 16 pp., 854 x 11 ins., inside. Illustrated. Provides the engineer with practical data on all types of incinerators, covering heat, incineration, refrigeration, etc.


INSULATION


The Insulation of Roofs with Armstrong's Corkboard. Booklet, 16 pp., 854 x 11 ins. Illustrated. Describes principle and design of the Armstrong Corkboard, gives list of buildings where it has 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 Kernerator. Gives list of hospitals where installed.


JOISTS

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

Catalog No. 4. Booklet, 22 pp., 854 x 11 ins. Illustrated. Gives details of true construction of load bearing trusses and specifications.

Concrete Steel Company, 42 Broadway, New York, N. Y.

Structural Economies for Concrete Floors and Roofs. Booklet, 32 pp., 854 x 11 ins. Illustrated.

REQUEST FOR CATALOGS

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to The Architectural Forum, 521 Fifth Avenue, New York.

"Let it express the soul of America." — The remarks of Calvin Coolidge concerning Washington.
<table>
<thead>
<tr>
<th><strong>JOISTS—Continued</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Concrete Reinforcement. Brochure, 32 pp., 8'/2 x 11 ins. Illustrated.</td>
<td></td>
</tr>
<tr>
<td>Construction Details for Installing Havemeyer Trusses, Data sheets, 8'/2 x 11 ins. Illustrated.</td>
<td></td>
</tr>
<tr>
<td>Steel Joists for Placing Havemeyer Reinforcement in Columns, Beams and Slabs. Data sheets, 8'/2 x 11 ins. Illustrated.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>KITCHEN EQUIPMENT</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>School Cafeteria. Booklet, 6 x 9 ins. Illustrated. The design and application of equipment for schools. Information on installation and plans for standardized units.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LABORATORY EQUIPMENT</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberene Stone Co., 153 West 23rd Street, New York City. Brochure, 8'/2 x 11 ins., 26 pp. Stone for laboratory equipment, shower partitions, stair treads, etc.</td>
<td></td>
</tr>
<tr>
<td>Durston Acid, Alkali and Rust-proof Drain Pipe and Fittings. Booklet, 8'/2 x 11 ins., 20 pp. Full details regarding a valuable type of piping.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LANTERNS</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Durston Acid, Alkali and Rust-proof Drain Pipe and Fittings. Booklet, 8'/2 x 11 ins., 20 pp. Full details regarding a valuable type of piping.</td>
<td></td>
</tr>
<tr>
<td>Steel Data Sheet No. 1. Folder, 8'/2 x 11 ins. Illustrated. Silexcel for floors. Booklet, 26 pp., 8'/2 x 11 ins. Illustrated. Complete details of all items of Curtis woodwork, for the use and benefit of architects, designers and builders.</td>
<td></td>
</tr>
<tr>
<td>LAUNDRY MACHINERY</td>
<td></td>
</tr>
<tr>
<td>American Laundry Machinery Co., Norwood Station, Cincinnati, O. Functions of the Hotel and Hospital Laundry. Booklet, 8'/4 x 11 ins. Illustrated.</td>
<td></td>
</tr>
<tr>
<td>Troy Laundry Machinery Co., Inc. 9 Park Place, New York City. Laundry Machinery for Small Institutions. Loose-leaf booklet, 50 pp., 8'/2 x 11 ins. Illustrated.</td>
<td></td>
</tr>
<tr>
<td>Dry Cleaning Equipment for Institutional Purposes. Brochure, 30 pp., 8'/2 x 11 ins. Illustrated.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LIGHTING EQUIPMENT</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The Lighting of Schools; A Guide to Good Practice. Booklet, 24 pp., 8'/2 x 11 ins. Illustrated.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LUMBER</strong></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>MAIL CHUTES</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutler Mail Chute Company, Rochester, N. Y. Cutler Mail Chute Model F. Booklet, 4 x 9'/4 ins., 8 pp. Illustrated.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MANTELS</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The Georgia Marble Company, Tate, Ga.; New York Office, 1328 Broadway. Why Georgia Marble Is Better. Booklet, 36 x 9 ins. Gives analyses, physical qualities, comparison of absorption with granite, opinions of authorities, etc. Convincing Proof. 5'/4 x 6 ins., 8 pp. Classified list of buildings and memorials in which Georgia Marble has been used, with names of Architects and Sculptors.</td>
<td></td>
</tr>
<tr>
<td>Hurst Building, Atlanta; Senior High School and Junior College, Muskegon, Mich. Folders, 4 pp., 8'/2 x 11 ins. Details.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>METALS</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Company of America, Pittsburgh. Architectural Interior and Exterior Woodwork. Standardized Book, 9 x 11'/4 ins., 240 pp. Illustrated. This is an Architects' Edition of the complete catalog of Curtis Woodwork, as designed by Trowbridge &amp; Ackerman, architects for the Curtis Companies.</td>
<td></td>
</tr>
<tr>
<td>Curtis Details. Booklet, 295 x 23'/4 ins., 20 pp. Illustrated. Complete details of all items of Curtis woodwork, for the use of architects.</td>
<td></td>
</tr>
<tr>
<td>Curtis Cabinet and Stair Work. Booklet, 48 pp., 7'/4 x 10'/4 ins. Illustrated.</td>
<td></td>
</tr>
</tbody>
</table>

**REQUEST FOR CATALOGS**

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to The Architectural Forum, 521 Fifth Avenue, New York.
THE experience of Mr. M. J. Schubert with his cork-lined home in Pierre, S. D., affords convincing proof of the effectiveness of Armstrong's Cork-board in extremely cold weather. Mr. Schubert built his home in 1926, insulating the walls with 2,200 square feet of Armstrong's Corkboard 1 3/4 inches thick and the second-floor ceilings with 1,500 square feet, 2 inches thick. His letter, after he had lived in his house more than two years, reflects the enthusiasm invariably displayed by clients of architects who specify Armstrong's Corkboard. The letter follows:

"We have never been as warm in winter and as cool in summer as we have been since living in this house. Perfect comfort at all times. Do not notice the wind at all. The last two months have been a good test, as we have had some severe cold weather. The Armstrong's Corkboard Insulation is the best investment anybody could make when building a house. Wouldn't build one without using it—knowing what I do about it."

In specifying insulation for residence work, the proper thickness is of paramount importance. For best results, that is, for the maximum of comfort and saving of fuel per dollar invested in insulation, 1 3/4 inches of Armstrong's Corkboard is recommended for the wall and 2 inches for the ceiling or roof. If you do not have the Armstrong Catalog for Architects in your files, send for it at once. Armstrong Cork & Insulation Company, (Division of Armstrong Cork Company), 900 Concord St., Lancaster, Pa.; Mc Gill Bldg., Montreal; 11 Brant St., Toronto, 2.

Armstrong's Corkboard Insulation

A Heatproof Lining for Walls and Roof
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 194

MILL WORK—See also Wood—Continued

Hartmann Lumber Company, 2155 E. 11th Ave., Chicago, Ill.
Column Catalog, 275 ft x 10 ins., 48 pp. Illustrated. Contains prices on columns 6 to 36 ins. diameter, various designs and illustrations of columns and installations.

The Prowler, 84 x 11 ins., 64 pp. Illustrated. Contains illustrations of pergola lattice, furniture in wood and garden, cement, garden accessories.

Klawonn & Co., Inc., 19 East 27th St., New York, N. Y.
Two Dwirwood Interiors. Folder, 4 pp., 676 x 11 ins. Illustrated. Deals with interior woods.

A New Style in Interior Decoration. Folder, 4 pp., 676 x 11 ins. Deals with interior woods.


Roddis Lumber and Veneer Co., Marshall, Wis.
Roddis Doors. Brochure, 24 pp., 3545 x 855 ins. Illustrated price list for doors. Folder, 6 x 9 ins. An interesting color catalog in the ten shades in which Clinton Mortar Colors are manufactured.


MORTAR AND CEMENT COLORS

Clinton Metallic Paint Co., Clinton, N. Y.
Clinton Mortar Colors, 105 x 11 ins., 4 pp. Illustrated. Gives full information concerning Clinton Mortar Colors with specific instructions for application.

Sonneborn Sons, Inc., Dept. 4, 116 Fifth Ave., New York, N. Y.
Color Catalog, 855 x 11 ins. Illustrated. Color of cement in the ten shades in which Clinton Mortar Colors are manufactured.


ORNAMENTAL PLASTER

A Book of Old English Designs. Booklet, 47 plates, 12 x 9 ins. A line of decorative plaster work.


Decorative Ceiling Booklet, 22 plates, 7 x 9 ins. An important work on decorative plaster ceilings.

PAINTS, STAINS, VARNISHES AND WOOD FINISHES

Minnewax Company, Inc., 11 West 42nd St., New York.
Color Chip and Specifications for Minwax Brick and Cement Coating. Folder, 4 pp., 855 x 11 ins. Illustrated.

National Leaded Glass, 161 Broadway, New York, N. Y.
Handy Book on Painting. Book, 154 x 94 ins., 100 pp. Gives directions and formulas for painting various surfaces of wood, plaster, metals, etc., both interior and exterior.


Gatle Lead. Booklet, 6 x 9 ins., 12 pp. Illustrated. Describes the country by sections.

Pratt & Lambert, Inc., Buffalo, N. Y.
Special Manual for Paint, Varnishing and Enameling. Booklet, 38 pp., 7x5 x 1045 ins. Complete specifications for painting, varnishing and enameling interior and exterior wood, plaster, metal, and metal work.

Shaw-Wilkins Company, 601 Canal Rd., Cleveland, Ohio.
Painted Surfaces and Stucco Surfaces. Bulletin No. 1. 855 x 11 ins., 8 pp. Illustrated. A complete treatise with complete specifications for the subject of Painting of Concrete and Stucco Surfaces. Color chips of paint shown in bulletin.

Revised Finish for Interior and Exterior Surfaces. Bulletin No. 2, 855 x 11 ins., 12 pp. Illustrated. Thorough discussion, including complete specifications for securing the most satisfactory enamel finish on interior and exterior walls and trim.

Plastic Coatings Laboratory of Interior Walls, Bulletin No. 4, 855 x 11 ins., 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. 5, 855 x 11 ins. Illustrated. A practical color analysis of metal and various causes of corrosion. Accompanying text is complete and written in a scientific manner.

Somehow Sons, Inc., L. Dept. 4, 116 Fifth Ave., New York, N. Y.

Toch Brothers, New York, Chicago, Los Angeles.
Architectural Specifications. Sheets in loose leaf binder, 855 x 11 ins., dealing with an important line of materials.

U. S. Gypsum Co., Chicago, Ill.
Information Book. Brochure, 24 pp., 5 x 9 ins. Lists grades of plaster manufactured; gives specifications and uses for plaster.


REQUEST FOR CATALOGS

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to THE ARCHITECTURAL FORUM, 521 Fifth Avenue, New York.

PAINTS, STAINS, VARNISHES AND WOOD FINISHES—Continued

Valentine & Co., 464 Fourth Ave., New York, N. Y.
How to Use Valapar. Illustrated booklet, 32 pp., 354 x 8 ins. Deals with interior uses for Valapar.

How to Keep Your House Young. Illustrated brochure, 24 pp., 856 x 11 ins. A useful work on the upkeep of residences.


PARCEL DELIVERY DEVICES


PARTITIONS

Circle A. Products Corporation, New Castle, Ind.

Dahlstrom Metallic Door Company, Jamestown, N. Y.

Masserman Company, E. F., Cleveland, Ohio.
Hollow Steel Standard Partitions. Various folders, 856 x 11 ins. Illustrated. Gives 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, 856 x 11 ins., 14 pp. Illustrated. Shows typical offices laid out with Telesco partitions, cuts of partition units in various specifications and cuts of buildings using Telesco.

Detailed Instructions for Erecting Telesco Partitions. Booklet, 24 pp., 856 x 11 ins. Illustrated. Complete instructions, with cuts and drawings, showing how easily Telesco Partition can be erected.

Partitions. Booklet, 7 x 10 ins., 22 pp. Illustrated. Describes complete line of track and hangers for all styles of sliding, accordion, and flush-door partitions.

U. S. Gypsum Co., Chicago, Ill.

PIPE

American Brass Company, Waterbury, Conn.

American Rolling Mill Company, Middletown, Ohio.

Clow & Sons, James B., 354 S. Franklin St., Chicago, Ill.
Catalog A. 4 x 1055 ins., 700 pp. Illustrated. Shows full line of steam, gas and water works supplies.

Coburn Rolling Mill Company, Coburn, Ohio.

Duriron Company, Dayton, Ohio.
Duriron Acid, Alkali, Rust-proof Drain Pipe and Fittings. Booklet, 20 pp., 856 x 11 ins. Illustrated. Important data on a valuable line of pipe.

National Tube Co., Erie Building, Pittsburgh, Pa.
"National" Bulletin No. 2. Corrosion of Hot Water Pipe, 856 x 11 ins., 24 pp. Illustrated. In this bulletin is summed up the most important research dealing with hot water systems. The text matter consists of investigations by authorities on this subject.

"National" Bulletin No. 3. The Protection of Pipe Against Internal Corrosion, 856 x 11 ins., 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. 26. "National" Pipe in Large Buildings. 856 x 11 ins., 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., 856 x 11 ins., profusely illustrated with halftone and line engravings of the important operations in the manufacture of pipe.

PLASTER

Information Book. Brochure, 24 pp., 5 x 9 ins. Lists grades of plaster manufactured; gives specifications and uses for plaster.

No. 45 Sylphon Damper Regulator, with bulb 4 in. long, can be screwed directly into boiler or into pipe fitting. Will control water temperatures from 120° to 220° F.

That is why Sylphon Damper Regulators have been made standard equipment by over thirty of the nation's leading boiler manufacturers.

Long Life Automatic Control
When you install a boiler equipped with a Sylphon Damper Regulator you give to the customer a guarantee of life-long automatic control with attendant fuel economies, regardless of whether the system be hot water or steam. A Sylphon Damper Regulator can easily be installed on an old heating system with positive assurance of satisfactory results.

Damper Regulation for hot water heating systems is fully as important as for steam heating systems. Sylphon Damper Regulators on hot water heating systems maintain water temperatures at exactly the desired point. Home owners are sure to appreciate the permanent heating satisfaction—the reduced fuel consumption and freedom from care which Sylphon Damper Regulators provide.

No. 45 A.
Used to control the dampers on hot water heating boiler and tank heaters. Simple, accurate regulators which will regulate the draft so as to maintain a constant temperature of the water at any point between 120° and 220° F.

Let us send you complete details of Sylphon Damper Regulators.
Write for Bulletin ADR—

FULTON SYLPHON CO.
KNOXVILLE, TENN., U.S.A.

## SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 196

### PLASTER—Continued

**Interior Walls Everlasting.** Brochure, 26 pp., 8¼ x 11½ ins. Illustrated. Describes origin of Kleece’s Cement and views of buildings in which it is used.

### PLUMBING EQUIPMENT

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Address</th>
<th>Catalog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clow &amp; Sons, Inc., Chicago, Ill.</td>
<td>354 S. Franklin St., Chicago, Ill.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>Plumbing Suggestions for Schools, Railroads and Industrial Plants</td>
<td>354 S. Franklin St., Chicago, Ill.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>John Douglas Co., Cincinnati, Ohio.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Douglas Plumbing Fixtures.</td>
<td>Address: 442 Franklin St., Kewanee, Ill.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>Another Douglas Achievement. Folder, 4 pp., 8½ x 11 ins. Illustrated. Data on new type of stall.</td>
<td>Address: 442 Franklin St., Kewanee, Ill.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>Hospital, Brochure, 60 pp., 8½ x 11 ins. Illustrated. Deals with specifications for hospitals.</td>
<td>Address: 442 Franklin St., Kewanee, Ill.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>Duriron Company, Dayton, Ohio.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.</td>
<td>Catalog, 12 ins.</td>
<td></td>
</tr>
<tr>
<td>The Trane Co., La Crosse, Wis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>John Van Range Company, Wilmington, Del.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madison's Sons Company, Thomas, Trenton, N. J.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Western Expanded Metal Company, Chicago, Ill.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roofing Services, 521 Fifth Avenue, New York.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio Corporation of America, Woolworth Building, New York City</td>
<td>10 East 40th St., New York, N. Y.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>Radiator Corporation of America, Woolworth Building, New York City</td>
<td>10 East 40th St., New York, N. Y.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>The Trane Co., La Crosse, Wis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio equipment for hotels, hospitals, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Control of Refrigeration Systems.</td>
<td>21 East 40th St., New York, N. Y.</td>
<td>Catalog 12 ins.</td>
</tr>
<tr>
<td>Refrigeration</td>
<td>North Western Expanded Metal Company, Chicago, Ill.</td>
<td>Catalog 12 ins.</td>
</tr>
</tbody>
</table>

### PNEUMATIC TUBE SYSTEMS

- **John Douglas Co., Cincinnati, Ohio.**
- **Clow & Sons, James B.**
- **Speakman Company, Wilmington, Del.**
- **Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.**
- **Kewanee Private Utilities Co., 442 Franklin St., Kewanee, Ill.**
- **Gillis Building Corporation, 21 East 40th St., New York, N. Y.**
- **Radio Corporation of America, Woolworth Building, New York City.**
- **Ludlow-Celvin Company, 104 S. Michigan Ave., Chicago, Ill.**
- **North Western Expanded Metal Company, Chicago, Ill.**

### ROOFING

- **Heinz Roofing Tile Co., 1253 West Third Avenue, Denver, Colo.**
- **Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8½ x 11 ins. Illustrated. Planning Hospitals and Industrial Buildings in which it is used.**
- **Ramp Buildings Corporation, 521 Fifth Avenue, New York, N. Y.**
- **Heinz Roofing Tile Co., 1253 West Third Avenue, Denver, Colo.**
- **Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8½ x 11 ins. Illustrated. Planning Hospitals and Industrial Buildings in which it is used.**
- **U. S. Gypsum Co., Chicago, Ill.**
- **Sheet Steel Trade Extension Committee, Terminal Tower, Cleveland.**
- **Sheet Metal Handbook. Brochure, 128 pp., 8½ x 11 ins. Illustrated. Apparatus for apartment houses and similar large buildings.**
- **Gypsteel Pre-cast Fireproof Roofs. Booklet, 48 pp., 8½ x 11 ins. Illustrated. Data on new type of stall.**
- **Shearing Stresses in Reinforced Concrete Beams. Booklet, 8½ x 11 ins., 136 pp., loose-leaf catalog, 8½ x 11 ins. Illustrated. Data on new type of stall.**
- **Maddock's Sons Company, Thomas, Trenton, N. J.**
- **The Blue Book of Plumbing. Brochure, 182 pp., 8½ x 10½ ins. Illustrated. Planning the Small Bathroom. Booklet, 5 x 8 ins. Discusses planning bathrooms of small dimensions.**
- **Federal Cement Tile Co., 608 S. Dearborn Street, Chicago, Ill.**
- **Ludowici-Coladon Company, 104 S. Michigan Ave., Chicago, Ill.**
- **Structural Gypsum Corporation, Linden, N. J.**
- **Heinz Roofing Tile Co., 1253 West Third Avenue, Denver, Colo.**
- **Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8½ x 11 ins. Illustrated. Planning Hospitals and Industrial Buildings in which it is used.**
- **U. S. Gypsum Co., Chicago, Ill.**
- **Sheeting Pyrofill Roof Construction. Folder, 8½ x 11 ins. Illustrated. Covers roof of surface which is poured in place.**
- **Kewanee Private Utilities Co., 442 Franklin St., Kewanee, Ill.**
- **Gyproc Building Paper. Booklet, 48 pp., 8½ x 11 ins. Illustrated. Describes Featherweight Concrete Insulating Root Slabs, including complete data, weights and dimensions, specifications and detail drawings. Also includes complete information on Featherweight Concrete Insulating Root Slabs for use with ornamented slate or copper covering. The catalog is profusely illustrated and contains also a full list of detail drawings.**
- **Examples of Thonters and Theater Roofs. Brochure, 16 pp., 8½ x 11 ins. Illustrated. Contains drawings of theaters designed by some of the country’s leading architects.**
- **Heinz Roofing Tile Co., 1253 West Third Avenue, Denver, Colo.**
- **Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8½ x 11 ins. Illustrated. Planning Hospitals and Industrial Buildings in which it is used.**
- **U. S. Gypsum Co., Chicago, Ill.**
- **Sheeting Pyrofill Roof Construction. Folder, 8½ x 11 ins. Illustrated. Covers roof of surface which is poured in place.**

### REQUEST FOR CATALOGS

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to THE ARCHITECTURAL FORUM, 521 Fifth Avenue, New York.
Many automobile accidents that might not have been serious except for flying glass led to the development of stronger, LAMINATED, non-shatterable glass.

The excessive cost of replacing toilet seats smashed by the slam-bang abuse of the careless public led to the development of indestructible Whale-bone-ite LAMINATED construction—the only construction that can be guaranteed for the life of the building—the only construction that immediately ends all replacement expense.

We and others have tried to make toilet seats as strong, as light and as sanitary by other methods. But it can't be done. Only laminated construction can give the abuse-defying strength of Whale-bone-ite—the careless abuse that every public toilet seat receives. Fourteen years and a million Whale-bone-ites in use have proved it. Today, nearly all seats going into public toilets are of laminated construction.

Whale-bone-ite Seats are found quite generally in the guest bathrooms of fine hotels as well as in public institutions where service requirements are severe. Many new apartment houses are equipping all toilets with them.

Send for free cross-section
—see its strength yourself

Figures show that on the average ordinary seats have to be replaced about every three years. If you want to end this needless expense, just as it already has been ended in more than a million public toilets in modern and remodelled buildings, simply install Whale-bone-ite Seats as fast as other seats wear out. Not only will the replacement expense end, but the toilets will be cleaner as Whale-bone-ite is easier to keep clean. Without obligation send for a free Whale-bone-ite cross-section. Simply address Dept. A-8, Seat Division, The Brunswick-Balke-Collender Co., 623 South Wabash Ave., Chicago.

Send for free cross-section
—see its strength yourself
**SELECTED LIST OF MANUFACTURERS’ SCREENS**

American Brass Co., The, Waterbury, Conn.

Facts for Architects About Screening. Illustrated folder, 95 x 114 ins., giving actual samples of metal screen cloth and data on a valuable line of screens.

**STEEL PRODUCTS FOR BUILDING**

Battleship Steel Company, Bethlehem, Pa.

Steel Joists and Stanchions. Booklet, 72 pp., 4 x 9 ins. Illustrated. Data for various types of frames, apartment houses, etc.

Sheet Steel Trade Extension Committee, Terminal Tower, Cleveland.

This committee will send upon request full data published by its members. Complete information with detailed sheets and installation instructions convenient for architects’ files.


Columbia Mills, Inc., 225 Fifth Avenue, New York, N. Y.

Orange Screen Co., Maplewood, N. J.

This company features “B” Store Front Construction, designed for the American type of building.

American Brass Co., The, Waterbury, Conn.

Catalog M, 1929 Edition, 64 pages, 8 ft x 11 ins. Illustrated. Describes the complete line of Structural Clay Tile. battalion.


Natco Face Tile for the Up-to-Date Farm Bulletin. 8 x 11 ins. Natcoiler Bulletin. 8 x 11 ins., 6 pp. Illustrated.

Natco Header Backer Tile Bulletin. 8 x 11 ins., 4 pp. Illustrated.

Terra Cotta


Terra Cotta

Terra Cotta

Steel Frame for Gasoline Service Stations. Brochure, 8 pp., 8 x 11 ins. Illustrated.


The Armoring of Structural Steel. Booklet, 8 pp., 8 x 11 ins. Illustrated. Deals with an important structural process.

STONE, BUILDING

Indiana Limestone Company, Bedford, Ind.

Volume 1. Series B. Indiana Limestone Library, 9 ins. 36 pp. Illustrated. Data for various types of stone for small houses with floor plans of each.


Pardee Tiles. Bound volume, 48 pp., 8 ft x 11 ins. Illustrated. The Art Portfolio of Floor Designs. 9 ft x 12 ins. Illustrated in color.

C. A. Dunham Co., 450 East Ohio St., Chicago, 111.

The Dunham Packless Radiator Valve. Brochure, 12 pp., 8 x 11 ins. Illustrated. Data on an important type of valve.

Jenkins Brothers, 80 White Street, New York.

Jenkins Safety Key-Set Store Front Construction. Catalog, 8 x 11 ins., 60 pp. Illustrated. Company information with detailed sheets and installation instructions convenient for architects’ files.


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

**TELEPHONE SERVICE ARRANGEMENTS**

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


Terra Cotta

National Terra Cotta Society, 19 West 44th St., New York, N. Y.


Clay Architectural Service Library. Permanently bound volume, 9 x 12 ins., containing a treatise upon the basic principles of color in architectural design, illustrating early Egyptian and modern American examples. Excellent illustrations in color.

Better Banks. 8 x 11 ins., 50 pp. Illustrating many banking buildings in terra cotta with an article on its use in bank design by Alfred C. Bossom, Architect.

TILE HOLLOW


Natco Face Tile for the Up-to-Date Farm Bulletin. 8 x 11 ins. Natcoiler Bulletin. 8 x 11 ins., 6 pp. Illustrated.

Natco Header Backer Tile Bulletin. 8 x 11 ins., 4 pp. Illustrated.

TUNA Tile


Manley Quarry Tile. Folder, 4 pp., 5 x 8 ins. Illustrated.


Pardee Tiles. Bound volume, 48 pp., 8 x 11 ins. Illustrated.


Art Portfolio of Floor Designs. 9 x 12 ins. Illustrated. Colors. Patterns of quarry tiles for floors.

**VALVES**

Cane Co., 856 S. Michigan Ave., Chicago, Ill.

No. 51. General Catalog. Illustrated. Describes the complete line of the Crane Co.

C. A. Dunham Co., 430 East Ohio St., Chicago, Ill.

The Dunham Packless Radiator Valve. Brochure, 12 pp., 8 x 11 ins. Illustrated. Data on an important type of valve.

Jenkins Brothers, 80 White Street, New York.

Jenkins Safety Key-Set Store Front Construction. Catalog, 8 x 11 ins., 60 pp. Illustrated. Company information with detailed sheets and installation instructions convenient for architects’ files.


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

Jenkins Valves for Plumbing Service. Booklet, 48 pp., 8 x 11 ins. Illustrated. Description of Jenkins Brass, Globe, Angle Check and Gate Valves commonly used in home plumbing, and from Body Valves used for larger plumbing installations.

**REQUEST FOR CATALOGS**

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to THE ARCHITECTURAL FORUM, 521 Fifth Avenue, New York.
Finishing Lumber
Bevel Siding · Drop Siding
Colonial Siding
Softwood Flooring
Ceiling and Partition
Shelving · Stepping
Casing · Base · Mouldings

A DEFINITE CHECK on LUMBER QUALITY is now PROVIDED

4-SQUARE LUMBER gives the Architect the first and only means of definitely checking lumber quality. It puts an end to uncertainty. It makes substitutions and "mistakes" easy to detect and prevent. Specifications can now be written with new confidence.

4-Square Lumber protects the architect and those who retain him.

4-Square Lumber is properly seasoned and milled to precise standards of size and finish. All pieces are cut to exact lengths and trimmed square at both ends. Grade for grade, it is the finest lumber money can buy.

Then 4-Square Lumber is packaged and labeled. Every label is plainly marked for species and grade. The lumber comes to the job in the original package. You can see that the contractor is using the species and grade you specified. You can be sure.

4-Square Lumber can now be supplied in the items listed on this page. Reliable lumber dealers have it or can get it. Contractors can meet your specifications for it.

WEYERHAUSEN FOREST PRODUCTS
ST. PAUL, MINNESOTA

Species and Grade are Marked and Guaranteed

TRIMMED SQUARE · PACKAGED · READY TO USE · GUARANTEED
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 200

VENETIAN BLINDS


VENTILATION

American Blower Co., Detroit, Mich.

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

Staynew Filter Corporation, Rochester, N. Y.
Permanite Liquid Waterproofing. Folder. 4 pp., 8½ x 11 ins. Illustrated. Describes the “Burlington” Venetian blinds, method of operation, advantages of installation to obtain perfect control of light in the room.

WATERPROOFING

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

Columbia Steel Company, Cleveland, Ohio.
Waterproofing and Dampproofing File. 36 pp. Complete descriptions and detailed specifications for materials used in building with concrete.

Minwax Company, Inc., 11 West 42nd St., New York.
Waterproofing Stadia. Folder. 4 pp., 8½ x 11 ins. Illustrated. Describes the “Burlington” Venetian blinds, method of operation, advantages of installation to obtain perfect control of light in the room.

Senoremi & Co., Ltd., 342 Madison Ave., New York, N. Y.
“Permanite 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, 8½ x 11 ins.

Sommers & Sons, Inc., 101 Madison Ave., New York, N. Y.
Epoxy Coating. Folder, 6 pp., 8½ x 11 ins. Illustrated. Data on value of materials.

Tuck PARAS, New York, Chicago, Los Angeles.
Architect’s Specification Data. Sheets in loose leaf binder, 8½ x 11 ins., dealing with an important line of materials.

WEATHER STRIPS

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

WINDOWS

Detroit Steel Products Co., 2220 E. Grand Boulevard, Detroit.
Continuous Steel Windows and Mechanical Operators. Catalog, 6¼ x 9½ ins., 46 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.

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


WOOD—See also Millwork

American Walnut. Booklet, 7 x 9 ins., 46 pp. Illustrated. A very interesting and useful 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.

Curtis Companies Service Bureau, Clinton, Iowa.
Curtis Cabinet and Stair Work. Booklet, 7¼ x 10½ ins. Illustrated.


Curtis Interior Doors. Booklet, 7½ x 10½ ins. Illustrated.


Airplane Hangar Construction. Booklet, 24 pp., 8½ x 11 ins. Use of lumber for hangars.

WOOD FINISH

Minwax Company, Inc., 11 West 42nd St., New York.
Color card and specification for Minwax Flat Finish. Folder, 4 pp., 8½ x 11 ins. Illustrated. Deals with a penetrative, preservative stain finish giving stain and soft wax effect.

REQUEST FOR CATALOGS

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to THE ARCHITECTURAL FORUM, 521 Fifth Avenue, New York.
The perfect interior telephone system provides:

- Absolute Privacy
- 24-Hour Service
- Special Services
- Unfailing Accuracy
- Low Cost of Operation
- Instantaneous Connections

The discriminating architect specifies Strowger P-A-X because it provides all of these features.

Strowger P-A-X—the most widely used automatic interior telephone system—is known not alone for its invaluable contribution to efficient handling of interior communication but also for a long list of practical special services for which many of the types may be equipped; for example:

Code Call Service makes Strowger P-A-X a most efficient paging system, permitting the immediate location of, and conversation with, any employee, no matter where in the organization he may be.

Conference Service permits the holding of a telephone conference at any time, the conferrees remaining at their desks.

Executives' Priority Service provides right-of-way for designated executives' telephones over ordinary connections.

Emergency Alarm Service may also be provided, the Strowger dial making each P-A-X telephone a potential reporting station for alarms.

Watchmen's Supervisory Service, by means of which the chief watchman may keep in constant touch with his subordinates at all times, certain designated telephones being used as reporting stations.

You are invited to call upon Strowger engineers to make a survey of the needs of your client in connection with any project involving the specifying of interior telephone equipment. Studies will be made and estimates submitted entirely without cost or obligation.

The makers of Strowger P-A-X are the originators and foremost manufacturers of automatic telephone systems for both public and private service. The complete line of Strowger Automatic Systems embraces a wide variety of communication and signaling equipment for industry and business in general. Complete information will be gladly supplied on any of the following products:

- Public Automatic Telephone and Signalling Systems
- Private Automatic Telephone Systems—(Strowger P-A-X)
- Code Signal Systems (Audible and Visual)
- Fire Alarm Systems
- Railway Communication Equipment
- Marine Telephone & Signalling Systems
- Miscellaneous Telephone and Signal Accessories.

Strowger P-A-X render every special service required.
FROM MANHATTAN TO
THE GOLDEN GATE

Architectural preference for United Hollow Metal Doors and Trim is confined to no section or city. From Manhattan to the Golden Gate an ever-increasing percentage of the more important commercial buildings are employing this durable, fire-safe construction.

A current example is the 450 Sutter Building at San Francisco of which J. R. Miller and T. P. Flueger are the architects. This most recent addition to West Coast sky-scrapers has all elevator and swing doors and frames of United construction. Wherever the project, United engineering service is promptly available through a far-flung field organization.

THE UNITED METAL PRODUCTS CO.
MEMBER PRODUCERS COUNCIL
CANTON, OHIO

MICHEL & PFEFFER IRON WORKS—SAN FRANCISCO, CAL.
WEST COAST REPRESENTATIVE

---

MINERAL WOOL
The Perfect Insulator

\[ \text{COLD PROOF} \quad \text{HEAT PROOF} \quad \text{FIRE PROOF} \quad \text{SOUND PROOF} \quad \text{VERMIN PROOF} \]

for Year Round Protection

Prospective home owners can greatly reduce the upkeep of their homes and add untold comfort by insisting that they be properly insulated. Mineral Wool, placed in the walls, floors and rafters of a building, will keep it many degrees warmer in Winter and cooler in Summer, in addition to making it thoroughly sound proof.

Its first cost is its last cost—and this is quickly offset by the saving it effects in Winter fuel. Mineral Wool is a sanitary, indestructible, entirely mineral material, easy to apply and low in cost. We will gladly send you a free sample of Mineral Wool and our illustrated booklet upon request.

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

---

AUTOMATIC SELF-LOCKING DELIVERY RECEPTACLE

Installed in door or outside wall, apartment or residence. After a delivery is made, outside door automatically locks and remains so until delivery is removed through inside door. After delivery is removed inside door automatically locks and outside door is unlocked for next delivery. On market 13 years. In many finest residences and apartment buildings in United States. Permanently lasting as the building itself. Highly refined, in accordance with every architectural and building standard: yet not expensive. Architect’s portfolio explains in complete detail, with interesting drawings of installation and usages. Write for copy now. Or see Sweet’s catalog.

RECEIVADOR

WRITE TO
RECEIVADOR SALES COMPANY
71 Ionica Ave., N.W. Grand Rapids, Mich.
WIDENING THE HEARING CIRCLE

Progressive architects—ever awake to the value of "widened circles"—have succeeded in widening the hearing circle to its utmost limits. Now—thanks to the Western Electric Public Address System—that circle includes the entire building.

Mere walls need no longer impede the distribution of sound. The same voice—the same full-toned music—the same radio pick-up, may be heard in one room, or 1,500 rooms at once.

That means, hundreds of specific uses in any architectural undertaking: in civic buildings, in hotels, hospitals, schools, clubs and auditoriums. In fact, there are no limits to the applications of the Public Address System in any building—save the limits of human ingenuity.

Architects everywhere are taking advantage of the endless possibilities of this system—as an opportunity to render their clients a definite, bigger, and far-reaching service. Without doubt, your client will be interested . . . For full information, consult Sweet's Catalogue. Or send for interesting booklet to the distributor, Graybar Electric Company, Graybar Building, New York, N. Y. Offices in 72 principal cities.

Western Electric
PUBLIC ADDRESS AND MUSIC REPRODUCTION SYSTEMS
Distributed by Graybar Electric Company
TRUSCON
INTEGRAL
DOOR JAMBS AND TRIM

THIS complete Door Frame and Trim is anchored into the construction and becomes an integral part of the building. No door bucks nor plaster grounds are required.

Truscon Integral Door Jambs and Trim are of high quality throughout and adapted to the finest buildings. They are fireproof and permanent, eliminating unsightly shrinkage cracks in casings and plaster.

Furnished in standard sizes for single doors from 2'-0" to 4'-0" wide, and for double doors 4'-0" to 8'-0" wide, both in heights from 6'-6" to 7'-6".

Made with or without transom bar as integral part of frame.

Write for full information and quotations

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO
Steel Door Division
Truscon Steel Company of Canada, Limited, Walkerville, Ontario
Sales and Engineering Offices in all Principal Cities

There Was Much To Be Done

WHEN this photograph was taken there was still a lot of work to be done before goods could be displayed and the public invited to enter.

Walls and floors, Elevators, Heating and lighting. One group of workmen after another. And then, when the great establishment approached the appearance of completion, the final test. Would it really be "shelter" for thousands of people and protection for merchandise, or would it allow drafts of air to filter through, carrying in dust and moisture and cold?

Obviously it would have been folly to neglect so important a detail in a structure of this character, so the points most easily penetrated were protected against the attack of wind pressure. Joints around wall openings were calked with Pecora Calking Compound. At the same time, the projecting masonry courses were protected from moisture-damage by calking with the same material.

Pecora Calking Compound is made by the makers of Pecora Mortar Stains—the pulp mortar colors.


Please tell me why a building isn't completed until it is calked. And give me full information on Pecora Calking Compound.

PECORA PAINT COMPANY,

Name ...........................................................
Firm Name .......................................................
Street and No ...................................................
City and State ..................................................
What Is Incineration?

The Incinerator
Plus The Service
Plus The Company

The Service

Savings on incineration begin with the building plans. The proper location of the incinerator often affects building costs and is frequently a difficult technical problem.

KERNERATOR sales-engineers located in over one hundred cities are trained to locate the incinerator on the plans for the greatest economy to the builder, and the greatest convenience for the occupants of the building.

You can bring your incineration problems to us with the certainty that the proper solution will be found in our experience, as old as the industry.

KERNER INCINERATOR CO.
715 EAST WATER STREET MILWAUKEE
THE reference books you depend upon give a good general idea of Vilter ice-making and refrigeration machinery.

Any detailed information desired will be furnished on request. Simply address our Engineering Department on whatever problem arises.

Remember, so long as you want facts regarding any phase of refrigeration, Vilter stands ready to furnish the data that will enable you to proceed rapidly, economically, surely. The Vilter Manufacturing Company, 815 Clinton St., Milwaukee, Wisconsin.

Write

Send the coupon below for special Bulletins.

The Vilter Manufacturing Co.
815 Clinton Street
Milwaukee, Wisconsin

Please send me FREE Bulletins covering the following subjects:

Name
Address

Clinton
for Durability

CLINTON Colors are specified for mortar and cement by far-seeing architects.

Down through the ages, Clinton Colors will withstand the elements for they are Nature's own mineral pigment—impervious to the pranks of the weather.

These colors are especially adaptable for use wherever concrete and cement demand a touch of "that something different." Would you like us to send you the full story about Clinton Mortar and Cement Colors?

CLINTON METALLIC PAINT CO.
4109 Clinton Road, Clinton, New York

KITCHEN PLANNING
DESIGNING and
ENGINEERING

Our service covers every phase of the kitchen, from its layout, to its complete equipment, for preparing and serving food. Savings in time and labor of operation assured. Standardized and special equipment furnished. We recruit from the world's markets. No playing favorites. The need defines the selection.

BRAMHALL·DEANE·CO.
40-53 E. 21st Street
NEW YORK CITY
or 100 tons of refuse daily

...there's an Incinor that does the job

Incinor Engineers invite consultation on your every Incineration Problem

WHETHER you're designing the tiniest honeymoon bungalow or a giant industrial plant, there's an Incinor specially built to your need. Portable, "Brick Set" and special Forced Draft types; for the quick disposal of every possible variety of wet garbage, refuse, rubbish, sludge, trade and mill wastes and animal and vegetable matter.

Incinors dispose of both wet and dry material with equal efficiency. Special exclusive patented features accomplish complete destruction of contents with a rapidity unknown in other types of incinerators—and without smoke, embers or odors.

Three Different Types


For Mills, Factories, Hotels, Medical Institutions and all types of Industry—Incinor "Brick Set" Waste Furnaces, Goder-designed. Capacities from 175 pounds per hour up. The Goder Step-Grate Natural Draft combustion process employed in these models is the most efficient and economical known in incineration. May be fired with gas or any other auxiliary fuel if needed. Special Hospital Type for Medical Institutions.

For Municipalities and large Corporations—Incinor Forced Draft Waste Furnaces—Goder-designed and built to the specific requirements of each installation in any capacity from 25 tons daily up. Free architectural data on all models gladly furnished.

HOME INCINERATOR COMPANY, Security Building, Milwaukee, Wisconsin

© 1929, H. I. Co.

HOME INCINERATOR COMPANY, Dept. I-10 Security Bldg., Milwaukee, Wis.

Kindly send Architectural data on:

☐ Portable Incinor
☐ "Brick Set" Incinor
☐ Forced Draft Incinor

Name..................................
Address.................................
City..................................
One of the greatest Contributions ever made to Hot Water Heating

ARCO PACKLESS No. 901

This claim is made because the 901 is the first and only hot water valve to combine these three vital features all in one valve—at practically no extra cost.

PACKLESS—Does away with the expense and trouble of repacking—complete protection against leaks.

SWINGING PLATE—So designed that it acts as a cleaning tool—Impossible for the valve to stick.

EQUALIZING FEATURE—Adjustable stop with indicator makes it possible to balance the job after installation and then set permanently, maintaining a perfect equalization of flow regardless of pipe size.

Never has any heating accessory met with such widespread acceptance—Leading heating contractors everywhere were quick to realize the great improvements this new valve will effect in hot water jobs.

The 901 is only one of a complete line of Packless valves for steam, water or vapor.

PART ONE

The Georgian Period

Edited by WM. ROTCH WARE

ORIGINAL EDITION

The plates of this standard work prepared under the supervision of William Rotch Ware have long been considered the most authentic source for details of the best examples of our Colonial Architecture. The exteriors shown in this Original Edition were reproduced by the Heliotype process that gives every line and curve its full value. The drawings of elevations, sections, details, etc., are all measured and scaled. Profiles and ground plans are also given to complete the picture.


There are over 200 drawings covering interiors, and exteriors of residences and churches with details of doorways, porches, entrances, mantels, staircases, furniture, pulpits and naves, etc. The plates are 10x14 inches in size.

Price $6.00 Postpaid

ARCHITECTURAL FORUM Book Dept.

521 Fifth Avenue, New York City
SAVE valuable KITCHEN floor SPACE

This Electrolux Refrigerator saves space by doing two jobs

MAKE half the floor area do twice the work. That sounds hard, but it's very simple... with an Electrolux Double-Duty Gas Refrigerator.

The Double-Duty is a new design among refrigerators. The top can be used as a kitchen work table or as the base for a gas range. Either way, it eliminates space for one article of kitchen furniture. Besides its convenient design, the Double-Duty has all the unique advantages of every Electrolux Gas Refrigerator.

There isn't one bit of machinery in the Electrolux... not a single moving part to grind or whirr... to disturb tenants... to get out of order. A tiny gas flame and a trickle of water do all the work of making endless dry cold. Furthermore, the Gas Refrigerator costs least to operate of all refrigerating systems.

Write to-day for full information about the many different Electrolux models. There's one for the largest mansion or the tiniest apartment. And they come in colors, too. Servel Sales, Inc., Evansville, Ind.

ELECTROLUX
THE GAS REFRIGERATOR

A COMBINATION THAT SAVES SPACE. The Electrolux as a base for gas range conserves valuable floor space and gives utmost convenience in apartment kitchen.

DOUBLE WORK HERE. In picture at the left the Double-Duty serves admirably as a kitchen work table. Food capacity—6 cubic feet, 12 large ice cubes.
Identified with the Big Jobs—
this RUST RESISTING Lath

Hotel St. Regis Ball Room
Sloan & Robertson, Architects

BERLOY BUILDING PRODUCTS
Metal Lumber, Bar Joists, Metal Lath,
Corner Beads, Channels, Wall Tiles, Cool
Doors, Steel Ceilings, Shingles, Floor Cores,
etc.

WHEN a plaster job assumes
the responsibility of period
interpretation in ceiling, sidewall,
pilaster and arch, the lath speciﬁcation takes on a new signiﬁcance.

A plaster reinforcement, expanded
from Toncan Copper Molybdenum
Iron, with its universal acceptance
for rust resistance, would, in itself justify preference. In addition, all Berloy laths have re-
squared ends, full covering width and the maximum number of
strands per square inch to insure
plaster economy and strength.

When you specify Toncan, your
plaster base exempliﬁes the mod-
ern application of product justi-
ﬁcation.

A Berloy lath for every purpose.

THE BERGER MFG. CO.
CANTON, OHIO

COMPLETE INFORMATION UPON REQUEST
HOME building has kept pace with the world. It has not lagged behind while tremendous advances and improvements were made in the radio, aviation, the automobile. Home building has made progress, too!

That progress is Steel Framing.

You do not have to make any special plans for buildings erected with Steel Framing, because Steel Framing is adaptable to any type or kind of home you may design. It is just as flexible in application as ordinary construction. Any home... regardless of the style, design, room arrangement; whether it is brick, stone or stucco... can have this strong, lasting, steel framework.

Imagine the strength and rigidity that go into a home with a steel constructed framework. Steel won't warp or shrink or weaken. Changing weather doesn't affect it. Steel Framing is permanent construction... safe from fire, rigid against wind and storm. No other material can match it for long life.

Everywhere... homes of Steel Framing are being built. It was natural that steel was chosen for progress in home building... it meets all the requirements of modern construction. And such homes are more valuable, today and fifty years from today. What is there to depreciate in this construction? A steel-built home will never be an old house. It won't sag or settle or run down like ordinary construction. It can't... it is built like a giant skyscraper and that is the strongest, most enduring method of erection known among builders all over the world.

We shall be glad to give complete information and any co-operative assistance to architects in the use of Steel Framing for the erection of truly modern homes.

STEEL FRAME HOUSE CO.
Subsidiary of McClintic-Marshall Corp.
OLIVER BUILDING, PITTSBURGH, PA.
CARNEGIE Floor Plate is the improved raised pattern type, providing a sufficient raised contact area to furnish a satisfactory bearing surface and insuring longer life, comfortable walking and high resistance to slipping. The design is such that the plate drains completely and cleans easily.

CARNEGIE Floor Plate is recommended for boiler room and industrial flooring, stair treads, sidewalk doors and openings, traffic treads on bridges, elevated platforms and for any and all service where a safe foothold is required. This plate is offered in sizes shown on left. The long dimension of the raised figure is in the direction of rolling and the length of plate required should always correspond to this direction. The thickness of plate furnished is the thickness of the flat plate, exclusive of the height of the raised figures.

CARNegie Floor Plate is the improved raised pattern type, providing a sufficient raised contact area to furnish a satisfactory bearing surface and insuring longer life, comfortable walking and high resistance to slipping. The design is such that the plate drains completely and cleans easily.

CARNEGIE Floor Plate is recommended for boiler room and industrial flooring, stair treads, sidewalk doors and openings, traffic treads on bridges, elevated platforms and for any and all service where a safe foothold is required. This plate is offered in sizes shown on left. The long dimension of the raised figure is in the direction of rolling and the length of plate required should always correspond to this direction. The thickness of plate furnished is the thickness of the flat plate, exclusive of the height of the raised figures.

CARNegie Steel Company
Subsidiary of United States Steel Corporation
PITTSBURGH, PA.
NO WELDS IN STRESS—one piece of steel—expanded—without rivets, bolts or welds in shear or tension—these are the features responsible for the rapid gain in Bates-Truss Joist popularity.

A simple I-beam section is expanded into a lattice truss web. The expansion increases the depth of the beam—the truss materially increases its strength. The points of contact of the lacing and flange members are simply unsheared portions of the original plain web. By this process, all defective beams are automatically eliminated.

Contractors, engineers, builders should all know about the Bates Expanded Steel Truss. We have prepared a book giving complete information. A copy will be mailed to you upon request.
The Floor and Roof Construction of Tomorrow

Through engineering genius and modern manufacturing methods Kalman is able to offer the architects this new and improved method for building fire-safe floors and roofs.

In this construction the principle of the old wood floor and roof construction is maintained—but the materials used are greatly improved.

Kalmantruss Steel Joists are made by a new and different method—a rolling process. As a result, joints are one-piece and the joist has unusual dependability.

Kalmantruss Rigid Bridging follows the engineering principles of wood cross bridging, but it is fire-safe.

In addition, the application of Kalmanlath and the distinctive line of Kalman accessory products, such as ceiling and floor lath clips, result in producing the improved fire-safe floor and roof construction of tomorrow.

KALMAN STEEL COMPANY
Successors to Sykes Metal Lath Company
Do not make hospital corridors into speaking tubes that carry the conversation of every visitor into wards and private rooms. Cover the ceilings with Acoustex. Acoustex does its work efficiently; eliminates irritating echoes and reverberations. Yet not at the expense of appearance. Acoustex is a ceiling finish beautiful in itself. Its rich textured surface, tinted to your specifications, is at home in any surroundings.

In more and more hospitals, offices, schools, and public buildings the ceilings of Acoustex prove that in acoustical design the trend is definitely decorative.

DO NOT make hospital corridors into speaking tubes that carry the conversation of every visitor into wards and private rooms. Cover the ceilings with Acoustex. Acoustex does its work efficiently; eliminates irritating echoes and reverberations. Yet not at the expense of appearance. Acoustex is a ceiling finish beautiful in itself. Its rich textured surface, tinted to your specifications, is at home in any surroundings. In more and more hospitals, offices, schools, and public buildings the ceilings of Acoustex prove that in acoustical design the trend is definitely decorative.

BOSTON ACOUSTICAL ENGINEERING DIVISION of HOUSING COMPANY
40 CENTRAL STREET, BOSTON, MASS.

Acoustex erectors are located in principal cities. Should one not be available in your vicinity, write direct.

ACOUSTEX
The Decorative Sound Absorbent
There is more than "black" to blackboard
... be sure of these 6 features

When you casually glance at a sample of blackboard it may be black—but we advise you to go well beyond the surface—beyond the appearance of that sample.

First—know the history of its maker—for 47 years experience has taught us that blackboard manufacturing is a highly scientific work.

Second—what pledge of satisfaction stands behind it—who makes that pledge and what do they mean? We mean complete satisfaction and our honor is more to us than a sale.

Third—is the sample a stock sample—a piece of the very same blackboard that will be installed in your school?

Fourth—is it a uniform blackboard, scientifically made to meet the exact requirements of the school, and free from all imperfections?

Fifth—is its surface "live" and elastic so that it will never check or crack—so that it will write and erase easily without causing reflection and resulting eyestrain?

Sterling Lifelong Blackboard

Sixth—is the backing permanent—one that is tough and not easily broken in transit and in handling?

Sterling performs exactly as we promise—and exactly as the educator expects an efficient blackboard to perform. It is a scientific laboratory product embodying only those features found desirable in a good blackboard.


WEBER COSTELLO COMPANY
Chicago Heights, Illinois

MAKERS OF
Sterling Lifelong Blackboard — Old — Reliable Hyleplate — Globes — Maps — Erasers — Crayon

55 Distributor Warehouses Assure You Immediate Service
ARCHITECTS of today are building for the future. Maintenance costs, and repair bills are items of utmost importance to them. That is why so many of them habitually specify Toncan Copper Mo-lyb-den-um Iron for all exposed metal parts such as gutters, canopies, flashings, sky-lights, cornices, window frames, sash, etc.

Also for those hidden parts that so quickly can send repair bills sky high. Metal lath, ventilating system, and scores of other unseen parts of great buildings are genuinely economical when fashioned from Toncan Iron.

No other metal has just the properties of Toncan. No other ferrous metal puts up so gallant a fight against corrosion and rust.

For Toncan is an alloy, made from scientifically combined pure iron, copper and molybdenum, many times more resistant to rust than ordinary metal.

If our new book on sheet iron is not in your files, we will gladly send it on request. It contains practical information of value to every architect. You should have it.

CENTRAL ALLOY STEEL CORPORATION
Massillon and Canton, Ohio
WORLD'S LARGEST AND MOST HIGHLY SPECIALIZED ALLOY STEEL PRODUCERS
Figure less radiation when Balsam-Wool is part of the heating equipment

YOU accept the insulating idea as a sound building principle. But do you think of insulation as a vital part of complete heating equipment? And when writing specifications do you consider the fact that a full inch blanketing of Balsam-Wool will reduce necessary radiation 25%—that this saving will pay all or at least a large part of this heat conservation cost?

Think of Balsam-Wool as part of the heating equipment and you'll understand why it is insulation—why it is not a structural material—why its only purpose is to insulate.

Balsam-Wool is flexible. This flexibility permits snug blanketing between studding, joists and rafters. It permits caulking of every crack and crevice. Because it can be tucked in everywhere it makes the house heat-tight and prevents the usual one-third heat loss. It supplies the comfort the home owner demands.

Balsam-Wool samples and technical data will be sent you on request. We suggest you study these and investigate before writing specifications. May we answer your questions?

Balsam-Wool is a guaranteed Weyerhaeuser product—a blanket of fluffy wood fibre that looks and acts like sheep's wool. It is TRUE Insulation—keeping the house warm in winter and cool in summer—because it is—FLEXIBLE-THICK EFFICIENT WINDPROOF WATERPROOF FIRE RESISTANT VERMIN PROOF LIGHT WEIGHT PERMANENT

WOOD CONVERSION COMPANY, CLOQUET, MINNESOTA
Makers of Balsam-Wool, the Flexible Insulating Blanket, Also Makers of Nu-Wood, the ALL WOOD Insulating Wall Board and Lath
SOLD THROUGH RETAIL LUMBER DEALERS
Nailing Strips

When a sub-floor of wood is desired to be laid directly over Havemeyer Trusses, the trusses are shipped to the job with solid 2" x 2" wood nailing strips firmly bolted in place. The flooring operation thus becomes practically identical to that used with solid wood beams, while the other advantages of the Havemeyer Truss—its rigidity, strength, fire resistance, lightness and speed of handling are still retained.

Because of the demand for comprehensive data on the various uses of Havemeyer Trusses, Concrete Steel Company has produced a complete folio of 32 pages and 3 data sheets giving the most recent information. In requesting this book, "Structural Economies for Concrete Floors and Roofs," please address Executive Offices.
Building for Safety and Saving

These desired advantages—greater rigidity, minimum dead load and economical cost—are obtained in a concrete floor of Meyer Steelform construction.

Architects and contractors, everywhere, have proved this to their own complete satisfaction—a fact that is responsible for the universal acceptance of this floor construction and for its use in the largest buildings in the world where strength, speed of operation and low cost are the real essentials.

In planning Cleveland's new tower of safety and saving—the Midland Bank Building—the architects have again paid tribute to Meyer Steelform construction and to the services of this organization which make this floor construction so intensely practical and so genuinely economical.

Meyer Steelforms are installed and removed by an organization especially trained to render the greatest possible cooperation to both architect and contractor. A nominal rental covers both installation and removal.

Warehouses located at strategic centers make immediate shipments to the building site.

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

Meyer Steelforms are furnished in 1, 2 and 3 ft. lengths. Standard widths are 20 in. and 30 in.; special widths—10 in. and 15 in.
The Beauty of Travertine

A characteristic of this new Acoustical Product

It has the richness and beauty of rare old tile. Wherever acoustics offer a problem, its remarkable quieting properties provide effective sound control.

USG Acoustical Tile absorbs noise. It is quickly applied over wall and ceiling surfaces in old or new buildings.

USG Acoustical Tile adds dignity to any decorative scheme. It is available in several shades and sizes. Redecoration is not required—simple vacuum cleaning serving to restore its original appearance.

Maximum noise absorption is assured. The United States Gypsum Company will contract for the installation of USG Acoustical Tile only where the desired results will be secured.

Complete information on this inexpensive way to reduce noise will be sent on request. United States Gypsum Company, 300 W. Adams St., Chicago, Ill. New York Office: 17 State St.

USG ACOUSTICAL TILE

A product of THE UNITED STATES GYPSUM COMPANY
from Broadway
to the
takou Road

Public Market Building, Takou Road, Tientsin, China, owned by British Concession. Fourteen Ilg Aerofin Units have operated "with entire satisfaction" since 1927.

Aerofin is the Heat-Surface in the Master Buildings of the World!


Aerofin Corporation
850 Frelinghuysen Avenue, Newark, N.J.

Burnham Bldg.
Chicago

Land Title Bldg.
Philadelphia

11 West 42nd Street, New York

United Artists Building
Detroit

Oliver Bldg.
Pittsburgh

Paul Brown Bldg.
St. Louis
Concerning
An Important
Part of
Building Planning

Run the gamut of materials or articles to be transported—from the light and fragile to the heavy and cumbersome—and you will find there is a Standard Conveying System that will admirably serve as the carrying agent.

In planning new buildings or in redesigning old ones, Architectural Engineers who are intent upon providing their clients with cost-cutting, efficient conveying systems, will do well to look thoroughly into the merits of Standard Conveyors.

Indeed, why not enlist the cooperation of our Conveyor Counselors? Experienced in the solution of conveying problems of every conceivable kind, they can perhaps render you an invaluable service. This, of course, involves no obligation.
Permits full expression of the architect’s art. Beautiful interiors depend upon this basic feature of design and construction, which gives complete freedom for correct decorative and furnishing treatment.

It eliminates the one obstacle which architects, interior decorators and owners, alike, have fought to overcome — by banishing unsightly radiators which destroy harmony and symmetry in the room.

Then there is the practical advantage of Trane Concealed Heating—more generous, cleaner and quicker heat, uniform heating, instantaneous control of heating, and continuous savings in fuel used.

Trane Concealed Heating is the big new feature of any building with which to render a real service and satisfaction to the client. It is a wonderful boon to the architect.

To recommend Trane Concealed Heating is the progressive thing to do. Leading architects are doing this and Trane sales are mounting tremendously. Invariably the complete Trane Vapor System is used, because of its known reliability.

Write now for facts regarding this revolutionizing heating method.

Trane Concealed Heating is the logical, and economical method for the modest home, as well as the palatial residence.
RELIABLE HEAT

FOR A NEW AQUARIUM

JOHN G. SHEDD AQUARIUM
OF THE FIELD MUSEUM, CHICAGO

ARCHITECTS: GRAHAM, ANDERSON, PROBST & WHITE
HEATING CONTRACTORS: MEHRING & HANSON CO.

UNIFORM temperatures eliminate many of the hazards of keeping fish healthy in aquariums...Tropical fish and aquatic animals require reliable heat...In the John G. Shedd Aquarium in Chicago, now being built, the water will be heated with IDEAL GAS BOILERS...Two million-gallon reservoirs have been provided—one for salt water and one for fresh water...This shows the magnitude of the project...The more intricate and exacting the heating problem — the more the utter reliability and positive automatic operation of IDEAL GAS BOILERS is appreciated.
The SPEED HEATER
—different in design
—radically different in price!

The smallest heaters we ever made—yet the capacities are high. The design is clean-cut. Uses high-pressure Aerofin and a two-speed motor. Vibrationless, very quiet, flexible, sturdy, easy to hang and low in price... in fact it strikes a new low!

The SPEED HEATER is manufactured in two types—Industrial and Cabinet—and in several capacities.

An interesting feature is the vertical vanes, in addition to the regular horizontal vanes. These radiate the heat in a wider arc and break up objectionable hot air streams.

Complete, but concise, Data-book now on the press. We would like to send you a copy—it will enable you to get working information on SPEED HEATERS—capacity, speeds, features... and Price!

The coupon is handy!

B. F. STURTEVANT COMPANY
Plants and Offices at: Berkeley, Cal. • Camden, N.J. • Framingham, Mass.
Galt, Ontario • Hyde Park, Mass. • Sturtevant, Wis.

B. F. Sturtevant Co. • wires: "Speed Heaters"}

The SPEED HEATER
—different in design
—radically different in price!

The smallest heaters we ever made—yet the capacities are high. The design is clean-cut. Uses high-pressure Aerofin and a two-speed motor. Vibrationless, very quiet, flexible, sturdy, easy to hang and low in price... in fact it strikes a new low!

The SPEED HEATER is manufactured in two types—Industrial and Cabinet—and in several capacities.

An interesting feature is the vertical vanes, in addition to the regular horizontal vanes. These radiate the heat in a wider arc and break up objectionable hot air streams.

Complete, but concise, Data-book now on the press. We would like to send you a copy—it will enable you to get working information on SPEED HEATERS—capacity, speeds, features... and Price!

The coupon is handy!

B. F. STURTEVANT COMPANY
Plants and Offices at: Berkeley, Cal. • Camden, N.J. • Framingham, Mass.
Galt, Ontario • Hyde Park, Mass. • Sturtevant, Wis.

B. F. Sturtevant Co. • wires: "Speed Heaters"
THE ARCHITECTS' MANUAL ON AUTOMATIC OIL BURNERS is a useful guide for any office that is planning buildings in which oil will be used as a fuel. It is of inestimable value to the designer and specification writer who wish to cover the details in connection with the installation of any approved make of oil burner. In addition to being a comprehensive textbook on oil burners, it contains a complete reprint of the Regulations of the National Board of Fire Underwriters, covering oil burners. This Manual will be sent to you upon request. It affords you the opportunity of obtaining complete information on oil as a fuel in one well-edited manual.
Do You Need a Good Book on Period Furniture or Interior Decoration?

AMERICAN FURNITURE AND DECORATION
Colonial and Federal
By Edward Stratton Holloway

FURNITURE, like people, has inherited traits as well as acquired characteristics—it is charming and altogether delightful in certain environments and not in others. It has ancestry, and really to know furniture one should know something of its history and development. American furniture in its true aspects is not known as it should be even by many decorators and furniture dealers. Here is one of the most fascinating and helpful books on American furniture that has ever been published. Mr. Holloway shows the best way of learning the "family tree" of American furniture. By the practical method of illustrating and treating the furniture of each style by itself and in proper chronological order he makes it easy to distinguish the characteristics of the styles and to place any furniture one sees. Transition pieces then cause no difficulty, for the characteristics of the two styles are recognized, and the article is assigned to its natural place between the two modes. The book is ideal for either the beginner or the connoisseur. Every detail is clearly and tersely expressed, and no information is omitted that might be necessary for complete and quick recognition of the most elaborate piece.

Here is one of the most fascinating and helpful books on American furniture that has ever been published. Mr. Holloway shows the best way of learning the "family tree" of American furniture. By the practical method of illustrating and treating the furniture of each style by itself and in proper chronological order he makes it easy to distinguish the characteristics of the styles and to place any furniture one sees. Transition pieces then cause no difficulty, for the characteristics of the two styles are recognized, and the article is assigned to its natural place between the two modes. The book is ideal for either the beginner or the connoisseur. Every detail is clearly and tersely expressed, and no information is omitted that might be necessary for complete and quick recognition of the most elaborate piece.

MANOR HOUSES AND HISTORIC HOMES
OF LONG ISLAND AND STATEN ISLAND
By Harold Donaldson Eberlein

For the architect or builder interested in re-creating our early American architecture this book is invaluable. In these stately mansions and vine-covered cottages old world glamour and dignity mingle with the freshness and vigor of a younger world, and the result is an architecture seldom surpassed for its strength and beauty. The homesteads of some of America's oldest families are here—the Vanderbilts, the Winthrops, the Townsends, the Bownes and many others. This book is one of Lippincott's Limited Editions of Historic Homes. Printed from type and not to be reprinted, it will guide them according to the number of premises is indicated—color schemes, appropriate walls, furniture, textiles and accessories being suggested for each room. The furniture illustrated is that which can be purchased in the open market. An effective plan for the securing of unity and variety in color is presented and applied. The chapters on color and form alone are worth the price of the book. 9 plates in color, 192 in double-tone, 7 diagrams. $7.50.

THE PRACTICAL BOOK OF INTERIOR DECORATION

By Harold Donaldson Eberlein, Abbott McClure, and Edward Stratton Holloway

A complete course covering interior decoration in all its phases is divided into three sections: 1. A résumé of the development of decoration in England, Italy, Spain and France; 2. The why and how in adapting this furniture to their decorative schemes. To make the furniture more comprehensible, the architectural and decorative backgrounds of each period are clearly outlined. The illustrations show clearly the details of contour, scale, material and color that distinguish the various periods. Frontispiece in color, 316 Illustrations in double-tone and 57 line-cuts. $10.00.

THE PRACTICAL BOOK OF FURNISHING THE SMALL HOUSE AND APARTMENT

By Edward Stratton Holloway

Treating of furnishing from the most inexpensively equipped cottage, bungalow or flat to the smart apartment house of fair dimensions, and by both the modern non-period and period methods. All grades of expense are provided for. Complete furnishing of a number of premises is indicated—color schemes, appropriate walls, furniture, textiles and accessories being suggested for each room. The furniture illustrated is that which can be purchased in the open market. An effective plan for the securing of unity and variety in color is presented and applied. The chapters on color and form alone are worth the price of the book. 9 plates in color, 192 in double-tone, 7 diagrams. $7.50.

THE PRACTICAL BOOK OF ITALIAN, SPANISH AND PORTUGUESE FURNITURE

By Harold Donaldson Eberlein and Roger Weare Ramsdell

A unique volume—the only one of the kind available. For the first time the furniture of these three countries is adequately and comparatively treated in one volume at moderate cost. It will fill a definite need among owners and decorators who have felt the lack of a practical and informative hand book which will guide them in adapting this furniture to their decorative schemes. To make the furniture more comprehensible, the architectural and decorative backgrounds of each period are clearly outlined. The illustrations show clearly the details of contour, scale, material and color that distinguish the various periods. Frontispiece in color, 316 Illustrations in double-tone and 57 line-cuts. $10.00.

Sent Prepaid on Receipt of Price by Book Service Department of

The Architectural Forum - - 521 Fifth Avenue, New York
When costs are figured closely, oil heating is an Electrol job

As often happens, the architect must give first consideration to cost. When this is the case, he is unable to specify the higher quality of material or product his judgment really dictates.

On the question of heating, however, the most rigid limitations as to cost entail no compromise with quality. For Electrol Automatic Oil Heat is within reach of all.

You may be thinking of Electrol in terms of high price. A natural mistake—caused in part by the widespread preference for Electrol among those to whom cost is not a consideration, and caused also by the generous praise accorded Electrol by users everywhere.

Thousands of owners and hundreds of architects will tell you that Electrol is not high in price. The healthful comfort, cleanliness, labor-saving convenience and greater fuel economy make it outstanding in value. Home builders of even the most modest means find the cost surprisingly low. And the first cost is final—no extras come later.

You will find the Electrol dealer competent to assist you in outlining specifications. He will work under your direction to determine an accurate estimate of Electrol’s cost on any given job.

ELECTROL INCORPORATED
227 E. 45th St., New York City

A Consultation Service for Architects
Electrol has a staff of engineers who devote their entire time to the formulation of heating plans and specifications from information sent us by architects. Electrol welcomes the opportunity to put this free service at your disposal.

A Cambridge, Massachusetts, home—one of the 5000 homes in New England alone which are heated by Electrol.
The new Western Union Building, now under construction in New York City, will be equipped with 20,802 sq. ft. of Vento Cast Iron Heaters.

This installation adds one more outstanding building to the already impressive list of American Skyscrapers that are Vento equipped.

For 25 years Vento has been the growing choice of heating engineers. And in all the millions of sq. ft. of Vento now in operation there is not one known instance of failure.
The Dunham Differential Vacuum Heating System will furnish delightful warmth for the tenants of this palatial new 24-story Chicago residence apartment building...

No. 1430
LAKE SHORE
DRIVE
CHICAGO

Owner: 1430 Lake Shore Drive Building Corporation, Chicago
Architects: Robert S. DeGolyer & Co., Chicago
Consulting Engineer: H. L. Clute, Chicago
Heating Contractor: Kinzie Engineering Co., Chicago

No. 1430 Lake Shore Drive is an outstanding building projecting some 270 feet skyward amid a setting of famous skyscraper apartment buildings, with a permanently unobstructed and commanding view of Lake Michigan. It contains twelve twelve-room apartments, including six baths, and eleven eleven-room apartments, including five baths. Its architecture is modified Tudor Gothic. The first floor plan includes a twenty car garage for use of tenants, with chauffeurs room adjoining.

The apartments, each of which occupies an entire floor, give the privacy of a detached residence and offer the most lavish and complete of accommodations, with every modern convenience and improvement for the comfort and welfare of tenants.

The Dunham Differential Vacuum Heating System installed in this palatial building will simulate, as closely as modern heating science can accomplish it, the balmy, delightful warmth of famous winter resorts in California and Florida. There will be no overheating in this building. Regardless of the outdoor weather conditions, each room will be warmed to a degree that is comfortable—healthful—exactly right for ideal living conditions. The structure has a total cubage of 1,439,970 cu. ft. and its heating system comprises 20,622 sq. ft. of direct radiation.

Over eighty 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.

C. A. DUNHAM Co.
DUNHAM BUILDING
450 East Ohio Street : CHICAGO

Look for the name DUNHAM

This nameplate identifies a genuine Dunham Thermostatic Radiator Trap
More Than Mechanical Equipment

A satisfactory installation of heating and ventilating equipment requires more than a series of mechanical units. It requires engineering skill and service. These intangible factors are just as important as silent operation, an efficient radiator, up-to-date methods of temperature control, and other features which are embodied in the modern PEERVENT Unit. This Company offers the service and skill of the Pioneers in unit heating and ventilation. Peerless Units installed eighteen years ago are still giving satisfactory service, and the improved PEERVENT Unit of today is backed by forty years of specialized experience in heating and ventilating. For catalog, please address

PEERVENT

PEERLESS UNIT VENTILATION CO., Inc.
Bridgeport, Conn.

Sales and service representation in all principal cities from coast to coast.
MODERN woman’s scanty raiment brings the need for more heat in homes than is comfortable for wool-clothed men. The heating system that satisfies every member of the family must enable the occupant of each room to govern its temperature without effect on any other room.

Many architects and heating engineers have found the answer. It is Hoffman Controlled Heat. With this modern luxurious system, the heat output of each radiator is regulated or changed at any time by the pressure of a finger on the lever handle of the radiator valve. This system automatically adjusts itself to the hour-to-hour need for heat. It is economical as well as comfort assuring, because only as the call for heat increases does the supply of steam automatically accumulate.

The equipment that makes it a Hoffman Controlled Heat system can be added to any standard boiler and radiators, coal, gas or oil fired. This equipment includes (1) Hoffman No. 7 modulating valves, which are easily adjustable for quick balancing of the system and for controlling steam flow into each radiator, (2) Hoffman return line valves, which automatically open for passage of water and air and close to steam, (3) the precise Hoffman Damper Regulator, which in response to the demand for steam automatically operates the check damper and draft door, (4) the remarkable Hoffman Differential Loop which safeguards the water line of the boiler, and, (5) the No. 15 Vacuum Valve.

Hoffman Controlled Heat is guaranteed in writing by a conscientious maker to fulfill every promise for years. For architects and heating engineers who are interested in modern heating methods we have published a booklet describing in detail the operation of Hoffman Controlled Heat. Address Hoffman Specialty Company, Inc., Dept. EF-10, Waterbury, Connecticut. It will reach you promptly.
Cabinet Heaters

MORE and more, architects are specifying Modine Cabinet Heaters—the modern Copper Radiation.

The improved room appearance with Modine Equipment is something that even builders of more modest homes desire. And for the costly home, nothing else could suffice.

Latest Catalog Sent on Request

MODINE MANUFACTURING COMPANY (Heating Division) 1718 RACINE ST., RACINE, WIS.
London Office: S. G. Leach & Co., Ltd., 26-30 Artillery Lane - - - - - - - - - - - - - - - Branch Offices in all Large Cities
30 stories below here

...you'll find

TITUSVILLE BOILERS. They are preferred for their performance. And men instinctively choose them as heating equipment for the modern building. Because their reputation for excellent quality and absolute dependability is long standing.

TITUSVILLE IRON WORKS
Division of Struthers-Wells Titusville Corp.
TITUSVILLE, PA.

TITUSVILLE STEEL BOILERS
Until now, the architect has never had a dependable yardstick for measuring the cost of heating.

The cost per room, cost per family per day, cost per cubic contents—these are no more accurate than an order for a house full of lumber. Any large unit, like the annual ton cost, varies widely in different years.

There is a unit of heating cost, which makes surprisingly little variation from year to year. It is based upon the scientific relationship between cubic contents, exposed surfaces, glass areas, and all of the factors which make heating costs for buildings of the same size vary so widely.

The radiation is gauged according to the building's needs. Two buildings of equal size may require vastly different radiation maximums. The cost of heating will naturally vary. Yet the cost of heating each square foot of radiation should not vary, if the radiation is correctly figured. That is why this new unit of heating measure, the cost per square foot of radiation per annum, is fast becoming known familiarly by its initials—c.p.s.f.

It is when the cost of heating is reduced to the c.p.s.f. that architects have been able to demonstrate to their clients the amazingly efficient operation of the Spencer Magazine Feed Heater. In residences, by using No. 1 Buckwheat anthracite, instead of larger sizes that cost twice as much, the Spencer can cut the annual heating cost in half. In the middle west, where anthracite is not used at all, Spencer Heaters use small size coke, to produce heat at a c.p.s.f. that is as much as one-third less than the cost with soft coal.

In schools, the most remarkable demonstration has been made. Spencer Heaters have been able to cut the c.p.s.f. to an average of ten cents and lower. Some instances are recorded of cost cut as low as six and ninetenths cents per square foot of radiation per year. You probably have some data on buildings in which you are interested, where the heating costs run as high as thirty and forty cents per square foot.

If you are interested in low cost heat for large buildings, write in and ask for detailed information, with the names of the buildings, their locations, and the size and type of Spencer boiler used. This should be of value to the architect in the design of all public buildings. Spencer Heater Company, Williamsport, Pennsylvania.
Johnson All Metal Intermediate Thermostat illustrated above, is a graduated acting thermostat which opens and closes dampers or valves gradually, and holds them partially open or partially closed for a long or short period, as conditions require. The Johnson Intermediate graduated acting thermostat has been on the market since 1906, and is performing with perfect satisfaction in thousands of buildings in which it has been installed, giving the true gradual motion to dampers and valves.

THE ULTIMATE OBJECT OF ALL HEATING AND VENTILATING SYSTEMS IS TO CREATE A CORRECT CONDITION IN A BUILDING, FOR THE BETTER HEALTH AND COMFORT OF THE BUILDING'S OCCUPANTS. PRODUCTION OF HEAT AND HUMIDITY AND THE DIFFUSION OF THEM ARE EASILY OBTAINED. HOWEVER, POSITIVELY CORRECT CONDITION REQUIRES AND DEPENDS UPON CONTROL INSTRUMENTS, THERMOSTATS AND HUMIDOSTATS OF PRECISE ACCURACY AND EFFICIENT OPERATION. JOHNSON SERVICE COMPANY IS THE ORIGINATOR OF PNEUMATIC THERMOSTATS AND HUMIDOSTATS, AND HAS BEEN MANUFACTURING AND INSTALLING THESE CONTROL INSTRUMENTS FOR MORE THAN FORTY YEARS. JOHNSON THERMOSTATS AND HUMIDOSTATS APPLY TO EVERY FORM AND PLAN AND SYSTEM OF HEATING AND VENTILATING APPARATUS WITH MARVELOUSLY ACCURATE RESULTS AND SATISFACTORY SERVICE, AND ARE ACCEPTED TODAY AS STANDARD. WRITE NOW FOR THE BOOK, "JOHNSON SYSTEM OF TEMPERATURE AND HUMIDITY CONTROL".

JOHNSON SERVICE COMPANY, MILWAUKEE, WIS.
BRANCHES IN ALL PRINCIPAL CITIES

THE ALL PERFECT AUTOMATIC GRADUATED CONTROL OF VALVES AND DAMPERS. FUEL SAVING 25 TO 60 PER CENT PER YEAR.

JOHNSON HEAT AND HUMIDITY CONTROL
The matter of heating which must be decided by a prospective home owner,—or more frequently by his architect,—involves making a choice among several types of heating equipment. The principal types are: oil, natural gas, electric, and solar. Each has its advantages and disadvantages. For example, oil is the most efficient fuel, but the least convenient to handle. Electric heating is the most convenient, but the least efficient. Solar heating is the most efficient, but also the most expensive.

In choosing one of several kinds of fuel, most people consider heating efficiency and cost. However, it is important to consider other factors as well, such as comfort, ease of maintenance, and environmental impact. For example, natural gas is a clean-burning fuel, but its extraction and transportation can be environmentally harmful. Solar heating, on the other hand, is a renewable resource, but its effectiveness can be affected by weather conditions.

It is also important to consider the long-term costs of different heating systems. While the initial cost of installing a solar heating system may be higher, the long-term savings can be significant. Similarly, while electric heating may be less efficient, the cost of electricity is often lower than other fuels.

In the end, the choice of heating equipment will depend on the specific needs and preferences of the homeowner. It is important to consult with a qualified heating contractor to help make an informed decision.
The radically different

FIREBOX BOILER

The Z U is a distinct advance in firebox boiler design. It is a better firebox boiler because it adds to the time-tried-and-proven good points of the conventional design a number of vital developments which (1) definitely improve combustion; (2) produce quicker, more efficient heat transfer. Ample proof of the benefits of these developments is furnished by the many installations in which more steam at substantially lower cost is the rule.

The new Z U Boiler Catalog explains these developments and the clear-cut scientific principles on which they are based. It shows: how complete combustion with minimum excess air is secured; how the thermo-syphonic action created by the design induces a remarkably positive and forceful water circulation; why the Z U picks up the heating load with unusual speed. It also explains the many other noteworthy features of this outstanding steel firebox boiler and gives complete information as to ratings and dimensions.

Write for a copy of the Z U catalog—today.

FITZGIBBONS BOILER CO., Inc.
570 SEVENTH AVE.
NEW YORK, N. Y.
WORKS: OSWEGO, N. Y.
BRANCHES AND REPRESENTATIVES IN PRINCIPAL CITIES

TYPES FOR ALL FUEL REQUIREMENTS

The Z U Steel Firebox Boiler for steam or hot water heating is built in the following types:

Smokeless Type for burning soft coal smokelessly.
Updraft Type for burning bituminous coal, anthracite coal including buckwheat sizes, coke and wood.
Oil, Gas, Stoker Type for oil or gas or stoker firing.
Sizes—from 4,000 to 34,000 sq. ft. radiation.
REVIEW AND ANNOUNCEMENTS

INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York. “Sink Design Contest.”

With a view to securing greater excellence in the design of sinks and in the use of Monel metal in their making, this large concern recently conducted a contest in which more than 500 designs were submitted, the contest being conducted by the Art Alliance of America. The jury of award consisted of several well known New York architects,—Harvey Wiley Corbett, Ely Jacques Kahn, and Miss Martha Mead; an interior decorator,—Mrs. Frederick Ackerman; a craftsman in metal,—Oscar Bach; Miss Katharine A. Fisher, Director of the Good Housekeeping Institute; and Louis Hassinger, President of the John Trageser Steam Copper Works. This brochure reproduces as illustrations the drawings and details of the five prize-winning designs, the three which received honorable mention, and a number of others. “The selection of the winning designs by the jury of award was made doubly difficult because of the excellence of the many submissions and the conditions of the contest which called for the judging of each design on the basis of appearance, utility and suitability for quantity production. All have been selected as offering the greatest possibilities to the builders in meeting the ever changing demands of the modern housewife for pleasing appearance and utility. All indicate how extensive is the modern trend toward process that requires no personal attention. You fill the magazine. That's all. Care of the ashes need be removed at the most only twice a week.”

McPHILBEN STUDIOS, 153 Jamaica Avenue, Jamaica, N.Y. “Suggestions from McPhilben Studios.”

These pages of THE FORUM have often drawn attention to the fact that among all the items involved with furnishing and decorating there is no one more important than fixtures used for lighting. In every age architects and designers have produced fittings suitable for use with the types of architecture with which they were working, and the result is a store of design so large and rich that whatever be the conditions, there are to be had lighting fixtures which will not only be appropriate but which may often be depended upon to add a note of distinction to their surroundings. This brochure illustrates and describes an assortment of lighting fixtures of such variety that an interior either quite formal or extremely informal may be suitably lighted, some of the fittings having been obviously designed for particular uses.


Specifications writers as well as builders and contractors know the aid to construction afforded by the publications of a concern which manufactures a complete line of structural clay products. This well edited and carefully prepared booklet lists, describes, and to a great extent illustrates the extensive variety of clay tile building materials made and sold by the National Fire Proofing Company. The total production of the National Fire Proofing Company approximates a million tons of structural clay products annually. This production comprises hollow building tile to meet every building need. The company operates 22 plants in 17 different localities. In addition, it operates a plant in Hamilton, Ont. It owns or leases over 5000 acres of clay deposits. It is estimated that the deposits thus controlled contain not less than 50,000,000 recoverable tons of clay, which is amply sufficient to last more than 50 years.

INDIANA LIMESTONE COMPANY, BEDFORD, IND. “Administration Buildings of Limestone.”

A demonstration of the desirability of using limestone as a material likely to give a building dignity and architectural character has been made in the erection of this Company’s own administration building. This booklet gives many views of the exterior and interior of the structure, of which Granger & Bollenbacher, of Chicago, were architects. “The entire exterior of the building is faced with Select Gray Indiana Limestone. Its architectural form, like all architectural forms, is necessarily bound up with the character of the materials used, and in this respect the architects have taken full advantage of the opportunity afforded them to design a building of distinct architectural interest and of an imposing character consistent with its purpose as a commercial building, the administrative headquarters of a large corporation. The architects are to be complimented on the masterful and appropriate design that they developed for the structure as it combines the logical use of stone in an economical way without sacrifice of an impressive architectural treatment.” The brochure likewise gives views of several other structures of limestone which form part of the Company’s plant, and one particularly interesting illustration shows part of a wall of some 25 sections, each of the sections being built to show the effect of some treatment.

VAN RENSSLERAER P. SUXE, C.E.
Consulting Engineer
STRUCTURAL STEEL
CONCRETE CONSTRUCTION
Knickerbocker Building  Baltimore
Specify Hydrocide Mastic (Plastic) and Semi-Mastic for waterproofing foundations and dampproofing inner surfaces of exposed walls above grade, and for bonding plaster and protecting it from staining.

**Plaster Bond and Dampproofing**

Hydrocide No. 633 for dampproofing inner surfaces of outside vertical walls above foundation. Saves expense of furring and lathing. If furring and lathing are used, walls and furring should be coated with Hydrocide No. 633. Use Hydrocide Semi-Mastic where conditions are more severe.

**Stain-Proofing of Cut Stone**

Hydrocide No. 611 waterproofs and protects lime stone, even stone, marble and other fine stones from destructive action of alkali in cement mortar.

**Integral Waterproofing of Mass Concrete Foundation Walls, Floor Systems, Swimming Pools, etc.**

Use Hydrocide Integral, Waterproofing Powder or Paste. Waterproofs by the incorporation of a permanent water-repellent ingredient. Also Hydrocide Integral Liquid.

**Exterior Waterproofing of Walls Above Grade**


**For Decaying Brick**

Use our colorless brick-filler, an amber-colored preparation.

Kaukit, an elastic caulking and glazing compound, adheres to any surface. Caulks around window and door frames, mortar joints, etc.

---

**Again we say:**

Waterproof Your Buildings So They Could Stand Under Niagara!

Our years of experience; our close study of constructional needs; our research laboratories; have combined to create products of the highest quality and performance.

You can always be sure and safe by specifying any product in the Sonneborn Waterproofing line, listed in the column on the left.

And you are further safeguarded by the Sonneborn policy to satisfy the architect at any cost and always to make good!

**SONNEBORN Waterproofers and Dampproofers**

Some Other Sonneborn Products

- **Lapidolith**—The original Concrete Floor Hardener.
- **Lignophol**—The penetrating Preservative for Wood Floors.

**L. SONNEBORN SONS, Inc.**

114 Fifth Ave.,
NEW YORK
No small amount of anxiety is caused today by clients demanding that their radiators be out of sight and out of the way. Covering the old-fashioned radiator is hardly enough. They want the space in front of the windows unoccupied because they want the curtains to hang straight from valance to floor or because of some preferred arrangement of furniture.

A conservative answer to the problem is the use of ROBRAS 20-20 Radiators. These radiators have a history of successful use in some of the finest residences and apartment buildings in this country. ROBRAS 20-20 Radiators are designed for installation between the studding. There need be no fear that they will fail to live up to their rated radiation. They are strongly made of brass plates electrically welded together. They can't leak.

The fins are of sturdy brass. They cannot easily be bent, closing up the tiny flues. These ROBRAS 20-20 Radiators actually accelerate the flow of air in the room.

Because of the high heat conducting properties of brass they give off useful heat at once when the heat is turned on.

They are exceedingly adaptable, due to the numerous lengths and variety of assemblies. ROBRAS 20-20 Radiators can be made to fit in to almost any space whatever its size or shape. They can be used in the steps of stair-cases, under or at the sides of French-doors or as direct—indirect radiators. Wherever they are used they are out of sight, and out of the way.

Sweets' catalog, your A. I. A. file or one of our offices can give you any additional information you may want.
Good for the life of the building—and even longer

Table-tops, sinks, fume-hoods, drainboards and shelving of acid- and moisture-resisting Alberene Stone installed twenty-five years ago look to be good for twenty-five years more of continuous service.

Joints have remained gas, air and moisture tight because Alberene Stone is fabricated with tongue-and-groove joints, cemented with a special cement.

Since laboratory floors and wainscot have to resist the action of corrosive acids and alkalis, many technicians insist that Alberene Stone be used for them also, so that the entire laboratory will be free from upkeep cost and good for the life of the building.

The special Laboratory Bulletin is complete with informative data and suggestions. Send for a copy.

ALBERENE STONE COMPANY
153 West 23rd St., New York
Quarries and Mills at Schuyler, Va.

ALBERENE STONE
Table-tops, Floors, Shelves, fume-hoods —
The crash of waves

Sound travels in waves. Sound waves may not be arrested by a wall or ceiling, but set it vibrating, somewhat as a telephone diaphragm vibrates, with the result that the sound is transmitted to the opposite side.

In this industrial age we live in bedlam. Outside the buildings in which we live and work are whistle, blare and screech; within are the spoken word, the sounds of musical instruments, the jar and racket of machinery.

From bedlam we require protection that we may live and relax in peace.

Modern science has made it possible to prevent the transmission of sound from room to room. Such prevention is provided by the USG System of Sound Insulation.

This system is a supplemental construction for floors, partitions and ceilings so that audible sound will not be transmitted through them. It includes the treatment of vents, ducts, etc., and the setting of machinery bases.

The USG System of Sound Insulation is installed, under contract, by the United States Gypsum Company, which assures undivided responsibility, and guaranteed results. For information address Sound Insulation Department, United States Gypsum Company, 300 W. Adams St., Chicago, Ill.

USG SYSTEM OF SOUND INSULATION
SHERARDUCT CONDUIT is a permanent wiring raceway doubly protected against corrosion. Spellerized, scale-free, pipe zinc treated by Sherardizing inside and outside combined with a treatment of acid-resisting enamel makes a rust and corrosion-proof surface on the outside and inside that will last as long as the building.

National Electric Products Corporation
National Metal Molding Division
Pittsburgh Pennsylvania