THE ARCHITECTURAL FORUM
IN TWO PARTS

ARCHITECTURAL ENGINEERING & BUSINESS

PART TWO
AUGUST 1929
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Sheathed Cable makes possible more electrical circuits and conveniences—helps you to make a sale. You can install more circuits and more outlets, for the same cost, if you wire a house throughout with Sheathed Cable. A Sheathed Cable job will last as long as the house itself.

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FIVE MILLION SQUARE FEET of Masterbuilt hardened concrete floors are being installed in the world's largest building, The Merchandise Mart, Chicago.

All heavy duty areas are being integrally hardened with METALICRON.

Commercial areas are being integrally hardened with MASTERMIX.

Metalicron and Mastermix are "Plus Omicron" products. Each has as a basic ingredient this latest discovery of Master Builders Research Laboratory, Omicron, which combines with and reduces the soluble elements in concrete, changing them from weak factors to strength-adding factors in the structure, and so checking disintegration or "corrosive wear" at its source.

In the heavy duty floors Metalicron replaces brittle sand in the wearing finish with tough, ductile metal. No plain cement floor, no matter how well laid, can have the resistance to abrasive wear or to disintegration that Masterbuilt Floors, thus armored, possess.

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PLAN AND ELEVATION DETAILS OF ALUMINUM TOWER FINIAL

This tower finial is described on pages 22, 23 of this issue.

SPECIFICATIONS

This material shall be made of No. 43 Alloy. The average tensile strength shall be not less than 19,000 lbs. per square inch, and the weight shall not exceed .097 per cubic inch. It shall not be less than 3/8" thick except for the surfaces of the steps to be walked on—where it shall be not less than 3/4" thick. The surface shall be free from imperfections, and in all respects equal to sample submitted.

Further details of this job, and of all others described in the booklet "Architectural Aluminum", will be gladly furnished by ALUMINUM COMPANY OF AMERICA
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Chicago Daily News

INSTALLS

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Where durability plus lasting smoothness was important in floors, the Chicago Daily News used BLOXONEND—a composite wood block floor laid in 8 ft. strips and splined together. The vast composing room and other mechanical departments equipped with 22,000 square feet of BLOXONEND.

This flooring stays smooth, prevents pieing of forms, speeds up traffic, saves power (man or electric), eliminates vibration damage to equipment and reduces floor upkeep.

The Kansas City Star, Hearst Publications, Cleveland News, Chicago Evening Post, Condé Nast and numerous other prominent publishers and printers have standardized on BLOXONEND for heavy duty floors. Also widely used by leading industrials and in gymnasiums and shops of finer type schools.

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BLOX-ON-END FLOORING

Bloxonend is made of Southern Pine with the tough end grain up. It comes in 8 ft. lengths with the blocks dovetailed endwise onto baseboards.
YES, IT LOOKS O. K.....BUT

How much does it cost to operate?

AND our answer is, don't take our word for it. Let us see what unbiased engineers have to say on this point.

26 Cans raised and lowered for ONE CENT

Engineers of the Sprague Electric Works conducted a series of comprehensive tests to determine current consumption of G&G Electric Ash Removal Equipment operating under varying conditions. At the Mergenthaler Linotype Co., Brooklyn, N. Y., a Model D, similar to illustration, handled 78 tons of ashes in one k.w.h. with current costing 3 cents.

15½ Tons Ashes moved in ONE k.w.h.

At a New York Telephone Co. building (one of 169 Bell Telephone buildings) where a Model E (no overhead crane) Hoist was tested, 85 round trips were made for one cent current cost. Another test (at a Public School) showed 33 cans handled for one cent. Still another test (at a Telephone Building) showed 15½ tons of ashes handled in one k.w.h. In every case, distance of lift and rate per k.w.h. must be considered.

Complete Test Data Available

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You will find the services of our Engineering Department of considerable value in determining how various ash removal problems shall be met and in determining which Hoist and what equipment best suits the specific condition—so that the completed installation may give the building owner the utmost satisfaction throughout the years.

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The new Heggie-Simplex jacketed steel boiler—the most modern of residence heating units—has all of the qualities home owners are seeking.

The smart coloring of its durable lacquered jacket—French grey with black trim—is what women want.

Built of steel, fused by electric welding into one seamless unit, it is crackproof and leakproof.

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*92% of the women who saw this boiler displayed in a variety of colors at a recent exhibit, chose the French grey and black combination. They like its dignified, unobtrusive beauty. They appreciate its practical value in not showing dust.

Heggie-Simplex Boiler Co., Joliet, Ill. Representatives in principal cities—telephone and address listed under "Heggie-Simplex Boilers."
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The modern heating equipment for modern rooms... harmonious, decorative and above all, wonderfully efficient... The fact that the Modine Cabinet Heater insures complete heating comfort in rooms that are recognized as hard to heat, recommends it to you for all rooms... Built in two models... Floor Type above equipped with efficient built-in humidifier... Wall Type, only 5½ inches in depth and recommended where space is a most important factor as in apartments, offices, shops, etc.

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With the growing appreciation of the important part communication plays in every-day life, there is coming a radical change in the telephone needs of the nation. Especially is this true as to the number and location of telephones within the home. Where previously one, or possibly two telephones were considered sufficient, people today want telephones throughout the house... Particularly in those rooms most frequently used, so that calls may be made and answered without waste of time or effort.

Many architects are providing for this modern convenience in their plans for new and remodeled residences. By consulting with their clients, and with representatives of the local telephone company, they can determine not only what rooms are desirable for telephone locations, but also what places in those rooms are most suitable. In addition, planning in advance for the telephone arrangements makes it possible to lay conduit for wires within the walls, thus affording protection to the wires, and resulting in improved appearance.

Many other things contribute to modern telephone convenience. Your Bell Company will be glad to explain them to you—and to help you plan the telephone arrangements for your new building projects. Just call the Business Office.
The New Ribbed STEELTEX takes plaster out of the replacement group

THE reinforcing principle of STEELTEX is well known to architects, contractors, and builders through over a quarter of a million installations. It has won definite approval from building experts, because it puts plaster walls and ceilings in the class of one-cost building items, wherever it is used.

Now we announce a new, perfected form of this tried and tested material.

The rigidity and workability of the New Ribbed STEELTEX is due to its new stiffening rib, an exclusive STEELTEX feature. This rib makes the sheets straight, flat and rigid. For this reason the New Ribbed STEELTEX is easy to install by the average plasterer, giving the plasterer a level, rigid, trouble-free job on which to work, and assuring uniform, good results.

The New Ribbed STEELTEX consists of a 2" x 2", 16-gauge reinforcing fabric of cold-drawn steel attached to a tough fibrous backing. The entire sheet is trussed and stiffened by 26-gauge V-shaped channel ribs on 3 1/4" centers, running at 90° to the studding.

The reinforcing fabric of the New Ribbed STEELTEX is galvanized, electrically welded at the intersections, and automatically furred out from the backing. The application of plaster to it in the ordinary way produces a plaster slab of furnishing materials, wall paper, paint, ordinary plaster.
and puts it into the single-cost group

uniform thickness, continuously reinforced by a network of completely embedded steel. No special skill is required.

10 reasons for using the New Ribbed Steeltex

1. New V-rib stiffener produces level lathing job of board-like rigidity.
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Made by the makers of STEELTEX for Stucco, STEELTEX for Brick or stone veneer, and STEELTEX for Floors and Roofs.
When your client wants something better

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APARTMENT house builders are constantly seeking new ways of building more convenience, attractiveness, and durability into their properties. It is significant that they recognize in Monel Metal a material that offers an opportunity to give kitchens and kitchenettes a new note of distinction. Monel Metal sinks make apartments easier to rent or sell.

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Monel Metal will not rust. It resists corrosion. It has no surface coating to chip, crack or wear off. While it is tough and strong, a Monel Metal surface is more resilient—it actually reduces dish and glass breakage.

In specifying kitchen equipment for modern buildings, give thought to Monel Metal. Let us send you additional information.

Monel Metal is a technically controlled Nickel-Copper alloy of high Nickel content. It is mined, smelted, refined, rolled and marketed solely by The International Nickel Company, Inc. The name "Monel Metal" is a registered trade mark.

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Wherever pipe is used in building construction—in plumbing, heating, sprinkler, and refrigeration systems, and in power plant steam lines—Youngstown pipe has earned its reputation for lifetime performance by its service-record in thousands of fine buildings.

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LONDON REPRESENTATIVE—The Youngstown Steel Products Co., 55 New Montgomery St.
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The entire line has been redesigned for greater simplicity and strength. First costs have not been increased, and maintenance costs have been cut to what seems the irreducible minimum. A number of these improved devices have been especially designed for listed and labeled hollow metal and metal clad Paneled Single Acting Hinged Doors, and have been listed as Standard by the Underwriters' Laboratories.

A complete catalog of these new devices for metal doors has recently been issued, and will be gladly sent to you on request.

To be sure of getting these new and finer devices, we suggest that you specify Von Duprins by name as a separate item of the specifications, rather than as a part of the finishing hardware specification. Von Duprins can be supplied by any reputable hardware dealer, since we sell all dealers at the same price.

VONNEGUT HARDWARE CO.
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Listed as Standard by Underwriters Laboratories
ALTHOUGH the outstanding examples of recent architecture have been made familiar through the pages of the architectural journals, members of the profession will be able to appreciate the value of a publication made up of large loose leaf plates showing illustrations and measured drawings of these great buildings in a compact and well organized manner. The collection of plates which is the subject of this review is one of the first important attempts on the part of an architectural publisher to cover the important subject of American architecture of the twentieth century in anything like a complete, compact and usable form. Certainly material of this sort should be greatly in demand by the architectural profession, since it presents clearly the form, proportions, and detail of the best examples of buildings which go to make up the outstanding achievement of twentieth century architecture and of the American people for all time.

The skyscraper form of building is a distinctly American type and is the product of a great industrial people. The so-called classical styles were undoubtedly beautiful and filled the needs of the people by whom they were developed, but in the present era of frenzied activity and intense concentration of business industry within limited areas, these classical types have been found to be quite inadequate, and it became necessary to develop an entirely new order of construction and new forms of building materials so that greater freedom might be had in building vertically to great heights. At first, attempts were made to support buildings on masonry walls, but when the structures exceeded six or seven stories in height the lower walls were of necessity so massive as to occupy the greater part of the lower floor space. The problem of verticality was solved by the use of steel or ferro-concrete framework supporting curtain walls of masonry. The height to which such structures may be carried now seems to be almost unlimited, and as we look at the Chanin Building and realize that on the opposite corner will be a still taller structure, we wonder where the thing will end. It early became apparent that the construction of so many enormous structures along the edges of comparatively narrow thoroughfares would result in the streets becoming dim and narrow canyons such as are found in the lower part of Manhattan today. In providing for the elimination of this condition, the city planners unwittingly invented a type of structure which in the hands of our best architects has resulted in the beautiful “set-back” style and has brought to the world an entirely new architectural type. Inspired by the greater possibilities latent in the new building materials, designers have developed a new form of design which, in its better manifestations, is characterized by a dignified simplicity and appropriateness to the spirit of modern times. New freedom in design naturally is not restricted to structures of the skyscraper type but has resulted in many beautiful edifices among other classes of buildings, such as churches and smaller buildings where the need for height was not so pressing as in other buildings.

As we continue to develop, it is difficult to foresee what the future may have in store, and it would be impossible at this time to predict anything in the nature of a final work on twentieth century architecture. It therefore seems very fitting that the publishers and editor of the present series of illustrations and drawings have chosen to issue it in the form of a progressive publication of separate volumes and parts, each of which may be purchased separately. In this way the development and trends of building design may be followed and a splendid collection of reference on the new architecture be built up as rapidly as further
GRADE SCHOOL BUILDINGS; BOOK II

IN no department of architecture have the last ten years seen quite the progress which has been made with schoolhouses, a class of buildings of the first importance, since they exert a strong influence upon their communities, and by their architectural excellence or the lack of excellence they elevate or lower the architectural standards of entire districts. Study of school structures, particularly at the hands of a group of well known architects, has resulted in their being given a high degree of architectural distinction and dignity in the way of design, while study directed toward their planning and equipment has led to their being practical and convenient far beyond what was regarded as an advanced standard of efficiency anywhere in America even a few years ago.

![Kensington Schoolhouse, Great Neck, N. Y.]

Wesley Sherwood Besso, Architect

THIS volume, a companion to another published in 1914, records the results of endless study and experiment in different parts of the country, summed up and presented. By illustrations of exteriors and interiors, by floor plans and carefully written descriptions and articles by well known architects and educators, the present high standard of schoolhouse design is made plain, and these results which have been achieved by a few architects and school boards are thus made possible to all architects who are interested in schoolhouse design. The compiler has selected from almost 1000 exteriors and floor plans the school buildings to be illustrated, and the volume records "a process of innovation and elimination, namely, the introduction, from time to time of features which have been deemed desirable and practical, and the elimination of things which, owing to changed school methods, are no longer required."

400 pages; 7½ x 10½ inches
Profusely Illustrated; Price $10

THE ARCHITECTURAL FORUM
521 FIFTH AVENUE NEW YORK

progress is made. The size of the plates, 14 by 20 inches, together with the fact that they are loose leaf, makes them extremely usable, and their collection into portfolios of 20 plates also adds to their utility. The work is carefully edited by Oliver Reagan, A.I.A., and the paper, printing and general make-up of the work resembles the well known monograph of the work of Mc Kim, Mead & White, published likewise by the Architectural Book Publishing Co., Inc. The choice of buildings to be shown is left to the readers, and subscribers are invited to write suggesting the names of buildings they would like to have shown. The publishers agree that when a sufficient number of such requests have been received for a given building, that structure will be presented in a forthcoming issue.

Six parts of this series have already been issued and include a notable selection of important American buildings including the Bowery Savings Bank, New York: Ford Engineering Laboratory, Dearborn, Mich.; U. S. Army Supply Base, Brooklyn; Indianapolis Public Library; Grauman's Metropolitan Theater, Los Angeles: Panhellenic House, New York; Irvine Auditorium, University of Pennsylvania; Los Angeles Mail Order House of Sears, Roebuck & Co.; and many other outstanding buildings of the same class representing the work of many of the foremost American architects of the day.

Of course no work on our modern architectural design would be complete without examples of the work of Bertram Grosvenor Goodhue, who played such an important part in the origination and development of the new type of design. A complete portfolio of 30 plates is devoted to some of the best specimens of his work, including the Nebraska State Capitol; the Church of St. Vincent Ferrer, New York; National Academy of Science, Washington; and the Los Angeles Public Library. Of the buildings published thus far, from two to four plates of illustrations and from one to four plates of drawings are shown for each, the photography being done in the best architectural manner so as to show the proper proportions and as much detail as possible, and the choice of subjects is representative of all classes and types.


In no department of architecture has there been made more striking progress than in its application to schools. The entire subject of schools in fact, from first to last, seems to have been so well and thoroughly studied that there is little if anything which has not been examined and re-examined, analyzed and classified at the hands of educators, architects and the designers and manufacturers of school equipment. When a school is to be established today the scope of its activities is made the subject of an exhaustive and critical survey, first to determine the need of a school, and then to discover just what type of school it should be. With the results of

Unless otherwise noted, books reviewed or advertised in THE FORUM will be supplied at published prices. A remittance must accompany each order. Books so ordered are not returnable.
The photograph above shows one of the many Arco Metal Pipe installations now being made in Marshall Field & Company's world-famous Chicago store. Throughout the building Arco Metal Pipe is being used exclusively to replace other piping which, after a few years of service, developed leaks. These leaks were so serious that the entire systems in many of the lavatories had to be completely torn out.

Arco Metal Pipe will prevent damage, trouble and expense of this kind—Arco Metal Pipe will mean permanence because it is a superior corrosion-resisting cast alloy pipe. It is made from a special nichrome alloy cast iron and cast by a process which gives it greater flexibility and tensile strength and far greater corrosion and erosion-resisting qualities than ordinary grey cast iron. And Arco Metal Pipe can be cut and threaded on the job with the same tools used on wrought steel and iron pipe.

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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

Such a survey as a foundation, there comes consideration of a site with reference to its accessibility, its being near the center of the district to be served, the character of its surroundings, the nature of its soil, etc., and all this before there comes more than slight consideration of its architecture. With extensive data thus at his command, the school architect approaches its actual planning and designing, aided constantly by highly trained and experienced educators and by the designers and makers of every possible detail of school equipment, the school when finally completed and turned over to the school board and teachers being probably the last word in completeness and in architectural and mechanical excellence and well fitted to perform the work for which it was built. All this now forms the subject matter of many publications,—weekly, monthly or annual,—and recently there have been published a number of excellent works dealing with different aspects of the school problem.

This volume is the second annual edition of "a year book devoted to the design, construction, equipment, utilization and maintenance of educational buildings and grounds," and among the names of the many contributors who have collaborated in the preparation of the work one notes those of leaders in all the fields which are concerned,—widely known educators, architects, landscape architects and others. The completeness of the work and the thoroughness with which it deals with the subject might be indicated by an enumeration of its chapter headings: I, Selecting the Site and Planning the Budget. II, Design and Construction of Buildings. III, Modernization, Maintenance and Insurance. IV, Landscaping and Upkeep of School Grounds. V, Buildings and Equipment for Physical Education and Play. VI, Classroom, Office, Library and Auditorium. VII, Home Economics.—Cafeteria,—Laundry. VIII, Laboratories and Shop. IX, Chemical Index. X, Distributors of Equipment. XI, Architects for Educational Buildings. XII, School Superintendents in Cities of 10,000 and over. XIII, State Departments of Public Instruction. XIV, Alphabetical and Classified Lists of Manufacturers. School boards today depend upon their architects for far more than mere architectural service. The architect is expected to be fully informed regarding a host of subjects not even remotely concerned with architecture, and often in proportion to his knowledge and resourcefulness is the value of his service gauged. The excellence of this work entitles it to circulation among architects interested in any type of school architecture.

OLD WORLD MASTERS IN NEW WORLD COLLECTIONS.

EVEN before the beginning of the World War period, vast changes were taking place in the world. Countries which for ages had been leaders in commerce, in industry, in art, and in every other form of activity found their power gradually waning as the Republic of the West increased in strength and power and moved ever more and more toward the center of the world's stage. The Great War, which left the greater part of Europe impoverished if not actually ruined, meant the unconditional surrender of the Old World to the New, and gain to America in possibly more ways than one in...
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perhaps a ratio out of all proportion to Europe's loss.

In every age conquerors have taken toll of the art treasures which circumstances have placed at their disposal. The practical Romans had heavy hands upon the riches of cultured Greece; persecuted Christianity emerged triumphant from the catacombs to plunder the temples of pagan antiquity for material of which to build the Christian fanes which presently arose; St. Mark's, that treasure house of splendor, meant much pilfering from the East; Napoleon dealt with ruthless hands with many of Europe's museums, and in fact many a museum has been enriched at the cost of those in other countries, the balance having been sometimes restored when later wars and other victories made restoration necessary. Long before the Great War the world's art treasures began coming to America's shores,—the result not of victory in battle, unless economic and commercial rivalry be so considered, but due to America's lavish and constantly increasing wealth. Paintings, marbles, tapestries, statuary and other works of art which for centuries had been among the ancestral possessions of great families were suddenly found to be in American museums or private collections. Even some cathedrals and ancient monastic foundations found themselves unable to resist the lure of gold offered them by the resourceful art dealers who constitute the link connecting owners old with owners new, and today one has ceased to express surprise at hearing that some priceless treasure has passed from the possession of an Italian prince or an English duke into that of some American manufacturer or banker. The transfer of ownership, it might be observed, is much more than likely to be eventually to the advantage of the world, taking the world as a whole. Americans as a rule bequeath their collections to public museums where they enrich the facilities for public culture, while in Europe the same treasures served merely to give pleasure to their owners and their owners' friends.

In this volume an author widely known as holding accurate and conservative views on art has made a survey of the paintings by the great masters of Europe which at present are in American private collections. The work deals with rather more than 100 paintings, and to facilitate the preparation of the volume she has had the enthusiastic cooperation of the collections' owners. The work, be it understood, deals with portraits, mythological and genre subjects and with some subjects which are religious, but leaving out subjects which portray suffering; here there are no pietas, crucifixions, or paintings of saints undergoing martyrdom. Under the general heading of Italian painting the author considers work of various schools,—Siena, Florentine, Umbrian, north Italian, and Venetian, and then in their turn she deals with painting of the Flemish, Dutch, German and Spanish masters and with the work of France and England during the eighteenth century. The author, as has been already suggested, approaches dealing with a subject so important with extensive background. She is already widely known for her writings on various departments of art, and the volume's illustrations as well as its text have been prepared with all the thought and care which one would look for in a work from her study.
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Vertical Perspective

VIEW OF THE FULLER BUILDING, NEW YORK

WALKER & GILLETTE, ARCHITECTS

Photo. George H. Van Anda

The Architectural Forum
THE CONSTRUCTION AND EQUIPMENT OF THE FIDELITY-PHILADELPHIA TRUST BUILDING

SIMON & SIMON
ARCHITECTS AND ENGINEERS

I N the construction of the Fidelity-Philadelphia Trust Building, Philadelphia’s largest office structure, within 16 months from the time wreckers went on the site until the completed structure was turned over to the new tenants, emphasis was placed on the time element, important in large building enterprises. In Part One of this issue of The Forum there is a description of the architectural features of this building. In this article it is proposed to extend this description to cover the constructional, structural, mechanical and electrical features of the building.

Demolition. On January 24, 1927, a contract was awarded to Irwin & Leighton of Philadelphia. On March 1, 1927, work began on the demolition of the existing buildings. This work was an important factor in the limit of time allowed for the completion of the structure and affected the entire building program. One of the old buildings was a large theater, the foundations of which were of rubble, mass concrete and brick. The structural frame of this building was of steel, and the floors, balconies, proscenium arch, box fronts, lobbies, etc., were of reinforced concrete with slabs from 8 to 12 inches thick. In fact, this applies also to the reinforced concrete in the theater building, all of which was extraordinarily heavy in keeping with the building practice of the day when concrete construction had not been sufficiently developed to permit the use of light slabs and modern reinforcement. Because the use of dynamite might have inconvenienced neighbors or have endangered wheel and pedestrian traffic, skull crackers were employed to reduce these large masses of concrete to fragments which could be conveniently removed.

Foundations. An elaborate system of core borings was made, and the location of the ledge rock was definitely determined prior to the preparation of the foundation design. Calculations were made of a number of kinds of foundations, and the final decision was for the open caisson type which accomplished the required purpose in the least time and with the minimum expenditure. The large tonnage of the column loads required that the foundations be carried to the solid rock, and accordingly a foundation was build for each column. There are 138 caisson foundations varying in size from 3 feet, 8 inches square to 8 feet, 4 inches square at the top. The caissons are of concrete, cast in place, unrenforced except at the tops immediately below the points of application of the column loads. Considerable difficulty was experienced in sinking these caissons, as the level of the ground water is approximately 45 feet below the curb. Owing to the density of the soil overlying the rock, it was found after experiment that the only way to expeditiously construct these foundations was by pumping the ground water from each caisson pit. The same type of foundations, although entirely apart from those of the building, was used for the safe deposit vault which measures approximately 38 feet wide, 91 feet deep, and is two stories in height. There was nothing extraordinary about the character of the foundations, except that record speed was made in building them, considering the fact that it was necessary to begin work on many before the demolition of the buildings overhead had been begun.

Underpinning. It was necessary to underpin the westerly wall of the Witherspoon Building, adjoining the Fidelity-Philadelphia Trust Building on the east. The Witherspoon Building is 15 stories in height; several of these stories are unusually high due to there being an auditorium, thus making extraordinarily heavy concentrated loads. Several different methods of underpin-
ning were considered, but that which would cost the least money and which could moreover be the most rapidly performed was the erection in individual sections of a concrete wall of adequate thickness supporting the foundations of this building to the depth of the lowest excavation of the Fidelity-Philadelphia Trust Building. This wall was supported on concrete-filled steel-shell piles 16 inches in diameter, the steel shells being 3/8 inch in thickness and designed to carry the entire load to bed rock. Each individual pile supported not more than 60 tons and was tested to 90 tons without producing settlement. The Fidelity-Philadelphia Trust Building stands on gneiss rock at a depth of about 60 feet below curb.

Less than two months after the contractors began work, the first caisson was sunk. Four months later, in the presence of officials of the Fidelity-Philadelphia Trust Company and their guests, the cornerstone was laid. Progress was rapid, and seven weeks later the topmost structural steel member was swung into position. More than 14,200 tons of steel and 350,000 rivets were used in framing the structure. Six large girders span the top of the banking room and carry the center portion of the building. These are 60 feet long, 9 feet, 6 inches deep, and weigh approximately 58 tons each. They are among the largest girders in any office building in the city. The movement of materials was so planned that encroachment upon traffic was exceedingly small.

**Steel Design.** Let us consider the problem presented by the steel skeleton of the building. The heaviest dead loads for floors are those on the first floor. Those assumed for beams for this floor in pounds per square foot are:

- Marble .......... 15
- Cement .......... 12
- 3-inch fill .......... 20
- 4-inch stone concrete slab .......... 48
- Ceiling (of first basement) .......... 15
- Partitions .......... 35
- Fireproofing .......... 22
- Steel .......... 10
- **Total** .......... 177

For girders into which these beams frame, an additional dead load of 7 pounds steel and 15 pounds fireproofing or a total of 199 pounds is assumed. Another heavy floor is that of the first basement with a dead load of 145 pounds for beams and 165 pounds for girders. For the typical office floor the dead loads for beams are:

- Cement finish .......... 12
- 3-inch fill .......... 20
- 4-inch cinder concrete slab .......... 38
- Ceiling or plaster .......... 7
- Partitions .......... 15
- Fireproofing .......... 15
- Steel .......... 6
- **Total** .......... 113
Rear of Boiler Room, High-pressure Steam Header

For the girders into which these floor beams frame, an additional dead load of 4 pounds steel and 8 pounds fireproofing, or 125 pounds, is assumed. The roof loads vary according to type of material used and the location of the steel member. Over the 29th and 29th mezzanine, the dead loads are, for purlins:

- Slag: 6
- Cement: 5
- 4-inch cinder concrete slab: 38
- Fill (average 6-inch): 33
- Fireproofing: 12
- Future ceiling: 16
- Steel: 7

Total: 117 pounds

An average of 9 pounds was added for the girders and trusses. The roof over the board room is assumed as weighing:

- Copper: 6
- 4-inch cinder concrete slab: 38
- Ceiling: 20
- Fireproofing: 12
- Steel: 9

Total: 89 pounds

Limestone 6 inches thick: 80
8-inch hollow brick: 60
Plaster: 5

Deduction of 20 per cent for windows: 20

Total: 145 pounds

In each wall panel, 11 feet, 6 inches by 17 feet, 4 inches, are two windows, 4 feet, 4 inches wide by 7 feet high, permitting an allowance of about 30 per cent reduction in weight; the calculated reduction of 20 per cent is conservative. Heavier loads are assumed for walls below the fifth floor.

Marked cooperation between the subcontractors, contractors, architects, and the building committee made it possible for the time for construction to be shortened. In September, 1927, the date of comple-
tion was stipulated as June 1, 1928, three months earlier than required in the original contract. On March 1, 1928, 12 months after work had been begun, the Baltimore & Ohio Railroad occupied its space at the corner of Broad and Walnut Streets, and on June 1, 1928, in accordance with the new schedule, the office building portion was opened for occupancy, with but 15 months elapsed working time.

**Elevators.** The passenger elevators are arranged in two banks of ten each. One section of ten cars cares for the local passenger traffic and operates from the first to the 17th floor, at a speed of 700 feet per minute. These are of the gearless traction type with signal control and automatic floor-finding devices. The other section of ten cars serves express passenger traffic, with 800 feet per minute elevators of similar type and control to those of the other system. Two of these express shafts have openings to every floor throughout the building, and eight of them are enclosed shafts from the second to the 16th floor inclusive. In the banking house there are installed for operation between the second basement and the fifth floor, six elevators operated at a speed of 450 feet per minute. Two service elevators with a speed of 600 feet per minute open from the lowest or third basement to the 29th floor inclusive, and are used for freight and general building service.

**The power plant** in the lowest basement has five water tube boilers, semi-automatically stoked and built for a safe working pressure of 160 pounds per square inch. Three of these develop a horse power of $4\frac{1}{2}$ each, and two 185 each, giving a combined normal horse power total of 1,610. From this plant are furnished the heat of the building, high pressure steam for pumps, and medium pressure steam for the kitchens. Three 6,000-gallon capacity oil tanks have been installed to be ready should the necessity for using this fuel ever arise.

**The heating system** is of the two-pipe vacuum return type with steam feeder main in the pipe loft of the 23rd floor. The office and bank portions have separate feeder mains, and the banking room is provided with a system of temperature control with automatic thermostat arrangement. Automatic control has been installed in the offices to shut off heat from radiators only. An elaborate system of ventilation assures an adequate supply of fresh air for all units of the building. The entire banking area has both supply and exhaust ventilation. In the main banking room four complete changes of air are accomplished every hour. This air is introduced to the system at the sixth floor level above the point where street dust contaminates, where it is filtered and then distributed. An independent supply of air is provided for the bank vaults.
Boiler Room Mezzanine Showing Steam- and Motor-driven Pump and Condensate Meter

**Electrical System.** The entire electrical requirements of the building can be carried on either of two 13,200-volt feeders, which enter the building from the Philadelphia Electric Company's service. In case one feeder should fail, a bus tie oil circuit breaker is automatically closed, which energizes the entire main truck board from one feeder, since the main high tension truck switchboard is arranged in two sections, one 13,200-volt feeder going to each section. When the feeder that fails is again placed in service, the incoming line oil switch on that feeder is automatically closed, and the bus tie switch is automatically opened, thus restoring the normal service. In case of trouble on a regulator, it is automatically shunted out of the circuit. There are two feeder regulators, each of sufficient capacity to carry the entire load, controlled by a six-board high voltage truck switchboard.

A bank of 13,200-volt primary to 230 volts secondary is of sufficient capacity to furnish all of the power requirements, excepting the elevators. A similar bank of transformers, except 115 volts secondary, furnishes the lighting requirements. A third bank of high voltage transformers, with 2,300 volts secondary, furnishes the electric elevators with power, and in an emergency will operate the fire pump. Although these nine transformers will meet the total requirements, there is installed a duplicate bank of nine other transformers, which will be automatically thrown in circuit should trouble be encountered in any other bank of transformers, so that continuity of service is assured.

The power for the elevators at 2,300 volts is fed through steel armored cable to the elevator substations located on the 18th and 28th floors. In each of these elevator substations there is located a four-panel truck type switchboard, together with transformer equipment. Two sets of transformers are used, each of sufficient capacity, so that it might, if required, meet the total demand. The switching is so arranged that one bank of transformers is normally in operation. If the load goes above a predetermined value, the other bank of transformers is automatically cut in in parallel to take care of this excess demand. As soon as the load decreases, this second bank is automatically cut out. Should trouble develop in one bank of transformers, that bank will automatically be switched out of service, and the other bank will take care of the load. By interchanging the truck panels in the elevator substations, approximately the same amount of power can be taken from each bank of transformers during certain periods of time. Also located in the elevator substations, but in separate rooms, are four-panel low tension switchboards, containing metering equipment, feeder lines, etc., for each bank of elevators.
A 15-panel low tension switchboard in the basement distributes all of the power and lighting requirements. By means of connections on this board, the entire lighting load of the building may be instantly changed to secure its current from either of the duplicate banks of lighting transformers, or in case both of these have failed, an auto transformer may be immediately switched into service, which will then supply the lighting from either of the duplicate banks of power transformers. By means of this same switching equipment and auto transformers, should both of the banks of power transformers fail, such power as must be maintained may be secured from either of the lighting transformers. In addition, a large storage battery has been installed, which furnishes emergency exit lighting and power for the automatic operation of switching equipment. On the same floor, but located in a different room, are four battery charging motor generator sets and control equipment.

Two static condenser equipments are installed in the same room with the elevator transformers, located in the elevator transformer station. The purpose of these is to improve the power factor of the load imposed by the elevator equipment. Between 60 and 70 motors and controls are installed throughout the building for operating ventilating fans and circulating pumps. Lighting and power distribution cabinets of the most up-to-date type are placed throughout the building. There are installed in this building approximately 740,000 feet, or 140 miles, of No. 12 and No. 14 code wire. On each wing of each floor is located a meter bar cabinet type panel of unique design. The design of these panels is such that it is a simple matter to readily arrange for the metering of the electric service furnished to one or more offices through a single meter.

Bank Vaults. The vaults of the bank are in the first and second basements. These two vaults are each 86 feet long and 33 feet, 4 inches wide. The safe deposit vault in the first basement is entered from an ample public lobby accessible
Another View Showing Kitchen for Bank Employes' Dining Room

View of Kitchen with Steam Kettle in Foreground

Hot Water Storage Heaters in Background. Boiler Feed Water Heater in Foreground

from the first floor by stairways and elevators. The vault is 12 feet, 5 inches high. Lacking only a few feet, eight full sized Philadelphia Rapid Transit trolley cars could be stored in the space occupied by the upper vault. These vaults are in reality separate structures within the building. No beams, girders or columns of the main structure pass through the vaults' walls or ceilings. Their walls and roofs are 24 inches thick. More than 200 tons of high grade steel make up the lining and equipment. Nearly 40 tons of special formula stainless steel renders the handling of the safe deposit boxes a cleanly process. The grease which has been the usual safeguard against rust is eliminated, and untarnished surfaces are maintained without inconvenience to patrons. Two electrical systems protect the vaults, while a sound accumulating system provides a third mode of safeguarding against attack. The individual booths of the safe deposit department
are so equipped that a record of each booth's tenancy and an inspection after every occupancy insure the safety of valuable papers overlooked by patrons. The vault for the bank's own cash and securities is on the second basement level. In this vault are held also those securities entrusted to the safekeeping of the bank and those in the custody of the corporate trust department.
In order to maintain her prestige as one of the foremost convention cities of the country, Atlantic City is building the largest auditorium in the world. This municipal project will have cost when finished about $10,000,000 and will accommodate 40,000 people. The building occupies a block fronting on the Boardwalk. It is located midway between the two principal groups of the largest and newest hotels. The structure is 350 feet wide and has an average depth of 66 2/3 feet, occupying the entire block.

**Design and Construction.** The main auditorium floor is 350 feet wide and 450 feet long. It has balconies on three sides and a stage on the fourth. These balconies project 38 feet into the auditorium, and are so planned that there will be 15 feet clear height underneath them, thereby affording ample space for exhibition over the entire auditorium floor. In addition to the main auditorium there is a large hall, 130 by 185 feet, on the second floor in the headhouse of the building. This hall can be used for smaller conventions, art exhibitions, banquets and dancing. It has a seating capacity of 5,000, and includes a stage, a large balcony, and a small musicians' balcony. There are committee and retiring rooms at each end of this hall. On the Boardwalk side of this hall there are full height bronze doors and windows opening out to a loggia 12 feet in width overlooking the ocean. The outer side of the loggia consists of a series of arched openings.

On the Boardwalk level an arcade has been arranged across the front of the building. Along this arcade are located 14 shops faced with marble and trimmed with ornamental bronze. In the center is a large ornamental entrance, 50 feet in width, leading to the main auditorium. This entrance lobby has walls of limestone with a vaulted ceiling of Guastavino tile. Corridors lead from it and connect with ramps leading to the lower and upper levels of the balcony of the auditorium. There is a basement under the entire area. At the front of the building there are bathhouses with entrances under the Boardwalk leading directly to the beach. Space has been provided on the ground floor to accommodate 400 automobiles. One-way traffic is provided for by means of a ramp entrance on Georgia Avenue leading from the street down to the ground floor.
DIAGRAMMATIC FLOOR PLANS OF THE ATLANTIC CITY CONVENTION HALL

Lockwood Greene Engineers, Inc., Architects; Cook & Blount, Associated Architects
Erecting the Hunt* Trusses of the Main Auditorium

with a similar exit opposite, on Mississippi Avenue. This will allow guests at conventions to arrive and depart without confusion of traffic. Platforms ramping up from the Boardwalk grade extend the full length of the two sides of the building, and serve as exit areas to the auditorium.

The exterior walls of the headhouse are of Indiana limestone backed up with 8 inches of solid brick and 4 inches of hollow brick supported on a steel frame. The remaining portion of the building is faced with a buff brick. The exterior design is a modern adaptation of the Romanesque, incorporating therein the spirit of Atlantic City. The building is of first class construction throughout, short span concrete slabs with steel frame. The basement floor is built at the level of the ground water, grade +2.0. The grade of the ocean adjacent to this site is zero for mean low water and +3.5 for mean high water. The maximum grade of the ocean recorded in the most severe storms has been -10.0. The construction of the basement and the boiler room, which is 15 feet below the basement, was designed for a full hydrostatic pressure, with water at +5.0.

The character of the soil is a fine sand extending to an unknown depth. The foundation was built on 20,000 piles 30 feet long with a minimum butt of 12 inches. The capacity of the piles was taken as 15 tons. This capacity was not derived from any formula, since in this soil it is impossible to drive piles to resistance; 15 tons per pile was established by previous load tests. There have been many buildings built in this vicinity on spread footings, but it was considered advisable in this case that piles be used, as the beach at this particular locality is building up from year to year, and the level of the ground water is likely to change. In order to eliminate hazard of settlement by the lowering of the ground water grade from any cause, it was deemed wise to use piles. Piles were driven by water-jetting to within 2 feet of their final position. A day or more was allowed for the sand to settle around the piles, and then they were driven the last 2 feet by steam hammers. This eliminated the possibility of there being water or air pockets at the tips of the piles. In order to lower the ground water for the excavation of the basement and for pile driving work, a wellpoint system of piping was installed over the entire site. The natural grade of the site was +10.0. Two thousand feet of main 6-inch pipe were laid on the four sides of the site, with 20,000 feet of secondary lines of 3-inch pipe.

During the excavation of the boiler room, which is 25 feet below the street, two levels and in some cases three of wellpointing were necessary in order to efficiently operate the pumps. Piles were spaced 2 feet, 6 inches on centers. No trouble was experienced in accurately spacing the piles and driving them straight by the water-
jetting method in the type of soil encountered. The basement or ground floor was designed for a 125-pound live load and a hydrostatic pressure of 3 feet at the level of the floor. The construction consists of concrete beams and slabs. The beams were tied to the concrete mats of the pile foundations by hairpin dowels in order to help resist the hydrostatic pressure. Wood forms were used for the beams. The sand was properly graded between beams and acted as a form for the concrete slabs. Beams and slabs were poured in one operation. Hydrolictic waterproofing was applied over the entire basement. No expansion joints were used. Special care was employed at pouring joints to insure good bonding of concrete. The floor was heavily reinforced for temperature, and has thus far shown no visible cracks. The boiler room was one of the most difficult parts of design and construction in the entire project. The boiler room floor grade is —15.5, with a calculated hydrostatic head of 20 feet, 6 inches. The action of the fine sand saturated with water proved to be of such instability that the boiler room might as well have been built in the ocean, except for the use of the well-point system. When the water was lowered to a sufficient depth by use of the wellpoint system, the sand was easily handled and would stand without shoring to a height of from 15 to 20 feet. The boiler room was large, and there were few interior points of support available to resist the hydrostatic pressure. It was necessary to build a 7-foot slab to resist most of this pressure by its own dead weight. It was found by tests that the piles exerted an appreciable resistance to uplift. This resistance was not figured in the calculations and was considered only as a factor of safety. Here again no expansion joints are made, and large percentages of temperature steel were used. Steel reinforcement for the basement, the walls and the boiler room amounts to 1,500 tons.

Concrete walls are used up to the level of the main auditorium floor, grade 18.0, and in the headhouse portion to the Boardwalk grade. The superstructure consists of a series of straight members changing to a part of the first floor framing. The truss ties assumed the stress of the truss load, movement was experienced at the roller end of the truss; ¾ inch was found to be the maximum.

Leaving the construction of the auditorium for a moment, attention is called to the end walls of the auditorium. The tremendous wind pressure of these end walls was a special problem to meet. On the front walls the vertical columns were supported at the bottom at the grade of the headhouse roof, and the top at the bottom chord of the main auditorium trusses. The bottom reaction of the wall columns was transferred to the row of columns at each end of the ball room of the headhouse by a flat truss in the plane of the headhouse roof, and in turn transmitted by portal bracing to the foundation. The wind pressure of the Pacific Avenue wall of the auditorium was taken care of in a similar manner. Cross bracing instead of portal bracing was used in the row of columns each side of the stage to carry the wind loads down to the foundation. The main auditorium trusses were of a three-hinged type, 334 feet, 3½ inches pin to pin with a rise of 136 feet, 4½ inches. They had a 7-inch diameter crown pin and an 8½-inch bottom pin. The chord members were of a tee section with an 18-inch stem plate, two 8 x 8 angles, and one or more 18-inch flange plates. The compression web members at alternate panel points where purlins occurred consisted of four angles and two angles at intermediate panel points. Tension web members consisted of two angles. The tee section type of chord worked out very satisfactorily. The use of large gussets was eliminated, and use of secondary stresses was minimized.

The general shape of the truss is a curve, and it is made up of a series of straight members chang-
ing direction at alternate panel points where splices occur. No abutting compression members were employed, the transmission of stress at all points being done entirely by rivets. One-inch rivets were used at the truss joints and ¾-inch rivets for bracing connections. Here again particular care was taken by the fabricators in the manufacture of these trusses. All materials of the trusses were sub-punched ⅛ inch smaller. Half of each truss was laid on the assembly racks to ordinates of the curvature, bolted together and properly reamed to size. For ten pairs of trusses it is realized that this work involved the setting up and assembly of 40 units.

Referring to the former mention of the end walls of the auditorium, the top support of the wall columns was provided with a sliding connection to the bottom chord of the end trusses. These sliding joints allowed horizontal and vertical movement between the tops of the columns, which were embedded in the brick wall, and the truss chords, which are free to move under varying temperatures. It is to be realized that the trusses, wind bracing and cross bracing between pairs of trusses are independent of all other steel framing and brick walls. At the intersection of the walls and the ceiling soffit of the trusses, joints of copper sheets were installed to allow for movement at these points. The trusses were designed in pairs 10 feet on centers and the pairs 49 feet, 2 inches on centers. Purlin trusses 39 feet, 2 inches long and 3 feet, 6 inches deep are spaced 24 feet on centers and come at every other panel point. Jack rafters, 15-inch I-beams, are framed to the purlins at the third points. Secondary 7-inch channels, 6 feet on centers receive the 3-inch solid gypsum roof slab.

In order to provide lateral support for wind pressure at the upper ends of the columns in the end walls of the auditorium, where the sliding joints occur, two sets of cross bracing in the plane of the upper chords of the trusses were employed in the first and fourth bays at each end of the roof. Each set is destined to take half the wind load of the upper portion of the end wall. It was afterwards deemed advisable to install for erection purposes additional cross bracing in the second bay from each end of the roof, thus obtaining a system of bracing approximately 100 feet in depth for the first three pairs of trusses erected. Wire guys were used and maintained until these first three pairs of trusses were erected and riveted, and the cross bracing 50 per cent riveted. This bracing consists of 6 x 4 angles flush with the plane of the roof and spliced with gussets at the intersections of the jack rafters and the truss chords. The interior bracing in the pairs of trusses consists of one 5 x 3½ x ¾
angle for tension and two 5 x 3 1/2 x 3/4 angles for compression members. This cross bracing occurred in the horizontal planes of top and bottom chords of the trusses and in vertical planes at every panel point. Six towers were used for the erection of the trusses. Trusses were assembled in place in 24-foot lengths and bracing connected as the work progressed. They were completely riveted to within eight panel points of the crown pin, the remainder being half bolted and half pinned and all the bracing bolted before the erection towers were removed.

The only point of deflection necessary to observe was at the haunch of the truss, at which point there was allowed a clearance between the auditorium wall and the trusses. The deflection of the trusses at the haunch point for the dead load was figured to be, by the method of internal work of distortion, 2 inches. Careful tests were made during the erection of the trusses. Three measurements were taken, first with the weight of the trusses alone, second with the filling-in framing of the roof, and third with the roof covering of 3-inch gypsum. These measurements averaged 1 1/2, 1 3/4 and 2 inches, respectively, thus indicating that the theoretical deflection checked with the actual.

The heating and ventilating systems, particularly the ventilating of the main auditorium, furnished a problem of unprecedented size. This is indicated by the number and capacity of the fans which it was considered necessary to install, —106 fans supplying a minimum of 746,000 cubic feet of fresh air and exhausting 1,140,000 cubic feet of vitiated air. All the fresh air is heated by indirect heaters having an aggregate surface of about 44,000 square feet. In addition to the indirect heaters, there are 16 window type unit heaters and ventilators for entrance vestibules, and a total of 30,000 square feet of direct radiation.

The ventilation of the auditorium was designed on the basis of upward air movement. In order to understand the arrangement of the apparatus to give this circulation, some features of the design of the building should be known. The roof of the auditorium is supported on ten double trusses spaced 49 feet on centers, each truss consisting of two members on 8-foot centers. These trusses are in the form of three-hinged arches spanning 350 feet and weighing 220 tons to each pair. The trusses rise vertically for about 70 feet before curving toward the center of the building. At this elevation, space was available for fan rooms, and the main supply and vent fans are located here. There is accordingly at each truss on both sides of the building, 70 feet above the street, a double fan room, one part containing a fresh air fan and heaters, and the other an exhaust fan. The fresh air supply is drawn through a circular opening in the outside wall about 75 feet above the street, passing through the indirect heater and into the fan. The fan stands directly over the space between the truss members and discharges vertically downward, utilizing the space in the truss as a duct. At the level of the balcony floor the truss is baffled off and the air diverted into ducts terminating in grilles along the edge of the balcony and along the side wall of the auditorium below the balcony. The supply fans, 16 in number, are of 31,000-c.f.m. capacity, double-width, double-inlet, silent vane type, operating at 382 r.p.m. with 10 h.p. variable speed, remote-control motors and textile drives. The vent fan in the other part of the truss fan room draws its air from the truss space as does the supply fan, but it extends above the fan room level, in the ceiling of the auditorium.

In the sides of the beams formed by the trusses there are openings, some of which are used for lighting apparatus and others for inlets from the auditorium to the vent duct. The vent fans, 18 in number, are of 40,000-c.f.m. capacity, double-width, double-inlet, multivane type, operating at 162 r.p.m. with 7 1/2 h.p. variable speed, remote-control motors and textile drives. The vent fans discharge through pent houses on the roof behind the parapet wall. In addition to the main vent fans there are two 5,000-foot propeller fans at the peak of each truss exhausting directly from the top of the room. These fans have constant speed, remote-control motors and are considered an important feature in the proper ventilation of the auditorium, particularly for the summer. Recirculating arrangements are provided for the fresh air fans so that ordinary heating operations will be on an economical basis. These main auditorium supply and vent fans, as here described, constitute the major part of the heating and ventilating equipment. It is of great importance that the ventilation and temperature be properly controlled, because the success of a convention is largely dependent on physical comfort.

The ventilation of the exhibition and garage space in the first story below the main auditorium, presented a considerable problem on account of the large amount of automobile engine exhaust and the relatively low headroom. The data obtained during experiments for the Holland Tunnel were used as the basis for determining suitable quantities of air supply and exhaust. The fan rooms are adjacent to the outside walls. There are two fresh air supply fans with heaters, each fan being of 40,000-c.f.m. capacity, multivane type, double inlet, double width, 206 r.p.m. with 15 h.p. variable speed motor. These two fans are on opposite sides of the room, draw their air from above the marquee, and discharge into
Pouring Concrete Footings over Piles

transverse ceiling ducts connecting in the center of the room to a longitudinal duct which is 40 feet wide by 2 feet deep. It could not be made deeper on account of restrictions of headroom. Outlets into the room are in the bottom of this duct at regular intervals. The exhaust fans are 11 in number, 6 in fan rooms along Mississippi Avenue, and 5 along Georgia Avenue. Each of these fans is a single-inlet, single-width multivane of 12,000-c.f.m. capacity, drawing direct from the side of the exhibition room, through grilles near the floor.

The ball room supply fans are three in number, located in the space above the loggia and discharging into the room through grilles along the edge of the balcony, in the columns along the loggia side, and under the stage. One of these fans is of 25,000-c.f.m. capacity, and the others are of 28,500-c.f.m. each. There are five vent fans each of 15,000-c.f.m. capacity exhausting through 50 small arched openings around the upper part of the room, these openings being provided with pneumatic dampers with remote control. There are also in the ball room about 2,700 square feet of concealed direct radiation.

The boiler plant is located near the Pacific and Georgia Avenue corner, occupying a depressed section of floor, with the pump room and the electrical equipment room. Atlantic City datum is El. 0.0 for mean low water. Mean high water is El. +4.83. The ground floor of the convention hall is El. +2.0, the auditorium floor El. +18.0, and the boiler room El. -15.0. The boiler room extends up through the ground floor to the auditorium floor level, thus having a total height of 33 feet. The excavation for the boiler room is the largest and deepest of any building in Atlantic City, and was protected and kept dry during excavation by a wellpoint system. All concrete below high water level has been waterproofed, and every precaution was taken to prevent any puncturing of the membrane by equipment supports or anchors. Under the boilers, the waterproofing is protected against the heat of the furnaces by hollow tile floor construction, through which air will circulate when the boilers are operating. The anticipated maximum load on the boiler plant is about 3,500 boiler h.p. This load will be reached only a few times a year, and it is planned to carry it as a high overload on the boilers, thus conserving the investment for boilers and boiler equipment. Three water tube boilers have been installed, one of 270 h.p. size and two of 610 h.p. each. The smaller boiler is intended to carry the summer load, providing steam for heating water and other building services. All three boilers at about 225 per cent of rating will carry the winter peak.

Fuel oil is received in tank cars and unloaded by gravity into the storage tanks buried under the platform on the Georgia Avenue side. An excavation has also been made for coal storage in case oil should at any time cease to be available. Oil was chosen as fuel for this building after thorough consideration of its relative costs and advantages as compared to small size anthracite, which is the fuel generally used in Atlantic City. The oil burners are of the steam atomizing type, two burners for the small boiler, and six for each large boiler. They have full automatic control for oil, steam and air flow. The boilers operate at 100 pounds pressure. Feed pumps are duplex,
piston pattern, two size 12 x 8 x 12 and one size 7 1/2 x 5 x 6. The feed water heater is a combination open heater and receiver, having storage capacity for 1,800 gallons of water. The fuel oil pumps are duplex steam pumps with exhaust steam oil heaters. As a starting-up unit an electric pump and electric oil heater are provided. Feed water controllers have been furnished for each boiler, and excess pressure governors for each feed pump. Instruments in the boiler room include fuel oil meters, recording and integrating flow meters, and 2-point draft gauges on each boiler, and feed water thermometer.

Steam Distribution and Control. The steam distribution from the boiler room to the building is accomplished by an 8-inch high pressure steam loop, making the circuit of the entire first story. Each indirect heater for the auditorium has a steam supply connection to this loop, with reducing valve at the heater for 15 pounds' pressure. The unit heater and direct radiator systems are divided into three main groups, each with its reducing valves and low pressure mains. Returns are collected in three pump rooms located as nearly centrally as possible to the group of radiators served. Each pump room contains two motor-driven vacuum pumps and two condensation return pumps. The vacuum pumps discharge into the receivers of the return pumps, which are vented, and these discharge back to the feed water heater at the boiler room.

Temperature Control. A very complete system of temperature control has been provided applying to both the direct and indirect heating systems. Use is made of a method for controlling the main auditorium temperature and for keeping alternate blasts of cold and warm air from the fresh air fans. Eight compound thermostats are provided, two on each side wall, two under the musicians' balcony, and one at each side of the stage. These thermostats control individual and in some cases groups of heaters. In addition to the room thermostats there are provided two-point intermediate acting pilot duct thermostats acting on the diaphragm valves of the fan heaters. During the warming-up period the room thermostats are in control and the duct thermostats inactive. When the hall reaches the desired temperature, the room thermostats act to close the diaphragm valves on the heaters. The control is then automatically referred to the duct thermostats, which by controlling the diaphragm valves prevent the air from dropping below a predetermined air temperature.

Control of the heating and ventilating systems is centralized at two points,—first, the engineers' room, adjacent to the boiler room, controlling the auditorium, garage and other departments in this end of the building, and second, the utility room near the Boardwalk end, controlling the ball room and front portion of the building. The remote control switches on supply and vent fans and the pneumatically controlled dampers are centralized in these rooms. An electrically operated temperature indicating system enables the operator to determine instantly and at any time the temperatures at 117 locations within the building, thus making possible an intelligent manipulation of the control features.

Fire Protection equipment consists of automatic sprinklers with hose standpipes and roof nozzles. The primary water supply is the city water system, and the secondary supply a 150,000-gallon reservoir adjacent to pump room and 12,000- and 20,000-gallon elevated sprinkler tanks in the Boardwalk and Pacific Avenue ends of the building. Automatic sprinklers are provided for the entire first story, for all store basements, storerooms, auditorium and ball room, stages, proscenium arches, and dressing and chorus rooms. The static pressure on the city water system is 40 pounds, but the residual pressure is only 15 pounds. Neither of these pressures is sufficient to supply water to the sprinklers in the higher parts of the building, and consequently the automatic fire pump now to be described is necessary to make the primary supply available at these heads. A cast iron main, of partly 8 inches and partly 10 inches, was laid in the streets forming a loop around three sides of the building, and connected to the city mains through check valves at three points.

Two 1,000-gallon Underwriter pumps are located in the pump room near the boiler room and adjacent to the reservoir to which their suction pipes are connected. One pump is a motor-driven, centrifugal unit, and the other a duplex reciprocating pump size 18 x 10 x 12 with an auxiliary pump size 4 1/2 x 2 3/4 x 4, both with automatic governors. The auxiliary pump operates under control of its governor to maintain full pressure on the system up to the highest sprinklers. If a sprinkler head should open or any flow of water occur beyond the capacity of the auxiliary pump, the main pump will immediately start up, and its 1,000 gallons per minute capacity would be available. The fire pump supply reservoir is kept full by a 6-inch pipe with float valve direct from the city water mains.

The Convention Hall with its equipment was designed by the Architectural and Engineering Departments of Lockwood, Greene & Co., Inc., Walter W. Cook, Chief Architect, and Alexander H. Nelson, of Atlantic City, Associated Engineer.
WALL STREET ENTERS THE BUILDING FIELD

BY

JOHN TAYLOR BOYD, JR.

PART III

In the new type of building finance, stocks constitute an important feature. Stocks, particularly common stocks, are a much more variable and difficult factor to deal with than bonds, and in order to sell stocks effectively—and bonds too for that matter—to the public, a quick, active, and free market, such as only a securities exchange can provide, is necessary. This is one of several reasons that have prompted the Real Estate Board of New York to establish a special exchange for dealing in real estate securities of all types. The term “real estate security” will be broadly interpreted, and will include real estate stocks and bonds of various classes and other securities based on real estate properties or on real estate business, or on the financing of real estate transactions. It is expected that the new exchange will be open for business by October 1, 1929, and earlier if possible. The exchange will be located in the New York Real Estate Board building at 12 East 41st Street, just off Fifth Avenue, where the executive offices of the Real Estate Board are located. There will be 250 seats sold at $5,000 each, with yearly dues of $300 per seat, and it is expected that all seats will be sold before the exchange opens.

These seats have been taken up largely by associates of most of the large real estate offices, and a number have been bought by associates of houses represented on both the New York Stock Exchange and the New York Curb Market, and by individuals connected with various financial, construction, promotion and other interests allied to real estate. A constitution has been drawn up modeled closely on that of the New York Stock Exchange, and the same high standards which will be maintained on the floor of the exchange, on which will be shown quotations of previous closing prices on securities, last sale, and also the number of the post at which the security is traded in. The brokers’ offices will obtain these price quotations by telephoning in to the exchange. The New York Stock Exchange has generously placed at the disposal of the new exchange full information as to its own workings and policies.

Among all these innovations of new finance the establishment of this real estate exchange is the most unusual. Its sponsors feel that not only will it benefit real estate generally, but that in several respects it will become an essential part of real estate and construction finance. It should aid in keeping real estate up to date and in making the necessary adjustments to financial developments since the war. No effort is being spared to make the project a success; it has the backing and good will of powerful real estate and construction interests of New York, and influential men in the New York Real Estate Board are making themselves personally responsible for the success of the undertaking. Architects who are interested in construction finance may find it advisable to watch the success of the real estate exchange. A full understanding of its success requires more than a knowledge of its mechanical function in real estate finance. One should grasp the economic function of a securities exchange in the industry of today.

But why, it may be asked, is a new exchange necessary in New York, where there are already three great general securities markets? Why not use these exchanges in some such manner as was illustrated in the case of the U. S. Realty & Improvement Company and the other real estate companies? The answer is that the exchanges dealing with general securities of New York now deal in such large issues that the average real estate issue, placed on a single building, and of less than $1,000,000 in amount, is too small to be handled by them to the best advantage. There are few companies left on the “big board” with common stock issues of less than 1,000,000 shares. Only a huge corporation, such as the U. S. Realty
& Improvement, which is developing a chain of properties for which it needs constantly millions of fresh capital, can make the best use of the New York Stock Exchange. And we have seen how U. S. Realty, in conjunction with the National City Bank, employed the over-the-counter market to float the issue of approximately $4,000,000 on the Beaux-Arts Apartments building. On the "big board," the common shares of the gigantic Equitable Building on lower Broadway, Manhattan, and the bonds of the similarly large Drake Hotel, of Chicago, stand almost alone.

The Curb Market, likewise, deals chiefly in large issues of expanding companies, generally new issues, many of which, after a process of "seasoning," find their way eventually to the Stock Exchange. We have seen how most of the group of newer real estate development companies herein described, and their construction subsidiaries, have used the Curb Market for their shares. As regards the over-the-counter market, it is true that a rather small number of the largest mortgage bond issues, based on well known huge buildings, have a market there, but even these large issues,—large from the point of view of the building industry,—seem insignificant in size and are easily overlooked by the public. Also, another drawback is that the big Wall Street investment houses are not much interested in an issue of less than $1,000,000. They are organized to handle larger issues, preferably of $10,000,000 or more. The smaller Wall Street houses which will accept the small real estate issue lack the widespread distribution of their large rivals, and their selling costs are likely to be comparatively high. Real estate, therefore, needs its own securities exchange where its smaller issues of $1,000,000 or less will not be dwarfed.

Architects outside New York might consider the possible value to the building industry of the stock exchanges in the other large cities of the country.—Chicago, San Francisco, Los Angeles, Boston, Detroit, Philadelphia, etc. For marketing comparatively small security issues based on local or regional real estate enterprises, these regional securities exchanges might be much more effective than the huge New York general securities markets. They follow the same strict standards as the New York Stock Exchange, and like it, are constantly growing in importance. Though I am not familiar with these exchanges outside New York, it would seem reasonable to suppose that their governing boards would be only too glad to cooperate with the local building industry in encouraging the listing of its securities. Individual building organizations might seek a listing for their issues, or the leaders of the local building industry might consider an approach modeled somewhat on the action of the Real Estate Board of New York in establishing its own exchange. In localities where this does not seem practicable, the leaders of real estate and construction interests, including the architects, might actively sponsor a special section of real estate securities in their local stock exchange.

For it is important to bear in mind that there are grave dangers in introducing to the public a large group of new "unseasoned" securities. A wild speculation, such as took place recently in the new aviation and amusement securities and in various "specialties," is something to avoid if possible. In real estate we have had quite enough of that sort of thing already. Anyone can think of certain nimble gentlemen who would be quick to seize the opportunity offered in the new finance, to unload bushels of worthless paper on the public. The building industry does not want a repetition of the mortgage bond failures of a few years ago. In fact, the sponsors of the New York Real Estate Exchange had just this condition in mind when they decided to create a special real estate exchange. The fullest publicity will be given to the finances of the companies whose securities are traded in, to aid the careful investor in picking out sound securities.

We have seen how the New York Stock Exchange enforces a high standard of publicity as to the finances of the companies whose issues are listed. This is the only means so far devised of protecting the individual investor and of reducing the evils of manipulation of security prices as far as is possible without interfering with a free market. The new real estate exchange will carry this principle even further in one respect,—by subjecting, as a requirement for listing, the real estate properties on which a security is issued to the independent appraisal of the exchange's official appraisal committee. This novel proposal has excited much interest. It does not mean that the exchange will endeavor to fix the price of a security by making public an estimate of the value of the property. That would interfere with a free market, and besides, since appraisal must be in some degree a matter of opinion, there could be no assurance that the exchange's appraisal, however expert, would be 100 per cent correct. What it means is that the exchange will not publish the appraisal but instead will make public the financial statement of the company applying for listing, and will announce that the properties of the company have been appraised by the exchange's committee on appraisal and have been judged suitable for listing. Annual statements of the company's condition will be required, and the company is further obligated to report to the exchange any changes in its financial affairs which will modify the official appraisal. These arrangements will aid the public.
August, 1929

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The new exchange will follow precedent in taking full precautions to ensure the financial responsibility of the brokers. Its committee on business conduct has the right to investigate the dealings, transactions and financial conditions of members and to examine their books and papers at any time. This right the New York Stock Exchange exercises with greatest severity. Recently it expelled a member because its auditors discovered that he had defrauded the government in filing his income tax return. It was argued that such a man could not be trusted with customers' money. Where transactions are closed by word of mouth,—although "comparisons" of the records are made afterward to ensure accuracy,—the standard of honesty must be absolute for the protection of both brokers and the public. One clear case of crooked dealing or failure to live up to an agreement, and a man is done. As a result of this discipline, the New York Stock Exchange has not had a financial failure among its members in a couple of years,—a record that is not approached even by the banking systems of the country.

Such, in general, are the plans for the new real estate securities exchange, designed to serve the needs of the building industry. Its backers have been considering the project for 14 years, when the idea originated in the desire to free the industry from the grave abuses resulting from extravagant appraisals, this being the chief cause of foreclosures resulting in heavy losses to the public, particularly to those in the "widow and orphan" class, whose patronage the building industry has always sought. These influential New York realtors were alarmed at the disclosure of the conditions attendant upon the crash of a large nationally known mortgage bond house not many years ago, and they resented bitterly the very recent collapse of certain huge buildings,—the financial collapse, of course, because the properties were of the finest architectural standard and were excellently located,—but they could not stand up under the overload of inflated issues.

All finance today places great emphasis on the collateral value of a security. In this connection the promoters of the New York Real Estate Board Exchange were somewhat surprised at receiving hundreds of letters from all sections of the country approving their project soon after its announcement. They looked into this aspect and discovered that both bankers and investors were impressed with the need for collateral value in real estate securities, such as only a securities exchange can supply and approve. Suppose, for example, that a man in Tulsa approaches his banker for a loan of $10,000 to build himself a home. He offers as security $15,000 par value of mortgage bonds issued on a big New York office building on Fifth Avenue. But the banker is embarrassed to inform him that the bonds won't do because there is no quick, sure market to sell them in the event the loan turned "sour," and in fact that there is no information available on which to form an opinion as to what the bonds are actually worth. So the bank cannot accept a good business deal, the man can't build a home, and the building industry loses a desirable customer,—all because the real estate bonds have no standing as collateral. This is an illustration of the advantage of establishing collateral value in a security. Today loans made on good stock exchange collateral are coming into favor for financing all sorts of business transactions. Banks favor this type of loan because it is by far the safest,—one of the easiest to make, and one that is satisfactory to the cus-

A Real Estate Exchange Might Market the Securities for a Huge Combination Store, Office Building and Apartment House Such as this Proposed Battery Tower, New York

Thompson & Churchill, Architects
tomoter. This is one reason why many investors favor stock exchange securities.

It may also be said that the sponsors of the real estate exchange are alive to the implications of the new method of construction finance, and the radical changes in economic conditions on which it is based. "The day of the small real estate holding is passed," is a statement they have made on several occasions. "We must take the public into the ownership of real estate. These buildings are getting so large that there is no other way to finance them." A block building proposition becomes a public affair because no one man or syndicate can swing it. Since there are always uses for the small building, the chain principle of ownership may find opportunity in that field, and create another demand for large-scale financing.

This brings us to a brief consideration of the economic function of a stock exchange and its peculiar relationship to common stock issues. Especially is it necessary to form a clear idea of the difference between speculation and investment which will be considered later. This is essential in working out any specific plan of building finance. It is well to avoid becoming involved in the present controversy over the unprecedented speculation on the security exchanges of the nation. The situation seems much too involved for an architect to understand, since some of the greatest financial authorities of the world are at odds over it. For this reason, architects should be on their guard against accepting uncritically the opinion that is now being expressed by some of the financial experts in the building industry to the effect that the money which the building industry needs for mortgages and equities is being diverted to speculation in Wall Street. This diversion, it is argued, will injure the industry. Without attempting to solve such a knotty problem, it may be worth while to point out that the situation in building finance discussed in these articles throws a different light on the problem. Briefly, we have seen how these new financial-construction organizations, like the Beaux-Arts Development Corporation-U. S. Realty-National City combination have gone into Wall Street, to the Stock Exchange, Curb and over-the-counter markets, and have there obtained their junior mortgage and equity financing much more easily, and what is even more important, they got all the money they wanted and got it on much more economical terms than were offered in the conventional method of building finance. I have not heard any of them complain that Wall Street speculation was strangling their business!

It is apparent that there are many reasons besides the alleged reason of get-rich-quick speculators which makes Wall Street attractive to the public. As previously pointed out, the question of the investor, "What do I get out of it?" gives him control of the situation today. But the matter goes even deeper. The claim is made that one of the controlling factors in the situation is the change of the American nation from a debtor to a creditor nation since the war. We now pile up surplus capital so fast that we must have a new and larger channel to conduct the flow of capital away from the many money tanks which might otherwise clog up and burst. The securities exchange provides a needed safety valve, without which the surplus money might be employed in speculation in commodities, in both urban and farm lands, and in the over-expansion of industries, with disastrous effects to general business. This is about as far as an architect can go. Whatever be the truth to economic theory, there is a very practical point for architects to take note of in the situation. They should note carefully the growth of the security exchanges as a primary source of long-term capital, for no one can deny that long-term capital is what the building industry sorely needs. Nor can one deny the fact that the building industry generally has enjoyed the benefit of low-cost, long-term capital only on first mortgages. It has practically never enjoyed that advantage for junior mortgages and equity financing that other industries have.

This brings us to the distinction between investment and speculation. A delightfully amusing incident took place a few months ago when a prominent New York realtor, long noted for his promotion of sub-divisions, publicly attacked Wall Street for having diverted money from real estate investment into stock speculation! This is the view of a clever salesman, and the man who represents his own goods to be "investments" and the other fellow's goods as "speculations!" But this emotional distinction is not of practical use in working out plans of building finance based on stock issues.

Without splitting hairs on economic theory, one may accept, as a good workable definition, the theory that investment means solely the purpose of conserving one's principal, neither adding to it nor subtracting from it, but merely drawing interest thereon by lending it to someone else. Examples of investments are life insurance endowment policies or savings bank accounts or very conservative first mortgages. Only on that basis can one be a pure investor. But the moment that one listens to that little devil Appreciation whispering in one's ear, one becomes corrupted by speculation, and to the extent that one acts on his suggestions, one passes from the 100 per cent of security investment toward the opposite pole of 100 per cent of speculation, which is in the nature of gambling.
On the other hand, it is only too evident that speculation can be excessive, particularly in the highly complex, delicately adjusted economic system of today. One may say that speculation becomes excessive when the evil it works overbalances the good it does as an incentive to business activity. In that case speculation does become harmful, although the problem of how to deal with it practically seems almost insoluble.

Understanding these principles is essential in determining the proper proportions of investment and speculation in working up plans for stock issues. The question is of course one of the amount of risk that seems reasonable in each case. Here one may accept the principle that the value of common stocks in the financial practice of today is likely to rest chiefly on intangibles. Common shares values are based chiefly on earning power and on public confidence in the management and in the competitive strength of the enterprise. For example, General Motors has great earning power and strength, but its "book value" is very low. U. S. Steel is also strong in earning power, but has high book value. On the other hand, most of U. S. Steel's surplus is tied up in highly specialized plants and equipment, and it is likely that, if the management failed to make a success of the steel business, no one could be found who would be willing to take over these plants at 100 cents on the dollar. But with real estate stocks, we have seen that they can have great real liquid book value behind them in the form of fine real estate properties, and this should be a valuable investment advantage in this class of security. The "bonus" stocks, which were discussed in the last article, are very interesting in this connection. When issued they represented nothing but expected appreciation in specific real estate properties; hopes of earning power, and of increasing equity value as mortgages or preferred stock were paid back. On the other hand, as an offset to their speculative character, those bonus shares cost nothing, and are a fairer type of investment than "watered" stocks for which real money is paid.

Now, the point of this intangible nature of common stock is that a security exchange provides the only practical yardstick for appraising its values. The prices fixed in the trading represent the consensus of the many different opinions of both public and experts as to the merits of any stock, or in other words, as to the future prospects of the real estate properties on which the stock is issued. Thus in its trading a securities exchange sets a flexible standard for appraising individual stocks and classes of stocks.

This discussion of securities exchanges concludes the account of the new financial developments in the building industry in New York. How different is all this maze of ideas and methods from the good old fashioned plans of building finance! Actually, for years there has been only one plan in building finance. Set the equity and, that done, the choice of two or three possible mortgage alternatives became almost automatic! Such has been the formula for 50 years.

But, from a historical point of view, the placing of junior and equity financing on the basis of long-term security issues seems plausible. It merely completes the transition begun 40 or 50 years ago when the existing elaborate system of first mortgage loans replaced the ancient practices of "private" finance. Up to that time the mortgage and title business rested chiefly in the hands of small individual capitalists, executors of estates, and brokers and lawyers acting for clients. It was costly, inefficient, none too responsible, and was not without its abuses. The needs of the building industry had grown beyond this small scale, uncertain traffic, and accordingly the first mortgage business was organized into a system of public large scale finance, operated by large mortgage and title companies, insurance companies, savings banks and building loan associations, all of which drew funds from the general public for first mortgages in almost unlimited amounts. But since that time nothing has been done for junior and equity financing. Now, after 50 years, that final step may at last be taken. If the movement continues, we may witness further changes in the first mortgage system itself,—possibly greater flexibility and a tendency to obliterate the sharp lines of cleavage which now separate mortgages from equity financing. This latter change was made in the Beaux-Arts financing, as has been described.

The use of security exchanges may become of greater importance in finance. The trend of general finance today is to seek capital from the public as a principal source. Real estate, which has existed more or less as a world apart, with its own peculiar system and customs of finance, may not be able much longer to avoid the change. It may be obliged increasingly to compete with other industries for its share of the surplus capital of the American public in the public securities markets. The Real Estate Board of New York Exchange may prove a valuable aid in making the change.

Such are the possibilities of an interesting and important situation, new and amazingly complex. One sure fact, however, stands out strongly in the uncertainty, like a tower. That is, the crying need of the building industry for the economy of long-term financing of junior mortgages and equities of buildings.
This Controlling Purchase Schedule Is Explained on Page 253
CONSTRUCTION CONTROL BY SERVICE CONTRACT

BY

L. M. RICHARDSON

MANAGER OF CONSTRUCTION, MORTON C. TUTTLE COMPANY, BOSTON

THERE are three chief points of interest to the man investing in construction,—first, the efficiency of the work as indicated by organization and method of construction; second, the progress in time; and third, the cost of the work. In the case of a contract placed on the basis of price competition, once an award has been made, the method of operation is entirely in the contractor’s hands; the matter of time has been specified and is presumed not to concern the owner until the work is completed, and the cost is, as a matter of choice, entirely in the builder’s hands. On this latter point an owner buying a building in competition never knows what the work actually costs. On the other hand, where a contract is placed on a service basis and the builder is selected for his particular ability, while the control of the work and responsibility for it are necessarily in the hands of the builder, it is the owner’s privilege to interest himself at all times as far as he may wish in following any phase of the construction.

The contractor operating on a service basis naturally counts as his chief asset the good will of his clients, and accordingly he must make every effort to so handle his work that the owner will always find the work proceeding efficiently, with time and cost systematically controlled and periodically recorded. To attain this result, the service builder must pay unusual attention to the selection of his field forces and to the organization of each contract; he must carefully plan the progress of his work to coordinate the various trades, and record progress in such a manner that the time status of the work will at all times be apparent; and, what is of the greatest importance, he must systematically record and follow the cost aspect of the work from every angle to show at all times the actual cost as compared with the original estimate. Because the interests of the owner are paramount in fact as well as in theory, the cooperative aspects of the relation must be carried out in every phase of the operation. The owner’s viewpoint must never be lost sight of. Construction procedure, including the systematic recording of cost and progress, must be viewed through his eyes, all records be carried in such manner as to be clear to him rather than in the language of the builder, and a full record in clear, understandable shape always be available to him and to the architect who represents him.

The application of these principles is illustrated in the description here of a construction operation carried out on a service basis. The structure is that referred to in previous articles in The Forum, by Morton C. Tuttle (January, 1929), and Clayton W. Mayers of the Morton C. Tuttle Company, Boston (April, 1928), discussing respectively the advantages of collaboration of designer and cost expert and the application of this service in the preliminary stages of a development and prior to starting construction.

The building taken as an example is a fireproof office building, three stories in height, of modified Georgian architecture, with a brick exterior. The entire structural frame of the building is of reinforced concrete with no transverse beams. Reinforced concrete slabs span across the building from side walls to longitudinal beams running lengthwise and located on the lines of the main corridor walls.

Progress Schedule. The basic secret of successful construction may be given almost in a word; it is that of getting the right men and the right materials, in right quantities, at the right place at the right time. And the essence of all this rightness is time. Only systematic planning of a building operation before the work starts, including a thorough analysis and careful consideration of each operation involved, can assure completion on a definite, pre-arranged date and guarantee a smoothly coordinated procedure from start to finish. Such planning in the case of the building under discussion is illustrated by the progress schedule produced herewith, showing the time status of the work on November 27, after it had been under way for eleven weeks. This schedule is prepared under the direction of the Manager of Construction from comprehensive records of past experience and is one of the first steps in starting the work, being preceded only by a preliminary survey of local conditions. The schedule is laid out on a printed form with as many columns as there are weeks in the course of the work, each column being headed by the month and day. The original schedule serves as a master sheet and is held in the Company’s home office. When completed and finally approved, a number of blue prints are made from it and sent to the field office. Each week the field engineer, whose duty it is to record progress, fills in the schedule up to the current date, and after approval by the field superintendent it is forwarded to the Manager of Construction at the main office. He in turn scrutinizes the schedule and makes such suggestions as field conditions indicate.

Every schedule is based on some one key point, which in this instance was an occupancy date of June 1, desired by the owner. This required the
delivery of the building approximately one month earlier than the final date, to allow the owner sufficient time to install furnishings and make such preliminary preparations as were necessary to assure full occupancy at the desired time. The secondary point in this schedule is November 20, on which date it was desirable to have the concrete frame of the building completed in order to avoid severe weather conditions, with consequent expense, that would undoubtedly be experienced after that date, as the structure is located in northern New England. The schedule was accordingly worked back from November 20, and subsequent operations laid out to show completion on May 1.

It will be noted that this progress schedule lists the various main divisions of the work in the order of construction. These operations are numbered, for convenience of reference, in the first column. Any scheduled item departing more than a day or two from schedule is indicated by a cross in the third column opposite the item. The fourth column is divided to show the percentage of completion of each item and is of particular value as showing at a glance those items which are completed and accordingly require no further attention, and the status of each uncompleted item.

Excavation, the first item in the schedule, was started approximately on time and was completed in slightly less time than had been anticipated. Footings also were completed about as planned. In the case of foundation walls, however, excavation uncovered a more difficult condition than was anticipated, with the result that this item was started three days late, and its completion extended one week beyond the planned time. This naturally delayed the erection of floor forms which, in the case of each floor, were completed about one week later than had been planned. However, because of the desirability of completing the concrete frame as planned, the placing of concrete was accelerated to show completion of each floor in five days rather than the ten days shown, with the result that the concrete roof was in place only two days later than planned.

It is particularly noteworthy that up to this point the progress schedule has served its purpose in indicating each week the exact status of each major operation, and in this case it has shown the steps necessary to bring the work up to time. The removal of forms, covered by Item No. 7, was delayed by the later starting of concrete, but the final removal was not of particular importance once the first story was clear to permit the starting of the brickwork. This brickwork was started on time and was immediately followed by the erection of window frames in order to close in the building as the work progressed. The schedule at
this point shows granolithic work just starting, five weeks ahead of schedule. A reconsideration of this item showed the desirability of making an earlier start, since the completion of this item with the paving would also complete all the concrete work of the building.

This schedule, taken at a later point in the work, would usually show more variation than in the earlier stages, due to the fact that it is more difficult to predict the exact progress of the work of equipment installation, which is usually sub-let, and of interior construction. It is accordingly necessary to pay much closer attention to time during the latter half of an operation than in the earlier stages. A copy of this schedule is sent each week to the owner and to the architect. It is also posted at the field office in order that the full field organization may know the rate of accomplishment.

Purchase Schedule. (See page 250). Progress is directly dependent on delivery of material on definite dates, and accordingly the time of delivery of each major item of material must be pre-determined. To accomplish this a purchase schedule, in form similar to the progress chart on which it is based, is prepared immediately after progress is laid out. The purchase schedule on this particular project is reproduced herewith and is generally self-explanatory. In fixing dates for the delivery of various materials consideration is given to sources of supply and, in the case of subcontractors, to the time required for manufacture or fabrication,—this consideration applying to such items as elevators and enclosures, stairs, doors and windows, etc., which show the dates of placing orders somewhat early as compared with other items. In the third column, after each item, will be noted either the letters "B. O." or the word "Job." This column indicates whether purchase of the particular item is to be made by the Boston office of the Company or by the field office on the job. Where both are shown opposite an item, this indicates that local prices will be taken by the job and figures taken by the Boston office as well. In this particular instance the owner wished all orders placed through his own purchasing department, which accounts for practically all purchases being noted as handled by the job. Regardless of the actual placing of the order, all major purchases are made under the supervision of the general purchasing agent at the main office. This purchase schedule shows the date on which plans must be available as a basis for the field accountant. Accordingly, as soon as plans were sufficiently developed, a revised estimate was prepared and submitted to the architect for his approval, and when approved a copy sent to the owner for his information. In developing this estimate the units used are not general assumptions based on past experience but rather exact unit costs taken from work of a similar character. This is made possible by the operation of the cost accounting system, described here, which makes available in usable form the detailed costs obtained on each contract carried out. Tabulated in simple form, these costs are always available as an up-to-date source of accurate estimating data.

Job Budget. In order that the field forces may be fully informed as to the expected cost accomplishment on the work, the job office is furnished with a budget taken directly from the estimate, but unlike the estimate it is split up into two sections,—labor cost and materials' cost. This budget in preliminary form was made up immediately following the completion of the estimate in order to give a basis for the field cost accounting. As soon as plans were finally completed and the purchases made, a revised budget was prepared which showed numerous changes in various details but little change in the total amount. The total amount shown in labor and material budget is somewhat less than the total of the estimate, since the estimate carries a 5 per cent contingent item which is not shown in the budget. The first column in the labor budget shows the code classification for each item.

**Job Budget**

for

A FIREPROOF OFFICE BUILDING

IN NEW ENGLAND

LABOR

<table>
<thead>
<tr>
<th>Excerption</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear site (cut trees and dig roots)</td>
<td>1,800 c.y.</td>
<td>$0.29</td>
<td>525</td>
</tr>
<tr>
<td>Steam shovel excavation</td>
<td>1,800 c.y.</td>
<td>$0.29</td>
<td>525</td>
</tr>
<tr>
<td>Steam excavation</td>
<td>1,800 c.y.</td>
<td>$0.29</td>
<td>525</td>
</tr>
<tr>
<td>General hand excavation behind</td>
<td>150 c.y.</td>
<td>$0.50</td>
<td>75</td>
</tr>
<tr>
<td>Hand excavation for footings, walls and pits</td>
<td>500 c.y.</td>
<td>$1.25</td>
<td>625</td>
</tr>
<tr>
<td>Backfill footings and walls</td>
<td>500 c.y.</td>
<td>$0.75</td>
<td>375</td>
</tr>
<tr>
<td>Level and tamp for paving</td>
<td>6,780 sq. f.</td>
<td>$1.00</td>
<td>6780</td>
</tr>
<tr>
<td>General grading 10' from building</td>
<td>200</td>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>

Changes in Estimate. The purpose of an estimate on a building operation is not only to show the probable final cost of the work but to serve as a basis for the recording of costs as the work progresses and the comparison of unit costs with estimated cost as the work proceeds. Although the estimate on which the award of this particular building was made was a close approximation and sufficient to show the amount of the investment involved, it had been based only on preliminary sketches and was not sufficiently accurate to serve as a basis for the field accountant. Accordingly, as soon as plans were sufficiently developed, a revised estimate was prepared and submitted to the architect for his approval, and when approved a copy sent to the owner for his information. In developing this estimate the units used are not general assumptions based on past experience but rather exact unit costs taken from work of a similar character. This is made possible by the operation of the cost accounting system, described here, which makes available in usable form the detailed costs obtained on each contract carried out. Tabulated in simple form, these costs are always available as an up-to-date source of accurate estimating data.
### Forms

- Pew Temporary walls, heals and fuel
- Pew Sawmill
- Pew Temporary buildings
- Pew Misc. other plant
- Pew Tower, boom hoist and motors
- Pew Heating and weather
- Pew Sanam shovel
- Pew Other plant
- Pew-T Team plant

### Steel Reinforcement

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ref</td>
<td>Cut bend and place all slab and beam steel</td>
<td>62 tons</td>
<td>25.00</td>
</tr>
<tr>
<td>Rec</td>
<td>Cut bend and place all column steel</td>
<td>19 tons</td>
<td>26.00</td>
</tr>
<tr>
<td>Res</td>
<td>Cut bend and place all foundation wall, footing and misc. steel</td>
<td>22 tons</td>
<td>85.00</td>
</tr>
<tr>
<td>Ru</td>
<td>Steel reinforcement unloading and sorting</td>
<td>94 tons</td>
<td>2.00</td>
</tr>
<tr>
<td>Ru-T</td>
<td>Team all steel reinforcement</td>
<td>94 tons</td>
<td>75.00</td>
</tr>
</tbody>
</table>

### Concrete

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med Footings</td>
<td>78 c. y.</td>
<td>1.80</td>
<td>141</td>
</tr>
<tr>
<td>Medw Foundation walls, plasters and arrangements</td>
<td>244 c. y.</td>
<td>2.25</td>
<td>548</td>
</tr>
<tr>
<td>Mop Paving</td>
<td>84 c. y.</td>
<td>1.80</td>
<td>151</td>
</tr>
<tr>
<td>Mop Platform</td>
<td>5 c. y.</td>
<td>2.50</td>
<td>12.50</td>
</tr>
<tr>
<td>Mef Steps, landings</td>
<td>68 l.f.</td>
<td>.60</td>
<td>40.80</td>
</tr>
<tr>
<td>Mef Slabs, girders and columns</td>
<td>700 l.f.</td>
<td>2.00</td>
<td>1,400</td>
</tr>
<tr>
<td>Kluf Granolithic finish (paid after)</td>
<td>258 sqs.</td>
<td>8.00</td>
<td>2,060</td>
</tr>
<tr>
<td>Kluf Foundation troughs, miller, etc.</td>
<td>80 l.f.</td>
<td>.85</td>
<td>68.00</td>
</tr>
<tr>
<td>Kluf Float finish</td>
<td>12 sqs.</td>
<td>3.00</td>
<td>36.00</td>
</tr>
<tr>
<td>Klw 1</td>
<td>19 sqs.</td>
<td>.80</td>
<td>15.20</td>
</tr>
<tr>
<td>Klw 2</td>
<td>Sandry carbo. run in parts of base ment left unplastered</td>
<td>150 sqs.</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Masonry

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med w.</td>
<td>2,450 bbls.</td>
<td>.14</td>
<td>343</td>
</tr>
<tr>
<td>Medw-T</td>
<td>Team cement</td>
<td>200 bbls.</td>
<td>1.04</td>
</tr>
<tr>
<td>Mywz</td>
<td>Trim sand and gravel pile</td>
<td>2,570 tons</td>
<td>.06</td>
</tr>
<tr>
<td>Mecw Cinder concrete fill</td>
<td>18 c. y.</td>
<td>5.00</td>
<td>90.00</td>
</tr>
</tbody>
</table>

### Other Trades

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td>Cut fins and voids on concrete ceiling</td>
<td>600 sqs.</td>
<td>.25</td>
</tr>
<tr>
<td>Mo-T</td>
<td>Unload and handle cement</td>
<td>2,450 bbls.</td>
<td>.14</td>
</tr>
<tr>
<td>Mysz</td>
<td>Trim sand and gravel pile</td>
<td>2,570 tons</td>
<td>.06</td>
</tr>
<tr>
<td>Mecw Cinder concrete fill</td>
<td>18 c. y.</td>
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<tr>
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<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bw</td>
<td>Steel, iron and steel</td>
<td>8,090 c. f.</td>
<td>.90</td>
</tr>
<tr>
<td>Bet</td>
<td>Terra cotta tile partitions, 4&quot; and 6&quot; thick</td>
<td>17,955 c. f.</td>
<td>12.15</td>
</tr>
<tr>
<td>Bwsc</td>
<td>Clean down brick and stone</td>
<td>1,300 sqs.</td>
<td>4.00</td>
</tr>
<tr>
<td>Bwsc</td>
<td>Set metal covered and steel doors</td>
<td>1,000 sqs.</td>
<td>1.30</td>
</tr>
<tr>
<td>Bv</td>
<td>Fire, etc., including fire brick and fire clay</td>
<td>1,100 sqs.</td>
<td>1.30</td>
</tr>
<tr>
<td>Bu</td>
<td>Terra brick, tile, lime and stone</td>
<td>1,600 sqs.</td>
<td>.50</td>
</tr>
<tr>
<td>Bu-T</td>
<td>Unload and handle all brick, tile, lime, and granite</td>
<td>800 sqs.</td>
<td>.75</td>
</tr>
</tbody>
</table>

### Steel and Iron

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedf</td>
<td>Set door frames</td>
<td>50</td>
<td>.00</td>
</tr>
<tr>
<td>Sede</td>
<td>Set metal covered and steel doors</td>
<td>50</td>
<td>.00</td>
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</table>

### Carpentry

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Rate</th>
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</tr>
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<tbody>
<tr>
<td>Cef</td>
<td>Set wood door frames</td>
<td>70</td>
<td>.05</td>
</tr>
<tr>
<td>Ced</td>
<td>Set wood doors, Front Entrance</td>
<td>110</td>
<td>.11</td>
</tr>
<tr>
<td>Cedi</td>
<td>Set metal covered and steel doors</td>
<td>80</td>
<td>.10</td>
</tr>
<tr>
<td>Celi</td>
<td>Set steel ladders and column cores</td>
<td>100</td>
<td>.10</td>
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### Miscellaneous

<table>
<thead>
<tr>
<th>Material</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Cer</td>
<td>Miscellaneous carpentry work in</td>
<td>1,600 sqs.</td>
<td>.16</td>
</tr>
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</table>

### Other Trades

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Cem</td>
<td>Cement</td>
<td>2,450 bbls. at 3.05</td>
<td>7,480.00</td>
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### Materials and Sub-contracts

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total labor and teams</td>
<td>856,748</td>
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</table>

### Summary

- **Total Labor and Teams:** 856,748
- **Materials and Sub-contracts:** 85,000
- **Sub-Contracts:** 100,000
- **Total Material:** 95,195
August, 1929  THE ARCHITECTURAL FORUM  255

(JOB BUDGET, CONTINUED)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quant'ly</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heating, boilers and stack</td>
<td></td>
<td>15,000</td>
</tr>
<tr>
<td>2. Plumbing, conductors, drains and sewers</td>
<td>7,500</td>
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</tr>
<tr>
<td>3. Gas piping</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>4. Elevator (height of 10 tons, alone speed)</td>
<td>2,000</td>
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<tr>
<td>5. Electric work and wiring (no fixtures included)</td>
<td>4,500</td>
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<tr>
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<td>$29,650</td>
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</table>

**LABOR**  56,748

**TOTAL LABOR, MATERIALS AND SUB-CONTRACTS AND EQUIPMENT**  $179,593

Items not included:
1. Roads, sidewalks, general planting, auto space, landscape work.
2. Removing old buildings.
3. Wood top floors except in Assembly Hall.
5. Screens for windows and doors.
6. Rock, ledge or quicksand or running water in excavation.
7. Lighting fixtures, telephones, furniture or rugs.
8. Window shades.

**Timekeeping.** The timekeeping code in use by this Company is based on the "mnemonic" system. The first letter of the code item is a consonant indicating the general classification; D for excavation or digging, P for plant, F for forms, B for brickwork, etc. The second letter is a vowel indicating the kind of labor; that is, a for making, e for placing, i for removing, etc. The third letter or combinations of third and fourth letters are consonants indicating the part of the building to which the item applies. These last letters have different meanings in some different classifications, but as far as possible are confined to one kind of work; that is, d would apply to footings whether in connection with excavation, forms, concrete or reinforcement; c would apply to columns in every case; and f would always mean floors.

This code is used primarily for recording at definite times through each day the exact work on which each man on the job is engaged. The time sheet on which this record is made is divided into columns, each representing one hour of the day, while a vertical column at the left shows the number by which each individual on the job is known. In recording the time the timekeeper simply notes opposite a man's number and in the proper hourly column the code classification of the work on which the man is engaged. This time sheet is summarized each day by collecting all of the charges under each code classification. Incidentally, the total number of hours of each man's labor is transferred to the payroll sheet.

Although the various labor charges are summarized in finished form only once each week, it will be obvious that it is a simple matter to check up, whenever desired, what a single day's costs are on a given item. For instance, it is frequently desired to know what the day's cost is on concrete or brickwork, the quantity measurement of which is a simple matter. Accordingly, an hour's work on the time sheet will summarize the particular item so that the actual cost of a day's work is easily shown the early part of the following day, and opportunity is given to correct any irregularity that may be shown by the figures.

**Labor Statement.** Daily labor costs are transferred to a summary sheet which is completed once each week and transferred to a form called the labor statement. This form follows exactly the items as laid out in the labor budget. The labor statement reproduced herewith is taken at the end of the tenth week of the work. It will be noted that it shows the week's cost, that it compares the actual cost with estimated cost in both total expense and units and, what is of the greatest importance, it indicates what the final cost of each item will be if completed at the going rate of accomplishment. Too much emphasis cannot be placed on the value of this particular point. It will be obvious that a cost system which shows costs only at the completion of a contract is of value only to the contractor in estimating future work and is of no use whatever during construction as offering an opportunity to correct unsatisfactory conditions. It will also be obvious that if, in the labor statement shown, the expenditure on each item were given without reference to the uncompleted remainder, it might well indicate a false condition. For instance, certain items involving a limited amount of work might show a saving totaling some hundreds of dollars, whereas one of the larger items, of which only a small part of the total had been completed, might show an over-run in actual expenditure far less than the total of savings on other items. Therefore, considered as an independent statement, the weekly report would show the job to have saved money, yet on the large item which is over-running (if the rate of over-run were to continue through the life of the job), the final extra expense might far more than offset any savings on smaller items.

This labor statement is forwarded each week by the field superintendent to the Manager of Construction at the main office, who immediately interests himself in any items which may be out of proportion, and in consultation with the field superintendent he gives particular attention to the items in question with a view to correcting them while the work is still under way.

**Material Statement.** A material statement similar in form to the labor statement is also based on the job budget. Because this material statement is largely a record of purchases and does not offer the opportunity for correcting conditions as does the labor portion of the work, it is compiled only once each month. It does, however, carry out the same idea as the labor statement in showing in its final columns the probable standing of the cost of material at the end of the work. It will be noted that actual quantities vary in many cases from estimated quantities, and that there is also frequent variation between both esti-
### Page 54

**Morton C. Tuttle Company**

**Job No. 54**

For Fire Proof Office Bldg. At

**Labor Statement thru November 27th, 1926**

#### Transportation

**Shipment**

| Item | Weight | Dimensions | Quantity | Rate | Total
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#### Special Labor

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#### Material

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</table>

#### General Information

- **Job No. 54**
- **For Fire Proof Office Bldg.**
- **Labor Statement thru November 27th, 1926**

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### Page 55

**Morton C. Tuttle Company**

**Job No. 54**

For Fire Proof Office Bldg. At

**Labor Statement thru November 27th, 1926**

#### Transportation

**Shipment**

| Item | Weight | Dimensions | Quantity | Rate | Total
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#### Special Labor

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#### Material

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</table>

#### General Information

- **Job No. 54**
- **For Fire Proof Office Bldg.**
- **Labor Statement thru November 27th, 1926**

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_Facsimiles of Labor Statement Sheets, Omitting the Ruling, in Light Blue and Red, of the Originals_.

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Arcitectural Engineering and Business Part Two
orever, show that various savings more than offset and actual total costs. The last columns, however, show that there is at this point a substantial margin.

\[ \text{Savings} = \text{Estimated} - \text{Actual} \]

\[ \text{Over-runs, and that on the material side of the work there is at this point a substantial margin.} \]

\[ \text{Cost Tendency Chart.} \]

To more quickly and clearly indicate the condition of the work as regards labor costs, it is a practice in this Company to plot each weekly labor statement on a cost tendency or "lightning" chart. This
chart, covering the work at the end of the eleventh week is reproduced herewith and will be generally self-explanatory. By reference to the chart it is immediately apparent just which items are showing greatest deviation from the budget.

Like the labor and material statements, the principal emphasis in this chart is on the probable final cost of the work rather than the total expenditure to date. Therefore the high points of the variations are the points which would show at the end of the work if the going rate of accomplishment were continued. The amount of saving is the indicated saving at the end of the work rather than at the time the chart is plotted. Copies of this cost tendency chart are sent each week to the architect and to the owner, thus keeping them informed in detail as the work proceeds.

**Extra Work.** The method of caring for additions and changes under the service type of contract as compared with the usual agreement made on the basis of competitive bids is interesting. In the latter case the contractor generally names a lump sum for each item, and there is usually little opportunity for architect or owner to question the amount. Under a service type of contract, however, the architect or owner is given an estimate in detail showing exactly what each addition or change involves. When an extra item is authorized it is simply carried along and accounted for in the same way as the rest of the work under a number assigned to it. In this way the owner pays the exact cost of labor and material plus the contractor's fee, which is usually a pre-determined percentage of cost. A periodic statement of all extras is compiled and given to architect and owner in order that these costs may be added to the weekly labor and material statements to show the total probable final cost. It is, therefore, obvious that on the service basis there is no opportunity for making arbitrary demands in connection with extra work, and that one major source of discord is in this way eliminated.
THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 8. FORM WORK

SPECIFICATIONS for form work for the school building under discussion read:

FORMS:

"(A) IN GENERAL. The Contractor shall provide all required wood (or other) forms for the proper execution of all concrete work, plain and reinforced, and supplied in sufficient quantity so that the work can be prosecuted with despatch. Removable steel forms of No. 16 gauge metal, of approved design, may be used where appropriate for floor slabs, at option of Contractor.

"(B) STRENGTH of all forms shall be sufficient to carry the dead load of materials and construction operations without deflection or vibration. They shall be so braced as to be rigid under trucking and other action incidental to building. They shall be so designed as to be capable of needed adjustments, shall be carefully watched as work proceeds, and all faults promptly corrected.

"(C) SMOOTHNESS. Surfaces of forms in contact with concrete, intended to remain exposed, shall be of dressed lumber with tight joints, so built as to provide, after removal, a true, smooth finished concrete. Members and surfaces shall be straight and true to line; walls, columns and piers absolutely perpendicular, and all horizontal members free from the slightest sag. Perfect finish will not be required on those surfaces exposed in unfinished rooms, in basement, or in ducts, or those elsewhere which are to be concealed by subsequent construction. All surfaces shall, however, be true to planes and profiles detailed.

"(D) INSPECTION. Ample opportunity shall be given the Superintendent to examine all forms just before concrete is poured. They shall then be thoroughly clean, free from shavings, tags, dirt or other rubbish, and shall be thoroughly drenched, except in freezing weather. Forms for vertical construction shall have openings at bottom, until ready for pouring, to permit removal of rubbish and dirt.

"(E) WRECKING OF FORMS shall not be started for 7 days after pouring, and none shall be done until the Superintendent gives consent and then only at the sole risk of the Contractor. After wrecking, sufficient struts shall remain to insure rigidity and strength until final set."

So far as the interest of the architect or engineer is concerned, forms (or centering) are in the same category as other equipment of the builder's,—merely tools of his trade intended to produce certain desired results at minimum expense. It is the contractor's business to determine—

1. Of what material the forms shall be constructed.
2. How they shall be put together.
3. How they shall be braced and secured.
4. That they are clean at time of pouring, and drenched, oiled or soaped as called for.
5. What means are to be provided for easy wrecking, with least damage.
6. That wrecking is not done too soon and that sufficient struts are left.

The superintendent must see—

1. That the form material is such that it will produce true surfaces of the intended texture.
2. That forms are built to the exact dimensions of the finished work.
3. That all bracing is adequate.
4. That all surfaces are in proper condition at the time of pouring.
5. That wrecking of forms is done in such manner as not to injure the concrete.
6. That wrecking is not done too soon, and that sufficient temporary supports are left.

Form lumber is often the first material delivered, and carpenters are at once set to work to prepare it to be placed. As to this material, the superintendent's main concern is that it is of a character to produce the desired finished surfaces. Second hand material should not be used for forms for finished surfaces, owing to its lack of uniformity. There is an increasing tendency among architects to build finished concrete surfaces on which all form marks are plainly visible, and the marks of the grain of rough lumber. This is frankly monolithic concrete, without any rubbing or coating whatever. Others require the surfaces to be rubbed, treated with grout or by means of a cement gun. For the former effect, one must see that no form member is of a character to mar the intended finish. But, if the surfaces are to be rubbed, coated, plastered or veneered, then a lesser degree of perfection of form surface is necessary. In any event, form lumber should be medium dry and free from loose or large knots. Kiln-dried lumber is too absorbent, and green lumber is too likely to shrink and cause leaks and ridges.

The builder may construct his basement wall forms of separate boards or planks or of sections previously built up and intended to be interchangeable. Such sections are sometimes taken from job to job and can be used six or eight
times, whereas separate boards can seldom be used more than two or three times,—frequently only once.

By referring to Fig. 8, it is to be noted that, in this work, forms were required for the upper portions of footings, the lower portions of which were deposited within earth banks; 2 x 6-inch members were used for these footing forms, which were held in place by driven stakes and, later, easily removed. After the footings were partially set and the waterproof course in place, work on wall forms proceeded at once, progressing in both directions from the southeast corner.

The superintendent carefully verified all dimensions and saw that the form work was rigidly braced, especially at the bottom, where the weight of the fluid mass exerts greatest pressure. Weak forms are said to constitute one of the four principal causes to which have been attributed the failures in some concrete buildings. These causes are (1) imperfect design, (2) poor materials, (3) faulty construction and (4) weak forms."

Especially must the superintendent see that forms made of 3/4-inch boards are erected with more frequent ribbing than if 1 3/4-inch plank is employed. For the former, the ribs or studs cannot exceed 2 feet on centers with safety, while those for plank can be double the distance, except that, where the depth of forms exceeds 12 feet, it may be found necessary to decrease the spacing in either instance, in order to prevent "bulging" and the consequent "wavy" surface in the concrete.

The experienced superintendent will be in no way officious in his inspection and criticism of form work. He is particular to impress upon the foreman the latter’s full responsibility for everything pertaining to the forms. The superintendent’s cooperation in this regard is advisory only, and hence he must avoid assuming any liability,—as is ever the case where he is privileged to be paid to considerations of beam and girder work, making sure of proper thicknesses and alignment, and overseeing the method of installing supports. If any one of the several proprie-
tary systems of concrete floor construction is used, the superintendent should be supplied with detailed drawings and specifications in order to make sure that the workmen know what they are doing and are performing the work correctly.

Notwithstanding that the specifications place upon the contractor the entire responsibility for premature removal of forms, it is well for the architect and superintendent to have a working knowledge of what is considered good practice in this regard. Here is an excerpt from a consensus of opinion of several contractors whose expressions on the subject were combined and published by the Atlas Portland Cement Co.: "As a guide to practice these rules are suggested: Walls in mass work: one to three days, or until the concrete will bear the pressure of the thumb without indentation. Thin walls: in summer, two days; in cold weather, five days. Slabs up to 6 feet span: in summer, six days; in cold weather, two weeks. Beams and girders and long span slabs: in summer, ten days or two weeks; in cold weather, from three weeks to one month. If shores are left without disturbing them, the time of removal of the sheeting in summer may be reduced to one week. Column forms: in summer, two days; in cold weather, four days, provided girders are shored to prevent appreciable weight weakening columns. Conduits: two or three days, provided there is not a heavy fill upon them. Arches: of small size, one week; for large arches with heavy dead load, one month. A very important exception to these rules applies to concrete which has been frozen after placing, or has been maintained at a temperature just above freezing. In such cases the forms must be left in place until after warm weather comes, and then until the concrete has thoroughly dried out and hardened."

From this it will be seen that the question of the length of time that must elapse after pouring before forms can be removed depends much upon the service they are performing, and it is likewise a matter of judgment of the experienced concrete worker, it being borne in mind always that in the desire of a contractor to hasten the work and at the same time economize on form lumber, there is a constant temptation to wreck the forms a day or so too soon. Many floor failures have resulted from shortsightedness, and hence a superintendent should see that the contractor "plays safe."

THE SUPERVISION OF CONSTRUCTION OPERATIONS
CHAPTER 9
CONCRETE WORK

SPECIFICATIONS for cement and aggregates were quoted in a preceding chapter. As is customary, the superintendent in charge of construction of the schoolhouse being considered here gave early attention to the brand of cement to be used and to the character of aggregates delivered. Strictly speaking, the passing upon these materials is presumed to be based upon laboratory reports, and hence is not a function of the superintendent. However, inasmuch as the sand and crushed stone generally used are of kinds and grades easily judged by visual inspection, laboratory tests are frequently confined to the cement, even on work of importance. For the work under discussion, the contractor proposed using pit-run gravel for his plain concrete, adding the amount of sand or coarse aggregate that might be needed to make it conform to the specifications. For reinforced work, he was to screen out all stones larger than 24-inch.

It is not expected that a superintendent will decide what kind of concrete will be used in any location. All questions of design are predetermined. He is at the site to see that they are properly carried out, to know that what is produced is fully up to specification requirements. To be able to assert that this has been accomplished, he must know:

1) That the aggregates are
   a) of proper kind,
   b) sufficiently clean,
   c) of correct size and shape,
   d) well graded,
   e) of adequate hardness,
   f) of due moisture content;

2) that the proportions are such as to produce the maximum density of each type called for;

3) that the cement is fresh, up to test standards, and used in correct ratio;

4) that all ingredients are properly mixed;

5) that the completed mixture is
   a) deposited promptly, without separation of ingredients,
   b) adequately agitated,
   c) undisturbed after setting begins,
   d) properly bonded to previous work,
   e) deposited only against surfaces in proper condition to receive it,
   f) properly protected until final setting is complete.

Treating of these matters in the order enumerated, the superintendent gave his attention to the aggregates, while awaiting reports on the samples sent in for testing.

1-a) Kinds of Aggregates. Our specification called for broken stone or gravel for the coarse
aggregate, and sand for the fine, with a provision for the use of pit-run material. Crushed furnace slag is often specified in localities where it is procurable, and in some districts pulverized stone is used in place of sand. Crushed brick or tile may also be used for coarse aggregate, if of adequate hardness, of proper size, and free from dust. Cinders are used by many architects and engineers and are permitted in reinforced floor slab construction by certain building codes, notably that of New York. Other codes (as that of Chicago) permit the use of cinder concrete for fireproofing of steel members, but limit its workable compressive strength to 700 pounds per square inch. They also require that metal pipe embedded in cinder concrete shall first be coated with a cement grout. A typical specification for cinders for concrete reads:

"CINDERS shall be clean, hard, steam-boiler coal cinders, crushed to range in size from \( \frac{1}{4} \)- to \( \frac{3}{4} \)-inch (or 1-inch), and free from unburned coal or other substance injurious to concrete or its reinforcement."

Probably no building material is the subject of more controversy than cinders, principally because there is so much variation in them, and because it is impossible to make conditions for testing identical with those maintaining in all structures. The "personal element" in concrete construction stands out stronger with use of this aggregate than with use of any other. If cinders are specified, they must conform in general to requirements for other aggregate, the main variant being that of the substances in their composition, other than unburned coal, which would be "injurious to concrete or its reinforcement." Some writers mention sulphur in this category, but the prejudice against presence of that chemical appears to be unfounded. Perhaps the whole gist of the subject can best be summed up by quoting Professor C. L. Norton of the Massachusetts Institute of Technology: "Sulphur might (cause corrosion) if present, were it not for the presence of the strongly alkaline cement; but with that present the corrosion of steel by the sulphur of cinders in a sound Portland concrete is the veriest myth, and as a matter of fact the ordinary cinders, classed as steam cinders, contain only a very small amount of sulphur. There is one cure (for the rusting of steel in cinder concrete) and only one,—to mix wet and mix well. With this precaution, I would trust cinder concrete quite as quickly as stone concrete in the matter of corrosion."**

(1-b) Cleanliness of Aggregates. With the recent vast increase in the annual output of cement products, the preparation and handling of aggregates have become so commercialized that, even in rural communities, one generally finds them properly prepared for market by due grading and washing. The coarser material usually offered is crushed rock,—granite, trap rock, boulders, sandstone or limestone. Any of the first three will be clean if not in contact with earth nor stored too long. Sandstone or limestone will probably be covered by their own dust to such an extent as to need washing; and should be admitted only on that condition, assuming them to be otherwise acceptable. Sand and gravel, on the other hand, may be offered just as taken from the pit, hence must be carefully inspected. Up to a few years ago, concrete experts were accustomed to demand that sand and gravel must be close to 100 per cent clean, and one still encounters specifications containing this requirement. More recent authorities, however, have satisfied themselves that a small amount of clay, even up to 8 per cent of the volume of the sand, is not injurious and may even be beneficial.* But, in the use of both sand and gravel, one must be sure that a permissible silt content containing clay and sand doesn't also carry loam, organic matter, or oily substances.** Such material is not "clean," and will not make good concrete and should be washed. Some specifications stipulate that the volume of foreign substance removed by decantation shall not exceed 3 per cent of the weight.*** While decantation means properly a laboratory test, it can also be performed in the field in a crude way by giving the aggregates a thorough washing and rinsing; pouring the dirty water into a vessel and allowing it to settle; then pouring off the clear water, and drying and weighing the residue; then comparing that weight with that of the bulk from which the dirt was removed. Some specifications stipulate that such objectionable matter shall not exceed 2 per cent, but the judgment of engineering committees permits the larger quantity. Care as to cleanliness of ingredients must be continued until they are actually incorporated in the work, and hence specifications require that all aggregates shall be deposited on plank floors or paving. If dumped on the ground, there will be "foreign substance" shoveled into the barrows or mixer in spite of all precautions. Water should also be clean, and this is generally so specified: "WATER for concrete shall be clean and free from in-


*** These arc subjects for laboratory tests; see pages 726 and 727 in Hool & Kinne's "Reinforced Concrete and Masonry Structures."

**** "Tentative Specifications for Concrete and Reinforced Concrete" by the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete of the American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, American Concrete Institute and the Portland Cement Association.
jurious amounts of oil, acid, alkali, organic matter or other objectionable content." Ordinary drinking (potable) water is always fit for the purpose, as is rain water that has not picked up too much improper admixture from surfaces with which it has been in contact. Any water under suspicion should be sent to the laboratory for analysis.

(1-c). Size and Shape of Aggregates. Specifications for broken stone (crushed rock) and gravel call for a range in size from or cations for broken stone (crushed rock) and jurious amounts of oil, acid, alkali, organic mat­gregates, since minor variations are unimportant. Yi,-or 1-inch for reinforced work, and up to too much improper admixture from surfaces with purpose, as is rain water that has not picked up drinking (notable) water is always fit for the aggregate has been customary from the time when "ring" specifications is disappearing. Screens of ring of given diameter, grading screens were per­forated sheets with holes to comply. But this re­finement is being abandoned, and use of the "ring" specifications is disappearing. Screens of square wire mesh are now in as common use as those with round holes.

Insistence upon sharpness or angularity of ag­gregate has been customary from the time when concrete was mortar with coarse aggregate added, the former made with hydraulic or other cement which adhered to angular or rough surfaces bet­ter than to those that were round or smooth. Fractures of concrete made of gravel and Port­land cement, however, disclose cleavages through round pebbles, rather than around them; hence "sharpness" of aggregate is no longer demanded. The one objectionable shape of aggregate is the thin and laminated. The presence of many of these will seriously cut down efficiency, especially in reinforced work.

(1-d). Aggregates to be Well Graded. This is insisted upon in both sand and coarse aggregate, and is essential to density. If one were to attempt to make concrete with a single size of coarse ag­gregate and a single size of sand, it would take too much sand to fill the interstices for economical construction. Even "grading" means that all in­terstices will be filled by largest size pieces, from coarsest to finest. Graded sand for the purpose (sometimes termed "torpedo" sand) should conform to this specification: "SAND shall range in size from fine to coarse, and the percentage of weight of sand retained when passing through standard screens shall be at least 100 per cent on a No. 100 sieve, 80 per cent on a No. 50, 25 per cent on a No. 40, 10 per cent on a No. 20 and none on a No. 10."

These proportions are varied somewhat by dif­ferent authorities* but will be found generally practicable as given. Finer sand will make good concrete (though quite unsuitable for mortar), but it demands an undue amount of cement.

(1-e). Aggregates to be of Adequate Hard­ness. If doubt exists as to the hardness of the ag­gregates, samples should be sent to the laboratory. Ordinarily, granite and gravel pebbles are safe enough; limestone and sandstone are open to doubt, but "no type of aggregate such as granite, gravel or limestone can be said to be generally superior to all other types. There are good and poor aggregates of each type.***

(1-f). Aggregates to Have Due Moisture Con­tent. The ratio of water in aggregates, prior to their being put in the mixer, is of less import than that the moisture content shall be known and that the water added shall be proportioned accordingly. It is always well to use a hose on the material in the pile just before using, both to carry off the dust and, in the case of porous stone, slag, brick, tile or cinders, to prevent the later absorption of too much thin cement.

(2). Proportions to be Such as to Produce the Maximum Density of Each Type Called For. The ratios of concrete ingredients most commonly used are 1:1½:3 or 1:2:4 for reinforced work and 1:2½:5 or 1:3:6 for plain or non-reinforced. The workable compressive strengths of variously composed concretes (other than cinder concrete) are from 1,500 to 3,000 pounds per square inch, dependent upon the ratios of cement and fine and coarse aggregate, the moisture content, the excel­lence of the mix, and the thoroughness of the compacting.*** Unfortunately, the "personal ele­ment" in the making of concrete is its most out­standing characteristic. It is easy to make good concrete, but still easier to use careless methods and produce inferior work; hence one reason

* Some specifications refer by number to commercial sizes of aggregates which are rated thus:—
No. 1 crushed rock, graded up to that which passes a 3-inch sieve. No. 2 da., graded from a 1-inch sieve up to a 2-inch sieve. No. 3 da., graded from a No. 6 sieve up to a 1-inch sieve. No. 4 da., graded from a No. 16 sieve up to a No. 3 sieve. (All sizes assumed to be standard meshes.)

** "In large masses of concrete one-man stones may be em­ployed, provided that they first be cleaned and wetted thoroughly, and provided that they be not placed any nearer than six (6) inches to each other or to the exterior of the construction." Dr. J. A. L. Waddell in "Bridge Engineering," page 1852.

for the unduly large number of failures in this construction. From the ratios here given, it is seen to be a general assumption that it takes about half as much sand as coarse aggregate in order to fill the voids in the latter. Such being the case, it is apparently inconsistent to name 1:2:4 and 1:3:5 in the same specification, as is done in some localities,—notably in Chicago. Obviously, if 1:2:4 is correct for a rich concrete, then a 1:3:6 mix with similar materials will produce cheaper concrete than 1:3:5 and of equal strength.

The main task for the superintendent is to assure himself that the ratios fixed in the specifications will produce concrete of maximum density with the materials at hand. As to this, the specifications say:

“VARIATIONS. The proportions given for the various kinds of concrete are based upon the use of well graded aggregates, as specified. In case the aggregates are not so graded, the Architect may change the proportion of cement to fine aggregate, without changing the proportion of cement to coarse aggregate and without additional compensation to the Contractor. No gravel (pit-run or other) shall be used until the Architect has had opportunity to test same and to determine what additional coarse or fine aggregate is to be added to such gravel, or if any addition is necessary. The Contractor shall conform to such demands to produce concrete of maximum density and shall not permit a change in the character of aggregates delivered at the site without due notice to the Superintendent and revised instructions as to procedure.”

The indeterminate feature of this, insofar as pit-run material is concerned, is that there is no positive statement as to the proportion of such aggregate that will be the equivalent of what is specified. There seldom is, in any specification, and so there exists a cause for argument that could as well be eliminated. It should be clear enough, since one purpose of using the finer material is the filling of voids in the coarser aggregate, so that, if ratios are correctly specified, the bulk of the mix will only slightly exceed that of the coarse aggregate, and hence a 1:3:6 ratio becomes 1:6, if the aggregates are delivered ready mixed. Nevertheless, a young inspector may be surprised to find the contractor and all his mechanics insisting that a 1:3:6 mix is equivalent to 1:9, with pit-run material. Being faced by more experienced men, the novice may be much embarrassed in his contention, if he finds nothing specific in the contract documents on the subject and can lay his hand on no other authority to back him up. The truth is that not enough attention is ordinarily given to obtaining precisely correct proportions of aggregates, except for very important work.*

On this subject, the Portland Cement Association, in its publication, “Concrete Data for Engineers and Architects,” says: “A 1:3:5 nominal mix does not give a 1.8 true mix as sometimes assumed, but about a 1.7 true mix.” This means that the “true mix” should be computed at 40 per cent more than the bulk of the coarse aggregate, whereas the author’s contention is that it should be only about 10 per cent additional, that is, 1:3½. Supporting the Association’s statement, their authority, Prof. D. A. Abrams, says further: “As a matter of fact, instead of filling the voids, a coarser particle in fine aggregate will actually separate the particles of coarse aggregate farther than they would be normally. This is the reason it is necessary to use a considerable portion of sand, more than the theoretical amount required to fill voids. In any section of concrete which has been cut, one will note that in general aggregate particles are floating in a cement-water mixture. It is for this reason that the cement-water ratio becomes of controlling importance. Within the usual range of quantities, the volume of mixing aggregate will be about 85 per cent of the total volume of the fine and coarse aggregate.” From which it will be seen that the ideal and surest way of stating the desired amount of cement would be to give its ratio per cubic foot of finished concrete; then to use the cement-water ratio for ascertaining desirable percentages of aggregates and moisture.

Given his design and proportions, the superintendent must know that the materials to hand are such as will properly “fill the bill.” He can measure the voids in the coarse aggregate by filling a vessel with a known quantity, then pouring in enough measured water to fill to the same level. The amount of sand used should be slightly in excess of the quantity of water. In other words, if half as much sand as coarse aggregate is called for, then it is assumed that the voids in the latter are about 45 or 48 per cent of its bulk. Voids in the sand can be measured the same way and should run 25 to 40 per cent. Measurements should be by weight, and the water should be weighed before being poured in, since capillarity will prevent its all being drawn off. To ascertain roughly whether or not pit-run material contains a proper grading of all the aggregates, it is necessary to separate the fine and coarse by screen with a ¾-inch mesh sieve, then measuring the quantities of the two sizes and the voids in the larger, in the manner just described here.


(To be continued)
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Rust-resisting Pipe of TONCAN Iron Defeats the Menace of Rust and Corrosion

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But today, architects, builders, men of vision, erecting for permanence specify pipe of enduring TONCAN Iron. After all, there is no sounder economy.

TONCAN shows amazing resistance to rust and corrosion. For generations it has withstood punishment that would have quickly ruined ordinary ferrous metals. But TONCAN endures. Gutters, flashings, cornices, ventilators and all other exposed metal parts are prolonged indefinitely when made from this durable alloy of pure iron, copper and molybdenum.

Wherever metal must resist rust and corrosion, you can count on TONCAN for long life and dependability.

CENTRAL ALLOY STEEL CORPORATION
Massillon and Canton, Ohio

WORLD'S LARGEST AND MOST HIGHLY SPECIALIZED ALLOY STEEL PRODUCERS
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.
Cowing Pressure Relieving Joint

A Positive Protection against Cracks and Spalls

The Cowing Pressure Relieving Joint gives such protection to any facade of stone, terra cotta or marble... Its record of performance can be found in many world-famous buildings... It is a part of the standard specifications of many leading architects.

The Cowing Joint is installed in place of one mortar joint in each story height—it consists of a corrugated sheet lead filler enclosed in a sheet lead envelope... it zones a building into story heights... it delivers exact and automatic compensation for all destructive stresses thrown on the facing material by temperature changes, compression or imposed loads.

The Cowing Joint is neat... it will not squeeze out... it lasts as long as the building... it protects the mortar joints and eliminates frequent tuck pointing.

Write for our Illustrated Booklet
Cowing Pressure Relieving Joint Co.
160 N. Wells St. - Chicago, Ill.
For exacting sheet metal requirements...

pure ARMCO Ingot Iron

WHATEVER the requirements, there is no sheet metal specification too exacting for pure ARMCO Ingot Iron. In fact, the more difficult the service, the more necessary to have this specially made durable sheet metal.

If the major requirement is long life, ARMCO Ingot Iron gives a full and satisfying measure of service. Its freedom from rust-promoting impurities assures many trouble-free years of service.

And where ductility is essential—cornices, marquises, and other ornamental designs—you’ll find that the most intricate details are achieved easily when ARMCO Ingot Iron is the sheet metal used.

These are some of the reasons why architects everywhere are turning to ARMCO Ingot Iron for all types of sheet metal construction.

Our Architectural Consulting Service will be glad to share with you its knowledge of sheet metal and its diverse applications. Just write the office nearest you. There is no obligation involved.

For supplementary data on ARMCO Ingot Iron see page 510, Section A, of Swift’s Architectural Catalog.

THE AMERICAN ROLLING MILL COMPANY
Executive Offices, Middletown, Ohio

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

DISTRICT OFFICES
Chicago
Cincinnati
Cleveland
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DISTRICT OFFICES
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San Francisco

ARMCO INGOT IRON RESISTS RUST
Milcor offers three metal building materials designed especially to protect and preserve the lines of graceful interiors. They are Stay-Rib Metal Lath... Expansion Corner Bead... and Expansion Metal Casing. Each of these products has a definite place in modern, fire-safe construction. And each of these products has certain structural advantages which make them particularly practical.

Stay-Rib Metal Lath is a perfected plaster base... It represents the highest development of expanded metal design. Reinforced by longitudinal ribs, Stay-Rib Metal Lath has great strength and rigidity without excess bulk and weight. Its mesh is so formed, that in plastering, slight pressure of the trowel completely embeds it. A maximum protection against plaster cracks. Expansion Corner Bead and Casing have patented wings of expanded metal. When used over Stay-Rib Metal Lath, the plaster keys through the mesh of both the casing or corner bead and the lath...making these vulnerable points the strongest parts of the wall.

Specify Milcor products for permanence... The "Milcor Manual" will be sent you upon request.

Milwaukee Corrugating Company
1405 Burnham Street
Milwaukee, Wis.

"By its dignity and architectural inspiration we stimulate pride in our country." — Herbert Hoover, speaking concerning Washington.
Why Clinton Wire Lath Is Preferred

Only the finest materials were used in the construction of the Pershing Square Building at the corner of 42nd Street and Park Avenue, New York City. The greatest care was taken by the architects, York & Sawyer and John Sloan, in drawing the specifications. As in many other famous buildings throughout the country, Clinton Wire Lath was chosen because of the permanence, strength and beauty it gives to any plaster and stucco construction. Clinton Wire Lath is made out of finely-tempered steel wire, woven into a close, even mesh. A DOUBLE key (vertical and horizontal) is provided for the plaster or stucco, no matter what direction of stroke is used in troweling.

Test the strength of Clinton Wire Lath against that of any other base and you will be convinced of its superiority.

See Street’s Architectural and Engineering Catalogs for Specifications

Wickwire Spencer Steel Co.
41 East Forty-second Street, New York

Worcester Buffalo Cleveland
San Francisco Los Angeles Seattle
Portland Chicago Atlanta

WICKWIRE SPENCER STEEL CO.
41 East 42nd Street, New York City
Please send me additional information regarding Clinton Wire Lath.
Name
Address

RIGIDECK FOR ROOFS
Insulated to Any Degree and Waterproofed

Rigideck—the new Armco Ingot Iron Roofdeck—is as easily laid as board. Its interlocking ribs occurring every six inches are securely attached to the purlines, providing a rigid, smooth, unperforated roof deck adapted to all buildings. Weight of completed roof approximately 5 pounds per sq. ft. Fireproof and economical.

GENFIRE STEEL COMPANY
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Concrete Rib Floor Construction

Dedicated to Public Service

Like the modern building, designed to serve the public, the Meyer Steelform method of concrete rib floor construction is dedicated to public service.

To the architect it makes possible exact adherence to ideals of beauty and requirements for strength. To the contractor it means high speed constructions and lower labor and material costs. The owner finds in it welcome economy and a finished structure perfectly adapted to his own or his tenant's needs.

Meyer Steelforms are installed and removed by an organization especially trained to render the greatest possible co-operation to both architect and contractor. Their use is based on a nominal rental charge—and warehouses located at strategic centers make possible immediate shipment to the job.

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

Concrete Engineering Company
General Offices: Omaha, Nebraska
Sales Offices and Warehouses: Chicago, Detroit, Milwaukee, Minneapolis, St. Paul, Des Moines, Kansas City, St. Louis, Dallas, Houston, San Antonio, Oklahoma City, Los Angeles, Pittsburgh, Oakland, San Francisco

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.

MEYER Steelforms
THE STANDARD
THE ORIGINAL REMOVABLE STEEL FORMS FOR CONCRETE RIB FLOOR CONSTRUCTION
NEXT TIME YOU VISIT THE RITZ

INSPECT the hollow metal elevator doors and enclosures. In this famous hotel, as in scores of equally notable buildings in all parts of the country, these important fixtures are of United construction.

The United organization are specialists in hollow metal interior trim. United engineering service is a practical assistance to the Architect, not a high-sounding phrase. Call upon us for help on any hollow metal problems.

Sales Offices in all Principal Cities

THE UNITED METAL PRODUCTS CO.
CANTON, OHIO
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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.
Making Every Construction a Castle of Strength

In planning modern construction, the progressive architect specifies those products that assure unvarying execution of architectural design. He specifies those products that have inherent strength and unusual quality — those that mean the least possible friction and the best understanding between himself and the contractor. In other words, with an eye on costs, he gives the contractor the “right tools” to work with. And the wide acceptance of Kalman fire-safe building products, the qualities and design of which mean greater dependability, is true recognition of their superiority. Kalman products offer the architect a modern means of making every construction a castle of strength.

KALMAN STEEL COMPANY

For Improved Floor and Roof Construction

Specifying Kalmantruss Steel Joists, Kalmantruss Rigid Bridging, Kalmanlath, is a positive way of improving fire-safe floor and roof construction. Kalmantruss Steel Joists are made by a new and different method — a rolling process. As a result, they have unusual dependability. Kalmantruss Rigid Bridging assures the rigidity of the construction and reduces vibration. The new and distinctively designed ceiling and floor lath clips are still another advantage of the advanced Kalman method of building fire-safe floors and roofs.
Where shall we put the laundry department?

How shall we power the machines?

In the planning of the modern laundry of any type and size—hotel, hospital, school, club, department store—the counsel of The American Laundry Machinery Company is at your disposal.

“American” engineers have collaborated in working out plans for scores of laundries—institutional and commercial. They can help you on such questions as dimensions, equipment, powering, lighting and ventilating. They can show you first-hand figures and actual photographs—aid you in reducing laundry-practise problems to the simplest terms.

An “American” representative will be glad to call at your office whenever his visit will be most convenient for you.

The Pennsylvania Hotel, New York City

The interesting laundry installation at the Pennsylvania Hotel, New York City, designed with the cooperation of American Laundry Machinery Company engineers. Note the American-Perry Automatic Washroom equipment. Goods are unloaded automatically, conveyed overhead to the unloading extractors, then to the finishing equipment.

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
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, and may be had on request unless otherwise noted, by applying on your business stationery to The Architectural Forum, 521 Fifth Ave., New York, or the manufacturer direct, in which case kindly mention this publication.

ACOUSTICS
R. R. George Company, 40 Court St., Boston. Acoustolith Plaster. Brochure, 6 pp., 8 1/2 x 11 ins. Important data on a valuable material.

ASPHALT

CEMENT
American Face Brick Association, 1751 Peoples Life Building, Chicago, III. Brickwork in Italy. 298 pp., size 7 1/2 x 10 1/2 ins., an attractive and useful volume on the history and use of brick in Italy from ancient to modern times, profusely illustrated with 69 plates of old and modern colored plates, with a map of modern and XII century Italy. Bound in linen. Price now $15.00, postpaid (formerly $20.00). Half Morocco, $7.00.
Industrial Buildings and Housing. Bound Volume, 112 pp., 8 1/2 x 11 ins. Profusely illustrated. Deals with the planning of factories and employees' housing in detail. Suggestions are given for interior arrangements, including restaurants and rest rooms. Price now $14.00, postpaid (formerly $20.00).
Skimmed Brickwork. Brochure, 16 pp., 8 1/2 x 11 ins. Illustrated. Tells how to secure interesting effects with common brick. Building Economy. Monthly magazine, 22 pp., 8 1/2 x 11 ins. Illustrated. $1 per year, 10 cents a copy. For architects, builders and contractors.

CERAMIC ARTS
Carney Company, The, Mankato, Minn. A Remarkable Combination of Quality and Economy. Booklet, 26 pp., 8 1/2 x 11 ins. Illustrated. Important data on valuable materials.
Kosmopor, the Mortar for Cold Weather. Folder, 4 pp., 3 1/2 x 6 1/2 ins. Tells why Kosmopor should be used in cold weather.
Louisville Cement Co., 315 Guthrie St., Louisville, Ky. BRIXMENT for Perfect Mortar. Self-filing handbook, 8 1/2 x 11 ins. 16 pp. Illustrated. Contains complete technical description of BRIXMENT for brick, tile and stone masonry, specifications, data and tests.
Town and Country Houses of Concrete Masonry. Booklet, 20 pp., 8 1/2 x 11 ins. Illustrated.
Facts About Concrete Building Tile. Brochure, 16 pp., 8 1/2 x 11 ins. Illustrated.
The Key to Firesafe Homes. Booklet, 20 pp., 8 1/2 x 11 ins. Illustrated.
Design and Control of Concrete Mixers. Brochure, 22 pp., 8 1/2 x 11 ins. Illustrated.
Portland Cement Stucco. Booklet, 64 pp., 8 1/2 x 11 ins. Illustrated.

COLD-PROOFING

CONSTRUCTION
North Western Expanded Metal Co., 1224 Old Colony Building, Chicago, Ill. North Western Expanded Metal Products. Booklet, 85 x 10 1/2 ins. 16 pp. Fully illustrated, and describes different products of this company, such as Kahn-built metal lath, 20th Century Corrugated, Plaster-Sava and Longporte bath channels, etc. A. I. A. Sample Book. Bound volume, 8 1/2 x 11 ins., contains actual samples of several materials and complete data regarding their use.

CONSTRUCTION, STONE AND TERRA COTTA
Coping Pressure Relieving Joint Company, 100 North Wells St., Chicago, Ill. Pressure Relieving Joint for Buildings of Stone, Terra Cotta or Marble. Booklet, 16 pp., 8 1/2 x 11 ins. Illustrated. Deals with preventing cracks, spalls and breaks.

CORNICES, METAL
Sheet Steel 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

DOORS AND TRIM, METAL
Par-Lock Specification. "Form 1" for dampproofing the tile wall surfaces that are to be plastered.

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.

Cement—Continued
Concrete in Architecture. Bound Volume, 60 pp., 8 1/2 x 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., 8 1/2 x 11 ins. Illustrated.

CONCRETE COLORINGS

CONSTRUCTION, FIREPROOF

CORNICES, METAL
Sheet Steel 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

DOORS AND TRIM, METAL
Par-Lock Specification. "Form 1" for dampproofing the tile wall surfaces that are to be plastered.

DOORS AND TRIM, METAL
The American Brass Company, Waterbury, Conn. Anaconda Architectural Bronze Façade Shapes. Brochure, 180 pp., 8 1/2 x 11 ins., illustrating and describing more than 2,000 standard bronze shapes of cornices, jambs, casings, moldings, etc.

SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 177

ELEVATORS
Otis Elevator Company, 260 Eleventh Ave., New York, N. Y.
Otis-Push Button Controlled Elevators. Descriptive leaflets, 8½ x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.
Otis Gearless with Non-Cogging Traction. Elevators of All Types. Descriptive leaflets, 8½ x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.
Escalators. Booklet, 8½ x 11 ins., 22 pp. Illustrated. Describes use of escalators in subways, department stores, theaters and industrial buildings. Also includes elevators and dock elevators.
Elevators. Booklet, 8½ x 11 ins., 24 pp. Illustrated. Describes complete line of “Ideal” elevator door hardware and checking devices, also automatic safety devices.

SOUNDPROOF
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.

DOORS AND TRIM, METAL—Continued

DOORS
Sedgwick Machine Works, 151 West 15th St., New York, N. Y.
Concrete and Steel Doors. Catalog 150. Booklet, 48 pp., 8½ x 11 ins. Illustrated.

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

DRAINAGE FITTINGS

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

ELECTRICAL EQUIPMENT
Baldor Electric Co., 4388 Duncan Avenue, St. Louis, Mo.
Bryant Electric Company. Bridgeport, Conn.
BookEx Plug and Receptacle. Folder, 6 pp., 3½ x 6½ ins. Illustrated.
KNeX Plug and Receptacle. Folder, 6 pp., 3½ x 6½ ins. Illustrated.
Three-wire Polarized Caps and Receptacles. Leaflet, 8½ x 10 ins. Illustrated.
Three-wire Polarized Caps and Receptacles for Heavy Duty. Leaflet, 8½ x 10 ins. Illustrated.

Wiring System Specification Data for Apartment Houses and Apartment Hotels. Booklet, 20 pp., 8 x 10 ins. Illustrated. Describes complete line of “Ideal” elevator door hardware and checking devices, also automatic safety devices.

Harvey Hubbell, Inc., Bridgeport, Conn.
Electrical Specialties. Catalog No. 59. 52 pp., 8½ x 10 ins. Illustrated.

Pitt-Barth Company, Inc., Albert, 302 West 35th St., Chicago, and Cooper Square, New York.
Sedimentary Catteneries. Booklet, 6 x 9 ins. Illustrated. The design and equipment of school catteneries with photographs of installation and plans for standardized units.

Electric Power for Buildings. Catalog, 14 pp., 8½ x 11 ins. Illustrated. Describes complete line of “Ideal” elevator door hardware and checking devices, also automatic safety devices.

Wisconsin Central Systems as Applied to Electric Elevators. Booklet, 12 pp., 8½ x 11 ins. Illustrated. Deals with the system and details of mechanism.


Electrical Equipment for Heating and Ventilating Systems. Booklet, 24 pp., 8½ x 11 ins. Illustrated. This is “Motor Application Circular C-79.”

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

Beauty; Power; Silence; Westinghouse Fans. (Dealer Catalog 45.) Booklet, 56 pp., 8½ x 11 ins. Illustrated. Valuable information on fans and their uses.


 requesting 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 a coupon to The Architectural Forum, 521 Fifth Avenue, New York.

name

address

business
Where shower rooms are below disposal plant level

Disposal by gravity of waste from showers and other fixtures in the basement is frequently difficult to obtain in planning a country club. Situating the club house in the desired location often means that its basement floor will be at a lower level than the septic tanks or disposal plant. Or, in order to place sewer pipes and cesspools sufficiently below the floor level, a prohibitive amount of excavation would be necessary.

To such problems the "Type B" Jennings Sewage Ejector affords a ready solution. Low in cost, it operates pneumatically without employing air valves, or air storage tanks. It cannot clog because vital moving parts do not come into contact with the sewage. Screens are avoided. Anything that will pass through the four inch inlet pipe is easily handled.

The Nash Hytor Compressor operates only when sewage is being moved. A smaller motor, with less horsepower is required than is needed for a centrifugal sewage pump of the same capacity. Power consumption is small.
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 178

FLOORING—Continued
- Planning the Color Schemes for Your Home. Brochure, illustrated in color; 36 pp., 7½ x 11 ins. Gives excellent suggestions for use of colored tiles, for use in floor construction for houses and apartments.

Hudley Quality Sample Folder of Linoleums. Gives actual samples of linoleum, cork carpet, “Felton,” etc.

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

Blahon Company, Linoleum and Cork Carpet. Gives quality samples, 3 x 6 ins. of various types of floor coverings.

Curtar Floor Plan, Catus, Linoleum Co., Kansas City, Missouri.
- Building and Flooring. Booklet, 96 x 9¼ ins., 20 pp. Illustrated. Describes uses and adaptability of Blooroxed Flooring to concrete, wood or steel construction, and advantages over loose floor coverings.

File Folder, 9½ x 13¼ ins. For use in connection with A. I. A. A system of floor planning. Details the use of Blooroxed Flooring in conditioned floor space for use in floor construction for homes, shops and offices.

Celotex Oak Flooring, Memphis, Tenn.
- Style in Oak Floors. Booklet, 16 pp., 6 x 9 ins. Illustrated.

Conseco American Laminate, 976 Belgrave Ave., Rochester, N. Y.
- Facts you should know about Resilient Floors. A series of booklets giving facts for: (1) schools, (2) libraries, (3) offices, (4) stores, (5) churches, (6) clubs and lodges, (7) apartments and hotels. Illustrated.


Sealed Concrete Floors. Two booklets, 8 and 16 pp. Illustrated.


Thomas Moulding Floor Co., 165 W. Wacker Drive, Chicago, Ill.
- Better Floors. Folder, 4 pp., 9½ x 13½ ins. Illustrated. Floors for office, administration and municipal buildings.

Homer Hume, Inc., New York, N. Y. Brochure, 4 pp., 9½ x 13½ ins. Illustrated.


P. & F. Corbin, New Britain, Conn.
- Cast Iron Door Hardware. Booklet, 48 pp., 8½ x 11 ins.

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

HEATING EQUIPMENT
American Blower Co., 6004 Russell St., Detroit, Mich.
- Heating and Ventilating Utilities. A binder containing a large number of valuable publications, each 8½ x 11 ins., on important subjects.

American Radiator Company, The, 40 West 40th St., N. Y. C.
- Ideal Radiators for Oil Burning. Catalog 3½ x 8½ ins., 20 pp. Illustrated in 4 colors. Describing a line of Heating Boilers especially adapted to use with Oil Burners.


Ideal Arco Radiator Warmer. Brochure, 6½ x 9½ ins. Illustrated. Deals with the use of these small radiators for small residences, stores, and offices.


Jefferson Manufacturing Co., 1820 Broadway, New York, N. Y.

C. A. Dunham Company, 450 East Ohio St., Chicago, Ill.

American Radiator Company, The, 40 West 40th St., N. Y. C.
- How to Lock Out Air, the Heat Thief. Brochure, 48 pp., 9½ x 12½ ins. Illustrated.


The Fulton Sulphon Company, Knoxville, Tenn.
- Sulphon Temperature Regulators. Illustrated brochures, 8½ x 11 ins., dealing with general architectural and industrial applications, including: Sulphon Heating Specialties. Catalog No. 202, 202 pp., 3½ x 6½ ins. Important data on heating.

HOW TO ORDER 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, New York.
The new Y. W. C. A. Building, Cincinnati, Ohio. An interesting construction feature is the use of Carey Elastite Asphalt Plank, applied over a section of the Carey Built-up roof—an ideal roof promenade.

—Rendigs, Panzer & Martin, Architects, Cincinnati, Ohio. F. B. & A. Ware Associate Architects, New York.

It wears "plus-quality" protection overhead

The overhead covering of the new Y.W.C.A. Building, Cincinnati, is the kind of protection that architects have specified for hundreds of other splendid structures everywhere. A Carey Built-up Roof.

Multi-layered, Multi-sealed. Made of the toughest fibred felts, and asphalts carefully blended at Carey's own factory by Carey's own experts in roofing technique. Weather-tight, long-lastingly dependable. The roof that has been tested in every climate and under all conceivable conditions—the roof that asks no favors of weather and time. Write us for full particulars—also for your copy of our Architects' Specification Book.

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

HEATING EQUIPMENT—Continued

S. T. Johnson Co., Oakland, Calif.

Modine Mfg. Co., Racine, Wis.

Sarco Company, Inc., 183 Madison Ave., New York City, N. Y.

Trane Co., The, La Crosse, Wis.

Kewanee Radiator Corporation, Kewanee, Ill.

May Oil Burner Corp., Baltimore, Md.

McQuay Radiator Corporation, 35 East Wacker Drive, Chicago, III.

McQuay Visible Type Cabinet Heater. Booklet, 4 pp., 8½ x 11 ins. Illustrated.

McQuay Unit Heater. Booklet, 8 pp., 8½ x 11 ins. Illustrated.

Johnson Oil Burners. Booklet, 9 pp., 8½ x 11 ins. Illustrated.

Data on Johnson Rotary Burner with Full Automatic Control.


Data on Sarco Packless Supply Valves and Radiator Traps for vacuum and vapor heating systems.


Trane Co., The. La Crosse, Wis.

Photographs and drawings, showing the types of light for use in hospitals, as operating table reflectors, linolite and multilite concentrators, ward reflectors, bed lights and microscopic reflectors, giving sizes and dimensions, explaining their particular fitness for special uses.

Hoholene Company, 434 Madison Avenue, New York.

Lighting Special for Hospitals. Booklet, 30 pp., 8½ x 11 ins. Illustrated.

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

Hospitals and Buildings. Booklet, 16 pp., 8½ x 11 ins. Illustrated. Gives types of equipment in which Monel Metal is used, reasons for its adoption, with sources of such equipment.

Pick-Barth Company, Inc., Albert, 1200 West 35th St., Chicago, and Cooper Square, New York.

Some Thoughts About Hospital Food Service Equipment. Booklet, 22 pp., 8½ x 11 ins. Valuable data on an important subject.

HOTEL EQUIPMENT

Pick-Barth Company, Inc., Albert, 1200 West 35th St., Chicago, and Cooper Square, New York.

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

INCENTRATORS

Home Incinerator Co., Milwaukee, Wis.


A. I. A. File, 12 pp., 8¼ x 10½ ins., inside. Suggestions for architects on incineration, showing the modern equipment.

Specialized Home Comforts Service Plan Book. 40 pp., 8½ x 11 ins., inside. Illustrated. A complete outline of the many advantages of incineration.

Blue Star Equipment for Home Buildings. 16 pp., 8¼ x 11 ins., inside. Illustrated. Explaining fully the Blue Star principles, covering heat, incineration, refrigeration, etc.

Josan Mfg. Co., Racine, Wis.

Josan-Graves Incinerators. Folder, 4 pp., 8½ x 11 ins. Illustrated.

Kern Incentrator Company, 715 E. Water St., Milwaukee, Wis.


INSULATION


The Insulation of Roofs with Armstrong's Corkboard. Illustrated, 7½ x 10½ ins., 32 pp. Illustrated. Describes insulating roofs of manufacturing or commercial structures.


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


Structural Gypsum Corporation, Linden, N. J.


INCENTRATORS

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

Catalog 3, 4 pp., 8½ x 11 ins. Illustrated. Gives details of truss construction with loading tables and specifications.

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

Business
Adequate Thickness...

An Essential Factor in Roof Insulation

To insure economy of fuel in winter and protection from the heat of the sun in summer, the roof must be not merely "insulated," but insulated with an adequate thickness. There is neither economy nor satisfaction in less than enough.

Every building presents its own special problem, but under average conditions, proper insulation for roofs is 1 1/2 or 2 inches of Armstrong's Corkboard. Experience has proved many times over the efficiency of these thicknesses and their economy, and that it pays to insulate when the insulation is adequate. Armstrong's Corkboard is supplied in 1, 1 1/2, 2 and 3 inch thicknesses. Whatever the roof may require, the full insulation can be laid in a single layer of Armstrong's Corkboard—one labor operation, one labor cost.

Armstrong engineers will gladly cooperate with architects in working out the problem of roof insulation for any particular building. Armstrong Cork & Insulation Co., (Division of Armstrong Cork Co.), 900 Concord St., Lancaster, Pa.; McGill Bldg., Montreal; 11 Brant St., Toronto 2.

Armstrong's Corkboard Insulation

for the Roofs of All Kinds of Buildings
LAUNDRY MACHINERY—Continued

Laundry Machinery for Small Institutions. Loose-leaf brochure, 50 pp., 8% x 11 ins. Illustrated.

Accessory Equipment for Institutional Laundries. Leather bound book, 50 pp., 8% x 11 ins. Illustrated.

Dry Cleaning Equipment for Institutional Purposes. Brochure, 50 pp., 8% x 11 ins. Illustrated.

LIBRARY EQUIPMENT

Art Metal Construction Co., Jamestown, N. Y.
Planning the Library for Protection and Service. Brochure, 52 pp., 8% x 11 ins. Illustrated. Deals with library fittings of different kinds.

LIGHTING EQUIPMENT

The Fink Co., 1033 Lexington Ave., New York, N. Y.
Catalog 435, 8% x 11 ins., 46 pp. Photographs and scaled cross-sections. Specialized book lighting, screen and partition reflectors, double and single desk reflectors and Polarsite Signs.

Halophane Company, Inc., 342 Madison Ave., New York, N. Y.

Lighting Specifications for Hospitals. Brochure, 30 pp., 8% x 11 ins. Illustrated.


Holophane Catalog. Booklet, 48 pp., 8% x 11 ins. Combination catalog and engineering data book.


Pass & Seymour, Inc., Syracuse, N. Y.
Lighting Your Home with Aluminum. Folder, 6 pp., 3 x 6 ins.

Smyser-Royer Co., 1700 Walnut Street, Philadelphia, Pa.
Catalog "F" on Exterior Lighting Fixtures. Brochure, illustrated, giving data on over 300 designs of standards, lanterns and brackets of bronze or cast iron.

Todhunter, 159 East 57th St., New York, N. Y.
Lighting Fixtures, Lamps and Candelsticks. 24 pp., 8% x 11 ins. Illustrated. Fine assortment of lighting accessories.

Industrial Lighting Equipment. Booklet, 22 pp., 8% x 11 ins. Illustrated.


LUMBER

Use of Lumber on the Farm. Booklet, 28 pp., 8% x 11 ins. Illustrated.

MAIL CHUTES

Cutler Mail Chute Company, Rochester, N. Y.
Cutler Mail Chute Model F. Booklet, 4 x 9%/4 ins., 8 pp. Illustrated.

MANTELS

Arthur Todhunter, 119 E. 57th St., New York, N. Y.
Georgian Mantels. New booklet, 24 pp., 8% x 64 ins. A fully illustrated brochure on eighteenth century mantels. Folders give prices of mantel's and illustrations and prices of fireplace equipment.

MARBLE

The Georgia Marble Company, Tate, Ga.; New York Office, 3238 Broadway.
Why Georgia Marble Is Better. Booklet, 34% x 6 ins. Gives analysis, physical qualities, comparison of absorption with granite, opinions of authorities, etc.

Convinced Proof, 34% x 6 ins., 8 pp. Classified list of buildings and memorials in which Georgia Marble has been used, with names of Architects and Sculptors.

Kurt Building, Atlanta; Senior High School and Junior College, Magasen, Mich. Folders, 4 pp., 8% x 11 ins. Details.

METALS

Aluminum Company of America, Pittsburgh.
Architectural Aluminum. Booklet, 30 pp., 8% x 11 ins. Illustrated.

An excellent booklet on the subject.

Central Alloy Steel Corporation, Massillon, Ohio.
Sheet Iron Primer. Booklet, 54 pp., 8% x 7%/4 ins. Illustrated.

The Path to Permanence. Booklet, 52 pp., 8% x 11 ins. Illustrated. Data on sheet iron.

The International Nickel Company, 50 Wall St., New York N. Y.
Mold Metal Primer. 6 folders, 4 pp., 8% x 11 ins. Illustrated. Valuable data on use of metal in kitchens, laundries, etc.

MILL WORK—See also Wood

Curtis Companies Service Bureau, Clinton, Iowa.
Architectural Interior and Exterior Woodwork. Standardized Book, 9 x 11 ins., 290 pp., 8% x 11 ins. Illustrated. This is an Architect's Edition of the complete catalog of Curtis Woodwork, as signed by Trowbridge & Ackerman. Contains many color plates.

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CLEVELAND'S NEW LINCOLN STATUE
Above is a drawing from a photograph of the statue  “Lincoln at Gettysburg.” This heroic bronze of the  "Great Emancipator" is the work of the eminent sculp­  tor, Max Kalish. It is soon to be unveiled in Cleveland.

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THE WORLD'S most durable,  flexible and sensitive expansion member. Employed as the motor element of hundreds of thousands of thermostats in the most highly recognized radiator traps, refrigerating machines, automobiles, industrial and building temperature regulators.

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THE first and foremost name in automatic Temperature or Pressure Regulation for air, liquids or gases is "SYLPHON." By twenty years of dependable performance in the industrial, chemical, architectural, and engineering fields Sylphon instruments have fairly won their recognition as the nation's "great emancipators" from manufacturing waste, process spoilage, and excessive fuel costs.

That Sylphon enjoys the confidence of engineers, architects, building contractors and owners is evidenced by the preponderance of Sylphon specification and installation. Its general leadership is well typified in Cleveland, Ohio, where in 28 out of 30 notable buildings in the heart of that city, Sylphon Temperature or Pressure control is employed.

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Our plant is the largest in the world devoted exclusively to the manufacture of thermostatic instruments. We invite those interested to write for fully descriptive bulletins and to submit (without obligation) problems involving Sylphon Temperature or Pressure Control.

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KNOXVILLE, TENN., U.S.A.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 184

MILL WORK—See also Wood—Continued

Better Built Homes. Vois. XV-VIII, incl. Booklet, 9 x 12 ins., 46 pp. Illustrated. Design for houses of five to eight rooms, respectively, in several authentic types, by Trowbridge & Ackerman, architects for the Curtis Companies. Curtis Cabinet and Stair Work. Booklet, 46 pp., 7¼ x 10½ ins. Illustrated. Complete details of all items of Curtis woodwork, for the use of architects, etc.


Curtis Interior Doors. Booklet, 74¼ x 10½ ins. Illustrated.

Curtis Extrusions and Exteriors. Brochure, 74¼ x 10½ ins. Illustrated.

Hammond Company, 2155 Elston Ave., Chicago, Ill.

Column Catalog, 7¼ x 9 ins. 6 pp., 3½ x 9 ins. Illustrated. Contains illustrations of columns and installations.

The pergola Catalog, 7¼ x 9 ins. 6 pp., 3½ x 9 ins. Illustrated. Contains illustrations of pergola lattices, garden furniture in wood and cement, garden accessories.

Klein & Henry, 11 East 37th St., New York, N. Y.

Two Dwirood Interiors. Folder, 4 pp., 6¼ x 9 ins. Illustrated. Use and specifications for paneling walls.

A New Style in Decoration. Folder, 4 pp., 6¼ x 9 ins. Illustrated. Deals with interior woodwork.

Driwood Periodic Mouldings in Ornamental Wood. Booklet, 28 pp., 5½ x 8½ ins. Illustrated.

How Driwood Periodic Mouldings in Wood Set a New Style in Decoration. Folder.

Roddles Lumber and Veneer Co., Marshfield, Wis.

Roddies Doors. Brochure, 26 pp., 5¾ x 8½ ins. Illustrated price list of doors and list of types of buildings.

Roddies Doors, Catalog G. Booklet, 104 pp., 8½ x 11 ins. Complete list of doors for interior use.

Roddies Doors for Hospitals. Brochure, 16 pp., 8½ x 11 ins. Illustrated.

Roddies Doors for Hotels. Brochure, 16 pp., 8½ x 11 ins. Illustrated.

Roddies Doors for Hotels. Brochure, 16 pp., 8½ x 11 ins. Illustrated.

MORTAR AND CEMENT COLORS

Clinton Mortar Colors. Folder, 8½ x 11 ins., 4 pp. Illustrated in full information concerning Clinton Mortar Colors with specific instructions for using them. Colors Catalog A. Booklet, 8½ x 11 ins. Illustrates the color the shades m which Clinton Mortar Colors are manufactured. Something New in Stucco. Folder, 8½ x 6 ins. An interesting discussion of coloring matter for stucco coated walls.

ORNAMENTAL PLASTER

Jacobson & Co., 21 East 44th St., New York, N. Y.

A Book of Old English Designs. Brochure, 40 pp., 12 x 9 ins. Deals with a fine line of decorative plaster work.


Geometrical Mouldings. Booklet, 23 plates, 7 x 9 ins. Important work on decorative plaster ceilings.

PAINTS, STAINS, VARNISHES AND WOOD FINISHES


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


American Rolling Mill Company, Middletown, Ohio.

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


How to Keep Your House Young. Illustrated brochure, 24 pp., 6¼ x 9½ ins. A useful work on the upkeep of residences.

Pease Brothers, Inc., 40 Fourth Ave., New York, N. Y.

How to Use Valgarp. Illustrated brochure, 32 pp., 3¼ x 8 ins. Deals with domestic uses for Valgarp.

PARCEL DELIVERY DEVICES


PARTITIONS

Circle A. Products Corporation, New Castle, Ind.

Circle A. Partitions Sectional and Movable. Brochure. Illustrated, 8½ x 11½ ins., 32 pp. Full data regarding an important line of partitions, along with erection instructions for partitions of three different types.

Dahlstrom Metallic Door Company, Jamaica, N. Y.


Hausmann Company, E. F., Cleveland, Ohio.

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


How to Keep Your House Young. Illustrated brochure, 24 pp., 6¼ x 9½ ins. A useful work on the upkeep of residences.


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

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


PIPE

American Brass Company, Waterbury, Conn.


American Rolling Mill Company, Middletown, Ohio.

How ADAMS Brass and Copper Pipe is made. Brochure. 4 pp., 8½ x 11 ins. Illustrated.

National Pipe. Catalog A. 4 x 10 ins. Catalog A. 4 x 10½ ins. 100 pp. Illustrated. Shows full line of steel pipe, threaded pipe, screwed pipe, flanged pipe and screwed pipe.


How to Keep Your House Young. Illustrated brochure, 24 pp., 6¼ x 9½ ins. A useful work on the upkeep of residences.

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National Pipe. Catalog A. 4 x 10½ ins. 100 pp. Illustrated. Shows full line of steel pipe, threaded pipe, screwed pipe, flanged pipe and screwed pipe.

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National Pipe. Catalog A. 4 x 10½ ins. 100 pp. Illustrated. Shows full line of steel pipe, threaded pipe, screwed pipe, flanged pipe and screwed pipe.
LAMINATED construction secures for Whale-bone-ite exactly what the I-beam cross-section secures for steel girders—immense strength combined with light weight.

We and others have found it impossible to make a seat by any other method anywhere near as sanitary, as strong, or as light.

Fourteen years of on-the-job experience have failed to reveal a weakness. Now, more than a million Whale-bone-ite laminated seats stand the use and abuse of public toilets.

Those concerned with the design, construction and operation of buildings have found this experience safe to follow, so that today nearly all seats going into public toilets are of laminated construction.

Ends burden of replacement costs

It is a well-known fact that public toilet seats receive constant, careless slam-bang abuse from the public. But the public cannot smash Whale-bone-ite. Its unbreakable laminated construction—guaranteed for the life of the building—immediately ends all replacement expense.

Its handsome polished Whale-bone-ite surface will last a lifetime. It is easy to clean and non-inflammable.

Whale-bone-ite Seats are found quite generally in the guest bathrooms of fine hotels. 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-6, Seat Division, The Brunswick-Balke-Collender Co., 623 South Wabash Avenue, Chicago.

NOTE the Laminated Construction—a core of alternating-grain layers of hardwood—sealed and bonded to the whole by Whale-bone-ite. It is warp-proof and is guaranteed against warping, cracking, and splitting.
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 186

PIPE—Continued
Modern Welded Pipe. Book of 88 pp., 8 1/2 x 11 ins., profusely illustrated with halftone and line engravings of the important operations in the manufacture of pipe.

PLASTER
Interior Walls Everlastling, Brochure, 20 pp., 6 1/4 x 9 1/4 ins. Illustrated. Describes origin of Keene’s Cement and views of buildings in which it is used.

PLUMBING EQUIPMENT
Clow & Sons, James B., 534 S. Franklin St., Chicago, Ill. Catalog M. 9 1/2 x 12 ins., 354 pp. Illustrated. Shows complete line of plumbing fixtures for Schools, Railroads and Industrial Plants.
Another Douglas Achievement. Folder, 4 pp., 8 1/2 x 11 ins. Illustrated. Data on new type of small Hospital. Brochure, 60 pp., 8 1/2 x 11 ins. Illustrated. Deals with complete line of plumbing equipment.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. Wrought Patent Flush Valves, Duplex Water Closets, Liquid Signet and other equipment. Catalog, 9 1/2 x 12 ins., loose-leaf catalog, showing roughing-in measurements, etc.
McKee’s Sons Company, Thomas, Trenton, N. J. Catalog, 16 pp., 6 x 9 ins. Illustrated. Data on vitrified china plumbing fixtures with brief history of Sanitary plumbing.

PUMPS

RADIO EQUIPMENT

RAMPS

REFRIGERATION
The Fuller Syphon Company, Knoxville, Tenn. Temperature Control of Refrigeration Systems. Booklet, 8 pp., 8 1/2 x 11 ins. Illustrated. Deals with cold storage, chilling of water, etc.

REINFORCED CONCRETE—See also Construction, Concrete
Longspan 44-inch Rib Lath. Folder, 4 pp., 8 1/2 x 11 ins. Illustrated. Deals with a new type of V-Rib expanded metal.

RESTAURANT EQUIPMENT

ROOFING
Federal Interlocking Tile and Glass Tyle. Folder, 4 pp., 8 1/2 x 11 ins. Illustrated.
Federal Long-Spare Roof Slab. Folder, 4 pp., 8 1/2 x 11 ins. Illustrated.
New Federal Light Six Roof Slab. Folder, 4 pp., 8 1/2 x 11 ins. Illustrated.
Heinz Roofing Tile Co., 1925 West Third Avenue, Denver, Colo. Plymouth-Single Tile with Specular Finish. Brochure, 8 1/2 x 11 ins. Illustrated. Shows use of English single tile with special hips. Italian Promenade Floor Tile. Folder, 2 pp., 8 1/2 x 11 ins. Illustrated. Floor tiling adapted from that of European palaces. Mission Tile. Leaflet, 8 1/2 x 11 ins. Illustrated. Tile such as are used in Italy and Southern Europe, and in modern ^

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Business
Hampden Hall (PITTSBURGH) is installing the new RCA Centralized Radio

A single antenna will provide radio reception for 55 apartments in the new Hampden Hall, now being erected in Pittsburgh.

The owners have solved the antenna problem by adopting RCA Centralized Radio.

In each apartment there will be a wall outlet, connected with the central antenna, enabling the tenant to connect his own receiver, pick out his favorite stations and programs—and get better reception than if he had his own individual aerial.

RCA Centralized Radio is being adopted 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 3000 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.

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

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.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 188

SHADE CLOTH AND ROLLERS
Columbia Mills, Inc., 226 Fifth Avenue, New York, N. Y. Window Shade Data Book. Folder, 28 pp., 8½ x 11 ins. Illustrated.

SHELVING-STEEL

SOUND DEADENER

STEEL PRODUCTS FOR BUILDING
Bethlehem Steel Company, Bethlehem, Pa. Steel Joists and Stringers. Booklet, 72 pp., 4 x 6½ ins. Data for steel for dwellings, apartment houses, etc.


STONE, BUILDING

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


STORE FRONTS


Store Fronts by Zozi. Booklet, 30 pp., 8½ x 11 ins. Illustrated.

TELEPHONE SERVICE ARRANGEMENTS

TERRA COTTA


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

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

TILE, HOLLOW

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


TILES


VALVES

C. A. Dunham Co., 450 East Ohio St., Chicago, Ill. The Dunham Packless Radiator Valve. Brochure, 12 pp., 8½ x 11 ins. Illustrated. Data on an important type of valve.

Jenkins Brothers, 80 White Street, New York. Jenkins Radiator Valves for steam and hot water, and brass valves used as boiler connections.

Jenkins Valves for Plumbing Service. Booklet, 4½ x 7¾ ins., 28 pp. Illustrated. Description of Jenkins Brass GLOBE, Angle Check and Gate Valves commonly used in home plumbing, and Iron Body Valves used for larger plumbing installations.

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- Transformers
- Turbines
- Wiring Devices
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 190

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 furnace hoods.

Stevens Filter Corporation, Rochester, N. Y.

WATERPROOFING

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

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

Minwax Company, Inc., 11 West 42nd St., New York.
Specification Form for Acid-proof Exhaust Fans. Folder, 8 x 10½ ins., 8 pp. Illustrated. Transparent Waterproofings for All Masonry Walls and Surfaces. Folder, 4 pp., 8½ x 11 ins. Illustrated. Data Sheet on Membrane Waterproofing. Folder, 4 pp., 8½ x 11 ins. Illustrated.

The Kawneer Company, Niles, Mich.


List of Parts for Assemblies. Booklet, 8½ x 11 ins., 16 pp. Full lists of parts for different units.

WINDSCREENS

Detroit Steel Products Co., 2250 E. Grand Boulevard, Detroit.
Fenestra Screen Casements. Brochure, 16 pp., 8½ x 11 ins. Illustrated.

Orange Screen Company, Maplewood, N. J.
New Vogue Aluminum Frame Screens. Booklet, 12 pp., 8½ x 11 ins. Illustrated.

WINDOW SHADES AND ROLLERS

A. Booklet, 48 pp., 8½ x 11 ins., 16 pp., 9 x 12 ins. Illustrating a very useful and interesting little book on the use of lumber for hangars.

Airplane Hangar Construction. Booklet, 24 pp., 8½ x 11 ins. Illustrated.

WOOD—See also Millwork

American Walnut. Booklet, 7 x 9 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.

American Walnut for Interior Woodwork and Paneling. 7 x 9 ins. Illustrated. Discusses interior woodwork, giving costs, specifications of a specimen room, the different figures in Walnut wood, Walnut floors, finishes, comparative physical properties and the advantages of American Walnut for woodwork.

Curtis Companies Service Bureau, Clinton, Iowa.
Curtis Cabinets and Stair Work. Booklet, 47 pp., 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., 342 Madison Ave., New York, N. Y.

New Vogue Aluminum Frame Screens. Booklet, 12 pp., 8½ x 11 ins. Illustrated.


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


WOOD—See also Millwork

American Walnut. Booklet, 7 x 9 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.

American Walnut for Interior Woodwork and Paneling. 7 x 9 ins. Illustrated. Discusses interior woodwork, giving costs, specifications of a specimen room, the different figures in Walnut wood, Walnut floors, finishes, comparative physical properties and the advantages of American Walnut for woodwork.

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with 10 Telephone Capacity

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Three-point, sensitive ball bearings.

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Large Diameter steel through shaft with patented locking feature.

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The building was redeemed, added to, and improved at a cost so small that the owners took absolute satisfaction in the job. The insurance rate was materially lowered.

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HERE is a work of enormous value to restaurant owners and managers, architects, chefs, stewards, kitchen engineers and manufacturers, in fact to all in any way connected with institutional kitchens. The author is a well known authority in the hotel and restaurant field. This book is the result of his experience, and of his interviews with literally thousands of experts, over 200 of whom directly cooperated in preparing the work.

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Apartment residents today demand automatic refrigeration. And they prefer Frigidaire. For they have confidence in the Frigidaire name. They want the convenience of the famous Frigidaire "Cold Control" which speeds the freezing of ice and desserts. They know that Frigidaire offers surplus refrigerating power; that it is incredibly quiet; that it brings about great economies through the ending of ice bills, elimination of food spoilage, and through remarkably low operating cost.

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Sixty-two in the past 7½ years, buildings of the General Baking Company, Bakers of Bond Bread, have been covered with Barrett Specification Roofs. There could hardly be more conclusive proof of the confidence placed in the Barrett reputation, and in Barrett Coal-tar Pitch and Felt and gravel, by first-class concerns.

Coal-tar pitch and gravel roofs—Barrett Roofs—40, 50 and 60 years old and still hale and hearty, are not uncommon. Unaffected by weather, fire, or atmospheric acids, there seems to be no limit to their longevity. Barrett Specification Roofs are bonded for the first 20 years against repair or maintenance expense.

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The most Luxurious heating system

Entire System is controlled locally from each room...

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that shows the superior efficiency of Insulite as a non-conductor of heat or cold.

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because an adequate supply is assured for many generations . . .

CAREFUL study of the following statistics from the most recent report of the U. S. Bureau of Mines shows that an abundance of oil fuel for hundreds of years is a certainty.

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1926 Production per day—Barrels . . . . . . . 2,100,000

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Estimated Amount of Oil Left in Ground Under Production after Present Pumping and Flowing Methods Cease—Barrels . . . . . . . 26,394,157,000
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Send for our Manual of Information for Architects on Automatic Oil Burners if it is not already in your files.

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THE LUNDOFF-BICKNELL CO. BUILDERS
EQUIPPED WITH
JOHNSON HEAT AND HUMIDITY CONTROL
The International Air will always be good in the Detroit-Canada Tunnel

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—It was because of a reputation for low operating cost that Silentvanes have built up for themselves in the Holland Tunnels and the George A. Posey Tube in California . . .

—and because of Sturtevant's special experience in building fans for this kind of work . . .

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The new tunnel connects Detroit, Michigan and Windsor, Ontario. It consists of a single tube 5100 feet long with a roadway 22 feet wide. There are two ventilating buildings—one in Canada and the other in the United States.

To keep the air pure at all times—even in emergencies—twenty-four Sturtevant Silentvane Fans were chosen—twelve Blowers and twelve Exhausters. Capacities range from 61,500 to 195,000 C.F.M. Under maximum operating requirements, the load will be about 900 H.P.

Architects and Engineers are invited to make use of the Sturtevant Research Laboratories where valuable cooperating facilities are available in the development of special ventilating apparatus.


Ole Singstad, Consulting Engineer on Ventilation.

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Offices in Principal Cities.
The Dunham Differential Vacuum Heating System provides completely satisfying heat for the beautiful new STERICK BUILDING MEMPHIS, TENN.

Few American cities can boast of buildings more gracefully beautiful than the Sterick Building in Memphis, Tenn. The charm of the towering Gothic style of architecture in which this building is designed combines most fittingly with the modern set-back type of construction.

The Sterick Building is 29 stories in height, with a mansard roof which brings the total height to 347 feet. Polished granite is used in the base of the building, with three floors above in Bedford stone, the remainder of the building being faced with artificial stone and brick. High speed electric express elevators, the most modern of equipment and appointments and high grade construction throughout make the Sterick one of the South’s most outstanding structures.

The selection of the Dunham Differential Vacuum Heating System for this building reveals the care with which every detail of its equipment was considered. For not only will fuel economy be thus assured the owners, but comfort and health of tenants will be cared for by the mild, beneficent warmth of Sub-Atmospheric Steam on the many days when but little heat is required; in colder weather “hot” steam, at pressures higher than atmospheric, will provide ample warmth. There is over 34,000 sq.ft. equivalent direct radiation in this installation.

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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.

Look for the name DUNHAM
This nameplate identifies a genuine Dunham Thermostatic Radiator Trap.

The Dunham Differential Vacuum Heating System and individual parts of the apparatus used in that system are fully protected by United States Patents Nos. 1,644,114 and 1,706,401, and Canadian Patents Nos. 282,193, 282,194 and 282,195. Additional patents in the United States, Canada and foreign countries are now pending.
The Brownell Company has been designing and building boiler room equipment for 74 years. They are the only company in the entire country building both boilers and stokers. Neither is an "assembled" product—both being designed and built in their entirety at the Brownell Shops.

The Brownell Welded Steel Boiler line is complete and embodies features exclusively "Brownell"—features that combine in one unit effective heating, year round domestic hot water service without resorting to an auxiliary heater, and without heating the building in warm weather; also, when oil fired, an odorless inbuilt incinerator.


The Brownell Company, Dayton, Ohio
Representatives in Principal Cities

Brownell Automatic Underfeed Stokers are far heavier built than any other make—also built to closer tolerances—obviously reducing maintenance expense and prolonging their period of dependable service.
ICY DRAFTS no longer chill the whole building whenever doors swing open, once Venturafins stand guard at your doorway. Venturafin Unit Heaters easily conquer any cold that comes their way. They are always effective and efficient.

With the Venturafin Method of Heating, you can actually control heat in every part of the building. You can force healthful, heated air—accurately and directly—where it is needed most. You can wipe out cold corners and heat pockets. You can avoid freezing one worker and roasting the next.

Venturafin forces heated air directly into working areas—where you want it, when you want it, and as much as you want. It saves you the needless expense of heating ceiling areas first.

You'll be surprised, too, at the moderate cost of Venturafin Units . . . their adaptability to practically any position in your plant . . . their economy of space . . . their low maintenance costs and the actual saving in fuel that results year after year. You'll note, also, the increased productiveness of your men when they work under heating conditions that are exactly right.

Call in any of the reliable heating contractors in your city. Ask them for all the facts about Venturafin, or mail the coupon.

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For stores, showrooms, factories, shops, garages and many other types of buildings.
Preference for Oil Heat usually implies knowledge of Electrol

You may not realize how much Electrol, the Oil Burner with the Master Control, has contributed to the now widespread and general acceptance of oil heat.

For more than a decade, Electrol has played a leading role in the improvement of heating methods and the elimination of furnace drudgery. In that time, Electrol’s reputation for healthful comfort, cleanliness, labor-saving convenience, and fuel economy, has done much to mould favorable public opinion for this new form of home comfort.

You can specify Electrol Automatic Oil Heat secure in the knowledge that your professional judgment is wholly in accord with your client’s ideas. Both will be right in preferring Electrol.

Electrol employs electricity throughout. A small electric motor furnishes the power. An electric thermostat keeps the temperature uniform. Ignition is entirely electric. Quiet... economical... completely automatic.

Wherever Electrol is sold you will find a complete oil-heating service, backed by a sound, large and growing manufacturing organization. Purchase can be financed along with the financing of the new building.

Write for the Electrol regulation A.L.A. Folder, or consult the Electrol Sales and Service Representative in your city.

ELECTROL INCORPORATED
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ELECTROL
The OIL BURNER with the Master Control

LISTED AS STANDARD BY THE UNDERWRITERS' LABORATORIES
The Common Sense of Ash-
in good condition today. Their architecture, however, left
along with adequate funds. Houses erected 20 or 30 years
of an old and completely unattractive house when there is
have been chosen for examples, carefully studied, and new
designs developed for each and presented here. They will
serve as suggestions applicable to thousands of old houses.
Individual application may easily be determined according
to personal preference, location, and cost, in consultation
with the lumber dealer, carpenter, and architect." One detail
of the brochure,—a detail of more than passing interest,—is
presented upon two pages which show the extremely un-
METALS COATING COMPANY OF AMERICA, 495 N. Third
Street, Philadelphia. "Metalayer, The Putting-on Tool.
There are of course countless uses for a device which
spreads a metallic coating of any desired thickness over a
surface of any material. This folder deals with a tool which,
operated by compressed air, feeds a continuous wire of any
required metal into an oxy-acetylene melting flame. A com-
pressed air jet atomizes the melted metal and distributes it
over the surface being treated. To mention but one of the
purposes for which the device is used, there is the very
important detail of protecting iron or steel against corrosion.
The folder says: "Because of the thickness of the coatings it
applies, Metalayer creates a new order of effectiveness in
rustproofing. Sneeze is no obstacle; bridges, railway signal
posts, high tension transmission towers, etc., may readily be
zinc-coated to a depth insuring indefinite life. There is
no danger of hidden corrosion, nor is it necessary to add a
coating in the original design to offset corrosion. Structures of
the most vital importance, like bridges, may be coated by
Metalayer with complete confidence and with a marked sav-
ing in maintenance cost. Iron and steel mechanical parts,
exposed to the weather and difficult to paint, are effectively
protected by Metalayer. Examples are pipe fittings, bolts
and nuts, roofing nails, and certain parts in the brake rigging
of railway cars and in mining machinery. Parts subject
to wear and abrasion may be coated to a depth that allows for
wear. If desired, copper, bronze or lead may be applied over
the protective zinc coating. Street lighting standards, orna-
mental grilles, sign posts, etc., may be given highly artistic
effects in this manner. Hardware may be made of iron or
steel instead of bronze, and finished with Metalayer coatings
that combine protection with decorative effects. Chemical
vats may be made of iron and cheaply metal-lined; and parts
exposed to corrosive gases may be made of iron or steel,
and coated with lead, monel metal, cadmium, or whatever is
needed. Sometimes two coats of different metals give better
protection than a single metal.

The folder describes another use for the tool and gives
several illustrations showing interesting decorative effects
had by spraying molten metals of different colors through
streams of gas producing pattern in relief. "Decorative use of
Metalayer cover a wide range. Iron hardware may be
given a durable coating of copper, bronze, or nickel. Coat-
ings may be left with the natural (matt) surface of the
metal. Not only metal, but plaster, tile, pottery and wooden articles may be coated
in this manner. Use may be made of contrasting metals.

REVIEW OF MANUFACTURERS PUBLICATIONS

NATIONAL LUMBER MANUFACTURERS' ASSOCIA-
TION. "Transformation from Old House to New Home.
It is amazing what can be done to alter the appearance
of an old and completely unattractive house when there is
brought into action even a fair degree of architectural skill
along with adequate funds. Houses erected 20 or 30 years
ago were generally well built with good materials upon excel-
leACKETED houses and so well roofed that their roofs are often in
good condition today. Their architecture, however, left
almost everything to be desired, for it was before the time
when architects exerted themselves to make the small house
attractive, and such work was generally left to carpenters,
trained as a rule in use of old fashioned methods of building
without much care given to the dress in which structural
strength might be clothed. What can easily be done to com-
pletely transform the appearance of such houses is well
demonstrated in this excellent brochure issued by a large
association of lumber manufacturers. "A number of old
houses typical as to shape, height, and general appearance
have been chosen for examples, carefully studied, and new
designs developed for each and presented here. They will
serve as suggestions applicable to thousands of old houses.
The individual application may easily be determined according
to personal preference, location, and cost, in consultation
with the lumber dealer, carpenter, and architect." One detail
of the brochure,—a detail of more than passing interest,—is
presented upon two pages which show the extremely un-

JOHNS-MANVILLE CORPORATION, 292 Madison Avenue,
Architects and their designers are constantly looking for
new varieties of stone and marble. This is no wonder, for
so much when employed for such interior uses as facing the
walls of vestibules, foyers, halls and corridors, and for
facing at times the walls of certain monumental interiors.
The richness of real travertine has of course placed it among the
most desirable of materials for such uses, since the beauty
of its appearance is unquestioned, while its durability is at-
tested by its use during many centuries,—from early Roman
times to the present day. Real travertine, however, has
necessarily been brought from abroad, and the fact that its
cost has been considerable has naturally interfered with its
use in places where it would have been highly desirable.
This brochure or folder gives data regarding a travertine
quarried in America, its history having a certain tinge of
romance. It was quite by chance that a deposit of travertine
was discovered, on what is now known as the 'Floridine' properties.
Due to an embargo on building ma-
terials, a contractor in Florida sought to substitute Florida
native soil a suitable concrete aggregate. He discovered a
small part of the Floridine deposits and took samples of the
stone to mineralogists for analysis. Not long after it was
proved that his find was a natural travertine. J.-M. Flori-
dene Stone is found in free ledge formation, unfaulted, there
having been no geological disturbance in this area. At the
time of the initial operation, various engineers estimated the
quantity of available stone in excess of 80,000,000 cubic feet.
Recent core drillings, however, reveal the practicability of
mining to four times the depth that formed the basis of the
original estimate. This stone ranges in color from a light
creamy buff to darker shades of cool grayish cast, with soft
and interesting mottlings. These include flowering effects
of pure calcite. The intermediate tints and shades admit
unusual latitude for successful combinations with other ma-
terials, thus avoiding the more restricted scope which the
architect encounters in harmonious use of the imported traver-
tines. J.-M. Floridine Stone has a finer grain than the im-
ported travertines with less pronounced pitting and less no-
ticeable language. It is protected from the weather by a
coating which prevents the growth of moss and lichen. This is an
important consideration in economical building upkeep.
The structure is unusually sound and uniform. Being homogene-
ous in form and color and not subject to the natural (matt) surface
of the imported stone, it may be cut in different directions or
which rigidly restricts setting. It is also unusually free from flaws and faults. This
makes extreme care in handling unnecessary and conduces to
economy in setting costs. There are no structural limits to the size slab which may be had. The booklet is well illustrated.

RANDOM ASHLAR STONE. "The Common Sense of Ash-
tone." The proper methods of using the material.
Everybody wants a substantial home, not only for com-
fort, but also because one wants a permanent home. Two
important factors must be considered when choosing a build-
ing material. First, it must have strength. Second, it must
have beauty. In both respects "Ashtone" completely measures
up to requirements. Hewn from the earth, Ashtone has
solidity and lasting strength. As for beauty, no material
ages so gracefully, nor so staunchly dehes time. Producing
a beautiful building is a complex affair, involving many
factors. Not only the material must be right, but it must
be properly put together. Occasionally a building of Ashlar
falls somewhat from expectations because some part of the
builder failed to employ the stone to the best advantage.
Generally it is the fault of the builder; when it is, it is due
to his unfamiliarity with his working medium. This booklet
is issued to give one a knowledge of this remarkable stone.

AMERICAN ENCAUSTIC TILING COMPANY, LTD., 16
East 41st Street, New York. "Lombardic Mosaic."
The various publications being issued by the American
Encaustic Tiling Company are excellent examples of every-
AMERICAN ENCAUSTIC TILING COMPANY, LTD- 16
East 41st Street, New York. "Lombardic Mosaic."
The various publications being issued by the American
Encaustic Tiling Company are excellent examples of every-

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Do You Still Specify Radiators?

In this modern age with its demands for greater comfort, beauty and efficiency, there is no place for the old-fashioned radiator. There is a new mode in heating—Trane Concealed Heating—which is far superior. It is just as difficult to conceive of a perfect modern interior with unsightly radiators in view, as it would be with exposed piping, conduits and drains.

Trane Concealed Heating does away with radiators entirely and provides a system of heating which affords greater heating comfort and economy. It harmonizes perfectly with any decorative scheme—it does not take up any floor space—and costs no more than cast iron radiation equipped with high grade metal covers. The only visible parts are the inconspicuous grilles.

Trane Concealed Heaters are built in standard units with adjustable steel stacks which permit installation in any type of construction. There is complete accessibility to the heating element through the lower grille. It is not necessary to disturb any part of the wall or setting. The economy of Trane Concealed Heating rests on the scientifically developed heating element and the method of distributing heat into the room, which eliminate entirely the undesirable radiant rays.

A perfect heating system, of course, will employ Trane Vapor Heating in conjunction with Trane Concealed Heaters and Trane Specialties. Trane Bellows Packless Valves and Traps are well known for their high quality and exclusive features which make them essential in any high grade heating installation.

Our new booklet “Modern Style in Room Heating” will be sent you on return of the coupon.

THE TRANE CO.,
Dept. 8, 220 Cameron Ave., La Crosse, Wis.
Send free booklet on new style in heating.

Name ____________________________
Address ____________________________
City ____________________________ State ____________________________
Robert C. Edwards announces the opening of new offices at 1143 East Jersey Street, Elizabeth, N. J.

Alec B. Ayres and Robert M. Ayers announce their removal to the 30th story of the Smith-Young Tower, San Antonio. They would appreciate the catalogs and other publications of manufacturers.

A Correction.—In the June issue of The Architectural Forum an error was made in crediting the design for the store in the Stanton Plaza at Larchmont, N. Y., which were illustrated on page 883. D. A. Summo was architect.


When one thinks of the X-ray at all, there immediately comes to mind its use in a hospital, a dental laboratory, or in some other place where it is a powerful aid to medical or dental science. "But such a valuable tool should not readily confine itself to the needs of the anatomical sciences in this day of alertness to new uses for existing processes. X-rays are increasingly being used to determine the internal structure of inanimate objects, such as steel and aluminum castings. This information, as part of a brief survey of the theory and use of X-rays in industry, is included in this booklet. The publication, which will be sent to those interested, suggests some of the industrial applications of X-rays in inspecting the internal construction of opaque materials. This booklet should stimulate manufacturers to visualize many applications of radiography peculiar to their own business."

PITTSBURGH REFLECTOR CO., 304 Ross Street, Pittsburgh. "Floodlighting." A treatise on the subject.

By the term "floodlighting" there is brought to the mind of the average man the more or less ornamental lighting equipment required for the night lighting of fountains, certain important buildings, some advertising signs, etc. Such lighting, however, is frequently required for purposes which are wholly practical. Often construction areas, railroad classification yards, and airports must be so lighted unless their use at night is to be made wholly impossible. This is particularly true in the case of airports, since the approach to an airport must be made plainly visible to enable aviators to properly use the airports' facilities. "Floodlighting through common consent, has become a sort of blanket term, denoting a wide variety of exterior night lighting application. Floodlighting made its appearance in lighting a prominent tower, the projection of the gas-filled tungsten lamp employing a concentrated light source which made the projection of powerful beams of light for considerable distances possible when installed in weatherproof lighting units containing paraboloidal mirror reflectors." To consider more in detail the necessity of floodlighting for airports, this extremely helpful booklet has this to say: "Successful night flying is an accomplished fact. Projectors, floods, obstruction lights, boundary lights and beacon lights make safe night flying possible. The air mail could not reach its full usefulness as long as it was limited to the role of an auxiliary daytime service. After the completion of the artificial lighting system for the 900-mile airway between Chicago and Cheyenne, Wyo., transcontinental air mail became a through-service. Rotating beacons at 10-mile intervals along the night airway mark the course for the aviator. In addition, airports must be equipped so as to mark off the landing fields, and provide sufficient illumination for reasonable safety in landing airplanes at night. For these purposes, floodlights find useful application. It would hardly be possible, in the space here allowable, to more than suggest the wide application of the subject matter of this very valuable booklet. It should certainly be had by every architect or engineer, or by anyone else interested in subjects to which floodlighting of any variety would apply.
The architects who designed this wonderful group not only considered appearance from the standpoint of artistic endeavor but also knew that this must be combined with a never-failing source of heat—thus Titusville Boilers were chosen for this most important task. Their reputation for design, material and workmanship is such that they were preferred above others.

There are scores of other similar installations in all large cities.

The Titusville Iron Works Co.
Titusville, Pa.
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Illustrated at the right is beautiful Beaufort Gardens, of Mt. Vernon, N. Y., designed by Margon & Glazner, architects, of New York City. Below is a picture taken in the boiler room showing the Spencer Steel Tubular Steam Boiler for heating, and the Spencer Cast Iron Sectional Heater used as a tank heater. Note the open doors of the steam boiler. They were left open long enough for a time exposure to register the glow of the fire in the fire box—yet the gauge hand has not even flickered enough to blur the photograph.

Heat and hot water at nine cents a day and no night fireman to pay

Here are three different points of view given by one man. Mr. August Stolz, the heating contractor for Beaufort Gardens, was also the builder, and is the owner now. What he says about his experience with heating should have and does have triple authority. This is what he says:

"Here, with a small Spencer for hot water in the summer, we burn the same No. 1 Buckwheat all the year 'round. Our total cost for 365 days a year for 37 families, ran about 9 cents per family per day, for heat and hot water.

"You may have figures to beat this; but remember, in operations of this kind with which I am connected, there is no skimping on heat and hot water service.

"After installing various types of heating plants, I have come to the conclusion that your proposition, up to date, has proven the most satisfactory and economical for my work."

Here are some of Mr. Stolz' figures. For the 365 days, for 37 families, 175 tons of No. 1 Buckwheat anthracite were used for heat and a 1,500 gallon hot water tank. The reason why the cost per family is so low is simply because the Spencer burns No. 1 Buckwheat anthracite, with no blowers, and no machinery, at about half the cost of domestic anthracite sizes. The Spencer needs no night fireman—for it is a magazine feed heater. Once the magazine is filled, steam, vapor or hot water for heat and for a tank heater is supplied at the temperature required, without any attention, for twelve to twenty-four hours. For apartment house design, as well as commercial and industrial buildings, architects everywhere agree with Mr. Stolz that the Spencer "has proven the most satisfactory and economical for my work." Write for new catalog showing all of the Spencer cast iron sectional and steel tubular heaters. SPENCER HEATER COMPANY, Williamsport, Pa.
America's Most Exclusive Apartments  
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It is a very striking reflection of Hardinge's quality to be consistently selected for so many of America's leading structures. Precision-built in 12 distinct sizes, including a moderate-priced burner for the average and small-sized home, Hardinge makes a specific model to meet every heating need from bungalow to skyscraper. Architects are specifying an oil burner that has already proved itself marvelously efficient and economical in hundreds of America's most prominent homes and skyscrapers when they recommend the Hardinge Fuel Oil Burner.

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WHY IS Each of These Important Buildings Equipped?

TWO years on the market and Robras 20-20's have become a prime requisite in all the better buildings in New York's most exclusive residential district!

How have these radiators achieved such popularity?

Because they go in the wall out of sight, and out of the way. Because they contain more square feet of radiating surface per cubic foot, than any other radiator. In other words, more Robras 20-20 Radiation can be installed in any given space, than can any other type or kind of radiation, no matter what the size or shape of the space may be.

These radiators when installed give added beauty and dignity to the design of the room. They cost but little more than enclosed cast iron radiators, or cast iron radiators with covers.