THE ARCHITECTURAL FORUM

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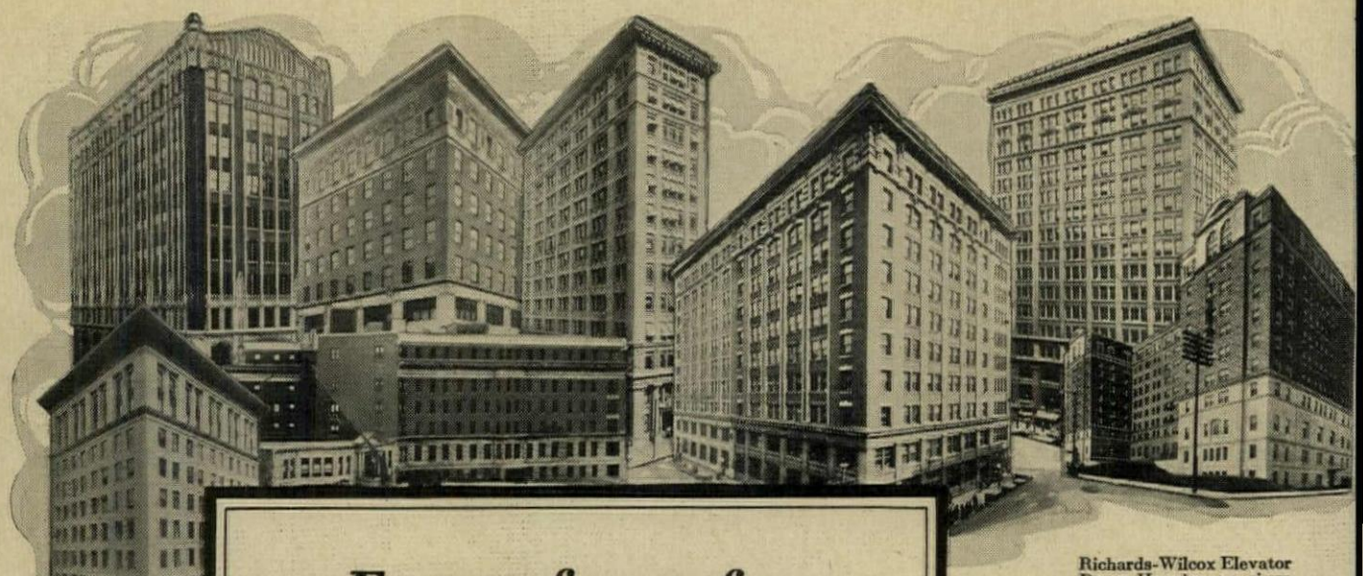
PART TWO

MAY

1928



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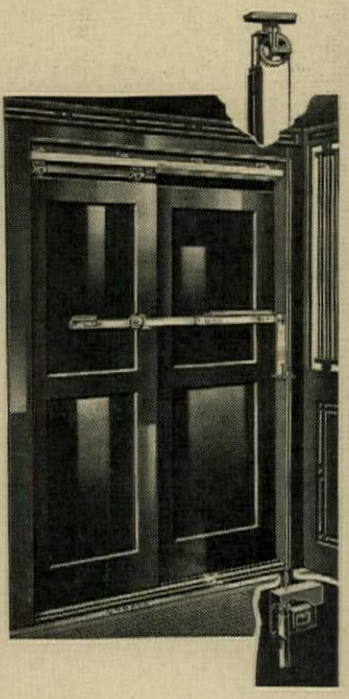

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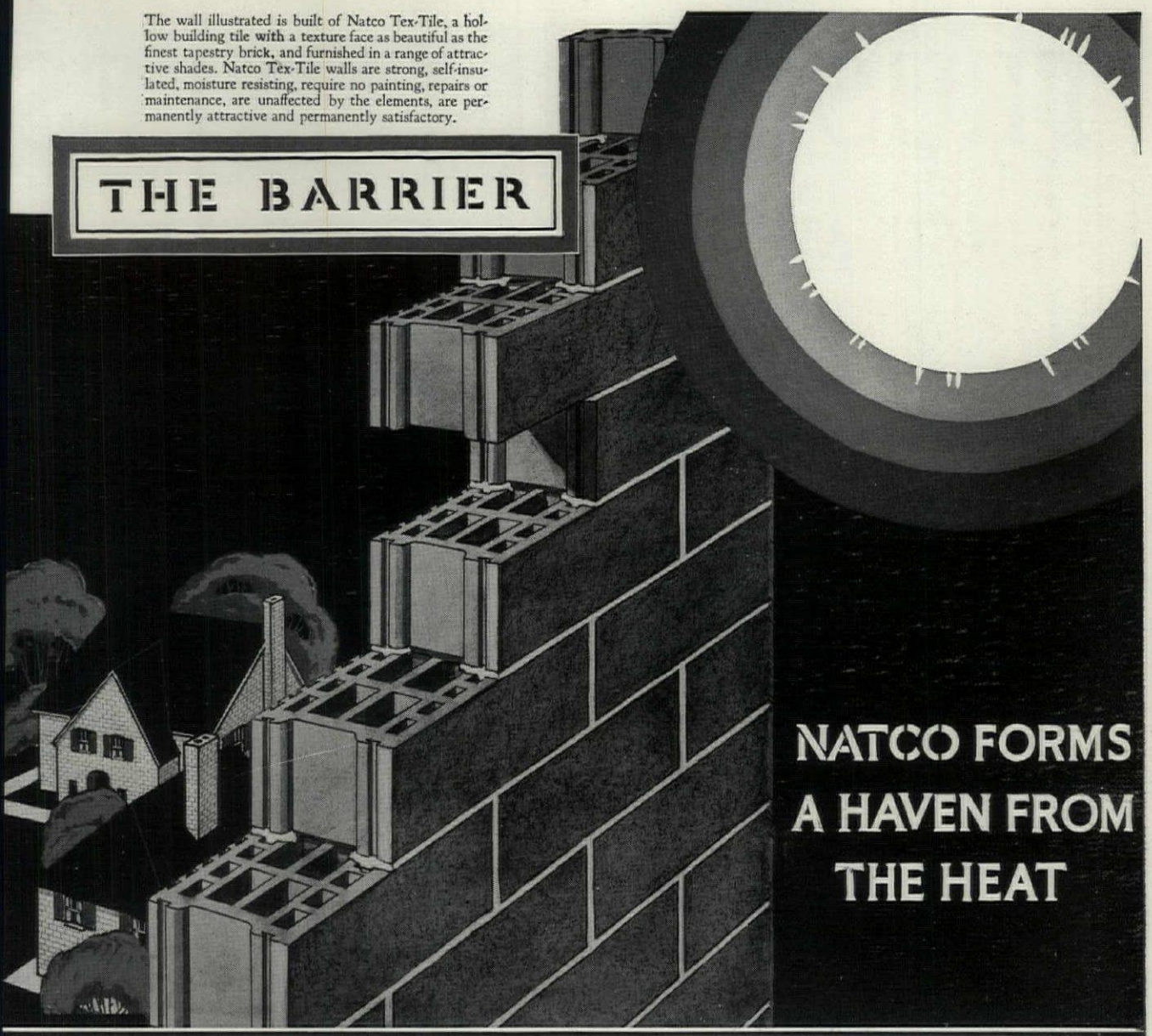

A GLANCE at a table of the insulating values of various walls will show why structures built of Natco Hollow Building Tile are more cool and comfortable in summer. (And, of course, warmer in winter.) Natco keeps *out* the summer heat, keeps *in* winter warmth.

Heat travel through hollow tile walls, ordinarily low, is even lower through Natco. For it has the exclusive double shell feature that increases the number of blankets of dead air which shield the building.

The complete Natco Line provides for every building need. Natco Header Backer, Unibacker, Interlocker, and Backup for brick faced walls. Natco Double Shell Load Bearing, and Triple X, for stucco walls. Natco Tex-Tile and Vitritile, for attractive finished face walls. Natco Partition Tile for interior dividing walls. Natcoflor, Combination, and Flat Arch systems for floors. Natco Beam, Girder, and Column Covering for protecting steel work.

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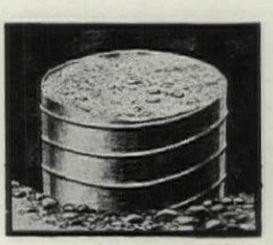

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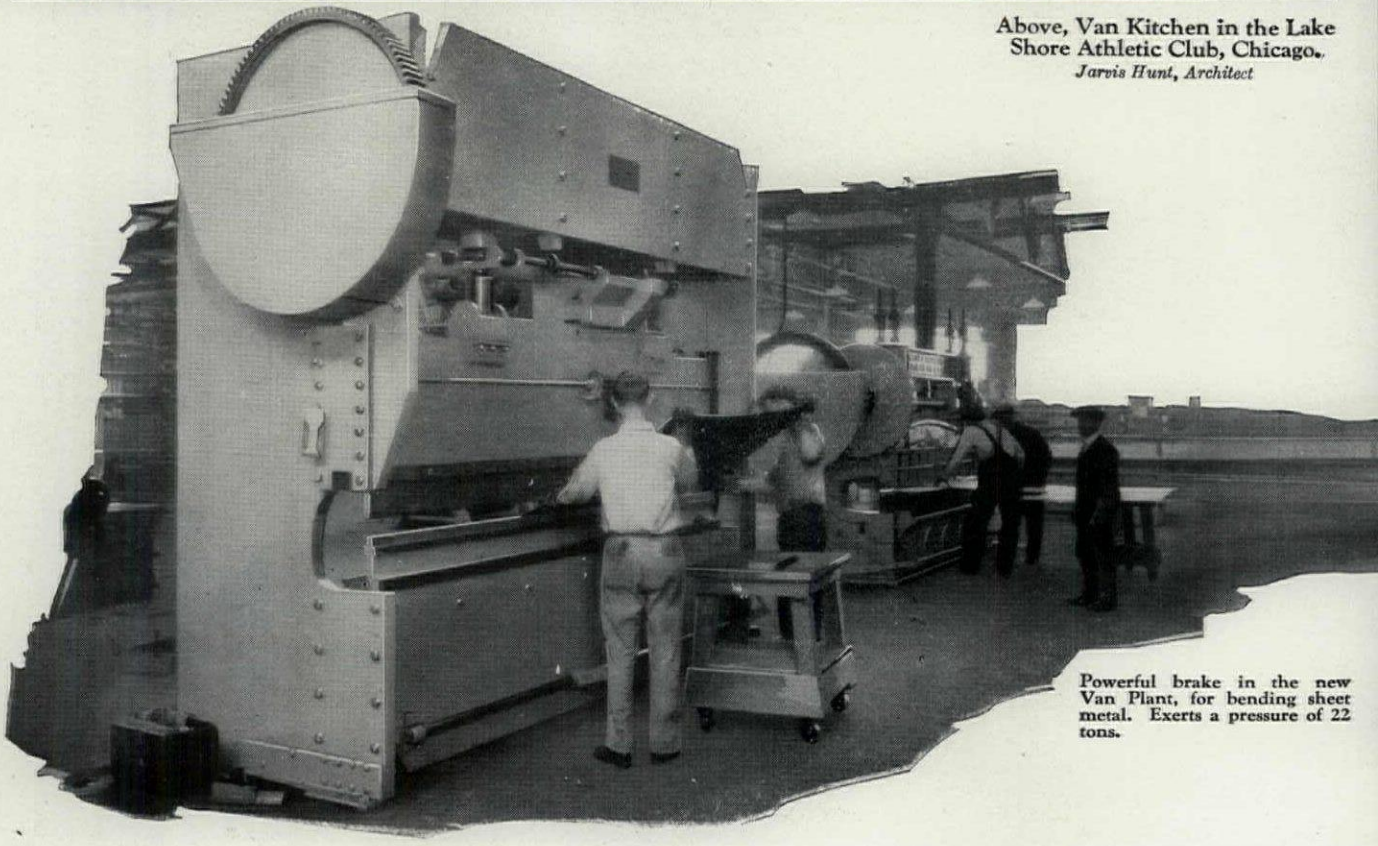
THE MEN · THE METHODS

behind

Above, Van Kitchen in the Lake Shore Athletic Club, Chicago.
Jarvis Hunt, Architect



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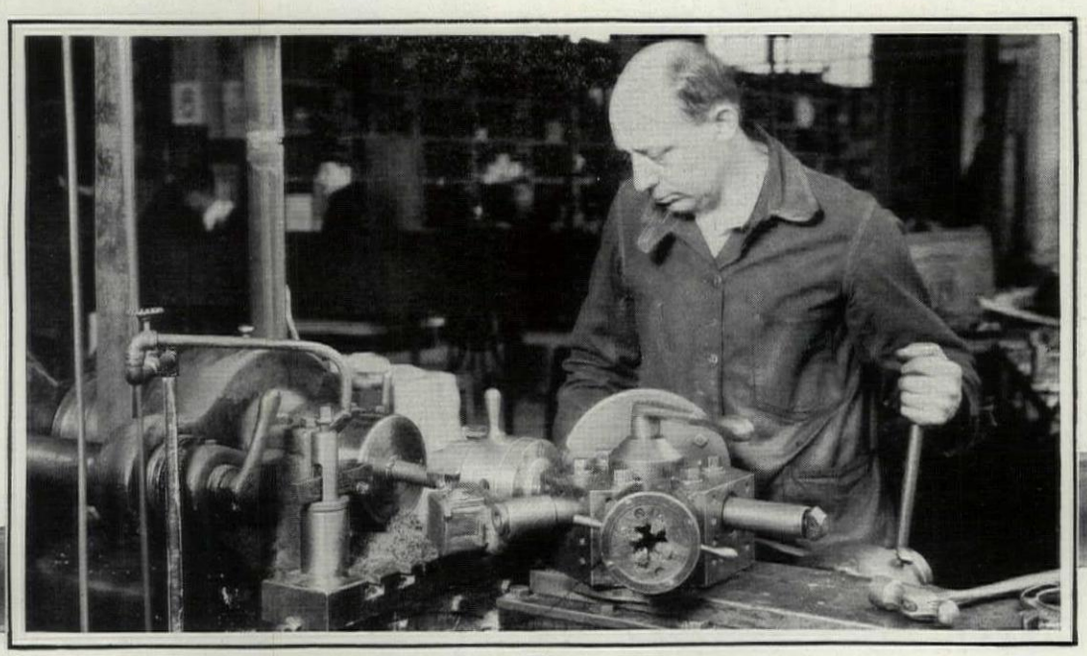

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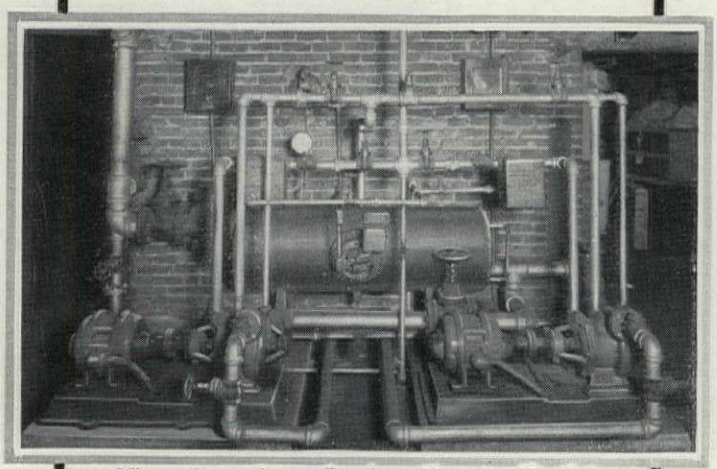
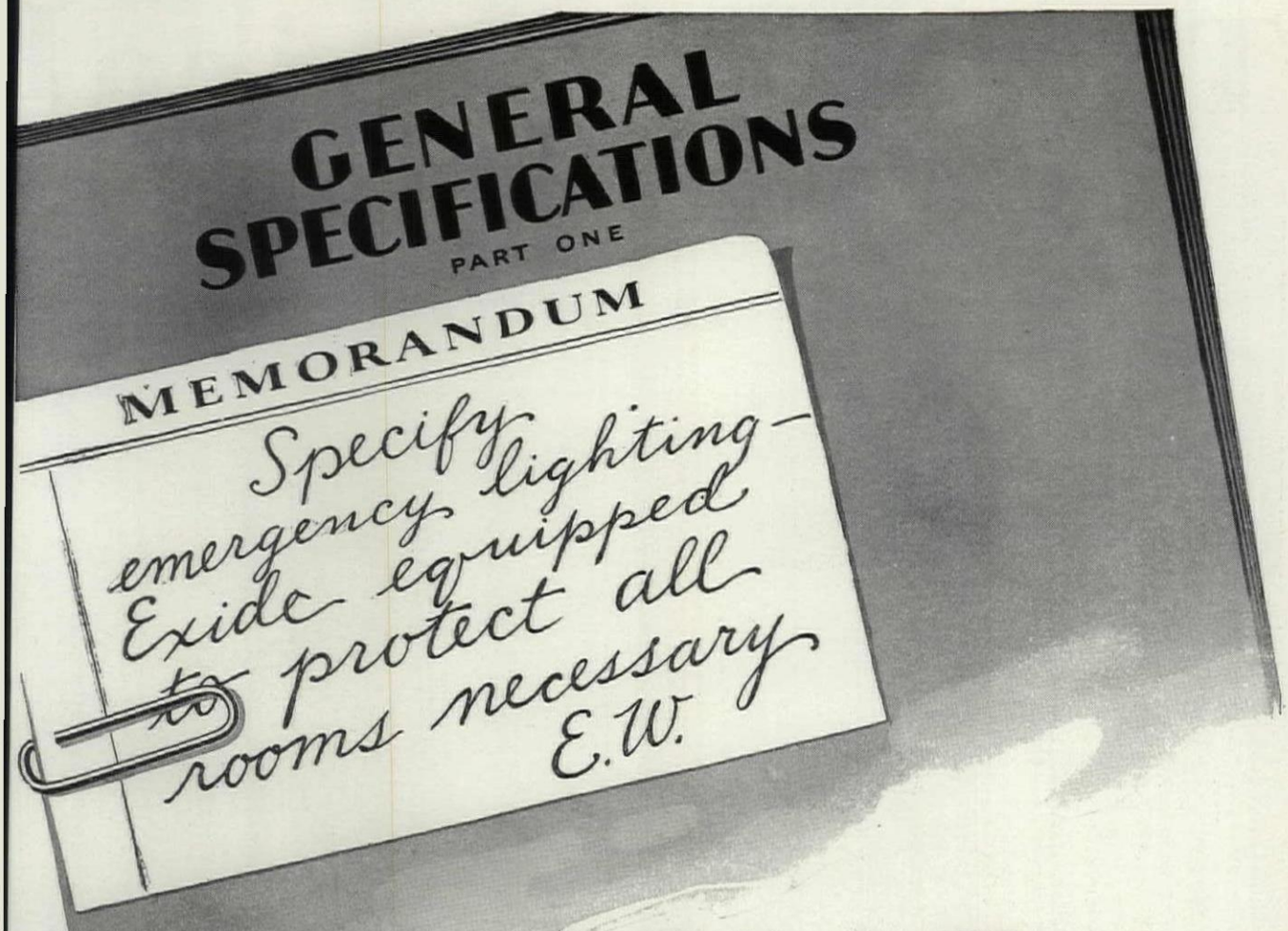
For complete information, write for Bulletin 71.



View above shows Jennings Vacuum Heating Pump, duplex type, size D-20, as installed in the Rich Department Store.

RETURN LINE AND AIR LINE VACUUM HEATING PUMPS ∾ CONDENSATION PUMPS ∾ COMPRESSORS AND VACUUM PUMPS FOR AIR AND GASES ∾ STANDARD AND SUCTION CENTRIFUGAL PUMPS ∾ HOUSE SERVICE PUMPS ∾ SEWAGE EJECTORS ∾ SUMP PUMPS ∾ FLAT BOX PUMPS ∾ MARINE PUMPS

Jennings Pumps



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Now you can give any building positive protection against light failure

A GREAT assembly hall thronged with people—lights shining brilliantly . . . Suddenly the power fails—lights out . . . A blanket of darkness that can bring disorder and fear.

Continuous light is imperative where the public assembles. The emergency needs of a single operating room or an entire theatre vary—yet both must have positive protection against light failure.

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Dependable . . . Made by the world's largest manufacturers of storage batteries for every purpose, the Exide Battery for emergency lighting assures: (1) absolute power dependability, (2) long life, (3) freedom from trouble, (4) low first cost, (5) low operating cost.

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Exide
BATTERIES
FOR EMERGENCY LIGHTING

* * *

For a more technical description of emergency lighting, see page 2876 of "Sweet's Architectural Catalogue"—Section C.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

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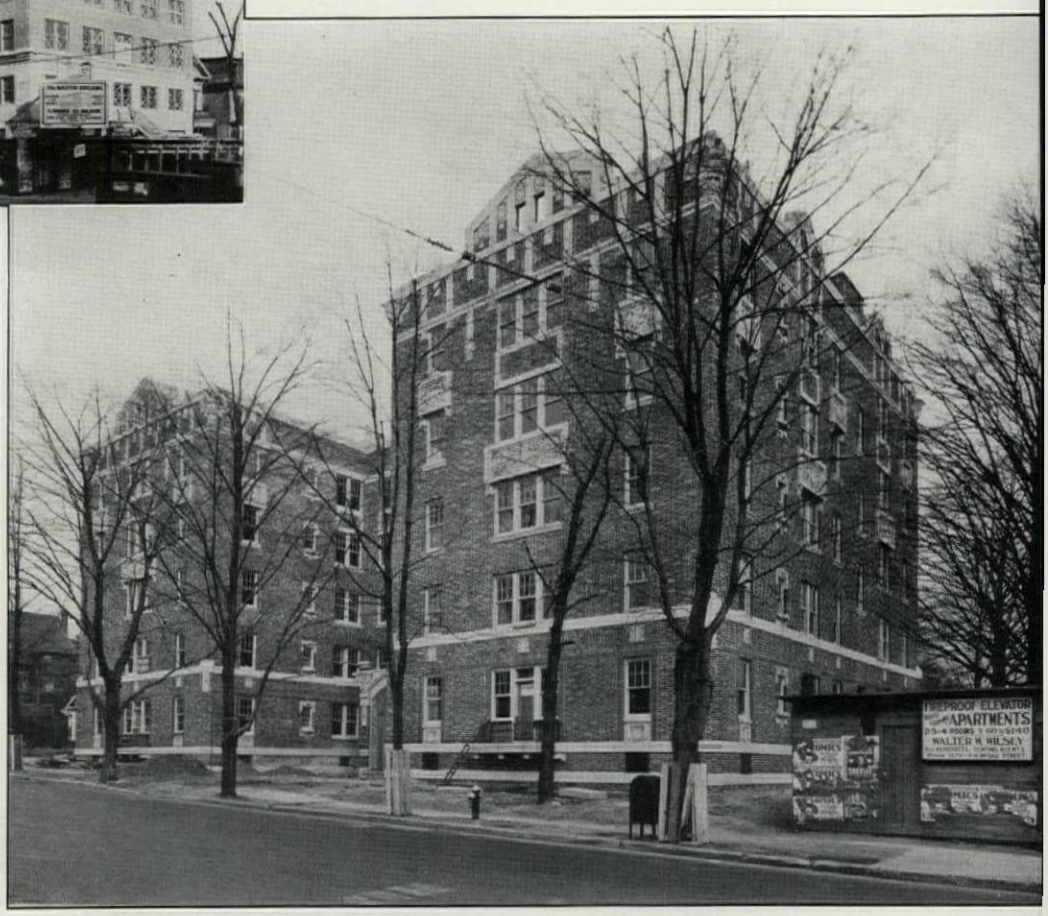
The economical Floor System a wide range

The Martin Building, shown above, of Elizabeth, N. J., is one of the many office and store buildings of moderate size employing the Havemeyer Truss floor system. Frank A. Berry, Architect. John W. Ferguson Company, Builders



The Havemeyer Truss floor system is used throughout the building shown at right. Located at Ridgewood, N. J. Daniel J. Scrocco Architect. Corrado & Maturi, Contractors

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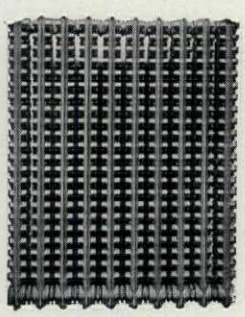

A typical stack of VENTO Cast Iron Heaters

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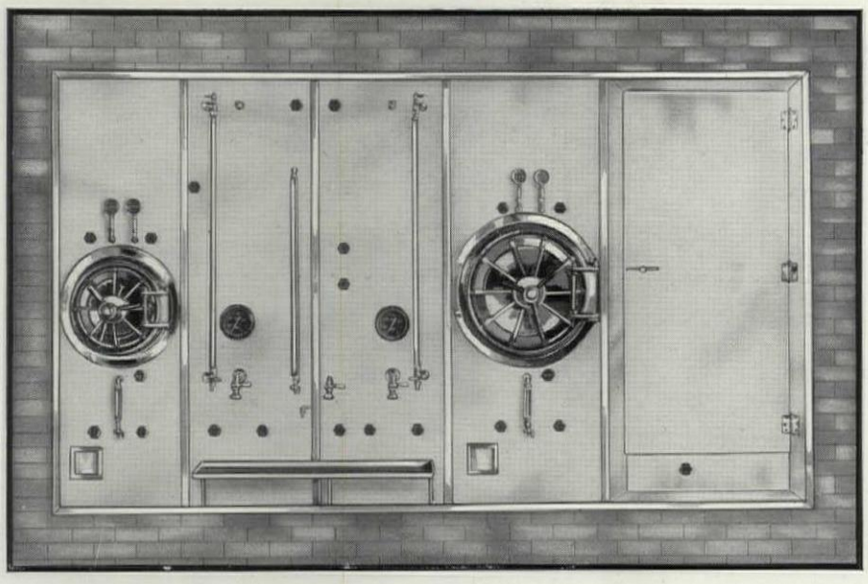

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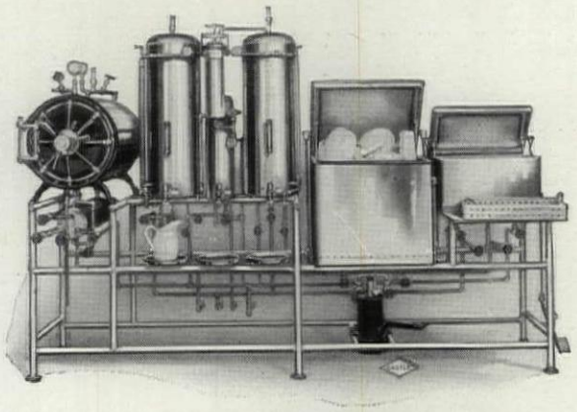

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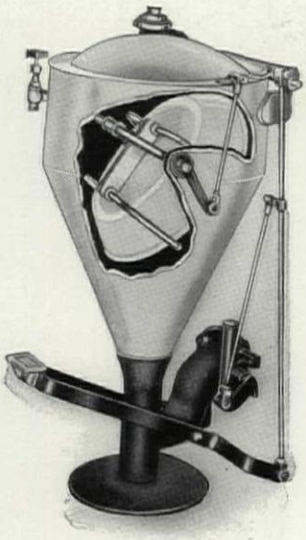

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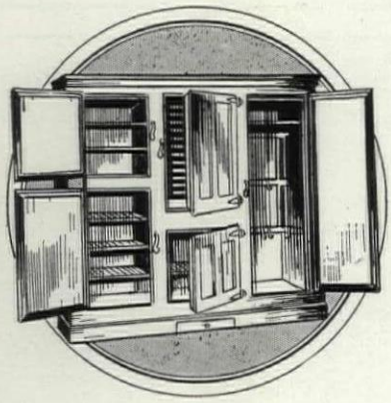

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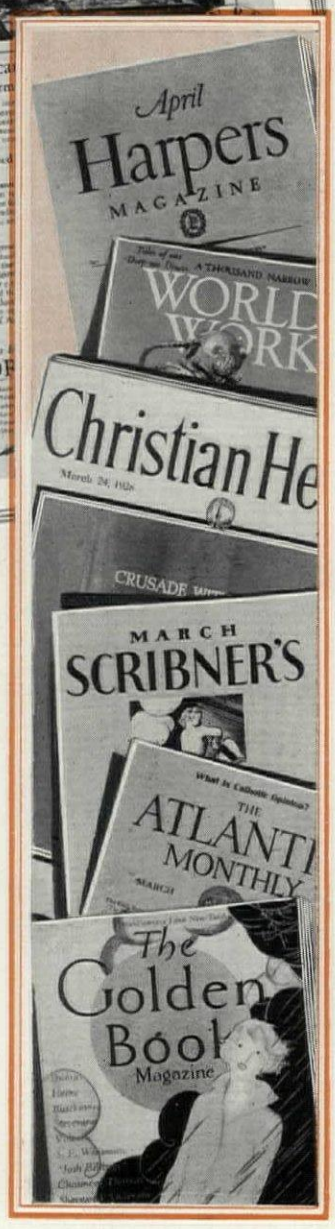

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BOOK DEPARTMENT

A VOLUME ON THE COMPOSITION AND PLACING OF CONCRETE

Reviewed by C. W. SPENCER

TO gain satisfactory results in any form of work it is of the greatest importance that the workman know thoroughly the materials with which he is to work. Thus in order for an artist to create paintings of lasting beauty it is necessary not only for him to understand how to mix his colors to obtain the necessary shades and tints, but it is also desirable for him to know something of the chemistry and the permanency of the pigments that make up his palette so that he will know which can be safely mixed and used so that the original effects will last indefinitely without fading or changing color. This is also true of the architect, who performs his work indirectly, using a large variety of building materials as his medium. The variety and complexity of these materials are rapidly increasing, but the three most important in order of their importance are steel, lumber, and concrete. The latter, which is of comparatively recent development, is rapidly gaining in importance and will undoubtedly soon surpass timber in importance as a structural building material. Portland cement, which is by far the most important binding material used in concrete, was invented in England a little over 100 years ago, but up until 1872, when David O. Saylor started his investigations with Portland cement, it was little used in America. From that time until the beginning of the twentieth century the development was very slow, and in 1894 there were only about 20 plants in the United States, producing about 800,000 barrels annually. The growth since then, however, has been phenomenal, so that at the present time there are about 140 plants producing more than 150,000,000 barrels of cement annually. This growth is due partly to new discoveries of suitable raw materials and new and improved methods of manufacture, and partly to the enormous demand for this type of building material which has arisen, its properties making it particularly suitable to the modern type of building. New equipment and elevating machinery now make it possible for the tallest structures to be constructed of reinforced concrete, producing a building of great strength, rigidity and permanence. The use of iron and steel as reinforcing for concrete also adds greatly to its possibilities as a structural material, and there is scarcely a single instance of a modern building of any considerable size which has been constructed recently without the use in at least some portion of this material. Another reason for the wide use of concrete is the necessity of building fireproof structures, and there is no material more useful in this connection, especially in floor construction. In addition to all this, the possibilities of concrete construction have been enhanced by its new use as a decorative medium.

In using concrete it is of the utmost importance that great care be taken in proportioning the mixture, mixing it, and placing it under proper conditions so that it is adequate for the purpose for which it is to be used. A slight error in any of these processes is capable of causing enormous damage, there being instances where entire buildings have collapsed due to carelessness in one of these details. While these problems are primarily the concern of the contractor, it is highly desirable that the architect be thoroughly familiar with them in order to render efficient service in designing a structure and supervising its construction. There is a large amount of material available as a result of the scientific research which has been carried on by the various cement companies as well as by public and semi-public agencies, such as technical schools and colleges. So great is the necessity of care in connection with concrete work that many of the larger construction companies maintain their own testing and research laboratories for the careful study of concrete.

Courses in the use of concrete are given in certain colleges and vocational schools throughout the country, and it is as a textbook for such a course that "Concrete Practice" by George A. Hool and Harry E. Pulver, professors of structural engineering in the extension division of the University of Wisconsin, was written. However, the subject is so presented that the volume should be a useful guide and source of information to those connected in any way with work in concrete. The book is divided into six main sections. The first deals with fundamental considerations, discussing the various parts of the mix, describing the aggregate, both fine and coarse, and placing special emphasis on the fact that strength in concrete depends largely on having the proportion of water to cement as small as possible and still have a workable mix. The properties of concrete and the effects of various substances on its strength are also discussed. The second section covers the proportioning, mixing and placing of the concrete, considerable space being devoted to description of the various methods of determining the proper mix to give the required strength according to individual requirements. Some description of forms, concrete block manufacture, and the making of cast stone is included. In the third section typical contracts, specifications, and plans are given for various kinds of structural work. Section six is of great practical value, as it shows the best practice in estimating all the different branches of concrete work, including forms and reinforcing steel. One section is devoted to outlining the procedure to be followed in the laboratory work in designing and testing concrete, and another is on field work and takes up the subject from the standpoint of the inspector, a section which should be especially interesting to the architect. Field methods in connection with several different kinds of concrete work are described.

The appendix at the end of the volume contains much valuable and useful information in tabular form, including much material from reports of the American Society for Testing Materials, and a table from "the 1924 report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete," by use of which it is possible to determine the composition of the mix which may be expected to give a required compressive strength after having been allowed to cure for 28 days.

CONCRETE PRACTICE. A Textbook for Vocational and Trade Schools. By George A. Hool and Harry E. Pulver. 369 pp., 5½ x 8 ins. Price $3. McGraw-Hill Book Co., Inc.

THE IMPORTANCE OF SECOND MORTGAGE FINANCING

A Review by TYLER STEWART ROGERS

WITHIN recent years the architectural press in general, THE ARCHITECTURAL FORUM in particular, has been placing increased emphasis upon the importance to architects of a practical working knowledge of building economics and finance. Even a casual examination of the statistics showing the annual construction in the United States will indicate that but a fraction of 1 per cent of all building construction is of a purely monumental character, governed entirely by æsthetic considerations and free from problems of utility and cost. Except for the homes of the wealthy and a relatively small number of institutional and public buildings for which funds have been donated or appropriated, building construction depends upon the success of efforts to finance the projects. At least a great majority of homes and business buildings are constructed with funds supplied in part by others than the owners. The financing of real estate by mortgages has become such common practice that only rarely are new projects undertaken without securing a certain proportion of the funds through mortgage sources.

In presenting his book on second mortgages and land contracts, Dr. Reep has devoted himself to an exceedingly important aspect of real estate financing. First mortgages and the practices surrounding their procurement are practically standardized in all details. They can be obtained for almost any building venture. There are plenty of sources for funds for use in these "senior" securities. The real economic and social problem in real estate finance is the procurement of funds to bridge th gap between the amount available on a first mortgag and the amount of the owner's equity. This need fo "junior" loans has never been satisfactorily filled, an yet it is of the utmost economic importance to the con tinued progress of the entire building industry that i should be. This book is an exceedingly clear and de tailed presentation of the problem of junior financing o real estate. It is written by a man of broad experienc in home financing. Dr. Reep is a lecturer on real estat at the University of Minnesota; Chairman of the Mort gage and Finance Division of the National Associatio of Real Estate Boards; and President of the Hom Financing Corporation and Home Building and Loa Association of Minneapolis. Much of the data pre sented in his book has been collected through detaile researches carried on in connection with his work fo the National Association of Real Estate Boards and hi analysis of building and loan associations as sources fo junior financing, and this work is the first complete an comprehensive study that has been published.

Junior financing has long been burdened with bad repute, due partly to its speculative nature, but very largely to the sharp practices which have commonly pre vailed. There is a peculiar legal problem having an im portant influence on the junior financing field which Dr Reep has analyzed in detail and for which he has sough a constructive solution. The early pages of the book ar devoted to junior financing as the chief real estate finan

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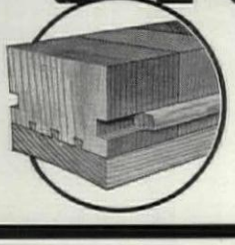

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cing problem. This is followed by a discussion of the security in back of junior liens. The security back of first mortgages is carefully analyzed, and the conclusion is reached that a 50 per cent margin is necessary for the adequate security of these senior obligations. The prevailing rate for first mortgages ranges from 5 to 7 per cent with 6 per cent as a more or less standard average, and in many states this return is the legal rate and may also be the statutory maximum. Obviously, junior liens are worth a higher return, for they have less security, but usury laws frequently make it illegal to charge any appreciable increase over the rate obtained for senior obligations. The usury laws are frequently enforced by severe penalties, ranging from forfeiture of excess interest up to forfeiture of both principal and interest and conviction for misdemeanor. Naturally, the usury laws restrain capital from entering the junior lien field, for an adequate return can be obtained only by evading the law or else by attempting to camouflage usury in an illegal manner. The risk attending the latter course is exceedingly high, for legal restrictions have been so written as to make it almost impossible to camouflage usury. Naturally, a business which must depend upon evasion or directly illegal practices has lacked interest to financial sources of integrity and responsibility, and the field of junior financing has been left almost entirely to individual lenders whose operations are without the regulation accorded by law to other types of banking.

The basic need for second mortgage financing, combined with the necessity for obtaining higher rates than are charged for senior securities and the problem of obtaining this higher rate without taint of usury, is a ma ter of direct interest to all architects, builders and bank ers interested in real estate financing and developmen The solution presented by Dr. Reep calls for the modif cation of usury laws and the proper legal control of sec ond mortgage financing. A possible solution is als presented in the opportunities for developing secon mortgage building and loan associations. In most state building and loan associations (which confine themselve entirely to making first mortgages with rare exceptions are exempted from the operations of the usury laws Their low cost of doing business, their intimate knowl edge of the factors influencing each loan, and their co operative nature are also factors pointing toward th possible development of such associations to solve th home building financing problem. Attention is also de voted to land contracts as compared with second mort gages. A land contract is essentially an agreement fo the delivery of a deed on a specified date in considera tion of payments made at stated intervals in the interim The seller retains the deed for the property until al payments with interest have been completed. Whe used in its proper manner, i. e., for an actual sale based upon an extended payment system, it stands legally as a contract. When used to secure a loan it is interpreted by the courts as a mortgage and must be foreclosed rather than cancelled. Since foreclosure involves a period of redemption, whereas the simple cancellation o a contract can be accomplished in a relatively shor period, land contracts have often been used in place o mortgages because of the advantages they give to the

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A field of financing so essential to national welfare and prosperity, so important in all housing and many business building problems, and so hampered by unwise or antiquated legislation and by a reputation of an unsavory nature, is worthy of the authoritative and comprehensive treatment which Samuel N. Reep has given it in his new book. The volume will doubtless have some influence toward the corrections of the evils which now retard the sound development of second mortgage finance companies. It will enjoy wide distribution among real estate brokers, operators and investors, and it will do much to clarify the problems of those now engaged on a plane of high integrity in the essential work of providing second mortgage funds. The architect will find in this book much information of value to him and to his clients in securing adequate financing for building operations on a sound and proper basis.

The author has confessed that much difficulty attended the division of the subject matter into chapters. He has, nevertheless, achieved a very logical sequence covering all of the essential points and the important ramifications of the subject by basing his discussion on the sequence of operations in making a loan. The first chapter discusses "The Chief Real Estate Financing Problem," and the two following chapters take up the "Field of Junior Lien Financing" and "Junior Lien Security." Chapter 4 is entirely devoted to "Appraising the Security," which is the first practical operation in making or purchasing a second mortgage or land contract. The following chapter discusses "Commissions and Discounts" and is based on much special research in many cities. Chapters 6 and 7 are devoted to the "Preparation of Second Mortgage Papers" and the "Preparation of Land Contract Papers." These chapters are exceedingly practical and explain clearly even to the layman the meaning of the statutory requirements and phrases used in these documents. Since usury plays such an important role in junior lien financing and since it is determined as of the time the papers are delivered. Chapters 8 and 9 deal with this subject,—the former discussing the problem fundamentally, and the latter treating of its practical aspects. Chapter 10 is devoted to the important question of "Second Mortgages by Building and Loan Associations." After the second mortgage has been closed, or after the property has been sold on land contract, the next important operation may be the enforcement of its performance or some remedy in lieu thereof. In Chapter 11 on "Foreclosure of Second Mortgages" and Chapter 12, "The Cancellation of Land Contracts," these problems are analyzed in detail.

To assist in overcoming the many obstacles now present in junior lien financing of real estate, and on the theory that light dispels darkness, the author has devoted Chapter 13 to "Sharp Practices in this Field." Here are explained many of the methods employed by unscrupulous lenders, brokers and borrowers which have brought disrepute into the lay mind to this form of banking. The closing chapters are devoted to the "Broker and Junior Lien Field" (Chapter 14); the "Second Mortgage Market" (Chapter 15); the "Organization of Second Mortgage and Land Contract Companies" (Chapter 16); and the "Future of Second Mortgage and Land Contract Financing" at the close of th volume. These chapters form the basis for a constru tive development of junior lien financing and point th way to what will probably become an important an ethical branch of real estate banking and financing.

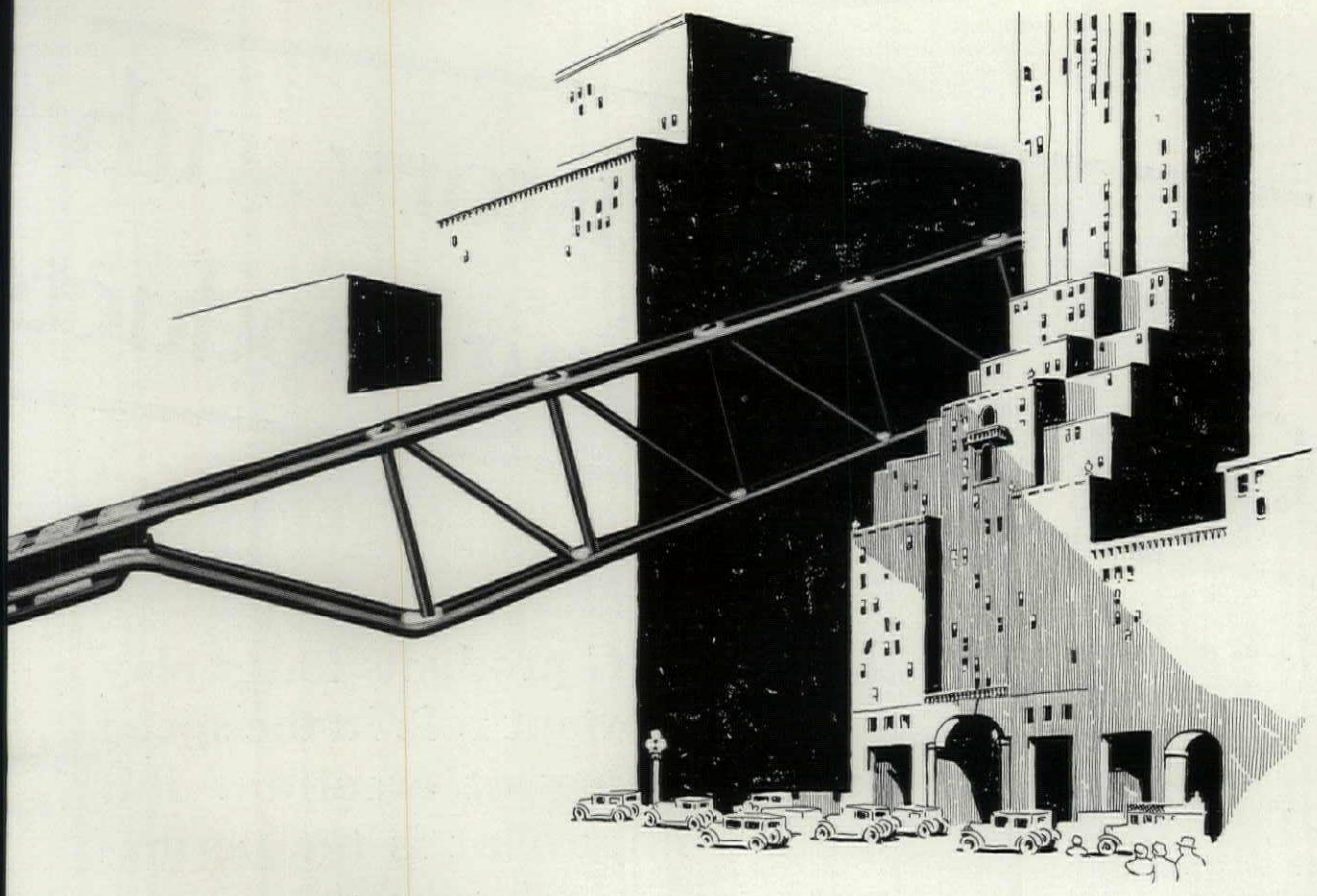
In general, the author is to be commended for th clarity with which he has presented his facts, for th completeness with which the influencing factors ha been analyzed and set in their proper order, and for th saneness and reserve which mark this conclusion an recommendations. The book will have a wide range o interest, benefiting the student, the layman, the broke and banker alike. It is a work to be recommended t the architect who appreciates the value to himself and t his clients of a thorough knowledge of the busines practices which are essential to the development of th business from which he derives his income.

The author has in no sense made this book a mediu for propaganda; nevertheless his clear exposition of th legal difficulties besetting the junior lien field may becom instrumental in bringing about much needed changes i usury laws. This matter deserves further notice her At present the several states (with Massachusetts as notable exception) have usury laws which so definitel conflict with the natural operation of the laws of suppl and demand in their influence on the second mortgag and land contract market that they compel evasion o infraction, and directly result in higher charges than ar necessary because of the trouble or risk involved. Thes laws have teeth. The losses attending an action on th grounds of usury are very bad. Infraction is attempte only by the unscrupulous lender dealing with the mos ignorant borrowers, and the rates then charged are indee exorbitant. Evasion is legally accomplished by the dis count system involving a third party or straw man, whos services must be paid for as part of the borrower's ex pense. Either way, the borrower pays a premium be cause the laws designed for his protection limit the lega charges to a point substantially below a reasonable com pensation for the risk involved.

The author does not seek the repeal of usury laws *per se;* rather, he feels the need for intelligent regulation o this branch of banking and real estate finance with a rea sonable opportunity to place junior liens on a credit basi compatible with their worth under freely competitiv conditions. Through such regulation, the cost of junio financing would be reduced, and part of the risk lessened to the benefit of lender and borrower alike and to th advancement of real estate building. Likewise, junio lien financing would regain its lost prestige and repute and would be restored to its rightful place among legiti mate and beneficial financial practices.

Another point of special interest to those concerne with building finance is the discussion of real estate a security, and the corollary problem of real estate ap praisals. The younger business generation, whose expe rience in real estate does not date back to pre-war period of depression, will find the author's review of the factor which influence realty values most instructive. The im portance of the work should secure it wide circulation

SECOND MORTGAGES AND LAND CONTRACTS IN REAL ESTATE FINANCING. By Samuel N. Reep. 255 pp., 6 x 9 ins Price $5. Prentice-Hall, Inc., 70 Fifth Avenue, New York



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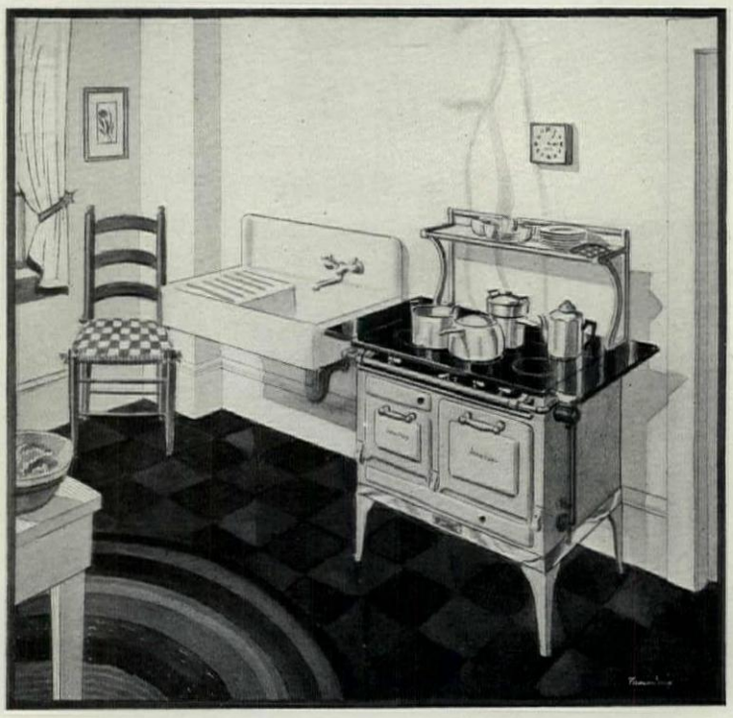

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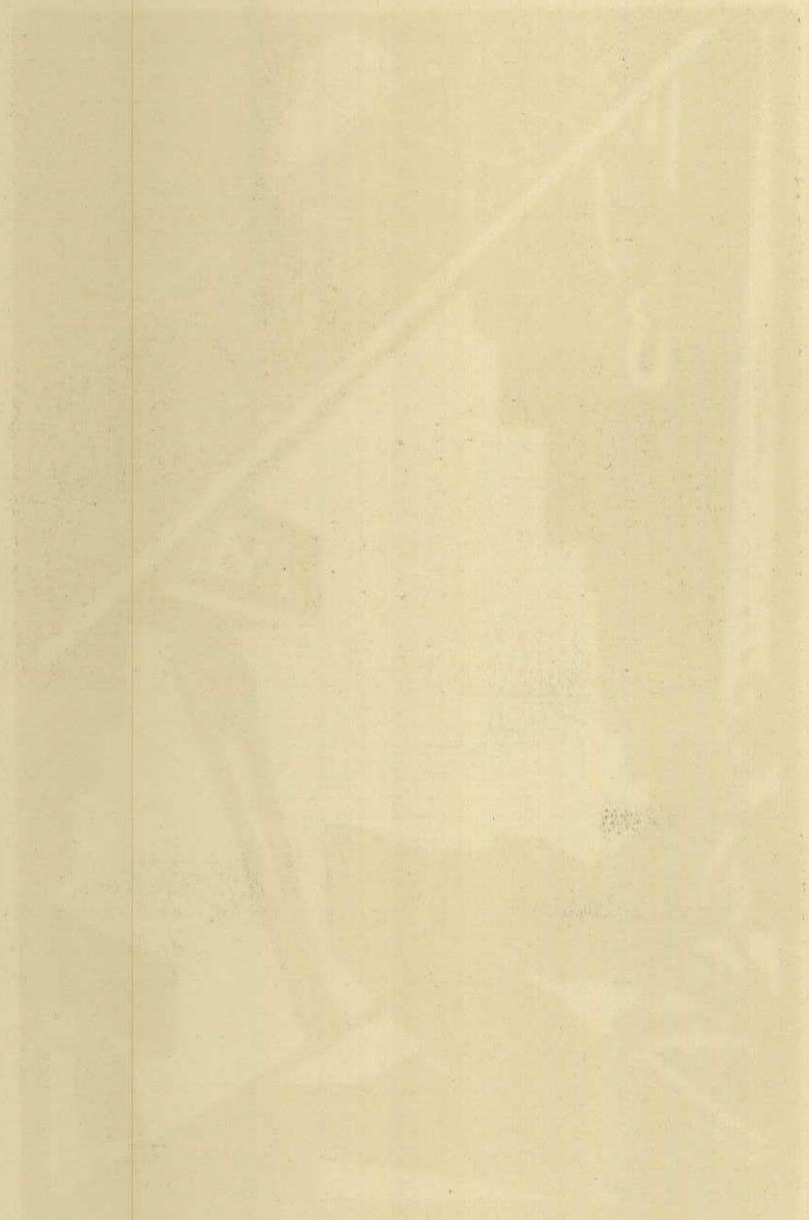

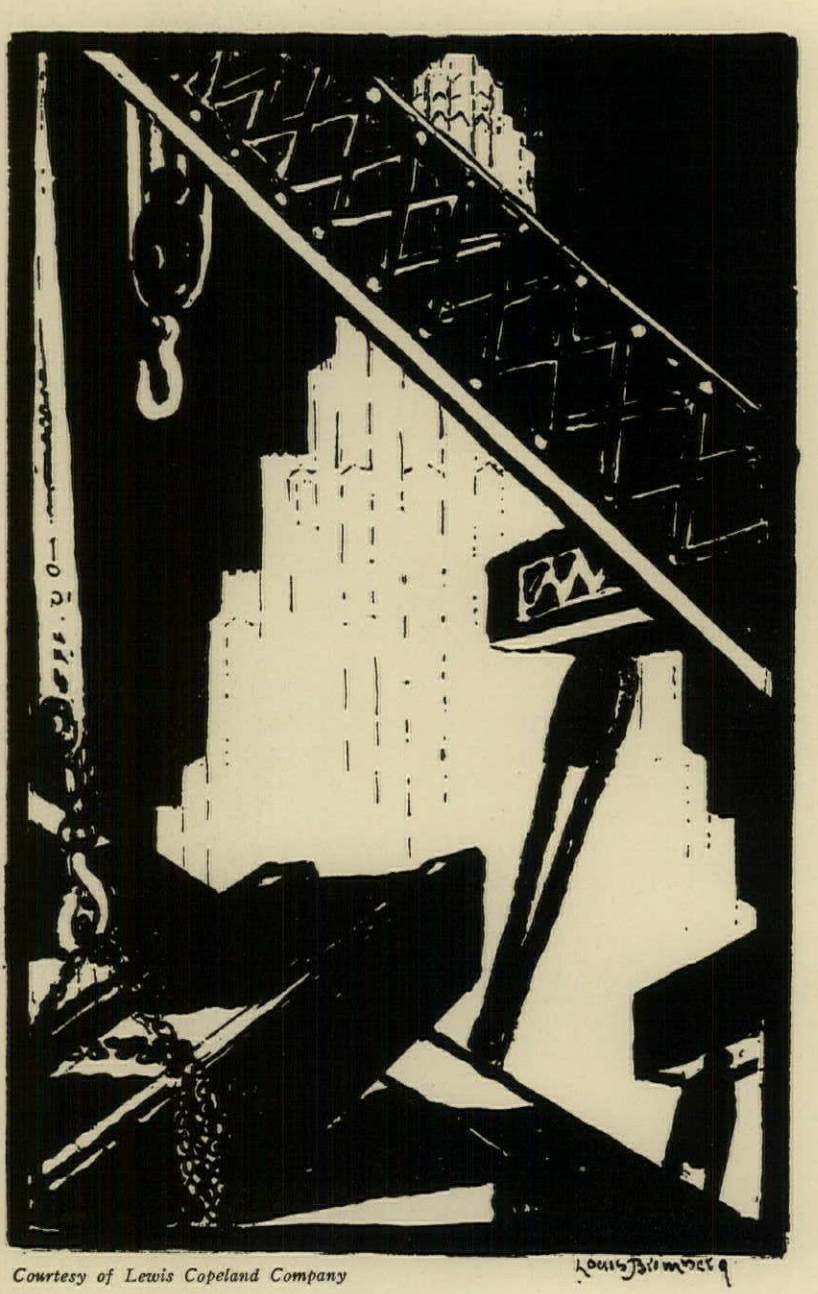

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The Architectural Forum

THE
ARCHITECTURAL
FORUM

VOLUME XLVIII NUMBER FIVE

MAY 1928

COLLABORATION IN BRIDGE DESIGNING

I. THE ARCHITECT

BY

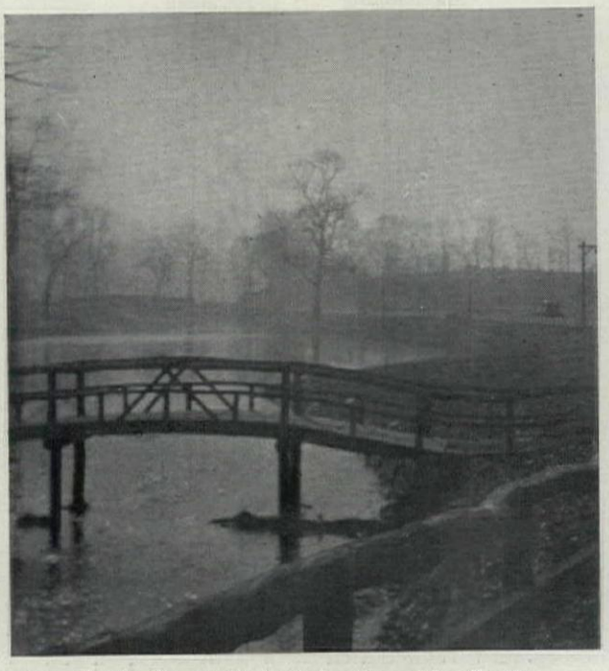
GILMORE D. CLARKE

LANDSCAPE ARCHITECT, WESTCHESTER COUNTY PARK COMMISSION

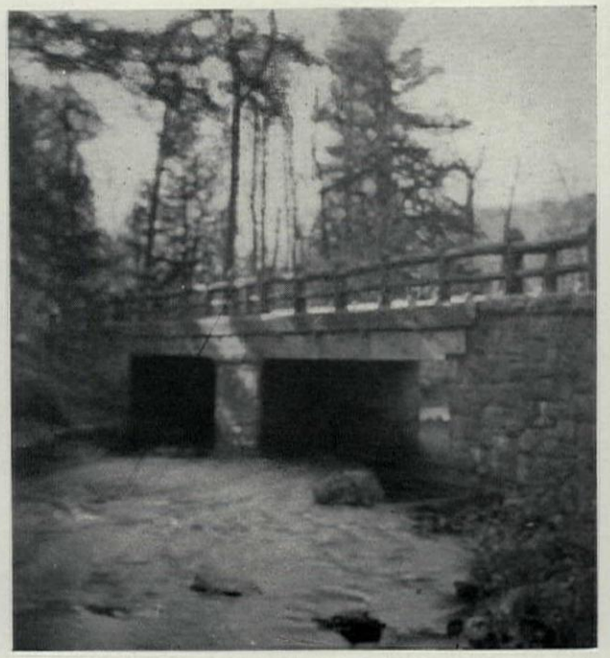
GRANTING that human happiness is greatly enhanced by beautiful and pleasing surroundings, it is highly desirable that utilitarian structures, such as bridges, should be as pleasing to the eye as it is practicable to make them, and that there should be a greater collaboration between the architect and engineer, with a realization on the part of each that science without art is apt to be unattractive, and art without science inefficient."—*Wilbur J. Watson.*

Ten years ago this spring, engineers of the American army were engaged in the construction of bridges across the streams in France to make possible the advance of the allied armies. The engineers were an important link in one of the greatest organizations of men ever assembled, and with a spirit of coördination and coöperation with other services these men made possible the advance of the armies over streams on bridges improvised at short notice. These bridge structures varied from *passerelles,* constructed of rafts kept afloat by gasolene cans, to steel structures of long multiple spans; naturally, appearance counted for naught so long as the structures sufficed for the exigencies of the occasion. We are concerned here with the design of unsightly and purely utilitarian bridges only insofar as to prevent, if possible, their construction on highways, railroads, and elsewhere. Such structures are good enough when built by armies in time of war, but they have no place in our modern civilization where beauty ought to be a much a part of life as food or shelter. But many, unfortunately the majority, of our modern highway and railroad bridges designed by engineers possess little if any more artistic merit than did those war-time structures. The creation of beauty is not primarily the business of engineers, and to obtain beauty we must call upon another profession, that of architecture. Bridges cannot be designed by engineers alone, nor by architects alone. Bridge design may be considered both an art and a science, which of course is true of almost every type of modern building construction. The fact that there have been few, if any, bridges designed by engineers within the past decade which can be said to possess beauty is a sufficient reason for considering the members of the engineering profession unfit to continue in this important work without the aid of architects. The engineer must be brought to a realization of the fact that the art and science of bridge building constitute a joint problem for architect and engineer.

When asked to prepare an article on bridges, I immediately replied that I thought the preparation of the article should be collaborative, since the architect's contribution is but one phase of bridge design. Modern bridge design must be based upon coöperative effort on the part of architect and engineer, just as during those trying times ten years ago the war had to be conducted by the coöperative effort of infantryman, engineer, artillerist, etc. No one branch of the army service could have won the war alone; neither can the engineer alone produce a bridge structure possessing beauty of line, of mass, of texture, of detail. There is, nevertheless, a tendency today on the part of many an engineer to think that the bridge is solely his problem. We see the results all around us, expressed in hideous bridge structures on highways, railroads, and even in some of our parks. Of course there are exceptions, illustrated by such examples as some of the large river bridges about New York which are the result of collaborative design. The designing of bridges requires creative ability of the first order, from the standpoint of artistic as well as of scientific design. Collaborative effort is required, and both architect and engineer must realize that fact. A tremendous amount of effort on the part of that group of broad-gauged engineers who realize that the architect is necessarily a contributor in part to the design of the bridge, is required before artistic bridges will take the places of the ugly structures which are a disgrace to our civilization. The engineers with whom I have collaborated in the designing of many bridges believe thoroughly in collaborative bridge design. That neither architect nor engineer can alone design a satisfactory bridge structure has been proved to them. And they further believe that the architect must do more than merely attempt to "dress up" an engineering design; he must work on the problem with the engineer from the beginning. It has been shown conclusively by the engineers with whom I have collaborated that artistic bridges can be designed



Footbridge at Garth Lake, Scarsdale, N. Y.
Bronx River Parkway

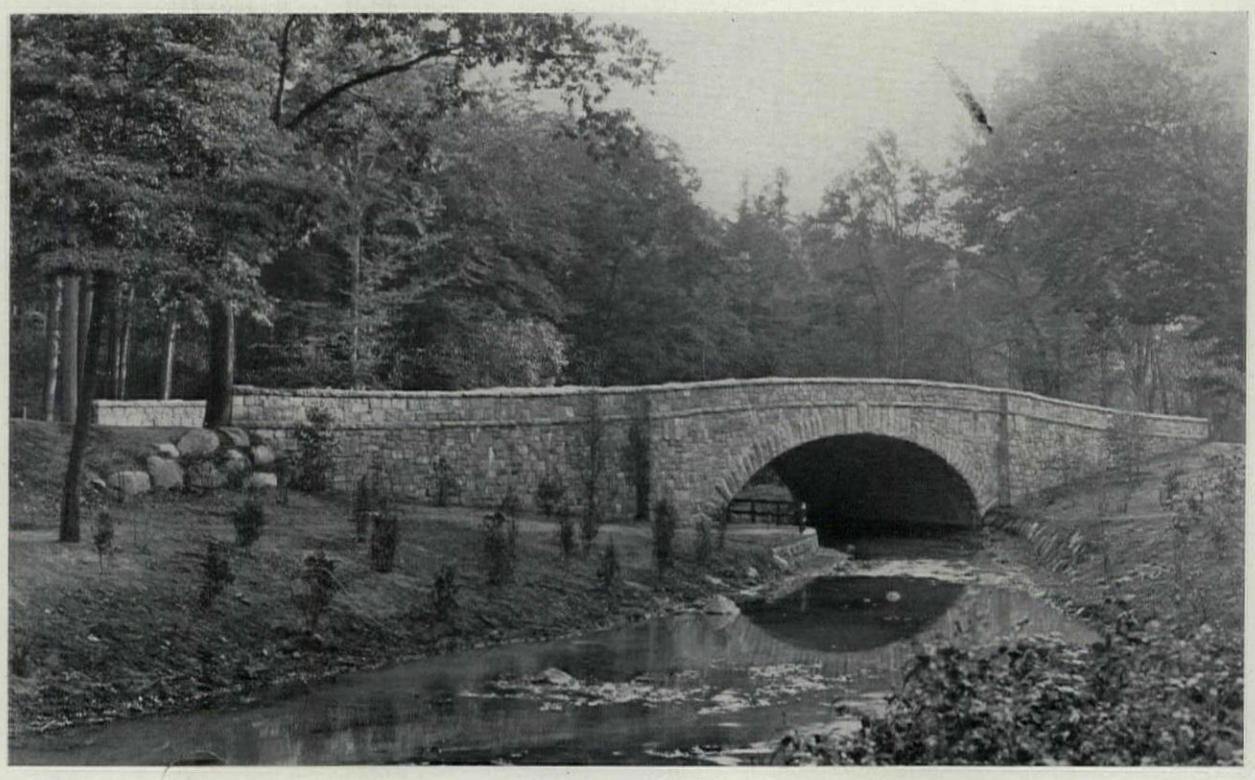


Garth Woods River Bridge
Chester E. Wheeler, Designer

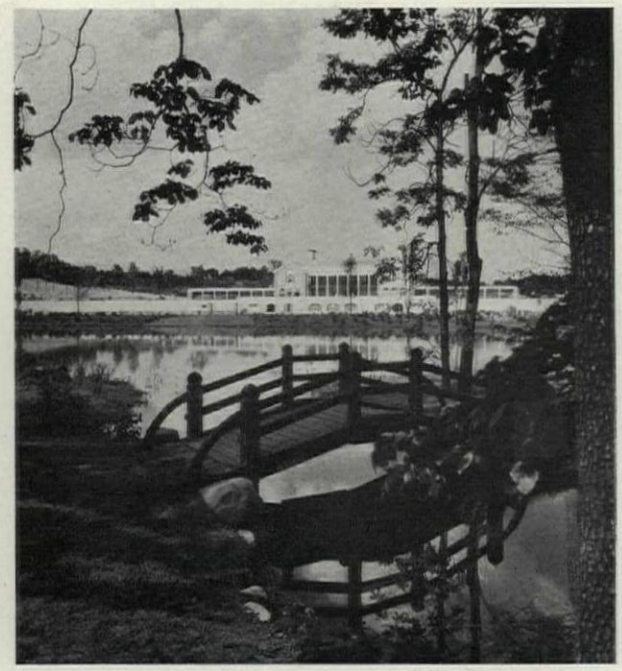
so as to cost very little, if any, more than the ugly.

In spite of a full knowledge of these facts, our nearby neighbors, the engineers in charge of the great program for the elimination of grade crossings in the Empire State, are unwilling to take heed, and still continue to perpetrate upon our highways structures that are a disgrace to an intelligent public. Their designs are still of the types originally developed when reinforced concrete was first used; or, if steel, are similar to those designed 50 years or more ago. How long the public will tolerate the construction of these concrete and steel monstrosities it is hard to tell. The bridge has apparently wandered a long way from the architectural fold of which it was once so charming and honored a member, and I hope the architect may be able to call it back.

In New York state there was for a time some hope of getting artistically acceptable bridge struc-



"Bridge 33," Bronx River Parkway, Hartsdale, N. Y.
Gilmore D. Clarke, Architect A. G. Hayden, Designing Engineer

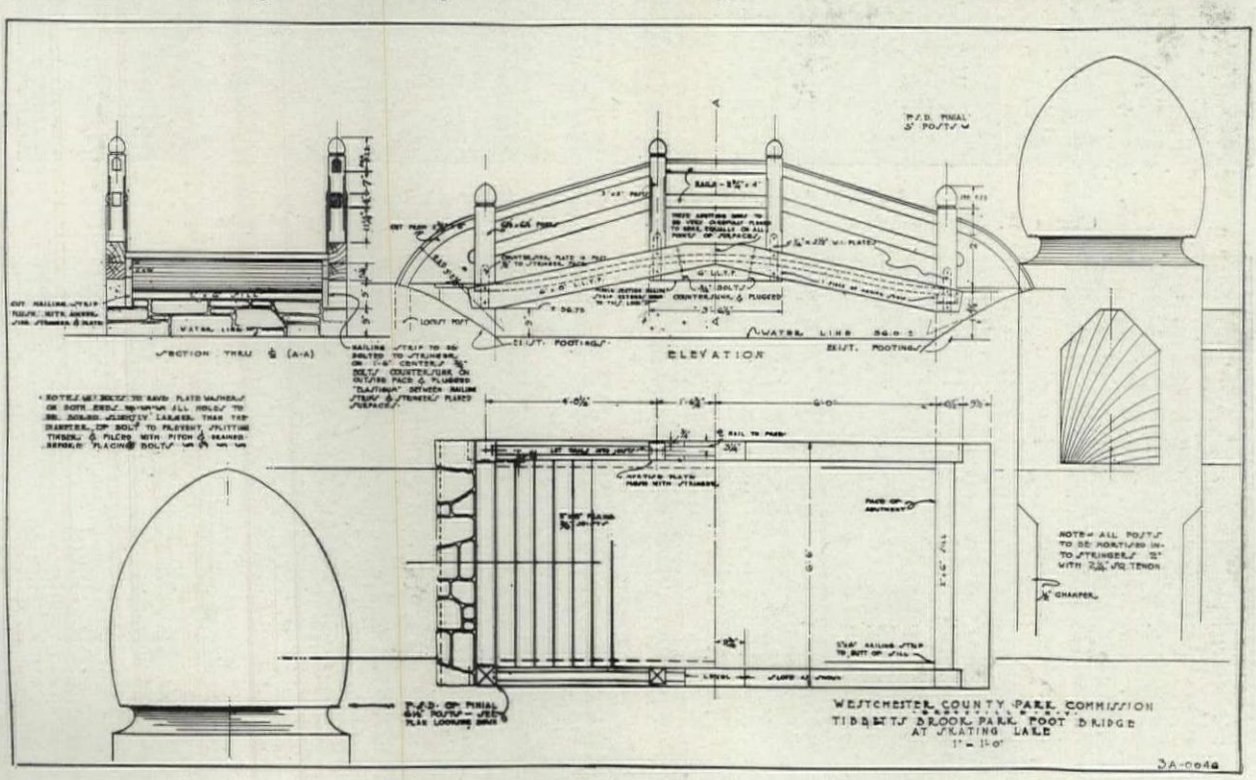


Photos. Nyholm

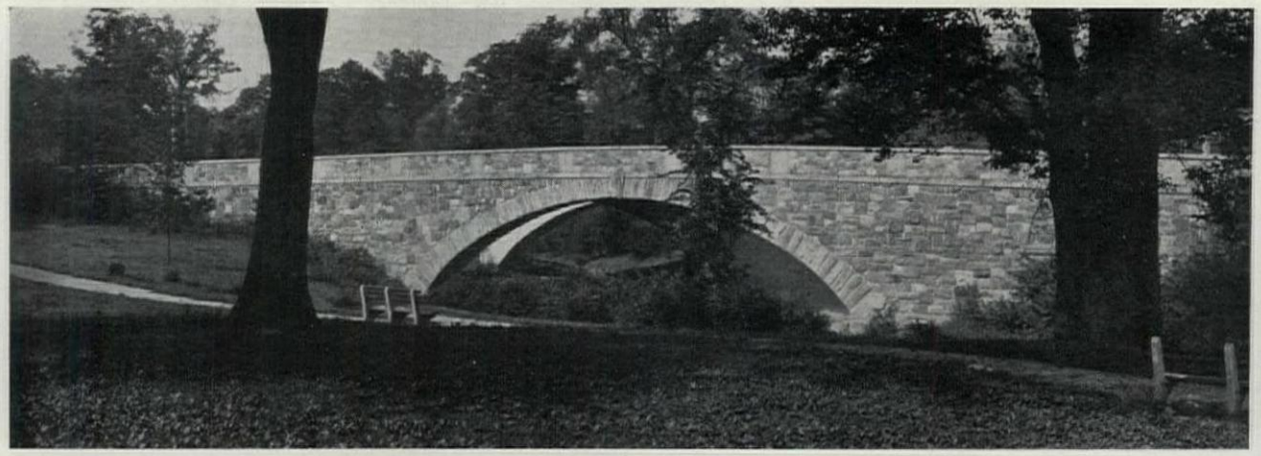
Footbridges, Tibbett's Brook Park, Yonkers, N. Y.

Gilmore D. Clarke, Landscape Architect — A. R. Jennings, Designer

tures for our highways and railroads by reason of the formation of the state Fine Arts Commission, authorized by law to pass upon all structures for which state funds were spent in whole or in part. This Commission functioned effectively for a time, but was abolished a few months ago, and the state has thereby moved backward a decade or more. At present there is no control whatever to protect the public against the engineer, unwilling to admit his limitations, and who designs an ugly bridge which is an insult to the taste of the people who pay for it. The public needs to be informed in full concerning the facts; ugliness is not wanted; it will not be long tolerated. It is time for the architects to act, and I for one believe that the engineering profession will take the stand that the architect should be a collaborator in the designing of bridges as well as of tall buildings. The architectural profession should ac-



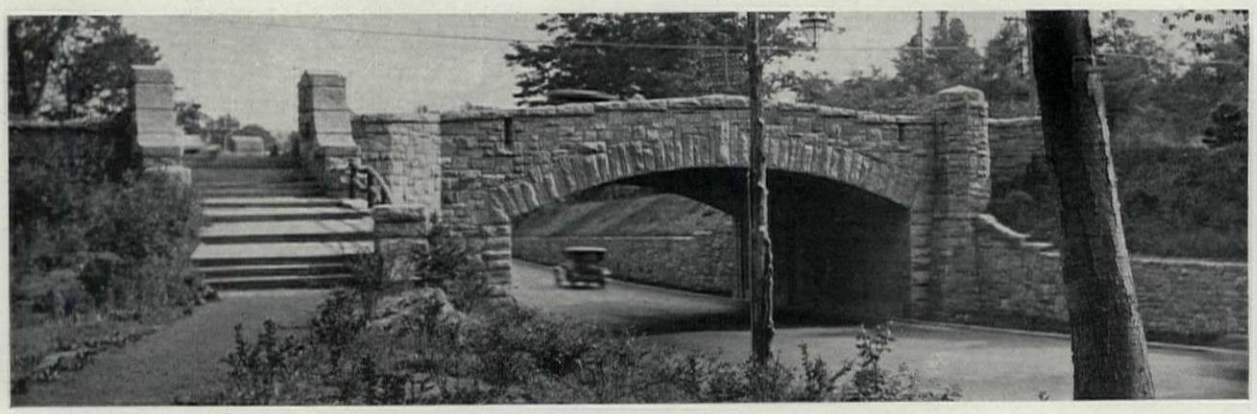
Working Drawing of Footbridge, Tibbett's Brook Park



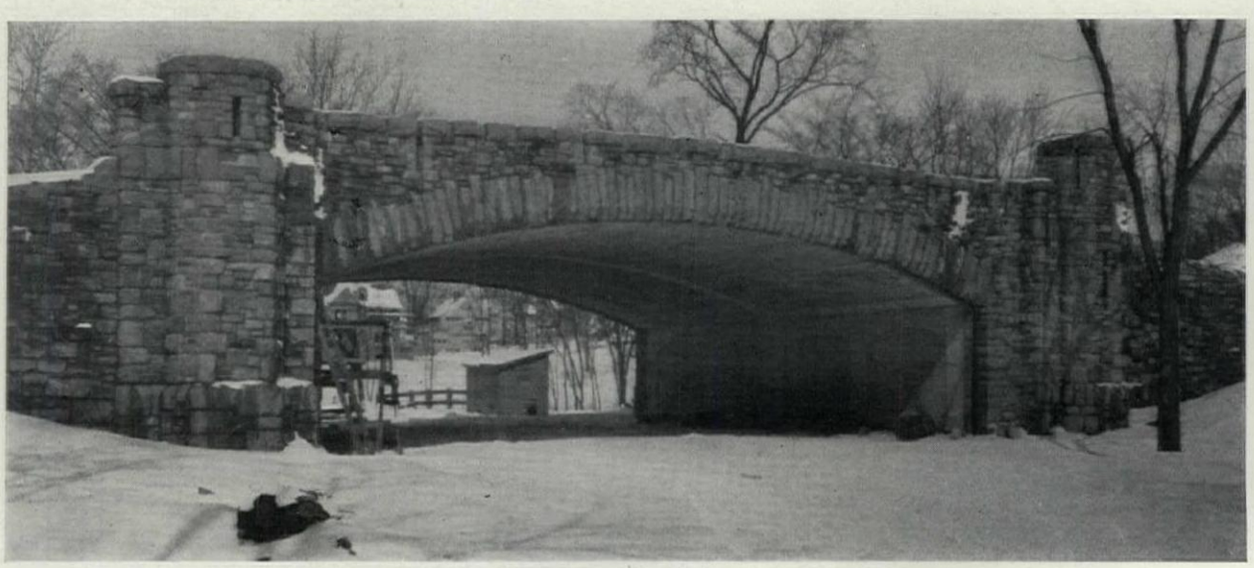
Bridge Over Bronx River, South of Gun Hill Road, New York
Carrere & Hastings, Architects — Guy Vroman, Designing Engineer

cept the challenge and make it a duty encumbent upon it to see that art becomes an inherent part in the design of bridge structures throughout the nation. Noble bridges live longer than any other structures built by man, as many of the old bridges of Europe bear witness,—the *Pont du Gard,* attributed to Agrippa, built in 19 B.C.; the *Ponte Sant' Angelo* in Rome, started by Hadrian; the old *Pont Neuf,* the finest over the Seine in Paris, and many others.

Accompanying this article are illustrations and sketches of several bridge structures built or to be built in parks and along parkways in the County of Westchester, New York, by the Bronx Parkway and Westchester County Park Commissions and designed by architects and engineers in close collaboration. A number of the structures are river crossings; others are at the intersections of parkways with highways, where a separation of grades is imperative for the



Palmer Avenue Crossing of Bronx River Parkway
Charles W. Stoughton, Architect — A. G. Hayden, Designing Engineer

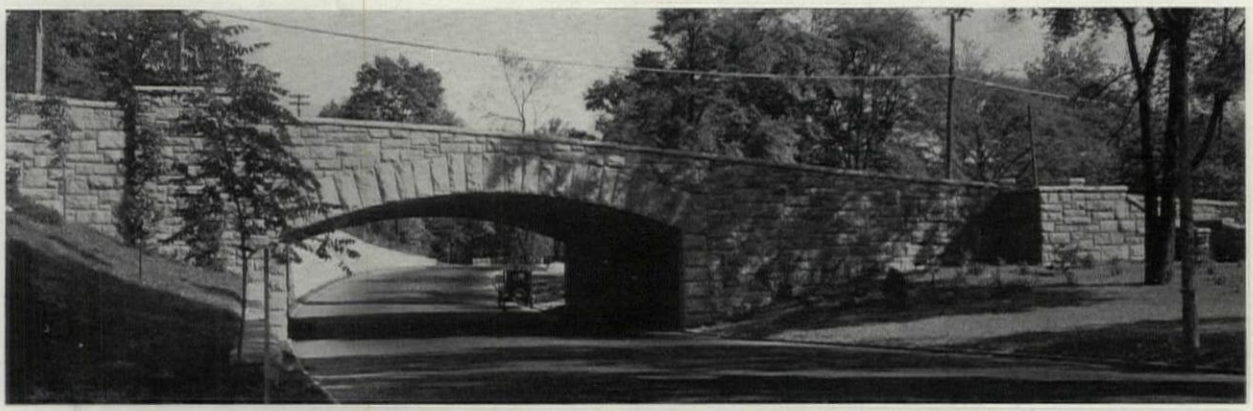


New Rochelle Road Bridge, Hutchinson River Parkway
Gilmore D. Clarke, Architect — A. G. Hayden, Designing Engineer

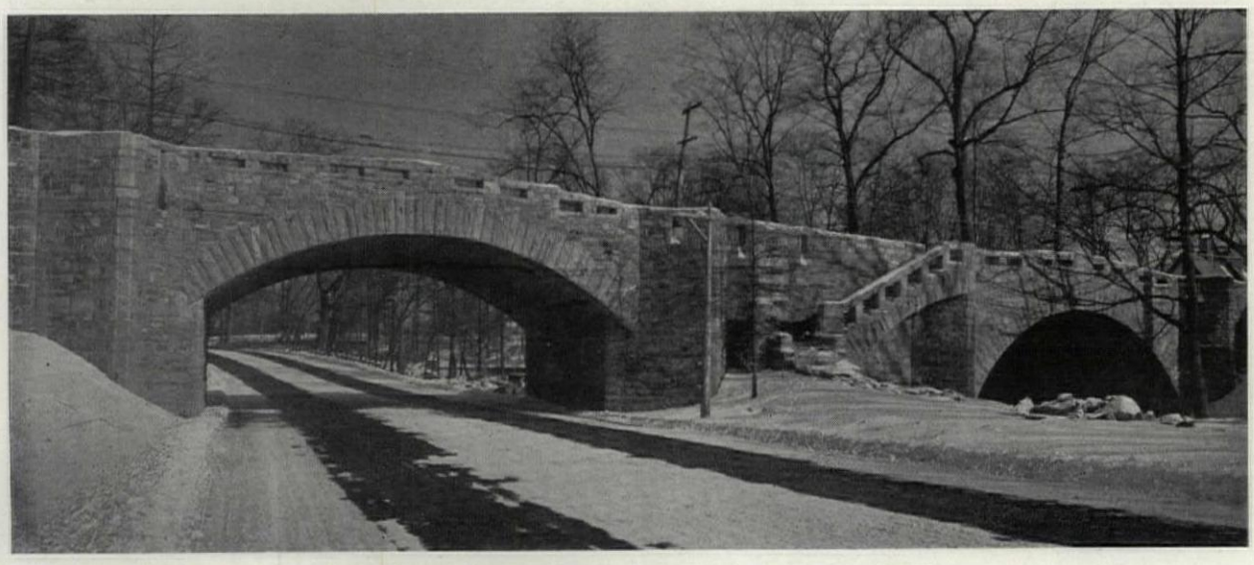
Bridge Over Bronx River at Tuckahoe, N. Y.
Gilmore D. Clarke, Architect A. G. Hayden, Designing Engineer

safety of modern transportation by automobile. Parkway systems are being developed, and similar types of bridge structures will be required, and let us hope that those charged with the conducting of the work spare no effort in order to clothe every structure with a charm only possible when aided by the creative ability of the artist.

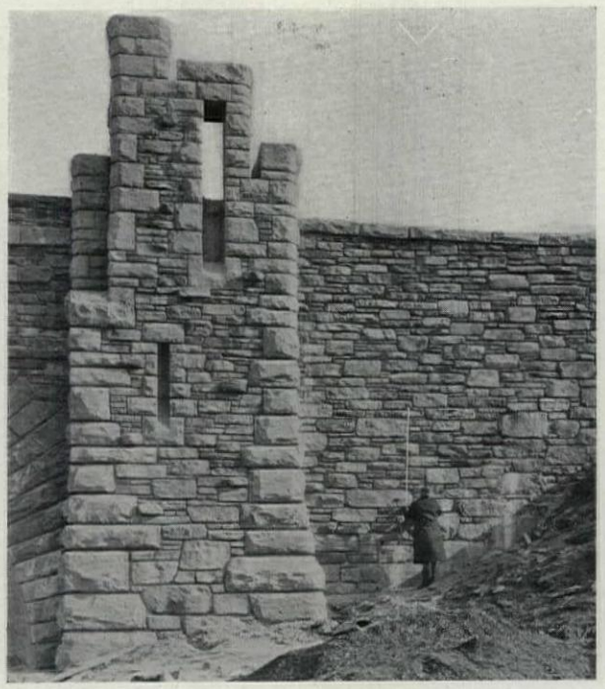
Modern bridge design necessitates the use of steel and concrete. Neither one of these materials harmonizes with a naturalistic countryside, more particularly where rock outcrops abound; therefore the bridges of the Westchester County Park System have been faced with native stone, utilizing the latest developments in engineering design for steel or reinforced concrete. In sections of the country where it is impracticable to obtain stone for facing bridges and where the concrete must be exposed, that material can of course be interestingly treated. There

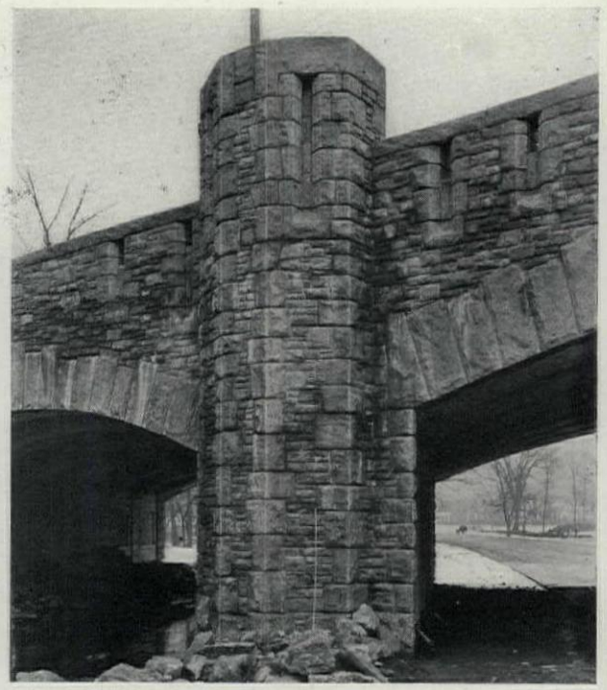


Tuckahoe Road Crossing, Bronx River Parkway
Delano & Aldrich, Architects A. G. Hayden, Designing Engineer



Bridge Over Bronx Parkway Reservation, Scarsdale, N. Y.
Charles W. Stoughton, Architect A. G. Hayden, Designing Engineer

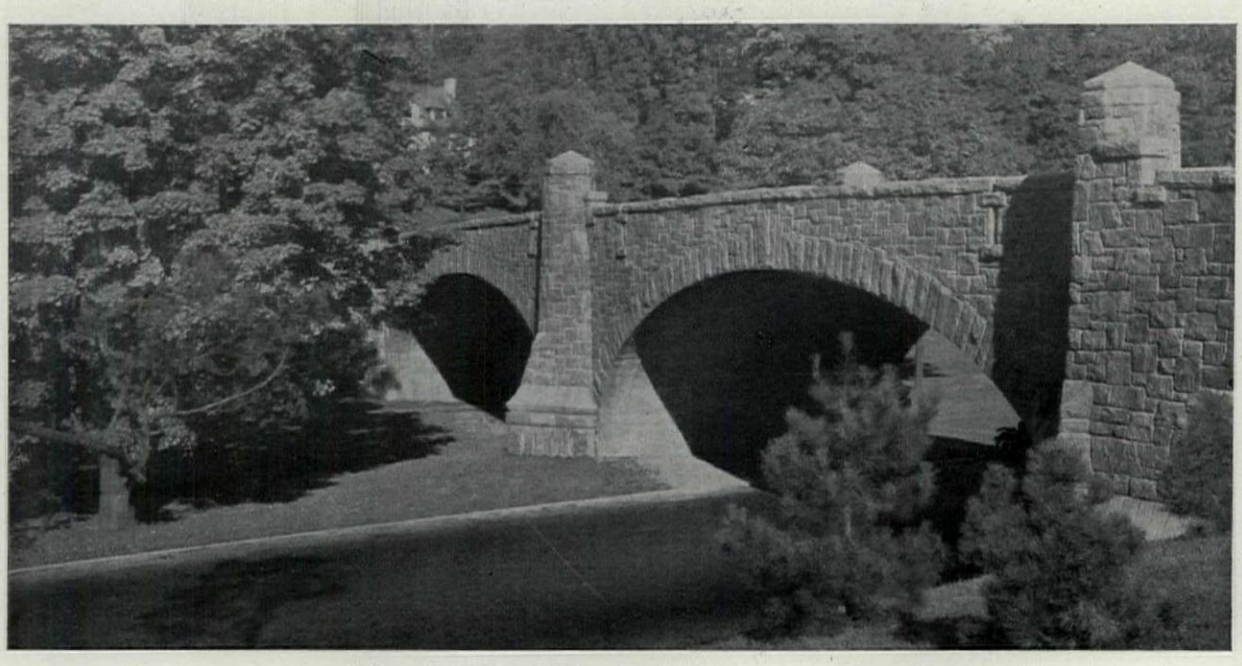




Masonry Details, Bridges of Hutchinson River Parkway
Gilmore D. Clarke, Architect

are many bridges of concrete which possess beauty of mass, of line, and of detail, and which harmonize with their surroundings. Where it is necessary to span railroads, a steel arch is often used in place of the stone-faced reinforced concrete arch, since the railroads are unwilling to bear the burden of the cost of a stone and reinforced concrete structure. A steel arch springing from stone-faced concrete abutments has been proved to be no more costly than the ugly, heavy steel girders on concrete abutments, which railroads are accustomed to build. The New York Central Railroad has coöperated splendidly with the Westchester County Park Commis ion where parkway and railroad closely parallel each other and where single structures must be had to eliminate grade crossings of intersecting highways.

We are making rapid progress in eliminating the ugly bridge, but there is still a great deal of work to be done, and the architects' aid must be enlisted to the end that the bridges of America may possess the same charm as those of Europe. Bridges are a measure of our civilization, as they have been for centuries. Do we want our present generation measured by the ugly bridges we see dotted along our highways, or by bridges treated by artist and engineer, æsthetically good and structurally sound?



Bridge Over Bronx River Parkway, Crestwood, N. Y.
Bowdin & Webster, Architects A. G. Hayden, Designing Engineer

COLLABORATION IN BRIDGE DESIGNING

II. THE ENGINEER

BY

LESLIE G. HOLLERAN

DEPUTY CHIEF ENGINEER, WESTCHESTER COUNTY PARK COMMISSION

WHAT has the engineer to do with bridge architecture or, for that matter, with the architecture of any structure? On the one extreme he may become the passive servant of the architect, and possibly lend himself to the perpetuation of unsuitable or uneconomical structural forms; on the other hand, he may become his own architect, with the disastrous results, from an artistic viewpoint, which Mr. Clarke has pointed out in the accompanying article. These extremes are equally undesirable. Between them, however, lies the middle ground of active coöperation between the engineer and the architect, by which the engineer is often able to lead the architect away from use of architectural designs which involve bad engineering, and by which on the other hand the architect must sometimes convince the engineer that a certain form of structure is bad architecturally or unsuited to the surroundings in which it is to be placed. It is gratifying to know that this active coöperation, which has long been customary in Europe, is gradually becoming more common in the United States. The movement in this direction will undoubtedly be accelerated by pressure from the general public, which is gradually acquiring a keen appreciation of properly designed structures that harmonize with their surroundings. This public will not much longer tolerate additions to our past mistakes in the way of ugly structures, such as continue and will continue to disfigure urban vistas and suburban landscapes everywhere throughout our land until they are worn out or torn down through obsolescence.

This appreciation of better design is, strangely enough, being fostered to a very great extent by strictly commercial interests, such as the manufacturers of our motor vehicles, musical instruments, radios, and other everyday equipment, in which mechanical design has reached a high degree of perfection; and improvement in outward appearance has become one of the principal aids to sales promotion. The problem of adapting structural forms to satisfactory architectural requirements is often difficult and frequently requires the discarding of ideas and methods which have been considered essential since scientific design originated. While the basic theories of structural design, which are founded on natural laws, must necessarily be retained, the requirements of the engineer and those of the architect can, nevertheless, be brought into substantial conformity if there is a sufficient desire to have them do so. It will never be possible to reach common ground if the engineer assumes the attitude that the structural requirements are of paramount importance, nor if, on the other hand, the architect is unalterable in the belief that the architectural requirements are supreme. In any given problem it will almost invariably be found that the requirements of one or both can be modified without greatly compromising the requirements of either.

The architectural and structural forms illustrated

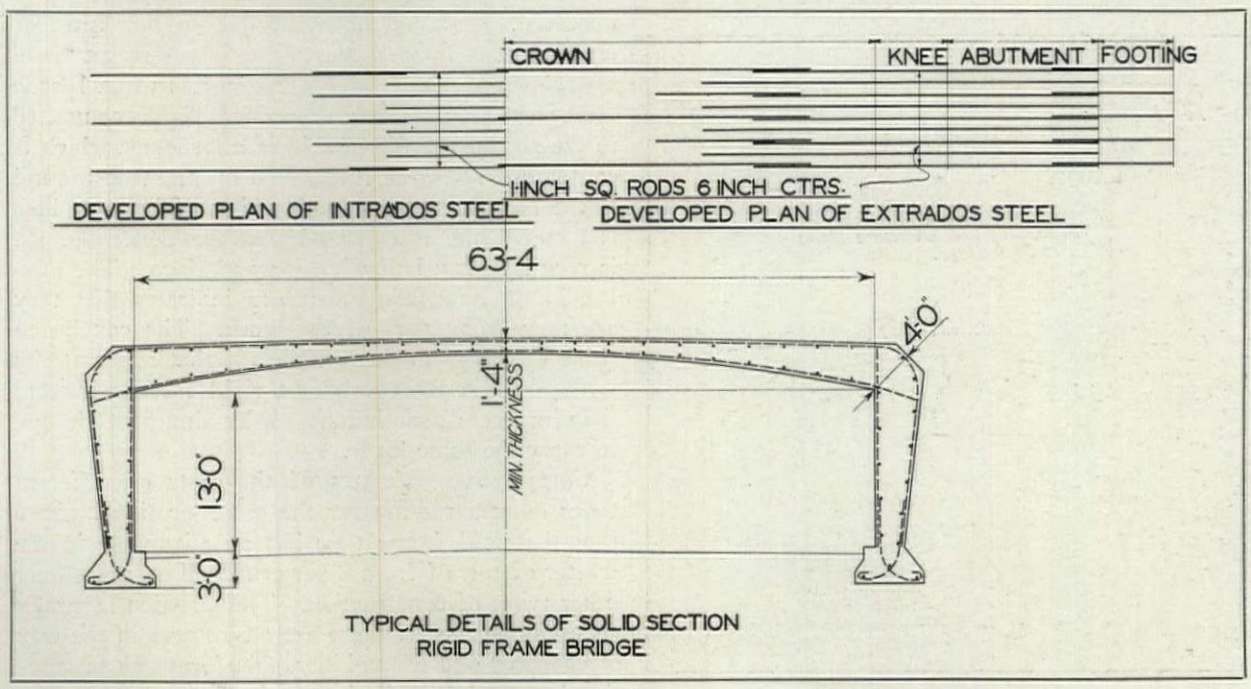
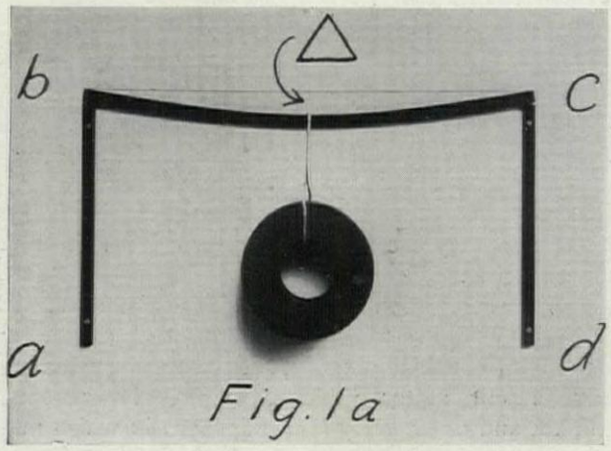
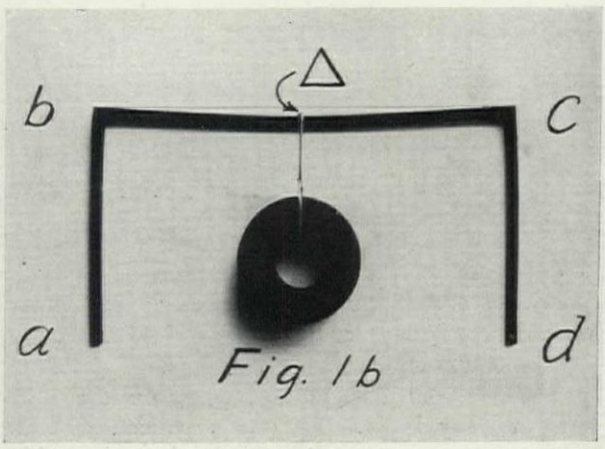


Fig. 1



Model of Girder Abutment Bridge. Girder Simply Rests on Supports



Model of Continuous Rigid Frame Bridge. Girder and Supports Form One Frame

in these pages were, it is true, adapted to the requirements of park and parkway construction, but there is nothing inherent in their design or construction which would preclude their use on highways throughout the country. Fig. 1 shows the design of a rigid frame reinforced concrete structure which was adapted for use in bridge construction by the Westchester County Park Commission's designing engineer, A. G. Hayden. Mr. Hayden describes this design in these words:

"The principle of continuity (rigid frame construction) was deliberately applied in the invention of a new structural form calculated to best meet conditions imposed by restricted headroom at highway crossings and possessing the utmost flexibility for architectural treatment. New methods of design were developed, which permitted great improvement over the few existing examples of simple frame construction. Moreover the new type of structure showed substantial economy over many other types.

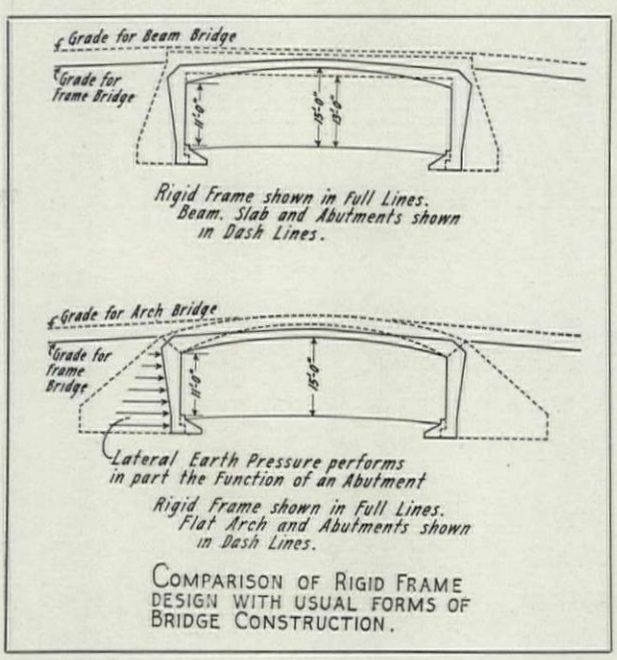


Fig. 2

Fig. 1 illustrates a statically indeterminate structure, that is, one in which analysis of the stresses is impossible by the principles of statics alone. The determination of the stresses is possible, however, by higher forms of analysis. It is beyond the scope of this article and the ability of the writer to enter into a thorough discussion of stress analysis for indeterminate structures. Those who desire to go more fully into the matter of design are referred to articles by A. G. Hayden, *Engineering News-Record*, January 11, 1923, p. 73; *Engineering News-Record*, April 29, 1926, p. 686; by Professor George E. Beggs of Princeton University in the "Proceedings of the American Concrete Institute, 1923." Figs. 1-a and 1-b will indicate clearly the difference between the statically indeterminate rigid frame and another common type of construction. In Fig. 1-a is shown a model of a girder-abutment bridge of three parts, a girder simply resting on two supports. A load is applied and a certain deflection, $\triangle$, is observed. It should be noted that in this form of structure the supports play a purely passive part and are subject to compressive stress only. In Fig. 1-b the same parts are used, but the girder is rigidly connected to the supports. We now have a structure which is continuous from the foundation on one side around to the foundation on the other side. The same load is applied, and it is found that the deflection, $\triangle$, is now less than half what it was before. The flexure in the supporting members indicates that they are now doing part of the work. The conclusion to be drawn from these models is that less material is required in the continuous rigid frame structure than in the discontinuous girder-abutment design, to carry the same loads.

Comparative estimates of the costs of different types of construction for the same location indicate that the rigid frame type has an advantage in the matter of cost of from 8 per cent to 10 per cent over other types of construction. The question naturally arises as to why, if there are advantages in the way of economy and adaptability, this form of construction has not been seized upon for general use. One

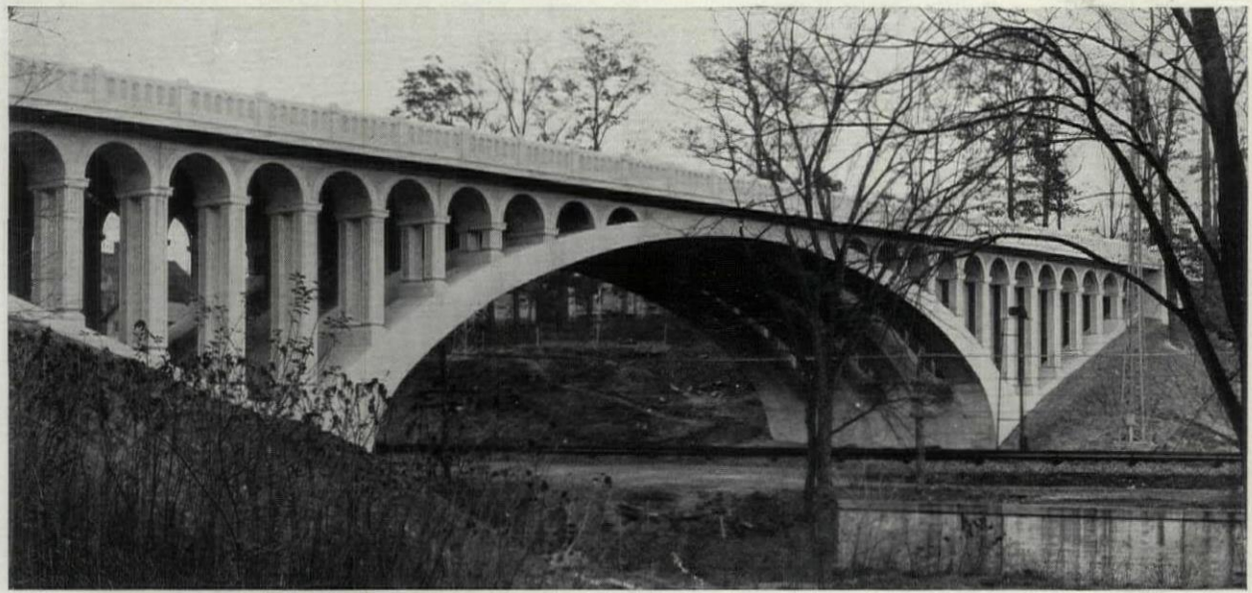


Fig. 3. Reinforced Concrete Bridge, Bronx River Parkway, near White Plains, N. Y.
Palmer & Hornbostel, Architects Guy Vroman, Designing Engineer

reason is that inertia must always be overcome before an innovation of any sort is generally adopted, and the second is that while most engineers in general practice are able to handle beam-abutment designs, reinforced concrete girder-slab-abutment designs, or even reinforced concrete arch designs, they are alarmed at the apparent complexity of the mathematics which must be employed in the designing of many statically indeterminate structures. It has been found in the work of the Bronx Parkway Commission and the Westchester County Park Commission, however, that as the designing of structures proceeds, new and shorter methods are continually being developed. These are being published in the technical journals, and as they become more and more widely known, they will, no doubt, be more generally adopted for use in highway bridge construction and for grade crossing elimination work.

In Fig. 2 the advantages of the rigid frame design in the way of economy of material, increase in headroom due to decrease in depth of material, and resulting decrease in grades for the same length of

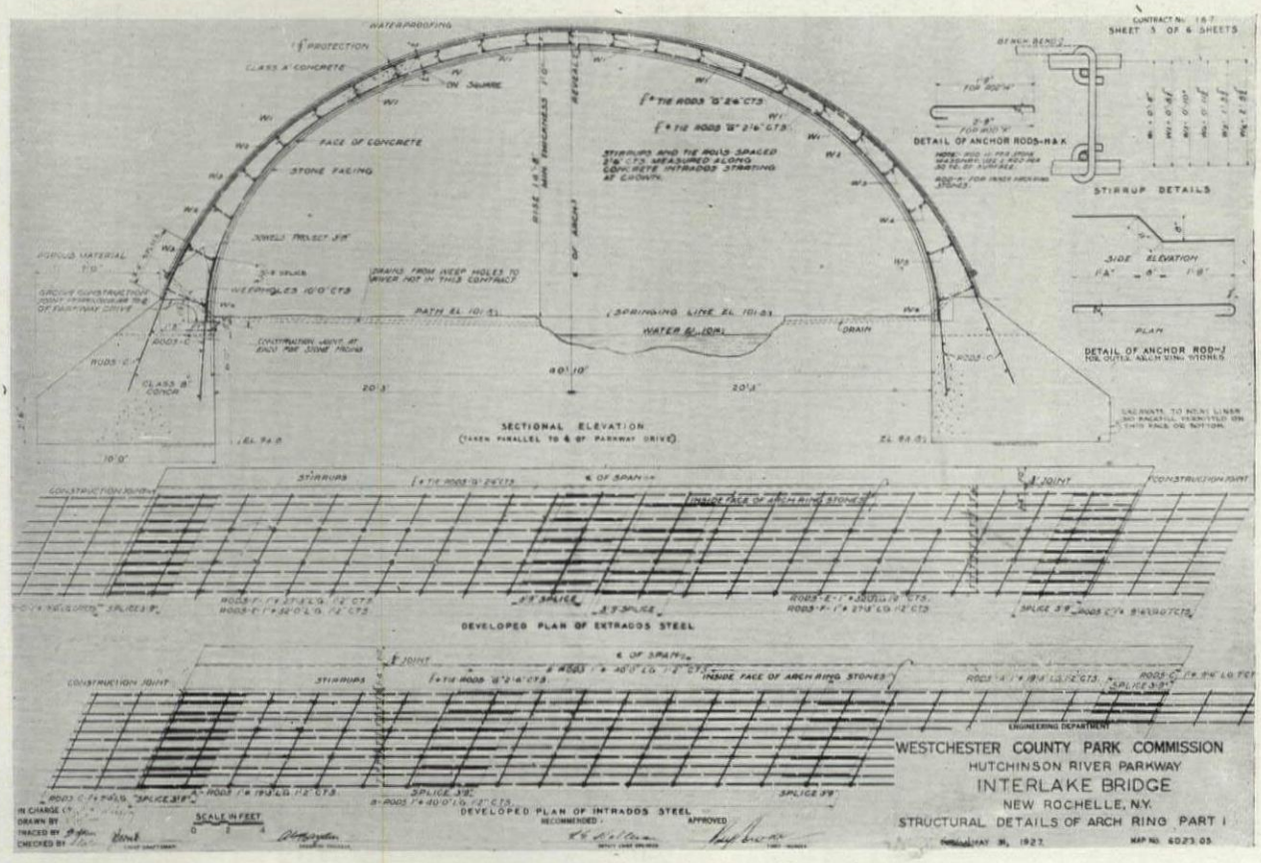


Fig. 4. Economical Type of Reinforced Concrete Arch

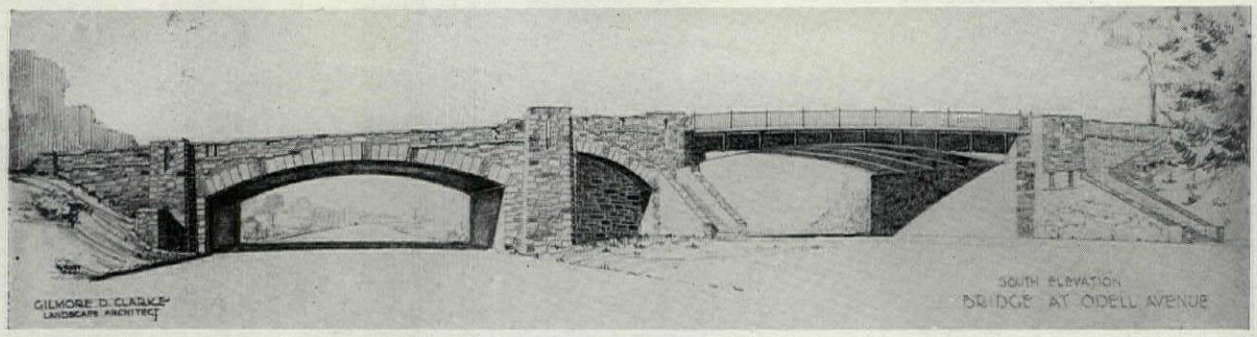


Fig. 5
Architectural Design for Odell Avenue Bridge, Saw Mill River Parkway
Stone Faced Rigid Frame Span at Left. Steel Rigid Frame at Right
Gilmore D. Clarke, Architect A. G. Hayden, Designing Engineer

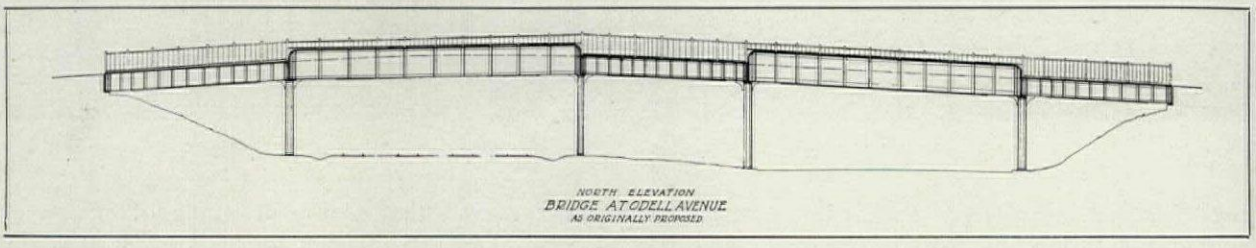
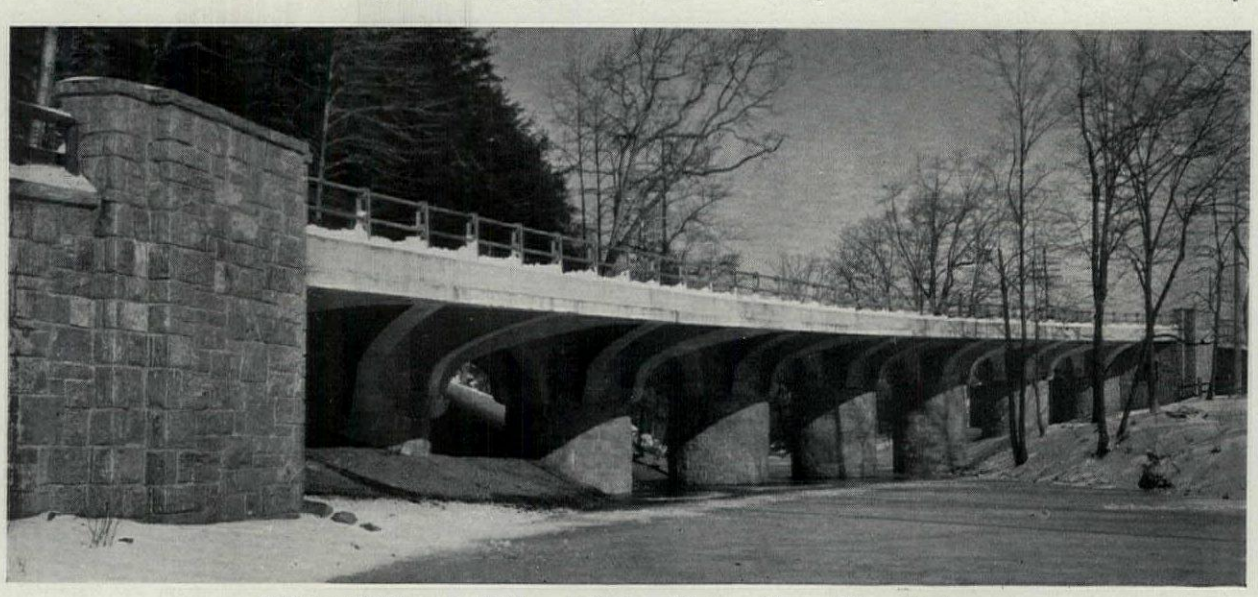


Fig. 6
Steel Girder Design Originally Proposed for Odell Avenue Bridge

approach, are strikingly shown. This rigid frame design was used as the structural parts of several of the bridges shown in this and the accompanying article by Mr. Clarke, and in a number of other bridges not illustrated. Nor should the reinforced concrete structure without stone facing be entirely discarded. There are locations where a properly designed concrete bridge will be found not inharmonious. Fig. 3 shows such a bridge, which was erected in the Bronx River Parkway over the Bronx River and tracks of the New York Central Railroad near White Plains, N. Y. Fig. 4 shows a very economical reinforced concrete design which lends itself to certain forms of arch construction. Steel may also be adapted to certain locations and conditions, as is evidenced by the bridge shown in Fig. 5, which was designed to take the place of a broken-backed girder bridge originally proposed and shown in outline in Fig. 6.

The coöperative spirit under which the Bronx Parkway Commission and Westchester County Park Commission bridges have been designed, and the new structural forms which have been developed by Commission engineers for adaptation to the architectural requirements, have caused widespread discussion, particularly among engineers. Representatives from several state highway departments and railroad companies have visited the Commission's offices to study the methods used so successfully.



Reinforced Concrete Bridge of Unique Design, Bronx River Parkway
Delano & Aldrich, Architects A. G. Hayden, Designing Engineer

PLUMBING FOR THE TOWER TYPE OF BUILDING

BY
HAROLD L. ALT

MODERN development in building construction tends toward the planning and erecting of higher structures. Congestion of population, rising real estate values, and the desire for light all combine to make increased heights desirable, and since the plans of a building over 100 stories high were approved by the New York Bureau of Buildings, no doubt of the possibility of making structures of lesser heights entirely stable should exist.

Granting that, with modern steel construction scientifically designed, buildings of from 40 to 80 stories are entirely feasible, the next problem has to do with the proper servicing of such an enormous amount of floor area so high above the street. Elevators to properly serve the upper floors require so much additional space as to seem almost prohibitive; heating lines grow to abnormal sizes, with the expansion increased in proportion to the height; the chimney occupies a gross floor area, owing to the large number of stories through which it must pass, as to seem unreasonable. But the greatest difficulty seems to concern the plumbing. It must be remembered that the plumbing system handles water, and as water is a commodity of considerable weight, difficulties arise in the plumbing which require special treatment. Roof drains, soil stacks and hot and cold water lines are some of the items which cannot be handled in the same manner as in lower structures. Pipes multiply and require space allotment which would be considered out of proportion in lower buildings.

Plumbing Work. It is the purpose of this article to point out some of the difficulties encountered with plumbing in the high or "tower" type of building, and to make constructive suggestions in connection with various schemes that have already been worked out for the purpose of overcoming these difficulties. For the purpose of this article the "plumbing," as far as covered, will be considered as consisting of soil, waste and vent stacks, hot and cold water pipes, and roof leaders. Special services, such as compressed air, gas, vacuum cleaning, drinking water, refrigeration, fire lines and so on, cannot be covered in an article of limited length, so these must be left for future consideration. In general, a building in which proper provision has been made for the incorporating of the major services, can have the special services included with only unimportant changes.

The Soil System. In providing for water closets in high buildings great care must be taken in arranging the soil piping; this is due, primarily, to the unusual height and to the excessive number of fixtures on a stack. In cities where combined soil and waste stacks are permitted, the load on the stack is increased by whatever number of waste branches drain from each floor. In order to assure the most dependable type of service, soil stacks are run so as to take care of alternate floors. Thus one stack would take the drainage from all the odd numbered floors in the manner illustrated in Fig. 1. In the event of one of these stacks becoming clogged up or having a stoppage occur in the horizontal basement section, only the toilets on alternate floors would be put out of commission, so that occupants by going either up or down one flight of stairs would find facilities in spite of the one stack's being unusable. At the base each stack would be run into a separate house sewer, which would be carried to and connected with different sewers in streets on either side of the building, so that even the temporary blocking of the street sewer or connection between the building and the street would still leave toilets on alternate stories in service.

Soil stacks for the lower portion of the building should be taken care of separately from those serving the higher portions, and the arrangement should be made so that stacks serving the upper portions have no connections of any nature with those in the lower stories, this again operating toward a reduction in stack size and also giving an opportunity for the building of an enormous head behind any stoppage which may occur near the bottom of the stack or in the horizontal run to the street. Setbacks, which usually accompany the tower type of construction, materially aid this arrangement by permitting soil stacks serving the lower portions of the building to be brought out of the lower setback roof and there terminated. Stacks serving the next higher section run through the lower section without openings and serve the portion of the building between the first setback and the next higher; this scheme is followed out until the stacks going to the top of the tower portion are encountered, which stacks serve alternate floors in the tower with no outlets below. This is diagrammatically shown in Fig. 2. It has been found that in tall structures it is not desirable to run soil stacks in a perfectly straight, vertical line, because the water flowing down the stack attains too high a velocity, giving rise to noise. For this reason soil stacks are deliberately offset at points about 10 stories or 15 stories apart, and the flow is thus retarded. Provision for such offsets or changes in direction should be made in the original building design, since otherwise considerable difficulty may be experienced in trying to incorporate them later.

Waste Stacks. Waste stacks must be provided where lavatories are to be installed in offices, and these in most cases will follow the structural columns. Considerable floor space may be saved if the installation of these waste stacks is anticipated in laying out the steel frame. It may sound unreasonable to suggest the arrangement of steel framing

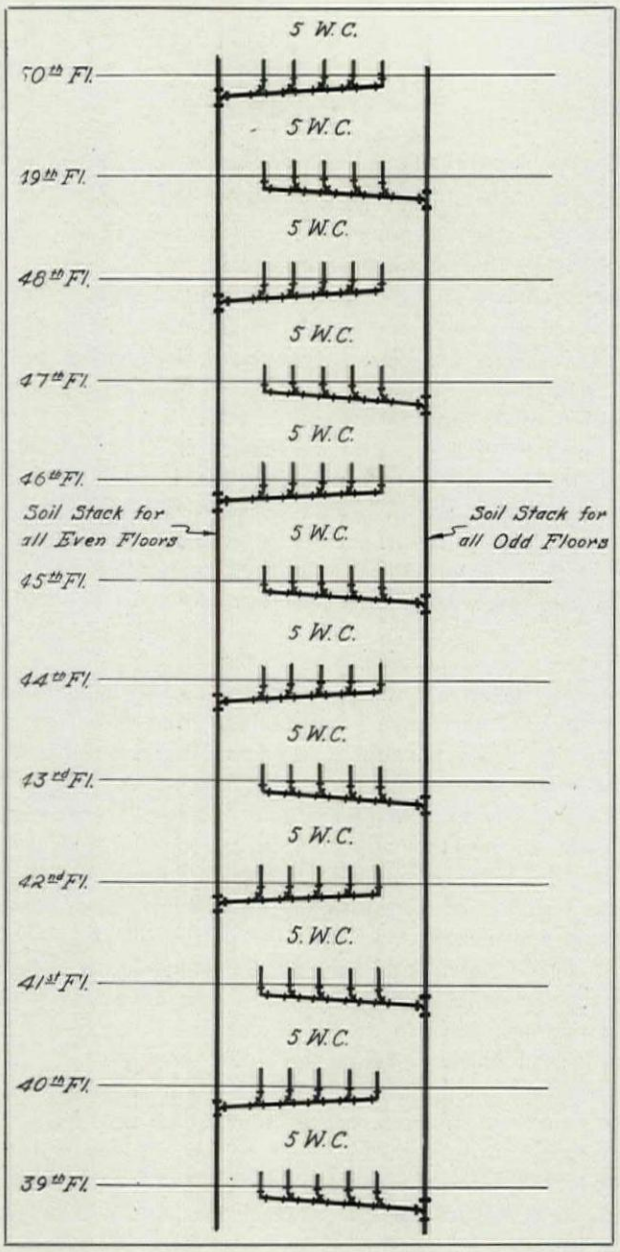


Fig. 1

to suit the plumber's waste pipes, but such has already been done and the space saving is considerable. It is not necessary to make any changes in the structural steel beyond working out a special column connection for beams, so that a small opening is provided on each side of the column in the manner illustrated in Fig. 3. This is commonly termed a "bracket" connection as distinguished from the ordinary "angle" connection shown in Fig. 4. This scheme lends itself very readily to the putting of the waste stack and cold water riser on one side of the column and the vent stack and hot water riser on the other side, as illustrated in Fig. 5. If the ordinary steel framing should be used, about the best that could be done would be as indicated in Fig. 6. The remarks just made about soil stacks apply in less forceful form to the waste stacks; they should not be made over 3 inches in size if possible, and they should serve only certain horizontal sections of the building; they should be offset or shifted from time to time to break the water fall.

Vent Stacks. Venting and vent stacks should receive careful attention. Plumbing codes vary so greatly in their venting regulations that it is hard to give any recommendations except to say that in high buildings vent stacks should be installed whether the local code requires their use or not. Where larger sizes are not demanded by ordinance, the vent stack may be safely made somewhat smaller,—a 6-inch soil stack with a 4-inch vent stack or a 4-inch soil stack with a 3-inch vent stack. For waste stacks the same applies, only running to smaller sizes, such as a 4-inch waste stack and 3-inch vent stack, a 3-inch waste stack and a 2½-inch vent stack, or a 2½-inch waste stack and a 2-inch vent stack. There is nothing to be gained in offsetting vent stacks, as there is no water flowing through them. Vent stacks should be parallel the respective soil or waste stacks which they serve, and as soon as the bottom connection on each particular stack is reached, the vent stack should be run back into the stack through a 45° ell and a Y fitting. There is no object in venting soil or waste below the bottom fixture connection, since any air caught below this point cannot blow out in fixtures below (owing to there being no lower connections to the stack), and any retarding effect on the falling water in the stack is really of beneficial character.

Materials of Construction. In all high building work, galvanized steel or galvanized wrought iron pipe can be used for waste, soil and vent stacks, this being made up with galvanized, cast iron, screwed recessed, drainage fittings, with all pipe most carefully reamed out. Where lines run underground, extra-heavy, uncoated, cast iron soil pipe and fittings with calked lead and oakum joints should be used. Expansion joints are sometimes used in the vertical risers every 20 stories or less, but difficulty will probably be experienced with the local authorities if any type of slip joint is advocated. A corrugated copper joint with flanged ends and companion flanges can generally be used. There is also a cast iron slip joint which has been approved in some of the large cities.

Water System. Furnishing water supply for the building will have an important bearing on the building design, and this is one point on which it is well to be forewarned. It is most essential to keep the water pressures down to a point where excessive splashing and undue wear and tear on the equipment will be avoided. For this reason the building should be divided into horizontal sections or zones of 10 to 15 stories each, and each of the separate zones should have its own individual house tank and hot water heater. The house tanks and hot water heaters for the same zone will not come in the same tank room. In order to obtain satisfactory water pressure on the highest floor of each zone, the tank room for that particular zone should be located in the zone above

and two stories higher. This will result in a pressure head on the fixtures in the top story of the zone equal to that of two stories plus the height of the water line in the tank (which usually is about 25 or 30 feet). The hot water heater for the same zone must be located at the bottom of the zone in order to circulate the zone by gravity.

Hot Water Systems. For convenience the hot water heater is usually placed in the tank room of the zone below, and the hot water is fed down one story without circulation, but it circulates to the stories in the portion of the zone above the hot water heater level as usual. This will probably he made a little more clear by referring to Fig. 7, where a typical zone is illustrated with the levels on which the house tank and hot water heater for that zone would be installed. Of course the hot water heaters may be dropped down to the story below the lowest in the zone, which will give hot water circulation to all stories included in the zone without dead ending. This will entail extra heater rooms at certain levels which will not be the same levels as those on which the house tanks are set, so that this arrangement, which is shown in Fig. 8, is usually not as economical in floor space as the scheme shown in Fig. 7.

Materials for Water Systems. It is the growing practice to use brass pipe and fittings for both hot and cold water lines in the best class of construction work, and especially when lines cannot be replaced readily. Steel and genuine wrought iron pipe, galvanized, are often installed in the larger sizes, owing to the greater thickness of shell and the rapidly increasing cost of brass as the diameter enlarges. All joints should be screw joints on the smaller sizes and flanged joints on the sizes of 6 inches or over. They should be made up with only red or white lead used as a lubricant on the male thread only, and they should be tested to a pressure 50 per cent in excess of the maximum working pressure. House tanks are invariably steel, usually square or rectangular, and braced with substantial angles; they are built with angle iron curbs, and have ⅛-inch steel covers, made up in sections and suitably stiffened. The house tank construction is similar to that in the building of ordinary height. The same may also be said concerning the hot water heaters; owing to the zoning of the building, the pressure on the heaters is no more than that ordinarily encountered in lower buildings, and the same heaters of proper capacity will give satisfaction in structures of the tower design.

Hung Ceilings and Pipe Spaces. It is highly desirable to zone the building for water supply purposes at the earliest possible moment, so as to provide hung ceilings with pipe spaces above for horizontal distribution mains. When such spaces are provided it not only means increased floor heights for those particular stories but also provides the heating system with horizontal distribution space for supply mains and drip lines. With a proper amount of forethought, ceiling spaces and tank rooms may

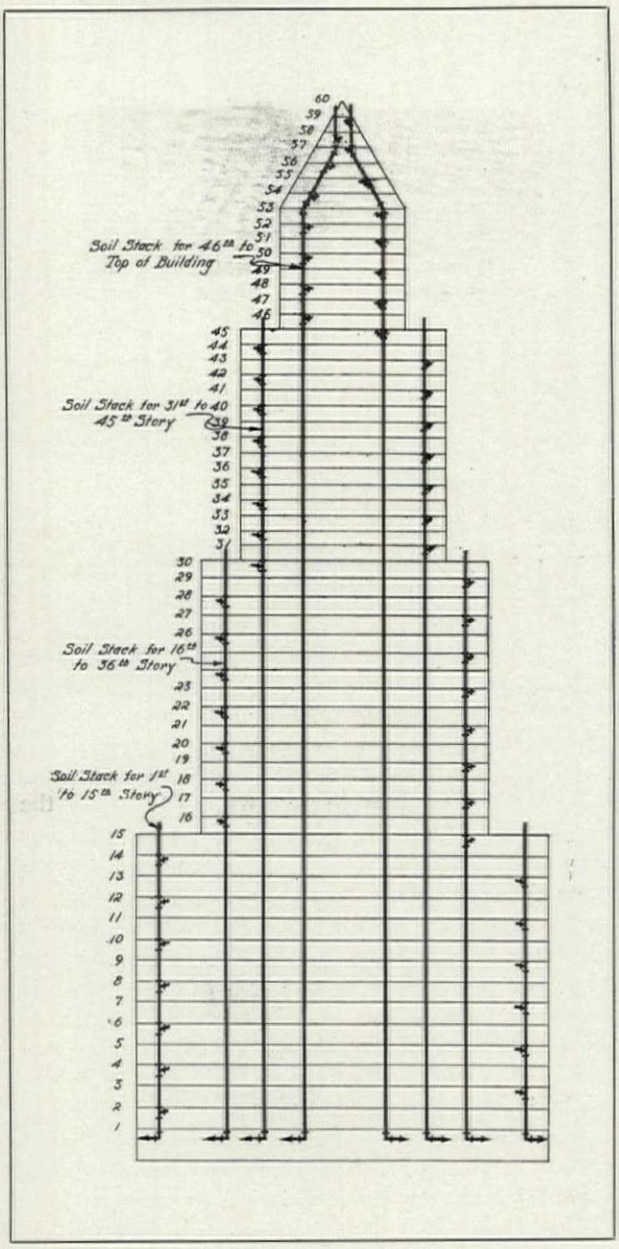


Fig. 2

be arranged so as to dovetail with the hot water and heating arrangement. Through lack of appreciation of certain possibilities in the original designs, most builders fail to take the full advantage possible from the hung ceiling owing to the fact that it is usually attempted to fit in the equipment installation with previously located hung ceilings instead of the hung ceilings being arranged to suit the requirements of the installation.

In Fig. 9 is illustrated an arrangement of hung ceilings so located as to accommodate:

(a) Cold water supply horizontal distribution for each zone.

(b) Hot water supply horizontal distribution for each zone.

(c) Hot water return mains for each zone.

(d) Heating supply and return distribution for each zone.

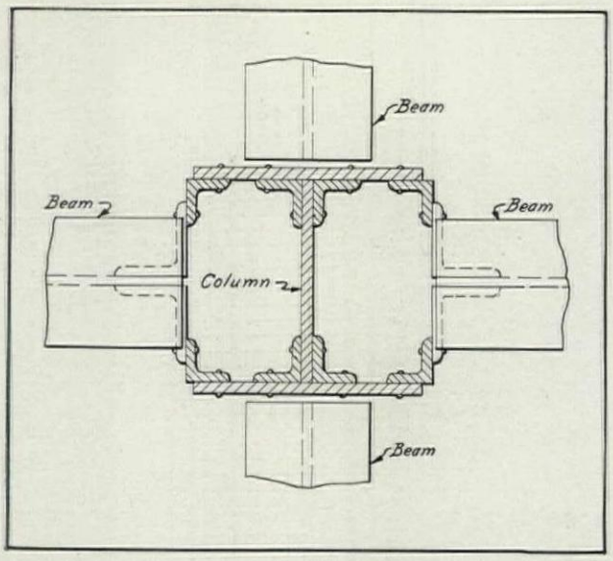


Fig. 3

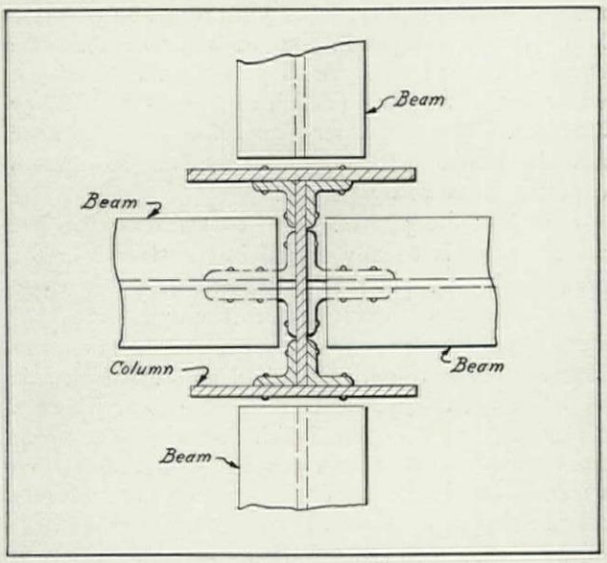


Fig. 4

This is accomplished by placing the hung ceiling over the story just below the tank room and placing the tank room two stories above the particular zone which the tank may serve.

Pumping to House Tanks. In the matter of filling these tanks with water for the various zones and the keeping of them filled when each has a different amount of water taken from it each hour in the day, some real difficulties have presented themselves. It is not economical to pump all the water required in the building up to the highest house tank and then let it run down through consecutive tanks with ball cocks until the lowest tank is reached, because this means pumping all of the water to the highest portion of the building when some of it is only required in the lower portions, involving a considerable waste in electric power. Moreover, an extremely high-pressure pump is required to operate against gravity heads of 500 to 1,000 feet, to which must be added the pipe friction. This has led to the adoption of the scheme of locating a pump in each and every tank room. Each pump then uses the tanks in that room as suction tanks and lifts the water from the zone in which the pump is located into the tank of the next zone above; here another pump takes the water from the tank and raises it into the next higher zone. It is self-evident that with such an arrangement the water used in each zone is pumped no higher than the tank supplying that particular zone.

Pump Capacities and Control. The capacities of these pumps are carefully graded so that the higher pumps can never dry the lower house tanks, as this would interfere with the water supply for the lower zones. To forestall any such possibility, the capacity of the pumps is steadily reduced from the lowest pump to the highest. Thus, if the basement pump has a capacity of 100 g. p. m., then the pump in the

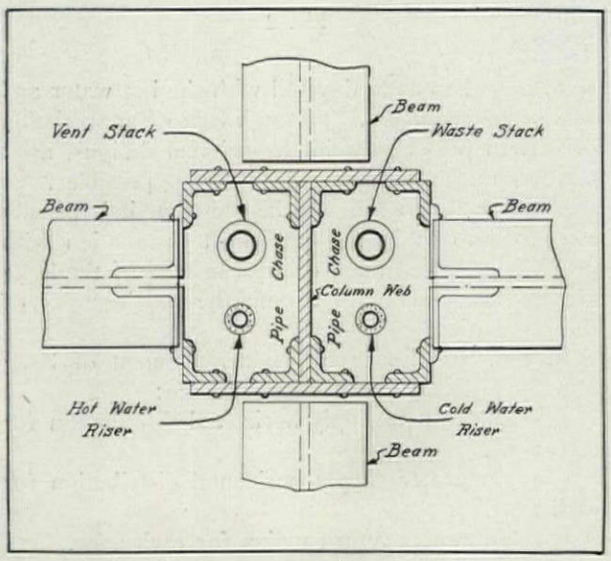


Fig. 5

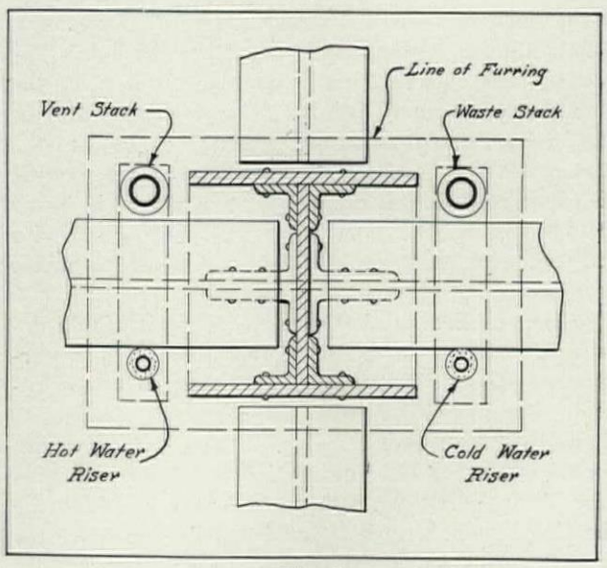


Fig. 6

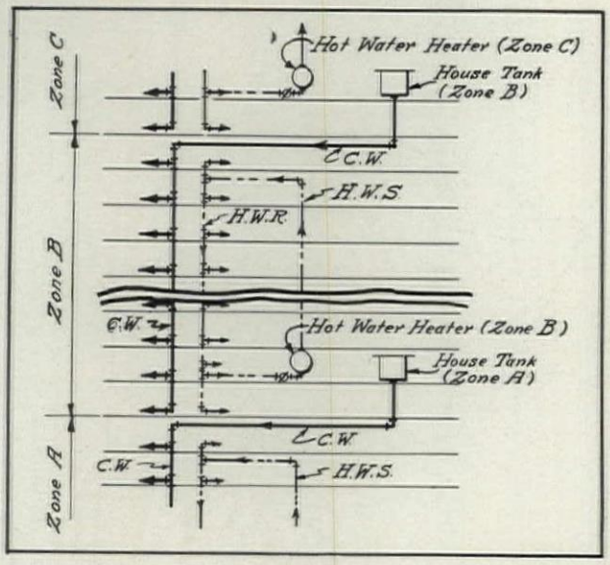


Fig. 7

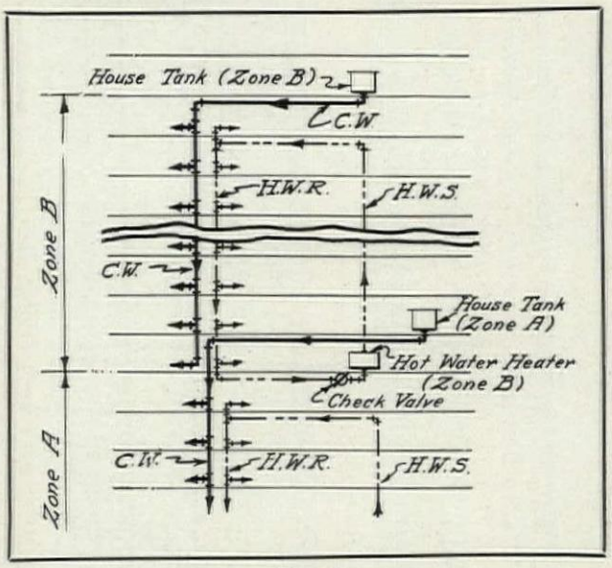


Fig. 8

next higher zone should have a capacity not to exceed 80 g. p. m.; the next higher pump not over 60 g. p. m.; then 40 g. p. m., and so on. Usually the decreasing floor area in the upper sections will quite justify the cutting down of the house pump capacities in the upper zones. Pumps should be installed in duplicate sets with one for reserve and should have float controls from the tanks into which they discharge. The heads on the pumps will be governed by the vertical height and pipe friction as in any pumping installation. Pumps are generally of the centrifugal type, directly connected to motors and set on a common bedplate. Throw-over switches should be provided in the control wiring from the house tanks, so that either pump can be thrown into service as desired.

Roof leaders, owing to the numerous setbacks, occur at frequent intervals in the tower type of building. Here again, hung ceilings should be provided directly under the roofs of the setbacks, not only for leader boxes located in the roof immediately above, but to provide space in which leaders from the roofs above may be offset. The same space will also serve for the heating risers, and so it is doubly useful. In cases where it is intended to carry leaders down the outside, the roofs should be arranged to pitch toward the outer parapet, so as to bring the leader boxes as nearly vertical over the leaders as possible. It frequently happens that space is not available at the window pilasters to accommodate large leader lines as well as the heating risers; the alternative in such cases is to slope the roofs toward the middle of the building and to carry the leaders down in pipe shafts. It is not always advisable to join leaders from upper levels with those of lower roofs until the lower leaders have dropped down a couple of stories so as to have a head of water in the lower leader. There is an old saying that if the roof water can once get into the leader it will *go*. But if leaders are small, or if they are temporarily overloaded by a miniature cloudburst, it is very easy for the flow from the higher roofs to retard the incoming water from the lower roofs if connections are made too near the level of the roof outlets from the lower levels.

There is generally allowed 1 square inch of leader area to every 200 square feet of roof or other drainage area. This is the ratio customarily used in New York. In localities where very heavy rains are experienced, as in Pittsburgh, it is safer to use only 150 square feet or even 100 square feet of roof to 1 square inch of leader area to take care of short but exceedingly heavy rainfalls.

In designing high buildings it is sometimes forgotten that the water caught in setbacks may be increased by rains which do not fall in a truly vertical direction. The maximum amount of water which could be caught on the roof of any setback is governed by the area of the setback roof plus the area of the side of the building from the setback up to the next higher roof when projected at an angle of about 60° from the vertical. Reference to any high building elevation will show that if the rain is assumed to be falling at an inclination of 60° from the horizontal, or 30° from the true vertical direction, the setbacks on one side of the building will not only have to provide for carrying off their own normal rain water but will also receive a certain additional quantity which will strike the side of the building above the setback. This is indicated in Fig. 10, and it will be seen that the area which should be figured for any setback roof with a vertical wall at the back is the projected area of the roof and wall taken at 60° from the horizontal. In horizontal leader lines the sizes may be based on the "flow of sewers," which is given in almost any handbook, or it may be governed by the local plumbing code. In cases of combined roof leader and soil drainage systems it is customary to jump the size of the horizontal leader line one pipe size over that actually required

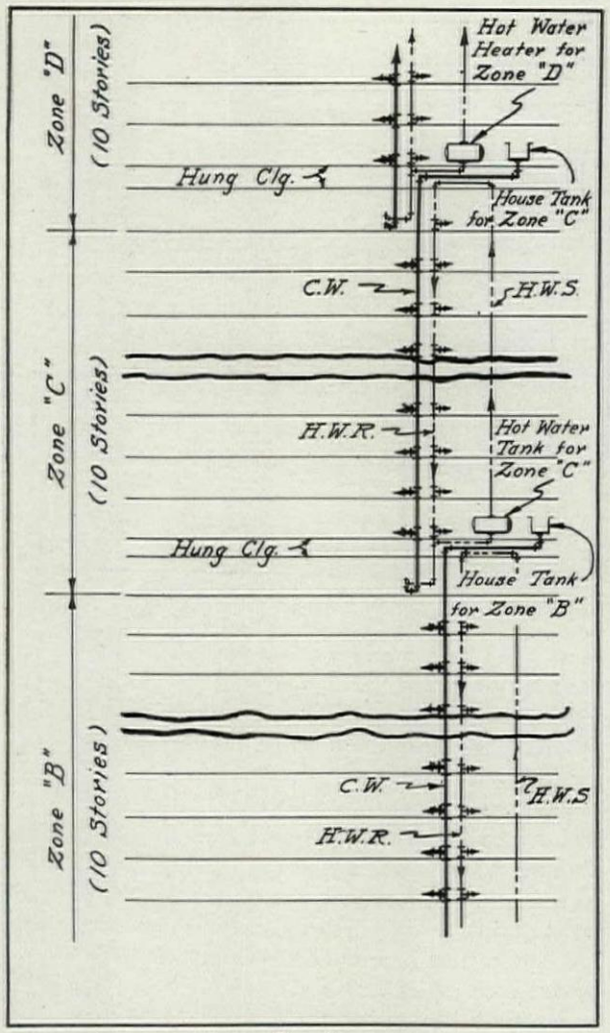


Fig. 9

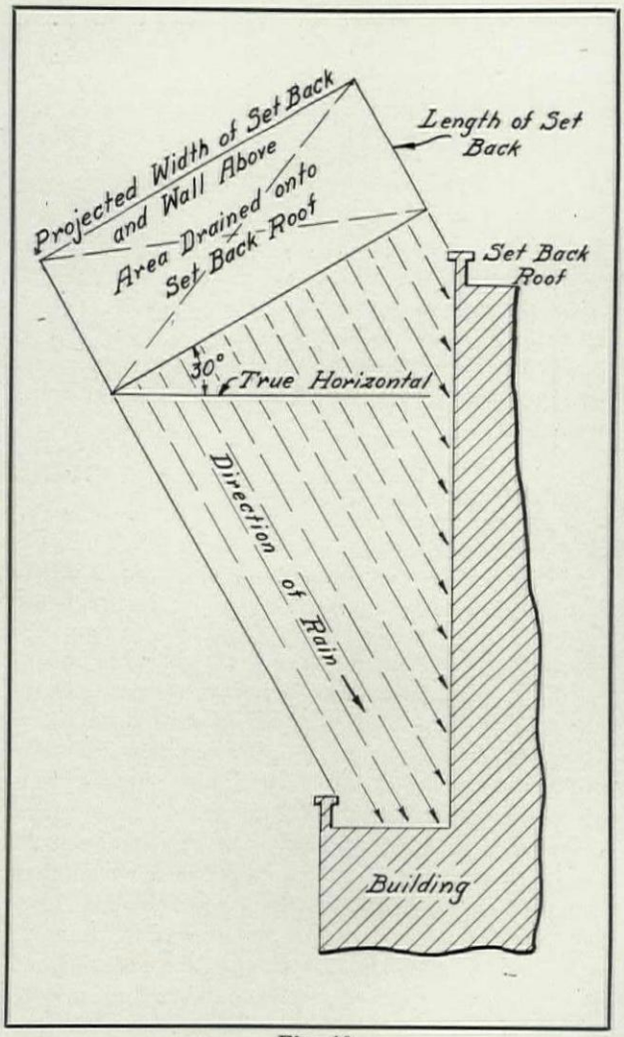


Fig. 10

to carry off the roof water, the extra area being usually more than sufficient to provide the necessary capacity for the soil and waste lines even during heavy rains.

Snow Melting Pipes. In vicinities where very low outside temperatures are encountered, snow melting pipes are often utilized. These are for the purpose of melting out the gutters over to the leader box, so that the leaders cannot become clogged with ice even when the combined action of the sun and the building warmth causes the snow on the roof to melt. They are usually made of perforated brass pipe with perhaps ⅛-inch diameter holes on 2-inch to 4-inch centers, and the size of the pipe is made sufficient to supply all the holes with steam at full pressure; the end of the pipe is capped. The pipe is set 2 inches or 3 inches above the bottom of the gutter, with perforations pointing down. These perforated pipes are provided with valves inside the building and should be supplied with steam of at least 10 to 15 pounds gauge pressure. The ordinary heating system steam will usually not have sufficient pressure to satisfactorily operate these lines.

It is often necessary to make a steam connection to the leader just below the leader box so as to heat the leader pipe near the top as well as to thaw out the roof outlet. Unless this is done the action of the whole scheme may be prevented. These snow melting pipes and their cost of installation do not reach as high a figure as might be at first supposed; they have not returns to consider, and each roof,—or even each part of each roof,—may be thawed consecutively so that the risers are never carrying a very heavy load. Probably a 2-inch or 3-inch main steam pipe riser would be sufficient for any high building whose ground area does not exceed 200 x 300 feet.

A NEW WAY TO DETERMINE ECHOES

BY
R. F. NORRIS
ACOUSTICAL ENGINEER

TO determine the proper period of reverberation for given auditoriums is not difficult, nor is making an estimate of the proper amount of sound-absorbent material necessary to obtain the desired acoustical results. This phase of the subject of acoustics has been clarified. With patience and care, the proper period of reverberation of echo in a room may be determined from formulæ, and an acoustical correction may be computed.

Sometimes, after the proper period of reverberation in an auditorium has been ascertained, one finds places in the room where it is extremely difficult to hear. These places are usually called "dead" spots and are caused by the concentration of reflected sound that is out of phase with the direct sound by one-thirtieth of a second or more. To get rid of these spots, one must find the reflecting surfaces which cause them, then change the shapes of the surfaces or treat them with enough sound-absorbent material to eliminate the disturbing reflections. Several methods have been employed for the detection of "dead spots." An ingenious plan developed by Prof. F. R. Watson of the University of Illinois uses an arc light at the focus of a parabolic reflector. A beam of light is cast and a hissing sound emitted simultaneously by this instrument. The apparatus may be set up on the stage of the auditorium to be tested, and the beam of light directed against any portion of the room's interior. By placing mirrors on the surfaces against which the beam of light is directed, the path of the light after it is reflected may be noted. A sound is reflected in much the same manner as a light beam. In an auditorium being thus tested, the sound may be heard distinctly if the ear is moved into the path of the beam of light. By careful and assiduous manipulation of this apparatus, a thorough survey can be made of any auditorium, its "dead spots" plotted, and the surfaces which cause them determined. Then one may either change these surfaces in shape or pad them with a sound-absorbent material to eliminate the cause of the disturbance.

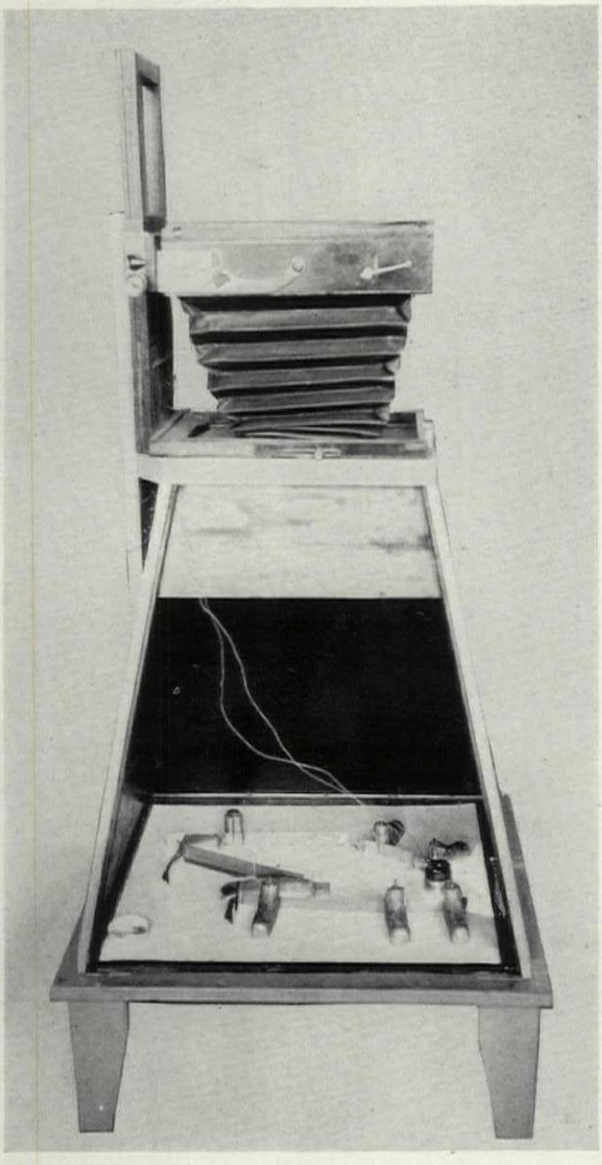


Fig. 1
Camera Mounted Above Section of an Auditorium, as Used in Studying Echoes

Another method, developed by Dr. Paul Sabine of the Riverbank Laboratories, involves making the model of a cross section of the auditorium to be studied, and the production of a very intense, single-sound wave at the spot where the speaker stands. This sound wave is then photographed. The machine may be timed so as to photograph the sound wave at any increment of time after it has left the source. In this way, a series of photographs may be taken, each one showing the spherical sound wave as a ring, expanding away from the source. With a succession of these photographs, the progress of the wave may be noted, its reflection from the various surfaces studied, and the disturbing surfaces determined. A third way of studying an auditorium in regard to its echo-producing surfaces is to lay out the significant sections of the room, then in each section take the speaker's location as a source, and draw lines or rays out to all the boundaries of the section from this point. The rays are assumed to reflect at an angle which is equal to their angle of incidence, and are reflected into the auditorium. These rays then show the paths in which sound travels after its first reflection. If a great number of these rays are accurately drawn, and the angles of incidence and re-

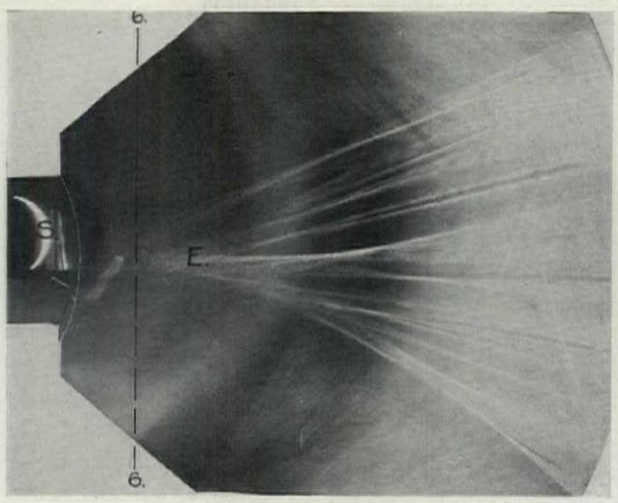


Fig. 2
Photograph of Plan Section of Uncorrected Auditorium Showing Sound Focus at E

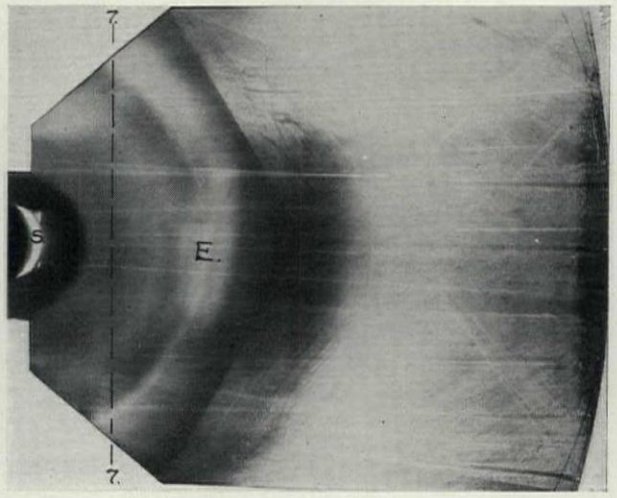


Fig. 3
Photograph of Plan Section of Corrected Auditorium Showing No Sound Focus

flection carefully measured, the resulting picture gives a fair idea of how the sound acts.

Of the methods mentioned, the first is applicable only to auditoriums which have been erected; it cannot be used on the sketches of proposed auditoriums. The models employed by the second method may be made from the architects' sketches of the room, but this method is laborious and time-consuming, due to the necessity of building plaster models of the various cross sections of the auditorium to be studied, and because carefully timed photographs are essential. The third method is applicable to auditoriums of which the plans are available, and it can be utilized in the case of buildings which are only in the sketch state. It had previously been employed by the Burgess Laboratories in making acoustical analyses of rooms before the buildings had been erected, or even fully designed. This method consumes so much time, however, that an accurate short cut was sought.

The significant sections of a room to be studied are usually: (1) the floor plan, (2) longitudinal section, (3) cross sections. They are laid out in line on a stiff white paper (Fig. 1). The section to be studied first is placed on a flat surface, and a highly polished strip made of metal ½-inch wide is placed along the boundary lines of the section, the width (the ½-inch dimension) being perpendicular to the plane of the section. This strip is bent to conform to the outline of the section, and is held in place by weights similar to spline weights. The section is then placed in a darkened room and a small bulb situated at the source of sound is lighted. The reflections from the polished metallic strip are found to make the same pattern on the surface of the paper as would be obtained if one should carefully construct lines representing all the rays of light from the same point and from the reflecting surfaces. This method gives results more accurate than those secured by drafting, and in a fraction of the time required for that method.

Although sound is reflected in the same manner as is light, sound is of such a long wave length in comparison to light that it is much more easily dispersed. Consequently, the engineers studied with extreme care this detail in their method of analysis, since light was employed in place of sound. Under the older method, where the rays of sound were laid out on the drafting board, they were laid out as rays, and no provision was made to correct for the dispersion of the sound. The new method is more accurate than the old, because the likelihood of there being drafting room errors in working out all angles of incidence and reflection is eliminated.

Several auditoriums were laid out and thoroughly studied by the old drafting table method. Small models were then set up with the reflecting walls, using an electric light at the speaker's position. The resulting patterns cast on the paper were found to coincide almost exactly with the patterns obtained from the drafting method. It was only necessary, then, to devise some way of making a record of the light patterns which were cast in the auditorium sections. This was done at first by setting up the sections on photographic paper in a darkened room. The bulb was placed at the desired position and lighted. The intensity of the light is greater where the light is reflected from the walls in addition to the general lighting, so that paper is exposed more at these places, and a shadow picture of the reflections is obtained. In studying the effects of the reflected sound, pegs or pins inserted at different points along the floor and balcony of the auditorium (in the cross section at points in which auditors would be stationed) proved to be exceedingly helpful. These pegs cast shadows which pointed directly away from the surfaces from which the light was being reflected. By reversing the direction and following these shadows, each surface causing a shadow was found. If the distance from the source of the sound to any one of the surfaces and then onward to the listener were greater than the direct distance from

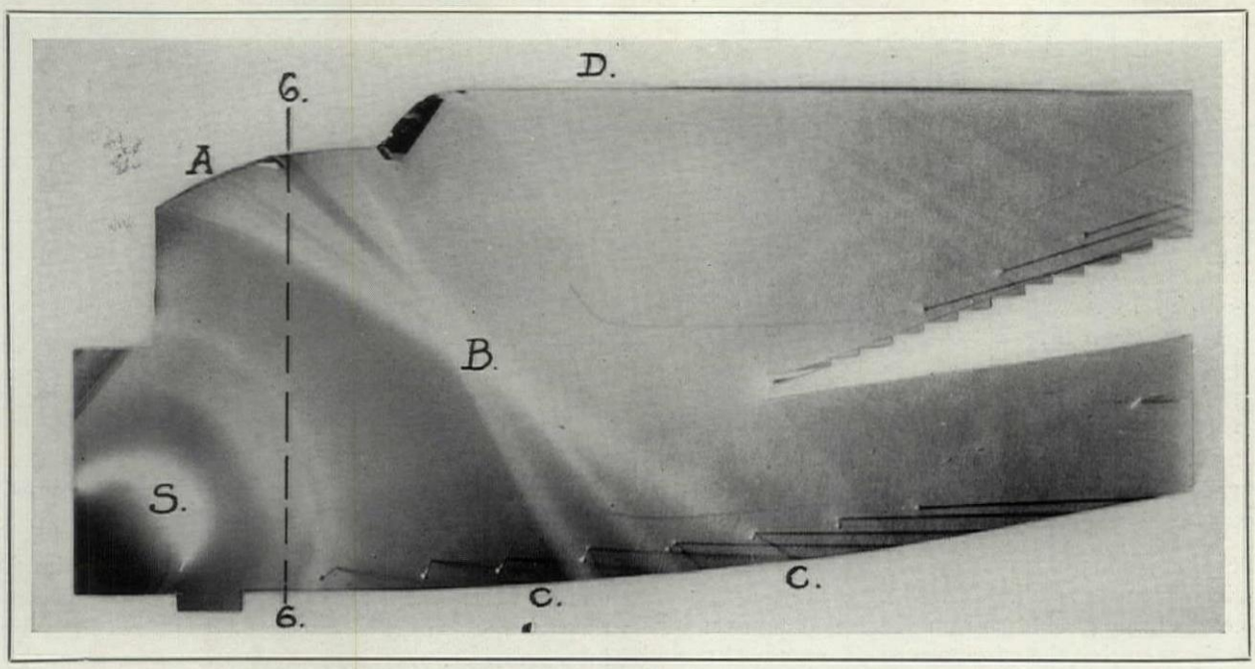


Fig. 4. Longitudinal Section Through Auditorium Showing Echoes at C-C

the source to the auditor, a confusion of the sound would be heard. If the difference in the two paths were more than 70 feet, an echo would be heard; if it were less than 70 feet but more than 35 feet, a blurring effect would make it hard for auditors to understand the speaker.

Referring to Fig. 2, which is the plan view of an auditorium, it will be seen that, with a source at S on the stage, there is a reflection from each side wall toward the center of the room, and that there is a reflection from the rear wall which concentrates at E. The reflections from the side walls are everywhere divergent and do not come to a focus. For this reason, the intensity of this reflection to any single auditor is small, and in all probability would cause no disturbance. Investigations in actual rooms have proved this to be the case. The concentrated reflections at E, however, produce an irritating conflict of sound waves in this region. The reason for this is that practically all of the reflected sound from the rear wall is concentrated in this area, and the intensity of the reflected sound here may be greater than that of the direct sound. In Fig. 3 the curvature of the rear wall has been changed, with the result that all of the concentration at E is eliminated. The sound from the source at S is now reflected in paral-

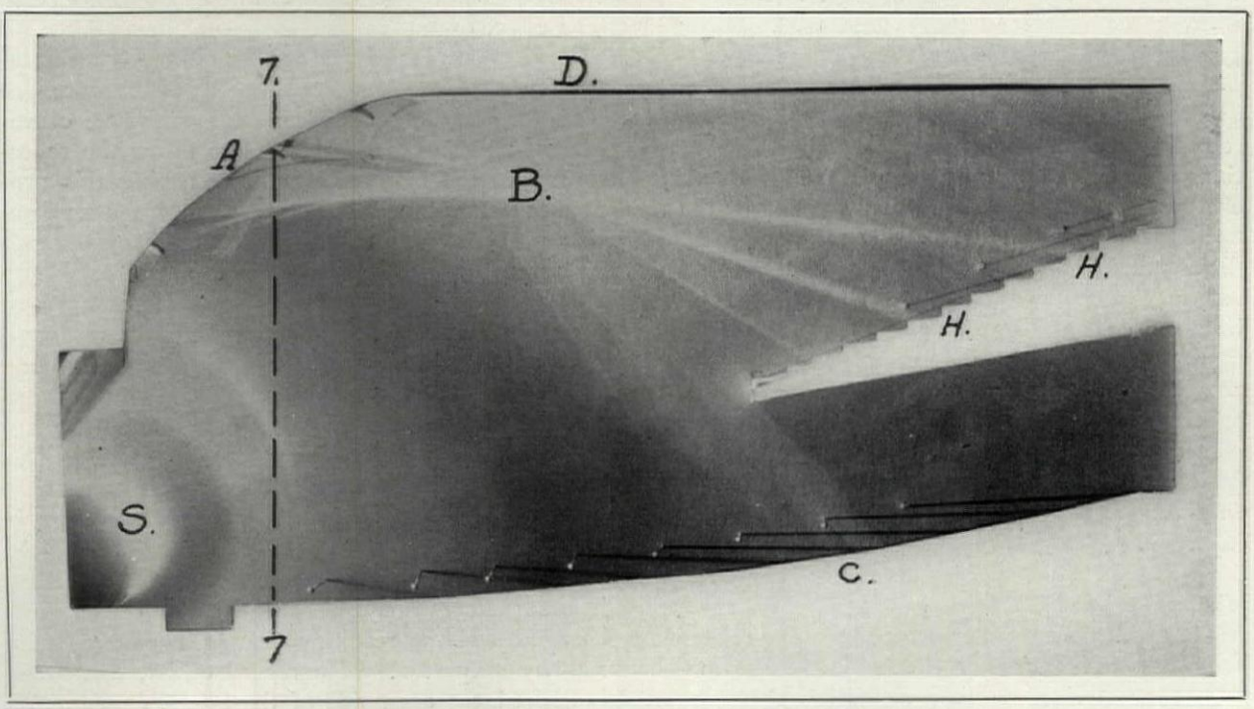


Fig. 5. Longitudinal Section Through Auditorium Showing Elimination of Echoes and Sound Reinforced in Balcony

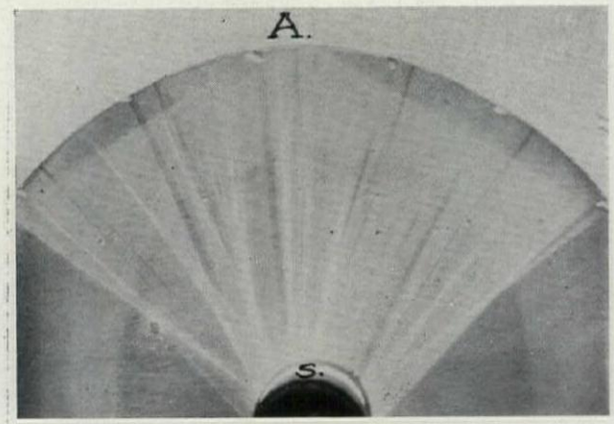


Fig. 6

Transverse Section Through Auditorium Showing Concentration of Sound Due to Ceiling Curvature

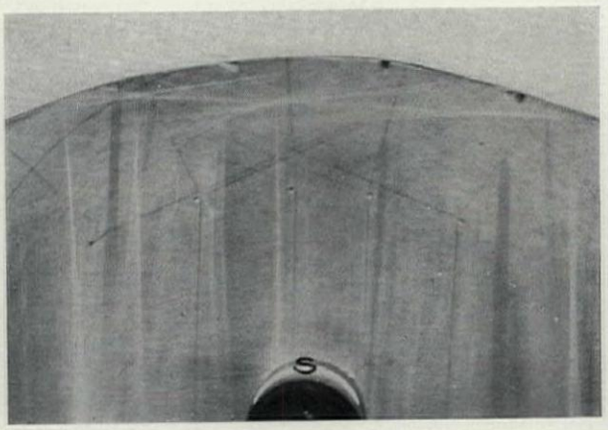


Fig. 7

Transverse Section Through Auditorium Showing Changed Curvature Eliminating Sound Concentrations

lel lines, and the intensity of the reflection at any given point is small. A wall of this type produces no disturbing echo. From these two figures, it is easily seen that the curvature of the rear wall should not be greater than that shown in Fig. 3.

The next two diagrams, Fig. 4 and Fig. 5, show longitudinal sections of the auditorium. Fig. 4 shows the auditorium as originally designed. The ceiling surface nearest the proscenium arch is curved in both directions, and the main part of the ceiling is flat. When this section was set up for study, the reflections from this first ceiling surface A, with the sound source at S, showed a decided concentration of sound at B. This sound then diverged and covered an area (C-C) at the floor level. In this section pegs were inserted along the floor and balcony surfaces to simulate auditors. The fourth, fifth, and sixth pegs from the stage cast two shadows. One, when prolonged past the peg, intersected the source; the other, similarly prolonged, touched a portion of the ceiling surface A. Lines drawn from the source to the points where these prolonged shadows intersect this ceiling surface would properly represent the path of the sound. Since these sections were made to a definite scale, the distance traveled by the direct sound and that traveled by the reflected sound could be accurately measured. If the difference in these distances is more than 35 feet, acoustical trouble over the area C-C occurs. It will be noted that the seventh peg from the stage also casts two shadows. The secondary shadow, when projected through the pin, intersects the ceiling surface D, which is flat. For this reason, as in the case of the floor plan, the reflected sound does not come to a focus, but is everywhere divergent, and is so dispersed when it reaches the auditor as to cause no troublesome echo or blurring.

In Fig. 5 the ceiling surface A has been changed. The curve has been started lower at the stage, and has been run to meet the surface D. The reflections from this surface are not directed into the main floor of the auditorium as they are in Fig. 4, but are thrown back into the balcony, striking the area H-H. The pegs along this area now cast double shadows, one of which when prolonged from the peg passes through the source. The second intersects the ceiling surface A. Again, if lines are drawn from the source to these points of intersection, the paths of the direct sound and reflected sound may be measured. It will generally be found that in a case of this kind, the difference between the two paths is relatively small,—less than 35 feet,—and that the reflected sound acts as a reinforcement of the direct sound, and improves audition in the balcony seats. Notice that the reflection indicated at C is unchanged, but as before said, this reflection is from the flat ceiling surface D, and has no bad effect on audition at this point.

Fig. 6 and Fig. 7 show transverse sections through the auditorium at the line 6-6 in Fig. 2 and Fig. 4, and at line 7-7 in Fig. 3 and Fig. 5. In Fig. 6 the transverse curvature of the ceiling surface A is great. The effect of this is that the sound is concentrated toward the center of the auditorium. A concentration in this direction aggravates the disturbance, due to this surface. Even when the longitudinal curvature of this surface is changed to throw the reflections into the balcony, a surface having this pronounced curvature is certain to cause a concentration of reflected sounds in the middle of the balcony, and this will be distinctly uncomfortable to auditors there. When this curvature is changed, as it is in Fig. 7, the reflected sound travels in practically parallel rays which tend to distribute the sound evenly over the balcony surface. The apparatus used at the Burgess Laboratories to make this diagnosis of acoustical defects is shown in Fig. 1. This illustration shows a cross section of an auditorium erected for study. When laid out in miniature in this way, the auditorium may be studied directly by observing the reflections from the different surfaces. These surfaces may be quickly and conveniently changed, and the resulting change in pattern is instantaneously seen. If a record of any one set-up is desired, the open side of the box is closed and a photograph is taken, camera mounted above model.

HEATING AND VENTILATING FOR THE ARCHITECT

BY

PERRY WEST

CONSULTING HEATING AND VENTILATING ENGINEER

Editor's Note. In this article Mr. West takes up the practical standards in regard to temperature, humidity and air motion requirements. He considers the questions of artificial ventilation; the ways of determining whether or not such ventilation is necessary and, if so, the character of the ventilation to be provided; and air conditioning. The first article of this series by Mr. West appeared in THE ARCHITECTURAL FORUM for April, 1928, Part Two.

CONSIDERING the matter offhand, the heating of a building is a simple problem, but when thoroughly analyzed it is found to present a number of interesting sides which are well worth the consideration of the careful designer. Good heating consists in the maintenance of comfortable temperatures throughout the occupied spaces of any building, an economical "process temperature" where required in manufacturing buildings, and enough heat elsewhere in all classes of buildings to prevent freezing of pipes, etc. An important consideration in any of these cases is the maintenance of the required temperature where it is needed, with as little waste as possible in the adjacent spaces where heat is not required. This is of importance in all kinds of buildings, but especially where heat may be required at or near the floor, where because of the natural tendency of heated air to rise, there may be a high degree of overheating in the upper spaces, with much unnecessary loss of heat through the upper walls and roof. Heat may be required in certain parts of a space only. In such cases the problem is to control the heat so as to establish the required conditions where needed and waste as little heat elsewhere as possible. Recent research has shown that much economy may be had by confining the heat to the 6-foot height of rooms, thereby preventing the usual difference of about 1½° Fahr. per foot in height between the floor and ceiling. This difference may be reduced to about 2/10° Fahr. with some of the newer types of radiators or concealed heaters. This may mean a saving of 40 per cent in extreme cases, and something over 10 per cent ordinarily.

Theory of Heating Standards. When we speak of the "temperature," we generally refer to the "dry bulb" temperature. This measure of temperature is of little value for determining the conditions of comfort for human beings or the proper atmospheric conditions for the processes of manufacture. Recent research at the American Society of Heating and Ventilating Engineers' Research Laboratory, operating in conjunction with the United States Bureau of Mines and the United States Bureau of Public Health, has shown that there are three important factors which go to make up the effective temperature, or the physiological temperature effect which atmosphere will exert upon human beings. These are *dry bulb* temperature, *wet bulb* temperature, and *air* motion; on them our comfort depends.

The *dry bulb temperature* is that taken with an ordinary thermometer (usually reading in Fahrenheit degrees), and this represents the temperature of the air without reference to the effect of its moisture content.

The *wet bulb temperature* is that taken with a similar thermometer, which has its bulb encased in a silk mesh bag; the reading being taken after the bag has been moistened with clean water and the instrument has been whirled through the air until the indication has become stable. This wet bulb temperature takes into account the conditions of the atmosphere as to its moisture content, due to the fact that the rate of evaporation of the moisture from the bag and the consequent cooling of the thermometer bulb, caused by this evaporation, depend upon the relative amount of moisture in the air.

By *air motion* is meant the velocity of the air in feet per minute. Its effect is that of a breeze, in removing the enveloping air and bringing new air to take its place, thus producing a cooling effect by increasing evaporation.

The combined effect of these three factors is designated as the effective temperature. An idea of the relative importance of these factors may be gained by taking an ordinary dry bulb temperature of 70° and considering that there is an effective temperature of 60° when the air is absolutely dry and without motion, an effective temperature of 50° when dry and with an air motion of 500 feet per minute, and an effective temperature of 70° when fully saturated and without air motion. These factors have a similar bearing upon the effect that an atmosphere will have upon processes or products of manufacture. They affect the drying, cooling, heating, expanding, contracting, hydrating, dehydrating, cracking, warping, sweating and other effects and variations which any particular or varying atmospheric conditions may exert upon the product.

The effective temperature, not the dry bulb temperature or the wet bulb temperature, or both without the consideration of air motion, determines the heating requirements as far as the health, comfort and efficiency of workers or the quantity and quality of products of manufacturers are concerned. The exact physiological effect of these factors has been established by the American Society of Heating and Ventilating Engineers' Research Laboratory, as illustrated by the accompanying chart shown in Fig. 1. This shows the effective temperature chart for human beings at rest in still air with different dry bulb and wet bulb temperatures corresponding to different percentages of relative humidity, or moisture in the atmosphere. The relative humidity is

calculated from the difference between the wet and dry bulb readings. This chart is made up of vertical isothermal lines representing the dry bulb temperature, as shown on the horizontal scale at the bottom; horizontal lines, representing the grains of moisture per pound of dry air as shown on the vertical scale at the left; light oblique isothermal lines sloping downward toward the right, representing the wet bulb temperatures as shown in the scale along the upper curved line; heavy oblique effective temperature lines, representing the effective temperatures as shown on the same scale as the wet bulb temperatures; and the oblique curved lines, representing the relative humidity in percentages of the quantity of moisture required to saturate air at the particular dry bulb temperature under consideration. The shaded section between the effective temperatures of 62° and 69° covers the conditions of substantially equal human comfort and is designated as the "comfort zone." The effective temperature of 64° is the optimum for the average human being at rest in still air, and is designated as the "comfort line."

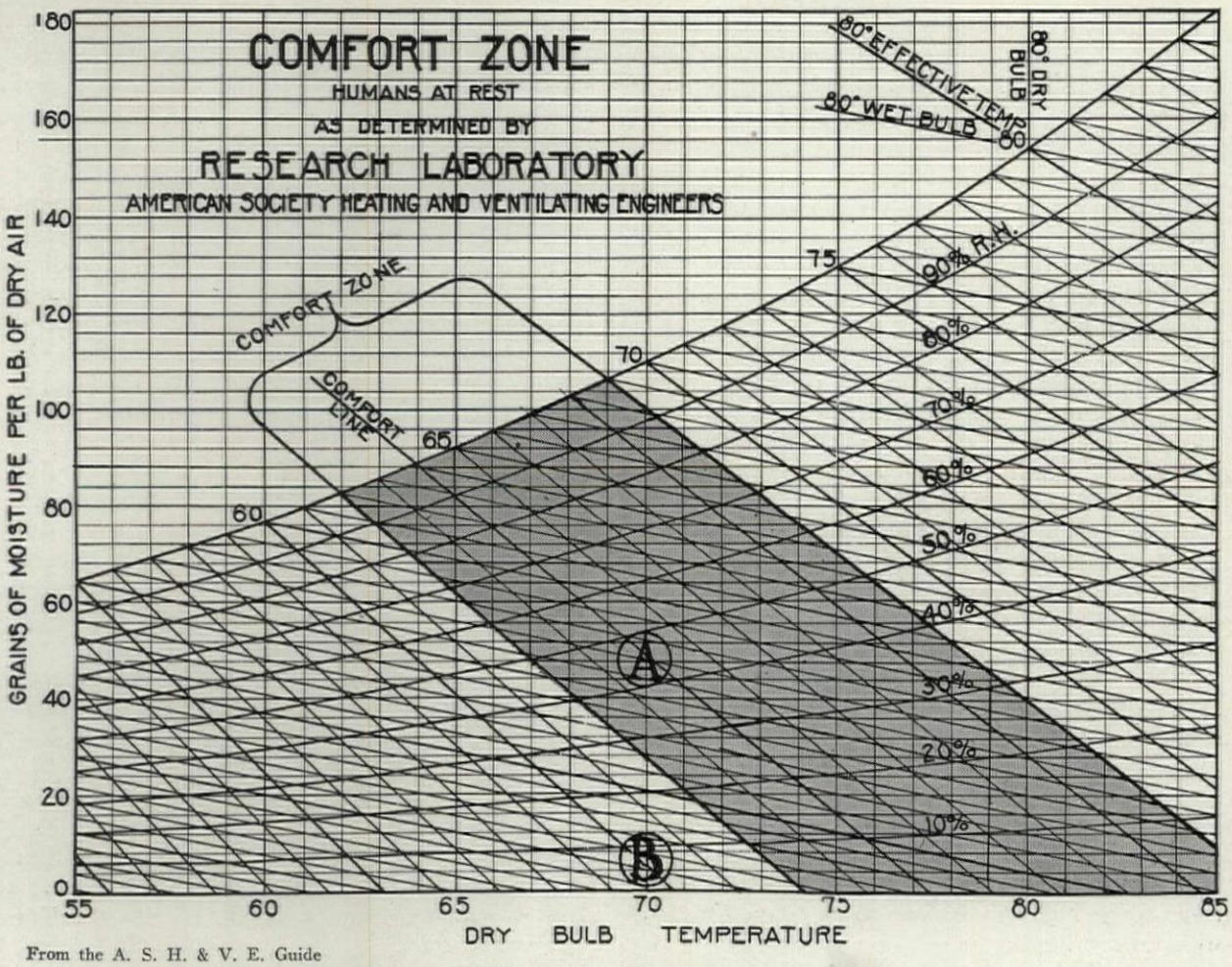
To use this chart, start with the dry bulb temperature, for example, of 70°, at (A) and follow the vertical line to its point of intersection with the wet bulb temperature, say of 57°, at (B). The curved line passing through this point of intersection will represent the relative humidity, which in this case happens to be 45 per cent. Starting from (B) a line drawn parallel to the nearest effective temperature line to the scale of effective temperature will intersect this scale at the effective temperature reading, which happens to be 64° in this case. Starting again from (B), a horizontal line will intersect the scale of moisture contents at the number of grains per cubic foot of air, or 44°. Similarly, by starting with any two known factors, the other may be found. The example represents the optimum effective temperature condition for a dry bulb temperature of 70°. It will be seen that for this dry bulb temperature the moisture contents may be varied between 24 and 100 grains per cubic foot, corresponding to a variation from 28 to 92 per cent of relative humidity, and an effective temperature variation from 62 to 69 degrees, without getting outside the comfort zone in either direction.

It should be borne in mind, however, that this comfort zone covers the extreme limits for health and comfort, and that the nearer the conditions are kept to the comfort line the more ideal they will be. It should be noted that around 70° dry bulb the allowable variation in humidity is greater than at temperatures far below or above. Also the dryer the air the hotter it must be, and the more moist the air the cooler it must be, in order to produce the proper degree of comfort. It should be noted in connection with air motion that a dry bulb temperature of 76½° with 150 feet per minute air motion, and 82½° with 500 feet per minute air motion, are required to meet the comfort line requirements of 70° without air motion, with 45 per cent relative humidity in each case. Also that the widest allowable variation in humidity is near these temperatures.

There are conditions, therefore, under which moisture in the air assists the cooling effect of air movements, and other conditions under which it retards it. This is why the wind makes one feel colder on a cold, damp winter day and hotter on a hot, damp summer day. So far we have discussed the conditions pertaining to human beings at rest. For those actively engaged in work, there is considerable variation from these conditions of comfort, depending upon the character of the work. These conditions have not been very accurately determined as yet, but present indications are that for human beings at hard work the effective temperature may be reduced at least 5 degrees, as far as health and comfort are concerned. Some recent studies throughout the industries indicate that male workers show best results at a temperature of 72° and a relative humidity of 40 per cent, and female workers at 80° and a corresponding lower relative humidity, with both conditions corresponding to an effective temperature of about 65°.

It has long been known that overheating is very enervating and greatly lowers the capacity of workers, but this condition cannot be diagnosed from the dry bulb temperature alone. If the humidity is decreased in proportion, the temperature may frequently be increased with advantage, as shown by these studies. Studies of the New York Commission on Ventilation indicated that the capacity of workers is reduced about 28 per cent with a temperature of 78° and a high relative humidity as compared with a temperature of 68° and a low relative humidity. This report is not definite, but the higher temperature and humidity would probably correspond to an effective temperature of 75° and the lower conditions to about 63°. It is fairly safe to say that an increase of each degree in effective temperature will decrease the capacity of workers about 2½ per cent. These studies are being further carried out, and more definite results will be forthcoming, but it can be seen that the data already available are very useful if properly understood and applied. The reason that the data on proper standards of heating are not more definite is that the physiological reactions upon human beings are so different and indefinite that a great amount of very careful and laborious research is necessary to determine the exact conditions of comfort, and vastly more to determine the effects on health, efficiency and longevity. In the effects upon processes and products, the determinations are much easier and the available data much more exact. For this reason it is sometimes found that better heating and ventilating conditions are maintained for making chewing gum, candy, tobacco, textiles and other products of manufacture than for the employes working in the factories producing them.

Practical Heating Standards. The proper standards for heating comfort where the occupants are



From the A. S. H. & V. E. Guide

Fig. 1. Chart Showing Relations of Temperatures and Humidity to Comfort

not engaged in manual labor, is from 62° to 69°, with an optimum of 64° effective temperature, but as already pointed out, the dry bulb temperature necessary to produce these results may be varied from 62° to 90°, depending upon the relative humidity and air motion. Optimum conditions for all of these factors are perhaps around 70° dry bulb, 45 per cent relative humidity, with a light air motion. Where occupants are performing light work, the dry bulb temperature may be reduced to 67½°, and where performing heavy work to 65° with 60° as the low limit. Departures from these standards will represent a loss in comfort and efficiency of about 2½ per cent per degree.

In producing these results it is necesary to take into account not only the heat to be supplied by the heating and ventilating equipment, but the body heat given up by the occupants themselves, as well as the heat given off by the lighting, motors and other equipment, and these must be properly balanced against the heat losses from the building. In special cases where furnaces or other large heat-emitting sources are present, it is important to know the exact physiological effects which these will produce on the occupants, as it sometimes involves a problem of cooling by air motion or other means to prevent overheating at these points, and at the same time maintain sufficient heat elsewhere in the room. The Kata thermometer, which is an instrument which can be held at body temperature and at the same time record the rate of heating or cooling effect of surroundings, is used to determine the conditions to be met in such cases.

Kinds of Heating Apparatus to Use. Cast iron boilers are desirable for residences or small buildings, or even for larger buildings where low pressures are carried and load fluctuations are small. They have the advantage of high resistance to corrosion, ease of rigging to the point of erection, flexibility in the addition or replacement of sections, low first cost, and small space requirements. Steel boilers of the fire-box or self-contained types are desirable for larger buildings with fluctuating loads and higher pressures, and have larger water and steam storage capacity, great tensile strength, freedom from cracking, high economy, quick response and capability of being forced. Water tube boilers are desirable for high-pressure plants where large capacity must be gotten into small floor space and where the duty is heavy and continuous, loads fluctuating, and extreme safety an important item.

The use of oil fuel is largely a matter of choice

and opinion with the owner. Generally speaking, it is cleaner and requires less labor than coal, is more easily stored, and requires less space. It is not a panacea for all fuel troubles, as oil burners depend on electrically or steam-driven machinery which must be kept in repair and is subject to many difficulties if not properly installed, understood and taken care of. Here again the psychology of the situation should be well considered, and use of oil should not be forced on unwilling owners or operators, as it takes good will, good service and good operation to make it successful. In residences, schools and small buildings generally, where expert operating organizations are not in charge, the lighter oils which are subject to automatic control should be used. The cost of heating with oil at about 10 cents per gallon is equivalent to that with $15 coal. The cost of the apparatus will add from 20 to 50 per cent to the cost of the heating system, most of which is offset by the saving of space, especially in larger buildings. In larger structures heavy oil may be used at from 4 to 5 cents per gallon, which is equivalent in cost to heating with coal at from $6 to $8 per ton.

Gas fuel is very satisfactory; requires little space; is entirely free from dirt and labor; and susceptible to ready automatic control. Its cost with the ordinary heating system and at $1 per 1000 cubic feet of 500 B. t. u. gas, is equivalent to that with $32 coal.

Concealing radiation in recesses or cabinets is being done to a great extent, but care should be taken to see that this is done so as not to interfere with proper heating (see pages 77 and 78 of the American Society of Heating and Ventilating Engineers' Guide, 1928). Concealed and cabinet radiators are fast coming to the front and are very effective and economical, but have hardly been in use long enough to determine the effect of dust and lint collecting between the fins, or to demonstrate as to how they stand up otherwise after long usage. Radiation with a preponderant radiant factor as compared with ordinary radiators which operate largely on the convection principle, has recently been developed. It is claimed that this new type gives the same degree of comfort in the lower parts of small rooms as the other types of radiation, but with appreciably less heat input. It is interesting to note that the concealed or cabinet radiators tend to accomplish the same purpose by causing a more rapid and extensive circulation of air in the lower portions of small rooms to and from the radiator, thus reducing the overheating of the air in the upper parts and reducing the heat loss. These new developments seem to be along the right lines. Their tendency is toward more efficient heating with much better opportunity for artistic treatment than afforded by the architect's old enemy,—the radiator.

The Ventilating Problem. Ventilation perfection is a very definite thing, and may be thus defined: that atmospheric condition in every part of indoor space occupied by human beings which is continually maintained with a proper amount of oxygen; free from dust, bacteria, objectionable odors; poisonous and other objectionable substances; with suitable air movements, and at the temperature and humidity condition within the zone of human comfort as scientifically determined. Good ventilation may be considered as that percentage of perfection of these factors which is warranted by the requirements of human health, comfort and efficiency on the one hand, and expense and labor to produce these conditions (whenever they do not naturally exist) on the other. In the popular mind the general subject of the theory and practice of ventilation is in a state of complete flux. There is, however, a very rapid crystallization toward very definite standards and practices.

Is Ventilation Necessary? The answer to this depends upon the particular requirements for the space in question, but generally speaking, any space within which the atmospheric conditions cannot be naturally maintained within the range of comfort can well be given the best mechanical ventilation devisable. It is no longer felt that the chemical composition of the air is the important factor, but that proper ventilation depends more largely upon a number of other factors which are given here in approximately the order of their importance:

1. Air supply.
2. Air temperature.
3. Air cleanliness in reference to its freedom from dust and other suspended matter.
4. Air sanitation with reference to its freedom from bacteria.
5. Relative humidity.
6. Distribution.
7. Air motion.
8. Freedom from odors.
9. Freedom from other injurious substances.
10. Freedom from monotony, in regard to noise and too much regularity of indoor conditions.

Air supply is put at the head of the list, because without air supply there can be no artificial ventilation. Air temperature is second, because it has been proved by practically all of the accredited experimenters that overheating is more detrimental to the quality of ventilation than any other one thing.

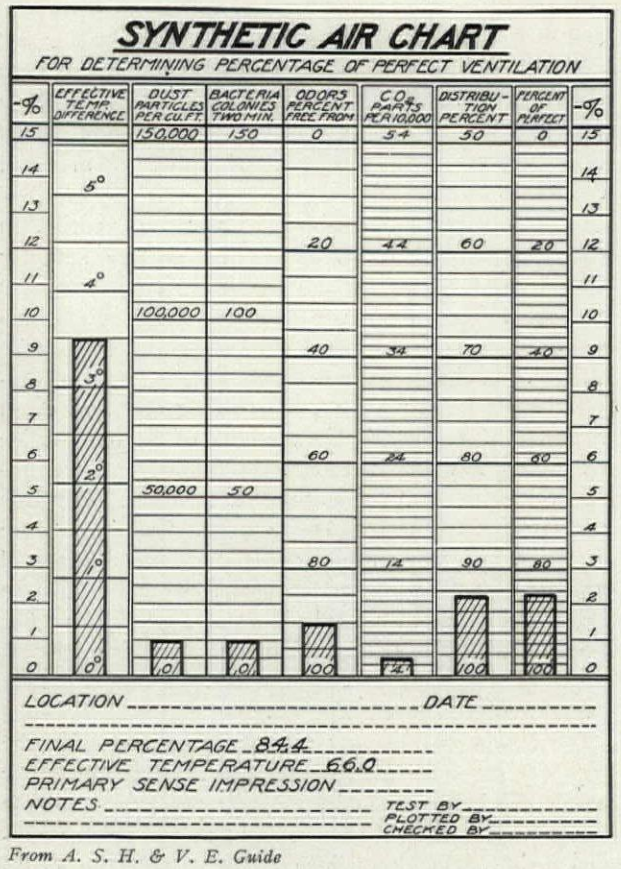
Air cleanliness is third, because it has to do with human health from the standpoint of freedom from dust and other suspended substances which irritate and clog the air passages, and from the standpoint of freedom from bacteria and other media of infection carried along with these substances. Air sanitation is fourth, as it also affects human health and is correlated with the third item. Relative humidity is fifth, not because it is of so much less importance than air supply and temperature, but because it also bears such an intimate relationship with these two items that it receives a part of its due consideration in their determination. Distribution is sixth, for a similar reason, for while it occupies a much more important place than this position might indicate, it is intimately connected with the effective air supply

because it is a factor in effective temperature. Air motion is seventh, in the same way. Freedom from odors is eighth, for the reason that odors are seldom dangerous or permanently detrimental to health, though quite disagreeable and even nauseating. Freedom from other injurious substances is ninth, because these substances are seldom found in ordinary ventilating practice and must be practically eliminated in any case. Freedom from monotony is tenth, because it has to do with the last refinements and the psychology of ventilation only.

In order to properly measure and compare the effects of these various factors the synthetic air chart as shown in Fig. 2 has been devised and adopted as the standard measure of the quality of ventilation. This chart takes air supply into account under the heading of carbon dioxide content, CO_2. The scale for this factor is based on the assumption that 300 parts of CO_2 in 10,000 parts of air, together with the other vitiation which would accompany this quantity of CO_2 when exhaled with the human breath, might produce results that would be permanently injurious to health. For each part of CO_2 in 10,000 (above that ordinarily contained in the outside atmosphere and assumed at four parts in 10,000) a deduction of ⅓ per cent is made for this particular column or department, and 0.3 per cent as the deduction in the final per cent of perfection column. The various other air factors are given their proper weight in determining the percentage rating of the ventilation conditions in the test. Air temperature, air motion and relative humidity are represented under the column of effective temperature difference. The percentages of perfection for good ventilation as thus determined range from 95 in new school classrooms to 80 in existing churches.

In the normally crowded city places of assemblage the heat given off by the occupants together with that given off by the lighting and power equipment is usually more than the normal heat loss through the structure to the outside air, even in winter under cold climatic conditions. This means that in order to preserve an equilibrium of effective temperature the entering air must be cooler than the leaving air, so that the problem is usually one of cooling and ventilating rather than heating and ventilating. In the practical work of engineers who design ventilating systems, and of architects and owners who pass upon these systems, the one item involving standards which is the basis of all calculations and layouts is the quantity of air to be handled by the system. The functions of the air are to supply the necessary oxygen for respiration, to keep the dilution of CO_2 and other objectionable substances down to the proper point, and to maintain the proper effective air temperature.

On the basis that the air brought in from the outside is for oxygen supply and dilution only, these cubic feet per minute per person would be required for the ventilation percentages shown, if all other factors are 100 per cent perfect.



From A. S. H. & V. E. Guide

Fig. 2. Chart for Recording Results of Ventilation Tests

Percentage of perfection	*Cu. ft. of air per minute required per person at rest*	*Cu. ft. of air per minute required per person at hard work*
98	15.0	30.
96	7.5	15.0
94	5.0	10.0
92	3.75	7.5
90	3.0	6.0

In theaters, assembly rooms, auditoriums and other places of public amusement and assemblage there are usually several other factors to consider, such as the removal of excess heat, excess moisture, dust raised by the movements of the occupants, and odors. We may not hope to get better than from 40 to 60 per cent ventilation in warm summer weather without some method of air cooling. Air motion will assist, but unless increased beyond the usual 10 to 20 feet per minute ordinarily obtained from the movement of the air through the room, it will not improve the percentage of ventilation by more than from 2 to 3 per cent. By the use of refrigerating and dehumidifying apparatus this effective temperature department can be maintained at any desired percentage of perfection. The use of a good air washer should reduce the temperature about 70 per cent of the difference between the wet and dry bulb temperatures. About 10 cubic feet of air taken in from the outside, per person per minute, is

sufficient for winter conditions but inadequate for summer climates, where heat and humidity are the determining factors, unless refrigeration is used. It should also be noted that increasing the air supply from 10 to 50 cubic feet per person per minute gives little improvement unless some form of artificial cooling is used.

It would seem that about 75 per cent ventilation can be obtained under reasonably severe summer conditions with an air supply of 30 cubic feet per person, using an air washer, and that beyond this point there is little to be gained by increasing the supply. It should be noted that this is based on upward ventilation and that the cooling effect of from 5 to 10 degrees with air washers of perhaps twice this amount with refrigeration will produce uncomfortable drafts on the occupants at times. For this reason and for the further reasons that it is more sanitary and more easily controlled, the downward system of ventilation is perhaps more efficacious in large and constantly used places of assemblage. On account of transporting all of the heat from lights downward and of forcing the body-heated air back over the occupants, it is usually necessary to do much more cooling of the air than can be done with the air washer without refrigeration. On the other hand, the air is brought in high enough to permit of its being diffused and brought to the proper condition before coming into contact with the occupants. It can be seen, therefore, that the air supply per person per minute for assemblies could be 10 cubic feet in winter, 30 cubic feet in summer with the air washers, and anywhere between these two figures for the entire year with refrigeration. Also that nothing better than about 75 per cent ventilation can be secured in hot, sultry, summer weather without artificial cooling, but that with cooling, especially if the air supply is taken from overhead and exhausted from below, almost any percentage of perfection can be maintained.

Recirculation. The foregoing does not take into consideration the matter of recirculation, but it can readily be seen that there is little to be gained by recirculation unless an appreciable amount of CO_2 and attendant impurities which are put into the air can be taken out during recirculation. The handling of the larger quantity of air may be of value to produce air motion or for use as a better cooling medium with less temperature difference between incoming and outgoing air. Recirculation may also be used as a purely economic feature during the warming up of the building or during periods when the space is only partly occupied and the mechanical arrangements are inadequate for properly varying the quantity of air handled to suit. A good arrangement is to provide apparatus for handling 30 cubic feet of air per person per minute with provisions for recirculating any amount up to as much as two-thirds of this. The percentage of air recirculated may be varied to suit the seasonal change so as to conserve heat in winter and refrigeration in summer.

Where effective temperature is controlled, according to the usual method, from the dry bulb temperature in the room, there may be a wide variation in this effective temperature due to the varying amounts of moisture in the air, unless humidifying apparatus with accurate humidity control is employed. Between the condition of absolute dry air at 70° and absolutely saturated air at 70°, there is a difference of 10 degrees in effective temperature which means an average difference of 25 per cent in the quality of ventilation. This may be taken to mean about 10 per cent on each side of the neutral point for ordinary ventilating conditions, so that the air washer and humidity should improve the ordinary ventilating plant another 10 per cent on this count. Good filters will of course serve the same purpose for cleaning the air of suspended matter, and may improve the ventilation about 10 per cent.

Relative Humidity. It should be noted, in connection with our present means of measuring and comparing qualities of ventilation, that we do not take into account any of the functions of the relative humidity of the air except that bearing upon effective temperature. This means that air of any temperature and relative humidity, within proper physical range, i.e., below 64° wet bulb, may be made to meet the comfort line by either heating or cooling without addition or deduction of moisture. Absolutely dry air may be heated or cooled to 78° and be 100 per cent as far as effective temperature is concerned, and still be far from perfect as far as effects on the membranes of nose, throat and lungs are concerned. Such dry air is also very conducive to the increase of dust in the atmosphere of a room from the standpoints of dryness and electro-static agitation. The air washer and humidifier correct these difficulties, and there should be some definition of limits for the relative humidity in our measure of ventilation.

Eliminating Dust. It is not unusual to find from one to two million particles of dust per cubic foot in the outside air surrounding city buildings, and unless this is eliminated it will give dust counts in rooms equivalent to a deduction of from 5 to 20 per cent in the perfection of ventilation. A good air washer should eliminate from 80 to 90 per cent of the dust entering the intake and perhaps reduce the dust penalty in the rooms to less than one-half of these figures. It will be seen, therefore, that air washing and humidification may improve the quality of ventilation about 10 per cent in the effective temperature department, plus another 10 per cent in the dust department, plus other improvements in the quality of ventilation by maintaining proper humidity and removing injurious substances and odors.

ARCHITECTURAL LAW

THE DWELLINGS LAW

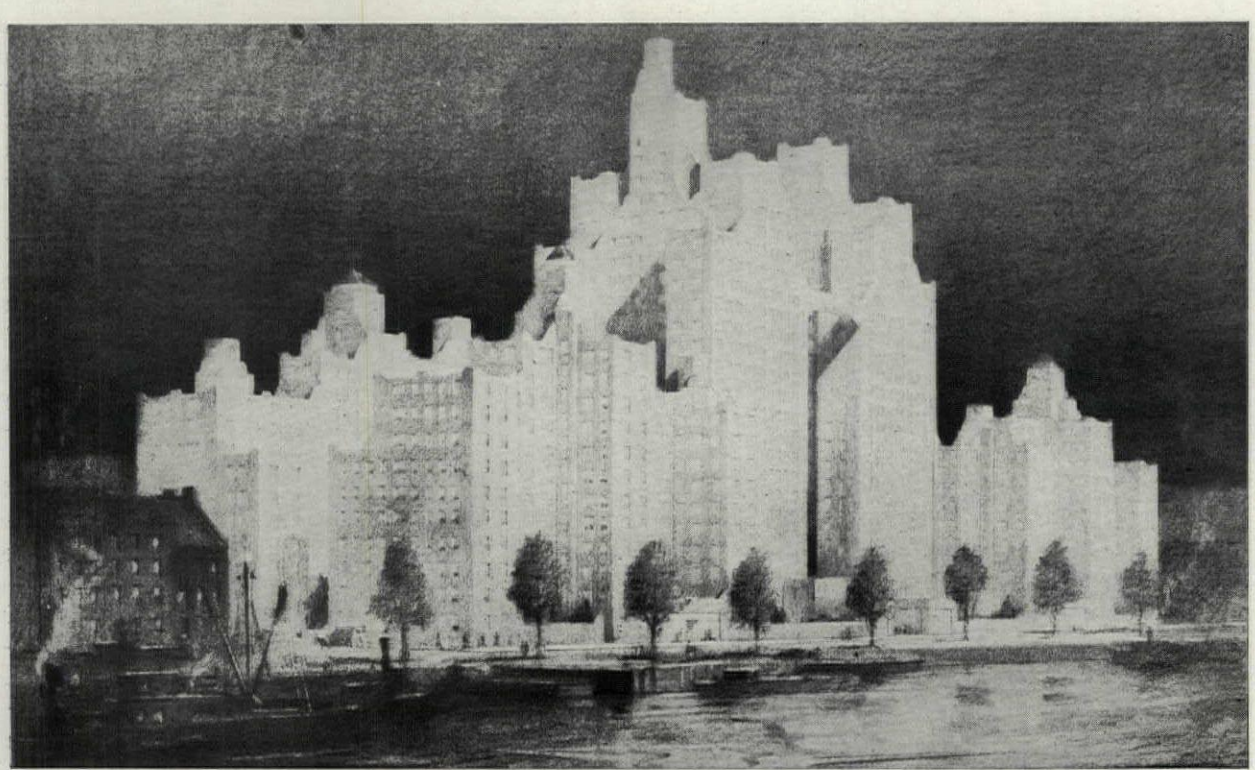
BY

JOHN TAYLOR BOYD, JR.

RARELY has an item of legislation so interested New York architects as the proposed "Dwellings Law," which was submitted to the legislature last winter by the "Temporary Commission to Examine and Revise the Tenement House Law." The Real Estate Board of New York requested the appointment of this Commission for the purpose of making changes in the existing tenement house bill, which applies to the design, construction and maintenance of apartment houses in New York and in Buffalo. The request was worthy, for there can be no question that the existing law is obsolete in many provisions, and that it imposes unreasonable and costly penalties on design and construction.

So a new standard was demanded. Should it be a higher or a lower standard? That is the question. "We want a higher standard in some respects," said the Real Estate Board in effect, in its detailed recommendations to the Commission. "But," said the Real Estate Board, and here there was raised a large issue, "we want the privileges of building a greater bulk of structure on a given site, up to the limits permitted by the local zoning regulations which allow greater bulk for business structures, hotels, apartment hotels and institutional buildings, than does the tenement house act in the case of apartments." In other words, the real estate organization demanded lower standards of light and air, although generally it favored adequate protection of sanitation and fire safety. But the Commission thought otherwise. In its proposed law the Commission stood squarely for somewhat higher standards of light and air than those in the existing tenement house bill. It went further. In order to protect the light and air of the individual property owner from the blanketing effect of tall non-apartment structures, the Commission greatly broadened the scope of the law. It included within its jurisdiction hotels, lodging houses, boarding houses, boarding schools, furnished room houses, lodgings, club houses and college and school dormitories, as being multiple dwellings, designating them as "Class B." "Class A" designation means multiple dwellings of the apartment class and includes apartment hotels. By this means, practically all structures that are likely to be erected in a residential district are brought under the same regulations governing height and bulk, thus enforcing a more orderly arrangement of buildings and blocks and preventing blanketing light and air.

The Commission went still further. It enforced certain requirements of plan arrangement, sanitation and fire safety for dwellings likely to be converted in the future for multiple occupancy, in order that undesirable building may not result; and it also en-

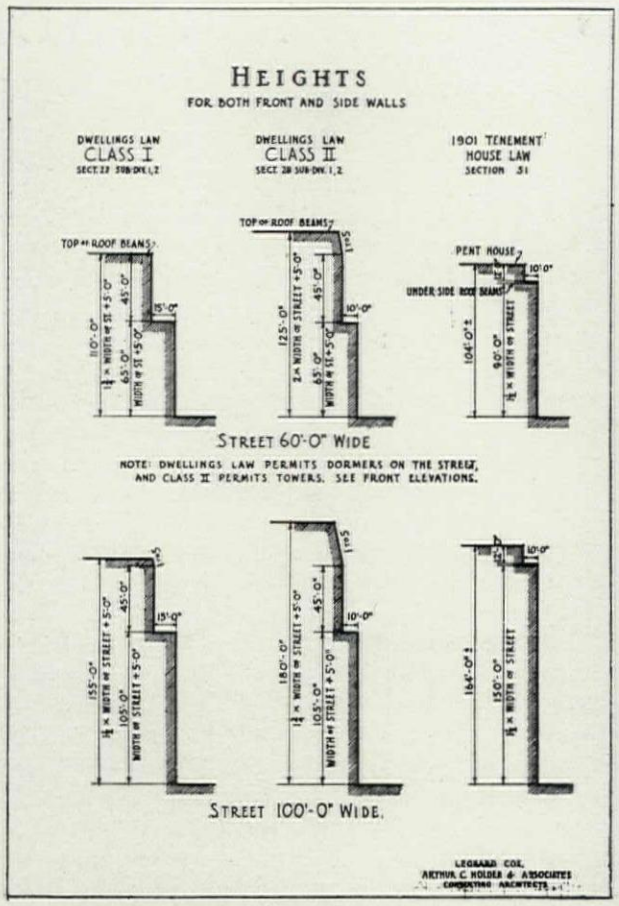


Possible Low Rental Development of City Block Under Proposed Dwellings Law

Arthur C. Holden & Associates, Architects

forced additional requirements of fire safety and sanitation on tenement houses erected prior to 1901, which have proved veritable fire traps and dangerous sources of infectious diseases. It also enforced higher standards on houses already "converted" illegally which had escaped the administration of the tenement house law, and of which the Commission says that some 30,000 cases exist. These requirements are chiefly matters of alteration and repairs. They are very important, however, as will be realized from a detailed reading of the law.

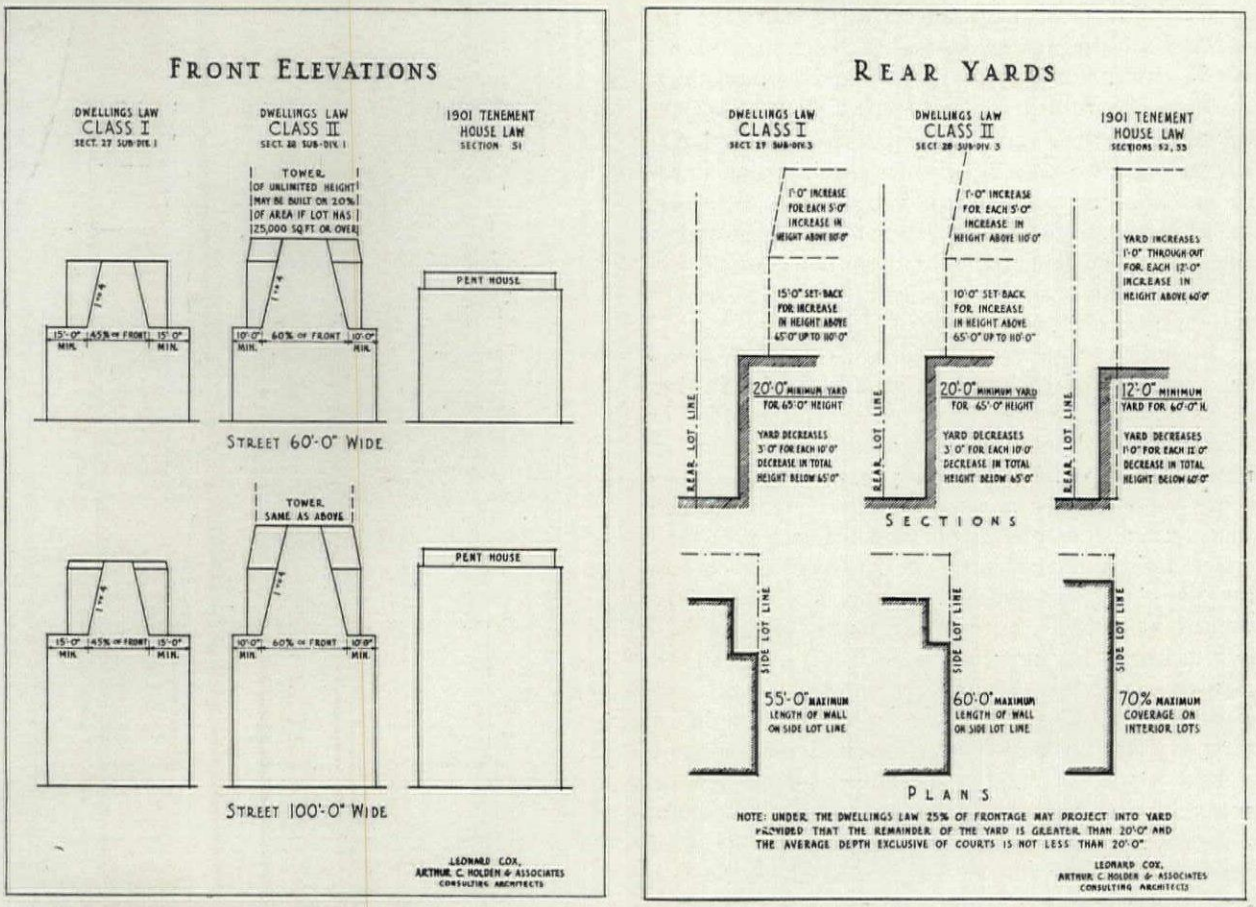
It is the new standards set for new multiple dwellings that are of the greatest interest for architects. Here the new law goes well ahead in the prescription of an improved type of apartment house. The net rentable area permitted under the Dwellings Law appears to be about the same, or even a little greater than under present practice, as indicated by the table of comparative floor areas under the existing law and under the proposed measure, and by several typical floor plans of apartment houses. This is part of the work of the consulting architect of the Commission, Leonard Cox, of Arthur C. Holden and Associates. But, although the volume of building is roughly identical, a new shape of building is required. Larger courts and rear yards are necessary;—on the street fronts the cornices must be dropped about 30 per cent lower than at present, and on all four sides, if the building is to rise higher, there must be stepbacks until the maximum height limit is reached. This maximum height is raised above the limit of the existing tenement house law, thus giving back to the property owner the bulk taken away from him in the lower stories of his building. This is the great advance in standards made by the law. It brings us nearer the ultimate goal of the free-standing city building, which is essential for the skyscraper. On page 27 of its report, the Commission says that "the ideal condition (for light and air) involves a spacing between structures equal to twice their average height." The lower of the standards prescribed in the law shows, as the result of scientific candlepower measurement, 50 per cent more daylight and 20 per cent more sunlight than under the existing law's minimum standard. Judged by this criterion, the advance can be carried much further before a wholly satisfactory condition is reached. But, judged purely architecturally, the advance is greater than that. In the lower stories the skyscraper is partly disengaged from its neighbors along the lot lines, through larger court requirements,—something the Commission was very particular about,—but even more important, the buildings are completely disengaged beginning at a height approximately above the sixth story. "Dormers" are permitted on the street front, much as in the New York zoning regulation. In addition, a tower, covering no more than 20 per cent of the area of the site, where the plottage is 2,500 square feet or more, may be built up to an indefinite height under certain circumstances. The operation will be seen in the diagram, and one is referred to THE FORUM for February, to the article on "Architectural Law."



Heights and Setbacks for Front and Side walls

The purpose of the lower cornice heights, larger courts and yards and the pyramidal stepbacks is to admit more daylight into the lower stories of the city block. In the individual structure, a much larger proportion of rooms will be arranged two deep, and the stepbacks will facilitate the planning of single apartments with two or three exposures and terrace spaces. Quarters will be more like homes, with some of the amenities which make life decent. Architects will certainly approve of this standard, and will view with favor the appearance of the new type of city building which it introduces. They will see that it brings architecture back into city buildings and makes for order and an orderly city, as Harvey Wiley Corbett has well said. Under present conditions, skyscrapers,—yes, and lower buildings,—are jammed together, usually on undersized or ill-shaped plots, the buildings themselves distorted, box-like, ugly. The result is bound to be low-standard, no matter what the architect's ability. What has become of architecture as an art of three dimensions? There is no real planning but merely a skillful piecing together of a few standard parts and details. Homes have no character, and all look as much alike as rooms in a hotel. The people who must live in these abortions are getting well fed up with them.

As regards elevations of the typical New York apartment, what more favorable can be said? Eleva-



Possible Front Elevations and Rear Yards Under Proposed Dwellings Law and Under 1901 Tenement House Law

tion as an integral part of a mass,—which is the essence of architecture,—is nowhere to be seen, unless in a few exceptionally well situated buildings. The architect is a mere surface decorator,—as the engineer has at times unkindly called him,—a beauty specialist, who "lifts" the faces of buildings. Where are there any signs of beauty on Park Avenue, with its miles of solid walls of *casernes?* Billions of dollars' worth of buildings in New York, built from acres of blue prints skillfully contrived, but scarce a cent's worth of architecture! The Dwellings Law should abolish this unhappy practice, from which, in the long run, nobody gains.

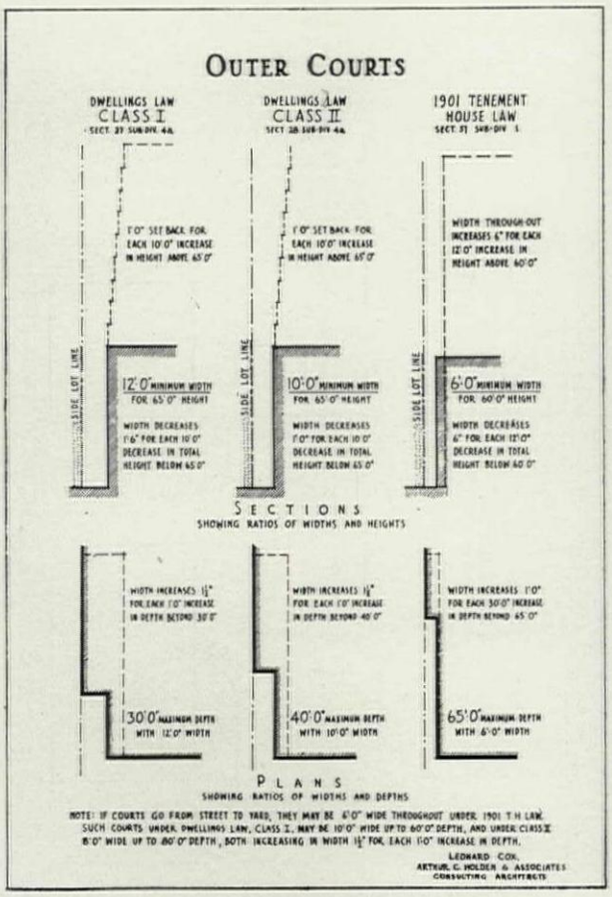
But the most novel feature of the new law is the introduction of the principle of adjusting standards of light and air according to land values. Greater bulk, i. e., lower standards of light and air, are allowed on practically all of Manhattan Island, and on a very small portion of the area of Brooklyn which amounts nevertheless to about half the area of Manhattan. The exact working of this double standard should be clearly understood. The Dwellings Law requires that all new multiple residence structures built on sites, the assessed value of which, exclusive of the buildings thereon, is not more than $2 per square foot, be deemed "Class I" buildings, and that those where the assessed value of the site is higher be "Class II," as explained in the Commission's report. Class I structures are restricted to a lower height and smaller area than are Class II, and they do not all enjoy the tower privilege allowed in Class I for plots of 2,800 square feet or larger. This distinction does not mean that $2 per square foot is a theoretical dividing line for a change in standards of bulk. It is more practical than that. It means that the Commission mapped out the "unspoiled" areas of Greater New York and then took this figure as a formula which best fitted actual conditions. The outstanding fact is that throughout the Class I areas there are practically no buildings which are built up to anything like the bulk permitted for Class I. In Brooklyn, for example, practically all existing buildings in Class I area are less than five stories high. There is thus ample opportunity under the law for larger buildings and consequent increased land values in Class I area. The differences between Class I and Class II requirements are seen in these illustrations.

Another excellent feature of the Commission's work was the enforcing of better conditions along side lot lines. This is a further step toward the ideal of separation of adjoining buildings, which has become essential in the modern city because of the introduction of the skyscraper and the increase of traffic in the streets. Indeed, in these many provisions governing bulk, mass and planning, may one not conclude that here is an almost new type of law governing buildings? It is an architectural law, instead of a construction or sanitary law, a *plan* law,

as distinct from the usual *specification* law which the average building code is;—is this not significant? To be sure, building codes and zoning laws have provisions governing plan, and this Dwellings Law, as well as its progenitor, the existing tenement house law of 1901, contains provisions requiring standards of sanitation and of fire safety. But the distinction seems sound. Its introduction is significant today, when every evidence points to a growing public demand for a more scientific coördination of buildings, one with another, and with the city plan.

One other important provision of the law deserves the sympathy of architects. That is in the further restrictions which are placed on the narrow lot of about 25 feet frontage, making more difficult its use for a skyscraper. The existing tenement house law legislated indirectly against the narrow lot to such an extent that in Manhattan and the Bronx it generally forced the abandonment of the 25-foot lot for five- and six-story tenements, at first to the despair of builders, but afterwards to their satisfaction, because they now use wide frontages, 100 feet or more, for either skyscrapers or "walk-ups." But in Brooklyn, multi-family dwellings are still built on narrow plots. On the whole, it is just as unreasonable to ask that a tall building be allowed on a narrow lot as that an automobile be run on the sidewalk!

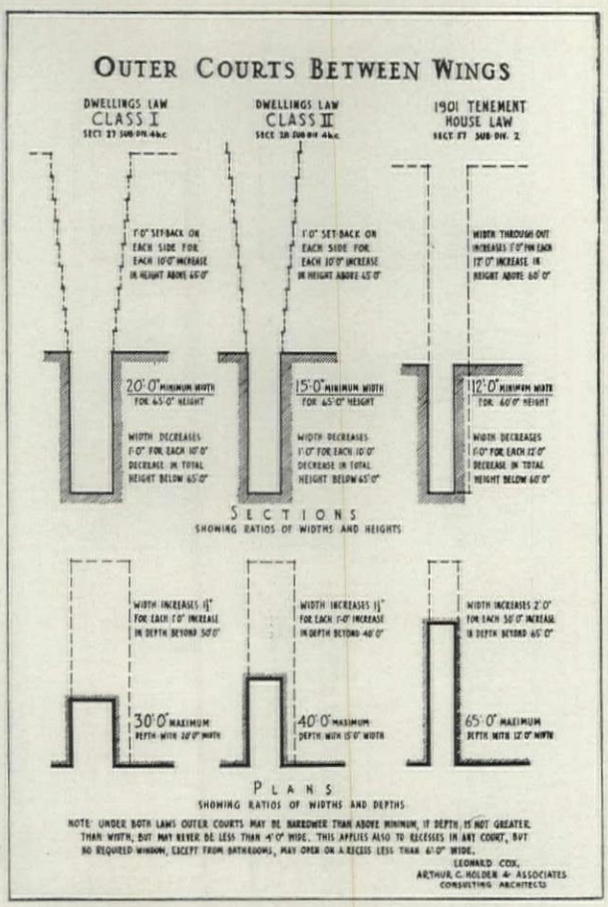
Again, let it be remembered that all these questions are fundamentally those of light and air. "Shall I develop my property at my own expense, or shall I contrive it so that I can force my neighbors to pay for it?" In England there is the law of "ancient lights" which protects a property owner in his rights to light and air, and it is said that portions of Westminster Abbey had to be set back in order to maintain the neighbors' rights. Would that a similar law could have been invoked in the United States when the skyscraper appeared! Then we should have seen this wonderful modern invention of the architect used as a blessing and not as an apple of discord! In New York, as already suggested, no one can be found to admit that he disbelieves in light and air. In fact, the tendency of both real estate promoters and of tenants is increasingly in the other direction. The difference is that the tenants are more willing to pay for it themselves. The real estate promoters, on the other hand, have engaged in a scramble for special sites where, paradoxically, the other fellow pays the bill. There are plots which are situated on street corners, or opposite parks or beside low buildings of a fairly permanent character, such as single-family houses, public structures, schools, churches, etc. But, as more and more skyscrapers appear, the number of these strategic sites grows smaller. There is increasing danger for the man who blankets his neighbor's property that his own building in turn may be blanketed or closed in. The opponents of the Dwellings Law, in alleging cases (in which they were rarely sustained) of hardships created by the new law, appeared to forget that the existing law creates infinitely more cases of damage to property.

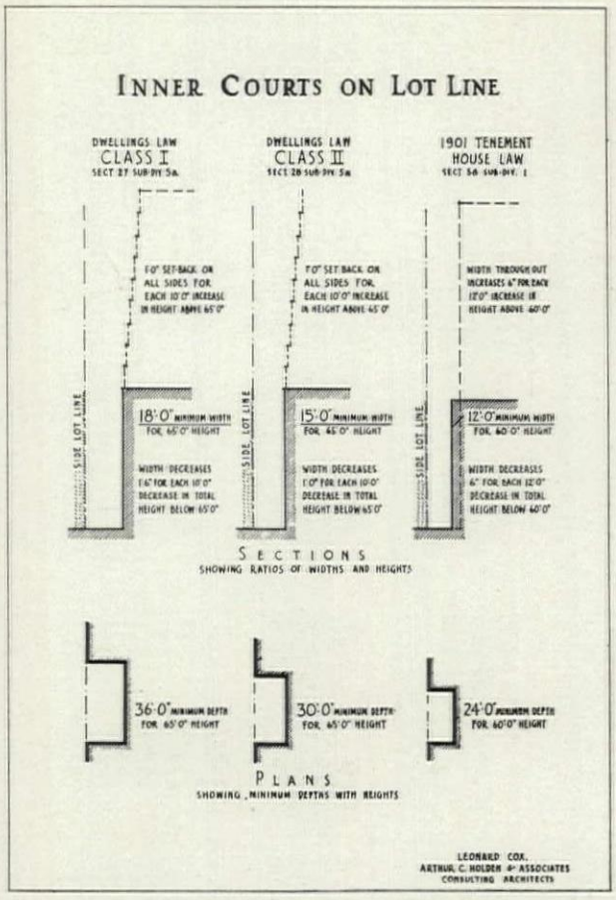


Possible Dimensions of Outer Courts Under Proposed Law and Under Existing Law

Furthermore, the existing law was originally designed to apply to "walk-up" tenements, at a time before the skyscraper problem became acute, and consequently the coverage and court sizes prescribing for low buildings none too sufficient light and air, are impossible for skyscrapers of from two to three times that height.

There are many other provisions in the law relating to new buildings which will repay study. Complex as it is, it is admirable in being written in every line under the supervision of an architect, in coöperation with the counsel of the Commission, Harold Riegelman. The consulting architect had the criticism of other architects and many experts. As a result, the bill is free from those grotesque provisions that are now and then found in building codes, and which indicate the hands of engineers who lack knowledge of planning. Also, the bill is purposely drawn to serve as a handy manual for architects, builders and owners, instead of being merely the usual catalog of "can do" and "cannot do," which wastes so much time on a drafting table. The provisions regarding sanitation and fire safety are worth study in themselves, in their application to both new and existing buildings. Interesting facts in this connection are that 60 per cent of fires in non-fireproof buildings originate below the second floors, and that the worst hazard is a non-fireproof stair. Particularly necessary is the requirement that



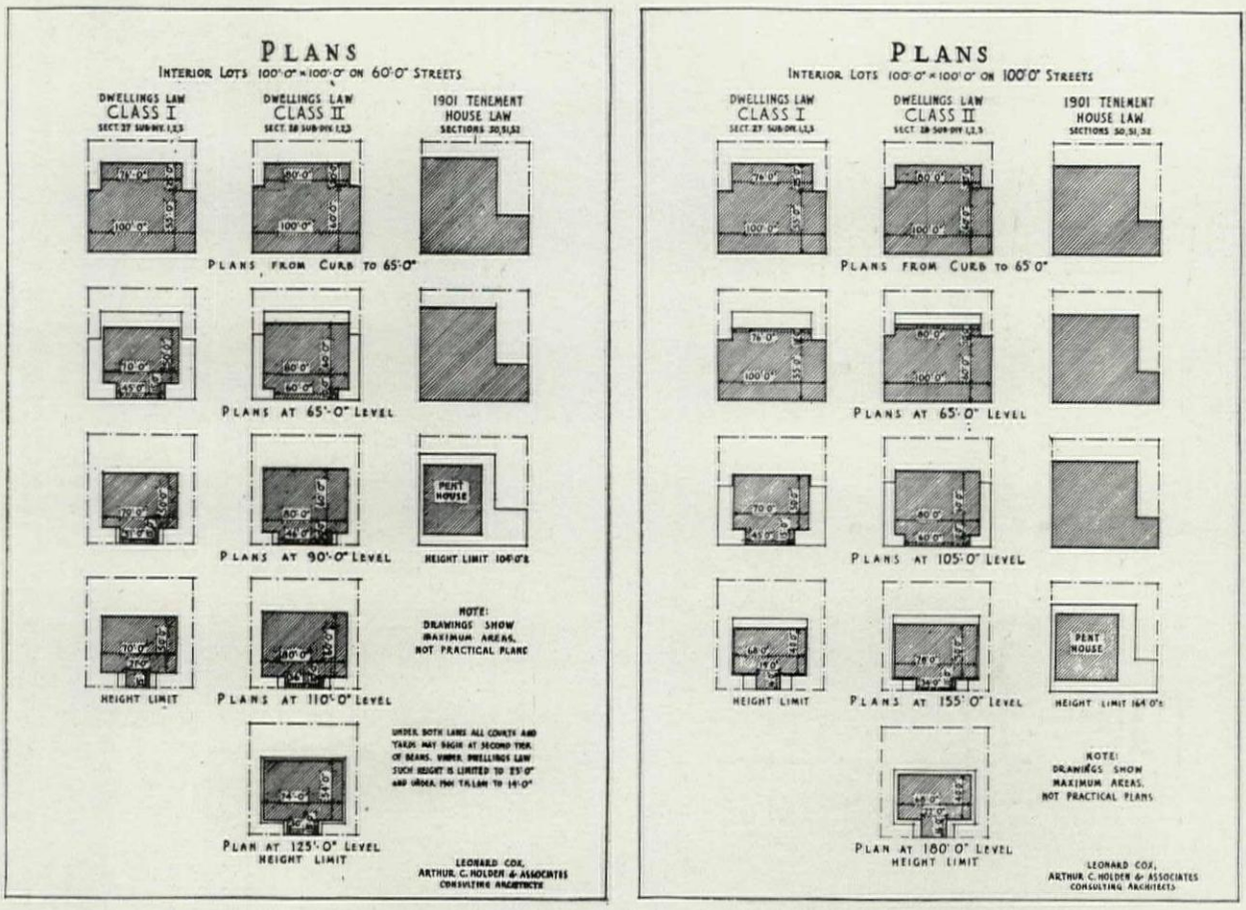


Comparison of Requirements in Regard to Sizes of Courts Demanded by Proposed and Existing Laws

frame buildings be spaced farther apart, about 12 feet as compared with the 4 to 6 feet permitted by the New York code. The result of this local practice has been to create huge areas of little frame dwellings, often of flimsy construction, equal in total area, it is said, to that of Chicago at the time of its great fire. This frame construction is located in the borough of Queens. In many cases it is without adequate fire protection, and is probably one of the worst fire hazards in the world, comparable only to Yokohama and Tokio before the recent fire and earthquake. The New York Chapter of the A. I. A. had previously publicly called the attention of the city authorities to this menace. The Mutual Association of Lumber Manufacturers approved the restriction on this hazard as preventing an illegitimate use of lumber. The underwriters also supported the law.

These portions of the law are important for architects, because in similar situations architects may find it difficult to gain the political support of other interests for improved standards for new buildings, unless they themselves are willing to take a stand in regard to structures already existing. One can readily see that such a law as the Dwellings Law, enforcing higher standards for nearly all classes of residence buildings, provoked certain real estate circles. These interests viewed the Commission as its own progeny and were shocked to find disobedience to their wishes. A small hornet's nest was stirred up, and in the excitement it was even rumored that some architects thought they had been "stung." The result of the controversy at the time of writing is that the Commission will be continued for another year for the purpose of proving its case to the public. In nearly a hundred years of tenement house legislation in New York, no measure looking toward improvement has ever failed to be enacted. Nevertheless, the bearing of real estate opinion is important in evaluating an architectural law. In New York, the opposition developed from a small minority which had been guilty of violating or evading existing laws. Others had an interest in low standards, such as the frame construction fire hazard or ramshackle "old law" tenements. The latter were built prior to 1901, have paid for themselves, and should be scrapped.

The more powerful opposition to establishing improved standards is of a different type, coming from people holding a number of views. There are those who will not take time to examine the law carefully. Others want no change under any conditions, and object to the inconvenience of change. Judging from the approval of the new law given by a few prominent real estate men and builders, the Commission may expect to overcome this opposition in the course of a year. It should be able to prove to the more responsible real estate men that the law will give better protection to property than does the existing regulation. The Commission should be able to demon-



Maximum Plan Dimensions Allowed at Various Story Levels Under Proposed Dwellings Law and 1901 Tenement House Law

strate that not only is the rentable area of buildings as large under the Dwellings Law, but that this area has, in one way or another, greater rentability, since it is generally more desirable space, even in the lower stories. In addition, the Commission has simplified the intricate provisions of the existing tenement house bill relating to stairways, halls, elevator vestibules and other means of egress. These latter economies are appreciable, and they offset any slight increased cost of the stepbacks. Most of these minor improvements which relate to new buildings are heartily approved by real estate men and builders. These considerations, however, do not entirely explain the basis of the real estate attitude. The speculative foundation under so much real estate activity is, of course, the real reason for opposition to architectural laws enforcing higher standards. It is this speculative phase which works such injury to the building industry. Excessive speculation is obsolete today in most of the American industrial, business and financial world. The trend is all the other way,—toward a solid investment basis,—and it is doubtful how long real estate can lag behind.

At any rate, the havoc wrought in New York by low standards of development is terrific, if we are to believe the statement made to *The New York Times* by Thomas Adams, the well known city planner and city borough director of the Regional Plan of New York and Environs. "It is giving people what they want that makes buildings profitable," said Mr. Adams. "The demand today, even among the comparatively poor, is for buildings that have light, air and good sanitary conditions." Then Mr. Adams referred to the startling fact that low standards were doubtless the chief reason for the exodus of New York's population to Westchester County on the north, to Nassau County on the east, and to New Jersey across the river. In Nassau and Westchester Counties "the increase in population was, during the five-year period previous to 1925, 34.6 per cent as against 4.5 per cent" in New York, or about 8 to 1. There is plenty of room left in New York where, as the Regional Plan had previously pointed out, about 90 per cent of the population lives in about 10 per cent of the area. This is the answer to those who defend congestion in the greatest and most congested city in the world!

The zoning resolution of 1916 has done practically nothing to relieve congestion in New York. One might even argue that zoning has increased it. The Dwellings Law is perhaps the first real step toward that end. Since, at the same time it establishes better living conditions and brings back architecture into city dwellings, the law is an aid to architecture.

BUSINESS AND FINANCE

THE ARCHITECT'S POSITION IN RELATION TO MORTGAGE FINANCING

PART I. IN THE FIELD OF DWELLING CONSTRUCTION

BY

C. STANLEY TAYLOR

Editor's Note. This is the first of several articles which will discuss mortgage financing for various types of buildings, and particularly the architect's functions and responsibilities in connection with this important phase of building. These articles will also set forth the general requirements on the part of mortgagees, which have been developed as a result of experience in this type of financing.

THE use of mortgage financing for residential projects of all types has become so general within the past few years that practically no dwelling is built without the provision of a large proportion of the necessary funds through such channels. In fact, it may be said that probably 75 per cent of the total amount expended for new dwelling construction is originally derived from mortgage sources of various types. This includes, of course, first and second mortgages, or, as the terms are often used today, "senior" and "junior" financing.

For a great many years mortgage financing in the residential field was somewhat haphazard in its nature, mortgages being obtained usually from individuals or from savings banks, estates or institutions. The last two decades, however, have seen a sound and scientific development of this function of mortgage financing for residences. There have been established, often with very rapid growth, banking institutions having as their sole function the provision of mortgage money for the residential field. These include not only building and loan associations, but divisions or offshoots of title guarantee or trust companies and also real estate bond houses whose function it is to secure money from the public for use in this manner. The older types of mortgage sources, such as savings banks and insurance companies, have developed their departments to such a degree that in some cases a great many million dollars are loaned annually by individual organizations. In addition to these large individual loaning sources, we find that the organizations which specialize in building and permanent loans for residences have grown in some cases to such sizes that thousands of homes are financed annually through individual companies. As might be expected, this tremendous extension of mortgage financing has brought with it exhaustive economic study on the part of those who are interested in the subject, and particularly by those who are investing their money in this manner.

Before going into this phase of the subject, it might be well to deviate for a moment in order to describe briefly the more or less standardized existing sources and methods through which money is obtained for the purpose of financing residential construction. The various forms in which senior or first mortgage financing is obtained include straight building and permanent loans, which are placed on the property for a definite period of years, usually three or five, and the amortizing type of first mortgage which is reduced periodically until it is paid off or replaced by a straight loan. The most usual form of amortizing first mortgages is typified by the financing which is provided through building and loan associations. As a general rule, the owner of the house pays 1 per cent of the face value of the loan each month. By doing this, the interest and principal of the mortgage are completely paid in approximately eleven years and seven months. Other types of amortizing mortgages have no standard rate of payment, but are simply developed through individual agreements between owners and mortgage sources, and can be arranged to meet the owners' personal financial situations.

The junior financing or second mortgage phase of a home-building operation is usually developed in one of three ways: (1) by a direct second mortgage loan, established for a given period of years (usually expiring when the first mortgage does); (2) by a second mortgage, provided through an arrangement with the building contractor; or (3) as is often done, when part or the whole of the purchase price of the land is subordinated to the first mortgage and takes the form of a second mortgage. Most second mortgages are today placed on an amortizing basis to be reduced by easy payments over a period of a few years. This entire junior financing market is entirely disorganized, or it might be more correct to say that it has never been organized. For some reason it has received practically none of the careful study which has been given to senior financing. As a result, the second mortgage field presents many dangerous factors. It abounds with evil practices in which shrewdness and unscrupulous manipulation in many instances threaten the home owner with direct loss of his money, if not of the property itself. Because there are no organized methods of second mortgage financing, and few if any recognized channels for the clean handling of this important phase, it is difficult to obtain junior financing except by the payment of high premiums, and there is also a constant traffic in the discounting of second mortgages, which as a rule the contractor or the speculative builder figures in as part of the cost in the building of homes.

The customary sources through which first mortgage money for home-building is obtained include primarily savings banks, insurance companies, title guarantee companies, trust companies, real estate loaning institutions, estates, and individuals. The amortizing type of first mortgage is primarily obtained from building and loan associations which function also as savings banks for prospective home-

builders who wish to accumulate part of the necessary investment before actually beginning building operations. Some of the real estate loaning institutions offer various types of amortizing first mortgages, and because of the amortization feature, it is usually possible to obtain a larger loan in proportion to the value of the property. With this general background in mind, it soon becomes apparent that the more scientifically mortgage financing is administered in the residential field, the more important becomes the architect's relationship and his responsibility. Many of the established loaning institutions or sources have come to realize that they must to a considerable degree control both the *quality* and the *design* of the buildings which are to become collateral for mortgage loans. The customary first mortgage loan is approximately 60 per cent of the appraised value of land and building, while through second mortgage channels from 15 per cent to 20 per cent more of the cost may be borrowed. Thus if a project carries both a first and a second mortgage, the owner as a rule will have only 25 per cent or less of the cost as his immediate equity.

Obviously, it is really the loaning institution which pays the bills for materials and labor, for architects' fees and contractors' profits. It is but natural, therefore, that many of the loaning institutions have developed departments or employed supervising architects to check carefully the plans and specifications submitted in connection with mortgage applications. Here is where the architect of the individual project enters very importantly into the financing picture. If his plans are efficient in character, representing sound, economical construction methods, and if his specifications present a selection of materials which seem to insure permanency and low maintenance cost, it is quite apparent that when the mortgage company makes an appraisal, the home owner will receive much more favorable financial consideration and will be able to carry out his project with a smaller cash investment. An examination of the records of mortgage companies will show a great many instances where mortgage loans have been refused because plans were impractical or specifications were not drawn in a manner which would insure good construction. After all, the ultimate real estate valuation of a completed project and the likelihood of its maintaining a consistent, good market value must be highly important from the point of view of those who provide mortgage money. Not only must the property hold its position in competition with other dwellings which may be offered for sale in the immediate neighborhood, but it must be of a character which is readily salable, so that it will not enter the so-called "white elephant" class of dwellings on which past experience has shown extensive losses, not only for owners but for mortgagees.

In designing dwellings for individual owners or for speculative builders, the architect in modern practice is usually called upon to have a clear understanding of mortgage financing methods and to assist the owner in obtaining favorable financing. In fact, in many instances today the architect performs the financing function and finds it to be a valuable part of his service. If he designs many houses, he soon becomes well known, at least to local loaning institutions. It is not an unusual experience to hear bankers make the statement that on houses designed by certain architects, they will readily give higher appraisals and make loans perhaps 10 per cent greater. This is because they know through experience that the particular architects in question plan efficiently and build well. In other words, they know how to create collateral better than the average. Most architects probably know by experience that the average home-building client is not familiar with mortgage sources or mortgage methods. As a result, the business aspect of many of these projects is not good as originally established by the home-builder. Often it turns out that the home-builder has not sufficient money to provide the necessary equity, and if the architect understands local mortgage financing, he may be able to rearrange the situation so that the project may proceed instead of being abandoned or held in abeyance until the owner finds himself better situated financially.

There are at least three ways in which the architect benefits directly through the development of knowledge of this kind. He gains an enviable prestige, not only with financing institutions but in real estate and local home-building circles, so that such knowledge often brings in commissions which he would not otherwise obtain. He will find that local real estate operators and real estate brokers appreciate business-like administration on the part of the architect, and that they are much oftener ready to work with an architect who combines knowledge of both design and the business phase of a residential project than with one who must be constantly checked from this angle. It is also often the case that mortgage institutions will recommend architects because they have developed appreciation of the architects' business-like service as well as of their designing ability.

It should, of course, be apparent that no one expects the architect to have an intimate, detailed knowledge of mortgage rates, discounts, and the other technicalities of this type of financing. If he possesses such knowledge, it is of great value, but the type of knowledge and experience which is really desirable in this connection involves primarily technicalities of design and construction. In other words, the architect's function is to design a project in a manner which will be consistent with the requirements of those who are expected to loan money for the operation. For this reason, it may be of interest to review briefly some of these requirements as they have been expressed from time to time by those in charge of the appraisal or technical departments of loaning institutions.

When a mortgage application covering a home-

building project is brought to one of the modern types of mortgagees, the first consideration is usually given to the location of the property and the physical evaluation of the land. There are certain districts as affected by neighborhood conditions which are considered much more favorably by loaning institutions than others. The general environment is important; the trend of local development is considered; the existence of community facilities and mechanical improvements such as water, sewer, gas, electricity, etc., is thoroughly examined; the physical condition of the land is analyzed, together with local real estate valuations. In more than one instance architects have taken part in this and rendered important service to clients. Just because a client happens to own a given plot of land on which he intends to build a residence does not mean that he *should* build there. It may be that unfavorable local conditions exist or are developing. It may be that the location or the physical aspects of the particular plot are not suitable for the type of house which the client prefers. It is, therefore, quite possible that through the architect's suggestion a change of site may be found practical and desirable, and in this manner the project may be made much more readily subject to favorable mortgage financing.

The next consideration is given to the plans of the house. Here is where an extremely careful study is made primarily to eliminate two dangerous factors,—first, waste space which is uneconomical from the point of view of both owner and mortgagee, and, second, impractical building construction conditions as imposed by the plan. Here is where an architect has an opportunity to display both ingenuity and practical knowledge, because if the plan is efficient, a much more favorable appraisal will be rendered, and if it is not efficient, the mortgage application may be refused or the amount granted may be considerably less than the owner wishes to obtain. After the plans have been thoroughly analyzed, the element of design is given consideration, not from the æsthetic point of view but primarily from the *market* aspect. Is the house designed in such a manner that it will appeal to the type of prospective purchaser to whom it might ultimately be offered for sale? Is it designed in a manner suitable for its environment, and does the design offer a balanced ratio with probable construction costs? In other words, mortgage lenders realize that there may be waste or increased construction cost imposed not only in the plans of a house but also in its general design. If it is overelaborate or if it calls for details which are inconsistently expensive, it will not make a favorable impression at the time when the loan is being considered.

After the plan and the general design have each received careful analysis, the next, and one of the most important considerations, is the question of specifications. Here as a rule the requirements of mortgage lenders are becoming constantly more stringent and more definite. The value of various building materials and types of equipment is known today and can be measured accurately. Manufacturers have done much to educate not only architects, contractors and owners, but also those who are interested in loaning mortgage money as to the merits of various materials. The particular points of interest include permanency and low maintenance cost as primary factors. The dwelling that soon begins to require replacements and shows comparatively rapid deterioration naturally does not constitute good collateral for mortgage loans. The banker is interested in the owner's ability to pay his interest, his amortization payments, and ultimately the principal of the mortgage, and he knows that if a dwelling is costly from the maintenance and depreciation point of view, the owner is in a less favorable position to keep up his payments. He knows, too, that even the quality of appearances after a few years has much to do with the appraised value of the property, and if a dwelling begins to look shabby and to show the need of repairs, thousands of dollars may drop off its market value. For this reason, the architect's specifications are in most cases quite thoroughly analyzed before the mortgage loan is made, and while some lending institutions may take the trouble to suggest changes in plan and in specifications, many of them will simply turn down the application or offer a smaller amount of money without any special explanation of the reasons. Specifications are, of course, analyzed also from the point of view of construction cost. The materials and equipment used should in the main be consistent with the general cost of the house. It is, of course, permissible for the owner to exercise his own judgment in the use of comparatively luxurious appointments, but these will gain very little recognition in the general appraisal of the dwelling, except where they might be in the nature of unusually good mechanical equipment, which has a definite utility value and which might function as an additional factor of value in the ultimate sale of the property.

It must be quite apparent that the architect in his service exercises a very definite relationship with mortgage financing, because in practically each division of appraisal, his function has its place and his work will meet with approval or disapproval. It must be remembered also that in appraising the value of property, those who are making an analysis in the way described in this article must sum up the total favorable and unfavorable points in relation to the land and its treatment, the house and its design, the plans and the specifications. The final total sum of impressions and facts forms the basis of the appraisal itself, and there may be a variation of thousands of dollars between two dwellings of equal cubic footage. Making the most of this variation is the architect's responsibility, and it is for this reason that he should thoroughly understand how mortgage appraisals are made and should constantly think of this ultimate test when he is developing each part of a project.

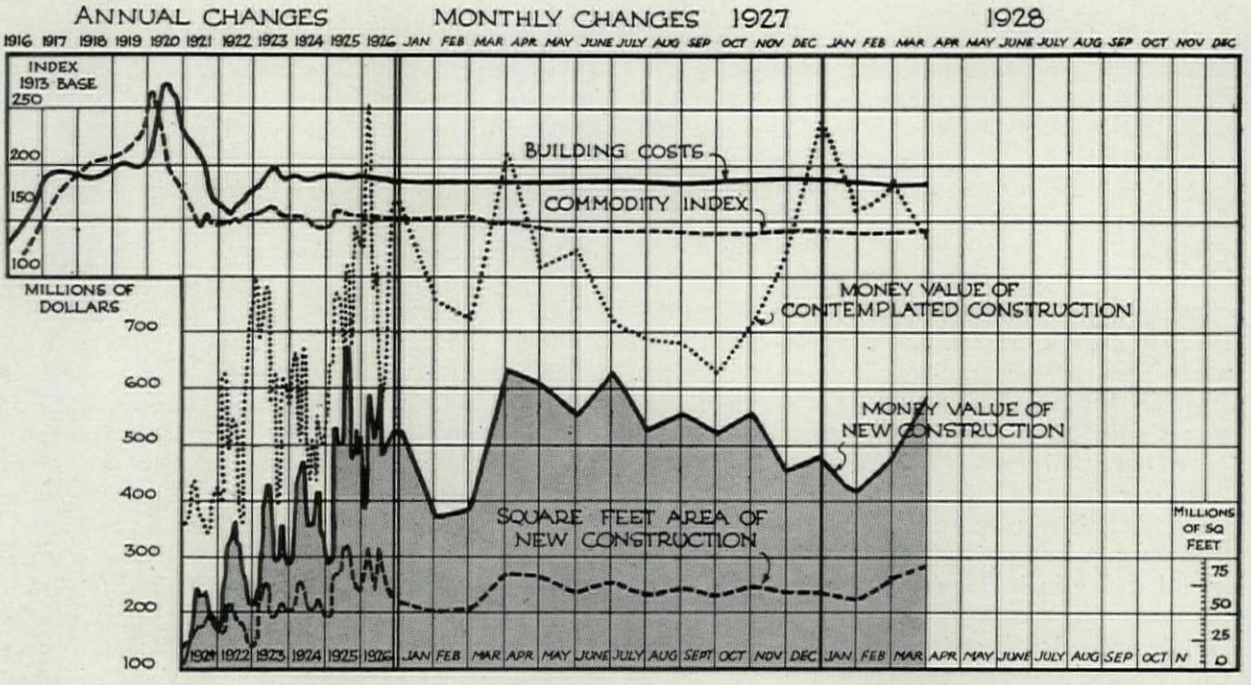
THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

IN spite of many predictions to the contrary, construction activity for the year 1928 has opened in record-breaking volume which bids fair to continue for at least the first half of the year. According to figures of the F. W. Dodge Corporation covering the 37 states east of the Rocky Mountains, there were contracts let for new construction during the first quarter of this year to the amount of $1,485,067,000, which is an increase of approximately 6 per cent over the amount of building started in the first quarter of the year 1927. This figure also represents the highest first quarter record ever established in the 37 Eastern states. A glance at the chart included here would indicate graphically the comparison of activity between this and other first quarters, and it becomes obvious that the year 1928 will add another record volume to the construction history of the last four years.

The new work contemplated, as indicated by plans filed, during the month of March, is considerably lower than the figure for March of 1927. The types of buildings for which plans have been filed are somewhat different and include a much larger number of institutional and commercial projects with a definite decrease in the amount of speculative building of both apartments and residences. On the other hand, the amount of building by owners for their own occupancy in the residential field is evidently increasing this year as compared with the 1927 figures. Contracts let during March amounted to $592,567,000, 46 per cent for residential buildings, 19 per cent for public works and utilities, 12 per cent for commercial buildings, and 6 per cent for educational projects.

Considering the plans which were filed for new construction in the month of March, as compared with March of 1927, we find these territorial changes which perhaps offer some basis for predicting trend of activity in the various districts. New York state and northern New Jersey show a 16 per cent gain in plans filed as compared with March, 1927. The New England States show an increase of 32 per cent; the Middle Atlantic States show a loss of 44 per cent; the Pittsburgh district shows a gain of 35 per cent over the contemplated record of March, 1927. In the Central Western States there is a loss of 44 per cent; in the Northwest a loss of 22 per cent; in the Southeastern States a drop of 54 per cent, and in Texas a drop of 35 per cent. It is probable that part of the unusual activity of the first quarter has been the result of an effort to let contracts early in order to partially avoid the usual spring buying activity.



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

PLANNING GROUP HOUSES FOR RENT

BY
RICHARD H. MARR, ARCHITECT

WE have seen, illustrated in our professional journals, numberless fine examples of residence architecture,—in plan, with exterior and interior views,—permanent homes of happy and (occasionally, perhaps) satisfied owners. Why not attempt further to endow with the same taste and completeness the homes of the great number, who of necessity must rent? When we erect a building to rent we are in a position akin to that of a merchant investing in a stock of merchandise, for we must please the public fancy and also make profit in the transaction. The one great point of difference, however, is the fact that the merchant may vary his next order in whole or in part through his knowledge gained by the previous sale and owing to any change in the trend of public desire. The builder, however, must so present his merchandise of land, buildings, and equipment that it will meet with the approval of the clientele for which his building is designed, not only one year but for each year during the expected life of the structure. It is, of course, assumed that the responsibility of the builder is not to be transferred to some unfortunate investor after the first group has tenanted the building!

For the purpose of analyzing this problem, we might consider the most usual type of building investment,—that of multiple housing, and a more specific and not as widely treated subject, that of the semi-detached dwelling,—the suburban brother (or sister) of the urban apartment house. The particular group used to illustrate this text was not chosen because of merit in the solution of the problem, but because it represents the average solving of the problem facing the investment builder. The questions which the author attempts to answer are not indigenous to any special location. The problem of financing will not be touched upon except to say that buildings erected as outlined here will, perhaps, bear a closer investigation and warrant a more favorable loan than those in which these apparently obvious, but often neglected, points have been overlooked or treated in a careless manner. Principal and interest must be paid from earnings, which in turn come from satisfied occupants. The three main divisions in order of procedure are: (1) choice of location; (2) plan and arrangement; (3) material and equipment.

Choice of Location. As the buildings illustrated would cost approximately the same in any part of a given area suited to their clientele, it is evident that a good location will complete a good scheme, or a poor location make good buildings unrentable. Assuming that an approximate decision has been made on the total amount to be invested, and a portion allotted to the purchase of a site, these details should be considered:

(a) *Permanence.* Is the adjacent property of suitable character and likely to remain so?

(b) *Competition.* The site should be selected to give the group a decided advantage over any similar project that might be contemplated in the neighborhood. An effort should be made to obtain property facing a park or open space, or with a decided advantage in regard to view.

(c) *Accessibility.* The site must be chosen with due regard to transportation facilities, street car service

Group of Fourteen Semi-Detached Houses, Detroit
Richard H. Marr, Architect

The Garages are Grouped Together

and good roads, streets or boulevards for motorists.

(d) *Good address.* The appeal of a fine, accepted residence avenue has a decided advantage over a short, unimportant street.

Plan and Arrangement. The great amount of contemporary material made available through advertising in the architectural press should assist one in developing almost any given type of plan. Bear in mind, however, that too great a difference in rentals in the same building is not advisable. Do not attempt to get a few extra dollars by putting mediocre or small apartments adjacent to those for which a considerably larger rental is asked. There are several considerations in regard to plan that are very important. A plan should be as direct and simple as possible. This not only saves in construction costs, but usually improves both the appearance and the utility of the rooms. The shapes of the rooms should be considered very carefully to make sure there is available space for the usual furniture of the people to whom the house will be rented. Rugs come in various more or less standardized sizes and will not fit well in rooms of unusual proportions or odd shapes.

Windows should be so placed as to not only admit ample light and air, but to leave adequate wall spaces at the corners of the rooms for the placing of furniture. Weather-stripping of the windows is often a very desirable feature. Some operators have found that the use of glass admitting the ultra-violet rays of the sun is very desirable in sun-rooms or certain of the south rooms, if possible. It is well to consult the booklet of the United States Bureau of Standards in making the choice of such glass in order to make sure that the glass specified really admits enough ultra-violet light to be worth while. It is

Street Front of Group, Showing Variation in Exterior Design

naturally necessary to keep the service entrances well separated from the main entrances of the houses, and to make sure that the service entrance for one house does not come close to the main entrance of another. It is well to build in as few equipment cases, etc. as possible, except in the kitchen. The individual taste of tenants is too varied to make much built-in furniture usable, and the unused bookshelves of the tenant who has no books are depressing as well as useless. The planning and equipment of the kitchen constitute one of the greatest factors in renting houses, as the mistress of the menage usually scrutinizes this very carefully and is a competent judge of the working efficiency of the kitchen plan and arrangement. The provisions in regard to servants' rooms should be commensurate with the living standards of the tenants. One must consider, also, the paths of travel of servants in order to plan for their work with as little interruption or contact with the household as possible.

In group houses built for renting it may be economical to have a central heating plant for the group. However, if there is any likelihood of the houses being sold separately, it is well to provide a separate heating plant for each house. Garage space must be provided for each tenant, and it is sometimes well to provide an extra garage or two for the use of guests of the tenants or for the use of the tenant who uses two or more cars. In the case of an apartment that rents for $300 or more a month, the family frequently needs space for two cars. On the general plan it is desirable to have a play yard or recreation space for young children, area well separated from the street in order to avoid accidents. Provision for the welfare of children is an important item in suburban groups of this kind. It is advisable

An Attractive Entrance Motif

Excellence of Design Enhances Rental Values

to provide a play room in the basement of each house or over the garage. The newer types of heating plants and the cleaner fuels often make possible the use of the basement as a play or recreation room.

Materials and Equipment. The choice of the materials for the exterior should be made with due consideration of maintenance cost as well as of first cost. Choose, if possible, materials which will age gracefully and which are not drab in color. The attractiveness of the exterior is the first factor influencing the prospective tenant, and first impressions are very often lasting. By all means, avoid use of the theatrical and the sham. This does not mean that color should not be used. It should be, but used with taste and restraint to make the houses attractive.

The equipment of the building is most important. The innovations and so-called luxuries of five years ago have become the necessities of today. It is well to introduce as many modern notes (of tested merit) as the rental will allow, as these items are desirable from the renting agent's point of view. A list of such equipment to be considered and specified, if possible, should include:

Mechanical refrigeration.

Thermostatic heat control.

Provisions for mechanical equipment,—washers, mangle, dryer, etc.

Resilient floors in kitchens.

Dining alcove furniture.

Ironing board provisions.

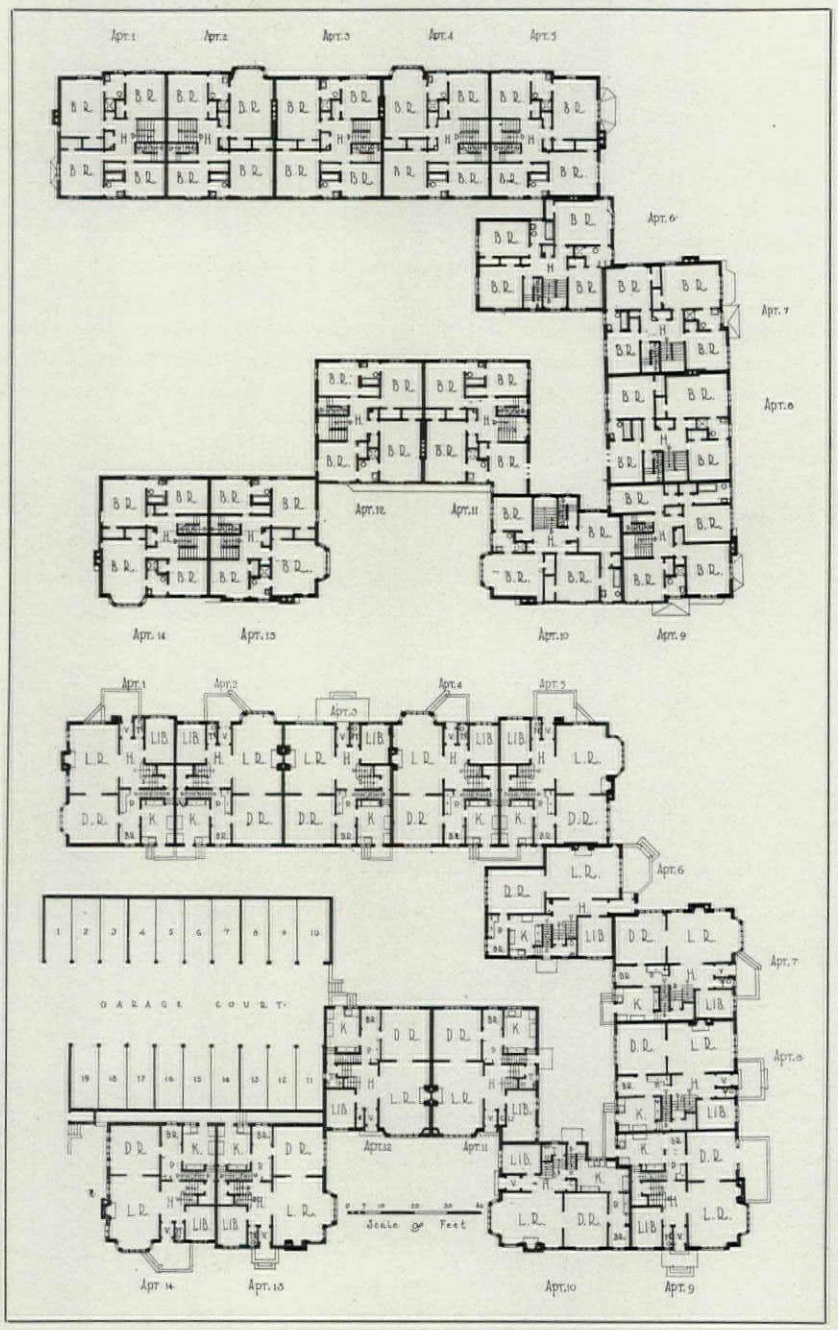
Built-in bathroom accessories.

Color in bathrooms,—tile and fixtures.

Cedar closets, etc., etc.

Ample electric outlets, including power outlets for cooking equipment, laundry equipment or electric heaters should be installed. Careful consideration must be given to the placing of base plugs to make them useful in connection with various arrangements of furniture. The wiring should be done with radio connections in mind. If these are provided in the initial wiring, unsightly and dangerous makeshifts will not be put up by the tenants. After all, this may seem to be a bromidic prescription, but it is the author's belief that a thorough study of the buildings most easily rentable and those most successfully operated will reveal the fact that most of the features enumerated here have been incorporated in the structures.

It is necessary for the architect to bear in mind constantly the desires and needs of the class of people who will be the tenants, rather than his own personal prejudices or desires. The owner of the development is usually informed in these matters, as he is in close touch with the local renting conditions and understands the requirements. The architect can fulfill these needs economically and efficiently and add his own good taste. He will always find that the requirements can be met without outraging good taste and good architectural design. It is his funtion to be the guide.



Plans of Group Illustrated
Richard H. Marr, Architect

THE ARCHITECT AS CONSTRUCTOR

BY
WILFRED W. BEACH, ARCHITECT

THE present building boom in our larger cities has brought such a satisfying amount of business into the offices of most of the country's architects that it seems quite unnecessary to even suggest a question as to what tomorrow may bring forth. Yet the "tomorrow" of architecture is what most interests the younger men in the profession. Is the architectural practice of the future to mean a continuation of methods now in vogue, or will it be vastly different? If different, wherein will lie the variation? Architecture and building are so fundamentally interlocked that it is quite obvious that a change of procedure in either calling is bound to affect the other. Hence a study of the evolution of either must, perforce, be accompanied by due consideration of the progress of the other.

When our nation was young, it harbored few architects; and still fewer of those who called themselves such were worthy of the appellation, as is amply evidenced by such of their drawings as are still in existence, notably those submitted in competition for the capitol at Washington. For many years, construction work of the young republic was handled by four classes of individuals: (1) the architect, *per se*, more or less as of today, but of a quite limited sphere; (2) the "surveyor," forerunner of the modern engineer; (3) the "undertaker," who bid upon and undertook the construction of the concepts of the two first named; and (4) lastly, the "architect and builder," generally a country carpenter, by whom was performed the major portion of the building of that day.

Some have described the present-day architect as an outgrowth, the fruit, so to speak, of this latter group, but that seems hardly fair,—true only to a very limited extent. Rather, we of today are really the logical successors to those pioneers who lighted the way with a few conspicuous monuments which still remain, speaking evidences of their truth and sincerity. The "architect and builder" was more than likely to drop the first part of his title, thus becoming the "general contractor" of our day. And how have we architects kept our heritage? We elders have seen architecture expand from a comparatively simply affair of foundations, walls, floors and roofs to the present highly involved creation involving a vast multitude of things, many of which were unknown even to our immediate predecessors. We readily accept as axiomatic the assertion that it is humanly impossible for any single one of the *genus homo* to completely master *all* the intricacies of a large modern building,—but does each of us go as far as he may?

Thirty-five years ago the architect was undisputed "boss of the works." Does he occupy the same pedestal today? Then, no building project of any consequence, aside from the single item of bridges, was essayed until an architect had first been retained to design it and direct its construction. The complete architectural organization included men with sufficient knowledge of construction and the mechanical trades to design framing, heating, plumbing and wiring, in addition to the more æsthetic features of external appearance. But there came other architects, also of the first rank as to design and ethical status, whose practice did not warrant, or who did not choose to give, steady employment to men of exclusive engineering attainments. These architects found groups of engineers prepared to offer such service to all comers,—and the line of least resistance was readily pursued. Soon it came about that such engineering concerns were learning to solicit direct the designing of factories and warehouses, buildings which did not appear to demand embellishment,—"architecture," as by some considered. Next in the progression was the employment by such engineers of architectural designers, where these were demanded, to supply a needed touch to the otherwise simple mass. Whether the modern engineer has graduated from the ranks of the old time land surveyor and bridge designer or whether he is a direct offshoot of our own profession, makes little difference. He has become a powerful factor to be reckoned with in the acquisition of new business. To the small city practitioner this defection of industrial construction has not been of much moment. Whether such work be carried out by a distant city architect or engineering "specialist" worries him not at all,—it is not his funeral. Smaller fry "have smaller fleas to bite 'em."

For instance, there was a time when the stable "pot boiler" of the small office was the country home, costing from $5,000 to $10,000. The planning of these carried no direct profit,—even at a fee higher than the American Institute's minimum,—but they enabled the town architect to steady his small organization, and they increased the circle of his clientele. Much of this business has gone by the board with the inauguration of the Architects Small House Service Bureau. Presumably, this service has filled a "long felt want," so one must not quarrel with it. It merely takes its place with others among those things which have to do with the changes in office practice that have been and are still going on. True, the actual number of houses built from the Bureau's working drawings is probably proportionately small; but these drawings have furnished inspiration for countless others,—copies of which can be had at any lumber yard,—and which, by the way, are vast improvements over the comparative few that were in existence before an organization of architects added to the marketing of ready-made drawings and plans.

But the growth in the influence of the engineer and the influence of the ready-made plan on the volume of work in architects' offices pales to insignificance when compared with the steady advance into our field of the modern general contractor. This entity, formerly a willing and earnest bidder for the architect's favors and working under his supervision, has now become a most formidable rival in the securing of business direct from the owner; getting, in short, the planning of the work in order to be sure of getting its construction. Frank N. Watson, Secretary-manager of the Dallas Associated General Contractors, deals candidly with this situation. He speaks quite frankly of the demoralizing effect on building in general of the operations of the shyster and the novice in both architecture and contracting, and repeats the oft-reiterated complaint against awarding building construction by competitive bidding. He further says: "In too many instances, even the architect who appreciates his professional obligation permits himself to be over-ridden by the demands of the owner, and stands idle while the owner indulges in the common pastime of 'whip sawing' the three low contractors, or disregards his own interests by buying construction on price alone." This we all admit, and we also know to our sorrow that "entirely too many contractors, who make claim to skill, integrity and responsibility, are bidding for the profit instead of for the contract and are giving their 'subs' and 'dealers' the same or worse treatment than they complain of on the part of the owner and architect."

Well, why shouldn't they? If we consider only those offices which have never mistreated a contractor nor permitted a client to do so, can we find therein any fundamental reason that should lead a contractor to make a building better, simply for the love of that building? No, that is the sole privilege of the architect! The contractor is to make the building good because he is compelled to do so and for no other reason. In fact, he could not be depended upon to make it good without being hedged about with restrictions that prevent his doing otherwise. Such is the being created by our building contract. Nevertheless, our practice is so predicated on the custom of competitive-bidding contracting that we remain its sponsor and will probably continue to do so. We do not willingly try to educate the owner to other methods. We know full well that there are no ethical standards in such a game, and we write our specifications and contracts accordingly. Then, after the contracts are let, we accept the post of paid detectives and try to keep the contractor straight. Do we keep him so? Mr. Watson believes (and it is probably quite too true) that "any experienced contractor will admit that the leeway between good and bad afforded the contractor by the ordinary set of plans and specifications is not seriously impaired by architectural supervision; that the unscrupulous contractor, or even the ordinary honest contractor, faced with a possible loss through a price-competition, forced bid, can find many ways to skimp his work, —giving construction that will pass the eye of the average inspector, but not giving the owner the quality he wants or thinks he is getting." This from the contractors themselves! But, suppose a builder of character and commensurate reputation has opportunity to serve a friend who wishes to build and wants him to do the work? "Even then," Mr. Watson complains, "by reason of the fact that our industry cherishes a taboo that design and construction are inviolably separate, the contractor must turn the prospective owner over to an architect who cherishes the same taboo, and the project usually ends in the same old free-for-all competition, and 'price' emerges the victor."

Discouraging this, for a builder who has the interest of a prospective client at heart and who steers him to a good architect. Why shouldn't he instead, if his initial hold on the owner be sufficiently strong, hire a good designer (away from some architect, if necessary) and execute the whole work as he knows it should be done and in a way that he and the owner may both take pride in? That's exactly what he's doing today,—and he's going to do it more and more often as the days go by. "Truth endures",—perhaps more fully in architecture than in some other fundamentals. Are we building with truth when we make use of unworthy vehicles, questionable materials and unrighteous intents? Competitive-bidding contracting is a relic of the day of *caveat emptor*. Why should the architectural profession collectively strive to maintain that iniquitous slogan when all the better class commercial world is seeking to place all business on a higher plane? Is it not natural for the business of building to follow suit, in spite of the architect? Then may we expect Mr. Watson's conclusion: "But, in the main, future construction work will be handled by firms which unite in one organization the functions now separately performed by architects or engineers and contractors."

Who may this entity of the future be, who is thus to combine the former distinct functions of architect and builder? Obviously, at the start, it is whoever first occupies the field. To an alarming extent, we find the contractor already there. But, is the field rightfully his? To a very large degree, his ability to sell his services in the dual capacity has been aided and abetted by a most powerful ally,—his willingness to finance, as well as to design and build the projected structure. It is in this line of endeavor that the large builder, operating his own architectural and engineering departments, has found the greenest pastures,—the ripest fields. Such a concern, functioning through a reciprocal agreement with a powerful bond house, wields a potential lever under that unassigned project. Even if the tradition be observed and an independent architect be favored, his retention is by sufferance of the builder, over whom he exercises no control whatever. If architects are to compete with this formidable protagonist, they must either equip themselves accordingly or find other points of advantage to aid them

in securing the business. It is very largely a selling proposition, pure and simple; a setting forth of the qualifications of the seller of services. To begin with, the architect finds himself possessed of one worth-while asset which connotes a corresponding weakness in the armor of his rival; he is a subscriber to a well defined code of ethics. No matter what one may think about this or that particular architect who is alleged to have side-stepped the code, the fact remains that the public has a sufficient respect for the standard of business dealings of the profession at large to hold such a transgressor to be an out-and-out crook, whereas a contractor may do those same things and worse, and be regarded merely as a shrewd business man.

Naturally, the architect's most ready entry into the construction field is by means of some form of cost-plus building. The solicitation of building construction without a guarantee of cost presupposes the highest type of salesmanship,—and architects pride themselves on being poor salesmen. They,—the best of them,—are sometimes heard to say that they never went out after a commission. Well, be that as it may, this article must be for those others who are willing and eager to expand; whose joy in the conception of an appropriate design can best be completed by the greater inspiration of the actual creation of the thing of materials enduring, that shall make the ideal real. Nor need such a one be deterred by Mr. Watson's showing of the scant profits in building construction. After saying that "statistics recently compiled from data in the Bureau of Internal Revenue show the average profit of general contractors to be only 2.1 per cent," he adds his impression that, if consideration were given also to those whose business was insufficient to demand a government return, "the 2.1 per cent is certainly 50 per cent high." That is, he thinks the average profit might be about 1.4 per cent.

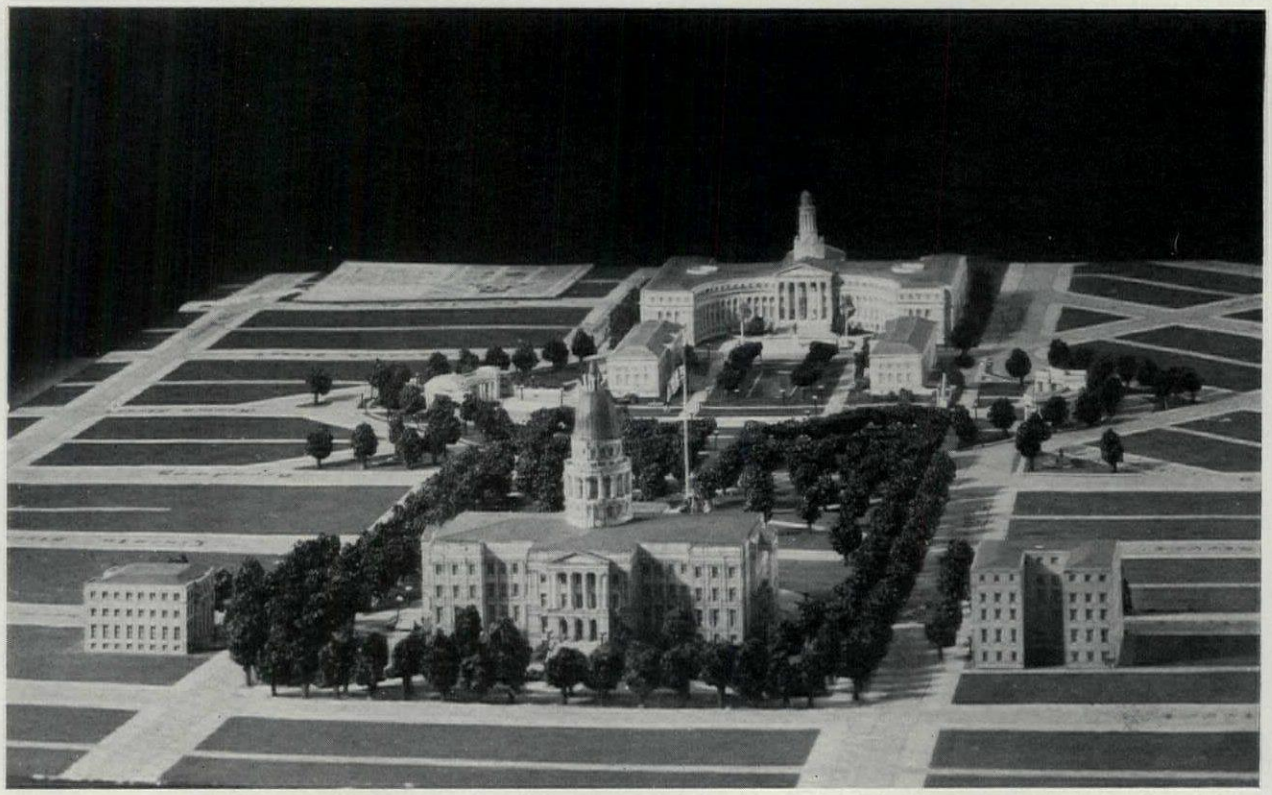
But we need not reckon with these smaller fry, as they are proverbially poor business men, the majority being "carried" by the local lumber yards which reap the real profit, secure behind the mechanics' lien laws. Even the 2.1 per cent makes little if, as is generally figured, it depends on volume of business. A contractor with $50,000 capital can readily handle $2,000,000 worth of work a year, on which 2.1 per cent figures $42,000,—not a bad return on the investment. But, in cost-plus building, where there are no losses to be charged off, and where the actual capital needed is proportionately less (say about 1 per cent of the gross business), the profits are, as for other forms of service, more of a return on energy expended than on actual financial investment. The building owner "carries" the operation. It is his deal, already financed. Why should he pay a high rate of interest on someone else's funds during construction, when his own have been set aside for the purpose,—are either idle or drawing a low return? If the builder is to have a hand in the financing, that is another matter. It then becomes a subject of too many sides to be dealt with here and now. In any event, the financing should be segregated from the building construction and paid for as an independent factor; otherwise both may be found to be costing the owner inordinately.

One dispenses also with the incubus of fixed-price contracting, the 1½ per cent "thrown away" on a bond. As a matter of fact, an architect, upon first entering the building field, is more than astonished at the savings he can effect,—can turn back to the owner as part of the reduced cost of safe and sane building over that of cut-throat contracting. In a measure, the general contractor has "cooked his own goose" in the cost-plus game by the opprobrium brought upon it by his very lack of ethical procedure therein. Unless he can convince the owner that he himself is an exception (admitting that his competitors are not to be trusted), he must either be backed by the financial interests bonding the project or must have recourse to super-selling propaganda. In the last instance, he is likely to add a maximum guaranty to his offer,—and the owner is landed, tied up in a deal whereby the builder is both contractor and judge of what that contract is supposed to include, without price competition. This situation is always puzzling to an architect, who can with difficulty conceive how an astute business man can allow himself to be inveigled into such a palpable swindle. The answer is,—superior salesmanship. Nor is the salesman necessarily dishonest, though he may prove his employer to be. If the owner is so supremely foolish as to entrust cost-plus work to someone in whom he hasn't absolute confidence, perhaps he deserves to reap the proceeds of his own imbecility. *Caveat emptor!* And the warning is quite apropos in modern building, unless the prospective owner is careful to assign his work only to a firm of known integrity.

Let us cite, briefly, some actual instances. "A" was a banker who "fell for" the elaborate advertising of a concern grown plethoric with gain on such victims. The ordinary architect might not serve him, nor yet one extraordinary. He had so educated himself on biased propaganda as to believe he wanted a single entity to take all the building worry off his hands down to the inkstands on the counters. He couldn't see that that was exactly what any dependable architect would prefer to do, if permitted. But he got what he wanted, *plus*. The contractors were to get "cost, plus 10 per cent, not to exceed $67,500," and made much of an assertion that they had once turned back over $3,000 under such a contract. When this project was finished and the banker demanded a statement, all he received was that of a "certified accountant" to the effect that, inasmuch as the guaranteed maximum did not allow the builders the 10 per cent to which they would otherwise have been entitled, no further statement was necessary,—and none was forthcoming. Referring to his contract, the banker found that it called for "a statement," but that nothing was said about its being detailed or itemized.

That the building could have been reproduced for less than $40,000 was amply proved by the experience of "B," another banker in the same town who built a year later, in the same block with "A." Costs were slightly higher; his building was exactly half as large as that of "A." The same builders offered the same kind of contract, with a guaranty not to exceed $36,000. But "B" didn't think that "A" had fared any too well, and he looked up an architect who wanted the work, but wouldn't solicit it, wouldn't cut his price below the American Institute rate, and wouldn't guarantee the cost,—"quite evidently a poor business-getter." This architect had planned other banks of the sort and had the best of references, as the banker's investigation proved. He thought the building could be produced for under $22,000, and submitted an itemized estimate in support of his theory. The owner employed him, and the work which the architect had estimated at $22,000 was executed for under $21,000, and is at least 25 per cent better than that in "A's" building.

"C" was a banker in a distant city, solicited by the same concern that had built for "A." But "C" was a perspicacious individual, who could at least see through ordinary glasses. Marvelous salesmanship and extravagant advertising fell upon barren soil. He sought an architect experienced in bank work and discovered one with a construction division in his organization. But, when that architect said "cost-plus," he found he was "waving a red flag at a bull." The memory of much ill-used privilege, which had masqueraded under that title, was fresh in the mind of the wide-awake Mr. "C." However, after thoroughly investigating this architect's past performances, he employed him for architectural services only, freely asserting that "no cost-plus-everything-else-possible builder would get a chance to stick a harpoon into him and twist it." But his troubles were not so easily disposed of. His appropriation was $60,000, and his architect's estimate was $65,000. Bids, solicited by the cautious banker, elicited a minimum of $66,000 for the general contract alone. Impasse! There remained the heating, plumbing, wiring, bank fixtures, marble work, vault equipment decorating and numerous other *et ceteras,* for all of which the architect thought an additional $25,000 or $30,000 would be required. After several weeks of hesitancy, during which prices were steadily trending upward, the unfortunate banker allowed his need to over-rule his better judgment, closed his eyes and signed, "on the dotted line," a wide open contract, whereby his architect was to deliver the building which he had planned, and would be paid "cost, plus a lump sum." The portion of the work, for which the low bidder had demanded $66,000, was done for under $40,000, and the entire building turned over complete, within the estimated total cost. These are isolated instances, cited to prove nothing, but rather to indicate that an architect need not be timid about entering the practical building field.



Model of the Civic Center and Municipal Building, Denver
Allied Architects Association of Denver, Architects

OFFICE PRACTICE

THE ALLIED ARCHITECTS ASSOCIATION OF DENVER

BY
ROBERT K. FULLER, PRESIDENT

TO complete plans for the development of Denver's civic center and to provide architectural service for the proposed municipal building of Denver, were the principal objects which led to the formation of the Allied Architects Association of Denver. It seemed appropriate and feasible that this service be undertaken as a civic enterprise by the Institute architects of Denver because of widespread interest among members of the profession. The project contemplated by the city involved the expenditure of $5,000,000 for the proposed municipal building, and the erection of this structure will form the major development of the civic center. The importance and responsibility of the architectural service necessarily required a high standard of excellence.

After careful investigation, the Colorado Chapter, which sponsored the enterprise, became satisfied that a properly organized association of architects could render the service required. Such an organization would permit of the selection and functioning of specialized groups, directing respectively the problems in plan and design, construction and engineering, and construction supervision. The proposal of the architects was received with favor by the city of Denver, and as a consequence the Allied Architects Association of Denver was employed by the city to render the service proposed. The membership of the Association includes all Denver members of the Colorado Chapter of the American Institute. The Association functions as a coöperative organization, incorporated under the state laws, and is governed by a board of seven directors. To render the service for the municipal building, a separate office organization was set up, and it has functioned similarly to that of any large firm of architects. Problems arising in plan and design, in construction engineering, and in construction supervision are reviewed by the respective committees on these subjects. The active direction, control and responsibility of the organization rest with the board of directors, to which all committees report. A member of the Association may enter the drafting room, if the need of such employment arises, but upon entering the drafting room his status becomes that of an employe only. Members are privileged, and were required at the beginning of operations, to submit preliminary sketches for the design of the building, and from this procedure much valuable information was procured for the later development of the scheme.

The work of the Association has proved of great interest to the members, and the coöperative character of the service has insured unity and harmony in the affairs of the Association. The working drawings and specifications have been fully completed and have received the official approval of the Denver Art Commission, the Mayor and the City Council of Denver. The Supreme Court of Colorado has recently rendered a decision clarifying certain phases of legal procedure in the awarding of contracts, and it is now contemplated by the city that the actual work of construction on the municipal building shall begin within the next few months. The construction of the building will probably require three or four years' time, and when the service is completed the principal object of the association of architects will have been accomplished, and it will then in all probability disband.

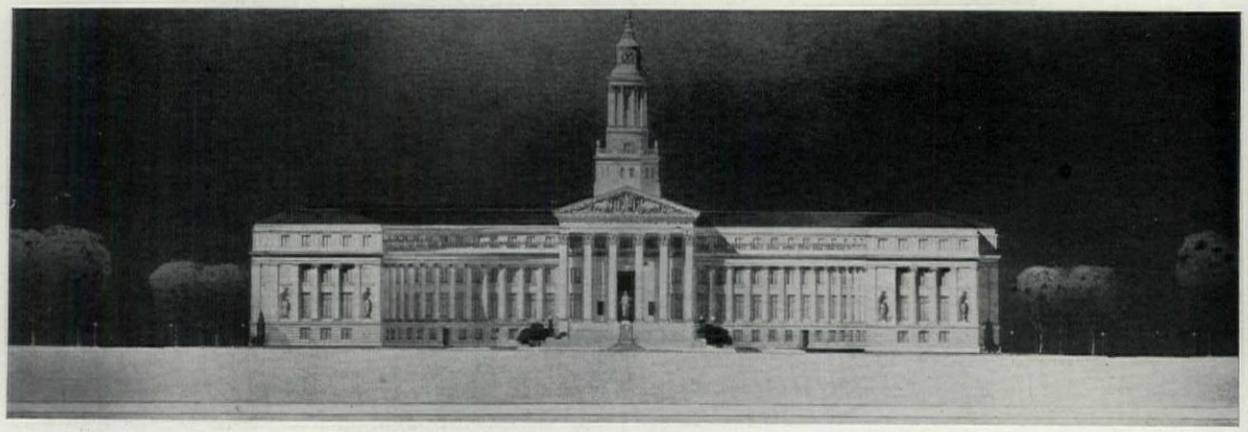
The Allied Architects Association of Denver is committed to these principles of operation, which make it unlike other associations and which may be briefly summarized as:

1. Dealing with a single work,—a civic center and municipal building.
2. The adoption of a policy of non-interference with the private practices of its members.
3. Carrying out an enterprise undertaken by the profession in the interest of civic responsibility by the Institute architects of Denver, sponsored by the Colorado Chapter of the Institute.
4. The purpose of the Association to conserve profits, in order that, upon completion of the work, such funds may be administered for the benefit of the profession in Colorado.

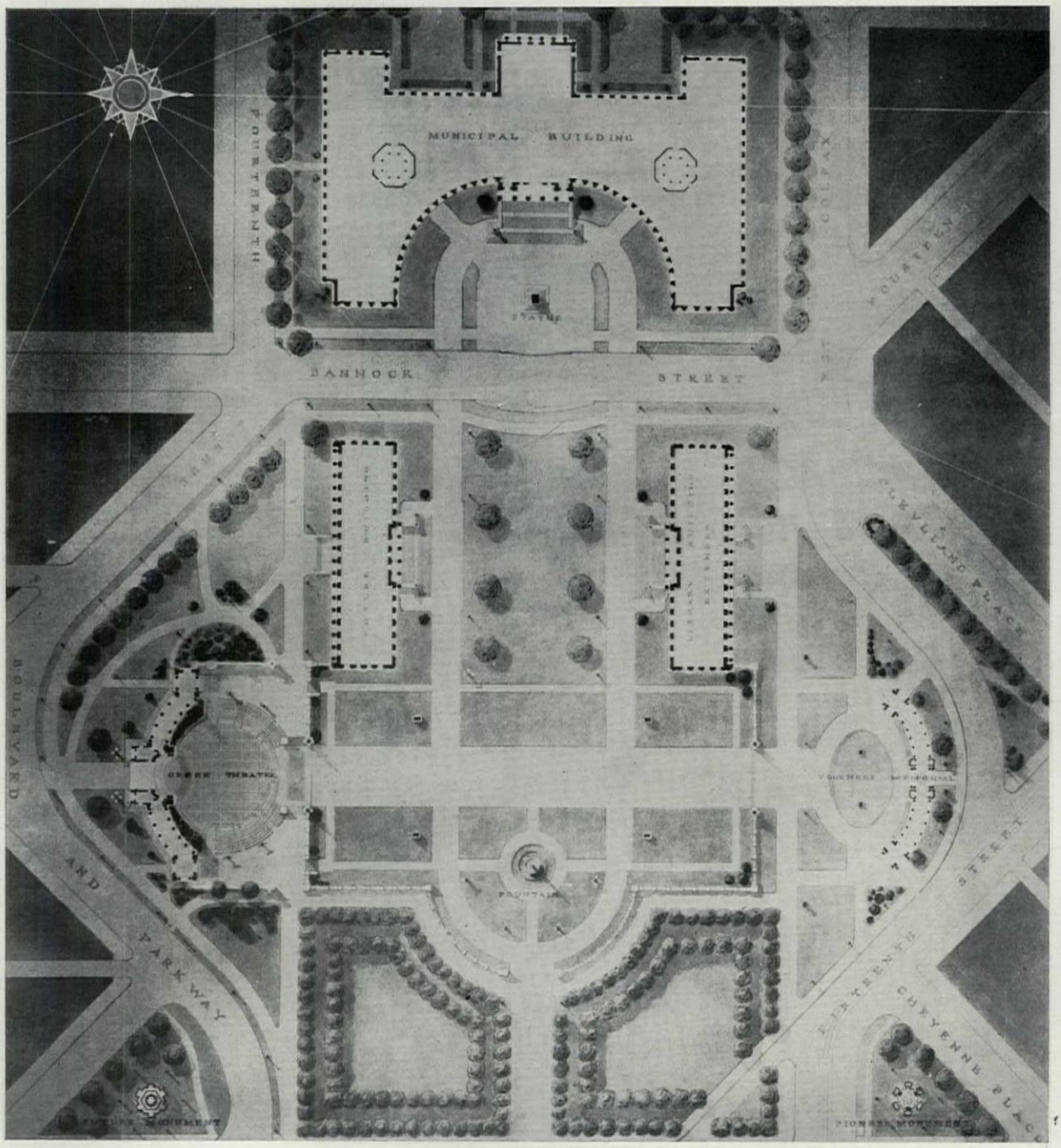
The success of the Association in its work may be attributed to these dominant characteristics:

1. The urge of civic responsibility accepted by the architects.
2. A service well coördinated and fully representative of the Institute architects of Denver.
3. The altruistic purpose concerning disposition of accrued profits.

Enduring benefits have already been attained in the profession from the unifying influence of a constructive work undertaken for Denver by the members of the Association. As a consequence, the Chapter's prestige has been elevated to new significance in municipal and state affairs. In recognition of this influence, members of the Institute are now serving on the State Examining Board of Architects, the Colorado Engineering Council, the Denver Art Commission, the City Zoning Commission, and the Denver Smoke Commission, in addition to having active representation in the Chamber of Commerce, the City Club, and various other civic organizations.



ELEVATION, CITY AND COUNTY BUILDING, DENVER



PLAN OF THE CIVIC CENTER, DENVER

ALLIED ARCHITECTS ASSOCIATION OF DENVER, ARCHITECTS

THE ALLIED ARCHITECTS ASSOCIATION OF KENTUCKY

BY

OSSIAN P. WARD, PRESIDENT

THERE had been considerable discussion as to the forming of an Allied Architects Association of Kentucky. This was brought to crystallization and consummation by the opportunity to design some buildings for the University of Louisville. On March 31, 1925, the Allied Architects Association of Kentucky was incorporated under the laws of the state of Kentucky. This Association was organized primarily for the advancement of architecture in connection with the designing of public buildings, and not for the profit of its members. Quoting Article I of the by-laws: "The paramount purpose of this Association is to advance the art of architecture, and by professional coöperation and collaboration to secure for and provide municipal, county, state and national governments and organizations formed for civic betterment or mutual or business advancement with the highest and best expression of the profession of architecture at the least possible cost in the design and constructlon of buildings, structures and improvements." This organization will not accept commissions or perform architectural services for private individuals, firms or corporations.

The board of directors, of whom there are five, elected by the members of the Association, have the power to fix the compensation to be paid to its officers, representatives and employes. In the month of January of any year, the directors can at their discretion divide the profits acquired by the Association among the members whose membership has been continuous for a period of one year prior to the date of said division. So far there has been no division of profits among the members of this Association. The conducting of the architectural work of the Association is carried on very much as it would be in any architect's office, except that the board of directors, instead of the individual architect or partners of a firm, manages all the affairs of the Association. The field of endeavor, however, being limited to public buildings, is very much restricted.

The board of directors selects the members best suited to take charge of the different branches of the work, and employs draftsmen and outside help whenever necessary. In connection with the only work that the Association has had to date, the board of directors became the executive committee and had charge of the preparation of plans and specifications and the supervision of the construction, holding frequent meetings during the progress of the work. It is not the intention of the Association to cut commissions or compete with architects outside of the Association, except, of course, in the field of public buildings, and even in this field there is a disposition to give the individual architects first chance, or at least every opportunity, to obtain the commissions.

A complete set of books is kept, and also a record of the cost to the Association of conducting the various branches of the architectural work. The question of legal responsibility is very important, and one that I may not be able to answer properly. So far there has been, in our experience, no occasion to decide any legal responsibility, but it would seem

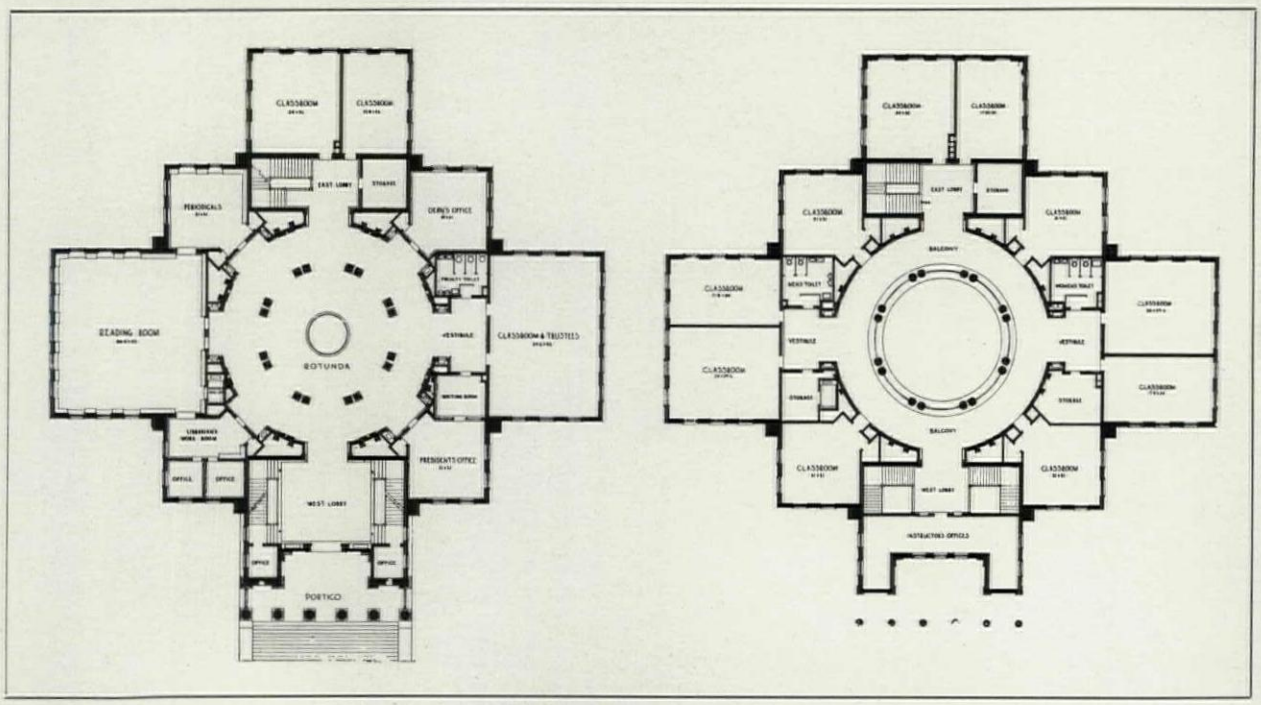
Administration Building, University of Louisville

Allied Architects Association of Kentucky, Architects

that what would apply to any other corporation in Kentucky would apply to the Allied Architects Association, incorporated under the laws of Kentucky. In our articles of incorporation it is provided that "the highest amount of indebtedness and liability which the corporation may at any time incur shall be $30,000," and also that "the private property of the stockholders of the said corporation shall not be subject to any extent whatever to the payment of the debts and obligations of the corporation." The laws of Kentucky require that every corporation shall own capital stock, so each one of the 11 members of the Association owns three shares of stock of par value of $33.33 each. No person shall own more or less than three shares of stock in this corporation, and every member has the same rights.

At the outset it appeared as though the University of Louisville would have $500,000 or $600,000 out of a bond issue of $1,000,000 to expend for new buildings, and the Allied Architects Association obtained the contract to erect three buildings for the University. Unfortunately, the resultant funds dwindled, and so far the Association has designed only one building,—a new administration building, for the University of Louisville, costing, with driveway, approximately $300,000. As this is the only work that the Association has performed, its success or failure must necessarily be rather limited. The building itself has been quite generally commended, and we hope will satisfactorily fulfill its purpose. The relations and associations of the various members of the organization working upon this project have been cordial, friendly and enjoyable, and it seems that there are many beneficial features in such an organization, provided enough work can be obtained to permit proper organization and to hold the interest and coöperation of the members. On the other hand, there seems to be a difference of opinion, even among the members of the organization, as to the possibility of such an organization's working efficiently and satisfactorily. Our organization has been and still is in an experimental stage, and its future success or failure is dependent upon enough work to keep the Association together and interested; for no organization can endure and properly function without something to do. It also requires a leader who can devote considerable time to the affairs of the organization,—one who can inspire the members and arouse their interest and loyalty. Much can be done, and great benefit can be derived by the members of such an organization, provided that it is properly organized and governed. The things that militate against the success of such organizations as allied architects associations, are the complexity of modern life; the busy and crowded hours of most architects, which make it hard for them to devote much time to anything outside of their routine business; and the fact that it is harder for a group to come to a decision and function than for an individual.

In conclusion, in my humble opinion, an allied architects association may be very successful provided it is properly organized, led and has plenty of work. On the other hand, there can very easily be failure if there are little work and lack of leadership and interest on the part of the members. On the whole, it would seem that the advantages in an association such as this outweigh the disadvantages, and that bringing competing architects together into a group working for the same cause creates and fosters cordiality that would not otherwise be obtained.



Plans, Administration Building, University of Louisville
Allied Architects Association of Kentucky, Architects

CHARGING FOR PROFESSIONAL SERVICES

THE COST PLUS SYSTEM OF ROBERT D. KOHN AND ASSOCIATED ARCHITECTS

BY

MAUD M. ACKER

EDITOR'S NOTE. In the April issue of THE ARCHITECTURAL FORUM, William Stanley Parker wrote of the "Fee Plus Cost System for Architects," as employed in the office of R. Clipston Sturgis, Architect. Mrs. Acker describes the interesting cost-plus system used in the office of Robert D. Kohn and Associated Architects, which differs, in some respects from the method described by Mr. Parker.

WE have used the cost-plus charge for professional services in our office for many years and have found it works out to the advantage of the client and to our own. The form in which we write to clients is substantially given here:

"As you know, it is the usual practice of architects to charge a fee based on a certain percentage of the cost of the work executed. This has worked fairly equitably in the past. But in view of changing prices and other conditions it may not always work equitably now for both owner and architect. We have therefore in recent years proposed a plan to our clients which bases the payments to be made to us as architects entirely on the actual cost of the work we do, plus overhead and a reasonable profit. We protect the owner against any excessive cost by placing an upset maximum price. The owners pay us monthly for the amount of work done for them in the previous month. If the work goes along smoothly and no extraordinary complications arise they are likely to pay for our service a lesser total sum than would be involved under the old percentage rate of charge. If, on the other hand, the work is complicated or delayed by unusual conditions that arise, or if changes have to be made which involve additional drawings, the cost is more. But there is never any question as to what the amount charged should be, since the whole matter is based on actual expenditures in our office. The scheme which we propose for your building is as outlined in the next paragraph.

"We are to give full professional services including all the usual plans, details, specifications and superintendence for this work, and we are to receive as compensation therefor the direct cash expenditures of our office in the payment of the salaries of our staff and other assistants of any character for necessary work done while engaged on this project, plus 66⅔ per cent for overhead, plus a charge for the time of the principals charged for on a salary basis when the time of the principals is devoted to this work, plus fees paid to structural engineers, plus one-third for profit, plus the net cost of blue prints and cash expense incurred for long distance telephoning, traveling expenses, etc. We hereby agree that the total amount which you will thus be required to pay us will not exceed the basic rate of .... per cent of the proposed cost of the building work, as a basic fee of that amount would be calculated under the normal conditions of practice mentioned in the latest schedule of the American Institute of Architects."

Our cost on an imaginary case would be kept in this way:

Draftsmen's time	$100.00		
66⅔ overhead	66.66		
Total	$166.66	$166.66	
Principals' time (hourly salary basis)	$ 50.00		
Engineer's fees	50.00		
	$100.00	$100.00	
			$266.66
33⅓ profit			88.88
Blueprints			30.00
Cash expense			4.46
			$390.00

We have often been asked how the principals keep a record of their own time and what they charge as their salaries. It will be noted that the scheme as defined in the contract includes in the cost of production the time spent by the principals. Each of the principals keeps a separate time sheet, just as do the draftsmen. To be sure, it is impossible for the principals to find more than half of their actual working time that can be directly entered on the time slips. This is due to the fact that it is impossible to charge up time spent in telephone conversations, dictation and general office supervision. A careful record kept for the better part of a year shows that the average is just about one-half of the number of working hours. That being the case, the principals' time entered for each commission is doubled. We have also been asked how we arrive at our overhead. We find that our costs for office rent, stenographers, materials, telephones, telephone operator, office boys, printing, etc. (all the unassignable costs) averaged for a number of years 66⅔ per cent of the amount expended in the same years for directly assignable salaries of draftsmen and superintendents. In busy times the overhead is less,—at other times more. We have therefore thought it right to take the average of a number of years as a constant to be applied to every project in figuring the overhead. If a surplus accumulates under this heading in one year, it should be retained as a reserve fund to meet the deficit of another.

Aside from the overhead, an item of profit had to

be determined on. It was quite customary to assume formerly that something like 40 per cent of the total fees collected ought to be profit to the architect, the profit being the total amount which the architect himself was supposed to receive as clear of all expenses. Some architects claim that half of their total fees are profit, but we believed that to be exceptional, and that in the general run of work the expenses of a commission amount at least to 60 per cent. But in the instance given here the profit is calculated on a cost which includes the architect's salary. Accordingly, after considerable calculation and discussion, we reached the conclusion that 33⅓ per cent would be a reasonable profit item to charge when based on such inclusive costs.

There are two or three considerations which are of importance in this cost-plus scheme. The first is that any waste in the office on the part of draftsmen or carelessness in duplicating work is naturally to the detriment of the client, just as would be waste in a cost-plus contract for building construction work. Though the owner is protected by the upset percentage fee, it might be claimed that there is still leeway enough for considerable waste, since we always make this upset maximum 1 per cent more than the usual Institute percentage fees. That is a valid criticism. It is up to the office unquestionably to guard most carefully against waste. We have found in our experience that on several occasions we felt called upon to credit an account with the salaries of men who had for one reason or another neglected their work or failed to produce drawings that were of value to the client. Such items are charged back against the profits of the office. In every such case the men in the office are informed of the items, so that they realize that this is a charge against their shares in the profits. The scheme of charging a distinct item for profit sets aside a certain fund which can be divided under a profit-sharing scheme with the whole office force. The architect himself has been paid a salary, an amount at any rate which gives him some return for his services, even if not an entirely adequate return. It is therefore simple to work out a profit-sharing scheme in which the workers can share in a reasonable ratio to the amount of profit.

The next important point is that the architect does not benefit by receiving an enormous fee on work that is simple, where the client makes few demands and where the work is repetitious; but he does not lose large amounts where the client is difficult and the work complicated, as is the case with some residential work. A New York architect in criticizing this scheme to Mr. Kohn one day said: "Your plan may be all right, but you can never make a killing"; to which was replied: "We do not have to make a killing, since under our scheme we make no loss on any commission." Under our plan an architect does not profit inordinately on one project and give his work away on another. The client pays for exactly what he gets. Another advantage under this scheme is that each month, the first of the month, a bill is

NAME John Jacob
WEEK ENDING Feb 17/28

OFFICE OF
ROBERT D. KOHN & CHARLES BUTLER
NEW YORK

	SAT.	MON.	TUES.	WED.	THUR.	FRI	TOTAL FOR WEEK		
ARRIVE	9	9	9	9	9	9			
LUNCH		1	1	1	1	1			
RETURN		2	2	2	2	2			
LEAVE	1	5:30	5:30	5	5	5	HOURS	RATE	AMT.
COMMISSION NO. 471	2	2				3	7	1.2	11.4
320		1	3				4		8
413	1						1		2
408			4				4		8
466	1	3		4			8		16
470						4	4		8
318			1/2				1/2		1
440		1 1/2		3			4 1/2		9
448					7		7		14
449									
TOTAL	4	7 1/2	7 1/2	7	7	7	40		$80

Weekly Time Card Arranged for Charging Directly Against Commission Numbers

rendered to the client for the expenditures of the previous month, plus overhead and profit. Without exception our clients have become accustomed to this plan and pay these bills promptly, and the whole financial health of the office has been improved since we do not run credit accounts. The old habit of borrowing money from the bank to carry on commissions is gone, we trust for good. Just as a reform, it would be well if the whole architectural profession adopted the habit of sending monthly bills, whatever might be the system of their charges. At the beginning of a project the client is always comparatively flush and is ready to pay bills, while otherwise, under the old plan, the architect has been the last one to be paid, because the client is often short of cash after paying the contractors. Under our scheme of monthly bills the greater part of the architect's fee is paid long before the contractor gets in his final work.

This outline of our plan is a somewhat revised and corrected statement of the working of our cost-plus plan as prepared by Mr. Kohn some years ago. Considering it now in the light of more than eight years' experience, we would not change back to the percentage basis under any circumstances. We have to acknowledge that once or twice we have come out badly on commissions, despite the cost-plus basis. The reason was that we fixed too low an upset percentage. In one case, on a hospital built at a remote point, we made a contract on the cost-plus basis with an upset percentage of 8 per cent plus traveling expenses and cost of a clerk of the works. Owing to a disagreement between the members of the medical staff, the work stretched over a great length of time and the costs ran inordinately high. But we maintain that had this been a straight percentage commission, the story would have been the same. It happened to be one of those cases where it was hard to prove, without going to court, that the nature of the changes imposed upon the architects justified extra compensation.

CUBIC FOOT COSTS OF BUILDINGS

BY

JAMES E. BLACKWELL, ARCHITECT

THE practical man always wants a "thumb rule"; speed is the demand of modern life; there is often no time for long calculations, and we begrudge the time it takes to make reliable estimates. As a draftsman once said, upon hearing a client's demand for speedy work, "a man will take a year to decide whether he will build or not, and when he does decide, he wants the plans finished day before yesterday." There is no short rule uniformly accepted as reliable in estimating the cost of buildings, and many times what is called an estimate, is what an old architect called "a mere *guesstimate.*" There have been in use the methods of cost obtained by the cubic foot; by the square foot, or floor area; and by the room. Of these the cost by cubic foot seems to be the only one *approximately* reliable and used generally and for many years.

The cost by floor area is obtained by measuring the aggregate area of all the floors and dividing the total cost of the building by the total number of square feet. To get the approximate cost of a proposed structure, its floor area is multiplied by the cost per square foot of an actual building of the same type recently completed.

The cost by number of rooms is used by taking a building of known cost and rooms; dividing the number of rooms into cost, to ascertain the cost per room. This cost can be used as a constant in multiplying the number of rooms in a proposed structure to obtain the approximate total cost. This is the most unreliable of the three methods mentioned, as the cost per room may vary from $500 to $2,000 or $3,000, depending upon the sizes of the rooms and the materials of which the building is constructed.

The cubic foot method was brought to this country from Great Britain and has been in use some 50 years or more, and so far as the writer knows, a table of costs and explanation thereof was first published in 1887, giving the cost per cubic foot of some 38 selected United States government buildings of various classes and materials of construction, ranging in cost from $.08 for a frame building to $1 per cubic foot for a granite, "fireproof" structure. It may be said at the start that a man without wide and long experience and good judgment cannot use this method with any reliability whatever. The practice is to obtain the cost per cubic foot of a known building and to use this rate per foot to multiply the measured cubic contents of a proposed structure to determine its cost. The proposed building, should, of course, be similar to the known structure in sizes of rooms, in total contents and in the materials of which the building is constructed. If it is not exactly so, then good judgment must be used in making due allowance for the differences. In measuring the cubic contents of a building, the actual volume is usually taken from the outside of all walls and from the bottom of the foundations to the top of the roof, considering the slopes, towers, and dormers, chimneys, projecting courses and cornices as immaterial. In judging the rate per cubic foot a building should cost, careful consideration must be given to the sizes of the various rooms and enclosed spaces and the total size of the building, as well as the interior fittings, finish, the number of finished fronts and the kinds of materials of which they are constructed. Consideration must be given to the materials, such as brick, etc., and also to the construction of the interior partitions, frame or fireproof, and to the interior decorations, plaster, marble, tiling, etc. It is in this that the experienced judgment of the estimator is necessary,—in knowing the cost of completed buildings, in order to arrive at the cost of the structure and to make proper allowances, because very often a demand is made for such information in a very short time, and often before a line of the design or drawings has been made.

The accompanying table shows the cost of some fairly representative buildings constructed in Seattle and neighboring cities of the state of Washington, giving dates of completion and costs at those times, and the costs per cubic foot to conform to price costs of 1927, using for this conversion the changes as shown on page 128 of THE FORUM for January, 1928. These changes in prices taken from the chart assume 1913 and previous years as 100 per cent, and figures for subsequent years are: 1914, 98 per cent; 1915, 114; 1916, 156; 1917, 189; 1918, 190; 1919, 200; 1920, 268; 1921, 198; 1922, 171; 1923, 186; 1924, 194; 1925, 190; 1926, 187; and 1927, 185. The table printed herewith includes 69 buildings, 41 fireproof and 28 of cheaper construction, compiled from the best sources obtainable (generally the architects' figures). Using the costs as of 1927, this table gives 17 office buildings, varying in cost per cubic foot from 32 cents to 74.8 cents, average 52.6; two hotels, 40 and 60 cents; four apartments, 44 to 58.7 cents, average 51.2; four theaters 26.7 to 44.2 cents, average 36.9; nine loft buildings, 12.6 to 25.1, average 18.9; and five school buildings, 22.3 to 30.8, average 25.8 cents. This table of such varyings costs shows conclusively the necessity of having the completed and the proposed buildings approximately the same in size, in number of rooms and in construction. It also shows somewhat the effect in costs of much decoration and yet large inside spaces, as in theaters, compared to buildings having less decoration but many small spaces or rooms, as in office buildings or hotels. The buildings of cheaper construction shown in the table are simply given as statistics for varieties in uses and construction, varying in cost from 9 to 54 cents per cubic foot. These

may be used only when the proposed building is similar to one of these. It is to be noted, however, that even in this type of building, larger structures often cost less per cubic foot than smaller buildings.

The writer has a list of costs of many residences, but they vary so greatly in cost, plan, equipment and finish that they would be of no value as a guide in estimating. The accompanying table may be of some aid to architects and builders in cities other than Seattle, but as there is a wide difference in costs of materials and labor in various cities, a table of costs in each city would be of more value. It is to be hoped that tables will be prepared for other large cities.

The estimator in comparing the requirements of the proposed building to those of a structure of known cost should know the relative costs of materials and labor in the different cities and the dates of construction. He must know the class of building, its purpose; whether fireproof, mill or ordinary construction; the kinds of finish for interior and exterior walls, etc., and the class of people who are to occupy the proposed building. Manifestly, in connection with the last item, the kind of building required for a hotel or apartment for laborers, sailors, or lodgers, would not be as expensive as a first class hotel or apartment. The kind of apartment for well bred, well educated people, but of moderate means, would not be as elaborate and expensive as for the very wealthy. The variations in customs or in demands in different cities are sometimes very great; for instance, the demand for apartments in Seattle and many western cities is for two- or three-room suites,—seldom more than four or five rooms, with rents varying from $70 to $125 per month; while in New York, Chicago, Washington and some other eastern cities there may be considerable demand for apartments of from 10 to 15 rooms, renting for from $800 to $1500 per month. In such cases the rates given in the table for apartments would be of no value for comparison.

Of course, no thumb rule is as good as a detailed estimate, and the latter is not as conclusive as *bona fide* bids; but neither can be reliable until after working drawings and specifications have been made. An owner never wants to pay for all this architectural service as long as there is a doubt of proceeding with the building, and he always asks for an estimate before proceeding beyond the preliminary drawings stage. The estimates based on cubic foot costs are never accurate, except by a lucky coincidence, but they do serve a useful purpose in approximating the cost in the quickest way yet devised. An expert in actual costs can give a much more reliable estimate if he is provided with carefully drawn plans and an outline specification. Such an estimate can be made quickly by an experienced man.

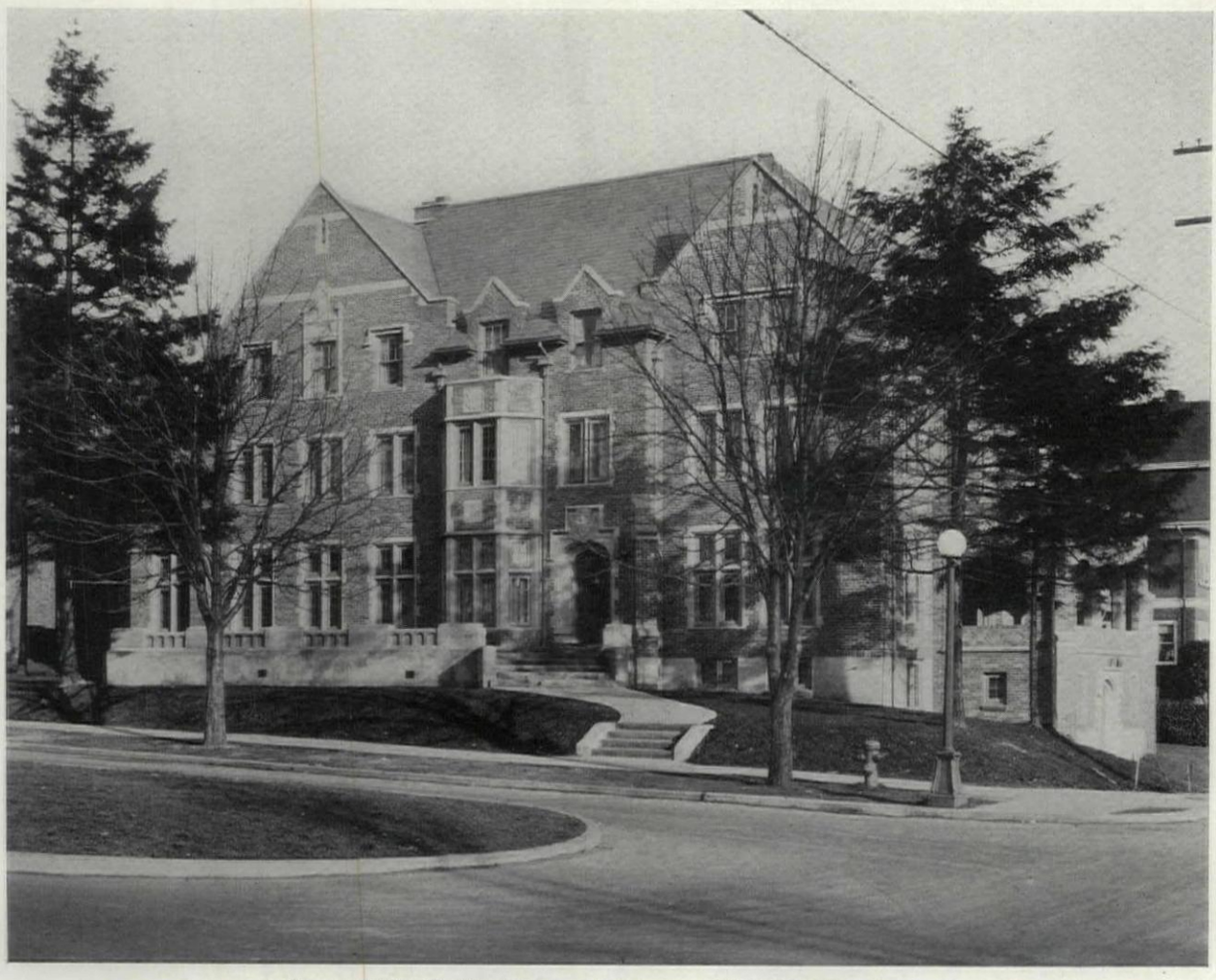
COST OF BUILDINGS IN SEATTLE PER CUBIC FOOT

FIREPROOF BUILDINGS

Name of Building	*Year Built*	*Use or Occupancy*	*Construction Type*	*Number of Stories*	*Total Cubic Feet*	*Total Cost*	*Actual Cost Per Cu. Ft.*	*Cost Per Cu. Ft. As Of 1927*
Bigelow	1923	Office & Stores	R.C.	7	60 x 120	.....	45 cts.	45 cts.
Lloyd	1926	" "	"	10	819,910	.....	52	52
Shafer	1924	" "	"	10	866,320	$385,733	44	42.2
Alaska	1905	" "	S.F.	14	1,823,040	690,000	37.8	69.9
White	1911	" "	R.C.	14	.....	.....	36	66.6
Henry	1912	" "	"	14	.....	.....	34	62.9
Cobb	1914	" "	"	14	.....	.....	40	74.8
Eagles Temple	1924	Aud. Office & Stores	"	10	2,050,090	1,010,984	49.3	49.3
Northern Life Tower	1928	Office	"	27	2,710,926	1,500,000	55.3	55.3
Puget Sound Power & Light	1925	Office	"	2	201,000	66,529	33	33
Mutual Life Annex	1905	" & Bank	S.F.	6	297,000	106,804	36	66.6
Dexter Horton	1924	" "	R.C.	14	4,883,760	2,250,000	46.1	46.1
Medical & Dental	1924	" "	"	18	2,533,044	1,535,000	60	60
Telephone	1921	"	"	13	2,208,690	1,307,000	59.2	54.6
Vance Hotel	1926	Hotel & Stores	"	10	814,928	.....	60	60
Stratford Hotel	1927	" "	"	9	580,860	235,000	40	40
Terminal Sales	1923	Stores & Lofts	"	11	1,309,900	329,971	25.1	25.1
Hubbell Building	1922	" "	"	2	498,688	106,256	21.3	23
Hanford Building	1921	" "	"	2	349,333	50,350	14.4	13.4
Grunbaum Store	1921	" "	"	4	1,850,350	337,177	18.2	17
McDowall	1926	" "	"	9	1,417,000	468,000	32	32
Republic	1927	Loft	"	10	.....	.....	41	41
Liggett	1926	"	"	10	.....	.....	42	42
Century Addition	1923	"	"	5	.....	.....	21	21
Sherman-Clay W. H.	1924	"	"	3	772,800	.....	20.4	20.4
Tyee Building	1925	Garage & Lofts	"	2	682,240	147,486	21.6	21.6
Kelly-Springfield	1920	"	"	2	219,000	40,000	18.2	12.6
Louisa Frye Building	1926	"	"	3	358,441	57,278	16	16
Mann Building	1926	Store-Theater-Lofts	"	2	789,702	210,264	26.7	26.7
Paramount Seattle Theater	1927	Theater	"	8	2,833,920	1,250,000	44.2	44.2
New Orpheum	1927	Theater, Moving Picture	"	6	2,300,204	1,000,000	43.4	43.4
Mayflower Theater	1927	" " "	"	6	2,256,400	750,000	33.2	33.2
Lawton Apartments	1925	Apartments	"	7	.....	.....	57.5	57.5
Windham Apartments	1925	"	"	7	329,820	193,066	58.7	58.7
Stockbridge Apartments	1925	"	"	6	567,000	253,106	44.6	44.6
Paramount Apartments	1927	"	"	8	568,770	250,000	44	44
St. Benedict's School	1924	Boys' School	"	2	433,000	133,511	30.8	30.8
Bryant School	1926	Grade "	R.C.-Fr.fl.		593,000	164,076	27.7	27.7
Marshall School	1926	" " Junior	" " "		1,989,278	442,812	22.3	22.3
Garfield School	1922	High "	" " "		2,430,000	619,394	24.5	27
Roosevelt School	1921	" "	" " "		2,800,000	899,800	32.2	30

NON-FIREPROOF BUILDINGS
WOOD FLOOR CONSTRUCTION

Name of Building	Year Built	Use or Occupancy	Construction Type	Number of Stories	Total Cubic Feet	Total Cost	Actual Cost Per Cu. Ft.	Cost Per Cu. Ft. As Of 1927.
School at Mt. Vernon	1921	High School	Brick		715,000	$167,000	23.4 cts.	22.2 cts.
School at Blaine	1925	" "	R. C.		210,000	36,500	17.5	17.5
School at North Bend	1921	Grade "	Brick		266,000	55,158	20.7	19.3
School at Ronald	1913	" "	"	2	108,650	10,080	9.3	17.2
L. & M. Stores	1925	Stores	Masonry & Wood	1	.....	.....	14	14
Gov. McGraw Stores	1909	" & Bus. School	" "	3	343,440	27,616	8.1	15
Backus Building	1909	" & Lofts	R. C. & Mill	4	506,250	48,327	9.6	17.8
Graves Building	1908	" "	" " "	4	436,800	40,864	9.4	17.4
Sears-Roebuck, Mail Order Bldg.	1916	" "	" " "	6	2,732,460	202,000	7.4	9
Willis-Overland Buldg.	1925	Garage "	" " "	2	50' high	.....	9.8	9.8
Chanslor & Lyon Bldg.	1919	" "	" " "	2	700,000	101,220	14.3	13.2
Alvin Investment Co.	1924	" "	" " "	3	462,000	49,268	11	10.5
Colsky Stores	1926	Stores & Garage	Brick & "	1	262,000	26,070	10.3	10.3
Wenatchee Realty Co.	1910	" & Apts.	Masonry & Wood	3	471,120	72,000	15	27.8
Nesika Apts.	1915	54 Apts. 2 & 3 Rooms	Brick & Mill	5	333,360	64,756	19.4	31.4
Lake Investment Co.	1926	" " " "	" "	3	231,700	65,000	28	28
L. & M. Apartment	1924	Apartments 34	Masonry & Wood	3	.....	.....	37	35.3
L. & M. Apartment	1921	Apartments 30	" "	3	.....	.....	28	26.2
Fairfax Apartment	1923	Apartments	" "	3	152,779	51,634	33.8	33.8
Carnegie Libr'y, Olympia	1914	Library	" "	1	166,406	21,768	13.1	24.5
Carnegie Libr'y, Wenatchee	1912	"	" "	1	65,996	9,500	14.4	27.6
Delta-Upsilon House	1924	Fraternity House	" "	3	134,750	40,689	30	28.5
Theta-Xi	1926	" "	" "	3	112,640	38,463	34	34
Alpha Sigma Phi	1920	" "	" "	3	140,000	48,000	34.2	23.6
Inglewood Club	1926	Country Club	" "	2	447,900	133,017	30	30
C. M. & St. P. Gateway	1927	R.R. Hotel & Sta.	" "	2	455,303	247,772	54	54
Armory N.G.W., Bellingham	1911	Drill Hall & Co. Rooms	Stone "	3	851,640	64,880	7.6	14.1
Gray's Harbor Power House	1908	Steam Power Machy.	Brick & Mill	2	541,440	59,987	11.1	20.5



Sigma Alpha Epsilon House, University of Washington, Seattle

Stuart & Wheatley, Architects

THE FAIREST OF COMPETITIONS

BY
WILLIAM O. LUDLOW
OF LUDLOW & PEABODY, ARCHITECTS

SO many times have I told my spellbound friends the inside story of that marvelous feat of legerdemain,—the taking of a two-million-dollar commission out of a hat,—that I don't mind telling it again.

It happened this way: Frank Manville, president of the Johns-Manville Corporation, decided that his company must have a larger building to take care of its larger business. So far easy enough; they had the land, the money, the will to do; but immediately Mr. Manville was faced with a staggering question,—how could he select one architect, from all the architects who had been giving him business, without offending the individuals of the entire profession,—save one,—and without thus jeopardizing the future of the Johns-Manville business? If, for instance, he handed the commission outright to Cass Gilbert, imagine the look of scorn on the face of Whitney Warren's specification man when next the Johns-Manville salesman suggested asbestile for the latest Park Avenue skyscraper! Again, if he held a competition, he knew he would be set down as a man of execrable taste and bad judgment by the personnel of the entire profession,—save one,—when the winning design was exhibited! While pondering this difficulty one day, one of his men (said to have been originally on the stock exchange) suggested to Mr. Manville: "Why not let them *draw* for it?" Mr. Manville, naturally a quiet and cautious man, at first laughed at the joke for, knowing the haughty dignity and the high ethical standards of the members of the profession, he didn't propose to insult his good friends and customers.

The foregoing is from reputable hearsay;—from now on I speak from personal knowledge. One day a well known officer of the Johns-Manville Corporation appeared in our office and asked if it would be beneath our dignity or contrary to our ethical standards to take a chance on drawing from a hat an opportunity to design the new Johns-Manville building. Of course we said that it certainly would,—but possibly we might consider the matter,—just this once. We understood that some of the members of the profession thus approached did not take the same high ground that we did, but trampling on all principle, simply answered: "We would be glad to." A few days later we received a personal invitation for a "representative of our firm" to a luncheon given by Mr. Manville at the Union League Club. As there happen to be two representatives of our firm, we decided that the firm would not be adequately represented unless both went,—not harboring for a moment the thought that some firm might have only one representative when the hat passed!

Twenty of us sat down to a big round table overburdened with delicious food. Finally, we recognized a cool, yellow, sparkling liquid served in beer mugs, and then the stillness was broken by Mr. Manville, as he arose with a derby hat in one hand and a bunch of little white envelopes in the other. In a few well chosen words he told his guests of his proposed project and said that he had confidence that any one of the gentlemen present would design for him a suitable building, adding that he would be glad to give it to all of us, but as that method might be unsatisfactory, would we kindly each one draw from the hat an envelope? In each envelope, he said, was a blank card excepting one in which would be found a card saying "You Win," and he would like the man who drew that card to be his architect. As the fateful hat went around each man dipped in. I hasten to interject here, to avoid being suspected of double dealing (perhaps that is in the wrong metaphor), that my partner was so scrupulously generous and honest, that he passed his opportunity over to his partner; was ever virtue so instantly rewarded? I am going to ask Briggs to draw a cartoon entitled "What does a man think about when he holds in his hand an envelope containing either a two-million-dollar commission,—or nothing?" Something like this went through my benumbed mind:—In this little envelope a skyscraper or a blank piece of paper! One chance in twenty! Pshaw, that's what I take every time I jay-walk across Fifth Avenue, and I've never been hit yet! I wonder whether Tom Hastings, or Breck Trowbridge, or Whitney Warren will get it!

"Now," said Mr. Manville, "begin here and open up,—each one announcing in turn what he has drawn." With painful slowness the words began to come to my somewhat clouded mind,—"Nothing doing," "Blank," "Blank," "Left again." Then the brilliant deduction began to dawn in my mind that if all the others got *blank*, I got *it!* The suspense was terrible, so with my table knife I slit my envelope and cautiously pulled a little at the card inside,—cat and mouse performance. Hello, what's this! A tiny wreath appears;—yes, I suppose they all have wreaths on them like other tombstones. Great —— "You Win!" I took the blow just like Tunney,—manfully,—everything went around inside my head, but at the count of ten I recovered, found everybody still there, and sat trying to look like a sphinx but feeling like an opium addict. Then John Cross, who had peeped at my card, spilled the beans by shouting "Here he is!" I faintly heard yells of "Speech! speech!"

Twenty handshakes from as many slightly disappointed but complacent men;—then, "Glad you fellows are going to be my architects, I want to begin right away, see you tomorrow,"—and so ended the fairest and most satisfactory competition on record.

PLANNING RELIGIOUS EDUCATIONAL BUILDINGS

BY
M. W. BRABHAM

THE phenomenal increase of interest and investment in religious education during the past ten years has been followed by a like increase in attention to the standard requirements for buildings suited to the purposes. Leaders in religious education are today considering their work in a manner approaching if not equaling the seriousness of leaders in general education processes. This has resulted in the study and gradual development of a new type of building which is a far cry from the "Sunday School room" or "annex" of a few years ago. The introduction of a definite program of training involving theories and practices in educational processes of a religious nature extending far beyond the customary one-hour Sunday School, calls for structures as carefully planned and equipped as the best educational buildings for public schools. The numerical growth has also been astonishingly large, until today it is not an unusual thing to find structures accommodating from 1000 to 5000 persons.

The Sunday School is coming to be known generally nowadays as the "Church School," the very name implying a change of emphasis and a broadening of program. The school for religious work is graded in all its educational processes, and this is calling for buildings also graded in arrangements. Within the organization there are eight age groups commonly recognized, these being based on well founded psychological principles. Within each of these eight age groups there are subdivisions by grades and classes. The program for each age group varies in essential points, all of which calls for different arrangements as to sizes, shapes and general appointments of rooms. This can be readily seen as a highly specialized field, demanding preparation and experience not commonly regarded as a part of the general architectural preparation of those practicing in this field. To date the number of architectural organizations employing specialists in the field of religious administration and theory is very small, but the probabilities are that these workers will be engaged for handling such aspects of the work in increasing numbers. There are several available books on the subject which may be found helpful to architects in connection with this special line of service: "Building for Church Work and Life," by Mouzon William Brabham (Cokesbury Press, Nashville, 1928); "Building for Religious Education," by Henry Edward Tralle and George Merrill (The Century Company, New York, 1925); "A Complete Guide to Church Building," by P. E. Burroughs (Baptist Sunday School Board, Nashville).

The schedules printed here have been worked out as a general guide for architects and committees to be used in determining some important features of religious educational buildings.

TABLE I
Church School Having 900 Members

Group	Ages	Per Cent	No. of Pupils	Sq. Ft.	Assembly Rooms	Classrooms	Members Per Class
Cradle roll	1-2-3	5	45	675	2	0	
Beginner	4-5	8	72	1080	1-2	0	...
Primary	6-7-8	10	90	1350	1	9	8-10
Junior	9-10-11	10	90	1350	1	9	8-12
Intermediate	12-13-14	10	90	1350	1	7-10	8-15
Senior	15-16-17	10	90	1350	1	7-10	8-20
Young people	18-23	20	180	2700	1	6-8	15-40
Adult	24 upward	27	243	3645	1	6-9	15-150
Total			900	13,500	9	44-55	

Adults may use main auditorium of church for assembly if necessary.

Note. Classrooms not opening into the assembly room are to be preferred where shape of lot and size of building lend themselves to this arrangement.

Other Rooms. Social hall, which may also be the assembly room for one of the departments of pupils above 12 years old; kitchen and serving rooms; mothers' room or rooms, in close proximity to the cradle roll; women's parlor or parlors; boy scout and camp fire girl rooms, both of which may be figured in floor space for either intermediate or senior classes; chapel adapted to prayer meetings and other gatherings, which may be used as an assembly for one group, such as intermediate or senior. Rooms adapted to meetings of young people; these may also be used for an assembly or for large classes; pastor's office and study; room for pastor's assistant or assistants; church offices; Sunday School officers' room; library and reading room; coat room facilities; toilets; cabinets in each assembly room and in library; storage and janitor's room; gymnasium, where local conditions require it and where adequate supervision will be maintained. Minimum size classroom: 8 x 10 feet. Blackboards should be provided in classrooms and in assembly rooms.

TABLE II
Church School Having 1200 Members

Group	Ages	Per Cent	No. of Pupils	Sq. Ft.	Assembly Rooms	Classrooms	Members per Class
Cradle roll	1-2-3	5	60	900	2	0	
Beginner	4-5	8	98	1,440	2	0	...
Primary	6-7-8	10	120	1,800	1	12-14	8-10
Junior	9-10-11	10	120	1,800	1	10-12	10-12
Intermediate	12-13-14	10	120	1,800	1	10-12	10-15
Senior	15-16-17	10	120	1,800	1	9-12	10-20
Young people	18-23	20	240	3,600	1	7-12	15-40
Adult	24 upward	27	324	4,860	1	6-10	15-150
Total			1,200	18,000	10	54-72	

Note. Classrooms for primary and junior groups should be apart from the assembly room when size and shape of lot permit separate arrangement. The number of classrooms for each of these groups may be reduced by providing for one-half to be in classes while the other half is in assembly.

Other Rooms. Social hall, which may also be used as an assembly room for one of the departments,—this room should accommodate from 800 to 1000; kitchen and serving room; kitchenette convenient to room or rooms used for smaller social gatherings or young people's department; mothers' rooms (2) convenient to cradle roll rooms. These may be counted in as a part of the total floor space for adult classes; women's parlors (2), which may also be used as adult classrooms, or one may be arranged for young people; boy scout and camp fire girl rooms, which may also be counted in total classroom space for either the intermediate or senior classes; pastor's study; pastor's office and conference room; church offices; assistant pastor and director of religious education (2 rooms); Sunday School officers' room or rooms; library and supply room; reading room, which may also be training classroom and figured in total classroom space for young people; coat room facilities; toilets; storage and janitor's room or rooms; gymnasium. Minimum size of classrooms: 8 x 10 feet. Blackboards in classrooms.

TABLE III

Church School Having 1600 Members

Group	Ages	Per Cent	No. of Pupils	Sq. Ft.	Assembly Rooms	Classrooms	Members per Class
Cradle roll	1-2-3	5	80	1,200	2	0	...
Beginner	4-5	8	128	1,920	2	0	...
Primary	6-7-8	10	160	2,400	1	16-20	8-10
Junior	9-10-11	10	160	2,400	1	16-24	8-12
Intermed.	12-13-14	10	160	2,400	1	12-20	8-15
Senior	15-16-17	10	160	2,400	1	10-18	10-20
Young people	18-23	20	320	4,800	1	10-14	15-50
Adult	24 upward	27	432	6,480	1	8-10	15-200
Total			1,600	24,000	10	72-106	

Note. Junior and primary classrooms should not open into assembly room unless the size and shape of lot make other arrangements impossible. The number of classrooms for each of these departments may be reduced by planning for one-half of the department to be in class session while the other half is in assembly. This is an administrative matter for the local school.

Other Rooms. Social hall, which may also be the adult or young people's assembly room,—this room should care for at least 1,000 to 2,000; kitchen and serving rooms; kitchenette for smaller gatherings; mothers' rooms (2) near cradle roll rooms may be counted as adult classes; women's parlors (2 or more); church parlor and steward's rooms, boy scout and camp fire girl rooms; also counted as intermediate or senior classrooms; pastor's study; pastor's office and conference room; assistant pastor's room; room for director of religious education; church offices and vault; storage and janitor's rooms; library; reading room; Sunday School officers' rooms; coat rooms; toilets; gymnasium and locker rooms; chapel for prayer meetings, which may also be assembly room; rooms adapted to young people's meetings; men's club room; girls' club room; boys' club room; nursery.

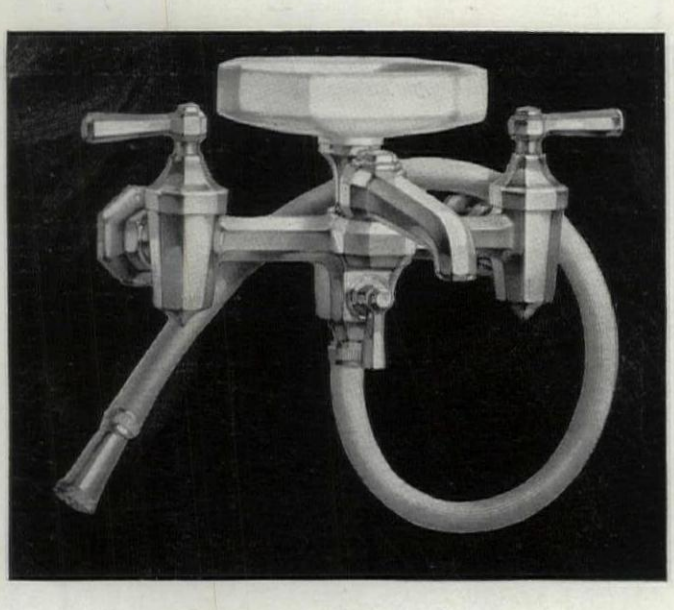
TABLE IV

Church School Having 2,000 Members

Group	Ages	Per Cent	No. of Pupils	Sq. Ft.	Assembly Rooms	Classrooms	Members per Class
Cradle roll	1-2-3	5	100	1,500	3	0	...
Beginner	4-5	8	160	2,400	3	0	...
Primary	6-7-8	10	200	3,000	2	20-22	8-10
Junior	9-10-11	10	200	3,000	2	18-20	8-12
Intermed.	12-13-14	10	200	3,000	1	18-20	8-16
Senior	15-16-17	10	200	3,000	1	18-20	10-20
Young people	18-23	20	400	6,000	1	12-16	15-50
Adult	24 upward	27	540	8,100	1	10-15	15-200
Total			2,000	30,000	14	96-113	

Note. Junior and primary rooms may be reduced in number by planning for one-half of the department to be in class work while the other half is in assembly, but this is an administrative matter to be worked out locally. Classrooms for these two departments should be separate from the assembly rooms, preferably not opening into the assembly room at all.

Other Rooms. Social hall, accommodating from 1,200 to 1,400, to be used as adult or young people's assembly; kitchen and serving room nearby; kitchenettes within easy reach of smaller rooms for social purposes; mothers' rooms (3) near cradle roll rooms; these may be counted in as part of space for adult classes; parlors (3 to 5) may be used as classrooms if necessary; boy scout rooms (2); camp fire girl rooms (2),—they may be used as classrooms for intermediate or senior classes; club rooms,—young women (1); boys' (1); girls' (1); women (1); men (1); young men (1). Some of these, if located conveniently, may also be used for classes. There shall be administrative rooms: pastor's study (1); pastor's office and conference room (1); assistant pastor (1); director of religious education (1); church offices (2 to 4); vault (1); janitor's rooms (2); library (1); reading room (1); Sunday School officers' rooms (2); chapels (2 to 4). These may be used as prayer meeting rooms and as assembly rooms in some cases. There should be a gymnasium with locker and shower rooms for each sex; blackboards in all class and assembly rooms; cabinets in all department rooms built in to side or rear; coat rooms; toilets; drinking fountains; nurseries and rest rooms.



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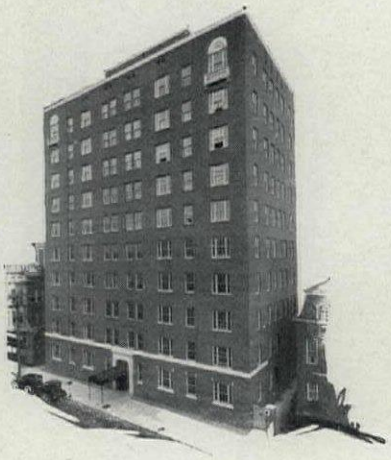

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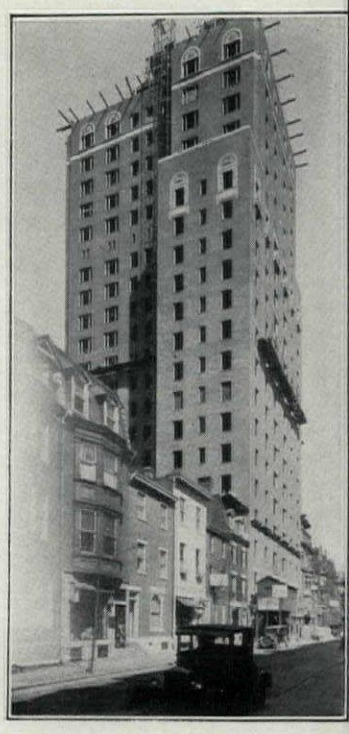

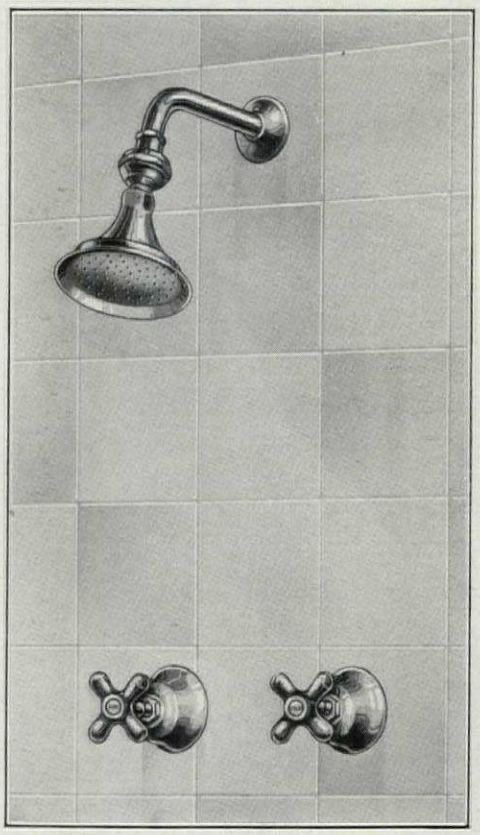

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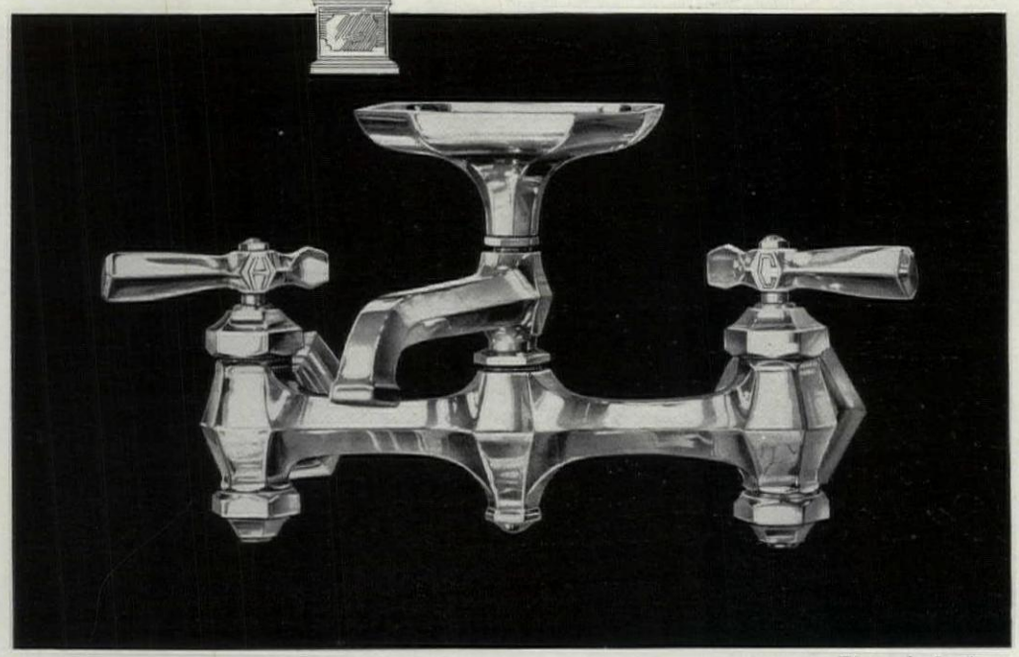

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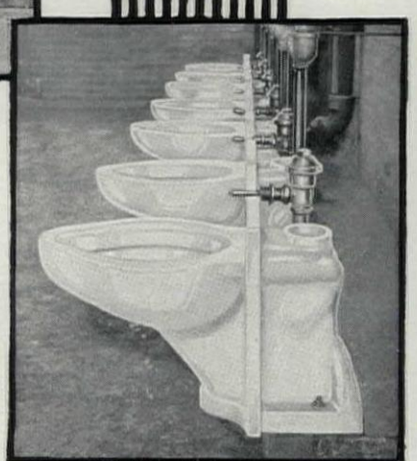

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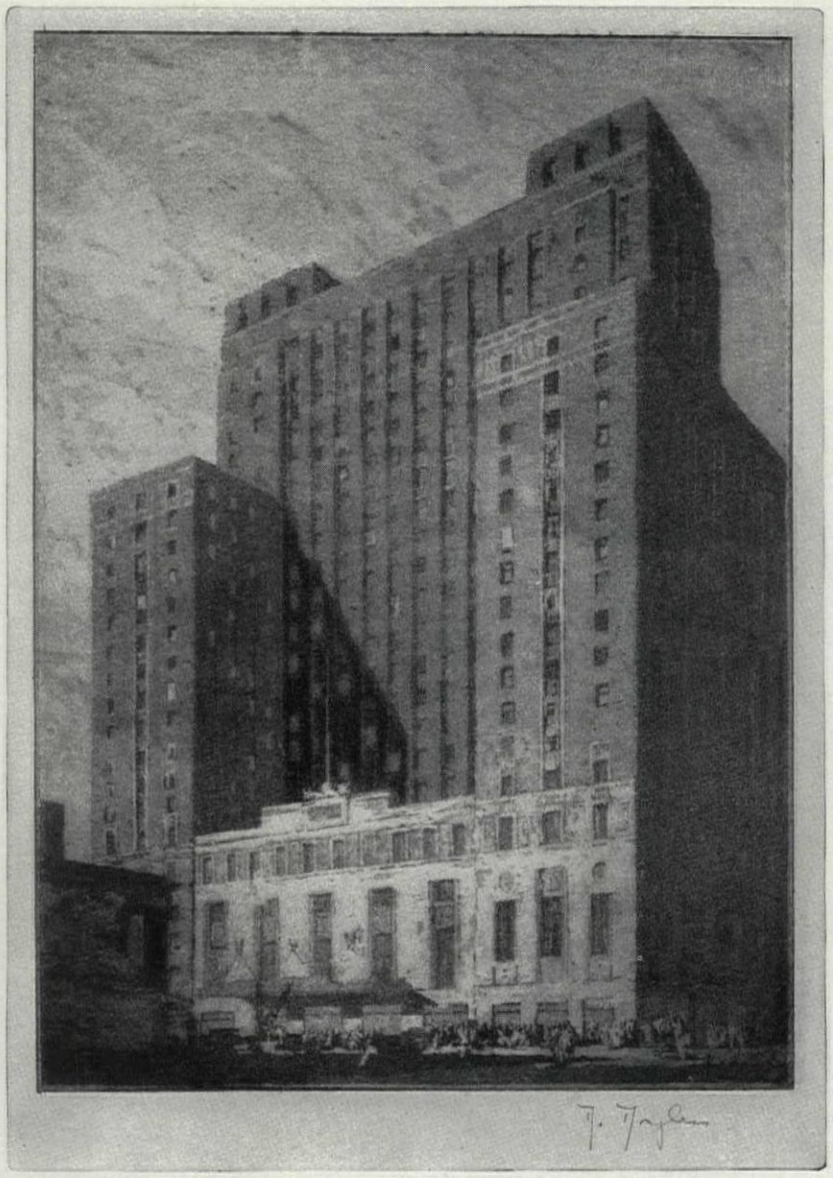

A Donald Douglass Aquatint study of the SCHROEDER HOTEL *Milwaukee, Wisconsin*

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Fig. 370 Jenkins Standard Bronze Gate Valve, screwed

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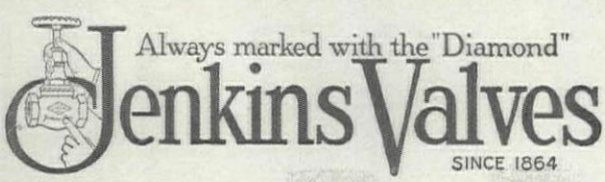

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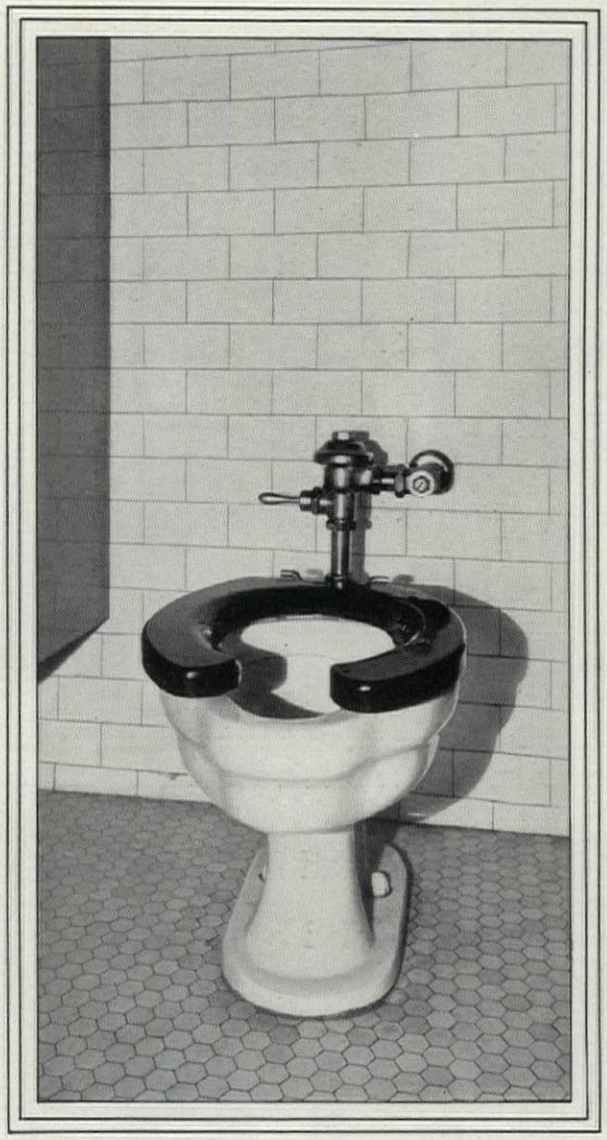

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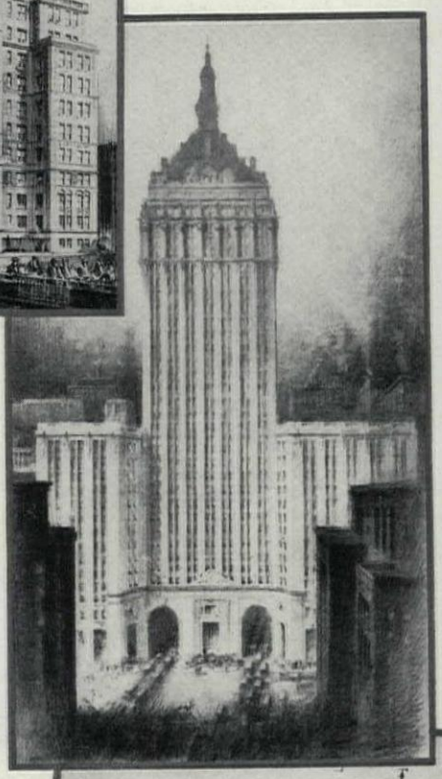

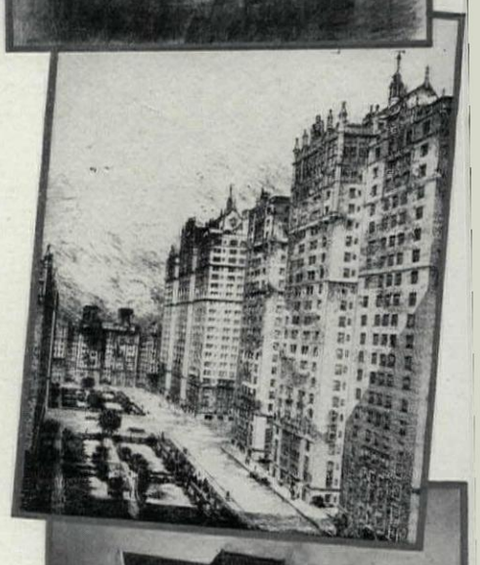

Youngstown Pipe in New York City

New York City, in 1927, set the pace in modern building construction, for all other American cities. It is significant therefore, that Youngstown Pipe was selected for the heating or plumbing lines for a large percentage of the newer and better buildings in the big metropolis. Those shown on this page are a fairly representative group, and beginning at the left, include The Midway Theatre and Hotel—The 1060 Fifth Avenue Apartment Building—The New York Central Building—The Tudor City Apartment Project—The Paramount Hotel. What further conclusive evidence can we offer of the merits of Youngstown Pipe than arguments such as these buildings, themselves, present to you?

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NATIONAL TUBE COMPANY

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"NATIONAL"

New Edition of Bulletin No. 14

Trane Bulletin 14 contains valuable data on vapor and vacuum heating. It includes complete descriptions of Trane Bellows Radiator Traps, Trane Bellows Packless Valves, and the complete line of Trane specialties, for vapor and vacuum heating systems.

The new edition, now ready for distribution, contains added information on recent developments in the Trane line — the Thermostatic Drip Trap, New Quick Vent, New Valves, etc.

Dirt Strainers Now Available

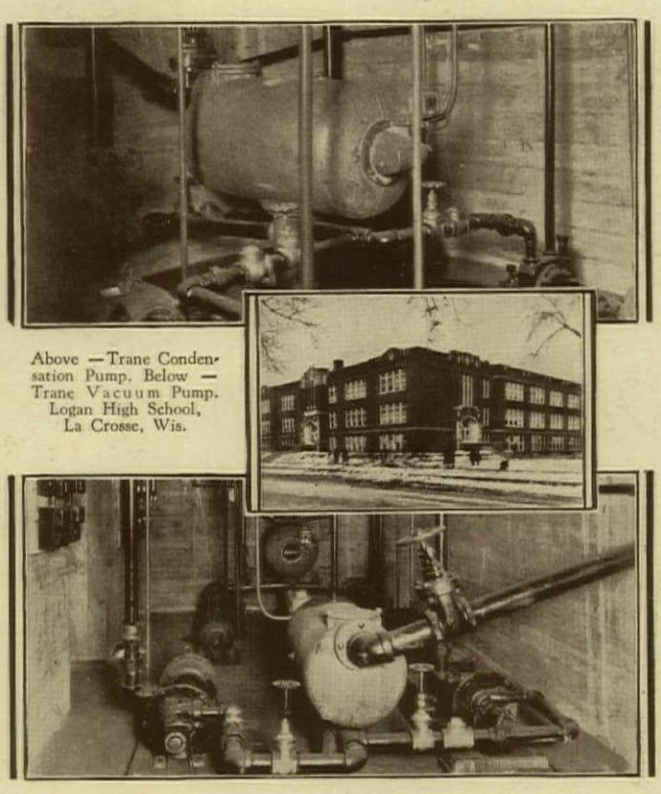
Dirt strainers of Trane manufacture — sizes ½", ¾", 1" and 1¾" — are recommended as substitutes for dirt pockets on all main drips, riser drips, and unit heaters. Adaptable to either horizontal or vertical pipe lines.

Write for a copy of the new Bulletin 14

Trane Bellows Packless Valve

Trane Bellows Radiator Trap

"..... in a neat and workmanlike manner"



Above — Trane Condensation Pump. Below — Trane Vacuum Pump. Logan High School, La Crosse, Wis.

When You Specify Trane Pumps, You Can Depend on All-Round Satisfaction

Trane Pumps help any heating system deliver the performance you expect — and a little bit more. The completed installation carries out the ideas you had in mind when planning the layout and writing the specifications. To layman and engineer alike, it is always a pleasure to inspect and test a Trane-equipped job.

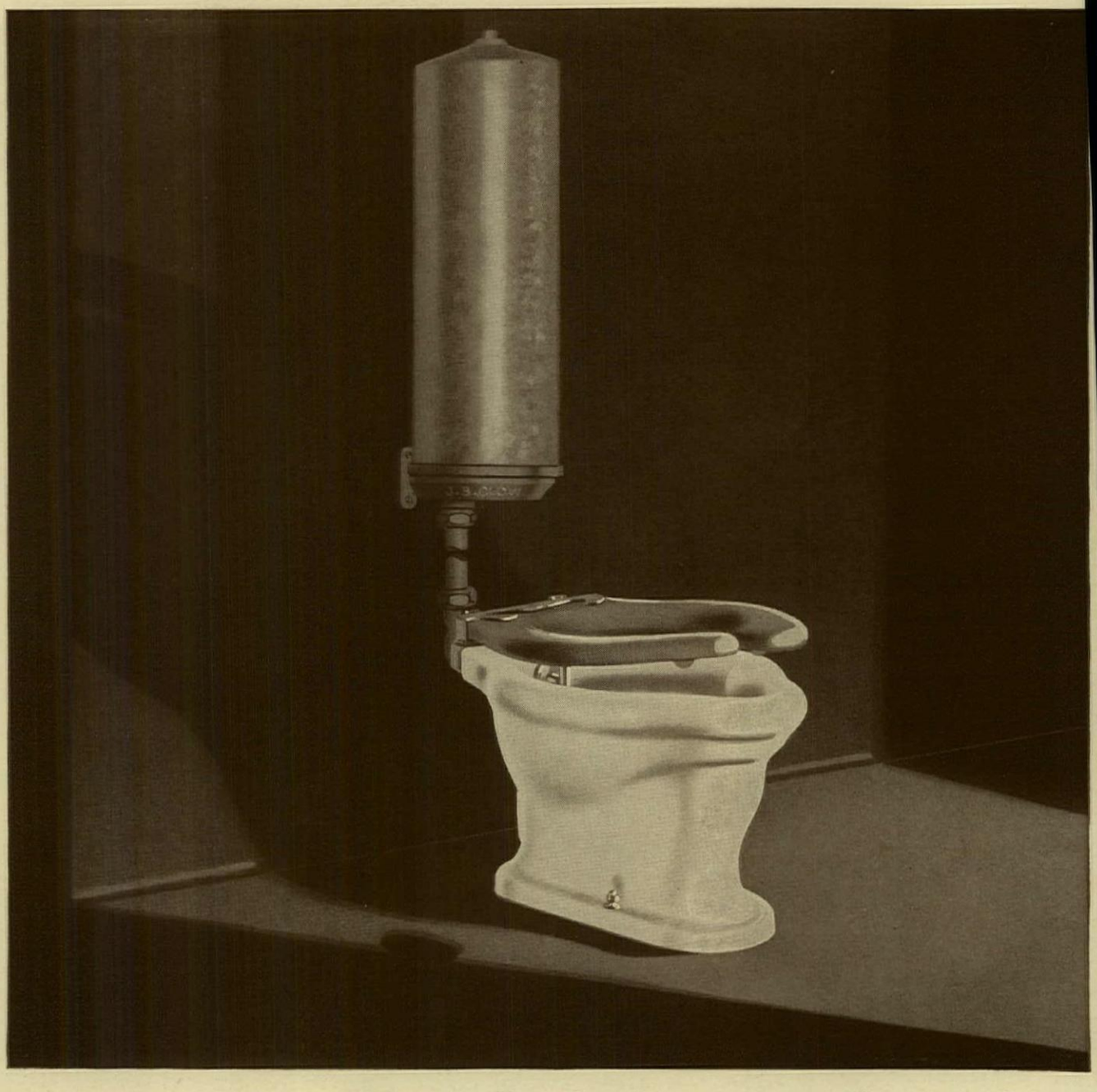
Trane Pumps are designed to give a well-balanced installation in actual service. No "feature" receives too great emphasis at the expense of all-round results.

Write for Bulletin 20 containing complete facts.

THE TRANE CO., *220 Cameron Ave., La Crosse, Wis.*

HEAT CABINETS **TRANE** CONCEALED HEATERS

··· PUMPS AND HEATING SPECIALTIES ···



They Can't Stand Unflushed . . .

Record No. 103
In 1908, 28 Clow Madden Automatics were installed. In 1922, there were no repairs to date (14 yrs.). They were then reinstalled in new school building and are now (1928) still going strong. *Location: School, Buffalo Center, Iowa.*

Unflushed closets are filthy, dangerous headquarters for filthy, dangerous insects, smells and germs. Clow Madden Automatics *never* stand unflushed.

Each time, *each time,* no matter how many times they are used . . . Clow Madden Automatics flush themselves. They're Automatic. They can't stand unflushed.

Each time, a deluge of water whirls away all waste. Each time, the bowl is purged of taint. And Clow bowls co-operate with water. They have no bumps or hollows to cause eddies.

CLOW MADDEN

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

Probably for the Next 35 Years

Simple, sure, strong, describe the Clow Madden Valve (it has no by-passes, floats or temperament). It's sensible about water . . . never wastes it . . . never stints it.

Sanitation follows Clow Madden Automatics — through thirty-five years and sometimes more. Water bills become easy to pay. Repair bills seldom happen. (Read Records No. 103 and No. 106.) Send for the Clow School Plumbing Booklet.

Record No. 106
In 1906, 22 Clow Madden Automatics were installed. In 1928, after 22 years service, every closet is still in perfect working condition. *Location: Dewey School, Evanston, Illinois.*

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

AUTOMATIC

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

Selected List of Manufacturers' Publications

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

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

ACOUSTICS

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

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

ASH HOISTS—ELECTRIC AND HAND POWER

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

BASEMENT WINDOWS

Genfire Steel Company, Youngstown, Ohio.
Architectural Details. Booklet, 28 pp., 8½ x 11 ins. Details on steel windows. A. I. A. File No. 16E.

BATHROOM FITTINGS

A. P. W. Paper Co., Albany, N. Y.
Onliwon for Fine Buildings. Folder, 8 pp. 3¼ x 6 in. Illustrated. Deals with toilet paper fittings of metal and porcelain.
Architects' File Card. 8½ x 11 in. Illustrated. Filing card on toilet paper and paper towel cabinets.
A Towel Built for Its Job. Booklet, 8 pp. 4¼ x 9⅝ in. Illustrated. Paper Towel System and Cabinets.
Cabinets and Fixtures. Booklet, 31 pp. 5¾ x 4¾ in. Illustrated. Catalog and price list of fixtures and cabinets.

BRICK

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

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

CEMENT

Carney Company, The, Mankato. Minn.
A Remarkable Combination of Quality and Economy. Booklet, 20 pp., 8½ x 11 ins. Illustrated. Important data on valuable material.

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

Kosmos Portland Cement Company, Louisville, Ky.
Kosmotar for Enduring Masonry. Folder, 6 pp., 3½ x 6½ in. Data on strength and working qualities of Kosmortar.
Kosmortar, the Mortar for Cold Weather. Folder, 4 pp., 3⅝ x 6½ in. Tells why Kosmortar should be used in cold weather.

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

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

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

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

Portland Cement Association, Chicago.
Concrete Masonry Construction. Booklet, 47 pp., 8½ x 11 ins. Illustrated. Deals with various forms of construction.
Town and Country Houses of Concrete Masonry. Booklet, 19 pp., 8½ x 11 ins. Illustrated.
Facts About Concrete Building Tile. Brochure, 16 pp., 8½ x 11 ins. Illustrated.
The Key to Firesafe Homes. Booklet, 20 pp., 8½ x 11 ins. Illustrated.

CEMENT—Continued

Design and Control of Concrete Mixtures. Brochure, 32 pp., 8½ x 11 ins. Illustrated.
Portland Cement Stucco. Booklet, 64 pp., 8½ x 11 ins. Illustrated.
Concrete in Architecture. Bound Volume. 60 pp., 8½ x 11 ins. Illustrated. An excellent work, giving views of exteriors and interiors.

CONCRETE BUILDING MATERIALS

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

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

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

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

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

CONCRETE COLORINGS

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

CONSTRUCTION, FIREPROOF

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

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

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

DAMPPROOFING

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

Genfire Steel Company, Youngstown, Ohio.
Waterproofing Handbook. Booklet. 8½ x 11 ins. 80 pp., A. I. A. File No. 7. Illustrated. Thoroughly covers subject of waterproofing concrete, wood and steel preservatives, dusting and hardening concrete floors, and accelerating the setting of concrete. Free distribution.

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

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

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

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 177*

DOORS AND TRIM, METAL

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

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

DOORS, SOUNDPROOF

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

DUMBWAITERS

Sedgwick Machine Works, 151 West 15th St., New York.
Catalog and Service Sheets. Standard specifications, plans and prices for various types, etc. 4¼ x 8¼ in. 60 pp. Illustrated.
Catalog and pamphlets, 8½ x 11 in. Illustrated. Valuable data on dumbwaiters.

ELECTRICAL EQUIPMENT

Benjamin Electric Mfg. Co., 120 So. Sarigamore St., Chicago.
Reference Wall Chart, 22 x 28½ ins. "Enables one to select at a glance the right type of reflector or other lighting equipment."
Benjamin-Starrett Panelboards and Steel Cabinets. Booklet, 80 pp. 8½ x 10½ ins. Full data on these details for light and power.
Benjamin-Starrett Panelboards for Light and Power. Booklet, 80 pp., 8½ x 11 ins. Illustrated. Full data on company's line of panelboards, steel cabinets, etc.

General Electric Co., Schenectady, N. Y.
"Electrical Specification Data for Architects. Brochure, 36 pp., 8 x 10½ ins., illustrated. Data regarding G. E. wiring materials and their use.
"The House of a Hundred Comforts." Booklet, 40 pp., 8 x 10½ ins. Illustrated. Dwells on importance of adequate wiring.

Pick & Company, Albert, 208 West Randolph St., Chicago, Ill.
School Cafeterias. Booklet. 9 x 6 in. Illustrated. The design and equipment of school cafeterias with photographs of installation and plans for standardized outfits.

Signal Engineering & Mfg. Co., 154 W. 14th St., New York.
Signal Call Code System. Booklet, 16 pp., 8½ x 10 ins. Illustrated. Important telephone accessories.
Fire Alarm Systems,—Bulletin A-35. 12 pp., 8½ x 9½ ins. Illustrated. Data on fire alarn equipment.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Electric Power for Buildings. Brochure, 14 pp., 8½ x 11 ins. Illustrated. A publication important to architects and engineers.
Variable-Voltage Central Systems as applied to Electric Elevators. Booklet, 13 pp., 8½ x 11 ins. Illustrated. Deals with an important detail of elevator mechanism.
Modern Electrical Equipment for Buildings. Booklet, 8½ x 11 ins. Illustrated. Lists many useful appliances.
Electrical Equipment for Heating and Ventilating Systems. Booklet, 24 pp., 8½ x 11 ins. Illustrated. This is "Motor Application Circular 7379."
Westinghouse Panelboards and Cabinets (Catalog 42-A). Booklet, 32 pp., 8½ x 11 ins. Illustrated. Important data on these details of equipment.
Beauty; Power; Silence; Westinghouse Fans (Dealer Catalog 45). Brochure, 16 pp., 8½ x 11 ins. Illustrated. Valuable information on fans and their uses.
Electric Range Book for Architects (A. I. A. Standard Classification 31 G-4). Booklet, 24 pp., 8½ x 11 ins. Illustrated. Cooking apparatus for buildings of various types.
Westinghouse Commercial Cooking Equipment (Catalog 280). Booklet, 32 pp., 8½ x 11 ins. Illustrated. Equipment for cooking on a large scale.
Electric Appliances (Catalog 44-A). 32 pp., 8½ x 11 ins. Deals with accessories for home use.

ELEVATORS

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

Richards-Wilcox Mfg. Co., Aurora, Ill.
Elevators. Booklet. 8½ x 11 ins. 24 pp. Illustrated. Describes complete line of "Ideal" elevator door hardware and checking devices, also automatic safety devices.

Sedgwick Machine Works, 151 West 15th St., New York, N. Y. ..
Catalog and descriptive pamphlets, 4¼ x 8¼ ins. 70 pp. Illustrated. Descriptive pamphlets on hand power freight elevators, sidewalk elevators, automobile elevators, etc.
Catalog and pamphlets. 8½ x 11 ins. Illustrated. Important data on different types of elevators.

Concrete Engineering Co., Omaha, Nebr.
"Handbook of Fireproof Construction." Booklet, 53 pp., 8½ x 11 in. Valuable work on methods of fireproofing.

FIREPROOFING

Genfire Steel Company, Youngstown, Ohio.
Fireproofing Handbook, 8½ x 11 in. 32 pp. Illustrated. Gives methods of construction, specifications, data on Herringbone metals, lath, steel tile, Trussit solid partitions, steel joists, Self-Centering formless concrete construction.

FIREPROOFING—Continued

North Western Expanded Metal Co., 407 South Dearborn St., Chicago.
A. I. A. Sample Book. Bound volume, 8½ x 11 ins. Contains actual samples of several materials and complete data regarding their use.

FLAGSTONES

J. G. Robinson, 6202 Germantown Avenue, Philadelphia.
Robinson Flagstones. Brochure, 12 pp., 8½ x 11 ins. Illustrated. Data and Specifications.

FLOOR HARDENERS (CHEMICAL)

Master Builders Co., Cleveland Ohio.
Concrete Floor Treatment. File, 50 pp. Data on Securing hardened dustproof concrete.
Concrete Floor Treatments—Specification Manual. Booklet. 23 pp. 8½ x 11 in. Illustrated. Valuable work on an important subject.

Sonneborn Sons, Inc., L., 116 Fifth Ave., New York, N. Y.
Lapidolith, the liquid chemical hardener. Complete sets of specifications for every building type in which concrete floors are used, with descriptions and results of tests.

FLOORS—STRUCTURAL

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

Structural Gypsum Corporation, Linden, N. J.
Gypsteel Pre-cast Fireproof Floors. Booklet, 36 pp. 8½ x 11 ins. Illustrated. Data on flooring.

FLOORING

Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Armstrong's Cork Tile Floors. Booklet, 7¾ x 10½ in. 30 pp. An illustrated work on cork flooring.
Linotile for Home Floors. Brochure. 7½ x 10½ ins. 27 pp. and colored enclosures of floor installations.

Armstrong Cork Co. (Linoleum Division), Lancaster, Pa.
Armstrong's Linoleum Floors. Catalog. 8½ x 11 in. 40 pp. Color plates. A technical treatise on linoleum, including table of gauges and weights and specifications for installing linoleum floors.
Armstrong's Linoleum Pattern Book, 1927. Catalog. 3½ x 6 in. 272 pp. Color Plates. Reproduction in color of all patterns of linoleum and cork carpet in the Armstrong line.
Quality Sample Book. 3½ x 5¾ in. Showing all gauges and thicknesses in the Armstrong line of linoleums.
Linoleum Layer's Handbook. 5 x 7 in. 32 pp. Instructions for linoleum layers and others interested in learning most satisfactory methods of laying and taking care of linoleum.
Enduring Floors of Good Taste. Booklet. 6 x 9 in. 48 pp. Illustrated in color. Explains use of linoleum for offices, stores, etc., with reproductions in color of suitable patterns, also specifications and instructions for laying.

Barber Asphalt Co., Philadelphia.
Specifications for Applying Genasco Asphalt Mastic. Booklet. 8 x 10½ in. Directions for using Asphalt Mastic for flooring.

Blabon Company, Geo. W., Nicetown, Philadelphia, Pa.
Planning the Color Schemes for Your Home. Brochure illustrated in color; 36 pp., 7½ x 10½ in. Gives excellent suggestions for use of color in flooring for houses and apartments.
Handy Quality Sample Folder of Linoleums. Gives actual samples of "Battleship Linoleum," cork carpet, "Feltex," etc.
Blabon's Linoleum. Booklet illustrated in color; 128 pp., 3½ x 8½ in. Gives patterns of a large number of linoleums.
Blabon's Plain Linoleum and Cork Carpet. Gives quality samples, 3 x 6 in. of various types of floor coverings.

Bonded Floors Company, Inc., 1421 Chestnut St., Philadelphia, Pa.
A series of booklets, with full color inserts showing standard colors and designs. Each booklet describes a resilient floor material as follows:
Battleship Linoleum. Explains the advantages and uses of this durable, economical material.
Marble-ized (Cork Composition) Tile. Complete information on cork-composition marble-ized tile and the many artistic effects obtainable with it.
Treadlite (Cork Composition) Tile. Shows a variety of colors and patterns of this adaptable cork composition flooring.
Natural Cork Tile. Description and color plates of this superquiet, resilient floor.
Practical working specifications for installing battleship linoleum, cork composition tile and cork tile.

Carter Bloxonend Flooring Co., Keith & Perry Bldg., Kansas City, Mo.
Bloxonend Flooring. Booklet 3¼ x 6¼ in. 20 pp. Illustrated. Describes uses and adaptability of Bloxonend Flooring to concrete, wood or steel construction, and advantages over loose wood blocks.
File Folder, 9¾ x 11¾ in. For use in connection with A. I. A. system of filing. Contains detailed information on Bloxonend Flooring in condensed, loose-leaf form for specification writer and drafting room. Literature embodied in folder includes standard Specification Sheet covering the use of Bloxonend in general industrial service and Supplementary Specification Sheet No. 1, which gives detailed description and explanation of an approved method for installing Bloxonend in gymnasiums, armories, drill rooms and similar locations where maximum resiliency is required.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 178*

FLOORING—Continued

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

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

United States Quarry Tile Co., Parkersburg, W. Va.
Quarry Tiles for Floors. Booklet, 119 pp., 8½ x 11 ins. Illustrated. General catalog. Details of patterns and trim for floors.
Art Portfolio of Floor Designs. 9¼ x 12¼ ins. Illustrated in colors. Patterns of quarry tiles for floors.

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

FURNITURE

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

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

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

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

New York Galleries, Madison Avenue and 48th Street, New York.
A group of Distinguished Interiors. Brochure, 4 pp., 8¾ x 11¾ ins. Filled with valuable illustrations.

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

GARAGES

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

GLASS CONSTRUCTION

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

Libbey-Owens Sheet Glass Co., Toledo, O.
Flat Glass. Brochure, 11 pp., 5⅝ x 7⅝ ins. Illustrated. History of manufacture of flat, clear, sheet glass.

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

GREENHOUSES

William H. Lutton Company, 267 Kearney Ave., Jersey City, N. J.
Greenhouses of Quality. Booklet, 50 pp., 8½ x 11 ins. Illustrated. Conservatories making use of Lutton Patented Galvanized Steel V-Bar.

HARDWARE

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

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

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

Richard-Wilcox Mfg. Co., Aurora, Ill.
Distinctive Garage Door Hardware. Booklet. 8½ x 11 in. 65 pp. Illustrated. Complete information accompanied by data and illustrations on different kinds of garage door hardware.
Distinctive Elevator Door Hardware. Booklet, 89 pp., 16 x 10½ ins. Illustrated.

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

HEATING EQUIPMENT

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

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

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

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

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

The Fulton Sylphon Company, Knoxville, Tenn.
Sylphon Temperature Regulators. Illustrated brochures, 8½ x 11 ins., dealing with general architectural and industrial applications; also specifically with applications of special instruments.
Sylphon Heating Specialties. Catalog No. 200, 192 pp., 3½ x 6¼ ins. Important data on heating.

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

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

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

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

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

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

Molby Boiler Co., Inc., New York and Lansdale, Pa.
Molby Heating Boiler. Booklet, 24 pp., 4 x 9 ins. Illustrated. Deals with well known line of boilers.
Chimney Construction. Booklet, 26 pp., 6 x 9 ins. Data recommended by National Board of Fire Underwriters.

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

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

He Stopped the Leak as Best He Could

OVER a long period of troublesome years, architects, contractors and owners of large buildings also have contended with leaks; *ever increasing steam leakages from Expansion Joints* used on heating pipe risers.

Joint packing, as was the Dutch boy's arm, is *only temporarily efficient.* A joint stuffed with commercial packing is bound to leak eventually. It is totally unfit for a vacuum system or a system where a slight vacuum is pulled.

The over-loaded pump fails to retain the vacuum, heating efficiency becomes poor, and fuel and repair costs multiply.

Sylphon TRADE MARK **PACKLESS EXPANSION JOINT**

Allows Absolutely No Leakage

Its heart, the *all metal, original and genuine Sylphon Bellows* acts as a continuous yet flexible barrier to steam escape. It *is steam tight now, tomorrow or ten years from today,* requires no attention, and yet has perfect freedom of motion without risk of "jamming." It does away with "Expansion loops" those story-height *space wasters.* No more packed or "sliding sleeve" expansion joints, almost *impossible to repack* in the case of a riser concealed in furring.

Sylphon Packless Expansion Joints Are Easily Installed in the Vertical Riser

We will be glad to send you complete data, sizes, prices and shipping weights. Use the coupon or write if you prefer.

The ORIGINAL GENUINE SYLPHON BELLOWS

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

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

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

Gentlemen:

We are interested in the application of the Sylphon Packless Expansion Joint to

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Company .....

Address .....

City ..... State.....

THE FULTON SYLPHON COMPANY — Sylphon — AUTOMATIC TEMPERATURE CONTROL

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

HEATING EQUIPMENT—Continued

Petroleum Heat & Power Co., 511 Fifth Avenue, New York.
Heating Homes the Modern Way. Booklet, 8½ x 11¾ ins. Illustrated. Data on the Petro Burner.
Residence Oil Burning Equipment. Brochure, 6 pp., 8½ x 11 ins. Illustrated. Data regarding Petro Burner in a bulletin approved by Investigating Committee of Architects and Engineers.
Petro Mechanical Oil Burner & Air Register. Booklet, 23 pp., 8½ x 11 ins. Illustrated. Data on industrial installations of Petro Burners.
Present Accepted Practice in Domestic Oil Burners. Folder, 4 pp., 8½ x 11 ins. Illustrated. A reprint from Heating and Ventilating Magazine.

Trane Co., The, La Crosse, Wis.
Bulletin 14. 16 pp. 8½ x 10⅝ in. Covers the complete line of Trane Heating Specialties, including Trane Bellows Traps, and Trane Bellows Packless Valves.
Bulletin 20. 24 pp., 8½ x 10⅝ in. Explains in detail the operation and construction of Trane Condensation. Vacuum, Booster, Circulating, and similar pumps.

HOSPITAL EQUIPMENT

The Frink Co., Inc., 24th St. and Tenth Ave., New York City.
Catalog 426. 7 x 10 in., 16 pp. A booklet illustrated with photographs and drawings, showing the types of light for use in hospitals, as operating table reflectors. linolite and multilite concentrators, ward reflectors, bed lights and microscopic reflectors, giving sizes and dimensions, explaining their particular fitness for special uses.

The International Nickel Company, 67 Wall St., New York, N. Y.
Hospital Applications of Monel Metal. Booklet. 8½ x 11½ in. 16 pp. Illustrated. Gives types of equipment in which Monel Metal is used, reasons for its adoption, with sources of such equipment.

The Pick-Barth Companies, Chicago and New York.
Some Thoughts About Hospital Food Service Equipment. Booklet, 21 pp., 7½ x 9¼ ins. Valuable data on an important subject.

Wilmot Castle Company, Rochester, N. Y.
Sterilizer Equipment for Hospitals. Book, 76 pp. 8½ x 11 in. Illustrated. Gives important and complete data on sterilization of utensils and water, information on dressings, etc.
Sterilizer Specifications. Brochure, 12 pp. 8½ x 11 in. Practical specifications for use of architects and contractors.
Architects' Data Sheets. Booklet, 16 pp. 8½ x 11 in. Illustrated. Information on piping, venting, valving and wiring for hospital sterilizer installations.
Hospital Sterilizing Technique. Five booklets, 8 to 16 pp. 6 x 9 in. Illustrated. Deals specifically with sterilizing instruments, dressings, utensils, water, and rubber gloves.

HOTEL EQUIPMENT

Pick & Company, Albert, 208 West Randolph Street, Chicago, Ill.
Some Thoughts on Furnishing a Hotel. Booklet, 7½ x 9 ins. Data on complete outfitting of hotels.

INCINERATORS

Kerner Incinerator Company, 715 E. Water St., Milwaukee, Wis.
Incinerators (Chimney-fed). Catalog No. 15 (Architect and Builders' Edition). Size 8½ x 11 ins. 16 pp. Illustrated. Describes principles and design of Kernerator Chimney-fed Incinerators for residences, apartments, hospitals, schools, apartment hotels, clubs and other buildings. Shows all standard models and gives general information and working data.
Sanitary Elimination of Household Waste, booklet, 4 x 9 ins. 16 pp. Illustrated. Gives complete information on the Kernerator for residences.
Garbage and Waste Disposal for Apartment Buildings, folder, 8½ x 11 ins. 8 pp. Illustrated. Describes principle and design of Kernerator-Chimney-fed Incinerator for apartments and gives list of buildings where it ahs been installed.
Sanitary Disposal of Waste in Hospitals. Booklet. 4 x 9 ins. 12 pp. Illustrated. Shows how this necessary part of hospital service is taken care of with the Gernerator. Gives list of hospitals where installed.

INSULATING LUMBER

Mason Fibre Co., 111 West Washington St., Chicago, Ill.
Booklet, 12 pp., 8½ x 11 in. Illustrated. Gives complete specifications for use of insulating lumber and details of construction involving its use.

INSULATION

Armstrong Cork & Insulation Co., Pittsburgh, Pa.
The Insulation of Roofs with Armstrong's Corkboard. Booklet. Illustrated. 7½ x 10½ in. 32 pp. Discusses means of insulating roofs of manufacturing or commercial structures.
Insulation of Roofs to Prevent Condensation. Illustrated booklet. 7½ x 10½ in. 36 pp. Gives full data on valuable line of roof insulation.
Filing Folder for Pipe Covering Data. Made in accordance with A. I. A. rules.
"The Cork Lined House Makes a Comfortable Home." 5 x 7 in. 32 pp. Illustrated.
Armstrong's Corkboard. Insulation for Walls and Roofs of Buildings. Booklet, 66 pp., 9½ x 11¾ ins. Illustrates and describes use of insulation for structural purposes.

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

Philip Carey Co., The, Cincinnati, Ohio.
Carey Asbestos and Magnesia Products. Catalog. 6 x 9 in. 72 pp. Illustrated.

Celite Products Co., 1320 South Hope St., Los Angeles.
The Insulation of Boilers. Booklet. 8 pp., 8½ x 11 ins. Illustrated. On insulating boiler walls, breechings, and stacks to reduce amount of radiation.
Heat Insulation Specifications and Blue Prints. Booklet, 20 pp., 8½ x 11 ins. Illustrated. On approved types of insulation.

INSULATION—Continued

Structural Gypsum Corporation, Linden, N. J.
Heat Insulation Value of Gypsteel. Folder, 4 pp., 8½ x 11 ins. Brochure, by Charles L. Norton, of M. I. T.

JOISTS

Bates Expanded Steel Truss Co., East Chicago, Ind.
Catalog No. 4. Booklet, 32 pp., 8½ x 11 ins. Illustrated. Gives details of truss construction with loading tables and specifications.

Genfire Steel Company, Youngstown, Ohio.
Steel Joists. 8½ x 11 ins. 32 pp. A. I. A. File Number 13G. Illustrated. Complete data on T-Bar and Plate-Girder joists including construction details and specifications.

KITCHEN EQUIPMENT

The International Nickel Company, 67 Wall St., New York, N. Y.
Hotels, Restaurants and Cafeteria Applications of Monel Metal. Booklet. 8½ x 11 in. 32 pp. Illustrated. Gives types of equipment in which Monel Metal is used, with service data and sources of equipment.

McDougall Company, Frankfort, Ind.
Kitchens for Homes and Apartments. Booklet, 32 pp., 8½ x 11 ins. Illustrated. Views and plans of conveniently equipped kitchens.
File Folder. Service sheets and specifications useful in preparing kitchen layouts.
Domestic Science Kitchen Units. Brochure, 8 pp., 8½ x 11 ins. Illustrated. Deals with flexible line of kitchen equipment.

Pick & Company, Albert, 208 W. Randolph St., Chicago, Ill.
School Cafeteria. Portfolio. 17 x 11 in. 44 pp. Illustrated. An exhaustive study of the problems of school feeding, with copious illustrations and blue prints. Very valuable to the architect.
School Cafeterias. Booklet. 9 x 6 in. Illustrated. The design and equipment of school cafeterias with photographs of installation and plans for standardized outfits.

LABORATORY EQUIPMENT

Alberene Stone Co., 153 West 23rd Street, New York City
Booklet 8¾ x 11¼ in., 26 pp. Stone for laboratory equipment, shower partitions, stair treads, etc.

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

LANTERNS

Todhunter, Arthur, 119 E. 57th St., New York.
Hand Wrought Lanterns. Booklet, 5¼ x 6¼ in. 20 pp. Illustrated in Black and White. With price list. Lanterns appropriate for exterior and interior use, designed from old models and meeting the requirements of modern lighting.

LATH, METAL AND REINFORCING

Genfire Steel Company, Youngstown, Ohio.
Herringbone Metal Lath Handbook. 8½ x 11 in. 32 pp. Illustrated. Standard specifications for Cement Stucco on Herringbone. Rigid Metal Lath and interior plastering.

National Steel Fabric Co., Pittsburgh.
Better Walls for Better Homes. Brochure. 16 pp. 7¾ x 10¾ ins. Illustrated. Metal lath, particularly for residences.
Steeltex for Floors. Booklet. 24 pp. 8½ x 11 ins. Illustrated. Combined reinforcing and form for concrete or gypsum floors and roofs.
Steeltex Data Sheet No. 1. Folder. 8 pp. 8½ x 11 ins. Illustrated. Steeltex for floors on steel joists with round top chords.
Steeltex Data Sheet No. 2. Folder. 8 pp. 8½ x 11 ins. Illustrated. Steeltex for floors on steel joists with flat top flanges.
Steeltex Data Sheet No. 3. Folder. 8 pp. 8½ x 11 ins. Illustrated. Steeltex for folders on wood joists.

Northwestern Expanded Metal Co., 1234 Old Colony Building, Chicago, Ill.
Northwestern Expanded Metal Products. Booklet, 8½ x 10¾ in., 20 pp. Fully illustrated, and describes different products of this company, such as Kno-burn metal lath, 20th Century Corrugated. Plasta-saver and Longspan lath channels, etc.
Longspan ¾-inch Rib Lath. Folder 4 pp., 8½ x 11 ins. Illustrated. Deals with a new type of V-rit expanded metal.
A. I. A. Sample Book. Bound volume, 8½ x 11 ins. Contains actual samples of several materials and complete data regarding their use.
Northwest Metal Lath. Folder. 8½ x 11 ins. Illustrated. Data on Flat Rib Lath.

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

LAUNDRY CHUTES

The Pfaudler Company, 217 Cutler Building, Rochester, N. Y.
Pfaudler Glass-Lined Steel Laundry Chutes. Booklet, 5⅛ x 7⅜ in. 16 pp. Illustrated. A beautifully printed brochure describing in detail with architects' specifications THE PFAUDLER GLASS LINED STEEL LAUNDRY CHUTES. Contains views of installations and list of representative examples.

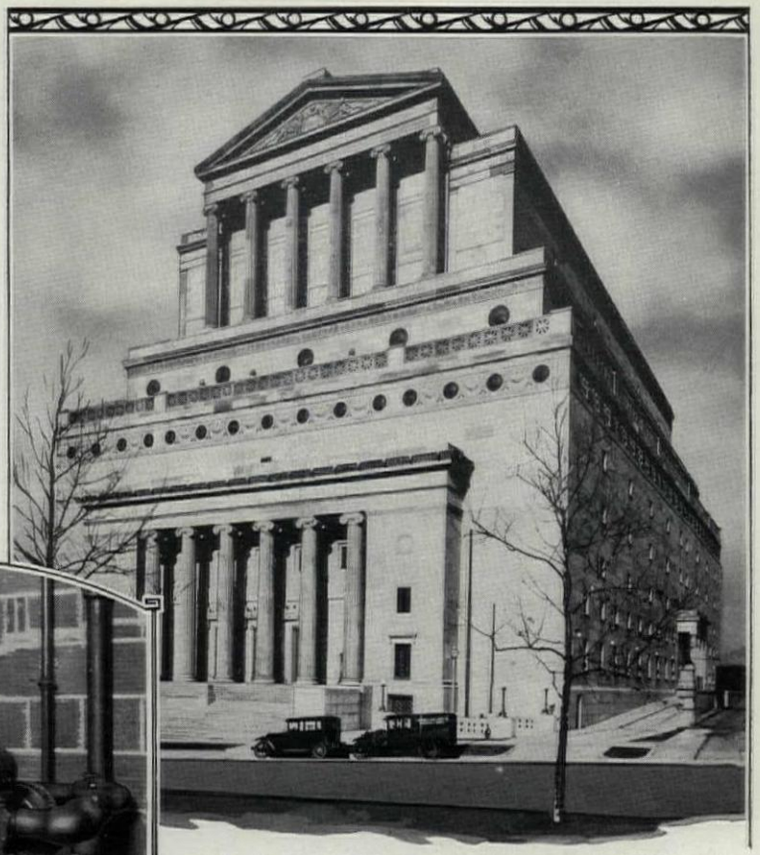
LAUNDRY MACHINERY

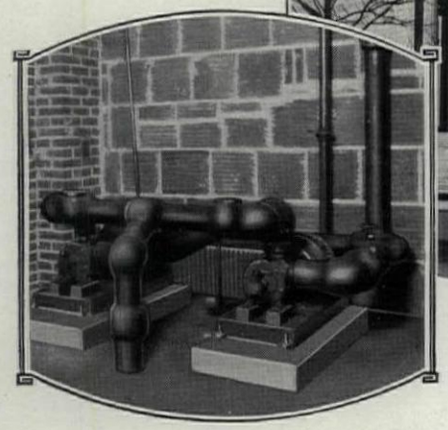
American Laundry Machinery Co., Norwood Station. Cincinnati. Ohio.
Functions of the Hotel and Hospital Laundry. Brochure, 8 pp., 8½ x 11 ins. Valuable data regarding an important subject.

LIBRARY EQUIPMENT

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

Drinking Water in the St. Louis Masonic Temple





MASONIC TEMPLE, St. Louis, Mo., EAMES & YOUNG, *Architects*
JOS. A. OSBORNE and GEO. E. WELLS, *Consulting Engineers*

IN the Masonic Temple, St. Louis, all the distributing lines, pump connections, and tanks are insulated with Armstrong's Cork Covering. This dependable insulation, which engineers everywhere recognize as the standard, insures the maintenance at all times of proper water temperatures *at the fountains* with the minimum use of refrigeration. Operating cost is therefore extremely low and the water at the farthest fountain is always "just right"—within a very few degrees of the tank temperature.

Maintenance cost is almost negligible since Armstrong's Cork Covering is moisture proof and not subject to deterioration in either structure or insulating value from normal operating conditions. Lines insulated with Armstrong's Cork Covering may, therefore, safely be enclosed in pipe chases or run in inaccessible places with every assurance of permanence and security against staining since cork covered lines do not sweat.

Engineers of the Armstrong Cork & Insulation Company have had many years' experience in the designing and insulation of refrigerated drinking water systems. Their counsel is freely available to architects and engineers. Armstrong Cork & Insulation Company, 132 Twenty-fourth St., Pittsburgh, Pa.; McGill Bldg., Montreal; 11 Brant St., Toronto 2.

Send *for* This Book

"Refrigerated Drinking Water Systems" a handbook for architects, engineers, and specification writers. Sent free on request

For Cold Lines, Coolers and Tanks.

Armstrong's Cork Covering

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

LIGHTING EQUIPMENT

The Frink Co., Inc., 24th St. and 10th Ave., New York City.
Catalog 415. 8½ x 11 in. 46 pp. Photographs and scaled cross-sections. Specialized bank lighting, screen and partition reflectors, double and single desk reflectors and Polaralite Signs.

Gleason-Tiebout Glass Co. (Celestialite Division), 200 Fifth Avenue, New York.
Next to Daylight Brochure, 19 pp., 4 x 8½ ins. Illustrated. Deals with a valuable type of lighting fixture.
Celestialite Circular No. 40. Folder, 4 pp., 3½ x 6 ins. "What Nature does to the Sun, Celestialite does to the Mazda lamp."
Attractive Units in Celestialite. Folder, 12 pp., 3¼ x 6½ ins. Illustrates Decorated Celestialite Units.
It Has Been Imitated. Folder, 4 pp., 10 x 13 ins. Data in an important detail of lighting equipment.

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

MAIL CHUTES

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

MANTELS

Arthur Todhunter, 119 E. 57th St., New York, N. Y.
Georgian Mantels. New Booklet. 24 pp. 5¼ x 6¾ in. A fully illustrated brochure on eighteenth century mantels. Folders give prices of mantels and illustrations and prices of fireplace equipment.

MARBLE

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

MEMORIALS

Georgia Marble Company, Tate, Ga.
Today for Tomorrow. Bound volume, 77 pp., 9½ x 12½ ins. Lavishly illustrated.

METALS

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

MILL WORK—See also Wood

Curtis Companies Service Bureau, Clinton, Iowa.
Architectural Interior and Exterior Woodword. Standardized Book. 9 x 11½ in. 240 pp. Illustrated. This is an Architects' Edition of the complete catalog of Curtis Woodwork, as designed by Trowbridge & Ackerman. Contains many color plates.
Better Built Homes. Vols. XV-XVIII incl. Booklet. 9 x 12 in. 40 pp. Illustrated. Designs for houses of five to eight rooms, respectively, in several authentic types, by Trowbridge & Ackerman, architects for the Curtis Companies.
Curtis Details. Booklet, 19½ x 23½ in. 20 pp. Illustrated. Complete details of all items of Curtis woodwork, for the use of architects.

Hartmann-Sanders Company, 2155 Elston Ave., Chicago, Ill.
Column Catalog, 7½ x 10 in. 48 pp. Illustrated. Contains prices on columns 6 to 36 in. diameter, various designs and illustrations of columns and installations.
The Pergola Catalog. 7½ x 10 in. 64 pp. Illustrated. Contains illustrations of pergola lattices, garden furniture in wood and cement, garden accessories.

Roddis Lumber and Veneer Co., Marshfield, Wis.
Roddis Doors. Brochure, 24 pp.. 5¼ x 8½ in. Illustrated price list of doors for various types of buildings.
Roddis Doors, Catalog G. Booklet, 183 pp., 8½ x 11 in. Completely covers the subject of doors for interior use.
Roddis Doors for Hospitals. Brochure, 15 pp., 8½ x 11 in. Illustrated work on hospital doors.
Roddis Doors for Hotels. Brochure, 15 pp., 8½ x 11 in. Illustrated work on doors for hotel and apartment buildings.

MORTAR COLORS

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

OFFICE SUPPLIES

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

ORNAMENTAL PLASTER

Jacobson & Co., 241 East 44th St., New York.
A book of Old English Designs. Brochure. 47 plates. 12 x 9 ins. Deals with a fine line of decorative plaster work.
Architectural and Decorative Ornaments. Cloth bound volume. 183 plates. 9 x 12 ins. 18 plates. Price, $3.00. A general catalog of fine plaster ornaments.
Geometrical ceilings. Booklet. 23 plates. 7 x 9 ins. An important work on decorative plaster ceilings.

PAINTS, STAINS, VARNISHES AND WOOD FINISHES

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

National Lead Company, 111 Broadway, New York, N. Y.
Handy Book on Painting. Book. 5½ x 3¼ in. 100 pp. Gives directions and formulae for painting various surfaces of wood, plaster, metals, etc., both interior and exterior.
Red Lead in Paste Form. Booklet, 6¾ x 3½ in. 16 pp. Illustrated. Directions and formulae for painting metals.
Came Lead. Booklet, 8¾ x 6 in. 12 pp. Illustrated. Describes various styles of lead cames.
Cinch Anchoring Specialties. Booklet. 6 x 3½ in. 20 pp. Illustrated. Describes complete line of expansion bolts.

Pratt & Lambert, Inc., Buffalo, N. Y.
Specification Manual for Paint, Varnishing and Enameling. Booklet, 38 pp., 7½ x 10⅝ ins. Complete specifications for painting, varnishing and enameling interior and exterior wood, plaster, and metal work.

Sherwin-Williams Company, 601 Canal Rd., Cleveland, Ohio.
Painting Concrete and Stucco Surfaces. Bulletin No. 1. 8½ x 11 in. 8 pp. Illustrated. A complete treatise with complete specifications on the subject of Painting of Concrete and Stucco Surfaces. Color chips of paint shown in bulletin.
Enamel Finish for Interior and Exterior Surfaces. Bulletin No. 2, 8½ x 11 in. 12 p. Illustrated. Thorough discussion, including complete specifications for securing the most satisfactory enamel finish on interior and exterior walls and trim.
Painting and Decorating of Interior Walls. Bulletin No. 3. 8½ x 11 in. 20 pp. Illustrated. An excellent reference book on Flat Wall Finish, including texture effects, which are taking the country by storm. Every architect should have one on file.
Protective Paints for Metal Surfaces. Bulletin No. 4. 8½ x 11 in. 12 pp. Illustrated. A highly technical subject treated in a simple, understandable manner.

Sonneborn Sons, Inc., L., Dept. 4, 116 Fifth Ave., New York.
Paint Specifications. Booklet. 8½ x 10¾ in. 4 pp.

U. S. Gutta Percha Paint Co., Providence, R. I.
Barreled Sunlight. Booklet, 8½ x 11 in. Data on "Barreled Sunlight" with specifications for its use.

Valentine & Co., 456 Fourth Ave., New York.
How to Use Valspar. Illustrated booklet, 32 pp., 3¾ x 8 in. Deals with domestic uses for Valspar.
How to Keep Your House Young. Illustrated brochure, 23 pp., 7 x 8½ in. A useful work on the upkeep of residences.

Zapon Co., The, 247 Park Ave., New York City.
Zapon Architectural Specifications. Booklet, 28 pp., 8½ x 11 in. Describes odorless brushing and spraying lacquers and lacquer enamels.

PAPER

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

PARTITIONS

Circle A Products Corporations, New Castle, Ind.
Circle A Partitions Sectional and Movable. Brochure. Illustrated. 8½ x 11¼ in. 32 pp. Full data regarding an important line of partitions, along with Erection Instructions for partitions of three different types.

Hauserman Company, E. F., Cleveland, Ohio.
Hollow Steel Standard Partitions. Various folders, 8½ x 11. Illustrated. Give full data on different types of steel partitions, together with details, elevations and specifications.

Improved Office Partition Company, 25 Grand St., Elmhurst, L. I.
Telesco Partition. Catalog. 8¼ x 11 in. 14 pp. Illustrated. Shows typical offices laid out with Telesco partitions, cuts of finished partition units in various woods. Gives specifications and cuts of buildings using Telesco.
Detailed Instructions for erecting Telesco Partitions. Booklet. 24 pp. 8½ x 11 in. Illustrated. Complete instructions, with cuts and drawings, showing how easily Telesco Partition can be erected.

Richards-Wilcox Mfg. Co., Aurora, Ill.
Partitions. Booklet. 7 x 10 in. 32 pp. Illustrated. Describes complete line of track and hangers for all styles of sliding, parallel, accordion and flush door partitions.

U. S. Gypsum Co., Chicago.
Pyrobar Partition and Furring Tile. Booklet. 8½ x 11 in. 24 pp. Illustrated. Describes use and advantages of hollow tile for inner partitions.

PIPE

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

Cleveland Heights High School, Cleveland
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Engineer: Mayer & Valentine
Heating Contractor: T. M. Shand
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Cincinnati, Ohio—Spring Grove & Elmira Avenue
Indianapolis, Ind.—431 W. Georgia Street
Johnstown, Pa.—221 Central Ave.
Louisville, Ky.—1126 W. Breckenridge St.
Milwaukee, Wis.—124-130 Jefferson St.
New York, N. Y.—55 W. 42nd St.
Omaha, Neb.—108-112 S. Tenth St.
Philadelphia, Pa.—121 N. Broad St.
Pittsburgh, Pa.—1509 Arrott Building
Richmond, Va.—3032 Norfolk St.
St. Louis, Mo.—1042 Central Industrial St.
Washington, D. C.—2205 Fifth St., N. E.

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

PIPE—Continued

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

Central Foundary Co., Graybar Building, New York.
Introducing Nuhub Soil Pipe. 1-page folder giving data on soil pipe.

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

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

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

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

PLASTER

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

PLUMBING EQUIPMENT

Central Foundary Co., Graybar Building, New York.
G. & W. Revent and Drainage Fittings. Booklet, 164 pp., 4¼ x 6¾ ins.

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

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

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

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

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

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

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

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

PUMPS

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

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

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

RAMPS

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

REFRIGERATION

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

REFRIGERATORS

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

REINFORCED CONCRETE—See also Construction, Concrete

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

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

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

ROOFING

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

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

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

Heinz Roofing Tile Co., 1925 West Third Avenue, Denver.
Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8½ x 11 ins. Illustrated. Shows use of English shingle tile with special hips.
Italian Promenade Floor Tile. Folder, 2 pp., 8½ x 11 in. Illustrated. Floor tiling adapted from that of Davanzati Palace.
Mission Tile. Leaflet, 8½ x 11 ins. Illustrated. Tile such as are used in Italy and southern California.
Georgian Tile. Leaflet, 8½ x 11 ins. Illustrated. Tiling as used in old English and French farmhouses.

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

Structural Gypsum Corporation, Linden, N. J.
Relative Effectiveness of Various Types of Roofing Construction in Preventing Condensation of the Under Surface. Folder, 4 pp. 8½ x 11 ins. Important data on the subject.
Gypsteel Pre-cast Fireproof Roofs. Booklet, 48 pp., 8½ x 11 ins. Illustrated. Information regarding a valuable type of roofing.

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

SASH CHAIN

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

SEWAGE DISPOSAL

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

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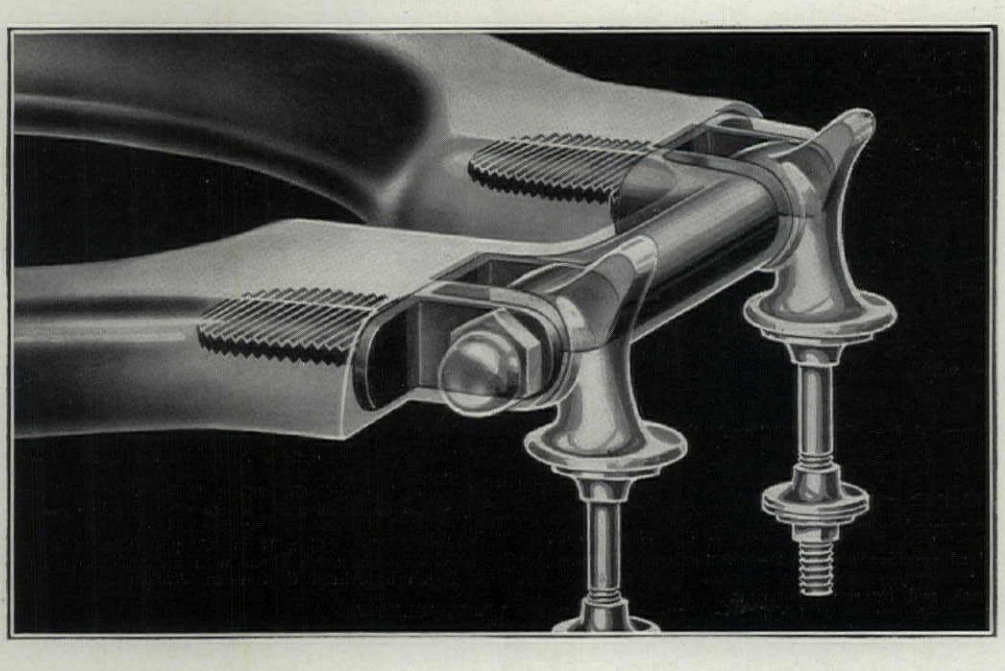

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Birmingham	Charlotte	Cleveland	Des Moines	Houston	El Paso	New York	Richmond	St. Louis	Montreal	Havana

For a free cross-section of a Whale-bone-ite Seat, address Dept. 211 Seat Division, The Brunswick-Balke-Collender Co., 623 South Wabash Ave., Chicago

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

SCREENS

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

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

The Higgin Manufacturing Co., Newport, Ky.
Your Home Screened the Higgin Way. Booklet. 8½ x 11½ in. 13 pp. Illustrated in colors. Complete description of Higgin Screens, designed to meet every need.

SHELVING-STEEL

David Lupton's Sons Company, Philadelphia, Pa.
Lupton Steel Shelving. Catalog D. Illustrated brochure, 40 pp., 8½ x 11 in. Deals with steel cabinets, shelving, racks, doors, partitions, etc.

SKYLIGHTS

Albert Grauer & Co., 1408 Seventeenth St., Detroit, Mich.
Grauer Wire Glass Skylights. Folder, 4 pp., 8½ x 11 in. Illustrated. Data on an important line of wire glass lights.

The Effectiveness of Sidewalk Lights. Folder, 4 pp., 8½ x 11 in. Illustrated. Sidewalk or vault lights.

Let in the Light—The Light That's Free. Folder, 4 pp., 8½ x 11 in. Illustrated. Data on securing good lighting.

SOUND DEADENER

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

STAIRWAYS

Woodbridge Ornamental Iron Co., 1515 Altgeld St., Chicago.
Presteel Tested for Strength—stairways, catalog, 92 pp., 8½ x 11 ins. Illustrated. Important data on stairways.

STEEL PRODUCTS FOR BUILDING

Genfire Steel Company, Youngstown, Ohio.
Herringbone Metal Lath Handbook. 8½ x 11 in. 32 pp. Illustrated. Standard specifications for Cement Stucco on Herringbone.

Rigid Metal Lath and interior plastering.

Fireproofing Handbook. 8½ x 11 ins. 32 pp. Illustrated. Describes the full line of products manufactured by the Genfire Steel Company.

Ingalls Steel Products Co., Birmingham, Ala.
Construction Details. Booklet, 16 pp., 8½ x 11 ins. Illustrated. Important data on building with steel.

Standard Specifications for Reinforced Concrete and the Ingalls Trust Floor. Brochure, 8 pp., 8½ x 11 ins. Authoritative specifications covering much construction.

Ingalls Trust. Booklet, 12 pp., 8½ x 11 ins. Loading values and details.

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

STONE, BUILDING

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

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

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

Volume 5. Series B. Indiana Limestone Library. Portfolio. 11⅜ x 8¾ in. Illustrated. Describes and illustrates the use of stone for small houses with floor plans of each.

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

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

Old Gothic Random Ashlar. 8½ x 11 in., 16 pages, illustrated.

STORE FRONTS

Brasco Manufacturing Co., 5025-35 South Wabash Avenue, Chicago, Ill.
Catalog No. 31. Series 500. All-Copper Construction. Illustrated brochure. 20 pp. 8½ x 11 ins. Deals with store fronts of a high class.

Brasco Copper Store Front. Catalog No. 32. Series 202.

Brasco Standard Construction. Illustrated brochure. 16 pp. 8½ x 11 ins. Complete data on an important type of building.

Detail Sheets. Set of seven sheets; printed on tracing paper, showing full sized details and suggestions for store front designing, enclosed in envelope suitable for filing. Folds to 8½ x 11 ins.

Davis Solid Architectural Bronze Sash. Set of five sheets, printed on tracing paper, giving full sized details and suggestions for designing of special bronze store front construction, enclosed in envelope suitable for filing. Folds to 2½ x 11 ins.

STORE FRONTS—Continued

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

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

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

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

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

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

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

SWIMMING POOL EQUIPMENT & STERILIZATION

R. U. V. Company, Inc., 383 Madison Ave., New York City.
Water Sterilization by Means of Ultra Violet Rays. Booklet 8½ x 11 in. 16 pp. Full data on a system of purifying water.

Swimming Pool Sterilization. Booklet 8½ x 11 in. 24 pp. Describes a method of purifying water in bathing pools.

TERRA COTTA

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

Color in Architecture. Revised Edition. Permanently bound volume 9⅛ x 12¼ in., containing a treatise upon the basic principles of color in architectural design, illustrating early European and modern American examples. Excellent illustrations in color.

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

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

TILE, HOLLOW

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

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

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

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

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

Natcoflor Bulletin, 8½ x 11 in. 6 pp. Illustrated.

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

TILES

Kraftile Company, 55 New Montgomery St., San Francisco. High Fired Faience Tile. Booklet. 32 pp. 8½ x 11 ins. Illustrated. Presents a fine line of tiles for different purposes.

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

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

VALVES

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

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

Illinois Engineering Co., Racine Ave., at 21st St., Chicago, Ill.
Catalog. 8½ x 11 in. 88 pp. Illustrated.

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

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

VENETIAN BLINDS

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

A view of the Carey-roofed City Hall Building, Cleveland, Ohio.

When Cleveland's City Hall *was re-roofed...*

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"A ROOF FOR *EVERY* BUILDING"

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

VENTILATION

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

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

Globe Ventilator Company, 205 River St., Troy, N. Y.
Globe Ventilators Catalog. 6 x 9 in. 32 pp. Illustrated profusely. Catalog gives complete data on "Globe" ventilators as to sizes, dimensions, gauges of material and table of capacities. It illustrates many different types of buildings on which "Globe" ventilators are in successful service, showing their adaptability to meet varying requirements.

Van Zile Ventilating Corporation, 155 East 42nd St., New York, N. Y.
The Ventadoor Booklet. 6½ x 3½ in. 16 pp. Illustrated. Describes and illustrates the use of the Ventadoor for Hotels, Clubs, Offices, etc.

WATERPROOFING

Carey Company, The Philip, Lockland, Cincinnati, Ohio.
Waterproofing Specification Book. 8½ x 11 in. 52 pp.

Genfire Steel Company, Youngstown, Ohio.
Waterproofing Handbook. Booklet. 8½ x 11 in. 80 pp. Illustrated. Thoroughly covers subject of waterproofing concrete, wood and steel preservatives, dustproofing and hardening concrete floors, and accelerating the setting of concrete. Free distribution.

Master Builders Company, Cleveland, Ohio.
Waterproofing and Dampproofing and Allied Products. Sheets in loose index file, 9 x 12 in. Valuable data on different types of materials for protection against dampness.
Waterproofing and Dampproofing File., 36 pp. Complete descriptions and detailed specifications for materials used in building with concrete.

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

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

WATERPROOFING—Continued

Toch Brothers, 110 East 42nd St., New York City.
Specifications for Dampproofing, Waterproofing, Enameling and Technical Painting. Complete and authoritative directions for use of an important line of materials.

The Vortex Mfg. Co., 1978 West 77th St., Cleveland, Ohio.
Par-Lock Specification "Form D" for waterproofing surfaces to be finished with Portland cement or tile.
Par-Lock Specification "Forms E and G" membrane waterproofing of basements, tunnels, swimming pools, tanks to resist hydrostatic pressure.
Par-Lock Waterproofing. Specification Forms D, E. F and G. Sheets 8½ x 11 ins. Data on combinations of gun-applied asphalt and cotton or felt membrane, built up to suit requirements.
Par-Lock Method of Bonding Plaster to Structural Surfaces. Folder, 6 pp., 8½ x 11 ins. Official Bulletin of Approved Products,—Investigating Committees of Architects and Engineers.

WEATHER STRIPS

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

The Higgin Manufacturing Co., Newport, Ky.
Higgin All-Metal Weather Strips. Booklet. 6 x 9 in. 21 pp. Illustrated in colors. Describes various types of Higgin Weather Strips for sealing windows and doors against cold and dust.

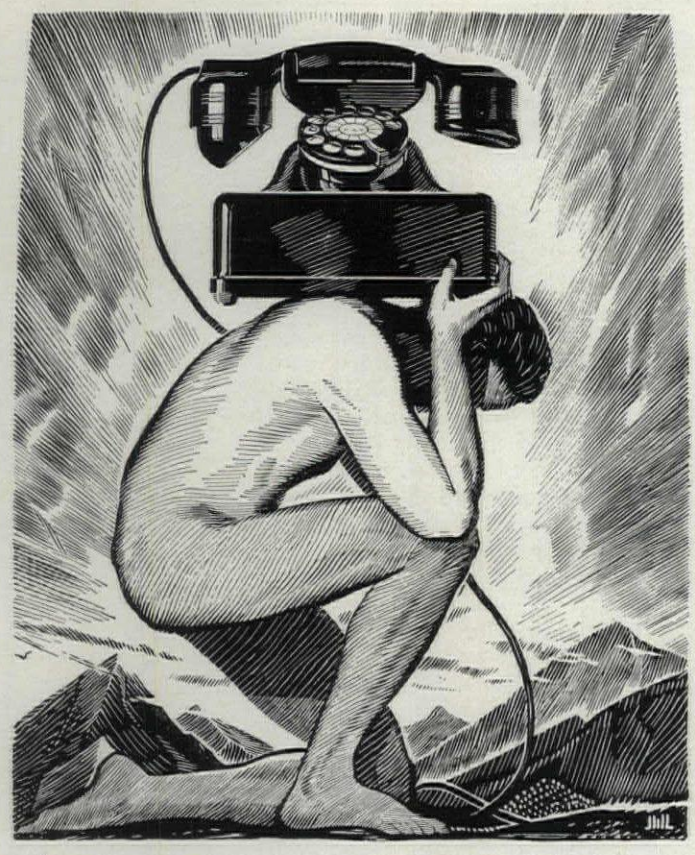
WINDOWS

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

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

WINDOWS, CASEMENT

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



STROWGER P-A-X
PRIVATE AUTOMATIC EXCHANGE

Not merely an automatic telephone, but a perfect system of interior communication designed and built to the finest engineering standards and of the same type of equipment that has been adopted for public exchange service the world over.

STURDINESS

DELICATE, easily disabled mechanisms have no place in any system of interior telephony. To fulfill its purpose, the equipment must be dependable under any circumstances that may arise.

That Strowger P-A-X has stood the test of time and use, functioning under circumstances which might well be expected to disable any electrical equipment testifies to the sound engineering principles and superior materials that characterize all Strowger products.

But what is more important is the absolute dependability of P-A-X to save time and money in your business. Will you let one of our engineers make a survey at no cost to you and furnish full details.

STROWGER AUTOMATIC
Communication, Control and Signalling Systems

Strowger Automatic Equipment includes Public Automatic Telephone Systems . . . . P-A-X (Private Automatic Exchange) . . . . Watchman Supervisory Systems . . . . Tele-Chec Systems (for Theaters) . . . . Industrial Fire Alarm Systems . . . . Supervisory Control Systems for Power Stations . . . . and Railway Signalling and Communication Systems.

Engineered, Designed and Manufactured by

Automatic Electric Inc.

Factory and General Offices: 1005 West Van Buren St., Chicago, U. S. A.

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Atlanta, Ga.	Detroit, Mich.	Philadelphia, Pa.	Boston, Mass.
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Dallas, Tex.	New York, N. Y.	Pittsburgh, Pa.	Seattle, Wash.

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

WINDOWS, CASEMENT—Continued

Genfire Steel Company, Youngstown, Ohio.
Architectural Details, Casement Windows and Doors. 8½ x 11 ins. 28 pp. A. I. A. File No. 16E. Specifications and construction details.

Hope & Sons, Henry, 103 Park Ave., New York, N. Y.
Catalog. 12¼ x 18½ in. 30 pp. Illustrated. Full size details of outward and inward opening casements.

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

David Lupton's Sons Company, Philadelphia, Pa.
Lupton Casement of Copper-Steel. Catalog C-122. Booklet 16 pp. 8⅝ x 11 in. Illustrated brochure on casements, particularly for residences.
Lupton Heavy Casements. Detail Sheet No. 101, 4 pp., 8½ x 11 ins. Details and specifications only.

Richards-Wilcox Mfg. Co., Aurora, Ill.
Casement Window Hardware. Booklet. 24 pp. 8½ x 11 in. Illustrated. Shows typical installations, detail drawings, construction details, blue-prints if desired. Describes AIR-way Multifold Window Hardware.
Architectural Details. Booklet, 8½ x 11 in. 16 pp. Tables of specifications and typical details of different types of construction.
List of Parts for Assembly. Booklet, 8½ x 11 ins., 16 pp. Full lists of parts for different units.

Truscon Steel Co., Youngstown, Ohio.
Architectural Details. Booklet. 8½ x 11 ins. 16 pp. Tables of specifications and typical details of different types of construction.
List of Parts for Assembly. Booklet. 8½ x 11 ins. 16 pp. Full lists of parts for different units.

WINDOWS, STEEL AND BRONZE

Genfire Steel Company, Youngstown, Ohio.
Architectural Details, Steel Pivoted, Commercial and Architectural Projected Windows. 8½ x 11 ins. 24 pp. A. I. A. File No. 16E. Specification and construction details.

David Lupton's Sons Company, Philadelphia, Pa.
A Rain-shed and Ventilator of Glass and Steel. Pamphlet, 4 pp. 8⅝ x 11 in. Deals with Pond Continuous Sash, Sawtooth Roofs, etc.
How Windows Can Make Better Homes. Booklet. 3⅞ x 7 in. 12 pp. An attractive and helpful illustrated publication on use of steel casements for domestic buildings.

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

WINDOWS, STEEL AND BRONZE—Continued

Truscon Solid Steel Double-Hung Windows. 24--pp booklet, 8½ x 11 in., containing illustrations of buildings using this type of window. Designs and drawings of mechanical details.

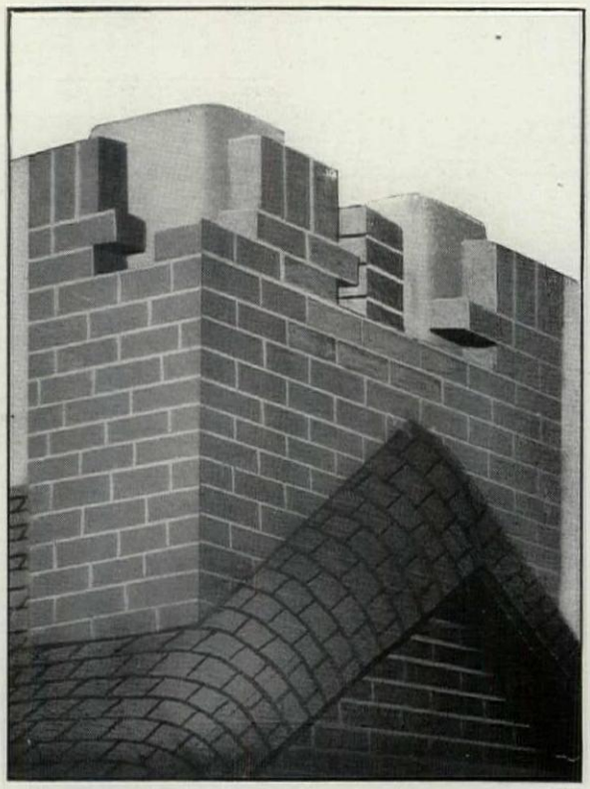
WOOD—See also Millwork

American Walnut Mfrs. Association, 618 So. Michigan Blvd., Chicago, Ill.
American Walnut. Booklet. 7 x 9 in. 45 pp. Illustrated. A very useful and interesting little book on the use of Walnut in Fine Furniture with illustrations of pieces by the most notable furniture makers from the time of the Renaissance down to the present.
"American Walnut for Interior Woodwork and Paneling." 7 x 9 in. pages, illustrated. Discusses interior woodwork, giving costs, specifications of a specimen room, the different figures in Walnut wood, Walnut floors, finishes, comparative tests of physical properties and the advantages of American Walnut for woodwork.

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

Long-Bell Lumber Co., Kansas City, Mo.
The Perfect Floor. Booklet 5¼ x 7¾ in. 16 pp. Illustrated. Valuable for the data given on the use of wood for floors.
Saving Home Construction Costs. Booklet 4⅛ x 7½ in. 24 pp. Discusses economy and value in domestic building.
Experiences in Home Building. Booklet 6 x 9 in. 16 pp. Records the testimony of a number of builders and contractors as to the value of certain materials.
The Post Everlasting. Booklet 8 x 11 in. 32 pp. Illustrated. Describes the production of posts and their use in various ways.

West Coast Lumber Trade Extension Bureau, Seattle, Wash.
"Durable Douglas Fir; America's Permanent Lumber Supply." Booklet, 32 pp., 7 x 11 ins. Illustrated. Complete data on this valuable wood.
"Douglas Fir Wall Hanger." Metal-bound hanger, 31 x 32 ins. An attractive advertisement for Douglas fir.
"Where to Use Douglas Fir in Your Farm." Brochure, 32 pp., 6 x 9 ins. Data on use of this wood for farm buildings.



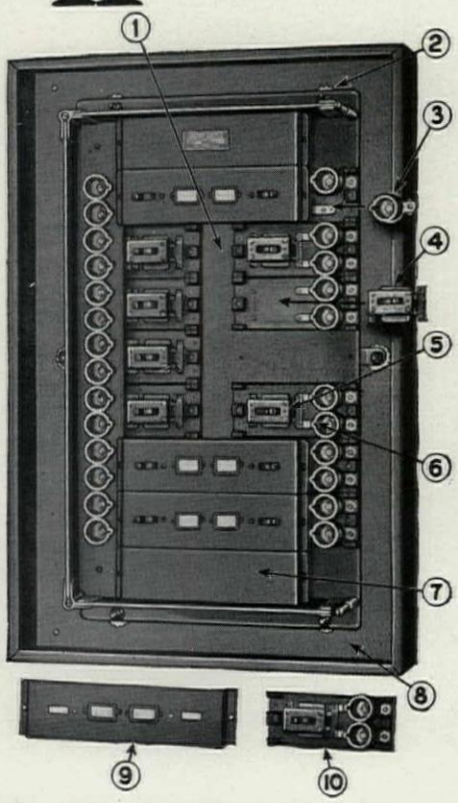
Fire chiefs agree that the sure preventive of chimney fires is fire clay flue lining

CLAY PRODUCTS ASSOCIATION
CONWAY BUILDING
Chicago

FIRE CLAY
Flue Lining

AF5—Gray

You Will Like these 11 big features



in the New Heavy Duty Line of

BENJAMIN-STARRETT

Panelboards and Steel Cabinets for Light and Power

1. Heavy Gauge—One-Piece Steel Panel Back on which are mounted Standardized Unit Bases.
2. Panels are provided with adjustable Mounting Studs so that Panel Adjustment may be made both in and out and laterally in box.
3. All Fuse Receptacles are individual and are easily removed from front.
4. Switches removable individually from front without removing trim.
5. Underwriters Approved 30 ampere 250 volt *Heavy Duty Tumbler Switches* in both single pole and double pole.
6. Fuse Receptacles have slot at side which permits testing of fuses without removing fuse.
7. All Metal Panel Parts are Rust-proofed.
8. Full Four-Inch Gutter Space on all Four Sides of Panel.
9. Switch Cover Plates Removable Individually from the front.
10. Unit Composition Base for all types of Branch Switches assure interchangeability of parts.
11. Boxes shipped from stock for immediate installation. Unit section assembly assures prompt delivery of panelboard.

Send for our new 80-page catalog, free.
Ask for Catalog SF-5.

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Manufactured in Canada by the Benjamin Electric Mfg. Co. of Canada Ltd., Toronto, Ontario.

NO BACK-TALK for 20 years at least!

Y that we mean: A roof that can be forgotten—a roof so free from uble that the building owner never to give it a thought!

When a Barrett Specification Roof aid, a Surety Bond is issued guar-eeing the building owner against air or maintenance expense for the t twenty years*—until 1948.

And 20 years is not the whole story ot by any means. Many American iness buildings of the 70's, 80's 90's are still protected by their ginal roofs of Barrett Coal-tar Pitch Felt. And what is more, these old fs are in first-class condition after 40 and even 50 years of service.

When a Barrett Specification Roof aid all work must be done by an erienced roofer who is approved The Barrett Company — a Barrett Inspector supervising each step of the job.

Directly after the roof is down the Barrett Inspector makes the famous "cut test." And not until this test is made does his O.K. release the Surety Bond.

Two years after the roof is finished the Barrett Inspector again checks up —makes a thorough re-examination of the roof.

Little wonder that Barrett Specification Roofs give dependable service many years after the 20-year guarantee has expired.

* The Barrett Company also offers a Specification Type "A" Roof which is bonded for 10 years. This type of roof is adaptable to a certain class of buildings. The same high-grade materials are used, the only difference being in the quantities applied.

Depend on the Barrett Approved Roofer

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

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

THE BARRETT COMPANY
40 Rector Street, New York City

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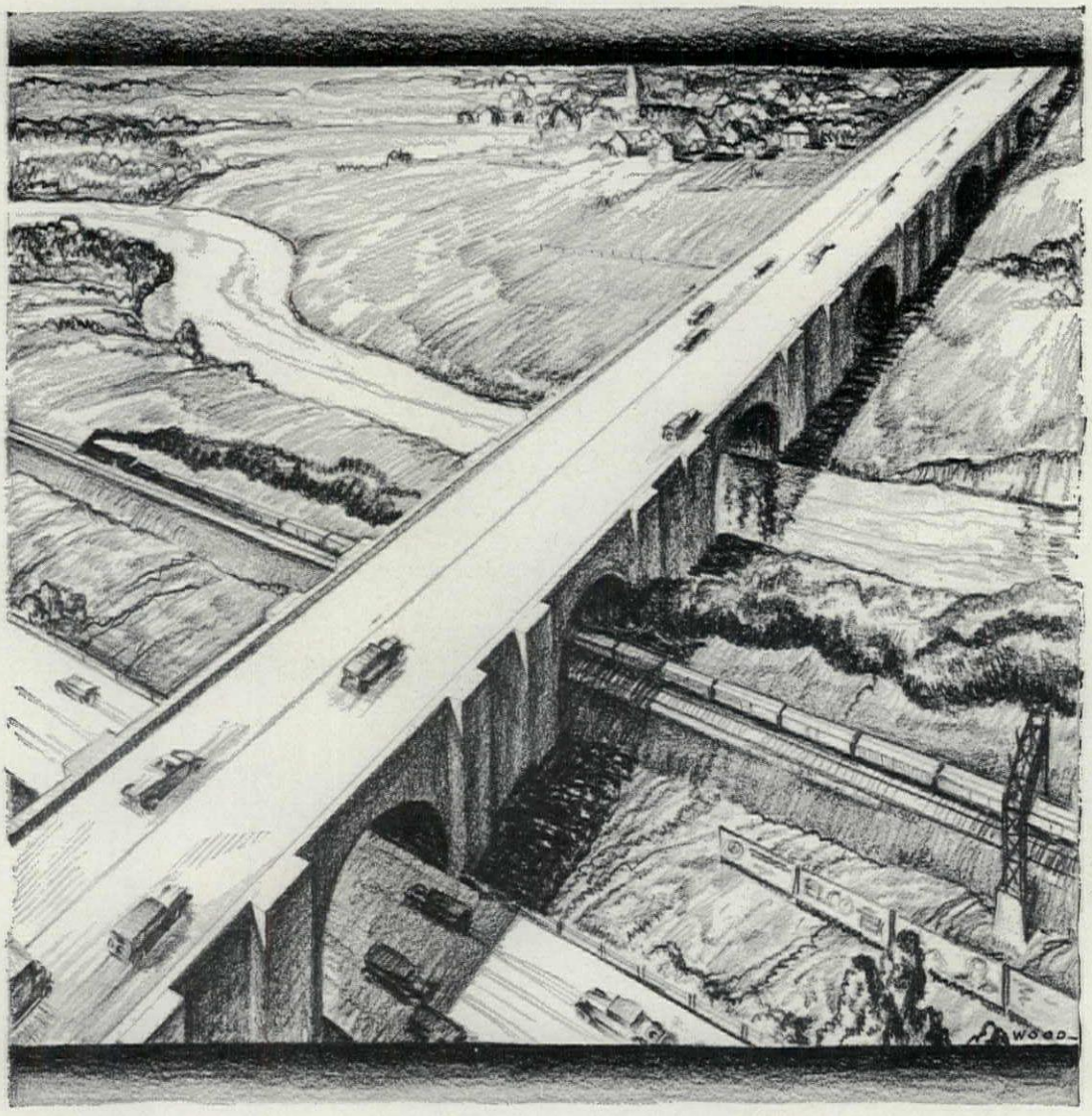
5551 St. Hubert Street, Montreal, Quebec

Barrett Specification Roofs



Modern plaster is reinforced— just like concrete!

The same principle used in reinforcing concrete is now applied to plaster. **STEELTEX** has been successfully used in over 110,000 installations. Besides guarding plaster with fabricated steel (rust-proofed and completely embedded) **STEELTEX** insulates, damp-proofs, and deadens sound—thanks to the heavy specially processed backing.

Even more—the entire job is automatically "back-plastered." **STEELTEX** is welded steel mesh locked to a waterproof backing. The steel strengthens the plaster — the backing seals it. Each room is bound by a network of galvanized steel, embedded in the plaster.

Send the coupon for a copy of our booklet, "Better Walls for Better Homes." It is free.

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Pittsburgh Steel Co.

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The world's largest manufacturers of welde steel fabric for reinforcing concrete construc tion of all kinds.

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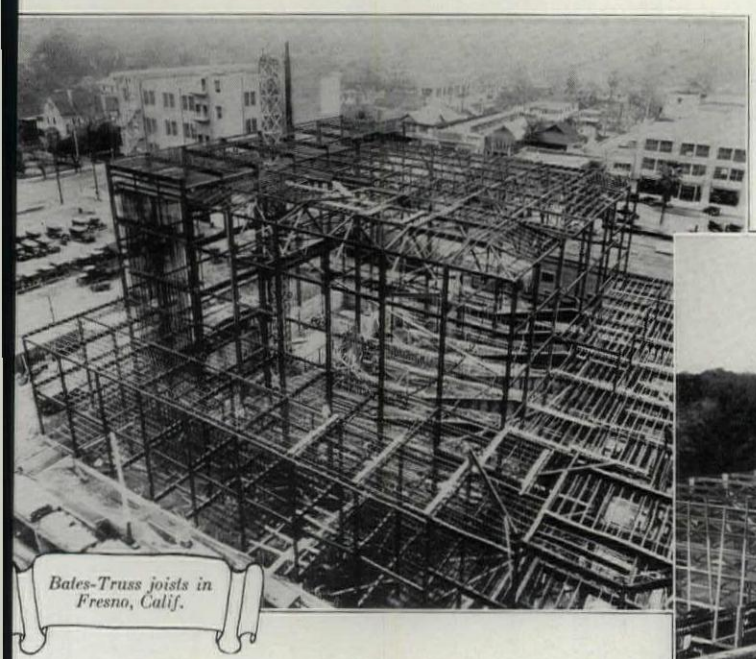
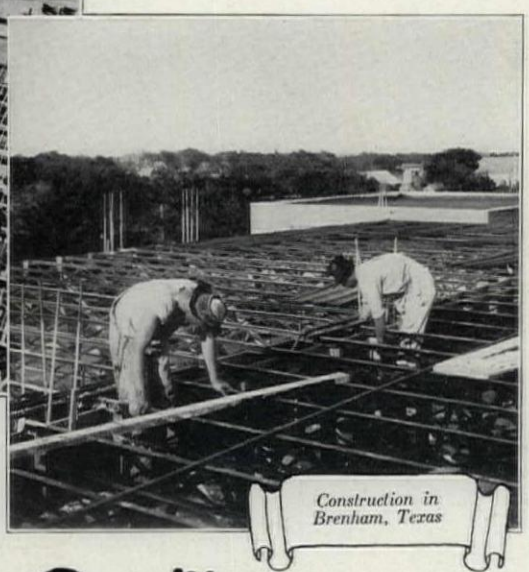


Bates-Truss joists in Fresno, Calif.

BATES-TRUSS JOISTS
Throughout the Country!



Construction in Brenham, Texas

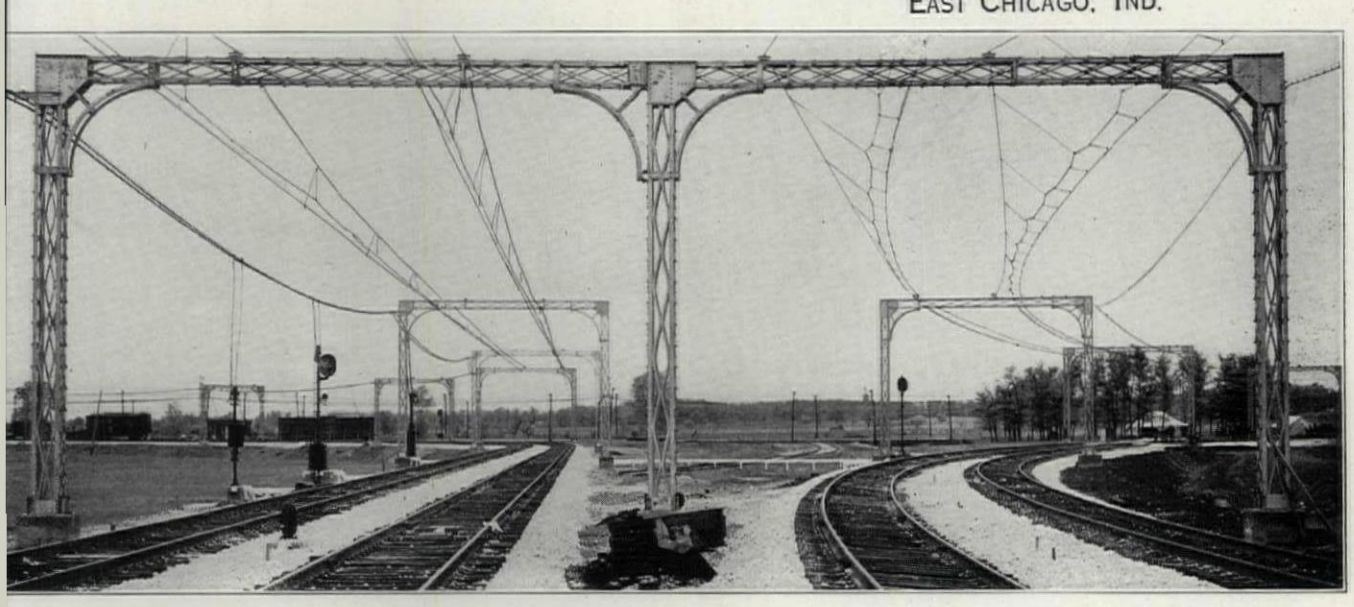
Bates-Truss joists in concrete construction St. Louis Mo.

One-piece Dependability!

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

BEST Bates Expanded Steel Truss Co.

EAST CHICAGO, IND.

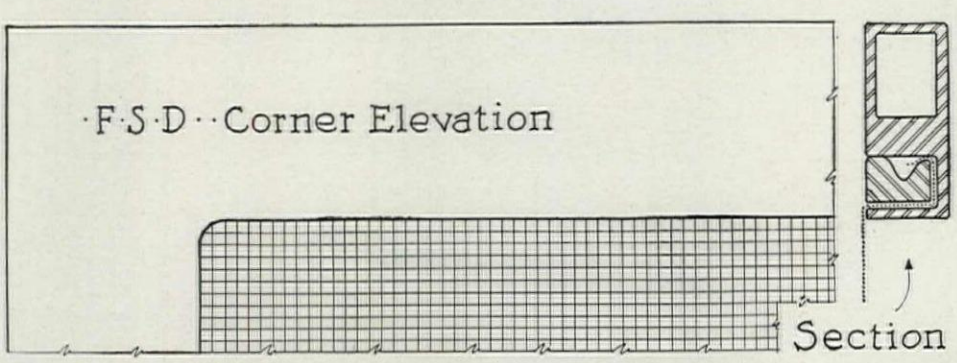


ORANGE SCREENS

Fire H. Q. Building, Yonkers, N. Y., Equipt with Orange Aluminum Screens . . H. Lansing Quick, *Archt.*, Lynch & Larkin, Inc., *Bldrs.*

Orange
ALUMINUM FRAME
Screens

Orange Aluminum Frame Screens do not mar the architectural beauty of any building. They retreat modestly into the picture and are absorbed by the bolder lines around the windows . . . . For inside use, Orange Screens are strong and practical. The sturdy aluminum frame is light in weight and can be finished to match interior trim.



ORANGE SCREEN COMPANY

Maplewood . . . . . New Jersey

Advantages of Aluminum Frames:

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

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

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

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

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

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

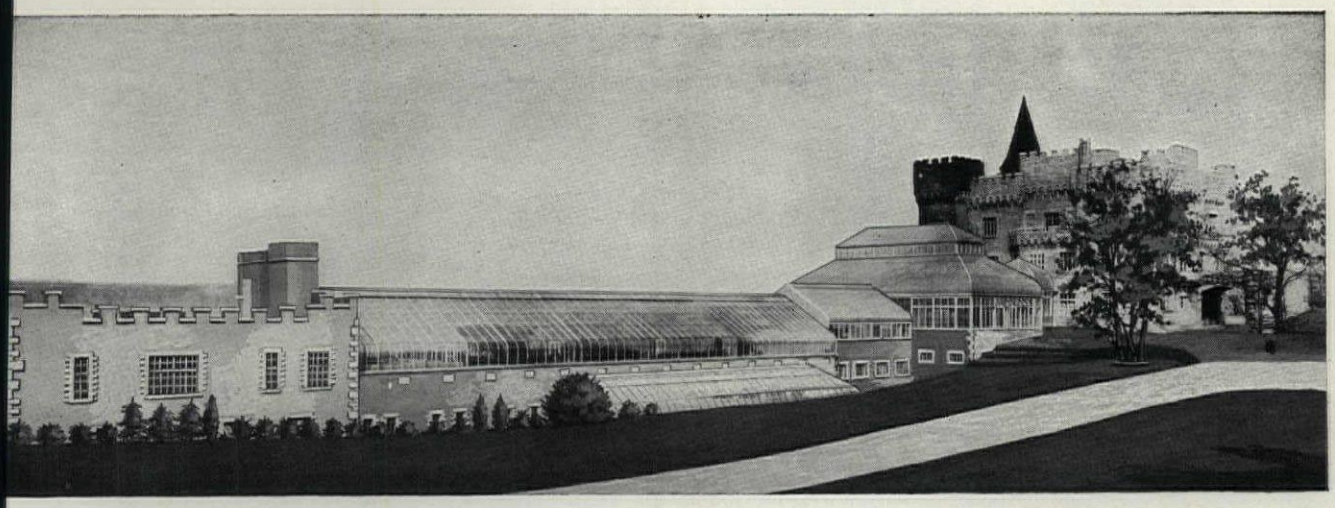
This improved construction eliminates unsightly ridges, irregular corners, and uneven or corrugated surfaces that would mar the beauty of the frame.

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

Service and Dependability

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

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

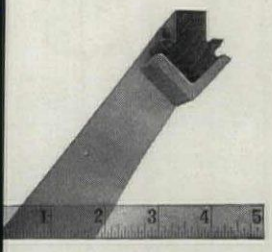


A Famous Builder Chooses *The Lutton* V-BAR *Greenhouse*

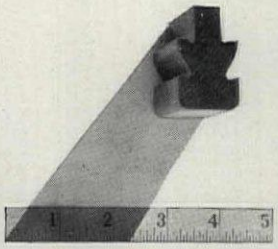
ONE of the many experienced builders who have chosen the Lutton V-Bar Greenhouses for their private use is Dr. Charles V. Paterno of New York.

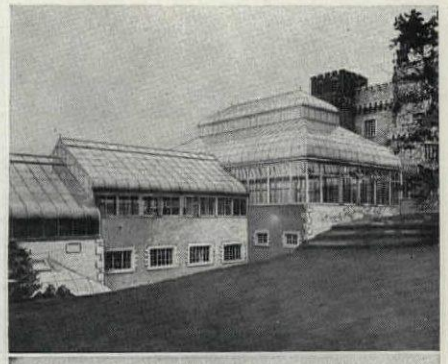
At his magnificent home on upper Riverside Drive, Dr. Paterno has built a range of Lutton V-Bar greenhouses, which includes 28 growing houses, a large conservatory and a service building with swimming pool and gymnasium below.

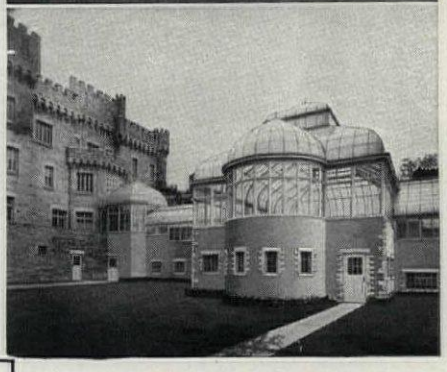
The choice of Lutton V-Bar construction by such an expert speaks for the superior design, construction and economy of our greenhouses. While no work is too large for us, neither is any too small. Consult us on any greenhouse problem.

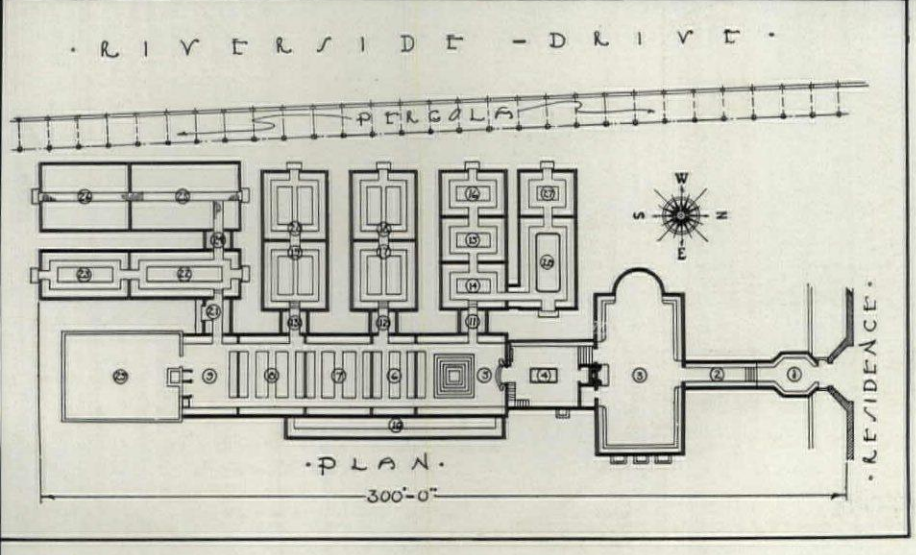


Notice the difference in the shadow cast by the Lutton Steel V-Bar (left) in comparison with the ordinary wooden bar (right). The Lutton V-Bar, though three times as strong as the wooden bar, casts far less shadow, and gives a pleasant impression of airy lightness.









KEY FOR RANGE

1. Breakfast Room
2. Passage
3. Conservatory
4. Billiard Room
5. Orchid House
6. Gardenia House
7. Carnation House
8. Rose House
9. Potting Room
10. Leanto
11. Propagating House
12. Propagating House
13. Propagating House
14. Potted Fruit Compartment
15. Potted Fruit Compartment
16. Potted Fruit Compartment
17. Bulb and Ornamental Plants
18. Lilies, Cut Flowers and Ornamental Plants
19. Carnation House
20. Rose House
21. Propagating House
22. Sweet Pea House
23. Chrysanthemum House
24. Propagating House
25. Late Grapery
26. Early Grapery
27. Conifer House
28. Palm and Fern House
29. Boiler House

WM. H. LUTTON *Company*
266 Kearney Ave., Jersey City, N. J.

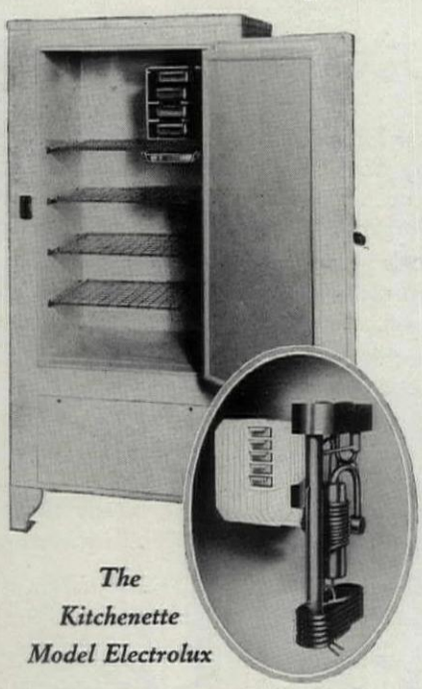
Gas Refrigerator Wins Again

The LOMBARDY, 56th Street near Park Ave., New York City. Farrar and Warmouth, Architects. Henry Mandel Building Company, Builder.

Read why the architects chose ELECTROLUX *for this great New York Apartment Hotel*

A GREAT new apartment hotel—the Lombardy—erected in the heart of New York's most exclusive residential section—22 stories of Italian Renaissance beauty—every detail of construction and equipment the finest. Electrolux put in each apartment after exhaustive tests by the architects.

Small wonder, when one considers the advantages of this marvelous new invention. A refrigerator without moving parts . . . absolutely silent . . . that never wears out . . . that requires no attention. And, best of all, costs much less to operate. Instead of mechanical compression, a tiny gas flame causes a physical change that produces a steady cold. And it is absolutely safe. If the flame goes out, the gas stops automatically.



The Kitchenette Model Electrolux

Four cubic feet storage capacity. Excellent for smaller families. Other models are the Hostess . . . the Chef . . . the Mansion, with 5, 7 and 10 cubic feet capacity. Also the Double Duty, with 5 cubic feet storage capacity. This model is table-top height and makes the base for a gas range or can be used as a table. An excellent space-saver. All boxes are constructed of steel and Armco Ingot Iron . . . Vitreous porcelain seamless lining . . . Extra-thick cork board insulation.

In the oval is pictured the completely sealed unit that makes cold from heat. This is entirely hidden from sight—nothing on top or outside the cabinet.

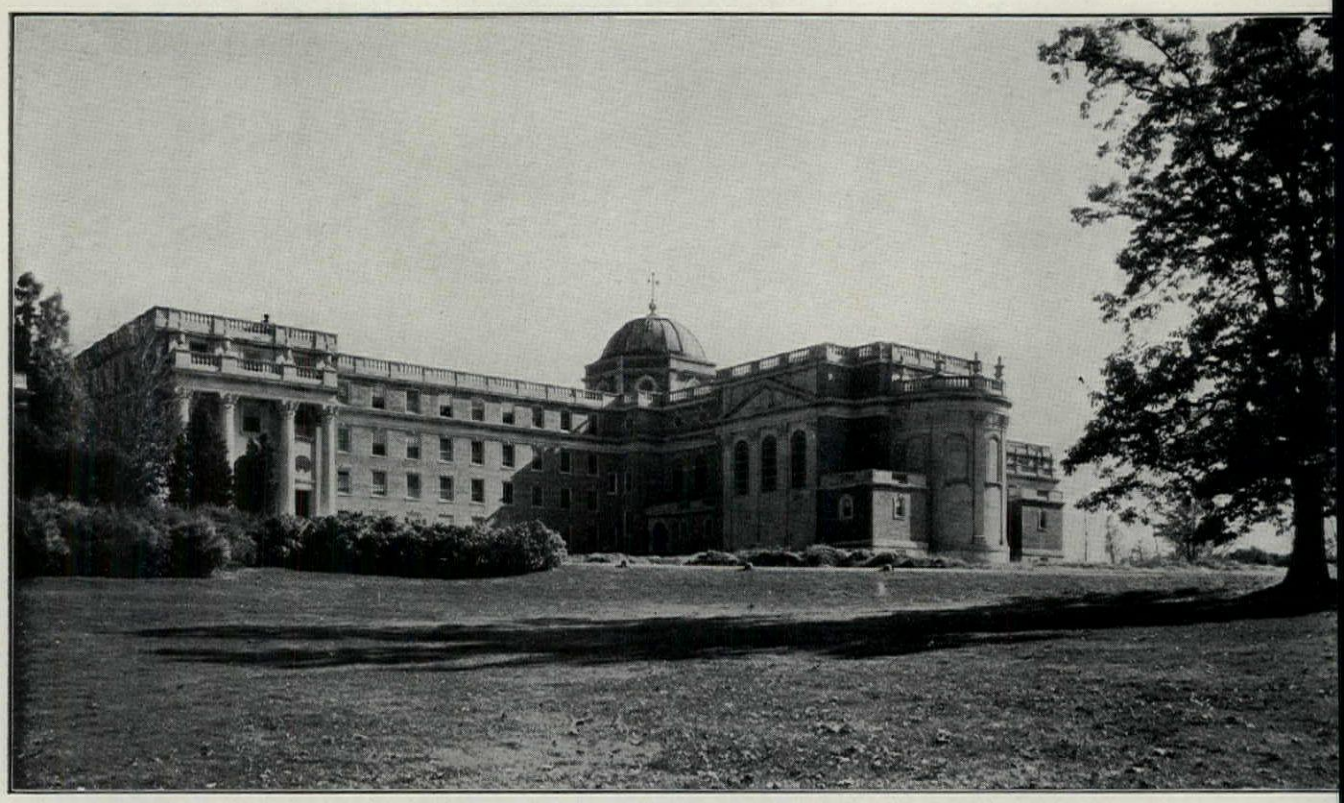
Electrolux is not merely an improved mechanical refrigerator. It is entirely different. It goes far beyond old methods of refrigeration. The features that appeal to the architect and builder attract the tenant as strongly. Apartments equipped with Electrolux are much easier to rent.

The wide range of Electrolux sizes are all available in four color harmonies as well as white. These color finishes . . . Biscay Blue . . . Silver Grey . . . Ivory Tan . . . Crystal Green . . . can blend nicely with your decorative scheme.

We shall be glad to send you detailed specifications. Please write: Servel Sales, Inc., Evansville, Indiana.

ELECTROLUX REFRIGERATOR

MADE BY SERVEL



Par-Lock Protects the House of Studies

THE new House of Studies at Weston, Mass., is a noteworthy addition to the educational architecture of America and the use of Par-Lock in this stately structure is an endorsement of the highest authenticity.

Par-Lock Specifications A and B were used on columns, beams and ceilings throughout. Par-Lock Specification I was used on all exterior walls that were furred.

The architects are Maginnis & Walsh, Boston; the general contractors, J. P. Keating of Boston and the plastering contractors, Nicholson, Ferris and Sheehy of Boston. The Par-Lock Appliers of Boston, Inc., applied the Par-Lock as described.

There is a Par-Lock Applier ready to help you with your problems of damp-proofing and plaster key.

THE VORTEX MANUFACTURING COMPANY
1984 West 77th Street .. .. *Cleveland, Ohio*

Par-Lock Appliers

ALBANY,
425 Orange Street
BALTIMORE,
613 West Cross Street
BOSTON,
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BUFFALO,
958 Ellicott Square Bldg.
CHICAGO,
111 West Monroe Street
CLEVELAND,
218 Hunkin-Conkey Bldg.
COLUMBUS,
751 South Cassingham Rd.
DETROIT,
2544 First National Bldg.
KANSAS CITY, MO.
2035 East 19th Street
MINNEAPOLIS
200 Builders Exchange
NEWARK, N. J.
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Par-Lock Appliers

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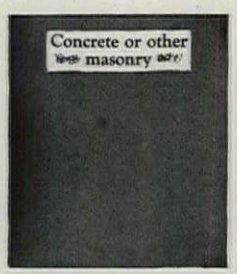
SCRANTON, PENNA.
Cedar Avenue
ST. LOUIS
906 Chemical Building
TORONTO,
2258a Bloor Street, West
TRENTON,
339 Broad St. Bank Bldg.
YOUNGSTOWN,
503 City Bank Building
WILKES-BARRE, PA.
904 Second Nat'l Bank Building
PAR-LOCK CORK INSTALLATIONS
United Cork Companies,
Lyndhurst, N. J.

Par-Lock
PLASTER KEY



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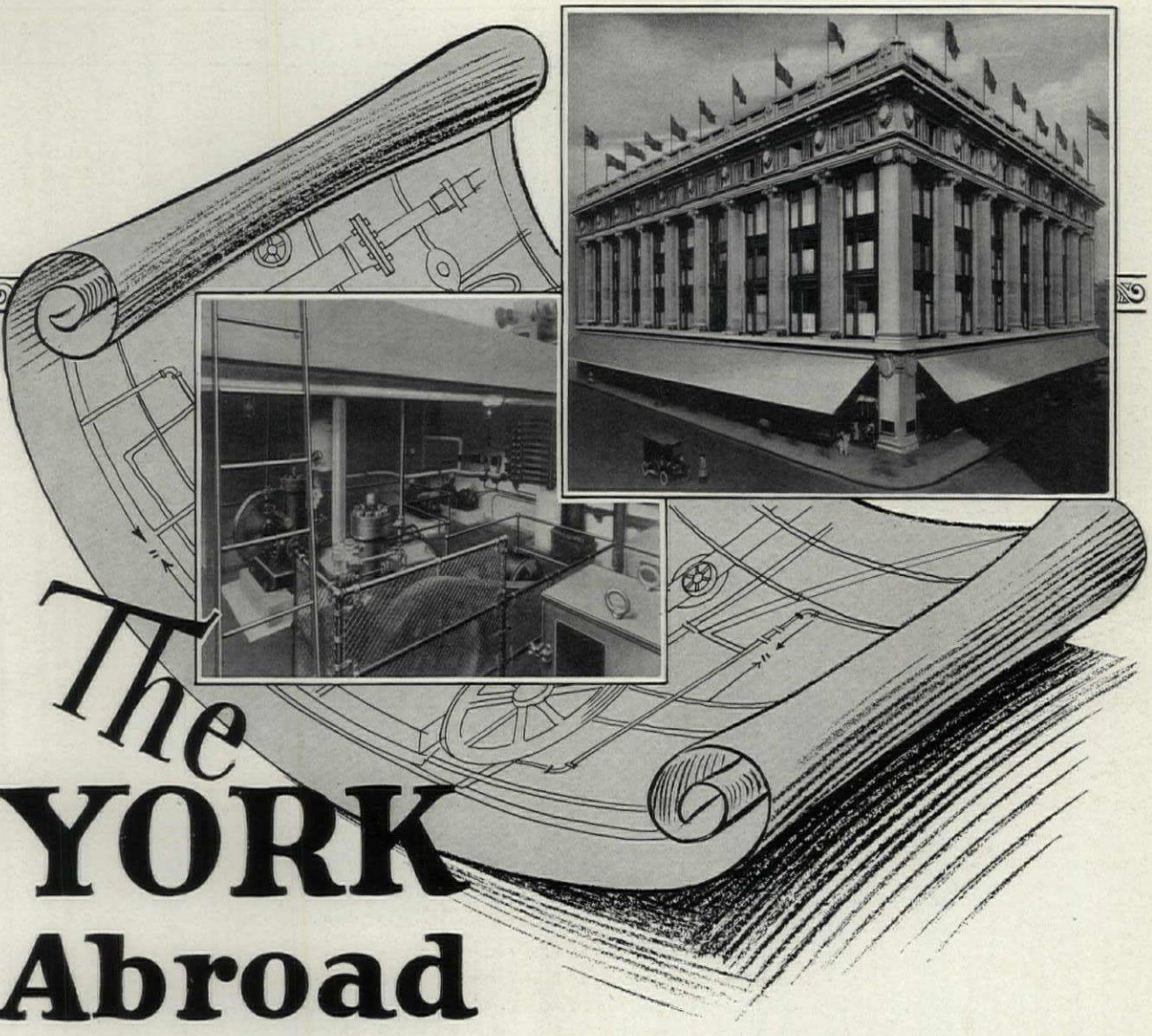


The YORK Abroad

All over the world—Europe, Asia, Australia, Africa and South America, York refrigeration is being profitably used. One of the most interesting European installations is that at Selfridges, prominent London department store. Here, the York carbon dioxide system of refrigeration is used to maintain low, dry temperatures for the fur storage vaults.

The two great detrimental factors in the life of fine furs—the ravages of the moth and the summer heat which destroys a fur's lustre, are absolutely and entirely overcome in this York equipped freezing chamber.

To architects and builders contemplating the subject of fur storage facilities, the York engineering department offers a definite service. Plans, specifications, costs, etc. will be furnished without obligation and the benefit of nearly fifty years experience in the commercial and industrial refrigeration field provides an authoritative background invaluable to the prospective client. Let us assist you on any application of mechanical refrigeration.

YORK
ICE MACHINERY CORPORATION
YORK Y PENNA

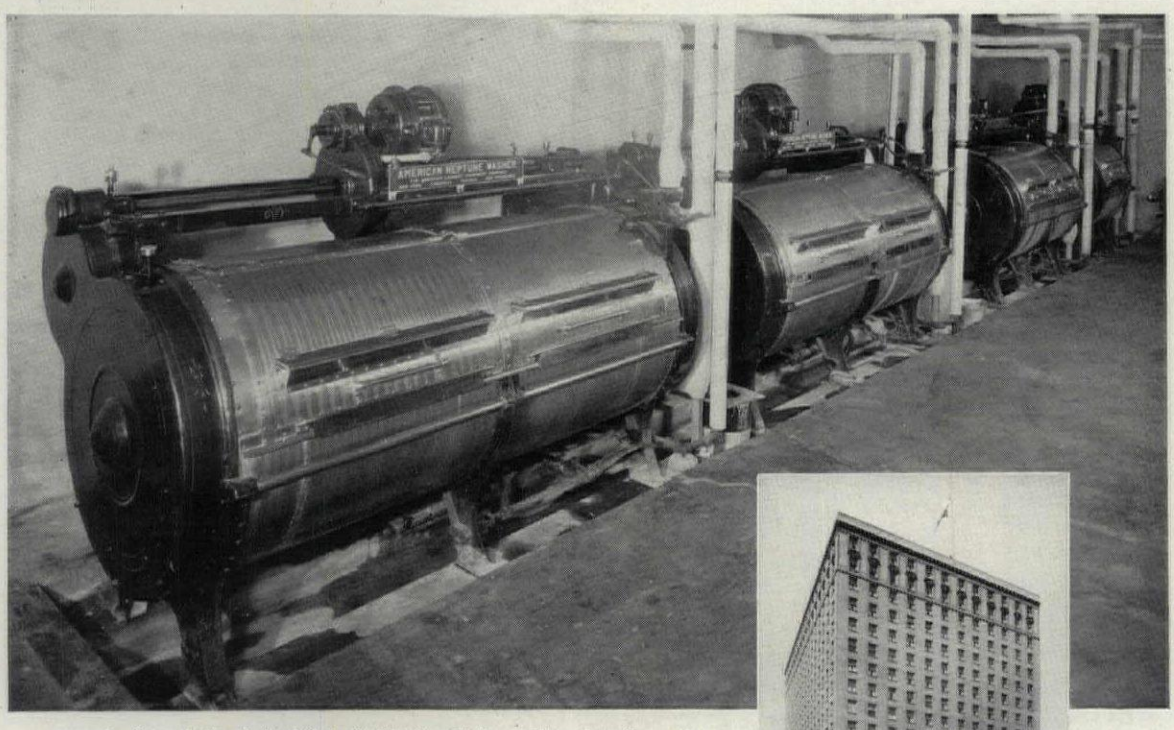
YORK ICE MACHINERY CORP.,
York, Pa.

Without obligation please fully describe your service to architects contemplating the application of modern centrally located refrigerating systems.

Name.....

Address.....

o. 44 of a series of advertisements featuring prominent laundry installations



A view of the Leland-Detroit Hotel and its modern laundry. An up-to-date department included in the original plans for the hotel—similar to dozens of fine institutional laundries which "American" engineers have helped to install.

Rapp and Rapp, of Chicago, Architects

The institutional laundry
—*a present-day necessity*

YOU probably have observed that, nowadays, practically every modern hotel has its own laundry department. Hospitals, too, as well as clubs and schools. For the officials of all these institutions know the many advantages of having the laundry work done under their own watchful supervision. Dependable service—perfect quality. Economy, too, of course.

The laundry at Leland-Detroit Hotel, Detroit, is an excellent example of the present-day institutional laundry. Like so many other such modern departments, it was designed and equipped in collaboration with the engineers of The American Laundry Machinery Company. These men will be glad to confer with you on problems pertaining to laundry practices—furnish you with first-hand information—show you typical layouts and photographs of specialized equipment. "American" service—yours for the asking.

The American Laundry Machinery Company

Norwood Station, Cincinnati, Ohio

THE CANADIAN LAUNDRY MACHINERY CO., LTD.
47-93 Sterling Road, Toronto 3, Ont., Canada

Agents: BRITISH-AMERICAN LAUNDRY MACHINERY CO., LTD.
Underhill St., Camden Town, London, N. W. 1, England

A poor "finish" on commercial floors is only a costly beginning

A Con-Tex Bond Surface on the top surfaces of underslabs enables a perfect topping to be applied as a finishing operation

THE direct and indirect loss to the owner of the floors pictured above is estimated to have been more than $60,000.00. Tenants viewed them and canceled their leases.

Bad floors are no longer "mysterious accidents," or "acts of God." The reasons for failures and deteriorations in floors are now known, as well as how such troubles may be prevented.

One important step in preventing floor troubles, as well as in floor economies, is to give the finish coat some sure means of bonding to the underslab.

A clean-stone bond surface is readily obtained on any slab by Top-Surface Con-Tex. To this clean-stone surface an applied topping will bond as though it had been cast integral with the slab.

And on this clean-stone surface, the topping may be laid *when you are ready*—even months later—with full assurance of bond. And this topping need not be an inch or more in thickness as is old practice. It can be as thin as one half an inch, thereby securing not only an unmarred, perfect finish, but economy as well.

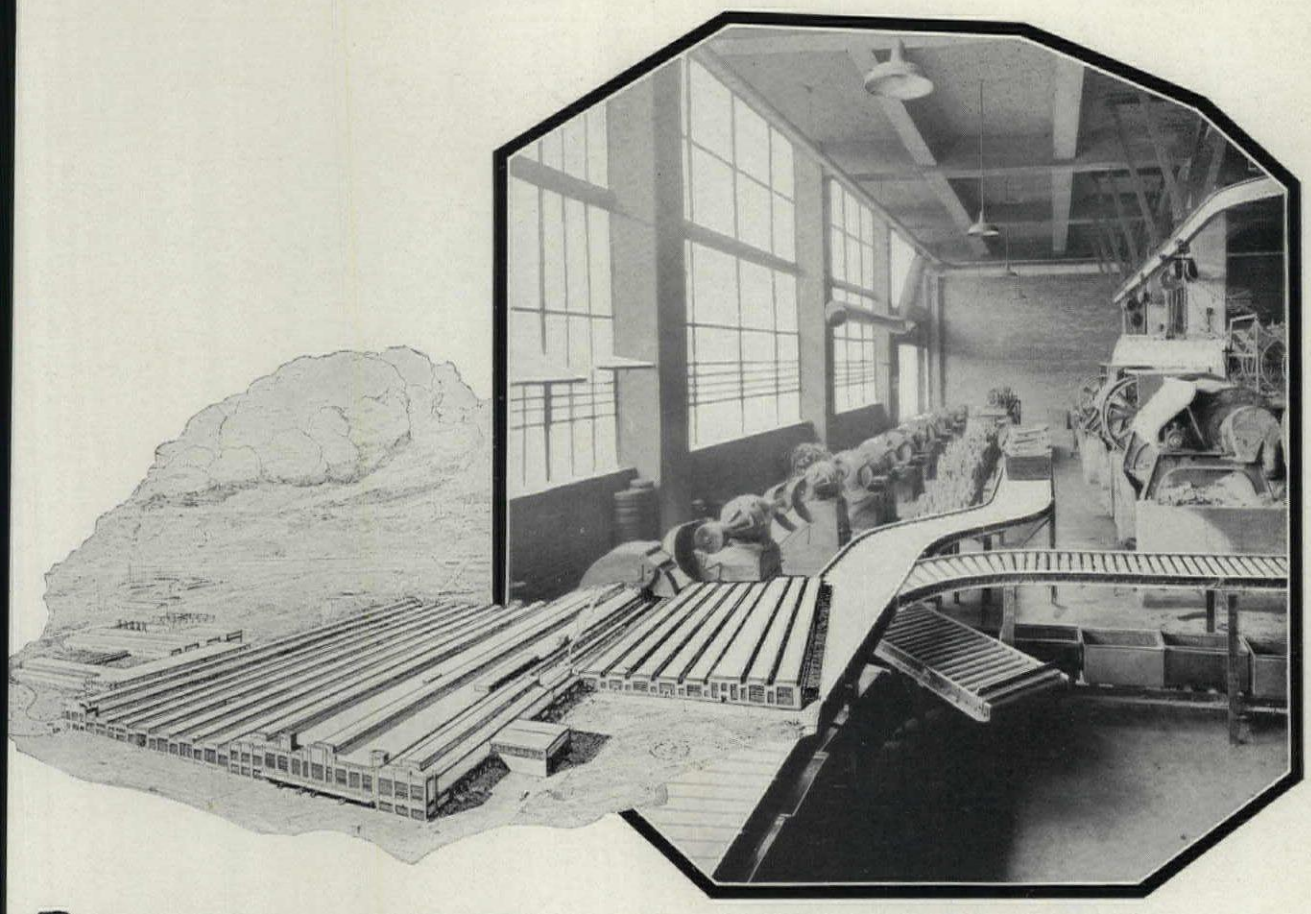
Mechanical Roughening, as with rakes, is not sufficient. "There is a reason" and this reason is fully given in our new book on "Bonding Surfaces on Concrete."

It is sent free, but only on application. Write us today for your copy.

CONCRETE SURFACE CORPORATION

342 MADISON AVE. NEW YORK, N. Y.

Licensed Under Product and Process Patent Rights of Nathan C. Johnson, in U. S. A. and Abroad



Less cubic footage that pays Greater — a Standard Conveyor feature

In all of industry, the necessity of concentrating production operations in the smallest plants possible, is of great consequence. This conservation of cubic footage reacts favorably to production efficiency and to production economy. It saves ultimate capital investment. It decreases operating expense and lowers depreciation over larger plant.

The Automotive industry is symbolic in its manufacturing policies and practices of production efficiency. It is indicative of possible efficiency in all industrial manufacturing units. A highly competitive market with the necessity of continually increasing quality and reducing costs resulted in such a condition.

Engineers and Architects today, in planning buildings, are specialists in figuring space, material handling facilities, lighting and other important factors that enter into manufacturers' production economy.

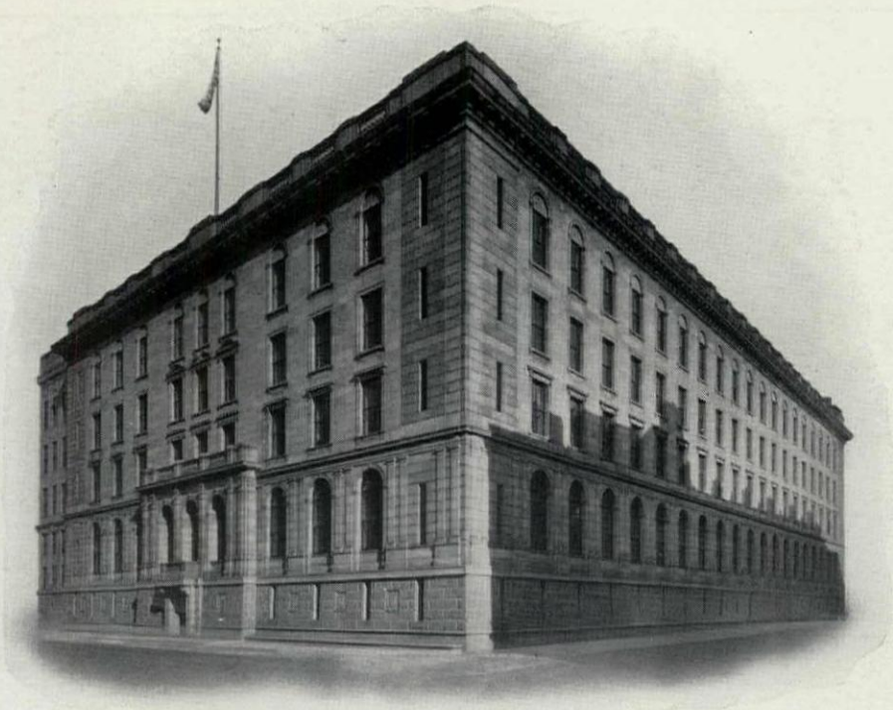
Where built-in Standard Conveyor Systems were included in the plans, engineers and architects have made possible most successful material handling operations.

Out of the old, man-power, material handling methods have come modern conveying methods. Today, material is kept off of the floor and in motion to its final assembly. Material is not allowed to pile up between departments. Man power and floor space is more efficiently applied and utilized.

Our conveyor counselors will be glad to show you how we have helped design efficient material handling units in the automotive field.

STANDARD
CONVEYOR COMPANY
NORTH SAINT PAUL, MINNESOTA

New York Office, 420 Lexington Avenue
Chicago Office, 549 West Washington Street
Philadelphia Office, 3110 Market Street
Cleveland Office, 1108 Hippodrome Building
Buffalo Office, 908 Ellicott Square
Kansas City Office, 419 Manufacturers' Ex. Bldg.
Milwaukee Office, 209 Wisconsin Avenue
Los Angeles Office, 335 So. San Pedro St.
Seattle Office, 321 Lumber Exchange
Charlotte Office, 301 Builders Bldg.



THE FEDERAL RESERVE BANK, BOSTON
R. Clipston Sturgis, Architect *L. P. Soule & Son Co., Builders*

The Most Important Financial Structure in New England

In order that there would never be any question of a dry basement, the contract for waterproofing — with our Cow Bay Waterproof Cement—the most important financial structure in New England, was awarded to us.

We also waterproofed the Federal Reserve Bank in New York which has five basements —the lowest being 92' 9" below grade.

Small work receives the same careful attention as the largest contracts.

The Waterproofing Company

Engineers and Contractors for Waterproofing

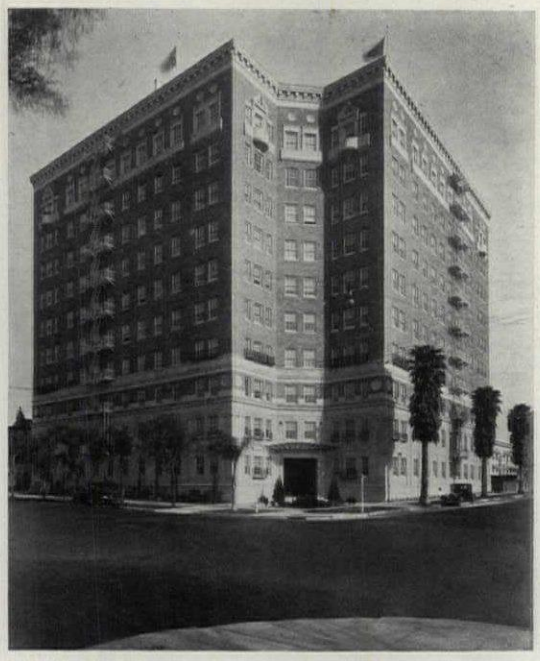
345 East 33rd Street
New York

THE WATERPROOFING CO.
ESTABLISHED 1909
NEW YORK BOSTON
COW BAY
WATERPROOF
CEMENT

65 Albany Street
Boston

"In our 23 years of Waterproofing none of our work has had to be done over."

S. T. Johnson Co. oil burners in the Norma Talmadge Apartments



The Talmage Apartments, Los Angeles—Johnson burner equipped

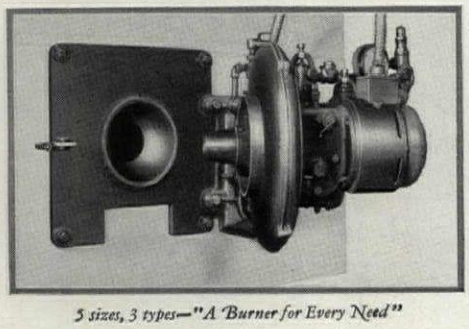
Covering a range of 250 to 27,800 square feet of steam radiation or its equivalent, Johnson burners, made in five sizes and three types, assure an installation exactly suited to any need.

The S. T. Johnson Co. Burners operate efficiently with lowest grades of commercial fuel. The fully automatic type has five positive safety controls (room thermostat, master switch, oil shutoff, and one other depending on the type of furnace) electrically in series to protect and regulate the whole system at all times. Only one fuel tank, outside underground, is required.

The picture shows the simplicity, accessibility, compactness, and neat appearance of the Johnson burner. All moving parts are entirely enclosed for protection, and require practically no attention.

Called by engineers "the most scientific oil burner on the market" the full automatic models are approved by the Underwriters Laboratory, by the New York Board of Standards and Appeals, and by fire prevention bureaus of principal cities everywhere.

Precision manufacturing, the result of 23 years of oil burner experience, assures a dependable, efficient, clean, quiet burner.



5 sizes, 3 types—"A Burner for Every Need"

MEMBER OIL HEATING INSTITUTE
OIL HEAT
AS BENEVOLENT AS SUNSHINE

S. T. JOHNSON CO.
OIL BURNERS
TRADE MARK REGISTERED

Main Office and Factory: 943 Arlington Avenue • Oakland, California
Factory Branch Offices: San Francisco • Sacramento • Philadelphia

DISTRIBUTORS AND DEALERS THROUGHOUT THE UNITED STATES

HARDINGE FUEL OIL HEAT

for any heating requirement

Our two models, Domestic and Industrial, in 12 different sizes and combinations, enable *specific* treatment for any heating problem. See our catalog in Sweet's. You can be specific and specify HARDINGE with confidence for any type or size building

from Bungalow to Skyscraper

See Our Catalog in Sweet's

Hardinge Brothers, Inc.

Manufacturers of Precision-Built Machines for 38 Years

Factory and General Offices:
4149 Ravenswood Avenue, Chicago, Ill.

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Distributors in All Principal Cities

Flamingo Hotel
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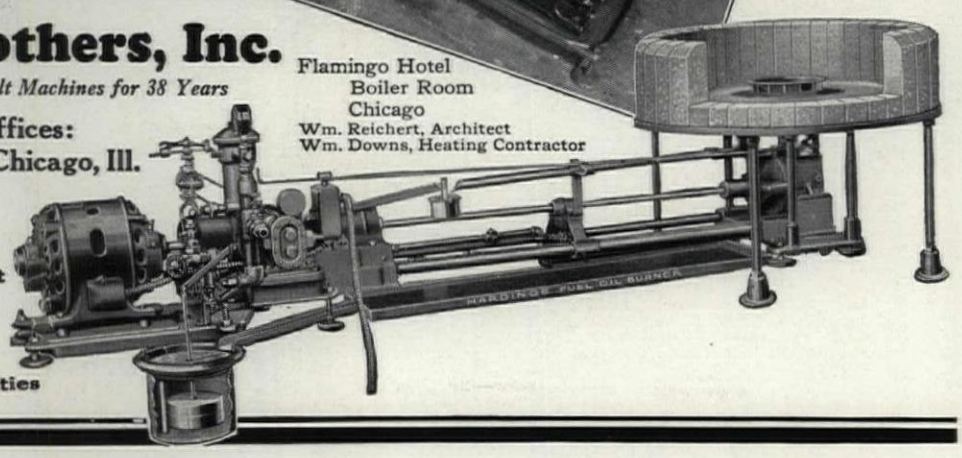
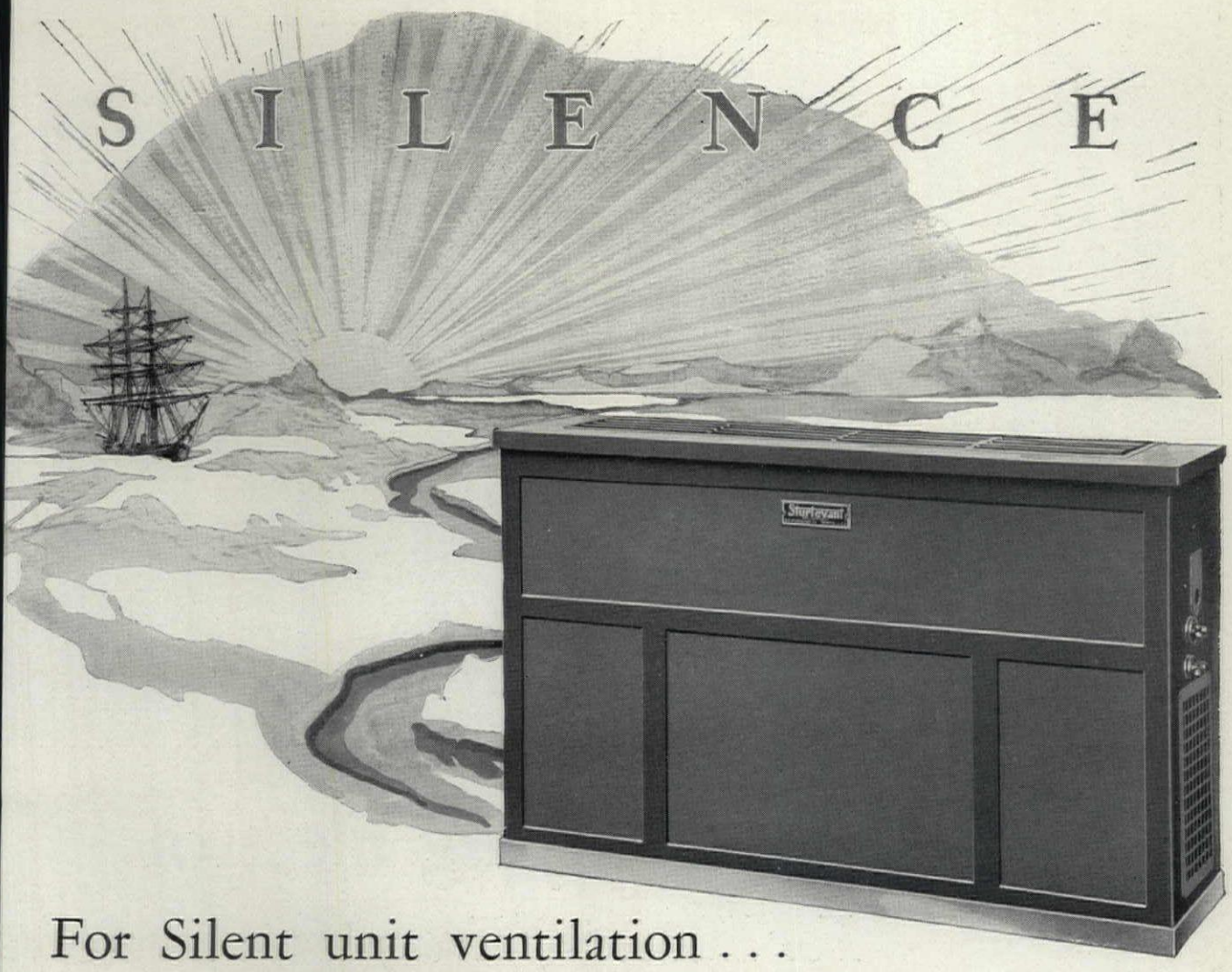
Wm. Downs, Heating Contractor





For Silent unit ventilation . . . specify the "Silent" Sturtevant

NOISELESSLY, the new Sturtevant Unit Ventilator draws in fresh energizing air. Not a sound comes from the attractive metal cabinet to disturb the quiet of the schoolroom, church or office.

Silent unit ventilation is an outstanding Sturtevant achievement. Because of the special design of the fan wheels used in the "Silent" Sturtevant Unit Ventilator the air is moved noiselessly, and in addition a saving in electric power is effected.

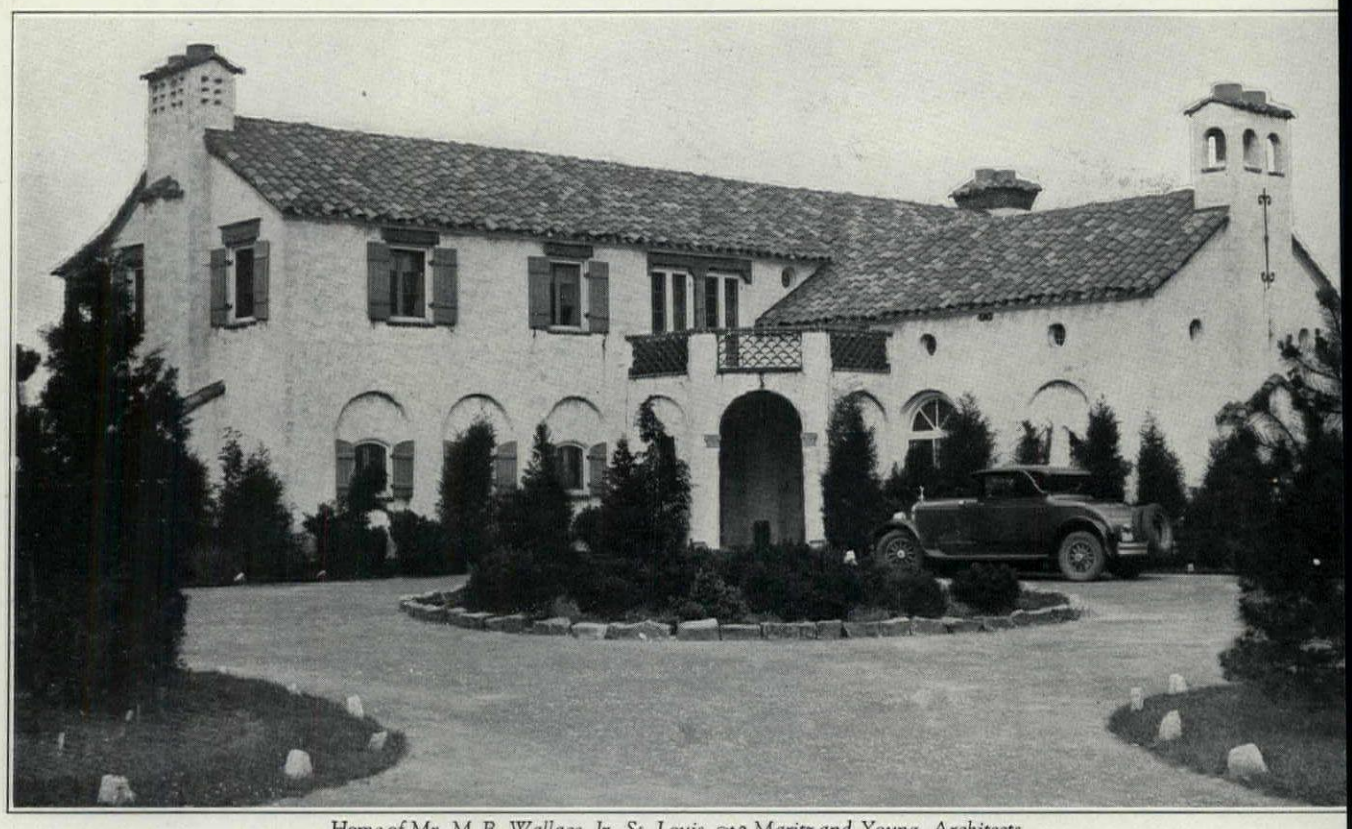
For silent unit ventilation . . . specify the "Silent" Sturtevant Unit Ventilator. Bulletin No. 344-A contains complete information. Write to our nearest office for a copy.

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

Atlanta	Buffalo	Chicago	Dallas	Indianapolis	Minneapolis	Portland	San Francisco
Birmingham	Camden	Cincinnati	Denver	Kansas City	New York	Rochester	Seattle
Boston	Charlotte	Cleveland	Detroit	Los Angeles	Pittsburgh	St. Louis	Washington
				Hartford			

Canadian offices at: Toronto, Montreal, and Galt, Ontario; also agents in principal Foreign countries

Sturtevant REG. U.S. PAT. OFF. *the Silent Unit Ventilator*



Home of Mr. M. B. Wallace, Jr., St. Louis. ∽ Maritz and Young, Architects

Architects are Specifying Electrol

For Homes of Every Type and Size

The Electrol automatic oil burner is being specified by architects for some of the most costly city and country homes in America. For homes and buildings of all types and sizes. There is an Electrol for every heating requirement.

Quiet... Economical... All-Electric... Entirely Automatic. It employs the proved principles of positive, automatic, electric ignition and mechanical fuel atomization.

Over every phase of this finer burner's operation, *The Master Control* stands guard day and night, like a living sentinel always at the furnace door. ⁘ Wherever there is an Electrol distributor complete oil heating service is available, backed by a sound, large and growing manufacturing organization. Your request will bring a copy of Electrol Regulation A. I. A. Folder containing much information you will want.

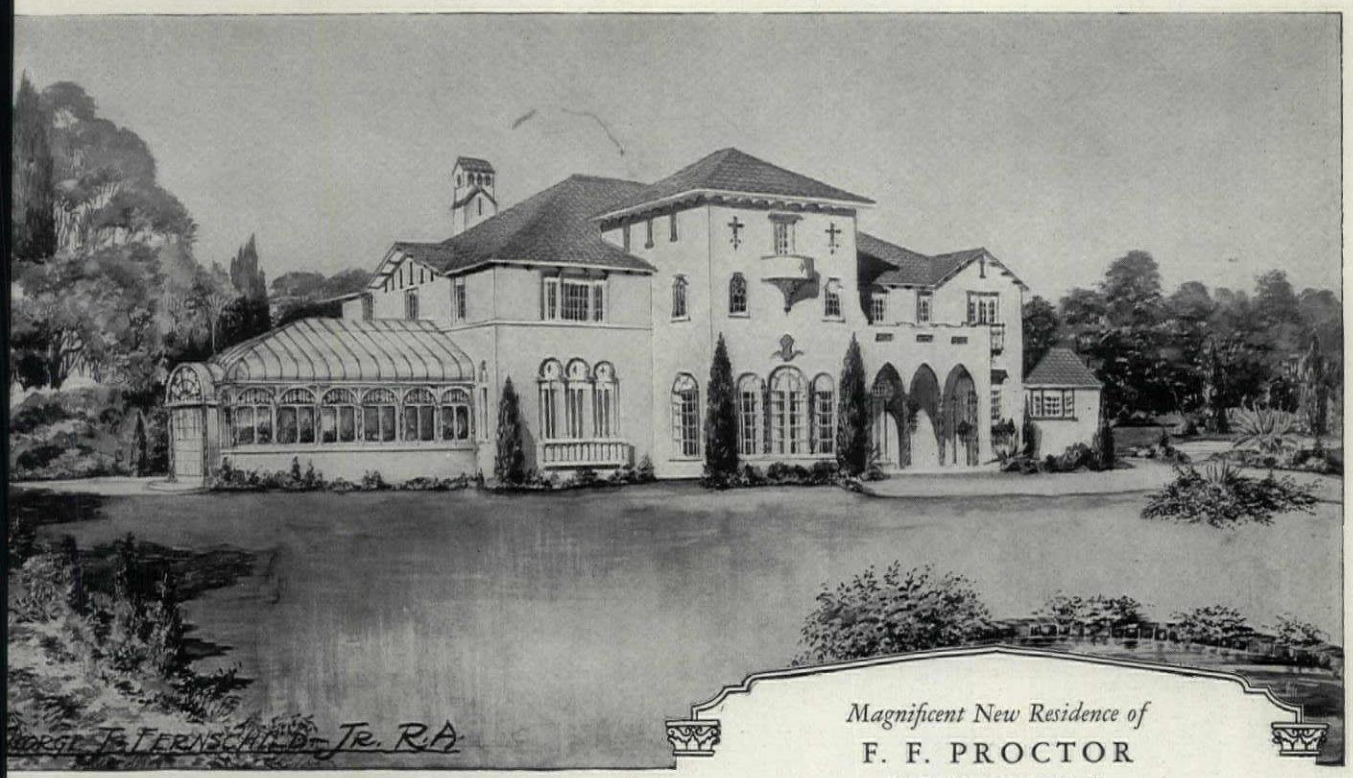
ELECTROL INC. *of* MISSOURI
179 DORCAS STREET ⁘ ST. LOUIS, U. S. A.

ELECTROL

The OIL BURNER *with The Master Control*

Listed as Standard by the Underwriters' Laboratories, and bears their label

KNOW ELECTROL BY THE HOMES IT HEATS



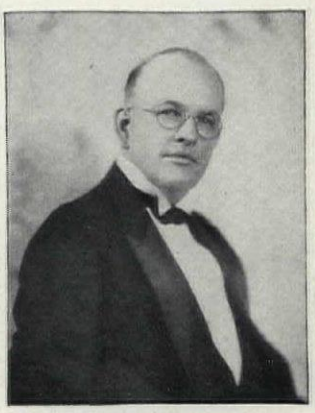
Magnificent New Residence of
F. F. PROCTOR
LARCHMONT, N. Y.

Approved *—as specified*

THE owner put the heating problem up to the architect. The architect favored the Quiet May but consulted his engineer.

The engineer confirmed the architect's selection.

In the magnificent new residence of Mr. F.F. Proctor at Larchmont, N.Y., three Quiet Mays were installed, two in the eighteen-room residence, one in the garage, exactly as specified by the architect.



GEORGE J. FERNSCHILD, JR.
Registered Architect
The Proctor residence is but one of many notable Westchester County show places to his credit.

QUIET MAY
AUTOMATIC OIL BURNER

etro Takes Care of Any Heating Plant

from 200 sq. ft. steam radiation to a 1000 h. p. boiler

In this one line alone, you have a listed oil burner for *every* building that has a central heating plant. Whatever its type or size, there is a Petro Oil Burner built expressly for it. The four domestic sizes, all automatic, ranging in capacity from 200 sq. ft. of steam radiation to 18,000 sq. ft. are all listed to operate with 24 gravity fuel oil. Industrial sizes range from 50 h. p. to 1000 h. p. using fuel as low as Bunker C oil.

For 25 years Petro Oil Burners have been used extensively in large heating and power plants. Their success led to the development of a domestic line of Petros 5 years ago. Every single one of these installed is in active service today in the original house. We believe this to be the only perfect 5 year record ever established in the history of oil heating.

Being an engineering organization, we have a wealth of technical data available for architects on request. Or your local Petro dealer will supply you with full information and assist you in writing up your heating specifications. Factory engineering service is offered on all large industrial installations. Write today.

PETROLEUM HEAT & POWER COMPANY

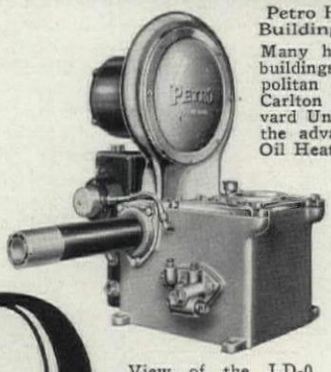
Makers of oil burners since 1903

511 5th Ave. : : New York City

FESS SYSTEM CO. (Subsidiary) 220 Natoma St., San Francisco, Calif.

Petro Heats Equitable Building, New York City

Many hundreds of such buildings as the Metropolitan Life Ins., Ritz-Carlton Hotel and Harvard University enjoy all the advantages of Petro Oil Heat.

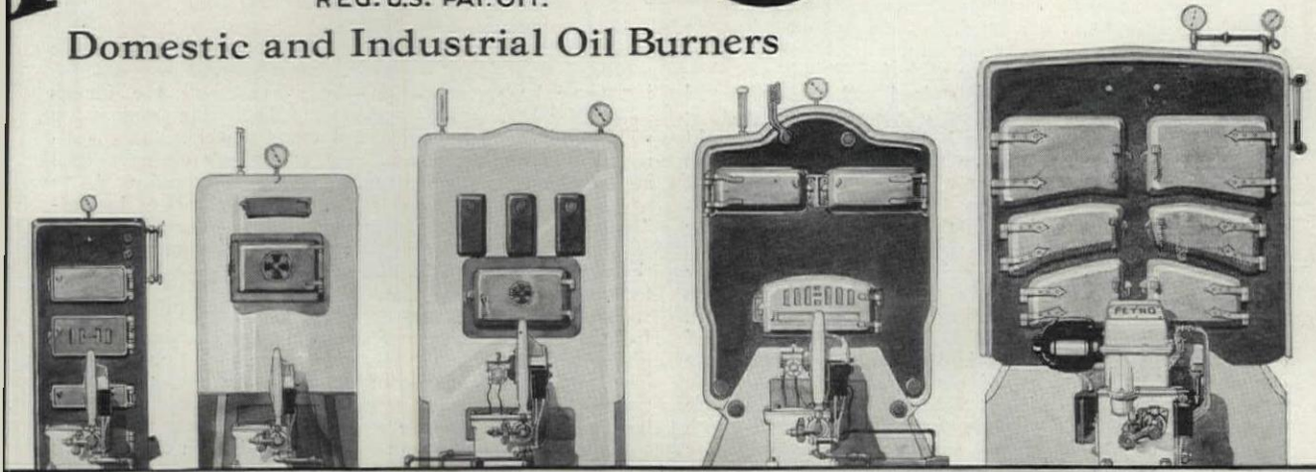


View of the LD-0 Petro sufficient for a house of 4 to 10 rooms.

PETRO

REG. U.S. PAT. OFF.

Domestic and Industrial Oil Burners



LD-0 Petro
200 sq. ft. st. rad. to 1000 sq. ft. 1 gal. to 2½ gal. per hr. ⅜ h. p. motor.

LD-1 Petro
800 sq. ft. st. rad. to 2000 sq. ft. 2 gal. to 5 gal. per hour 1-6 h. p. motor

LD-2 Petro
1800 sq. ft. st. rad. to 4000 sq. ft. 5 gal. to 10 gal. per hour ¼ h. p. motor

LD-3 Petro
4000 sq. ft. st. rad. to 18,000 sq. ft. 10 gal. to 42 gal. per hour. 1 h. p. motor

REVIEWS OF MANUFACTURERS' PUBLICATIONS

NATIONAL RADIATOR CORPORATION. "Announcing a New and Greater Boiler and Radiator Corporation."

Announcement has recently been made of the formation of this new corporation, formed by consolidating a number of concerns which have hitherto operated separately,—the Continental Heater Corporation, the Gurney Heater Mfg. Co., the National Radiator Company, the Niagara Radiator & Boiler Company, the Union Radiator Co., and the Utica Heater Co. The announcement says: "The size and scope of the new National Radiator Corporation tremendously increase the breadth and degree of service which any of the component companies has heretofore been able to offer to the heating industry, without affecting in any way the manufacture and distribution of those products for which an appreciable demand exists. The annual capacity of the new National's ten plants will be more than 90,000,000 pounds of boilers and over 60,000,000 feet of radiation. Through these combined facilities, the previous standards of service of all the merged companies will be vastly improved, and the close personal relations with the trade maintained and strengthened. The fact that these plants are located at strategic points throughout the country makes short hauls possible, effecting savings in freight charges."

ALUMINUM COMPANY OF AMERICA, Pittsburgh. "Aluminum Paint." A handbook on its use in industry.

The countless advantages which use of aluminum paints presents make them particularly useful for many purposes. Aluminum paint is fundamentally different from other paints. It is made with metallic aluminum flakes called aluminum bronze powder, which no other paint pigment has. The simple mixing of this aluminum bronze powder with a suitable oil or varnish vehicle at once provides an aluminum paint which renders unusually satisfactory service in a wide variety of applications. Among the advantages suggested there are: (1) Its "hiding" or "covering" power, for one coat will readily obscure or cover a surface already painted or stained. (2) Its reflectivity or lighting efficiency, so high that sometimes as much as 70 per cent of the light falling upon a surface so painted is reflected and but 30 per cent absorbed. (3) Its lessening of evaporation, which because of its preventing radiation renders it useful for painting cooling tanks or oil storage tanks. (4) Its waterproofing properties, brought about by the resistance to moisture which aluminum bronze powders possess. This valuable brochure has been prepared for the company's customers by Junius D. Edwards, Assistant Director of Research, and Robert I. Wray, Research Chemist, of its laboratories.

GENERAL FIREPROOFING CO., Youngstown, O. "G F Floor Enamel; G F 115." Data on a valuable material.

Unless they are properly treated, cement floors do not always meet the expectations of those who demand their use. While most serviceable and adaptable under many conditions, such floors are sometimes objectionable because they dust up and wear away easily, are cold and cheerless in appearance, do not harmonize with furnishings and decorative effects, become quickly stained and unsightly, and are hard to clean. In such cases a cement floor paint or enamel is the easiest material with which to impart a bright colored finish, to prevent dusting up, and to hide any stains or discolorations that may exist upon the surface. A paint made with linseed oil is of very little value upon a cement surface. The lime contained in the cement acts chemically upon the linseed oil, turning it into a soap. This soap is readily water soluble, so that it is gradually washed away and worn off until finally only the dry pigment remains which soon wears off. An efficient cement floor paint must, therefore, be made of an oil that is unaffected by lime of cement and that will penetrate into the pores of the surface carrying with it a portion of the coloring pigment. This small folder deals with an admirable floor enamel, the vehicle of which is China wood oil, one of the few oils upon which lime has no deleterious effects, combined with certain spar gums to give increased degrees of elasticity and toughness.

NORTH WESTERN EXPANDED METAL CO., Chicago. "Longspan ¾-Inch Rib Lath." Data on a New Material.

Constant improvement takes place in the production of different kinds of metal base for plaster and reinforcement for concrete, and along with this improvement there goes the introduction of many new materials. This particular brochure, for example, describes and illustrates "a new type of U-rib expanded metal used as a combined centering and reinforcement for concrete construction in which there have been incorporated several valuable new features. Parallel, heavy, cold-drawn, ¾" deep, U-shaped ribs are spaced 4.8" center to center and connected by sections of expanded steel mesh. These sections consist of two 'panels,' each composed of six rows of diamonds with a ⅛" bead of secondary stiffening rib through the center. Ribs, mesh and beads are all formed from a single sheet of steel. Longspan ¾" rib lath is made in sheets seven ribs or six sections wide. Ribs are ¾" high, spaced 4.8" center to center. Size of the diamonds in the connecting mesh—⅜" x 15/16". 'Longspan' is cut from standard sheet and painted black. 'Copper-bearing Longspan'—i.e., cut from Keystone sheet and painted red—also furnished on special order." Sheets are nested, shipped uncrated, as they are not easily injured.

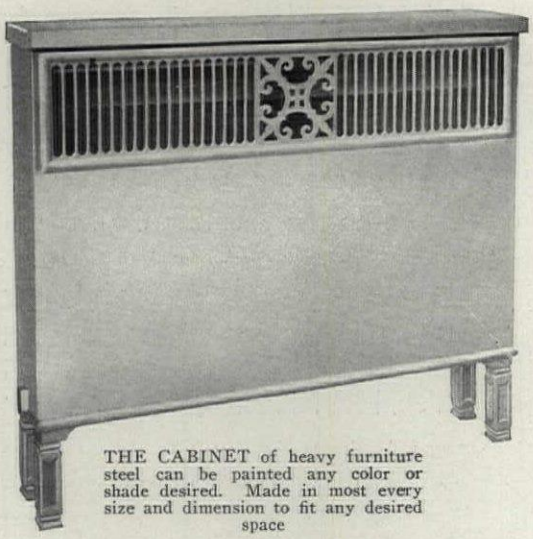
WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh. "Electric Power for Buildings."

Architects and engineers well know the importance, in any building, of the electricity which supplies energy for lighting, for operating many different kinds of mechanical equipment, and at times for furnishing heat as well. Probably with a view to placing before architects data which would aid them in intelligently specifying the countless details of equipment which it sells, the Westinghouse firm issues quite a number of booklets or brochures containing matter of the highest practical value. This particular brochure, for example, is a reprint of an article by E. B. Dawson, General Engineer of the Westinghouse Electric & Manufacturing Co., which appeared originally in one of the architectural journals. Its purpose is to outline the sources of electric power available, the characteristics of the various systems which may be selected, the power requirements of the various loads, the characteristics of the loads in several types of buildings, and to place in the hands of those responsible for the selection of electrical apparatus reliable performance and cost data. As might be expected, Mr. Dawson gives the matter close study and analysis, and the result is a collection of data well worthy a place in the equipment of any architect or engineer.

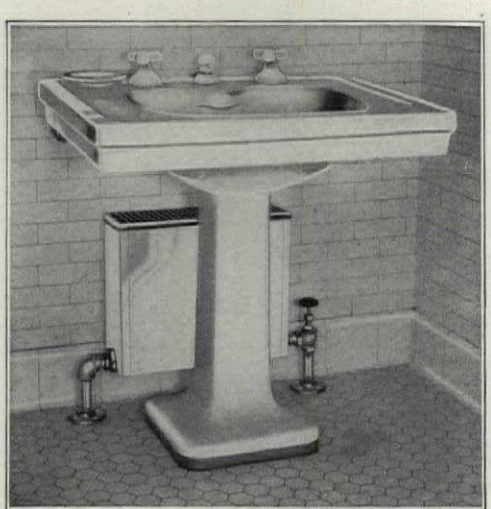
WEST COAST LUMBER TRADE EXTENSION BUREAU, Seattle. "Douglas Fir; America's Lumber Supply."

Travelers in certain parts of the country bring back discouraging reports of the appearance of entire regions, once covered with thick forests, but now "cut over" and merely dreary wastes of bare land and stumps of trees. This brochure, besides giving data regarding a most valuable wood, gives a reassuring report regarding the progress being made by re-forestation,—by so renewing the forests that instead of being completely ruined after giving one yield of timber they will afford many a yield. "It is estimated that the growth in new forests on cut-over land alone represents more than 3 billion feet annually. With present-day fire protection and modern methods of lumbering and forestry, it is rightly estimated that the West Coast forests will supply the lumber wants of the nation for all time." As the late Mr. Roosevelt said, "wise forest protection does not mean the withdrawal of forest resources, whether of wood, water or grass, from contributing their full share to the welfare of the people, but, on the contrary, gives the assurance of larger and more certain supplies. The fundamental idea of forestry is the perpetuation of forests by use. Forest protection is not an end of itself; it is a means to increase and sustain the resources of our country and the industries which depend upon them." This booklet is filled with valuable information.

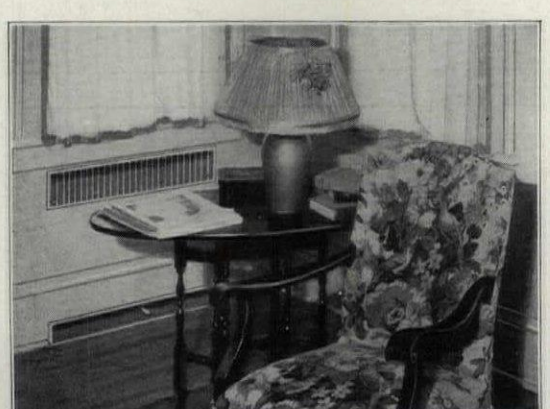
Greater Beauty — *PLUS* Quicker, Better Heating



THE CABINET of heavy furniture steel can be painted any color or shade desired. Made in most every size and dimension to fit any desired space



THE BATH-ROOM type is designed for installation back of lavatories, or in other "out-of-the-way" places. An ideal unit where only small space is available



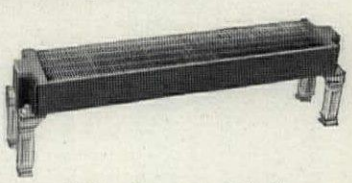
THE CONCEALED type provides the utmost in efficient, comfortable heating, without the use of any floor space

McQUAY Cabinet RADIATOR

Meeting every architectural requirement for a radiator that combines real beauty with more efficient heating, McQUAY Cabinet RADIATORS and McQUAY Concealed RADIATORS fill a long felt need.

Cold air from the floor enters the cabinet at the bottom, passes thru the heating unit and is impelled thru the grille with sufficient velocity to insure positive circulation. This means *quicker heating.* A water chamber above the heating unit humidifies the air, resulting *in more comfortable and healthier heat.*

The Heating Unit



A distinctive McQUAY development consists of a series of flat horizontal tubes, tinned inside, securely held in place by copper fins, and firmly nested in bronze headers. It is immune from rust and corrosion—*will not "clog"*—and is practically indestructible.

Tested in actual installations McQuay Cabinet Radiators prove their ability to heat quicker and more efficiently, without the "bulky ugliness" of ordinary radiators. **Yet their cost, installed, is only slightly more.**

Also: A complete line of UNIT HEATERS
Descriptive literature upon request

McQUAY RADIATOR CORPORATION
General Sales Office: **Pure Oil Building, Chicago**

Eastern Branch—2148 Graybar Bldg., New York City

Branches in most principal cities

REVIEWS AND ANNOUNCEMENTS

W. Newton Diehl has recently opened offices in the New Monroe Building, Norfolk, Va.

Anderson & Young announce the opening of offices in the Vermont Building, Salt Lake City.

The Cullan Co., Inc., has opened offices in the Stroh Building, Detroit, and desires the publications and other matter issued by manufacturers. The organization includes J. A. McCullough, F. W. Langhenrich, and Barton D. Wood.

EDISON ELECTRIC APPLIANCE CO., INC., Chicago. "Architect's Handbooks of Electric Cooking."

The arguments likely to be advanced for use of electricity for cooking are much the same as are urged for its use for any other purpose. Among them are the ease with which electricity is used, and its cleanliness, since it produces neither smoke nor soot. In fact almost the only argument brought against this use of electricity is that of its higher cost, and most service companies are meeting this objection by giving special rates on current used for cooking,—rates considerably lower than those for current used for other purposes. These two brochures,—"Architect's Handbook of Electric Cooking for Residences and Apartment Hotels" and "Architect's Handbook of Electric Cooking for Hotels, Hospitals, Institutions, Clubs, Ships, etc.," cover fully the scope indicated by their titles. Each is replete with data of great value to architects and engineers.

THE CELOTEX COMPANY, Chicago. "Celotex Technical Notes." Important data on the use of the material.

To insure correct use of its widely known and extremely useful product, the Celotex Company issues what are practically specifications, which if followed will guarantee satisfaction with Celotex when used for any one of the many purposes for which it is sold. This publication is a folder, prepared in accordance with the recommendations of the A. I. A., and in the folder there are fastened (so that they may be removed) "Technical Notes" on use of the material, —applying Plastic Paints on Celotex; Celotex in its Relation to Fires; the Strength of Celotex; Bonding of Concrete and Portland Cement to Celotex; Wall Paper on Celotex; Celotex for Sound Insulation; Celotex Carpet Lining; Celotex Ashlar Stone Decoration; Celotex Paneled Interiors; Celotex for Cottages, Cabins and Camps; and attaching Celotex to Steel Framing. The care with which these "notes" have been prepared and the inclusion in their pages of numerous diagrams illustrating approved methods of construction should result in a wider use of this highly adaptable material. They are replete with information.

CHARLES CORY & SON, INC. 185 Varick Street, New York. "Seamless Flexible Metal Hose."

The practical value of a metal hose is, very naturally, determined by its durability and strength. There are many purposes for which metal hose is used which involve considerable pressure, and the force of this pressure is likely to develop leaks which presently result in breaks, generally between the hose and its fittings. This brochure or booklet describes and illustrates a type of hose which is built to withstand pressure and to prevent leaking. "Cory Seamless Flexible Metal Hose, as its name implies, is seamless from the tip of one fitting to the tip of the fitting at the opposite end, and therein lies its superiority to other types of hose. Fittings are brazed or welded to the hose, forming an integral part of it." This hose is designed for use as a flexible conveyance of non-solids and non-abrasives, and for flexing and expansion between delivering and receiving connections at moderate and very high pressures and temperature as well as for the alleviation of destructive vibration. The booklet is replete with data which could hardly fail to be of interest to an engineer or to anyone requiring a strong and thoroughly dependable metal hose.

Milton M. Friedman, of Los Angeles, announces his removal to 6001 Santa Monica Boulevard.

Carl C. Tallman, formerly of Auburn, N. Y., has opened offices at 29 West Third Street, Williamsport, Pa.

Lang, Raugland & Lewis, of Minneapolis, announce the opening of a branch office at 1955 University Avenue, St. Paul. They desire catalogs and publications issued by manufacturers and to have their name added to mailing lists.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE ARCHITECTURAL FORUM

Published Monthly at New York, N. Y., for April 1, 1928

State of New York, County of New York, ss.:

Before me, a Notary Public, in and for the State and County aforesaid, personally appeared Robert Sweet, who having been duly sworn according to law, deposes and says that he is the business manager of THE ARCHITECTURAL FORUM and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager, are:

Publisher—Rogers & Manson Co., 383 Madison Avenue, New York, N. Y.

Editor—Parker Morse Hooper, New York, N. Y.

Managing Editor—None.

Business Manager—Robert Sweet, New York, N. Y.

2. That the owners are:

Rogers & Manson Co., 383 Madison Avenue, New York, N. Y.

Stockholders holding 1 per cent or more of the total amount of stock:

Howard Myers, Bronxville, N. Y.
C. Stanley Taylor, New York, N. Y.
James A. Rice, Chicago, Ill.
Robert Sweet, New York, N. Y.
Paul W. Hayes, New York, N. Y.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also, that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities, than as so stated by him.

ROBERT SWEET,
Business Manager.

Sworn to and subscribed before me this 12th day of April, 1928.

(Seal) STELLA L. BOWMAN,

(My commission expires March 30, 1930.) Notary Public.

Through the years, a building must withstand as much water and moisture as if it were placed under Niagara.

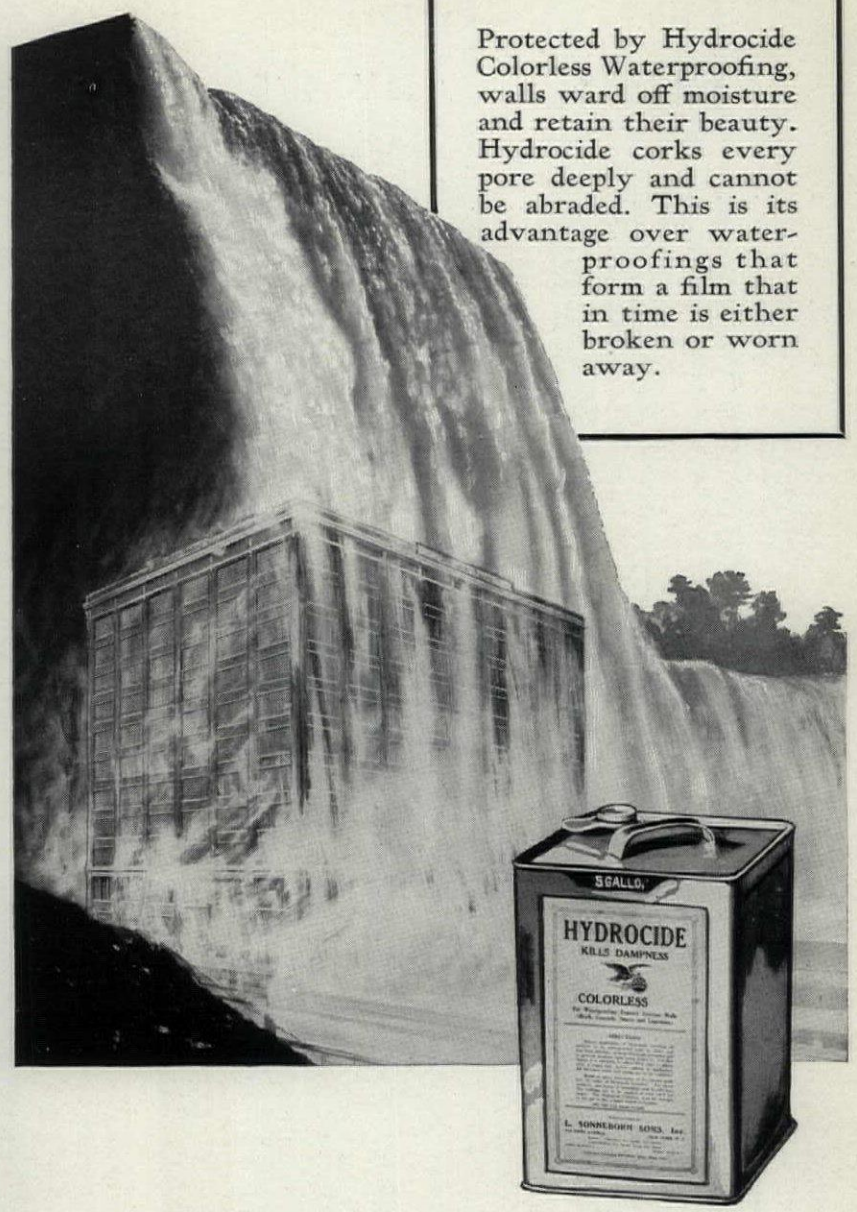
The question is not whether to waterproof a building but *how* to waterproof it most efficiently and permanently.

There is one waterproofing that has won the support of architects for its serviceability. This is Hydrocide Colorless Waterproofing, the product of L. Sonneborn Sons.

The reputation of Sonneborn is your assurance of the unvarying quality of any Sonneborn product. By specifying Sonneborn's Hydrocide you have the satisfaction of knowing you are giving your client the most dependable protection for the walls of his building.

L. SONNEBORN SONS, INC.

114 Fifth Avenue
New York



Protected by Hydrocide Colorless Waterproofing, walls ward off moisture and retain their beauty. Hydrocide corks every pore deeply and cannot be abraded. This is its advantage over waterproofings that form a film that in time is either broken or worn away.

Hydrocide
Colorless Waterproofing

Some other Sonneborn Life Savers *for Buildings*

LAPIDOLITH
Protects concrete floors as Hydrocide Colorless protects your walls. Makes floors granite-hard, dustless, lasting.

LIGNOPHOL
Is the only wood floor preservative that lasts. Linseed oil is useless. Shellac and varnish wear off. Lignophol stays.

CEMCOAT
Reduces painting costs. A white paint that will not turn yellow. Can be washed over endlessly.

MAIL THIS COUPON TODAY

L. SONNEBORN SONS, Inc., 114 Fifth Ave., New York
Please send me, without obligation, demonstration samples and literature on: — Lapidolith ____; Lignophol ____; Cemcoat ____; Hydrocide Colorless ____ (Check products that interest you.)

Name .....
Address .....
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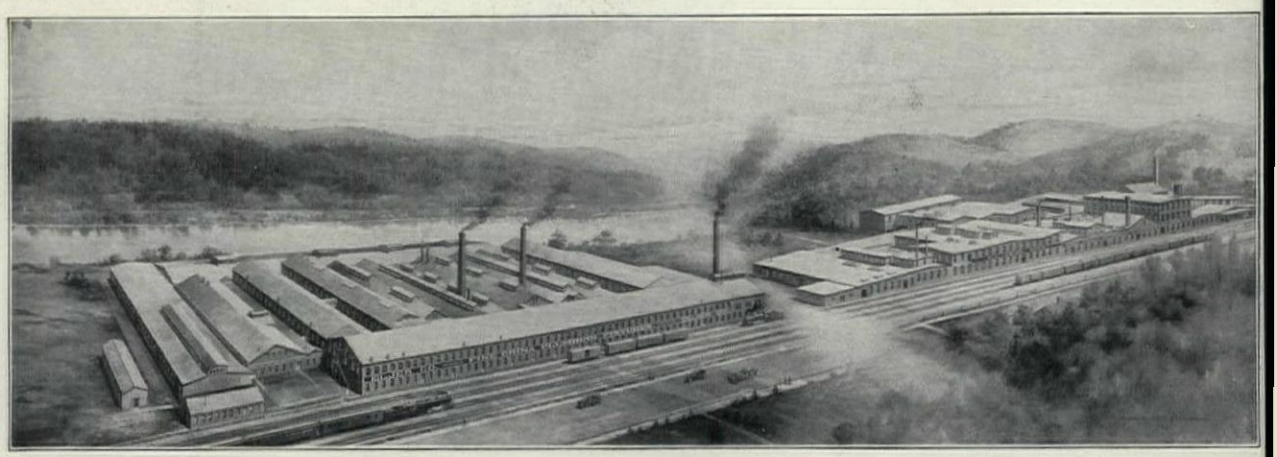
Position .....

A.F.-5

INDEX TO ADVERTISING ANNOUNCEMENTS

PART 1—ARCHITECTURAL DESIGN

PART 2—ARCHITECTURAL ENGINEERING AND BUSINESS



Something's been going on

WITHIN the walls of these plants things have been happening!

One of the most complete lines of vitreous china fixtures ever offered has been developed. There is scarcely an item you cannot get—and have it delivered *quick*, too.

New pieces of outstanding design have been produced. The kind that make hard installation jobs easy by exactly fitting conditions.

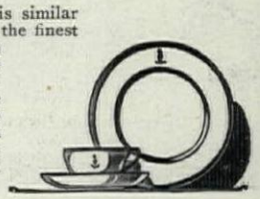
Service has been polished up till it runs like a well-oiled watch. Twenty-four hours or less on all but unusual specialties—from receipt of order till the shipment rolls out of the yard. That *means something* when you're in a hurry.

For Special Attention

Consider the Carlton, No. 545, an example of Eljer progressiveness in design. A compact, quiet, beautifully shaped syphon jet bowl with square base and extended lip. No exposed metal valve to corrode. It's shielded from view. The Carlton has the good points of a hundred types and designs rolled into one.

Catalog, Catalog—have you got a Catalog? By all means have an Eljer Catalog on hand, the key to fine fixtures and fast service. Send for it now. Eljer Company, Ford City, Pa. Factories at Ford City, Pa. and Cameron, W. Va.

Eljer China is similar in texture to the finest French Table China—but with the added toughness necessary to stand rough usage. Acid-proof and rustproof.



ELJER

VITREOUS CHINA PLUMBING FIXTURES

All of the GREAT IMPROVEMENTS
in Soil Pipe have been made by
THE CENTRAL FOUNDRY COMPANY

1 **Strength Where Strength Is Needed Most**

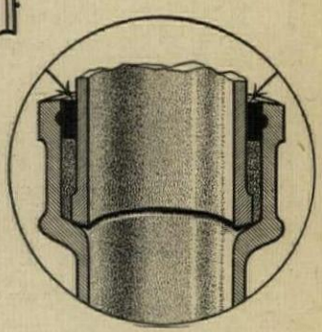
Patent Pending

Look for the Bead at the Base of the Hub and the Led-LoK Groove inside!

NUHUB

TRADE MARK

SOIL PIPE



Led-LoK Groove

This is the one lead groove worthy of NUHUB soil pipe. This lead groove—on all "Central Foundry" soil pipe for the past fifteen years — is retained in NUHUB pipe. The lead can't work loose.

Fifteen years ago The Central Foundry Company introduced the Led-LoK groove, the first successful lead groove on soil pipe and since imitated by the remainder of the industry.

Today the pioneering leadership of The Central Foundry Company is again demonstrated with the perfection of NUHUB trade mark soil pipe.

NUHUB is the soil pipe with the bead at the base of the hub. This bead assures double strength where the hub and the barrel of the pipe meet—*where strength is needed most.*

No matter how many stories high, NUHUB trade mark soil pipe meets all requirements of proper pipe hanging in steel and reinforced buildings.

Every length of NUHUB soil pipe is tested under fifty pounds hydrostatic pressure. Made in *extra heavy* only.

Price? No higher than that asked for old style pipe. For sale by jobbers of plumbing supplies.

Look for the bead at the base of the hub and the Led-LoK groove inside.

2 Old Style Soil Pipe

Compare photo number 1 with photo number 2. Note the thin easily broken wall at base of hub in old style soil pipe. See how this glaring weakness has been eliminated in NUHUB pipe.

~*Specify* NUHUB

~*Use* NUHUB

for the Tallest Buildings

Architects and Engineers can safely specify NUHUB soil pipe for soil lines, waste lines, leader lines, vent lines, house drains and house sewers in the tallest buildings with complete assurance that it meets all present day requirements of expansion and contraction.

They appreciate, too, that NUHUB is a protection against error and substitution, that the "bead at the base of the hub" is a permanent and a distinctive mark of identification that can always be seen after the pipe is installed.

Plumbing Inspectors and Plumbing Contractors find the problem of calking for water or air test reduced to a minimum. NUHUB permits lead joints to be thoroughly calked without splitting hubs.

Jobbers have less breakage in handling because NUHUB is stronger.

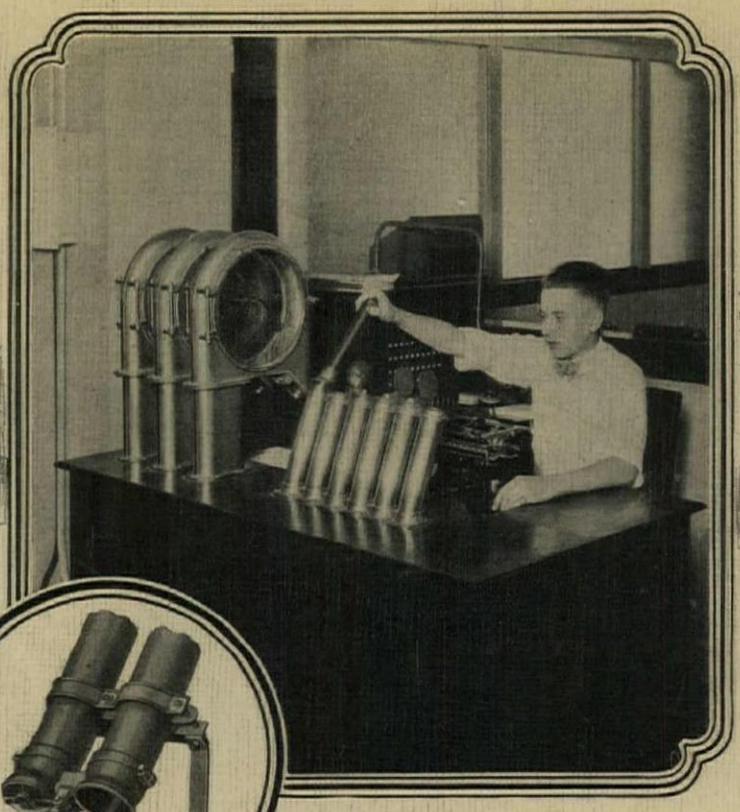
THE CENTRAL FOUNDRY COMPANY

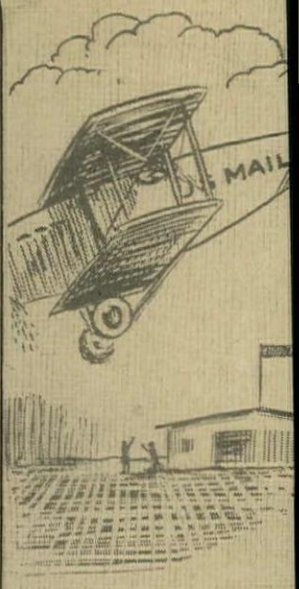
AND ASSOCIATE COMPANIES: ESSEX FOUNDRY, CENTRAL RADIATOR COMPANY
MOLBY BOILER COMPANY, INC. AND CENTRAL IRON AND COAL COMPANY
SUBSIDIARIES OF THE UNIVERSAL PIPE AND RADIATOR COMPANY

General Offices: Graybar Building, Lexington Avenue at 43rd Street, New York

Atlanta · *Birmingham* · *Boston* · *Brooklyn, N. Y.* · *Chicago* · *Dallas* · *Newark, N. J.* · *San Francisco*

Also manufactured under special agreement by ESSEX FOUNDRY, NEWARK, N. J.





Two-Way Vacuum Inlet. Also made in three-way vacuum. Applied to combination vacuum lines, where two or three stations are served by one pick-up or return line. Also illustrates method of supporting from desk. 2¼ in., 3 in. and 4 in.

Putting the Air to Work

The Chase Bage Company of Saint Louis does not believe in spending money for work that can be done free. They have connected the various departments of their plant with a Standard Pneumatic Tube system and inter-office memorandums, invoices for O. K., production orders, shipping instructions, and the thousand-and-one other daily messages of business are zipped in the flicker of an eyelash from one end of the plant to another. No dallying messenger boys, no losses in transit, no confusing of verbal messages—everything written, yet delivered with telephone speed. And, the saving in salaries pays for it all. To architects whose clients could use pneumatic tubes to advantage, we offer a detailed analysis of this job and others. No charge—a request on your letterhead will be honored.

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