THE ARCHITECTURAL FORUM

IN TWO PARTS

ENGINEERING & BUSINESS

PART TWO

MARCH 1928

SCHOOL BUILDINGS REFERENCE NUMBER
PRICE $3

NATCO DEFIES THE FIRE DEMON

IN THEORY, constructing a fire proof building is simple enough. Floors and partitions that will act as fire-tight bulkheads; load bearing members built of, or protected by, refractory material. *In practice*, it is almost as simple. Just utilize Natco—the Complete Line of Hollow Building Tile.

Natco tile are made of special clay, mined, molded, and hard-burned in great kilns to the density of rock. No water in them to be driven off by heat, and so cause disintegration. No solid mass to conduct heat inward to the skeleton.

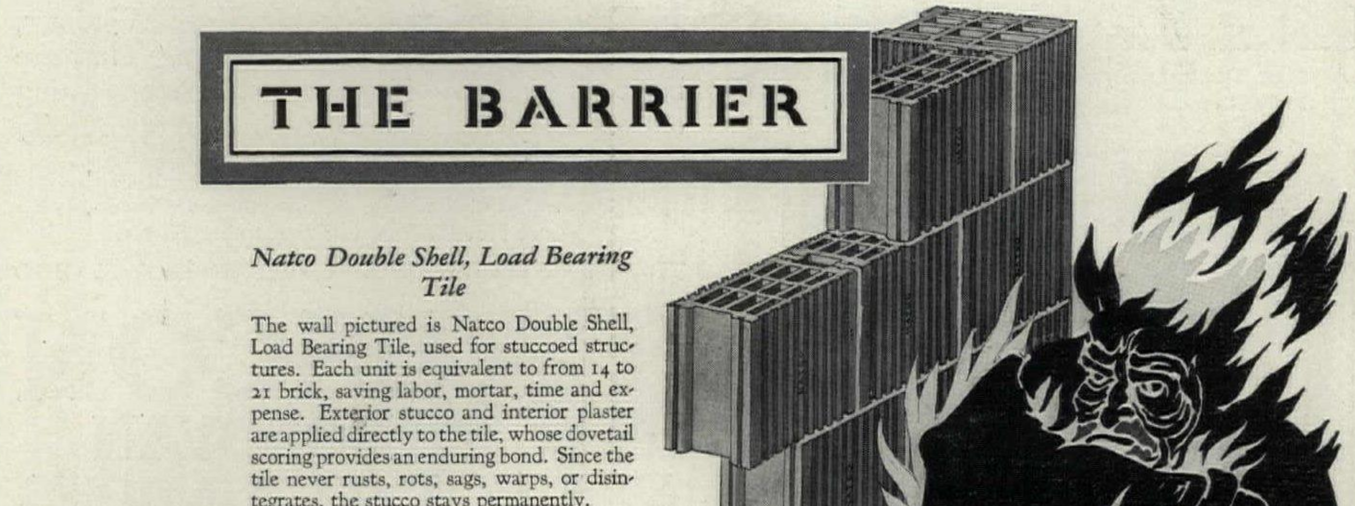
For every need there is a Natco tile. For protecting steel: Natco beam, girder, and column covering. For floors: Natco-flor, Natco Flat Arch, and Natco combination floor systems. For brick-faced walls: Natco Header Backer, Unibacker, Interlocker, and Bakup. Natco Double Shell Load Bearing and Triple X for stucco walls; Natco Textile, and Natco Vitritile for finished face walls. Partition tile, for dividing walls.

Natco effectively bars the fire demon—ushers in increased economies, greater permanence, complete satisfaction.

NATIONAL FIRE-PROOFING COMPANY

***General Offices:* Fulton Building, Pittsburgh, Pa.**

Branch Offices: New York, Flatiron Bldg.; Chicago, Builders Building: Philadelphia, Land Title Bldg.; Boston, Textile Bldg.; *In Canada:* National Fire Proofing Co. of Canada, Ltd., Toronto, Ontario.



Natco Double Shell, Load Bearing Tile

The wall pictured is Natco Double Shell, Load Bearing Tile, used for stuccoed structures. Each unit is equivalent to from 14 to 21 brick, saving labor, mortar, time and expense. Exterior stucco and interior plaster are applied directly to the tile, whose dovetail scoring provides an enduring bond. Since the tile never rusts, rots, sags, warps, or disintegrates, the stucco stays permanently.

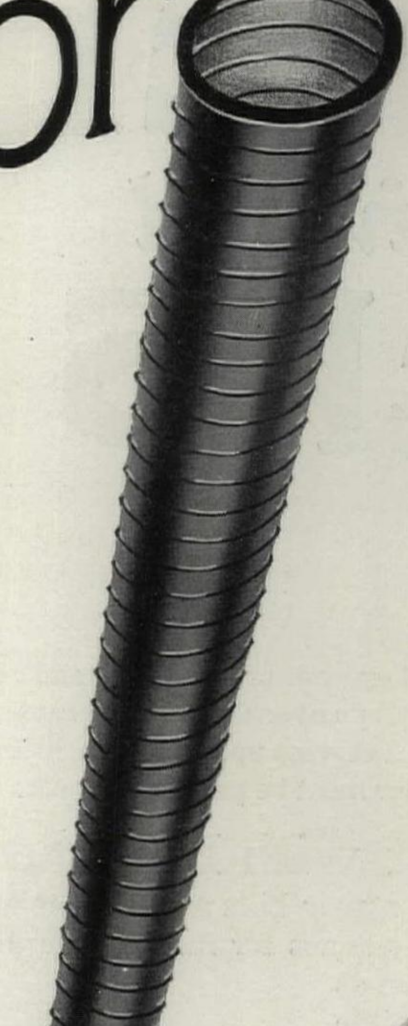
Natco Hollow Building Tile is susceptible to use in both steel and concrete construction.

NATCO

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

HOLLOW BUILDING TILE

protection



The spirally reinforced tapering steel shell that is left in the ground on every standard Raymond Concrete Pile PROTECTS the "green" concrete against the natural squeezing pressure of earth and the additional compression created when the shell is driven.

So many things can and do happen to unprotected "green" concrete pile columns underground that experienced architects and engineers KNOW the wisdom of using the Raymond Method.

Raymond Concrete Pile Co.

NEW YORK: 140 Cedar St.

CHICAGO: 111 West Monroe St.

Raymond Concrete Pile Co. of Canada, Ltd.

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Branches in All Principal Cities

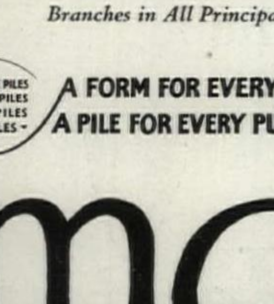
CAST IN PLACE PILES · COMPOSITE PILES · PRECAST PILES · PIPE PILES

A FORM FOR EVERY PILE

A PILE FOR EVERY PURPOSE

BUILDING FOUNDATIONS · BULKHEADS & DOCKS · UNDERPINNING ETC. · BRIDGES

Raymond



GENERAL METAL LATHING SPECIFICATION FOR SCHOOLS

Wood Stud & Joist Construction. Contractors shall use one of the following:

Walls: NorthWestern Kno-Burn or Norwest ⅛″ Rib Lath, wght. 3.0# per sq. yd.

Ceilings: NorthWestern Kno-Burn or Plasta-Saver lath, wght. 3.4# per sq. yd.

Application. Lath shall be first applied to ceilings and sheets carried down 6″ on to walls and partitions. Continue on walls, working down from the top to the bottom. Erect lath with long dimension of sheet across supports. All metal lath shall be started one stud from corner, avoiding joints at juncture of walls, unless NorthWestern Corna-lath be used. It is allowable then to let joints come at junctures, applying Nemco Corna-lath to all vertical corners and corners between ceilings and partitions. Attach lath with 6d nails driven in to at least ⅞″ penetration and spaced 6″ o.c. Lap ends 1″. Tie at least once between supports with 18-ga. tie wire (galv.)

Ceilings Under Concrete Joists. ⅜″ Longspan lath weighing 3.5# per sq. yd. shall be used for standard 5″ concrete joists 25″ o.c. Lath to be attached to joists by means of No. 10 ga. galv. wire (or equal) hangers placed 6″ o.c. in joists before pouring concrete.

Suspended Ceilings. Channel framework for suspended ceilings consists of 1½″ runner channels weighing not less than .442# per lin. ft., placed 4 feet o.c., crossed with ¾″ furring channels weighing .276# per lin. ft., placed 14″ o.c. 3.4# Kno-Burn lath to be wired to this channel framework at 6″ centers with 18-ga. galv. annealed tie wire.

Two Inch Solid Partitions. ¾″ channel studs to be placed 13½″ o.c., fastened at top and bottom. 2.5# Kno-Burn lath to be wired to channel studs lengthwise of sheet, running horizontally. Plaster to be applied on both sides to an all-over thickness of 2″.

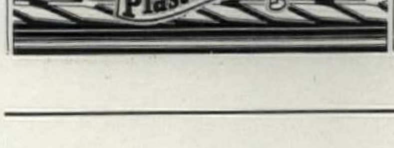
Steel Joist Floor Construction. ⅜″ Longspan rib lath to be used for both floors and ceilings. Sheets to run lengthwise across steel joists. Longspan floor lath shall weigh not less than 4.0# per sq. yd., ceiling lath 3.5# per sq. yd. for joist spacings 24″ o.c. For ceilings where joists are spaced less than 24″, use 4.0# ⅜″ Longspan rib lath on floors and 3.0# ⅜″ Longspan lath on ceilings.

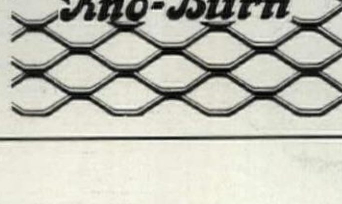
Blackboards: Grounds. (To be inserted in Carpenter's Specification.) Carpenter shall provide grounds over metal lath at proper heights to receive blackboard and trim around same, as shown in architect's drawing.

Carpenter shall also furnish and install rough bucks for all wall and partition openings where called for and shall secure lower end of bucks to masonry floors by spiking to wood plugs or shall provide other satisfactory and rigid means of attachment.

"A.I.A." Reference Portfolio Containing Samples of Metal Lath, Descriptions and Specifications Gladly Sent.

NORTH WESTERN EXPANDED METAL CO., 1234 Old Colony Bldg., CHICAGO





View of Foxhall Village, Washington, D. C. Boss and Phelps, Owners and Developers. Partitions and backing of Cinder Blocks throughout the entire operation.

Exterior of a house in Foxhall Village. Cinder Blocks have been used as a base for stucco and as backing for stone and brick work, as well as for all partition walls.

An entire community made fire-safe with Cinder Blocks

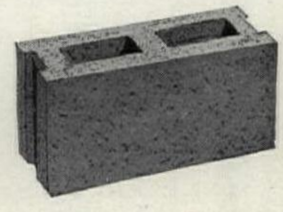
THE increasing development of the town planning idea finds expression in the new Foxhall Village, Washington, D. C.

A universal desire for complete insulation has been realized in the same operation. Cinder Building Units have been used in all partition walls, as base for stucco, and as backing for brick and stone work.

Tests of every kind, and practical experience in many actual fires have established the superior fire resistance of Cinder Units. The adaptability of this material to all types of architecture makes it possible to utilize its safety factor in any operation.

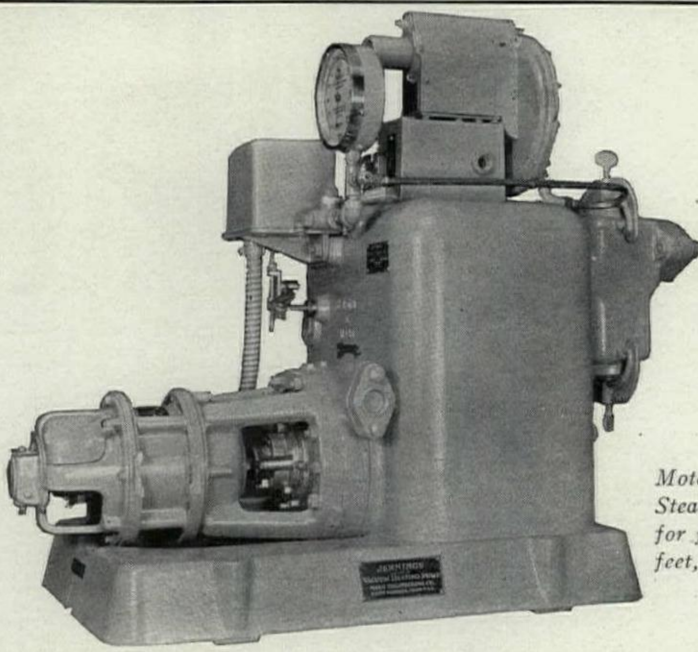
Cinder Building Units, as manufactured by 84 plants under Straub and Bo Patents, may be obtained throughout the United States and Canada.

Complete information regarding the characteristics of Cinder Concrete Building Units is contained in our new catalogue, which will be sent free upon request.



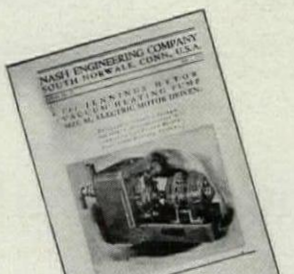
The NATIONAL BUILDING UNITS CORPORATION

1600 Arch Street *Dept. F* Philadelphia



Motor-driven Jennings Return Line Vacuum Steam Heating Pump. In standard sizes for jobs ranging from less than 2,500 square feet, up to 300,000 square feet radiation.

Quick heat on starting up in zero weather



Write for Bulletins Nos. 71 and 25

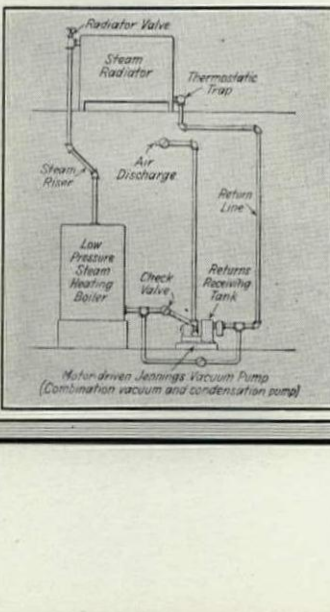
A Jennings Pump in the return line of the vacuum steam heating system makes possible quick heat in starting up in the morning, even in zero weather. Steam flow throughout the system is steady, and positive. Each radiator receives its share of the heat—the one farthest from the boiler, as well as the nearest radiator. Heating being more efficient, less fuel is consumed.

There is a Jennings Pump for your small heating jobs—jobs of less than 2500 square feet radiation—as well as the larger sizes, suitable for up to 300,000 square feet equivalent direct radiation.

NASH ENGINEERING CO.
12 Wilson Road South Norwalk, Conn.

Jennings Pumps

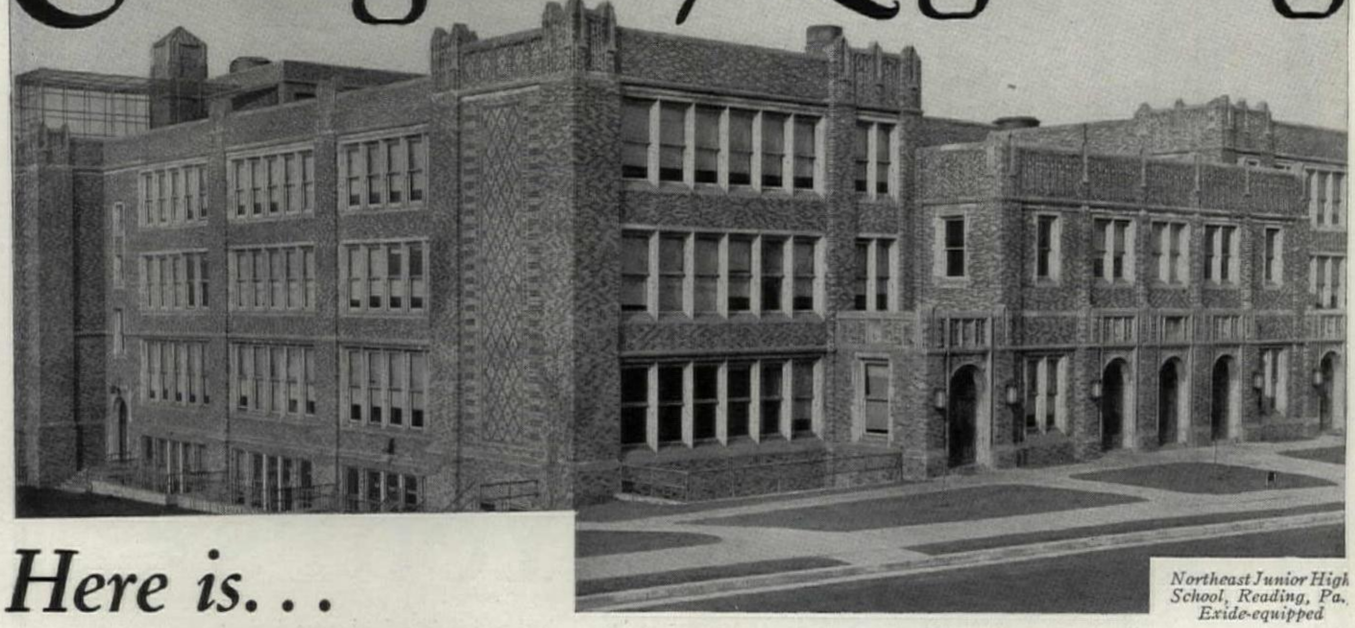
At right: a diagrammatic installation of the Jennings Vacuum Heating Pump. Steam, generated in the boiler, flows to the radiators, where it gives up its heat and is condensed into water. Under the action of the vacuum created in the return line by the pump, the condensation and whatever air may be present in the radiators are withdrawn through the thermostatic trap and passed to



the return tank. From here, the air is removed and discharged by the pump into the atmosphere; the condensation is pumped back into the boiler.

The pump operates automatically — removing water and air only when the water reaches a predetermined height in the return tank, or when the vacuum in the return line falls below a fixed minimum.

NOW.. Automatic Emergency Lighting



Northeast Junior High School, Reading, Pa. Exide-equipped

Here is...

thoroughly dependable lighting protection that fits any building plan...

CONTINUOUS light is vital wherever the public assembles indoors. To insure against lighting failures, many architects are now specifying Exide emergency lighting batteries. In fact, in some states legislation has been passed making the installation of emergency lighting obligatory.

The protection afforded by the Exide emergency lighting battery is automatic. If the main current fails, the lights instantly draw power from the battery—*without a hand touching a switch.*

This method of lighting protection is absolutely reliable. There is no intricate machinery to get out of order. No expert electrician is needed for its care.

An Exide emergency lighting battery can be obtained to fit the requirements of any building plan. It can be easily adapted to just those rooms or exits where lighting protection is really necessary.

Whether you are specifying an emergency lighting battery for an entire school or theatre auditorium, or merely a single operating room of a hospital, there is an Exide Battery of the proper size and capacity to do the job at a corresponding cost. This battery assures (1) absolute power dependability; (2) long life; (3) freedom from trouble; (4) low first cost; (5) low operating cost.

Send for one of our engineers to consult with you. He will be able to give you helpful information on emergency lighting.

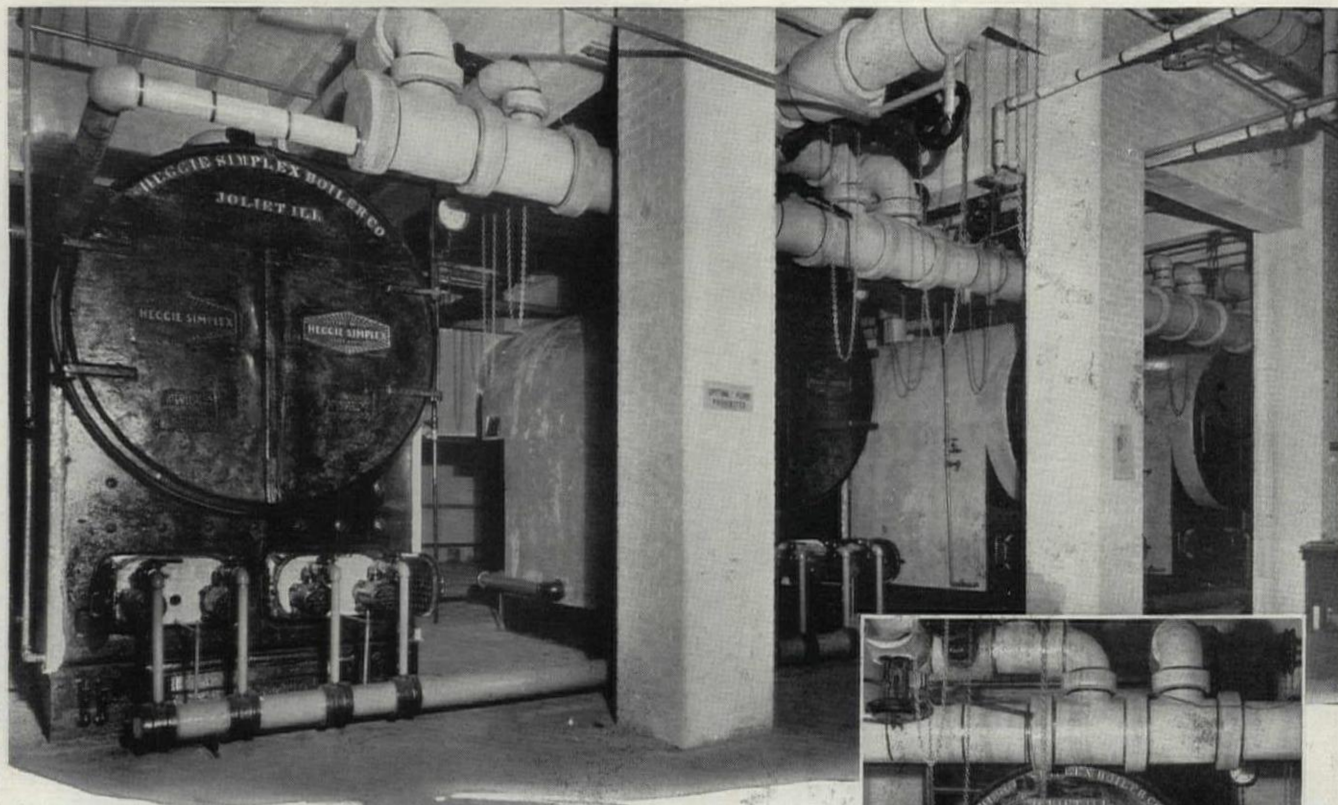
For a more technical description of emergency lighting, see page 2876 of "Sweet's Architectural Catalogue"—Section C.

Exide

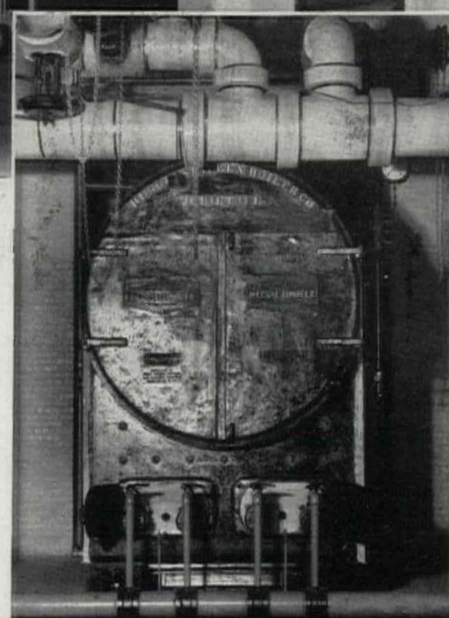
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

Exide Batteries of Canada, Limited, Toronto



Battery of four gas fired Heggie-Simplex Steel Boilers installed in the Charleston, West Virginia, Senior High School.



Boiler number two of battery.

The Foundation for Scientific Teaching.

WHERE the health and comfort of school children depend upon sure and even heat—in the most modern of America's school buildings—you find Heggie-Simplex Steel Boilers steadily growing in popularity. Their design, their dependability, their economy—appeal to architects and engineers because arrived at scientifically.

Architects
Warne, Tucker & Patterson
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Heating Contractors
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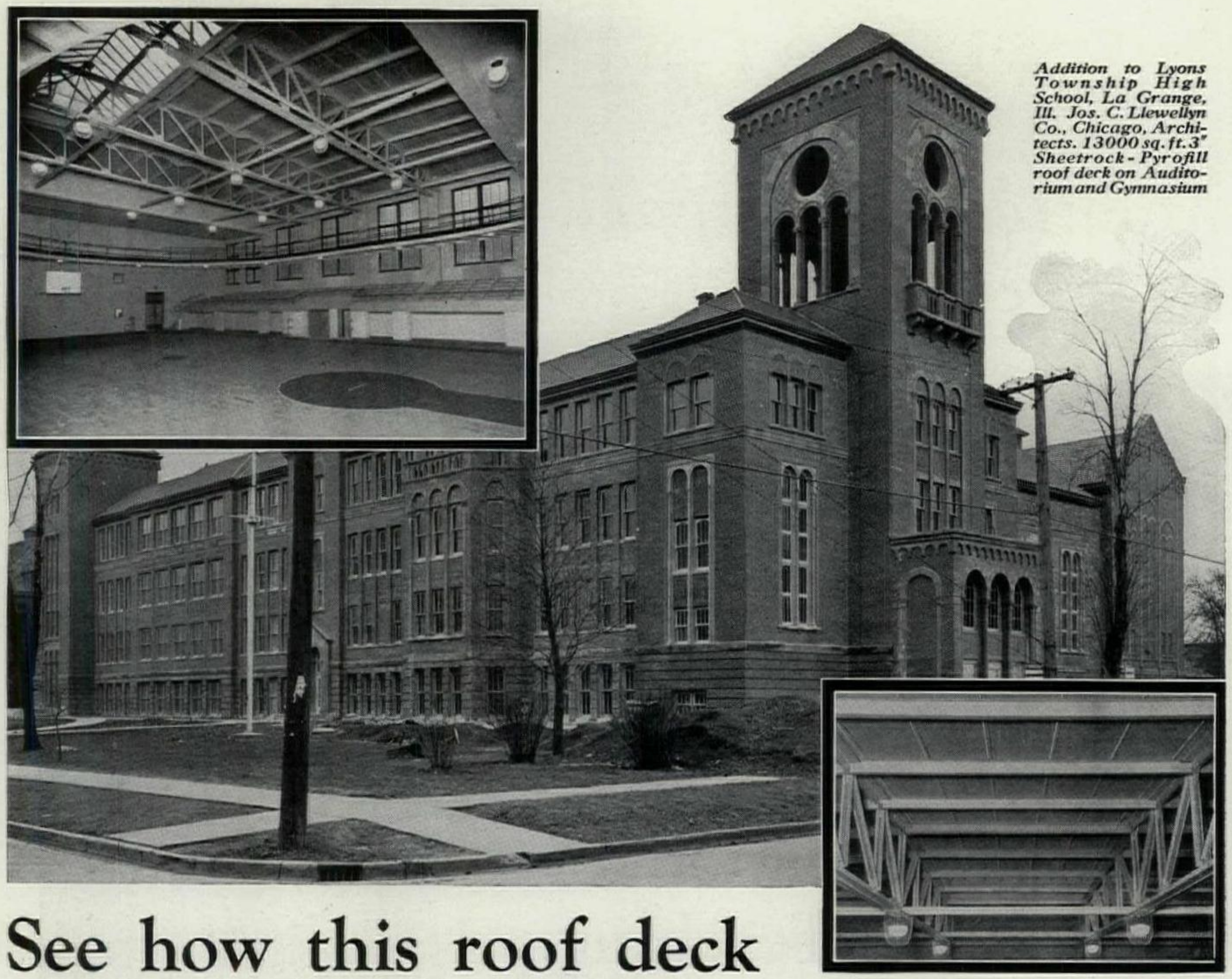
Heggie-Simplex Boiler Co., Joliet, Illinois. Representatives in principal cities — telephone and address listed under "Heggie-Simplex Boiler Company."

HEGGIE-SIMPLEX

ELECTRIC-WELDED STEEL HEATING BOILERS



Addition to Lyons Township High School, La Grange, Ill. Jos. C. Llewellyn Co., Chicago, Architects. 13000 sq. ft. 3" Sheetrock-Pyrofill roof deck on Auditorium and Gymnasium

See how this roof deck solves the problem

GYMNASIUMS, auditoriums and similar steel framed buildings require roofs with these definite characteristics: Roofs must be light in weight to save supporting steel. They must insulate effectively. Must be economical in first cost and low in maintenance. They must present a good appearance and reflect light. See how completely the Sheetrock-Pyrofill roof on the gymnasium of the new Lyons Township (Ill.) High School meets these requirements.

Sheetrock-Pyrofill is a fireproof reinforced gypsum construction with a Sheetrock undersurface. It has light weight without sacrifice of strength. It provides a positive insulation that permits accurate heat control and appreciable fuel economy. The initial cost is moderate and the maintenance negligible. It gives a finished appearance.*

For complete data on Sheetrock-Pyrofill roof construction, just mail the coupon.

UNITED STATES GYPSUM COMPANY
General Offices: 300 West Adams Street, Chicago, Illinois

SHEETROCK-
PYROFILL
Reg. U. S. Pat. Off.
ROOF DECKS
Made by the United States Gypsum Company

*APPEARANCE

The above close-up of the Lyons Township High School gymnasium shows the smooth, paneled undersurface of the Sheetrock-Pyrofill roof deck. This undersurface provides, also, maximum diffusion of light and requires no initial painting or surfacing. There are no projecting ribs to catch dust, and no joints or form marks to mar the effect of good design. A "finished" appearance, however, is but one of its many advantages.

USG
STANDARD BUILDING
MATERIALS

Mail this Coupon Now

UNITED STATES GYPSUM CO.
300 W. Adams Street, Chicago, Ill.

Please forward your special information on Pyrofill Construction.

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Architectural Forum, March, 1928

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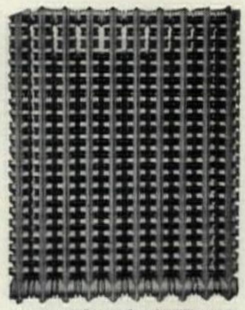

A typical stack of VENTO Cast Iron Heaters

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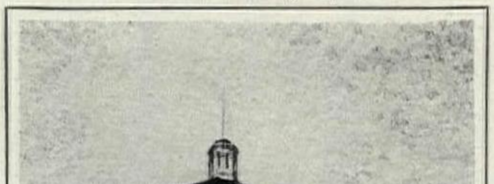
Architect
S. G. Davenport, Montreal, Canada
Ass't. Architect
Meyer Strong & Jones, N. Y. C.
Consulting Engineer
Wilson & Kearn, Montreal, Canada
Ass't. Consulting Engineer
John Colford, Montreal, Canada
Heating Contractor
B. F. Sturtevant Co., Hyde Park, Mass.
Blower Company

The 10,418 square feet of VENTO installed in the Royal Bank of Canada is further indication of the rapidly growing preference for VENTO Cast Iron Heaters. The thousands of installations in our great skyscrapers and modern buildings of all types are convincing proof of VENTO'S superiority. Engineers, architects and building owners find in VENTO the utmost in durability, perfect control and operating efficiency at a decidedly lower initial cost.



ROYAL BANK *of* CANADA
Montreal, Canada

AMERICAN RADIATOR COMPANY

VENTO DEPARTMENT: 816-820 South Michigan Ave., Chicago

Makers of IDEAL *Boilers,* AMERICAN *Radiators,* ARCO *Tank Heaters,* VENTO *Ventilating Heaters,* AIRID *Air Valves,* MERCOID *Controls and devices for drying, humidifying, cooling and refrigeration.*

Showrooms and sales offices: New York, Boston, Providence, New Haven, Newark, Philadelphia, Baltimore, Washington, Richmond, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, Atlanta, Chicago, Milwaukee, Indianapolis, St. Louis, St. Paul, Minneapolis, Omaha, Kansas City, Denver, San Francisco, Los Angeles, Seattle, Toronto, London, Paris, Milan, Brussels, Berlin.

"— or equal" can't give you UNIVENT VENTILATION

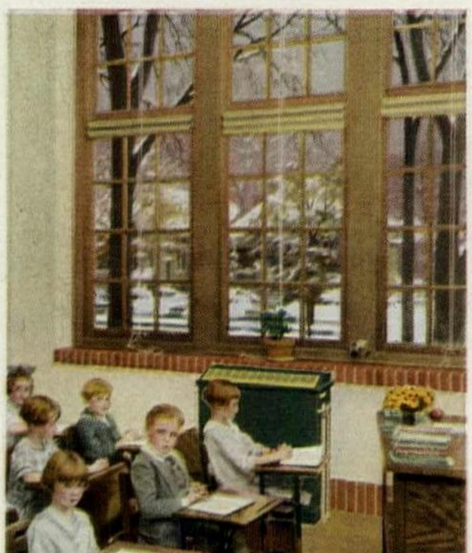
because Univent results are due to exclusive features that cannot be duplicated

SUCCESSFUL results of the Univent have brought national recognition to the basic idea of unit ventilation. With success has come imitation; but— imitation is not duplication.

Thanks to the architect, this fact is becoming known to the public: the results of Univent Ventilation *cannot* be duplicated by any other unit ventilator. The Univent's important features *are* exclusive to the Univent.

The Univent is a complete individual ventilation machine which draws fresh air directly from out of doors, cleans it, warms it to a comfortable temperature, distributes it gently, silently yet thoroughly throughout the room. Windows may remain shut. Dangerous drafts are eliminated.

For schools, hospitals, telephone companies, office and public buildings, the Univent has created a new standard of helpful, economical ventilation. The Architects' and Engineers' edition of "Univent Ventilation" will be gladly sent to you upon request. The Herman Nelson Corporation, Moline, Illinois.



Univent *and* Glass *make the difference*

UNIVENT

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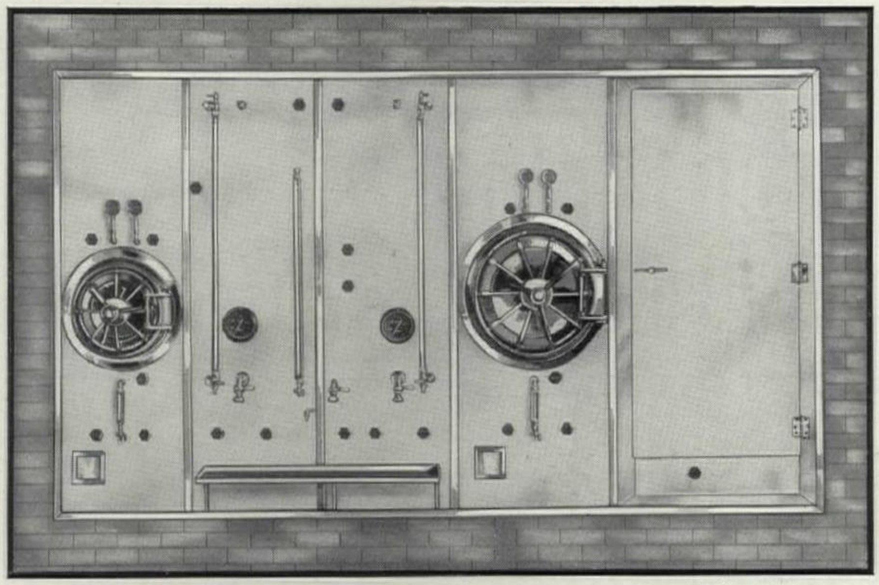

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Built-in Battery
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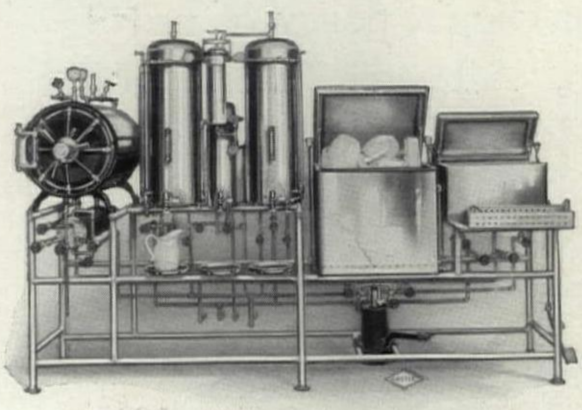
Castle Sterilizer Service Rendered by Competent Service Agents

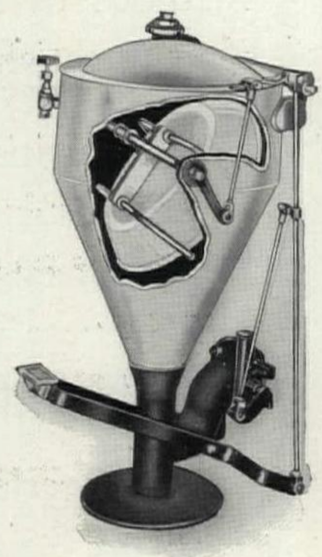
Castle service and sales representatives are near you to give competent advice and data on any sterilizer installation you contemplate. Write us your requirements and you will be called on at your convenience.



Complete Battery, A-005 for 50-Bed Hospital

Skilled Engineering Service

Castle engineers at Rochester will be glad to cooperate in furnishing plans, lay-outs, specifications and advice for new installations. Correspondence is invited from superintendents, consultants, architects and contractors. Data furnished without obligation on any installation on submission of general requirements.



Bed Pan Washer and Sterilizer

The Castle Bed Pan Washer and Sterilizer has the endorsement of prominent hospital executives because it actually does the work it is supposed to. A patented and exclusive washing feature gives this surety. Write for details and installation specifications.

WILMOT CASTLE COMPANY 1209 University Avenue Rochester, N. Y.

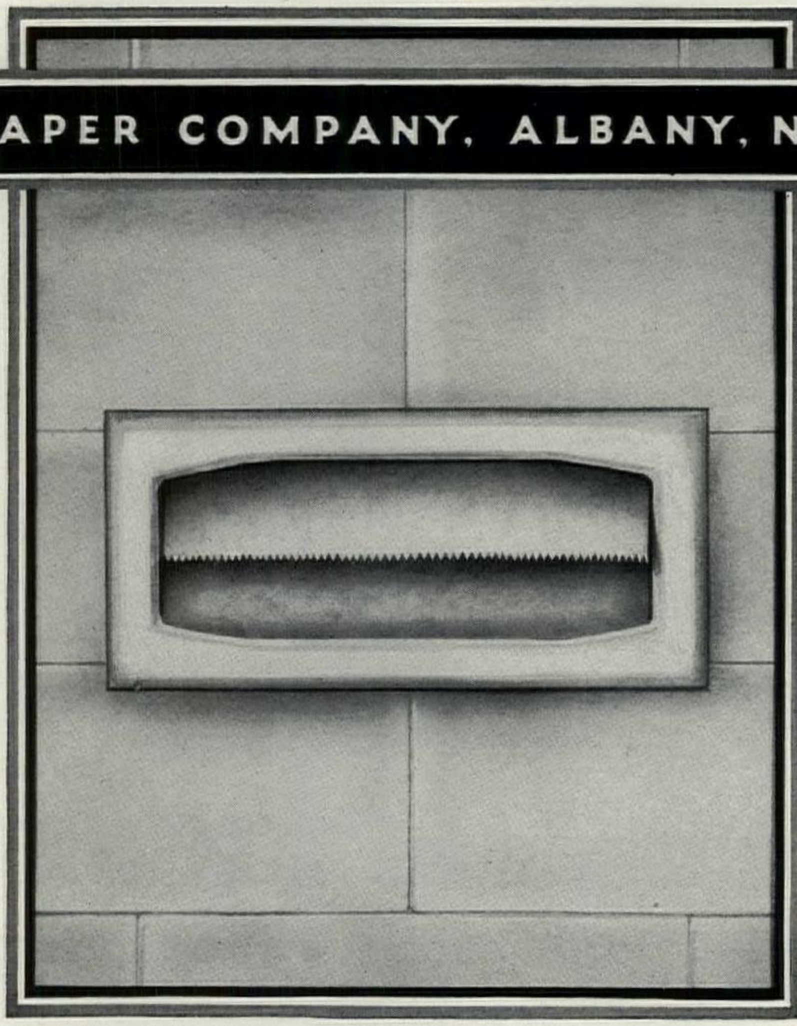
Largest line of Hospital, Physicians', Dental and Bacteriological sterilizers

CASTLE

FOR DATA ON CASTLE BUILT-IN STERILIZERS FILL AND MAIL TODAY

NAME.. ADDRESS..

A. P. W. PAPER COMPANY, ALBANY, N. Y. U. S. A.



Onliwon toilet paper cabinet cast in solid white porcelain to fill recess wall tile space.

This silky tissue pleases guests

ONLIWON toilet paper pleases discriminating guests. They are quick to appreciate its soft, smooth, satin texture.

So most of the fine hotels and buildings throughout the country have found it pays them to rely on Onliwon service exclusively. Such nationwide acceptance is the result of Onliwon's three outstanding features—*beautiful cabinets . . . finer paper . . . less waste.* A. P. W. Paper Company, Albany, New York, U. S. A.

Onliwon

TOILET PAPER AND PAPER TOWEL SERVICE

BOOK DEPARTMENT

A WORK ON STRESSES, GRAPHICAL STATICS AND MASONRY

Reviewed by FRANK W. SKINNER, CONSULTING ENGINEER

WHEN the seniors of today were students in schools or colleges, wooden beams, girders, columns and trusses were being displaced by wrought iron; the requirements for framed structures were usually vague and arbitrary, the strength and other properties of the materials used were not well or widely determined, and methods of analysis and computation of stresses were crude and inadequate. In the early days of some of our leading technical colleges, instruction in calculation and design of structures was largely derived from the applied mechanics of Rankins and Weisbach and the analytical and graphic methods of Greene and Wood for computing truss stresses, supplemented by the interpretations and extensions of some notably brilliant lecturers in classrooms. The student learned, maybe, to calculate the stresses in a few simple types of structures, under more or less accurate assumptions, and attempted to take out an insurance policy for ignorance by the use of a "factor of safety," large enough to cover uncertainties, mistakes, and "acts of God." Now, the analysis of structures and computation of stresses are a highly perfected art, with a multitude of writers and teachers producing numerous papers and textbooks, some of high value,—and some conflicting,—that not only cover a wide field with elaborate data, but by their volume and variety appall the student and the ordinary practitioner. A great service has therefore been rendered to architects, engineers, and other designers and students, in the preparation by Dr. Swain of this complete, up-to-date, authoritative description and analysis of structural stresses, with clear and simple demonstration of the best and the most accurate methods for their rapid, practical determination by analytical and graphical methods that verify each other.

By also discussing the theory and design of masonry structures, giving the fundamental principles and methods of their application in equally convenient and comprehensive manner, the author has so practically covered the two great classes of steel and masonry that are the first essentials in nearly all important structures, that the competent designer may safely adopt his methods, formulæ, and supplementary data with great economy of time and labor, and assurance of accuracy and compliance with high standards. This book deals with stresses developed in structures of wood, metal and stone, chiefly buildings, bridges, sub-structures, and their elements, that are subjected to stress in tension, compression, flexure, and torsion; and defines and studies the dead and live loads and their reactions that constitute the outer forces which produce the inner forces of stresses that are analyzed and calculated. Valuable data are given of the amounts, character, application and effects of various kinds of loads, including snow, wind, crowds, trains, vehicles, merchandise, earth pressure, liquid pressure, etc.

In Chapter X, Dr. Swain places the first use of the truss idea in about the year 1560, and sketches the development of the principal types of trusses up to date. He devotes five chapters to stresses in trusses, the analytical method of joints, and the methods of moments, with abundance of diagrams, formulæ, explanations and examples. The chapter on economics of simple trusses considers the most advantageous determination of various requirements besides the bare consideration of minimum weight. Several of the book's chapters are devoted to graphical statics, their general principles, and the determination by them of reactions, moments, shears, centers of gravity, moment of inertia, and of stresses by the methods of moments and of joints. The chapters on dimensioning and impact give the most advanced methods, standards, theories and observations, contain extracts from specifications, and give data of great practical value, derived from tests, experiments and investigations, including the impact percentages found in working structures, and the velocity of transmission of stress in materials. The treatment of these subjects is well considered.

The nine chapters covering earth pressure, masonry, retaining walls, piers, arches and dams, give extended consideration to the cohesion of earth, friction, angle of repose, surcharge, comparison of theories, hydrostatic and hydraulic pressures, experiments, masonry types, repose, specifications, rules and principles of design, stresses, strength and stability, and detail and design of retaining walls, loads, shape and dimensions of piers and abutments, theory of loads, stresses, design, types and details of hinged and hingeless arches, linear arches, and concrete arches. Dams are considered as substantially straight or curved retaining walls, holding back water instead of earth. Vertical, horizontal, and inclined pressures, uplift, cross section, stresses and stability, foundations, spillways and expansion are considered; diagrams, formulæ, and notable examples of important structures are given. The remarkable clearness, attractive presentation, logical treatment, and the combination of mathematical and scientific accuracy, with practical considerations that characterize the entire book, are the natural expression of Dr. Swain's notable experience and services as a distinguished educator and eminent practicing engineer of many years' prominence as Gordon McKay Professor of Civil Engineering, Harvard University; Chairman, Boston Transit Commission; Consulting Engineer, Massachusetts Railroad Commission; Past President American Society Civil Engineers; member of many technical, scientific and engineering societies; consulting engineer, and author of many papers and monographs.

The book is equally valuable for reference, for study, and as a working tool. It is at once a handbook, a summary, and a very complete treatise that reduces difficult and complicated problems to their lowest terms, and solves them by the obvious application of simple rules and principles without complex operations, tedious calculations, or intricate mathematics. It should find a place in every technical school and library, and be indispensable for every structural designer as well as to many architects.

STRESSES, GRAPHICAL STATICS AND MASONRY. By George F. Swain, L.L.D. Professor of Civil Engineering at Harvard University. 525 pages, 6 x 9 ins. Illustrated. Price $5. McGraw-Hill Book Co., 370 Seventh Avenue, New York.

Any book reviewed may be obtained at published price from THE ARCHITECTURAL FORUM

THE A. B. C. OF PLASTERING. By A. H. Telling. 235 pp., 5 x 7½ ins. Price $3.25. Oxford University Press, New York.

ONE of the consequences of the present high costs of construction seems to be careful study into use of materials and methods of building in order to secure whatever may be had in the way of economy in using materials and the best possible results when a building has been completed. Thus different aspects of carpentry, wiring for electricity, and the installation of plumbing, heating and ventilating equipment have been dealt with, and numerous manuals are being published for the guidance of artisans and for the information of architects and their specification writers. The present volume deals with plastering, discussing its history as well as its practical use. While written from an English point of view and making use of terms which are no doubt different from those used in America, the work supplies a most excellent manual for the use of plasterers anywhere.

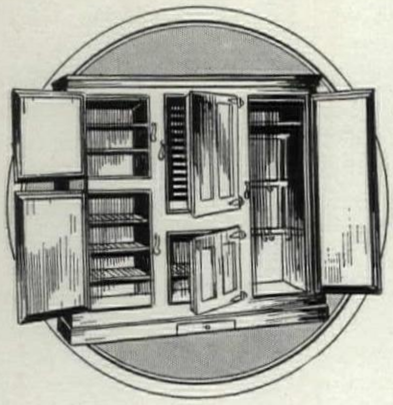
CIVIL ENGINEERING SPECIFICATIONS AND QUANTITIES. By G. S. Coleman and G. M. Flood, 282 pp., 5½ x 8½ ins. Price $4. Longmans, Green & Co., Ltd. New York.

DURING the past year the presses of many large publishers have been producing volumes dealing with engineering in one or another of its phases, with materials and their use, and with other subjects which to engineers and builders are interesting details of theory or practice. These works are of value not only to established engineers, who desire to keep abreast of the latest, but also the large number of engineers who each year leave academic halls for practice in the field.

This particular work, by two widely known English engineers, deals with its subject from what is naturally an English point of view, and it might be regarded, in a sense, as setting forth the very fundamental elements of professional practice. It deals with the duties and responsibilities of a civil engineer to his clients and to the public in general; with his relations to contractors; with countless matters in regard to contracts and the methods of dealing with the municipal boards or authorities with which civil engineers generally have to do. Then it takes up the choosing of materials, their use, and the matter of the workmanship which is required for the proper use of materials, and then the highly important matter of preparing adequate specifications for the economical obtaining of just what is required; and finally the estimating of the quantities of material which will be needed, and their costs, which logically have much to do with the matter of obtaining cost estimates. The broad scope of the work and the excellence and clarity of its presentation give it a highly practical value to engineers and architects.

WOOD AND LUMBER. By Adnah Clifton Newell. 211 pp., 6 x 9 ins. Price $2.25. Manual Arts Press, Peoria, Ill.

IT is doubtful if the use of any of even the most adaptable building materials will ever equal in extent the use of wood. Wood enters and always has entered into the construction of buildings of every conceivable kind, and it is not likely that anything else will ever be found to take its place. The wide use of wood naturally gives importance to consideration of its qualities, and study of



wood's qualities or characteristics forms the subject matter of this volume, one of the useful works of a more or less technical nature being published by the Manual Arts Press. The author, who is Director of Manual Arts at the Illinois State Normal University, considers the nature and characteristics of woods of different kinds, their growth and composition, matters which have to do with their strength, liability to shrinking, swelling, warping, durability, decay, etc., and part of the volume is devoted to the important matter of wood preservation. The latter chapters are devoted to consideration of lumber, the term used apparently when the wood of a tree has been made ready for marketing and use. These chapters deal with "Lumber Classification and Grading," Lumber Manufacture," and "Sizes of Lumber," fully and adequately.

CONSTRUCTION DETAILS SHOWING MODERN APPROVED PRACTICE. 160 pp., 9 x 12 ins. Price $1. Building Age and National Builder, New York.

CERTAIN individuals fully familiar with developments in the building field report that with the slipshod methods by which workmen construct a large part of the building which is being done today there is danger of the trades' losing that strong grasp upon their work which in all ages of our history has characterized the American workman,—a knowledge which has always been a cause for honest pride. The danger, it is further pointed out, is all the greater in that the trade or "vocational" schools, the function of which is to train mechanics or workmen for the different building trades, may find themselves obliged to train men to work not according to traditional standards but to the far less admirable standards maintained by present-day contractors and sub-contractors, the inference being that workmen not so trained may find themselves handicapped when they begin actual work. And yet, as is well known, these trade schools are responsible for training a great part,—possibly greater part,—of the men who must maintain and carry on the traditions of American building. The failure of the schools, by lowering their standard, will mean logically the destruction of the traditions behind the different trades. This valuable work, prepared by the editorial staff of *The Building Age and National Builder*, is intended for the guidance of carpenters, architects, draftsmen, detailers, contractors and others concerned in building construction.

"Today there is no question before the building industry more important than that of better building. To build to last, we must not only use good design and materials, but also follow correct methods of erection. In that way we will build comfort, convenience, fireresistance and permanence into every structure. This book is not an attempt to impose dogmatic ideas of detailing on its readers. The details presented here, have been gained from widely scattered sections of the country. A sincere attempt has been made to serve all localities without discrimination. Buildings erected according to these details can be relied upon as being in line with the best practice of the day. They will not be classed as shoddy; they will be the type of structure that future citizens will look back upon with pride,—the work of master builders of our age and representative of their methods."

The work discusses every detail of building and equip-

ment,—wood joints, stucco on frame construction and monolithic concrete; double concrete walls; building with brick and hollow tile; balloon and braced frame construction; shingling and other forms of roofing; millwork; heating of different types. Every detail is considered and illustrated with diagrams and in many instances with working drawings. It is a valuable handbook on building, and its teachings are in accord with the best building practice which is obtaining today.

STANDARD CONSTRUCTION METHODS. By G. Underwood. 407 pp., 6 x 9 ins. Price $5. McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York.

THERE would seem to be no lack of recent works dealing with construction in its many and varied phases, the intention of their authors being no doubt to supplement the training which the workman receives in his trade school and to constitute a kind of encyclopædia or guide to standard practice to which the workman or the superintendent of building may refer. This particular volume, the work of a well known construction engineer, is one of the fruits of considerable experience and much observation. Primarily the book is intended for the use of construction superintendents and others upon whom the responsibility of getting things done may rest. It covers a wide field, as is essential if it is to be useful to men who are expected to have a wide general knowledge of construction work.

"The author has endeavored to make simplicity and preciseness the outstanding characteristics of the book. He has adhered to simple principles and has described only such methods as he has found to be the most useful in the ordinary run of work. Descriptions of 'stunts' and unusual methods have been carefully avoided. In planning the book, each subject has been visualized from the standpoint of a construction superintendent, and the usual and most up-to-date way of doing the work has been described. Sufficient other information has been given in each chapter to make clear the science of the subject. The different classes of work have been arranged in chapters following one another in accordance with the sequence of operations usually followed in construction projects, describing all the steps necessary to carry on a project from excavation to painting. The introductory chapter suggests the organization of the construction force and the layout of the plant and describes the various pieces and types of equipment used on an up-to-date construction project. The first step in the operation being excavation, this is discussed including layout, retaining measures, blasting, water control, and pile driving. Following this, the major portion of the book deals with structural operations divided according to the kind of materials used,—that is concrete, brick and steel construction, describing in some detail each of these materials and the operations and equipment used in assembling them. In the chapters on "Roofs and Flashing," the author seems to have confined himself almost entirely to the application of various kinds of built-up or composition roofing on flat roofs. The interior finish of buildings is then discussed under the heading of "Lathing and Plastering." Following this more detailed information is given on the subject of equipment in a chapter on "Scaffolds," their planning and erection.

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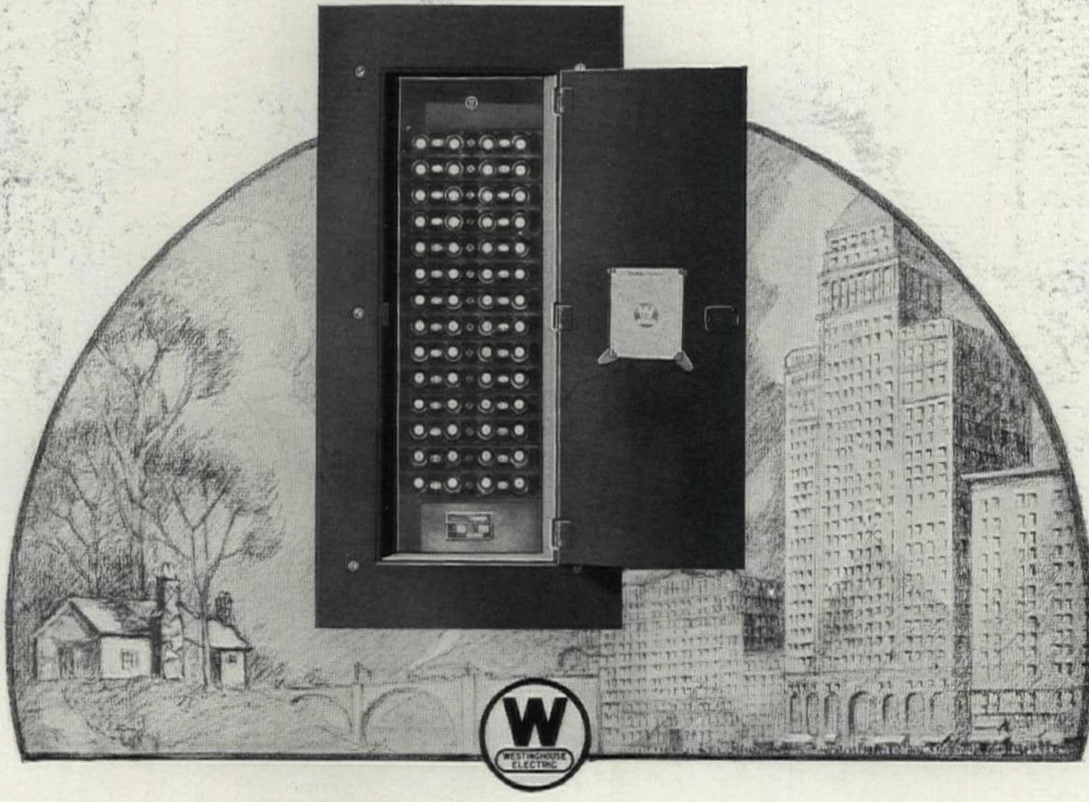

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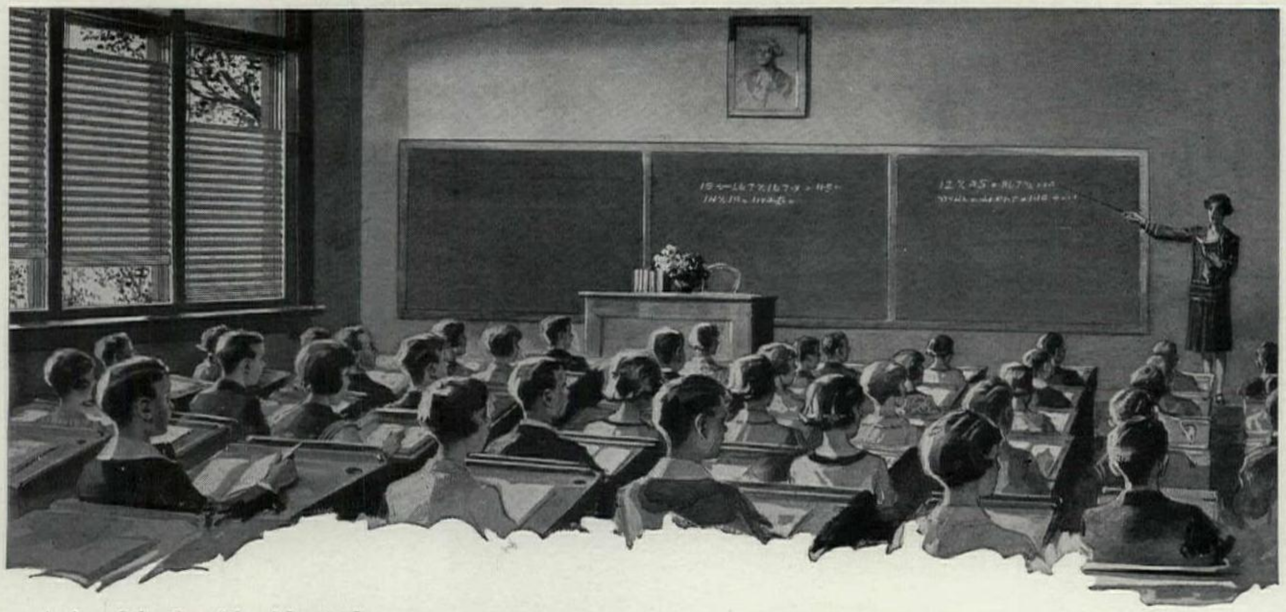

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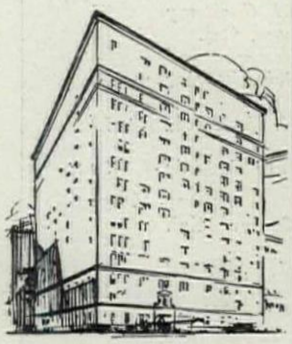
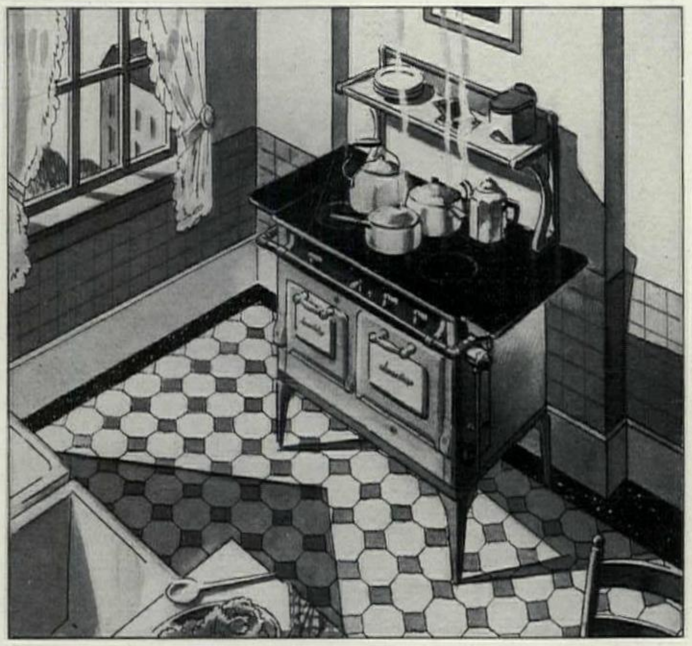
"SMOOTHTOPS SAVE SPACE"

—Sigmund Solomon



"845 West End Avenue" Where light, airy kitchens space themselves around Smoothtops . . . .



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Tooker & Marsh, Architects

THE
ARCHITECTURAL
FORUM

VOLUME XLVIII NUMBER THREE

MARCH 1928

THE CONSTRUCTION OF SCHOOL BUILDINGS

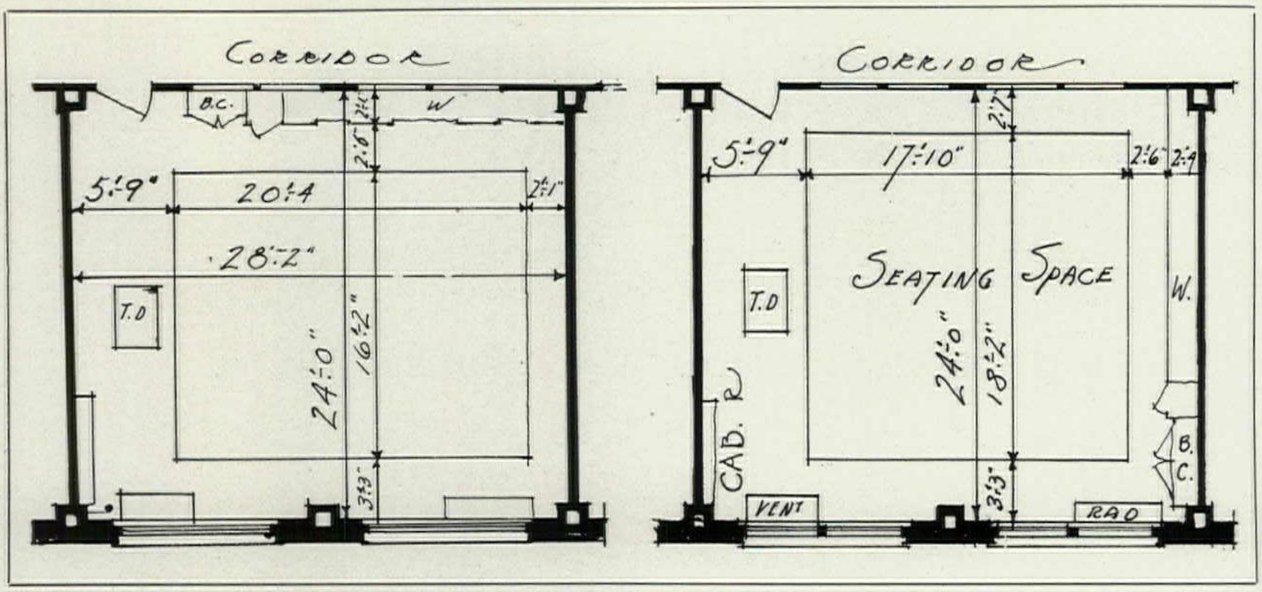
BY
C. B. J. SNYDER
FORMER SCHOOL ARCHITECT FOR NEW YORK

ALTHOUGH all school buildings are intended for the same general use, they present an unusually wide range of construction problems. They vary in size from one to almost 200 rooms, and in height from one story to ten or more. These differences in size are entirely physical, but the character of the scholastic curriculum has an important influence on the construction of a school building. The curriculum usually includes a wide range of subjects, many of which require specific accommodations. The development of and changes in curricula are continuous and sometimes of a decidedly radical nature, and to attempt to envisage their future nature and requirements would be impossible. To provide for new and often radically changed needs requires construction that has a certain measure of flexibility. The correct limitation of materials permits easy and economical alterations and changes in the structure and plans. The architect must consider the possibilities of the site; the required pupil capacity; the amount of money available; the scope and nature of the curriculum; the probability of the necessity of enlarging the building to accommodate an increased pupil population; the probability of there being new and specific requirements for future developments in teaching methods and additions to the curriculum. More remotely, the architect has to consider also the possibility of there being a radical change in the character of the population of the surrounding territory; the intelligence and the ability of the superintendent of schools and the board of education; and public opinion. The factors involved render the designing of a school building a most complex problem.

The operation of a public school might be likened to a production process. The school building should be planned in essentially the same manner as an office or loft building. Suitable facilities for safe entrance and exit of the occupants are essential. In addition, sufficient means of circulation through corridors and stairways is also necessary. With these essentials provided for the safety and convenience of the pupils, the remaining working space should be laid out in such a manner that it can be subdivided to suit general and special requirements as they arise.

Types of Construction. The usual types of construction, from a structural standpoint, used in building schools are the wall-bearing type and the skeleton-frame type. The former usually has brick outside walls and brick bearing walls for the corridors. The floor and roof construction may be of wood, either simple frame or heavier "mill" construction; or light steel or the newer steel trussed joists may be used, fireproofed or not. There are many variations and combinations possible, such as the use of steel beams to support the shorter floor joists, etc. Fireproof construction is not usual in a wall-bearing type of building. Some of the materials may be incombustible or some slow-burning, but fireproof buildings are today practically all of the skeleton-frame type.

Wood and "Mill" Construction. School houses to accommodate a small number of pupils can be very satisfactory when built of wood or standard mill construction, in connection with brick exterior walls and corridor partitions. They can be made entirely safe with certain obvious precautions. The element of fire protection is one of the most important in schoolhouse planning, allied to which is the necessity of providing sufficient means for circulation and egress in case of possible panic conditions among the pupils. Panics may be caused by means other than fire, and if sufficient circulation and exit facilities are provided, fire protection can be safely limited to the construction of fireproof boiler or furnace rooms and the insulation of heating or ventilating ducts and steam pipes. There is little cause for fire hazard in a school building except in these items and in the accumulation of rubbish in basement rooms or closets. Although the wood stud partitions are generally and usually quite rightfully considered a fire hazard, they can be so fire-stopped that with metal lath and plaster they are fire-resistive to a high degree. It is feasible in this type of building to construct fire partitions of hollow tile, made either of clay or gypsum, or solid metal lath and plaster. The only other problems in connection with a mill-constructed school building would be the soundproofing of the floors so that the noise of moving pupils would



Side Wardrobe — End Wardrobe

Typical Classroom Plans

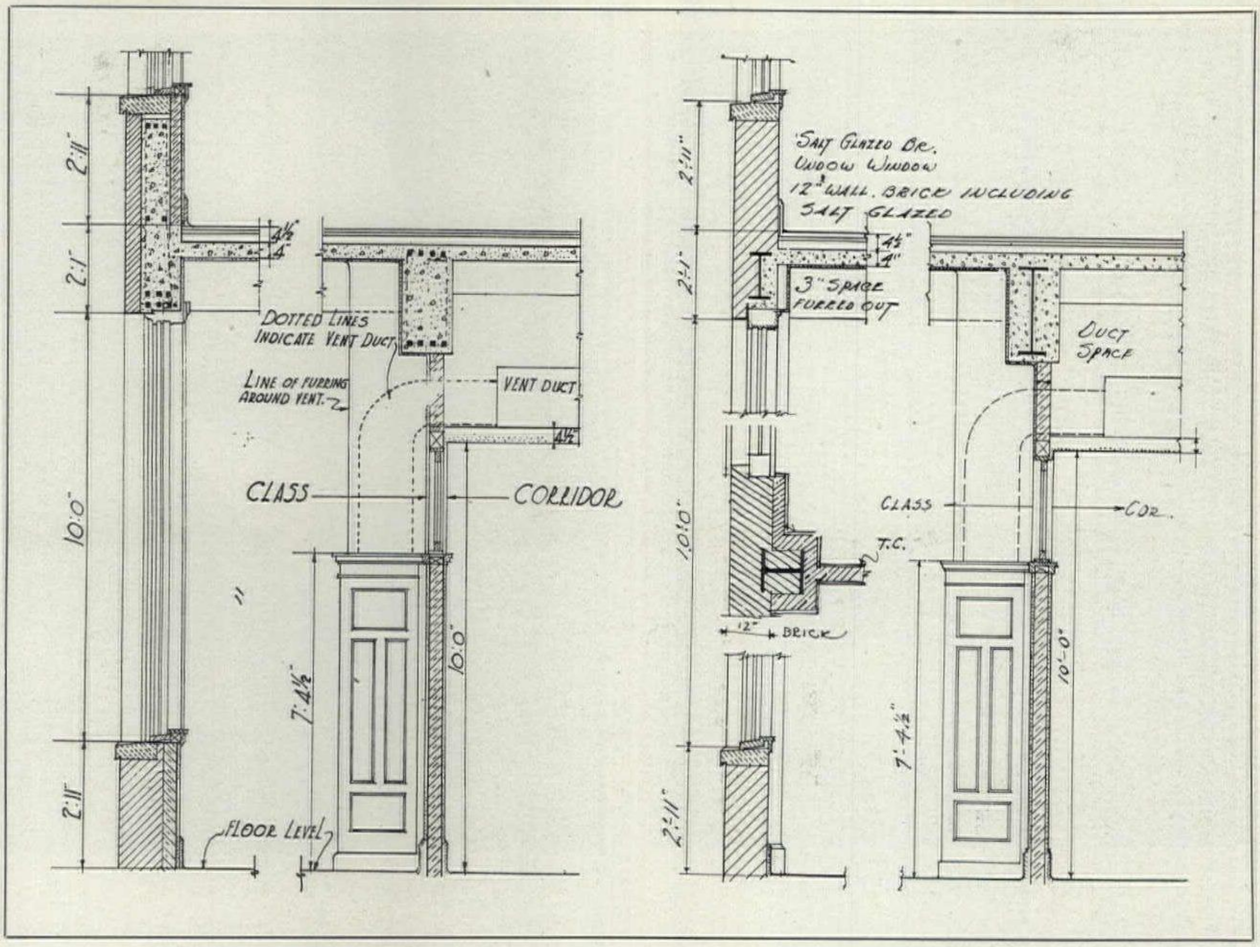
not be transmitted from one story to another. It is not likely, however, that buildings of this type would be more than two stories high. There could be no question whatever about the safety of such buildings if they were equipped with automatic sprinklers.

For the light floor loads common to school buildings, a form of steel construction which consists of light steel trussed or bar joists or pressed steel joists has been found very satisfactory. These are placed approximately 2 feet apart, and on them is laid a thin concrete floor slab with such a finished surface as is desired. The ceiling is usually constructed of metal lath and plaster or a gypsum slab.

Skeleton Frame Construction. Larger school houses are quite commonly built with skeleton frames. These frames are either constructed of structural steel or of reinforced concrete. Hollow tile arches or reinforced concrete slabs are used for floor construction. The type of construction selected is influenced largely by the plan of the building and to a certain extent by the methods adopted for heating and ventilating. The ventilating system often includes vertical ducts which supply air to the rooms and exhaust it therefrom. It is readily apparent that when these ducts are built in the walls between two adjoining rooms they become a permanent structure and cannot be removed to another position without great expense, as this would amount to a practical rebuilding of the ventilating system. When the ventilating ducts are placed along the corridor walls it is possible to remove the partitions between rooms and rebuild them at any desired place. The location of ventilating ducts therefore differentiates the *fixed* from the *flexible* plan. Greater flexibility of plan is secured by placing the main ventilating ducts in the corridor ceilings with openings into the upper parts of the classrooms. If these openings are placed in such a way as to furnish the half-units with the required amount of air, the cross partitions can be placed at will without any interference whatever with the ventilating system. This is perhaps the most flexible plan which has yet been devised for schoolhouse construction.

It is becoming increasingly popular to select the classroom as the basic unit. For this unit two window openings are sometimes provided, which permit this standard unit to be divided in half or to be extended longitudinally to one or more units in length, according to the requirements. In this way it is entirely feasible to plan a schoolhouse without reference to the classroom by merely setting up the limits of the corridors and stairways, permitting the remaining space to be divided into classrooms and laboratories as desired.

The equipment of a modern schoolhouse is such that each lineal foot of wall surface is definitely allocated to some particular use. This wall use is divided between blackboards, various kinds of cabinets, bulletin boards, map spaces and other facilities. In some schools a certain proportion of the wall is utilized for wardrobe cabinets, so that they will be under the constant surveillance of the teacher in charge. Many school authorities prefer this system to the cloak room system, where the wardrobe is entirely removed from the classroom. The wardrobe placed in the school room is saving of floor space because of the elimination of a partition, and the aisle of the school room also serving the needs of wardrobe use. In other words, the area of a partition and an aisle is saved in the plan. In junior and senior high schools where the pupils are not assigned to any particular room, these wardrobes are often placed in the corridors so that they can be accessible without disturbing the occupants of any one room. It can readily be seen that where the walls of the classroom or laboratories are entirely utilized by standard equipment, designed to fit a certain size classroom with a certain size column, an increased size of columns would disarrange this standard equipment and require either a redesigning of the equipment or mak-



Reinforced Concrete Frame

Structural Steel Frame

Typical Sections

ing the rooms larger in order to provide the necessary lineal feet of wall. The type of fireproof construction used results in a minimum or an increased area of ground coverage due to these conditions. The thickness of the exterior wall is affected by the type of skeleton construction used. In one instance a 12-inch wall may be sufficient as compared with a 16-inch wall required by another type of construction. This would naturally affect the extreme width and length of the building a foot or so. The true worth of the structural parts of the school building is established by their comparative strength, durability and adaptability. All of these characteristics should be possessed in the maximum degree. The strength of the materials should be susceptible of accurate determination, not merely based on a theoretical assumption, before they are incorporated in the structure. The materials should possess an enduring strength which does not decrease with age. All materials of whatsoever kind are injuriously affected by exposure to the elements, and this characteristic entails the necessity of protecting them by means of adequate weatherproofing and fireproofing. It sometimes happens that some materials are commonly accepted as unaffected by exposure to air and moisture in combination, or to fire. Observation of their endurance performance under exposure, however, has demonstrated the necessity of providing essential protection.

Adaptability to Other Uses. The adaptability of the structure to new requirements vitally affects its value. This can be secured only by such a plan in combination with structural parts that are susceptible of alterations, removal, replacement or reinforcement. It sometimes happens that the character of a neighborhood so changes that the need of the school ceases to exist. The problem, then, is whether to adapt the building to an entirely new use in order that it may yield a profitable income or demolish it. In the latter case, the cost of demolition and the amount of valuable salvage are important in establishing the sale value of the property.

Comparative Costs. The comparative initial cost of the structural frame does not establish its real value in the structure. A true comparative cost is determined only by making an estimate of cost based on complete sets of plans and specifications for each of the types of construction. Either one may affect the cost of the foundations because of the difference in the dead weight of the structure; the cost of installing the heating, ventilating and sanitary systems may vary; the cost of plastering, carpentry and brickwork may also be affected. These costs can be known only by making careful, individual estimates.

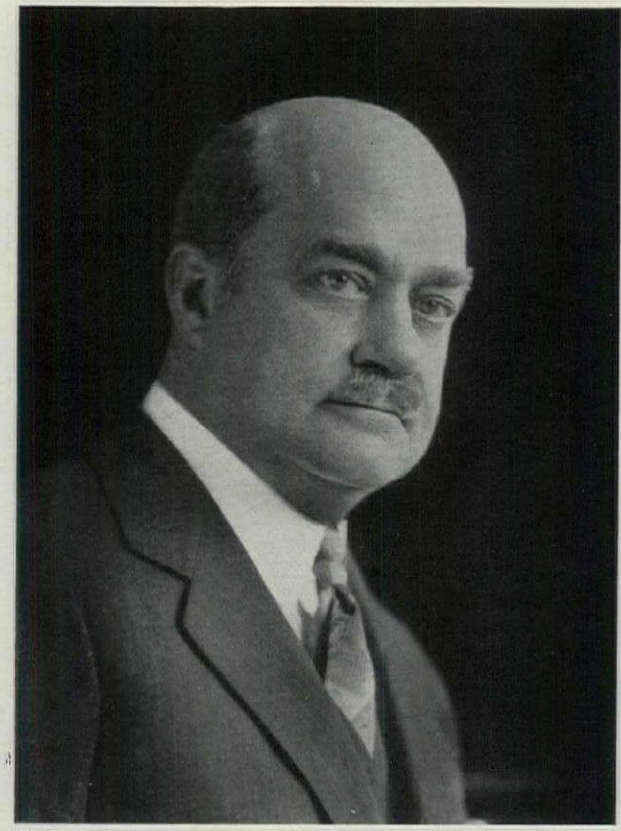


Photo. Strauss

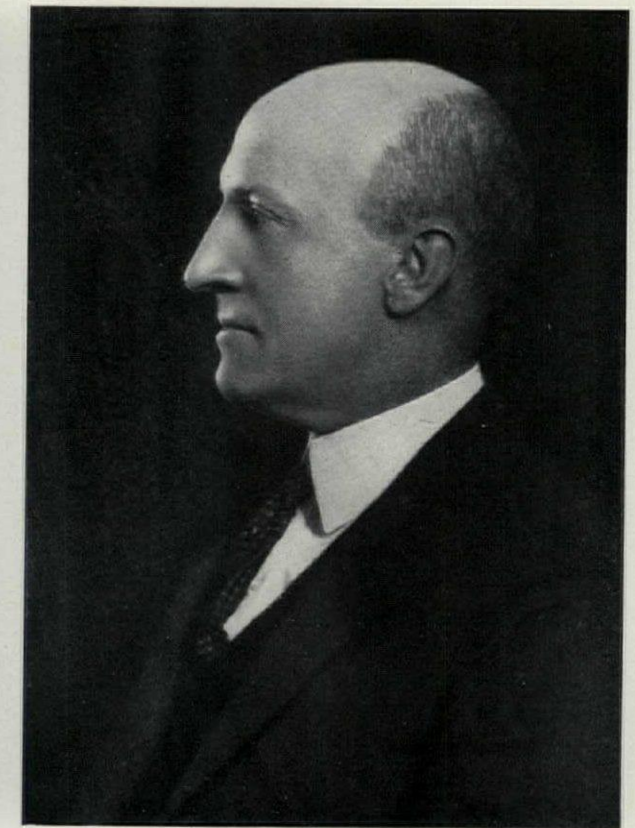


Photo. Potter

WILLIAM B. ITTNER

WILLIAM BUTTS ITTNER was born, September 4, 1864, in St. Louis. He attended the public schools and the Manual Training School of Washington University, and was graduated as a special student of Cornell University in 1887. Travel and study abroad supplemented his education and enriched his professional preparation. He took up his profession with Eames & Young in St. Louis in 1888, establishing an office of his own the next year. In 1897 he was elected Commissioner of School Buildings for St. Louis, and continued to serve in that capacity until March, 1910, when he was elected architect for the Board of Education, which position he filled until 1916. During the past decade Mr. Ittner has served 59 cities and towns in 24 states as planner and designer of schools. Mr. Ittner initiated and developed the "open plan" in school buildings, which automatically brought about maximum light and ventilation and better design. Aside from his school work, he was architect for the recently completed Scottish Rite Cathedral of St. Louis and many prominent buildings. The A. I. A. elected him to Fellowship, and a medal was presented to him for marked and meritorious achievement in the design and construction of school buildings by the St. Louis Chapter of the Institute, of which he was president in 1895-96. He has served as a member of the board of directors and an officer of the American Institute of Architects. Blessed with an excellent baritone voice and with a genial spirit, he takes great pleasure in music and dancing.

JAMES O. BETELLE

JAMES O. BETELLE was born in Wilmington, Delaware, April 1, 1897, where he attended the public schools. He started his architectural career by working for Cope & Stewartson, of Philadelphia. While there he studied at the School of Industrial Arts, and in 1900 came to New York to work for Cass Gilbert. He studied architecture at the atelier of Donn Barber and at other art schools in New York, going to Europe to study in 1905. Returning, he entered the office of John Russell Pope, where he remained until 1910. While with Cass Gilbert and John Russell Pope, he came in contact with Ernest F. Guilbert, and in 1910 they formed the partnership of Guilbert & Betelle. Mr. Guilbert died in 1916. From 1917 to 1925, Mr. Betelle lectured at Columbia University, on "Modern School Buildings and Their Equipment." The course was attended by school principals and superintendents from all parts of the country and from foreign lands, so that his influence on school architecture has not been limited to the buildings he has actually designed. Mr. Betelle believes that architects should render service to the community. Mr. Betelle is now president of the Newark Chamber of Commerce, a member of the North Jersey Transit Commission, and other civic bodies. Mr. Betelle is a past president of the New Jersey Chapter of the A. I. A., and he was elected a Fellow of the Institute in 1927. His hobby is his work, and he seems never to tire, in spite of the fact that he has had but one vacation in four years.

CHECKING SCHEDULE FOR NEW SCHOOL BUILDINGS

BY

JAMES O. BETELLE

GUILBERT & BETELLE, ARCHITECTS

IN order to start the preparation of plans and specifications for a new school building, the architect needs certain information. This information must be furnished him by the board of education after careful consideration and after consultation with the superintendent of schools. It would be of considerable assistance to all parties concerned if the various items on which information is needed or instructions desired could be brought together and listed in a convenient way, in order that they may be considered separately and consecutively and thereby develop the type of building to be erected, together with the materials to be used, and the facilities to be included. Such a list of items is given here, with the hope that it may prove useful to not only the architect, but to boards of education and to superintendents of schools as well. When all the questions suggested in the list have been answered, and the special information requested has been furnished, the architect is in a position to proceed with the preparation of his plans and specifications.

For the information of boards of education and superintendents of schools, it might not be amiss to outline the procedure the architect goes through in making his plans and specifications. The architect first makes preliminary plans and specifications, which he submits to the board of education and the superintendent, for their criticism and approval. Changes can easily be made in these preliminary plans, and possibly the architect will submit a number of different preliminary schemes before a final scheme is definitely decided upon and adopted. Preliminary plans and specifications are just what their name implies, and for the reason that they are preliminary, they can be easily modified and changed. Before approving the preliminary plans, the board of education and the superintendent should give ample time to their study, and the architect will gladly make any desired changes and adjustments in them until they are entirely satisfactory. The time for making changes and adjustments is during this preliminary plan stage, and not when the working drawings are being made or after they have been completed and estimates obtained,—or worse still, during the time when the building is being erected. These belated changes and adjustments cause delay and trouble all along the line, and may mean an additional charge by the architect for changing the completed plans and specifications, and by the contractor if the changes are made while the building work is in progress. From the preliminary plans the architect prepares his contract working plans and specifications, and when they are completed they are usually submitted to the board of education for final approval and authority to advertise for bids, and for sending them out to the contractors for estimates. It is also necessary that the final working drawings and contracts be filed with and approved by the department of education of the state in which the building is to be erected.

While it is the duty of the architect to include in his plans and specifications all the various features and instructions given him by the board of education, it is also the duty of the school board or its representative to know in a general way what the finished plans and specifications include or omit. It is practically impossible for the busy superintendent or the busier school board members to read through the entire specifications and check up everything on the plans, and it is with the idea of simplifying the checking of the plans by the superintendent and board members that this checking schedule has been prepared, which at the same time gives the architect the information with which to start his plans. It is the architect's duty to see that the plans and specifications are complete and agree with each other, and that the state and local laws applying to school buildings have been complied with. Also that the instructions given from time to time by the board of education as to the arrangement, materials or finishes are carried out, and that a complete and substantially safe building is produced when the plans and specifications are realized in brick, stone and mortar. The examination and approval of the plans by the superintendent of schools and the board of education is not made with the idea of relieving the architect of any of his responsibility, but simply to assure the owner that the general instructions given the architect have been carried out.

LIST OF ITEMS

Name of Owner:

Get the correct corporate name of the board of education to be mentioned in the specifications as owner of the proposed building. This is often worded incorrectly.

Kind of School:

- Consolidated school?
- Grade school?
- Junior high school?
- Senior high school?
- Manual training or commercial high school?
- Vocational school?

Organization of School:

- Scheme of organization should be given.
- Standard or traditional school program?
- Platoon, duplicate, or modified "Gary" system?
- Number of grades to be taught in the new building?

Capacity of Building:

Total number of pupils for which accommodations are now required?

Number of pupils in various class units? What excess pupil capacity is desired in the building now to be erected?

Rules for Computing Number of Pupils Accommodated in a School Building:

The American Institute of Architects and the Committee on Standardization of School Buildings of the National Education Association have both adopted this method:

> "Compute the number of pupils normally accommodated in rooms designed for classes only. Special rooms are to be figured at the actual number of

pupils accommodated for one class period only. Auditoriums and assembly rooms are to be ignored, but gymnasiums may be figured for one or two classes, as the accommodations may provide. No gymnasiums, however, shall be accredited with two classes, if below 40 by 70 feet in size."

It should be noted that the pupil capacity of a building computed on the basis given here represents a *maximum* capacity. It is not altogether desirable to begin the use of a new school building counting upon such rooms as laboratories, shops and other special rooms as home seats. After the school has been built a few years and before an addition can be constructed, it is often necessary to use these special rooms as home seats or stations for pupils, at which time the maximum pupil capacity will be reached. Pupil capacity can possibly best be stated as "maximum pupil capacity," in accordance with the A. I. A. and N. E. A. rules and upon which the cost per pupil is figured, and "normal pupil capacity," which is the desirable number of pupils any building will accommodate and which represents about 80 to 85 per cent of the maximum capacity.

Scheme of Study Rooms:

Number of study rooms and seating capacity of each?

Storage Rooms for Books and Stationery:

Give desired number, size, and preferred location.

Number and Sizes of Rooms for Different Purposes:

Number of classrooms and pupil capacity of each?

Number and kind of special rooms and pupil capacity of each?

The size of a standard classroom is easily determined when the pupil capacity is settled, the size being dependent upon the number of square feet per pupil required by law in the various states. The size of a special classroom is determined by the number of pupils it is to accommodate in each class, and also by the size and arrangement of the special furniture to be used. A school building should be so constructed that changes in sizes of rooms may be easily made to take care of future educational requirements.

Auditorium:

Total seating capacity?

Number of seats desired on main floor?

Number of seats desired in gallery, if any?

Main floor to be flat or sloping?

Area desired for stage?

Shall stage be arranged for scenery?

Built-in fireproof motion picture booth?

Provision for darkening interior of auditorium in daytime for motion pictures?

Easily accessible for community meetings, or other outside purposes in evenings, or at other times without opening up entire building?

Heating and ventilating systems separate from rest of building so room need only be ventilated when actually in use by a large number of persons?

Will auditorium be used for any other purpose, such as gymnasium or study hall?

Gymnasium:

Size and height?

Accommodation for spectators and number of seats desired?

Will more than one gymnasium be required, or an additional exercise room needed?

Arrangement of locker, dressing and shower rooms, and number of lockers and showers desired in each?

Physical examination rooms?

Physical director's office?

Apparatus storage room?

Gymnasium accessible from outside for community uses without opening main part of building?

Note that minimum size of a standard basket-ball court is 35 x 60 feet; maximum size, 50 x 90. A space of at least 3 feet should be allowed all around court.

Swimming pool?

Library:

Size and preferred location?

Number of books at present in school library and probable maximum number in future?

For school use only, or also a circulating library?

If circulating community library, provision should be made for its use outside school hours, evenings and holidays, also provision for heating without running main heating plant.

Library stack room?

Library work room?

Library may also be used to advantage for teachers' meetings and school and community club meetings.

Laboratories (Physics, chemistry, biology, general science, etc.):

Kinds of laboratories?

Number, size, and preferred locations?

Number of pupils to be accommodated at one time in each?

Equipment?

Lecture Rooms:

Number, size, use, and preferred locations?

Seats on raised platforms?

Pupils to be accommodated in each?

Equipment?

Special Rooms:

Number, size, and preferred locations of all special rooms, such as:

Bookkeeping,	Sheet metal shop,
Stenography,	Forge shop,
Typewriting,	Printing shop,
School bank,	Agriculture
Music rooms,	Machine shop,
Domestic science dept.,	Kindergarten,
Laundry,	Mechanical drawing room,
Model apartment,	Freehand drawing room,
Sewing room,	Arts and crafts room,
Men teachers' room,	Museum,
Women teachers' room,	Janitor's room,
Girls' rest room,	Principal's office,
Medical inspection rooms,	Superintendent's office,
Dental clinic room,	Board of education rooms,
Playrooms,	Bicycle room,
Woodworking shop,	Secretary's office.

Give number of pupils to be accommodated in each at one time; approximate size and preferred location of each room; also description of special equipment and accessories.

Lunch Room and Kitchen:

Provision for preparing and serving lunches to scholars and teachers?

Number of pupils to be seated at one time, and preferred location of rooms?

Types of Wardrobes and Method of Taking Care of Pupils' Clothing:

Wardrobes in rear of room?

Separate cloak rooms adjoining classrooms?

Steel lockers built in along corridor walls, or in alcove rooms off corridors, or elsewhere?

Any other special arrangement desired?

Provision for Extension of Building to Take Care of Future Growth:

Buildings should always be designed so that additions can be easily built. It is recommended that a future addition be actually drawn out on the preliminary sketches for future reference. Later boards of education can then see what was contemplated in the way of an addition when the building was planned, and whether they follow it in all its details or not, they at least have a basis on which to start work.

Money Available:

For building ....$......
For driveways, paths and grading property..$......
For architect's fees.......................$......
For furniture and equipment...............$......
Surplus for contingencies..................$......
Total ....$......

When It Is Desired to Have School Building Completed:

It must be remembered that for a medium-sized building it takes from two to three months to prepare plans and specifications, and from ten months to one year or more to build the school, depending upon its size.

Survey of Property:

It is the duty of the board of education to furnish the architect with a complete topographical survey of the property. This survey should give dimensions, levels, show streets, locate all trees and existing buildings, gas mains, water main, sewers, electric mains, and kind of current available; also any peculiar features of the property, or any restrictions applying to them.

Test Borings:

The board of education should have test borings made or test pits dug to determine the character and bearing capacity of the soil; also to locate the level of sub-surface water, and the location of rock, if any. Neglect to determine the character and depth of the underlying soil has many times been the cause of great expense later on, when the construction of the building was under way.

Work to Be Included or Not Included in Contract:

Are lighting fixtures to be included or purchased later?

Is entire property to be graded, or only just around building?

Are roads, paths and sidewalks to be included?

Is the architect to include the handling of furniture and equipment or any special items?

Temporary Facilities While Building:

Decide who furnishes and pays for water, light and heat, used during the construction of the building,—the owner or contractor?

Investigate cutting down of certain trees within the area of new building and the boxing around or protecting of those trees which are to remain.

Removal of any old building on site and disposal of old material? Is it desired to save any old materials?

Insurance of Building During Construction:

The board of education usually insures the building against fire and tornado during construction, for the benefit of all parties concerned, as their interests may appear at the time of loss. Liability insurance and damage to persons or property is carried by the contractor.

Method of Making Payments to Contractors:

This is usually done monthly, upon certificate of the architect, and equal to 85 per cent of the value of labor and material actually incorporated into the building at the time of calculating payment. The remaining 15 per cent accumulates as a final payment, which is generally made within 30 days after completion and on acceptance of the building by the owners.

Book Lifts, Dumbwaiters, Dust Chutes:

If any are required, number, size and location should be given. Vertical shafts and doors to them should in all cases be fireproof.

Wainscoting in Corridors and Classrooms:

Lower walls of classrooms, and especially corridors, are subjected to heavy wear and abuse. Wainscoting of painted burlap is often used in classrooms, and of glazed brick about 5 feet high in corridors.

Sound Deadening of Floors or Partitions:

Certain floors and partitions, such as the floor of a gymnasium, where located over an auditorium, or a toilet room adjoining a classroom, need to be insulated and have sound deadening. There may also be other cases where such sound deadening is required, as, for instance, around music rooms, gymnasiums, noisy shops, etc.

Waterproofing:

What measures have been taken to make walls and floors of rooms below grade waterproof?

Do soil conditions make a tile sub-surface drain necessary around building?

Materials or Appliances to Be Used in the Building:

Materials and trim used on exterior?

Building of fireproof or semi-fireproof construction?

Kind of floor construction?

In a fireproof building it is assumed that all floor construction is fireproof, although the roof construction is sometimes built of heavy timber to save money. In a semi-fireproof building it is usual to make the corridors and stairs fireproof, and also floors and ceiling of boiler room and manual training room fireproof. Other construction of wood.

Materials of roofs?

Kind of wood for inside trim?

Kind of wood for classroom floors?

Kind of floors in corridors?

Kinds of floors in miscellaneous spaces?

Kind of floors and wainscoting in toilet rooms?

Type of windows,—double-hung, hinged, or special type?

Kind of stairs?

Spaces where wall or ceiling, or both, are not to be plastered?

Ash lift or other provision for getting ashes out of boiler room?

Are outside woven wire window guards required for protection of windows on lower story?

Any folding iron gates across corridors desired to cut off certain portions of building when auditorium or other rooms are being used at night?

Any iron fence desired around playgrounds and rest of property?

Any fireproof record vault required?

Bolts for window cleaner's belt on outside of all window frames above ground floor?

Kinds of blackboards and their location?

Cork display boards in classrooms and bulletin board in corridors?

Any folding or rolling partitions required between classrooms?

Are partitions between toilet fixtures, wood, metal, soapstone, slate, etc.?

Bookcase and teacher's closet in each classroom?

Metal-covered doors to boiler room and manual training rooms, closing them off from corridors and basement?

Metal-covered partitions and doors glazed with wire glass enclosing staircases and acting as a smoke and fire screen?

Special locks for special rooms, such as principal's office, laboratories, etc.

Key system for various rooms and master key for all doors?

Metal numbers or card holders on doors to classrooms?

Panic bolts required on all outside doors?

Any spring checks desired on outside or inside doors to keep them closed?

Plaster walls painted, and where?

Painting of brick walls, and where?

Painting of cement floors?

Lettering of doors to various rooms?

Special decorative painting of auditorium and main entrance hall?

Quality of glass used in outside windows?

Quality of glass used in exterior and interior doors?

Obscure glass used in such places as toilet room windows, shower and locker rooms, etc.?

Wire glass for fireproof partitions, doors, and stair enclosures?

Plumbing:

Location and size of water main, sewer, and gas main?

Any apparatus for hot water? Kind, size and location?

Locations of fixtures to be supplied with hot water?

Is plumbing a cast iron or screw pipe project?

Disposal of rain water on surface of ground or into sewer?

Pipe covering on hot and cold water and steam pipes?

Connections on outside of building for water hose?

Are fire line stand pipes and hose reels desired in corridors?

Type of plumbing fixtures. Number of fixtures usually fixed by regulation of the state department of education.

Location and number of drinking fountains?

Sewerage disposal plant required where no sewers are available?

Inside cast iron rain water leaders from roofs or outside sheet metal leaders?

Any laundry tubs desired in connection with domestic science room?

Any pipes running through cold air rooms or any unheated spaces should be carefully covered to prevent freezing.

Any gas outlets in corridors, stairs, auditorium, etc.?

Provide gas outlets in laboratories, lunch room, domestic science room, boiler room, teachers' room, etc.

Electric Work:

Obtain full information as to the kind of current and its phase and voltage furnished by the local lighting company, together with location of service connection.

Number of lights in classrooms and control of them?

Any outside lights at entrance?

Base receptacles where needed?

Electric outlets for special furniture in laboratories, demonstration tables, etc.

Outlet for motion picture or stereopticon machine?

Footlights and overhead lights for stage?

Location of program bells and how operated; by a program clock or hand push-button?

Electric power outlets for motors, fans, etc.?

Outside door push-button ringing bells in front corridor and boiler room?

Special program bells in noisy rooms?

Push-button and buzzer from stage to stereopticon location?

Fire alarm bells and their location? How operated?

Bells, telephones and clocks operated by dry batteries or storage batteries?

Long distance outside telephones?

Any interior telephone system? Location of central switchboard for interior telephone system?

Number and location of interior and outside telephones?

Number and location of secondary clocks in classrooms which are operated by master clock in principal's office?

Locations of master clock, program bells, switchboard, fire alarm switchboard, telephone switchboard?

Any electric outlets required for electric irons or electric stoves?

Kind and design of lighting fixtures?

Is electric service wire from street main run exposed overhead on poles or concealed in conduit below ground?

Heating and Ventilating:

Type of heating system: one-pipe, two-pipe, vapor or vacuum system?

Are fans to be used for either or both the fresh air supply and exhaust ventilation?

Type of boiler or furnace?

Kind of boiler grates,—stationary or shaking grates? Kind and size of coal to be burned? Oil-burning boilers in certain localities?

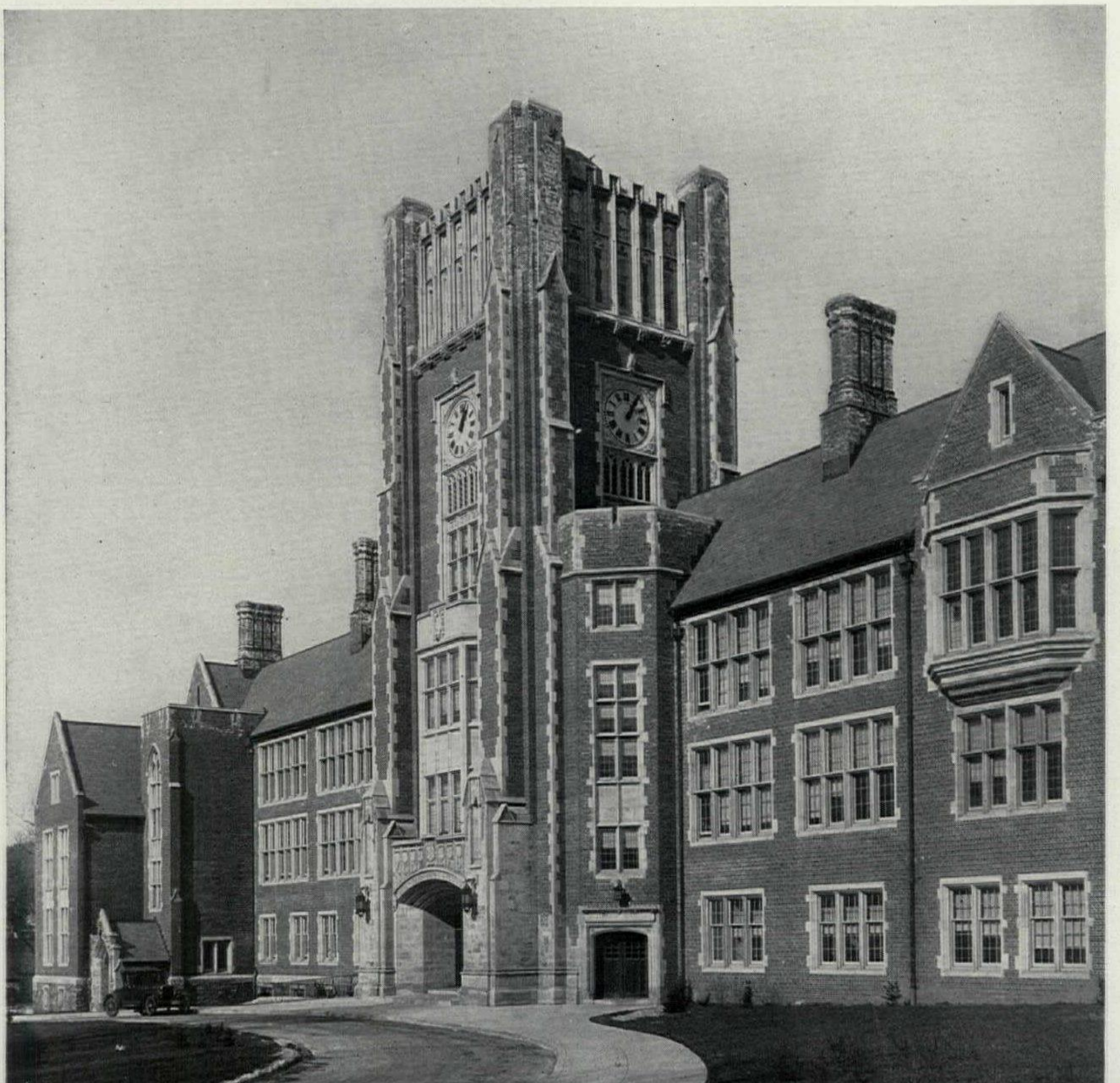
Special provision for heating principal's office, board of education rooms, superintendent's office during winter holidays and evenings, so entire building will not have to be heated?

Is automatic temperature control called for? What sections are so controlled?

Special ventilation for toilet rooms, independent of school ventilation?

Piping system to be valved for separate control of direct radiators in classrooms, auditorium, etc., and for indirect air heaters for ventilation? Also sections of building to be shut off in case of accident to any part of system?

Classroom and auditorium heating and ventilating controlled separately, so that either section can be used without the other?



Tower, High School, South Orange, N. J.

Guilbert & Betelle, Architects

SPECIAL ROOMS IN HIGH SCHOOLS

BY

DWIGHT H. PERKINS

PERKINS, CHATTEN & HAMMOND, ARCHITECTS

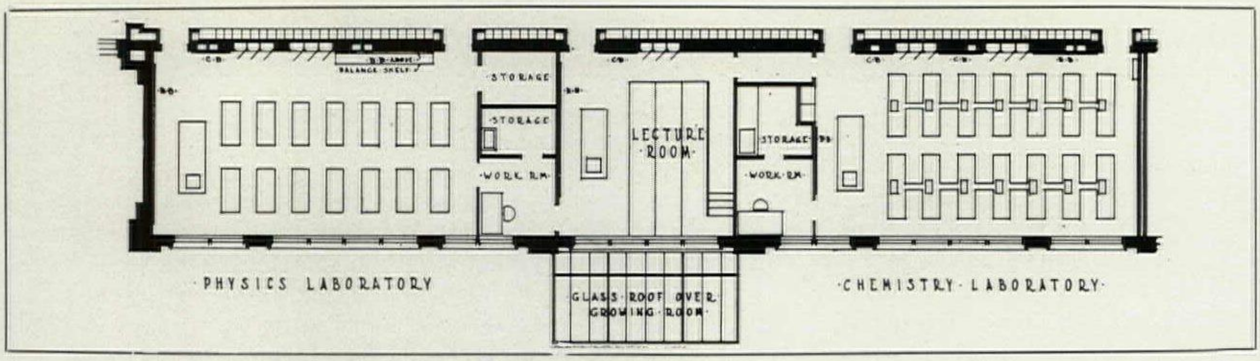
PROGRESS in education necessitates constant change in schoolhouse planning. This constant change is due not only to change in the requirements in order to carry out certain newer methods in the teaching but is likewise due to very rapid increase in the high school population. Whatever may have caused this increase in high school population, we have it with us and it must be provided for. School boards are further embarrassed by having thrust upon them the problem of erecting more buildings at a much higher unit cost. The reaction to this very simple problem of providing more buildings for more pupils at enormously increased prices has caused the demand for the strictest economies in floor planning. In the good old days when a high school building meant classrooms of large proportions with an occasional room designated the "laboratory," and another the "library," there was no particular need for research and study of methods for economy; but nowadays, with seating shortage prevailing in almost every school district in the country, and with boards of education bewildered because of no available funds and very serious restrictions as to the measures for increasing their funds, everybody,—architect, school administrator and members of the board itself,—is vitally interested in every measure which will conserve space and at the same time not interfere with the full opportunity of the student and the convenience of the instructor. Unfortunately, this last item has been given little attention. No business corporation would employ high salaried people such as are employed in our modern high schools and handicap them from day to day with a non-workable, unproductive environment.

It is with this situation in mind that this discussion of special rooms is undertaken. The special rooms have become a large factor in the high school. Academic rooms in a modern high school seldom exceed 50 per cent of the number of the total units provided for the operation of the school. In a recently planned high school for 1200 pupils, it was found that only half of the total recitation units to be provided were actually classrooms. In addition to the recitation units, there is required the usual office space, as well as study halls, library, lunch room, gymnasium and assembly hall, all of which may come under the designation of "special rooms."

Laboratories. Within recent years, there has been developed for use in laboratories special equipment built around the necessity for conserving space, adding to the convenience of the pupil, and giving some attention to the administration of the room as a teaching unit. The most recent development in this field is a series of tables connected back to front through the center of the table by a narrow compartment through which the plumbing and other service lines are laid. A part of this narrow compartment is used for storage; in some instances, bottle racks; in others, the less frequently used apparatus. This scheme has some points in its favor, particularly in chemistry, where the disposal of waste has always been a very definite problem. By utilizing this scheme, the sewer line can be brought to one point above the floor and then be carried under the floor slab to the corridor wall without disfiguring the ceiling of the room beneath the chemistry laboratory with unsightly pipe lines and their occasional leakage. The plan of this type of table is shown in an accompanying drawing for the chemistry laboratory. (Page 426). The further advantage in the use of this table is that with only slight inconvenience it can be used for other laboratory work, such as physics, biology or general science. Its fundamental weakness is that it requires a low height if used for other purposes, and, consequently, pupils are generally seated, occasionally with attached chairs, which makes more numerous opportunities for accidents. The pupil at a chemistry table requires for his own safety and convenience at least the opportunity to stand while working. The second criticism is the lack of circulation for the instructor, which is an essential where individual instruction is considered fundamental.

Another type of recent development in laboratory equipment is the two-pupil table, which is coming more and more into favor, because it does provide for the concentration of two pupils on one problem, for the utmost freedom in supervision, and for the the ready adjustment of the room in providing for additional pupils. For use in physics and biology, as well as for general science or other laboratories where plumbing is not a major requirement, this two-pupil table is a distinct contribution. It is in marked contrast to the old six- or eight-pupil table set full width of the room, except for an aisle at each end and usually requiring that half the pupils face the other half. Only the extreme necessity for conserving space can justify the utilization of this old type of multiple-station table. The two-pupil table has another distinct advantage, in that its equipment is easily modifiable to suit the individual projects for all succeeding occupants. If properly equipped, the modern school occupies all of its recitation units every period of the day, which means that the science laboratory is used by four different classes each day, and on alternate days by another four.

Placing Equipment. It is essential that full consideration be given to the best utilization of the space available. It should be remembered that pupils spend most of the time at the work tables, and therefore it is essential that tables be given first call on



Laboratories, Lecture Room, Growing Room and Services
Senior High School, Fort Smith, Ark.
Perkins, Chatten & Hammond, Architects

the best light of the room. In many old laboratories everything except the pupil's table is close to the light, placing the pupil's table on the dark side of the room. For instance, the balance or microscope table is frequently placed under the windows, with the presumption, obviously, that it should be near the light. Modern artificial light is so efficient and so easily provided and these units are used so seldom that we recommend placing these tables on either the rear or corridor wall of the laboratory. The instructor usually objects until he sees how it works.

In a chemistry laboratory, fume hoods are a necessity, but generally a nuisance. If the fume hoods can be located before the structural plans are determined, confusion and expense can be avoided by proper location of vents. In order to get positive exhaust of these fume hoods, the installation of small fans, which, by the way, will improve the ventilating of the whole room, should be made in the vents. Various experiments are under way now for the installation of fume hood facilities on the pupil's desk itself. No doubt this will become a practical device in due time, but as yet we are not ready to accept this idea. It requires much more expenditure than would seem justified for satisfactory operation.

One of the most constant sources of annoyance in all laboratory work is lack of the proper storage for notebooks. Various schemes are being used. Recently the notebook rack has been heralded as the solution for the evil, but in actual operation, the notebook rack is an invitation to copying and petty annoyance. Some protection should be given to the pupil by providing cabinet locks for each class using the racks. It may be the occasion for a little additional expense or inconvenience in distribution, but it saves in the long run those annoying circumstances which so frequently arise in the conducting of the class. Under certain circumstances, office files, each section locked separately, have proved useful.

Ample bulletin board spaces for the posting of announcements or display of excellent work are a great convenience. These should be placed near the most used exit, as should also the file cases or notebook racks. A very limited amount of blackboard is sufficient. A folding blackboard in 4½-foot sections, so that the work of each class may be retained without interfering with that of other classes, is the most serviceable. It costs more to install in the original layout, but it leaves space for other purposes.

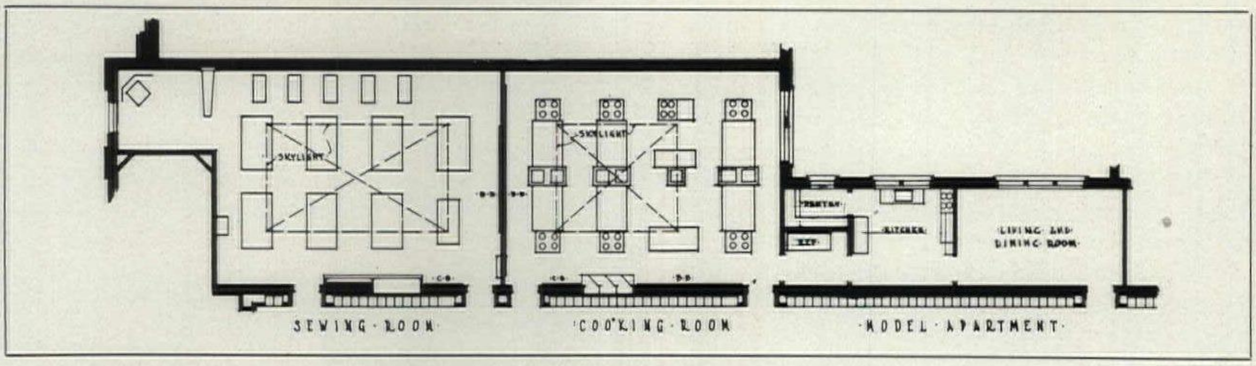
Care of Equipment. It is the duty of the architect to provide for the best care of all equipment. It is a remarkable fact that neglect costs more than the actual use of certain apparatus. To place the storage area in some dark corner, frequently in a segregated place, is to insure rapid deterioration because of neglect of the apparatus. Whatever the architect may do to provide for this care, only the most persistent effort on the part of those responsible for the school's administration, will guarantee the proper use of facilities. The architect should assume the responsibility for making this care a possibility.

Accessories. In addition to the regular laboratory space, every suite of laboratories should have well equipped lecture rooms so placed that they may be used to supplement more than one laboratory, and so organized that they will be easily accessible from the private workroom of the instructor. In biology, much confusion is saved by providing growing rooms or greenhouses in connection with lecture rooms.

The accompanying plans proposed for the Fort Smith, Arkansas, High School illustrate most of the measures which have been suggested. We should note, however, that the faculty of the school prefers to use the two-pupil tables in the chemistry department, because of added convenience, and such has, therefore, been planned. The biology laboratory is on the first floor immediately under the physics laboratory; and classrooms, planned for conversion into an additional biology laboratory, should it become necessary, are beneath the chemistry laboratory. The physics laboratory was not needed for full time, and therefore provision was made for extra storage room, so that this laboratory might be used to supplement the one biology laboratory for which the demand was temporarily out of proportion.

Girls' Shops

The cooking room is one of the hardest units in the whole building to plan. There are two major



Sewing Room, Cooking Room and Model Apartment
Senior High School, Fort Smith, Ark.
Perkins, Chatten & Hammond, Architects

types of plans. Incidentally, it might be said that those responsible for the operation of this unit are quite positive in support of whichever plan they favor. The older plan is that which became so common some 20 or 25 years ago, when cooking was being generally adopted as a school activity. This consisted of a hollow square, open at one end, furnishing a place where materials could be prepared and cooking operations be conducted either by the pupil individually or by the instructor as a demonstration. It had its advantages, many of which cannot be continued in the newer type of organization. It was cheaper. It gave the instructor an across-the-table contact with the individual pupil with a minimum traveling distance. It had the disadvantage of forcing too many pupils into very limited space.

Recently, there has been developed the so-called "unit" plan, wherein a sample kitchen is built for each two, three or four pupils. Its adherents claim for it the advantages of simulating home conditions. Some of its opponents have pointed out that there is only one cook at home with about twice as much space as that usually devoted to two students in the school, and that the reproduction of home conditions is far from actual. Others seriously question the necessity for an attempt to reproduce the home environment. Somewhere in between the two extremes is the sound middle ground upon which most teachers will finally come to an agreement. As between these two extreme viewpoints, the poor architect does not dare make a choice. If he plans for one type, the other will be wanted within a short time, because the change of teachers in this department is usually due to a change in the opinion as to the proper method of securing results. It is not at all impossible, however, for the architect to provide a distribution of his units in such a way that segregation into individual compartments may be inexpensively provided, or vice versa. Insofar as it is possible, the equipment used by pupils should be common to each station in a cooking room. This lessens the confusion in getting materials and is conducive to continuity in developing any given project. As in other laboratories, provision should be made for adequate storage space of frequently used apparatus, and a compact but easily accessible filing space for notes. One of the most common faults in this particular laboratory is the omission of space for the storage of aprons or other clothing which should be worn by the students while engaged in this activity.

The accompanying plan is not quite illustrative of the point in hand, because we had the distinct advantage here of a room lighted with a skylight. However, it does illustrate the possibility of providing space for small groups with sufficient segregation for good operation. This is on the same principle as that defined in the planning of the laboratories for this same school. The somewhat unusual floor plan of the cooking room was developed by the faculty of the school after much study of the problem and the discarding of many suggested plans.

Sewing Room. As this room does not require fixed equipment to any considerable extent, great freedom can be exercised in its planning. The equipment has usually consisted of sewing tables fitted with individual drawers for the maximum number of pupils using this room. However, as the schools have become crowded and the requirement for full-day use of this unit has developed, it has become practically impossible to provide so many drawers of adequate size in an ordinary sewing table. The tendency now is to use a very simple table with an open space provided for the placing of separate trays, which take the place of the drawers. These trays are individual and are cared for in stacks with locking devices or doors. The proper distribution of these trays is a simple matter, but it seems to have become objectionable to some people who have had difficulty in organizing the procedure. The minute of confusion in the distribution of these trays is fully compensated for by the greater amount of working and storage space which each individual pupil has, and therefore, better opportunity to organize her belongings. The sewing room should be provided with display space as well as storage space. It has been found advisable to segregate these two because the front of the storage space cannot be kept organized for display purposes, and if the display space is used for storage, it is always out of order.

Where both sewing and millinery courses are offered, the school can very readily use the same room for both purposes if, in addition to the main room, a small room is provided with storage space, well equipped with shelving. One of the most frequently misused features of equipment of the sewing room is a triple mirror. These are not only expensive, but they are easily and frequently broken. Taking the cue from the large department stores, the architect will find that a much simpler device is much more efficient. Setting one mirror on the wall with one side extended from the wall line a few inches, and then using one other mirror hinged to the opposite wall or else on a movable frame, gives an efficiency fully equal to that of the triple mirror.

Placing sewing machines in disappearing cabinets improves the appearance of the room and leaves the well lighted portion for the work tables. In general, the equipment of this room can be simplified and made more efficient by a careful study of the best practices in our large department stores.

Model Apartment. The home-management or home-making courses offered in our schools frequently lead to the building of a model apartment within the school building. This may seem to be an extravagance at first thought, but when one remembers the many purposes for which such a space may be used, the expenditure can be justified. Where nothing more can be provided, at least the kitchen and dining room should be built in close proximity to the cooking laboratory. The accompanying diagram of the Fort Smith, Arkansas, girls' shop illustrates well how the two may be coördinated. For instance, the refrigerator which serves the cooking laboratory, is a part of the kitchen in the model apartment. Frequently, the appearance of the model apartment has been ruined by the use of a ceiling height equal to that of the regular classrooms. This is not necessary, and should be avoided.

Small School Requirements

We who have been planning school buildings for large urban centers have almost completely lost sight of the problem confronting our neighbors in the smaller communities. A very large percentage of our high school children are housed in schools where the number of pupils does not justify the provision of all of the facilities ordinarily found in our larger high schools. This should pique the interest of the architect and the school man to develop a combination which will be effective and inexpensive. A plan of a combined laboratory and household arts room accompanies this article. (Page 430). It shows how, by providing separate storage space for the materials and apparatus of chemistry, for physics, for household arts, etc., the same room may be used for all purposes. It is essential that separate units be vented. Many other combinations, of course, could be made for this type of combined laboratory. The equipment would consist of a plain, easily modified table; even a separate top for this table might be provided when it is used for chemistry. Of course this does not meet all of the requirements of a modern laboratory, but some of the best chemists in this country had their early training in a laboratory where all waste was handled through the medium of a half-barrel in the middle of the room. The farm boy needs his chemistry as much as does anyone else. A similar combination can be made of commercial art and mechanical drawing rooms. It is pitiable to see how students in the smaller districts are handicapped by lack of thinking in terms of combining.

Boys' Shops

Wood Shop. This department has become quite standardized. For the lower grades, say the junior high school, the standard form of work benches together with a simple saw, and possibly a sanding machine, are generally accepted as sufficient. For senior high schools and trade schools, more equipment is necessary. Teaching through production requires modern industrial machinery. One of the main problems in these wood shops is the care of tools, which are used by successive groups throughout the day. We are recommending an accessory room where an individual tool kit equipped with all the cutting tools required in this work can be stored. This requires a little more time for distribution, but it saves enormously in the time spent with poor tools because somebody else was not responsible for their care. These individual kits can be placed in sections which can be locked, thus avoiding borrowing. Everyone takes greater pride in that which is his own. The school's investment is not materially increased, because the individual set of tools for each pupil gets less proportionate wear in the long run because of its more particular care. The space required for these tools is not expensive when properly organized. A very simple method is to provide storage space to the ceiling with an iron stair and platform at convenient height. If this scheme is used, the old-fashioned tool room can be reduced in size or eliminated.

Auto Shop. The auto shop is the most variable of all shops that have been provided in our schools. It is essential that it may be entered from the street. Outside of this there is nothing in common in the general practices throughout the country.

Electric Shop. To teach the electrical trades in a high school, it is necessary to have quite adequate space. There is a growing tendency to combine this with the auto shop, and to confine the instruction in principles to the physics laboratory. However, as electricity has come more and more into common use, the trade schools especially have required a segregated shop for teaching purposes. In the electrical shop, much shelving is required. It is shallow, however, and simply means that the architect provides wall shelving in small narrow compartments. Deep bins and drawers should be had only in limited number.

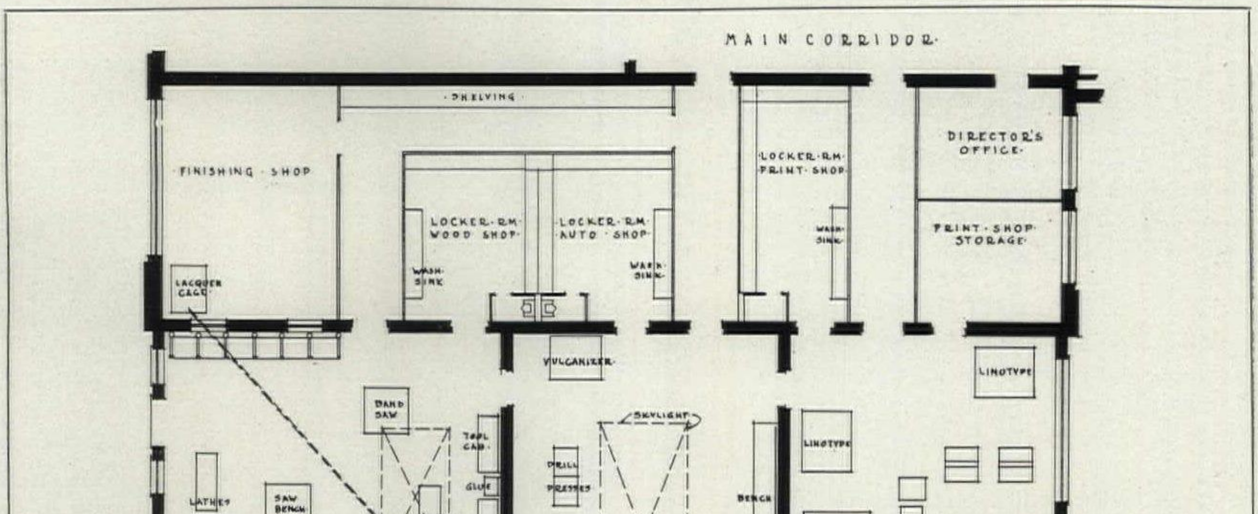
Print Shop. One of the most serious problems in laying out a print shop is the securing of adequate light. Natural illumination in a print shop is less practical than in any other place in the school. The work is such that it requires adequate artificial light, and therefore it is not objectionable to use some space which has shortage of natural light, and thus definitely depend upon artificial light. To equip a print shop in the school as a commercial shop is necessary only where advanced courses are given, or where full-fledged journeymen are trained. The problem confronting the architect is to get the school to definitely define its limitations in this field.

Sheet Metal. To give adequate courses in sheet metal work, only a very limited amount of space is necessary. It is not essential to do work on large units. The principles involved can be taught with very simple equipment, and by the use of small projects. Probably the most effective organization is found in a shop with a well equipped 30-inch, counter-high table underneath the windows. For this purpose, a bilateral lighted room is desirable. The space underneath the bench can be organized into storage space; the corridor side of the room can be equipped with shelving for display of projects and the housing of tools, equipment, etc.

Locker Rooms. In our boys' shops, it is quite essential that adequate locker space and washing space be provided. Most boys like to remove their ordinary clothing and change into working clothing before going into the regular daily exercises. This is one of the essential reasons for the increased size of the shop unit, so as to provide this locker and dressing room space. A simple equipment consists of a double tier of lockers about 10 x 15 x 36 inches, one compartment for each boy in the maximum sized class, and basket racks for the storage of work clothing, one compartment for each boy taking the course.

Mechanical Drawing. It is well to locate the mechanical drawing room near the shops, because of the general articulation of the work in these. Mechanical drawing supplements shopwork. Shopwork should not be undertaken without definite drawings. To motivate mechanical drawing, it is essential that these principles should be recognized. Adequate artificial light must supplement the best natural light obtainable. It is almost impossible to secure adequate natural illumination at all times. Many prefer north light for this purpose, but well regulated skylight is equally valuable.

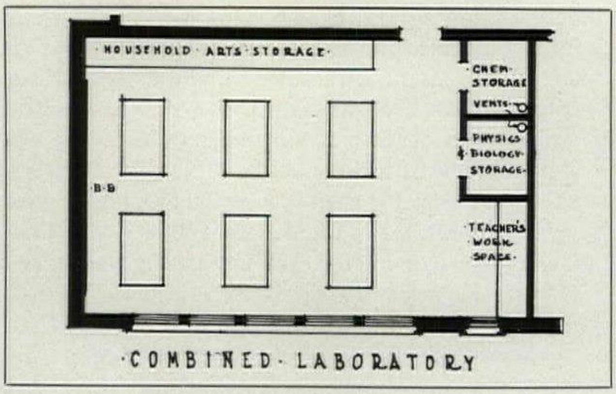
The equipment of the mechanical drawing room requires great care. Too often its utilization is limited by the number of individual compartments in the pupil's desk. In order to get more compartments in a desk, the space for each pupil has often been re-



Shop Unit

Senior High School, Fort Smith, Ark.

Perkins, Chatten & Hammond, Architects



Laboratory for Small School
Perkins, Chatten & Hammond, Architects

duced until it is hopelessly inadequate. The compartments should conveniently hold full-sized drawing kits and drawing boards with unfinished work attached. Extra classes to any desired number may each be served by a locked cabinet with the same compartments as those built into the desks. The instructor's table should be equipped with large shallow drawers for the storage of materials and drawings, and if many pupils are housed, this should be supplemented by a separate cabinet. Ample tack board and display rail for presenting subject matter or displaying finished products are essential. Very little blackboard space is needed.

A blue-print room should be incorporated in, or adjoin the mechanical drawing unit. If the blue-print room is well equipped, it can occupy a very limited space and yet be thoroughly efficient. It does not need outside light, and therefore, it can frequently be provided out of space undesirable for regular classroom purposes.

Art Rooms

What has just been said about mechanical drawing, applies equally well to the art room. This room must, for its best operation, be proportionately large, because it is necessary to have much open space in the front of the room, or, where movable furniture is used, in the center of the room. The art room should have running water, preferably in a sink with ample drainboard space. Running water in an ordinary wash bowl is almost useless. In addition to the requirements for the storage of large materials and individual kits and drawing boards needed in the mechanical drawing department, the art room requires much space for apparatus and its more varied materials. A generous sized room left to be equipped as needed is a great convenience to the art department.

Music Room

Probably no other one factor has contributed more to the shortcomings of the American people in the development of an appreciation and production of good music than has the handicap of inadequate space with which the American teacher has been required to work. The assembly hall is still the music room in many schools, and it is a rare teacher who can get results in this environment. In the first place, it invites overloading of the classes. In the second place, it is frequently unavailable at the regular class periods; and finally, the proper care of materials is an impossibility. A unit where music and dramatics can be equally well housed has much better possibilities. An oversized classroom,—as much as a unit and a half,—fitted with a small stage or platform, having adequate storage space, and located so that it can be segregated from the rest of the building, gives a much better opportunity for doing those unusual things which must be done in order to produce the best results. The use of the top story for this unit adds something in the way of isolation. In large high schools, a top story consisting of the music and possibly the radio departments only, is quite feasible. Where the music department must be provided for on the same floor with other units of the school, a simple scheme for isolation is to build all of the storage space on the wall or walls adjoining the other units. If this amount of storage space be not needed, it does not add greatly to the expense of the building to have a dead air area provided by furring out some distance from the wall.

Commercial Department

The proportion of the building needed for this department varies so extremely in different communities, and for that matter at different times in the same community, that planning for future expansion becomes essential. This can be done by planning classrooms with no unusual equipment adjoining the commercial department in sufficient number, so that practically an unlimited expansion is possible.

There is a distinct advantage in planning the commercial department as one unit. However, administration on adjoining floors near a stairway is less difficult than it is to have widely separated units on the same floor. There are only a few new movements in this department which require the special attention of the architect. The outstanding one of these is the replacement of the old method of bookkeeping by the machine method. Numerous electrical outlets, giving a maximum of flexibility in arrangement of the room, is less expensive than continuous alterations in order to get this flexibility later.

Bookkeeping. In bookkeeping, the utilization of the room is too frequently lessened by the number of drawers in the desk adopted. Six drawers seem to be about the maximum that can be provided, yet the school is called upon to organize as many as eight or ten classes in this subject. This can be done by providing a vacant space in the desk where the drawer or other container for the pupil in the extra classes can be placed while he is working. Cabinet space will house the extra drawers when not in use by the pupil. The individual lighting of desks may prevent eye strain, but care should be taken to prevent light from one desk reaching other desks.

Typewriting and Stenography. The teaching of typewriting and stenography may be combined in one room for advanced courses. The first courses in each of these should be given in separate rooms to avoid duplication of equipment which lies idle in a room housing both courses. In the typewriting room, ample file cases will make it possible for each pupil to learn something about filing, and at the same time keep a record of his own progress. The self-appraisal of one's own work in this subject makes for progress. In both the typewriting and the stenography room, a folding blackboard with tack board and display rail increases the efficiency of the room.

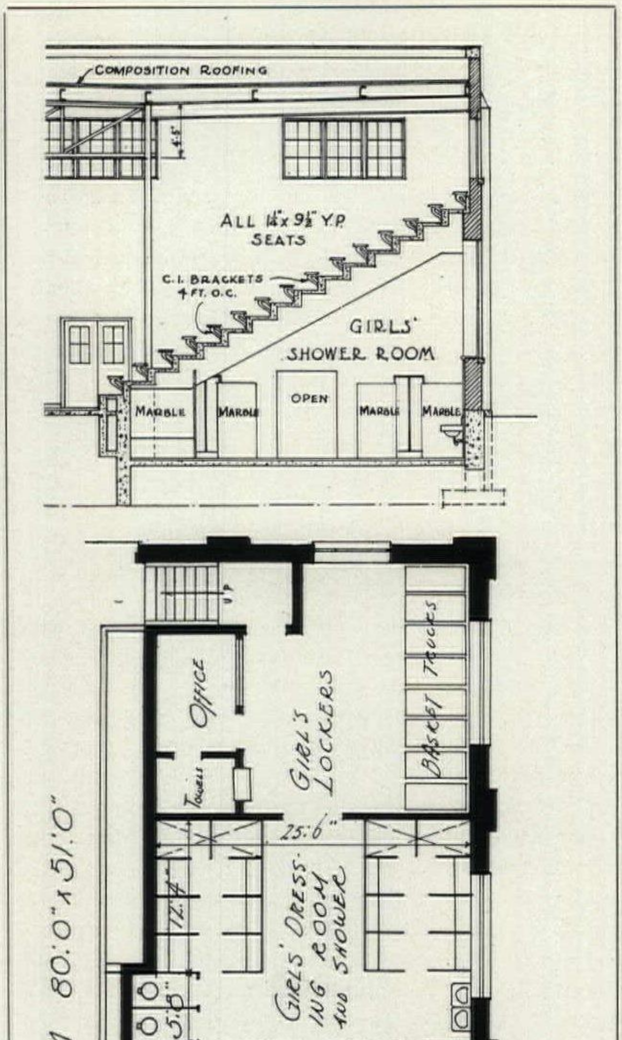
Library and Study Halls

The major features of a high school library are quite different from those of a public library, yet there are times when the same quarters may be used to house both, the public library being operated out of school hours, and, if necessary, its books being distributed to high school pupils only during regular library hours. The community use of this portion of the building is usually at its peak in other than school hours, so that there is no necessity for increasing the seating capacity of the reading room much beyond that demanded by the school. There is a general feeling among librarians, not shared fully by school people, that all libraries should be on first floors, because of better access. In planning buildings, to put the library on the top floor is a distinct advantage, because both sides of the corridor and the corridor itself can be combined in one unit without expensive structural features. This distinct advantage is lost when the library is put on the ground floor.

The school that utilizes study halls as a part of its program has an excellent opportunity to develop self-reliance and individual power in its pupils, if the school assures the pupil of the equipment,—texts, materials, etc., which may be necessary to keep him profitably occupied when he finds himself without assignment sufficient to take the full period in the study hall. A few copies of every textbook used and the most generally used reference material should be easily accessible to every student in the study hall. Book shelving, material racks, dictionary stands, and some deep bins for storage of materials, will aid the school administration in carrying out such a program. If the library is kept close to the study hall, additional advantages arise. Every pupil should form the habit of using the library before leaving the school.

Gymnasiums

There are some changes taking place in the attitude toward equipping the gymnasium. One of these is the demand that it be treated as a playing space, equipped for basketball, volley ball, and similar games, but not equipped with the numerous devices for individual exercise, which are infrequently used. These devices do have a place in the school program, but their use should be restricted to a small corrective department. They clutter up the appearance and



Plan of Locker and Shower Rooms, with Section Showing Seating Above

Senior High School, Fort Smith, Ark.

Perkins, Chatten & Hammond, Architects

the use of the main gymnasium. Locker and shower space can easily be placed beneath the bleachers or seating space if this be concentrated on one side of the playing floor. The relative merit of this scheme, as compared with placing seating on both sides of the playing floor and housing the shower and locker room in another part of the building, varies in different communities. Where the cost of construction of cement seating space, which is the only fireproof form of construction feasible, is very much cheaper in narrow sections, it sometimes becomes less expensive to forget the space beneath it, and to provide the shower and locker space in light construction adjoining the gymnasium.

The Lunch Room or Cafeteria

From the early high school lunch room, operated by the struggling household art department, to the present-day elaborate cafeteria, operated on a strictly commercial basis, was a long jump. Perhaps the planner of high school lunch rooms can do no better than to keep closely in touch with the commercial development in this field, and incorporate for his client the best ideas produced. The equipment has been thoroughly standardized and is briefly discussed elsewhere. The chief problem in current planning is how to make use of the lunch room floor area at times when not in use as a cafeteria. The high school administrator begging for more room is tempted to make use of this space for purposes for which it never was intended. Here is where the architect serves his purpose. In developing a plan, dual use should be kept in mind. Two questions arise. The first is, "Why must the whole unit be one open space?" This is a universal demand, based upon ease in supervision, but which is subject to considerable criticism. The second is, "What device is best for segregating the unit into smaller units for classroom or other purposes?" Folding partitions, roll curtains, light screens, have all been tried and found wanting. Will not someone, with more daring than the rest of us, plan a dining room with the outside, well lighted area divided into approximately standard classroom sizes by permanent partitions, and let us see how it works? Some extra doors in these partitions would facilitate the use of the recitation units for lunch room purposes. I believe this would be superior to any attempt to use movable partitions.

The size of the lunch room is an important factor. School administrators are inclined to underestimate the number of pupils who will demand service when a new project is being introduced in a community. Considerable expansion of the use of the lunch room can be made by extending the number of lunch periods. Many pupils are ready to eat their lunch at 11:30, and 30 minutes seems to be long enough in most schools. By using three 30-minute periods, pupils who do not take lunch at school can usually be given two of these periods, which automatically increases the range within which it is possible for pupils to go home for their lunch.

Assembly Hall

If an assembly hall is to be used for bringing the whole school together, as was originally intended, then our problem is almost insurmountable. With high schools quite commonly having as many as 3,000 pupils, the assembly hall becomes an institution equaling in size a commercial theater. Ex-superintendent McAndrew of the Chicago schools claims that the assembly halls should be built primarily for educational purposes, and that, therefore, it is large enough when it seats a sixth to a fourth of the student body. Incidentally, this meets practically all of the requirements for community purposes. It is quite seldom that a community demands seating quarters for a greater number than this. The standard argument in favor of the larger assembly hall is the need for seating at graduation time. This seems to be a habit rather than a necessity. Commencement exercises are not necessarily most desirable when a larger group is present. The essential elements to be incorporated in an assembly hall are three in number. First, the acoustics should be perfect. This makes it possible for the student with ideas but limited voice to be heard. It also makes it possible to utilize the hall for classroom purposes, particularly, dramatics and music. Second, it should be an attractive, pleasant place to meet. Dull, uninviting quarters are not conducive to the easy, free development of ideas, which is one of the essentials in our social life, and which the school should foster. Third, the seating should be convenient and comfortable.

Offices

It may be stretching the definition of a special room to include the offices as such, but so much of the success of the school depends upon good planning of the central offices, that I have chosen to include it here. Good office planning requires the recognition of a few fundamental principles of office management. First, one must know the interrelationship of the agencies to be housed. The principal of any high school is a busy person. He should, for this reason, be able to reach any of his subordinates with a minimum of effort. This precludes the segregation of the office suite into separate units by spacious hallways or corridors. Second, the equipment of the office should provide ample storage space easily accessible for all materials to be distributed to the school. Storage of large quantities may be provided at some distance from the main office, but the office itself should contain space enough for current supply. Third, good lighting, good ventilation and heat which may be made available when the school itself is not in operation, fosters good administration. Fourth, school administration has rush seasons. Planning a room adjoining the offices, so that it becomes available for the temporary assistants during these rush seasons, is an easy matter. The planner of school buildings owes it to the school to give it an office where efficient management can be maintained. He owes it to the taxpayer to avoid undue expansion.

STANDARD ARRANGEMENTS OF SCHOOL CAFETERIAS

BY

A. E. MERRILL

EQUIPMENT ENGINEER

THE accompanying plans represent standard arrangements for school cafeterias, and were adapted from actual installations in the central portion of the United States, where probably the largest number of schools have been so equipped.

Number of Patrons. In determining the space that is required for the particular school, it is customary to assume that approximately 40 per cent of the total enrollment will avail themselves of cafeteria privileges. Furthermore, as this equipment is to be used but once a day, it is always advisable in the larger schools, where there are 1000 or more pupils, to divide them into two or more shifts. A logical division is to have the girls come in at one time and the boys come in at another.

Counters. Even with such a division, there will often be more than could be conveniently handled by the maximum service counter in one shift, and in such cases, the arrangement shown as Outfit "D" is doubled, and two or more identical service counters are installed, preferably paralleling the walls separating the dining room from the kitchen. If space does not permit of such an arrangement, these counters are arranged in horseshoes with two services to each such division, extending vertically from the kitchen wall into the dining room.

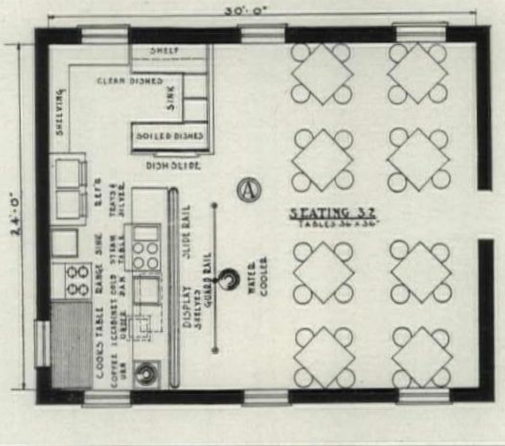
Pupils per Counter. Thus, taking an actual case as an example, a school of 1000 pupils, where at least 400 would be expected to use a cafeteria dining room, could be handled by one service counter and dining room, as shown in Outfit "D," providing the girls and boys used the room at different times. Whereas, if the school had an enrollment of from 1600 to 1800, it would be necessary to at least double this counter arrangement and seating capacity, even though the pupils were separated into divisions.

Time for Service. It has been found by experience that under normal conditions it is impossible to serve students more rapidly than at the rate of 12 or 13 per minute; consequently, if 200 pupils are to use a dining room at once, it would be approximately 15 minutes from the time the first was served until the last one had been taken care of.

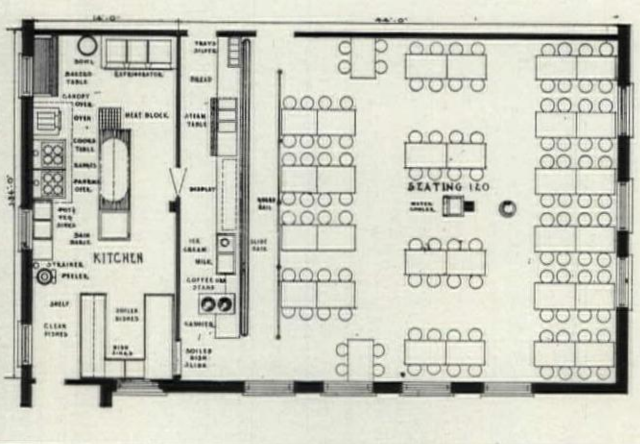
Seating Capacity. In order that seats may be assured for all the pupils after they leave the counter, it would be necessary to have at least 175 chairs provided for this length of counter, and the extra seats on the plan "D" are for those who will bring their lunch and not require counter service.

Outfits. The various plans indicate different types of table arrangement. Outfit "A" shows 36-inch square tables, diagonally placed through the dining room, which gives more freedom of space than any other arrangement, but is more expensive in floor space required, as at least 14 square feet per seat is necessary. Outfit "C" used 30 x 48-inch tables, placed end to end, and this type of arrangement is most economical of space, as it requires 12 square feet or less per seat, including counter service.

Type of Equipment. In selecting the kitchen equipment and dining room equipment, a wide range of qualities are available, and in the summary which is given here it is a standard serviceable variety, which is not ornate or elaborate. These prices may be lowered by at least 25 per cent for the cheapest or may be doubled if a particularly fine place is desired. Galvanized iron sinks are included and, with the exception of Outfit "A," glass-top tables are used. Where a wooden-top table and bentwood chair are used, the tables and chairs together may be secured for as little as $5.50 per seat, whereas when a glass-top table with a better grade of chair is se-



Plan, Outfit "A," Open Kitchen Type for Smallest Cafeterias



Plan, Outfit "C," Kitchen Separated from Serving Table

Open Kitchen Type, Similar to "A"
High School, Pelham, N. Y.

Cafeteria with Two Units Similar to "D"
High School, Asbury Park, N. J.

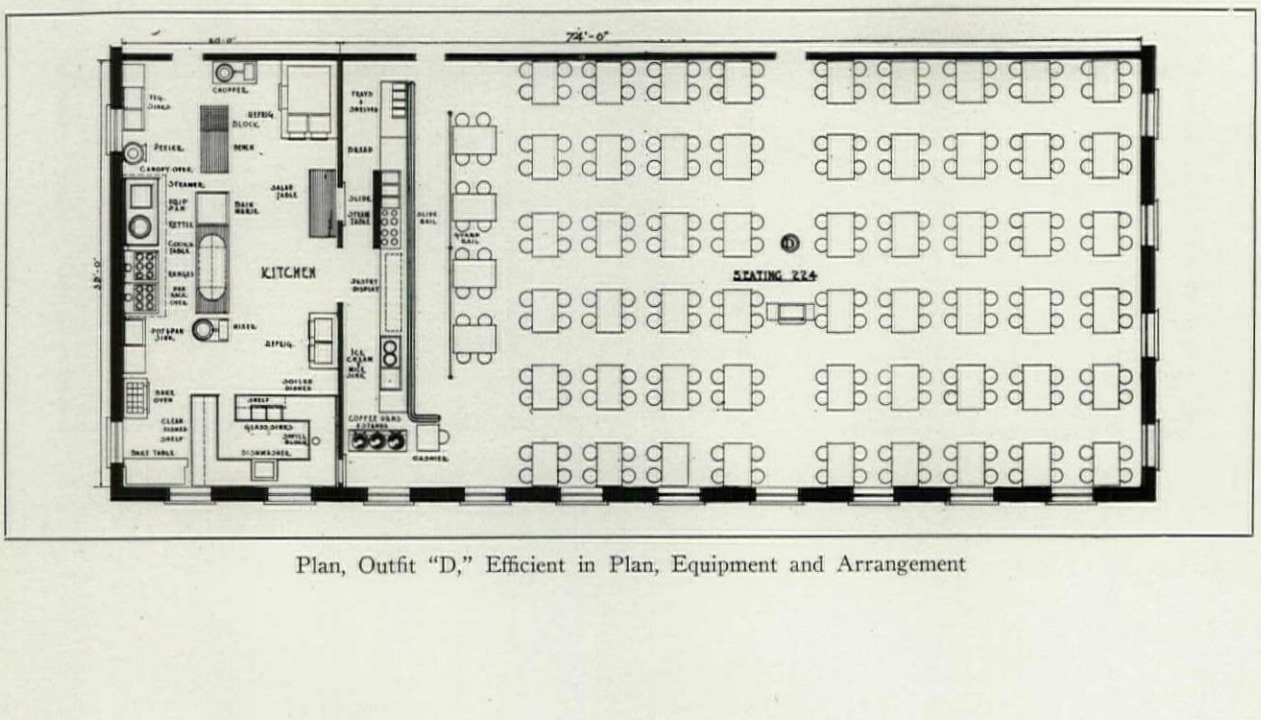
lected, the cost per seat may run as high as $15 each.

Power Machinery. The use of power machinery is recommended in Outfits "C" and "D," including in the latter a vegetable peeler, mixing machine, meat chopper and dishwashing machine, all of which labor-saving devices are an economy in operation. If any of these were to be eliminated, the dishwasher should be the last to be considered, as for sterilizing purposes alone it is practically a necessity. Only those types using the overhead spray should be given consideration, the type in which the dishes are held in racks, over the washing tank.

Electric Refrigerators and Refrigeration. No electrical refrigeration is included in the cost summary, although this is specified in the majority of the larger installations, and it adds only about $400 for each box of 75-cubic foot capacity or thereabouts. All refrigerators are figured with sheet cork insulation, and all boxes should be adaptable for the use of either ice or mechanical refrigeration.

COST ESTIMATES

Outfit "A," seating capacity of 32:	
Serving Counter and Equipment	$550
Cooking Department	410
Dishwashing	150
Tables and Chairs	220
Utensils and Trays	250
	$1,580
Outfit "C," seating capacity of 120:	
Serving Counter and Equipment	$1,850
Cooking Department	1,650
Dishwashing	200
Tables and Chairs	1,500
Utensils and Trays	650
	$5,850
Outfit "D," seating capacity of 224:	
Serving Counter and Equipment	$2,600
Cooking Department	4,000
Dishwashing	950
Tables and Chairs	2,600
Utensils and Trays	1,150
	$11,300



Plan, Outfit "D," Efficient in Plan, Equipment and Arrangement

RECREATIONAL AND ATHLETIC FACILITIES IN SCHOOLS

BY

JOSEPH C. LLEWELLYN, ARCHITECT

THE part which recreation and athletics play in schools of the higher educational organizations of the country today, as compared with the same work in schools only a few years ago, forms an interesting topic. Not very many years ago, in order to get a gymnasium into a school building without a great deal of opposition, it was necessary to camouflage it as a playroom, recreation room, or something similar,—the word "gymnasium" being not wholly understood. But with the playroom actually provided, its use became more clearly understood; it was extended and supervised, and the gymnasium grew into being. Whether the facilities provided are used to the fullest advantage may be a topic for discussion, but it is certain that the activities in this field of school life can be made useful in promoting health, in building character, and enabling boys and girls to get on with their fellows in after life. The adaptation of recreation and athletics so as to build and maintain good health and good character is the part of and is in the hands of the nation's educators, and we believe they are equal to the responsibility. It is the work of the architect to provide the housing and facilities with which to do the work to the best advantage, and to do this work well he must acquaint himself with the educators' viewpoint as fully as possible.

In the limits of this article it is possible to give only an outline of the essential requirements, and that in terms of the average present-day school, such as is found in the smaller cities and community groups. Briefly, the topic can be divided into two general heads: 1st, provisions for indoor athletics, including the gymnasium and the necessary locker and shower rooms and other accessories, and the swimming pool; and 2nd, provision for outdoor athletics and recreation.

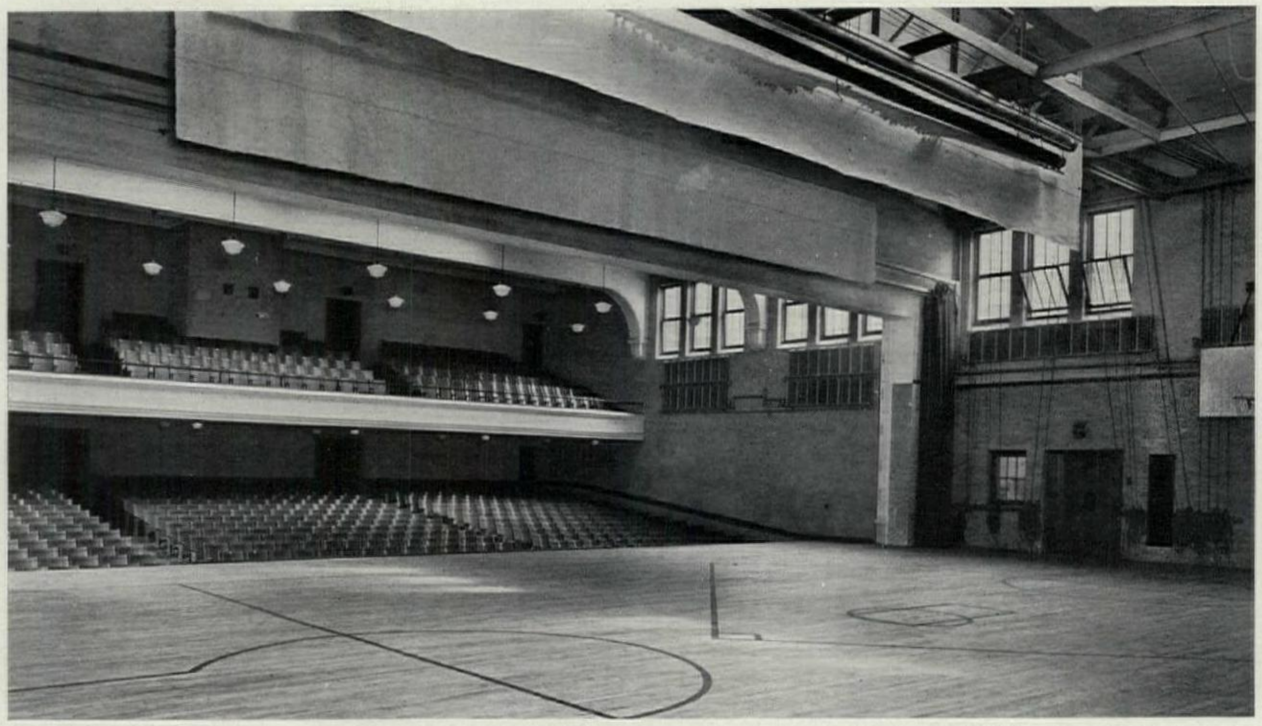
Originally, any rectangular room having a width of 40 to 50 feet, a length of 60 to 70 feet, and a height of 16 feet or more, would class as a gymnasium. Shower facilities were meager, seating space for the public absent or very small, running track and straightaways for the most part absent. Public interest grew, however, and facilities for witnessing the games became necessary. This necessity, together with the necessity of economy, led to the use of many plans looking to the double use of floor space, as, for instance, a corridor converted into a visitors' gallery by the installation of movable windows between the corridor and the gymnasium; the double use of the same floor space for an auditorium, when provided with movable chairs, and a gymnasium when chairs were removed,—a small stage being provided at one side of the room. These and similar arrangements have their drawbacks as they necessitate the use of removable chairs or bleachers.

The Stage-Gymnasium and the Auditorium. As athletics became popular the auditorium also came into more general demand, and the stage-gymnasium, in which the stage of the auditorium is enlarged to gymnasium proportions, with a proscenium practically the full width of the auditorium, came into use. The auditorium was provided with fixed seats, thus eliminating the storing and moving of chairs every time the occupancy changed, and it became possible to use both gymnasium and auditorium for different purposes at the same time. Improvement in the constructions of accordion doors of light construction and sound-resisting materials has made it possible to reduce to a very considerable degree any interference with the work of either gymnasium or auditorium by the other. The stage-gymnasium in conjunction with the auditorium having fixed seats is an economical arrangement for schools of medium size,—say of from 750 to 1,000 pupils,—and it is well liked by many who have used it, although the first reaction may have been one of opposition.

In large schools, and where funds are available, the arrangement will give way to a wholly separate auditorium and stage, and to separate gymnasiums for boys and girls. In some instances, the stage gymnasium is used by the girls and a separate gymnasium by the boys, the latter without bleachers or seating for the public, as all contests and athletic entertainments, exhibitions, drills, pageants, etc., are given on the stage-gymnasium. The tendency, however, is for larger gymnasiums and larger playing floors to permit more than one class to work at the same time and thus provide for growth in school enrollment; and to have permanent seating accommodations for an average audience, with movable bleachers for expansion upon special occasions.

Gymnasium Essentials. The essentials of a gymnasium are, 1st, a good floor, level, smooth and resilient; 2nd, smooth, hard walls for 10 to 12 feet above the floor and, above this wainscot, plaster quite porous to diminish sound reverberation; 3rd, sufficient height to accommodate the desired apparatus; 4th, permanent seats for average attendance at games, and provisions for caring for special occasions; 5th, shower and locker accommodations; 6th, good light and ventilation in gymnasiums, locker rooms and showers; 7th, other rooms such as coaches' offices, storeroom, workroom, special corrective gymnastic rooms, and rest room facilities for girls.

The floor for the majority of gymnasiums is maple, a serviceable floor when laid with proper care upon nailing strips supported on felt-lined screeds to give resiliency, with the nailing strips anchored to floor at intervals. Proper provision must be made for the expansion of the floor in damp weather. A fine playing floor is obtained by using blocks of yellow

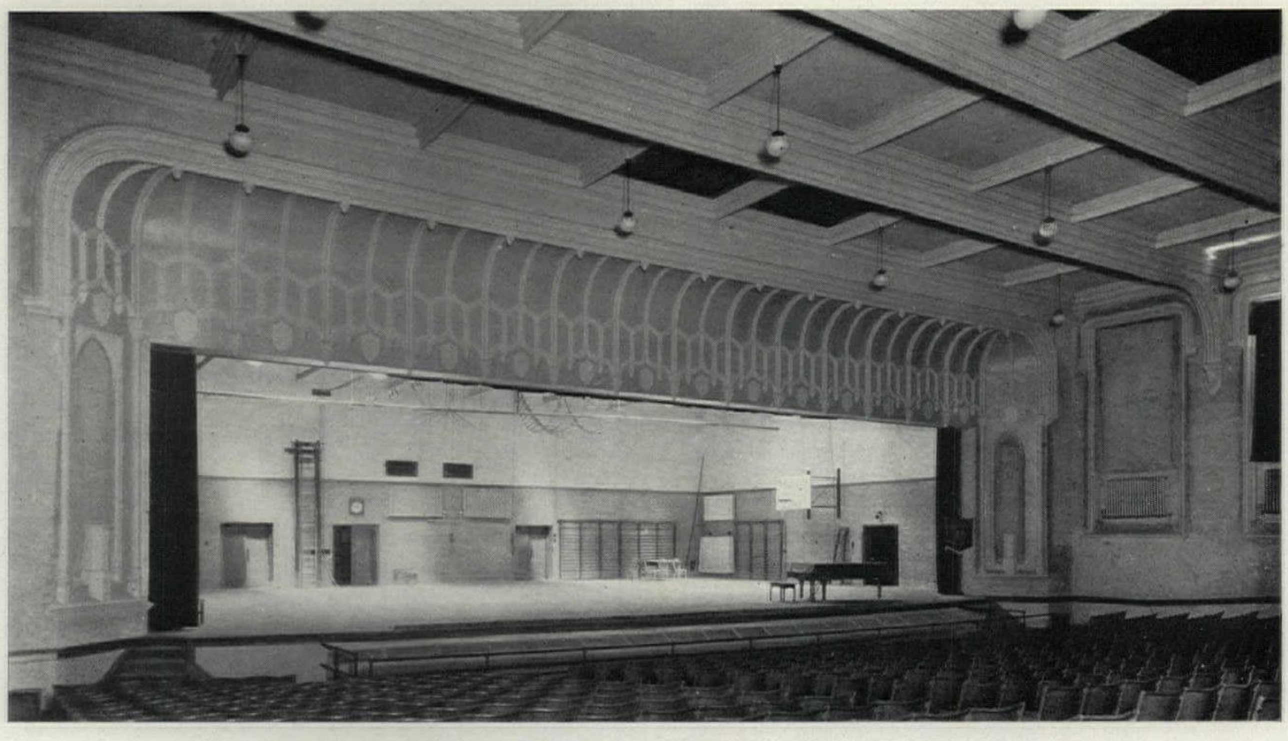


Stage, Combined Gymnasium and Auditorium, Community High School, Dundee, Ill.
Joseph C. Llewellyn Co., Architects

pine on end, glued to strips, then grooved and splined, and secured to nailing strips brought to true level. Wood floors should be sanded and treated with penetrating oil, placed with mop and left to penetrate the wood. Floors of short wood, laid herringbone or in small squares in mastic and sanded and treated as before, have been used in a limited way. Also a mastic top on a ¾-inch base of asphaltic concrete has come into use. It has the advantage of neither shrinking nor swelling, is easily repaired, and, in the case of basement gymnasiums especially, is well worth considering.

Walls of smooth, impervious, matt finish face brick laid with smooth flush joints for a wainscot 10 or 12 feet high will resist wear and tear. The ceiling should be covered with a sound-absorbing material. Heights of rooms will be governed by conditions, and must be sufficient to care for all suspended apparatus (usually 22 to 24 feet), and to provide clearance for running track, when installed, so as not to

Boys' Gymnasium, High School, Mount Clemens, Mich.
Joseph C. Llewellyn Co., Architects

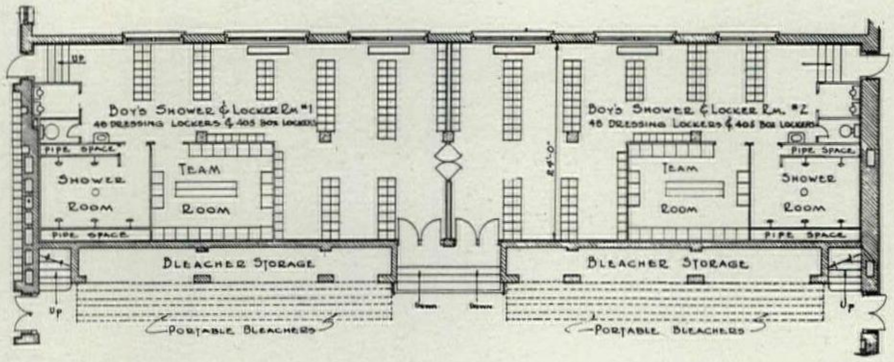


Stage, Girls' Gymnasium, Benjamin Bosse High School, Evansville, Ind.
Joseph C. Llewellyn Co., Architects

interfere with a full use of the entire floor area. For the bleachers, sight lines should be well considered. The fronts of the permanent bleachers should be as near to the floor as possible to permit of good view of practically the full playing floor, but high enough to permit of three or four rows of portable bleacher seats. Concrete construction, smooth finish, painted or chemically treated, forms a good base for seats made of 2 x 4-inch cypress or quarter-sawed yellow pine strips, shaped to proper section and secured to blocks to give required height, and well bolted to concrete.

Running tracks are less common now than formerly in the smaller gymnasiums. For large schools, the coaches want them. The construction must be able to carry the standard floor load, for while they should not be used for spectators, they often are so used, regardless of their inconvenience. The floor of the running track must be carefully planned with proper banking at all turns, and laid with narrow

Boys' Gymnasium, Lyons Township High School, La Grange, Ind.
Joseph C. Llewellyn Co., Architects



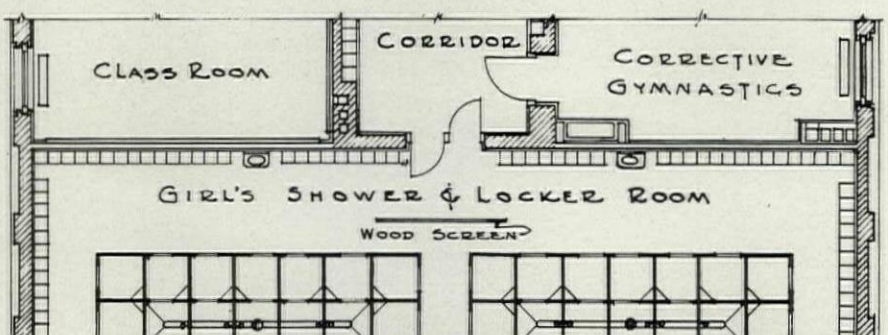
Twin Locker Rooms, Lyons Township High School
Joseph C. Llewellyn Co., Architects

flooring which will take the bending. It must be thoroughly nailed and dressed smooth, and finished with cork carpet or similar material well glued to the wood. Straightaways in schools are not common, though often desirable. However, opportunity offers at times in large schools to use a rear corridor adjoining the gymnasium as a straightaway by providing a suitable resilient floor.

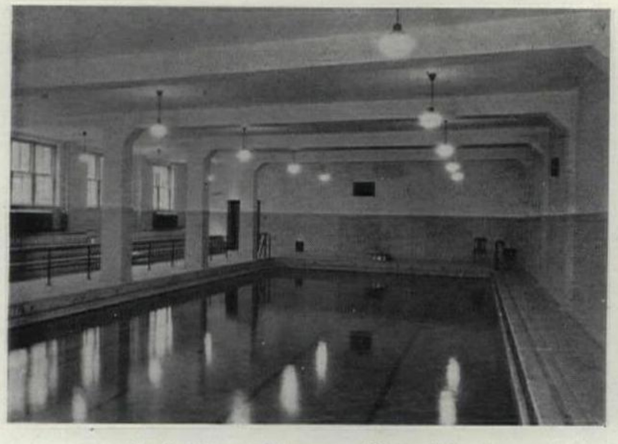
Shower and Locker Rooms. The structure of shower stalls and floors, and materials used to secure impervious divisions and walls, the treatment of walls, lighting and ventilation, all call for care and close attention. Careful planning is required to secure maximum locker facilities without crowding, to care for pupils and for home and visiting teams,—to give each the desired accommodation. For the larger schools, twin locker rooms, having shower, team and toilet rooms, make a convenient arrangement. (See page 438). In inter-school games the visitors occupy one room, the home team the other.

Various materials can be used for shower stalls. Built-up stalls of monolithic terrazzo on steel and metal cores built into the floors and ground to a smooth surface and polished, are of attractive appearance and are economical. In girls' locker rooms, dressing stalls are provided under various arrangements, varying from one dressing room to three to each shower. Some large schools, after experimenting, have adopted two dressing rooms to one shower as the best proportion, taking into consideration the time required to change classes. The size of classes determines the number of showers and dressing rooms. The average size of shower stalls is 3 feet to 3 feet, 4 inches in width and 3 feet, 6 inches in depth. A triangular locker in each girl's dressing stall permits the use of box lockers only in the locker room and is economical of space. A small mirror in each dressing room avoids crowding before general mirrors at the end of class periods.

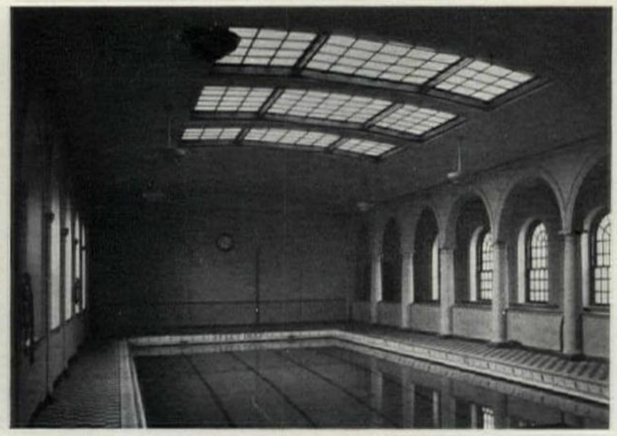
Accessories for gymnasium and shower rooms,—such as wall drinking fountains and cuspidors in gymnasiums,—located so as not to interfere with play,—add materially to the comfort of the pupils. Mechanical means of drying hands and for hair drying are sometimes used. Their success depends on the way they are used and the care in maintenance. Ventilation of gymnasiums and locker rooms should be carefully considered. Warm air, blown into the



Girls' Shower and Locker Room, Francis Joseph Reitz High School
Joseph C. Llewellyn Co., Architects



Pool, Mount Clemens High School
Joseph C. Llewellyn Co., Architects
Plan Below

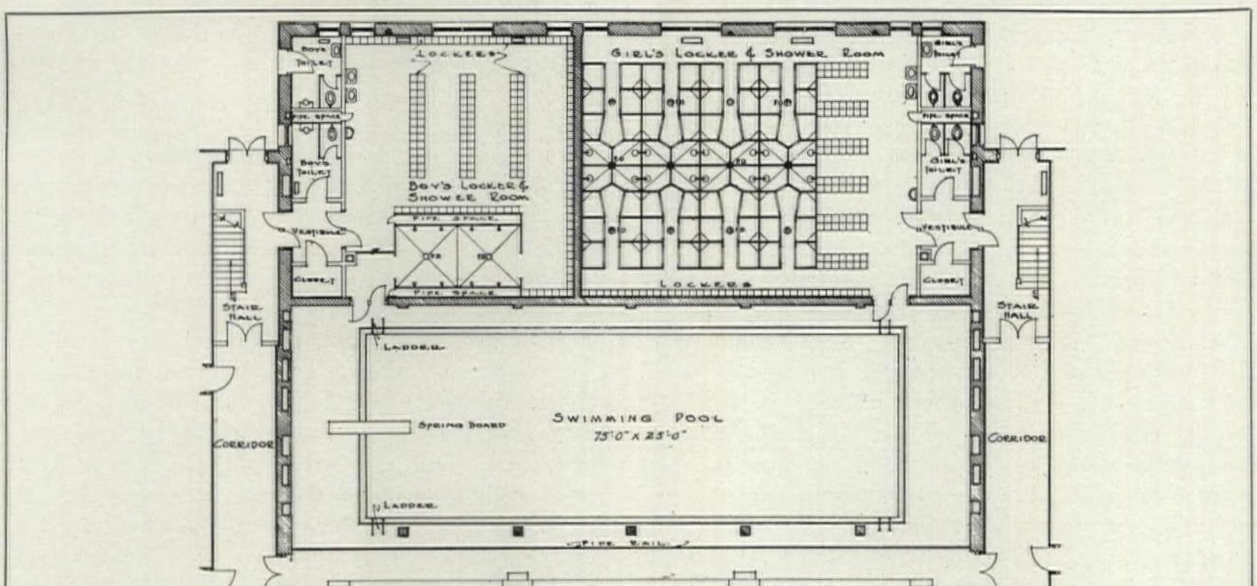


Pool, Junior High School, Trenton, N. J.
Ernest Sibley and Lawrence C. Licht, Architects; J. Osborne Hunt Associated

locker rooms and mechanically exhausted, will aid in maintaining dry rooms. It is desirable to locate shower rooms so that plenty of light and sunshine can be had if possible. Without warmth and good ventilation, shower room walls and ceilings will condense moisture and produce in time more or less disintegration of wall surfaces.

Swimming Pools. Where swimming pools are used, it is desirable to plan them *en suite* with the gymnasiums so that the same locker rooms and showers can serve both and so avoid duplication. Overhead light with lifting skylights, where possible, gives considerable flexibility to the ventilation of these rooms. Insulation of roofs over pools will be a material help, and care in selection of wall and ceiling finish is necessary. The building of the pool itself is not necessarily an expensive operation. If money is limited, a substantial pool can be constructed with a concrete pan reinforced horizontally and crosswise and waterproofed with integral waterproofing. It can be lined with a bottom of white vitreous tile, sides being of white tile or terrazzo waterproofed; terrazzo gutter and rail, with markings of inlaid tile. This gives a clean, sanitary, and quite satisfactory pool. The floors of pool room can be terrazzo with a mixture to prevent slipping. The room can be finished at a reasonable cost with smooth, light gray or buff impervious brick for walls, and cement plaster, properly painted, for the ceiling. Enameled brick, tile, or terrazzo make attractive walls at a somewhat higher cost.

Water purification in addition to filtering can be by use of chlorination, ozone, or violet ray. Each has its advocates; chlorination by mechanical means furnishes a simple and economical means. Much depends on the proper sizing of supply and circula-



Plan of Swimming Pool and Locker Rooms, Mount Clemens High School
Joseph C. Llewellyn Co., Architects

Stadium, Enlow Field, Evansville, Ind.
Joseph C. Llewellyn Co., Architects

Stadium, Oak Park, Ill.
Joseph C. Llewellyn Co., Architects

tion piping. Often pipe sizes are too small, causing sluggish circulation. Filters, heaters, and piping to recirculate in eight hours at least are desirable.

In schools of from 750 to 1,000 pupils, coaches for boys are provided with one or two rooms, shower, and storeroom; and the physical directors for girls are given two or three small rooms for offices and workrooms and a rest room for the girls. In larger schools, these suites will expand somewhat to provide a room for corrective gymnastics or exercises for boys, and the rest room facilities for girls will be enlarged to meet the larger enrollment. For the larger schools, also, boys and girls will have their separate gymnasiums and in many schools separate swimming pools. The size of the school, its possible future growth, and the financial capacity of the school district are determining factors in planning the recreational facilities for schools. Provision should be made for maximum classes in the gymnasiums, in case of rapidly growing districts, by making larger floors than needed at first and providing for expansion of locker facilities as required. Provision for expansion of space for special work or rest room requirements can easily be taken care of and should always be kept in mind in planning.

In the foregoing paragraphs, the high school has been primarily in mind, but the trend of education today recognizes the value of work and play and is making use of them in elementary schools as well. The architect must incorporate in his elementary buildings the auditorium and the gymnasium with their accessories. The school building is also becoming more than a school for children and is a community asset as well, as the public uses various parts, especially the auditorium, gymnasium, swimming pool and possibly the library. The auditorium or gymnasium can be made accessible and separated from the rest of the school as occasion demands.

The Athletic Field. The chief of outdoor features is the athletic field. The laying out of an athletic field is pretty well established as to necessary size and shape of ground required for the various games. What is not always cared for as it should be is the preparation of the field to give proper drainage, treatment of soil to properly prepare it for seeding, and the foundations for track and straightaways. These require care, not in the preparation and seeding alone, but in the use of the field itself, until a turf is grown and track is brought to a proper condition. This work is in the province of a landscape architect familiar with the locality in laying out drainage and seeding, and it is the work of the gardener to properly maintain it; in the hands of careful and capable men, it can be made of moderate cost when its benefits are taken into account. To preserve the field in condition for school athletics, it should be enclosed. Enclosure can be made by use of woven wire and steel posts, or by brick or concrete walls. The type used will usually be determined by the location of the school, by cost and the ability to pay for it. The enclosure simplifies control in all interscholastic games in the open air.

Outdoor games, as well as indoor, draw crowds, provision for which brings up the matter of permanent seating for the public to take the place of portable or wooden bleachers. These *stadia* are of various forms from the built-up banks of earth, faced with steps of wood or flat building stone and concrete, to those of wholly concrete construction (open or covered) and faced with brick walls to make a shelter as well as to provide seats. The concrete construction, covered or not, permits of providing various facilities for the comfort of the public which earlier forms of seating do not, and which are essential.

In conclusion, school athletics and recreational activities constitute one large element in creating and maintaining school spirit and in building up school traditions, in teaching young men and women to do team work and, in doing team work, to concentrate attention on the thing to be done; to think and act quickly when necessary; to be one with one's fellows,—all qualities quite essential in after life. To plan for the requirements of athletics and recreation in our schools and give the buildings all flexibility possible in providing for the present and anticipating the future is, as was said in the beginning, an interesting thing to do. It cannot be done in a haphazard way but calls for all the care and attention possible.

DETAILS OF SCHOOL BUILDINGS

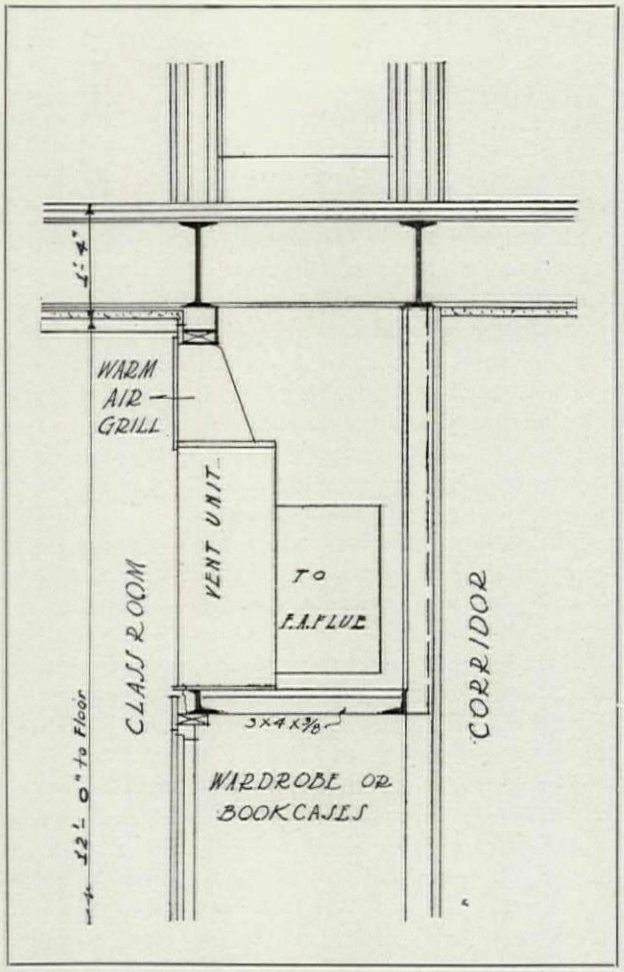
BY
WALTER H. KILHAM
OF KILHAM, HOPKINS & GREELEY, ARCHITECTS

UNDER the liberal appropriations of what the next generation may refer to as the "frenzied twenties," American schoolhouses have been developed to an astonishing degree, and while the proportion of cubic space devoted to education still remains an appropriate factor, sizes of rooms more particularly destined for athletics, amusement and times of general enthusiasm have increased by leaps and bounds, so that the planning of what might be called the "country club" type of building has come to absorb much attention from present-day architects, sometimes to the detriment of carefully thought out details. Happily the age of Romanesque monastery windows, guaranteed to exclude light from classrooms, has passed, as has the period when English hammer-beam trusses carefully constructed of plaster were considered the prime essentials for a good school auditorium; but careless or ill-considered interior details still often mar (or at least it seems so to the practiced eye) the effect of many a near-sumptuous high school. This article will consider a few of the many items which must come under the care of the schoolhouse architect and sooner or later call for prompt decision. Experience has been defined as something everyone gets when it is too late to use it; if some of these suggestions arrive in time to be helpful, the effort will not have been made in vain. As many features of schoolhouse detailing have been previously considered at length, the main discussion in this article will relate to developments in material and design which have come about since the war.

The Classroom. No matter how many accessories the modern schoolhouse may have accumulated, the classroom still remains the predominant feature, and its main attributes do not undergo many changes. The average size for 35 pupils of the sixth grade to high school remains at 22 x 30 feet, which accommodates five rows of desks across and seven rows deep, with a 3-foot wall aisle, four 18-inch interior aisles, and a blackboard aisle of 3 feet, counting the desks as 24 inches wide. The whole width then totals 22 feet, not too much for the inner part to receive a fair amount of light, but still not down to the standard of the future, which will some day reduce it to four rows or maybe 18 feet, when standard classes shall have been reduced to 28 or 30 pupils.

Windows. The standard window space remains at the empirical figure of 20 per cent of the floor area, which seems to be as much as can generally be obtained, considering the difficulties of wall and window frame construction and the heights of window radiators; and if the light is not affected by lowering shades, it is fairly satisfactory on bright days. The future may see a general adoption of some form of white "blackboard" which would materially reduce the absorption of light. The difficulties of wall construction, as far as they relate to wide window spaces, are largely overcome in steel or concrete frame construction, but the average rural or suburban schoolhouse is still far from being of that type, and depends on wall-bearing brickwork for its main supports. A certain amount of pier space along the 30-foot length of the room is therefore necessary, and the architect, while holding these piers down to the least width compatible with strength, has to see to it that they are not so wide as to cast any troublesome shadows.

The sashes themselves, which for the present may be considered as of wood, should also be kept reasonably narrow for ease in operation. If made over 4 feet, 6 inches or 5 feet wide they become unduly heavy, requiring larger weights and stronger frames, and are weak unless made with a liberal amount of woodwork. A good arrangement from the sash manufacturer's point of view is that of three pairs of double windows for each room, providing it does not interfere with the exterior architectural design. Three pairs of such windows, each about 3 feet, 6 inches x 9 feet will fulfill all the legal requirements for a room 22 x 30, and all the sashes will fall within comfortable sizes for glass, cords, weights and woodwork, and will be free from any tendency to stick. The question of "double-hung" versus tilting windows still remains open. Both types have warm friends and vigorous enemies, though the friends of the tilting type are very positive and numerous among the teachers,—who usually like the larger quantities of fresh air which they can thus secure in defiance of the heating engineer's calculations. Local ventilating units, locally controlled, by which the supply of pre-heated air can be shut off when it is desired to open the windows, are being installed in many schools. Their use obviates the long runs of warm air ducts of central systems and reduces cubage factors, which appeals to most architects, while teachers welcome the possibility of room control over the vexing matter of ventilation, a privilege which is not, however, very freely granted to them as yet. The objection to this type of ventilation is that it is dependent entirely on the ideas, whims and control of the teachers, who may or may not understand ventilating needs. As what constitutes proper ventilation is a moot question, which is considered in a separate article, we mention here only the space saving that attends the use of the local ventilating units. The whole unit apparatus is contained in a neat steel casing of unobjectionable appearance as far as its design is concerned, but it constitutes a certain obstacle if placed in the window aisle. This location is the most favorable from the point of view of economy, as no long runs of sheet



Sectional Diagram of Unit Vent Shown on Opposite Page
Kilham, Hopkins & Greeley, Architects

metal ducts are required to reach the outer air, but various efforts have been made to remove the unit from the room and to place it in a less conspicuous location. One of these sketches shows an arrangement designed by the writer for the James Russell Lowell School at Watertown, Mass., which places the unit in the space ordinarily wasted above the tops of the "Chicago" wardrobes, thus releasing the floor space and clearing the window aisles. A slight increase in cost, hardly appreciable in the total for the building, is caused by the short runs of galvanized duct between the unit and the outer walls.

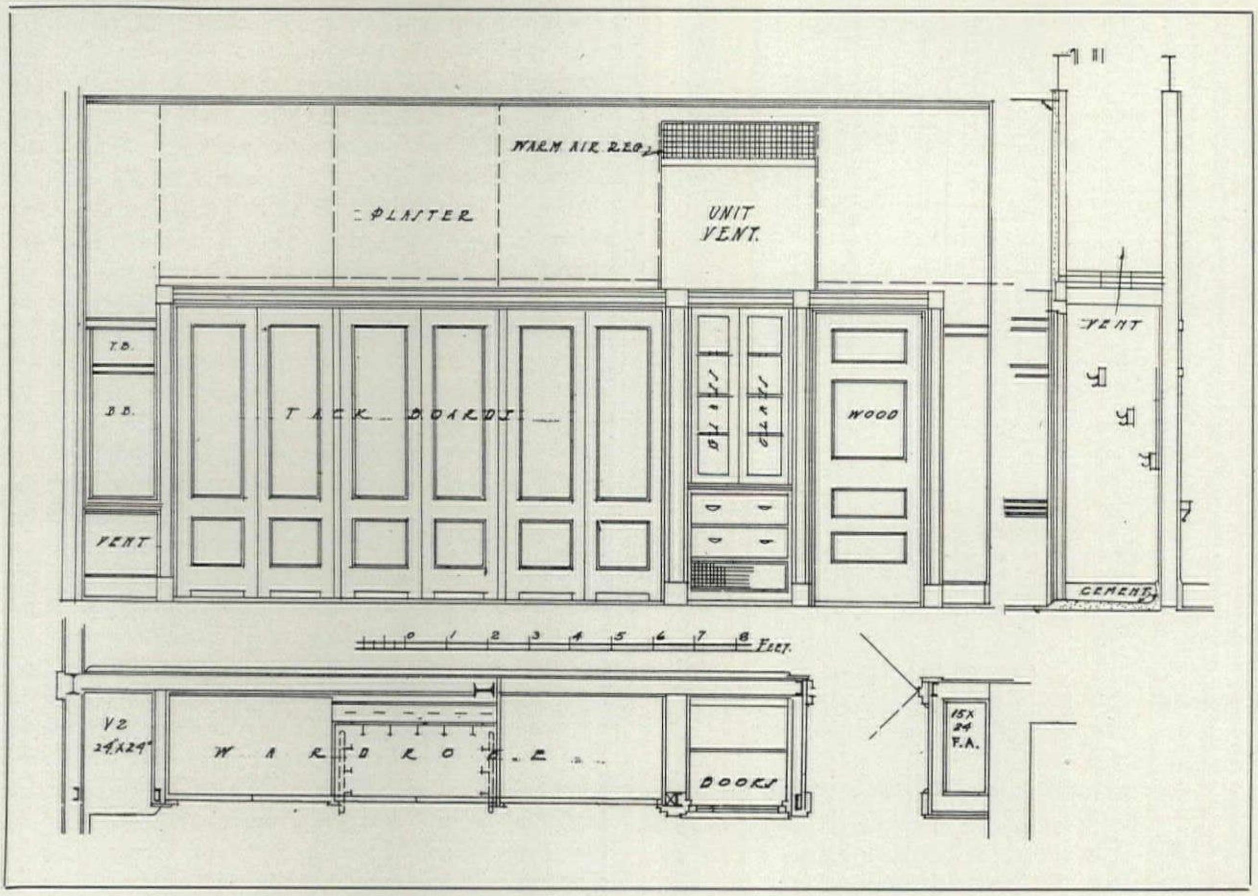
Blackboards and Tack Boards. Still another development seems to be the growing encroachment of the tack board on the time-honored blackboard space. Many teachers ask for as much as 50 per cent tack board space, going the full width of the blackboard, while others, generally those in the lower grades, want a cork carpet border about a foot wide going all around on top of the blackboard, which is reduced in height for this purpose; still others eschew the cork carpet and demand a board of soft pine or whitewood into which thumb-tacks can be easily pushed, leaving their marks, however, behind. There are ingenious devices available that provide easy means of hanging drawings and other exhibits without marring or danger of falling. Whichever fashion prevails, it is a useful practice to provide an instrument board near the door on which the switches, telephones, thermostats, etc., can be mounted,—that is, providing the electrician can be induced to forego his insatiable desire to put these contraptions in the center of the best wall space in the room.

Blackboards. Blackboards should never, of course, be placed on the window side, and as much space as possible should be saved for them along the inner wall and behind the teacher. A good general rule for heights of chalk troughs above floors is:

2′ 2″ from the floor in kindergarten.
2′ 4″ to 2′ 6″ from floor in grade IV.
2′ 8″ from floor in grades V to VIII.
2′ 8″ to 2′ 10″ from floor in high schools.

Screens for erasers above the chalk rail are not generally regarded as being standard equipment, but they are occasionally demanded. They should be of light but strong construction. The ideal, of course, would be a type supported from the back on brackets, so that the troughs could be wiped out with a continuous motion of the hand, but in practice some front supports are necessary.

Wardrobes. In grades below the senior high, the "Chicago" type of wardrobe, integral with the classroom, seems to have found great favor with school authorities on account of its convenience, and with architects on account of its saving of cubage, though probably no one would attempt to say that it is superior to the old separate coat room, especially if the latter is provided with an outside window on the sunny side of the building. Others like placing lockers or wardrobes along the corridor walls, an arrangement more suitable for high schools than the lower grades. The "Chicago" wardrobe saves cubic and square foot space, but it causes loss of a lot of blackboard space, unless it is placed at the rear end of the room opposite the teacher, which should, of course, always be done, but which is not always economical. The most difficult problem about it, after its location is settled, is that of the doors. Shall the doors be hung with weights and slide up and down, or shall they fold back into the wardrobe, or shall they pull down in roller-slat fashion? If they slide up like windows, the long frames and weight boxes are rather a disfigurement to the room, though space is certainly saved. If the doors are mounted on any of the clever folding hardware devices, each is likely to require a little of the length of the wardrobe for folding back, space which may be sorely needed for hook space in case the wardrobe shares the narrow end of the room with a bookcase, a communicating door, and the heat and vent ducts. Details included here show methods of constructing both of these types in recent buildings. The wardrobe may well have a cement floor with a coved base, raised an inch above the classroom floor at the front with a bevel and sloped back to prevent water from umbrellas or wet clothing running out on the classroom floor, and it should have a 6- or 8-inch vent connection in the top and suitable air intakes with



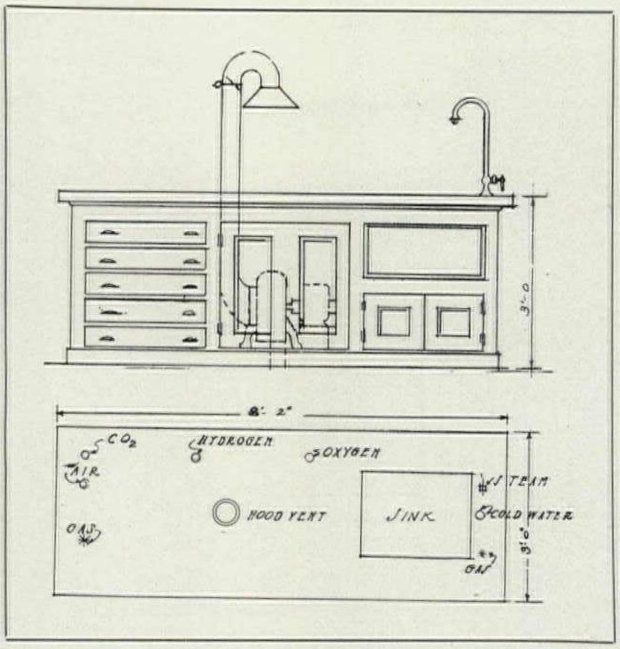
Detail of Wardrobes, Cases, Heating and Ventilating
James Russell Lowell School, Watertown, Mass.
Kilham, Hopkins & Greeley, Architects

doors at the floor, so that the draft will always be *into* the wardrobe from the room. The racks for coat and hat hooks may be either poles on metal brackets or flat 1x4-inch strips on wood or metal frames. The flat type has the advantage of never slipping and being adapted to stenciling numbers, should this be desired.

General Trim. This should be of simple design, without elaborate mouldings or sharp edges which could readily be injured. Architraves are desirable around doors, to prevent injuring the plaster, but they may be omitted at the windows if plaster jambs are substituted with corner guards, if the committee really wants to reduce upkeep costs in the future. Slate or artificial stone is a good substitute for wood window stools to prevent the deterioration of wood where exposed to water of condensation, strong sun and perhaps rain beating in if the window is open. On the whole, some architects think block trim more practical than mitered. Transoms over doors are usually unnecessary. Steel trim of course demands consideration for each project, but a form of substantially enameled base is wanted, as paint quickly disappears from the ordinary steel base when the floor is subjected to mopping. Bookcases are essential, but their type has undergone little change.

Stairs and Corridors. Here again the advent of battleship linoleum, cork and plastic floors has changed the scene and effected an enormous reduction in the amount of noise. The use of fabric flooring has done away with the old terrazzo cracks which always appeared to greet the critical visitor right inside the main entrance. The corridor dado needs to have eminently wear-resisting qualities, and can be made of tiling or salt-glazed brick in the more "Ritzy" type of buildings, or of plaster covered with cloth in plainer structures; but only a confirmed optimist will build them of that material hopefully termed "hard plaster" without protective covering.

A considerable variety of materials is now offered for stair treads. Steel pans filled with cement, asphalt, terrazzo, non-slip abrasive tiles, linoleum and many other products are available, as well as blue stone, slate, etc. A steel non-slip nosing is a guarantee against undue wear. Some schools have had wooden treads thus fortified go through over 25 years of hard usage without perceptible damage. Different states have various rules for the height of the balustrade, but in any case a handrail at the usual height on *both* sides of the run is essential. Some states even require a 5-foot balustrade. Careful checking up of local regulations in this respect is necessary. The balustrade, if of iron, should be of simple type, and consist mainly of vertical mem-



Demonstration Table

Alexander Hamilton Junior High School, Elizabeth, N. J.

Kilham, Hopkins & Greeley, Architects

bers for easy cleaning. In some cities solid balustrades are preferred to prevent objects' dropping through. The nature and characteristics of the stair well or tower also need thorough study. So many fires have gained headway by shooting up the stair wells that it seems that enclosing the platforms at each floor with self-closing fireproof doors should be universal practice, even though it is not always obligatory. These doors and the partitions which contain them are generally made of kalameined wood, which is neat in appearance and sufficiently fire-resisting. The panels and transoms are filled with wired glass to transmit light from the outer windows, that in the door being clear wire-glass. The "smoke doors" so called, should open *toward* the stairs and should preferably consist of one pair without a central bar, so as to direct the stream of pupils toward the downward flight. The hardware should consist only of self-closing door checks, butts, pulls, and push and kick plates. Floor stops, hooks, or other attachments for holding doors open should be omitted, in spite of the tearful protests often received from the teachers, for such accessories defeat the primary object of the doors, which is to provide constant protection against smoke or flame in the stair wells by closing off any up-draft of air. Massachusetts and some other states require that the outer corners of the well be rounded on a 2-foot radius or cut off with a diagonal corner of equal size, to prevent wedging of small pupils in the corners in case of panic; and all landing radiators should be either recessed in the walls or hung on the walls above head height. Where gas is available, emergency gas lights are also desirable; and the electric lights for stairs should be carried on separate circuits controlled from the principal's office as well as locally.

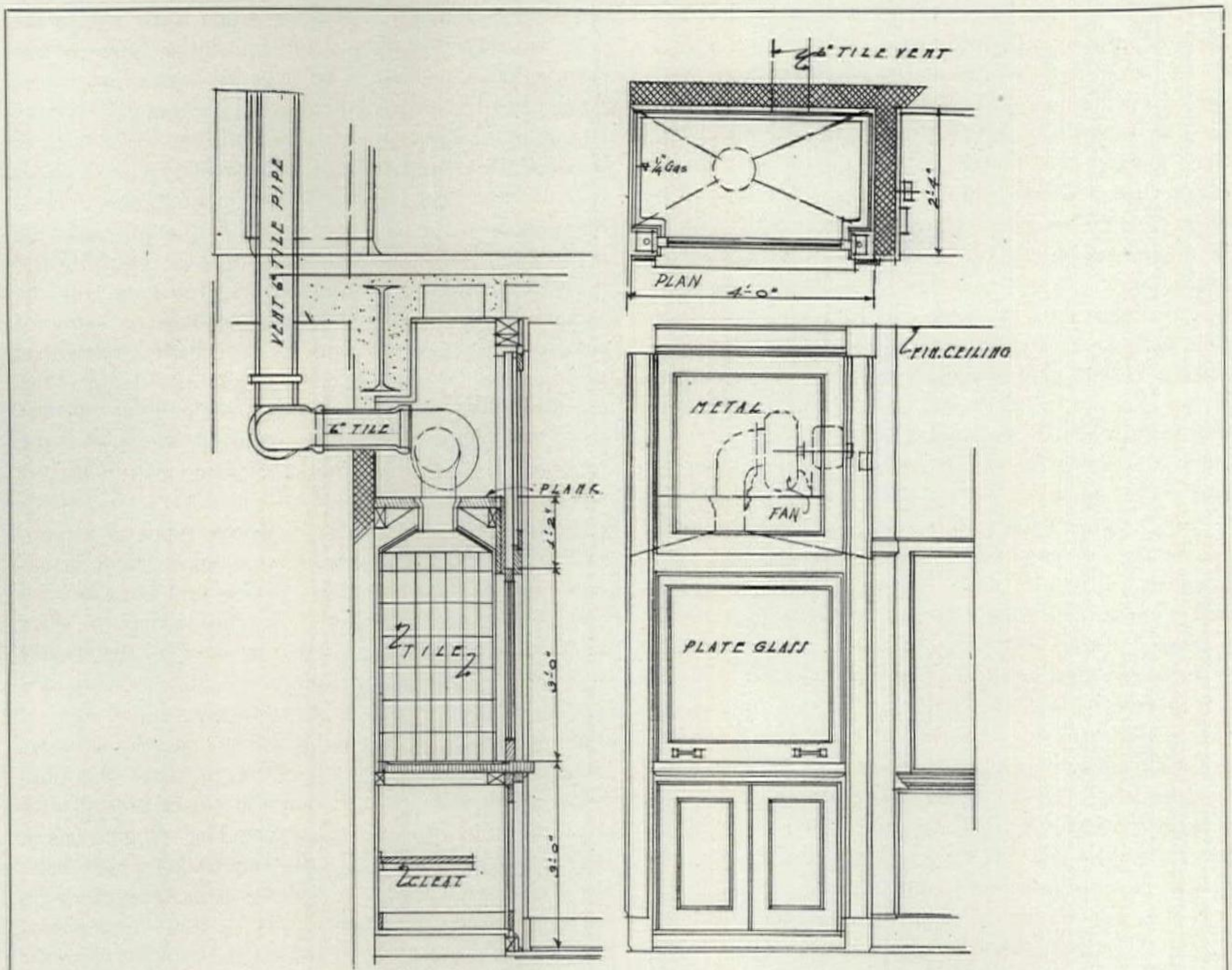
Even in buildings of second class construction the stair wells should be absolutely fireproof, and the best wall material, in the opinion of some architects, is glazed or salt-glazed brick, which is durable, cleanly and does not require painting. The stairs when practicable should be located at the ends of corridors, so that light from the stair windows will shine through the smoke partitions and along the corridors. Stair towers should not be more than 125 feet apart. Some states allow, and others forbid, by-passes through schoolrooms with communicating doors, so the architect has little option in this respect, and he can best serve the community by insisting on plenty of stairways, easily accessible. The riser and tread sizes are also subject to public regulation and should be kept at a comfortable proportion, for obvious reasons. Closets should never be constructed beneath stairways, under any conditions.

Toilets. The science of sanitation in this respect is well advanced; in fact, in the opinion of many foreign writers the character of American civilization is expressed in our plumbing, and the matter of designing toilet rooms for its accommodation is not less well developed. The architect will, however, have to decide upon the materials with which the floors, walls, and partitions are to be constructed. It should be said that the essential requirements are first, light, which shows up dirt; and second, ease of cleaning. To this end a light colored floor is most desirable, even though it keeps the janitor busy mopping up, for a black floor absorbs light, conceals dirt and is always unattractive. White vitreous tile or mosaic, perhaps with black dots or pattern, and white glazed tile dadoes are none too good for the purpose. For toilet partitions, marble or some of the white products are ideal, but costly. Slate has the disadvantage of absorbing light and being easily marked. Enameled steel is in quite general use, but wood doors are sometimes preferable to steel doors, as they are less noisy and easier to adjust when a measurement goes wrong.

A technical discussion of various types of plumbing fixtures would occupy more space than is afforded by the limits of this article and is more adequately treated elsewhere in this issue of The Forum. In passing, one might question the use of expensive individual vitreous china basins for hand washing, when a good white enameled sink provided with plenty of faucets where the hands may be washed under running water might serve the purpose far better and actually be in closer accord with modern ideas of cleanliness. The single basin, seldom cleaned, with self-closing cocks which limit the supply of water, while pleasing in appearance, is often more of an obstacle than a help to personal cleanliness. Some sort of screens, or deflected passages to toilet rooms from corridors are thought necessary by educators.

Museum Cases. A good many schools gradually acquire specimens of minerals and all sorts of natural history or other exhibits, not to mention athletic cups and trophies, for which no suitable place is provided. It is often easy to provide cases which can be snuggled into spaces around the heat and vent ducts, with glazed doors opening on the corridors where such objects can be properly displayed. Most cases should be white inside, and if the matter is of sufficient interest, may even be provided with lights.

The Kindergarten. The consensus of opinion requires that this room shall have a full southern exposure so as to obtain all the beneficial effect of floods of sunlight. This is mentioned somewhat guardedly, as the writer was recently a dissenting member of a jury of A. I. A. architects which awarded a competition to a plan which placed the kindergarten on the north side, mainly on account of an artistically drawn lilac bush placed in front of it by the skillful renderer. The program forbade any accessories! Having been then over-ruled on this point by prominent members of the profession, he is still a little timid about it, but continues to cherish the notion that the south side is best. The kindergarten should have its own separate entrance and, if possible, a level and sunny playground, even with the door sill, so that the juniors will not have to be helped up and down steps when they go out to take the air. Their coat room should be of a size which will allow a bench for the attendant to use when putting on their rubbers and arctics and buttoning them into their what-alls. The toilet, which should be of an extreme handiness to the main room, will need special low-height fixtures and plenty of light. As considerable time will be spent by the pupils on the floor, that detail of a kindergarten requires special consideration. The ideal material would be something warm, or at least not too much of a heat conductor, which is at the same time easily cleaned,—cork, either tile or carpet, or one of the new rubber fabric floors seems to fill the bill as well as anything. Some regard cork carpet as not being susceptible of easy cleaning, but it has been successfully used in a good many kindergartens and is warmer than linoleum. The fittings of a kindergarten will vary according to individual wishes, but will generally include boxes and compartments for blocks and playthings, a large amount of tackboard space, and probably a small amount of blackboard.



Hood in Science Room
Alexander Hamilton Junior High School, Elizabeth, N. J.
Kilham, Hopkins & Greeley, Architects

The larger and smaller rooms which usually constitute the kindergarten suite are sometimes separated by rolling or accordion doors, to allow them to be easily thrown together. Custom seems to decree that the kindergarten should have a fireplace, but committees seldom appropriate money to buy wood, so its bricks often retain their virgin cleanliness for generations, unmellowed by smoke. However, an inglenook with seats looks well, and sometimes there is a gift of firewood, so that a fire is actually started. For this reason it is always well for the architect to see that a practical flue is constructed, which does not end in an air duct! Bay windows and other attractive features are appropriate for this part of the building and are sure to be appreciated.

The Auditorium. It must be said that the type of school auditoriums seems to be passing through a transitional stage. For large schools of 1,000 to 2,000 pupils the effort has heretofore been directed toward providing an auditorium capable of seating the entire membership at once. The expense of building such rooms as these, as well as their somewhat unwieldy sizes, has led to the consideration of the suitability of smaller types. If, for example, a two-platoon school of 1,500 were equipped with an auditorium for 750, the costly overhanging balcony could be omitted and the entire number comfortably seated on a rising floor with every occupant in full view of the others and not hidden by balconies. For the construction of such a room the general specifications for a theater minus the expensive decorative effects, could well be followed. Every effort should be made to assure good acoustics. Fortunately, several commercial systems of treatment for the walls and ceilings are available, and they can be trusted to produce reasonably good results. Upholstered seats will help, and linoleum or fabric for the aisles, if not for the entire floor, is desirable to minimize the noise made by persons entering and leaving. A form of wainscoting, for which purpose there is really nothing much better than wood, is necessary to protect the walls from hard usage, and no projecting radiators should be tolerated. An auditorium, however, differs from a theater in that it usually has windows for day lighting, and means must be provided for excluding light when it is desired to give picture exhibitions. This may be accomplished by means of opaque rolling shades, running in grooves at the sides of the windows, or by heavy draw curtains, which are simpler and perhaps fully as good, as well as being more decorative. The windows themselves will require some thought, as the sashes should not be too large and heavy, and provision must be made for cleaning them.

Some schools wish completely equipped theatrical stages, with switchboards, fly galleries, smoke ventilators and even grids. Such halls will probably also want sunken musicians' pits and complete dressing room layouts. It is difficult to know just where to draw the line in these cases. Good school shows can be put on with very modest equipment, and if modern ideas of stage lighting effects are followed, the expensive borders and drops can be omitted. In any case, the architect must remember that his stage problem is four-fold, for he must provide facilities for (a) a single speaker with perhaps a few persons in chairs to form an *entourage;* (b) provision for a class of maybe 100 or 200 for graduations, or producing cantatas; (c) accommodation for a dramatic production, either by the students or by a regular troupe, professional or amateur; and (d) facilities for showing motion pictures. To fulfill all these requirements and satisfy everyone will require ingenuity and some tact. A "cyclorama" of velours provides a good background for the single speaker and closes off the somewhat dreary look of an empty back stage. The back of the proscenium must be arranged for the fire curtain, draw curtain, sprinkler pipes, picture screen and lighting effects. The switchboard should be sunk or raised so as not to interfere with the operation of the play, and all the local regulations will have to be carefully studied; and adequate special exits must be provided for the stage. Other special features of the auditorium are the motion picture booth and its ventilating system; the manner of lighting, which must not interfere with the projection machine; the type of entrance doors,—whether with or without transparent glass; and the type of ceiling. If the auditorium is contained in the center of the building, outside light is often admitted from the roof, which involves much care of the glass ceiling. This arrangement, however, seems to be passing out in favor of the exterior auditorium with side windows.

Aside from these observations regarding various special items of schoolhouse construction, there are certain basic requirements which ought to be kept in mind in drawing up the details. Among these are durability; ease of maintenance; economy in first cost, (which would include transportation and time required for obtaining the product); suitability for attractiveness of appearance. Mouldings with sharp edges or wide flat surfaces which collect dust are easily damaged and unsuitable, and yet one often sees clothes racks or stair newels carrying the full Doric order as decoration. Wall tiling has its place in toilets and corridors, but one of the most costly and highly praised of the recent high schools has the boiler room finished in white glazed tile and the main corridor in cheap textured plaster! Many chapters might be written about exterior detailing. Some optimistic members of the profession believe that painting the back of a parapet wall with some evil-smelling compound is a perfectly good substitute for 16-ounce copper, and they wonder why their million dollar roof leaks after a couple of years. Others are completely in the dark about the mysterious efflorescence which appears under their window sills, or the strange disintegration of elaborate pinnacles and ornaments. To all concerned in schoolhouse building, the question of detailing is a fascinating and profitable subject, which will repay study.

SCHOOLHOUSE MAINTENANCE AND MATERIALS

BY

GEORGE F. WOMRATH

ASSISTANT SUPERINTENDENT IN CHARGE OF BUSINESS AFFAIRS, MINNEAPOLIS PUBLIC SCHOOLS

TWO billion, three hundred forty-four million, nine hundred eighty-four thousand dollars! This represents the contract expenditure for school building construction and equipment in 36 states for the past seven years only. As the greater part of this construction work has been financed either by long term or short term serial bonds, it is fair to estimate that the actual cost to the tax-paying public for these schoolhouses by the time the bonds are retired will be 50 per cent more than the principal sum, or a grand total of $3,517,476,000. For the entire United States the gross investment in school building construction for the seven years, for which the foregoing figures were compiled, was a sum considerably more than $3,500,000,000, practically all of which must be paid by taxation.

With the completion of a school building, its cost to the public does not cease; there at once begins the cost of operation and maintenance. This latter cost becomes an index of the wisdom shown by those responsible for the original construction investment. The figures involved are so large that even a small percentage of saving becomes an impressive amount. It behooves those accountable for the handling of public school funds to carefully consider every item entering into the construction and equipment of a school building and to weigh its original cost against its subsequent cost of maintenance. It has been repeatedly demonstrated that, by carefully revising the plans and specifications of school buildings upon which bids have exceeded appropriations, a saving of from 5 to 10 per cent can be made. School board members, superintendents and school architects are called upon as never before to study the problems of schoolhouse construction, in order that the tax dollar may provide the best buildings possible, and that these buildings may be so constructed and equipped that subsequent maintenance costs will be a minimum.

Not many years ago, when a school building was wanted, the common practice was for the school board, or the superintendent, or the school building committee to select an architect and tell him to prepare plans for a school building of a stated number of rooms or to accommodate a certain number of pupils. In many instances the architect selected was totally unfamiliar with schoolhouse design. During this period, questions of economy and efficiency in schoolhouse design, construction and equipment received but slight study; as for standards for heating, ventilation, lighting and sanitation,—there were none.

Of recent years specialists in schoolhouse architecture, with their engineers, have made exhaustive and extremely valuable studies of the school housing problems in many cities, involving many types of school administration and widely divergent curricula. Surveys were made to establish relationships between educational activities and requisite floor space needed. The ultimate outcome of these surveys was use of the "candle of efficiency" in the report of the Committee of Standardization of Schoolhouse Planning and Construction of the National Education Association. Mechanical and physical data were worked out and made the bases for state and city laws, ordinances and regulations governing schoolhouse construction and mechanical equipment. These men carried their ideas from one part of the United States to another. During this period, architects and engineers practically determined all school building policy insofar as design, planning, construction and equipment were concerned, the superintendents confining their activities to instructional policy only. The pendulum had swung to the extreme of the arc. Schoolhouses were built almost without any consideration being given the superintendent; in many instances without regard to cost, elaborateness, or sizes and number of rooms. Time and time again a schoolhouse was handed over to the superintendent with the admonition to "go ahead and run it,"—a building in which he had had no part whatever in planning, designing or equipping.

Whether it was the high cost of the school buildings which were designed and constructed during this period of development or a recognition on the part of the superintendents of their waning control,—whatever the cause, by the year 1915 the pendulum began to swing back. Both educators and laymen began to recognize that the superintendent of a school system holds a dual position, which in industry is more often designated by the title of "general manager." He is not only responsible for the instructional phases of education, but also for the physical surroundings in which the youth of the nation are being educated. He is charged with the task of preparing the building and financial programs, and of appearing before the boards through which the money to carry out the programs must be secured, and of getting from them the needed appropriations. It gradually became fixed in consciousness that the principle of direct responsibility should be applied to school business as it is to industry, namely, that the person responsible for the quality of the product and its cost should also be made responsible for the complete organization and machinery by which the quality and cost of the product are determined.

As the superintendent began to be recognized in his dual role, we find the architect and superintendent discussing and selecting designs and elevations as to architectural beauty, grace and dignity; working out the problems of space allocation and economical floor planning for the kind, size and relationship of rooms needed and their utilitarian arrangement; examining construction features and studying and comparing original costs and subsequent maintenance charges; judging building materials with respect to their practicality and lasting qualities, and selecting efficient mechanical and educational equipment on the basis of low original cost commensurate with economical operating expense and cost of maintenance.

"Cost" has become an important word in the modern school world. It represents a factor entering into every phase of modern school administration. Simply stating the cost of building construction, no matter upon what basis,—whether cubic foot, square foot, classroom, pupil, or any other,—does not reveal where a lack of economy may exist in design and equipment, either as to original cost or subsequent maintenance. A detailed analysis of all costs,—a picking to pieces of all of the factors of cost that enter into the design, plans, construction, equipment, construction superintendence, and architectural and engineering fees,—often reveals places where economies may be made to very favorably affect construction and maintenance costs without lowering in any way the ultimate educational, architectural and mechanical value of the building. What, then, are some of the items through which savings may be effected?

Types of Construction. The only three types of construction which have been countenanced in recent years for schoolhouses are defined in the Classification Code of the American Institute of Architects as:

"Type A. A building constructed entirely of fire-resistive materials, including its roof, windows, doors, floors and finish.

"Type B. A building of fire-resistive construction in its walls, floors, stairways and ceilings, but with wood finish, wood or composition floor surfaces, and wood roof construction over fire-resistive ceilings.

"Type C. A building with masonry walls, fire-resistive corridors and stairways, but with ordinary construction otherwise, i.e., combustible floors, partitions, roofs and finish."

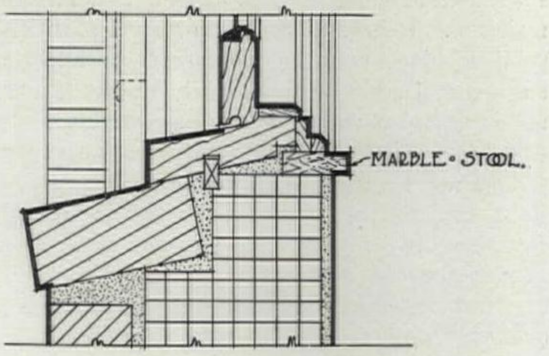
Type A construction seems impractical for a school building. To provide fire-resistive materials for classroom floors and built-in furniture and equipment would involve not only a high cost, but would be prejudicial to the comfort and well-being of the pupils. A schoolhouse must be made safe for the youth housed therein. For this reason, Type C construction, often referred to as "slow-burning mill construction," is not as desirable as Type B construction. Furthermore, as it has been repeatedly proved that the difference between the cost of a Type B and a Type C building is often as low as 5 per cent and seldom above 10 per cent, it is extremely unwise to attempt a saving in this direction if for no other reason than to safeguard child life. The factors of insurance rates and maintenance charges are financial considerations which militate against any type of construction below that of Type B. Not infrequently the temptation presents itself to build all one-story parts of school buildings of non-fire-resistive material. This is highly inadvisable, as the burning of these parts of otherwise fire-resistive buildings has not only caused large financial losses and the closing of buildings while repairs were being made but has caused stampedes which have resulted in large losses of life.

Materials and Details

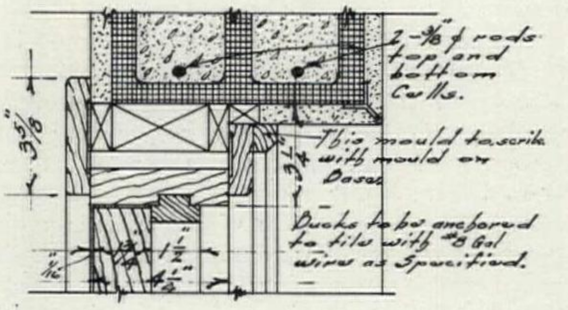
Face Brick. In addition to making a comparison of the appearance and prices of brick which are to be used on the outside of the building, special consideration should be given to their size, durability and weather-resistive qualities. The selection of a small brick will involve use of many thousands of additional wall brick and a much greater labor cost in laying them; the increased number of joints will multiply the chances for maintenance trouble; while the gross cost of the brick and labor is often much more than that of a larger size of brick at at higher cost per thousand. Soft, underburned brick with poor wearing qualities, laminated brick, and glazed brick with surfaces that may easily be chipped, should not be used, if subsequent maintenance expense is to be avoided. In addition to natural wear and tear, the defacement of these bricks by school children is to be considered.

Parapets. There are certain kinds of parapets which should be omitted from a schoolhouse regardless of their artistic beauty, simply because they are costly to maintain, especially in cold climates where frost and freezing occur. Parapets which are irregular in shape, highly ornamented, or with port holes are especially subject to rapid deterioration. The cost, utility and durability of the materials used as the covering for parapets should be carefully compared. The principal consideration is securing a covering which will not disintegrate under the action of either time or the elements. The method of application of the material is also of vital importance. A material of strength and durability, if applied with exposed joints and meeting strips so that the weather can penetrate them, is soon forced out of position and rain water is admitted. When this happens the coping is loosened and is likely to fall; the wall beneath the coping disintegrates; and water leaks into the building, causing ruin of plaster, woodwork and paint. It is a costly operation to repair roof parapets and chimney tops, so a careful consideration of the material used to protect them and its application is important. Copings of tin and galvanized iron are not durable. Bronze and copper copings are not sufficiently serviceable to warrant their high cost. Plain stone copings or copings of glazed salt tile of a selected quality will endure, if the joints are made properly, as long as the building itself, and they are moderate in cost.

Roofs. A flat roof is less expensive in original cost than almost any other type of roof construction,



Typical Window Detail



Typical Door Jamb and Trim

Bureau of Buildings of Board of Education, Architects, Minneapolis

is cheaper to maintain, is more easily accessible, and is safe for the public. Sloping roofs covered with slate are deserving of special consideration. Unless the slate is applied with extreme care, and the roof provided with guards, the slate often becomes detached in windy weather and slides off, as does also the accumulation of snow, endangering the lives of persons who may be below. Tile roofs are difficult to lay so that they will be perfectly weather-tight and are difficult to insulate. Maintenance costs are not as much of a problem in their case as is the heating cost of the building.

Chimneys. In these days when chimneys on school buildings are no longer looked upon by architects as disfigurements, these shafts have become the objects of special architectural study. When confined to simple and dignified lines they can be made beautiful and attractive. Costly patterns built into chimneys are often obliterated by soot and dirt, especially if these designs are near the tops of the chimneys. A poorly constructed chimney is a perpetual cause of maintenance expenditures; a badly designed chimney results in high heating costs and often develops into a smoke nuisance. The inside of the chimney should be perfectly straight, or preferably somewhat smaller at the top than at the bottom. This is for the reason that as the gases ascend they cool and contract and require less area for discharge at the top of the chimney than they require at the bottom when leaving the breeching. If the stack is larger at the top than at the bottom, the draft is destroyed by the air rushing down the stack and establishing cross currents. This will also result in the chimney smoking badly.

Windows. Schoolhouse windows have been for years and still are the matter of much debate. Wood versus steel sash; double-hung versus swivel sash; casements versus French windows;—around use of these various types there goes on a seemingly never-ending dispute. It is claimed that use of steel sash increases the operating expense of a building because steel conducts heat out of the structure so rapidly that the burning of a considerable larger amount of coal is required to properly heat the building. The original cost of installing window shades on steel window sash and their subsequent maintenance cost have also provoked much discussion. The experience of the writer has been that wood sash are preferable in northern climates.

Window Sills and Stools. It is false economy both in original investment and subsequent maintenance cost to build window sills and stools of any other than the very best materials. The drying, rotting, paint-removing, and wetting effects of the sun, rain water, and drippings from flower pots which are so often used in school buildings, have repeatedly demonstrated that sills and stools should be built of a durable material such as stone, brick or marble.

Entrance Doors. Heavy, metal-covered entrance doors were formerly looked upon as safety devices, in some mysterious way linked up with safety in case of fire. They were also looked upon as a means for protection from thieves, but are no longer considered in this light. Thieves enter through windows and by other easier means of ingress. Double-hung, light weight, glass paneled doors are being looked upon with more and more favor in schoolhouse construction from the standpoints of appearance, ease of operation, economy in first cost, low cost of maintenance, and light for the space just inside the entrance. Instead of using double doors in a full width of opening without a mullion, the practice is becoming quite general of having two single doors with a small mullion between them. This type of construction reduces weight, minimizes shrinking and swelling, simplifies the application of panic bolts, makes possible the installation of weatherproof doors, and makes possible the use of compact, light weight, standardized door units at low maintenance costs at all entrance openings.

Door Hooks. Only too often means of holding entrance doors open are omitted, resulting in some would-be mechanic's applying hooks or cleats which mar and cut the woodwork and not infrequently gouge deep grooves in valuable stonework. All such appliances should be avoided, and preference be given to one of the many kinds of automatic door catches which protect both door and woodwork and involve practically no maintenance charge whatever.

Outside Door Sills. Door sills which are made of a soft material, such as wood or slate, soon become cupped and present a very dangerous hazard for the school children who must cross them several times daily. Ordinary iron sills are slippery and, therefore, hazardous. Sills which become cupped need to be frequently replaced, since they admit large amounts of cold air in winter weather under the doors. Granite sills are durable, safe, and afford an unquestioned economy in maintenance. There are various durable non-slip sills which are satisfactory.

Window Glass. Plate glass for general use in a school building is an extravagance when compared with the use of the high grade, single-strength, selected glass of modern manufacture. The lower cost of the latter is noteworthy, as glass breakage is a considerable item of maintenance expense in all school buildings. It has been said that New York spends $90,000 every year for glass replacement, and Chicago $75,000.

Flooring. No other feature of schoolhouse construction has been given more consideration than the material which should be used for schoolhouse floors. Wood, cement, tile, asphalt, rubber, stone, linoleum, mastic, terrazzo, cork, and many other materials have been used more or less successfully. In this problem of selection, the matter of appearance is often the deciding factor, whereas durability, ease of cleaning, and maintenance cost should be the main considerations. If pupils' desks are changed frequently, will the floors be damaged by reason of the many screw holes? Will the floors be soft and sticky? Will the floors be cold, hard and noisy? Will the floors hurt the feet of the children? Will the hardness of the floors cause breakage of tools which may be dropped on them? Will the softness of the floors cause them to be damaged if pianos and heavy furniture are moved across them, or will heavy equipment sink into the floors, leaving them full of bumps and holes? These are some of the questions to be answered when selecting a schoolhouse floor. Not infrequently the faulty installation of an otherwise excellent floor material builds up subsequent maintenance costs as much as does the selection of an inappropriate kind of flooring.

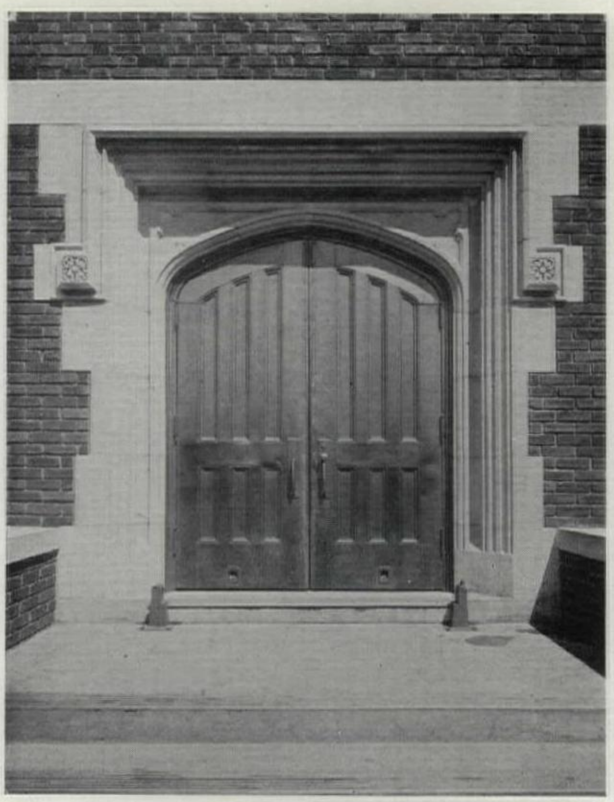
Inside Trim, Toilet and Shower Stalls. In a school building filled with irresponsible youth, the use of materials which will withstand the onslaughts of jackknife and pencil artists is a phase of the construction problem which is frequently overlooked. A child likes to lean against the walls, or to stand with one leg crooked with foot against the dado. For these reasons, corridor dadoes should be of hard surfaced brick, or tiling, or some other hard material which can easily be washed. Shower and toilet stall partitions should be of rugged construction and of a material that cannot be readily cut, scratched or marked. In toilet and shower rooms, and wherever there is any moisture, the use of wood should be avoided as it is unsanitary and costly to maintain. Enameled cement or steel partitions are good looking, sanitary, durable, less likely to be marked and cut by pupils, easily repaired, and their use is attended with low maintenance cost.

Wood and other materials of an absorbent nature should not be used in any room where there is a great amount of moisture or where immaculate cleanliness is demanded and frequent scouring necessary to prevent insanitation. The original low cost of wood construction in all such locations is offset many times by subsequent cost of upkeep.

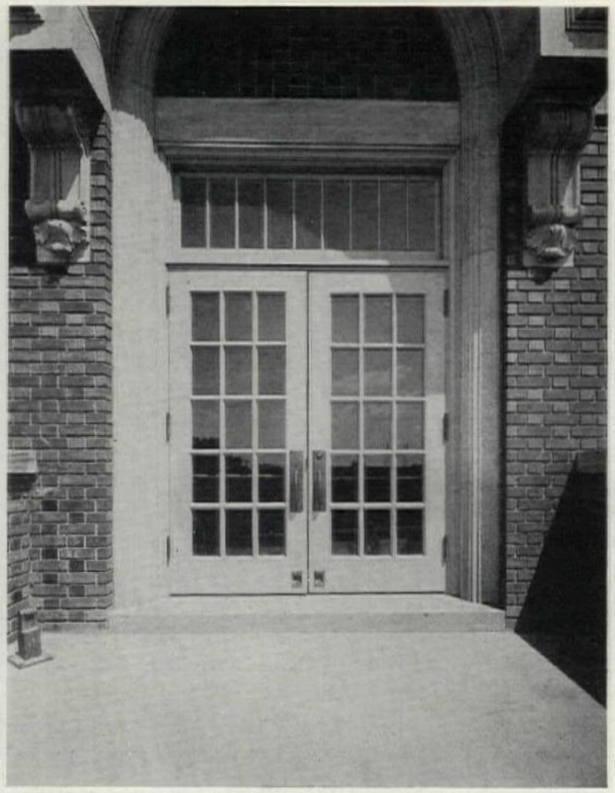
Specially Fabricated Steel. The widening of a classroom by a few inches sometimes requires that the beams be enlarged or that especially designed beams of specially fabricated steel reinforcing be used. This at once adds considerably to the cost of construction. The superintendent should not interfere with purely architectural structural matters, such as foundations, walls, floor slabs, girders, beams, spans and other physical details. There have been many instances, however, where a general inquiry by the superintendent or architect has revealed that, without interfering with the educational efficiency of the building in any way, the reduction by a few inches of the width of classrooms has made possible a complete change in the structural framing detail of the building at a great saving in cost of construction and maintenance. The use of standard stock materials and forms results in large economies. The only places where the use of expensive, specially fabricated steel is excusable are under balconies in auditoriums, in order to avoid use of columns which would reduce the seating capacity and impair the visibility of the stage, in special study rooms, and in gymnasiums when classrooms are to be built over them.

Heights of Ceilings. The standard height of a school classroom is 12 feet, measured from floor to finished ceiling. The finishing of the ceiling generally comprises metal lath on the under side of the ceiling beams and the finished plaster applied to this lath. The thickness of this construction, from the under side of the finished plaster ceiling to the top of the ceiling beam is, on the average, about 1 foot. In schoolhouses recently constructed, a little more attention has been given to the formwork in order to produce a more even finish to the concrete after the forms are removed. The concrete is then treated with a light application of cement wash which gives the entire surface a smooth finish. The metal lath and plaster are omitted. The concrete beams are left exposed and present a very pleasing appearance. This construction is very much less expensive and reduces maintenance cost to practically nothing. It possesses the additional advantage of reducing the floor-to-floor height by 1 foot. In the average 18-room elementary school building this represents a saving of about 17,920 cubic feet per floor. Exposed beams improve acoustical properties.

Wall Finish. The wall finish in schoolhouses is,



Heavy Solid Doors



Lighter Glazed Doors

Lighter Doors Are Growing in Favor for Several Reasons

generally, either smooth or rough plaster. Many years of experience with both kinds of finish and of observation in hundreds of schoolhouses, leads to the opinion that smooth plaster is much more easily marked and damaged than is rough-finish plaster, the original cost is higher, and the making of repairs is more difficult and costly. In industrial rooms the environment should approximate, as nearly as possible, the conditions which prevail in industry. It is not objectionable, therefore, to leave the tile walls unplastered, but painted. There is no need of plaster on the walls of these rooms, and its absence adds to their industrial "atmosphere" and reduces the cost of construction and maintenance.

Corridor Walls. Corridor walls are usually built flush on both the classroom and corridor sides of all supporting columns, and frequently with an additional breathing wall on the corridor side. This is done in most instances for two reasons—to avoid the exposure of supporting columns and to hide the ventilation ducts carried up through the building. Wherever experiments have been made in the elimination of all unnecessary filler tile, there has been a great gain in corridor space, part of which has then been used for built-in lockers and cupboards. Exposed columns in public school corridors are no longer considered objectionable. Where unit classroom ventilation is used, all vertical duct work and breathing walls are eliminated. This saves from 12 inches to 18 inches of corridor space, resulting in a very noticeable reduction in construction cost.

Lintels and Door Anchors. One of the most aggravating and persistent sources of schoolhouse maintenance cost is due to badly constructed door lintels and poorly anchored door frames. Every door lintel should be reinforced to prevent it from cracking or sagging. When a door frame is not securely anchored into the supporting walls, the constant jarring due to the opening and closing of the door soon breaks the plaster surrounding the frame. When this happens the only thing to do is to reset the entire frame, or there will be a continual maintenance charge.

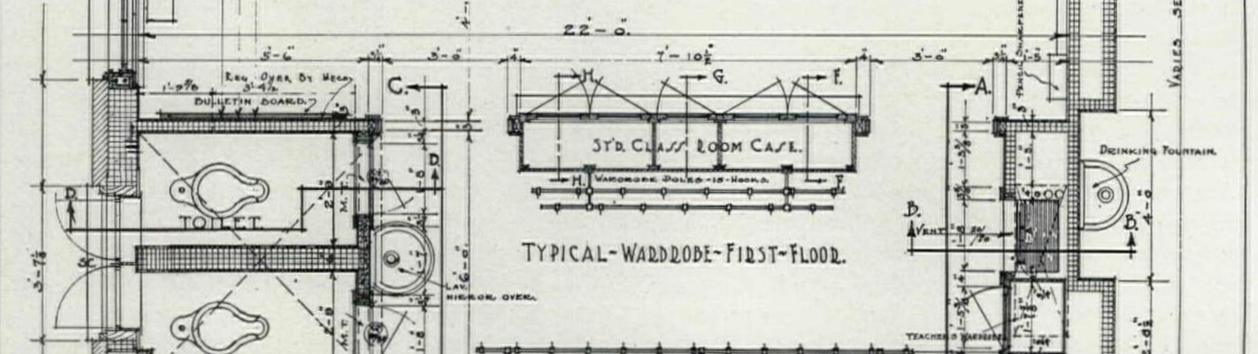
Wardrobes. Schoolhouse wardrobes or coat closets present a problem which causes much discussion among architects. It is safe to say that there can be no quarrel with the statement that exposed wardrobes are objectionable. Of other types there are three which are being quite generally used,—the wardrobe which is a separate room at the end of the classroom; the wardrobe which is built into either the end or the corridor wall of the classroom and which may be shut off from the classroom by pivoted or sliding doors; and individual lockers. If an opinion may be ventured, it would be that lockers have not been found to be satisfactory or practical in elementary grade school buildings. Small children cannot reach the hooks in the upper tier of lockers, with the result that their wraps are jammed into the bottoms of the lockers along with overshoes and other articles. In wet weather this condition is highly objectionable and unsanitary. The locker doors are frequently left open, and no little damage is constantly inflicted upon the hinges, locks and handles, which quickly runs up a considerable maintenance charge. Built-in wardrobes occupy wall space which may be used to better advantage by continuous blackboard surfaces. This type of wardrobe, when built into the corridor wall, also either reduces the width of the classroom or increases the width of the building, thus increasing construction cost,—and as in most instances where there are a large number of moving parts of some weight, the cost of maintenance is considerable.

Modern education is requiring more and more storage space in every classroom for materials and supplies. To meet this trend, the separate room end wardrobe is meeting with much favor. This room may be separated from the classroom by a half-height cupboard and bookcase. The low height permits sufficient light to pass over the top of the cupboard to light the wardrobe well. The cupboard may have deep shelves at the bottom, for storage of the largest sizes of project work, and narrow shelves above for storage of books and supplies. This type of wardrobe permits a better circulation of the pupils in the classroom, renders it possible to avoid congestion when getting cloaks, multiplies the storage area many times, eliminates the use of all other closets in the classroom, and reduces maintenance and operating charges to a minimum.

In General. A large maintenance expense is always introduced in schoolhouses where classroom display work, pictures, maps and charts are fastened to the wood trim and walls with pins, tacks, nails and stickers. Picture moulding should be furnished throughout the building, and no pictures should be hung except from this moulding. Means should be provided above the blackboard frame and below the chalk rail in every classroom, and display work should be hung by small clamps.

Schoolhouses are being built to last for 50 years or more. It, therefore, behooves the schoolhouse architect to equip his building with appurtenances which will have an equally long life under severe usage. Under this heading fall hardware, which should be of standard stock designs, strong and durable; kick-plates at the bottom of all doors to withstand the agile boot toes of children in a hurry; door checks to prevent doors from slamming, which is not only distracting but involves a severe strain on the doors and casings; natural slate blackboards, which will outlast the building itself, and when in need of resurfacing can be inexpensively rehabilitated with a piece of pumice stone or a common brick at a cost of less than five cents a square foot; balustrades, which may be built of reinforced concrete and made an integral part of the stairs themselves and never require any maintenance outlay, especially if the handrail brackets are anchored clear through the thickness of the balustrade and bolted; and a multitude of seemingly minor details, inconspicuous in themselves but which, when assembled in a composite list, constitute a formidable array of features indispensable in schoolhouse construction and equipment.

These are some of the items in connection with schoolhouse construction,—the selection of materials and maintenance cost,—which are receiving the analytical attention of all progressive school superintendents and architects. In addition, there are many items of mechanical equipment and educational equipment which are deserving of as careful study and selection as is given the items entering into the building construction, in order that much unnecessary expense in both original cost and subsequent operation and maintenance cost may be avoided. As it becomes more and more difficult to secure the enormous sums of money needed to meet the growing cost of public school activities, the first form of pressure that has been brought to bear is the demand that a saving be made on the material side,—the building construction side,—so as to release more of the available funds to the instructional side of education. This movement has brought the members of the school board, the superintendent and his assistants, the architect and the engineer into closer contact than ever before in the history of the public schools. Each has his important part to play in the great business of education.



Room End Wardrobe. Toilets Are Omitted in Some Cases, and Teacher's Unit Occupies a Portion of the Window End
Minneapolis Bureau of Buildings of Board of Education, Architects

HEATING AND VENTILATING THE SCHOOL

BY
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CONSULTING ENGINEER

THE unusual interest aroused in 1923 by the publication of the "Report of the New York Commission on Ventilation," which interest still continues, is sufficient warrant for an article reviewing the present status of school heating and ventilation from the standpoint of the architect.

The Present Situation. Since the beginning of the century and up to the year 1920, the several methods, or so-called "systems" of school ventilation were considered reasonably standardized. During the last 25 years the newer thought had evolved the broader idea of what is now termed "air conditioning," involving something more than the supply of warmed air; but for various reasons its application to school ventilation had made but little progress. In the latter half of the decade from 1880 to 1890, the results of research work by Pettenkoffer, confirmed by similar work carried on by French and English scientists, began to take practical form in an effort to supply a given volume of air to the pupil. The theory then advanced as the result of the research of that period seemed to indicate the need of supplying 30 cubic feet of fresh air per minute to each occupant of a schoolroom,—not that all of the 30 feet was deemed necessary for the actual need of the pupil, but rather for lack of known means of procuring proper diffusion throughout the occupied space and consequent dilution to a standard condition of purity.

Just here it is well to draw attention to the fact that no standards of air volume and purity have ever originated with the engineer or the architect. On the contrary, such requirements have always been laid down by the biologist, physiologist and their followers in the medical profession. There are today many among the same professions who would relegate the work of the past delvers into this particular branch of science to the limbo of those scientific truths that are not so. The subject, therefore, is at the moment highly controversial, but soonor or later the present fog of uncertainty will be lifted, and a rational scheme of school ventilation will probably be evolved which the writer suspects will measurably differ from the extreme positions now occupied by both parties to the present controversy.

If ever the medical profession, the physicists and the hygienists agree among themselves as to the proper atmospheric conditions to be maintained in our schools, the architects and engineers may be depended upon to fully meet the newer requirements. But before ignoring the sign posts of the past, reckoning them as entirely worthless, let the truth be ascertained by those best qualified for the task. This means broad-minded research by those branches of the medical profession qualified by some experience other than that of the laboratory, and it is gratifying to know that at this time whole-hearted efforts looking to a better understanding of the primary relation of fresh air to the health of the pupil are under way. As a hint to the school teaching profession, the engineer and architect and those not specially trained in the biological aspects of the subject, it would be the part of wisdom to reserve judgment with that modesty inspired by ignorance, until those better qualified than themselves reach a solution of the problem. With this brief review of present status on the subject, it may be well to consider the surviving schemes of school ventilation, for upon some or all of them must we still rely until such time as we shall know of something better;—keeping in mind also that those states heretofore having laws or regulations governing the matter have so far failed to remove them from their statute books.

The School Unit. In a short article a full discussion of all the controlling factors is impossible; therefore only the school unit,—the classroom,—will be considered. If the class and recitation rooms are properly warmed and ventilated, the other school apartments can be readily disposed of, and these will be briefly considered later on.

Systems Available. There are today probably not more than a half-dozen so-called systems of school heating and ventilation worthy of consideration, and these will be briefly described, omitting consideration of the one-, two- or three-room rural schools wherein the ventilating stove or the warm air furnace is usually found which affords reasonably good results where properly installed and operated. These small schools constitute by far the greater number, taking the country as a whole, and deserve greater care in design than is usually accorded them.

In the larger school buildings steam or vapor systems of supplying heat are generally employed. Vapor heating, it may be said, is nothing more or less than heating by steam at very low pressures, say not to exceed 8 ounces. In its simpler forms, no moving machinery, pumps, and the like are required for their successful and satisfactory operation; therefore, starting with the assumption that steam is to be the heating medium and for classrooms to accommodate about 40 pupils, the systems in more common use today are:

1. The gravity indirect system of heating with gravity ventilation.
2. The plenum fan system, better known as the "straight" or control fan system.
3. The "split" system.
4. The unit ventilator system.
5. The so-called "open-window system."

The Gravity Indirect System. This system is

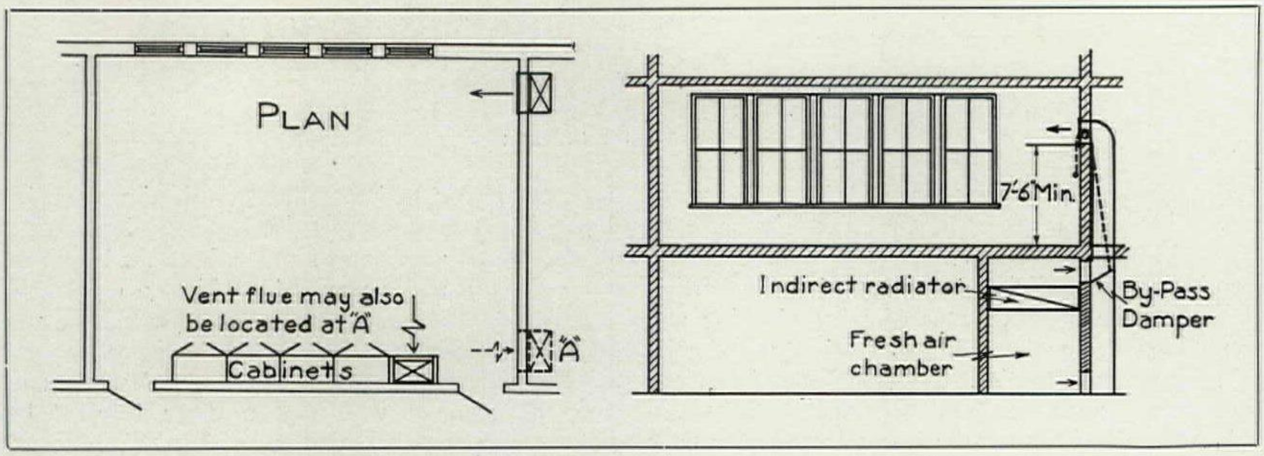


Fig. 1. The Gravity Indirect System of Heating and Ventilating

rarely used today in other than small buildings of from 4 to 12 rooms. It is one of the least valuable of the survivors of early experiments. It consists of a single flue for supplying warm air to the room and a single exhaust flue. In the basement there is installed an indirect radiator placed about 20 inches below the ceiling and just to one side of the warm air flue. Fresh air from outside is brought to the radiator where it is heated, passing thence to the room. A mixing damper is so placed at the base of the warm air flue that the temperature of the room may be kept at the proper point. The warm air, in volume (according to accepted standards) equal to 30 cubic feet per minute per pupil, should enter the room not less than 7 feet above the floor, and this flue should be placed in the same wall or in a wall adjacent to the exhaust flue. The opening into the vent flue should be at the floor. Neither flue should be on an outside wall, nor should the flues be on opposite walls.

Occasionally in this system, direct radiation is also installed in the room, but while the heating results may thereby be simplified, it is inevitably at the expense of the ventilation, due to the lower temperature required in the fresh air supplied, keeping in mind that the volume of air supplied by this system is dependent upon its temperature. The velocity of the air in the flues may be taken as 300 feet per minute in a two-story building. This velocity will be exceeded in very cold weather, thereby supplying more than the required volume of air, but in average winter weather the velocity is likely to be much less, with correspondingly less ventilation. than any other.

The advantages of this system are: 1. It is usually low in first cost, probably lower than any other. 2. It is simple to operate and usually not extravagant in fuel consumption. 3. Maintenance costs are reasonably low.

The disadvantages are: 1. That it usually precludes the use of the basement for any purpose other than boiler and coal space and playrooms. 2. It is unreliable in results, as the supply of fresh air to the rooms and consequent ventilation are dependent wholly on the outside temperature. The result is that official inspectors are not required to test for air supply and ventilation when there is less than 40° difference between the outdoor temperature and that of the air entering the room. That, in practice, usually means a deficiency in ventilation when the outdoor temperature is 35° to 40° or higher; ventilation by such a system is inadequate for at least half the heating season. 3. Its difficulty in keeping the indirect radiators and flues clean.

The Plenum Fan System. Considered simply from the standpoint of positive ventilation attained, good diffusion throughout the occupied space, and heating results generally, this system in the average sized school leaves little to be desired. Unfortunately, however, the fan cannot well be kept running during the night, resulting in there being a cold building in the morning, and requiring considerable time to get the walls up to room temperature and comfort. This condition also results usually in high fuel cost, and for that reason this system is infrequently employed. It has the advantage, however, of supplying at all times when heat is required, an adequate degree of ventilation, for in order to keep warm, the school authorities necessarily have to supply air for ventilation.

In designing a building for this system, the same arrangement of flues would be followed as outlined for use with the gravity indirect system previously described, except that the warm air flues may be proportioned for a higher air velocity, say 400 to 450 feet per minute; but the openings into the room should be kept down to 300 to 350 feet per minute in order to avoid objectionable drafts. In some states 300-foot velocity is the legal maximum for a standard-sized classroom. In this system the location and size of the vent flue remain as previously described for the gravity indirect system. The supply ducts from the fan, usually in the basement, may be of a size permitting much higher air velocities, reaching 800 to 1000 feet in main ducts, and in branch ducts to base of upcast warm air flues of from 500 feet to 700 feet.

For heating the air before delivery to the rooms,

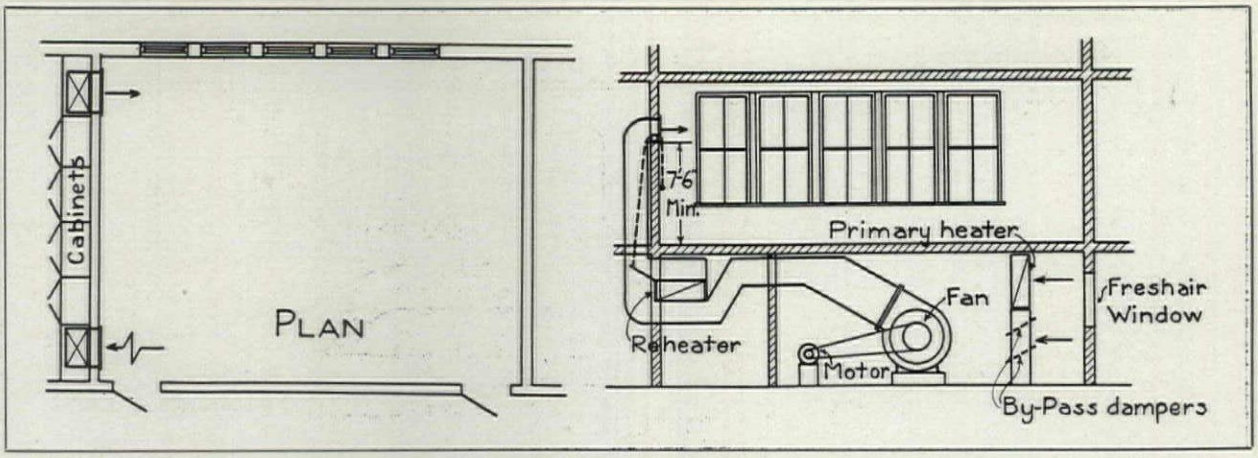


Fig. 2. The Plenum Fan System of Heating and Ventilating

an indirect radiator, or "Stack," so-called, is usually placed at the base of each warm air flue with a by-pass or mixing damper permitting temperature control either manually or from a room thermostat. In this arrangement the air at outdoor temperature is blown by the fan through ducts to the radiators where it is raised to whatever temperature may be required by the different rooms. In a modified and somewhat better designed installation the outdoor air may first be warmed by radiators or primary heater to 50° or 60° as it enters the fan chamber, and thence is delivered to the re-heaters at the base of the warm air flues as just described. In extremely cold weather, in order to maintain 68° to 70° room temperature, the temperature of the air as it enters the rooms might be as high as 115° (or even more) on the exposed side of the building, while at the same time it might not exceed 95° to 100° on the sheltered or sunny side. In the afternoon, with the sun farther around in its daily cycle, this condition may be found reversed, showing the need of adequate means for controlling the room temperature under all weather and exposure conditions.

All in all, the straight central fan system has much to offer in its favor, and were it as economical in fuel consumption as some other systems, it would no doubt be more generally installed. The advantages of this system are: 1. That it is reasonable in first cost. 2. It is adequate in heating and ventilating results. 3. Its maintenance or cost of upkeep is low.

The disadvantages are: 1. That it means continuous power expense, but no greater than in any other mechanically-operated system. 2. In cold weather some difficulty is frequently met in average building construction in getting the walls of the rooms up to a temperature that will not cause a feeling of chilliness to those sitting near them, although the air temperature may indicate 68° to 70° on an inside wall. 3. It is generally uneconomical in fuel requirements.

The "Split" System. This mechanical system is perhaps that most commonly employed in schools of considerable size, for with all its defects it does provide facilities, *where properly operated,* for adequate heating and ventilation according to present standards. It combines the use of direct radiation placed along the outside walls beneath the windows with a positive fan supply of fresh air warmed to from 70° to 80°, with the exhaust flue of usual size and location. It provides the air diffusion so greatly desired.

Alas, however, its very flexibility often defeats the virtue of its employment, for the frugally minded public authorities and that well known official, the janitor, severally or jointly contrive in average winter weather to heat the school rooms from the direct radiation only, without the use of the fan, thus saving fuel, but providing no adequate degree of ventilation. In this system the permissible air velocities through ducts and flues would be the same as in the plenum fan system. The location and use of the indirect surfaces (radiators) likewise are the same, but the degree of heat to be obtained thereby may differ from the preceding illustrations. In some cases the primary heater may be designed to heat all of the incoming air to from 60° to 80° which with the direct radiation in the rooms, usually proves sufficient regardless of north or south exposure. This is especially true where the direct radiators are under thermostatic control, it being understood that the primary heaters are similarly controlled. In larger buildings or in those where varying temperatures are needed in certain rooms, the tempered air at the fan may be only 45° to 60°, and in such cases a reheater is placed at the base of the warm air flues serving to raise the temperature of the air delivered to the rooms to the desired point. This latter arrangement requires, in order to afford satisfactory results, the use of thermostatic control of the radiators both primary and direct. Occasionally, also, there may be found in this system the installation of one or more fans connected with the exhaust flues. Their use would not alter the location of the exhaust flues, but would permit higher velocities therein, say up to 450 to 500 feet per minute where the exhaust fans are to be depended upon at all times. The inlet velocity from the room to the exhaust flue should not, however, exceed 300 feet per minute to avoid uncomfortable drafts at the floor.

Where direct radiators are placed under the win-

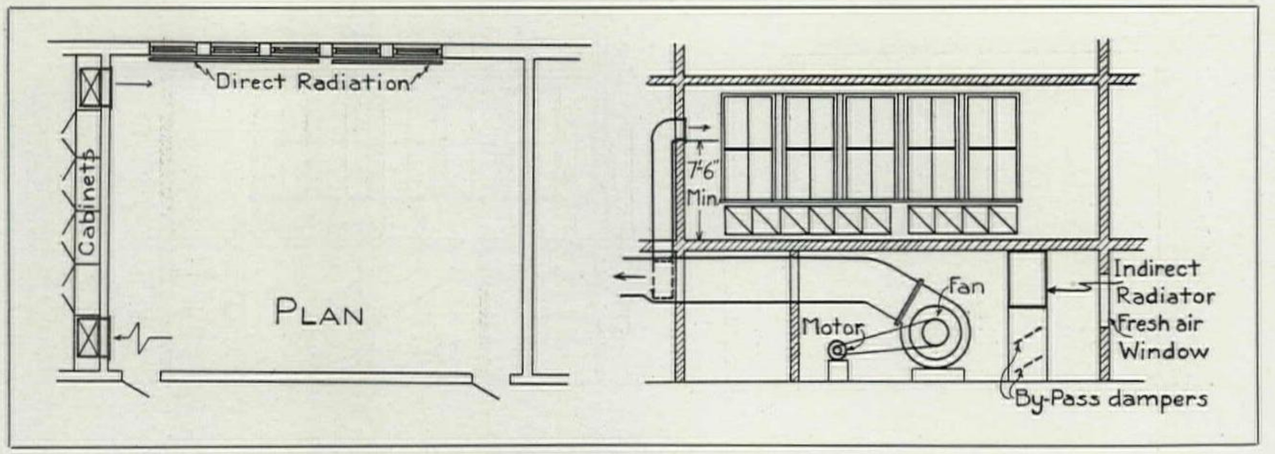


Fig. 3. The "Split" System

dows alongside the outer row of desks, complaint is often heard of the excessive heat to which the pupils are subjected. A sheet metal shield may be attached to a radiator extending from a point about 6 or 8 inches above the floor to the top of the radiator, and thus afford the desired protection. With this system the arrangement of the flues and their relation to the classroom would be as shown in Fig. 2.

The advantages of this system are: 1. Its being very low in fuel consumption. 2. That it is simple to operate, flexible. 3. Its being low in upkeep or maintenance costs.

The disadvantages are: 1. That installation costs are greater than for a gravity indirect or plenum fan system. 2. That from its very flexibility it is too easily subject to human manipulation in the sole interest of fuel economy.

The Unit Ventilator System. This is one of the most flexible systems known, combining in the individual classroom everything needed for its satisfactory heating and ventilation other than the boiler and pipe connections. The installation consists essentially of an indirect radiator; a small fan for the positive supply of fresh air taken from without the building through a wall opening; a fractional horse-power motor for the fan propulsion; all contained within a substantial metal enclosure. Usually a direct radiator also is placed against an outside wall to supply the heat necessary to compensate for that lost through wall and glass surfaces. A suitably placed damper excludes the air from outside when school is not in session, and a by-pass damper in the unit heater is employed to regulate the room temperature either manually or by thermostat.

All unit ventilators, so-called, are provided with means for recirculating the air from the room through the device and for the exclusion of fresh air from outside. This type also strongly appeals tc those civic authorities having an eye solely to the conservation of fuel, for in practice the unit ventilator will frequently be found shut down, and for heating the room, dependence will be placed on the direct radiator; or perhaps the device may be used to recirculate the warm air in the room with no fresh air supply. It is often best to specify that the recirculating feature be omitted, and where possible, that the direct radiator be also omitted from the room, thus assuring positive ventilation, at least whenever heat is required. Some unit ventilators operate upon the high velocity jet principle, the air leaving the unit directed toward the ceiling and at velocity varying from 800 to 900 feet per minute. These high velocities secure ample diffusion and equality in temperatures throughout the room.

Efficient installation requires that the unit be placed near the source of fresh air, as on an outside wall, with the exhaust on an inside wall located as far from the unit as possible. The exhaust flue may be proportioned for a higher velocity than is permissible in other gravity exhaust systems, say as high as 600 to 700 feet per minute, the flue being carried through the roof in the usual manner.

The advantages of this system are:

1. That each room may be treated as a unit, in no way dependent upon any other room for its successful operation. This is of greater importance in high schools than in the lower grade schools.

2. It affords a positive supply of fresh air to the rooms, properly warmed and generally well diffused.

3. It eliminates the warm air flue and connecting basement ducts of either masonry or sheet metal.

4. That the units are reasonably quiet in operation.

5. Maintenance or upkeep costs reasonably low.

6. That fuel cost is about the same as in any systems supplying an equivalent volume of outdoor air.

Its disadvantages are: 1. That it involves a higher initial cost than the other systems here described. 2. That it requires a multiplicity of small fans and motors to be looked after and kept in repair. 3. That it takes up some space on the outside wall of the classroom, varying from 14 inches to 20 inches from the wall and from 3 feet to 4 feet in length.

The "Open Window" System. This means a new adaptation of an ancient unsuccessful attempt to ventilate school rooms, which a former generation endured and then happily discarded. This observation must by no means be construed as an indirect expression of opinion concerning the merits of the

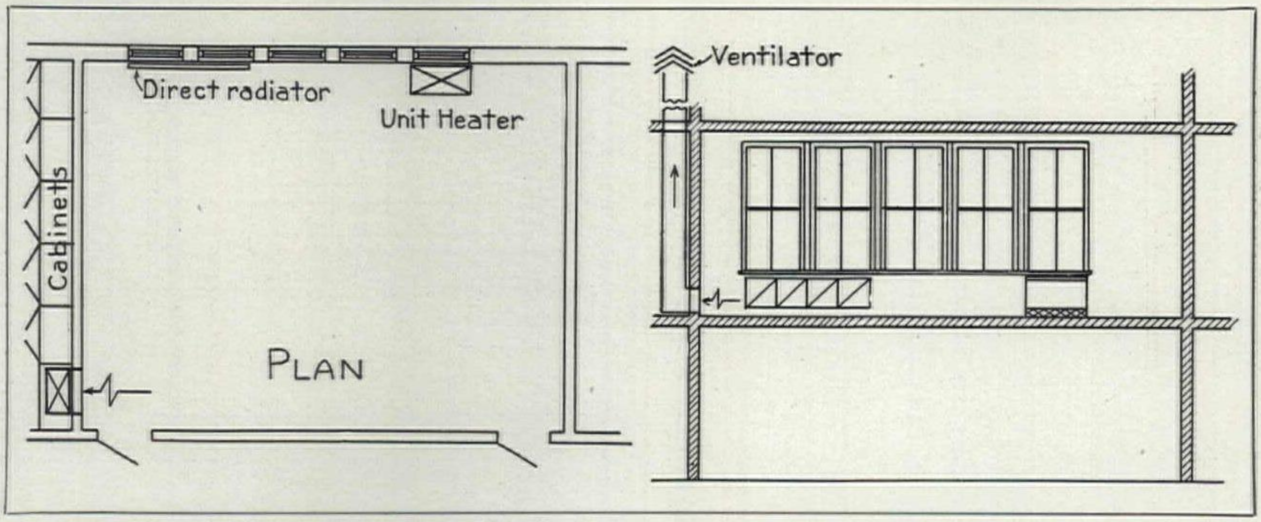


Fig. 4. The Unit Ventilator System

controversy now in full swing as to what constitutes the proper air conditioning of schools. It is just a plain statement of fact, as any observer of the conditions existing in urban schools of the early 90's can testify. Neither is the system referred to herein for any reason other than to acquaint the architect with its salient features.

In its entirety this system consists of just two exhaust flues, each of 4 square feet area, and of one or more radiators having a total surface of from 250 to 300 square feet. Each exhaust flue has an opening at the floor and also one at the ceiling. No means for creating a movement of air in these flues is advocated by the proponents of the system. Hand control only of the radiators is permissible. Deflectors at the window sills give direction to the increasing air when the lower sash is raised. In *theory* the incoming air (with the wind from the right direction) is warmed from the radiators, is deflected to the upper part of the room, and passes out through the upper openings into the exhaust flues; but if by chance the air falls, then opportunity is afforded for its passage into the exhaust flues at the floor. In this natural process of diffusion, drafts are ever present. Perchance luck may favor the anæmic (by no means rarely) in having for a teacher one whose comfort zone hovers around the 80° median, in which case the windows stay down. In *practice,* with the wind blowing from some other direction, expired and fresh air from other rooms and sources reaches the classroom under consideration via the corridors, or perhaps down the exhaust flues, thence, after being duly warmed by the radiators, passes out of the windows. This, of course, assumes that the windows are open, but usually for some reason or other they are kept closed. That the windows will be found in large part closed when the outside temperature is below 50°, is not an idle statement concerning the usual manner of operating the ventilation of such schools, *after* the investigating commission or other authority has completed its occasional or periodical survey. It should also be unnecessary to say that during such a survey the system is, of course, operated the way it was intended to be, but the same may as truly be said of any other system under similar circumstances. This system is not suitable for assembly halls, gymnasiums or classrooms accommodating more than 40 to 50 pupils.

Briefly, the human element in the operation of schools equipped with this system reacts in precisely the same fashion as in schools otherwise equipped, but with this difference: that when an "open window" system is installed there is an absence of control over the volume, temperature, humidity or any other desirable (yet to be determined) quality of the air the pupils breathe. If the room gets too cold, the remedy is to close or partially close the windows, and incidentally cut off or reduce the supply of fresh air.

The advantages of this system are:

1. That installation cost when properly installed, is about 10 to 15 per cent less than for a "split" system. 2. Its upkeep or maintenance cost is low.

Its disadvantages are:

1. That no control of proper air conditions is assured. 2. That to maintain the best room conditions with this system requires the constant and intelligent watchfulness of the teacher, and takes her from her legitimate duties. 3. Its fuel consumption is fully as great as in a well designed "split" or unit ventilator system, either of which will provide under all weather conditions from two to three times as much ventilation.

The Auditorium. Such rooms cannot well be standardized as to their heating and ventilation, varying as they do in design and outside window spaces. Those with small exposed walls and few windows usually require the supply by positive means, of fresh air, with of course means of heating. The air supply to auditoriums where not governed by official regulations, may be much less than in classrooms, owing to the usually shorter periods during which they are occupied. Based upon the full seat-

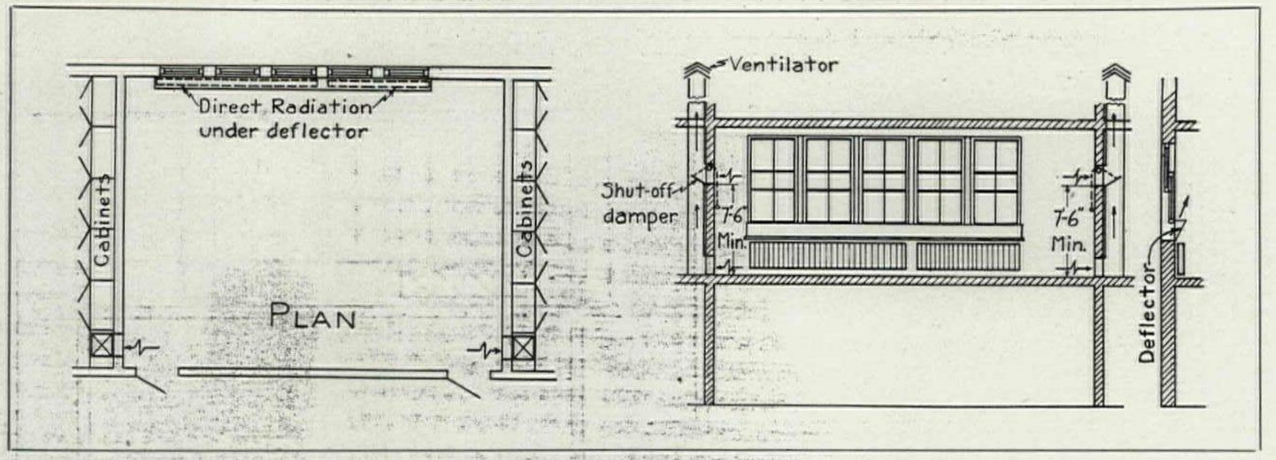


Fig. 5. The "Open Window" System

ing capacity,—allowing 6 square feet floor and gallery area per occupant,—the supply of from 10 to 15 cubic feet of fresh, warmed air per minute is considered sufficient. The temperature of the incoming air should be under thermostatic control, and it is desirable also, that the direct radiators should be similarly controlled. On the score of fuel saving, direct radiation should be installed in sufficient amount to keep the walls and furniture warmed.

Where there is an abundance of window space, and especially an opportunity for cross ventilation, roof ventilators for the relief of an overheated room, due to a combination of a large audience and mild weather will seldom be required. The warm air flues should be of an area for an air velocity of from 350 to 500 feet per minute, with a velocity through the openings into the auditorium varying from 350 to 500 feet per minute, depending upon the height from the floor to the bottom of the warm air grille. The flues may be located at one or more points in the room, and in some cases the exhaust may be taken through the front of, and under, the stage, if any, there connecting to upcast flues to ventilators or fans on the roof. Where an exhaust fan is installed, the exhaust flue velocity may be from 500 to 700 feet per minute.

Gymnasium. Such a room, in the absence of official regulations, would be heated and ventilated much the same as an auditorium, but owing to the character of the exercises, greater reliance can be placed upon window ventilation, and such a room should not be heated above 60° unless it is to be used as a combination gymnasium and auditorium.

Swimming Pool and Shower Rooms. There should be sufficient direct radiation properly installed and controlled, to maintain 80° temperature with adequate ventilation, either through exhaust fans or ample gravity exhaust flues. Fan supply of fresh air is rarely desirable in such rooms. Dependence for ventilation should be placed wholly upon the exhaust, with inlets for gravity supply of warm air.

Dressing and Locker Rooms. These should be warmed by direct radiation to about 70°, and there should be ample exhaust, preferably by fans.

Toilet Rooms. Such rooms with one or two fixtures, if located with ample outside windows, are seldom provided with special means of ventilation. General toilet rooms should be ventilated by means of fans to the extent of eight to ten air changes per hour, and heated by direct radiation only to about 65°.

Plant Operation. No matter how well a heating and ventilating plant is designed and installed, unless there is to be coöperative effort on the part of the school and town or city authorities, the best results from the installation will rarely be obtained. Whatever may be the final decision concerning the proper atmospheric conditions to be maintained in schools, so long as the authorities place fuel saving above the health of the pupil, or the janitor is inefficient and incompetent, anything but satisfaction is to be expected from any installation. In the final analysis, however, it is the public that must be brought to realize the facts,—by educational methods,—and to insist upon an adequate return for the expenditure of public funds.

Auxiliary Equipment. No mention has been made of air washing, humidifying or ozonating apparatus, and but brief reference to automatic temperature control. These auxiliaries are essential in many instances, but they require more space for their adequate description than can be accorded in this article.

THE ARTIFICIAL LIGHTING OF SCHOOLS

BY

D. J. FRANDSEN

ELECTRICAL ENGINEER

THERE are certain quite fundamental and obvious reasons why artificial lighting should be provided in all schools. Perhaps the most important of these is the fact that provision must be made for those inevitable cloudy or stormy days, which, in some localities, comprise such a startlingly large percentage of the school year. The increasing prevalence of night schools and the fact that the school building is often used for various community meetings, in addition to school activities, are direct evidences of the need of artificial light.

Of all the facilities placed at the disposal of the school child, good lighting is one of the cheapest. The *American City* Bureau reported a few years ago that the average cost of teaching each child, per year, was $57. The average child will reach the eighth grade at the age of 14 years, at a cost of $456 to the state. If, on account of defective vision caused by poor illumination, or slowness due to lack of visual stimulus, the child reaches only the sixth grade, the cost to the state has been the same, with only three-fourths the result. The state loses money, and the child will probably leave school poorly prepared to earn a living. At an estimated cost of less than $1.50 per child, per year, good illumination, which would tend to greatly decrease eye troubles and resultant backwardness, can be provided.

Lighting and the Eyes. That defective vision is frequently acquired and is often progressive is shown by the fact that eye troubles are more prevalent among children in the advanced grades. For instance, 10 per cent of the children entering school are near-sighted, while about 33 per cent are near-sighted at the end of their eighth year. That adequate illumination can offset to a great extent the handicap of defective vision was effectively demonstrated in a test conducted on a group of public school children who were decidedly backward in their studies. These children were observed under various intensities of artificial illumination, and a marked increase in mental alertness was noticed as the amount of illumination under which they worked was increased. This improvement in work continued until a maximum illumination, in the neighborhood of 17-foot candles, was reached. The results of this single test are in line with the results of other tests, and indicate that higher standards of illumination are desirable, and that the present standards of illumination for classwork are by no means final and may require future revisions. Progress of the children under the higher standards of illumination was so gratifying that specially lighted classrooms have been installed for their benefit.

Unlike home lighting or office lighting, school lighting is likely to remain unchanged for a long time, even if it is unsatisfactory. The architect must use care to insure permanent utility by correct design and planning consistent with the needs of the school.

Lighting Requisites. Before entering into any descriptions of the methods of securing proper results in school lighting, it will be well to consider a few of the desirable qualities of good illumination, and then to show by illustrations and data examples of these principles applied to typical buildings. The requirements of lighting are few, but important:

1. Adequate Light. Sufficient illumination for the work at hand; too little light is productive of eyestrain, fatigue and consequent poor work, and may be the cause of permanent eye trouble.
2. Elimination of Glare. This point cannot be over-emphasized.
3. Diffusion. Sharp shadows and harsh contrasts should be carefully avoided.
4. Distribution. This point must receive careful attention if good lighting is to be obtained.

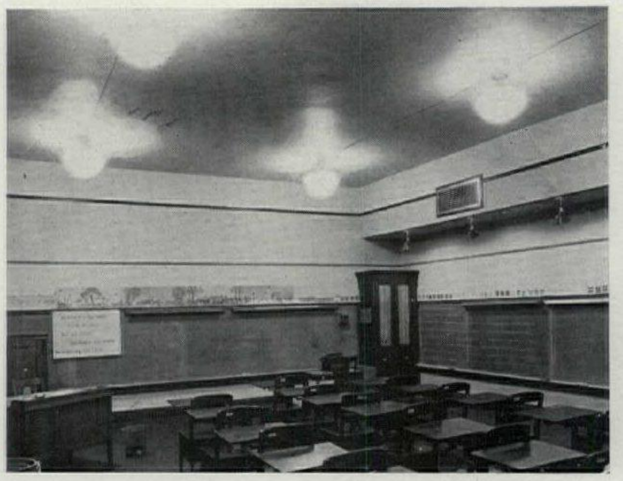
In considering the first point, it is evident that a suitable amount of light must be supplied if work of any kind is to be properly performed. Regardless of what type of lighting system is used, a sufficient amount of light must reach the work,—otherwise the system must be considered as inadequate.

Standards of Intensity. The unit ordinarily used in speaking of the illumination on any surface is the foot-candle (defined as the illumination on a surface normal to a one-candle power source at a distance of 1 foot). This value is measured with a foot-candle meter or other portable photometer. The values given in this table have been found from experience and observation to be desirable standards of illumination of schoolrooms:

Classrooms	8- to 12-foot candles on desks
Study Rooms	10- to 12-foot candles on desks
Offices	10- to 12-foot candles on desks
Drawing Rooms	15- to 25-foot candles on tables
Laboratories	8- to 12-foot candles on tables
Cloak Rooms	1- to 3-foot candles on floors
Corridors	2- to 5-foot candles on floors
Auditoriums	3- to 6-foot candles on floors
Auditoriums (if used for study room purposes)	8- to 12-foot candles on chairs

While such values as given here will produce satisfactory results, the application of the higher rather than the lower values might be advisable. With the higher values of illumination increased perception is obtained, and better results may be expected.

Diffusion and Glare. Sufficient diffusion and the elimination of glare are of importance in any lighting system, yet nowhere are they more important than in the schoolroom. Practically all commercial light sources are far too brilliant to be directly in the field of vision without causing a blinding effect and reducing the ability to see. The construction of our buildings places definite limits upon the heights at which lamps may be hung. We must,



Special Lighting for Pupils with Defective Vision. Average Illumination, 15-Foot Candles

Room 24x30x13 Feet. Average Illumination of 15-Foot Candles Is Provided by Eight 300-Watt Lamps

Guilbert & Betelle, Architects

therefore, always reduce the brilliancy of the light sources by means of diffusing globes, shades or reflectors, which either effectively enlarge the light sources or actually hide them from view. Diffusion is necessary in order that shadows be softened and harsh contrasts be eliminated. It is not desirable, however, to go to such an extreme of diffusion as to entirely eliminate shadows, for they are essential in showing the contours or shapes of objects.

The walls, ceilings and woodwork have a very large effect on the efficiency of a lighting system, and upon the way in which the light is distributed. In general, it is advisable to provide walls of a moderate reflection factor, the preferred colors being light gray, light buff, dark cream and some tints of green. Ceilings should have a high reflection factor, either a flat white or light cream color being suitable. In order to eliminate annoying reflections, desk tops and other woodwork should have dull rather than glossy finishes.

Distribution of Light. The fourth point to be considered in designing a lighting system is that of the distribution of light. We have, in general, two extremes,—local lighting and general illumination. In local lighting relatively low-wattage lamps located close to the work furnish a high level of illumination over a small area. Such lighting has very limited applications, none of which are found in the school. A system of local lighting usually abounds in those conditions which cause eye strain and eye fatigue. In general illumination, much larger lamps are used, these lamps being hung as high as possible in order to get them out of the field of view, and in order to provide good distribution. General lighting is, without question, the system best suited to schoolroom lighting. The wiring costs are lower, and the efficiency of the system is higher, due to the fact that higher-wattage lamps are much more efficient than low-wattage lamps. Proper location of outlets insures almost uniform distribution of light throughout the room; in fact, there is possible a much more uniform distribution than with daylight.

This table, taking the light from a 100-watt lamp as unity, indicates the relative amount of light which may be expected from the higher wattage lamps:

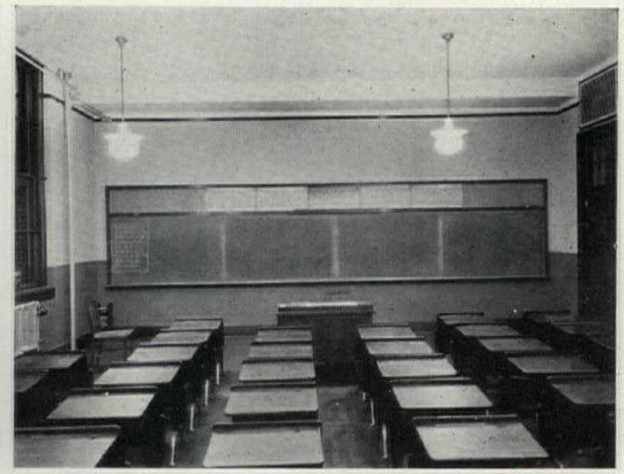
100-watt,	inside-frosted lamps	1
150-	clear lamps	1.75
200-	" "	2.45
300-	" "	4
500-	" "	7.2

It is essential that light should be directed on the object to be seen and not directed to the eye; therefore, since it is necessary to hang lamps high and out of the line of sight, we must equip them with reflectors or other devices in order to direct the light to the desk or to the ceiling to be re-directed downward.

Types of Lighting Fixtures. Direct, semi-indirect and totally indirect systems are all employed for school lighting. Each has certain inherent advantages, although they are all satisfactory if properly applied. Ordinarily more outlets are required for direct lighting, in order to obtain proper distribution and diffusion, than are needed for either the semi-indirect or the totally indirect systems. This is offset to some extent by the fact that direct lighting by enclosing diffusing globes is ordinarily more efficient than either of the indirect systems.

Indirect Lighting. Totally indirect lighting produces an extremely good quality of illumination, but it is somewhat less efficient than direct lighting with enclosing globes. In general, the illumination from a totally indirect or semi-indirect installation is about 66 per cent of that which would be produced by a direct lighting installation, using enclosing globes, if the same size and number of lamps were used in each case. A very light colored ceiling is absolutely essential if indirect lighting is to be used to best advantage, since with dark colored walls and ceilings, a larger percentage of light would be absorbed and the over-all efficiency of the installation would be considerably lowered. With indirect lighting there is little possibility of glare, and the resultant light is quite soft and free from shadows; glaring reflec-

Totally Indirect Lighting Provides 10-Foot Candles at Chair-tops



Semi-Indirect Lighting Provided by Four 300-Watt Frosted Lamps

St. John's Law School, Brooklyn

tions are reduced to a minimum, and there are no very severe contrasts to tire the eye. The principal objection to indirect lighting, other than from the standpoint of initial efficiency, is that bowls tend to accumulate dust, making frequent cleaning necessary.

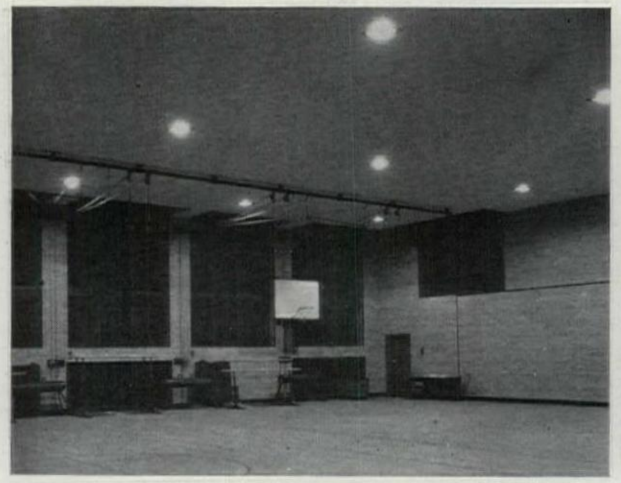
Semi-indirect Lighting. The luminaire employed in this type directs the greater part of the light toward the ceiling (as in the totally indirect system), yet a small portion of the light is permitted to pass downward through opal or frosted glass. This downward light serves the purpose of illuminating the luminaire so that it does not stand out as a dark spot against the lighted ceiling area. The directional quality of this downward light has, in some cases, an added advantage, in that it serves to emphasize to a slight extent shadows which might be wholly lost under totally indirect lighting. Semi-indirect lighting is slightly more efficient than totally indirect lighting. The resultant illumination is well diffused, and such shadows as are produced cause no annoyance. The better forms of semi-indirect units employ dense glass or some other means of reducing the brightness of the lighting unit. This type of lighting is particularly well adapted to schoolrooms, especially if the totally enclosing type of semi-indirect luminaire, of which the upper portion is of clear glass, is used. The open type, semi-indirect units are open to the objections applied to totally indirect luminaire as regards accumulation of dust.

Direct Lighting. Open-bottom direct lighting units are found in many of the older installations. These units are obviously efficient from the standpoint of light output, but their other characteristics are not such as to make them suitable for use in the schoolroom. The diffusion is not of the highest order, and sharp shadows and contrasts are likely to be extremely prevalent. Such units are also objectionable from the standpoint of direct and reflected glare, especially if clear bulb lamps are used. The use of this form of lighting is advisable only where cost must be kept at the absolute minimum, and where secondary consideration is given to the quality of the light. If such lighting is employed, it is advisable to use dense opal or etched prismatic glass deep bowl reflectors. Such reflectors will not produce an unpleasant glare. Flat type reflectors, of either metal or glass, should never be used in the schoolroom, for it is almost impossible to conceal the lamp filaments from view when this type of equipment is employed. Opaque reflectors, in general, are unsuitable, since the ceiling would be very dark if they were used. Diffusing bowls or white bowl lamps should always be used in preference to clear lamps if open-bottom lighting units are installed.

The enclosing, diffusing, direct lighting luminaire or enclosing globe seems to quite satisfactorily fulfill all of the major requirements of classroom lighting. If the proper type is chosen, a well diffused illumination, free from direct or reflected glare, is produced. With this type of equipment the major portion of the light is directed downward, although a considerable portion is transmitted upward, thus giving a character of illumination somewhat similar to that produced by semi-indirect units. The equipment is easily cleaned, and, in general, does not depreciate as rapidly from dust accumulation as do other fixtures giving comparable qualities of illumination. Of course, cleaning should never be neglected, for it is only from clean lamps and clean accessories that maximum light output is obtained.

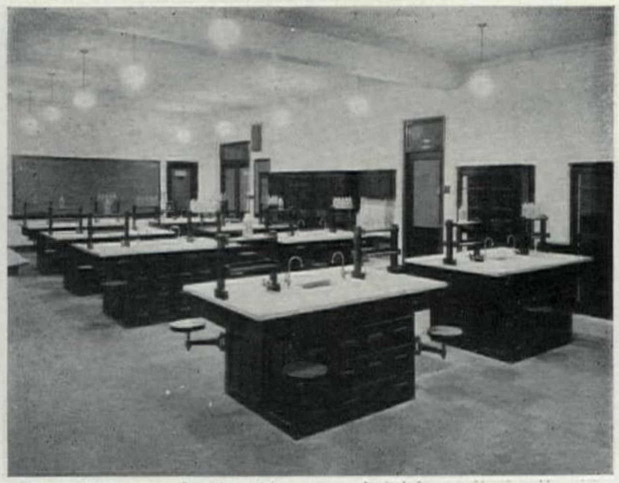
Ventilating the Fixture. The question as to whether or not it is necessary to provide ventilation for totally enclosing units is one that has often been raised. The results of carefully conducted tests have indicated that with a sufficiently large radiating surface, in other words the proper size of globe and fixture, ventilation is unnecessary.

Globe Sizes. In making a choice between commercial types of equipment of any one class, there are a number of factors which must be given consideration. With the enclosing globe, one very important element is the brilliance of the glassware. This depends on the character of the glass, the size of the globe, and the wattage of the lamp used. The



Mirrored Glass Reflectors, Recessed, Provide 6-Foot Candles Using 300-Watt Lamps

Guilbert & Betelle, Architects



Prismatic Glass Direct Lighting Luminaries; Illumination 10-Foot Candles

Schenck & Williams, Architects

diffusion should be such that the entire globe will be quite uniformly lighted when the proper size of lamp is used. There should be no bright spots opposite the filament. Assuming that the globe gives good diffusion, the brightness will then depend on the diameter of the globe and the size of the lamp used. Care should be taken to provide globes of a sufficient size to care for the lamp used. Glassware designed for 200-watt lamps will accommodate lower wattage lamps quite nicely, but a globe which might be entirely satisfactory with a 100-watt lamp would probably be unsatisfactory with a 200-watt lamp.

This table indicates the minimum desired diameter of enclosing globes, the diameter to be measured at the point of maximum width:

With	100-	watt lamps..........	12 inches
"	150-	" "	14 "
"	200-	" "	16 "
"	300-500-	" "	18 "

With light colored surroundings there is comparatively little choice between the various fixtures of the type under consideration as to shape, since the light walls and ceilings will be of material assistance in redirecting and diffusing the light. In general, an enclosing globe (of opal glass) will give off the major portion of the light in a direction approximately normal to its greatest projected area. That is, a globe of the stalactite shape will direct the greater portion of its light toward the walls, while a globe of the squat type will be more efficient in directing the light downward. This, of course, does not apply to those luminaires in which distribution of the light is controlled by the use of prisms moulded into the crystal glass body of the luminaire.

Spacing of Luminaires. The location of the luminaire in a classroom as well as in any other room depends upon the dimensions of the room and the type of lighting which is to be used. Indirect and semi-indirect systems permit of a slightly wider spacing than would be satisfactory if enclosing diffusing globes were to be used. With direct lighting from enclosing globes or reflectors, the spacing should never greatly exceed the hanging height of the luminaire. Ordinarily this spacing may be increased to one and one-half times the hanging height; if semi-indirect or totally indirect lighting is employed, however, it is frequently found that the same spacing is necessary for either direct or indirect lighting. For instance, in a room 21 x 21 feet, with a 13-foot ceiling, four outlets would be essential if good lighting is to be obtained. These four outlets would be necessary with either direct or indirect lighting. They should be spaced on approximately 11-foot centers, about 5 feet from the walls.

The calculation of the sizes of lamps which should be used involves consideration of the type of equipment, the colors of the walls, ceiling and other woodwork, and the dimensions of the room. Direct estimates based upon an assumption of a certain number of watts per square foot of floor area are liable to lead to erroneous results. The flux of light or *lumen* method as set forth in the standard texts on illumination and in the bulletins issued by the large lamp companies, will ordinarily give more accurate results, since it is based on the light output rather than the power consumption of the lamps.

Lighting of Gymnasiums. The lighting of those various rooms other than classrooms which are found in the typical school building presents no especially difficult problems. The high ceiling of the typical gymnasium makes the use of mirrored glass or other efficient light-directing reflectors quite feasible. The equipment should always be provided with suitable guards in order to protect it from possibly injury. It is becoming quite common practice to provide recesses in the ceiling in which lighting equipment may be installed. Care should be taken to avoid glaring light sources, since by their blinding effect they may become the cause of a serious fall or other injury. Shower and locker rooms may be quite adequately lighted by 100-watt lamps in opal bowl reflectors, although high percentages of moisture often necessitate the use of vapor-proof fixtures in the shower rooms.

SANITATION FOR SCHOOL BUILDINGS

BY

A. R. McGONEGAL

MEMBER AMERICAN SOCIETY OF SANITARY ENGINEERS

THE little old red schoolhouse of fond memory has faded into history, and even its successor, the two- or three-room village school is slowly but surely giving way to the new in school building and administration. The family flivver and the school "bus," cheap, rapid and dependable transports that fairly eat the miles that were too much for sturdy, plodding little feet, have wrought the transformation. Instead of many small township and cross-roads schools, we build a replica of the city school building to care for the entire county, and we bring the children to the school instead of taking the school to the children. Thus centralizing educational facilities, the rural community obtains most or all of the advantages of the city school system.

The rural community school building and the average city school building being alike in their physical aspects, the plumbing systems of the structures will be the same. The basic principles of sanitation as applied to the theory and design of plumbing are the same whether the school be located in Maine, Minnesota, California, Texas or Florida, in a small town or in a great city. There will be slight differences in details to accord with differences in climate, such as protection of pipes. County or small town schools may not have the advantages of a public water or sewer system, but isolated automatic water systems and modern sewage disposal plants take their places, and the plumbing installations in the buildings will be identical. The really immense school structures in some of our larger cities differ from the small town buildings only in size, so that the plumbing requirements of an average school building apply to all.

Site and Sanitation. The county school usually has an advantage over the city school in the matter of site, both as to suitability and amount of ground. It goes without saying that a school should have ample space for light and air on all sides, and it should have, if possible, sufficient playground area to keep the children off the adjacent highways. A suitable location is just off the main traveled thoroughfare, as it is less noisy and the air is less laden with dust and burnt gasolene fumes, but it should be close enough for easy access. If selection is not restricted, there are but four items to consider in a site, and "two of these items are water." As the old saying goes, "good property has water as is, and water as isn't." If a city or community water supply of unquestioned quality and ample quantity is not available, it will be necessary to depend on a well, and if this be the case, the deal for the ground should not be closed until the well has been drilled and the supply found satisfactory. Before drilling the well, it is wise to make a survey of the surrounding property to see that the sanitary arrangements are such that contamination of the well is not probable in the future. The other water attribute, the "water as isn't," refers to necessity of locating the school on comparatively high, well drained ground, suitable for firm foundations and a dry basement. Low ground and marshy, spongy or waterlogged soils are hardly suitable for school sites from standpoints of either economy or health. The other two basic items are space and accessibility. Space is necessary for light and air, playgrounds, and room for future expansion, which should always be planned at the time the original building is laid out. Accessibility means not only location on a good road near the main artery of travel, but a position near the center of population of the territory served; at the shortest distance from the greatest number of families.

Basements should be well out of ground, with high ceilings, so they will be healthful gathering places in inclement weather and can be used for overflow classrooms in emergency. Outside walls should be dampproofed to grade, even if the site is ordinarily dry. The plumbing of a school, both in design and installation, should be of the very best. This is not only wise from a future repair expense standpoint, but good plumbing begets good care, and if we teach our children what good plumbing is, it makes for the health of not only the children themselves, but of the homes, the neighborhood and the nation. The school toilet rooms should be cleaner than the home arrangements, if possible, and the arrangements of the exposed fixtures and pipes should be neat, substantial and easily kept clean and in repair.

The Locations of Toilet Facilities. Suggestions for locating school toilet facilities in outbuildings are frequently made by those having little knowledge of matters connected with the health requirements of growing children and with difficulties of supervision. Such a location, whether connected with the school building by a corridor or not, adds greatly to the already heavy burden of proper supervision; adds to the expense of heating and ventilation in northern climates; and is a decided disadvantage from a health angle. Ease of access, cleanliness and comfort in responding to nature's requirements make for regularity and full and complete operation, forming a healthful habit which should continue for years to come. Dingy, frequently dirty, outbuildings, damp and cold in inclement weather, are not inviting and consequently are responsible for self-imposed abstinence which may, and undoubtedly often does, result in unnumbered cases of irregular habits and constipation, causing much misery and sickness in after life.

Children are naturally mischievous and are likely to break or mar things within their reach when not under supervision; so, knowing that one in authority cannot be always in the school toilet rooms, we should accept the fact and contrive to create, as far as possible, conditions which will cause little satisfaction to those on mischief bent. This means having all our toilet room fixtures and equipment of substantial pattern, firmly fastened in place, and with as few exposed nuts, screwheads and other contrivances as possible on which a handy boy can use his jackknife. Rows of closets, urinals and basins should be set along the walls and not out in batteries at the center of the room, so that racing and playing tag around them will be out of the question. Fixtures and partition corners set out in the room seem to be desirable handholds and swinging posts for racing children, and many a standing partition has been torn away time after time, with recurring repair bills. Batteries of fixtures set out in the room also add to the difficulties of supervision by providing shields for those hiding from teachers passing or looking in the door. In general, it is excellent practice to lay out a school toilet room so that every portion of the room is visible from its entrance. It is also a good idea to have the entrance without doors but arranged so that the line of vision from the corridor is obscured as to any fixtures. This arrangement requires some consideration in the ventilation system so that there will always be a current of air from the corridors into the toilet rooms. Either an increased exhaust rate for the toilet room itself over the classroom rate, or definitely ventilating the corridors through the toilet rooms will take care of this.

In buildings of one story and basement it is quite customary to group all toilet facilities in the basement, or to put the boys' toilet there and the girls' toilet immediately above on the main floor, which is somewhat more economical on account of the more compact arrangement of the piping, but the best practice is undoubtedly to provide each floor with its own equipment for each sex.

Provisions for Teachers. Teachers' toilets should be provided, as well as slop or service sinks, on each floor. A kitchenette with a small sink in a rest room will be appreciated by the teachers. Extra drinking fountains should be in the basement playrooms, and pedestal fountains are often installed on the playgrounds and not infrequently in front of the building for use by the general public. Teachers should never be required to use the same fixtures as the pupils, but, on the other hand, good administration requires their presence in the pupils' rooms occasionally, and a way to insure this indirect supervisory effect is to locate fixtures for the teachers' use in private rooms opening from main toilet rooms so they must pass through one to get to the other, though other considerations may outweigh this.

Walls and Floors. Walls and floors of pupils' toilet rooms should be of non-absorbent materials with a finish not easily damaged. Buff, mottled, salt-glazed brick up to a line 7 feet from the floor has been found very satisfactory. Laid with thinly buttered joints in cement mortar without lime, these brick make a practically non-absorbent wall and one not easily scratched or marred or written on with either pencil or chalk. Ordinary cement-surfaced concrete floors are likely to be spongy and absorb moisture, giving rise to odors around the closet bases and urinals. There are a number of good composition floor materials and concrete floor hardeners on the market which can be laid with the ease of ordinary cement and troweled to a hard, glassy finish which is practically waterproof. A mastic bituminous compound has been successfully used, laid hot and ironed smooth much in the same manner as an asphalt-surfaced street pavement is laid. This material can be surface-heated and ironed smooth again if it has to be cut up or becomes worn or rough in spots.

Partitions. Wooden partition work for toilet room closet enclosures is unsuitable. Even with the best of finish, wood will absorb and will give off odors in time; even the window frames and sash should be metal where possible. There are any number of makes of unit metal closet partitions on the market. The best of these are of ingot iron or copper-bearing steel, all welded panels, factory enameled to resist rust, and they are sturdy and designed so they have small dust-collecting surfaces. Stock sizes include one 4 feet deep by 30 inches on centers, which makes a suitable unit for school work. Doors, if used, should be double-swinging pairs, without bolt or latch, and those with gravity hinges are less likely to get out of order. Doors should be shorter than the partition panels, and the bottoms should be 16 inches from the floor. Some school authorities leave doors off closet stalls altogether, and still others provide them for girls and not for boys, though there seems to be no good reason for the distinction.

Number of Fixtures. The economical number of fixtures to provide for any given condition has been worked out through months of investigation and timing under actual conditions of use. Even bearing in mind that it is customary to recess or dismiss many classes at the same time, the average use and re-use capacity of fixtures is very great, and the final rule is very close to the old 15 to 1 rule in force in many states and cities for factories, schools and similar buildings. This more complete rule is based on modern classes with from 35 to 40 pupils, evenly divided between the sexes, and calls for the schedule of fixtures for each such classroom served:

Boys' toilet room: ¾ water closet, 1¼ urinal, ¼ lavatory;

Girls' toilet: 1¼ water closet, ¼ lavatory,

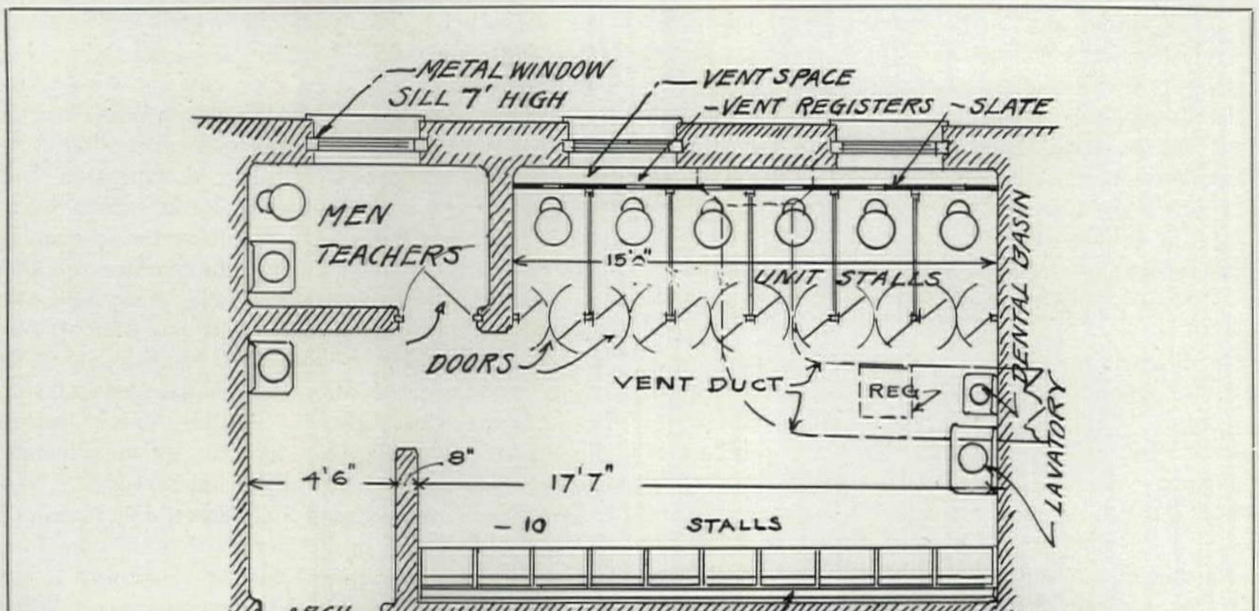
and ¼ drinking fountain in the corridor. If the school is for one sex only, or if the makeup of classes may be expected to differ continually, owing to some special local condition, it is a simple matter of figures to alter the rule to fit.

In following a fixture allowance rule, judgment should be exercised when there are an odd number of classrooms to serve, but toilet rooms should be built to fit the fixture requirements and not a number of fixtures provided to fit a room of a set size. It is important that we have a sufficient number of fixtures for proper and reasonable use, but it is just as important that we have no more fixtures than are necessary. Every unnecessary fixture adds to the cost of the building, to the amount of space unavailable for other needed uses, to the water consumption, and to the repair expenses through the years to come. Fixtures, and especially valves and faucets, should be the very best that money can buy. The difference in first cost between a good fixture and a poor fixture is at most only two or three dollars, and the first of many repairs will cost that in plumber's time alone. The good fixture will rarely need repair, and the poor fixture will frequently need attention, and a fixture that is chronically out of order and not usable might just as well not be taking up space.

Water-closets should preferably be of the type automatically operated, as children, especially the younger ones, are exceedingly careless in the matter of flushing. Attached seats must be provided, as integral seats have been tried and found to have a generally unhealthful effect, due to cold flushing water passing through the flushing rim and chilling the body resting on it. One of the largest single items in plumbing repair bills for schools is for taking up and removing obstructions from closet bowls. This can be minimized by using a full siphon jet bowl with a 2½-inch or 2¾-inch waterway throughout, so that pencils, knives, cloths and dropped articles generally that will go into the bowl outlet will pass entirely through the trapway to the sewer without hindrance. In some cities the inspector is furnished with a wooden ball which he passes through each closet bowl before setting it, to be sure that the waterway is full size and is clear of obstructions.

There is some controversy over the proper height of the bowl, but good practice seems to point to the regular juvenile height of bowl for all grades. This bowl is 13½ inches from floor to rim and, with 1½ inches added for seat, it is only slightly lower than the average chair, and fits in with the claim often made by medical men that closet bowls should be lower than the usual standard height to provide a more natural and healthful position of the body during use. The seat should be of the comfortable saddle type, open at least in front. Ordinary wooden seats with either a varnish or celluloid finish have not proved very successful for school work, but there are several good composition seats with a minimum of unprotected metalwork to corrode. The solidity and strength of the hinge attachment should be carefully investigated, as well as the quality and fastening of the seat bumpers, the best of which must be replaced from time to time or the flushing rim of the bowl will be broken by slamming seats. Some bumpers cost three times as much as others and are worth it.

Flushing. The flushing should be full and powerful. Pressure flush is the only suitable system for school work, and it can be had in either of two ways, —by compression tank or by direct flush valves. Either type of valve will operate on 15 pounds pressure, but 30 to 40 is better and appears to be general. If direct flush valves are used, the diaphragm



Plan of a Typical Boys' Toilet Room

type which requires no adjustment and is easy to repair can be used to advantage. Such valves, however, require larger supply pipes than are customarily used with tanks, as all the water necessary for the operation of the valve must be furnished during the flushing period of about seven seconds, whereas a tank can be allowed 30 or more seconds to fill between flushes. If pipes are too small, the velocity of flow causes an annoying singing noise, and the valve frequently develops a "hammer" at closing.

Two elements enter into the water supply of fixtures, and in a sense they are independent of pressure, although uninformed people frequently attribute unsatisfactory operation simply to lack of pressure, not realizing that proper flushing depends on volume at the fixture and that just as much water can be delivered by a large pipe at low pressure as by a smaller pipe at high pressure. The two elements are volume and time, and the quantity of water which can be furnished at a given point within the period of the flush is called the "rate of flow." Assuming a five-gallon flush in seven seconds, this means a flow rate of about 40 gallons per minute for a valve closet, but if a pressure tank is used on the closet as a sort of accumulator to collect the five gallons for the short flush, it can be allowed 30 seconds or more to fill, at a flow rate of ten gallons per minute. Thus, other things being equal, any given size of pipe will furnish water for four times as many pressure tank closets as valve closets at the same rate of flow. To properly proportion closet supply mains, all factors should be taken into consideration, and sizes should be figured back toward the source of supply from each closet and each group; but this is too rarely done because of the computation necessary. It is, of course, impossible to be exact without taking into consideration elevation of fixtures, friction loss for length of pipe and the number and character of bends and valves, type of meter, and initial pressure at the source; but the table included here has been worked out as satisfactory with an assumed average for friction loss, an initial pressure of 40 pounds at the source, and a graduated overlapping flush allowance:

Number of flush valve closets allowed on various branch supply sizes

1 or 2	closets	on	1¼"	pipe
3	"	"	1½"	"
4 to 6	"	"	2"	"
7 to 12	"	"	2½"	"
13 to 20	"	"	3"	"
21 to 45	"	"	4"	"
46 to 75	"	"	5"	"
76 to 110	"	"	6"	"

Number of pressure tank closets on other small fixture connections on various pipe sizes

1 to 2	connections	on	¼"	pipe
3 to 4	"	"	1"	"
5 to 8	"	"	1¼"	"
9 to 12	"	"	1½"	"
13 to 25	"	"	2"	"
26 to 50	"	"	2½"	"
51 to 80	"	"	3"	"

In estimating for urinals with flush valves, two urinals should be figured same as one water closet valve in the first table.

Urinals. There are two types of fixtures most suitable for schoolhouse use,—the vitreous china (not porcelain) stall urinal, and the slate stall type. In either case they should be set down into the floor construction so that the immediately adjacent floor surface grades into a waste trough part. The slate type should be used only where water is plentiful and where a continuous film of flowing water from the overflow flushing troughs can be maintained or an automatic periodic flushing device is used. The vitreous individual stall type should be flushed by a foot-operated flush valve set in the floor. The standard 18-inch width vitreous stall gives really too little shoulder room, even for children, if placed in battery, but if they were made in the 24-inch width, the same as biscuit porcelain, that would give more shoulder room than necessary. The medium of 21 inches on centers seems to be best for all purposes, giving sufficient but no excess shoulder room, economy of space and of cost. The 18-inch stalls as now made must be set 3 inches apart, with a dirt-collecting space, or the spaces must be blocked out, plastered and tiled, thus adding to the expense. Tiling these spaces makes them more sanitary than leaving them open, but not as sanitary as a vitreous unit 21 inches wide would be with its single joint. The slate stall fixture can be obtained in any of the three widths, and is a continuous fixture of practically non-absorbent material. It seems hardly necessary to mention the obsolete enameled iron trough urinal or slate slabs flushed by a perforated pipe. These are, of course, much cheaper than stall unit work, but a saving of money at the expense of sanitary conditions should never be considered.

Floor drains should never be installed in school toilet rooms unless they are provided with a full size vent and have a flushing rim automatically flushed from a tank on the wall two or three times a day. Without this flushing, they are catchalls for sweepings, and the water seal is rarely replenished and evaporates in a month or so, permitting direct entry of sewer air into the toilet rooms.

Lavatories or wash basins should be of substantial pattern with as small a slab size as can be used with an adequate bowl. A small slab has little space for dust collection and offers less inducement to tired boys as a resting place. The fixture should be supported on a leg or legs and have more than ordinarily strong fastenings to the wall, such as 4-inch expansion bolts or lag screws and lead sleeves. Extra-heavy, self-closing basin faucets should be used, so that water cannot be left running by careless pupils. The use of "pop-ups" and other such wastes should be avoided, as they are a constant challenge to the small boy with mechanical ideas. A plug and chain are all that are necessary, and the school authorities should make up their minds in advance that the chain will have to be replaced within a week after opening.

and that rubber plugs of the cheapest kind must be bought by the gross. They are, however, much cheaper than constant repairs and replacements to mechanical wastes.

The cleanest and really the proper way to wash hands is in running water, leaving a free opening to basin waste, but that cannot be done now with the self-closing faucets we have to select from, as all of the practical faucets are quick-closing, and we cannot use a compression faucet without risking much water waste, expenditure of coal or gas in heating water, and danger of splashing or overflow of fixtures. It is quite possible that some of the present slow-closing valves will be perfected to a point where they will be reliable for use on school basins. Dental lavatories are a distinct step in advance, and their provision in schools might teach pupils of an impressionable age that the lavatory is hardly the proper place to spew mouthwashings.

Drinking Fountains. Drinking fountains are of many kinds. The "bubble fountain" has taken the place of the old oaken bucket and the rusty dipper, and there are ring spray-bubblers, vertical- and diagonal-stream bubblers, and single-, double- and multiple-jet patterns. The diagonal-stream devices seem to appeal to one as less liable to contamination, and of this type perhaps one of the best known is the double-jet arrangement where two small jets meet to form a mound for drinking. This device was developed during the war for use in France, where water waste was of moment, and many thousands of the fountains were in satisfactory use there and in the training camps in this country. Water for drinking purposes will generally be found cool enough without refrigeration, unless the mains are laid shallow in warm climates, where the water comes from warmed tanks, or where for some other reason the temperature is higher than it would be from wells or from properly laid mains. Drinking water of icy temperature is unhealthful, and for ordinary drinking purposes it should not be colder than 45 or 50 degrees. This subject has been given much study by mill and factory medical men, and proper control of drinking water temperature is reported as greatly reducing layoffs on account of stomach troubles induced by drinking very cold water when in a heated condition. The same considerations apply to children drinking after a strenuous play period. If it is found advisable to cool the water, it should be done by a central refrigerating plant, controlled by a thermostat, instead of by introducing ice into the water.

One difficulty with diagonal-stream fountains is their response to variations in pressure by changing the height of the stream every time pressure is lowered in the lines by flushing several fixtures. This can be avoided by passing all drinking fountain supply through a water pressure regulator and reducing the supply to them to a point where variations will not drop below the setting of the regulator. In connection with the pressure-reducing valve, a sand trap is often installed to screen out any foreign matter in the water.

Hot water should be supplied to all lavatories, together with liquid or powdered soap and paper towels, as children will not wash in discomfort or without soap and means of drying. The hot water supply should be of the instantaneous type, or the equipment should provide large storage capacity with a comparatively small heater, as the total use is spread over about four hours out of the 24 and nearly all during some three or four 15-minute periods. A circulating return will tend to save much water, though it will require more coal or gas to operate. In case special kindergarten toilets are wanted, siphon-jet infant-size closet bowls can be had with heights of 8½ or 9 inches, and lavatories can be set 2 feet from the floor instead of at the regular height.

Fire Protection. Fire standpipes, although used extensively in school buildings, are rarely considered a necessity. In some localities rates may make their installation desirable financially, but generally all modern school buildings are fireproof up to the ceiling lines of the top floors, and a judicious distribution of extinguishers, taking care that they are periodically charged, will take care of any minor fire until the arrival of fire apparatus. Teachers should not be charged with fire fighting or anything that will take their minds from their most important duty, that of getting the children out. In case the building is in a country town with little or no fire department and without a pressure water supply, several hydrants in the school grounds attached to the school water system are much to be preferred to interior standpipes. These hydrants should be 50 or more feet from the walls of the building, so that fire heat may not prevent servicing them, and the hose should be kept in an outbuilding. If the school has an auditorium with stage space for scenery, an automatic sprinkler system should be provided beneath and over the stage, in all dressing rooms, and in all stage property storage rooms. It is good practice to have the asbestos fire curtain operate on a "trigger connection," so that if there is a lack of pressure the curtain cannot be raised for a performance, and if the pressure drops dangerously low, the curtain will come down of its own accord.

Piping. The plumbing piping system should be of the best. The materials and workmanship should be such that the plumbing installation will last for the reasonably-to-be-expected life of the building. This does not mean the entire structural life but until the condition of the entire building and plant is such that it becomes necessary to remodel. It is safe to say that this period will be at least 30 years and may be 50. Therefore, care should be taken not to bury in floor or wall construction any material of shorter life, and to see that all valves or other parts requiring repair or replacement are left, together with their connections, in accessible positions. It pays to use a heavier grade of fittings of galvanized iron or brass pipe than would ordinarily be specified, and to have all waste and soil pipe fittings of the long radius pattern to avoid the possibility of obstructions' building up. Probably extra-heavy cast iron soil pipe will have longer life than galvanized iron pipe. Some engineers prefer genuine galvanized wrought iron in place of the soft steel pipes of commercial grades. Brass pipe answers the need for long life water pipe where it is concealed, but galvanized iron, of a larger size to take care of inside corrosion, may last if it is painted and given a protective wrapping. Pure copper tubing is used to some extent, is much cheaper than iron pipe gauge brass pipe, and it is flexible and easily worked.

All water piping, whether concealed or exposed, should be covered with asbestos or hair felt covering. This protects the pipe from corrosion through contact with building materials such as mortars and concrete, minimizes loss of heat in hot water piping, and prevents condensation on the cold water lines. It also prevents, to some extent, noises due to pipe vibrations, though it is good practice to install shock absorbers at strategic points to take care of water hammer if it does develop. Each main water line in the basement should be painted its distinctive color, and all valves should be tagged. The plumbing system should be adequately vented, the fixture wastes having individual vents or being connected on a circuit or loop vent in accordance with modern practice. If the state, city or town has no plumbing code, the "Hoover Code*" requirements should be strictly adhered to.

Special Pipe. Wastes from chemical and physical laboratory sinks should never be connected to the general plumbing system of the building, and they should be run exposed for easy inspection and repair unless the waste lines are constructed of pipe proof against the commonly used acids. Special pipe for acid work can be had in several materials, such as a composition of hard rubber, stoneware, china, lead-lined iron, and cast iron with a high silicon content. They are all hard to work, and the fittings of some are cumbersome, but the silicon iron, being so similar to the cast iron soil pipe used elsewhere in the system, probably will be most satisfactory. In using this, or any acid-resisting pipe, joints are weak points, and special asbestos jointing material must be used.

Valves. Too much stress cannot be laid on quality of valves. They vary widely in price, but the best will be found much cheaper in the end. Globe valves should be used sparingly on account of their resistance to flow which is about 20 times as much as for the same size gate valve under equal conditions of pressure and rate of flow. It is best to select the make of valve to be used and have the same make throughout the work. All valves in rooms to which pupils have access should be of the lock shield, removable handle type, which cannot be meddled with.

Pumps and Tanks. If a pressure water supply is not available, then a pumping system and an elevated tank may be used, but as satisfactory operation of valve closets depends on a head of 35 or 40 feet above the topmost fixtures, a pressure tank layout will be found more serviceable and less costly. A proper size tank would hold not less than 400 gallons per classroom in combined air and water. The tank (or tanks) may be heavily coated with protective paint and buried in the ground with just the head and connections exposed in the basement. Gauge glasses as well as pressure gauges should be provided, and a dependable relief valve is a necessity whether there is one on the pump or not. Good practice is to have a separate air pump instead of relying on the snifter valve usually furnished on the water pump, as it places better control in the hands of the operator. Automatic intakes on pumps are almost always furnishing either too much or too little air, and trouble with the system results either way. Unfortunately, centrifugal pumps cannot always be used on wells and pump heads, and jacks are noisy and the monotony of their pound has a bad effect on school work. If deep well work is necessary, an air lift system will be found best, although more expensive.

Sewage Disposal. In the absence of a public sewer system, a sewage-disposal plant is a necessity. A leeching cesspool is an abomination and should never be considered, even if the law is loose enough to permit it. What is usually called a septic tank will answer for the preliminary treatment of reducing the sewage to a liquid form, but even in the design of this there is the difficulty that the quantity of sewage to be treated varies greatly. The plant must normally work five days and be idle two, and there are several short and one long vacation, and stale sewage will not respond readily to secondary or purifying treatment. This intermittent use also tends to sludge up the tanks excessively, but as the tank must be desludged each fall anyway, this condition only adds to the size.

A two-or three-part concrete tank of rectangular shape is generally used, although a much smaller unit built on the Imhof principle will occupy less space and possibly will cost less to build. The Imhof pattern has the advantage of quickly clearing of stale sewage on occasion, the mat area is small, and removal of sludge is easier.

*The so-called "Hoover Code" is published by the U. S. Department of Commerce under the title of "Recommended Minimum Requirements for Plumbing in Dwellings and Similar Buildings." It can be obtained from the Superintendent of Documents, Government Printing Office, Washington, for 35 cents, cash or money order; checks or stamps are not acceptable.

SCHOOL FINANCING AND THE ARCHITECT

BY

C. STANLEY TAYLOR

AT first thought it might seem that the architect would have no particular interest in the question of financing school building projects.

The reason that the architect's relation to the financing of school buildings is becoming of paramount importance is because the nature of such financing invariably establishes an almost absolute cost limit or budget for the building operation. It is quite unnecessary to go into details regarding the types of school bonds or the methods of taxation. The important point for the architect to consider is that a bond issue, a special tax, or an endowment, prescribes a definite sum of money which should not be exceeded by the cost of the land, building and equipment. Last year an extensive survey was made by the Better Schools League, Inc., of Chicago. So many valuable facts were developed in the course of this survey that it is drawn upon freely in the development of this article.

Costs and Appropriations. The Better Schools League survey brought out some very interesting information in relation to the question of construction and equipment costs' exceeding bond issues or appropriated funds. In 350 cities which erected school buildings within the past five years, 22 per cent of them over-spent the bond issues or appropriations. The results of incurring building and equipment costs which exceed appropriations are always unfortunate, and in many cases the architect is directly charged with the responsibility. In the first place, if there is an excess cost, the community is forced to issue warrants bearing high rates of interest. In many communities this practice is not legal, and the only thing that can be done where the construction cost is excessive is to curtail definitely the finishing and equipping of the building. Old equipment may be substituted for new, and in every way the final structure will be inferior, according to present-day standards. This situation may also lead to instructing important extra-curricular activities,—music, art, industrial arts, gymnasium and playground activities. Under these conditions also it becomes impossible to develop the school as a community center and to provide the various facilities necessary to contribute to community life. It becomes quite evident, then, that the architect's relation to financing has much to do with developing a building which will unquestionably come within the construction budget. The fact is, however, that this relationship should logically begin at the earliest stage, when the project of a new school building is first contemplated and before any bond issue or appropriation is established. An architect should be called upon at this stage to investigate the school requirements and with rough preliminary plans to indicate to city officials or the school board how much money is really necessary for the building and its equipment.

The Fixed Budget. This question of developing plans within fixed budget limitations offers in itself a series of problems which must be solved in a practical manner by the architect. The first temptation, of course, is to establish construction and equipment cost savings through the use of less expensive materials, and perhaps through simplified planning. This is a logical way to bring down the cost of a building of any kind, but at the same time it is a very dangerous procedure unless practical minimum standards are set. It must be remembered that school buildings are built to serve the community for a great many years and in the most efficient possible manner.

The information which follows is presented primarily as a guide to the architect who undertakes school work. It gives some very definite information as to the cost of the construction of schools of various kinds and also shows at least one recommended method of establishing the related budget of equipment cost as compared with the total building cost. The data have been taken from last year's survey by the Better Schools League, Inc.

Ratios of Building to Equipment Costs. General experience with the school equipment budget indicates that it should be established as an entirely separate fund upon which the building cost itself should not encroach. Reports received by the Better Schools League from 350 cities which have erected school buildings since the year 1923 showed a very consistent ratio of the percentage of the bond issue which should go into the building proper and that which should go into equipment. The experience of this group provides a basic standard of average practice. The summary for the different types of school buildings is indicated here. It may be noted that school buildings throughout are classified according to the grades housed in the structures. Thus, grades 1 to 8 represent the average elementary school; grades 1 to 9 represent elementary and junior high school combined; grades 1 to 12 represent elementary and high school combined; 7 to 9 junior high school; 7 to 12 junior and senior high school; 9 to 12 regular high school; and 10 to 12 senior high school. The term "upper 50 per cent" is also used, indicating the finer standards of modern construction and equipment, so that the general figures given represent average practice, but those labeled "upper 50 per cent" represent the practice of the better-than-average group.

According to analyses in 350 cities, in school buildings housing grades 1 to 6, the average equipment cost was 8.2 per cent of the bond issue or appropriated funds. The average of the upper 50 per cent, classified on the basis of per cent of bond issue going into equipment, was 11.2 per cent. In school buildings housing grades 1 to 8 the equipment cost was 10 per cent of the bond issue or appropriated funds. The average of the upper 50 per cent, classified on the basis of per cent of bond issue going into equipment, was 13.7 per cent.

In school buildings housing grades 1 to 9 (elementary and junior high school combined) the equipment cost was 13.6 per cent of the bond issue or appropriated funds. The average of the upper 50 per cent, classified on the basis of per cent of bond issue going into equipment, was 19.2 per cent. In school structures housing grades 1 to 12 the equipment cost was 14 per cent of the bond issue or appropriated funds. The average of the upper 50 per cent, classified on the basis of per cent of the bond issue going into equipment, was 18.3 per cent. In buildings housing grades 7 to 9 (junior high school) the equipment cost was 10 per cent of the bond issue or appropriated funds. The average of the upper 50 per cent, classified on the basis of per cent of the bond issue going into equipment, was 12.5 per cent. In school buildings housing grades 7 to 12 (junior and senior high schools combined) the equipment cost was 12.2 per cent of the bond issue or appropriated funds. The average of the upper 50 per cent, classified on the basis of per cent of the bond issue going into equipment, was 18.5 per cent. In buildings housing grades 10 to 12 (senior high school) the equipment cost was 16.6 per cent of the bond issue or appropriated funds. The average of the upper 50 per cent, classified on the basis of per cent of the bond issue going into equipment, was 22.6 per cent.

On the basis of these averages, a table of budgeting,—assuming the building and equipment cost $300,000.00,—would be:

Budget for School Building and Equipment

To House		Cost of Equipment	Cost of Building
Grades	1-6	$24,600	$275,400
"	1-8	30,000	270,000
"	1-9	40,800	259,200
"	1-12	42,000	258,000
"	7-9	30,000	270,000
"	7-12	36,600	263,400
"	9-12	45,000	255,000
"	10-12	49,800	250,200

It is manifestly difficult to lay down a definite and established ratio between the cost of the building and the cost of equipment. The average for the junior high school is low in comparison with others, possibly because it is a new institution, and its needs therefore, not so well standardized. The averages given here show the general trend and afford local school officials an opportunity to check their own school costs against the general averages.

For those who are interested in knowing what the "upper 50 per cent" or better than average groups are doing, this table indicates the allocation of the total budget for a school building project,—assuming again the cost of building and equipment to be $300,000.

AVERAGES FOR "UPPER 50 PER CENT"

Budget for School Building and Equipment

To House		Cost of Equipment	Cost of Building
Grades	1-6	$33,600	$266,400
"	1-8	41,100	258,900
"	1-9	57,600	242,400
"	1-12	54,900	245,100
"	7-9	37,500	262,500
"	7-12	47,100	252,900
"	9-12	55,500	244,500
"	10-12	67,800	232,200

Survey of Actual Costs. Returning again to the question of school building costs, the most reliable data was received by the Better Schools League, Inc., 53 West Jackson Boulevard, Chicago, in the course of their extensive cost investigation. In this survey will be found a detailed list of actual school building projects, giving in all cases the essential data, including cost per pupil and in many cases the actual cost per cubic foot. Of the various buildings on which costs are given, 228 are of fire-resistive construction; 94 are of the slow-burning type of construction; and 5 have practically no structural safeguards against fire. The tabulations give in the first column the type of school described by grades housed in the structure. The meaning of these various grades has already been presented in preceding paragraphs. The second column gives the year of construction; the third gives the maximum pupil capacity; the fourth gives the cost per pupil; and the fifth gives the cubic foot cost in cases where costs are available. These figures are conveniently divided into various states. They will unquestionably serve as a general basis for comparative cost estimating. It must be realized, of course, that cubic foot cost data have definite variations and limitations, and that the same structure in one locality may cost more or less than in another. The building that costs $300 per pupil may provide twice as much in the way of facilities of an auditorium, gymnasium, laboratories, etc., as the structure costing $150 per pupil, so that it is not safe to assume that the school built at lower cost is necessarily the most efficiently designed. The opposite may be the case.

Editor's Note—The full tabulation of school building costs, arranged according to the type of school, the year constructed, the pupil capacity, the cost per pupil and the cost per cubic foot, is published in a booklet entitled, "School Construction Costs and Equipment Budget." This booklet, which is described by Mr. Taylor, is published by The Better Schools League, Inc., 53 West Jackson Boulevard, Chicago, and is the result of an investigation which covered reports from 350 cities which have erected school buildings within the past five years.

COSTS AND CONSTRUCTION

BY

IRWIN T. CATHERINE

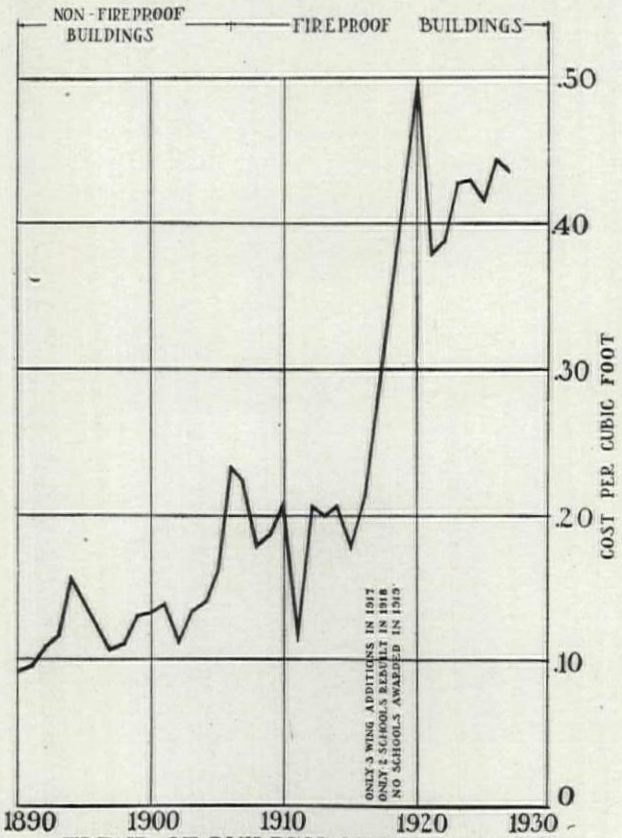
ARCHITECT, SCHOOL DISTRICT OF PHILADELPHIA

DURING the year 1905 and subsequent years, school buildings, when finances made it possible, have been constructed of fire-resisting materials, using the wall-bearing type of construction, which in more recent years has made way for the column-bearing type,—a more economical and practical form of construction. This change in design has been greatly augmented by the great number of school buildings that have been destroyed by fire. Statistics show, even in this modern age when everything is being done to preserve human life, that a great number of school buildings of all sizes throughout the country are still being constructed of non-fire-resisting materials and that on every day in the year, approximately five such buildings are burned to the ground. This is not confined to buildings erected during the early part of our educational development, but includes some constructed during recent years. The desire to reduce fire losses to the minimum, together with new standards of higher education and laws enacted by the legislatures of the different states, has resulted in the development of the modern school building.

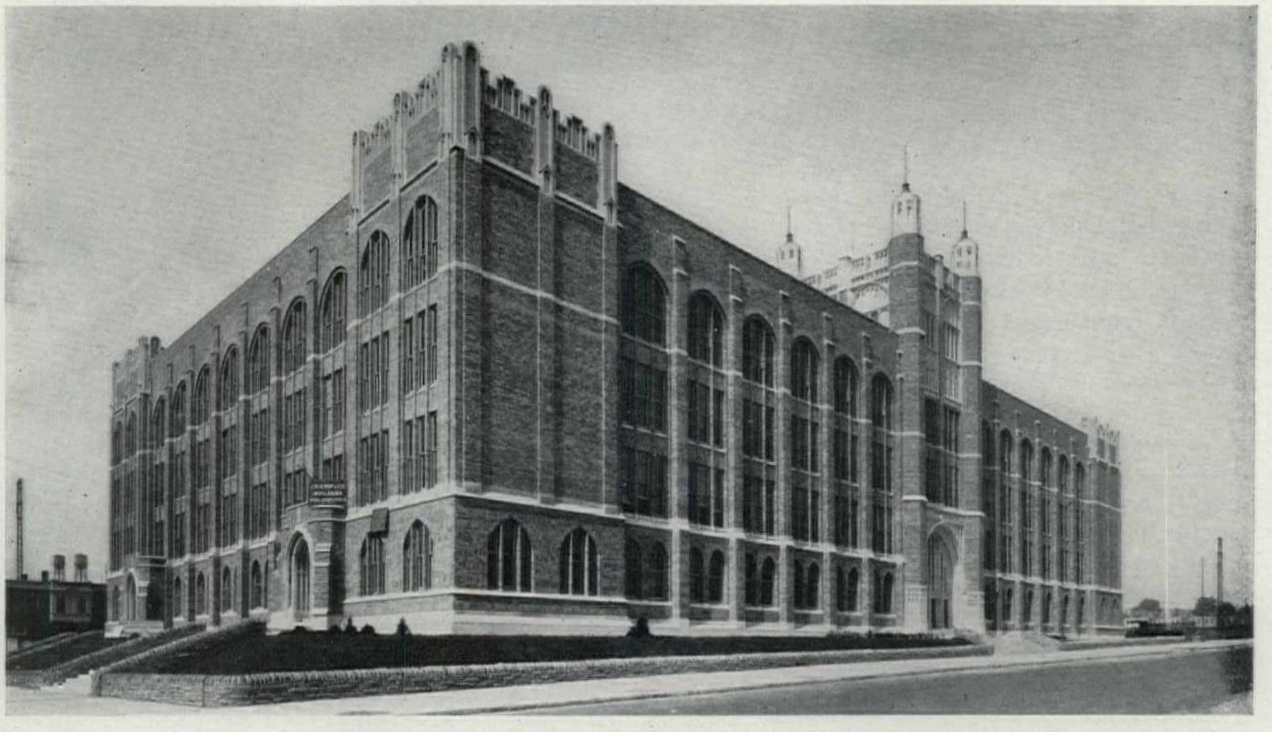
Costs. Some elementary schools completed during the latter part of 1927 in one of the large cities at a cost of approximately $543,000 each were designed of concrete with full column-bearing type construction and had in general 35 class units, including shops, recreation rooms, auditoriums, doctors' rooms and boys' and girls' interior toilets on each floor. Buildings are now completed in their entirety within 12 months from dates of awards, which would not have been possible had wall-bearing construction been used. A senior high school completed during the early part of 1927 at a cost of $2,170,191 of construction similar to that of the elementary schools, included over 100 class units, among which were units for the study of chemistry, physics, art, mechanical drawing, home economics, physical training, manual training, music, botany and others too numerous to mention. Within this building are also to be found a large auditorium, up-to-date administrative offices, toilets and rest rooms.

The constant change in ideas for the educational requirements of the child, together with new building laws, has kept the designers of school buildings on the alert in order to keep pace with the latest developments. As a result, many new details have been introduced in construction and design that would not otherwise have occurred. It is interesting to note the mounting cost per cubic foot of buildings of this class from 1890 to date, as indicated on the diagrammatic chart shown on this page. The rising prices can be attributed to increased cost of labor and materials and to the greater amount of materials being added to each cubic foot of space as the educational system develops, with a simultaneous elaboration and beautification of the exteriors of the buildings. Much study has been given to every part of the building in order that the cost of installation might be reduced to a minimum consistent with good design.

Economy of Space. There has been a great advance in what is known as concrete column construction, using spandrel beams to support exterior and interior walls. This type of construction provides saving in space, economy in construction and rigidity and rapidity of erection over the former wall-bearing type. The skeleton-frame type of construction allows a reduction in the gross area as well as the total height of building. This is very evident by referring to the illustration of "Comparative Types" which shows three systems of concrete construction. In the use of 13-inch curtain walls and 4-inch tile partitions one can readily visualize the saving in total area, which is often as much as 3 per cent. By reason of the shallow floor construction and the omission of the large factory-like windows sometimes placed in school buildings, about 5 or 6 feet may be saved in the total height of a three-story building, which may permit a total reduction in the cubage of the building of approximately 10 per cent.



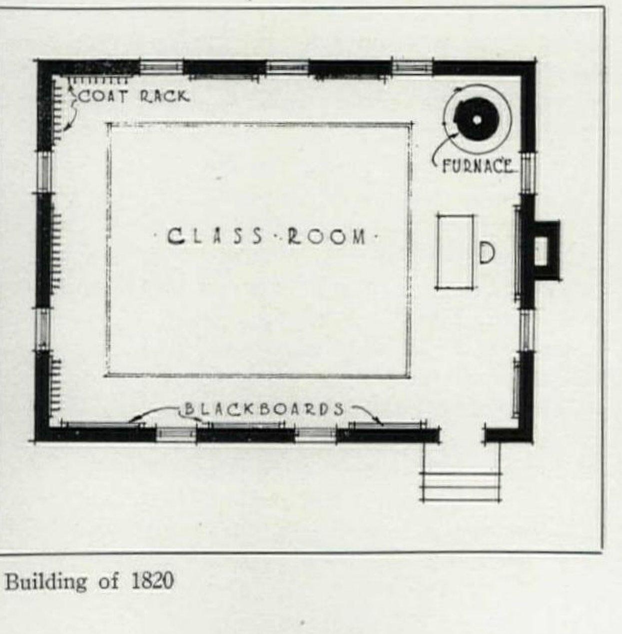
TREND OF BUILDING COSTS SINCE 1890



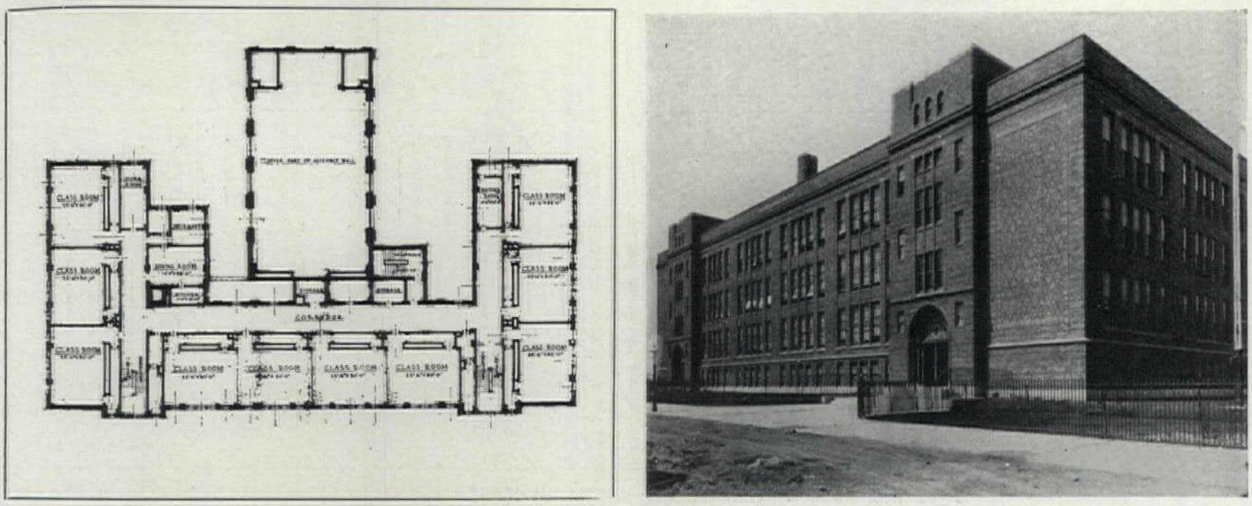
Typical Junior High School, Completed 1927. Cost Per Cubic Foot, 43 Cents. Cost Per Pupil, $608. Pupil Capacity, 2040

This reduction in cubage, however, is not so evident in the cost per cubic foot as in the total cost of the building and the cost per pupil. This theory is proved by the example of a school recently constructed without an auditorium, where the per cubic foot cost was 42 cents, with the per-pupil cost as low as $253. Here the plan was rectangular and had no waste areas. On the other hand, in another building, having an auditorium, the cubic foot cost was 43 cents, while the cost per pupil was $345. Thus, while the increase in the per-cubic-foot cost due to the inclusion of the auditorium is but 2½ per cent, the increase per-pupil cost is more than 36 per cent.

Rapidity of Construction. Rapidity in construction is an important factor in the building of schools, and this is best accomplished when all trades can proceed independently of one another and without interference of any kind. This is better accomplished with the skeleton form of construction than with the wall-bearing, for the reason that floor after floor can proceed without waiting for bricklayers and other sub-contractors to get on the site. The solid concrete floors and stairs become a protection to workmen against weather and accidents, and facilitate the movement of materials and labor as soon as this portion of the work is completed. School buildings with a cubage of over 1,000,000 cubic feet have been completed and fully equipped within a period of from nine to ten months after the work was started. The rapidity of construction resulting from the use of this type is closely allied with economy in construction, so that owner and contractor are always



A One-Room School Building of 1820



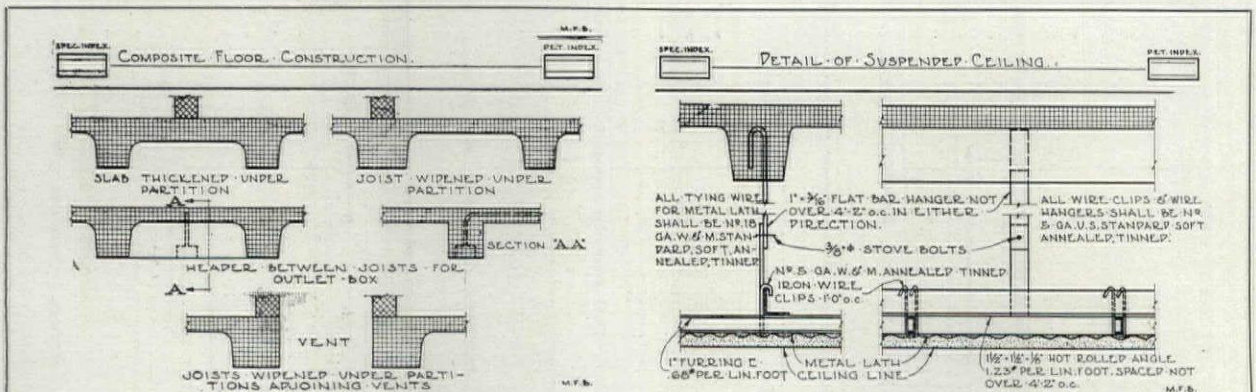
Typical Elementary School, Completed 1927

the principal beneficiaries, as indeed they should be.

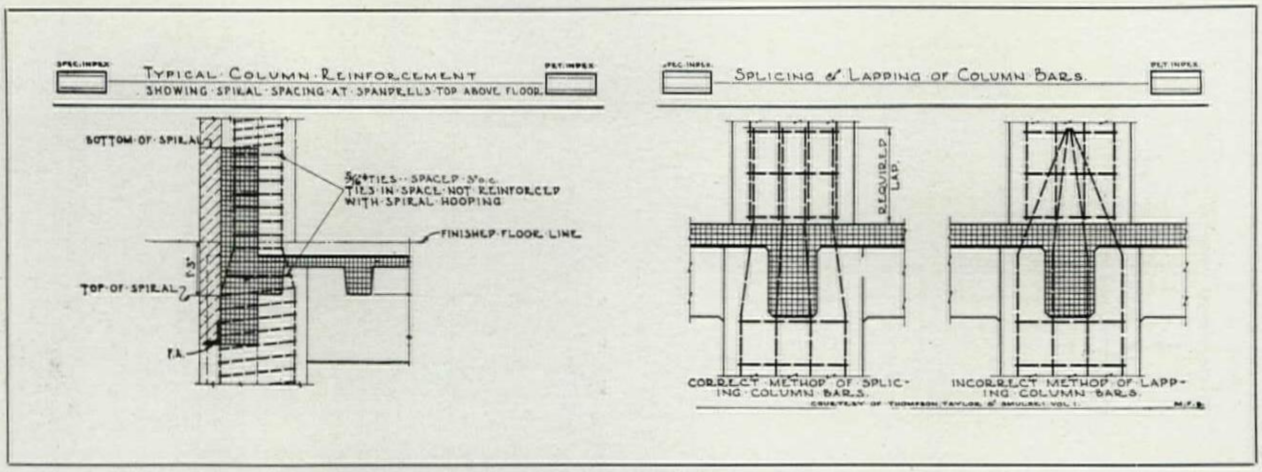
Rigidity of Construction. One of the most important qualities in the use of concrete is the rigidity that is secured by the skeleton type of construction. It is very important that the vibrations caused by children marching or drilling should not be transmitted to the classrooms, and that the noise and motion of the gymnasium should not in any way disturb the auditorium exercises. The rigidity of the concrete skeleton frame building gives assurance and satisfaction in a heavy wind storm such as have been experienced recently in many parts of the country. In connection with these wind storms, it will be noticed that wherever loss of life has occurred from a collapse, the building was of the wall-bearing type.

Economy of Construction. Since the adoption of the full skeleton type of construction, many buildings have been erected of the reinforced concrete skeleton type. Using this, it has been possible to complete and fully equip $500,000 buildings in ten months, when it once took twice that time. Study and research have made it possible to standardize certain drawings and details, with the result that within 24 hours after a contract is awarded practically 80 per cent of the details required for the building can be issued to contractors. In this way there is no wasteful and expensive delay, and the contractor is able to reduce his own overhead charges.

Details of Construction. The details of construction here shown may be considered typical for this kind of building. In general, classrooms are 30 feet long in the clear, so that the spacing of columns is 15 feet, 2 inches. The floor and roof construction is formed of 5¾-inch wide concrete joists (usually 8½ inches deep), 26 inches on centers, with slabs 2½ inches thick. This floor, known as "composite" construction, is framed to a large girder 16 inches wide by 26 inches deep, having a span of 23 feet, with a wide tee, which runs from column to column across the width of the room (Diagram page 474). The slabs and joists, in the schools just mentioned, are "formed up" by the use of No. 12 gauge removable steel forms, which may be removed two to four days after the concrete is placed, providing the supports under the joists are left in place. This permits the continuous use of the forms, so that a comparatively small quantity will be sufficient for the entire building. There are various other satisfactory types of concrete floor construction, such as terra cotta or light hollow concrete blocks spaced so as to form the rib beams, flat slab construction reinforced in various ways, etc. The finished ceilings of the classrooms, corridors, and other rooms are formed by expanded metal lath suspended beneath the soffits



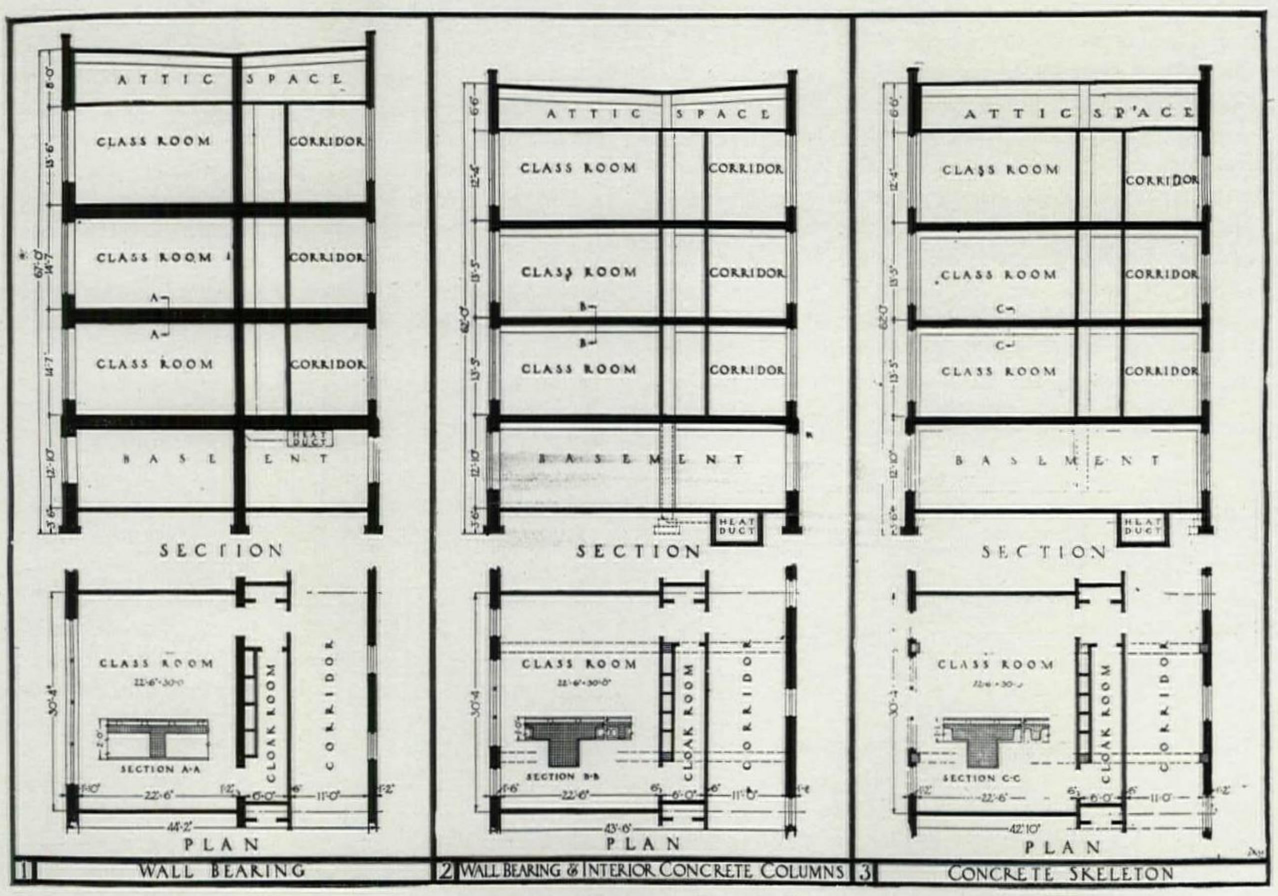
Typical Details of Construction Used in Connection with the Specifications



Typical Details of Construction as Issued by the School Architect

of these joists and plastered with the usual three-coat work. The ceilings of the upper stories are formed in a similar manner, supported on channels or angles which are suspended several feet below the roof construction. The space between the roof and the ceiling below is useful for the steam pipes and ventilating ducts which are so necessary in large school buildings. (See illustration "Comparative Types," below.) All exterior walls are of face-brick veneer with a backing of a hollow tile or common brick supported at each floor on concrete spandrel beams, which are framed monolithically with the floor, girder and column construction. An important feature of the construction is the all-concrete stairways which are poured with the floor construction, providing safe and easy access to all floors.

It is almost impossible to imagine what changes will occur in school buildings which may be erected during the next 100 years, considering the great changes that have developed during the past hundred. Will they be huge structures, three and four times the sizes of the present buildings, or will education, like all other enterprises and developments, reach a "saturation" point? The writer believes that there will come a time when the mechanical activities will be removed to special trade schools, and that the new education in these buildings will revert to that of the "three R's" of a more advanced standard.



Comparative Types of Construction

SPECIFICATIONS FOR THE SCHOOL BUILDING

BY

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THE "Tentative Contract Forms" submitted by the Interdepartmental Board of Contracts and Adjustment of the Bureau of the Budget, U. S. Government, contains this excellent definition of public and private contracts:

"1. All public contracts are made by agents with limited authority. Their authority is governed and controlled by the laws under which they are authorized to act.

"2. It is a well established public policy that all public contracts shall be let after open and free competition to the lowest responsible bidder, and that, in order to accomplish this result and have competition based on uniform terms, the government, states, counties and municipalities must dictate the terms and conditions that must be met by the bidder.

"3. In order to carry out this public policy it is necessary that the contracts shall be carried out and performed in substantial compliance with the terms and conditions under which they are let. No officer of the government, or of a state, county or municipality, has the right to vary the terms or waive the rights accruing under such contract.. In private business, however, the individual awarding the contract can do what he pleases with his own money or his own property, and he can select his own contractor upon his own terms. He is free to order any changes he may desire to have made in the contract and to make any kind of settlement he can arrange with the contractor after performance has been completed."

A contract for a public school is a public contract, subject to the restrictions quoted. There are some municipalities and school districts where a public school contract may be legally handled as a private contract. In these cases it is generally considered for the best interests of the public to handle them essentially as described for public contracts.

A close contact with public contracts over a period of years reveals the fact that the element of "good will" is absent in this class of work, and there appears to be a good reason for this condition of affairs. "The lowest responsible bidder" is an elastic term, which includes generally all not in receivership or jail. This state of affairs is due largely to the surety companies, which seem willing to furnish bonds to anyone able to pay their fees. When a surety company guarantees the responsibility of the contractor, the school board is in effect denied the right to judgment which the law intended. A public contract is awarded as the result of a "free for all" upon a strictly price basis, and the successful bidder generally feels that the contract was awarded without regard to ability, character, integrity or financial responsibility, and, therefore, he is entitled to take advantage of all of the "breaks," errors, misinterpretations and omissions, and will create as many of these to further his own interests as possible. The specification writer should be thoroughly familiar with the effect of public bidding and the lack of "good will," and he should erect a defense against the evils resulting from open bidding and the lack of "good will." In order to effectively carry out the policy and conditions defined for public contracts, it is necessary to include in the specifications requirements and conditions peculiar to this class of work. An attempt has been made in this article to restrict the discussion to those questions which require special treatment in public contracts, and no attempt will be made to cover questions which are encountered in specifications for the average work.

Advertisement: The advertisement is generally included as part of the contract documents and should, therefore, be prepared by the architect. The advertisement is the concrete expression of "open bidding" and is rquired to insure such bidding. Certain municipalities and school districts have requirements which differ from others, and the specification writer should consult the secretary of the school board before preparing it. The advertisement should state briefly when and where the bids will be received, the character and size of the project, the number of contracts, the deposit required to guarantee the bid, and whether it will be a certified check, bid bond or cash; also where plans can be obtained for estimating purposes and the deposit required for them. The advertisement should be included as part of the specifications and a copy turned over to the secretary of the school board for insertion in the papers. When this detail is handled by the architect, he should look up the law, as it varies not only in different states, but also in different municipalities and school districts.

Proposal Form. In order to carry out the policy of dictating all of the requirements and conditions that must be met by the bidder, and to insure the bids being received on exactly the same basis, the proposal form is always included. The proposed form should be prepared by the specification writer and is either included in the specifications or as a loose form with the specifications. The proposal form simplifies the public reading of bids and becomes part and parcel of the contract documents. The proposal form should be made out in complete detail, so that it will only be necessary for the bidder to fill in the amounts and sign it. When alternative estimates and separate estimates are required, the exact wording of each should be on the proposal form, so that it will be necessary to fill in only the amount. The courts have ruled that optional alternative bids which deal with a system or method different than that specified are illegal, due to the fact that the other bidders did not have the opportunity to estimate upon the same basis. For this reason proposal forms which request the bidder to name the time of completion have been held illegal because all bids were not on the same basis.

Deposit Guaranteeing the Bid. In order to prevent fraud in public work, a deposit is required with the bid guaranteeing that the bidder will execute the contract if it is awarded to him. The deposit may be cash, certified check or bid bond, and the amount required will generally vary from 2 to 10 per cent of the amount of the bid, depending upon the amount of money involved. A bid bond is furnished by a surety company for a nominal fee as an accommodation, and as such they expect to receive the contract surety bond if the bidder be awarded the contract. Some school boards will not approve some surety companies, and in order to prevent the necessity of disapproving a surety company after it has guaranteed the bid of a successful bidder, they refuse to accept bid bonds as deposits and demand certified checks or cash. To prevent issuing certified checks upon weak banks, some school boards require that the certified check be made upon a member bank of the Federal Reserve System, as a bank must qualify before being accepted as a member. It is usual to require all bids to hold good for 30 days after their receipt, and to require the retaining of the deposits of the three low bidders on each class of work until the contract is executed. As the deposit is frequently 5 per cent of the bid, this means that this amount is deposited without interest with the school board for this period of time. Some school boards do not request funds for building purposes from the public or board of school estimate until the bids are received, and it is manifestly unfair to tie up the liquid funds of an unsuccessful bidder for 30 or 40 days without interest.

Surety Bond. A bond guaranteeing the performance of the contract is required from the successful bidder and is a legal requirement of all public contracts. Personal bonds are legally acceptable in most states, but owing to the liability of the individual members of the school board, if the contractor should default and the security prove worthless, this class of bonds is rarely accepted. Practically all bonds are executed by companies which make a business of this class of risks. The fees for surety bonds are generally fixed by law, and the surety companies are generally licensed by the state before they can do business in that state. They are also required to deposit a percentage of their capital in the state treasury, the amount of the deposit being based upon the amount of business done. Some states legally define the liabilities which the surety company must assume, irrespective of the particular bond form it may have executed. One may often feel secure in the knowledge that he has protected the owner, subcontractor and materialman, by a cleverly worded and legally executed bond form, but may learn later that the state law has limited the liabilities of the bonding company to such an extent as to make it practically valueless. In New Jersey, the surety bond protects not only the owner, but the sub-contractors and materialmen. This is as it should be in building construction, owing to the fact that the contractor in this class of work is in effect a broker, who can easily shift his liabilities to the shoulders of the sub-contractors and materialmen, and let them "hold the bag." Such a condition of affairs exists in the state of New York, and it encourages fraud. The surety companies in New York are responsible to the owner only. The general contractor can finance a project from the sub-contractors' funds, collect at completion, and as long as he does not default to the owner the surety companies are not involved.

Qualifying as a Responsible Bidder. In a creditable attempt to take the definition of a responsible bidder out of the hands of the surety companies and to correct some of the evils of public bidding, the Joint Conference on Construction Practices, at Washington, has compiled standard questionnaires and financial statements which when executed should form a good basis on which to establish the proposed bidder's responsibility. The forms consist of an experience questionnaire, plan questionnaire and financial statement, and appear to be a step in the right direction.

General Conditions

Liquidated Damages. The General Conditions for a school building will vary from that used for a private project, due to the fact that all of the conditions and requirements must be decided beforehand and definitely specified, with nothing left to future negotiation. For example, the time of completion should always be given, so that all bids will be received on exactly the same basis. The amount of liquidated damages should be given, with detailed conditions under which the time will be extended. If the operation is awarded under different contracts the liquidated damages are more difficult to collect, but even under these conditions the amount has been collected. The amount of liquidated damages that the school board will stand is not in direct relation to the amount of the contract price of the building. Should the time of completion coincide with the beginning of the fall school term, the liquidated damages should be greater than if the time of completion were at the beginning of the summer vacation period. If a school addition or alteration is contracted for and if it affects the operation of the present building, the amount of liquidated damages incurred would be proportionally greater than if the building were a complete unit in itself. These facts should be considered when establishing the amount of liquidated damages. Liquidated damages for non- completion of the work on time should be required for all public contracts.

A "pitfall" in public work is the inclusion of cash allowances in the specifications, such as is frequently done in private work. This should never be done, for the reason that it turns over to the architect a definite sum of the public's money to spend without competition, and while this procedure may be consistent with the best interests of the building, it is not good public policy, and I seriously question if it is legal. The architect should reserve the right to approve the sub-contractor under all conditions, for it is through the "good will" of the sub-contractors and the materialmen that little difficulties are ironed out during construction.

"Or Equal." This is not the place to debate "or equal." The principle of open and free bidding in public work forces the use of "or equal" throughout school specifications. It is of the utmost importance that the architect be the judge of "or equal." A forcible paragraph should be included in the General Conditions to the effect that the exact brand specified must be used, and where substitutions are desired they must be submitted to the architect for approval, which approval must be given in writing through the general contractor. This provision keeps the control and selection of material under the architect's control, where they rightly belong. It also, if rigidly enforced, discourages the use of substitutions, as the sub-contractor is required to have the general contractor make the requests, and this operates as a restraint in many cases. Another method of handling the question of "or equal" is to require the exact brand of material specified with the provision that all substitutions must be submitted before the receipt of the bids, and that where a substitution is granted, the substitution will be included in a bulletin sent to all bidders upon the work, after the receipt of the bids no substitution being allowed. This requirement, which is in line with legal opinion, is, however, pretty rigid, and it is questionable whether it is in harmony with the best interests of the public. Another method of handling the question is to require all bidders to submit with their estimates the substitutions that they desire to make with the prices, more or less, which in effect really makes these alternative estimates. A statement is generally included to the effect that after the award of the contract no substitutions will be considered other than those decided from the list furnished with the bid.

The method of procedure in constructing the building should be given attention, particularly if the building is an addition. In these cases it is usual to require that no workmen be allowed in the existing building while the school is in session, and that the school shall be kept in operation uninterruptedly at all times. It also is general to require dust-proof and noise-proof partitions to be constructed where alterations are being performed in the present building, and to require that the contractor work out a schedule of procedure with the architect and school authorities.

General Contractor's Work. A section should be included in all school specifications covering the amount of work which must be done by the general contractor. It is important for sub-contractors and materialmen to have decided for themselves in advance questions as to who will furnish the water, heat, light, watchmen, hoists, scaffolding and toilet facilities, during construction. They are also interested in knowing whether these will be furnished free or whether the general contractor will charge them a pro-rata fee for their use. The general contractor should provide any temporary dust-proof partitions required in an existing building where alterations are being made. In addition to the services named already, he should also provide temporary fences, cutting off the area under construction from the other school property.

Sub-Contractors. Within the past decade a most unusual development has taken place within the building trades. This consists of the splitting up of the basic trades and the changing of their status from that of employes to sub-contractors. This movement is in line with the present age of specialization and standardization, and is in harmony with our present social structure. The architect and the contractor have not been alert and are slow in planning to meet this change. A decade ago an owner selected an architect who gathered around himself general contractors who were thoroughly familiar with the class of work desired by the architect. Specifications as we now know them were unheard of and unnecessary, due to the fact that the general contractor employed the mason, carpenter, painter, etc., on his own pay roll, and selected and trained them to do but one class of work, irrespective of what the specifications required. Now that the trades have organized into sub-contractors and that these sub-contractors have associations, we find them demanding definite and specific specifications on the work they are to furnish, so that they will feel sure their competitors will be required to furnish the exact article on which they estimated. This is particularly true of public work. It is no longer a question as to whether a certain material is good enough, but whether it is of the exact grade specified, in order to keep up the morale of the sub-contractors estimating upon the work. They soon find out whether their competitor is taking an "oat out of the bag" by furnishing one grade lower. If they find that this condition obtains, one may be sure they will go one step further than their competitors. It is for this reason that specifications in our modern methods of building should be very explicit and very complete.

Special Problems in Construction and Materials. A school building will not be sold, rented or leased, in the natural course of events, but must be kept and maintained by the owner until it becomes obsolete and is demolished. If the building be physically defective, requiring constant maintenance, it will not reflect credit upon the architect. Another point to consider is that the school will be in care of a janitor, who may be a political appointee who will give the building the most elementary maintenance, if any. The materials entering into a school building must not only be "fool-proof" but "abuse-proof." This creates several problems which are peculiar to school buildings: first,—the building will receive practically no careful maintenance service; second,—it will receive the hardest kind of wear and tear from minors at an age when destructiveness is most prevalent; third,—the building will never be sold, but must be carried by the owner. If there is any class of work where good, sound building construction should be practiced, it is in a school building. These suggestions should be given special attention.

Systems of Waterproofing and Dampproofing. Water is most difficult to contend with, and the toughest enemy to conquer. It causes trouble in three major portions of a building: 1. Foundations and Basement. 2. Exterior Walls. 3. Roofs.

There are three basic systems of waterproofing the foundations which I have used to some extent,—waterproofed concrete, membrane system and the pulverized iron system.

Integral System. A successful integral waterproofing system usually results from the use of a combination of labor and compound in the proportion of 90 per cent labor and 10 per cent compound. The "human element" enters into this class of work to a great extent, and when "good will" is absent the problem is greatly complicated. The architect sometimes takes the claims of the manufacturer on their face values, incorporates them in his specifications and asks the contractor to guarantee them. The manufacturer of the compound may claim that the reason one did not get the result he promised is because the contractor did not "follow the printed instructions." The contractor does not see why he should be required to guarantee the results claimed for a secret compound. My theory is that the manufacturer who developed the product knows what it is and will do, and is the one who should assume the responsibility for the success of integral waterproofing. To put this theory to practical application, the specifications require the manufacturer to furnish the material and supervise the installation of all concrete and mortar where his material is called for to produce a waterproof result. For this supervision he usually charges the general contractor about $20 per day, plus expenses. As the value of integral waterproofing depends on the kind of concrete produced, one is assured in this way that excellent concrete will result and no excess water will be used, which result is worth the supervision fee charged. In such a case the manufacturer guarantees and furnishes the owner a maintenance bond, co-executed by himself and an approved surety company, that the work will be water-tight.

Membrane System. When the problem of waterproofing is very serious, I generally turn (rightly or wrongly) to the use of a membrane system of waterproofing consisting of alternate layers of hot asphalt and cotton saturated with asphalt, though other satisfactory systems of membrane waterproofing use rag felt, asbestos felt and burlap for the reinforcing agent, and asphalt or pitch of various consistencies and grades for the waterproofing element. The best of waterproofing can be analyzed as 25 per cent materials and 75 per cent labor. A good waterproofer can produce better work with poor materials than a poor waterproofer can with the best of materials. My belief is that the best assurance for successful membrane waterproofing is the requirement that it shall be done by a specializing waterproofing contractor. Another requirement to assure success is to specify the materials of a high grade company which will follow through and look after the work in a general way so as to make it successful. Membrane waterproofing should be guaranteed directly to the owner by the waterproofer, which guarantee should be backed by a maintenance bond for about five years and co-executed by the waterproofer.

Pulverized Iron Systems of Waterproofing. This system is sometimes used when it is questionable whether a waterproofing system is necessary or not, because it is the only system which I will use that can be logically applied to the interior of the foundation walls. For this reason, when in doubt, a separate price is requested on work of this type with the reservation that the right to accept the bid will run for the life of the contract. This will allow the saving of the cost of the waterproofing in the event that it should develop that no waterproofing is required. I have found this an excellent method when in doubt, and have frequently saved the entire cost of the waterproofing.

The method of waterproofing by this system is generally this: Finely ground pulverized pure iron combined with chemicals is mixed with water and brushed into the pores of the masonry, applications being made until the desired oxidation results, after which a heavy slush coat of the compound, sand and cement is applied, and finally a neat cement wash is brushed over the waterproofing. The pulverized iron is oxidized by means of a chemical corroding agent and water. The result is a plating of corroded iron over the walls and bottom, of sufficient strength to withstand any hydrostatic pressure the structure is capable of withstanding. One of the dangers of this system is that the waterproofer must estimate the amount of application that may be necessary to withstand the most severe conditions, which generally occur during the spring thaws. The advantage of this system is that this work is being done at the present time by experienced waterproofers. This work should be guaranteed and bonded as suggested for the membrane system.

Dampproofing Exterior Walls. Here is a quotation from circular of The Bureau of Standards No. 151, being the report of The Bureau of Standards Plastering Conference: "There are certain localities in the United States where the climate is uniformly hot and dry. (In the preceding sentence particular emphasis is to be placed on the word *and.*) With the exception of in such localities, it is recommended that all exterior masonry walls be furred." This quotation is preceded by an authoritative and complete analysis of all the conditions of the problem, which warrants the conclusion reached. Poor workmanship and materials are responsible for most of the troubles encountered with water soaking through exterior walls. The present styles of architectural design have a bearing on the question, due to the lack of sill courses, water tables and cornice protection. Dampproofed exterior walls can be obtained if these precautions are taken:—Always fur plastered exterior walls. Never use thin back-up tile, clay or concrete. In severe cases parge the back of the exterior wall with waterproofed cement mortar before furring.

In connection with furred walls, the cheaper building can be furred with 1 x 2-inch spruce spaced 12 inches on centers and covered with metal lath and plaster. Wood furring should not be used for the better class of buildings or for buildings at the seashore where considerable dampness occurs. In these cases the inside of the exterior walls should be coated with an asphalt compound and then furred with split furring tile; the asphalt should continue out on the floors, ceilings and walls for a distance of about 3 feet. When the conditions are severe, such as at the seashore, it is desirable to parge the inside of the wall with a coat of 1:2 waterproofed cement mortar before the asphalt compound and furring are applied. The parging should continue out on the rough concrete floor slab and around the windows and out on the ceiling a distance of about 3 feet. Due to the fact that all face bricks are or should be laid up from outside scaffolds, and that face bricks are selected and laid for architectural effect, it is impractical to thoroughly slush the bed or cross joints of face brick. The mortar is deposited around the edges of the brick with the point of a trowel and the brick bedded, the mortar extending back from the face of brick about 1½ inches. When tile backing is used it is practically impossible to thoroughly slush and fill the joint between the face brick and the back-up tile, with the result that the water enters through the brick joints and soon filters and percolates through the joints of back-up tile, and in some cases builds up a pressure so as to force itself through the asphalt coating, window sills, floor slab, etc.

Roofs. Considering the lack of maintenance it generally receives, a good roof is of the utmost importance. For flat roof surfaces of large areas, the choice falls between a pitch slag and felt, or an asphalt and felt roof. Both types give excellent service if care is used in the selection of material and of the sub-contractor using it. On school roofs there are usually ventilators, skylights and scuttles. The composition is laid immediately after the roof slab has been cast. There results a considerable amount of traffic over the roof before the workmen are through. This damages the roof to a considerable extent and in a way that it is difficult to estimate. An improvement over the ordinary method of laying composition roofs is to apply the first three plies and then have the mechanics leave the work. When the parapet walls are completed, copings set, ventilators applied and all of the other work on the roof is completed, the roofer returns and repairs the damage to the base coats, and applies the final plies of the composition roofing. All flashings for a school roof should be of the most durable materials obtainable. The parapet walls should be flashed their full height. The best method of flashing a parapet wall is to use a lead cap flashing, as it seats well on a masonry wall. This cap flashing should be installed under the coping to form a drip on the outside, and should be continued through the wall and down the inside approximately 6 inches, with a 1½-inch lap. The base flashings should be of copper and locked to the lead cap flashing. An examination of parapet walls in a considerable number of schools discloses the necessity of thoroughly flashing the entire back of the parapet wall and indicates that all parapet walls should be 12 inches thick.

Stair Halls. Stair halls receive a tremendous amount of traffic and abuse. The reason is that the classes are constantly changing. This traffic is of the most destructive nature, and the materials should be selected to withstand it. The stairs are often of steel, strong enough to support a live load of 150 pounds a square foot. A balustrade is often provided about 5 feet high to prevent the pupils from pushing one another over the rail. Among the best stair treads are slate, soapstone, bluestone, terrazzo or cast iron with an abrasive element non-slip tile etc. Bluestone, which is extremely hard, comes about 2 inches thick, and wears non-slip. The platforms should be of the same materials as the treads. The walls of the stair halls should be wainscoted to a height of 5 feet or more with a material that will stand abuse and pencil marks. The best materials for this purpose seem to be glazed brick or salt glazed brick. The walls above the wainscot are generally plastered. A light colored impervious brick may be used above the glazed brick wainscot.

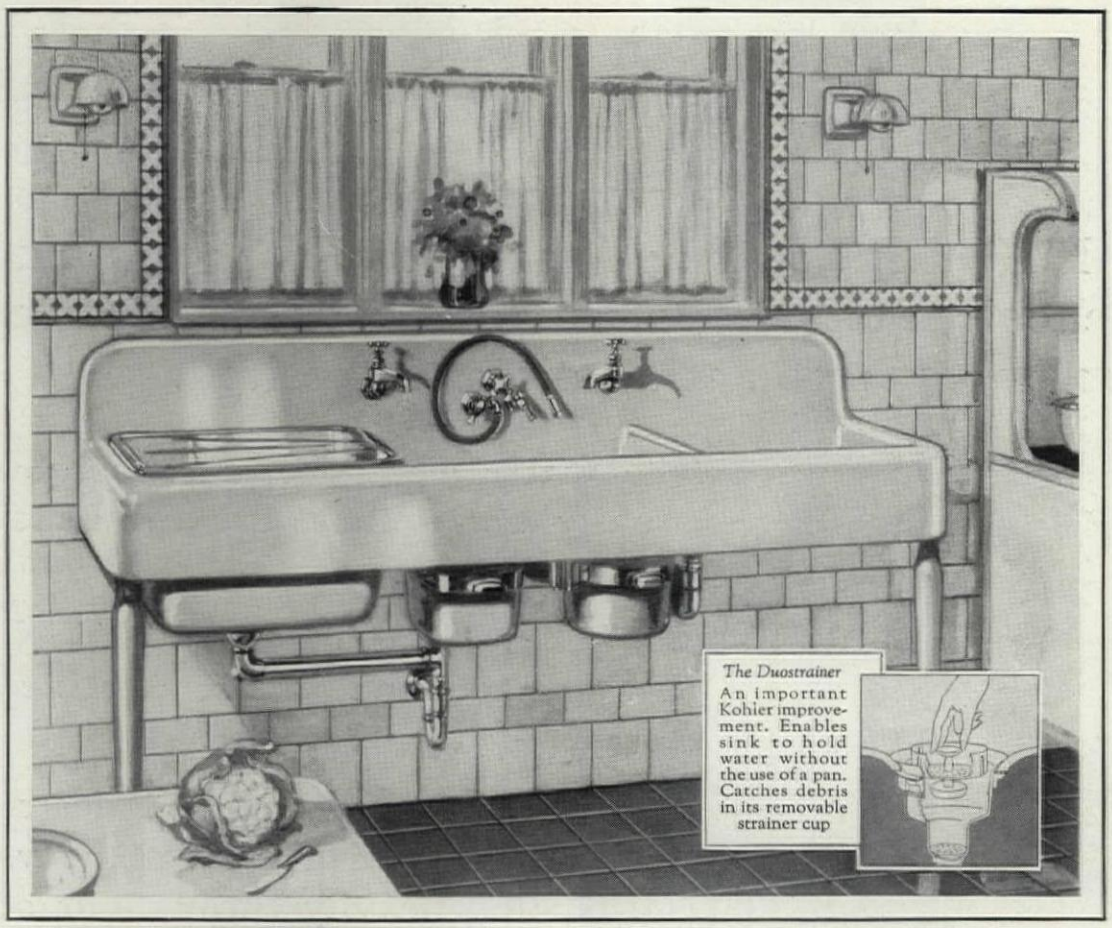
Corridors. School corridors receive the same traffic as the stair halls and should have materials to withstand the resulting wear. As noise is a disturbing element in the corridors, every effort should be made to minimize it. The materials most used for floors to accomplish this are either cork tile, linoleum tile, linoleum, rubber tile or mastic floors. Much might be said about each. Considering price, appearance, durability and value received, I consider plain brown battleship linoleum the best material for school corridors, providing it is properly laid and maintained. Terrazzo has been used with considerable success for corridor floors, but it is not very quiet. Terrazzo should be made non-slip by the addition of an aggregate which is sprinkled over the surface, displacing about 40 per cent of the marble chips. Mastic tile, cork tile and rubber tile have been used with varied degrees of success. Rubber tile, linoleum and linoleum tile are secured to the floor with the same kind of cement. Moisture attacks the cement used in laying these floors. For this reason these materials should not be used where the floor foundations are on earth, despite the fact that the basement may be waterproof. In these cases terrazzo or mastic floors have proved successful. The walls in corridors should withstand abuse, and the materials selected are generally those used for the stair halls. In cases where the appearance of a brick wall is objected to, a colored ornamental architectural terra cotta cap may be used above the brick wainscot to produce a pleasing effect.

Classrooms. Wood is often considered the best material for classroom floors, considering ease, underfoot quiet and ability to secure desks. The choice seems to lie between yellow pine and maple. Yellow pine should at least be specified as dense heart rift "B and better" grade. No inferior grade should be used, for the reason that the mopping of a yellow pine floor wears at the sap streaks and causes the floor to splinter at the edges. This is particularly true for sap rift flooring. The advantage of pine flooring is that it can be solidly nailed, lays perfectly straight and true, does not warp or twist to any appreciable extent, and comes in long lengths. Maple flooring should be graded as No. 1, formerly known as "clear" grade. This flooring comes in standard lengths of even feet, and when it is used the sleepers should be spaced not more than 12 inches on centers so that a bearing can be had on at least two surfaces. It is always preferable, where funds permit, to use under-flooring where maple floors are used. The wood floors should be finished with a sanding machine run diagonally across the floor to prevent cupping, and to assure perfectly level surfaces. The floors should then be treated with an oil or a floor preparation which holds paraffin in suspension. Walls and ceilings of the classrooms should be plastered. The lower portion of the classroom walls to the height of the chalk rail is often covered with a heavy woven canvas to prevent the children from damaging the plastered wall. Wood makes the best classroom trim. Oak, chestnut and yellow pine have been used with considerable success. The pupils' desks and seats are wood, teachers' desks and chairs are wood, cabinets as a rule are wood, and it is always well to recall the wood treatment in the blackboard trim, door and window trim. There are many composition blackboards, some of which seem to have merit. Natural slate is an old standby and has been used with much success, and is usually my preference, although there are some cases where water turns the slate to a gray color very quickly. Cork bulletin boards are generally installed in connection with blackboards, and in a good many cases a cork strip is placed over blackboards so that standard size illustration sheets can be installed for exhibition or decorative purposes.

Classroom windows can be made in a variety of types and sizes, but preference seems to be for double-hung wood windows and certain patented windows. Windows should be shaded at the center with the shades drawing up and down so that light can be had at the far side of the classroom, which would not occur if the shades were pulled from the top down in all cases.

Toilets. Floors in toilet rooms are generally of either tile or terrazzo. Terrazzo is the cheaper of the two, but is not as sanitary as ceramic tile. The wainscots are usually either tile-glazed brick, glass or Keene cement. Tile is the material most widely used, although structural glass in ashlar form is growing in popularity due to the new methods of, economy in the production of structural glass. Toilet partitions are generally wood, slate, soapstone, metal or marble. Wood should not be used, except where economy is of the utmost importance, as it is practically impossible to keep the doors in place. The pupils swing on them and soon tear them off the butts. Slate and soapstone, while very sanitary, do not make a very desirable impression, due to the fact that they are oiled during the vacation period and become black and greasy in color. The doors of the compartments are often of wood, and it is so difficult to keep the doors on these partitions that some school boards omit the doors entirely. Marble, while desirable, is rarely used owing to its cost, although in normal school buildings of the better class its use is legitimate. The most practical partition in my opinion seems to be the standard steel partition with metal doors, such as is used in the better class of factory buildings. These partitions stand abuse, and it is rare to find a door off the hinges.

Gymnasiums. Gymnasiums should have double floors. The finished floor should be 1⅛ inches clear grade maple with all lengths under 4 feet culled out and not used. The double floor allows for the insertion of the flush sockets which are required for gymnasium apparatus. The walls of the gymnasium should usually be buff brick, with a salt glazed brick wainscot about 8 feet high and laid with tight joints. Windows consisting of large banks of pivoted sash operated by sash-operating devices, with the interior protected by a wire guard, flush with the brick wall, make an ideal arrangement. A base of ⅜-inch steel plate about 6 inches high is generally installed around the walls and grouted solidly with Portland cement. This base prevents the gouging out of the brickwork by forcibly shoving the horses, parallel bars and other apparatus against the wall. The ceiling should be of Keene cement and the lighting fixtures should be recessed flush. Where clocks and bells are required, a recess should be provided for them, and they should be flush with the wall and covered with a wire guard. Pipe hangers with clamps should be installed in the ceiling, so that pipe beams can be installed by the gymnasium equipment contractor. If these pipe hangers are of more than 1 foot in length, they should be braced against side swaying.



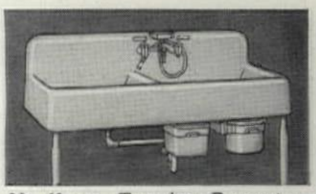
This Kohler Efficiency Sink (No. K-1150) is one of a complete line of new models, providing various combinations and ranging in length from 36 to 78 inches

A *three-well* Kohler *Efficiency* Sink—the very latest

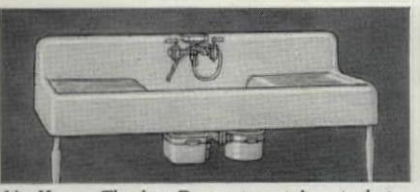
Look twice at this good-looking sink. Notice that it is really *three* sinks—with three sink compartments instead of one! Dishes are washed in the central sink and rinsed on the right—a sequence of efficient operations. The laundry tub on the left does the *everyday* washing of lingerie, children's clothing, handkerchiefs—filling a genuine modern need.

One of the remarkable points about this remarkable sink is that it is only one of a *complete line* of new Kohler *Efficiency* Sinks, all of which embody in varying combinations new features such as are shown above. For instance, all have the new Duostrainer drain and hold water like a wash basin. All are 8 inches deep, with 8-inch backs. All may be had with Kohler fittings in nickel or chromium plate; with rinsing hose; with receptacles underneath, one for cleaning materials and one for refuse. And all are made in six Kohler Colors in addition to white, and may be had in Kohler Flint-gloss acid-resisting enamel.

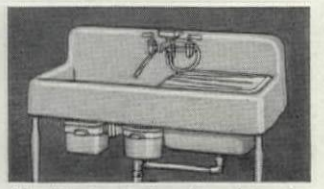
The illustrations below show other *Efficiency* models. Let us send you our folder describing these and other patterns in this important line.



No. K-1240. Two deep Duostrainer sinks. Refuse container and receptacle for cleaning material mounted on swinging arms beneath



No. K-1275. The deep Duostrainer sink, twin drainboards, rinsing hose, and other features combine to make this one of the finest sinks for medium and large kitchens



No. K-1160. A laundry tub at the right; a deep Duostrainer regular sink at the left. Ideal for small homes and apartments

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Plumbing Fixtures

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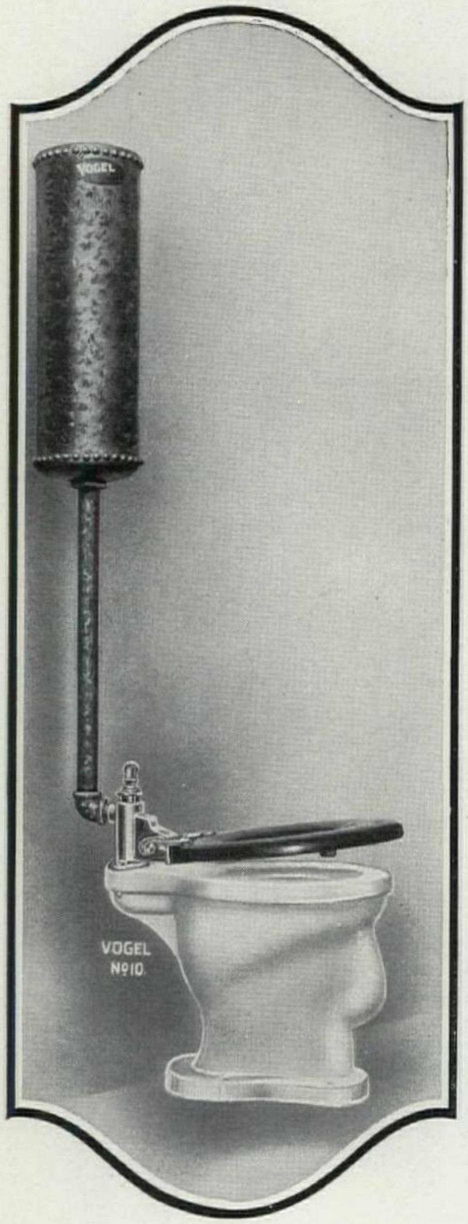
NUMBER TEN seat action water closet combination for schools, factories, comfort stations, and wherever a durable positive acting closet is desired.



The water closets in a school building usually receive more use and abuse than any other fixtures.

We believe VOGEL NUMBER TEN to be the strongest and most durable water closet outfit ever made.

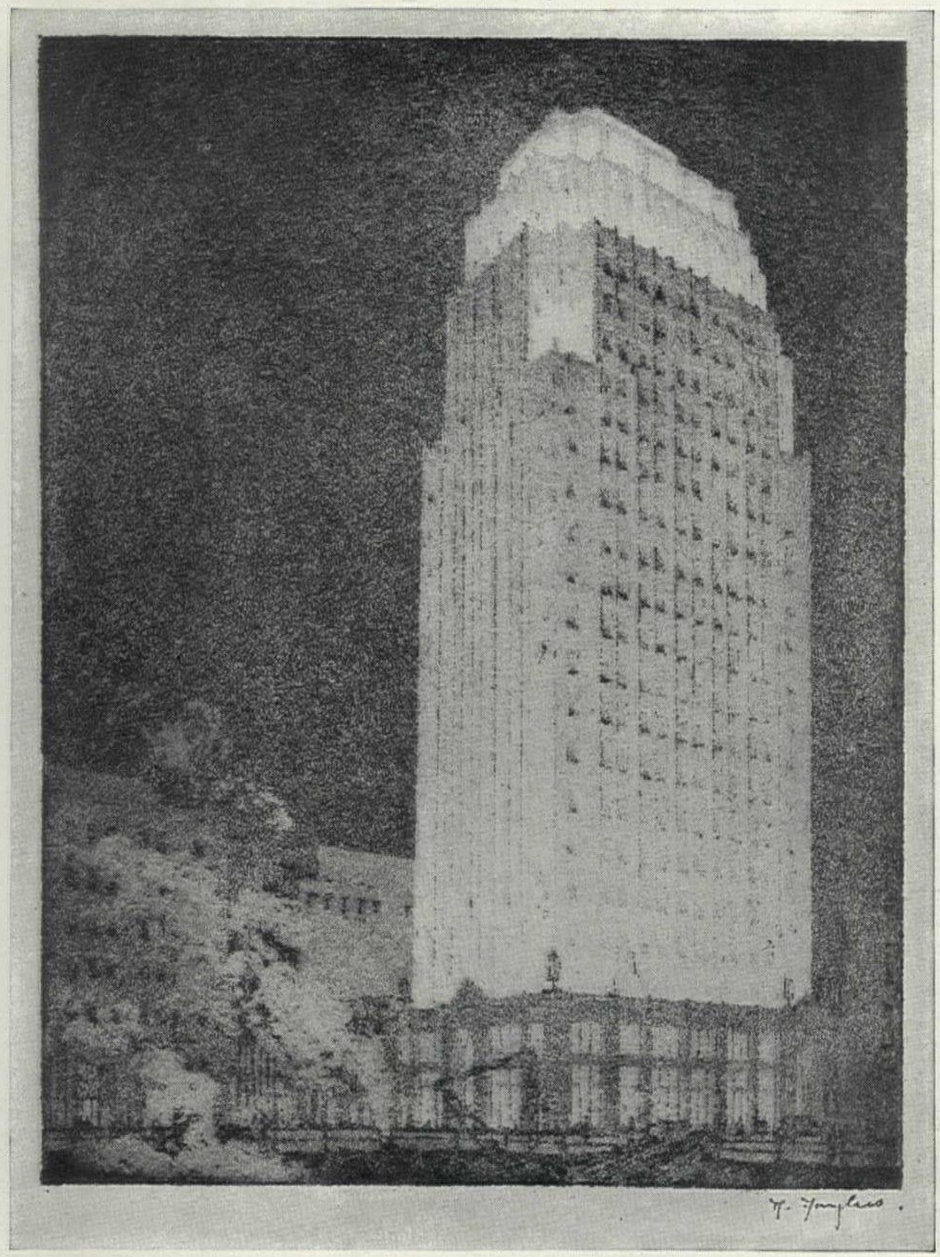
The tank is practically indestructible as is also the flush pipe. The valve is constructed heavily throughout of good quality material and attached to the bowl by a very strong connection. The closet seat is of a durable make and the bowl is of vitreous china. Operating lever and the flange it operates against are of heavy bronze, which will give years of service with little wear. The closet seat brace is stronger than any we have heretofore made.

A sample valve was tested 150,000 operations without any appreciable wear.

All water drains out of the flush valve body so that in places such as school buildings where the fires may be banked over the week-end, valves will not be damaged by frost.

The tank may be concealed back of the wall if so desired

UTILITY, TOO!



A Donald Douglass aquatint study of the PENNSYLVANIA POWER and LIGHT CO. BUILDING, Allentown, Pa.

* * *

Architects, Helmle & Corbett, New York, N. Y.; Heating Contractors, Riggs-Distler, Baltimore, Md.; Plumbing Contractors, John MacMillan, New York, N. Y.; General Contractors, Hegeman and Harris Company, New York, N. Y.

BEAUTY and utility are happily blended in this new 23-story building, erected for the Pennsylvania Power and Light Company at Allentown, Pa. Care was exercised in choosing the equipment. Utility was the keynote; "Jenkins throughout" was the logical choice for plumbing, heating, fire protection and boiler room work.

Every Jenkins Valve is built for long utility, yet is of pleasing appearance—in keeping with buildings of distinction. Among the Jenkins Valves installed in the Pennsylvania Power and Light Building are the New Low Bonnet Radiator Valves, designed to meet the need brought about by the modern trend toward compactness in radiator equipment.

To make sure of Jenkins service, may we suggest that specifications call for "Jenkins Valves marked with the diamond and signature"?

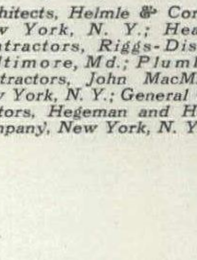


Fig. 853
Low Bonnet Angle Radiator Valve, male union

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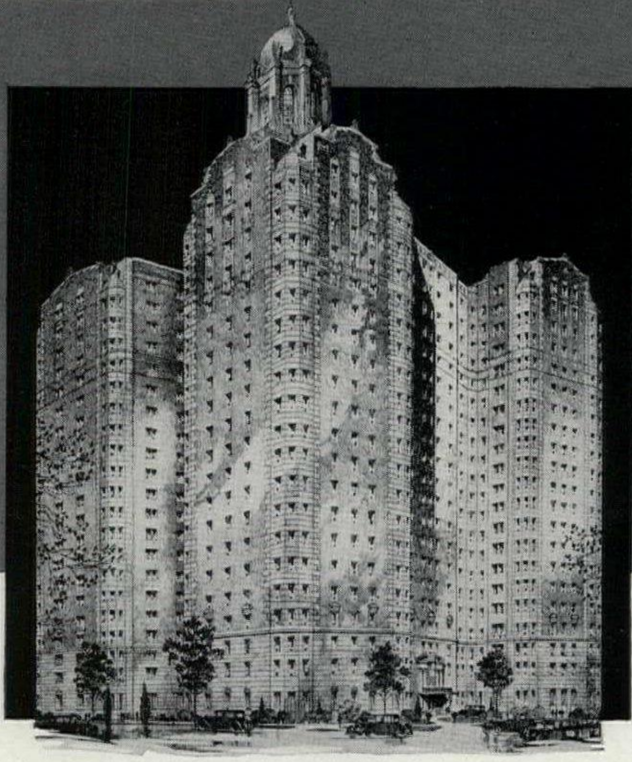
JENKINS BROS., Limited, Montreal, Canada; London, England

Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

WORLD'S LARGEST COOPERATIVE APARTMENT BUILDING



This installation also includes 970 Trane Heat Cabinets, "Successors to the Radiator."

100% TRANE EQUIPPED

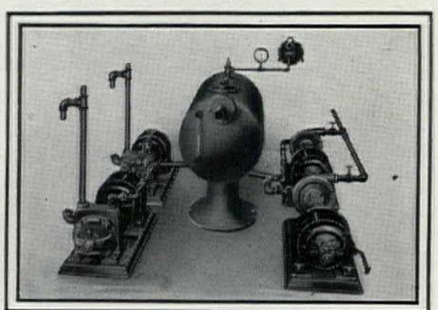
The Touraine, Lake Shore Drive, Chicago (Hooper & Janusch, Architects) stands out as a notable installation of Trane Heating Specialties with Trane Vacuum Pump. Write The Trane Co., 220 Cameron Ave., La Crosse, Wisconsin, for Bulletins 14 and 20, completely describing this equipment.

1475 TRANE BELLOWS PACKLESS VALVES

These successful units were developed originally by Trane to stop disastrous vacuum leaks. They are truly "packless." The bellows operates with an up-and-down movement — no objectionable turning movement to necessitate some form of packing, whether called by that name or otherwise. Absolutely leakproof—cannot stick—unaffected by high pressures. Every unit guaranteed for five years. Thousands in satisfactory operation the world over, on the highest-grade heating installations.

TRANE 4-MOTOR VACUUM PUMP

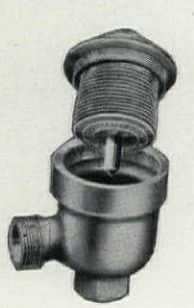
At the heart of the vacuum heating system is this dependable Trane equipment. Simple—flexible—economical to install—Trane Vacuum Pumps have long been regarded with respect by the heating world. Constant improvement keeps them in the very forefront of progress.



1495 TRANE BELLOWS RADIATOR TRAPS

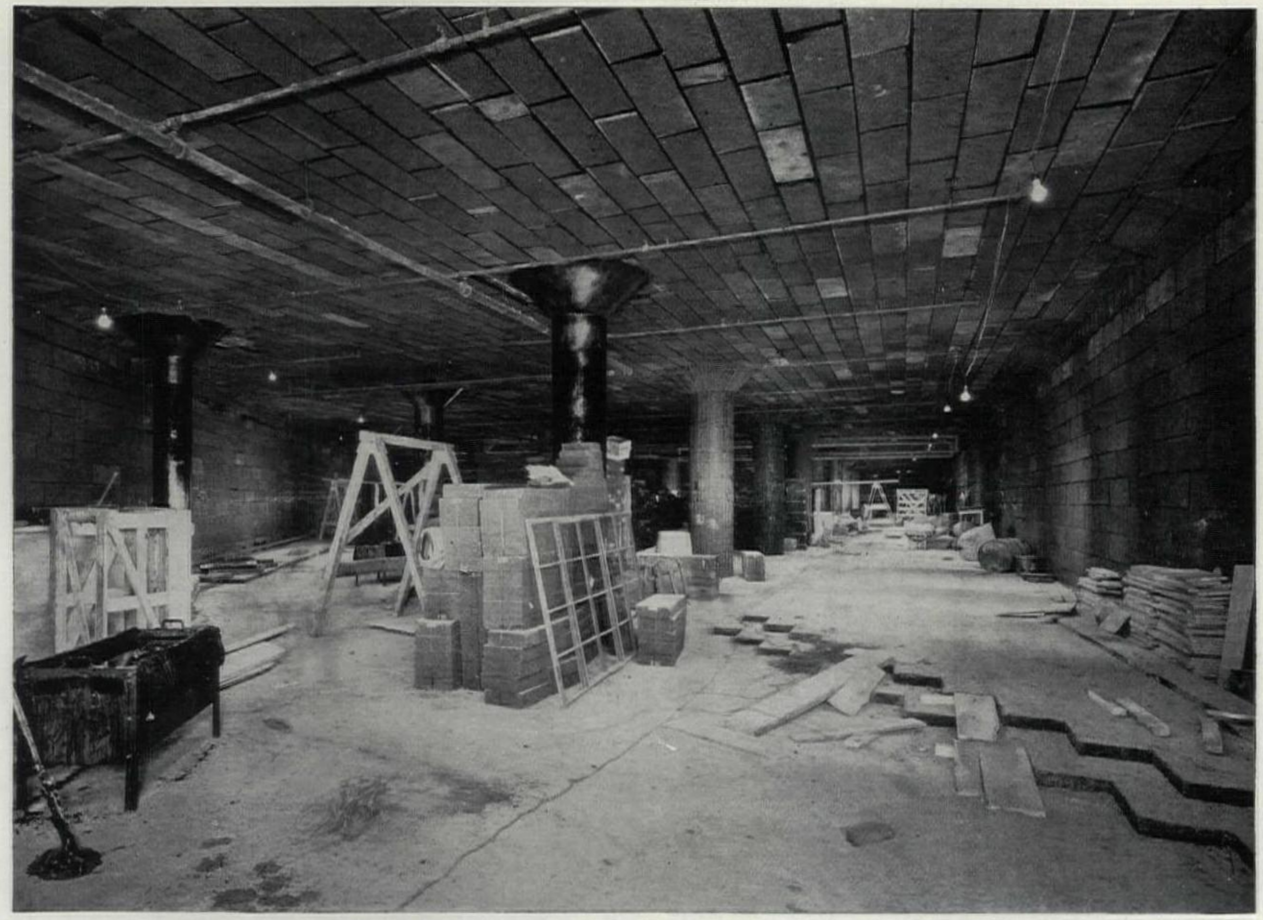
Trane Bellows Traps, which combine exceptional reliability with two distinctive Trane developments — balanced pressure and the signal feature — complete this 100% Trane installation.

Trane is the only manufacturer offering both high-grade pumps and heating specialties built in the same factory and designed to operate together—the only manufacturer assuming undivided responsibility for the operating success of vacuum heating systems.

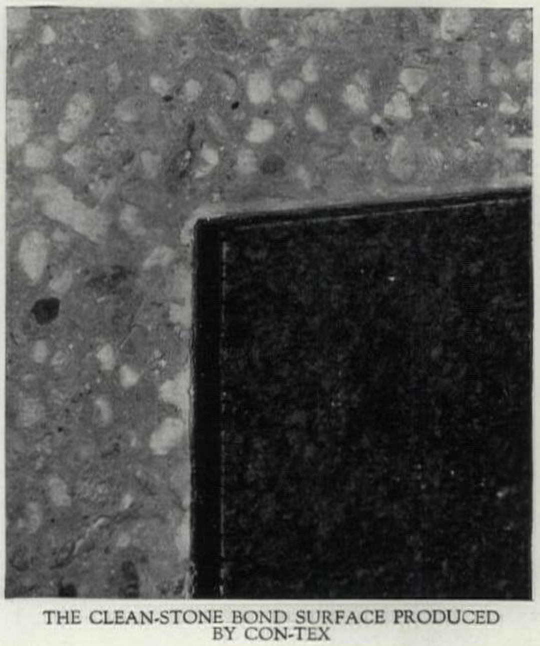


HEAT CABINETS **TRANE** CONCEALED HEATERS

··· PUMPS AND HEATING SPECIALTIES ···



COLD STORAGE WAREHOUSE, FILENE SERVICE BUILDING, CAMBRIDGE, MASS.



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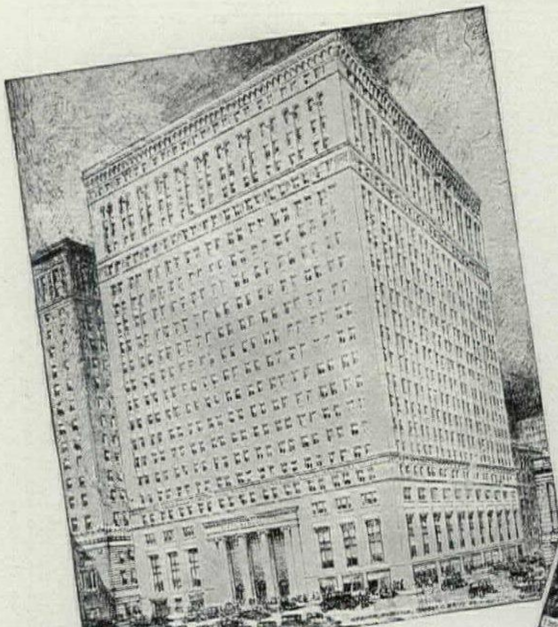
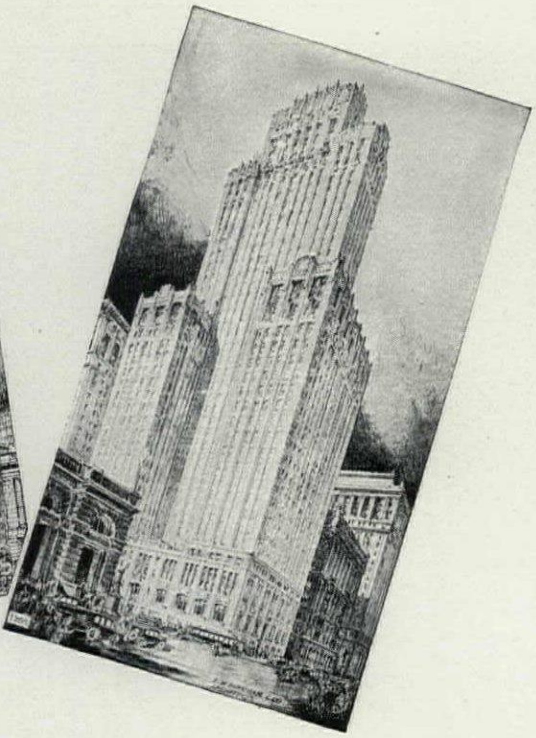
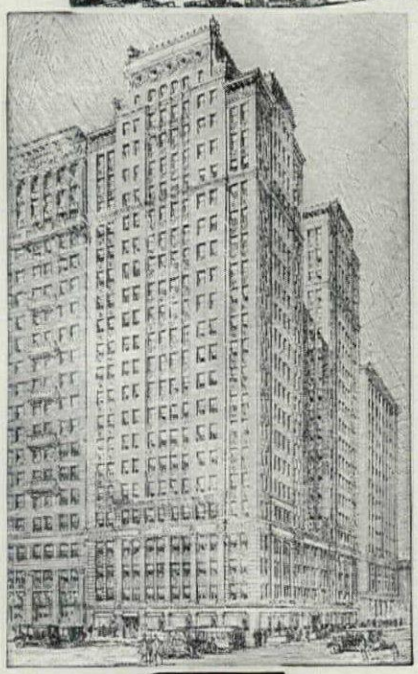




At the left of the page from top to bottom is The State Bank of Chicago, the Morton Building, and the Pittsfield Building, all of Chicago, and all designed by Graham, Anderson, Probst, and White. All equipped with Youngstown-Buckeye Conduit by A. S. Schuhman Electrical Co. of Chicago

At the right is the Bankers Building of Chicago designed by D. H. Burnham & Co. and equipped with Youngstown-Buckeye Conduit by J. Livingston & Co. of Chicago.

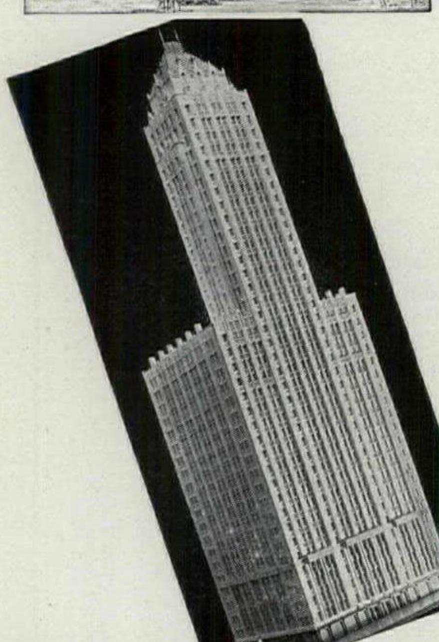


Chicago, for Instance—

IN Chicago alone, Youngstown-Buckeye Conduit is honored by installation in more stately and beautiful structures than exist in some of the larger cities of our country. The four shown here are among the most recently erected in Chicago's downtown district and are typical of the type of building, where architect and electragist alike, always can agree, that it pays to use the conduit that is "built up to a standard and not down to a price." That means "Youngstown-Buckeye" without fail.

The Youngstown Sheet & Tube Co.

Youngstown, Ohio

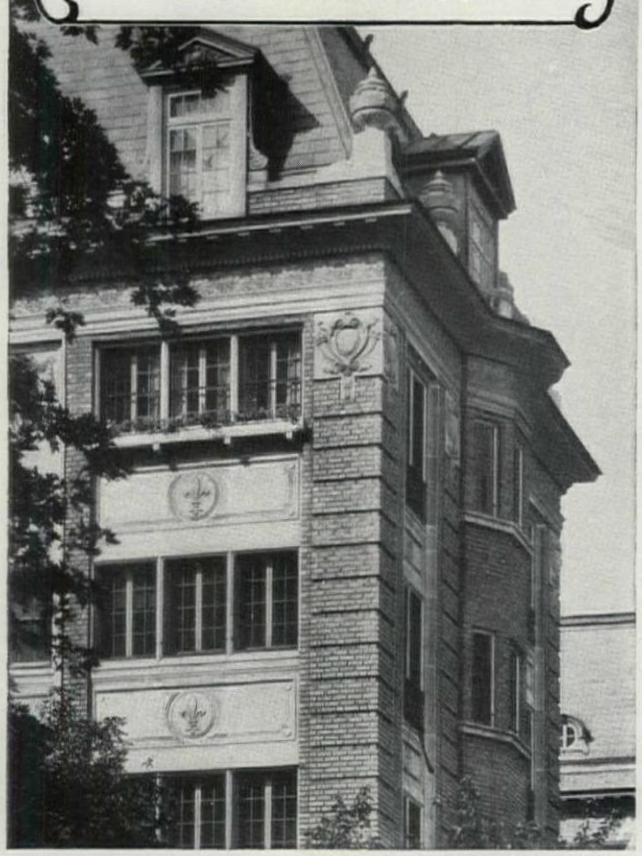


DISTRICT SALES OFFICES

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

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

Youngstown-Buckeye Conduit



Park Lane Villa Apartments
Cleveland, Ohio
Reynold H. Hinsdale, Architect
National Cornice & Ceiling Company
Sheet Metal Contractors

How Architect Hinsdale Provided for Rust-Fire*

WHEN Architect Reynold Hinsdale designed the Park Lane Villa Apartments he realized that rust-fire was one of his biggest problems. So he chose ARMCO Ingot Iron, for cornices as well as for the heating and ventilating system.

Thus, he assured his clients little or no replacement expenditures throughout the probable life of the building.

Perhaps you have in mind an assignment that needs better-than-average sheet metal equipment . . . at reasonable cost. Just the time, then, to call in one of our district consultants—experts in architectural applications of sheet metal. Get in touch with the office nearest you for this service. No charge nor obligation.

The American Rolling Mill Company
Executive Offices, Middletown, Ohio
Export: The ARMCO International Corporation
Cable Address—ARMCO, Middletown (O.)

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

ARMCO
INGOT IRON
RESISTS RUST

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

Why The NATION'S SCHOOLS use DURIRON

PALMER ROGERS
101 PARK AVENUE
NEW YORK CITY

October,
Twenty-nine,
Nineteen-twenty-seven.

The Duriron Company, Inc.
Dayton, Ohio.

Gentlemen:

After my consulting engineer and I had investigated the different materials available for acid waste lines we decided to specify Duriron for this purpose.

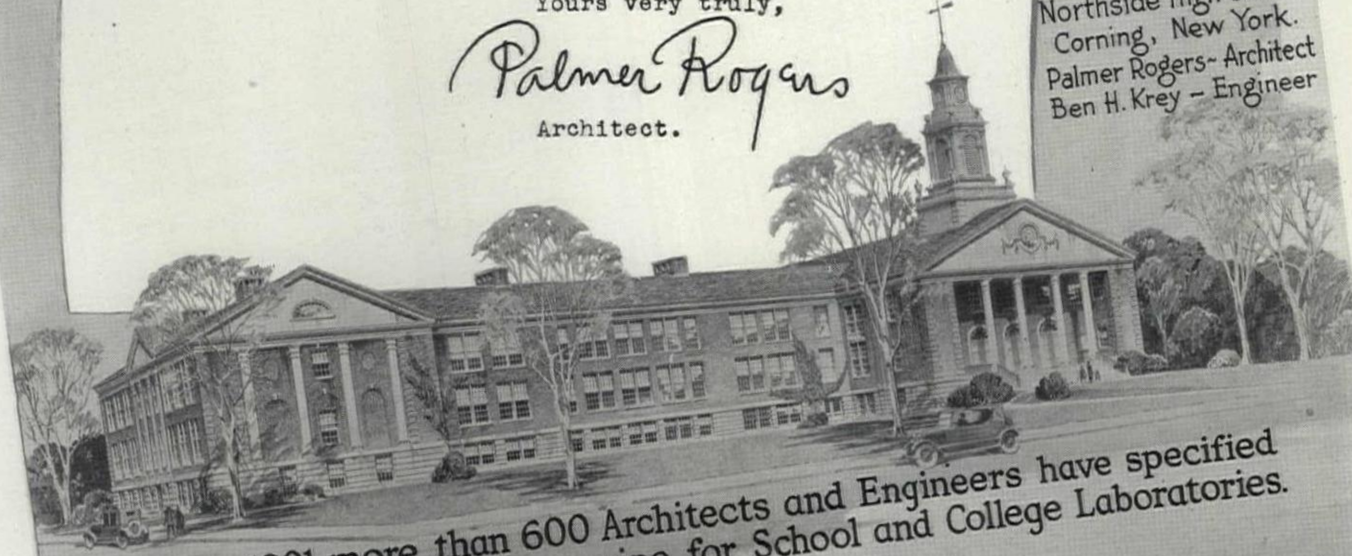
By using Duriron we have been able to locate laboratories in any part of the building, conceal the piping in the floors and walls where necessary and have had no trouble about the replacement of piping.

The initial cost of Duriron may be more but, "The recollection of quality remains long after the price has been forgotten."

Yours very truly,

Palmer Rogers

Architect.



Northside High School
Corning, New York.
Palmer Rogers~ Architect
Ben H. Krey – Engineer

Since 1921 more than 600 Architects and Engineers have specified Duriron acid-proof drain pipe for School and College Laboratories.

Duriron is produced only by

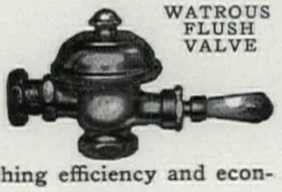
The DURIRON COMPANY
DAYTON·OHIO

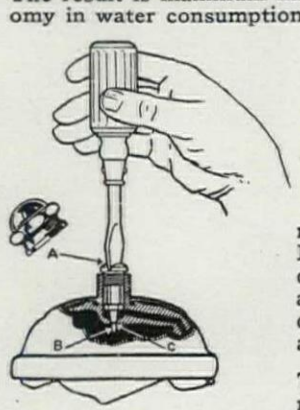
The Exact Length of Flush for Every Make of closet

is assured with the

Watrous FLUSH VALVE

THE Watrous flush valve is the only design that makes proper provision for adapting the quantity of water consumed to the needs of *any bowl with which it is used.* The result is maximum flushing efficiency and economy in water consumption.





A Simple Turn of a Screw

By merely turning the screw A (see sketch), the valve is adjusted to the requirements of the bowl. It is not necessary to turn off the water, or remove any of the working parts of the valve to make this adjustment.

The adjustment, once made, remains permanent.

Clogging Prevented

Every time the valve is flushed, the plunger (B) is raised off its seat (C), leaving an opening through which grains of sand, etc., can be washed out of the port. No type of flush valve, without this or a similar safeguard, is immune from obstruction.

No Regulation Required

The feature just described—control of the quantity of water supplied to the bowl—should not be confused with regulation for varying degrees of pressure. *The Watrous Valve requires no regulation,* from highest pressure down to approximately 5 lbs.

Watrous fixtures are furnished with exposed parts chromium plated, if desired. Write for details

PLUMBING DIVISION

Watrous Flush Valves—Duojet Closets—Self-Closing Basin Cocks—Combination Lavatory Fixtures—Pop-Up Wastes—Liquid Soap Fixtures—Etc.

Sold by leading plumbing jobbers throughout the U. S.

THE IMPERIAL BRASS MFG. CO.

1238 West Harrison Street Chicago

BRANCH SALES OFFICES

R. E. Cramsie, 404 Marquette Bldg., Detroit, Mich.
W. T. Frey, 605 Swetland Bldg., Cleveland, Ohio
Derbyshire & Mack, Real Estate Trust Bldg., Philadelphia, Pa.
W. E. Blair, Jr., care Coronado Hotel, St. Louis, Mo.
W. C. Shanley, 913 Holmes St., Kansas City, Mo.
Thos. J. O'Brien, 1812 Exchange Bldg., Memphis, Tenn.
T. A. S. Hall, 318 S. 5th St., Louisville, Ky.
H. E. Darton, 506 Carondelet St., New Orleans, La.
Dillard-Lewis & Co., Construction Industries Bldg., Dallas, Tex.
R. J. Shank, 920 Grand Ave., Des Moines, Ia.
Rex W. Williams, 402 Scott Bldg., Salt Lake City, Utah
Wm. P. Horn Co., 58 Federal St., San Francisco, Cal.
L. C. Coombs, 1010 North Gardner St., Los Angeles, Cal.
Richard O'Brien, 524 22nd St., North, Seattle, Wash.

N. Y. SILICATE BOOK SLATE CO.

20-24 VESEY STREET
NEW YORK CITY, N. Y.

Manufacturers of

SILICATE BLACKBOARDS
ASBESTOS BLACKBOARDS
CLOTH BLACKBOARDS
STONE SLATE BLACKBOARDS
CORK BULLETIN BOARDS
SILICATE BOOK SLATES FOR LEAD AND SLATE PENCIL USE
LIQUID BLACKBOARD SLATING

WE HAVE SUPPLIED THE PUBLIC SCHOOLS OF NEW YORK CITY, ALSO U. S. GOVERNMENT WITH OUR BLACKBOARDS, FOR THE PAST FIFTY YEARS

"Red Metal"

Solid Bronze

SASH CHAINS

Universally Used Because of Quality and Strength

Our Sash Chains are also manufactured in "Giant Metal" (Phosphor Bronze) and Steel (Cold Rolled)

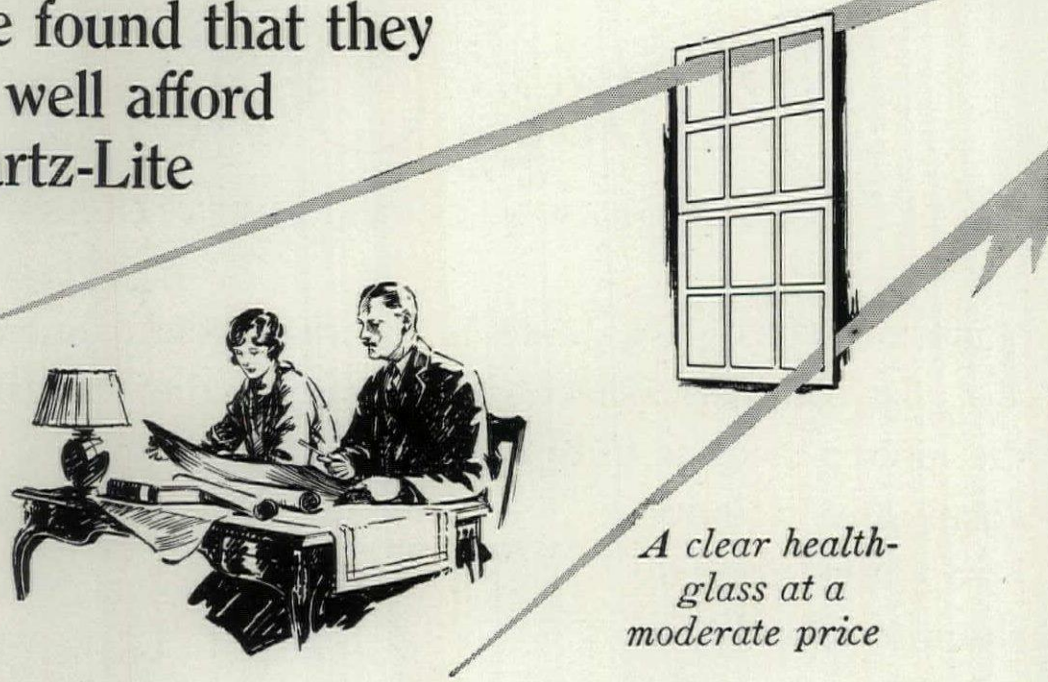
THE SMITH & EGGE MFG. COMPANY

BRIDGEPORT, CONN.

ORIGINATORS OF SASH CHAINS

See Page B-1797 Sweet's Catalog and Page 177 Specification Manual of the American Architect. Send for Catalog on Sash Chains.

Home Builders
have found that they can well afford Quartz-Lite



A clear health-glass at a moderate price

QUARTZ-LITE Glass is not an expensive luxury. Its price is only 50 cents a square foot.

Home owners have found that an installation of QUARTZ-LITE Glass is a permanent investment in health—an investment that pays precious dividends in health and happiness to the entire family. QUARTZ-LITE Glass makes the house a home for it "opens" the windows to nature's own tonic, *real* sunlight.

QUARTZ-LITE Glass is desirable for fine residences because: (1) QUARTZ-LITE is a beautifully *clear* health glass of high quality and brilliant lustre. It will enhance the appearance of any building in which it is used. (2) QUARTZ-LITE Glass transmits more of the sun's ultra-violet rays than any other clear glass used for windows. (3) The remarkably low price of QUARTZ-LITE Glass permits its use in *every window.*

Leading architects and builders throughout the United States are providing *better* living conditions by specifying QUARTZ-LITE wherever human beings live or work.

If you are interested in knowing more about this unusual health glass, write us direct. A post card will bring you a QUARTZ-LITE Booklet and Specification sheet. Write today.

Quartz-Lite
TRADE MARK

The Ultra-Violet Ray Glass

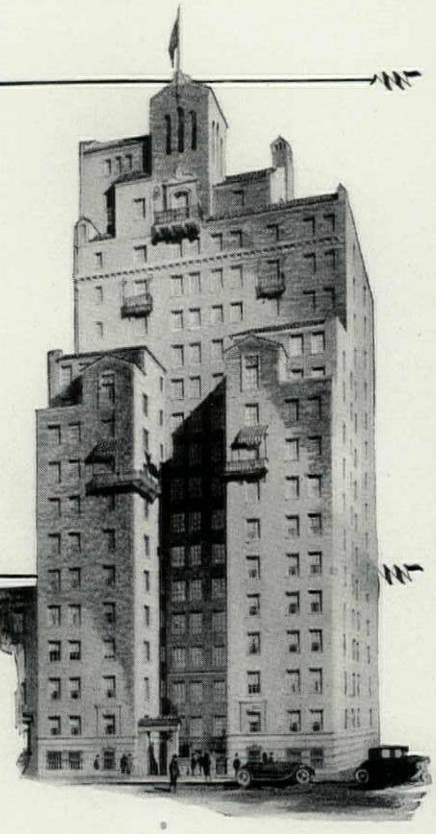
AMERICAN WINDOW GLASS COMPANY

World's Largest Producer and Pioneer Manufacturers of Machine-Made Window Glass of the finest quality—"The BEST Glass"

PITTSBURGH, PA.

District Sales Offices in Principal Cities

A new way to add HEALTH VALUE *to* DESIGN *with* VITA GLASS!



The owners of the beautiful new San Carlos Apartment Hotel at 150 E. 50th Street, New York, were quick to grasp the opportunity offered by Vita Glass. They installed it throughout. Building opened, as a result, 95% rented.

Vita Glass panes . . . admit health-giving ultra-violet rays of sunlight . . . increase utility . . . give more light . . . supplement service you already offer with your design

THE story of Vita Glass is interesting . . . how it came into being through demands of the architectural, medical and scientific professions.

A new type of glass was wanted . . . with all the qualities and advantages of ordinary window glass . . . that would be *more* than ordinary glass.

Then . . . this amazing glass was invented. Every demand was complied with.

Vita Glass admits, in volume, the vital health rays of sunlight. It brings out-of-doors into homes and offices.

In addition, it gives more light. A series of convincing tests in schools, hospitals, and offices proved it of tremendous benefit in curing disease, diminishing sickness.

It brings health . . . increased efficiency. Embodied in architectural designs, it gives the designs additional value . . . Read what it is.

What is Vita Glass?

Vita Glass is a highly efficient and inexpensive substitute for the *prohibitively* costly fused quartz, which is used in laboratories. Vita Glass permits the passage, in volume, of these vital ultra-violet rays *that cannot pass through ordinary window glass.* These are the rays that tan the skin—build up resistance to sickness and disease . . . the rays so effective in the prevention of rickets, tuberculosis, colds, grip and pneumonia.

The use of Vita Glass

Ever since its discovery by an eminent British scientist, Vita Glass has been under scientific observation. The Council of Physical Therapy of the American Medical Association has tested it and approved its use. Wherever ordinary window glass is used—wherever human beings spend their daylight hours indoors, there Vita Glass becomes an important health factor.

You give *extra service* to your clients by specifying Vita Glass, especially for sun porches and nurseries, or glass-lit factories. Thus, you contribute to longer life and sounder health of families . . . make workers more efficient and reduce sickness among them.

Comes in four forms

Vita Glass, whether for replacement or new construction, is cut, handled and installed exactly like ordinary glass. It comes cut to specification in four forms: *Clear*—for windows, sun-porches, or wherever clear full vision is desired. *Plate*—for use in large window spaces, show windows, where a smooth, polished surface is desired. *Cathedral*—for privacy—opaque. Skylights, parts of sun-porches, upper panes of windows, bathrooms, and rooms for sunbath. *Cathedral wire glass*—for use wherever building regulations require a wire glass.

Each light of Vita Glass is carefully identified for your protection and is guaranteed to be of the same high standard, able to transmit, in volume sufficient for all health purposes, the vital ultra-violet daylight rays.

Mail coupon for full information

Perhaps you would like to receive full information and data about Vita Glass. If you will clip and mail the coupon, we shall be glad to send you the facts. Address Vitaglass Corporation, 50 East 42d Street, New York City.

VITA GLASS

Each pane of Vita Glass is suitably identified for your protection, and is guaranteed to be of the same high standard.

Vitaglass Corporation, Dept. F-3,
50 E. 42d Street, New York City.

Please send me the facts about Vita Glass. This request obligates me in no way, nor will a salesman bother me.

Name____________________

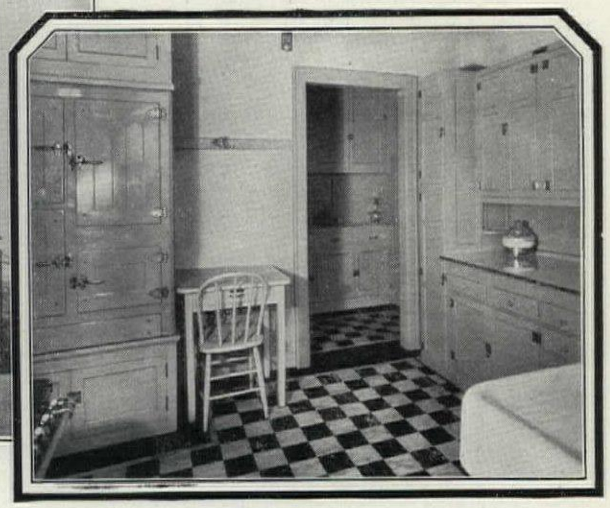
Address____________________

City__________ State__________


G.E.Miller

Owner—Vista Homes Building Corporation. Architect—Paul Frederick Oleson. Builder—Albert W. Swayne

Vista Homes Apartments, one of America's finest co-operative apartment buildings. Location, 39th and Stony Island, Chicago. Equipped throughout with McDougall Domestic Science Built-In Kitchen Units.



Equipped throughout with McDougall

ALBERT W. SWAYNE, the man who pioneered the idea of modern co-operative apartments, not only has creative vision, but he is a shrewd judge of sound investments.

And that is why Mr. Swayne used McDougall Domestic Science Built-In Kitchen Units throughout in Vista Homes Apartments, one of the finest structures of its kind in America.

McDougall Kitchen Units save floor space, they are a big help in selling or renting, and they assure lasting satisfaction. When you specify McDougall you get the highest quality of materials and workmanship, and you also have at your command the practical co-operation of our Architectural Service Bureau.

Write to the nearest office listed below for definite information about how McDougall Service can help you in designing modern kitchens.

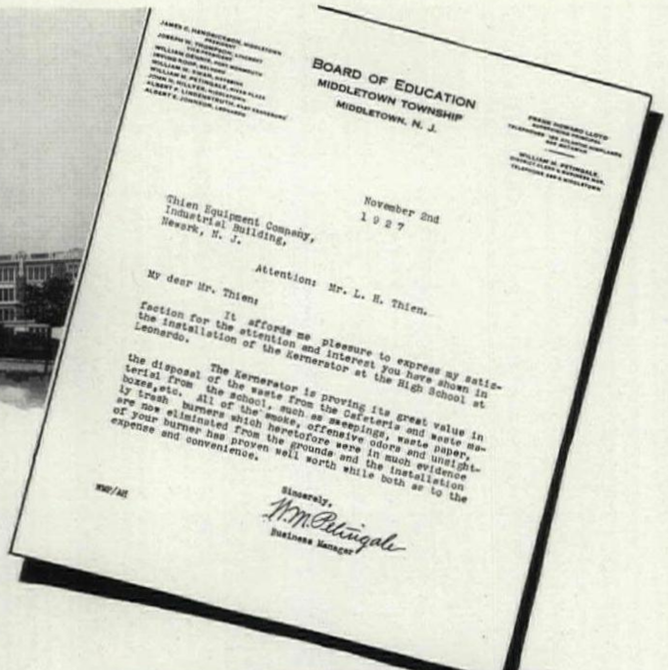
Chicago
McDougall Company, 180 N. Michigan
Pittsburgh
Built-in Equipment Co., 614 Bessemer Bldg.
Indianapolis
Neeves & Company, 906 Odd Fellow Bldg.
Milwaukee
E. A. Kuolt, 312 Colby Abbot Bldg.
Youngstown, Ohio
Building Specialties Co., 4th Floor, Park Theater Bldg.

McDOUGALL COMPANY
Frankfort, Indiana

McDougall
DOMESTIC SCIENCE BUILT-IN
Kitchen Units

New York
Built-in Products Co., 19 W. 44th St.
Rochester
Teekorator, Inc., Cutler Bldg.
Baltimore
Brauns & Graham, 509 N. Charles St.
Reading
Merritt Lbr. Yds., Inc., 4th & Spruce Sts.
Trenton, N. J.
Hart Engineering Co., 213 E. Hanover St.

Hughes High School, Cincinnati, Tietig & Lee, Architects. Principal C. M. Merry says: "The Kernerator is a valuable asset to the lunch room."



BOARD OF EDUCATION
MIDDLETOWN TOWNSHIP
MIDDLETOWN, N. J.

November 2nd
1 9 2 7

Thien Equipment Company,
Industrial Building,
Newark, N. J.

Attention: Mr. L. H. Thien.

My dear Mr. Thien:

It affords me pleasure to express my satisfaction for the attention and interest you have shown in the installation of the Kernerator at the High School at Leonardo.

The Kernerator is proving its great value in the disposal of the waste from the Cafeteria and waste material from the school, such as sweepings, waste paper, boxes, etc. All of the smoke, offensive odors and unsightly trash burners which heretofore were in much evidence are now eliminated from the grounds and the installation of your burner has proven well worth while both as to the expense and convenience.

WMP/AH

Sincerely,
W. M. Pettingale
Business Manager

The Safe, Sanitary Way Modern Schools Dispose of Waste and Garbage

THE Kernerator, chimney-fed incinerator has solved the problem of waste disposal in many of the country's best known schools, academies and seminaries, both large and small.

How effectively and economically it does its work is evidenced by these testimonials — a few picked at random from many.

In planning new schools — be sure that you include Kernerator *in the plans.* At least investigate the advantages and economies in having this long-wanted convenience in buildings where so many children and young people are under one roof.

Here's What Kernerator Assures:

1. Overcomes the chief cause of 75% school fires through trash piles in the basement.
2. Banishes the trucking of waste paper and sweepings to the basement.
3. Entirely does away with the expense of buying, cleaning, and replacing of garbage cans.
4. Provides for instant disposal of refuse from cafe and cafeteria.
5. Makes it unnecessary for foul-smelling garbage wagons to call for garbage.
6. Provides more sanitary surroundings, and greater health assurance.
7. Costs nothing to operate or maintain—requires no fuel—an occasional match burns the waste and air dried garbage.

Kernerator school models as low as $250 and the masonry adds but little more when the regular chimney is used. Send for our new illustrated school book which gives valuable information on uses and installation of Kernerator. You should have this data in your files.

KERNER INCINERATOR COMPANY
715 E. WATER STREET MILWAUKEE, WIS.

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

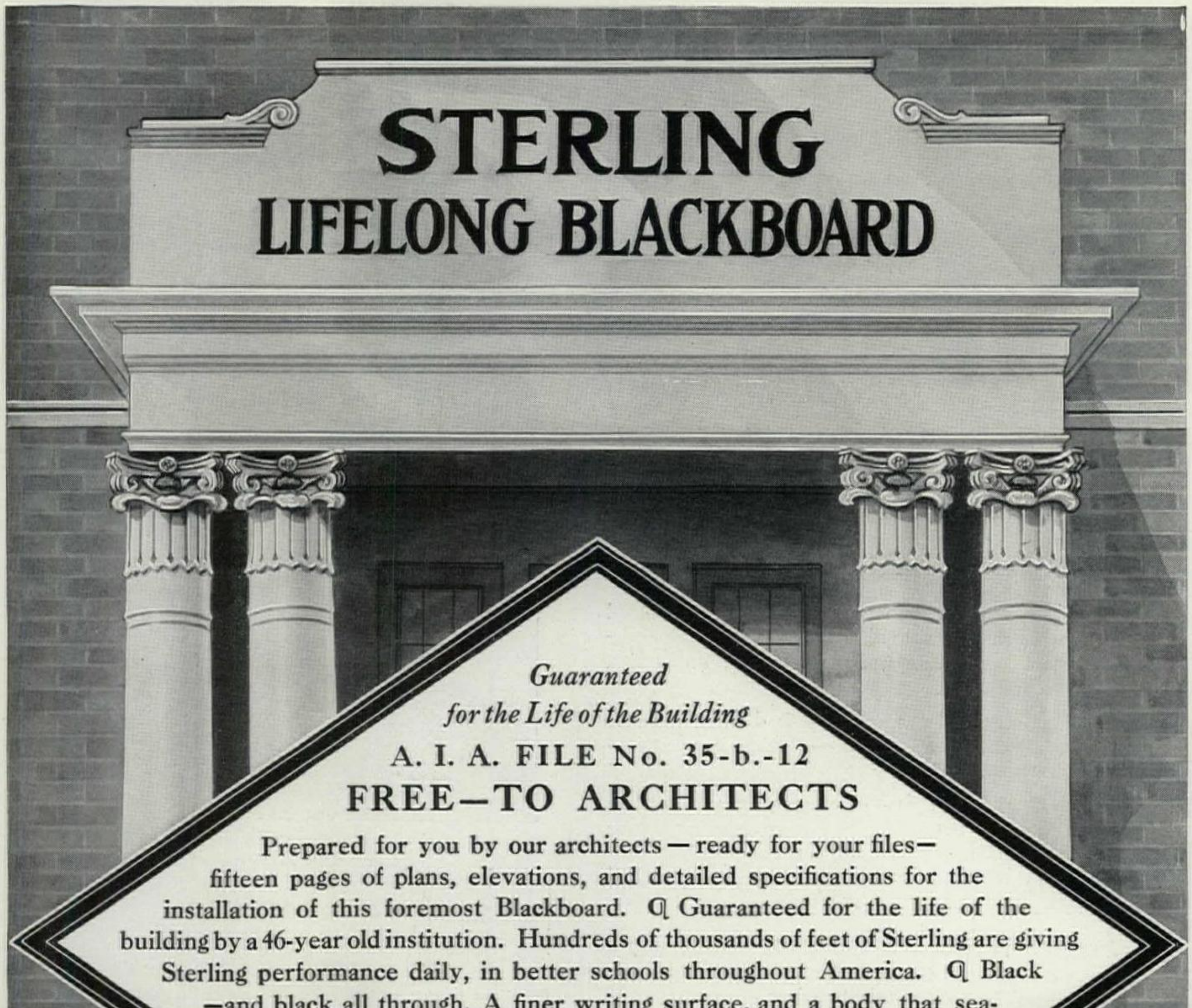
High School, Leonardo, N. J., designed by Ernest A. Arend, Asbury Park, N. J., Architect. (Letter reproduced above)

Simon Gratz and Gillespie High Schools, Philadelphia. Irwin T. Catherine, Arch. Fred V. Altemus, Chief Engineer, says, "The Kernerator is disposing of garbage, rubbish, shavings, etc., in a very satisfactory manner."

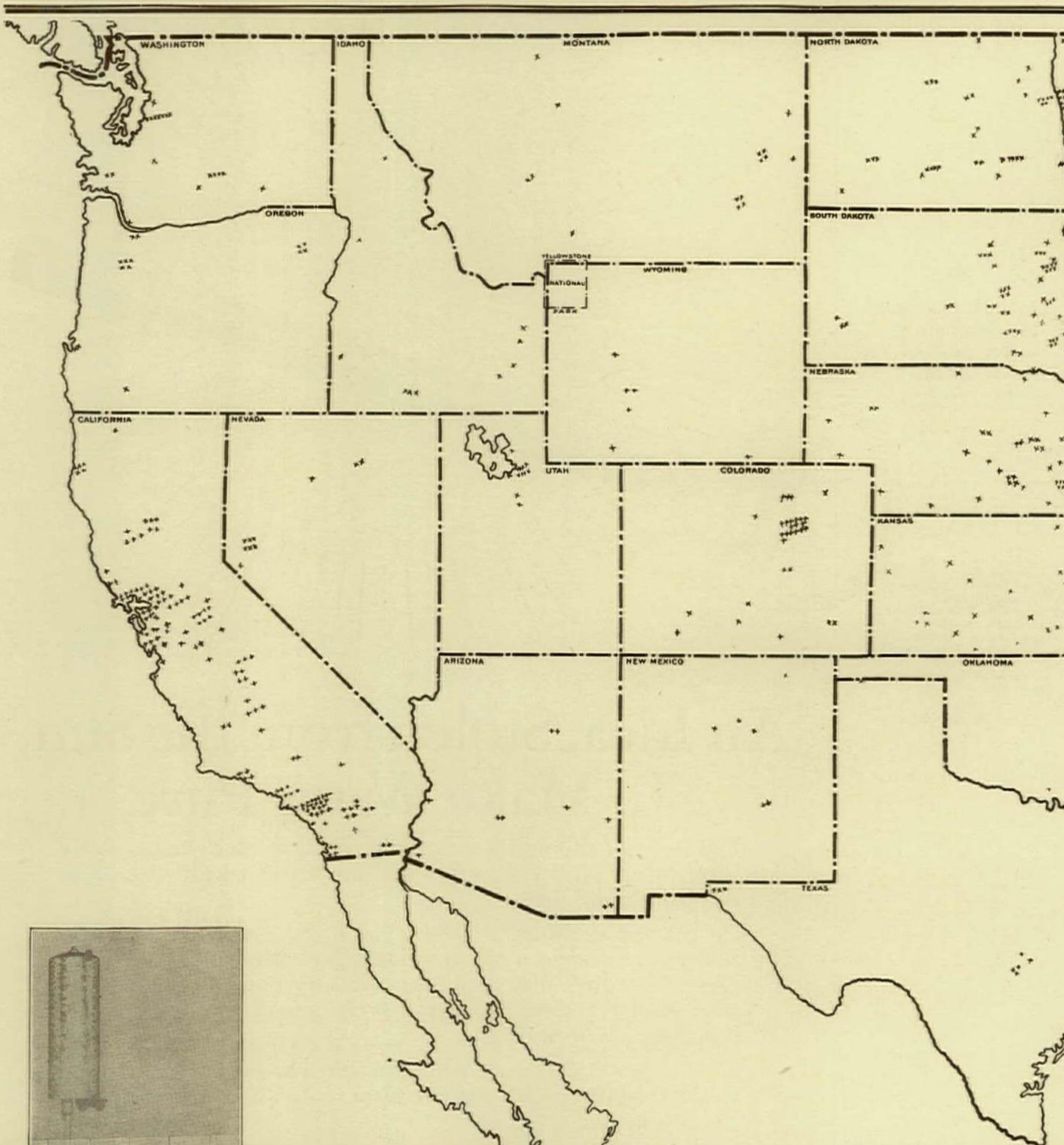
Frederick Douglass High School, Baltimore, Md. Owens and Sisco, Archts. H. G. Perring, Supervising Engineer. Principal M. A. Hawkins says, "Kernerator is satisfactory in every particular.

Nathan Hale Grade School, New Haven, Conn., Brown and Von Beren, Archts. Miss Bessie J. Rattelsdorfer, Principal, says, "The Kernerator has proven satisfactory in every way.

Stillman Hall, Colgate University, Hamilton, N. Y. Architect, W. B. Chambers, N. Y. North Eastern Construction Co., Contractors. Supt. Jas. Ballatine says: "Kernerator is indispensable."


STERLING
LIFELONG BLACKBOARD
Guaranteed
for the Life of the Building
A. I. A. FILE No. 35-b.-12
FREE—TO ARCHITECTS
Prepared for you by our architects — ready for your files—fifteen pages of plans, elevations, and detailed specifications for the installation of this foremost Blackboard. ¶ Guaranteed for the life of the building by a 46-year old institution. Hundreds of thousands of feet of Sterling are giving Sterling performance daily, in better schools throughout America. ¶ Black—and black all through. A finer writing surface, and a body that seasons and improves with age. Warp and buckle proof—strictly fireproof. Easy on eyes and nerves—and schoolboard pocketbooks too. If you don't know all about Sterling Lifelong Blackboard send for free sample and A. I. A. File No. 35-b.-12. Address Department Z-3.
Weber Costello Co.
Chicago Heights
TIME TESTED W.C. SCHOOL SUPPLIES
Illinois.

More Than 4000 American Educational



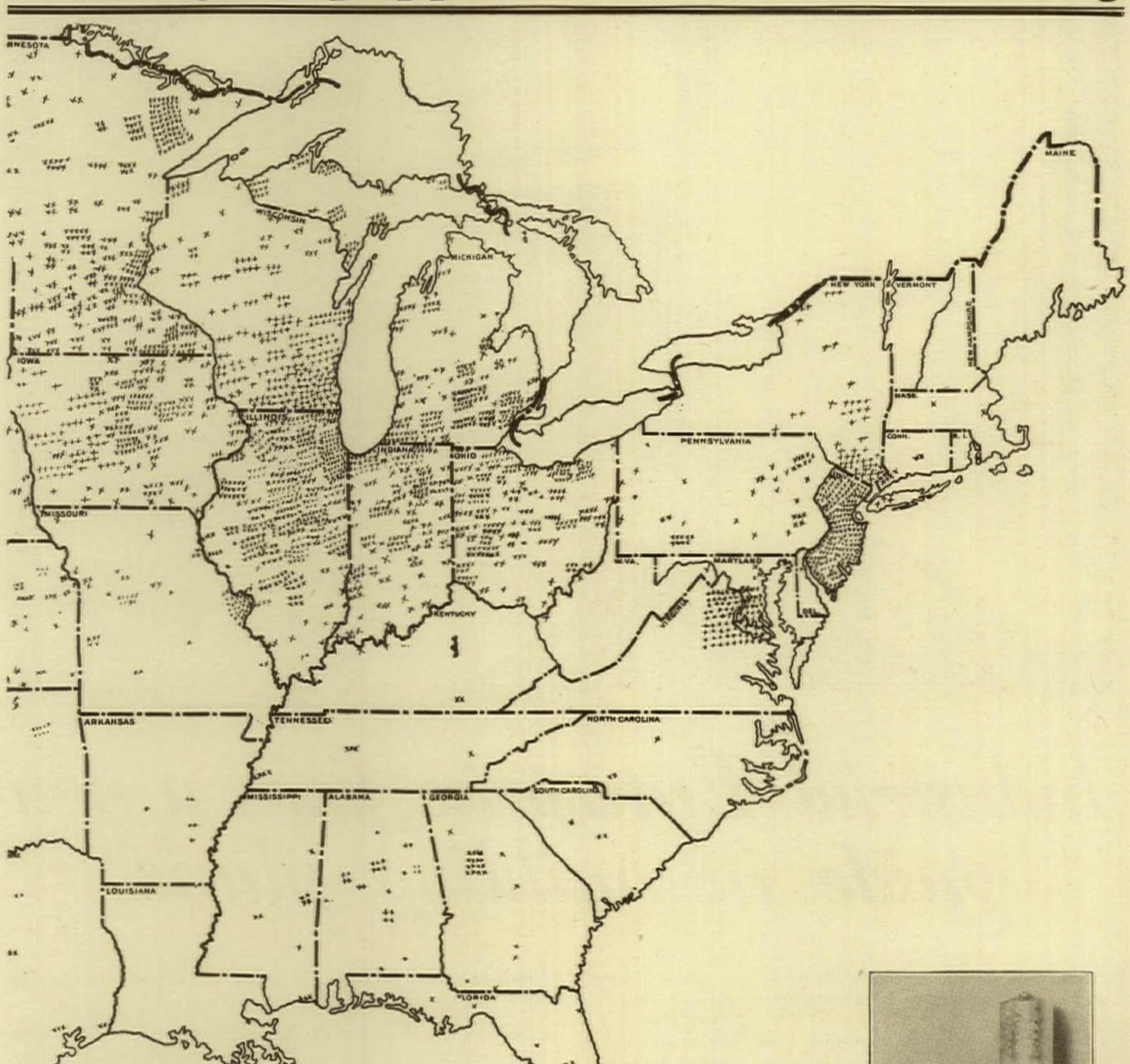
WE repeat—more than 4000 American Educational Buildings are equipped with Clow Plumbing. And, in them more than 105,000 Clow-Madden Automatic Closets are on duty. There are two reasons why—Clow-Madden Automatics guard health, and Clow-Madden Automatics guard costs.

They flush automatically after each occupation. Every Clow-Madden Automatic means a quarter-century of toilet room hygiene. Many Clow-Madden Automatics have served for 30 years—some for nearly 40.

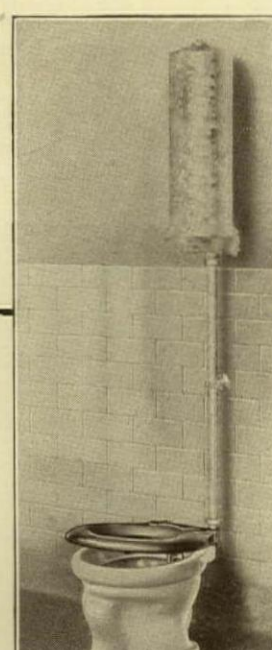
CLOW AUTOMATIC

Never, Never Forgets — *Forty-eight Styles, Heights and Types to Meet Your Requirements*

Buildings Equipped With Clow Plumbing



Crosses on map show approximate location of educational buildings equipped with Clow Plumbing. Map by courtesy of Rand, McNally & Co.



THE Clow-Madden Valve is simply built. Having no complicated parts to wear out or break, it practically never needs replacing. The Madden Valve uses gallons less per flush. And it never, never fails to flush.

All Clow school plumbing is designed by engineers who know the wear and tear that school plumbing must stand. That Clow stands up is plainly illustrated by the fact that it has been chosen for more than 4000 American educational buildings.

CLOW AUTOMATIC

JAMES B. CLOW & SONS :: :: :: *201-299 North Talman Avenue, Chicago*

Selected List of Manufacturers' Publications

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

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

ACOUSTICS

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

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

ASH HOISTS—ELECTRIC AND HAND POWER

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

BASEMENT WINDOWS

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

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

BATHROOM FITTINGS

A. P. W. Paper Co., Albany, N. Y.
Onliwon for Fine Buildings. Folder, 8 pp. 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.

BUILDING, STEEL PRODUCTS FOR

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

CEMENT

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

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

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

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

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

CEMENT—Continued

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

CONCRETE BUILDING MATERIALS

Celite Products Co., 1320 South Hope St., Los Angeles.
Better Concrete; Engineering Service Bulletin X-325. Booklet, 16 pp., 8½ x 11 ins. Illustrated. On use of Celite to secure workability in concrete, to prevent segregation and to secure water-tightness.
Economic Value of Admixtures. Booklet, 32 pp., 6⅛ x 9⅛ ins. Reprint of papers by J. C. Pearson and Frank A. Hitchcock before 1924 American Concrete Institute.

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

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

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

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

CONCRETE COLORINGS

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

CONSTRUCTION, FIREPROOF

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

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

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

DAMPPROOFING

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

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

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

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

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

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 187*

DOORS AND TRIM, METAL

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

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

DUMBWAITERS

Sedgwick Machine Works, 151 West 15th St., New York.
Catalog and Service Sheets. Standard specifications, plans and prices for various types, etc. 4¾ x 8¾ in. 60 pp. Illustrated.
Catalog and pamphlets, 8½ x 11 in. Illustrated. Valuable data on dumbwaiters.

ELECTRICAL EQUIPMENT

Frank Adam Electric Company, St. Louis, Mo.
Catalog No. 35—1925. Panelboards—Steel Cabinets. 7¾ x 10½ in. 64 pp. Illustrates and describes sectionally built panelboards, an important line of steel cabinets, and the fittings which go with them.

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 8¾ ins. 70 pp. Illustrated. Descriptive pamphlets on hand power freight elevators, sidewalk elevators, automobile elevators, etc.
Catalog and pamphlets. 8½ x 11 ins. Illustrated. Important data on different types of elevators.

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

FIREPROOFING—See also Construction, Fireproof

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

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

FLOOR HARDENERS (CHEMICAL)

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

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

FLOORS—STRUCTURAL

Truscon Steel Co., Youngstown, Ohio.
Truscon Locktyle. Booklet, 8½ x 11 in., 8 pp. Illustrations of material and showing methods of application.
Truscon Floretyle Construction. Booklet, 8½ x 11 in., 16 pp. Illustrations of actual jobs under construction. Lists of properties and information on proper construction. Proper method of handling and tables of safe loads.

FLOORING

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

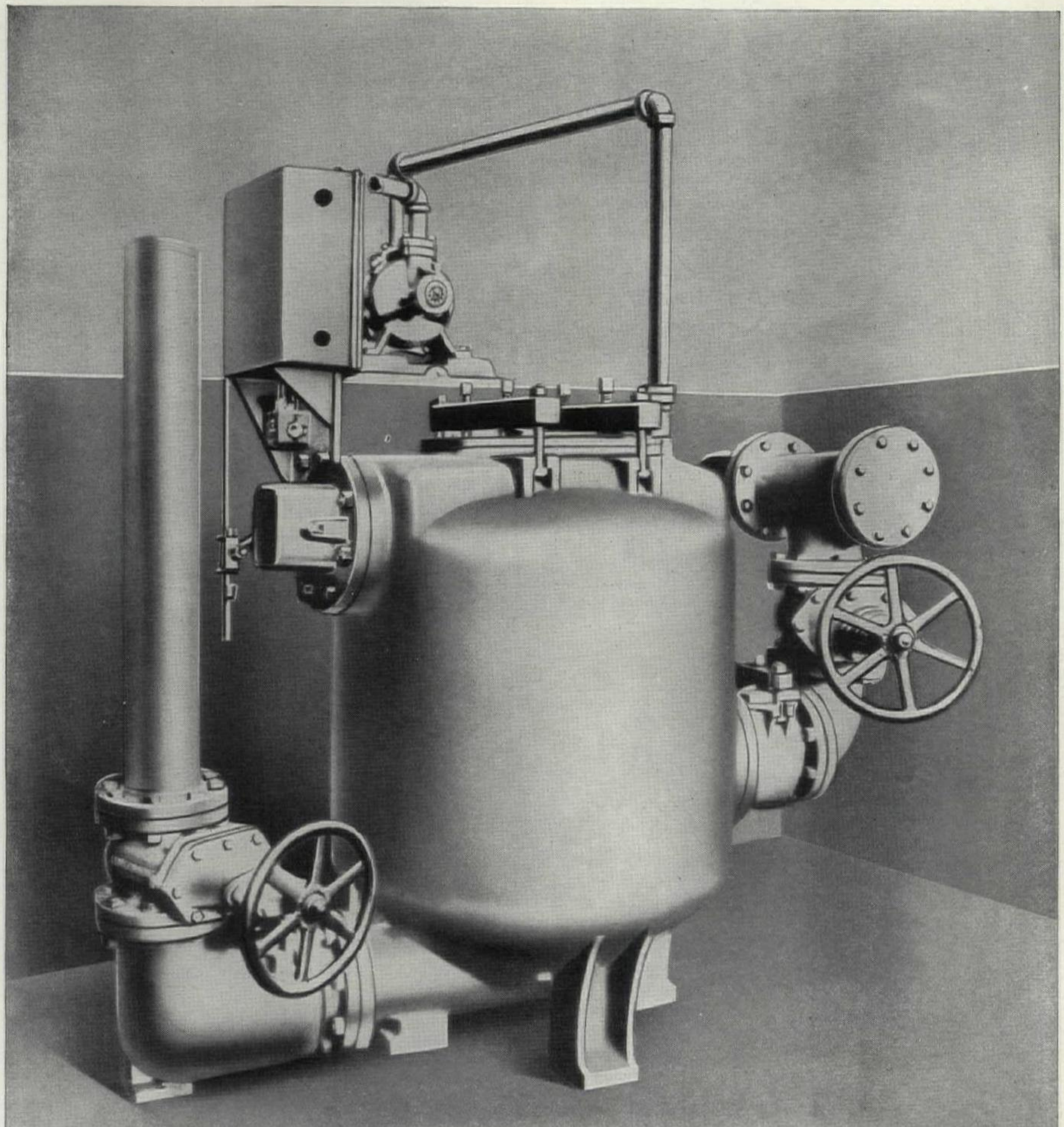
Armstrong Cork Co. (Linoleum Division), Lancaster, Pa.
Armstrong's Linoleum Floors. Catalog. 8½ x 11 in. 40 pp. Color plates. A technical treatise on linoleum, including table of gauges and weights and specifications for installing linoleum floors.
Armstrong's Linoleum Pattern Book, 1927. Catalog. 3½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

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

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

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



This Jennings Sewage Ejector is supplied in capacities up to 1500 g.p.m. Heads up to 50 ft. For pumping unscreened sewage or drainage from basements below the street sewer level, handling crude sewage from low level districts. pumping effluent, sludge and other heavy liquids.

Write for Bulletin No. 67.

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

Jennings Pumps

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

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.

Zenitherm Co., Inc., 390 Frelinghuysen Avenue, Newark, N. J.
Zenitherm Floors. Booklet, 14 pp., 8½ x 11 ins. Illustrated. Floors for interior and semi-interior use.
Contractors' Handbook. Brochure, 10 pp., 4½ x 6 ins. Complete data for using Zenitherm.

FURNITURE

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

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

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

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

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

GARAGES

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

GLASS CONSTRUCTION

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

Libbey-Owens Sheet Glass Co., Toledo, O.
Flat Glass. Brochure, 11 pp., 5⅛ 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.

HARDWARE

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

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

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

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

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

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

HEATING EQUIPMENT

American Radiator Company, The, 40 West 40th St., N. Y. C.
Ideal Type "A" Heat Machine. Catalog 7¾ x 10½ in. 32 pp. Illustrated in 4 colors. A brochure of high-efficiency heating apparatus for residences and commercial buildings.
Ideal Water Tube Boilers. Catalog 7¾ x 10⅝. 32 pp. Illustrated in 4 colors. Data on a complete line of Heating Boilers of the Water Tube type.
Ideal Smokeless Boilers. Catalog 7¾ x 10½ in. 32 pp. Illustrated in 4 colors. Fully explains a boiler free from the objection of causing smoke.
Ideal Boilers for Oil Burning. Catalog 5½ x 8½ in. 36 pp. Illustrated in 4 colors. Describing a line of Heating Boilers especially adapted to use with Oil Burners.
Corto—The Radiator Classic. Brochure 5½ x 8½ in. 16 pp. Illustrated. A brochure on a space-saving radiator of beauty and high efficiency.
Ideal Arcola Radiator Warmth. Brochure 6¼ x 9¾. Illustrated. Describes a central all-on-one-floor heating plant with radiators for small residences, stores, and offices.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

HEATING EQUIPMENT—Continued

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

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

W. S. Ray Mfg. Co., Inc., San Francisco.
Ray Rotary Burners. Booklet. 16 pp. 8 x 10½ ins. Complete data on the Ray Rotary Low Pressure Burner.

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 Kny-Scheerer Corporation of America, 119 Seventh Ave., New York.
Hospital Equipment, 16th Edition. 7¼ x 10½ in. 232 pp. Illustrated. Complete description of Hospital and Surgical Furniture, Hospital Appliances including Operating Tables, Cabinets, Sterilizers for Water, Dressing and Instruments, also Hydrotherapeutic Apparatus.
Surgical Sundries. Second Edition. Booklet. 7⅜ x 10½ in. 48 pp. Illustrated. A complete line of glassware, enamelware, rubber goods, restraint apparatus, instrument sterilizers, sputum cups, wheel chairs and sick room comforts.
Electro Medical. 25th Edition. Booklet. 7¼ x 10½ in. 160 pp. Illustrated. A complete line of Albee Bone Sets. Apparatus for AC and DC Cystoscopes, Heat Magnets, Vibrators, Compressors, Electric Light Baths, High Frequency Apparatus and X-Ray Apparatus and Accessories.

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.

INSULATION—Continued

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

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

Flax-li-num Insulating Company, St. Paul, Minn.
"Heat Insulation for Houses." Booklet, 64 pp., 9¾ x 11¼ ins. Illustrated. Authoritative information on thermal insulation with complete specifications for all types of buildings.

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

Celotex Company, The, 645 N. Michigan Ave., Chicago, Ill.
The Hidden Comfort of Costly Homes. Booklet 8½ x 11 in.
Celotex Specifications. Booklet 8½ x 11 in.

JOISTS

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

Truscon Steel Co., Youngstown, Ohio
Truscon Steel Joists. Booklet, 8½ x 11 in., 16 pp. Illustrated with typical buildings and showing details of construction. Tables of sizes and safe loads.
Truscon Steel Joist Buildings. Illustrated 32-page brochure, attractively illustrated, showing types of buildings equipped with Truscon Steel Joist.
Strip Steel Joist Construction. 14-page booklet, with illustrations. Reprint of paper presented to Building Officials' Conference, Madison, Wis., 1925, by J. J. Calvin, Secretary, Strip Steel Joist Association.

KITCHEN EQUIPMENT

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

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

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

LABORATORY EQUIPMENT

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

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

LANTERNS

Todhunter, Arthur, 119 E. 57th St., New York.
Hand Wrought Lanterns. Booklet, 5¼ x 6¾ 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.

Milwaukee Corrugating Co., Milwaukee, Wis.
The Milcor Manual. Booklet, 8½ x 11 in. 64 pp. Illustrated. Covers Milcor methods and materials, metal lath, corner beads, steel domes, channels, etc.

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.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 192*

LATH, METAL AND REINFORCING—Continued

Truscon Steel Company, Youngstown, Ohio.
Truscon 1-A Metal Lath. 12-page booklet, 8½ x 11 in., beautifully printed, with illustrations of details of lath and method of application.
Truscon ¾-inch Hy-Rib for Roofs, Floors and Walls. Booklet, ½ x 11 in., illustrating Truscon ¾-inch Hy-Rib as used in industrial buildings. Plates of typical construction. Progressive steps of construction. Specification and load tables.

LAUNDRY CHUTES

The Pfaudler Company, 217 Cutler Building, Rochester, N. Y.
Pfaudler Glass-Lined Steel Laundry Chutes. Booklet, 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.

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., 3¾ x 6½ ins. Illustrates Decorated Celestialite Units.
It Has Been Imitated. Folder, 4 pp., 10 x 13 ins. Data in an important detail of lighting equipment.

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

MAIL CHUTES

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

MANTELS

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

MARBLE

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

METALS

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

MILL WORK—See also Wood

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

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

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

MORTAR COLORS

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

PAINTS, STAINS, VARNISHES AND WOOD FINISHES

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

ORNAMENTAL PLASTER

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

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, 6¼ x 3½ in. 16 pp. Illustrated. Directions and formulae for painting metals.
Came Lead. Booklet, 8¾ x 6 in. 12 pp. Illustrated. Describes various styles of lead cames.
Cinch Anchoring Specialties. Booklet. 6 x 3½ in. 20 pp. Illustrated. Describes complete line of expansion bolts.

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

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

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

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

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

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

PAPER

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

PARTITIONS

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

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

Improved Office Partition Company, 25 Grand St., Elmhurst, L. I.
Telesco Partition. Catalog. 8¾ 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.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 194*

PIPE

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

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

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

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

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

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

PLASTER

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

PLUMBING EQUIPMENT

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

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

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

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.

Speakman Company, Wilmington, Del.
Speakman Showers and Fixtures. Catalog. 4½ x 7½ in. 250 pp. Illustrated. Catalog of Modern Showers and Brass Plumbing Fixtures, with drawings showing layouts, measurements, etc.
Toned Up in Ten Minutes. Booklet. 7½ x 10½ in. 16 pp. Illustrated. Modern Showers and Washups for Industrial Plants, showing the sanitary method of washing in running water.

PUMPS

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

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

RAMPS

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

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

REFRIGERATION

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

REFRIGERATORS

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

REINFORCED CONCRETE—See also Construction, Concrete

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

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

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

ROOFING

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

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

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

Heinz Roofing Tile Co., 1750 Champa St., Denver.
Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8½ x 11 ins. Illustrated. Shows use of English shingle tile with special hips.
Italian Promenade Floor Tile. Folder, 2 pp., 8½ x 11 in. Illustrated. Floor tiling adapted from that of Davanzati Palace.
Mission Tile. Leaflet, 8½ x 11 ins. Illustrated. Tile such as are used in Italy and southern California.
Georgian Tile. Leaflet, 8½ x 11 ins. Illustrated. Tiling as used in old English and French farmhouses.

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

Milwaukee Corrugating Co., Milwaukee, Wis.
The Milcor Architectural Sheet Metal Guide. Booklet. 8½ x 11 in. 64 pp. Illustrated. Gives valuable technical sheet metal data.

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.

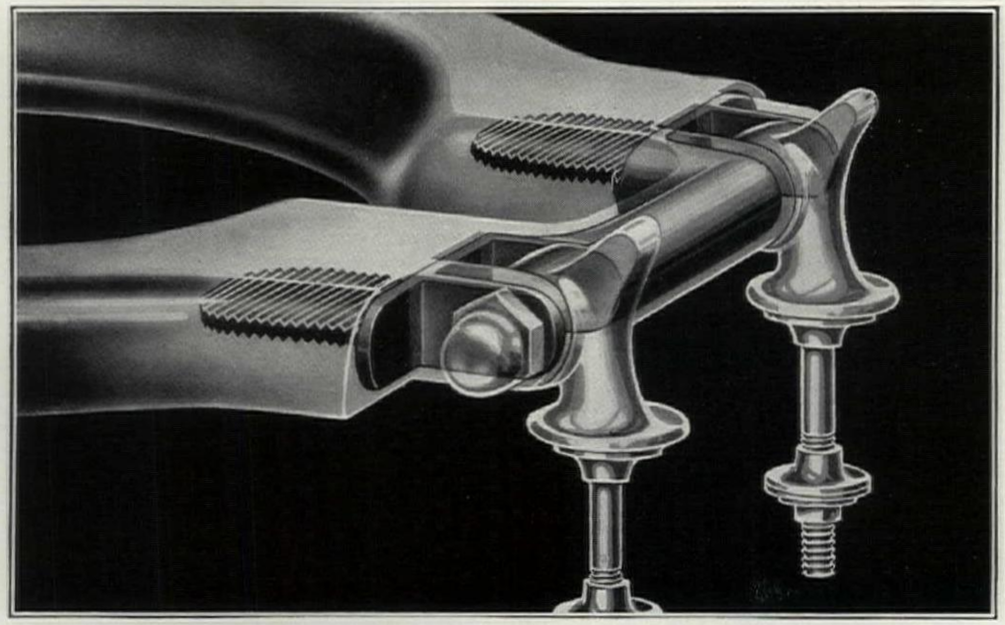
SEWAGE DISPOSAL

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.

Seat and Hinge Now One

Unbreakable, Solidified Unit!

An Exclusive Whale-bone-ite Feature



The new Whale-bone-ite hinge is part of the seat itself, being actually molded in one operation as an integral part of the seat. Re-inforced by a metal die-cast, one-piece insert, it is covered with highly polished Whale-bone-ite embodying the same strength and finish as the surface of the Seat.

Seat shown is Model 18-598. Phantom view gives details of construction.

THE makers of the Whale-bone-ite Seat have perfected a new hinge which brings a new standard of sanitation, strength and beauty to this finest of closet seats. This Whale-bone-ite Hinge brings strength to the weakest part of a closet seat—where seat and hinge are joined together. It makes both the seat and hinge one unbreakable solidified unit, impervious to moisture, absolutely non-corrosive. And because the surface is of Whale-bone-ite, this hinge will keep its highly polished surface under the most severe conditions of use.

Any model of closed or open back Whale-bone-ite Seats may now be obtained with this new hinge. Guaranteed for the life of the building. This new Whale-bone-ite feature makes this seat more than ever the logical choice where long life and unfailing service are desired.

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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. 188 Seat Division,
The Brunswick-Balke-Collender Co., 623 South Wabash Ave., Chicago

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 196*

Continued from page 196

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., 8⅜ 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 protection against sound.

STAIRWAYS

Woodbridge Ornamental Iron Co., 1515 Altgeld St., Chicago.

Presteel Tested for Strength—stairways, catalog, 92 pp., 8½ x 11 ins. Illustrated. Important data on stairways.

STEEL PRODUCTS FOR BUILDING

Genfire Steel Company, Youngstown, Ohio.

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

Rigid Metal Lath and interior plastering.

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

The Arc Welding of Structural Steel. Brochure, 32 pp., 8½ x 11 ins. Illustrated. Deals with an important structural process.

STONE, BUILDING

Indiana Limestone Company, Bedford, Ind.

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

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

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

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

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

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

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

STORE FRONTS

Brasco Manufacturing Co., 5025-35 South Wabash Avenue, Chicago, Ill.

Catalog No. 31. Series 500. All-Copper Construction. Illustrated brochure. 20 pp. 8½ x 11 ins. Deals with store fronts of a high class.

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

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

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

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

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The Kawneer Company, Niles, Mich.

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

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

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

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

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

Zouri Drawn Metals Company, Chicago Heights, Ill.

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

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

R. U. V. Company, Inc., 383 Madison Ave., New York City.

Water Sterilization by Means of Ultra Violet Rays. Booklet 8½ x 11 in. 16 pp. Full data on a system of purifying water.

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

TERRA COTTA

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

Standard Specifications for the Manufacture, Furnishing and Setting of Terra Cotta. Brochure. 8½ x 11 in. 12 pp. Complete Specification, Glossary of Terms Relating to Terra Cotta and Short Form Specification for incorporating in Architects' Specification.

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

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

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

TILE, HOLLOW

National Fire Proofing Co., 250 Federal St., Pittsburgh, Pa.

Standard Wall Construction Bulletin 174. 8½ x 11 in. 32 pp. Illustrated. A treatise on the subject of hollow tile wall construction.

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

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

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

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

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

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

TILES

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

Unites States Quarry Tile Co., Parkersburg, W. Va.

Quarry Tiles for Floors. Booklet, 119 pp., 8½ x 11 ins. Illustrated. General catalog. Details of patterns and trim for floors.

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

VALVES

Crane Co., 836 S. Michigan Ave., Chicago, Ill.

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

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

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

Illinois Engineering Co., Racine Ave., at 21st St., Chicago, Ill.

Catalog. 8¼ 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.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 198*

VENETIAN BLINDS

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

VENTILATION

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

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

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

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

WATERPROOFING

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

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

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

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

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.

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—*Continued from page 200*

—Continued from page 200

WINDOWS, CASEMENT—Continued

Genfire Steel Company, Youngstown, Ohio.
G F Steel Standard Casement Windows, Booklet, 16 pp., 8½ x 11 ins. Data and architectural details of casements.

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

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

David Lupton's Sons Company, Philadelphia, Pa.
Lupton Casement of Copper-Steel. Catalog C-122. Booklet 16 pp. 8⅝ x 11 in. Illustrated brochure on casements, particularly for residences.

Richards-Wilcox Mfg. Co., Aurora, Ill.
Casement Window Hardware. Booklet. 24 pp. 8½ x 11 in. Illustrated. Shows typical installations, detail drawings, construction details, blue-prints if desired. Describes AIR-way Multifold Window Hardware.

Truscon Steel Co., Youngstown, Ohio.
Truscon Steel Casements. Booklet, 8½ x 11 in., 24 pp. Handsomely printed with illustrations of houses equipped with Truscon Casement Windows. Illustrations of various units and combinations. Specifications, types and sizes and details of construction.
Architectural Details. Booklet, 8½ x 11 in. 16 pp. Tables of specifications and typical details of different types of construction.
List of Parts for Assembly. Booklet, 8½ x 11 ins., 16 pp. Full lists of parts for different units.

WINDOWS, STEEL AND BRONZE

David Lupton's Sons Company, 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 Company, Youngstown, Ohio.
Truscon Mechanical Operators for Steel Windows. Brochure, 8½ x 11 in., 65 pp. Complete description of various kinds of installations with drawings of details.
Drafting Room Standards. Book, 8½ x 11 in., 120 pages of mechanical drawings showing drafting room standards, specifications and construction details of Truscon Steel Windows, Steel Lintels, Steel Doors and Mechanical Operators.

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Truscon Solid Steel Double-Hung Windows. 24--pp booklet, 8½ x 11 in., containing illustrations of buildings using this type of window. Designs and drawings of mechanical details.
Truscon Donovan Awning Type Steel Windows. 12-pp. booklet, 8½ x 11 in., illustrating typical installation and giving construction details.

WOOD—See also Millwork

American Walnut Mfrs. Association, 618 So. Michigan Blvd., Chicago, Ill.
American Walnut. Booklet. 7 x 9 in. 45 pp. Illustrated. A very useful and interesting little book on the use of Walnut in Fine Furniture with illustrations of pieces by the most notable furniture makers from the time of the Renaissance down to the present.
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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.
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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.
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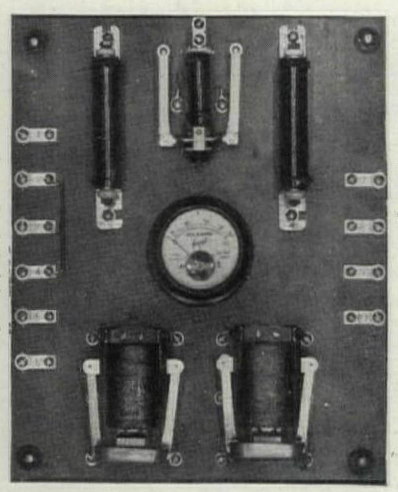

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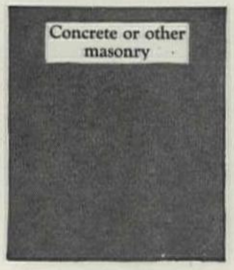

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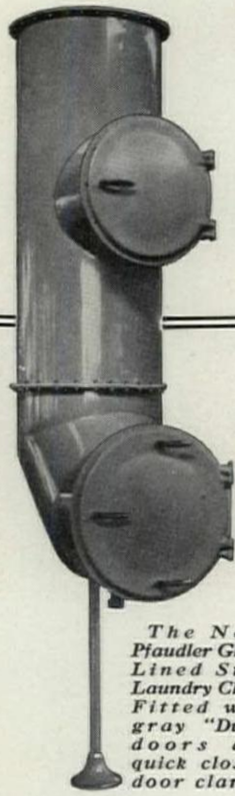
P-19

THE "ONE TIME" CHUTE FOR "ALL TIME" SERVICE!



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Installed under the Regulations of the Post Office Department in connection with the U. S. Free Collection Service by the Sole Makers.

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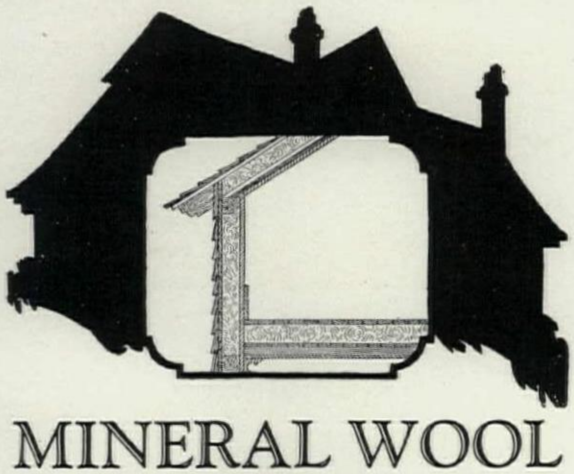

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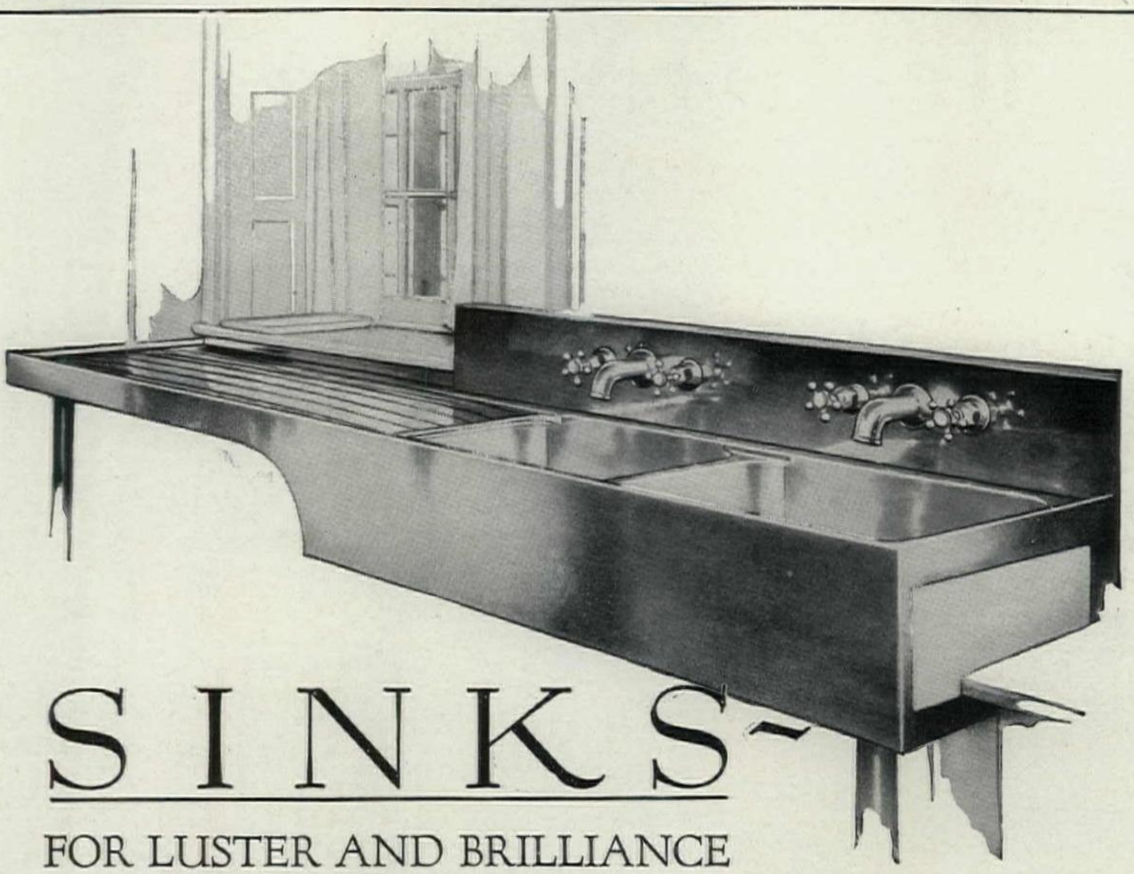
WHERE MONEL METAL SHINES



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A sink must stand all manner of use and abuse: the attacks of food acids and chemicals—the grind of sliding dishes and pans—all the traffic that must pass in and out of the kitchen sink. Monel Metal furnishes exactly that combination of properties required to meet the demands on this equipment.

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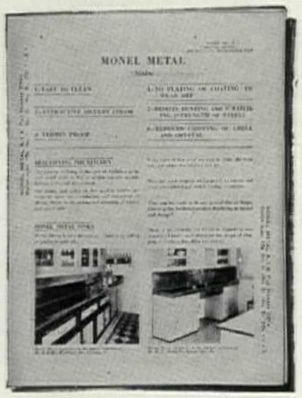

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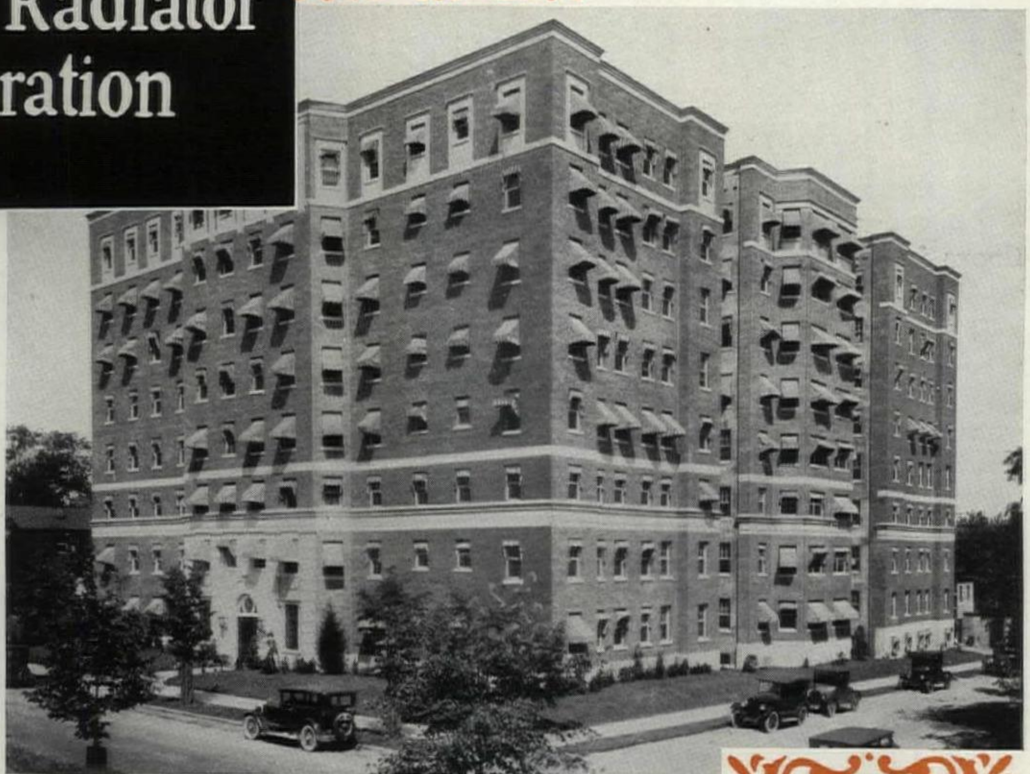

Corcoran Courts Apartments, Washington, D. C.
Architect: Harvey Warwick.
Builder: The Cafritz Construction Company.

A COMPREHENSIVE line of products that meet every heating need.

Performance, demonstrated over a period of years, on heating applications of every character.

Service that gives new meaning to a much-abused word.

These things you can expect, and will receive, when you specify National Radiator Products. Products which comprise the outstanding achievements of six great companies, backed today by a united responsibility, and widely distributed through a great chain of plants and warehouses.

In "National Radiator Products," you can expect quality, service, and permanent satisfaction for your clients, and yourself.

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NATIONAL RADIATOR CORPORATION

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NATIONAL PRODUCTS

Ten plants devoted to National Service through these Branch Offices and Warehouses:

Baltimore, Md.—2622 Frisby Street
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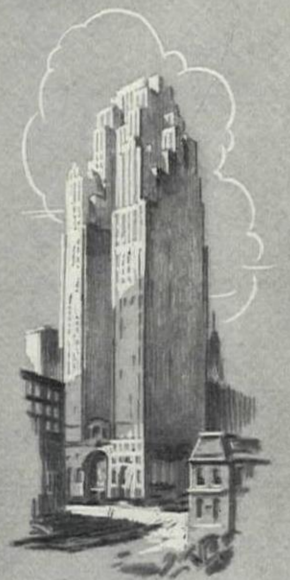
Cleveland, Ohio—935 E. 63rd Street
Cincinnati, Ohio—Spring Grove and Elmira Ave.
Indianapolis, Ind.—57 S. Bolton Avenue
New York, N. Y.—55 W. 42nd Street
Philadelphia, Pa.—121 N. Broad Street
Pittsburgh, Pa.—1509 Arrott Building
Richmond, Va.—3032 Norfolk Street
Washington, D. C.—2205 Fifth Street, N. E.

Royal Observatory, Ottawa. Seismograph chambers underground lined with Super Cement.

H. Gagnier's residence, Lambton, Ontario. Foundations and basement walls of Super Cement.

Breakwater at Toronto. Thousands of barrels of Super Cement used.



Penobscot Building, Detroit. Smith, Hinchman & Grylls, Architects. Foundations of Super Cement exclusively.

Precedent says "Super Cement"

Ten years ago, specifying Super Cement was pioneering. Today architects whose specifications include this improved form of Portland Cement follow many noteworthy precedents.

A decade of Super Cement has definitely established its value.

Used instead of and exactly like ordinary Portland Cement, Dragon Super Cement produces concrete that is waterproof, steel-hard, dense, strong and smooth-flowing. It resists acids, oils, sulphur and salt.

In foundations it obviates need for membranes, integral and remedial waterproofing. As stucco, it prevents crazing, cracking and seepage. In floors it eliminates hardeners. As a mortar, it precludes efflorescence and makes watertight joints. With Super Cement you can make old concrete waterproof; better still, you can make waterproof concrete.

Dragon Super Cement is produced by the makers of Dragon Portland Cement.

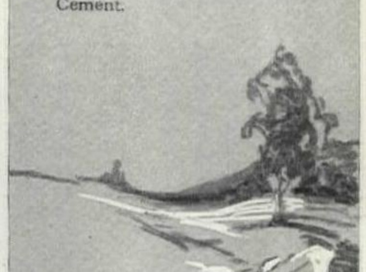
"How, Why, Where"—a booklet—contains data. Request for a copy entails no uninvited solicitation.

DRAGON
Waterproof
SUPER CEMENT
Absolutely

Barlum Hotel, Detroit. Bonnah & Chaffee, Architects. All concrete below ground level Super Cement. All bathrooms plastered with Super Cement.

Power House, Yellow Cab Corp., Pontiac. All concrete below ground level including transformer pits is Super Cement.

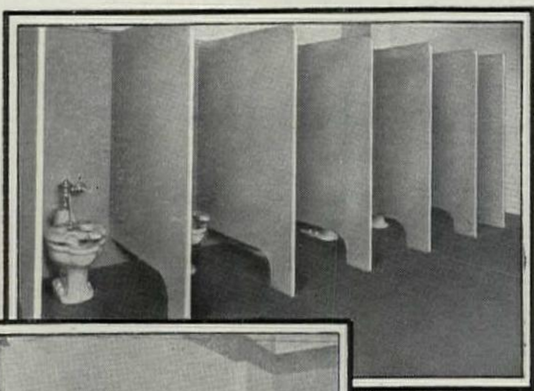
Francis Boynton School, Detroit. McGrath, Dohman & Page, Architects. All concrete below grade Super Cement concrete.



The Lawrence Cement Company

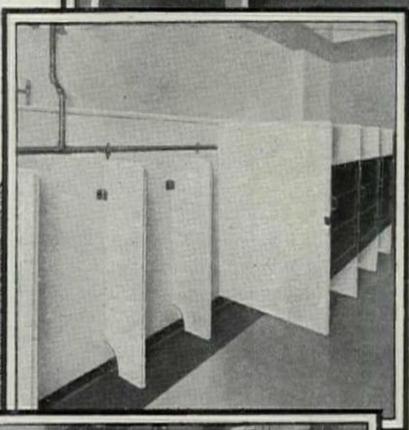
302 BROADWAY, NEW YORK. BRANCH OFFICES: BOSTON AND PHILADELPHIA

ALBERENE STONE



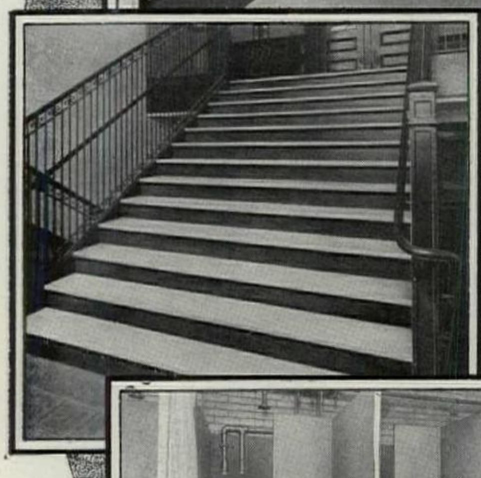
For Permanent Economy In School Construction

The illustrations here show typical school installations of Alberene Stone—for toilets and urinals, showers and dressing rooms, stair treads and landings, laboratory equipment.

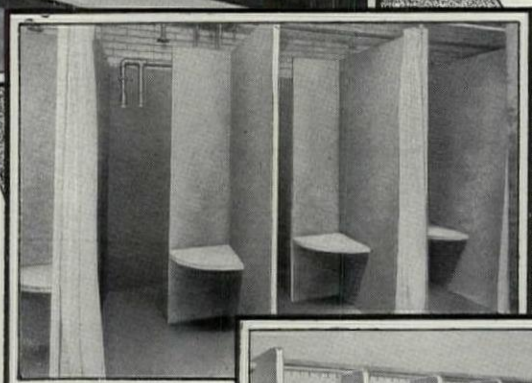


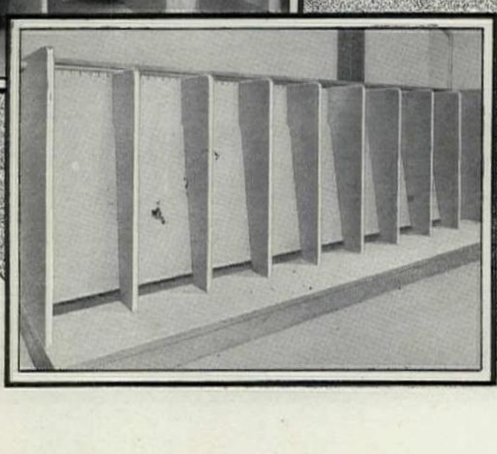
For these purposes, Alberene Stone meets every architectural, physical and chemical standard as no other material, whether natural or artificial, does.

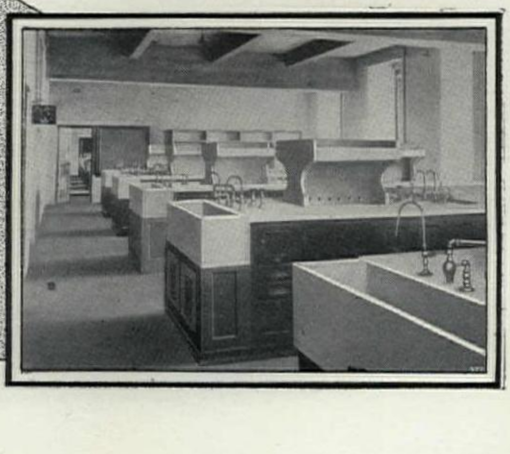
It combines the three qualities so desirable in modern school construction—durability, pleasing appearance, and permanent economy.



The Catalog gives complete information as to structure and composition, physical and chemical properties, detail drawings, and specifications. . . . *Write for your copy to Alberene Stone Company, 153 West 23rd Street, New York City.*







My MORTAR spreads easily *and* every brick stays where it's put when I use *Kosmortar*

The MASON

Let the Mason Talk:

"Kosmortar gives a smooth, fast, easy working mortar that piles up on the trowel and leaves without dragging. It has "body". The bricks, when laid, stay put. They do not slip and slide, nor does a lot of mortar squash out. Kosmortar sets slowly—making it workable longer. In its wall it hardens quickly—holding the brick. This allows me to run up the wall as rapidly as desired. Handled right, Kosmortar never has to be retempered; it's inconvenient to do so and I wonder that architects specify mortar that needs continual retempering because it certainly sacrifices strength. Kosmortar joints strike clean and true; little cleaning down is necessary after the wall is completed. I can use Kosmortar as soon as it is mixed; no time is lost by slaking or soaking."

Kosmortar makes an enduring, water-proof bond for brick, stone, tile and concrete block. It passes the same test for soundness as portland cement, and is very much cheaper. *The Ideal Cement for Masonry.* Kosmos Portland Cement Co., *Incorporated,* Kosmosdale, Ky., Sales Offices, Louisville, Ky.

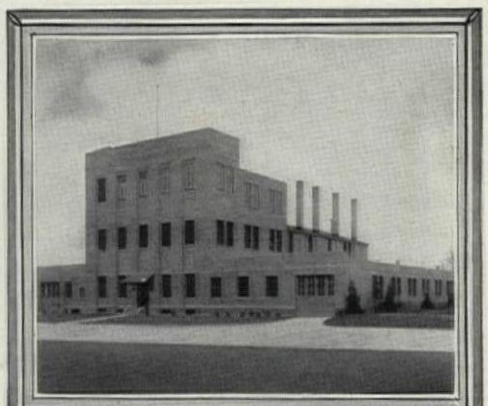
Kosmos Portland Cement

Uniformly high-test and reliable. Proved durable in concrete structures of every type of which many have stood for over twenty years. Perfectly adapted to making high early-strength concrete.

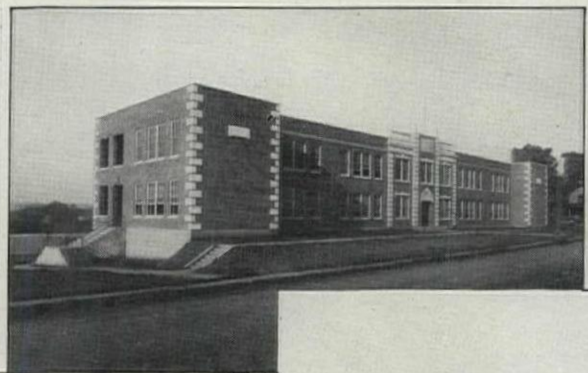
KOSMORTAR

A MASON'S CEMENT—*EASY TO SPREAD*

Dayton Bread Co.
Dayton, Ohio
Hill Smith & Co.
Engineers.
Dayton, Ohio



A new *and* economical concrete floor construction *for* schools



Morganton High School, Morganton, N. C. Havemeyer Truss Floor System used. Architect: Frank B. Simpson, Raleigh, N. C. Contractor: John W. Hudson, Jr., Tarboro, N.C.

Holy Trinity School, Protivin, Iowa. Another Havemeyer Truss Floor System job. Architect: C. I. Krajewski, Dubuque, Ia. Contractor: W. L. Yokom, Dubuque, Ia.

An Engineering Service

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

In various cities all over the country may now be seen schools (and other types of buildings) which incorporate a comparatively new but fully proven type of economical floor construction.

Its development begins as far back as 1855, when James Renwick, architect, designed what is considered the first steel joist floor. But the full solution of the structural problems had to wait upon a simplification of methods of utilizing a concrete slab together with a practical steel floor truss.

The Havemeyer Truss has proved the KEY to the long desired method of *economically* laying a concrete floor slab of proper load bearing strength and rigidity.

Its characteristics make it ideal for schools where problems of 100% safety and economy walk hand in hand. Consider the following:—

1 *Economy*. The light weight of the Havemeyer Truss concrete floor system lessens the load on walls, columns and foundations reducing construction costs through lightening the design.

HAVEMEYER

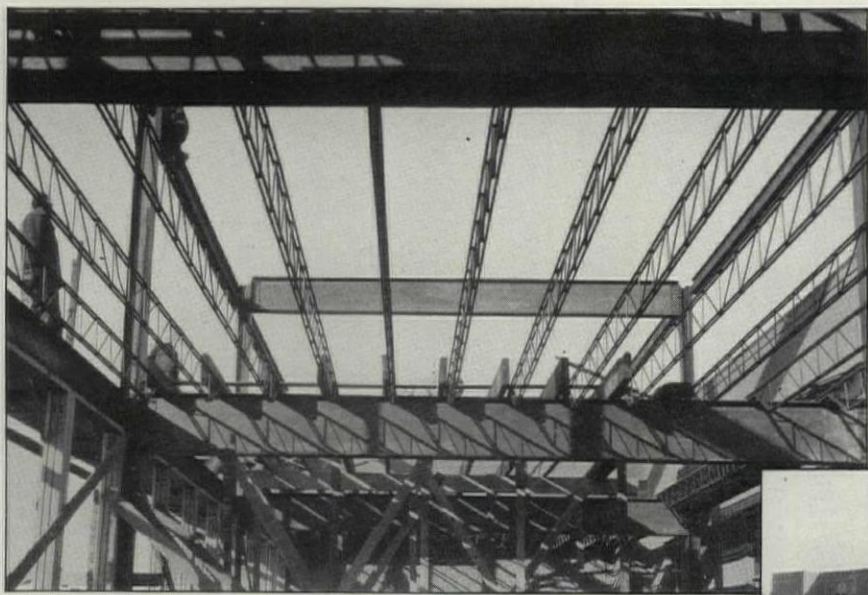
The many Havemeyer products listed here are made doubly valuable by the nearness to the job of some one of the many Concrete Steel Company offices and warehouses. The fabricating and service facilities of each location are remarkable for completeness.

Havemeyer Trusses

Meeting all spans from 4 feet to 31 feet, in stock for prompt delivery. No cutting or fabricating on the job.

Havemeyer Bars and other Reinforcing Products

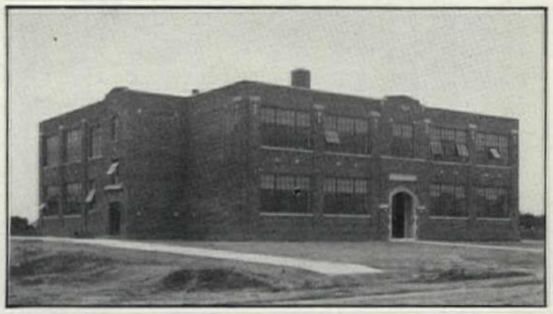
Reinforcing bars with *constant cross section.* Spirals, bends, mats, etc.,—an extraordinarily complete service from each of



Illustrating the placing and spacing of Havemeyer Trusses. After being stiffened by simple wire bridging, a complete covering of ribbed metal lath or waterproof-backed fabric is laid, on which a concrete slab 2" to 3" thick is poured.

Havemeyer Trusses were used on the Colored Graded School, Raleigh, N. C. Architect: Frank B. Simpson, Raleigh, N. C.; Contractor: Kenyon-Thompson Co., Raleigh, N. C.

Sawyerwood School at Sawyerwood, Ohio, incorporating Havemeyer Trusses. Architect: F. H. DeArment, Akron, Ohio; Contractor: C. W. & P. Construction Co., Akron, Ohio.



2 *Simplicity*. No fabricating on the job. No riveting. No form work. Easily handled. Open webs simplify placing of pipes and conduits.

3 *Adaptability*. For a wide range of building requirements including schools, apartments, hotels, hospitals, residences, industrial and commercial buildings, etc.

4 *Saves Time*. Trusses carried in stock, insuring prompt and efficient service. Standard units for spans up to 31 feet, meeting all conditions including irregularly shaped floors.

Beyond these are other practical advantages. The men on the job like it. It is easy to build. Little chance for error. It simplifies supervision. It meets a wide variety of conditions. And best of all, it actually saves money as compared with previously accepted floor systems to fill the same conditions.

Complete information is easily available. A new book is now on the press. The simple standard specifications are quickly adapted to any job. Write to Concrete Steel Company, 42 Broadway, New York. Sales Offices and Warehouses in Principal Cities: *Birmingham, Boston, Chicago, Cleveland, Detroit, Kansas City, Milwaukee, Minneapolis, Norfolk, Omaha, Philadelphia, Pittsburgh, St. Paul, Syracuse, Washington, Wichita.*

TRUSS FLOOR SYSTEM

the many company warehouses. Bar Spacers, Beam Saddles, Hy-Chairs, Inserts and Holding devices of all kinds.

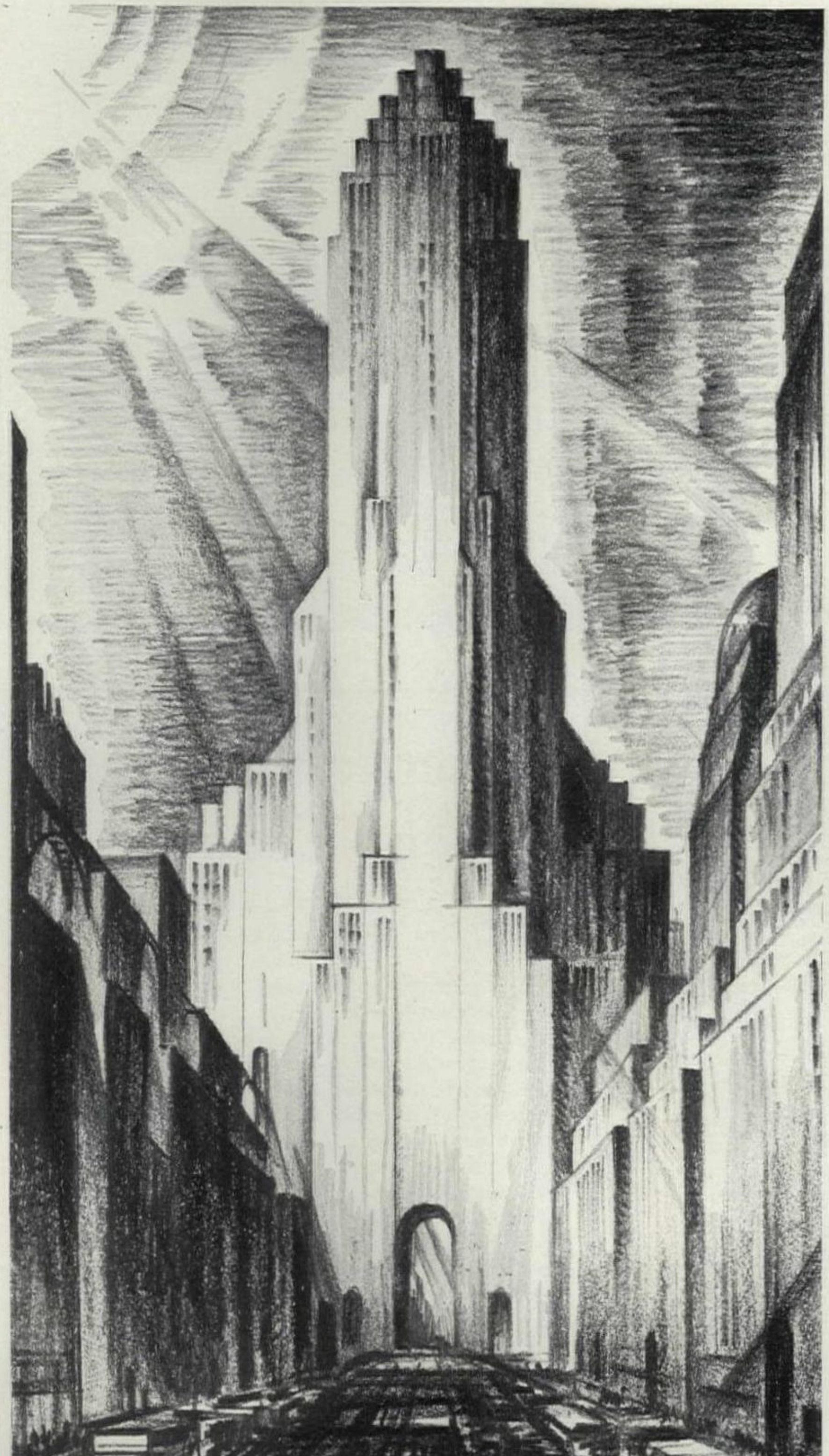
Metal Lath and other Fire-proofing Products

Metal Lath of all types. Door and Window Casing, Steel Casements, Corner Bead, Chalk Trough, Base Screed.

Havemeyer Road Reinforcing

Deformed bars with constant cross section, mats all assembled, Supporting Chairs and Spacers, Joint Plates, Cap Strips, Hoosier Asphalt Expansion Joint (which doesn't ooze all over the road). Angle Nosed and Round Nosed Curb Bars and everything necessary to meet State specifications.

Now plaster is reinforced exactly like concrete!



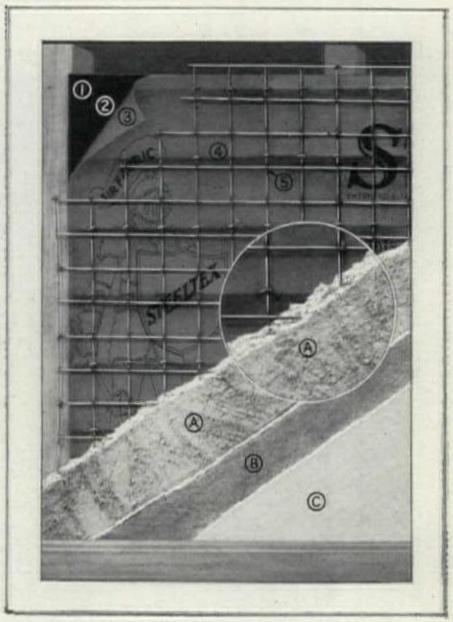
After many years of experience in the design and manufacture of reinforcing for concrete, the National Steel Fabric Company has adapted the same principle to the protection of plaster. **STEELTEX** used in place of lath means a network of fabricated steel completely embedded by automatic "back-plastering". And more. Because of a specially processed backing **STEELTEX** also insulates, damp-proofs and deadens sound. All this is made clear by the illustration below.

Send coupon for full information.

National Steel Fabric Company

DIVISION OF Pittsburgh Steel Co.

603 Union Trust Bldg. Pittsburgh, Penna.



Section showing STEELTEX and how it is used

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

National Steel Fabric Company,
603 Union Trust Building, Pittsburgh, Pa.

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

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THE WORLD'S LARGEST MANUFACTURERS OF WELDED STEEL FABRIC FOR REINFORCING CONCRETE CONSTRUCTION OF ALL KINDS

Los Angeles
or
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JOHNSON
OIL BURNERS
for
permanently efficient, clean heat

NEW LOS ANGELES CITY HALL
John C. Austin, Albert C. Martin, John Parkinson, *Associate Architects*
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Twenty-three years of pioneering explain the simplified compactness of Johnson Automatic Rotary Oil Burners. Twenty-three years of engineering effort devoted exclusively to oil burner refinement explain the uniformity of operation.... the high efficiency for which the Johnson is famed.

Exceptionally low fuel consumption, full automatic control and dependability are the fruits of Johnson development. They make Johnson Oil Burners the wise choice for uniform, *controlled* building temperatures.

For sky-scraper, factory or five-room home there is a correct Johnson model. *Write for brief descriptive bulletin on Johnson Oil Burners.*

THE Johnson Rotary Automatic is approved by Underwriters' Laboratories & New York Board of Standards and Appeals.

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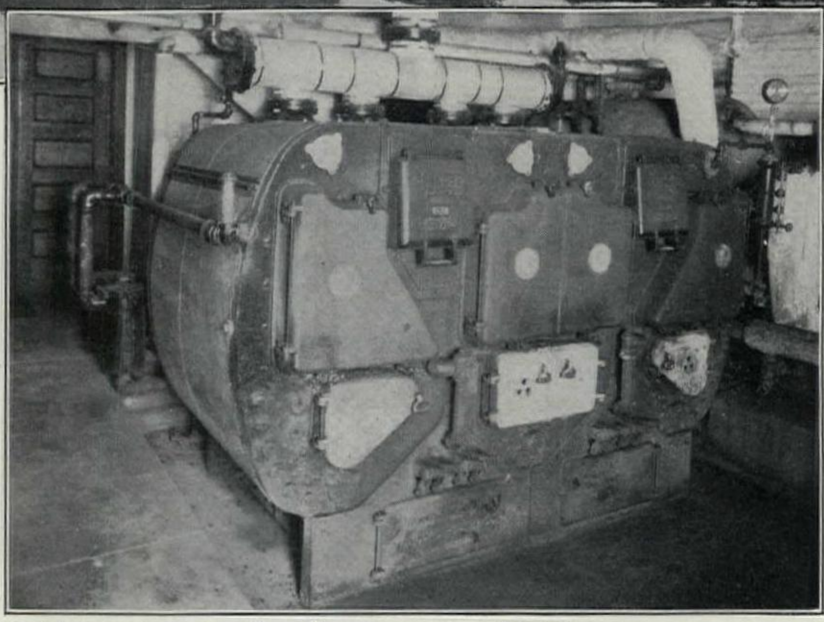
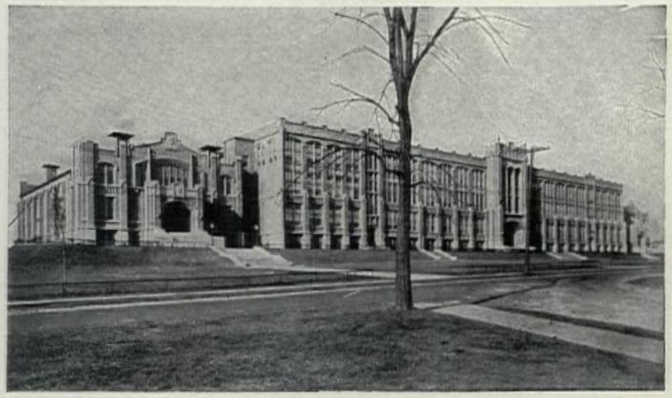


SPENCER CENTRAL CLEANING SYSTEMS

Babylon High School
Babylon, L. I.
Tooker & Marsh, *Architects*



Thomas Snell Weaver High School
Hartford, Conn.
Frank Irving Cooper Corp., *Architects*

Teachers' Training School
New York City
Wm. H. Gompert, *Architect*

Just a few of the many schools equipped with Spencer Central Cleaning Systems

Greenwich High School
Greenwich, Conn.

South Manchester High School
South Manchester, Conn.

Babylon High School
Babylon, L. I.

East Islip High School
East Islip, N. Y.

Jackson High School
Jackson, Mich.

Charles Carroll School
Baltimore, Md.

Cossitt Ave. School
LaGrange, Ill.

Junior High School
Glens Falls, N. Y.

Morey Junior High School
Denver, Colo.

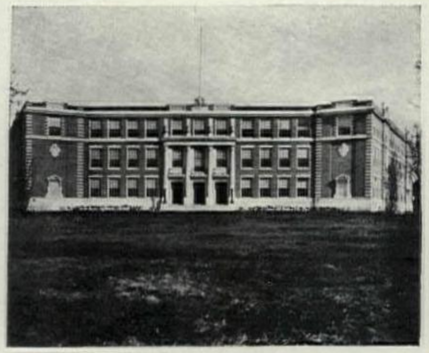
Cleveland Heights High School
Cleveland Heights, Ohio

Patchogue High School
Patchogue, L. I.

A complete list of over fifteen hundred schools that are Spencer equipped will be furnished on request.

Morey Junior High School
Denver, Colo.
W. E. & A. A. Fisher, *Architects*

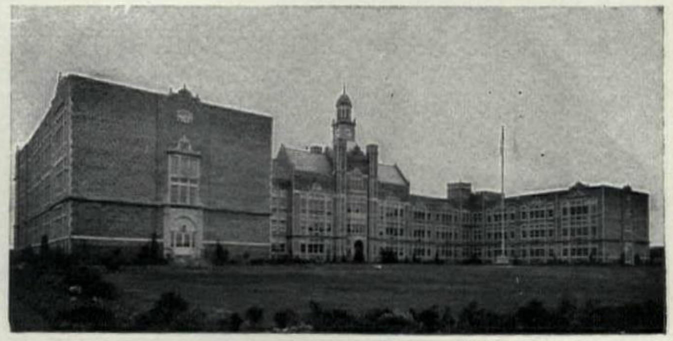
Roosevelt High School
Wyandotte, Mich.
B. C. Wetzel & Co., *Architects*



Beverly High School
Beverly, Mass.
Adden & Parker, *Architects*

Central High School
Detroit, Mich.
Malcomson & Higginbotham, *Architects*

Cleveland Heights High School
Cleveland Heights, Ohio
Warner, McCornack & Mitchell, *Architects*



Theodore Roosevelt Junior High School, San Diego, equipped with Ray Fuel Oil Burner

Flexibility

in Industrial Heating

THERMODINE Unit Heaters give *flexibility* to a heating system, impossible with old fashioned heating methods.

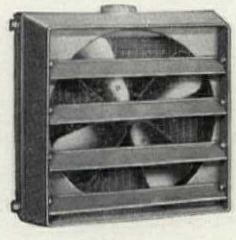
In buildings requiring a large amount of radiation, Thermodine Unit Heaters can be strategically located to deliver the heat *down* wherever it is needed. They suspend from the steam main out of the way, focusing heat wherever it is desired. They can be easily located to accommodate any heating conditions that may arise after their installation. Where a large number of Thermodine Unit Heaters are installed, part of them may be turned off as occasion demands. In mild weather, or in parts of a building where heat is required intermittently, some of the heaters may be shut off and only those permitted to run that are necessary. A remarkable saving of fuel and power is thus accomplished. Real *flexibility* in heating — in every sense.

Furthermore, *portability* of Thermodine Unit Heaters makes their installation a sound investment. In case it is desired to move some of the heaters to another building, or another portion of the same building, a Thermodine Unit Heater can be quickly taken down, moved and connected in a new location at slight expense. This portability is made possible by their light weight and method of suspension—outstanding Thermodine features.

Let us send you complete information and the name of our nearest representative. He will give further details and tell you of some of the installations we have in your vicinity.

MODINE MANUFACTURING CO. (*Heating Division*)
1718 RACINE STREET RACINE, WISCONSIN
Branch offices in all large cities

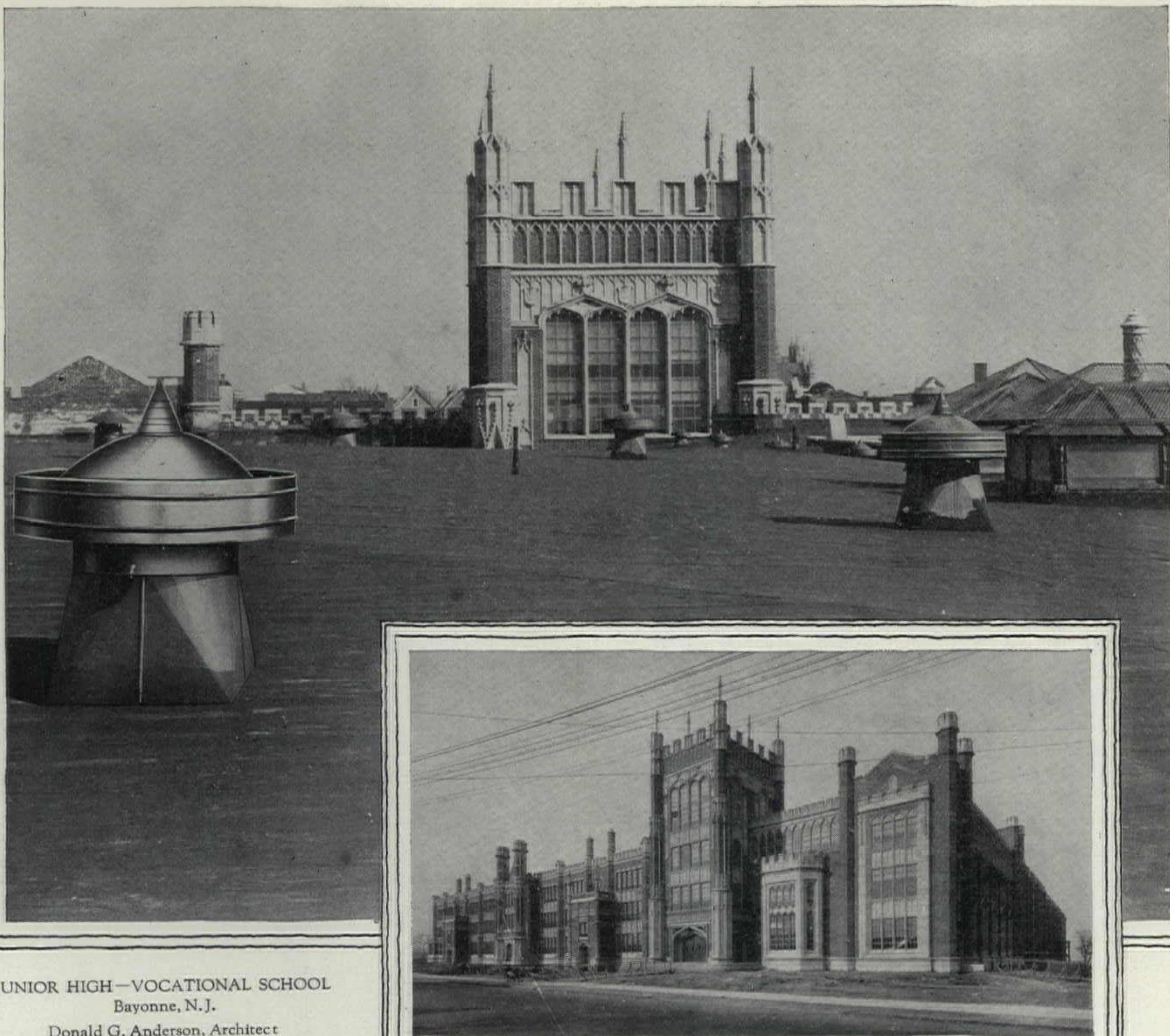
Thermodine Unit Heater No. 701
Is the equivalent of two tons of direct radiation—between 600 and 700 sq. ft.



Thermodine Utility Heater — No. 101
The smallest Thermodine — 12″ wide, 12″ high, 9½″ deep. Equivalent of 90 to 100 sq. ft. of direct radiation. There's a Thermodine adaptable to every size space.

TherModine
Unit HEATER
A MODINE Product

FOR STEAM OR HOT WATER HEATING SYSTEMS



JUNIOR HIGH—VOCATIONAL SCHOOL
Bayonne, N. J.
Donald G. Anderson, Architect
717 Broadway, Bayonne, N. J.

"GLOBE"

Ventilation for School Buildings

ARCHITECTS specify "Globe" ventilators for Universities and School buildings because "Globes" can be relied upon to furnish efficient ventilation.

The "Globe" removes all impure air, but air cannot enter the building through the ventilator, therefore, downward drafts are eliminated.

These ventilators on the Bayonne High School are sturdily constructed of heavy weight copper, making them practically everlasting, and they are absolutely stormproof and troubleproof.

There is no upkeep expense, and there are no moving parts to get out of order or to require lubrication.

We shall be glad to send you a catalog, blue prints showing full measurements of ventilators, or furnish any special data.

GLOBE VENTILATOR COMPANY

Department F

TROY - NEW YORK

REVIEWS OF MANUFACTURERS' PUBLICATIONS

GENERAL ELECTRIC COMPANY, Merchandise Division, Bridgeport, Conn. "The House of a Hundred Comforts."

The most complete electrical wiring which could possibly be had could cost so small a proportion of the total cost of a building of any kind that it is surprising it is not always insisted upon. If economy must be practiced, could it not better be somewhere else? This is suggested upon examining this booklet or brochure which is intended apparently for the information of owners of suburban and country homes, but which is so full of data that it well deserves a place in the specification files of every architect's office. The brochure takes up, one by one, every part of a house and its surroundings,—the porch, front door, hall, the different rooms, cellar, attic, garage, etc., —not only explaining the electrical appliances and devices useful for each, but giving diagrams of the proper wiring.

NORTH WESTERN EXPANDED METAL COMPANY, Chicago. "North Western Expanded Metal Products."

However full and complete may be the description of a building material, it is never half as "convincing" as an actual sample. Probably because the selling departments of this large concern realize this there has been issued this booklet or brochure which is so made and bound that along with the paragraphs describing the firm's products there are given samples of many of the materials. There are, for example, paragraphs giving data regarding Kno-Burn Metal Lath; Plasta-Saver Metal Lath; Copper-Bearing Plasta-Saver; Galvanized Metal Lath; Century Copper-Bearing Metal Lath; Corrugated Metal Lath; Steelhart Stucco Base; Longspan, etc; and along with the descriptions there are given samples and complete instructions or specifications for using the materials. The publication is of course extremely valuable to architects and engineers and to builders.

THE FINISHING LIME ASSOCIATION OF OHIO, Toledo. "Standard Specifications for Finishing Lime Plaster."

Securing good plaster for interior use requires that the plaster have a proper "bond" as well as an appropriate finish, the importance of the bond being obvious, while that of the finish is important because besides having much to do with the cost of a building's upkeep it must often afford a base or ground for some form of interior decoration. Highly necessary in securing good plaster is the use of the proper lime, and this brochure dwells upon the value of finishing hydrated lime from which there is produced a white high magnesium or dolomitic finishing hydrated lime, having plasticity and cool working properties which cause it to work smoothly under the trowel and to shrink less than any other lime. The Bureau of Standards recommends that magnesium limes be used for plaster work in preference to others. This brochure is replete with data on this lime and testimonials from many of those who have used it.

L. MUNDET & SON, INC., Hillside, N. J. "Roof Insulation." Data on its importance to architects and builders.

The value of buildings of certain types is regulated largely by the extent to which they are insulated against heat and cold; buildings of some kinds, in fact, could hardly be used at all were they not insulated. This folder deals with the merits of Mundet Jointite Cork Board. The insulating value of cork in preventing the passage of heat or cold through roof surfaces is of course widely known. Being immune to moisture, it is not subject to processes which destroy the value of certain materials which might otherwise be useful for insulating. Use of cork also prevents sweating of ceilings. All air contains moisture. Usually the warmer the air the greater the moisture content. When the warmest air in a room comes in contact with the cold ceiling conditions are ideal for deposit of moisture. As long as the ceiling is cold enough to cause the precipitation to continue, it will collect and drip. When a roof is insulated with baked cork board, the temperature of the ceiling will be that of the air with which it comes in contact.

ATLANTIC INSULATED WIRE AND CABLE CO., Rome, N. Y. "The Report of an Investigation."

The Investigation Committees of Architects and Engineers exist for the purpose of investigating anything in the way of material likely to interest an engineer or an architect in the construction of a building. Such an investigation is likely to be followed by a report, issued by the concern investigated and recording the findings of the committee. In this folder, of a size and form to agree with the suggestions of the American Institute of Architects and several engineering societies, there are enclosed sheets which give the results of such an examination of the plant of the Atlantic Insulated Wire and Cable Co. One sheet gives a review of "The Aims and Methods of Investigating Committees of Architects and Engineers" and an account of the methods under which such committees do their work.

INTERNATIONAL NICKEL COMPANY, New York. "INCO," A House Organ. Data on an important material.

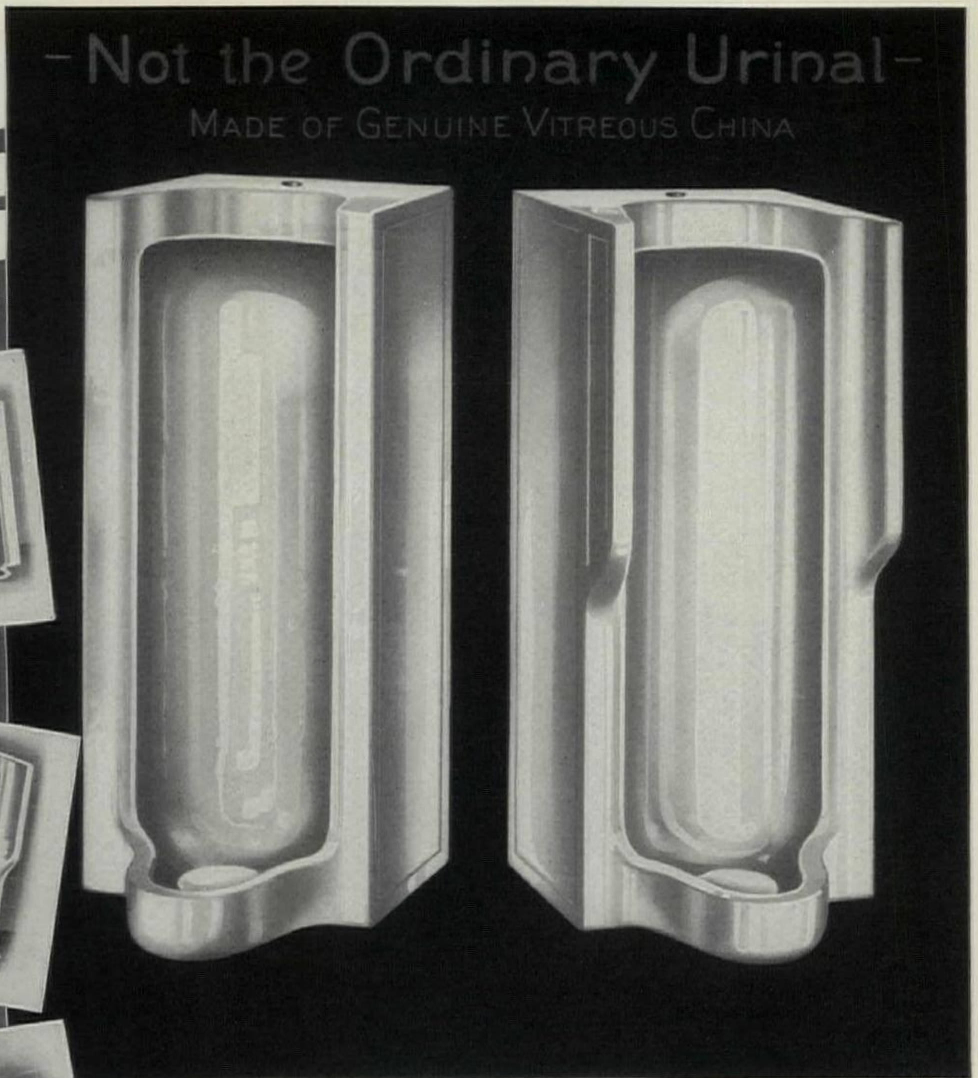
Webster's Dictionary defines "Monel Metal" as: "A whitish alloy of high tensile strength and elastic limit, containing of nickel 75 per cent, of copper 23.5 per cent, and of iron 1.5 per cent." Of this highly useful material there are being made objects of many kinds which come into direct contact with food, such as details of soda fountain equipment, steam kettles, faucets, and pantry fittings,—as well as parts of laundry equipment, such as dryers, which of course come into contact with clothing. This interesting publication no doubt acts as a medium for keeping architects and engineers posted as to the countless forms of highly useful equipment of different kinds manufactured and sold by this large concern. Replete as it always is with data of the most widely varied description, it might very well be received and filed regularly in any architect's office.

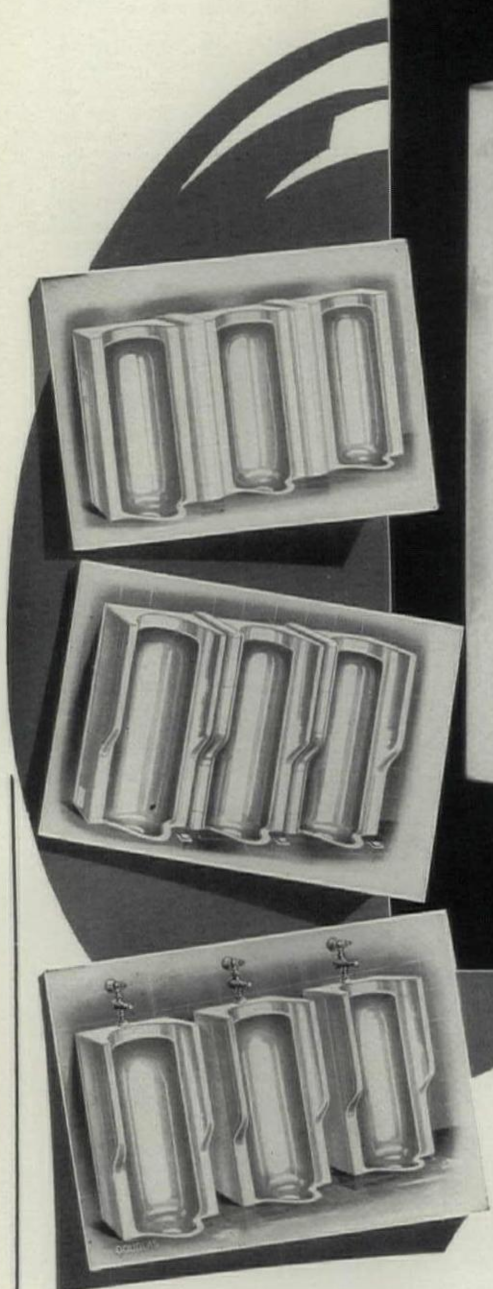
THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. Mansfield, O. "Electric Appliances. Catalog 44-A."

The ingenuity and resourcefulness of the firms manufacturing electrical devices add each year new refinements in the way of accessories for use in laundry, kitchen, pantry and dining room, or else in bedroom and bathroom. This brochure, for example, one of quite a number published by the Westinghouse Electric & Manufacturing Co., illustrates coffee sets of excellent patterns, the coffee pots, urns or percolators being of course electrically operated. Several pages of the booklet illustrate different sizes and types of flat irons, larger sizes intended for use in laundries, while smaller sizes are useful elsewhere, and a small, specially designed iron is meant for the use of travelers. Toasters, waffle irons, table stoves, "hot plates," and "disc stoves" are also illustrated and described, and of course such well known devices as curling irons, warming pads, tumbler water heaters and air heaters are fully dealt with.

MURPHY VARNISH CO., Newark, San Francisco, Chicago, Montreal. "Murphy Specification Manual for Architects."

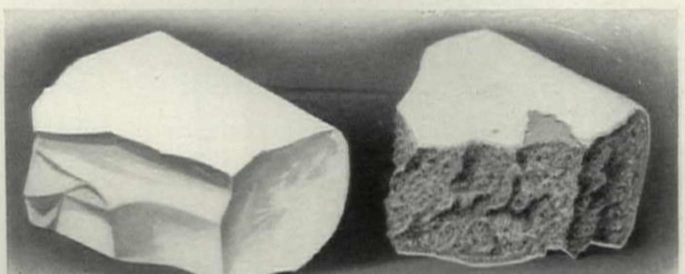
It is surprising that there prevails among people in general such a complete ignorance of the proper methods of using paints, stains, varnishes and other similar products. Even architects and their specification writers, who of course are expected to be properly informed, are frequently misinformed, and many a painter is mystified when he examines the specifications which architects issue to him. The manufacturers of these materials realize that if their products are to give satisfaction they must of course be properly used, and the best and surest way to insure satisfaction is to publish directions for the benefit of specification writers, painters, and others who may be concerned, specifications which after considerable study and much experience have been found adequate. This is done by the Murphy Varnish Co., in this brochure, which deals with the uses of varnish, enamels, lacquers, stains, and undercoats of all the modern types in preparation and finishing. The booklet covers quite adequately the use of these materials.





An Approved School Fixture of Highest Sanitary Quality and Design—

More than twelve hundred Douglas Vitreous China Urinal Stalls were used during 1926 and 1927 in Chicago Schools alone. Sixty-three were installed in the Roosevelt High School, America's largest and most modern High School building.



A Sectional Piece of Douglas Vitreous China Urinal

A Sectional Piece of the Ordinary Urinal

Made of genuine vitreous china, the same material as is used in the manufacture of water closet bowls and china lavatories.

The John Douglas Co.

Cincinnati, Ohio

Manufacturers of School Plumbing Fixtures Since 1887

REVIEWS AND ANNOUNCEMENTS

FRIGIDAIRE CORPORATION, Dayton, O. "Frigidaire Electric Refrigeration Systems for Residential Apartments."

There are quite a number of advantages which follow the use of refrigerators chilled by electrical current instead of by ice. The planning of apartment structures, particularly those having many small suites to a floor, generally precludes use of service entrances, which means of course that all deliveries must be made by way of the front doors, and the delivery of ice is likely to mean a train of moisture, while with use of electrical refrigeration and with the use of ice eliminated there will be few or no deliveries not easily made by means of the dumbwaiter which is easily installed. Another advantage is in the matter of economy, for it can be readily seen that with the refrigeration coming from one source the saving which follows "quantity production" is readily had. One more advantage is that there are no pans of water to empty (lest they overflow and injure ceilings), and still another, which might outweigh all the others, is that electrical refrigeration is *dry*. This brochure is quite naturally highly valuable to architects.

BISHOP & BABCOCK SALES COMPANY, Cleveland. "Air Washing and Air Conditioning Systems."

The planning required of present-day architects necessitates many compromises between what is desirable and what can be had. Often, for example, in hotels, theaters, schools, banks and other similar structures there are large areas which must be used for important purposes, but which are wholly without exposure to the outer air, and under these circumstances complete dependence must be placed, if these areas are to be useful, on the means for securing ventilation which modern ingenuity supplies. Nor is ingenuity found to be in any way lacking, as this brochure abundantly proves. This large concern is among the best known firms supplying apparatus for ventilation and for washing and cooling air for interiors, and this booklet in addition to giving all the data regarding such equipment which an architect or an engineer would be likely to desire, presents an impressive list of architects who have made successful use of the equipment, and in many instances it gives illustrations of the structures in which the installations have been made. To the general public and even to some architects the means for securing ventilation and particularly purified air constitute a deep, unfathomable mystery. There is really nothing mysterious about it. The mechanism is quite simple, when once its governing principles are fully grasped.

VAPOR HEATING COMPANY, York, Pa. "The Broomell System of Vapor Heating." Data on valuable equipment.

With the constantly increasing use of steam for heating there have come, quite logically, greater skill in its use and wide improvement in the mechanism which renders its use possible. This brochure, in answer to the question, "What is the Broomell System of Vapor Heating?" gives a detailed statement, which in part says: "The Broomell Vapor System is one of applied engineering principles, producing a positive circulation of steam through radiators, without pressure and without mechanical devices to circulate the steam through, or to remove the air from the system. As the Broomell Vapor System has been properly designed and certain laws of nature observed, no pushing or pulling of vapor is necessary. If there is sufficient fire in the boiler to generate vapor it will flow through the piping and radiators smoothly, silently, and continuously, until every radiator is full to the bottom and hot all over. With the Broomell Vapor System, the supply of vapor to the radiators is controlled by a four-ported modulating valve, this valve being readily adjusted to regulate the temperature of the room. This results not only in a delightfully heated house, but in great economy and ease of management. With the Broomell Vapor System, the Broomell receiver, which is attached to the boiler, automatically regulates the draft, checking or stimulating the fire as may be necessary for the production of vapor in relation to the amount being consumed by the radiators, this consumption being controlled by the modulating valve, which is adjusted to regulate the temperature of the room." Full data on heating are given.

C. A. DUNHAM CO., Chicago. "The Dunham Differential Vacuum Heating System"; Bulletins Nos. 114 and 115.

Many systems of heating are amazingly wasteful of fuel, whether the fuel used be coal, gas or oil, and in perhaps the great majority of instances much could be saved were careful surveys of conditions made and the heating equipments remodeled to function without the usual fuel and heat waste caused by overheating and excessive window ventilation. These two brochures deal with the Dunham Differential Vacuum Heating System, 114 as applied to the heating of residences and small buildings, and 115 as applied to heating hotels, apartment houses, and other large structures. The system furnishes steam to the radiators at the high degree of vacuum, with correspondingly low radiator temperature, or at the pressure above atmosphere which the weather conditions call for. These two booklets afford abundant data for a really intelligent use of heat, describe the mechanism adapted for use with each of the fuels in ordinary use, and illustrate by means of charts, diagrams, etc., the Dunham specialties which the system makes use of.

PORTLAND CEMENT ASSOCIATION. "Design and Control of Concrete Mixtures." Important data on the subject.

Concrete is made by mixing cement, water, and certain inert materials, the mixture being put into place or "worked" in a plastic condition, but hardening presently, due to the process of hydration of cement, the chemical reactions between cement and water. Unfortunately the quality or value of concrete cannot be judged until it has become hard. This therefore requires that great care be taken in the mixing or "fabricating" of the material. Study and research have made evident the dependence for strength and other necessary qualities of the concrete upon the quantity of the mixing water. The importance of proper control of the mixing water has long been known, but only later research has shown the importance of the relation between strength and the water-cement ratio. This brochure is one of the many which the Portland Cement Association issues in the interests of intelligent use of concrete. It deals not only with the important detail of mixing but also with the working of the material under field conditions. Many points are made plain by use of tables and diagrams, and part of the booklet is given up to giving the Standard Specifications and Tests for Concrete and Concrete Aggregates of the American Society for Testing Materials. The value and importance of the data here presented are great.

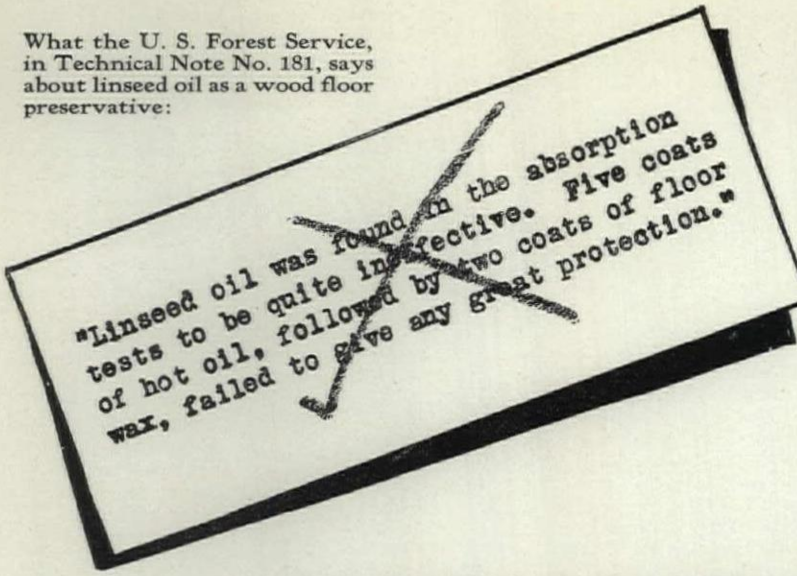
Wetherill P. Trout and Dale Truscott announce their removal to 442 Land Title Building, Philadelphia.

O. W. & H. B. Dryer are occupying their recently completed offices in the Fitch Building, 315 Alexander Street, Rochester, N. Y.

Henry Carlton Newton and Robert Dennis Murray announce the opening of new offices in the Architects' Building, Los Angeles.

Page 3 of The Forum for January carried an illustration of the Old National City Bank, Lima, Ohio. The architects of the building are Walker & Weeks, of Cleveland,—not of Chicago.

What the U. S. Forest Service, in Technical Note No. 181, says about linseed oil as a wood floor preservative:


"Linseed oil was found in the absorption tests to be quite ineffective. Five coats of hot oil, followed by two coats of floor wax, failed to give any great protection."

Linseed Oil Won't Do

for preserving wood floors—

Says U. S. Forest Service

Shellac Wears Off!

Varnish Wears Off!

Only **LIGNOPHOL** Lasts!

YOU can make wood floors serve without repairs. You can restore the natural gums and oils of the wood. You can keep the floors from splintering, rotting, drying out. This applies to both new and old floors.

But there is only one way. It requires Lignophol. Lignophol alone can give you smooth, hard, dustless floors that last for years. Tests conducted by the U. S. Forest Products Service proved that wood panels treated with 5 coats hot linseed oil and 2 coats wax registered a moisture-proofing efficiency of only 38%. Wood panels treated with just 1 dip coat of Lignophol registered a moisture-proofing efficiency of 60%.

In schools, churches, factories and other important buildings all over the country, Lignophol is being used as a life-saver for wood. It is easily and quickly applied at a low labor cost, and one treatment gives service for many years. THERE IS BUT ONE LABOR AND MATERIAL COST!

Permanently preserve wood floors. Eliminate future floor troubles. Prevent splintering, warping, dry and wet-rot! Lignophol will do it.

Lignophol is made in four standard colors: Natural, Light Brown, Medium Brown, and Dark Brown. Lignophol Wax Finish is Lignophol with floor wax incorporated. For floors in residences, apartments and dance floors. Medium or high polish. The Sonneborn Policy is that the architect must always be satisfied. Sonneborn always makes good.

A few of the many users of LIGNOPHOL

- Stone & Webster, Inc., Boston
- The Viscose Company, Lewistown, Pa.
- S. S. Kresge Company, Detroit
- Wm. F. Schrafft & Sons Corp., Boston
- Lincoln School of Teachers College, New York
- Armour & Company, Saint Paul

L. SONNEBORN SONS, Inc.

Some other Sonneborn Products

LAPIDOLITH—a chemical liquid hardener for hardening and dustproofing concrete floors.

HYDROCIDE COLORLESS — for waterproofing exposed exterior walls.

CEMCOAT—a paint that stays white after others turn yellow. Can be washed over endlessly. Adheres to brick or concrete as easily as to wood.

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NEW YORK

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