THE ARCHITECTURAL FORUM IN TWO PARTS

ARCHITECTURAL ENGINEERING & BUSINESS

PART TWO

JULY 1929
The whole world turns to R-W for solving intricate doorway problems. Here's an example—

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FoldeR-Way installations, assuring continuous satisfactory R-W performance, are common all over the World.

There is nothing like R-W equipment and R-W Service. Write for Catalog No. 43.
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The use of Natcoflor instead of the usual type provides higher ceilings—at no extra cost.

Natcoflor saves floor depth; a 9-inch slab is equivalent to a 12-inch slab of any ordinary type of construction.

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This new ingredient has now been combined with Master Builders Integral Hardeners, still further extending the span of life and flexibility of installation of concrete floors. It brings the Masterbuilt concrete floor one more step toward perfection.

Metalicron checks both corrosive and abrasive wear

Concrete, integrally hardened with Metalicron, now has increased its serviceability in floors for industrial plants. The wear and tear of heavy
traffic finds the concrete protected by a tough ductile metallic aggregate. The disintegrating factors present in oils, greases, or other mild acids and alkalis now have little chance for chemical reaction. These old limitations need no longer be considered. A new Master Builders book, The Fifth Ingredient, will tell you why.

MasterMix Plus OMICRON For commercial and office buildings, hotels, schools and other buildings where floors are subjected to steady traffic, concrete with the new Master Mix makes an ideal floor. Containing Omicron, Master Mix also checks the ever present factors of disintegration. And, as always, Master Mix integrally hardens and waterproofs the floor, making it smooth, hard, dustproof, easily cleaned.

COLORMIX Plus OMICRON is the third member of the new Omicron family. Here is concrete with the tile-like gloss, a strength and beauty of color that is adaptable to the office building, private residence, the club building, the hospital, school or church. Colormix adds a permanent color to porches, driveways, swimming pools, as well as to floors. With Omicron, Colormix concrete is protected against efflorescence. It shows increased resistance to the attack of salt water and other mild alkali and acid disintegrants. And the new Colormix concrete shows an increase of from 19% to 68% in tensile and compressive strength, as compared with plain concrete.

If your files are incomplete on any of the materials developed by Master Builders to extend the serviceability of concrete floors, write us for complete information.

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Cleveland, Ohio
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Above, a view of the Grill, with its panelled counter and special equipment behind.

Right, breakfast and griddle specialties are provided for by this compact department, with the dishwashing section beyond.

The main service aisle of the New York Athletic Club kitchen, New York, reflects the character of this brilliant new institution. The entire equipment was designed and built in the great Van Factory.
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The most expensive equipment you can buy is the kind that will be repaired, remodeled or altered constantly—the kind that breaks down when service must go on—the kind that costs money in dollars every day through inefficiency and careless handling. If you get such equipment for nothing, it still is no bargain.

Van Equipment costs no more than you would expect to pay for good equipment. Yet, if you compare its record of service, you will find that it is the least expensive equipment you can buy. It serves year after year, without maintenance or addition. It stands up under the severest use. Its cost is moderate the day it is installed, and nothing thereafter.
Comfortable temperatures have much to do with hospitality. So it is fitting that in the Sherry-Netherland, Jennings Vacuum Heating Pumps should be installed. For by keeping the heating system always free of air and condensation, Jennings Pumps make the radiation quickly responsive to varying heating demands.

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Any building where the public gathers must be protected against sudden power failure. Sudden darkness could be a menace in schools, theatres, churches, hospitals. That’s why so many architects are specifying Exide Emergency Lighting Batteries. They know these batteries... they know they’re adaptable to suit various building needs. And they know they are reliable. When power fails, lights continue to burn. They are switched to Exide Batteries instantly, automatically.

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PACKLESS The same packless construction used in hundreds of thousands of Arco steam valves without one instance of failure. Complete protection against leaks—Relief forever from the expense and trouble of repacking.

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Jacketed attractively for eye-appeal, the National Jacketed Boiler's chief claim to esteem is in its demonstrated quality. Quality built-in, hidden away, but expressing itself in outstanding efficiency, and upstanding service. Large grates, deep fire box, properly proportioned combustion chamber, long fire travel, unite to make this boiler easily fired, easy on fuel. Engineering design scientifically coordinates every part. National Bonded Boilers are designed to perform efficiently with all leading types of fuel: coal, coke, oil and gas. They can be converted on the ground to meet the individual requirements of the fuel selected. Each National Boiler is guaranteed—and the guarantee is endorsed by a Surety Bond, issued by The Fidelity and Casualty Company of New York. It covers three distinct guaranteed stipulations as to manufacture, design, performance, and replacement of any defective part. It assures customer satisfaction, protects against criticism or complaint. National Heating Systems are Made-to-Measure; that means that the heating requirements of each room are scientifically determined. Then the boiler, the radiators, and the accessories required to establish a balanced system, proportioned in every respect to the need, are selected and installed by the National Heating Specialist.

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The Herman Nelson Wedge Core Radiator is an exclusive feature of all Herman Nelson Heating and Ventilating Products and accounts for their unequaled performance.

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It operates at steam pressures from 1 to 150 lbs., and offers the better and more economical way of diffusing heat in Factories, Railroad Shops, Roundhouses, Mills, Warehouses, Garages, Gymnasiums and Industrial Buildings.

Herman Nelson Radiator Sections
for Blast Heating and Cooling

Indestructible, operating at any steam pressure from 1 to 150 lbs., non-corrosive and leak-proof.

May be arranged in banks to solve any special problem of heating or cooling.
Wherever you specify Genasco Trinidad Bonded Roofing there is more than the assurance of unusual resistance to weather and wear. A surety bond is actually issued by The United States Fidelity and Guaranty Company, Baltimore, Maryland, insuring definite years of service.

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THE BARBER ASPHALT COMPANY
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WORKING DETAILS OF ALUMINUM SPANDRELS

[These spandrels are described on pages 18 and 19 of the Architectural Design section of this issue]

SPECIFICATIONS

THESE Aluminum Spandrels shall be made of Number 43 alloy, having a silicon content of 5%. The average tensile strength shall be 19,000 lbs. per square inch and the average elongation in two inches 5%. The weight shall not exceed .097 pounds per cubic inch. The surface shall be free from imperfections and in all respects equal to sample submitted.

These specifications accompanied the purchase of the Aluminum Spandrels placed on the Koppers Building.

We will be glad to furnish further details, and to mail you the booklet "Architectural Aluminum," which sets forth many uses of Aluminum in the architectural field.

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Some architects have become accustomed to making panic bolts a part of the finishing hardware specifications. This is perfectly natural, since panic bolts are placed in such close proximity to the finishing hardware.

Yet it has become the source of considerable trouble to the architects, and to the owners of the buildings, since an occasional unscrupulous dealer accepts such a specification as an opportunity to substitute cheaper devices as part of the finishing hardware contract, which is far more difficult when panic bolts are made a separate item of the specifications.

In order to prevent substitution and to give the architect what he wants, we have for many years made it possible for every reputable hardware dealer to get Von Duprin devices at the same prices.

For your own protection, we earnestly urge that you specify panic devices separately from finishing hardware, and that you specify them by name.

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Von Duprin Fire and Panic Exit Devices are listed as Standard by the Underwriters Laboratories.
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This is the gymnasium of McKinley Technical High School, Washington, D. C., designed by A. L. Harris, Municipal Architect. The structure was erected at a cost of two and a quarter million dollars and is considered "The Capital's Finest School." The BLOXONEND floored gymnasium measures 185x92 feet—one of the largest high school gymnasiums in America.

F. C. Daniel, President of McKinley High, and the instructors and students are all justly proud of this BLOXONEND Floor. Above all else, it is SAFE—No splinters. The surface afforded is fast, resilient, handsome and smooth. This life-time floor may be utilized for any type of school activity without marring the floor's appearance or affecting its durability.

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BLOX-ON-END FLOORING

Bloxonend is specified by nearly all prominent school architects for gymnasiums and shops.

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.
NEWS!

A New Switch...

With a new form of contact spring which prevents burning of contacts at "make"... even in circuit with type "C" lamps.

For months a staff of electrical engineers, technicians and designers have been at work at a single task in the Hubbell laboratory. They had been instructed to design a new toggle switch — electrically and mechanically perfect.

This was no simple assignment. Before them lay many problems. Most important of these was the elimination of burning of contacts at the "make" when controlling type "C" lamps — the most frequent cause of switch failure. This necessitated the development of a radically different design which would provide for the enormous inrush of current at the instant of "make".

Opened for your inspection here is the achievement of this staff. For they have succeeded... they have solved every problem... they have provided a toggle switch, electrically and mechanically perfect in every detail. This switch has successfully passed the severest tests. It is truly a product worthy of the name of the pioneer manufacturer of wiring devices.

We are confident that you will give this new Hubbell Shallow Flush Toggle Switch your enthusiastic approval. You will understand our confidence when you check over the outstanding features listed here. A complete line of these new switches is ready to meet every need. The coupon will place a detailed description on your desk.

Electrically and Mechanically Perfect in Design—"Approved"

A radically new form of contact spring scientifically designed so that two different rates of vibration are set-up in the spring, one tending to counteract the other. Thus recoil is practically eliminated in the ends of the contact spring when the solid metal contact blade strikes between them. As a result, burning and pitting of the spring is prevented — even when in circuit with type "C" lamps.

An automatic "kick off" prevents sticking of blades in contact.

A perfectly insulated commutator support. Commutator blades rigidly riveted to carrier, insuring positive alignment.

Spring arm is pivoted on a round shaft, seated in a symmetrical bearing, facilitating faster, smoother action without wear.

Operating mechanism is separate from the bridge and perfectly insulated. A solid bridge with ears lies in a recess across Bakelite cover — entirely insulated; perfect alignment and rigidity insured.

Each wiring terminal is held by two screws. Bakelite case completely encloses mechanism.

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Toggle Switches

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A. F. 7-29.
THE IDEALS OF ENGINEERING ARCHITECTURE

A REVIEW BY CLIFFORD WAYNE SPENCER

THE importance of engineering to architecture is something easily appreciated by all, and the necessity for good engineering in buildings has never been so great as in the present era, with its towering structures based entirely on engineering formulae and principles. This necessity is duly appreciated by the architectural profession, and no architect would dream of attempting to design an important building without the aid of good construction engineers. On the other hand, the importance of architecture to engineering has too often been disregarded, and the country is full of structures whose engineering character has led their designers to feel that any adornment or artistic treatment was unnecessary, so that the resulting structures, by their barrenness or bad arrangement of parts, give a depressing effect of extreme ugliness. The designing of great engineering structures is often entrusted to men trained to figure accurately and to build with great mathematical precision but with little or no understanding of the fundamentals of artistic arrangement and adornment. As the training of architects errs perhaps on the side of too much study of archaic forms and ancient beauty, so the curriculum of the engineering student has contained too little consideration for the aesthetic possibilities of structural forms. More care and consideration for the appearance of engineering works would undoubtedly lead to a greatly improved type of engineering without making it necessary to sacrifice any of the utilitarian or economic advantages so important from a practical point of view. Often the things which go to make or mar the beauty of a structure seem surprisingly trivial. A well designed set of finials may save from ugliness the most ungainly of bridges without the use of any other decorative feature whatever. More often the structure can be given a curving or sweeping motion or rhythm that will add inmeasurably to its aesthetic quality without impairing its strength in the least. Therefore, the attention of the architect is needed.

New discoveries in engineering science have added greatly to the resources at the command of the engineering designer and doubtless will continue to do so. New materials and new ways of using old materials also are opening up vast new possibilities in the field of engineering as well as in that of architectural design. The comparatively modern use of steel and concrete, both independently and in combination as ferro-concrete, has put into the hands of the designer a medium of vast possibilities which at the same time provides unprecedented structural advantages. In the use of these materials engineering plays a far more important part than ever before, the materials and new scientific processes making possible a much lighter type of construction than was ever possible in the old masonry and wooden structures, and at the same time permitting buildings to be carried to almost unlimited heights. These new possibilities make it more desirable than ever that more attention be paid to the artistic planning of engineering works. If an engineer is to plan the whole, he should be sufficiently grounded in the basic principles of art and architecture to enable him to work out his designs in the most pleasing manner possible. On the other hand, if a special consultant is to be employed to beautify the structure, he should strive to understand the underlying principles and purposes of the work, for in no other way will he be able to achieve that harmonious and satisfying effect which should result.

For nearly two decades Charles Evan Fowler has been working to “develop a trend of thought, along somewhat systematic lines, tending toward a real system for the treatment of engineering structures by means of basic architectural design.” His book on this subject has recently been published and is entitled “The Ideals of Engineering Architecture.” Mr. Fowler is an eminent consulting civil engineer, the designer of many important structures, and author of many works on engineering and architectural subjects. The volume itself is perhaps the most extensive work on the subject of engineering architecture yet produced and covers the subject in a
"The Domestic Architecture of England During the Tudor Period"

By Thomas Garner and Arthur Stratton

A New, Larger, and Better Edition of an Architectural Classic

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© "Garner and Stratton" invariably comes into use when
an architect is working in the Tudor, Elizabethan or
Jacobean style. Its brilliant illustrations of old buildings
may be depended upon to afford precedent for modern
work and to supply inspiration for adapting these mar­
velous styles to present-day use. The difficulty of secur­
ing the two volumes, their unusual size, and the fact
that they have dealt chiefly with elaborate work have
hitherto prevented their wider use.

© A new, enlarged and improved edition of this impor­
tant work overcomes these objections. The page size of
the volumes has been considerably reduced, their con­
tents much enlarged, and the additions to the subject mat­
ter deal largely with work of the simpler, more mod­
crate character which is adaptable to use in America to­
day. The two volumes abound in illustrations of ex­
terior and interior of domestic buildings, and these
illustrations are supplemented by countless drawings of
details,—half-timber work; chimneys; wall paneling;
doors; door and window surrounds; mantels and chim­
ney-pieces; ceilings; stairways; interior vestibules, and
the other details which mean so much to the designer
and aid so powerfully in creating the atmosphere belong­
ing to these English styles.

2 volumes; 237 pp. and 210 plates; 12 x 15 ins.

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THE ARCHITECTURAL FORUM
321 FIFTH AVENUE, NEW YORK

most complete and thoroughgoing manner. Most of the
text matter is in the form of descriptions and criticism
of a large number and variety of engineering structures
in all parts of the world, with special reference to the
design features of the examples shown. These discus­
sions are abundantly illustrated from photographs of the
structures themselves, showing features favorable or un­
favorable to the appearance as pointed out by the author
in the text descriptions. The ideas and aims of the art
of engineering architecture and the part played by the
structural engineer in the new architecture are discussed
at some length in the introduction, and there is also a
brief historical sketch of engineering architecture includ­
ing a description of the seven wonders of the ancient
world. A very clear statement of the fundamental con­
siderations governing a good engineering and a good
architectural design is given, and a comparison drawn
between them, the prerequisites of good architectural
design being sincerity, propriety, style, and scale. As a
matter of fact, the fundamentals are probably much the
same in both cases, and the symmetry, harmony, sim­
plicity and proportion ascribed by the author to good
engineering design are but other words to define the sin­
cerity, propriety, style and scale said to be necessary to
successful architectural design. The major portion of
the work is devoted to bridge design, this being the class
of structure which is most likely to be entrusted to the
engineering profession. Stone bridges are among the
oldest in the world, and their design is the result of tra­
tition developed through the ages, the most usual form
being that of the arch. Many fine examples are shown,
and the lessons drawn from the criticisms by the author
will be found valuable in other lines. Concrete bridges
are a more modern development and lend themselves
readily to architectural treatment, as is very evident from
the examples discussed in the chapter on "Concrete
Bridge Design." Steel bridges are by far the most im­
portant, commercially, in this country and have fur­
nished some of the worst as well as the best examples of
bridge architecture. Many types and varieties are de­
scribed and illustrated, including among others, the
Forth Bridge, Scotland; the Queensboro, Hell Gate, and
Brooklyn Bridges, in New York, and many other exist­
ing and proposed spans. The treatment of details, abu­
mants and piers and the application of ornament to all
sorts of engineering work are discussed, and the chapters
on "Stone Towers," including lighthouses, steel towers,
mooring masts for dirigibles, dams and power houses
are all interesting from the architectural point of view
and important from that of engineering.

In the modern era it has more than ever before come
to be necessary for the architect to understand the en­
gineering point of view, and since the great variety of
subjects which form the basis of architectural education
will not permit the student to go into the more technical
phases of engineering to any great extent, it is very for­
tunate that we have available a work written by one who
sees problems as the engineer sees them and is yet keen­
ly alive to the artistic possibilities latent in every struc­
ture. The work abounds in matter of value to both
architects and engineers and deserves wide circulation.

THE IDEALS OF ENGINEERING ARCHITECTURE. By
Charles Evan Fowler. 383 pp., 6 x 9 ins. Illustrated. Price
Telephone Convenience is an Important Feature in the Planning of Modern Residences

Increasing attention is being given by architects, in the design of modern residences, to the location of telephones. It is becoming generally recognized that the time to plan for telephone arrangements is when a house is being built or remodeled. In co-operation with telephone company representatives, architects are including provision for telephones in the plans of the house by specifying that conduit be laid within the walls. The necessity of exposed wiring is thus easily avoided.

As each residence presents its own special opportunities for telephone convenience, no general rules can be applied. It is naturally desirable that the telephones should be sufficient in number and so located as to insure the greatest ease in the use of the service. Quite frequently telephone outlets are provided in rooms where the service is not needed immediately, but may be desired in the future.

Your local Bell Company will be glad to explain the additional features which constitute complete telephone convenience, and to help you in planning telephone arrangements for individual building projects. Call them today.
THE NEW MODE OF INTERIOR DECORATION

A REVIEW BY
CLIFFORD WAYNE SPENCER

WHEN a movement attracts as many followers and creates as widespread a disturbance among people of culture and understanding as does the so-called "modern art" movement, we should endeavor to decide for ourselves, if possible, just what its possibilities are and whether it is to become a lasting part of the world's art or is merely a frenzied attempt on the part of a dissatisfied and restless group of artists to accomplish overnight that which would normally require a period of one or more centuries to work itself out. Certain it is that a vast number of artistic sins are being committed in the name of modern art and that many people without the requisite good taste and background to create objects of beauty have seized the opportunity to foist on an unsuspecting public all sorts of atrocities bearing the art nouveau label. On the other hand, there can be no doubt that an underlying current of truth and reason runs through the movement, and that as time goes on a definite and national style will be evolved. As is always the case with a new movement of this sort, there is a tendency to unduly ridicule the efforts of its followers, due largely to lack of understanding of the ideals and aims actuating them. We are very likely to ridicule and make fun of that which we do not understand, and lest we condemn unjustly, it is always well to make an effort to comprehend the viewpoint of those who believe in the new movement before forming fixed and definite opinions.

Much of the published material on this subject has been of such a nature as to still further confuse the earnest seeker after understanding, it apparently being the habit of writers on this topic to envelope the entire subject in a veil of abstractness and absurdity. The simplicity and logic back of the movement is admirably expressed in the book entitled "The New Interior Decoration," by Dorothy Todd and Raymond Mortimer. According to these authors, the new design is a natural product of the age we live in,—the age of science and standardization. The theory is that the beauty that expressed the life of bygone eras should not be borrowed and grafted onto our own lives, but that we should evolve a new set of ideals of beauty inspired by the objects that surround us. The industrial prosperity of the present century is due not only to the invention and development of machinery but also in a large measure to the methods of modern business management. Scientific studies of production methods have been made and have rendered it possible to eliminate from the processes of manufacture much of the lost motion and other elements not absolutely essential to the making of the finished product. It is this elimination of the unnecessary that the modernists claim to be their keynote, and they propose to carry the efficient methods of modern business into the private lives of the people and to express in their surroundings the spirit of the new industrial civilization.

They propose to treat the modern house as a "machine for living in," and claim that "gracefulness in things, as in persons, results from an elimination of the unnecessary,—so that in order for a thing to be beautiful it must be useful." The modern designer "begins with an idea of utility and achieves beauty by careful arrangement and proportion of the necessary parts." Since the furnishing and decoration of a house depend largely on the manner in which the house is built, the authors of this work on interior decoration devote a great deal of space to a discussion of architecture and of modern architecture, which they claim to be a new renaissance of architecture based on the beauty of utility and made possible largely through the use of the new materials,—steel and ferro-concrete,—it being no longer necessary to work within the narrow confines prescribed by the use of brick, stone, and timber. The new materials and new engineering science permit of previously impossible shapes and sizes, and this gives the modern designer unlimited new opportunities. As the authors of the present work point out, "forms in architecture depend principally upon the materials employed, and the contemporary renaissance in architecture comes from the discovery of a new material,—reinforced concrete. With the use of a steel framework, the break with the old forms became a logical consequence. The first possibility afforded by these materials is that windows can stretch from wall to wall of a room, from one concrete support to the next. A house, if desired, may be entirely walled with glass. Hitherto the width of windows has been limited by the material,—stone or brick or wood,—which spanned their tops. It has been usual to light a room with tall, narrow windows. Today it is possible to use the more logical method of having a window at the level of the eye running the entire width of a room. In this way the general appearance of the facade at once changes. Horizontal lines dominate, and the ground floor plan dictates the form of the exterior."

Modern life is characterized by a tendency to concentrate a large number of people in limited areas, so that it has become, "more economical, as well as more harmonious, to build houses in series instead of singly. By standardizing various types of houses it is possible to enormously reduce the cost. The individual house is already an anachronism in cities, for the nineteenth century practice of making a street a collection of narrow houses, like towers, is utterly impractical. But it is possible to build enormous buildings, each apartment in which, has its open air terrace and garden. To facilitate this and to give light and air to streets, the buildings in the centers of cities are bound to approximate in form increasingly the pyramid. Already the zoning laws in New York are resulting in buildings of this sort, but in cities, where the space is less limited, the angle of retreat from the street can be advantageously more acute. In the past enormous mansions were built for the rich, confined cottages for the poor. Slowly these inequalities are disappearing. The modern house or flat needs to be large enough for a small family, and no larger, for the diminution in the supply of domestic servants is certain to continue. The modern architect is solving the problem by building the house as one large room with alcoves and balconies intended to serve various purposes."

In treating interior decoration, the subject is divided...
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Paint Sales Division, Joseph Dixon Crucible Company, Jersey City, N. J.

Established 1827

DIXON'S INDUSTRIAL PAINTS

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into two parts,—one on continental decoration and the other dealing with English and American decoration. The history and development of decoration have been closely bound up with that of architecture, and as in architecture the first requisite of good furniture is utility and comfort; especially is this true as regards chairs and beds. "With regard to the actual decoration of a room, there is naturally great variety of opinion. Le Corbusier advocates extreme simplification, color-washed walls; tiled or composition floors; unshaded opaque electric light bulbs hanging from metal pipes or ordinary twisted electric wires; no curtains; bent wood chairs; metal desks; and the pictures,—if any,—carefully placed to focus the architectural forms of the room. The habit of concealing radiators in framework of Louis Quinze design is naturally abhorrent to these decorators, who not only reject all 'period' decoration as unsuitable to the present, but delight in emphasizing the beauty of function. There is usually no attempt to mask gas or water pipes that run along the wall." Whenever possible, furniture is made in the form of built-in fixtures and becomes definite parts of the architecture of the room. "Economy in labor as well as the increasing demands of hygiene, receives in the modern house an attention it never received before. For floors a composite material of cement, sawdust and cork is now much used in France. It is durable and easily cleaned without being noisy, and can be procured in various degrees of hardness. Today our hygienic dislike for dust has led to a positively aesthetic preference for such objects as least collect it. A room crammed with dust traps offends our eye, and as a result there is a tendency to use American cloth where our parents would have used velvet. Chairs and tables can be painted with the same hard enamel which is used for motor car bodies, which neither marks with dirt nor can be easily scratched."

Opposed to this school of decoration there is the more conservative work of the English decorators, whose problem more often consists of transforming an old interior and making it suitable to the uses of an up-to-date civilization. In this they have been particularly successful in creating a more intimate type of treatment. The authors of the present work admit that while from their point of view there is practically no worth while consideration of many rigidly severe interiors, including an entrance hall in which the heater with its accompanying smoke pipe and water pipes constitutes the predominating decorative feature. Many of the interiors which follow are perhaps more intimate and somewhat more cheerful, and yet in all the impression is one of that clean barrenness which one usually associates with the interiors of refrigerators or hospitals. The illustrations of furniture include many extreme types, such as chairs consisting of pieces of bent pipe over which are stretched pieces of cloth or other material. These certainly constitute a good illustration of the "principle of the elimination of the unnecessary," and although they may have been designed to give a maximum of comfort they certainly do not give comfort to the eye. Mural decorations by Duncan Grant and Vanessa Bell are allotted considerable space and illustrate some of the best work of the modern English designers. The fabrics, rugs and tapestries shown are very interesting and in many cases attractive, since this sort of material lends itself more readily than some others to the forms of modern art, and the new fabric designs are often pleasing even to those who do not care for modern art in its other forms.

The final chapter is devoted to a description of the practical methods used in obtaining the modern effects, and for those who wish to try their hand at the new decoration, it should furnish many pointers and much valuable information on rearranging older rooms in the newer manner. Advice is given as to the selection and arrangement of furniture and fittings, methods of lighting, floor coverings and carpets, and curtains and textiles.

For those who wish to know what the new movement is all about, this is perhaps as sanely written an explanation as has yet come to our attention, and the illustrations indicate the tendencies of some of the better class of interior decoration in the modern manner. "The authors do not consider that all the experiments illustrated are successful; but they have tried to choose illustrations representative of the best work known to them. They believe that the twentieth century is likely to be distinguished by an important renaissance in architecture and the arts subsidiary to it, and it is their hope that this book, incomplete as it is, may help to persuade others of this exciting possibility. They have deliberately excluded from their survey all work in which traditional styles, even in modified forms, are apparent." They also claim to have excluded all work claiming to be modern but which is "only eccentric." The uninitiated, on viewing the frontispiece might be led to wonder just where the distinction lies! As has already been said, this new type of decoration and furnishing should be studied and its philosophy examined before an opinion is formed. Nothing worthless could have aroused such enthusiasm and enlisted so many earnest followers, and even the most conservative sometimes admit (though perhaps reluctantly) that in some of its more moderate aspects the style has a certain charm as well as interest.


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.
RCA CENTRALIZED RADIO now enters PHILADELPHIA in modern apartment construction

RCA CENTRALIZED Radio equipment has been installed in the new Garden Court Apartments in Philadelphia. Disfiguring roof antennae and lead-in wires are avoided, and every apartment has much better radio reception than would be possible with the old method of individual antennae.

In each of the 120 apartments the tenant can operate his own receiving set by plugging his antenna lead into an inconspicuous wall outlet connecting with the central antenna distribution system. If his radio set is "all-electric" his power lead is plugged into the house circuit.

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 control 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.
SHERARDUCT RIGID STEEL CONDUIT is doubly protected against corrosion, for safeguarding electrical conductors, everywhere. Zinc-steel alloy, obtained over inside, outside, threads and ends, by the Sherardizing process, makes Sherarduct corrosion-proof. High quality enamel, baked over the zinc, preserves Sherarduct under acid conditions. Conductors are permanently safe inside Sherarduct.
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Minimizing Heat Losses in Residences  
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The Institute publishes twelve booklets, one on practically every type of steel structure, and provides also in one volume, "The Standard Specification for Structural Steel for Buildings," "The Standard Specification for Fire-proofing Structural Steel Buildings," and "The Code of Standard Practice." Any or all of these may be had without charge, simply by addressing the Institute at any of its offices.
PLACING TRUSSES
APPROACH TO NEW CLEVELAND UNION TERMINAL

From a Photograph by Margaret Bourke-White

The Architectural Forum
NOT so long ago the heating plant was just a heating plant; the architect was chiefly concerned with the aesthetic side of his profession, and with the attempt to reconcile his clients' usually hazy and frequently absurd demands with the possibilities in structure and design. Having accomplished this essential task, the architect generally passed on, in toto, the problem of heating to the local artisan, of plumbing to the specialist in that line, and the lighting to the electrician.

Today, due largely to the intensive research that marks the age, heating plants for homes, as well as for commercial and industrial buildings, have reached a stage of specialized development, and the architect who would intelligently advise his clients is forced to inform himself regarding the highly perfected equipment now available.

With growing consciousness of the need for and possibilities of economical heating plants has come an appreciation of the fact that there is little use in specifying and having installed a highly efficient heating plant unless an equally intelligent effort is made to conserve the heat that is generated. Consequently, we find a rapidly growing industry, nurtured largely by the heating industry, concerned with the conservation of heat.

A study of a large number of typical houses shows that these losses average about in this way:

(a) Heat loss through walls, 27%
(b) Heat loss through glass, 26%
(c) Heat loss through roofs, 16%
(d) Heat loss through opened doors, 4%
(e) Heating infiltrating air, 27%

It is to be seen that three of these items constitute 80% of the total loss of heat; it remains to be seen how much these items can be reduced.

Reducing Wall Losses. Briefly, heat loss through walls depends upon the wall area and the coefficient of heat transmission. This coefficient is the number of British thermal units transmitted per hour, per square foot of area, per degree Fahr. difference between the inside and outside air temperature for such air conditions as exist in the coldest weather in the locality under consideration. Designated as "U," this coefficient then becomes a direct measure of the ability of any wall structure to retard heat flow.
Coefficients for typical building construction of today are given in Fig. 1 and these typical types of present-day practice. As the largest and smallest values of $U$ are approximately in the ratio of 2:1, it is evident that the best wall construction will allow heat to escape at about one half the rate of heat loss through a wooden wall of cheap and common construction. If, then, a house has a gross wall area of 2,400 square feet, with 20% windows, the net wall area will be 1,920 square feet, and the heat loss through this wall will be slightly less than 30% of the total heat loss for the house. If the house were built of frame construction of the better sort, wood lath and plaster on one side of the studding and sheathing, building paper and lap siding on the other, the transmission coefficient would be 0.222. If, however the lap siding were replaced by stucco on metal lath, and if the spaces between the studding were completely filled with a poured insulation, the coefficient would be reduced to 0.110—almost exactly one half that of the uninsulated construction. With this latter wall then, it would be possible to save about half of the 28% heat loss charged to the net wall area, or 14% of the heat that would be lost through the cheaper construction. Other materials properly applied could produce a wall equally as heat-resistant. Heat Loss Through Glass. Taking the heat loss through the glass of our typical house as 26% of the total loss from the house, we are immediately faced with a difficult problem in trying to reduce this loss. The quality of glass and the thickness have practically nothing to do with it. A double glass window, if the two panes are close together, approximately one quarter inch apart, transmits less than one half the heat passed through a single thickness of glass, but practical difficulties, such as keeping moisture and dirt from the inner surfaces, put a damper on such usage. If use of three panes were practical, this 26% loss could be reduced about three quarters.

Roof Losses. Losses through roofs vary even more than through walls. For a roof with wood shingles on wood strips and with nothing on the under side of the rafters, the coefficient may be taken as 0.50, while with the same construction with the addition of 2-inch sheets of corkboard nailed to the under side of the rafters and plastered on the inside, the coefficient would be almost exactly one fifth as great. An equally heat-resistant construction would be shingles over wood strips, wood lath and plaster on the under side of the rafters, and the spaces between the rafters evenly filled with an insulating material. There are, of course, many insulating materials and many more combinations of structural and heat-resistant materials. Thus it will be seen that it is possible to save, as between the poorest and best roof construction, about four fifths of the 16% of the heat loss of our average house.

The loss attributed to opened doors is quickly disposed of; it is small, and it is hardly controllable by the architect.

Infiltration. Cold air entering through the walls, and through cracks in and around windows and doors, as the result of wind pressure on the house, requires an expenditure of fuel as great as that required to offset the heat loss through the material walls,—almost 30% of the total. This loss can be materially reduced (a) by the use of high class weather strips, properly installed; (b) by applying so-called storm windows, properly caulked, on the windows taking the brunt of winter winds; (c) by installing, when the house is built, windows and doors having a minimum of cracks, both in length and width; (d) by reducing the number of windows on those sides of the house exposed to normal winter storms; (e) by caulking the cracks between window and door frames and walls, and (f) by giving careful attention to the construction of the walls themselves. Here we find many factors contributing to the loss, and as many possible ways of minimizing the wastage of fuel.

In many classes of construction metal windows are being used more and more, and manufacturers of this kind of equipment are leaving no stone unturned to produce windows that will be as nearly air-tight as possible. As an example of the leakage of residential casement steel windows, a test at the University of Michigan showed, with an indicated wind velocity of 20 miles an hour, and with the window as tight as good manufacturing and installing could insure, a leakage of only 25 cubic feet per hour per linear foot of movable portion of window. To illustrate the effect of a slight opening,—with 1/64-inch shims placed between the weathering contacts at the...
swinging edge, the leakage was 100 cubic feet,—four times as great,—while with the crack increased to 3/32 inch, the air streamed through at the rate of 200 cubic feet per hour. It will be evident that the architect who makes a careful study of infiltration prevention can render a real service to his client who builds a house but once and buys fuel every heating season.

Quantitative Tests. The earliest studies to quantitatively determine heat loss from building structures were made on walls and roofs. These showed how widely the rate of heat loss varied with the individual materials and with the methods of using and combining them. The derived data stimulated the American mind to discover preventatives of heat loss,—and the era of house insulation began. One of the most important aids to the advancement of knowledge of heat loss through walls and roofs is the heat-flow meter, developed from a crude laboratory device to a practical field instrument by Percy Nicholls, physicist at the U. S. Bureau of Mines experiment station, Pittsburgh. This device is applied directly to the wall or roof under investigation and permits the instantaneous and direct measurement of the rate of heat flow. Naturally it indicates flow inward as well as outward, and one of the most fascinating evidences of its sensitivity occurs when it is attached to the under side of a roof. On a bright day, when the rate of flow is approximately constant, the passage of a heavy cloud over the face of the sun is almost instantly shown by the meter reading.

It has been determined, through the use of this meter, that the flow of heat through a new wall is not what it will be under identical temperature conditions when the wall has aged. Also, when the wall is wet after a rain, the resistance to heat flow is not what it is when the wall is dry. Furthermore, the wide variations found in concrete walls, due to differences in “mix” and method of construction, have corresponding variations in heat flow.

Data on heat flow through homogeneous materials were both abundant and accurate, thanks to precise laboratory tests, but when it came to determining heat flow through typical composite walls of modern structures, the heating engineer...
was hard put to it. The conductance of a composite wall (the B. t. u. transmitted per square foot per hour per degree Fahr. difference between surface temperatures) had, in the past, been computed by an empirical formula, depending upon values experimentally determined; the accuracy of the final result also was open to question.

The worth of the heat flow meter in checking values of conductance of composite walls for which the computed values were known, as well as for finding values for walls difficult to handle by formula, at once became apparent. An elaborate series of field tests made during the last year, offers illuminating information on this subject.

The three last items indicate the interesting findings in regard to concrete, brick and tile, the fact that computed figures previously accepted probably are not accurate, and that a wide divergence exists in conductance where concrete is one of the elements, due to the wide difference in physical characteristics and the lack of uniformity in a given wall. Because of this discovery, a great deal of attention is being given to this phase of the study, and it is expected that both the range in actual values and safe average figures will be determined.

Here are some of the data obtained:

<table>
<thead>
<tr>
<th>Construction</th>
<th>As measured</th>
<th>As computed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2½&quot; T. G., felt, 3/16&quot; slate</td>
<td>0.36</td>
<td>0.37</td>
</tr>
<tr>
<td>1½&quot; plaster on wire netting</td>
<td>1.64</td>
<td>1.68</td>
</tr>
<tr>
<td>Guaranteed 5-ply roofing</td>
<td>0.46</td>
<td>0.48</td>
</tr>
<tr>
<td>4&quot; brick, 8&quot; tile, plaster, paint</td>
<td>0.30</td>
<td>0.31</td>
</tr>
<tr>
<td>Plaster, 3&quot; gypsum block, plaster</td>
<td>0.87</td>
<td>0.88</td>
</tr>
<tr>
<td>13&quot; brick, plaster</td>
<td>0.28</td>
<td>0.30</td>
</tr>
<tr>
<td>Clapboard, paper, sheathing, studding, lath, plaster, wall paper (which surprised the investigators)</td>
<td>0.28</td>
<td>0.27</td>
</tr>
<tr>
<td>8&quot; concrete slab, 1:2:4 mix</td>
<td>1.79</td>
<td>1.04</td>
</tr>
<tr>
<td>8&quot; concrete slab, 1:2:4 mix</td>
<td>1.66</td>
<td>1.04</td>
</tr>
<tr>
<td>4&quot; brick, 8&quot; tile, plaster</td>
<td>0.50</td>
<td>0.31</td>
</tr>
</tbody>
</table>

As might be expected, some unlooked-for results were obtained during a long series of field tests with the heat flow meter. During the study of heat flow through a tile, brick veneer wall, there was a decided drop in temperature, followed by a gradual rise. The low temperature continued over a three-day period. The salient data obtained are given here:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low temp.</td>
<td>40</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>High rate of heat flow (actual)</td>
<td>9.5</td>
<td>11.4</td>
<td>15.3</td>
</tr>
<tr>
<td>High rate of heat flow (theoretical)</td>
<td>8.9</td>
<td>14.0</td>
<td>15.6</td>
</tr>
<tr>
<td>Per cent of theoretical of actual rate of heat flow</td>
<td>93.7</td>
<td>122.1</td>
<td>102.0</td>
</tr>
<tr>
<td>Total heat flow for 12 hrs., (actual)</td>
<td>72.2</td>
<td>122.4</td>
<td>168.3</td>
</tr>
<tr>
<td>Total heat flow for 12 hrs., (theoretical)</td>
<td>106.7</td>
<td>168.0</td>
<td>187.2</td>
</tr>
<tr>
<td>Per cent of theoretical of actual total heat flow</td>
<td>147.8</td>
<td>157.2</td>
<td>111.2</td>
</tr>
</tbody>
</table>

It is evident that the maximum measured rate of heat flow increased as the outside temperature...
dropped, but not as rapidly as the theoretical rate of heat flow found by multiplying the conductance of the wall by the temperature difference. When the outside temperature started to rise, the measured rate of flow became greater than the theoretical rate. Lag in heat loss, due to the heat capacity of the wall, caused this condition, which was not fully appreciated until brought to light by these tests. The total heat loss over the 12-hour period as measured was less than the computed loss, based upon a continued maximum temperature difference over the entire period. This condition should be taken into account when estimating heat losses from buildings involving large wall masses capable of storing heat.

Another interesting finding developed through tests on the walls of the Hotel Schenley and of the Schenley Apartments, Pittsburgh, both being 4-inch brick, 8-inch tile and plaster. The conductance of the walls of the former, as determined by the meter, was almost exactly twice that of the latter. A study of the possible reason led to the fact that the heat-flow meter had been applied to a narrow strip of wall in the hotel, with an edge close to a window and another adjacent to a wall. Undoubtedly the lines of heat flow through the wall spread out from the inner to the outer surface, causing the discrepancy. From this, the operators learned to be more careful in choosing a location for the meter. The next year or two undoubtedly will see the accumulation and tabulation of a great many figures that will render more accurate the determination of heat losses from all portions of buildings of every class.

Insulation. Turning from a classification of heat losses through walls and roofs to the problem of reducing these losses to the economical minimum, there are to be considered three classes of insulation: rigid boards, flexible, and "fills." Each has qualifications for specific applications. Practically every type will absorb water to some extent; and insulation, when moist, ceases, in a large measure, to fulfill its function. Where there is a chance that condensation will occur, some effective waterproofing should be provided. Fire- and vermin-resisting qualities also should be given consideration.

Modern buildings designed for factory or office use usually have so much glass in proportion to wall surface that wall insulation seldom is warranted. The window area may be 60% to 70% of the aggregate exposed wall area, and the heat loss through 1 square foot of glass approximates that through 4 square feet of conventional 13-inch brick construction. So the heat loss through the wall is practically negligible. It is in the home, where comfort is paramount, that insulation is more than justified. With about one-fifth of the wall surface glass, the remaining wall area is well worth insulating, to say nothing of the roof. A plain brick wall is more of a sieve than is popularly assumed. With a 15-mile wind,
it will pass about $7\frac{1}{2}$ cubic feet of air per square foot per hour. The addition of a coat of plaster on furring will reduce this to one-fifth of a cubic foot. Insulation will reduce this air leakage to an almost negligible amount and, at the same time, reduce the heat loss through the wall.

Workmanship and Heat Loss. A comprehensive series of tests recently has been made at the University of Wisconsin to determine the rate of air infiltration through brick walls of various kinds. An elaborate test equipment was so constructed that sample sections of wall could be inserted between two air chambers, with all peripheral joints thoroughly caulked. Air pressure was produced in one of the chambers by a blower, and the air that passed through the wall into the other chamber was emitted through small calibrated orifices and its quantity measured.

Test wall sections were built up of two classes of brick,—hard and soft,—and in such a way as to differentiate between good and poor workmanship; in the latter, the mortar was "skimped" between the two outside surfaces of the wall, but the outside appearance was identical. Great variation was found in the air-passing character of the different walls. Careful analysis of a mass of data showed that there were many factors, and that reasons for certain results were more conjecture than anything else. Of the results, Professor Larson says:

"Since poor workmanship consists mainly in leaving voids between the bricks in the interior of the wall, and since the porous brick is likely to be much less uniform in density, it may be that poor workmanship opens up passageways for air through short distances from the face of the porous brick to the voids, and then out on the other face of the wall through a short distance of brick. This explanation requires that the hard brick wall passes most of the total infiltration through the mortar joints."

"Another possible cause for this greater variation between the best and the poorest of porous brick walls, as compared to the best and poorest hard brick walls is in the effect of the porosity of the brick on the proper setting of the mortar. It is likely that the porous brick draws the water from the mortar before it has had time to set, and consequently causes an opening of pores and shrinking away of mortar from the brick surfaces."

It will be evident that the architect, by insisting on the highest class of workmanship and materials, and by watchful inspection during the construction of brick walls, can insure to his client walls that will pass a minimum of air, and consequently result in materially reduced fuel bills and provide more comfort for the occupants.

That the economic thickness of insulation can be determined from essential data is shown in a typical analysis recently made by M. S. Wunderlich, in which he assumed:

- An annual heat demand of 6,000 degree days.
- Anthracite coal at $17.00 per ton.
- Coke at $12.50 per ton.
- Bituminous coal at $9.00 per ton.
- 3/8-inch insulation at $90.00 per 1,000 sq. ft., applied.
- 1-inch insulation at $130.00 per 1,000 sq. ft., applied, and where 1-inch insulation is applied to side walls, $15.00 is added per 1,000 sq. ft. to take care of additional depth of window and door frames, the insulation being installed to take advantage of air spaces and having a conductance of 0.30 per unit inch.

The conclusions drawn by Mr. Wunderlich are thus summed up:

"From this table it will be evident that the saving with 1-inch insulation in the ceiling, with $17.00 per ton coal, is slightly greater than the saving with 3/8-inch insulation in the side walls, and that with $9.00 per ton coal the saving with 1-inch insulation in the ceiling is slightly less than the 3/8-inch insulation in the side wall, while with $12.50 per ton coke the saving is the same. This would indicate that with a higher fuel cost the insulation in the ceiling should be increased over that indicated as compared with side walls, and that with $9.00 per ton coal the thickness of the ceiling insulation approaches the thickness of insulation of the sidewall. Therefore, it follows with the average cost of fuel to the home owner, that the ratio of 3/8-inch insulation in the side walls to 1-inch insulation in the ceiling is a well balanced insulated job."
A HOUSE FOR MASS PRODUCTION

BY

R. BUCKMINSTER FULLER

Editor's Note. The brief but illuminating and stimulating description of this house is taken largely from an address by Mr. Fuller, in Chicago, where his models were first exhibited.

It must be clearly understood that the models and drawings here presented are in no way assuming of perfection or that they indicate the only solution of a problem. They do, however, represent a very definite attempt at housing design on a ‘best-for-all’ basis, with no concession to material appearance or to vanity in advance of proper engineering and general scientific solution. By vanity is meant an association of ideas as to how something should be done because in the past a solution has been related to some event or person of whom we are fond, rather than to solving problems on the basis of their clearest reference to intelligence.

“Inasmuch as the major abode of the United States,—and it is assumed for discussion that the United States represents the advanced nations of the world,—is still the five-room individual house, and inasmuch as but 1 per cent of the five-room houses are designed by architects, it being economically inexpedient in a ‘tailoring’ business to design so small an entity, and inasmuch as the majority of these individual houses of the United States have still no bathrooms, there is indeed involved a problem of industrial best-for-all design.

“That there are 2,000,000 people who die in houses annually from floods, earthquakes and tornadoes, that there are multi-millions who die from unsanitary housing conditions, all of which can be overcome mechanically with no effort at all, indeed emphasizes the problem that there is a best-for-all solution. Inasmuch as we are all here in this world to live, and the one thing we need most is housing, housing on an industrial basis of fabrication, as opposed to the picayune ‘tailoring’ business it is today, would be in proportion to all other businesses as the battleship to a small boat. It has been found that the great popular buyers for monkey wrenches, automobiles, hats, etc., cannot purchase housing as they want it, there being no centralized industries on a universal competitive basis to overcome the exigencies enumerated before, to economically survive on their claim that they can overcome them, and so perform.

“This house is 40 feet high, 50 feet in diameter, proof against earthquake, flood, tornado, electrical storms, marauders, etc. It contains two bedrooms, each with its bath; foolproof worm-gear elevator; laundry unit in which each piece of soiled clothing is individually deposited, and completely finished and ready to use in 3 minutes; cooking grills which are like a piano and...
Elevation and Isometric Drawing of the Dymaxion House, Showing Stability of Construction Obtained by Triangulation of Steel in Tension

Plan of Dymaxion House Having Living Room, Study, Bedrooms with Baths, and Service Room

have nothing to do with a servant; refrigerator; dish closets in which the shelves come around to one instead of one's going around for them! incinerator pocket in which one shells the peas, etc., without ducking down under the pipes; pneumatic, soundproof floors and doors on which the children cannot hurt themselves; library in which the bookshelves come around to one, completely equipped with maps, globes, atlases, drawing board, typewriter, mimeograph, calculating machines, television unit, radio loud speaker and microphone; individual power plant providing both light and heat; sewerage disposal; compressed air cleaner; pneumatic beds; built-in furniture; semi-circular hanging coat closets with capacity of 32 overcoats or 50 dresses; hangar in which the transport unit, an amphibian airplane-automobile, is found as part of the equipment of the house; a 50-foot diameter play deck on top of the house sheltered from storms but where sun baths may always be had; windows that cannot be broken and are never opened, as the air is brought in mechanically without losing any of its fresh, spring smell, but freed of all dust and combined with the proper amount of humidity.—air never too wet nor too dry—and of the proper temperature, blown in through the rooms so that at the North Pole or at the equator no bed clothes need ever be used as the air is always perfect; where any amount of light or coloring of the light may be had in any room from completely indirect, translucent lighting of ceilings or partitions; rooms that are all soundproof so that when anyone rests he may rest in perfect peace. All delivered and ready to move into complete as described, it weighs but 6,000 pounds; at 50 cents a pound for this combination of conveniences, which involves aluminum, casein, etc., it comes to but $3,000 delivered. This house, apparently from cost of Diesel engine operation figures now current, can be maintained at a total expenditure of $5 a month. Being on a functional basis of design, like a ship, it can now be sold not on the land it occupies any more than the ship on the water it occupies, but on the acceptance time-faith basis of all other products.

"It is evident to all the most ardent aesthetes that such truth can also be beautiful. With such apparent results to be obtained on a best-for-all basis, it is evident that should the great industrial housing so indicated develop, which it must inevitably do, all other forms of housing extant will be obsolete and we will need at once 2,000,000 houses, let alone factories, office buildings, etc., of equivalent economic engineering economy, wherefore none need fear of being bereft of their business provided they realize that good prestige and organization, rather than material inventory, form their chief stock in trade."
PHOTO-VISUALIZING FOR ARCHITECTS

BY LEICESTER K. DAVIS

ILLUSTRATED FROM PHOTOGRAPHS BY THE AUTHOR

NOT for one moment is this article intended to go on record as recommending that survey photographs be made to take the place of professionally produced progress pictures which are now so thoroughly relied upon for records of the major phases of modern construction. The points which it emphasizes are meant solely to aid those who have need of accurate visualizations of subjects which cannot wait for, or perhaps do not justify employment of, the commercial camera man's skill and equipment.

Architects and engineers, construction superintendents and field investigators have assured me that failure on their part to make more use of the little camera as a survey instrument has been due merely to not knowing "how it should be done." Time and again there is need of visual evidence for future reference. To back that as­sertion, let's begin with consideration of the qualities demanded in such photographs.

The Lens. The average individual whose experience in photography hasn't gone much beyond the "press the button" stage is far from being certain as to what is meant by "speed" in a lens. Usually he has a hazy idea that it is associated with some special form of grinding or quality of glass peculiar to its type. If at all familiar with the numbers by which lens speed is designated, he realizes that "f :4.5" means an extremely fast lens, while "f :5.6" or "f :7.7" is considerably slower. Beyond that he is not sure as to what it is all about. A good many architects and others who are interested in survey photography, purely as a means to an end, have been surprised to learn that, broadly speaking, the speed of a lens is gauged by the amount of light which it admits to the emulsion-coated film on which the latent image is formed during exposure. A lens is numbered according to the ratio of the diameter of its full aperture to its focal length. For example, the diameter of an f :4.5 will, at full opening, divide exactly 4.5 times into the focal length of the camera for which it is intended, while a slower lens will be of smaller proportionate diameter. This does not mean that mere ability to admit a great amount of light makes a fast lens perfect in its recording. With speed as just
defined, there must be refractive qualities that correct aberration and distortion, eliminate chromatic blur and other errors far too technical for discussion here.

The point to be emphasized is that the faster the lens,—considering performance strictly in terms of light,—the greater will be its latitude for effective operation on badly lighted subjects. Correct refraction is quite as important as high speed. No qualities of depth and definition can be too good. For all-round performance under exacting conditions, I can unhesitatingly recommend the Carl Zeiss "f:4.5 Tessar" as being the ideal type for survey work; with its speed are flatness of field, depth, covering power, definition, precision.

Exposure. Correct exposures are, of course, necessary for the success of survey photographs. They must be timed for the details which are most wanted in the finished print or enlargement. The gauging of exposure,—determination of just what fraction of a second or number of seconds are required to get the details,—has made survey photography discouraging to many an architect and engineer whose records might otherwise be crammed with invaluable visual data. Here again, equipment of capacity unequal to demands made upon it has been to blame for a large percentage of failures.

There are several outstanding factors concerning exposure which should be understood. Generally speaking, a survey photograph has to be taken as rapidly as possible. With most views the use of a tripod is both inexpedient and a nuisance. Nine times out of ten there is fast or slow motion as well as fixed detail to be recorded, and the exposure must stop the one while securing the other.

Shutters. With correct analysis of the light with which we are working, there must be latitude in shutter speed that copes with every situation. A shutter of average snapshot limitations falls far short of requirements. As proof of this, suppose one has a camera with shutter adjustable to the usual 1/25-second, 1/50-second and 1/100-second instantaneous range. These will do nicely for everyday amateur picture taking. With an f:4.5 lens wide open it is possible to secure very fair records of street scenes, if not too close upon pedestrians and vehicles, on a cloudy day at 1/25-second. In better light faster action may be stopped by using 1/50-second, while, with light conditions being equal, some very fast action may be stopped at 1/100-second. These divisions are inadequate, however, where had lighting and motion require timing that borders upon actual time-exposure, or when in brilliant light there is action of "newspaper speed" variety to be stopped.

The shutter of the camera selected for survey work should have, in addition to at least 1/200-second maximum speed, a variety of in-between adjustments slower than 1/25-second in order to...
go the limit when necessary. The “Compur” shutter of the little camera with which all the accompanying illustrations were made offers a choice of eight instantaneous timings: 1-second, 1/2-second, 1/5-second, 1/10-second, 1/25-second, 1/50-second, 1/100-second, and 1/250-second. I find repeated use for all of them. Coupled with the reserve speed of the f:4.5 Tessar, they make few and far between the survey pictures which have to be passed by because of faulty light.

Of course, one must bear in mind that working at slow exposures calls for extreme steadiness of the camera,—1/25-second might be set as the deadline beyond which there is risk of hand or body tremor causing blur in the negative. In some instances, where exigency has demanded a handheld snap or no picture at all, I have secured remarkably clear and fully timed negatives at 1 1/10-seconds. In others, where the passing of heavy trucks, the grind of nearby machinery, or the shaking of a scaffold under wind pressure has caused vibration, 1/25-second has not been fast enough to prevent disappointing fuzziness of outlines. When vibration or unsteadiness of hand or body is at all suspected, it is well to work with the shutter set at 1/50-second or faster, and if in

poor light to open up to a lens aperture that calls on whatever lens reserve is required. Experience has taught me the wisdom of securing as firm a camera support as possible for all exposures slower than 1/25-second. The folding strut beneath the lens board of most small cameras usually makes it easy to find a foothold on some rigid object from which focus and exposure may be made with assurance that all movement has been eliminated.

Photographing Motion. It is sometimes surprising to those who haven’t figured the thing out how well fast-moving distant or semi-distant objects may be stopped by an exposure that is apparently much too slow for the task. Not long ago, I made an overhead shot of an army airplane laying a smoke screen at well over 150 miles per hour. Just what its altitude above me was I could not say. But through the wire focusing frame the airplane was tiny indeed. At closer range, as any news photographer would tell one, a wide open f:4.5 and many hundredths of a second focal plane exposure would have been required. My lens diaphragm happened to be set at f:8, with shutter working at 1/100-second. There was no time to make readjustment to higher speeds, so I made the attempt, hoping to stop the smoke trail but having no idea that the plane would be more than a blurred speck. The result amazed me; enlarged from the 2¼ x 3¼-inch negative, that plane stood forth as though it had been cut out and pasted on the print. Magnified under an ordinary reading glass, the rods and wheels of its landing gear were sharp and clear.
Some Structural Elements Call for Exposures That Disregard Unimportant Objects. Note Clearness of Essential Details

This instance is cited because of its bearing on those slow exposures where the survey subjects include distant or semi-distant objects moving too fast for close recording. The explanation, given by rule and formula, is, of course, that motion upon the film surface is proportionate to the distance of the object from the film. My airplane experience has stood me in good stead many a time since, when 1/10-second or even 1/5-second exposures made necessary by heavily overcast skies have recorded rapid motion at a distance, enlargement later bringing up the details to the size required for reference use.

Essentials for Architectural Photography. Research in photography has been quite as exhaustive as in other major sciences. It has established laws and has reduced them to rules which may be easily understood and followed by anyone. Boiled down to essentials, there are but three points on which the architect who wishes to make successful visual surveys needs to be thoroughly assured. These are: (1) that the lens of his camera be capable of admitting sufficient light for the film to "see" the details he desires in good light and bad; (2) that the lens be capable of refracting the lines, planes and colors of the object with fidelity and freedom from aberration and distortion; (3) that the shutter which regulates the volume of light required to form the image may be so adjusted that the aperture keeps the amount of light static despite changes in exposure time.

Focusing. The most important requirements in lens and shutter have already been discussed. The final element to be considered is focus, produced by the forward and backward movement of the lens and shutter assembly, required to register subjects at different distances sharply on the film. There is no need to go into the principles and laws which govern refraction, conjugates, bending of light waves, circles of confusion and what not. It is enough to say that the distance of lens from object determines the extension of bellows necessary for an image in critical focus. On the base board of one's camera, below an indicator attached to the lens carrier, is the scale which shows what extension must be made to insure sharp focus of objects at various distances. At the start of this scale, where the indicator rests when the bellows are at normal open position, will be found a marking ("Inf." or "Infinity") at which all objects beyond a definite distance will be critically sharp. On the type of camera which is here illustrated, the lens is rated as having 4½-inch focal length; that is, with bellows at normal extension the lens is at Infinity focus, 4½ inches away from the film surface. With such a focal length, Infinity begins at about 40 feet, all objects from one-half that distance on being sharp.

Infinity distances vary with focal lengths; the greater the focal length, the greater the distance at which Infinity begins. The ability of the camera of short focal length to perform as a fixed focus instrument at comparatively short range is, of course, a recommendation for its use on surveys. It is hardly necessary to add that the survey photographer should be thoroughly familiar with the focal length of his camera before he takes the field. Little more than these few facts would have to be known were it possible to confine survey photographs to subjects at Infinity. Some of the most important shots, however, must be made at distances shorter than 40 or even 20 feet, and for these detail must be as sharp as possible.

The focusing scale is intended to provide for these close-ups, and it does. But it does not tell one that the moment the lens moves forward of the Infinity mark it has lost ability to register unlimited focal depth. Only so far and no farther, depending upon the point at which the indicator is stopped, will the distances before and beyond the object produce sharply focused images. The more the lens is advanced, the shorter these distances become. It would be bewildering if this information and nothing more were given as an aid to close-up focusing where it is
not possible to see on the ground glass exactly what will be secured in the negative. Luckily, it has all been worked out by formula. These have been tabulated for easy and accurate reference in compact little depth-of-focus charts which show at a glance the depth of critical focus before and beyond objects at given distances, with lenses of different focal length, working at various apertures.

In making a photograph of a structural element at, say, 15 feet, with the diaphragm of a 5 5/16-inch lens set at f:6.3, the depth-of-focus table will tell one immediately that from such a combination one may expect sharp focus from 12 feet, 11 inches to 17 feet, 10 inches, while for the same lens reduced to f:16 these distances will be 10 feet, 9 inches to 24 feet, 10 inches.

In survey photography many subjects are met with in which the principal object desired is closer than Infinity distance, while others almost equally important extend far beyond the limits imposed by the depth of focus rule. An example of this would be a structural element at 15 feet from the lens, with desired contributing elements 100 feet or so beyond. The difficulty is easily overcome, for the Infinity point may be brought nearer than normal by establishing a hyperfocal point beginning at half its distance before the object and extending far beyond.

While in theory such a thing as fixed focus is an impossibility, every lens aperture has its hyperfocal distance, beyond which all objects will be sufficiently sharp for practical purposes. This distance may be determined either by ground glass or focusing scale. With hand-held cameras it may be worked out by a simple formula: the diameter of the aperture desired multiplied by the focal length of the lens and the product divided by 100 for average detail, or 200 if extremely critical definition is required. To the quotient is added the focal length, the sum being the exact distance of the object upon which the lens must be accurately focused to insure far and near sharpness. Handy little tables have been prepared which give all this information at a glance. Their advantages are obvious, when one realizes that with our little camera of 4¼-inch focal length opened at f:5.6 aperture and focusing scale set at 27 feet, everything wished for in the negative will be secured from 13½ feet on.

Judging Exposure. There should be no guesswork as to exposure where a variety of subjects under different light conditions are encountered. Even the experienced professional photographer is often puzzled in determining just how much or how little light of photographic quality he has to deal with. Time of year, atmospheric haze, color, nearness of objects, absorption of light by surrounding objects, and reflected light are all factors having direct bearing upon correct timing. It is also important that the exposure calculation be based upon the light reflected by the object itself and not by surrounding objects.

There are several types of exposure meters which make possible quick and accurate calculations. These may be roughly classified as: (1) card meters, which give close approximations of the light and subjects present, with proper exposures given for full range of apertures and shutter settings; and (2) extinction meters, which are sighted directly upon the object and manipulated until the light admitted by the eyepiece is reduced to proper exposure point, readings being taken from the instrument. My own preference is for either a “Diaphot” or a “Justophot,” both of which are of the extinction type. The former is quite inexpensive, handy in size, and once its extinction point is understood, it will be found dependable for interior or exterior use. The Justophot is more precise in its calculations, eliminating all chance of error, no matter how difficult the subject or its lighting.

Whatever means are employed in figuring out exposure, it is well to bear in mind the axiom: “Expose for the shadows, and let the high lights take care of themselves.” If after detail, one
must be sure to time the shot to get it on the negative. The emulsions of modern films and plates provide a surprising latitude in the matter of exposure; so it is better to err on the side of too much time rather than too little.

**Distance gauging** is not likely to be a great problem to men experienced in making rapid approximation of measurements. It is nevertheless well to be provided with a dependable range finder for close-ups that require critical definition. There are several types which give most satisfactory results,—compact little instruments not much larger than a cigarette lighter, requiring but rapid sighting and a finger and thumb turn of a calibrated dial to obtain readings of from 4 to 100 feet. A range finder will also be found quite valuable in making distance approximations where a tape is not available or practicable.

**The Camera.** And now for a brief consideration of the camera itself with which to make good survey photographs. Compactness, completeness, and ease of manipulation are equally important. After experience with various makes and types, my choice has settled upon the little camera here shown. It has everything and more to be desired by the architect, engineer or structural supervisor. Closed, its outside dimensions are but 7 x 3½ x 1½ inches. It weighs a trifle more than a pound, and its capabilities and adaptability extend to the most complicated forms of visual survey making. It is, of course, equipped with the f:4.5 Tessar lens and the Compur shutter already described. With these are included several features which make immediate appeal. The foremost perhaps is the "Iconometer" focusing frame, which swings out from and moves with the lens and shutter assembly. Through it the operator may view and compose his picture at architectural eye level, or standing point, up to and through the instant of exposure. There is also a brilliant reflecting finder adjustable to vertical and horizontal views, but on survey work the Iconometer will be much more frequently called into play. In fact, many a sharply-angled downward slant, over a scaffold's edge or into an excavation, would be next to impossible without it.

The rising front of this little camera is also of considerable importance. A simple finger and thumb control raises and lowers the lens and shutter assembly at will, increasing or decreasing the amount of foreground and helping to obviate distortion caused by tilting the camera. The hooded focusing back attachment, double extension of bellows, convertibility to roll film, film pack, cut film or plate, and adaptability to wide-angle and telephoto work through the use of supplementary lenses, are other features seldom found in a camera of such small size.

What the average "snapshotter" usually considers to be poor lighting is often an advantage to the survey photographer. As a matter of fact, I try when possible for a slightly overcast day on work requiring exterior views of construction. Brilliant sunshine may be fine for simple record pictures or contrasty pictorial effects, but, with structural elements it is quite another matter. "Expose for the shadows and let the high lights take care of themselves," but, as with all rules, this rule has its exceptions. To pierce the inky blackness cast by glittering sunlight upon a complicated structural detail half in and half out of shadows, and to expect a satisfying approximation of correct values, is asking too much of even the long-range emulsions found in modern films and plates. One will get one or the other, depending upon which one has time for, but there is small chance of getting both with the even balance of detail a good visual survey should have. Slightly overcast skies help matters mightily, and if one has the right sort of lens and shutter combination, there need be no worry about getting a good exposure on a bad day, provided it be at effective shutter speed.

**Wide Angle and Telephoto Work.** There are times when even an f:4.5 lens must have assistance. I speak particularly in reference to subjects which require a much wider angle of view than is made possible with the Tessar used alone. For this, a little wide-angle attachment becomes a very welcome accessory. It is slipped over the mount of the Tessar, shortening the focal length considerably and widening the angle of view in a most satisfactory manner. In such cases use of the ground glass becomes necessary, but this is made easy by the focusing back of the little camera just described. Supplementary lenses for telephoto work may also be used, making possible close-ups of distant and semi-distant objects which could be had in no other way.

A good filter should be part of the survey photo fitted kit. This, too, is slipped over the regular lens. Filter action slows up the ultra-violet rays which normally register far ahead of colors farther down the spectrum. Used in connection with pan-chromatic plates or films, a filter brings out reds and yellows which otherwise would be expressed in tones far darker than the originals. Used with ordinary films or film packs,—which now possess a high degree of color perception,—a light yellow filter will do much toward snappering out the contrasts of surfaces on which there is an abundance of reds and yellows. A filter increases exposure in ratio to its factor; that is, a 5-time filter lengthens normal exposure by just that many times; and except under the most brilliant light conditions, with lens at wide apertures, it is seldom feasible to use a filter without a tripod or other fixed support. A tripod should be carried.
CHOOSING THE STRUCTURAL SYSTEM AND MATERIAL

PART III—FLOORS AND ROOFS

BY

THEODORE CRANE
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ONE of the most important problems facing the designer of fire-resistant buildings is the choice of the floor construction to meet the particular requirements of his project. It is not the intention of this article to describe all of the various systems that have been devised, but rather to deal with the special characteristics of those most widely accepted, and to point out their respective advantages and limitations.

Let us consider the problem at the moment when the architect’s preliminary sketches have been approved and it is necessary to determine the structural design of the floors and roof. We can safely assume that the location and type of occupancy are known. The general dimensions of the building, the lengths of the spans and the proportions of the bays, are evident from the preliminary drawings. The locality determines the building ordinance which must be adhered to, or the architect develops his own standard for the structural design, based on his knowledge of what constitutes good practice.

In the larger buildings the first step in structural design is to make a tentative choice between a reinforced concrete and a steel frame. This is important, since some floor systems are not suited to both. Even if the building is a low structure with bearing walls, the framing of the interior will be of either of some form of steel or reinforced concrete, except in rare instances where bearing partitions may be used. If steel is employed, there are a number of floor systems covering a wide range of applicability. Prominent among these, in the east, is the so-called “cinder arch,” which has been used extensively in New York. The present municipal ordinance covering this system went into effect about 13 years ago, and it permits 4-inch cinder concrete slabs, properly reinforced, to be used in fire-resistant buildings for clear spans of up to 8 feet. As a 16-foot column spacing would be too close for economy, and as furthermore it would result in placing a concentration on the center of the girder, the almost universal practice is to space columns up to 24 feet and to bring the beams onto the girders at the third points. This system is particularly economical in New York, where neither the code nor department ruling has placed any limiting value on the load per square foot that may be carried by a 4-inch slab, provided that the sectional area of steel reinforcement meets the requirement of the empirical formula. General practice would seem to allow anything up to about 300 pounds per square foot, which is the sidewalk requirement. The concrete functions principally as a stiffener for the suspended mesh.

**Cinder Concrete.** To what extent we are justified in the structural use of cinder concrete depends upon the character of the materials, workmanship and exposure. Good work can be done with clean, anthracite cinders, and there is no evidence that the reinforcement corrodes in dry locations. Unfortunately, much of the cinder concrete now being placed, on even large structures, is neither well mixed nor thoroughly compacted. Furthermore, the structural slab is often screeded off level with the top flanges of the steel beams, which practice permits the cinder fill to come into direct contact with the wire reinforcement which, of course, passes over these supports. Presuming that a well proportioned cinder concrete offers some protection against corrosion, it would seem desirable to raise the slab sufficiently to give at least a 1-inch thickness over the metal. Aside from these criticisms, however, and the propriety of using cinder concrete in buildings referred to by their owners as “monumental,” it is a type of construction which has undoubtedly proved both economical and satisfactory with steel frames. But it should be remembered that in cities such as New York, where many firms of subcontractors have specialized in laying “floor arches,” the price per square foot is much less than could be expected in many localities.

**Ribbed Floor Systems.** Whereas the use of cinder concrete is principally confined to certain large centers, various types of ribbed floor construction are widely used throughout the country. These originally developed from the solid concrete slab by the simple expedient of replacing the concrete in the lower portion of the slab with fillers, such as terra cotta or gypsum block, or by framing voids with wood or metal pans. As this portion of the slab, being below the neutral surface, carries no compression except over supports, it is quite practical to concentrate the reinforcement in ribs spaced from 16 inches up to several feet on centers, and to design the latter of sufficient width to properly enclose the steel and provide for shearing stresses. The advantage of this method lies in the reduced dead load. For example, a solid concrete slab 10 inches thick would weigh 120 pounds per square foot; the same thickness, with 8-inch gypsum block fillers and a
Wire Fabric in Place for the 4-inch Cinder Concrete "Arches" on an Office Building in New York

2-inch "topping," would weigh 60 pounds. If it is desired to use a metal lath as a base for ceiling plaster, the metal or wood pans show even greater saving in weight, giving a floor load of only about 50 pounds for the same thickness. On multi­story buildings this is a very important matter, as the entire frame, including the footings, can be made correspondingly lighter. This type of floor can be used to advantage with either a structural steel or reinforced concrete frame, and it is particularly suited to comparatively light live loads, ranging from 40 to 90 pounds per square foot, and to long spans of from 18 to 28 feet.

It is futile to make general statements as to the comparative values of the various ribbed systems. From the structural designer's viewpoint, they all have the same characteristics. Ribs, 4 or 5 inches wide, are placed between filler blocks or pans and computed as small, individual T-beams. Many architects consider that the advantage of plastering upon a gypsum or terra cotta surface amply justifies the somewhat greater cost of the block systems, but metal pans are widely and successfully used in all parts of the country. These latter are referred to as of the "removable" or the "permanent" type, depending upon whether they are taken out and re-used or left in place. The reinforcement of the ribs or joists, as they are sometimes called, consists of one or two rods or bars, alternate rods being raised at about the fifth points of continuous spans to resist the tendency of the beam to fail in shear, or more correctly, in diagonal tension. Where light concentrations occur, such as under terra cotta partitions, joists of double width and with twice the typical reinforcement are employed; a "bridging joist" is used near the middle of long spans to give lateral support. It is usually possible to avoid the use of stirrups, as most building codes follow good practice in allowing 60 pounds per square inch in
Type of Framing Suited to a Two-way Floor System. Necarsulmer & Leihbach, Architects

vertical shear where the longitudinal reinforcement is properly anchored. If the shearing stresses are critical, or if the requirements for negative bending moment over continuous supports demand a larger section adjacent to supporting members, it is possible to obtain tapered pans, the use of which results in flaring the ribs. If the design actually requires stirrups, the "continuous" type is probably the more economical.

Over the tops of the terra cotta or gypsum fillers, as well as where metal or wood pans are used, it is customary to place a thin slab of concrete cast integrally with the ribs. The thickness of the slab, referred to as the "topping," is generally specified by code as not less than 2 or 2\(\frac{1}{2}\) inches. Where the lower limit is sufficient over terra cotta or gypsum block, it would seem desirable to have at least 2\(\frac{1}{2}\) inches over pan construction. Building ordinances do not usually make this differentiation. Reinforcement, in the form of small rods or wire fabric, is placed in the topping in order to carry the load to the joists and strengthen the slab against stresses due to volumetric changes or impact. The pan systems are particularly adapted to buildings where hung ceilings are necessary in order to provide for ducts.

Two-way Systems. Ribbed floors designed as two-way systems, that is with concrete joists running in two directions, constitute an extremely interesting part of this subject. The steel dome is the two-way application of the principle of the metal pan. The two-way system employing pre-cast concrete or terra cotta blocks between the joists is well known. These are both proprietary designs but have been widely used and with excellent results when the plan of the building and partition arrangement is appropriate for a two-way distribution. Taking advantage of the principles underlying the design of flat plates, which have been studied by many investigators both in this
country and abroad, the owners of these systems have gained the approvals of many building departments, and among them those of our largest cities, for the use of empirical coefficients in the moment computations. In the past it has been the practice to compute the sustaining power of a concrete slab of two-way design as if it consisted of a series of parallel beams, entirely neglecting the strength due to "plate action." In the light of both theoretical analyses and practical tests, it would appear justifiable to use moment coefficients on two-way designs 30 per cent less than those that would be applied to individual beams under similar conditions of restraint. In other words, the bending moments on all two-way slabs, of both solid and ribbed construction, might well be approximated as $\frac{W_L}{12}$, $\frac{W_L}{15}$ and $\frac{W_L}{18}$ instead of $\frac{W_L}{8}$, $\frac{W_L}{10}$ and $\frac{W_L}{12}$ in which $W =$ total load per lineal foot carried in the direction of the reinforcement under design, and $L =$ span as ordinarily defined. As a general principle, it may be borne in mind that when a building can be framed to obtain approximately square bays, with supporting girders or walls on all four sides, there may be a distinct saving in using a two-way system. It can be employed with either bearing walls, steel or concrete frames and have a wide range of application, being suitable for all loads up to those ordinarily used on the floors of buildings intended for light manufacturing purposes.

A comparatively new system employing slag block units between concrete ribs, running in two directions, furnishes an economical design falling under this classification. The blocks are made of Portland cement, sand and slag; owing to their strength and comparative lightness, they serve in a structural capacity as well as acting as fillers. A topping of concrete is not necessarily required, but it may be used to give the exact thickness called for by the design. This system is adaptable to either a structural steel or reinforced concrete frame and is particularly economical for light and medium loads. During this year it is being installed in several of the largest hotels in New York.

*Beam and Slab.* The first type of reinforced concrete floor construction that came into use for other than extremely short spans is known as the "beam and slab." In the typical arrangement, columns are placed on about 20-foot centers; girders run between columns in one direction, usually across the building, and the beams frame into the girders at the third points of their spans. An industrial building designed for a live load of 200 pounds per square foot with bays 20 feet square, would require, approximately, a 4-inch thickness for slabs, supported by beams and girders 8 by 20 inches and 12 by 28 inches, respectively. The depths are taken from the top of the
Pre-cast Concrete Channel Slabs Being Placed Over a Structural Steel Frame on a Detroit Factory

A Large Roof Area of Pre-cast Concrete Slabs Laid Over Railroad Yards in Hoboken

slab. This system is still used for floors built of solid concrete, the arrangement of which does not lend itself to the generally more economical design known as "girderless construction." Obviously, such a system can be adapted only to a concrete frame.

Girderless System. Within recent years beam-and-slab designs have been largely superseded by the girderless type wherever the size of the building and the interior arrangement permit three or more consecutive bays in each direction, provided that the bays are approximately square and of about the same size. This system, however, is not usually economical for live loads of under 100 pounds per square foot, and its particular function is use for industrial buildings and warehouses with live loads ranging from 125 to 300 pounds per square foot of floor area. For the loads ordinarily used in apartment house construction, a pan or ribbed design is more desirable from the viewpoint of structural economy, entirely aside from the architectural difficulty presented by the flared column heads. For industrial buildings designed for a live load of 200 pounds per square foot, and employing drop panels over the columns, the sizes of structural members for a bay 20 feet square would be approximately an 8-inch thickness for the slab; drop panels 6 feet, 8 inches square and projecting 3 inches below the soffit of the slab; column capitals 4 feet, 6 inches in diameter. These dimensions would conform to the requirements of most cities, including New York and Chicago. The girderless system can be used to advantage with either a reinforced concrete frame, which is the usual construction for comparatively low industrial buildings, or with structural steel column cores, which have recently become popular for comparatively tall city buildings.

Light Steel Joists. Passing from the class of heavy concrete construction to that of the lighter sections, we have various types of pressed and rolled steel joists. These are not used to advantage with a concrete frame, and although capable of carrying light manufacturing loads on comparatively short spans, are particularly suited to designs requiring live loads of from 40 pounds to 75 pounds per square foot. Pressed metal joists have been on the market for many years and are used in exactly the same way as wooden joists, except at a somewhat greater spacing, and usually as supports for a 2-inch concrete sub-floor poured on metal lath or similar construction. Recently, the new "light steel joists," which are actually light trusses, have been developed and widely used. This construction is extremely simple, the ends of the joists resting on supporting walls, or steel girders and the upper chords carrying the structural slab which may be of either concrete or gypsum, cast over metal reinforcement. As the joists are of open design, it is possible to conceal pipes within the floor. The plaster of the ceilings is applied to metal lath attached to the lower chords of the joists. The latter are occasionally
spot-welded to the upper flanges of the girders, and wire bridging is used to give lateral stiffness. Sometimes more lateral support may be required.

To fill the demand for a strong and rigid floor, yet one of lighter weight than would be obtained with standard sections, there have recently been placed upon the market light weight rolled steel beams which are normally set from 2 to 4 feet apart and used to support slabs of either concrete or gypsum. The latter may be in the form of pre-cast units or poured in place, reinforced with metal lath or mesh. These systems are generally used with structural steel frames, but are also suitable for floors supported by bearing walls.

Non-fireproof Framing. Owing probably to its obvious simplicity, framing the interiors of non-fireproof buildings, having exterior masonry walls, is a subject that has received very little attention. In fact, one often sees wooden posts and girders used in residence construction, with the result that the natural shrinkage of the wood causes the interior of the building to settle appreciably. To minimize this difficulty cast iron columns filled with concrete should be used in place of wooden posts, as the increased cost is negligible. For the main girders, carried by the columns, H-sections with square flanges should be employed for the support of the wooden floor joists. The standard I-beam sections are not very satisfactory, since the lower flange does not give adequate bearing and necessitates either bolting a carrying ledger to the beam, which is somewhat awkward, or the loss of headroom resulting from allowing the joists to rest on the tops of the steel girders, instead of framing into them. The stud- ding of main partitions should, of course, rest directly on the upper flanges of the girders and not upon the joists comprising the floor system. The sizes of wooden floor joists and the requirements for anchorage, or coping and bridging, are of such general knowledge that the subject will not be further treated in these articles.

Fire-resistant Roofs. The design and construction of fire-resistant roofs is a subject that has received considerable study during recent years. It is not a simple matter to build pitched roofs that will satisfy both structural and architectural demands and at the same time be practically fire-proof. In ancient and medieval buildings use of the wooden truss was the only alternative when the architectural treatment made impracticable the employment of vault or dome. Modern practice, however, demands that our monumental buildings be roofed with something more fire-resistant than lead-covered timber frames, and the result has been the employment of structural steel and reinforced concrete. Some years ago there was much talk of building with pre-cast concrete units. This system was actually applied to the walls of a few moderate-sized structures for which large slabs were cast upon the ground and raised into place by means of jacks. Twenty years ago the author worked as assistant superintendent on a large concrete residence, the pitched roof of which was built in this manner. Ridge and rafters were cast in place, after which large concrete slabs were raised from the ground by means of a gin-pole and dropped in place on the supporting members. It is quite possible, with proper care in detailing, to make a satisfactory weathertight and fire-resistant roof in this way, but it cannot be recommended as economical, nor would the concrete surfaces, even when colored, be architecturally acceptable in most cases.

At the present time, structural steel of standard or special sections would seem to be the most desirable for the supporting members of pitched roofs. Welded connections have been found satisfactory, particularly where electric welding was practicable. This method was successfully em-
ployed for the purpose of attaching the purlins to the rafters, on the steel framed roof of a large dormitory recently built at one of our eastern universities. Several materials, or rather systems, can be used over the steel. For industrial buildings, pre-cast concrete slabs offer a satisfactory surfacing but are not practical as a base for slate or tile. It is also possible to employ terra cotta "book blocks" laid between steel purlins, or pre-cast gypsum blocks. The steel of the roof should be designed to meet the special requirements of the system. These methods are particularly suitable for large roof areas which are not too complicated in design. If gypsum is employed, it is necessary to give the blocks a water-proof coating as soon as laid in order to protect them from moisture before the application of the surfacing material. The individual slabs should be securely anchored to the steel purlins and the joints filled with a gypsum mortar. Another very satisfactory method, which has been successfully applied to the roofs of monumental buildings, is the use of cinder concrete slabs cast in place over the structural steel framing. There is also a choice of various other materials, including gypsum and mixtures containing Portland cement combined with certain light weight aggregates which are suitable for roof work and are placed in a plastic state. When hardened, the cinder or composition slab is coated with a 2-inch layer of a proprietary material, applied like cement mortar, which serves to receive the nails holding the slate or tile in place.

Flat Roofs. A flat or slightly pitched roof offers no particular structural problem. In this case the designer's attention must rather be centered upon making the deck waterproof. The numerous offsets introduced by our so-called "set-back" laws, applying in all of the larger cities, have become the rule rather than the exception and are taken care of as a matter of course by the engineer or structural designer. The problem of waterproofing, however, is more often slighted. Specifications seldom fail to properly describe the typical work, but the details of flashings and the proper use of suitable mastics as joint fillers are too often left to the devices of the subcontractor.

Volumetric Changes. In this work, as well as in all else concerned with building construction, it is essential to realize that volumetric changes due to variations in temperature and moisture actually cause appreciable movement in our structures. The hair cracks which are characteristic of concrete and stucco surfaces, when used continuously over an extended area, usually have their counterpart in the joints of brick, terra cotta, natural and artificial stone. If the work is well done, the cracks are too small to cause trouble on unrestrained surfaces; they express what might be called the "respiration" of the building and are hardly more serious than the very measurable lengthening of large concrete structures under the heat of the sun. But the unit, or assembly, as the case may be, must be free to move, or something will break. An actual instance is on record of a cinder concrete roof filling having expanded with sufficient force to shear off a parapet post somewhat over a foot square in horizontal section and reinforced with four 3/4-inch rods. Good construction provides a mastic filled joint where materials are capable of expansion about parapets, chimneys or penthouse walls. This has become an established practice. Difficulty arises from much more subtle causes, among which is the contraction of the fluid concrete in the process of hardening. Provision should be made to permit the initial contraction of the concrete without rupture, and the work should be designed to allow each unit freedom to swell and contract with climatic changes which are certain to occur.
In most cases it is a mistake to cast long sections of concrete monolithically. The amount of reinforcement used in our industrial buildings, or others with reinforced concrete frames, tends to hold the mass together and to distribute the strains due to secondary stresses, but even for such structures it is desirable to limit the lengths between joints to 300 feet. A complete separation is then made between the two parts; double columns are constructed on the exterior, and the floor slabs are built as cantilevers on each side of a transverse joint, passing entirely across the building from the top of the footings to the roof, where the parapet and roof slab are also divided. Retaining walls, particularly those used in landscape work, often show signs of disintegration or develop serious cracks after only a few years' exposure. Although there are usually contributory causes, most difficulty is due to two factors,—faulty design in not providing properly for volumetric changes, and faulty construction which results in porous concrete. Both of these evils are preventable, and we all know that excellent results can be obtained in concrete if the work is properly designed and conscientiously built. It is an extremely simple matter to divide parapets and retaining walls into sections by introducing joints at the posts or pilasters. If such are made effective by the use of some material which prevents the adhesion of the two surfaces and gives a slight cushion, no difficulty will be experienced.

**Terraces, etc.** Similarly, the floors of exposed terraces must be given a chance to expand and contract. Sidewalks supported upon soil are generally cut through on 4- to 6-foot centers, which is satisfactory under normal conditions without any joint filler. The surfacing of exposed terraces, however, often requires carefully designed jointing to provide for temperature variations. Specifications normally call for a membrane seal beneath the tile or concrete wearing surfaces of loggias and exposed roof decks. Equal attention should be paid to the character of the mastic used to fill the expansion joints. Overflow due to expansion may be controlled by not filling the joints quite full, but there are few materials that will follow the receding masonry when the joint is broadened by contraction.

The method of obtaining a suitable grade over large areas of so-called "flat" roofs is another subject that deserves consideration. The simplest solution, and one often applied, is to lay the structural slab absolutely level and to obtain drainage by the use of cinder filling. This, however, increases the dead load, and where feasible it is better to pitch the roof slab itself. Of course there is no real objection to having an absolutely level roof surface, as the same guarantee can be obtained from the roofers, but if it is desirable to avoid pools of water remaining after rainy periods, a slight pitch is essential. It is usually practicable to work out a suitable grade in connection with the insulation of the roof, which becomes an important matter where conditions are likely to produce condensation. The steel roof deck, a type of covering which is extremely economical, and well adapted to certain types of buildings, presents a real problem in relation to insulation. Although furnishing a perfect base for the application of membrane roofing, \( \frac{1}{2} \) inch of fibrous insulation board is inadequate to prevent heavy condensation on the under side of the metal. It would seem desirable to provide thorough ventilation beneath all such installations.

**NOTE.** The author wishes to acknowledge his indebtedness to these firms and associations for the use of the photographs used as illustrations: American Steel & Wire Co.; United States Gypsum Co.; Truscon Steel Co.; Republic Fireproofing Co.; Barney-Ahlers Corporation; Jones & Laughlin Steel Corp.; Federal Cement Tile Co.; American Cement Tile Co.; Marc Eidlitz & Sons, Inc.
WALL STREET ENTERS THE BUILDING FIELD—II
BY JOHN TAYLOR BOYD, JR.

The preceding article, in The Forum for May, dealt with recent developments in construction finance, quite revolutionary in themselves and in their possible effect on the building industry. Introduced into the New York building world by several large corporations, with the strongest Wall Street financial support, they indicate a decided trend toward the efficiency of large scale operation. In this article there are discussed three specific financial plans illustrating the new methods. The plans are those of the Fred F. French Company, the Henry Mandel Associates, and the plan of the new triple combination of the Beaux-Arts Development Corporation,—a syndicate headed by a group of prominent architects with the huge U. S. Realty & Improvement Corporation, and the National City Bank, now the third largest bank in the world.

As explained in the former article, the principles of this method of financing, which is novel to the building industry but not outside it, are chiefly: (1) Investment value, as compared with the speculative element which characterizes too much conventional real estate finance. (2) Sale to the public of long term security issues at low rates for both junior and equity financing, involving the entrance of the public into ownership purchase of common stock of real estate.

These three financial plans are presented solely as illustrations of the new ideas of building finance. No attempt is made to select any one plan as the best. That is impossible, because the financial plan of a building varies in each case as does its architectural plan. Furthermore, any financial plan should be judged from these different viewpoints:

1. Of the construction corporation, seeking a steady supply of fresh capital at low rates.

2. Of the banking house whose aid is enlisted to market security issues directly to the huge public, composed of some 17,000,000 investors and speculators scattered all over the country. The securities sold must be sound and attractively priced in order to sell in competition with the flood of security issues of all types.

3. Of the individual investor, who selects his securities from among the myriad of offerings, according to his personal needs and preferences.

4. Of the building industry, to which the need is vital of obtaining for its expansion a constant flow of fresh capital at low rates.

5. Of the welfare of the American economic structure, which depends to a large extent upon the prosperity of the whole construction industry.

The financial plan of the Fred F. French Company is the first to be considered here. This is because this plan is well understood, having been in operation for a number of years and having been extensively advertised to the public. In the "French plan" the point of departure from conventional methods rests in its financing of that remainder of the cost of the completed building above the first mortgage of approximately 50 per cent by means of the sale of long term security issues directly to the public, using its own permanent sales force. In this way, the French Company obtains a never-ending stream of millions of dollars of new capital for its colossal building program, at presumably a much lower cost than it would if it used the ordinary methods of either mortgage bond issues or long term first and short term junior mortgages, both of which involve seeking equity from wealthy speculators.

In the French plan, the public takes on an actual ownership share in the individual building, with the opportunity of sharing in prospective profits in (1) increased land values, (2) increase in equity as mortgage is amortized, and (3) in prospective earnings and dividends. The investor's position is different from that of the purchaser of the conventional mortgage bond, who is a creditor and whose return is limited. The owner of stock in a French Company building depends for the soundness of his investment on these factors: (1) The success of the French Company's management, (2) the large proportion of equity, equal to approximately one-half of total cost, and (3) the economy and safety of the long term system of financing of junior and equity finance, under which both profits and repayment of junior financing are deferred for several years, until the earnings of the property are sufficient to carry the load. This advantage of long term financing was discussed in the earlier article. It was pointed out that it is (1) the terrific burden of heavy discounts, of premiums and high amortization rates on junior mortgages, and commissions of one sort or another,—often totaling 15 per cent or more,—and (2) the much higher cost of obtaining equity money, for which a big speculative profit must be shown "on paper," which break the back of many an intrinsically sound building enterprise. And, equally important to this financial load of short term issues, there may be charged the abandonment of many a good building enterprise, to the detriment of the construction industry.

The French plan bears two points of resem-
blance to the conventional method. One is its use of the conservative "institutional" first mortgage. In the ordinary French project the proportion of mortgage to total cost is, as already said, as near 50 per cent as practicable. The interest rate is usually 5 or 5 1/2 per cent, and the mortgage is amortized. The second point of its resemblance to conventional methods is that the French plan does not directly give to the investing public the full benefit directly of diversified ownership in the chain of buildings, although the Company itself receives this protection of diversified risk. The typical French security issue is limited to a single building, which is incorporated as a separate company, with limited liabilities, as in the case of the usual mortgage bond issue which is not "guaranteed" by the house of issue. Thus the investor puts all his eggs into one basket. On the other hand, it should be pointed out that the investor may gain the protection of an investment in a chain of buildings by spreading his purchases over a number of French buildings. Incidentally, the investor has also the opportunity of buying the common stock of the "parent" Fred F. French Company, which is now traded in on the unlisted market in New York. This stock, which not so many years ago was "given away" as a bonus, recently sold at over $1,000 a share before its split-up. The French plan illustrates the great advantage of the long term method of junior financing. It would indicate that the customary division of financing into the long term first mortgage on the one hand and on the other the short term remainder of cost, is arbitrary, and has been carried to an illogical extreme. It runs up building costs and, in addition, brings in its train a list of evils of excessive speculation.

The technical details of the French plan are interesting. The public buys preferred stock (6 per cent cumulative preferred, $100 par value) to the amount of about half the total cost of the operation, and with each share of this preferred stock the investor receives without further cost to him one share of common stock. For each share of common stock thus issued to the public, the Fred F. French Company receives one share of common as its profit. The result is that the investing public shares fifty-fifty with the French Company in the common stock ownership of the building, thus entitling it to half the profits. Profits accrue through retirement of the preferred stock, which is expected at the end of ten years in the average case. The retirement of the preferred is accomplished in ten equal payments of 10 per cent each, as the earnings permit, and no dividends can be paid on the common until all the preferred is paid off.

The Fred F. French Company performs all the operations that are necessary to produce a completed building,—buying the site, designing and constructing the building, selling the securities. In addition it operates the completed property through the Fred F. French Management Company. "Total cost" is the cost of land, construction, of carrying charges during construction, cost of selling securities, and of the normal fees paid to the Fred F. French Company for architecture, contracting, underwriting, for managing the building, and for the necessary advertising. I am informed that the usual underwriting fee is 5 per cent of the total cost of a French operation. This expense, be it noted, offsets somewhat the usual mortgage bond discount or charges for junior financing, but here again, in the French plan, the cost is spread over a period of years. The charge is not deducted at the beginning but instead is capitalized, and its payment is deferred.

When one has mastered the main points of the French plan, it is easy to understand the plan of the Henry Mandel Associates, which seems to be modeled along similar lines. The chief difference is that the Mandel plan gives the investing public the benefit of diversification through part ownership in a chain of properties, in addition to taking an interest in an individual structure. More specifically, the investor purchases "units" of stock at $110 per unit. The unit consists of one "investor's" share of $10 in the Henry Mandel Associates, the parent company, and one $100, 6 per cent convertible gold note in a single building. This gold note is convertible into 6 per cent cumulative preferred stock in the single building at the end of one year after completion of the structure, at the option of the holder, and, at the option of the company, in two years. The note matures in about ten years. Now, the investor's share of the common stock of the parent company, Henry Mandel Associates, is matched, share for share, and is paid for, dollar for dollar, by a "founder's" share, owned by Henry Mandel. In other words, Mr. Mandel invests in the common stock of the parent company owning the chain of properties, on the same basis as the public and to the same extent. Also, since the investors in the first buildings of the chain take a greater risk than those who invest in the later projects, when the success of this new enterprise has been presumably proved, these original investors will probably buy their common stock in the company owning the chain on a more favorable basis. In other words, the price of the investor's—and of the founder's—shares will doubtless be increased with each successive operation.

Other differences between the French and Mandel plans are (a) that the mortgage proportion of cost is about two-thirds in the Mandel plan, and (b) that the Henry Mandel Associates
makes public semi-annual financial statements of its own condition and of that of each of its buildings.

It should be pointed out that there is a theoretical limit to the expansion of the Mandel chain of buildings. That lies in the proviso that Henry Mandel himself invests dollar for dollar with the public in the parent company. Today there is no man in the world, nor any group of men, wealthy enough to go on indefinitely matching dollar for dollar with the American investing public. This is an era of mass-investment as well as of mass-production and mass-marketing. Everyone in Wall Street appreciates this fact but, curiously, the building industry has scarcely yet grasped it.

But to this point, this complicated discussion of building finance has failed to answer the real question at issue. That is the simple, homely question which the prospective investor asks the stock salesman: "How much, exactly, can I expect to get out of it?" That question is the crux of the situation for everyone concerned. To throw light on it, I quote from the pamphlet issued by the Henry Mandel Associates—"Our Plan,—Your Opportunity." On page 26 is the table which gives the expected operation of the retirement of the preferred stock:

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<td>6.78</td>
</tr>
<tr>
<td>6th</td>
<td>14</td>
<td>3.84</td>
<td>52</td>
<td>4.94</td>
</tr>
<tr>
<td>7th</td>
<td>14</td>
<td>3.12</td>
<td>40</td>
<td>3.82</td>
</tr>
<tr>
<td>8th</td>
<td>14</td>
<td>2.40</td>
<td>27</td>
<td>2.42</td>
</tr>
<tr>
<td>9th</td>
<td>14</td>
<td>1.62</td>
<td>14</td>
<td>1.80</td>
</tr>
<tr>
<td>10th</td>
<td>14</td>
<td>.84</td>
<td>96</td>
<td></td>
</tr>
</tbody>
</table>

Then, on the next page, it is said that after the preferred stock is retired, Henry Mandel Associates "will receive $14 per share per year for each share of common stock of the building. If it is assumed that a stock earning $6 per share is worth $100, then this income of $14 per share gives the common stock of the building a value of $233 a share." This is the stock for which the investors in the first building paid $10 ten years before, and received, meanwhile, no return on it, which adds to its cost at the end of ten years at say 6 per cent compound interest.

In Part IV of the same pamphlet, entitled "How Investors' Common Gains Value" is said: "Our experience has been that such buildings have a valuation on completion of upwards of 20 per cent above the cost of land and buildings, and that this increases after completion. Buildings are commonly sold at completion at profits of from 15 per cent to 50 per cent above cost." On the conservative assumption that the property gains 20 per cent in value at completion, the common stock of the building gains (in the typical case illustrated) immediately a value of $50." This value "rises as the 6 per cent cumulative preferred stock is retired, with the result that, at the end of the retirement period, this common stock value per share will include the $100 which was the original cost of the preferred stock investment." Then it is said that "land in the areas (of Manhattan Island) where the Henry Mandel organization operates has a natural increase in value ranging from 3 per cent to 10 per cent annually. Assuming the lower figure, this increased land value represents a gain of $225 a year for each share of common stock of the building."

The effect of these assumptions of increased value of the common stock is summarized in this table, copied from the pamphlet:

<table>
<thead>
<tr>
<th>Number of Years after Completion of Building</th>
<th>1</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Gain in value of building at completion</td>
<td>$50.00</td>
<td>$50.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>(2) Natural increase in land value</td>
<td>$4.50</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>(3) Retirement of preferred stock equity</td>
<td>$4.50</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>Total</td>
<td>$54.50</td>
<td>$59.50</td>
<td>$74.75</td>
</tr>
</tbody>
</table>

Office Building, New York, Financed on the Mandel Plan
Farrar & Watmough, Architects
These figures are, of course, estimates. No one can actually tell just what the exact financial position of the building will be in future years in respect to rentals, nor can one know exactly when obsolescence will set in, affecting the "economic life" of the property and its value. On the other hand, I believe that these mathematical computations of the possibilities of common stock ownership in real estate are well worth publishing, because they throw a new, clear light on the possible advantages of equity ownership in good real estate. That is an essential factor in real estate finance in these days when the investing public is seeking common stock ownership in basic American industries.

The plan of the Beaux-Arts Development Corporation-U. S. Realty & Improvement Company-National City Bank triangular combination, as illustrated in their first enterprise,—the $5,200,000 Beaux-Arts Apartments, Inc., located on East 44th Street, New York,—is more complex and is even more radical than the other two. The magnitude of the program contemplated, and the elimination of mortgages astonished New York, accustomed as it is to bold finance. This plan is not easy to describe. Kenneth M. Murchison, President of the Beaux-Arts Development Corporation,—the real estate promotion company composed chiefly of architects, discussed the plan frankly with me one morning.

The complication in the Beaux-Arts Apartments plan of finance centers in the involved interrelations of the three affiliated companies sponsoring the project. Between them, they perform about the same function as do the single French and Mandel organizations, in producing and operating a chain of buildings and selling securities to the public in the process, making investors part owners in the properties. Therefore, the picture clears if we imagine the triple combination taking the place of the French organization, and issuing securities, in the form of preferred and common shares, limited to a single building which is separately incorporated. That makes clearer the position of the investing public in the enterprise, and that, after all, is the point of this whole business. It is shown in this comparison, in which, in the Beaux-Arts plan, the three sponsoring companies are lumped together as "the Companies":

Division of Ownership in the Beaux-Arts Apartment Finances

<table>
<thead>
<tr>
<th>Ownership of Common Stock (Profits)</th>
<th>Total First Cost of Operation</th>
<th>Ownership of Common Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investing Public</td>
<td>75% consisting of 1st preferred stock</td>
<td>40%</td>
</tr>
<tr>
<td>&quot;Companies&quot;</td>
<td>25% consisting of 2nd preferred stock</td>
<td>60%</td>
</tr>
</tbody>
</table>

As compared with the conventional method, it is also apparent that, in the Beaux-Arts plan, the first preferred, bought by the public, takes the place of the usual two or three mortgages, and that the second preferred, contributed by the "Companies," takes the place of the usual equity. This arrangement puts the public in a very strong investment position. The investor cannot be "wiped out" by foreclosure. In fact, equally important, the consistent application of the principle of deferred profits protects that small proportion of junior mortgage risk which lies in his first preferred shares. Thus the soundness of the first preferred may be described by saying that about 85 per cent of it replaces a first mortgage (corresponding to the conservative 66 2/3 per cent first mortgage). The remaining 15 per cent contains a junior mortgage risk, or on the basis of a 60 per cent first mortgage, it represents an 80 per cent-20 per cent division.

The position of the public in the Beaux-Arts plan is completely explained when we understand the details of the retirement of the two series of preferred stock, and the possibilities of profit on their 40 per cent ownership in the common stock. The first preferred is 6 per cent cumulative, retireable in whole or in part, at the "Companies'" option, at a price of $102.50 per share. It is sold with the common in "units" of one share of first preferred and one share of common, at $100 a unit. It is expected that one-third of the first preferred will be retireable in ten years (Mr. Murchison thinks it will be six), leaving the remainder outstanding to the amount of 50 per cent of total cost of the property. The second preferred, representing approximately another 25 per cent of cost, should be retired completely about three years later. At the end of this period, the common stock, which originally represented nothing but hopes of future profit, may have an equity behind it of about one-half the original cost. In addition, the full benefit of any appreciation in the property accrues to the common shares. Earnings on this common are expected to be $3 a share at the end of ten or a dozen years; if earnings permit, dividends may be paid on it before the preferred is retired.

Comparing this $3 per share return on the Beaux-Arts Common with the $14 expected return on the Mandel common (which costs $10 a share), we see a large difference. The difference may be partly explained by the fact that the
Mandel preferred shares represent a 33 1/3 per cent equity risk above the mortgage, whereas the Beaux-Arts first preferred is more nearly equivalent to a first mortgage risk. One might therefore conclude that the Beaux-Arts plan is designed to attract a more conservative class of investors.

It remains to describe the operation of the Beaux-Arts plan within the three companies and their subsidiaries. "The Companies," we have seen, provide the 25 per cent equity cost of the project in the form of second preferred, and take 60 per cent of the common shares as deferred profits. On the Beaux-Arts Development Corporation there falls the burden of taking the entire issue of second preferred stock. What actually happens is that the Development Corporation buys the site for the building and contributes it, at a fair value, to the enterprise, receiving in payment the second preferred shares. This is, of course, a form of the familiar subordination principle. The individual architect among the stockholders who has worked up the project receives the architectural commission on a basis of office cost plus fee, the fee being taken in stock. The next point is that the Development Corporation, having provided most of the equity, obtains most of the common stock profits, specifically approximately 40 per cent, or the same share as the public. That is, three shares of common go with one share of second preferred. That leaves 20 per cent of the common stock still to be accounted for. This is split half and half between the U. S. Realty & Improvement Corporation and the National City Bank. Actually, this 20 per cent of
common goes into the treasury of the U. S. Realty Management Corporation, which is a subsidiary formed to own and operate the chain of properties that it is proposed to establish. This U. S. Management Corporation is owned equally by U. S. Realty and the bank, through the latter's securities subsidiary, the National City Company. When we have said that both the National City and U. S. Realty have an interest in the Beaux-Arts Development Corporation, we have completed the description of the chain of relationships in the three affiliated companies.

The responsibility of the U. S. Realty in the organization is two-fold. First, it constructs the building through its subsidiary, the George A. Fuller Company, on a cost-plus fee contract. Second, it shares with the National City in financing and underwriting the project. The function of the National City is to share with U. S. Realty in underwriting and to sell the securities to the public through its vast chain of branches, representatives and agents, assisted by its powerful affiliated group of Wall Street investment houses. The underwriting was done at cost, the charge therefor being 5 per cent, plus 20 per cent of common profits as noted, thus deferring the financier's profits. This compares with an 11 per cent charge on a mortgage bond issue, which, however, is deducted at the start. This issue of units of first preferred and common, to the amount of $3,937,500, was sold to the public, so we are told, in one day.

One point more. The Beaux-Arts Development Corporation really represents the land interest, which, as everyone knows, is the crux of the situation in many a real estate project. Recognizing this fact, we have this division:

<table>
<thead>
<tr>
<th>Division of Interests in the Beaux-Arts Apartments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investing Public</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>1st pref. stock</td>
</tr>
<tr>
<td>2nd pref. stock</td>
</tr>
<tr>
<td>Common stock</td>
</tr>
</tbody>
</table>

Thus, from the point of view of the construction industry, the Beaux-Arts plan may be summarized in very simple terms. The owner of a valuable plot of land goes to the officers of the U. S. Realty & Improvement Company and persuades them that they could do no better than to construct and finance a building on that particular plot. The land owner contributes the site, at a fair value, as the 25 per cent equity in the deal, and takes the 6 per cent second preferred in payment, plus a 40 per cent share in the future common stock profits. U. S. Realty agrees to finance the remainder of the cost, namely 75 per cent, which it does by joining with the National City Bank in underwriting the sale to the public of the first preferred shares. U. S. Realty also constructs the building. The profit to U. S. Realty and to the National City interests is 20 per cent of the common shares, each receiving 10 per cent. This common goes to the U. S. Realty Management Company in which both U. S. Realty and the Bank have an equal interest. Practically everybody, public included, contributes money, land and services at cost and defers his profits for several years.

Clearly, this method of long term financing, with deferred profits and public participation in the ownership of a building, is revolutionary in its efficiency. It raises real estate finance to a more stable investment basis. Still more important, it requires, to no small extent, that the adoption of the chain principle be considered in order to induce all interests concerned to accept deferred profits. With a chain of successful properties, people are willing to undergo a few lean years if they know that they are investing in a sound, continuing enterprise, by a method which steadily increases their equity, causing appreciation of the common stock and which, at the end of the waiting period, begins to flower with expanding profits. More accurately described, "deferred profits" really means postponing the taking of profits. In a successful real estate enterprise of the type here considered, the profits theoretically increase from the start, but are not taken out immediately. Particularly, they are not taken out in advance, as is sometimes done in "shoe string" operations. They may, however, be "anticipated" through the appreciation of the common stock before it pays dividends.

In conclusion, it should be said that the architect's position in the new development is important. Architects have every reason to approve efficiency and sound investment value in buildings. Particularly will they approve of the initiative of the group of architects who form the majority of the owners of the Beaux-Arts Development Corporation. These men seem to have applied the new ideas on a broad and consistent scale. They have shown, I think, the possibilities of the leadership of architects in improving the methods of building finance.
THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 7, FOUNDATIONS AND MASONRY MATERIALS

I

n these dissertations on the general subject of construction supervision, we are seeking to discuss the problems confronting a superintendent somewhat in the order that they are presented to him during the progress of the work. He arrives at the site about the time the building is being staked out and the excavating is beginning. Shortly thereafter, materials start to arrive,—form lumber, cement, concrete aggregates, reinforcing rods, brick and other masonry materials. The superintendent has, perforce, to inspect these and to watch the excavating at the same time. Ordinarily, the latter duty is not onerous, as soil conditions in small areas are generally uniform. It is only when they lack such uniformity that supervisory duties at this preliminary stage become at all pressing.

Two features somewhat out of the ordinary are introduced in connection with the schoolhouse work here described, to show that the need for the exercise of diplomacy and acumen may exist at the initiation of proceedings, perhaps in as great a degree as at any other stage of the work. One such feature is a presumption of irregular soil conditions, demanding a local test; and the other is the supposition of an improper personal interest in certain phases of the operations by members of the board of education. Such an undue interest may sometimes develop into one of the most embarrassing phases of the work. Its ramifications may be extensive and most ominous, without being readily discernible or easily traced. Pressure may be brought to bear from unexpected sources to influence leniency in the judgment of certain materials or even in the retention of incompetent employes and subcontractors. In such an event, the architect has but one course to pursue, and that is to act in accordance with his best judgment for the good of the building, regardless of consequences.

After the board meeting on Tuesday afternoon, the architect and superintendent were taken to the gravel pit by the contractor. The storm of the preceding day had done considerable damage by washing the top soil down into the pit and mixing it with the sand and gravel. At first sight, it appeared useless to attempt to extract any more usable material from the place, but the contractor was determined and promised to put in a power pump and washing plant, if needed. With this understanding, deliveries were permitted to continue, though the architect had heard severe criticism of the gravel in board meetings, origi-
mind. Some of the trucks were being used for hauling cinders to improve the temporary driveways. The architect was much concerned about the character of soil that would be encountered at the level of the bottom of the footings. The excavating had thus far disclosed nothing but sandy loam (below the black top soil), with a small percentage of clay. Borings and other excavations in the vicinity indicated this to be the general character of the terrain for a depth of from 3 to 5 feet, at which level the increasing ratio of clay and gravel tended rapidly to replace the loam, thus providing a bearing stratum, several feet in depth, which the architect deemed capable of sustaining a superimposed loading in excess of 4,000 pounds per square foot. There had been small doubt of reaching such a stratum, as the footings were originally designed, but, having raised them 3 feet, the situation was no longer one of certainty. It was therefore decided by the architect that as soon as excavating had reached bottom (a plane 9 feet below finished basement floor), the superintendent would have two tests made by the contractor at points to be selected. This procedure was covered by two specification provisions. Under the general subject of “Testing Materials” was found:

“TESTS shall be made by the Contractor of his workmanship and materials and of the operation of mechanical equipment as required by law and the Contract Documents, all in manner directed by the Architect or approved by him. All expenses in connection with such tests, including the use of materials, labor, power, light, heat and equipment, shall be borne by the Contractor, unless otherwise stated.

“ADDITIONAL TESTS, not called for by the specifications, shall be provided by the Contractor under direction of the Architect, at the expense of the Owner, except that, in cases where such tests give evidence of defective materials or workmanship for which the Contractor may be required to make allowance or replacement, then the cost of such tests shall be borne by the Contractor. The expense will be audited by the Architect who, if same is to be charged against the Owner, will have an extra order issued for the amount as elsewhere provided, which amount will include 10 per cent to cover Contractor’s overhead and profit.

“NOTICE OF TESTS shall be given to the Architect or his Superintendent by the Contractor in due time to permit advising all those interested. No tests will be deemed valid unless duly witnessed by the Architect or his Representative.

* See Chapter 1, pages 30 to 34 of T. M. Clark’s “Building Superintendence,” The Macmillan Company, 1893. There is much value to the young superintendent in this volume, but one must bear in mind that building conditions and methods are constantly undergoing changes, and hence certain items treated by Mr. Clark, such as the discussion on concrete here referred to, are obsolete.

“RECORDS of all tests, neatly typed on 8½" x 11" sheets, accompanied by necessary diagrams, charts or photographs to thoroughly explain same, all in duplicate and duly certified and signed, shall be prepared by the Contractor as part of the expense of the tests, and deposited with the Architect.”

And, under “Trench Excavating” in “Foundation Work”:

“INSPECTION AND SOIL TESTS. Bottoms of all trenches and pits shall be left level, free from rubbish and reasonably smooth. No concrete for footings may be poured until the Superintendent has had opportunity to examine surfaces to be covered. He may then order the surfaces to be placed in better condition or may order a test of the bearing capacity of the soil made by the Contractor at the Owner’s expense, after which the bottom of the trench or pit shall again be prepared at directed depth and re-submitted for inspection.”

After the architect left, the superintendent strolled over to the brick yard to confirm his suspicion that there had been no mistake in the delivery of the wrong brick. Being after hours, no one was about the premises. He could see beyond question that there had been no activity around the pile of “selects” since he had first inspected it. A large new pile, from which deliveries to the school had evidently been begun, was of the same character of brick as those already unloaded at the site. It was obvious that, if the latter had to be reculled, the same would be true of this entire pile, containing over 50,000 brick. No doubt remained in the mind of the superintendent as to the intent of the brick makers. The pile of “selects” had been made up for exhibition purposes only, with no intent to deliver therefrom. He could visualize the trouble ahead if the manufacturers continued deliveries, relying upon the “pull” of their partner on the board to prevent rejection. He was early on the job next morning and stopped the first brick truck, loaded as he anticipated, and notified the contractor not to permit the brick to be taken off.

The driver telephoned his office, and shortly there again appeared the ubiquitous lumber dealer who now contended that it had been arranged with the architect on the preceding day that the brick should be called at the job. The superintendent pointed out that this applied only to what was already unloaded and said with finality that no more improper material would be permitted to be brought to the premises. The dealer tried to reopen the subject from the beginning by arguing that the brick were being discriminated against; that, inasmuch as none were destined to be exposed to the weather, better brick than those offered were not needed. To this the superin-
tendent rejoined that it was his business to see that all material entering into the construction was up to the standard that the owner was paying for. The dealer was so palpably inclined to make an issue of the matter that the superintendent telephoned to the chairman of the board and asked him to come over and be present at the discussion. His appearance was somewhat disconcerting to his fellow board member, who was asked to re-state his case. Then, before anything else could be said, the chairman drew him aside and, after a brief colloquy, the latter spoke to the truck driver and the two drove away, much to the surprise of both contractor and superintendent. The chairman explained that he had anticipated some such impasse from the beginning and had foreseen the advisability of the dealer’s resigning from the board on account of his extensive interest in selling construction materials. This he had just consented to do, and hence would deliver no more brick until after his official connection had been formally severed. The contractor thereupon said that he would cancel the order for the remainder of the brick, and he agreed to see that those already on the ground were properly sorted before any were used.

Unfortunately, architects and engineers (and even some specification men) are not of one accord in their attitude toward common brick quality. For this there are probably several reasons. One is that engineers like to provide tests for structural materials,—and ordinary common brick will not stand severe tests. “Good bricks should be quite hard and burned so thoroughly that there is in­cipient vitrification all through the bricks. A sound, well burned brick will give out a ringing sound when struck with another brick or with a trowel. A dull sound indicates a soft or shaky brick. This is a simple and generally a sufficient test for common bricks, as bricks with a good ring will likely disclose the fact that the better class of all outside walls, except where face brick or other material is called for.”

“SELECT COMMON BRICK shall be firm and compact, well and evenly burned, of a good grade of clay or shale, free from lime lumps, of fairly uniform size, shape and color, free from cracks or other serious defects and 90 per cent whole. They shall have not over 20 per cent absorbency. They may be used for all brick masonry, except where select common brick or face brick are called for.

“COMMON BRICK shall be firm and compact, well and evenly burned, of a good grade of clay or shale, free from lime lumps, of fairly uniform size, shape and color, free from cracks or other serious defects and of 90 per cent whole. They shall be used whenever called for, also for all piers laid in cement mortar and for the facing of all outside walls, except where face brick or other material is called for.”

Probably such “selects” are shipped in, in those instances. A too exacting common brick specification is unwise, since unnecessary hardness means undue vitrification, which makes the brick difficult to lay, slippery when wet or cold, and not readily adherent to any but pure cement mortar. In the work being used here as an illustration, the walls above the basement were chiefly of load-bearing hollow tile, with facing of pressed brick, common brick being used only for certain piers and walls of heavy loading, and for certain basement partitions. The brick were correctly specified, and the specification properly interpreted.

The brick subject being disposed of for the time being, the contractor and superintendent next gave attention to conditions relating to the excavating. The general excavating (subcontract) extended to 6 inches below the tops of the footings (see Fig. 10), but the additional hand
work of trenches and pits was included under “Concreting” for obvious reasons. Specifications for this work read:

“GENERAL EXCAVATING is assumed to extend to sufficient depth (9 inches below upper planes of various basement floors) to permit material from trenches and pits to be distributed and compacted under cinder floor fill. This Contractor shall provide additional cinders or sand, if any is needed, to bring areas up to proper planes to receive the floor material as specified, or shall remove any surplus.

“ALL PITS AND TRENCHES shall be excavated to neat size required, if banks are sufficiently firm to be used as forms for concrete. If not, the form work required for upper portions of footings and pit walls shall be extended to bottoms of same, and the excavating shall be increased to accommodate same, without additional cost to the Owner.”

Then followed the paragraph on “Inspection and Soil Tests” previously quoted. This was supplemented by a paragraph under “Concrete Footings”:

“INCREASED DEPTH OR WIDTH OF FOOTINGS shall be provided by the Contractor when so ordered by the Architect, for which the Contractor will be allowed an extra price of fifty cents (50 cents) per cubic foot of concrete thereby made necessary, which price shall include also the cost of required additional excavating, backfill, overhead cost and profit. If additional form work is required in such case, it shall also be provided and will be paid for at the rate of five cents (5 cents) per superficial foot. Additional reinforcement shall also be provided, if required, and will be paid for at the rate of four cents (4 cents) per pound. All such extra payments will be made in accordance with provisions in General Conditions covering same.”

A formal order was received from the architect’s office next morning, covering the labor and material necessary for two soil tests, and the superintendent delivered copies to the contractor and the secretary of the board, directing the former to proceed with the work on authority of the architect’s signature, without waiting for formal board action. This “Change Order No. 3” was in form similar to those preceding, but the clause covering remuneration read: “for which material and labor, you will be reimbursed by the Owner to the extent of the net cost of same, plus 10 per cent; subject to the audit and approval of the Architect’s superintendent, which gross sum will be added to your contract price.”

Bottom was reached that morning along the south end of the east wing, and a shallow pit was dug out and leveled at the grade at which footings were supposed to rest. For testing purposes, a platform was constructed as shown in Fig. 9. This was supported and rigidly braced atop a post, the bottom of which was exactly 144 square inches in area. This contrivance was erected in the pit, extreme care being taken that the base should rest on original soil, perfectly level, since any tipping would cause compression on one side or corner and render the test worthless. While held rigidly in this position, the post was anchored in each of four directions, by means of a “two-by-four,” 14 feet long, placed horizontally (so as to offer no resistance to the settlement of the post), and each outer end was attached by means of a heavy spike to a stake driven firmly into the ground, the other end similarly spiked to the post. Another spike was driven at the center of the platform, and a yardstick was erected on the head and braced in position. A reading was taken on the yardstick by means of a surveyor’s level, and referred to a permanent bench mark. The object of resting the end of the yardstick on the nail head is to have a definite spot to which reference can be had in case the yardstick is displaced.

Sacks of cement were used for loading, placed two at a time on opposite sides, with much precision, to avoid disturbing the set-up; next, two were placed on the other two sides and one on each of the four corners, eight in all, making a superimposed load of 800 pounds. A second reading then taken showed a settlement of 13/16 inch. Another 800 pounds was then deposited, but the reading on that showed no further appreciable settlement, nor was more noted until the fifth such loading, when the platform went down 5/16 inch more. The test was thereupon stopped and the loading left to stand over night, with a watchman to guard it. In the morning it was found to have gone down 3/8 inch more, a total settlement of 13/16 inch, which the superintendent deemed excessive. He might recommend increasing the spread of the footings at this end
Fig. 10. Section Through Footing

Careful observance of all soil conditions is of first importance in building construction, especially when the architect is working in unfamiliar territory. The Chicago building ordinance gives these restrictions as to maximum loads permitted:

<table>
<thead>
<tr>
<th>Component</th>
<th>Lbs. per sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet clay</td>
<td>3,500</td>
</tr>
<tr>
<td>Wet sand or firm clay</td>
<td>4,500</td>
</tr>
<tr>
<td>Sand and clay, mixed or in layers</td>
<td>5,000</td>
</tr>
<tr>
<td>Fine and dry sand</td>
<td>3</td>
</tr>
<tr>
<td>Dry hard clay or coarse sand</td>
<td>4</td>
</tr>
<tr>
<td>Gravel</td>
<td>6</td>
</tr>
<tr>
<td>Soft rock</td>
<td>8</td>
</tr>
<tr>
<td>Hardpan</td>
<td>10</td>
</tr>
<tr>
<td>Medium rock</td>
<td>15</td>
</tr>
<tr>
<td>Hard rock</td>
<td>40</td>
</tr>
</tbody>
</table>

The two important factors relating to foundation bearings are that a certain safe loading shall be arrived at and that the various footings shall have been so designed that the loads shall be fully

* See "Foundations by Albert M. Wolf" in Hoel & Kinne's "Reinforced Concrete and Masonry Construction"; also "Foundations on Land" in Merriman's "American Civil Engineer's Handbook."
equalized for all foundations, guaranteeing equal settlements (if any) throughout the entire building area. If one uses a reasonable factor of safety in his footing load computations and these are free from error, one need have no fear of settlement cracks appearing, providing that the supporting stratum is uniform in character and that there is no undue variation in the subsequent live loading. It is therefore the superintendent’s duty to closely observe the character of the stratum on which the footings are deposited and report for consideration any lack of uniformity. A location similar to that we have presupposed for discussion may disclose such a dip in the harder subsoil as to demand considerable spread of footings or even the driving of piles.*

Much of the requisite ability to judge soil-bearing capacity by inspection is solely a matter of experience. The superintendent must train himself to expertness in this particular. For soils manifestly too soft to attempt a spread footing (with carrying capacity under 2,000 pounds per square foot) or where the stratum overlying such soft material is too thin, recourse must be had to some means for compressing such soil, or for carrying the foundations down to bedrock or suitable hardpan. The design and supervision of pile, caisson and concrete-filled well foundations is a branch of engineering demanding diligent study by any superintendent confronted with such needs.**

On straightforward concrete footing work, which constitutes an overwhelming percentage of all present-day foundations in this country, a superintendent has little to worry him, other than watching the concrete and checking dimensions, neither of which is, however, to be slighted in the smallest degree. Contractors have been known to make their trenches an inch or more scant in depth or width, or both. A saving of 1 inch in the depth of all footings of this school building would have totaled about 270 cubic feet of concrete and 10 cubic yards of excavating; and of more importance is the fact that it would have cut down the efficiency of the concrete from 6 to 8 per cent.

It is customary, in soil of sufficient firmness, to cut square banks and use the natural earth for forms, rather than to line the trenches with wood. In either event, there are frequent droppings of earth into the trenches (or into the fresh concrete), and hence the excavated material must be kept well back and adequately shored. Some architects specify that the bottoms of trenches shall be tamped before concrete is poured. Others prefer to have the concrete deposited directly on the natural earth bed, without tamping, because the presence of a tamp in the trench offers a constant temptation to compress in place the loose material that should be removed, if specification requirements are to be complied with. In either event, the superintendent must carefully watch the bottoms and sides of the trenches just before and during pouring and see that all surfaces are in proper condition to be covered. He must also be a good judge of the water-bearing capacity of soil strata. Foundation work must frequently be carried on in wet weather, in which event it may be found advisable to proceed with soil tests under unfavorable conditions. Such tests have been made and trench bottoms leveled in mud and running water, with a pump constantly at work. Ideal conditions are not always at the command of the superintendent. He takes conditions as he finds them and does his best, his goal being the securing of proper results.*

When the bottom of the general excavation for the school building was reached in the east wing and the trenching (which, with the foundation work, was being handled by the contractor’s own forces) was begun, the superintendent told the general foreman that shoring was specified. This was covered by a special provision under “General Excavating,” in addition to the paragraph in the “Supplementary General Conditions” quoted in Chapter 4:

“SHORING. The Contractor shall provide and install all shoring, sheet piling and other bracing required to maintain the banks of all excavated areas until foundation work has been approved for back filling. The Contractor shall be wholly responsible for the retention of all banks, but his shoring or other false work will not be permitted to encroach upon space required for foundation construction or form work.”

The superintendent and foreman agreed that this left the matter to the option of the contractor, who would obviously be the loser if damage resulted from lack of foresight in this particular;
hence the foreman said he would report that the banks were apparently solid, and that shoring at that depth was not customary in that locality. The contractor could then act as his judgment dictated. Before shoring was ordered, another rain occurred, immediately after which the first truck load of shipped-in brick was dumped too close to the northeast corner of the excavation, causing a small landslide which caught a man in the trench and broke his leg. Thereupon, all banks more than 6 feet high were shored, and no further trouble resulted. It will be noted that the owner, architect, superintendent and foreman were free from blame in the matter, and that the responsibility had been placed where it belonged; but the man of most experience had guessed wrong. No one has ever become infallible in the "building game."

Excavations in rock, or in sand or gravel containing boulders, necessitate specification clauses covering such conditions. If they are definitely predetermined, the contract may be formulated accordingly; but it is common practice to cover uncertainties by demanding unit prices from bidders on excavated materials out of the ordinary, thus:

"ROCK EXCAVATION. It is assumed that the material excavated will be such as can ordinarily be handled by a steam shovel. If a boulder or boulders or solid rock be encountered of mass in excess of one cubic yard, necessitating blasting or breaking by other means, the Contractor will be allowed a unit price per cubic yard for same in addition to the amount of his contract. Each bidder is requested to state in his bid the gross cost per cubic yard for such excavating in addition to that included in his contract for ordinary excavating."

It is then up to the superintendent to determine what excavated materials are affected by such a clause and to make due allowance for them, if allowances are indicated. Advance data as to soil conditions by borings or digging are informative but not conclusive. An architect designs his footings according to the best information available, and has the bidders make their proposals accordingly, eliminating all uncertainties, so that all bids will be on like quantities. The best practice does not countenance "passing the buck" to the contractor by means of such uncertain demands as:

"ROCK. Level off rock at depths indicated, and if at these levels firm rock is not found the Contractor shall excavate to greater depth until proper surface is secured."

If there is a possibility that usable sand or gravel will be found in the excavation, the superintendent may be charged with the responsibility of determining its fitness for use in concrete or mortar, thus:

"SAND AND GRAVEL. As excavating progresses, the Superintendent shall be afforded opportunity to inspect materials uncovered and may direct the separation (without additional expense) of all sand and gravel suitable for building purposes. Same shall be kept free from earth and shall be stored on premises to be used as directed. The Contractor shall allow a unit price of $2 per cubic yard for all sand and gravel so obtained and used."

Forcing the contractor to pay current prices for materials so used makes him more or less indifferent as to their incorporation in the work, and makes it simpler for the superintendent to control such usage. When the use of material from the excavation is permitted at a direct saving to the contractor, one who is unfair needs unusual watching. The unit price for extra concrete also applies in event of the discovery of some old cistern or other filled-in hole in the excavated area. If this extends below new work shown on the drawings, proper attention should be given to it. Footings should be carried to original soil under the same proviso as applies to other soils of insufficient bearing capacity, as previously quoted. If only floors occur over the old excavation, or if it is only a narrow trench crossing under a footing, such reinforcement can be added to the concrete as will guarantee safety, without adding bulk.

Thus, with premises well founded, calculations carefully made and checked, and construction adequately supervised, one is reasonably assured of satisfactory results; but, if changes are to be made from the footings as originally designed, there should be no question as to whose is the responsibility for such changes or for conditions resulting therefrom. On compressible soils, where the spread of the footings is such that minor settlement is anticipated, one should bear in mind that such "live loads" as are imposed upon warehouse floors act as "dead loads" after coming to rest for a time. This means that, upon the completion of such a structure, it may be expected that all structural dead loads will have operated to produce their permanent effect on the footings, whereas the more or less permanentlive loadings are yet to be applied. It is therefore of much import that such foundations be designed with sufficient spread to permit of minimum settlement, unequal as it is bound to be.

* A case is on record where the building committee of a large church, employing non-resident architects, hired their own superintendent, one familiar with local conditions. He found that the footings in certain locations were inadequate on account of soil conditions, and took it upon himself to change them and so notified the architects. Later, when bad settlement cracks occurred, the owners sued the architects for heavy damages, but the latter were able to show that they had no direct knowledge of the conditions uncovered by the excavating, that the information as to the change in footings was definite and not submitted to them for approval, and that they could not be held responsible for effects after being relieved from control of the causes. Such incident affords ample testimony to the need of the owner's insistence that the superintendent or clerk-of-the-works should always be employed by the architect, direct, never by the owner. There should be no divided responsibility for structural design.

* Or, if preferred, will be allowed a fixed amount per cubic yard.
THE BUILDING SITUATION
A MONTHLY REVIEW OF COSTS AND CONDITIONS

The anticipated increase in construction activities during the month of May has only partly materialized, a fact due in part to recent labor disputes in New York. The value of construction contracts awarded in the 37 eastern states during the month of May was, according to the F. W. Dodge Corporation, $857,765,900, a decline of 9 per cent from the preceding month, and 12 per cent lower than the total for May, 1928. Total construction for the first five months of 1929 shows a decrease of 11 per cent from May of last year. Less significance is attached to this decline when it is noted that the 1928 figures for this district were abnormally high, breaking all previous May records. Contracts for the five months were 17 per cent below the five months of 1928. With a total of $71,472,100, contracts awarded in the Pittsburgh district amounted to 17 per cent more than April and 8 per cent more than May of last year. This high figure brought the total since the first of the year up to 1 per cent above that for a similar period in 1928.

In the central western district the figures for the first five months ran 10 per cent below the five months of 1928. Nevertheless, the May figures of $159,136,400 were 18 per cent above the April record, and 3 per cent higher than May, 1928. The northwestern district shows a decided improvement when compared with either the previous month or the previous year. The May contracts amounted to $13,322,400, an amount 21 per cent ahead of the April total and 40 per cent ahead of the total recorded for May of last year.

These various important factors of change in the building situation are recorded in the chart given here:

1. **Building Costs.** This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages.
2. **Commodity Index.** Index figure determined by the United States Department of Labor.
3. **Money Value of Contemplated Construction.** Value of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corporation, and Engineering News-Record.
4. **Money Value of New Construction.** Valuation of all contracts actually let.

The dollar scale is at the left of the chart in millions. (5) **Square Foot Area of New Construction.** The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.
Waters from different sources may look alike and taste alike. They may be equally pure for drinking. And yet they may be very different in their action on pipe.

Some waters are normally corrosive. Other waters—often those that are purest and most healthful—are highly corrosive.

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Republic Steel Pipe is serving in buildings of generations ago... and is being built in modern skyscrapers to serve the years to come. This is tested durability. Republic Steel Pipe has proved dependable and lasting through continued use... assurance that it will be just as trustworthy for the even greater demands of the changing conditions of the future.

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You will find that architects and builders who have the future in mind, are frequently specifying Toncan Copper Molybdenum Iron for pipes and the exposed parts of buildings. Toncan—a scientific alloy of pure iron, copper and molybdenum combats rust and corrosion more successfully than any other ferrous metal known.

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WORLD'S LARGEST AND MOST HIGHLY SPECIALIZED ALLOY STEEL PRODUCERS
A small home or a large home
both can have the advantages of SKY-SCRAPER CONSTRUCTION with STEEL FRAMING

Maybe you have thought that only large homes seemed to justify the use of Steel Framing. But shouldn't small homes be strong and firm in construction, fireproof and stormproof, too? The size of the home doesn't matter, neither does the design. Architects are not limited in any way in making plans and specifications, and builders use methods already familiar to them. Every piece of the steel framework—for 5 rooms or 15 rooms—comes to the building site with all structural members marked for their places and ready for quick and easy erection.

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The Cowing Joint is neat—it will not squeeze
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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.

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The expanded section is covered by basic commodity and process patents, owned, controlled and operated under exclusively by this company.

BATES-TRUSS JOISTS

Sales, Engineering and Executive Offices EAST CHICAGO, IND.
Carnegie Beams solve a difficult problem

The marble columns of the Union Gas and Electric Company Building in Cincinnati (John Russell Pope—Garber & Woodward, Associate Architects—Euphrat & Hanly, Steel Designers) presented a difficult problem in steel designing, in that the outside dimensions of the finished columns limited the size of the section that could be used for the steel cores. The photograph on the right shows how Carnegie Beams solved the problem with complete satisfaction. Section CB 146, weighing 345 pounds per foot, was used as a column, reinforced internally with two 11" x 1" plates riveted to the web and four 6" x 6" x 1" angles riveted to the web and inside faces of the flanges. This type of reinforcement was made possible by the parallel flanges of Carnegie Beams, a unique feature of these sections. Eight surfaces are provided for connections instead of four.

The upper photographs show two heavy trusses for the same building. In these the top chord, the end diagonals, and in the case of the larger truss, the posts were all Carnegie Beams of the same section as the columns. Note also Carnegie Beams used as web members and the simplicity of the gusset plate construction.

Similar designs may be developed utilizing the constant depth feature of the 10" and 12" column sections of Carnegie Beams. A large range of weights is available in each depth, providing sections to meet the varying stresses in the truss members. Trusses are also designed in which the web members of less depth connect internally to the parallel flanges of the chords.

Carnegie Beams offer an economy, utility and flexibility of design never before possible in structural steel. Write for copy of handbook—"Carnegie Beam Sections."
Meyer Steelforms—Perform Unique Service for Builders of Iowa Stadium

STATE UNIVERSITY OF IOWA FOOTBALL STADIUM
Architects: Proulforf, Runyon, Sauers & Thomas, Des Moines, Iowa
Contractors: Tapagur Construction Company, Albert Lea, Minnesota

Construction Costs Lowered by Forming Treads and Risers in New University of Iowa Stadium with Meyer Adjustable Steelforms

Meyer Steelforms—the widely specified steel forms for concrete rib floor construction—open up new possibilities in stadium building. New possibilities for greater speed of operation, economy and better construction.

Meyer Adjustable Steelforms are especially suited to forming of concrete treads and risers. The simple centering required effects a saving in lumber that every designer and builder of a concrete stadium will readily appreciate. This, coupled with the saving in time and labor, not only insures favorable low cost but paves the way for speed of operation which is so important a factor in this type of construction.

A trained organization places Meyer Steelforms—removes them—and co-operates with architect and contractor in speeding the project through to successful completion. You are invited to write to the Ceco office nearest you for complete information on Meyer Steelform Tread and Riser Construction.

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THE ORIGINAL REMOVABLE STEEL FORMS FOR CONCRETE RIB FLOOR CONSTRUCTION
A MEZZANINE CONSTRUCTION That Does Not Interrupt Sales

NOT infrequently you will be asked to design a mezzanine to be built under the following conditions:
Use of floor space below mezzanine must not be interrupted during the construction. (This means no forms or scaffolding can be used.)
Quick completion of the job essential. (No wait permitted for poured material to harden.)
Must pass underwriters. (Fire-proofing material essential, eliminating timber construction.)
Must be economical. (A light weight construction to cut cost of steel and supporting members.)
Where all these conditions must be met the Gypsteel System with its pre-cast gypsum floor and ceiling slabs, alone fills the requirements. Nothing else will do. The pre-cast ceiling slabs can be hung without forms or scaffolds as soon as the steel work is in place. Floor slabs can be laid and their steel reinforcements tied together immediately afterward. The work can easily be completed within a few hours time after the steel is in place. Usually these mezzanines are completed over a holiday or week-end.
This Gypsteel construction is the lightest type of floor construction, absolutely fire-proofing the steel. It is put up without forms or the mess of dripping materials. The strength and light weight of the pre-cast gypsum slabs cuts down steel requirements and keeps the cost down.

A LIST OF NEW YORK MEZZANINE INSTALLATIONS
National City Bank
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Liggetts Stores
Owners
Penn Station McKim, Mead & White
G. M. Murphy
Merkle & Elberth
Munds & Winslow
Walker & Gillette
Savoy Plaza Hotel
McKim, Mead & White
Hanover Natl Bank
George F. Pelham

Mezzanine in Liggetts Drug Store, Broadway and 42nd St., New York, under construction.

Completed mezzanine.

Showing method of hanging Gypsteel ceiling slabs and laying floor slabs.

Hanging ceiling slabs  Clinching ceiling slab hangers  Grouting ceiling slabs  Laying Gypsteel floor slabs  Tying the reinforcement together.

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Great public schools today—such as Memphis Technical High—are built for service ... varied and exacting. Each building must be many things to many men—busy workshop, quiet library, public meeting hall, classroom, laboratory. And electric service—protected, adequate, dependable—is vital.

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Minwax Concrete and Terrazzo Floor Finish—is a clear, amber colored liquid, a combination of mineral waxes, oils and gums. It cures after application to a tough, rubbery, dry mineral gum which will polish under traffic or friction, possesses great binding power and, being predominately mineral in character, is highly resistant to all usual concentrations of acids and alkalies. When mopped on the surface, the material penetrates quickly, going into the floor sometimes as much as half inch in spots where the floor is unusually porous; then it cures and hardens, binding, filling and toughening the whole wearing surface, densifying and sealing it so that it is waterproof and therefore stainproof and sanitary as well as dustproof and wear resistant.

This material seeks, particularly in its application to Terrazzo, the ultimate lasting protection of the floor—not a superficial polish or surface coating.

This same material, with the same properties, may be had in three shades of color under the name Minwax Colored Concrete Floor Finish.

Near you there is a Minwax expert ready to confer with you on your flooring problems, or on questions of waterproofing or dampproofing. Feel free to call upon him. See our catalogue in Sweet’s.
Selected List of Manufacturers' Publications

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

The publications listed in these columns are the most important of those issued by leading manufacturers identified with the building industry. They may be had without charge unless otherwise noted, by applying on your business stationery to The Architectural Forum, 521 Fifth Ave., New York, or the manufacturer direct, in which case kindly mention this publication.

ACOUSTICS
R. Cunatino Co., 40 Court St., Boston.
AustroDith Plaster. Brochure, 6 pp., 8½ x 11 ins. Illustrated. Important data on a valuable material.
U. S. Gypsum Co., 205 W. Monroe St., Chicago, Ill.
A Scientific Solution of an Old Architectural Problem. Folder, 6 pp., 8½ x 11 ins. Describes Sablinite Acoustical Plaster.

AIR FILTERS
Staynew Filter Corporation, Rochester, N. Y.
Making the Most of Your Protectomotor. Folder, 6 pp., 7½ x 6¼ ins. Illustrated.

ASPHALT
Specifications for Applying Genaco Asphalt Masonic. Booklet, 16 pp., 8¼ x 5½ ins. Illustrated. Tells how to secure interesting effects with common brick.
A. P. W. Paper Co., Albany, N. Y.
Bradford Reds. Folder. 8 pp., 3 x 8 ins. Illustrated. Price 25 cents. Deals with the construction of fireplaces and chimneys.

ARCHITECTURAL FORUM

BATHROOM FITTINGS
A. P. W. Paper Co., Albany, N. Y.
Cutting-Edge File Card. Folder, 8 pp., 8½ x 6 ins. Illustrated. Data on useful detail of apparatus.
Toilet-Paper Fittings and porcelain.
Architect's File Card. Folder, 8 pp., 8½ x 11 ins. Illustrated. Filing card on toilet paper and paper towel cabinets.
Genaco Trinidad Lake Asphalt Masonic. Brochure, 22 pp., 6 x 9 ins.
Specifications for Applying Genaco. Booklet, 16 pp., 8 x 10½ ins.

BRICK
American Face Brick Association, 1785 Peoples Life Building, Cleveland, Ohio.
Brickwork in Italy. 288 pp., size 7½ x 10½ ins., an attractive and useful volume on the history and use of brick in Italy from earliest times to modern times, profusely illustrated with 69 line drawings, 360 half-tones, and 56 colored plates, with a map of Italy and XII century Italy. Round in linen. Price now $3.00, postpaid (formerly $6.00). Half Morocco, $7.00.
Industrial Buildings and Housing. Bound Volume, 112 pp., 8½ x 11 ins. Profusely illustrated. Deals with the planning of factories and employees' housing in detail. Suggestions are given for making plants and offices attractive and restful places for work. Price now $3.00, postpaid (formerly $2.00).
American Standards Association, 1717 N. Catholic Ave., Chicago, Ill.
Portland Cement Association, Chicago, Ill.
Concrete Masonry Construction. Booklet, 48 pp., 8½ x 11 ins. Illustrated. Deals with various forms of construction.
Town and Country Houses of Concrete Masonry. Booklet, 20 pp., 8½ x 11 ins. Illustrated.
Portland Cement Stucco. Booklet, 64 pp., 8½ x 11 ins. Illustrated.
Concrete in Architecture. Bound Volume, 40 pp., 8½ 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, 22 pp., 8½ x 11 ins. Illustrated.
Kosmos Portland Cement Company, Louisville, Ky.
High Early Strength Concrete. Using Standard Kosmos Portland Cement. Folder, 1 page, 8½ x 11 ins. Complete data on securing high strength concrete in short time.

CONCRETE COLORINGS
The Master Builders Co., 7016 Euclid Ave., Cleveland.

CONSTRUCTION, FIREPROOF
Master Builders Co., Cleveland, Ohio.
Color Mix Book. 58 pp., 8½ x 11 ins. Illustrated. Valuable data on concrete hardener, waterproofer and dustproofer in permanent colors.
North Western Expanded Metal Co., 1234 Old Colony Building, Chicago, Ill.
North Western Expanded Metal Products. Booklet, 65½ x 10½ ins. 16 pp. Fully illustrated, and describes different products of this company, such as Kno-burn metal lath, 30th Century Corrugated, Plaster-Sava and Longspan lath channels, etc. A. E. A. Sample Book. Bound volume, 8½ x 11 ins., contains actual samples of several materials and complete data regarding their use.

CONSTRUCTION, STONE AND TERRA COTTA
Cowing Pressure Relieving Joint Company, 100 North Wells St., Chicago, Ill.
Pressure Relieving Joint for Buildings of Stone, Terra Cotta or Marble. Booklet, 16 pp., 8½ 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
The Master Builders Co., 7016 Euclid Ave., Cleveland.
Waterproofing and Dampproofing, File. 36 pp. Complete descriptions and detailed specifications for materials used in building and concrete.

CEMENT
Kosmos Portland Cement Company, Louisville, Ky.
Kosmort for Enduring Masonry. Folder, 6 pp., 8½ x 10½ ins. Data on strength and working qualities of Kosmortar.
Kosmover, the Mortar for Cold Weather. Folder, 4 pp., 8½ x 10½ ins. Tells why Kosmover should be used in cold weather.
Lousiville Cement Co., 335 Guthrie St., Madisonville, Ky.
BRIXMONT for Perfect Mortar. Self-filing handbook, 8½ x 11 ins. 16 pp. Illustrated. Contains complete technical description of BRIXMONT for brick, tile and stone masonry, specifications, data and tests.

REQUEST FOR CATALOGS

To get any of the catalogs described in this section, put down the title of the catalog desired, the name of the manufacturer and send coupon to The Architectural Forum, 521 Fifth Avenue, New York.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 169

DAMPPROOFING—Continued
Minwax Company, Inc., 11 West 42d St., New York.
Complete Index of all Minwax Products. Folder, 6 pp., 8½ x 11 ins. Illustrated. Complete description and detailed specifications.
Specialties, 14 pp., 8½ x 11 ins. Descriptions and specifications of compounds for dampproofing interior and exterior surfaces.
Toch Brothers, Inc., 116 Fifth Ave., New York.
Handbook of R. W. Protective Products. Booklet, 40 pp., 4½ x 11. ins. Illustrated.
The Vector Mfg. Co., Cleveland, Ohio.
Par-Lock Specifications "Forms A and B" for dampproofing and plastering over concrete and masonry surfaces.
Par-Lock Specification "Form J" for dampproothing the tile wall surface prior to the application of plaster.
Dumbwaiters and Soundproof Doors. Specifications E, F, L, and J. Sheets 8½ x 11 ins. Data on copper applied asphalt dampproofing for floors and walls.

DOORS AND TRIM, METAL
Watertown Window, Waterbury, Conn.
An application of Architectural Bronze Extruded Shapes. Brochure, 13 pp., 8½ x 11 ins., illustrating and describing more than 2,000 standard bronze shapes of cornices, jamb casings, moldings, etc.
Fire-Doors and Hardware. Booklet, 8½ x 11 ins., 64 pp. Illustrated. Describes all standard types of fire-door assemblies, including fire-doors, complete with automatic closers, track hangers and all associated devices. All approved and labeled by Underwriters Laboratories.
Sheet Steel Trade Extension Committee, Terminal Tower, Cleveland.
This committee will send upon request full data published by its members on metal doors and trim and specifications for their use.
TruSteel Steel Doors, Youngstown, Ohio.
Copper Alloy Steel Doors. Catalog 110. Booklet, 48 pp., 8½ x 11 ins. Illustrated.

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

DRAINAGE FITTINGS
Joaam Marsh Gravel Plaster, Sediment and Hair interceptors. Brochure, 7 pp., 8½ x 11 ins. Illustrated.

DUMBWAITERS
Saginaw Machine Works, 151 West 15th St., New York, N. Y.
Catalog and Service Sheets. Standard specifications, plans and prices for various types, etc. 4½ x 8¼ ins., 60 pp. Illustrated. Catalog and pamphlets, 8½ x 11 ins. Illustrated. Valuable data on different types of elevators.

ELEVATORS
Otis Elevator Company, 260 Eleventh Ave., New York, N. Y.
Otis Push Button Controlled Elevators. Descriptive leaflets, 8½ x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.
Otis Geared and Gearless Traction. Elevators of All Types. Descriptive leaflets, 8½ x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.
Escalators. Booklet, 8½ x 11 ins., 22 pp. Illustrated. Describes use of escalators in subways, department stores, theaters and industrial buildings. Also includes elevators and dock elevators.

ELECTRICAL EQUIPMENT
General Electric Co., Bridgeport, Conn.
Modern Electrical Equipment for Buildings. Booklet, 32 pp., 8½ x 11 ins. Illustrated. A valuable work on an important item of equipment.

ELECTRICAL SPECIFICATION DATA FOR ARCHITECTS
William C. Joseph, Chicago, Ill.

ELEVATOR COMPANIES
National Elevator Co., New York, N. Y.
Elevator Specification Circular 7379. A work on an important item of equipment.

FLOOR HARDENERS (CHEMICAL)
Master Builders Co., Cleveland, Ohio.
Minwax Company, Inc., 11 West 42d St., New York, N. Y.
Concrete Floor Treatments. Folder, 4 pp., 8½ x 11 ins. Illustrated.
Sonnenbichler Sons, Inc., 116 Fifth Ave., New York, N. Y.
Lapidolith, the liquid chemical hardener. Complete sets of specifications for every building type in which concrete floors are used, with descriptions and results of tests.

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

FLOORS—STRUCTURAL
Concrete Steel Company, 42 Broadway, New York.
Structural Economies for Concrete Floors and Roofs. Brochure, 32 pp., 8½ x 11 ins. Illustrated. Describes entire line of tin-clad and corrugated fireproof floors.

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

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Getting full value from basement floors

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For serving basement kitchens, laundries, and wash rooms, the Jennings Sewage Ejector affords an efficient, reliable unit. Pneumatic in operation, it raises crude sewage or drainage to the necessary height without screening. Low pressure air is furnished by a Nash Hytor Compressor only when material is being moved. Air valves and air storage tanks are not employed. A Jennings Ejector cannot clog; retains its original capacity throughout its entire life.

Jennings Sewage Ejectors are furnished in capacities ranging from 30 to 1,500 g.p.m. Heads up to 50 ft. Write for Bulletins 67 and 103.

Leverich Towers Hotel, Brooklyn, N. Y. Starrett & Van Vleck, architects; Jarcho Bros., Inc., plumbing contractors. Two sets of Jennings Sewage Ejectors are installed in the Leverich Towers in a manner similar to the diagram shown above.

Jennings Sewage Ejectors are furnished in standard sizes with capacities ranging from 30 to 1,500 g.p.m. Heads up to 50 ft. Write for Bulletin 67.

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THE NASH ENGINEERING CO. 12 WILSON ROAD, SOUTH NORWALK, CONN.
SELECTED LIST OF MANUFACTURERS'

FLOORING—Continued

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Linoleum Facts Book, 1928, Catalog, 5 x 7 ins. 48 pp. Instructions for linoleum layers and others interested in learning most satisfactory methods of laying and taking care of linoleum.

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


Planning the Color Schemes for Your Home. Brochure, illustrated in color; 36, 7% x 10% ins. Gives excellent suggestions for color schemes for homes and apartments.

Handy Quality Sample Folder of Linoleums. Gives actual samples of Battalship Linoleum,” cork carpet, “Feltex,” etc.

Blanton’s Linoleum. Booklet, illustrated in color; 126 pp., 5% x 7% ins. Gives patterns of a large number of linoleums.

Blahna’s Plain Linoleum and Cork Carpet. Gives quality samples, 3 x 6 ins. of various types of floor coverings.

Carter-Bloxon & Co., 877 Locust Street, Kansas City, Missouri.

Bloxon Flooring. Booklet, 35% x 6%, 20 pp. Illustrated. Describes uses and adaptability of Bloxon Flooring to concrete, wood or steel construction, and advantages over loose wood blocks.

File Folder, 9% x 11% ins. For use in connection with A. T. A. system of filing. Contains detailed information on Bloxon Flooring in conditioned loose-leaf form for specification writer and architect. Literature embodied in folder includes standard Specification Sheet covering the use of Bloxon in general industrial service and Supplementary Specification Sheet No. 1, which gives detailed description and explanation of an approved method for installing Bloxon in gymnasiums, armories, drill rooms and similar locations where maximum resiliency is required.

Cement Building Co., Memphis, Tenn.

Style in Oak Floors. Booklet, 16 pp., 5 x 7 ins. Illustrated.

Congoleum-Nairn, Inc., 357 Belgrave Drive, Kansas City, N. J.

Fact Sheet should be read by everyone wishing to obtain a series of booklets for floors on (1) schools, (2) hospitals, (3) offices, (4) wide range of domestic uses. Includes college, apartements and hotels. Illustrated.


Senlex Battalship Linoleum. Booklet, 12 illustrated. Shows characteristics, specifications and uses.

Senlex Tredilette Tiles. Two booklets, 8 and 16 pp. Illustrated.


Thomas Moulding Floor Co., 165 W. Wacker Drive, Chicago, Ill.

Better Floors. Folder, 4 pp., 11% x 15% ins. Illustrated. Floors for office administration and high rise buildings. (3) apartments and hotels. Illustrated.


C. Paredes Works, 9 East 45th St., New York, N. Y., and 160 Walnut Street, Philadelphia, Pa.

Paredes Tiles. Bound Volume, 48 pp., 8% x 11 ins. Illustrated.

Stedman Products Company, South Braintree, Mass.

Special Institutional Reclaimed Wood Flooring and Paneling. Booklet, 36 pp., 8% x 11 ins. Illustrated. Valuable data on flooring.

Stedman’s Laminated Flooring. Laminated flooring, 48 pp., 8% x 11 ins. Illustrated. Data on flooring.


U. S. Gypsum Co., Chicago.

Pyrocal Tile Floor. Tile, 8%, 11 ins. Illustrated. Data on floorings of hollow tile or similar tiles.


Quarry Tiles for Floors. Booklet, 120 pp., 8%, 11 ins. Illustrated. General Catalog. Details of patterns and trim for floors.

Art Portfolio of Floor Designs. 9% x 12% ins. Illustrated in color with patterns of small and large tile floors and rooms.

U. S. Rubber Co., 1790 Broadway, New York, N. Y.

Policies and Operations for Modern Floors. Brochure, 14 pp., 11% x 8% ins., 60 pp. Richly illustrated. A valuable work on the use of rubber tile for flooring in interiors of different historical styles.

FURNITURE

American Seating Co., 14 E. Jackson Blvd., Chicago, Ill.

Architect Ecclesiastical Booklet, 6 x 9 ins. 48 pp. Illustrations of the work of this company.

Theatre Chairs. Booklet, 6 x 9 ins. 48 pp. Illustrations of theatre chairs.

Kittenger Hotel Club & Hotel Furniture. Booklet. 20 pp., 5% x 9% ins.

Kittenger Club & Hotel Furniture. Booklet, 20 pp., 5% x 9% ins. Illustrated. Deals with fine line of furniture for hotels, clubs, institutions, schools, etc.


Forethought Furniture Plans. Sheets, 9% x 9 ins., drawn to 1/2-inch scale. An ingenious detailed plan, also specifications and instructions for laying.


GARAGES

Ramp Buildings Corporation, 21 East 40th St., New York, N. Y.

Building Garages for Profitable Operation. Booklet, 8% x 11 ins. 16 pp. Illustrated. Discusses the need for modern mid-city parking garages, and describes the flamy Motoramp system of design, on the basis of its superior space economy and features of operating convenience. Gives vast analysis of garages of important subjects and calculates probable earnings.


GLASS CONSTRUCTION

Adsson Flat Glass Co., Clarksburg, W. Va.

Quality and Dependability Folded. Catalog 8%, 11 ins. Illustrated. Data in the company’s product.

Libby-Owens Short Glass Co., Toledo, Ohio.

Flat Glass. Brochure, 12 pp., 5% x 7% ins. Illustrated. History of manufacture of flat, clear sheet glass.

GREENHOUSES

King Construction Company, North Tonawanda, N. Y.

King Greenhouses for Home or Estate. Portfolio of half-tone engravings, and articles on these important subjects and calculates probable earnings.

Good Greenhouses for Home or Estate. Portfolio of half-tone engravings, and articles on these important subjects and calculates probable earnings.

Questions making use of Lutton Patented Galvanized Steel V-Bars.

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Early English and Colonial Hardware. Booklet, 8%, 11 ins. An important illustrated work on this type of hardware.

Locks and Builders’ Hardware. Catalog 8%, 11 ins. An exhaustive, splendidly prepared volume.

Colonial and Early English Hardware. Booklet, 8%, 11 ins. Illustrated. Data on hardware for houses in these styles.

Cutler Mail Chute Company, Rochester, N. Y.

Cutler Mail Chute Model F. Booklet, 4 x 9% ins., 8 pp. Illustrated.


Forged Iron by McKinney. Booklet, 6 x 9 ins. Illustrated. Deals with an excellent line of builders’ hardware.

Forged Ladder by McKinney. Booklet, 6 x 9 ins. Illustrated. Describes a fine assortment of ladders for various uses.


Distinctive Garage Door Hardware. Booklet, 8%, 11 ins. 66 pp. Illustrated. Complete information accompanied by data and illustrations on different kinds of garage door hardware.

Distinctive Elevator Door Hardware. Booklet, 90 pp., 10% x 16 ins. Illustrated.


Garage Hardware. Brochure, 16 pp., 5% x 7% ins. 66 pp. Data on various items of garage equipment.

Dooe Chute Brochure. Booklet, 16 pp., 5% x 7% ins. Data on various items of garage equipment.

Famous Homes of New England. Series of folders on old homes and houses on floor plans of each.

HEATING EQUIPMENT

American Blower Co., 6004 Russell St., Detroit, Mich.

Heating and Ventilating Utilities. Contains a large number of valuable publications, each 8%, 11 ins. on these important subjects and calculates probable earnings.

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

New American Radiator Products. Booklet, 44 pp., 5% x 7% ins. Illustrated. Deals with heating boilers especially adapted to use with oil burners.

Ideal Radiator Classic. Brochure, 36 pp., 8% x 11 ins. Illustrated. A brochure on a space-saving radiator of beauty and high efficiency.

Ideal Aroca Radiator Warmth. Brochure, 8% x 11 ins. Illustrated. Describes a central all-indoor heating plant with radiators for small residences, stores, and offices.

How Shall I Heat My Home? Brochure, 16 pp., 5% x 7% ins. Illustrated. Full data on heating and hot water supply.

New American Radiator Products. Booklet, 44 pp., 5% x 7% ins. Illustrated. Complete line of heating products.

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The largest plant of its kind in the world is Carey Built-up Roofed!

The huge, six-acre manufacturing plant of Hemp and Company, St. Louis, was given the dependable protection of more than one hundred thousand square feet of Carey Built-up Roofing.

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Hundreds of industrial structures, in cities everywhere, are weather-protected by Carey Built-up Roofs. Roofs blended of selected materials, built up as Carey has learned to build, in half a hundred years. Sealed, resealed, and then sealed again.

And bonded—for five, ten, fifteen and twenty years, by the Fidelity Trust Company of New York. So that you may have complete information about the roof which is so universally specified, we have prepared a new Carey Built-up Roofing specification book. Write for your copy today.

Carey Built-up Roofs
"A Roof for Every Building"

The Philip Carey Company, Lockland, Cincinnati, Ohio
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 172

HEATING EQUIPMENT—Continued


Heating the Visible Air. Folder, 8 pp., 3½ x 6 ins. Illustrated. Data on a valuable form of heating apparatus.

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

Dunham Packless Radiator Valves, Bulletin 104, 8 x 11 ins. Illustrated. A valuable brochure for house owners.

Dunham Return Heating System, Bulletin 105, 8 x 11 ins. Illustrated. Covers the use of heating apparatus of this kind.


The Fulton Stylphon Company, Knoxville, Tenn.

Stylphon Temperature Regulators. Illustrated brochures, 8½ x 11 ins. Dealing with general architectural and industrial applications; also specifically with applications of special instruments.

Stylphon Heating Specialties. Catalog No. 200, 392 pp., 5½ x 8½ ins. Important data on heating.


Heat, the Great Outfit, the Heat Thief, Bulletin 48, 5 x 7½ ins. Illustrated.

James A. Dunham Company, 516 West Monroe Street, Chicago.

More Heat from Any Hot Water System on Less Fuel. Folder, 4 pp., 8½ x 11 ins. Illustrated. Deals with use of the "Hydrolab".

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


Kewanee Rotary Burner. Brochure, 8 pp., 8½ x 11 ins. Illustrated. Deals with Kewanee Rotary Burners, ward reflectors, boiler water, water heaters, radiators, etc.

Catalog No. 76, 8 x 9 ins. Illustrated. Describes Kewanee Firebox Burners with specifications and setting plans.

Catalog No. 76, 8 x 9 ins. Illustrated. Describes Kewanee power boilers and ammous tubular boilers with specifications.

May Oil Burner Corp., Baltimore, Md.


Kewanee on the Job. Catalog, 8½ x 11 ins., 80 pp. Illustrated. Shown in detail, working of Kewanee burners, water heaters, radiators, etc.

Catalog No. 76, 8 x 9 ins. Illustrated. Describes-Kewanee Firebox Burners with specifications and setting plans.

McQuay Visible Type Cabinet Heater. Booklet, 4 pp., 8½ x 11 ins. Illustrated. Cabinets and radiators adaptable to decorative schemes.

McQuay Concealed Radiators. Brochure, 4 pp., 8½ x 11 ins. Illustrated.

McQuay Unit Heater. Booklet, 8 pp., 8½ x 11 ins. Illustrated. Describes specifications and radiator capacities.

Modine Mfg. Co., Racine, Wis.

Modine Copper Radiation. Booklet, 28 pp., 8½ x 11 ins. Illustrated with industrial, commercial and domestic heating.

Modine A. F. E., 10 pp., 8½ x 10½ ins. Interior. Suggestions for architect on incineration, showing installation and equipment.


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When Mr. H. B. Thompson, architect, Dallas, Texas, planned his own home, he determined to build a house that could be kept comfortable winter and summer by providing ample protection against an outside temperature range of 90 degrees. He used two inches of Armstrong’s Corkboard Insulation on the walls and second floor ceiling with such excellent results that, a year later, he made the following report:

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The full value of insulation, from both the comfort and the investment standpoints, is realized only when ample thickness is used. Two inches of Armstrong’s Corkboard for the roof and at least one and a half inches for the walls is the most economical insulation in returns per dollar of cost. Armstrong Cork & Insulation Company, 900 Concord Street, Lancaster, Pa.; McGill Bldg., Montreal; 11 Brant St., Toronto, 2.

Armstrong’s Corkboard Insulation

A Heatproof Lining for Walls and Roof
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 174

LATH, METAL AND REINFORCING—Continued
Steelite Data Sheet No. 2. Folder, 8 pp., 8½ x 11 ins. Illustrated. Steelite floors for steel joists with flat top chord. Steelite Data Sheet No. 3. Folder, 8 pp., 8½ x 11 ins. Illustrated. Steelite for floors on steel joists with flat top chord.

North Western Expanded Metal Co., 1224 Old Colony Building, Chicago, Ill.
North Western Expanded Metal Products. Booklet, 8½ x 10¾ ins., 30 pp., 8½ x 11 ins. Illustrated. And describes different products of this company, such as Kno-burn metal lath, 20th Century Corrugated, Plastic-saver and longspan lath channels, etc.

L.S.P. (Kernerator) (Chimney-fed) Incinerator for apartments and residences.
Kernerator for residences.

Truscum Steel Company, Youngstown, Ohio.

LAUNDRY MACHINERY


LUMBER


MAIL CHUTES

Cutler Mail Chute Company, Rochester, N. Y.
Cutler Mail Chute Model J. Booklet, 4 x 9¾ ins., 8 pp. Illustrated.

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What Would Washington Say?

An almost commonplace speculation, yes! In the 153 years of American Independence, celebrated this month, such a question has occurred countless times. But, in fact, just what would Washington say? Suppose he should behold our disks that sing, our radio that whirls the human voice around the earth, our aircraft that have conquered the skies and our talking moving pictures—to say nothing of our automobiles, rushing railway trains, vast industrial plants, towering buildings, giant steamships, our telegraph, telephone and electric lights, and electric refrigeration?

Here is the answer—He would say, "MARVELOUS"—and in two days he would cease to marvel. It would then be an "old story" to him, just as it is to all of us, now wondering what science will next bring forth.

Also an "old story"

Like the more spectacular discoveries of science the Sylphon Bellows is also an "old story." For twenty years its contribution to industrial progress and human comfort while, not so dramatic has been none the less, basic and essential. It is the World's most durable, flexible and sensitive expansion member and is 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.

As a damper regulator it is factory equipment on the principal heating boilers; as a sealing diaphragm in packless valves in thousands of representative buildings; as a diaphragm in packless fuel pumps; in pressure governors and many other important diaphragm applications. During the war it operated the firing mechanism of deep-sea mines, the governing mechanism of torpedoes and was invaluable to the airplane.

It is constantly finding new fields of usefulness. The original and genuine Sylphon Bellows is used only in Temperature and Pressure Regulators manufactured by the Fulton Sylphon Company. 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 Regulation. Address Department A.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 176

MANTELS
Arthur Todhunter, 119 E. 57th St., New York, N. Y.

MARBLE
The Georgia Marble Company, Tate, Ga.; New York Office, 1328 Broadway, New York, N. Y.
Why Georgia Marble Is Better. Booklet, 3½ x 6 ins. Gives analysis, physical qualities, comparison of absorption with granites, opinions of authorities, etc.
Convincing Proof. 3½ x 6 ins., 8 pp. Classified list of buildings and institutions in which Georgia Marble is used, with names of Architects and Sculptors.


METALS
Aluminum Company of America, Pittsburgh.
Architectural and Decorative Ornaments, Catalog, 30 pp., 8½ x 11 ins. Illustrated. An excellent booklet on the subject.

Central Alloy Steel Corporation, Massillon, Ohio.

The International Nickel Company, 67 Wall St., New York N. Y.
Klein & Co., Inc., Henry, 11 East 37th St., New York, N. Y.
Clinton Metallic Paint Co., Clinton, N. Y.
Roddis Lumber and Veneer Co., Marshfield, Wis.
Klein & Co., Inc., Henry, 11 East 37th St., New York, N. Y.

MILLWORK
Curtis Companies Service Bureau, Clinton, Iowa.

Toch Brothers, New York, Chicago, Los Angeles.

MORTAR AND CEMENT COLORS
Clinton Metallic Paint Co., Clinton, N. Y.
Curtin Mortar Colors. Folder, 8½ x 11 ins. Illustrated colors, gives full information concerning Clinton Mortar Colors with specific instructions for using them. Color Card. 2¼ x 6½ ins. Illustrates in color the ten shades in which Clinton Mortar Colors are manufactured.

MORTAR AND CEMENT COLORS
J. W. G. Adams, 951 E. 82nd St., New York, N. Y.

ORNAMENTAL PLASTER—Continued

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

PAINS, STAINS, VARNISHES AND WOOD FINISHES
Cabot's Creosote Stains. Booklet, 4 x 8½ ins., 16 pp. Illustrated.

Minwax Company, Inc., 11 West 42nd St., New York.
Color Card and Specifications for Minwax Brick and Cement Coating. Folder, 4 pp., 8½ x 11 ins. Illustrated.

National Lead Company, 111 Broadway, New York, N. Y.


Prett & Lambert, Inc., Buffalo, N. Y.

Shearin-Williams Company, 601 Canal Rd., Cleveland, Ohio.
Painting Concrete and Stucco Surfaces. Bulletin No. 1, 8½ x 11 ins., 8 pp. Illustrated. A complete treatise with complete specifications on the subject of Painting of Concrete and Stucco Surfaces. Color chips of paint shown in color.

Enamel Finish for Interior and Exterior Surfaces. Bulletin No. 2. 8½ x 11 ins., 22 pp. Illustrated. Thorough discussion, including complete specifications for securing the most satisfactory enamel finish on interior and exterior walls. Painting and Decorating of Interior Walls. Bulletin No. 3, 8½ x 11 ins., 20 pp. Illustrated. An excellent reference book on Flat Wall Finish, including texture effects, which are taking the country by storm. Every painter should have this book.


Senehorns Sons, Inc., L. Dept. 4, 115 Fifth Ave., New York, N. Y.

Toch Brothers, New York, Chicago, Los Angeles.
Architects’ Specification Data. Sheet 1, contained in binder, 8½ x 11 ins., dealing with an important line of materials.

U. S. Gutta Percha Paint Co., Providence, R. I.

Valentine & Co., 464 Fourth Ave., New York, N. Y.
How to Use Valspar. Illustrated booklet, 32 pp., 3¼ x 8 ins. Illustrated. Complete instructions with complete line of track and hangers for all styles of sliding partitions. How to Keep Your House Young. Illustrated brochure, 24 pp., 7 x 8½ ins. Illustrated. An excellent booklet on business of resistances.


PAPER
A. P. W. Paper Co., Albany, N. Y.
Here’s a Towel Built for Its Job. Folder, 8 pp., 4 x 9 ins. Illustrated. Pans with “Onilinen” paper towels.

PARCEL DELIVERY DEVICES
Receivor Sees Company, Grand Rapids, Mich.
Architects’ Portfolio. Booklet, 12 pp., 8½ x 11 ins. Illustrated. Deals with delivery problems and their solution.

PARTITIONS
Circle A Products Corporation, New Castle, Ind.

Dahlstrom Metal Door Company, Jamestown, N. Y.
Dahlstrom Structural Steel Partitions. Booklet, 26 pp., 8½ x 11 ins. Illustrated.

Hammerman Steel & Plywood, 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.

Improved Office Partition Company, 20 Grand St., Elmhurst, L. I.

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

Partitions. Booklet, 7 x 9½ ins., 12 pp. Illustrated. Describes complete line of track and hangers for all styles of sliding parallel, accordion and flush-door partitions.

U. S. Gymnasium Co., Chicago, Ill.

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This Public Toilet Seat

DEFIES slam-bang abuse

Careless, constant, unrelenting abuse is the only treatment a public toilet seat can expect. From the looks of some, you would think the public went armed with axes and sledge hammers. The only way to defy such treatment is to install seats that simply cannot be smashed.

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

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

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-5, Seat Division, The Brunswick-Balke-Collender Co., 623 South Wabash Avenue, Chicago.

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- Charlotte  Denver  Kansas City  New Haven  San Antonio
- Chattanooga  Des Moines  Los Angeles  New Orleans  San Francisco
- Savannah  Tampa  Toronto
- Charlotte  Denver  Kansas City  New Haven  San Antonio
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**THE WHALE-BONE-ITE Seat and Hinge form an unbreakable unit.**

The seat is molded around a laminated core of alternating-grain layers of hardwood, making it proof against warping, cracking and splitting. The die-cast hinge is molded integral with the seat.
SELECT LISTED OF MANUFACTURERS' PUBLICATIONS—Continued from page 178

PIUMS—Continued

Pumps, Indian Brand Pneumatic Tanks, and Complete Water Systems, as installed by Kewane Private Utilities Co.

The Trans Concrete Co., Milwaukee, Wis.

Trask Small Centrifugal Pumps. Booklet, 34 x 8 ins., 16 pp. Complete data and specifications on a valuable line of pumps, with pictures illustrating their uses.

Walt Pump Co., 215 W. Superior St., Chicago, III.

Pumps, Integral, 84 x 11 ins. Illustrated. Individual bulletin on sewage ejectors, and blies, house, condensation, booster and boiler feed pumps.

RADIO EQUIPMENT

Radio Corporation of America, Woolworth Building, New York City, N. Y.

R. C. A. Antenna Distribution System for Multiple Receivers. Booklet, 16 pp., 84 x 11 ins. Illustrated. Apparatus for apartment houses and similar large buildings.


RAMPS

Ramp Buildings Corporation, 21 East 49th St., New York, N. Y.

Building ramps for profitable Operation. Booklet, 84 x 11 ins., 36 pp. Illustrated. Discusses the need for modern mid-city, parking garages, and describes the "Flinny Motoramp" system of design, on the basis of its superior space economy and features of operation, comparing costs, conditions of different sizes, and calculates probable earnings.


REFRIGERATION

The Fulton Siphon Company, Knoxville, Tenn.

Temperature Control of Refrigeration Systems. Booklet, 8 pp., 84 x 11 ins. Illustrated. Deals with cold storage, chilling of water, etc.

REFINERCE CONCRETE—See also Construction, Concrete

North Western Expanded Metal Company, Chicago, Ill.


Longspun 14-inch Rib Lath. Folder, 4 pp., 84 x 11 ins. Illustrated.

Truscon Steel Company, Youngstown, Ohio.

Shearing Streaks in Reinforced Concrete Beams. Booklet, 84 x 11 ins., 12 pp.

RESTAURANT EQUIPMENT

John Van Range Company, Cincinnati.


ROOFING

The Barrett Company, 40 Root St., New York City.

Architectural and Engineers' Built-up Roofing Reference Series; Volume IV Roof Drainage System. Brochure, 64 pp., 84 x 114 ins. Illustrated. Gives complete data and specifications for many details of roofing.

Federal Cement Tile Co., 608 S. Dearborn Street, Chicago, Ill.

Federal Nailing Concrete Roof Slabs. Folder, 4 pp., 84 x 11 ins. Illustrated.

Roof Standards. Booklet. 30 pp., 84 x 11 ins. Illustrated.

Federal Interlocking Tile and Glass Tile. Folder. 4 pp., 84 x 11 ins. Illustrated.

Federal Long-Span Roof Shbuf. Folder. 4 pp., 84 x 11 ins. Illustrated.

New Federal Light Six Roof Slab. Folder. 4 pp., 84 x 11 ins. Illustrated.

Heinz Roofing Tile Co., 1925 West Third Avenue, Denver, Colo.

Designing Data. Booklet, 44 pp., 84 x 11 ins. Illustrated. Shows use of "Econo Expanded Metal" for various types of reinforced concrete construction.

Italian Fremadsen Floor Tile. Folder, 2 pp., 84 x 11 ins. Illustrated. Floor tiling adapted from that of Dano-Italian Paves.

Mission Tile, 84 x 11 ins. Illustrated. Tile such as are used in Italy and Southern California.

Goshen Tile, 84 x 11 ins. Illustrated. Tiling as used in New England and French farmhouses.

Johns-Manville Corporation, New York.

The New Book of Roofs. Brochure, 84 x 11 ins. Illustrated. Complete data on an important type of roof.

Roofing from the Architect's point of view.

Ludovici-Caladon Company, 504 S. Michigan Ave., Chicago, III.

"Ancient" Tapered Mission Tile. Leaflet, 84 x 11 ins. 4 pp. Illustrated. Describes briefly the "Ancient" Tapered Mission Tile, hand-made with full corners and designed to be applied with irregular irregular curves.

Milwaukee Corrugating Co., Milwaukee.

Milwaukee Architectural Sheet Metal Guide. Booklet. 72 pp., 84 x 11 ins. Illustrated. Metal tile roofing, skylights, ventilators, etc.

Milnor Sheet Metal Handbook. Brochure, 78 pp., 84 x 11 ins. Illustrated. Deals with rain-carrying equipment, etc.

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An aquatint study of the Daniel Boone Hotel, Charleston, West Virginia . . .
W. L. Stoddart, New York, Architect ~ Philip L. Brady, New York, Plumbing Engineer ~
Harry J. Cullen, New York, Heating Engineer ~ A. G. Higginbotham, Charleston,
General Contractor ~ Poe Piping and Heating Company, Charleston, Heating and
Plumbing Contractor . . . Jenkins Valves of bronze and iron are used in
both the plumbing and the heating in this new hotel . . .
Jenkins Bros. ~ New York ~ Boston ~ Philadelphia ~

"These buildings should express the ideals and standards of our time". — Herbert Hoover speaking in reference to our national capital.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 180

STONE, BUILDING—Continued


STORE FRONTS


Catalog No. 34. Series 202. Standard construction. Booklet, 16 pp., 8'/i x 11 ins. Illustrated. Complete data on an important type of building.

Details Sheets. Set of seven sheets, 8'/i x 11 ins., printed on tracing paper, giving full-sized details and suggestions for storefront designs. Davis Solid Architectural Bronze Sash. Set of six sheets, 8'/i x 11 ins., printed on tracing paper. Full-sized details and suggestions for designs of special bronze storefront construction.

The Kawneer Company. Illinois, III.

Store Front Suggestions. Booklet, 96 pp., 6 x 8'/i ins. Illustrated. Shows different types of Kawneer Solid Copper Store Fronts.


Modern Bronze Store Front Co., Chicago Heights, III.

Introducing Extruded Bronze Store Front Construction. Folder, 4 pp., 8'/i x 11 ins. Illustrated. Contains full data on details of metal storefronts.

Zowtr Drawn Metals Company, Chicago Heights, III.

Zowtr Safety Key-Set Store Front Construction. Catalog, 8'/i x 11 ins., 40 pp. Illustrated. Contains full data on details and installation instructions convenient for architects’. files.


TELEPHONE SERVICE ARRANGEMENTS

All Bell Telephone Companies. Apply nearest Business Office, or


Planning for Home Telephone Conveniences. Booklet, 32 pp., 8'/i x 11 inches, illustrated.

Planning for Telephones in Buildings. Booklet, 74 pp., 8'/i x 11 inches, illustrated.

TERRA COTTA


Better Banks. 8'/i x 11 ins., 32 pp. Illustrating many banking buildings in terra cotta with an article on its use in bank design by Alfred C. Boscom, Architect.

TILE, HOLLOW


Standard Wall Construction Bulletin 174. 8'/i x 11 ins., 22 pp. Illustrated. A treatise on the subject of hollow tile as used in walls, floors, girders, column and beam covering and similar constructions.

Standard Fireproofing Bulletin 171. 8'/i x 11 ins., 32 pp. Illustrated. A treatise on the subject of hollow tile as used in walls, floors, girders, column and beam covering and similar constructions.

Natco Double Shell Load Bearing Tile Bulletin. 8'/i x 11 ins., 6 pp. Illustrated. Illustrated a treatise on the subject of hollow tile as used in walls, floors, girders, column and beam covering and similar constructions.

Natco Face Tile for the Up-to-Date. Farm Bulletin. 8'/i x 11 ins., Natcofor Bulletin. 8'/i x 11 ins., 6 pp. Illustrated. Illustrated a treatise on the subject of hollow tile as used in walls, floors, girders, column and beam covering and similar constructions.

Natco Healer Backer Tile Bulletin. 8'/i x 11 ins., 4 pp. Illustrated.

Natco Unibailer Tile Bulletin. 8'/i x 11 ins., 4 pp. Illustrated.

TILES


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


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

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If you haven’t received your copy, write for it now!

The JOHN DOUGLAS CO.—Makers of High-grade Plumbing Fixtures—Cincinnati, Ohio
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 182

TILES—Continued
United States General Catalog. Illustrated. Describes the complete line of the Quarry Co.

VALVES
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
General Catalog. Illustrated. Describes the complete line of the Crane Co.
The Dunham Packless Radiator Valve. Brochure, 12 pp., 8 x 11 ins. Illustrated. Data on an important type of valve.

Jenkins Bros., 468 White St., New York, N. Y.

Jenkins Valves for Plumbing Service. Booklet, 4½ x 7½ ins., 16 pp. Illustrated. Describes the various Jenkins valves commonly used in plumbing and iron body valves used for larger plumbing installations.

VENETIAN BLINDS
Burlington Venetian Blinds, Method of operating, advantages of installation to obtain perfect control of light in rooms.

VENTILATION
American Blower Co., Detroit, Mich.
American H. S. Fans, Brochure, 26 pp., 8½ x 11 ins. Illustrates line of blowers.
Duriron Company, Dayton, Ohio.
American Balanced Fans, Folder, 8 x 10½ ins., 8 pp. Data regarding fans for ventilation of laboratory fume hoods.

Stynew Filter Corporation, Rochester, N. Y.

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

Waterproofing Supplies. Complete description and detailed specifications for materials used in building with concrete.

Minwax Company, Inc. 11 West 42nd St., New York.
Permanent Exterior Finishes. Folder, 4½ x 6 ins. 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.

Sonneborn & Co., Ltd., 342 Madison Ave., New York, N. Y.
"Permaninte Liquid Waterproofing" for making concrete and cement floors permanent. Impervious to water. Also circumscribed on floor treatments and cement colors. Data and specifications. Sent upon request to architects using business stationery. Circular size, 8½ x 11 ins.

Sonneborn Sons, Inc., 156 Fifth Ave., New York, N. Y.

Tech Brothers, New York, Chicago, Los Angeles.
Tech Brothers Insulation Co., 1100 South, Los Angeles. Loos leaf binder, 8½ x 11 ins., dealing with an important line of materials.

The Vertex Mfg. Co., 1978 West 77th St., Cleveland, Ohio.
Par-Loch Specification "Form D" for waterproofing surfaces to be finished with Portland cement or tile. Par-Loch Specification "Forms E and G" membrane waterproofing of basements, tunnels, swimming pools, tanks to resist hydrostatic pressure.

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Lupton Pivotet Sash Catalog U.A. Booklet, 48 pp., 8½ x 11 ins. Illustrated and describes windows suitable for manufacturing buildings.

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Hope & Sons, Harry, 103 Park Ave., New York, N. Y.
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The Kawneer Company, Niles, Mich.

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

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is installed in the 1185 Park Avenue Apartments, New York

This outstanding New York apartment building will be heated with a Dunham Differential Vacuum Heating System. The owners of this 15 story structure chose this System as offering the utmost satisfaction to tenants and greatest economy of fuel. "Cool" steam will be circulated in the building's 1650 radiators in mild weather, "hot" steam in cold weather.

This imposing six million dollar structure occupies an entire block on Park Avenue, on the crest of Carnegie Hill, from 93rd to 94th Streets. Its 6, 7, 8 and 9 room suites will be grouped around the beautiful formal garden about which the building is erected. Duplex and roof garden apartments of 11 rooms are also provided. Gothic architecture distinguishes the facade of this structure; limestone is used for the lower stories, with combination face brick and terra cotta above.

Needless to state, the 1185 Park Avenue Apartments will be ultra-modern in every detail of equipment, lavish in decorative beauty and designed throughout for the utmost comfort and convenience of its occupants. The entrance halls and vestibules are decorated in special period design and are executed by Hoffstatter, working in cooperation with Schwartz & Gross.

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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 Invisible Patronage Attraction

"Oh, yes, Bob and I always stop at the Victoria. The food and service are perfect. But what appeals to us, after having knocked around the world so much, is that the rooms are always so warm and comfortable and we have never had that most annoying experience of no hot water, just when a bath is wanted.

"You know I am interested in the Hospital at home, so I asked Bob to find out how this hotel managed to give plenty of heat and hot water. The Manager said it was because all radiators are equipped with Sarco Radiator Traps and Inlet Valves, and hot water is regulated by a Sarco Temperature Regulator. So I’m going to see that our Hospital is equipped with Sarcos, as we’ve had so much trouble with heat and hot water."

Small items, you say—just-right room temperature and plenty of hot water. True, perhaps, but these are two of the many things which go to make satisfied guests and tenants. And it is your attention to “little things” in the design and equipment of buildings that holds customers.

Sarco Radiator Traps, Temperature Regulators and Packless Inlet Valves are in hundreds of buildings. Let us give you the names of installations in your vicinity. Then ask the owners about the Sarco.

Send for Booklets, AK-1-10, AK-170 and AK-50.

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Johnson Rotary Burners are approved by the New York Board of Standards, the Underwriters Laboratory, and by fire prevention bureaus everywhere.
Grilles in the floors of the niches admit heat from ROBRAS 20-20 Radiators in the house of C. H. Mathiessen, Jr., Center Island, L. I. James Cameron Mackenzie, Architect

Heated by Hidden ROBRAS 20-20 Radiators
In the Wall—Out of Sight—Out of the Way

The designer of this attractive entrance hall showed no little ingenuity when he put ROBRAS 20-20 Radiators behind the walls in the manner shown. They are out of sight, and out of the way. To permit the passage of heated air from the radiators into the hall, he had grilles installed in the floors of each of the niches. When it is desired to get the full effectiveness from the ROBRAS 20-20 Radiators, the urns can easily be removed to give a more free opening for the passage of the heated air.

The cold air finds its way to each radiator through the floor openings on the reverse side of the walls. Here there is, on one hand, a cloak room, and on the other a room for preparing flowers.

Because ROBRAS 20-20's are only 20% the size of equal cast iron radiators, a comparatively large amount of this kind of radiation can be installed in a small space. ROBRAS 20-20's can be used in the walls where a recess only the depth of standard studding is necessary. They can be used under staircases where griled outlets can be made in the risers. These radiators, when installed, give added beauty to the design of the room. They cost but little more than cast iron radiators with enclosures.

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Part of a group of 3-apartment buildings erected around Dante and 89th Streets, Chicago, by John R. O'Connor. All are heated with McQuay Cabinet Radiators.

When asked why he selected McQuay Radiators to heat this group of buildings Mr. O'Connor—one of Chicago's foremost developers and builders—replied: "Because my experience has shown that this radiator is one of the best assets a building can have. The small additional cost means nothing. Everyone who sees these radiators, wants them. And this means quicker selling and renting."

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The McQuay takes air from near the floor, heats it and then sends it into the room, in a horizontal direction, with sufficient velocity to get it to the farthest points.

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Brownell Underfeed Stokers operate on the forced underfeed principle whereby the proper mixture of coal and air is constantly and automatically fed, thereby obtaining a uniform temperature, or boiler pressure, as well as effecting the economies on fuel and labor just referred to. They also eliminate smoke and enable the owner to observe his local smoke ordinance.

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

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

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


Mather Tower Building is conveniently located for business visitors to Chicago. The Architectural Forum staff will welcome the opportunity to serve you when you are in Chicago.
The new science in heating... which embodies beauty and economy

Wherever good taste and common sense prevail, there is instant acceptance of Trane Concealed Heating. Interiors can be planned to meet the exact requirements of a particular style or period without the embarrassment of clumsy radiators to mar the harmony of the completed room. Trane Concealed Heating offers economies that appeal to owners of moderately expensive homes as well as the pretentious ones. It must be remembered that Trane Concealed Heating is not a luxury but an actual economy.

In the first place, the cost is no greater than that of ordinary cast iron radiation equipped with metal covers. Heating is more efficient because of the scientific distribution of warm air in the rooms—installation is simpler due to the extreme light weight of the units which are completely assembled at the factory — there are no extras. Accessibility is provided through an opening at the floor permitting removal of unit without disturbing the wall.

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Read what the owner says about heating this prize-winning residence

"Granston Tower was awarded first prize for the best residence in Queens County (New York City), which is very flattering and exceedingly gratifying to me as owner and builder. In the above regard, you also should share my pleasure, as the Spencer boiler with its self-feeding coal magazine is an essential and a most important part of the heating installation.

"Were I to build a third house, I would again select the Spencer unit as I have found it to give very satisfactory results, to be very simple to run, and to permit of using a very fine and inexpensive grade of coal. There are thirty rooms to heat and there is every opportunity for it to show its merits, or vice versa, to raise the ire of the owner."

(Signed) A. P. Armour

Just recently, two practical steam fitters in Rochester, New York, won a cash award for erecting a Spencer Heater in two hours and twenty-eight minutes. A resident of Birmingham, Alabama, writes in to tell how much fuel he saved, and how much trouble he avoided by burning coke in a Spencer magazine feed heater. Just the other day a nationally known resident of Nebraska bought Spencer Heaters to replace the present boilers in his home. A great newspaper of New York City installed Spencer Heaters for economy coupled with the greatest heating efficiency.

Architects know the Spencer Heater—know it to be the original magazine feed heater, that uses small sizes of anthracite, coke and graded non-coking bituminous coals to save as much as half the owner's bill for heat. The Spencer has found its way into a disproportionately large number of prize winning homes and buildings.

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40 pages of helpful data for the architect and engineer, including full information on Sturtevant Unit Heater-Ventilators, and showing typical installations. A copy will be sent for the asking.
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The growth of good taste in domestic architecture which has made steady progress during the last few years is naturally considerably outdone by the production, at costs quite moderate, of excellent wood trim for exterior as well as for interior use. As architects know, the designing of "stock" woodwork carried ready made for delivery by manufacturers has often left much to be desired; sometimes it has been largely if not completely lacking in architectural character, or else has been so scaled that it could be appropriately used in only a few instances. The Curtis firm, for many years known for the excellent designing, scaling, and manufacture of its wood trim, is now issuing four booklets illustrating, describing and listing details of trim likely to interest the most careful architects and the most discriminating home owners: "Curtis Windows"; "Curtis Cabinet and Stair Work"; "Curtis Interior Doors"; "Curtis Exterior bronze and Exterior Doors". Among the many excellent types of woodwork admirably presented in these brochures one might perhaps choose for special mention the beautifully finished fan-lights for over important doors, several excellent mantels, and a number of hanging china cupboards and cupboards intended to be placed in corners. The booklets give the locations of a number of distributing centers where Curtis wood trim is to be had, and it gives as permanent display and sales offices the locations 9 East 41st Street, New York, and 1414 South Western Avenue, Chicago. The booklets are full of suggestions of importance to designers and specification men and also to home owners.

COOPER & BRASS RESEARCH ASSOCIATION, New York. "Ornamental Bronze in Banking Rooms." The importance of metal in various forms and the dignity which its proper use may add to a building's interior are brought directly to one's attention by this beautifully produced book. The designs for the book were made the 38 plates of the brochure were made by George S. Chappell, Frederic C. Hirons, and Julian Clarence Levi, the illustrations being interior views of distinguished banks in different parts of the country. Counter screens and grilles of many kinds, doors and gates, check desks, calendar cases, lighting fixtures and other accessories of bronze and grilles, as shown, details designed in a wide variety of architectural styles and given all the different finishes which bronze can be made to take. This book contains selected examples of bank interiors in which the architect has achieved noteworthy results through the use of ornamental bronze. As the plates indicate, bronze is adapted to all the variety of architectural forms that occur in the banking rooms; it conveys an impressive strength in its size and of beauty in its proportions and design; to the counter screen that not only symbolizes protection of the money but gives it; to the spitting gate that must stand constant use, and to the check desk that is an indispensable element in an interior of this type. The distinction of the examples shown in these plates is attributable in some instances to the design and use of bronze itself and in others to the felicitous combination of this metal with other materials. Whether bronze is considered in its ornamental treatment alone or in its relation, so treated, to the interior as a whole, it is evident that the metal offers architects a highly flexible medium for creative effort. The architect of today is expected to produce effects of enduring beauty within a period of time that would have seemed incredibly short to the ancients. Ornamental bronze in case and ex humiliates the idea of art in its relation to the interior as a whole, making an absolutely tight and permanent seal. The lower door is always closed, unless special facilities are provided. More than 300 other incinerators have been used successfully, both doors are closed, making an absolutely tight seal. Besides the convenient location for feeding, sweeping directly into the Josam Graver Incinerator is a decided advantage. This forms a receptacle for floor accumulations.
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REVIEWS AND ANNOUNCEMENTS

HOFFMAN SPECIALTY COMPANY, Waterbury, Conn.
"How to Lock Out Air, the Heat Thief."

Since the selection of a heating system depends in a large measure on the character of the building to be heated, on the types of fuel available, and on certain other conditions, the subject of heating deserves and generally receives care­ful consideration or study which is greatly aided by the ex­cellent brochures, booklets and other publications which are issued by the manufacturers of heating apparatus. This valuable brochure deals with the subject of steam heating, using the vacuum system. In addition it contains valuable data of a somewhat miscellaneous order which are sure to be useful to architects, engineers, builders and home owners. On page 28, for example, the booklet gives the temperatures which under normal conditions prevail in most of the principal cities of the United States during the heating season, which is generally reckoned from October 1 to May 1.

AMERICAN ENCAUSTIC TILING COMPANY, LTD., 16 East 41st Street, New York. "Aetio Tiles in the Home."

These pages of The Architectural Forum, devoted as they are to bringing to the attention of architects the most interesting and valuable of the publications which are being issued by manufacturers, have made frequent mention of the booklets, brochures, and other publications which deal with decorative tiling. It has been a pleasure during many years to note the constantly improving standard of good taste which has marked the production of tile, and the expanding sphere of their use. This particular booklet emphasizes just this, for in addition to illustrating a great variety of tile which are decorative in the highest degree, it shows excellent uses of tile for bathrooms, kitchens, pantries, the fac­ings of fireplaces and chimney breasts, and also for walls, wainscots and floors for such places as conservatories, greenhouses, etc. And there are illustrated in this booklet wall fountains and fountains apart from walls; panels set in­to walls, particularly the walls of loggias, of stairways, where tile are particularly decorative; and one especially interesting illustration shows a grille or screen which conceals a radiator, the grille being of a beautiful design and color and having all the open work or reticulation required.

EDWARDS & COMPANY, INC., 140th and Exterior Streets, New York. "Modern Hospital Signaling."

Unless an architect or specification writer has become ex­perienced in the planning, designing and equipment of hospi­tals, he might reasonably be unfamiliar with the development to which signaling systems for hospitals have been brought. This has been suggested by examination of the booklet which describes and illustrates the devices for this purpose which are manufactured by this firm, a variety which is astonishing. This has been suggested by examination of the booklet which describes and illustrates the devices for this purpose which are manufactured by this firm, a variety which is astonishing. The introduction to the booklet says: "Because every hospital has characteristics peculiar unto itself, arrangement of equip­ment which may fill requirements in one, may fall far short in another. For this reason this bulletin lists and describes hospital equipment in unit form. It describes all the com­ponent parts which may go to make up any desired system. This leaves the selection, makeup and arrangement to the hospital authorities, the architect, or the engineers. Our engineering department, with years of signaling experience behind it, is always at the service of those wishing advice or suggestions concerning selection of units, arrangement, or wiring diagrams best suited to any particular condition. As a further aid to visualizing any particular type of sys­tem, there is incorporated, in this bulletin, in addition to unit listings, what may be called 'model systems.' They are offered as suggestions, along with exemplary wiring dia­grams and wiring data. Systems comprising complete equip­ment embrace: Nurses' Call; Doctors' Paging; Doctors' 'In' and 'Out'; Maids' or Nurses' Location; Door Bell and Alarm Entrance; Telephones; Return Call; Watch­man's Time Detector; Fire Alarm and Tank Alarm. All Edwards devices are designed to give positive and efficient service, are thoroughly tested before leaving the factory, and are planned and designed for the simplest possible installation.

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Street___________________________
City___________________________State________________________

MAY OIL BURNER CORPORATION
3500 E. Biddle St., BALTIMORE, MD.
We live in bedlam

This industrial age creates noise. We live amid a confusion of jarring sounds. In the home, office and workshop we suffer the noises our neighbor makes incidental to working or living—his radio, phonograph and piano are examples. We suffer the whirr and racket of machinery. Our nerves are assailed by noises created in and out of buildings in which we work and live.

Yet we need quiet, that we may live and rest in peace.

Sound travels in waves. Sound waves created in one room seldom are halted by a wall or ceiling, but set it vibrating, somewhat as a telephone diaphragm vibrates, with the result that the sound is re-created on the opposite side.

Modern science has made possible the confining of sound within the room in which it originates. Such confinement is provided by the USG System of Sound Insulation.

This system is a supplemental construction for forming floors, partitions and ceilings so that sound will not be transmitted through them. It includes the treatment of vents, ducts, etc., and the setting of machinery bases.

The USG System of Sound Insulation is installed under contract, by the United States Gypsum Company, which assures undivided responsibility, and guaranteed results. For information address Sound Insulation Department, United States Gypsum Company, Dept. 27-K, 300 W. Adams St., Chicago, Ill.

USG SYSTEM OF SOUND INSULATION

Created by the United States Gypsum Company
ARCHITECTURALLY speaking, the charm of beautiful arches lies not only in the graceful curves and neat trim lines, which mark the finished work ... but also in the ease and surety with which such arches may be created.

Standard practice decrees the use of corner bead ... but Milcor Expansion Corner Bead has so many structural advantages that it is rapidly superseding all other types. The expanded metal wings ... a Milcor patent ... form an ideal key for the plaster, gripping it tightly right up to the corner and preventing the plaster from cracking or chipping, due to unavoidable abuse ... Milcor Expansion Corner Bead is precisely accurate in its formation ... drawn like a wire by Milcor patented machines ... economical in its application and artistic in its results.

Milcor Expansion Corner Bead is one of the famous Milcor fire-proof products ... Stay-Rib Metal Lath and Expansion Metal Casing complete the materials available for the most modern and permanent method of construction. Specify Milcor Products. A copy of the "Milcor Manual" will be sent you upon request.

MILWAUKEE CORRUGATING CO.  
1405 Burnham Street  
MILWAUKEE, WIS.

MILCOR PRODUCTS  
Branches: Chicago, Ill., Kansas City, Mo., La Crosse, Wis.  
Eastern Plant: THE ELLER MANUFACTURING CO., Canton, Ohio.