Stainless Steel ... that's the new “Linc-Weld” Totally Enclosed Fan Cooled Motor

What's the idea?

A better motor—cooler—greater overload capacity.

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The service behind Raymond Concrete Piles is as painstaking on small or moderate sized jobs as on the biggest ones. This is not too big a company to be approached by anyone with a desire for thorough foundation work, irrespective of the amount of money involved.

A Form for Every Pile
A Pile for Every Purpose

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NEW YORK: 140 Cedar St. CHICAGO: 111 West Monroe St.
Raymond Concrete Pile Co., Ltd., Montreal, Canada
Branch Offices in Principal Cities
When you are writing the specifications on

SCHOOLS, COLLEGES FACTORIES, OFFICE BUILDINGS, INSTITUTIONS, WAITING ROOMS

You take absolutely no chance when you specify FLAT Vogel Number Ten or Ten-A closet

These closets are backed by the 23 years' experience of the largest maker of seat-action closets in the world.

To prove to you and ourselves just how long one of these Vogel Closets would operate without repairs or adjustments, we now have one on an endurance test which started July 16, 1929.

This closet has flushed 300,000 times without even a washer being renewed—equal to 100 years of use.

Literature of interest to Architects, Specification men, Sanitary Engineers will be sent promptly upon request.

JOSEPH A. VOGEL CO.
Wilmington, Del.
St. Louis, Mo.
MACHINING...EVERY PART FINISHED TO CLOSE TOLERANCE

A high standard of precision, carefully maintained, governs every one of the scores of machining operations required in the making of a Jenkins Valve. Continual, systematic gauging assures a finish to the close tolerance necessary for the complete interchangeability of all corresponding parts... Precision manufacturing invests every Jenkins Valve with the strength and quality to provide long, leak-tight performance in any power plant, plumbing, heating or fire protection service. Jenkins Bros., 80 White Street, New York; 524 Atlantic Avenue, Boston; 133 No. 7th Street, Philadelphia; 646 Washington Blvd., Chicago, 1121 No. San Jacinto, Houston, Texas; Jenkins Bros., Ltd., Montreal, London.
SPECIFY ROOFS TO MEET SERVICE CONDITIONS

CAREY SPECIFICATIONS INCLUDE ROOFS FOR:

- FLAT DECKS—
- SLOPING DECKS—
- STEEP DECKS— FOR ALL CONDITIONS IN ALL CLIMATES

Tar and Gravel . . . . . . . .
Asbestos or Asphalt . . . .
Mineral or Smooth Surfaced . .

A ROOF which gives satisfactory, dependable service on a steep pitch area may fail entirely when applied on a dead level deck. A type of built-up roof which gives excellent service in Michigan may prove wholly unsuitable for an identical building in Alabama, Texas or the Orient.

Special care should be exercised in specifying Built-Up Roofs to meet the various service conditions. The two most important factors to be considered are climatic conditions and deck variations.

Only a manufacturer who can furnish Built-Up Roofs of every type can offer unbiased recommendations. Only a roof which is designed for specific conditions can be expected to give the maximum service at the minimum cost. Fifty-eight years of practical roofing experience are back of Carey Built-Up Roofs. They are applied according to rigid specifications by a nation-wide corps of roofing experts, and are bonded for ten or twenty years.

The Carey Specification Book tells exactly what roof to use under given conditions. A copy will be mailed on request.

THE PHILIP CAREY COMPANY
LOCKLAND • CINCINNATI, OHIO
BRANCHES IN PRINCIPAL CITIES

THE STANDARD FOR 58 YEARS
Do you WELDED DESIGN PIPING?

COMPARE the photos below with any welded jobs you've ever seen before ... compare the fittings!

They're not bends. They're not mitres. They're TUBE-TURNS, the seamless drawn fittings for pipe welding, now being used on dozens of jobs like the Empire State Building, the New York Hospital and Cornell Medical College Ass'n., the Bank of Manhattan Building, the new Waldorf, the Fidelity-Philadelphia Building, the Union Carbide & Carbon Building, Chicago.

Tube-Turns have seamless, uniform walls—no thinning of outside walls, no thickening or buckling of inside walls, no flattening of cross-section.

They combine greater strength and less weight than any other type of stock fittings.

They have no interior or exterior projections or shoulders—therefore cause less pressure-loss and can be nested closer, in less space.

Being made of the same material as the pipe in the line, they have the same factors of expansion and contraction—no leaks, no line strains.

Having a constant radius of 1\(\frac{1}{2}\) times the nominal pipe size, they are easier to design.

They are stocked in 45°, 90° and 180° types—or can be easily cut to form angles of any desired degree.

They can be fabricated, on the job, into any conceivable offset, compound or "special".

They are installed with easy welds, straight across the pipe.

Get All the Facts!

Tube-Turns have many other advantages and economies that can help you to improve your welded piping. All the facts are given in Bulletins No. 103 and 105—the latter a description and cost-comparison of an installation for the U. S. Bureau of Standards. Use the coupon for getting your copies. No obligation, of course. Tube-Turns, Incorporated, 1333 South Shelby Street, Louisville, Kentucky.

TUBE-TURNS, Incorporated, 1333 S. Shelby St., LOUISVILLE, KY. Gentlemen: Please send me, without obligation, Bulletins No. 103 and 105, giving full details about Tube-Turns, the seamless steel fittings for pipe welding.

Firm Name
Street
City
State

JUNE • 1931 • THE • ARCHITECTURAL • FORUM
A visitor to this Library cannot fail to be impressed by the quiet efficiency of its operating staff. If messengers from one floor to another, and from one department to another, were foot messengers, the very movement set up in handling requests for books averaging 1,658 volumes daily would create noise and confusion. It is inevitable, therefore, that mechanical messenger service as provided by G &• G Atlas Pneumatic Tube Systems should be installed here to promote the prompt handling of book requests in the most quiet, orderly manner . . . The STERLING MEMORIAL LIBRARY at Yale University, James Gamble Rogers, Architect, is also equipped with this System . . . Libraries constitute only one of the many types of buildings served by G & G Atlas Pneumatic Tube lines.

G & G ATLAS SYSTEMS, Inc.
544 West Broadway
New York, N.Y.
1344 The Canadian Bank of Commerce Bldg., Toronto
It is worth noting that the growing tendency to "Walworth throughout" jobs in new and important buildings of this type is by no means limited to New York City.

All over the United States prominent architects, engineers and contractors know that the high quality of Walworth valves and fittings, the completeness of the line and its ready availability, make it a wise and forward-looking specification.

All the heating and plumbing valves throughout the Grant Building in Pittsburgh were made and supplied by Walworth.
ADD another distinguished name to the growing list of leading hotels where Monel Metal shines... "Cincinnati's Classic"... the magnificent new Starrett's Netherland Plaza.

Here, as in other top ranking hotels throughout the country, the presence of gleaming Monel Metal equipment reflects the owners' desire to maintain the highest standards of food quality and service. It also proves that these farsighted operators are convinced that Monel Metal offers the best available combination of properties from a practical dollars-and-cents point of view.

Monel Metal's crisp, inviting beauty is the outward indication of inherent and enduring cleanliness. This lustrous Nickel alloy cannot rust. Its satin-smooth surface is easy to clean and keep clean. Strong as steel, with no coating to chip, crack or wear off, it keeps its original attractiveness through years of severe hotel service.

Monel Metal's desirable properties are due to its high Nickel content. Nickel is the whitening, strengthening metal that gives greater beauty and durability to Nickel Silver, Stainless Steel and other modern alloys. When you specify new equipment don't forget that "Nickel Alloys Look Better Longer" and that Monel Metal is a high Nickel alloy.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.
PROVISION is made for telephone convenience in the residence of Mr. J. R. Stewart, 2444 West Lake of the Isles Boulevard, Minneapolis, Minnesota, by built-in conduit serving six telephone outlets, including one in the basement game room. CARL A. GAGE, Architect, Minneapolis.

TELEPHONE CONVENIENCE, PLANNED IN ADVANCE, COSTS LITTLE, RETURNS MUCH

FEW modern conveniences contribute as much to living comfort as provision for adequate telephone arrangements. Planned in advance, they yield generous dividends to the home-owner in time and energy conserved, and add little, if anything, to construction costs.

You can assure full, flexible telephone service to your clients, and keep them long content with the homes you plan, by providing for telephone conduit within walls and floors. With built-in conduit, telephone outlets can be located wherever they're wanted throughout the house—and the telephone instruments can be easily shifted to meet changing needs. All wiring is concealed, affording improved appearance and protection against most types of service interruptions.

In planning the telephone arrangements for new or remodeled residences, consult your local telephone company. Their advice and assistance is given gladly, without charge. Just call the Business Office.

JUNE • 1931 • THE ARCHITECTURAL FORUM
Medusa Stoneselect Cement is a non-staining, waterproofed mortar cement for setting, parleting and pointing cut stone. By non-staining, we mean that it will not stain the stone with which it comes in contact. 

Authorities agree that all non-staining mortar must be waterproofed to prevent the staining elements in other materials in back-up masonry from passing into the stone. In the manufacture of Medusa Stoneselect Cement, Medusa Waterproofing is mechanically ground in the cement. This process, used in the manufacture of Medusa Waterproofed Cements (White and Gray) has proved **Successful for 21 Years.**

The cost of Medusa Stoneselect Cement permits its use for mortar in the back-up wall. The use of one mortar throughout the wall has many advantages from the standpoint of economy and convenience.

In Medusa Stoneselect Cement is found a carefully balanced combination of the essential properties of a good mortar. These essential properties are shown at the left.

**Fill out the coupon below or write us for complete information and specifications.**

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**MEDUSA PORTLAND CEMENT COMPANY**

1002 ENGINEERS BUILDING, CLEVELAND, OHIO

Manufacturer of Medusa Gray Portland Cement (Plain and Waterproofed); Medusa Waterproofing (Powder or Paste); Medusa White Portland Cement (Plain and Waterproofed); Medusa Portland Cement Paint; Medusa-Mix, the Masonry Cement; and Medusa Stoneselect Mortar Cement.

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**A BALANCED MORTAR CEMENT**

Send for A. I. A. Specification Folder

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**MEDUSA PORTLAND CEMENT CO., 1002 Engineers Bldg., Dept. G, Cleveland, Ohio**

**Gentlemen:** Without obligation please send me a copy of the folder "Medusa Stoneselect Cement."

**Name:**

**Address:**

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Are buildings you plan protected from LIGHT FAILURE?

These college buildings are equipped with Exide Emergency Lighting Battery Systems to insure electric light protection at all times.

What would happen in a building you had planned if a distant fire, flood or a bolt of lightning brought down power lines? ... cut off current? Do your specifications provide protection for such emergencies?

Imagine the confusion, inconvenience and possible danger of sudden current failure in hospitals, theatres, schools, auditoriums ... wherever people may gather. Guard against such risks. Include Exide Emergency Lighting Battery Systems in all your building plans and guarantee unfailing current to your clients.

Current failure may seldom happen, but once may be too often. Despite every precaution, power companies can't prevent unforeseen interruptions any more than you. But you can have your buildings prepared against such emergencies ... with an Exide Emergency Lighting System.

Then, should power fail, Exide instantly and automatically takes over the entire emergency load ... without a hand touching a switch. Lights keep burning. And when normal power is resumed, the battery is recharged automatically.

Exide Emergency Lighting Battery Systems are not expensive. Have one of our technical men call and discuss emergency lighting with you. Or write for our Emergency Lighting Bulletin. See pages D5810-11 in Sweet's Catalog.

A typical Exide Emergency Lighting Battery System; ready for action the second current may fail. Control panel may be seen in upper right-hand corner.

Dickinson College Gymnasium makes certain of adequate light at all times. It is equipped with an Exide Emergency Lighting Battery System. Wm. W. Emmert, Baltimore, Architect.

At Bryn Mawr College they take no chances with light. An Exide Emergency Lighting Battery System in Cudahay Hall, the auditorium, makes current certain. Melior and Meigs, Phila., Architects.

Exide EMERGENCY LIGHTING BATTERY SYSTEMS

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE
Exide Batteries of Canada, Limited, Toronto
The building industry

We welcome inquiries regarding the use and installation of the Josam Products listed below from Catalog G: Josam Drains for Floors, Roofs, Showers, Urinals, Garages and Hospitals; Josam Swimming Pool Equipment, Josam-Marsh Grease, Plaster, Dental and Surgical, Sediment and Hair Interceptors; Josam-Marsh Shock Absorbers for pipe lines; Josam Open Seat Back Water Sewer Valves; Josam Open Seat Swing Check Valves; Josam Adjustable Closet Outlet Connections and Bends, Water and Gas-Tight.

Josam products are sold by all plumbing and heating supply wholesalers.

There are no substitutes.

The Architectural Forum • June 1931
YOU may entertain a needless risk in thinking that the building you plan calls for something specially created, when the peculiar necessities of your particular job may be fully met by one or more of the drains comprising the Josam line.

Twenty-four sanitary specialties to May, 1931, (each an engineered device) provide ample assurance that particular requirements covering a wide scope shall be adequately and promptly met without costly experimentation.

To the Josam engineering department, from every part of the country, come the peculiar problems of thousands of architects and engineers. There is a striking similarity in these problems. A majority of them are solved merely by counsel on the application of a Josam sanitary device already in existence—a device engineered by Josam in anticipation of your need.

The completeness of the Josam line is founded upon recognition the building industry accords this practical engineering service. This recognition invigorates Josam pioneering—broadens its scope to serve. Indeed, it is through the offering of problems by thousands of architects and engineers that Josam pioneering is perpetuated. Few problems that come to Josam retain their perplexities because Josam is devoted to a policy of competing against past efforts to produce better products in the future.

Eagerly seeking out the problems that perplex architects and engineers and making them Josam problems, has raised the standard of Josam products and service above the competition of mediocrity. Every one of the twenty-four Josam products symbolizes, to the experienced craftsman's eye, that sense of responsibility for the performance of a product which extends beyond its immediate sale.

Apparently it is considered worthwhile by thousands of architects and engineers to utilize Josam engineering service for the solution of certain sanitary problems. Josam gratefully acknowledges this recognition. Josam representatives are pledged to a policy of practical helpfulness. There is one in your vicinity.

JOSAM MANUFACTURING COMPANY
4907 EUCLID BLDG.
CLEVELAND, OHIO

Factory: Michigan City, Indiana Branches in all Principal Cities

The constructive, ever broadening influence of the Josam watchword "Accept no Improvement as Final!" is evidenced by the proportions to which the Josam foundries and factory have expanded. Located at Michigan City, Indiana, this plant produces nearly 500,000 drain castings a year to fulfill requirements of specifications by hundreds of architects and engineers.

Total area of property is 2% acres, of which the plant covers nearly 2 acres. Josam growth in so short a time is just another symbol of the achievements of the building industry in the last decade.

FOR JOSAM PRODUCTS
Central America
BANANAS
ARE RIPENED ON DEMAND... in Newark!

Tropical weather in the heart of a northern winter... ripening of bananas properly controlled to meet daily demands... this is today's marketing achievement of the food distributing industry. Beneficial alike to Newark, New Jersey or Newark, Ohio.

Bananas picked green in Central America are shipped under refrigeration to warehouses here. They are put in ripening rooms containing air which is an exact duplicate of tropical air in warmth and humidity. By controlling these two factors, bananas are correctly ripened according to market demand. Thus the industry economically controls its warehouse "output," eliminates gluts, shortages and losses... maintains a steady supply "shock absorbed" to meet a fluctuating demand.

York experience and Air Conditioning Equipment were utilized in engineering and completing the installation of a large number of these ripening rooms.

Air Conditioning and Refrigeration being inseparable, York (for 50 years the refrigerating pioneer) is in a unique position to serve the refrigerating and air conditioning needs of business... and to smooth its path to profits.

In your own business there may be production or marketing problems that only refrigeration or air conditioning... or both... can solve. York will be glad to submit an answer. York direct factory branches are in 71 U. S. cities.

YORK ICE MACHINERY CORPORATION
- YORK PENNSYLVANIA

Scene in a banana ripening room in Newark, N. J., where 10,000,000 pounds of Central American Bananas are "schedule-ripened" annually. Similarly, huge quantities are ripened in other "ripening plants" located close to important population centers.

INDUSTRIAL REFRIGERATION

- ICE PLANT DIVISION
- AIR CONDITIONING DIVISION
- ICE CREAM AND MILK PLANT DIVISION
- COMMERCIAL UNIT DIVISION
- MARINE DIVISION
- ACCESSORY AND SUPPLY DIVISION
- EXPORT DIVISION
- SERVICE AND MAINTENANCE DIVISION

The type of air conditioning unit used in the above plant.
WHEREVER STEEL PIPE IS USED

J&L PIPE

Supplied in Black and Galvanized, in full Standard Weight, Extra Strong and Double Extra Strong.

UNIFORM QUALITY STEEL—only soft, ductile steel made to a special analysis is used.

FREE FROM DEFECTS—J & L pipe is straight and free from blisters, cracks and other injurious defects and is free from excess scale.

THREADS AND COUPLINGS—the pipe has good clean-cut threads. Couplings are sound and correctly tapped to give a tight joint.

GALVANIZING—the J & L process gives a thorough coating, which does not flake off, and prevents clogging with spelter.

MANUFACTURING CONTROL—J & L exercises ownership-control over all raw materials and processes of manufacture, from iron ore to finished product.

INSPECTION—all J & L pipe is subject to exacting and rigid tests and inspection.

IDENTIFICATION—look for the name JONES & LAUGHLIN on every length.
KALMANTRUSS JOISTS INSURE RIGID, FIREPROOF FLOORS FOR SCHOOLS

Throughout the country, a remarkably large number of school buildings are using Kalmantruss Steel Joists and Rigid Bridging in floor and roofs. Such general acceptance of this construction for schools is convincing proof of its outstanding merit.

The advantages are many. Floors are rigid, noiseless and fireproof. Complete elimination of formwork, faster erection and continuous operations regardless of weather, make this the most economical fireproof floor and roof construction in use.

Rolled from a single piece of steel, the Kalmantruss Joist assures absolute safety at all times. Kalmantruss Rigid Bridging forms a substantial cross bracing which acts both in tension and compression to distribute unequal floor loads. It insures correct spacing of joists and stiffens the entire floor construction.

The above buildings are representative of the many schools constructed with Kalmantruss Steel Joists and Rigid Bridging — also ideally suited for hospitals, homes, apartments and all other light occupancy buildings.
Five of the subsidiary manufacturing companies of the United States Steel Corporation are specializing in the manufacture of high grade Chromium and Chromium-Nickel Alloy Steel products. Communicate with these companies, as listed on the next page, relative to your requirements.
These stainless and low carbon steels, in a series of appropriate compositions, are a distinct contribution to the requirements of modern arts and industries. To their development and production the subsidiary companies have applied vast resources of equipment, organization, and research, aided by the scientific investigations of the Department of Research and Technology of the Corporation. Furthermore, by direct arrangement with Fried. Krupp A. G. of Germany, the processes and patents controlled by that firm have been made available.

Buyers and users of Chromium and Chromium-Nickel Alloy Steel products are invited to discuss their requirements with the subsidiary companies mentioned above. An interesting booklet describing USS Alloy Steels will be sent upon request.
The Cryer Valve Gives You "Hot Water"
Heat on Steam Systems, and Saves Fuel

Low Temperatures Held in Radiator on Mild Days

Exhaustive tests at Vanderbilt University, charted at the left, show strikingly the great economies in steam consumption given on mild days by the Cryer Radiator Control Valve. Results in actual practice check these figures.

Rooms were heated to a comfortable temperature with the valve open only one-eighth. The radiator temperature was held down to 93°F, and steam consumption was cut to less than one-tenth of the amount when the valve was fully open.

This is a greater saving than can be made by any other known valve.

The low radiator temperatures maintained by the Cryer Valve make two-pipe steam systems (of all kinds) in effect "hot water" systems—at the lower first cost of a steam installation.

See page D5526 of Sweet's for complete details.

How Cryer Valve Cuts Steam Use

(From tests at Vanderbilt University)

Note that the consumption of steam with the Cryer valve wide open is about 10 lbs. per hour on a 40-ft. radiator. But when the valve is open only one-eighth (as on mild days), the condensation is only 1 lb. A saving of 90%.

It is the unique re-circulating effect of the Cryer Radiator Control Valve, as shown by the Flame Test on the right, that effects these great savings.

Steam and air in the radiator are used far more efficiently.

You can feel the low temperature all over a radiator controlled by a Cryer Valve open one-eighth.

No other valves made can give this effect and such savings because they merely vary the amount of steam admitted, but not the temperature of the part of the radiator that they heat.
It is the ENGINEERING SERVICE

That Counts

In any heating, ventilating or air conditioning installation, intelligent engineering of the job is essential or the best of equipment may go "hay-wire." Keep posted on the latest developments in this field by reading

HEATING and VENTILATING

The June issue contains the following:

A review of psychrometric charts, by Professor C. O. Mackey, of Cornell University. Explains and shows the use of charts which have appeared during the last twenty years.


"Some Temperature Studies in Radiant Heated Rooms," by T. Napier Adlam. Compares the results obtained by the use of radiators, warm-air heaters and radiant heating methods.

The tenth installment of "Air Conditioning," by William Hull Stangle. Discusses the use of comfort charts and effective temperatures.

"The Degree Day—Its Application and Limitations." Discusses the history, derivation and limitations of this valuable estimating unit. Points out that it is not applicable to some of the comparisons to which it has been put.

An article on the proper thickness of building insulation when gas is used as the fuel. The economics of the problem are discussed.

An article on smoke eradication and the effect of smoke on the health of human beings.

The usual departments on Abstracts, Your Everyday Problems, News of the Month, Degree Days, Weather, New Equipment, etc.

$2.00 per year is all that it costs for this monthly service.

HEATING AND VENTILATING

521 Fifth Avenue

New York, N. Y.
The Seminary of St. Charles Borromeo, Overbrook, Pennsylvania

New Group in foreground:
Paul Monaghan, Architect
Chambersburg Construction Co., Heating Contractors

Alterations to old group in background:
Hofman-Henon Company, Architects
S. Faith & Company, Heating Contractors

The Seminary of St. Charles Borromeo
is one of many notable University Groups heated by Webster Systems

Others include Princeton University, Massachusetts Institute of Technology, University of Notre Dame, University of Alabama, William and Mary College, Vassar College, etc.

When the old group (shown in the background) was modernized three years ago the heating system was equipped with Webster MODERATOR Control—in which steam to the entire old group of buildings is actually Controlled-by-the-Weather through a unique Roof Thermostat. Results in terms of fuel economy, enhanced comfort, ease of operation and low maintenance cost deserve the most careful study by university adminis-

For complete details and able cooperation write: Warren Webster & Company, Camden, N. J.
IN GRACEFUL HARMONY WITH

the Architecture

OF THE BUILDING

THE Diebold Vault Door illustrated is designed for severe fire risks. It can be placed without full grouting. A patented offset door jamb provides less bulk and weight, without reducing the protective and fire-resistant qualities of the door. • Diebold Vault Doors are simply and gracefully designed, and harmonize with the architecture of any building. They are made by the makers of the famous Diebold Vaults and Vault Doors for banks. • Diebold engineers are always available for consultation. For specifications and details of Diebold fire-resistant vault doors, see Sweet's Architectural Catalog.

DIEBOLD SAFE AND LOCK COMPANY . . . CANTON, OHIO SEVENTY YEARS OF BANK SERVICE
operate elevator doors silently and easily

The standard set for elevator service will in a large measure be determined by door operation. Regardless of how operated, elevator doors must move freely, easily, quietly. Hangers must be sturdy, easily lubricated. They must handle up thrust at the end of door travel; they must roll smoothly. Hangers must operate at minimum maintenance cost throughout the life of the building.

These are rigid specifications. They point to the necessity for careful study of design and construction of hangers —to “ES” for hangers. “ES” engineers will gladly offer suggestions for your equipment specifications which will assure the kind of service you need. “ES” or equal in your specifications is for your protection.
Why Thermoflex TRAPS are immortal

They will outlast the radiator—and even the building itself. Its Hydron bellows will open and close tens-of-millions of times with no signs of giving out.

And that is true of each and every unit. The revolutionary method of forming the bellows avoids all factors which might cause failure—human, metallurgical and manufacturing.

By surviving an internal pressure far greater than the bellows will ever be given in use, each unit is self-inspected and proof-tested in the making. Never before could a trap be pre-tested by an infallible method. The Hydron bellows is in every Thermoflex radiator trap, drip trap, offset trap and high pressure trap.

Years of unfailing service in all types of buildings and under severe and varied conditions have proved their unfailing value, their uniformly high quality.
The Hydron bellows would be destroyed in the making if any weaknesses whatever existed in its structure. It is formed from a tube, by tremendous hydraulic pressure internally applied. Since the end fitting has previously been joined to the tube, any bellows which is not destroyed in the making can be truthfully called "immortal."

Also Certified Test by the Pittsburgh Testing Laboratory. One of their engineers tests each trap under operating conditions and affixes a certification tag.

Write for information and catalog to Grinnell Company, Exclusive Distributors. Our sales engineers will work with you to insure permanent satisfaction.

A revolutionary improvement in refrigeration. It replaces more than ten times its weight in pipe coils.

This remarkable Unit Heater is a better and cheaper means of heating industrial and commercial buildings. Heating systems can usually be modernized almost over-night, with a tremendous saving on fuel.

Pipe fabrication, lap joints, pipe bends, forged hangers and welded headers comprise the Triple XXX line for Super Power work. By modernizing to use high temperature steam your yearly savings will often run to five or six figures.

GRINNELL COMPANY INC.
Executive Office: Providence, R. I.
Branches in all Principal Cities
To fill its place properly, an elevator installation must be a smoothly coordinated whole, both in operation and appearance. . . . Mechanically, Otis gains this end by manufacturing all the equipment necessary to an elevator installation, in each case following a master design conceived as a unit. . . . Artistically, a similar unity can be maintained, following either the architect's or Otis' basic designs. For Otis shops and foundries are fully equipped to produce special ornamental fixtures in any desired metals, alloys and finishes. . . . The signal devices illustrated above give some idea of the way this works out in details of equipment. . . . Such flexibility of manufacture is particularly valuable to the architect, both in the designing of new buildings and the modernization of old.
**ENGINEERED FOR PERFECT WATER-COOLING SERVICE...**

Here's the water-cooling system architects and builders have been waiting for... quiet, efficient, and economical... a new standard of performance for years to come!

In modern offices and schools, in well-regulated factories and stores, in public buildings of all kinds—you will find Servel Electric Water-Cooling Systems on the job—supplying fresh, chilled water—silently, steadily.

Servel maintains a completely automatic source of palatable drinking water at a correct, healthful temperature. And it does this—day in and day out, summer or winter—without attention or bother.

Beautiful wall fixtures and pedestal models are available for installations where the Servel refrigerating unit is operated in a remote part of the building, for either single outlets or circulating systems.

The modern skyscraper home of the Central Union Bank in Evansville, Ind., is equipped with a Servel circulating system that provides fresh, chilled water for tenants on every floor.

Because Servel has the extra power to cool water quickly, it costs even less than ordinary water-cooling methods.

Efficient, economical—Servel Water Cooling systems may be readily installed in any building, old or new. Many different types of outlet equipment are available for every requirement.

NEW-STYLE CONDENSERS: interchangeable; highly efficient... MULTIPLE V-BELT DRIVES: insuring uninterrupted service and quiet operation... SIMPLIFIED CONTROLS: positive action, fully automatic... ECONOMICAL OPERATION: low-speed compressors; greater refrigeration for current used... RUGGED PRECISION CONSTRUCTION: built for long use, compact and accurate... WIDE RANGE OF 16 MODELS: with capacities of 150 to 1510 lbs. ice equivalent per day.

SERVEL SALES, INC., Dept. B-3, Evansville Indiana.

Gentlemen: Please send me complete information about SERVEL Refrigeration PLUS.

NAME ____________________________

ADDRESS ________________________________________
How Omicron permits the use of a low water-cement ratio

Omicron (the discovery of Master Builders Research Laboratories) adds to the plasticity of cement mixes without diluting the paste and reducing potential strength. Hence a low water-cement ratio can be used without sacrificing workability and speed.

Added plasticity is but one advantage accruing with the use of a Master Builders Omicron-containing hardening, coloring or water-proofing admixture, for Omicron also checks corrosive disintegration, increases strength and makes a smoother, denser floor finish possible.

Outstanding is the resistance to corrosive disintegration achieved through Omicron's action in largely replacing waste soluble salts (the point attacked by corrosive agents) with useful cementitious products that are highly insoluble.

Protection against corrosive disintegration is a recognized necessity in all industrial and certain commercial buildings; a prudent precaution in buildings of every type. For mild corrosive agents are universally present.

Omicron's practical value has been demonstrated both by laboratory tests and field observations. Over 43,000,000 square feet of Omicron-protected Masterbuilt Floors are giving daily testimony to the finer surface, the greater strength and the high resistance to both corrosion and abrasion that a Master Builders Omicron-containing admixture alone can give.

Complete technical data on Omicron will be submitted upon your request.
THE PLATE SECTIONS of the July issue present a wide range of architectural subjects. Among them will be an especially well-planned high school, three houses—one of them by Frank J. Forster—a parish church, a small college dining hall of unusual character, and a bank and office building. This last—the City Bank Farmers Trust Building in New York, for which Cross and Cross were the architects—is especially well illustrated, and will be a valuable reference for work of this kind. Each plate section comprises a monograph of its subject, designed to facilitate filing.

Adequate and economical housing is a question of the utmost importance, especially to the architect, since it is concerned directly with one of the fundamental phases of his business. "The Small House—A Problem To Be Solved," by Norman N. Rice, states a broad and logical view of the subject. Frankly, it is a controversial discussion, and its presentation offers to the architect an interesting challenge in both thought and action. Such challenges are the roots of progress, and now, as always, the pages of The Architectural Forum present the best in current professional thought.

Consistent with our policy of complete presentation and analysis is the survey of the mechanical equipment in the City Bank Farmers Trust Building. It is in effect a compact study of the best practice in the mechanical service of a tall building, as well as an outline specification of materials with the reasons for their use. In addition, the article contains pertinent information regarding special features of foundation work. The charts, pictures and drawings have been placed to clarify the text, which gives the subject an added value as a means of reference.

Comparatively little is known regarding the thin-shelled concrete structures recently built in Europe. In "Spiderweb Concrete in Europe," Major Eugene W. Stern explains not only the technical points of the structural design of such buildings, but also the method of their field construction. Many of the things that he describes are applicable to work in this country, and the article, with its numerous illustrations, should mean much to a progressive architect.

Of particular timeliness is an article by a member of our own staff, John Cushman Fister. "The Modernized Office Building" is a practical study of financial methods, construction practices, and means by which the architect may promote business of this kind. Examples of actual projects are given, illustrated by plans and charts.
A Railroad's Laundry Layout

... in which the "American" Specialists were of Service

Years ago, fire destroyed the laundry in which the Chicago, Milwaukee, St. Paul and Pacific Railroad Company washed and ironed its dining-car and sleeper linens. Some of the equipment was salvaged—a temporary, makeshift laundry was installed and operated on flat cars—then the department was moved into another building owned by the road.

Car-load after car-load of linens rolled in. The laundry worked day and night—but that time-worn equipment just couldn't keep up with the work. Then the officials decided to erect a new building...and to install in it the finest laundry of its kind in the world. They called on The American Laundry Machinery Company, to help carry out their plans...

The new Chicago, Milwaukee, St. Paul and Pacific laundry has now been in operation for one year. And, when Superintendent L. M. Jones writes that "real economies are being effected," he puts it mildly. Look...

At peak seasons, the laundry handles more than 10 tons of work every day. It operates 9 hours daily, instead of 16. It has saved thousands of dollars, worth of supplies, water and power. And it has trimmed down the pay-roll by as much as $2,000 to $3,500 a month!

May we remind you again that the services of "American" laundry-layout Specialists are at your disposal, always, without obligating you in any way?

The old laundry department. Antiquated equipment, haphazardly placed in a "wrong-shape" building—struggling 16 hours a day to keep up with the work.

The washroom in the new laundry, machined with mass-handling "American" equipment—easily handling many more tons of work daily, in 9 hours instead of 16.

THE AMERICAN LAUNDRY MACHINERY COMPANY
CINCINNATI, OHIO
Moreover, G-E Rigid Conduit is now made of a special Flexible Alloy Steel... and the smaller sizes can actually be bent with just two hands and a knee. Contractors like it... for it materially reduces installation costs.

G-E “White” has always been famed for its long life. It can be depended on to out-last any building... because it is hot-dipped galvanized, inside and out. It defeats rust... defies time itself.

CHICAGO'S great Merchandise Mart, a few steps from the shores of Lake Michigan... the new Empire State Building, towering above the skyline of New York... the one outstanding in size — the other in height.

Unlike in architectural design... offering entirely different problems in wiring construction... yet for both, the architects have selected G-E Rigid Conduit to protect the wiring system.

G-E “White” has always been famed for its long life. It can be depended on to out-last any building... because it is hot-dipped galvanized, inside and out. It defeats rust... defies time itself.

CHICAGO MERCHANDISE MART
Architect Engineer... Graham, Anderson, Probst & White
General Contractor... John Gribble & Son Company
Electrical Contractor... A. L. Shulman Electric Company
(all of Chicago)

THE EMPIRE STATE BUILDING
Architect Engineer: Shreve, Lamb & Harmon
General Contractor: Starrett Brothers & Eken, Inc.
Electrical Contractor: L. K. Comstock & Co.
Electrical Engineer: Meyer, Strong, & Jones, Inc.
(all of New York City)
What to Look for to Assure Heat at Lowest Cost

Architects and engineers who watch boiler performance carefully recognize four features of design as indispensable to operation at lowest cost.

"Does the boiler," they ask, "give fuel plenty of room to burn?" "How much of the heating surface is in direct contact with the fire?" "Are the gases stripped of heat before they reach the chimney?" "Does the water circulate freely?"

In Heggie-Simplex Boilers, the fire-box or main chamber is extra large. Fuel has plenty of room to burn. A spacious secondary combustion chamber, at the rear, provides additional space necessary for complete combustion of the valuable gases. Water legs surrounding these compartments assure the maximum of heating surface in direct contact with the fire. Heat is absorbed the instant released.

Numerous rear-front-rear tubular flues strip the gases of all usable heat before they reach the chimney.

The water in Heggie-Simplex Boilers—in water legs (front, rear and side) and in the barrel—is in one body. No restricted passages to impede the free flow of the heat to the outlet.

Built of steel, electrically-welded into one seamless, crack-proof unit, Heggie-Simplex Boilers are simple to install and economical to maintain. For complete facts, write Heggie-Simplex Boiler Co., Joliet, Ill. Member of the Steel Heating Boiler Institute.

1. Extra large fire-box
2. Secondary combustion chamber
3. Numerous rear-front-rear tubular flues to strip gases of heat
4. Single body of water free from restricted passages
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Cover Design

Frontispiece: Elliot House at Harvard University

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Education's New Demands

Kenneth Kingsley Stowell

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IF ROOF INSULATION HELPS
CLIENTS TO SECURE LONG LEASES

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Low-cost, Efficient Insulation for Roofs
CUPOLA CONSTRUCTION

FROM A FIELD SKETCH OF ELLIOT HOUSE, HARVARD UNIVERSITY
BY CONSTANTIN A. PERTZOFF
THE UNIVERSITY LIBRARY
BY
JENS FREDRICK LARSON

THE functions of a college library are to obtain, catalog and shelve printed matter; produce the information contained therein speedily on demand; display and make known its contents; provide suitable and comfortable space for reading and study of various sorts; and by architectural dignity and beauty suggest the importance of the printed word.

In order to fulfill the effective accomplishment of an educational institution, the library must, in a very real sense, be, both intellectually and physically, its center. Inasmuch as it contains reference material, it should be so located that it is equally accessible to all college departments.

GENERAL BUILDING PLAN

The library building should be planned to accommodate at least 50% of the student enrollment of the college in the total seating capacity of its reading rooms and stack. It should contain facilities for the accession and storage of books, the lending of books, their use within the building, various specialized forms of service, and the efficient administration of the plant as a whole.

It is well to consider the book storage and service to the books a feature distinct from the rest of the library, to be designed as a unit which is shut off from the circulation of the rest of the building.

THE STACKS

Publications may be obtained from the various manufacturers giving full and complete data on the latest and most efficient development of book stacks. In general, modern library stacks are fairly well standardized in dimensions, the stack height being 7' 6" from the floor of one deck to the floor of the next, with the bottom shelf 11" wide and the other shelves 9" wide. The stacks are spaced 4' 4" o.c. and made up of 3' 0" sections.

Inasmuch as the modern stack does not depend on window lighting, the outside windows should be used for tables, carrels, and faculty studies. It is more economical to build the block of stacks from the ground up on its own foundation.

A two story and basement building will accommodate six or seven stack tiers; two to basement, two or three to first floor and two to second floor. Stack tiers can be grouped in sections of two or three floors and vented to prevent draughts.

There are two general classes of construction: namely the stack with cast iron supports, and those built entirely of pressed steel. The stack with cast iron supports is more expensive, but it is recommended because of smaller liability to defacement, simplicity of maintenance, open construction and quietness.

FUTURE GROWTH

The stack structure should be planned on the basis of the unit construction of the stack manufacturers so that all parts will be interchangeable for future expansion. The stack should be in such a location that it can be expanded at will, either horizontally or vertically. In planning the capacity of a library stack, one should allow 25% greater capacity, on the basis of seven volumes to the running foot, than the number of books asked for. This allows for 25% eventual growth.
The growth chart, one method of predicting future space needs of the library stack room.

It does not mean, however, that any stack tiers will be empty, because the librarian, in allotting his books to the stack, allows for expansion in each subject for current growth. The books, therefore, even with 25% additional stack capacity, seem to fill the stack except for the lower shelves which are for new books as they come in.

The future growth of the stack, however, cannot be accurately predicted. The maximum yearly growth of a number of libraries seems to be 6% of the book capacity; the minimum yearly growth 3%. Certain libraries, such as Michigan and Princeton, practically double the number of volumes in their libraries every ten years; Harvard, every twenty-one years, and Dartmouth every twenty-three years. (See Fig. 1.)

STACK FLOORING

It is important that the flooring of the stack be of as light colored material as possible, so that the artificial light at the ceiling will be reflected up on the bottom rows of books.

White marble, although expensive and difficult to keep clean, has the advantage of providing a diffuse reflecting surface on both faces, which assists materially in the lighting of the stack aisles. Cast iron is relatively inexpensive but noisy. Glass, which transmits some light from one level to the next, is slippery and, therefore, dangerous. Slate is relatively inexpensive, is quiet, and is not slippery; but on account of its dark surface it does not aid by diffuse reflection in the lighting problem, and it is very difficult to keep clean.

A thin concrete slab with light colored rubber tile or cork composition tile would seem to be the
best material for stack flooring from the standpoint of light reflection, noise reduction and maintenance.

STACK USE

At the end of the stack on each level carrels should be provided for student research. The carrels, each furnished with a table and chair, should be screened one from the other and shut off from the stack by a low case to contain folios and the larger size books. (See Fig. 2.)

It is important to provide members of the faculty with an opportunity to carry on research work or the preparation of their courses in close proximity to their book material. For this purpose a number of so-called faculty studies may be provided off each tier of the stack. Sufficient rooms to care for one-fourth of the faculty should be provided. These studies are not administrative offices nor places for consultation, but are merely cubicles for individual study to which a member of the faculty may retire, secure from interruption of any kind. They should be assigned with the idea of placing the occupant as closely as possible to the level containing the material in which he is interested.

The construction should be sound-proof, and the furnishings consist merely of a desk, chair, filing cabinet, and coat tree. There should be no telephone connection, and only noiseless typewriters should be allowed.

NEWSPAPER STORAGE

Bound volumes of newspapers, because of their size and weight and also because of the poor quality of the paper on which they are printed, require special storage facilities. They must be laid flat on the shelves instead of being stacked in a vertical position. This requires a separate shelf for each volume or for, at most, each two or three volumes; only in this way can the books be properly preserved and made readily available for use. This stack room could well be located opening from the Reserve Book space for reference purposes.

A certain amount of dead storage must be provided in any library for books which should be temporarily or permanently retained by the library, but with which it is undesirable to cumber the operating stacks.

SERVICE PORTION

The control point between the storage, service of books and the general use of books, in reading rooms or for outside use, is the delivery desk.

The desk itself should be ample to accommodate a corps of trained library workers and have sufficient working space behind it for desks and temporary book storage for returned books previous to their replacement in the stack. One cannot be too emphatic in saying that most libraries allow insufficient space behind the delivery desk for services which develop with better management. (See Fig. 3 for delivery desk and work space.) This working space should have direct access to the Accessions Room and the Catalog Room, and also be in close proximity to the card catalogs.

CARD CATALOGS

The card catalog should be thought of as part of the service of the delivery desk and should be placed in close proximity to it, and also where it is easily accessible to the cataloging room.

The card catalog drawers may be contained in cases and serve as part of the furnishings of the main lobby of the building; or the drawers may be fitted into the partition between the public portion of the library and the catalog room, so that they are accessible to either side. A disadvantage of the latter method is that drawers are too often missing while in use in the catalog room.

Where card catalogs are in the lobby, high
Catalog drawers are standard and can be fixed to cases of special design.

CATALOG ROOM

The Catalog Room should be so located as to have direct access to the card catalog and should be of sufficient size to accommodate a staff adequate to handle the amount of books housed in the library. (See Fig. 4 for a typical layout of this room.) Future expansion, made necessary by greater book capacity, should be provided either by a mezzanine or by greater floor area which can have other use temporarily.

SERVICE ROOMS

Opposite the Catalog Room in the service portion of the building, space should be allotted for the Accessions Department. Off it, on a public corridor, should be the Order Office where new books are handled for the faculty.

Under the Order Room, with access from service drive, should be a Receiving Room of ample dimensions for the reception of crated books and the unpacking and temporary storage before delivery to the Accessions Department. Off this room should be provided an incinerator in which the vast amount of wrapping paper and packing can be burnt.

In small libraries, the Catalog and Accessions Rooms can be combined, care being taken to retain relationship with other services. Such an arrangement is shown in Fig. 5.

Provision should be made in the basement for building service rooms to house steam controls, hot water tank, vacuum cleaning apparatus, automatic control apparatus and the main electric system distribution boards; also office and supply room for the janitor or building superintendent.

The service portion of the building should be absolutely fireproof in construction, including exterior windows, interior trim and fire doors to public portion of plan. It should have internal staircase circulation, and should be equipped with fire-resisting furniture.

READING ROOMS

A careful study of modern library uses seems to show that very large reading rooms or rooms of monumental character should be avoided in planning a library, because of the impression produced by their size, and also because of the noise and confusion which are inescapable in such rooms. Furthermore, the various functions of the library can be most effectively exercised in separate rooms.

It is also important, if property restrictions do not limit the plan, to have windows on two sides and one end of the reading rooms for better distribution of reading tables.

REFERENCE READING ROOM

A most important function of a library is to provide a comprehensive collection of reference books and bibliographical aids of various types under the charge of a trained reference librarian. This room, which will be used mainly for research, should be located near the main circulation of the building, but should be easily
accessible to the Cataloging Room for the convenience of the cataloging staff. Alcoves and galleries give greater book capacity and add much to its charm. The cases which form the alcoves in this room need to be especially designed to take over-size books such as encyclopedias, atlases, etc.

Since a great number of readers do not use the room at one time, a table for two readers in each alcove would be sufficient, with the addition of a long library table in the center of the room.

If possible, a map and chart room should be a part of this service.

PERIODICAL ROOM

To display and make accessible to the reader the current numbers of a large collection of periodicals is one of a library's important functions. It is well to place the Periodical Room near the Reference Room in order that the same custodian may serve both.

Many libraries store their periodicals in closed cabinets from which numbers are issued on request. This method has the advantage of preventing loss, but an argument against it is that the periodicals are not displayed so as to attract attention of readers who may visit the room for any purpose. For this reason it is advised that periodicals be installed on shelves of open cases as shown in Fig. 6, the contents of which may be seen at a glance. The cases may be placed about the walls on either side of windows to form attractive alcoves, giving a certain atmosphere of privacy to a reader and encouraging him to browse among the material before him.

The current magazines are usually filed on shelves for a six months' period, after which they are bound and placed in the stack.

For further display and examination of the magazines, the center of the room should have large tables, approximately 3'-6" wide and 12'-0" long with chairs spaced 3'-0" on centers to allow plenty of room to spread out the magazines.

The architectural treatment of the room should be simple with restful color effects, and perhaps a sofa before a fireplace and a few lounge chairs to give an informal and comfortable atmosphere for the enjoyment of the more popular type of magazine.

STUDY ROOM

A general reading room or study room should be provided. In the case of a co-educational institution, separate study rooms are advisable for each sex. Its purpose is to allow students, who are disturbed in their dormitories and fraternity houses, to have one place in the college where they can study with absolute quiet. Small tables about 3 feet square to seat two, should be placed about the walls so as to take advantage of the window light, and larger tables, with chairs spaced 2'-3" on centers, should be in the center of the room, with a few round tables to break up the monotony. This room may be similar in treatment to the Periodical Room.

TREASURE ROOM

A room should be provided to house the collection of valuable manuscript material and rare books which a library possesses. The book shelves should be protected by metal grilles or glass under lock and key, and glass-topped tables.

A reading room in the Fisk University Library at Nashville, Tennessee. Henry C. Hibbs, architect. Tables and table-lamps for reading rooms are shown in Fig. 7 and Fig. 9.
should be provided for the display of manuscript, book plates and other similar material. There is small need of reading accommodation here as material for popular display would be shown in the main lobby.

In connection with the Treasure Room there should be a vault for the storage of books and records, and working space for assembling various collections of book plates, etc.

The Treasure Room is best located near the librarian's suite where an attendant is always on duty during library hours.

LECTURE ROOM

A small lecture room, sufficient to accommodate the entire staff, should be provided for lectures on library instruction, and other similar purposes.

EXTRA-CURRICULAR READING ROOM

This room is designed primarily for recreational reading, and offers an opportunity for the various departments to popularize their subjects by the display of interesting and descriptive books on subjects pertaining to their courses, each group in a separate alcove. Scattered on tables throughout the room are choice books with beautiful illustrations and bindings, and also the better modern fiction and books of general interest.

As it requires no service from the stack, this room can be located to advantage on the second floor of the building, away from the distractions of the general circulation of the main floor. In its architectural treatment and furnishings it should have the character of a well-appointed reading room of a large club, and should accommodate about one-eighth of the total seating capacity of the library.

Such a room is of the greatest importance as an educational feature as the student may acquire a love of books here and form reading habits which will remain with him all his later life.

SEMINAR ROOMS

A certain number of small rooms of varying size should be provided to accommodate small groups of students, where they may meet with an instructor and use certain library material. Books which an instructor desires to use are delivered to the seminar or conference room before the exercise and removed at its close. These rooms are in no way class rooms, but are for use simply when a large amount of library material is required for any specific problem.

Fig. 7. A type of library reading table recommended for reserve book room or study room. The use of other types, including those for two persons, or round tables, is suggested in order to prevent monotony.
RESERVE BOOK SERVICE

A special group of readers is made up of students using books which are placed on reserve for them by their instructors for quick reading in connection with their courses. Such collections, though relatively small in number, are subject to intensive use, and space should be set apart for them.

This Reserve Book Section, therefore, can be placed to advantage on the ground floor of the building with direct entrance from the street, thereby greatly lessening the circulation on the main floor, which can be closed off from the Reserve Book Section for late hour use.

As no special service is necessary, other than general supervision, this section can be more efficiently served by student help from its own delivery desk located directly under the main delivery desk where it can utilize the same service to the stack. (See Fig. 8.)

The only furnishings necessary in the Reserve Book Reading Rooms are sufficient tables and chairs conveniently spaced throughout the rooms to accommodate about one-third of the total seating capacity of the library. As in the case of the Study Rooms above, in a co-educational institution separate Reserve Book Reading Rooms should be provided for each sex, served of course from the one delivery desk.

EXHIBITS AND NEW BOOK DISPLAY

Realizing that the library is a going concern within a college which must sell its purpose, it is necessary to provide for the display of new books and library material on tables or in wall cases. The main entrance lobby is the ideal place for this purpose.

LIBRARIAN'S SUITE

The size and extent of the Librarian's quarters depend on the size of the library. In a large library it would be well to provide for a Librarian's private office, secretary's and general office, an office for the Assistant Librarian, and a Board Room. Since the Librarian has as many contacts with the faculty as with his staff, his office should be accessible from a public corridor as well as accessible to the service portion of the library.

WOMEN STAFF FACILITIES

It is essential to provide a comfortable lounge room, (with kitchenette in large libraries) in which the women of the staff may spend the lunch hour, and hold staff gatherings. Opening from it should be a locker room, dressing room and well equipped toilet with possibly a shower. This unit should be at the end of some circulation, and should be well lighted and ventilated as the comfort of the staff is of the utmost importance to the proper operation of the library.

TOILET FACILITIES: Adequate toilet facilities should be provided in locations most convenient to library users. There should be a toilet in the stack and general toilets on the basement floor and on the second floor at both ends of the building.

LOCKERS AND COAT ROOMS

A locker room should be provided for the student help.

Coat rooms should be located at side entrances.

PHOTOSTAT, PHOTOGRAPH AND BOOK REPAIR ROOMS

These are services which many libraries provide. A book bindery could be considered, but it is generally more economical to have this work done outside to avoid the expensive overhead. Only the large library can afford to maintain its own book bindery.

CONSTRUCTION DATA

The type of construction and material to be used will not be discussed in this article. It is well to consider, however, load bearing walls where possible to do away with reverberation which is so evident in a widespread low building of steel frame.

In general practice today libraries should be absolutely fireproof. It is only a source of regret if a fire occurs.

In general each reading room should be considered for sound proofing. From exterior annoyance double sash and internal ventilation would be recommended. In small communities, where exterior noises are not objectionable, there
is no problem of sound proofing except for private offices and special work rooms where there is machinery.

The halls and public lobbies, where circulation and talking occur, and reading rooms where absolute quiet is needed for concentrated study, require a certain amount of acoustical treatment. Here it would be sufficient to suggest acoustical plaster, acoustical tile, or other material for the walls, and sound deadening material for the floors.

In the seminar and conference rooms, rough cast plaster on the walls and ceiling does very well; but it is much better, if costs allow, to put acoustical treatment on walls or ceilings.

**FLOORING**

The flooring of the library is of the utmost importance. Rubber tile, or cork composition tile floor and base for public corridors, lobbies and important rooms is recommended and, if the budget allows, may well be used throughout the building. Linoleum is an excellent flooring material for many library rooms.

**HEATING AND VENTILATING**

**Types of Heating Equipment.** Preference should be given to types of heating equipment made and guaranteed by reliable manufacturers offering service facilities in the location where the building is being built. Equipment of a standardized type, wherein replacement parts may be obtained without delay in case of necessary repairs is of prime importance. This applies to valves, traps, fans, blowers, motors, pumps, automatic control apparatus, unit heaters, filters, air washers, and radiation. By the use of standardized equipment made by reliable manufacturers, careful design, skilled workmanship, and thorough inspection are assured before the apparatus is sent to the building. This keeps the maintenance and operating costs of the equipment to a minimum.

**Dust Elimination.** The methods of eliminating dust and dirt from the air are either by taking the outside air through air washers, viscous cell filters or dry air filters before the air passes through the supply fans and heaters. Air washers are of three types, which clean the air, (1) by passing it through a fine spray, (2) by passing it over wet surfaces, (3) by passing it through a washer having the combined features of both the spray and the wet surfaces. The latter type, while more expensive, is preferable because of its added efficiency. A well designed air washer, in addition to its cleansing properties is effective in the maintaining of proper humidity and temperature conditions.

**Direct Radiation** is advisable for use in the Stacks, Seminars, Faculty Studies, Corridors, Offices, Janitors Service, and Unpacking Rooms.

**Indirect Radiation** is advisable in the Delivery, Card Catalog, Reference Reading, Reserve Reading, Periodical, Study, and Treasure Rooms.

**Room Temperatures.** For the maintaining of the proper condition of books, manuscripts, etc., effective temperatures of 66° F in winter and 71° F in summer should be maintained at about 60% relative humidity for the greatest human comfort. This condition should be applied in Stacks, Delivery, Reading and Study Rooms, and Staff Offices at all times, Seminars, Faculty Studies, Corridors, and service portions where air is not conditioned, should be kept at 68° F.

**Quiet Operation** of the plant can be best obtained by isolation of the machinery, or by special construction. Space requirements in the building usually decide the latter method.

Floating concrete foundations covered with cork, felt, or lead on sand should be placed under fans, motors, and pumps. Electric conduits should not be directly connected with apparatus, but wiring should be made from condulets to motors with pig-tail connections. Fan inlets and outlets should be connected to the metal duct work with suitable canvas connectors.

In library ventilating systems a slow velocity of air should be maintained in fan outlets, ducts, and flues, and in grilles opening into rooms.
By carefully observing these conditions, the operating noises of the plant can be reduced to a minimum.

ILLUMINATION

A table of foot candles for each type of room follows:

<table>
<thead>
<tr>
<th>ROOM</th>
<th>GENERAL</th>
<th>LOCAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve Book, Delivery, and</td>
<td>10 ft.</td>
<td>8 ft. candles</td>
</tr>
<tr>
<td>Reading Room</td>
<td>candles</td>
<td>cases</td>
</tr>
<tr>
<td>Catalog Rooms</td>
<td>5 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Magazine and Newspaper Room</td>
<td>10 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Reference Reading Room</td>
<td>3 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Recreational Reading Room</td>
<td>3 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Study Rooms</td>
<td>3 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Seminar Rooms</td>
<td>10 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Offices</td>
<td>10 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Faculty Studies</td>
<td>3 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Entrance</td>
<td>3 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Halls and Corridors</td>
<td>3 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Toilets</td>
<td>5 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Juniors Service, Unpacking</td>
<td>8 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Rooms, etc.</td>
<td>15 ft.</td>
<td>10 ft. candles</td>
</tr>
<tr>
<td>Stacks</td>
<td>8 ft.</td>
<td>10 ft. candles</td>
</tr>
</tbody>
</table>

The above table indicates rooms requiring the two types of light sources, that is, a combination of a low intensity general illumination, combined with a high intensity local illumination on the working plane obtained by using table lights for reading and case lights on card catalog cases.

TABLE LAMPS. Careful consideration must be given to the type of table light used in order to avoid specular reflection which is common on books having glossy and heavily coated papers.

The accompanying drawing gives the dimensions and characteristics of an indirect type of table light which is designed so its indirect feature will overcome the annoyance of glare on the paper.

SPACING OF FIXTURES. Architectural requirements as to size, location, and use of each type of room require individual engineering calculations, both by direct and indirect fixtures, since the spacing, hanging heights, and type of luminaires must be considered for an even distribution of light and for appearance. It is impossible to make up any standard spacing of fixtures, as it is very seldom that parallel conditions are met with in the design of buildings of this nature.

ELEVATORS AND BOOK LIFTS

It has been found that one elevator, 4'-0"x4'-6", designed for a live load of 1000 lbs. at a speed of 100 ft. per minute, proves satisfactory for a library with 500,000 volumes. For the same size installation, one book lift, 2'-6" long x 2'-3" wide and 3'-0" high with three removable shelves, carrying a weight of 200 lbs. at 75 ft., has been adequate. It is recommended that shafts and electric outlets be provided for future book lift and elevator for use when the growth of the library indicates that 500,000 volumes will be exceeded.

A view of the book chute in the stack room of the Fisk University Library

SEATING

Based on a total seating capacity of 1000 for the library, seating accommodations in the various rooms may be allotted as follows:

- Reference Reading Room: 75
- Periodical Reading Room: 100
- Study Room: 150
- Extra-Curricular Reading Room: 125
- Reserve Book Reading Room: 300
- Stack: 100
- Seminars and Special Rooms: 150

TABLE SPACING IN READING ROOMS

4'-0" wide tables are spaced 11'-0" o. c. maximum.
3'-6" wide tables are spaced 10'-0" o. c. maximum.
Minimum spacing between tables 6'-0"
Chair spacing maximum 3'-0" o. c. minimum 2'-3" o. c.
A recommended type of table for reserve book room or study room is shown in Fig. 7.
A drafting table for work on boards not exceeding 30 x 40 in. in size. Advantages: Metal under-structure provides more leg and knee room by eliminating the apron used in wood construction and allows the seat to be higher in relation to the board. Bending at the hips rather than at the stomach line is accomplished by making the table 33 in. high instead of the usual 36 in. or 37 in. Specifications: length, 54 in., width, 32 in., height, 33 in. Top to be of clear, straight grained white pine T. & G., 1½ in. thick and not more than 3 in. in width. Finish to be three coats of natural varnish. Understructure to consist of two cleats (1½ x 4 in.) with drawer runs on the inside faces as shown and two sets of 1½ in. galvanized pipe supports, braced and interbraced. One drawer 21 x 40 x 3¼ in. (clear inside dimensions) to be provided on one side, recessed 8 in. from the front face of the table top. Sides of drawer to be rabbeted to fit drawer runs. Drawer and cleats to be finished in black enamel.

Details of a desk equipped with a cup light for use in a lecture room. The approximate cost per unit is as follows:

- Table .................. $6.00
- Chair .................. 4.00
- Fixture .................. 2.50
- Wiring & Installation .. 6.60

Total .................. $19.10

The plan illustrates the seating arrangement and capacity made available by the use of this desk.

LECTURE AND DRAFTING ROOM FURNITURE
DESIGNED BY RALPH G. GULLY
PROFESSOR OF ARCHITECTURE, RENSSELAER POLYTECHNIC INSTITUTE
As the avowed purpose of all institutions of higher education is to provide instruction and facilities for study, the housing of these activities is the first consideration. The administration building and the academic buildings with their classrooms, lecture rooms, and laboratories form the nucleus of the college group.

Administration

The housing of the executive and administrative functions is of course a primal necessity, but due to the continued expansion and increase in enrollment, the administrative building has not always kept pace with the demands. As the demands for facilities for instruction are the most urgent, the administration is often taken care of provisionally in a modest manner, with the idea that at some future date it will migrate to a building of its own.

As a result of this situation, it is frequently difficult for the visitor to locate these offices. Particularly is this so among the older institutions, or where the buildings of the college merge with those of the town. We find in many colleges and universities that the administration is housed with classrooms, libraries, or in other buildings, and as a rule occupying only comparatively small and makeshift quarters, inefficiently planned.

Administration usually consists of four divisions: (1) Academic Administration, represented by the President, the Dean and conferences of the faculty. (2) General Business Administration, as represented by officers of the corporation, the comptroller and the Registrar. (3) Auxiliary Administration, as managed by the Alumni, undergraduate bodies, various student welfare boards and committees. (4) Building and Grounds Department.

The administrative building should have a central location and yet should be near enough to the principal public entrance to the college grounds to be easily distinguished by those having business with the college or university authorities.

The building should make provision for: President's Office and Reception Room; Offices for his Secretaries; Offices for the Dean of the University and his Secretaries; Secretary's Office; Office for the Dean of Men (and of Women if coeducational); Registrars', Registrars', Examiners' Offices; Business Managers' or Bursars' Offices and Clerks; Offices for Comptroller and
The administration building at Agnes Scott College, Decatur, Ga.; Edwards & Sayward, Architects

Accounting Department and File Room; Vaults; Office of the Bursar's Department; Faculty Conference Room and Room for Faculty Records; Faculty Assembly Room; Board of Trustees Room, Committee Room; Office for the Graduate Division; Office of the Department of Buildings and Grounds. These and their relation to each other will no doubt be dependent on the form of organization developed by the institution for the effective carrying on of its work. In any event the buildings should be designed and constructed for flexibility and possible changes and expansion, much as a modern commercial office building, with soundproof office partitions.

The construction of such buildings will follow closely the usual system of fireproof construction used in schools and office buildings. Steel skeleton or part wall bearing construction with any of the systems of floor construction can be used. The bar joist adapts itself admirably to this type of building; reducing the dead load and effecting savings in all supporting members.

ACADEMIC BUILDINGS

Buildings devoted entirely to academic purposes should be planned with the idea of future expansion limited only by the area allotted to it on the group plan. The wide variance in the size of the classrooms, due primarily to the difference in teaching methods and requirements of the subjects of study, makes it difficult to establish any standardized sizes. The requirements of each department must be studied with each department head, allowing for future growth and possible changes in teaching methods.
Larger classrooms and lecture rooms should be on the first floor, as far as possible, with the idea of reducing traffic through the building to a minimum. Corridors should be ample in width,—from ten to fourteen feet,—capable of handling the occupants of the building in an orderly fashion with the minimum of disturbance to the classes in session. The wainscots in corridors should be of durable material easily cleaned. This material may be either a matt-glazed terra cotta wall tile which will bond with the partition construction, or a cement plaster which may be painted to give the desirable color scheme. The walls above, if painted, should be kept light in tone to reflect as much light as possible. The floors in corridors must be of a material which is washable, permanent, resilient, noiseless and capable of repair at a moderate cost. Asphalt, either in the mastic or tile form, has met these requirements and has found considerable favor for this use. Linoleum and rubber tile have many advantages and are used extensively. Terrazzo should be divided with metal strip into 3 or 4 foot units. Cement treated both for color and hardness is durable and inexpensive, although the latter does not produce such a quiet floor.

Study rooms and lecture halls should, if possible, be arranged to receive the benefits of natural lighting and should also be provided with adequate artificial light,—at least 10 foot-candles on desks. Higher intensity of illumination for the front blackboard is often installed. Drawing or drafting rooms should be equipped with 25 foot-candles on the working plane. Great care should be taken to avoid glare, for while an inadequate intensity of light causes eyestrain, it must be borne in mind that glare may be even more harmful. The system of direct-indirect lighting is widely used here. Seasonal, temperature and geographical location are the factors which will determine the orientation of classrooms, but generally speaking, east and west lighting is most desirable. North exposure is not considered desirable as a room which does not receive sunlight at some period of the day is losing the benefit of hygienic cleansing and cheerfulness.

The distinction between classrooms and lecture rooms is rather indefinite. Throughout the east, the practice would indicate that when more than thirty seats are provided, the room is known as a lecture room. In the West and Middle West, this figure exceeds eighty, and at Michigan, a classroom seating 248 is now in use. Stepped or sloping floors are limited to use in lecture rooms where demonstrations require a full and unobstructed view of the table or platform.

Opinion varies as to the type of seating and desk to use. Single seats, benches seating four or six, or bench-and-desk combinations, chairs with arms, all have their purposes and places, and this equipment must be determined in conference with the professors. Whether the seating is to be fixed or movable depends on the purpose of the class or lecture room, or on the personal preferences of the instructor. Movable seating has the advantage of flexibility, though it may be more noisy and more easily subject to breakage.

The Faculty and Administration Building at Creighton University; Leo A. Daley, Architect. The building is of fireproof construction, with aluminum spandrels and a limestone facing.
The Science Building at Berea College, Berea, Kentucky; George H. Gray, Architect. Notice the arrangement of the offices and laboratories and the location of the lecture room.

Ventilation in lecture rooms is of vital importance for drowsiness in lecture halls is a common failing even under the best of conditions, and it should not be encouraged by the architect. A minimum of 30 cubic feet of air per minute for each person, with a velocity below 400 feet per minute, should be provided. Heating and ventilating units placed in the room, which will provide heated fresh air under the control of the person in charge, are convenient and easily installed. The central type of heating and ventilating system supplying all class and lecture rooms with washed and tempered air is positive in action and the "split" system is advocated by many.

Acoustical treatment in class rooms is not considered necessary and its use in lecture halls will depend on the shape, size and the materials used in the interior.

BUILDINGS FOR THE NATURAL SCIENCES

In order to ascertain what facilities the buildings for the natural sciences should provide, it will be necessary for the architect to make a study of the growth of the institution, of its policy toward expansion and its probable increase in demand for instruction in the various branches of each group. The relation of the university to the natural resources of the state will also have a bearing on the grouping or isolation of the numerous divisions of science.

A single science building for the smaller college will take care of Biology, Physics and Chemistry, and perhaps also Mathematics and Astronomy. The customary groupings of the sciences are: Biology and Geology—Physics and Biology—Physics, Biology and Physiology. Universities and large colleges usually have separate buildings for each of the four branches of science which differ in proportion to the demands for instruction of undergraduates and research work.

The plan, structure and the mechanical plant of the science building is dependent on the equipment used, and special provisions are the rule rather than the exception. Therefore the closest cooperation of the architect with the faculty is necessary in making the requisite provisions. The types and sizes of equipment are determined by the science department and are selected from the many standard designs of the manufacturer or designed especially to meet the teaching requirements. The three basic sciences,—Physics, Chemistry and Biology,—are almost universally given in all the colleges and universities. If housed in a single science building, the physics department should usually occupy the ground or basement floor and portions of the first floor, with the others above, as precision instruments require bases with the minimum of vibration.

PHYSICS

A building wholly occupied by the department of physics requires varied apparatus for the study of mechanics, sound, light, electricity and magnetism, thermo-dynamics, radio activity, etc. It should provide for: storage battery room, constant temperature room, general storeroom and small rooms for the storage of glass tubing, iron, wood and brass stock, elevators or dumbwaiters to each floor near storeroom which will be available for the transfer of freight for any of the department. It should also provide: photometry room, generator and switchboard room, the shop, photographic dark room, physical laboratory, spectrometry rooms and electrical laboratories.

The upper floors should contain well lighted lecture rooms with seats arranged on risers so that a good view of the lecture table can be obtained from all parts of the room. Directly back and above the lecture table will usually be found a galvanometer booth provided with several outlets and with electric lights. A heavy I beam may be mounted directly over the lecture table to serve as a support for a transparent galvanometer scale and as a rigid support for demonstrations in the lecture courses.
The electrical measurements laboratory will usually be equipped with wall desks around two sides of the room and provided with ample drawer space and with water, gas, alternating and direct current outlets. High sensitivity galvanometers are mounted on these desks at suitable points along the walls. Provision should also be made for piers in the center of the room to provide supports for tables which are free from vibration.

Lecture rooms should be furnished with projecting lanterns and screen and some method for darkening the room, conveniently operated from the lecture table. Devices may be controlled manually or, preferably, electrically from the lecture table, so that a battery of windows may be darkened at one time. An efficient device uses shutters which, like Venetian blinds, collapse into a pocket out of sight when not in use. Others are of the roller type with light-proof pockets and shades of artificial leather and steel.

The main physics room should be ventilated by a special fan which introduces warm air through the openings in the ceiling, foul air being removed through the floor ducts by a separately controlled exhaust fan. A distilled water plant heated by steam should be located in the attic, connected to a tin-lined copper storage tank with an automatic control to keep the supply constant, and a system of block tin pipe to conduct the water to the laboratories in all parts of the building.

Due to the delicate machinery and the fine measurements taken, this building should be of a heavy type of construction, with great care taken to eliminate vibration and to provide independent foundations for various instruments.

BIOLOGY

A building for biology (zoology and botany) should provide for the following: Department offices, general laboratories with preparation room, large horticultural hall, large physical laboratory, several smaller laboratories, research laboratories, several small rooms for private laboratories for professors, museum, large lecture hall with preparation room, small lecture room, library, drafting room, herbarium, drying and pressing room, fumigating room, constant temperature room, chart room, photographic room, dark room, precision room, stock room, rest room, shop, incinerator room, greenhouses, cold storage room, incubator room, map room, animal room, aquaria, frog tank and abundant space for exhibition cases (often placed in corridors recessed with front flush with corridor wall).

The General Science Building at Antioch College, Antioch, Ohio; Eastman & Budke and Herbert Baumer, Associated Architects. The building has a frame of reinforced concrete and walls of solid masonry, faced with brick. Notice the corridor partitions which carry all the mechanical service lines, and are made in removable panels to facilitate access to pipes and ducts. Notice also that the doors on each floor are located to permit a continuous vertical shaft in each corridor panel. Each room of the building is ventilated by a duct from a plenum chamber located beneath the basement.
This chemistry building was planned for a college of 850 students. Advantage was taken of the sloping site to make a four-story building, although in the illustration above it appears to be only three. The practical considerations are set forth in the accompanying article. Koch Hall, Chemistry Building, Wittenberg College, Ohio. Robert C. Gotwald and Herbert Baumer, Architects, Associated.
THE COLLEGE CHEMISTRY BUILDING

BY

HERBERT BAUMER

PROBABLY one of the most useful ways to treat the subject of the planning, construction and equipment of a building for the study of chemistry is to take an actual example. For this purpose we may take Koch Hall which is occupied by the departments of chemistry and psychology at Wittenberg College, Ohio. A small portion only is devoted to psychology, the building being designed primarily for the teaching of chemistry.

ANALYSIS

When the building was authorized, the regular student body numbered 850. In order to ascertain what facilities the new building should provide for, Dr. R. F. Dunbrook of the department of chemistry made a study of the growth of the college, of its policy toward expansion and of the probable increase in demand for instruction in chemistry. From the results of this study it was decided that the new building should provide for a college enrollment of 1,100 students and that corresponding facilities for the teaching of chemistry should be provided for as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>Number of Students</th>
<th>Total Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshmen</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Qualitative Analysis</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>Quantitative Analysis</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Physical Chemistry</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Industrial Chemistry</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Bio-Chemistry</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

With these requirements as a basis, the program for the new building was then prepared, the intention being to provide all adequate and thoroughly modern facilities for the type and amount of instruction called for, but to avoid highly specialized arrangements for which there would be little need at this college.

SITE

The style in which the building is designed was predetermined in order that it might conform to the style of the newer buildings on the campus.
vided a multiplicity of conduits for live steam, compressed air, vacuum, gas, hydrogen sulphide, distilled water, ducts for the exhaust of fumes, direct storage battery current of any voltage from 2 to 50 volts, direct current of higher voltages, from motor-generators. In this case, the main horizontal distribution system is provided for in a tunnel under the corridor floor of the basement that runs the entire length of the building. Pipes of any length can be taken into or out of it from the area at its south end and it is of sufficient size to allow for inspection and repair. This tunnel also serves as a plenum chamber for the general ventilating system, the ventilating ducts for tempered air opening directly upon it.

LABORATORIES

The exhaust system for fumes from the hoods in the laboratories is also of importance in a chemistry building. In the present case the motors and fans are located in the attic on a concrete slab that forms the ceiling of the corridor on the fourth floor. The hood or hoods in each room have their own individual fan and motor controlled from the hood. The fans and motors are all set on beds of cork to prevent vibration. The hoods are of the open “Cornell” type.

AUDITORIUM

The auditorium is designed to seat 180 students. The program required that the service for this room,—from the preparation room and the museum,—be direct, and this requirement accounts for the arrangement at the north end of the building, as shown in the plans. The inclined floor of the auditorium is taken advantage of in the general chemistry laboratory beneath. Due to the pitch, the west wall of this laboratory from which it receives its light, is much higher than the other basement walls and this has allowed the room to be unusually well lighted in spite of its great depth.

CONSTRUCTION

Fireproof construction is used throughout, the floors being of concrete built with steel pan forms. The walls are of brick and the pitched roofs are covered with graduated slate, the flat roofs being of composition. The windows are steel casements. The trim is of cast stone having the appearance of a buff sandstone. Walls and ceilings are generally plastered (floated sand finish, unpainted) and the color is a rich buff, due to the color of the sand. The stairs are entirely of terrazzo and the corridors have a terrazzo base and border, with buff-colored tile floor. The floors, except in the corridors, are generally of a dark green mastic.

EXHAUST DUCTS

The question of ducts for fume exhaust is important. The most permanent material for this purpose is undoubtedly the special chemical vitreous product. After considerable study it was decided to use, in this building, simply a good grade of vitrified flue lining with butt joints, each joint being thoroughly swabbed with hot asphalt and then wrapped three times with canvas also thoroughly swabbed with hot asphalt as it was applied. One of these conduits thus prepared was tested for leaks by being filled with water for a height of 10 feet and it showed no sign of leakage.

PLUMBING AND DRAINAGE

The best material for the drainage system in a chemistry building is also the special chemical vitreous product but the expense is sometimes prohibitive except for runs that are inaccessible. In Koch Hall the drainage system is made of the ordinary cast iron product except the longer and larger horizontal runs which are made of a special well known corrosion-resisting cast iron. All steam and hot water pipes are insulated, and all cold water pipes which occur overhead in laboratories are also insulated to prevent condensation.

HEATING AND VENTILATING

Direct steam radiation is used throughout. Fresh air is drawn in through the area at the south end of the building, is tempered and forced into the tunnel, as described above. It then passes into ducts leading to various rooms. The Ohio code requires that all rooms have a separate duct system for the exhaust from rooms, exhaust through grilles in doors into the corridors not being permitted in Ohio as in some states. However, in all laboratories having fume hoods, the ducts connecting with these hoods serve also as a means of exhaust for the general ventilating system. Except for the tempering of the air forced throughout the building, there is no air-conditioning system.

The lighting throughout the building is generally by fixtures of the direct-indirect type. There is a vacuum cleaning system, a rubbish chute and special mechanically operated light-proof shutters on the windows of the auditorium. There is a battery switchboard which permits constant voltages in multiples of two volts to be obtained at any or all of the chemical desks at various places in the building. The building was completed in 1927 at a gross cost (not including furnishing) of $170,000, or 38½ cents per cubic foot.
The lecture room of the chemistry building at the University of Richmond; Charles M. Robinson, Architect. Notice the sound-absorbing tile on the ceiling and the type of lighting fixtures near the lecture table.

One of the laboratories in McGregor Hall, Colgate University; Walter B. Chambers, Architect. Notice the gutter in the center of the cabinets, and the location of the hoods. These hoods are individually ventilated by fans, located in the attic and controlled in the laboratory by switches.

SOME INTERIORS OF UNIVERSITY CHEMICAL LABORATORIES
Notice the abundance of natural light; also the individual sinks and laboratory hoods.

Two views of one of the laboratories in the Chemistry Annex at the University of Illinois; James M. White, Architect. The lower one shows the compact arrangement of the various pipe lines and the hood ventilating ducts, and illustrates the successive steps of the equipment installation. The upper picture is of the completed interior.
UNIVERSITY HOUSING PROBLEMS

BY

HAROLD R. SLEEPER
ASSOCIATE OF THE FIRM OF
FREDERICK L. ACKERMAN, ARCHITECT

The interest with which universities are treating the problems of collegiate housing is evidence of the changed aspect of college life and the demand for a wider scope of activity in education. The complete solution of this problem necessitates an appreciation of its history and a thorough understanding of its trends and future possibilities. More is involved than the mere physical housing of students; their spiritual, social and aesthetic development is concerned.

A statement of the problem involves a definite program as to number of students to be housed, areas to be considered for such housing, density of housing, standards of living, sizes of units and types of accommodations.

The goal for such a program should be to provide housing facilities which will offer comfort without ostentation, and which will insure to the student the continuance of a fair standard of living. These facilities must include opportunity for necessary concentration and privacy, for friendly contact with other students when desired, for recreation and for meals. The architect must solve this complicated problem economically, providing a practical efficiency of plan and operation with an atmosphere which will stimulate interest in social relations on the part of the student.

Our standards of living are high. Until a short time ago, however, the differential between the general standard and that of collegiate housing had been large. Comforts, conveniences, sanitary arrangements introduced by the machine age have gradually lessened this variation, and the barren and cheerless cubicle of yesterday is no longer accepted as an adequate home for a human being during the important formative years of his life.

More than that, the entire system of American university life is under question. Experiments, exemplified by the House System recently introduced at Harvard and Yale, indicate the widening scope and increased importance of collegiate housing units. Certain educational and social elements have been introduced; and libraries, common rooms, dining rooms, and recreational facilities are now being housed under the same roof.

The architect's problem includes, therefore, the provision for these things in the light of a thorough appreciation of the social and psychological requirements that are involved.

The practical solution of this problem is concerned with the technical means to fulfill best the requirements of each individual project. No definite rules may be formulated. Existing facilities, available funds, the type of property and its location—all combine to produce a complication of demands.

The following notes are concerned with types of housing now in operation, and may serve as a guide, as a basis for comparison, and as an indication of technical needs for future work.

PLANNING

PRELIMINARY COMPUTATIONS: There are several methods of making computations upon which the preliminary group plans may be based. First, the density per acre must be determined and on this selection rests the size of courts, the length of buildings and their spacing. If land is not readily available, this density calculation may determine the type of building capable of housing the desired number of students.

The following gives four types that will serve as a guide:

Very Dense
Dormitory Type; small courts, as Harkness at Yale 185 men per acre

Dense
Dormitory Type; as Men's Dormitory at Cornell 100 " " "

Spare
Residence Type; larger courts, as Women's Dormitory at Cornell 71 " " "

Very Spare
Dormitory System; large courts, as at Princeton 67 " " "

Crowding limits growth of trees in courts, prevents daylight from reaching certain rooms. The only advantage is a saving in land cost and unless this cost is excessive an allotment of ninety men to the acre is a maximum. An allotment of seventy is preferable.
Plot plans of two large housing groups of the residential type. The one at the right shows the relative locations of the new Harvard Houses, Coolidge, Shepley, Bullfinch & Abbott, Architects. At Harvard the study-and-bedroom unit has been used, with small common rooms and a single large dining hall for each House (see pages 658, 666 and 767). At Cornell, the unit is a study-bedroom, and a living room, reception hall, dining room and kitchen has been provided for groups of approximately 60 students.

Land coverage will vary directly with occupancy since buildings of the residential type cover more area per student than dormitories. The following coverages are typical of certain groups:
- Cornell Men’s Dormitories: 23% coverage
- Smith College, new group: 26% coverage
- Harkness, Yale: 41% coverage

Volume: The general scheme of room arrangement will be directly dependent on the volume allotted to each student. If finances are limited, then small rooms and a compact plan will result in a small cubage per student. If the university policy calls for dining rooms and other public rooms, then the cubage per student rises.

In making preliminary assumptions, cubic feet costs must be set up by means of the current index of general building costs and experience in previous building of similar type. The total costs may be roughly assumed by multiplying the cost per occupant by the number of occupants, using the accompanying table, which has been based on a survey of actual work.

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<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Single Dormitory</td>
<td>$2,200 to $3,000</td>
<td>$250 to $500</td>
<td>$300 to $600</td>
<td>$1,500 to $2,500</td>
</tr>
<tr>
<td>More elaborate type of dormitory</td>
<td>$3,000 to $4,000</td>
<td>$350 to $550</td>
<td>$400 to $600</td>
<td>$2,000 to $3,000</td>
</tr>
<tr>
<td>Residential type</td>
<td>$5,000 to $6,000</td>
<td>$600 to $700</td>
<td>$700 to $900</td>
<td>$3,000 to $4,000</td>
</tr>
<tr>
<td>Fraternity group (estimate only)</td>
<td>$6,000</td>
<td>700 to 800</td>
<td>7,000</td>
<td>4.5</td>
</tr>
</tbody>
</table>

The size of the housing unit will depend upon the size and kind of land available, relative building costs and the type of unit.

Recent buildings show that the trend is to group men in units of from 100 to 200. Women are being grouped into smaller units of from 50 to 100. Below units of 100 to 125 students, cost and cubage are increased.

Types of Units:
Experience has shown that except in small details the provision for both men and women is the same. Both are housed in structures that may be divided into two broad types.

1. Residential Type, or House: This is a comparatively new development in the field of university housing. Though it is relatively expensive to build, it offers obvious advantages of living and social contact to the student. It usually contains the following:
   - (a) Bedrooms and studies or study-bedrooms. (advisable for women)
   - (b) Guest suite and bath.
   - (c) Master’s, tutor’s or matron’s suite.
   - (d) Office (mail, keys, etc.).
   - (e) Social rooms, such as library, living rooms, reception rooms, game room, music room, club or assembly room.
   - (f) Dining facilities such as dining room, serving room, kitchen, store rooms, and other service rooms. One kitchen may serve 2, 3 or even 4 dining rooms.
Morrisey Hall at Notre Dame University, Kervick & Fagan, Architects. The plan of this building is typical of the simple dormitory, the unit being a study-bedroom. The absence of dining halls, common rooms and individual baths or toilets makes for economy

(g) Sport facilities, usually limited to squash courts, handball courts, etc.

(h) Baths and toilets. Women's buildings should contain a lavatory for every two rooms accessible to both and may include kitchenette and laundries in larger suites.

(i) Stairs, halls, entrances and lobbies. Stairs should serve from 10 to 12 rooms, for communication between rooms. Longer halls are more economical; wide halls are wasteful and increase the cubic foot cost. Widening long halls at stairways counteracts an institutional appearance.

2. DORMITORY TYPE: The function of this type is to furnish solely a place for the student to study and sleep. In the characteristic arrangement a stairwell serves from 4 to 8 rooms on a floor, each floor being similar to the others. Some buildings, particularly the early type, have continuous halls joining stairwells at the ends of the building.

Dormitories may house from 20 to 200 as there is no social reason for division of units. Dormitories usually contain the following spaces:

(a) Bedrooms and studies or study-bedrooms.
(b) Baths, toilets, lavatories.
(c) An office for mail and service rooms.
(d) Service rooms.

Dormitories, such as Harkness at Yale, may have living rooms but cannot be classified as residential units.

The acceptance of certain arrangements of halls and rooms will govern the building width and unit length (from stair to stair), though widths are dependent to some extent upon the type of roof. For a sloping roof 36 feet is an average width, though this may increase to 48 feet. (See plans on page 764.)

TYPES OF ROOM ARRANGEMENTS

The general standard of living in a university at the time a project is launched will naturally have much influence on the arrangement and size of rooms selected. The criterion must be set by the standard of American life. A student needs a home and not a cell.

The variety of room arrangements may be summarized as follows (sizes are net without closets, walls, etc.):

<table>
<thead>
<tr>
<th>Types</th>
<th>No. of Students</th>
<th>Large</th>
<th>Medium</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Single study-bedroom</td>
<td>1</td>
<td>180</td>
<td>130</td>
<td>110</td>
</tr>
<tr>
<td>2. Double study-bedroom</td>
<td>2</td>
<td>250</td>
<td>225</td>
<td>200</td>
</tr>
<tr>
<td>3. Triple study-bedroom</td>
<td>3</td>
<td>320</td>
<td>285</td>
<td>260</td>
</tr>
<tr>
<td>4. Bedroom and study</td>
<td>1</td>
<td>Study 170</td>
<td>150</td>
<td>130</td>
</tr>
<tr>
<td>B. R. 100</td>
<td>100</td>
<td>185</td>
<td>165</td>
<td></td>
</tr>
<tr>
<td>5. Bedroom and study</td>
<td>2</td>
<td>Study 200</td>
<td>185</td>
<td>165</td>
</tr>
<tr>
<td>B. R. 160</td>
<td>160</td>
<td>190</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>6. 2 Bedrooms and 1 study</td>
<td>2</td>
<td>B. R.</td>
<td>Same as No. 4</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Same as No. 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. 3 Bedrooms and study</td>
<td>3</td>
<td>Study 220</td>
<td>200</td>
<td>180</td>
</tr>
<tr>
<td>B. R.</td>
<td>Same as No. 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. 1 Bedroom and 2 studies</td>
<td>2</td>
<td>B. R.</td>
<td>Same as No. 4</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Same as No. 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Various types of University housing units now in use. The drawings illustrate what has become common practice in the layout of halls and corridors, stairs, and room combinations, and show approximate widths for different types of existing dormitories.
The small sizes are uncomfortable and larger units should be used if economically possible. Variation in room sizes is advisable, however, as it allows the student the choice of a selection based upon the cost of the room and his habitual standard of living.

Special care should be taken in making room layouts to provide proper locations for beds and desks in respect to light, air and convenience.

The following list indicates sizes that have been used by universities throughout the country.

**Type No. 1.** Single study bedrooms, is very frequently used in women's residential halls; it should be used either with a washroom in the room or adjoining two rooms (see plans on page 766) or with a small bathroom between rooms.*

* The averages as given by Klauder and Wise in their book "College Architecture in America" for this type of room are for men 162 sq. ft. and for women 95 sq. ft.

Tests accordingly, the following have been used:

<table>
<thead>
<tr>
<th>College</th>
<th>Men (Sq. Ft.)</th>
<th>Women (Sq. Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith College, new dormitories</td>
<td>127 1/2</td>
<td>127 1/2</td>
</tr>
<tr>
<td>Wellesley Tower Court</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Connecticut College</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Vassar (smallest)</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>Cornell Univ. (Balch Halls)</td>
<td>131</td>
<td>131</td>
</tr>
</tbody>
</table>

**Men**

- Princeton, Pyne Hall
- Cornell, Balch Halls
- Yale, Harkness
- Dartmouth, Tappan Hall

**Women**

- Smith College, new dormitories
- Wellesley Tower Court
- Connecticut College
- Vassar (smallest)
- Cornell Univ. (Balch Halls)

*The averages as given by Klauder and Wise in their book "College Architecture in America" for this type of room are for men 162 sq. ft. and for women 95 sq. ft.*

As given by Klauder and Wise, the average for women—170 sq. ft.

The average for men, taken from 11 dormitories, is 232 sq. ft.

**Type No. 2.** Double study-bedroom, is not used very frequently.

**Women**

- Cornell, Balch Halls
- Yale, Harkness
- Dartmouth, Tappan Hall

**Men**

- Louisiana State University
- Cornell, Boldt Hall

**Average**

- Men: 82 sq. ft.
- Women: 82 sq. ft.

**Type No. 3.** Triple study: This type is used only where space will not easily subdivide.

**Type No. 4.** Bedroom and study: This type is rather luxurious, but has been used extensively in the new house plan at Harvard. Studies are approximately 12 ft. x 14 ft. (168 sq. ft.) and have fireplace and bath (shower). Bedrooms are approximately 8 ft. x 12 ft. (96 sq. ft.).

**Type No. 5.** Bedroom and study for two persons: For men this is a very common type. Sizes are as follows:

- Princeton Graduate School
  - Study—12 ft. x 16 ft.
  - Bedroom—9 ft. x 12 ft.
- Stanford, Toyon
  - Study—13 ft. x 11 ft.
  - Sleeping porch type
  - 8 ft. x 11 ft.
- Harvard, Holden Hall (double study-bedroom)

Calculations based on data given by Klauder and Wise show averages of net areas for rooms as follows:

- Study (12 men's buildings)...
- Bedroom (13 buildings)...
- Double bedrooms...
- Studies are rarely used separately in women's buildings so no figures are given for such rooms.

The other three types are combinations of the former with the following:

**Single Sleeping Room Areas**

- Yale, Harkness
  - 7 ft. 6 in. x 11 ft. 6 in.
- Harvard, Lionel
  - 7 ft. 6 in. x 10 ft.
- Michigan, Law Courts
  - 7 ft. 6 in. x 10 ft.
- Williams
  - 8 ft. 6 in. x 11 ft. 6 in.
- Princeton, Pyne Hall
  - 7 ft. x 10 ft.
- Dartmouth, Tappan Hall
  - 8 ft. 6 in. x 11 ft. 6 in.
UNIVERSITY HOUSING

AREAS
Large 80 sq.m.
Medium 30 sq.m.
Small 10 sq.m.

MIN. DIMENSIONS
Width 10 ft.
Length 16 ft.
Soiling height 6 ft.

DETAILS OF VARIOUS ROOM ARRANGEMENTS GIVING LIMITING SIZES FROM THE GENERAL UNITS SHOWN ON PAGE 764. IN MANY INSTANCES THE PLANNING OF COLLEGE DORMITORIES BECOMES A PROBLEM SIMILAR IN DETAIL TO THAT OF A RESIDENTIAL, OR APARTMENT HOTEL. PROVISION FOR FURNITURE IS IMPORTANT.


766 THE ARCHITECTURAL FORUM JUNE 1931
The first floor plan of Eliot House at Harvard University; Coolidge, Shepley, Bullfinch & Abbott, Architects. Each of these Houses has a master's house adjoining, with an entrance to the dormitory through the Senior Common Room. The plan of most of the Houses does not include a kitchen, the food being cooked elsewhere, carried through tunnels, and served to the dining room from steam tables located in the serving room.

A plan of Stone-Davis Hall at Wellesley College; Charles Z. Klauder, Architect. The left half is of the first floor, and the right half shows the second floor, the building being symmetrical about the centerline. In effect, the building contains two separate dormitories of the study-bedroom type with a central kitchen serving both units.

TOILET FACILITIES

BATH AND TOILET FIXTURES should be arranged to produce a room of minimum size. Medicine cabinets should be provided. No standards exist regarding the number of students per toilet fixture. The following table, developed from existing plans and other data, will serve as a basis for further investigation. This list should be modified to include private lavatories or baths.

<table>
<thead>
<tr>
<th>Plumbing Fixtures</th>
<th>No. of Occupants</th>
<th>Per Fixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubs</td>
<td>75</td>
<td>10 or 11</td>
</tr>
<tr>
<td>Showers</td>
<td>5 or 6</td>
<td>10 or 11</td>
</tr>
<tr>
<td>Basins</td>
<td>3 to 4</td>
<td>(1 every room) or 3½</td>
</tr>
<tr>
<td>Toilets</td>
<td>5 or 10¹</td>
<td>5 or 6</td>
</tr>
<tr>
<td>Urinals</td>
<td>10¹</td>
<td></td>
</tr>
</tbody>
</table>

Slop Sinks—one to every 3,000 sq. ft. fl. and 1 in each Serving Room; 1 in each kitchen.

¹Use 10 if urinals are included.

CLOSETS should be at least 2 ft. deep, with no provision for trunk storage, which should be located in the basement. Rooms may have built-in trays, thus saving space and one piece of furniture.

WINDOWS

Most college buildings are poorly lighted because of insufficient window area and deep exterior reveals. A high window will provide a greater intensity of usable light than one of the same area placed near the floor. Window heads should be approximately 7 ft. from the floor. Sills should be 2 ft. 8 in. to 3 ft. from the floor for bedrooms. In public spaces this dimension may become 2 ft. 4 in., in which case transoms should be provided.

Window areas are based on a percentage of room floor area which for adequate lighting should be between 10 and 14 per cent, dependent upon orientation and the general location of the building. The criterion should be the amount of window area which in a particular location would give a mean average of at least 8 foot-candles of daylight upon the working plan.
### TABULATION OF RECOMMENDED FINISHES

The schedule of finishes covers the main interior spaces and relative suitability is indicated numerically. Where no number exists, equal suitability is indicated, though differences in locality, variations in standards, costs, etc., may outweigh a consideration of exact requirements.

<table>
<thead>
<tr>
<th>Space</th>
<th>FLOORS</th>
<th>WALLS</th>
<th>CEILINGS</th>
<th>TRIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basement &amp; Serveing Spaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Colored cement</td>
<td>1. None</td>
<td>Rough concrete; Cold water paint</td>
<td>Unplastered except cold water paint</td>
<td>Steel</td>
</tr>
<tr>
<td>2. Plain cement</td>
<td>2. Cement hardener (no paint)</td>
<td>partitions T.C. None for T.C.</td>
<td>Sound insulation for machines</td>
<td>Tile and steel; Enamel or glossy lithophone</td>
</tr>
<tr>
<td>1. Terrazzo</td>
<td>as above</td>
<td>1. Glazed brick</td>
<td>1. Cement or glossy lithophone or enamel</td>
<td>Wood</td>
</tr>
<tr>
<td>2. Mastic; Fin.</td>
<td></td>
<td>2. Hard white brick</td>
<td>2. Sound absorbing blocks or plaster</td>
<td>Wood</td>
</tr>
<tr>
<td>3. Cove, base spaces</td>
<td>Wax or none</td>
<td>Depends on architectural treatment</td>
<td>Depends on architectural treatment</td>
<td>Plaster, etc.</td>
</tr>
<tr>
<td>Kitchen &amp; Serving Rooms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ceramic tile, quarry tile, etc.</td>
<td>None</td>
<td>1. Ceramic tile</td>
<td>None</td>
<td>Tile and steel; Enamel or glossy lithophone</td>
</tr>
<tr>
<td>2. Non-slip terrazzo, cove base</td>
<td>Varnish or lacquer</td>
<td>2. Glazed T.C. blocks</td>
<td>2. Sound absorbing blocks or plaster</td>
<td>Wood</td>
</tr>
<tr>
<td>Dining Room</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cork tile</td>
<td>None</td>
<td>Depends on architectural treatment</td>
<td>Sound absorbing depends on materials used</td>
<td>Wood</td>
</tr>
<tr>
<td>2. Rubber tile</td>
<td>Varnish or lacquer</td>
<td>architectural treatment</td>
<td>architectural treatment</td>
<td>Wood</td>
</tr>
<tr>
<td>3. Wood (oak)</td>
<td>None</td>
<td>1. Wood (oak)</td>
<td>Wood boards</td>
<td>Plaster, etc.</td>
</tr>
<tr>
<td>4. Terrazzo (cateria)</td>
<td>None</td>
<td>1. Wood (oak)</td>
<td>(laid)</td>
<td></td>
</tr>
<tr>
<td>Living Rooms, Library, Lounge, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Cork</td>
<td>2. Special finish</td>
<td>2. Cork</td>
<td>Scenic paper (laid)</td>
<td>Steel</td>
</tr>
<tr>
<td>3. Rubber</td>
<td>Wax</td>
<td>3. Rubber</td>
<td>Wax, etc.</td>
<td>Plaster</td>
</tr>
<tr>
<td>1. Cork</td>
<td>Cork finish; waxed, except cork to have cork finish or may be also waxed</td>
<td>Cork</td>
<td>2. Marble</td>
<td>1. Tile</td>
</tr>
<tr>
<td>3. Linoleum; base wood</td>
<td>Wax or lacquer</td>
<td>3. Magnesite terrazzo</td>
<td>Tile; terrazzo</td>
<td>2. Colored cement</td>
</tr>
<tr>
<td>Bedroom &amp; Study</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ceramic tile</td>
<td>None</td>
<td>1. Tile</td>
<td>None</td>
<td>Tile trimmers</td>
</tr>
<tr>
<td>2. Terrazzo</td>
<td>2. Marble</td>
<td>1. Gustavino vault</td>
<td>None</td>
<td>Steel</td>
</tr>
<tr>
<td>Showers, Gangs or Groups</td>
<td>Use non-slip</td>
<td>3. Magnesite terrazzo</td>
<td>2. Colored cement</td>
<td></td>
</tr>
<tr>
<td>Toilets &amp; Lavatories</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ceramic tile</td>
<td>None</td>
<td>Tile; terrazzo</td>
<td>Painted; gloss</td>
<td>1. Marble</td>
</tr>
<tr>
<td>2. Terrazzo</td>
<td>2. Marble</td>
<td>2. Painted</td>
<td>Lithophone or lead and oil</td>
<td>2. Marble</td>
</tr>
<tr>
<td>Main Stairs</td>
<td>Treads—1. Marble, 1. Precast terrazzo, on steel or reinforced concrete</td>
<td>3. Marble</td>
<td>Painted</td>
<td>1. Marble</td>
</tr>
</tbody>
</table>
### TABULATION OF CONSTRUCTION RECOMMENDATIONS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>NON FIREPROOF</th>
<th>FIRE RESISTING</th>
<th>F.P. EXCEPT ROOF</th>
<th>FIREPROOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundations &amp; Footings</td>
<td>Stone or concrete</td>
<td>Stone or concrete</td>
<td>Concrete</td>
<td>Concrete</td>
</tr>
<tr>
<td>Walls &amp; Their Use</td>
<td>Masonry to carry beams</td>
<td>Masonry to carry beams and slabs</td>
<td>Masonry; self-supporting or skeleton construction</td>
<td>Steel or concrete</td>
</tr>
<tr>
<td>Beams &amp; Girders</td>
<td>Wood</td>
<td>Junior I-beams or bar joists</td>
<td>Reinforced concrete; 1 way long span</td>
<td>Reinforced concrete; 1 way long span</td>
</tr>
<tr>
<td>Floor Slabs</td>
<td>Stud; plaster on metal lath</td>
<td>Solid plaster; T. C. or gypsum block on stairs</td>
<td>Metal or T. C. furring; metal lath</td>
<td>Solid plaster; stair and bath T. C.; large spaces, gypsum block</td>
</tr>
<tr>
<td>Partitions</td>
<td>Metal lath; wood furring</td>
<td>Metal furring and lath</td>
<td>Wood girders, purlins, and planks; finish slate or tile; slow burning</td>
<td>Metal or T. C. furring; metal lath</td>
</tr>
<tr>
<td>Furring &amp; Lathing</td>
<td>Wood frame; finish of asbestos, slate, or tile (no wood finish)</td>
<td>Wood frame; finish of slate or tile</td>
<td>All-steel fireproofed with concrete, gypsum, or T. C.</td>
<td>All-steel fireproofed with concrete, gypsum, or T. C.</td>
</tr>
<tr>
<td>Roofing; Framing Fireproofing &amp; Finish of Roof</td>
<td>Steel girders fireproofed, with gypsum, T. C. or concrete</td>
<td>Steel girders fireproofed, with gypsum, T. C. or concrete</td>
<td>All-steel fireproofed with concrete, gypsum, or T. C.</td>
<td>All-steel fireproofed with concrete, gypsum, or T. C.</td>
</tr>
</tbody>
</table>

**Steel Frame Fireproofing**

**Stair Framing & Well Construction**

**ITEMS USUALLY PENALIZED BY INSURANCE RATING BUREAUS**

For omitting fireproof doors at stairs and for not fireproofing stairs; for omitting fireproofing on any steel girder or beam, even in frame construction. Openings or shafts through floors, unless in masonry wall with fireproof doors, areas over certain limits that are not subdivided by fire walls of brick (12 in.) and fire doors.

**Floor Load Allowance (unless building regulations require more):**

- Dormitory Floor: 40 lbs. per sq. ft.
- Living room floors, commons, halls and corridors: 75 lbs. per sq. ft.
- Storage and service: 75 lbs. per sq. ft.

This standard should pertain on dull days, and means of controlling an excessive daylight intensity should be provided for use on very bright days. This recommendation is based on the supposition that no particular architectural style is being utilized, as it is obvious that the design factor plays an important part in relative window sizes. In any case, window areas should be definitely fixed when the preliminary plan is developed.

The foregoing is based on what should be used rather than on what has been used, and applies to studies or study-bedrooms. The requirements for bedrooms are less by 4 to 6 per cent.

**HALLS AND CORRIDORS**

These should be planned for minimum practical sizes. From 4 ft. 6 in. to 6 ft. should be ample, wider halls implying service to a greater number of rooms from the same entrance or stair.

The following are approximate widths of halls in a few existing buildings. The length of halls is indicated by the number of rooms which they serve without interruption by a fire wall or stairway.

<table>
<thead>
<tr>
<th>Type of Hall</th>
<th>Hall Widths</th>
<th>Approx. 4 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cornell, Baldt</td>
<td>4 ft. 6 in.</td>
<td>2 rooms long</td>
</tr>
<tr>
<td>Princeton, Pyne</td>
<td>4 ft. 8 in.</td>
<td>3 rooms long</td>
</tr>
<tr>
<td>Stanford, Toyon</td>
<td>6 ft. 8 in.</td>
<td>7 rooms long</td>
</tr>
<tr>
<td>University of Chicago</td>
<td>5 ft.</td>
<td>6 rooms long</td>
</tr>
<tr>
<td>Michigan, Martha Cook</td>
<td>7 ft.</td>
<td>very long</td>
</tr>
</tbody>
</table>

**DINING ROOMS**

**Spacing Requirements:** If the residence type of house is adopted, small tables seating from 6 to 10 students should be used, with a small allow-
ance of 13 to 15 sq. ft. per person. If long tables are used this allotment may be reduced to 10 or 12 sq. ft. with 10 sq. ft. as a minimum.

SEATING: The average area, from a survey of existing dining rooms, is just under 13 sq. ft. per person. The type and size of table is a factor in the definite determination of space allotments. The following give capacities for round, square and rectangular tables.

<table>
<thead>
<tr>
<th>Round Tables</th>
<th>Area Per Person Dia.</th>
<th>5 at table</th>
<th>6 at table</th>
<th>7 at table</th>
<th>8 at table</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>at Edge 22 in.</td>
<td>22 in.</td>
<td>22 in.</td>
<td>22 in.</td>
<td>22 in.</td>
</tr>
<tr>
<td></td>
<td>Dia. 35 in.</td>
<td>35 in.</td>
<td>35 in.</td>
<td>35 in.</td>
<td>35 in.</td>
</tr>
<tr>
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Use 22 in. allowance at edge for service dining tables only.

Square Tables:

| J x 3 ft. table seats 4 persons | Allowance for Chairs: Allow 16 in. for chairs from edge of table and 2 ft. 6 in. behind chairs for aisle. |
| 4 x 4 ft. table seats 8 persons |

Rectangular Tables:

| Service—width 2 ft. 4 in. and 2 ft. 6 in. |
| Student—width 2 ft. 8 in. and 2 ft. 10 in. |

Allow 2 ft. o.c. for each person.

If ends are used, spacing remains the same for calculations, but actual area occupied will be slightly more. Thus in 8 ft. tables will take eight people in either method of seating.

Use 22 in. allowance at edge for service dining tables only.

Dining rooms, if seating 100, should be a story and a half or two stories high to assure proper ventilation. Dining rooms seating about 50 to 75 may be 11 to 12 ft. high if acoustically treated.

KITCHENS AND DEPENDENCIES

The use of student help and arrangements for their meals influence the plan of development of both the main dining rooms and service areas. The minimum allowance per person should be made in all service dining rooms. Kitchen areas, including all dependent services, occupy nearly as much area as the dining room, though certain spaces may be isolated from the general services and sometimes may be placed on another floor. These include receiving room, food and general storage, refrigerators, vegetable storage and preparation, garbage room, helps' room and toilets, spoiled linen and sewing rooms, and laundry.

The dependencies that should be located near the kitchen are: dietitian's office, serving rooms, service refrigerator, helps' dining room, dishwashing room. Butcher shop may be either with this group or with the former and should contain its own refrigerating facilities.

EQUIPMENT: Each problem is peculiar to itself and should be solved by determining with the college authorities and a consulting specialist upon a definite method of operation, the items of equipment to be used, etc. Much of this should be done with sketch plans so that details of construction can be developed accordingly.

Non-corrosive metal should be used for all sheetmetal parts of equipment, except that certain kitchen sinks may be of heavy galvanized iron. In very large kitchens special attention should be paid to the pan in front of the soup kettle. Heavy steel of some type should be used.

All service spaces should have the extruding corners of walls protected with steel angles to approximately 7 ft. above floor.

OTHER SERVICES

The garbage room should be adjacent to the service entrance with a separate outside entrance. Walls should be glazed brick or glazed machine-made terra cotta. If finances are very limited cement plaster may be used. This space should be ventilated and is sometimes cooled with brine coils so as to render the garbage odorless. Ashes should have a hoist to the service yard and this yard should be carefully screened from view.

MECHANICAL REQUIREMENTS

HEAT AND VENTILATION: Automatic heat regulation in public spaces, either by automatic radiator or room control, is advisable.

Kitchens may be located above grade and hence present ventilating problems not often found in the usual restaurant. An efficient ventilating system is necessary and all steam tables, bain-maries, dishwashers, ranges, broilers and cookers, should be fitted with hoods and pans with duct connections. Hoods may be of non-corrosive metal or of tile held by metal channels and angles. The lower edge of all hoods should contain a trough to catch condensation.

SANITATION AND PLUMBING: The best type of grease trap should be installed in all kitchens. Kitchen waste lines should always be connected with sanitary sewers; and leaders with storm sewers to avoid solidification of kitchen grease in the pipes. Cleanouts must be provided at all bends and at the bottom of all waste stacks. Use over-size house drains in women's dormitories.

Pipe shafts are not necessary as the risers take off as needed from the service lines which are carried in a system of concrete trenches. Trenches should have 6 ft. minimum head room and pipes should be spaced to facilitate repair. Lights and frequent manholes should be installed; and the trenches should be vented with louvres and areas. Fire lines and built-in hose cabinets should be provided in every stairwell. Underwriters require at least fifty feet of hose. Siamese connections should be installed where outside Fire Department is within calling distance.
THE COLLEGE UNION

BY

IRVING K. POND

THE term College Union has two connotations. It refers in the first place to an organization directing the operations of various extra-curricula bodies in the social life of the college; and in the second to a building which shall house the activities of such an organization. The activities included in the scope of the Union are such as minister broadly to the social and communal life of the college and are not concerned with such narrow or specialized groups as the fraternities, the student Christian associations, the church guilds, and the individual clubs of one sort or another.

Every man’s Union has to be planned to accommodate women; and every women’s League must be planned in reference to the accommodation of men. In a man’s building the very minimum of accommodation for women may quite properly be provided; while in a woman’s building the maximum of accommodations must be provided for men. For men will gather in clubs and enjoy themselves without the presence of women, while women, especially college girls, find their enjoyment greatly enhanced by the presence of men or boys. There are psychological as well as sociological problems to be considered in planning a college social center.

Though the college Union, in order to increase its revenues and, in certain cases, its popularity, may see fit to cater to outsiders, yet the outsider’s interest must be regarded as secondary. The needs of the student body are of prime importance. However, there is another class whose interests must not be ignored. There is the body of alumni who, though away, are still an integral factor in the college equation; the equation—at least the Union equation—cannot, except in rare instances, be solved without them.

ANALYSIS OF THE PROBLEM

It will be no easy task for a Union board contemplating the erection of a new building to formulate its program; to reconcile conflicting interests and justly apportion the space;—keeping in mind meanwhile the economic problem. It is no easy task to say just what space shall be income producing and just what shall be devoted to the amenities; just what shall be devoted to character building and what to filling the till. Here, at the outset, if the Union committee is wise it will seek the services of an architect; not one entirely ignorant of the sciences of psychology, of sociology, of economics; one versed in the art of living.
In giving advice on all these various items, which are but a fraction of those to be encountered, the architect will be keeping in mind the purse strings; for he will not in any probability have unlimited means at his disposal. The ground area, the vertical dimensions, the number of features which can be accommodated, the size of the various units—all these, and more of deepest import to the architect, depend upon the limited sum which the purse generally holds. How can that sum be spent to the best advantage?

As there are no hard and fast formulae for planning a college Union, no absolute standards of size, as the analysis is first qualitative and then quantitative, how shall one proceed when the problem is presented for solution? The course has been indicated in what has already been said. Begin the study at the fountain head which is the traditional idealism and spirit of the college to be ministered to. Study other college Unions, perhaps; but not as abstract affairs detached from the compelling factors of their environment. No one can really understand a plan who does not know the conditions which have produced it.

**PLAN FACTORS**

There follows an incomplete list of the physical factors which may (all) or must (some) enter into the makeup of a college Union building. These factors are not set down in order of importance, for each has about the same relative importance as any of the others in a perfectly complete and unified whole; but the list is made in about the order in which a casual inspection of the building would tend to reveal them. They are: the lobbies; offices; check and toilet rooms; lounges; the cafeteria, the food shop, main dining room and committee dining rooms; assembly room; kitchens; food preparation; serving rooms; china and table linen storage; library; billiard room; game rooms; bowling alleys; bath, plunge and locker rooms; barber shop; beauty parlor; rest room; quiet room; secluded rooms with kitchenettes; sleeping rooms; linen rooms; help's quarters. The theatre; stage and dressing rooms; theatre and stage craft workshops; music and drama club and study rooms. And others. And still others. And then the mechanical plant—with lighting, heating and plumbing branches; re-
frigoration; hot and cold water; pumps; water softeners; air conditioning rooms; filter and fan rooms. The items in this list are susceptible of division and subdivision—almost *ad infinitum.*

**LOBBIES**

Let us assume that the Union building under consideration serves a good sized group of colleges called a University; one which enthusiastically supports its teams and has a faculty and equipment sufficient to make the town attractive to scientific and cultural bodies in convention. These factors will affect the size and location of the lobbies, the chief of which must be on the main floor of easy access from broad walks and driveways. In the main lobby (convenient to the office counter with cashier, information desk and telephone operator, convenient also to check and toilet rooms), the various groups commingle, and later separate, each to proceed to its own special lobby upon which dining and committee rooms give. Special lobbies will be on each floor, with separate retiring rooms for men and women. Where the women most naturally do congregate a rest room is supplied with cubicles containing each a couch or day bed. This room may for reasons of economy be placed adjacent to a minor woman's toilet and retiring room. (So it is the University of Michigan League.)

**OFFICES**

As to offices: two sets and generally three are to be provided. The first suite of general and private offices will be for the management of the building; the third, closely related to the kitchen, having to do with employing and paying help, is sometimes located near the service entrance, sometimes connected with the business office. In office suite number two is carried on all the business of the organization which gives the building its name—offices for the president of the Union, the departmental vice-presidents, the committee men who have the handling of the multifarious and perplexing activities of the organization. A private office or two, and a large general office with space for numerous desks at and about each of which a group may sit in conference, must be provided. This office suite should be upon the main floor if possible and made readily accessible and attractive to the student body.

**LOUNGES AND DINING ROOMS**

In a coeducational Union there should be one ample lounge for men only, one for women only, and an ample concourse immediately adjacent in which the sexes may commingle. From this concourse it will be well to plan to reach easily the main dining room, in which both sexes may be served. This dining room, too, if not on the main floor, should be reached directly from the main floor so that guests who are not members, but who are privileged on special occasions to dine in the Union, need not intrude upon the space naturally devoted to the membership.

Every room in a Union building which is not dedicated to some especial use, and even if it is, should be in easy communication with the kitchen so that meals may be served therein. The societies
and committees and organizations which wish to be entertained in a Union are innumerable, and at times each will require "banquet" or dinner service. While it is not to be recommended, yet economically it is often necessary to have rooms in series, separated by folding partitions so that they may be thrown together to accommodate various sized parties. Aesthetics and acoustics vote against this arrangement, economy votes for it—economy of structure, that is; and too often economy wins!

The cafeteria may be located in the basement; but wherever located it must be easily accessible from the street or principal approach. In size it will take all the space one can give. As a rule it should adjoin the main kitchen and should be attractive in color and outlook and as quiet and restful as acoustical material can make it. The cafeteria generally contains the ice cream and soft drink bar. The quantitative equipment of the bar has not as yet been satisfactorily solved. Too large a bar is a dead loss on ordinary days. Too small a bar is an aggravation on days of peak load and sometimes on dance nights.

**ASSEMBLY ROOM**

The next important room to discuss is the assembly room. Like the bar it never can be made the right size to suit all occasions. It is only upon occasion, and rare at that, that a very large assembly room is needed in a Union building. It is better to overcrowd at times than to have a sense of vacancy pervading most of the time. When great space is in demand for special dances or banquets (the latter is rare) armories or gymnasium floors may furnish it.

**LIBRARY**

The library is a feature in certain Unions. These rooms generally are memorials, and when such should be endowed sufficiently to cover the salary of a librarian and an assistant, and the purchase of new books. Some studying is done in the Union between classes, but, as the specialized libraries of the college furnish study space and all opportunities for consultation, the Union should cater only to the best of light reading. Therefore the shelf space need not be very extensive. A beautiful quiet room with a modicum of shelving is all that would seem necessary.

**THEATRE**

The theatre of the Union presents a most interesting problem. Of the necessity of a separate entrance as well as of a foyer and retiring rooms we have spoken. There should be a ticket lobby of ample size with a two-windowed office, one window for current and one for advance sales. The check room may well be off this lobby. As to capacity—two hundred and fifty seats would be a minimum; seven hundred or so probably a maximum. The maximum would require the presence of a balcony. The Michigan League theatre seats seven hundred. Its orchestra pit is
Purdue Memorial Union Memorial Hall looking toward the entrance

deep so that the musicians are not in evidence. The pit contains a piano and an organ console. At the back of the balcony is a well planned and equipped projection booth with two machines and openings for spot lights. There is communication with the stage. Concealed flood lights in the ceiling of the auditorium are controlled from the stage switch board as are all house and stage lights. On the League stage is a sky dome flooded with colored light from a trough on the stage. All the atmospheric effects possible may be produced on this stage. The parabolic sky dome extends to the gridiron which is thirty-six feet from the stage. Below stage are two tiers of dressing rooms, one tier on each side. Between the tiers of dressing rooms and reaching to the underside of the stage is a work room where scenery and props may be constructed and taken to the stage through a triple trap operated from a large elevator platform. A paint bridge is on the stage left and a paint room below the orchestra pit. Under the auditorium floor are the manager’s office and club rooms, all accessible to the stage, where chorus can dress and wardrobes be manufactured. Chamber music and picture shows, as well as amateur and professional plays and dance programs, have been successfully presented on this stage and in this house which is considered a model. Up to the underside of the balcony and to the top of the balcony rail the room is wainscoted in wide oak panels of rich brown stain. Above the rail line is sand finish lime plaster.

KITCHENS

Now we come to a very important—perhaps the most important—practical feature, the kitchens. In designing a kitchen and its accompaniments the progress of the food must be traced from the preparation rooms in the basement up through the main and subsidiary kitchens and serving rooms to the topmost floor on which food is served. The course must be followed from the refrigerator to the range, the broiler, the kettles, onto the dishes, onto the carts and trays to the tables. Then the dishes must be followed from the tables to the trays, carts, elevators, dumb waiters (make them big), the subveyors, to the washing machine and back to the cupboard shelves—or to the dish warmers in the respective kitchens. Plot the course, locating in succession the necessary fixtures, making everything ample for the peak load, and give the diagram or plot with instructions to the kitchen equipment experts. Compare their offerings, replot and write the final specifications. There will probably be supplemental kitchens with considerable cooking and warming equipment and dish storage on each floor.
GAME ROOMS

For uses other than those indicated above are the bowling alleys, billiard and game rooms. Bowling alleys sometimes are deemed to take up considerable space in proportion to the income they afford. This depends on the local attitude toward the sport. Games are played in the concourses and newspaper reading rooms which adjoin the lobby. Writing tables are provided in these spaces. The billiard room is generally popular and provides considerable income. The number depends upon the size and character of the student population. The Michigan Union has twenty-five tables in a room with a floor area of about seventy-five hundred square feet. There are raised seats for spectators of exhibition games. There should be ample toilet facilities immediately adjoining the billiard room. Lights should be strong, but devoid of glare.

On each floor of any Union or League building install conveniently located retiring and toilet rooms for both sexes. One for men should be in close proximity to the barber shop; one for women in conjunction with the beauty "parlors." Fully and attractively equipped barber shop and beauty parlor are absolutely necessary features; and drinking fountains should be installed near them and at other strategic points in the building. Telephone booths should be liberally provided, the greater number convenient to the main lobby. Outlets should make it possible to augment the number at times of peak load, and an instrument should be installed in each bedroom.

BEDROOMS

Every sleeping room should be provided with a bathroom in which is a shower or tub and frequently both, especially in a women's building. In
the private bathrooms should be a full complement of fixtures; and there should be a public toilet room off the alumni lobby. The sleeping rooms need not be large but should be of varying sizes for one or two beds and should be light and airy. These rooms may be made good income producers—and the Union will need all the income it can get. Cement floors smoothly laid are appropriate for these rooms. Upon the floor a carpet may be spread, not tacked, covering about the entire area. These rooms, if above the second story, must be served by passenger and freight elevators. In fact, elevators must be installed to serve the club rooms; for students dread to walk up one flight of stairs. It is well to have rooms set aside for visiting teams with ample showers and toilet rooms. These quarters ought to be planned with a separate entrance.

SERVICE ROOMS

The help must be provided with shower, toilet, locker, and rest rooms and cafeteria; for professional help and student help separately. Receiving rooms for food supplies, root cellar and storage rooms for canned goods and unpacking and storage rooms for china and linen, and storage for wheeled cars or tables are of prime necessity; while the cold storage for meats, fish and perishables must be readily accessible to preparation rooms and kitchens. No hard and fast rule as to capacities can be laid down but it were well to make them ample.

MATERIALS AND EQUIPMENT

What of the materials of the interior? Kitchen floors of baked clay, storage room floors smooth, treated cement; walls in both cases some vitreous clay product; ceilings plaster painted. For the cafeteria, acoustical ceilings and walls; on the latter Zenitherm has been used successfully for color and design, while the same material has been used for floors in club and committee rooms where rugs are used for decoration. In smaller club rooms where especial attractiveness is desired oak in herringbone pattern laid in mastic is used. In women's lounges floors are of random width walnut laid on an under floor, as already noted, and wainscoted richly in the same wood. In men's lounges, as in lobbies and concourses, floor with honed Ridgeway flag in fairly large units, with borders of rose brick or colored tile for contrast; wainscot in oak or walnut to harmonize with the rest of the scheme. Neighboring buildings and local conditions will determine the materials to be used on the exterior if the designer cares to have his building in harmony with the rest.

It will be well at this point to be a bit specific as to the assembly room,—a room with so many different purposes to serve. The large dances are held in the assembly room and so the floor is of high importance. One of the best, all things considered, is a floor of narrow (one and three-eighths) maple, side and end matched, in fairly short lengths laid parallel to side and end walls, the side and end pieces meeting at ninety degrees with a butted rather than a mitered joint. The maple may be laid on a diagonally laid under floor on sleepers (as in the Michigan League) or nailed to a porous concrete (as in the Michigan Union); or, as is not infrequently the case, laid in mastic. A canvas covering should be provided from the first to protect the floor when the room is in use for banquets, when the room is set up for concerts or lectures, or when large receptions are in progress. The lighting fixtures in this room should be equipped with dimmers and be provided with colored lamps. Music and speaking are heard so frequently in an assembly room that

The cafeteria of the Women's League Building, University of Michigan. The floor is of rubber tile, and the walls have a Zenitherm wainscot with plaster above. The ceiling is acoustically treated.
The Assembly Room in the Women's League Building. The ceiling and upper portions of the walls are of float finish, lime mortar plaster. The wainscot is quartered oak, stained a rich brown, wiped out and treated with gray filler. The floor is of maple, which should be covered with canvas when the room is to be used for banquets.

The acoustics should be carefully considered. This room, as indeed all the larger rooms of the Union building, can be effectively ventilated by introduced fresh air warmed to seventy degrees Fahrenheit and exhausting it at the floor. Thermostatically controlled radiation near the floor will supply heat. This same method may be employed to good advantage in the theatre and in the larger lounges. In low rooms there should be deflecting surfaces if the air is introduced in the ceiling. To have the air blown down from the ceiling upon one's head is uncomfortable and sometimes dangerous.

There should be an ample lobby or foyer connected with the assembly room, and retiring and toilet rooms for men and women. This same applies to the theatre; and while both of these rooms should be reached from the main portion of the building through controlled passageways, each should have its own separate carriage entrance which will permit direct access from the outside—precluding, thus, the necessity of an outsider entering from the building. Cloak rooms must, of course, be conveniently located in each case. The theatre and assembly room cannot be combined with good effect in any Union which pretends to serve the fullest need. Dances, plays, banquets, musicales, receptions, etc., must conflict many times a week to the absolute obliteration of one if all must depend upon the use of one room. This doubling of the functions of an important room has proven so generally unsuccessful as hardly to be debatable.

Space does not serve to deal in detail with the mechanical plant. Generally the Union is considered by the authorities as a college building and steam and hot and cold water are brought to the walls. Inside the problem is that of any first class club house. In any event water should be analyzed and pipe used which will best stand the wear.

As to construction: where the building is not more than five stories in height load bearing walls may be used to good effect. Reinforced concrete will serve well for posts, girders and floor systems. The joist and pan construction is very adaptable. If the ceiling below the roof construction is well fireproofed the steel of the roof may safely be left unprotected while the slate or other roofing may be laid on gypsum or on a wood sheathing one and three-fourths inches thick.
BUILDINGS FOR INDOOR ATHLETICS

A practical compilation of the modern trends in planning, design and construction of buildings for collegiate athletics, including paragraphs on the arrangement of elements which will permit the utmost flexibility of use, and on the requirements of the various facilities together with data sheets and details.

BY

DANIEL BOYDE CATHCART

The prime requisite in the solution of the planning problem of a gymnasium is a thorough appreciation of its functions. This implies a knowledge of the size and tendencies of a student body, the scope of particular needs, and the importance of intra-mural activities. The elements of cost make necessary, within a minimum area and volume, provision for a diversity of activities to attract the maximum of students. To prevent premature obsolescence, such a building must offer the utmost flexibility of use; plan arrangement which will adequately provide for the present facilities is not sufficient. The building must be designed to function under other conditions and must be easily adaptable to changes in requirements, methods of operation, and management. Finally, the building should allow, as far as possible, all the benefits of exercise in the open air.

The large athletic building usually contains most of the facilities which are incorporated in a field house or in a natatorium. The gymnasium of average size will contain: the main gymnasium floor, swimming pool, locker rooms, shower rooms, offices, examination rooms, lecture rooms, separate exercise and activity units and services.

MAIN GYMNASIUM FLOOR

Area: Provision for all or part of the following should be made: basketball courts, calisthenics classes, apparatus facilities, bleacher space, visitors' gallery, running track, dance floor, banquet facilities and possibly a stage. Basketball court dimensions determine the area and shape of the room. The exhibition court should be laid out longitudinally, the ideal dimensions for official play being 48 feet by 84 feet. This area, plus the required free space around the court, will allow three practice courts of minimum size (35 feet by 60 feet) to be laid out side by side across the floor. The need for adequate natural ventilation in the lower part of the room, and the excessive cost of dampproofing sub-grade construction in most locations, point to a first or second floor location. The problem of exterior design and the necessity, in most cases, for top light, are best met by placing the main gymnasium room in a wing by itself.

Circulation. Spectator and player traffic should be separated, and the former diverted from the playing area. To eliminate confusion between sets of players, the basketball practice courts should have separate entrances; all other doors should be located near the corners of the room. This arrangement gives the uninterrupted wall space necessary for the installation of equipment and for the most convenient arrangement of bleachers.

Stairs and main exits should be kept out of the room. To prevent congestion, the stair runs should be at right angles to the line of exit, offset from the doorway. When spectators are to be accommodated and admission charged, the means of ingress should be controlled.

Running Track. Running tracks are not desirable in the main gymnasium room. They are expensive, interfere with the lighting and reduce the clear area of the floor.

Seating Facilities. Spectators' balconies are of little use unless the gymnasium is large enough to allow an uninterrupted sightline from the topmost row of seats to the nearest edge of the exhibition court. If installed, the underside should be from ten to twelve feet from the floor to allow the installation of apparatus, and lighting units beneath them should be recessed flush with the soffit to prevent glare in the players' eyes. Spectators' galleries at the floor level have been substituted for the balcony in many cases, but these reduce the wall space required for apparatus. Portable bleachers are advantageous, at least for the smaller gymnasium, as they are economical to erect and allow the greatest amount of clear playing area when not in use.
Gymnasium room in the Physical Education Building, University of Southern California. Note the lighting fixtures recessed flush with the ceiling. This type of gymnasium, equipped with a stage, could well be used as an auditorium in a small college.

Main Gymnasium Room, Pomerene Hall, Ohio State University, Columbus, Ohio. The advantages of the skylighted, open ceiling type room are noted in the text. The exposed rafters in this ceiling are effective in the reduction of excessive reverberation common to the gymnasium.

Basketball Arena in the Men's College, University of Rochester, Rochester, New York. Permanent seating facilities located near the floor allow an uninterrupted view of the playing area. Basket standards for practice courts are swung out of the way.
Maximum and minimum basketball court dimensions and official floor markings. The size and shape of the basketball court determines, in most cases, that of the main gymnasium room.

DIRECTOR'S ROOM. Most gymnasiums provide an office for the director from which he may have an unrestricted view of the main gymnasium floor when seated at his desk.

FINISH MATERIALS

Floors. Long strips of hard maple, ¾ to 1½ inches wide, machine sanded, are generally used with felt or waterproof paper between the upper and under floors. Wood blocks laid on end are also used for flooring and have found favor among many. Boiling raw linseed oil, or a combination of boiled linseed oil, turpentine and Japan drier, or one of the special gym floor finishes is recommended for finishing the floor. Varnish should be avoided.

Walls. Walls should be of solid masonry construction with their lower portions smooth enough to prevent injury. Glazed brick, or a wooden wainscot mounted on heavy stringers bolted to the wall may be used. A 2 by 4 angle iron makes an excellent base for protection against movable equipment. An apparatus strip of wood, 8 inches wide, bolted to the wall, is necessary and should extend all around the room. Projections of any kind in the main gymnasium room are to be avoided. Folding doors, canvas curtains or nets having a canvas strip about 4½ feet wide along the bottom are used to separate playing areas.

Ceilings. Ceilings should reflect light and absorb sound. Open ceilings with exposed trusses or beams are preferred unless the room is to be used as an auditorium. The bottom chords of trusses should be at least from 18 to 22 feet above the floor.

LIGHTING

Natural Light. An evenly lighted playing area requires overhead lighting. Side light in a room where players are moving rapidly is not entirely satisfactory. Skylights should be of the monitor or saw-tooth type or of glass blocks set in mastic. The heating and ventilating system must be designed to overcome the down draft of cold air from them in the winter. Provision must be made to prevent condensation water from dropping to the floor. If there are no skylights, the architectural idioms of the exterior should not be allowed to determine the quantity of side light. Mechanically operated sash of the factory type tend to keep out rain and may be opened and closed easily without moving the protecting wire guards. Windows less than 6 feet from the floor interfere with the apparatus strip, require extra-heavy wire guards and allow glare. On the other hand, high windows reduce natural ventilation at the level where it is most needed (about 4 feet from the floor).

Artificial Lighting. Fixtures should be located near the ceiling and between, not on, beams or trusses, and should be so placed that shadow and glare are eliminated. They should be protected by wire guards fixed to the ceiling rather than to the reflector.

HEATING AND VENTILATION

The proper temperature of the room is 60 degrees during exercises or games and up to 65 degrees for other purposes. Radiators or combination heating and ventilating units (unit heaters) recessed in the wall and covered with wire guards are recommended. Steam pipes should never be exposed, even if insulated, as harsh treatment will soon tear the covering off. Hot air, washed and recirculated, is also used.

Natural ventilation is excellent provided the air is kept in motion at the 4-foot level, but this is difficult unless auxiliary ventilation is installed.
The natatorium in the new Indoor Athletic Building at Harvard University. The large pool is of the constant-depth type. In the foreground may be seen the division between the deep pool and the smaller. The shallow one is used for instruction. Plans of the Indoor Athletic Building are shown below.
The "Double Spoon" type pool, recommended when the length exceeds 60 feet. The plan and section indicate the proper lane and turn markings. The detail is for steel shell construction, having thin, light walls.

ACOUSTICS

The unpleasant reverberating qualities of most main gymnasium rooms make it advisable to use some form of acoustic treatment. Felt between upper and under floors, and sound-absorbing wallboard, tile or plaster on walls or ceiling are means of reducing noise.

SWIMMING POOLS

Very few of the recently constructed gymnasium buildings fail to include one or more swimming pools. The size and shape of the pool is determined generally by cost, but 75 feet is the recommended length and 30 or 36 feet the width. A 60-foot pool is also standard. The "double spoon" type illustrated is considered the best by some authorities for a pool over 60 feet long. However, some recently constructed college buildings have pools of the flat bottom type about 8 feet deep for competition with additional shallow pools for instruction. The volume of a graded depth pool is less than that of the flat bottom type and therefore is more economical, easier to clean and requires less water heating.

The side walls should be kept about 12 feet away from the pool edge to allow space for instruction. Fifteen feet is recommended from the springboard end of the pool to the wall, and not less than 6 feet for the walkway at the opposite end. The best location for permanent seats is at one or both sides of the pool with the first row at the floor level, as a better view is obtained and the air temperature is more comfortable than in the over-heated upper portions of the room. Splash walls of masonry at least 3 feet high should be provided in front of the first row of seats.

POOL CONSTRUCTION.

Floor and walls may be of heavy concrete with membrane and integral waterproofing, or may consist of a welded steel plate outer shell, gunite on galvanized wire lath, tile bedding and the finish tile. An inspection corridor completely around the structural walls of the pool is a necessary feature.

Light-colored tile or glazed brick is the accepted lining material, non-slip tile being used for the floor. Distance, depth, turning and lane markings should be of tile of a contrasting color. Provision should be made during construction for the installation of equipment by placing brass sockets or inserts in the floor and walls. All exposed metal must be such that it will not deteriorate or stain the pool walls. Ladders should be of the recessed or built-in type. Walkways must be of non-slip material.

WALLS AND CEILINGS. Tile or glazed brick are the most widely used materials, but above splash height various sound-deadening materials may well be applied. Pressed cork has been used advantageously for this purpose. The walls of the room should be free of obstructions. Ceilings should be of acoustical material,—plaster, cork or acoustic tile may be used. Unless sound-deadening materials are applied, the echoing will be highly objectionable.

HEATING, LIGHTING, VENTILATING. Swimming pool rooms are kept at a temperature of 70 to 80 degrees. Steam, recirculated hot air, or the combination unit system are all equally good. The pool may be located in the basement but it must have abundant natural light and ventilation. Minimum window or skylight area equal to one-half of the room area is a good basis for calculation. All ventilation should be arranged to eliminate drafts.
The court sizes and floor markings given on this sheet were obtained from current guide books published by the Spalding Company. Owing to changes made from time to time by officials, it is well to check all sizes before laying out courts. Squash Racquets court dimensions, not shown here, have been changed recently from 17 by 32½ feet to 18½ by 32 feet.

Indirect or semi-indirect lighting fixtures produce the best results and should be accessible from the floor. Underwater lighting is also effective and useful.

WATER FILTRATION, STERILIZATION, AND HEATING. Filtration through the pressure type filter is generally preferred for the college or university pool. Chlorine in solution or as a gas, introduced through the proper apparatus, is one of the methods used for sterilization. The ultra-
violet ray process is also recommended. The water heater should be designed to heat all or part of the circulation water and should be provided with ample surface for heat interchange. It should also be equipped with automatic thermal control.

Sanitation and Drainage. Outlets of sufficient capacity to drain the pool in four hours or less should be installed. The floor outlet openings should be four times the area of their discharge pipes to reduce suction currents. Scum gutters necessary only on the side walls should be of the type which does not permit matter entering them to be washed out by a sudden surge of water and should have drainage outlets not more than 10 feet on center. Drainage of the floor around the pool should be toward the walls and the water carried off through a narrow gutter.

Locker and Shower Rooms for Men

The area required for lockers will be governed by the system used, which may be either the "permanent" or the "tote box" arrangement. Required area per locker and required area per student during the period at which the locker room is most used are also factors. The following formula, applicable to the permanent system, considers both of these factors, and is accurate enough to be used as a working basis:

\[
\text{Size of largest class that may be accommodated} = \frac{\text{Required area per locker} \times \text{No. of lockers}}{8 \text{ sq. ft. (minimum allowance per locker)}} \times \frac{\text{Size of largest number of showers needed}}{32 \text{ sq. ft. (minimum allowance per shower)}}
\]

Example: 
\[
\frac{32 \text{ sq. ft. (minimum allowance per student)}}{8 \text{ sq. ft. x 200}} = 50 \text{ students per class}
\]

The tote-box system permits approximately double the number of persons to be accommodated in the same area but is not as widely used as the permanent system as yet, due to necessity for increased handling of clothes.

Approximately 10½ feet is the minimum ceiling height for locker rooms or 12 feet if the room is lighted from above. Centrally located locker rooms placed on the swimming pool floor level between the swimming pool and the main gymnasium room are the most efficient. Long, fairly narrow rooms with windows between the rows of lockers are advised. Among the many objections to the use of one large locker room are lack of control, appearance and proper ventilation. Fixed lockers may be installed as indicated in the illustration. Lockers built up on concrete bases 4 inches high eliminate dirt pockets beneath them and allow the corridors to be easily cleaned. Benches of the fixed type are recommended.

Materials. Floors may be finished with non-slip tile, cork or linoleum or treated cement. Cork flooring, next to tile, is the most favored.

Walls should be of light-colored tile or brick of the hard-burned variety which does not crumble or shed particles of dust or sand. Steam pipes, ducts, etc., should be concealed.

Ceilings should be furred and plastered where there are many exposed pipes; otherwise the underside of the concrete slab painted a light color, will serve. A ceiling material which will not disintegrate because of shock should be selected, especially if the room is located beneath the main gymnasium floor.

Windows should be near the ceiling and of a type which will insure privacy. They should be glazed with obscure glass with the rough side out for easy washing.

A temperature of 70 degrees is usually maintained in locker rooms. Radiators should be high on the wall or recessed and screened. Positive ventilation must be provided. Ventilation of the lockers themselves is the most important phase of air-conditioning in these rooms. Many layouts provide steam pipes or hot air supply ducts under or between the backs of lockers with exhaust ducts directly above them to dry clothing and to remove foul air.

Shower Rooms. One shower head for every three to five men of the largest class using the shower room is recommended. Twenty-five square feet per shower head multiplied by the number of showers needed will give the required area of the room. The shower room height is variable but the proper shower head location is at shoulder height. Valves of the mixer variety are most favored and controls should be 4 feet above the floor, accessible without reaching through the water streams.

Shower rooms used in connection with a pool should be immediately adjacent to it with access possible only through a foot bath. Traffic from the pool should be through foot bath, shower room and toweling room to the locker room, and traffic to the pool should be the same but in reverse order, for reasons of sanitation in the swimming pool and to keep the locker room floor clean and dry.

Materials and Construction. Tile is replacing concrete for the shower room floor. Mosaic, granolithic, terrazzo or non-slip tile may be used but small units in either floor or wall are the best as they reduce the possibility of trouble-making voids occurring behind them. Drainage should be from the center of the floor to narrow drain troughs at the walls. Pipes should not be laid in this floor.

Glazed brick or tile is the material generally used for walls. No piping should be exposed in the shower rooms and all pipe should be non-rusting.
Boxing room in the Sports Forum, recently constructed at Charlottenburg, Germany

A well planned shower room

Ceilings slightly arched to drain condensation to the side walls are recommended and should be of waterproof materials. Ordinary plaster will absorb water and permit disintegration of the lath. Tile is the recommended material but a mixture of soapstone and plaster will serve.

Windows and doors must be of non-rusting metal surfaces. Obscure glass is necessary for privacy and all hardware should be of bronze or other rustproof metal. Natural light is not necessary in the shower room. Artificial lighting systems must be waterproof and lamps should be equipped with vaporproof housings. Radiators of rustproof material, preferably brass, should be placed out of reach. Exhaust ducts should be provided to remove steam which would otherwise drift out into the locker room.

LOCKER AND SHOWER ROOMS FOR WOMEN

Women are usually provided with individual dressing rooms. Various systems have been devised which combine two or four dressing rooms with one shower. The present trend, however, is toward the locker system as used by the men, with additional dressing rooms provided without showers. The combination of dressing rooms and showers is held in disfavor by many physical directors as it allows steam to circulate through the locker rooms. The tote-box locker system generally used in connection with this arrangement is also unsatisfactory because of too much waste movement between locker and dressing room. If the dressing room system is used, the same provision for wet and dry circulation must be made as was outlined for the men’s lockers and showers.

Additional locker and shower rooms will probably be required for: home team, visiting team, visiting officials, corrective class, and faculty.

SEPARATE EXERCISE AND ACTIVITY UNITS

HANDBALL COURTS. The standard four wall court is 20 feet wide, 40 feet long and 18 to 20 feet high. One court of this type for each one hundred students is not too many and most institutions mark off additional single wall courts wherever wall conditions permit.

Floors should be constructed of wood as in the main gymnasium. Walls of solid masonry with a smooth cement plaster finish or of wood are equally good. Flush finished doors with flush hardwood are the only type that should be considered. Lighting must come from overhead and fixtures must be arranged to illuminate the court evenly. They should be fitted with flat wire guards.

Heat, if necessary, should enter through heavy metal grilles located near the floor on the side or back walls. Ventilation grilles should be in the ceiling. All ducts must be kept out of the room and grilles kept flush with wall surfaces.
Ellison

Interior of Yost Field House, University of Michigan, Smith, Hinchman & Grylls, Architects. This field house is 165 feet wide and 345 feet long. Daylight is admitted through the roof by the use of interlocking cement and glass tile.

SQUASH COURTS. Standard squash tennis court dimensions are 17 feet x 32½ feet x 16 feet in height and squash racquets courts are 18½ feet x 32 feet x 16 feet in height. The games are rapidly gaining in popularity and as many courts as possible should be provided. Walls of horizontal wood strips are best. The floor may be of maple but wood blocks on end are used extensively, as evidenced by the fact that twenty-one squash courts in the new dormitory buildings at Harvard University are floored with this material.

MISCELLANEOUS FACILITIES

These include: corrective exercise rooms, small gymnasium, faculty gymnasium, boxing rooms, wrestling room, fencing room. The area for the first three rooms may be computed on the minimum basis of 50 square feet per person, and the latter should allow approximately 200 square feet per person. The construction and design of these rooms will be practically the same as that recommended for the main gymnasium room.

Other rooms to be considered are: office, examination room, lecture room, ladies’ room, conference room, reception room, trophy room and library.

Services include: stock room, trainer’s room, janitor’s room, bleacher storage, drying room, apparatus storage, machine and repair room and laundry.

FIELD HOUSE MATERIALS AND CONSTRUCTION

The floor or playing area of a field house differs from that of a gymnasium in that it is of earth instead of wood. A mixture of clay, sand and sawdust has been found to be one of the best flooring materials. The clay gives firmness of footing and the sand and sawdust keep the surface from becoming too hard. A floor of this type must be periodically raked, dragged, sprinkled and rolled to keep it in condition. An occasional light application of sawdust will be effective in keeping the surface moist and free from dust. Many of the larger field houses are equipped with portable basketball floors which are built in sections and only set up for match and practice games during the playing season.

If provision is to be made for an ice rink, the floor will, of necessity, be of concrete with steel taking the place of stone in the aggregate. Pipes for refrigeration should be laid perpendicular to the long side of the rink and alternate pipes should be supplied with refrigerant from opposite sides of the room. The most important feature of piping for this purpose is to maintain equal runs and distribution from the refrigerant source.

With the exception of these features and the engineering problems indigenous to buildings having wide roof spans, the data on gymnasium buildings will, in almost every case, be applicable to the facilities listed for a field house.
### Tabulation of Athletic Activities as a Basis for Gymnasium Design

#### Facilities and Their Requirements

<table>
<thead>
<tr>
<th>Facility</th>
<th>Area and Volume</th>
<th>Maintenance</th>
<th>Side or Top</th>
<th>Temperature</th>
<th>Ventilation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calisthenics</td>
<td>60x63x20</td>
<td>500</td>
<td>102000</td>
<td>175000</td>
<td>55 Nat.</td>
</tr>
<tr>
<td>Apparatus</td>
<td>50x75x20</td>
<td>3750</td>
<td>75000</td>
<td>125000</td>
<td>55 Nat.</td>
</tr>
<tr>
<td>Rowing Machines</td>
<td>30x60x20</td>
<td>3000</td>
<td>60000</td>
<td>85000</td>
<td>55 Nat.</td>
</tr>
<tr>
<td>Rowing Tank</td>
<td>50x60x20</td>
<td>3000</td>
<td>60000</td>
<td>100000</td>
<td>55 Nat.</td>
</tr>
<tr>
<td>Two Valley Ball Courts</td>
<td>30x60x20</td>
<td>3000</td>
<td>60000</td>
<td>85000</td>
<td>Top</td>
</tr>
<tr>
<td>Five Basketball Courts</td>
<td>45x75x22</td>
<td>16875</td>
<td>370000</td>
<td>530000</td>
<td>Top</td>
</tr>
<tr>
<td>One Basketball Spectator Gallery (500 Cap.)</td>
<td>3570</td>
<td>70000</td>
<td>100000</td>
<td>Nat. and Mech.</td>
<td></td>
</tr>
<tr>
<td>Six Handball Courts</td>
<td>30x60x20</td>
<td>2700</td>
<td>140000</td>
<td>190000</td>
<td>Top</td>
</tr>
<tr>
<td>Six Handball Courts</td>
<td>15x30x15</td>
<td>2250</td>
<td>41000</td>
<td>55000</td>
<td>Top</td>
</tr>
<tr>
<td>Pole Vaulting, Pole Jumping, etc.</td>
<td>3 strips</td>
<td>3940</td>
<td>119000</td>
<td>150000</td>
<td>Top and Side</td>
</tr>
<tr>
<td>Tennis, Indoor Soccer, Hockey</td>
<td>50x60x25</td>
<td>26000</td>
<td>150000</td>
<td>225000</td>
<td>Top</td>
</tr>
<tr>
<td>One Tennis Spectator Gallery (500 Cap.)</td>
<td>2500</td>
<td>90000</td>
<td>110000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fencing</td>
<td>40x45x15</td>
<td>1800</td>
<td>27000</td>
<td>40000</td>
<td>Top</td>
</tr>
<tr>
<td>Wrestling</td>
<td>30x60x20</td>
<td>2400</td>
<td>48000</td>
<td>66000</td>
<td>Top</td>
</tr>
<tr>
<td>Boxing</td>
<td>40x60x15</td>
<td>2000</td>
<td>40000</td>
<td>45000</td>
<td>Top</td>
</tr>
<tr>
<td>Swimming Pool</td>
<td>35x75</td>
<td>3500</td>
<td>200000</td>
<td>300000</td>
<td>Top and Side</td>
</tr>
<tr>
<td>Swimming Pool Spectator Gallery (Cap. 1500)</td>
<td>10600</td>
<td>260000</td>
<td>300000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrective Gymnasium</td>
<td>30x40x20</td>
<td>1200</td>
<td>24000</td>
<td>32000</td>
<td>Top</td>
</tr>
<tr>
<td>Indoor Golf</td>
<td>20x20x15</td>
<td>400</td>
<td>6000</td>
<td>80000</td>
<td>Top</td>
</tr>
<tr>
<td>Lecture Room</td>
<td>35x40x15</td>
<td>1400</td>
<td>21000</td>
<td>40000</td>
<td>Top</td>
</tr>
<tr>
<td>Medical Examination Room</td>
<td>60x60x15</td>
<td>23400</td>
<td>300000</td>
<td></td>
<td>Top</td>
</tr>
<tr>
<td>Faculty Gymnasium</td>
<td>45x75x20</td>
<td>3375</td>
<td>68000</td>
<td>90000</td>
<td>Top</td>
</tr>
<tr>
<td>Three Thousand Lockers</td>
<td>16x100</td>
<td>16000</td>
<td>260000</td>
<td>275000</td>
<td>Top</td>
</tr>
<tr>
<td>200 Faculty Lockers</td>
<td>28x30</td>
<td>1400</td>
<td>17500</td>
<td>22000</td>
<td>Top</td>
</tr>
<tr>
<td>Sixty Showers</td>
<td>40x50</td>
<td>2000</td>
<td>35000</td>
<td>45000</td>
<td>Top</td>
</tr>
<tr>
<td>Indoor Track 12 to 16 laps</td>
<td>10x60x15</td>
<td>2000</td>
<td>35000</td>
<td>45000</td>
<td>Top</td>
</tr>
</tbody>
</table>

#### Use and Efficiency of Facilities

<table>
<thead>
<tr>
<th>Use</th>
<th>Days Per Week</th>
<th>Hours Per Day</th>
<th>Area Per Player</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>1000</td>
<td>500</td>
<td>50</td>
</tr>
<tr>
<td>Class</td>
<td>500</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Game</td>
<td>2000</td>
<td>100</td>
<td>200000</td>
</tr>
<tr>
<td>Game</td>
<td>2000</td>
<td>200000</td>
<td></td>
</tr>
</tbody>
</table>

**Editor's Note:**

This tabulation as well as the explanation on the following page has been adapted from a list of athletic facilities compiled by Frederick L. Ackerman, Architect, in studies for Cornell University, and published by The Society of Directors of Physical Education in Colleges.
EXPLANATION OF THE TABLE ON THE OPPOSITE PAGE

Facilities. The facilities noted in the table on the opposite page include practically all of the requisites for a gymnasium building.

Total Use. Figures under this head represent the agreed-upon assumption as to the maximum number of students that would use a given element or group of elements during the term.

Daily Use. Figures represent the agreed-upon assumption as to the maximum number of students that would utilize a given element or group of elements daily.

Number of Periods. Figures represent the agreed-upon assumption as to the daily "turnover" or the number of times an element or group of elements would be utilized by different groups for classes, games or play.

Number per Period. Figures represent the assumed number of students that would utilize a given element or ONE unit of a group of elements in class, game or casual play.

Length of Period. Self-explanatory.

Hours. The graphical indication under this head indicates an assumption as to the varying intensity of use during the hours of a day. A detailed study of this aspect of the problem would yield accurate information as to (a) the number of showers, and hence the amount of water required, and (b) the number of lockers necessary in case a tote-box system is used. The number of showers and the number of lockers of a tote-box system are functions of the peak load on gymnasium and fields; they have no direct relation to the enrollment or total number utilizing these features during the year.

Spectators. Spectators' galleries where required in connection with an element, are shown as an area without physical relation to the element served by it. Generally a gallery serves one element of a group. For example: there are six squash courts required; one is served by a gallery seating two hundred.

Natural Lighting. The adequate lighting, both natural and artificial, of the various spaces constitutes an extremely important element of the problem. To state the problem of natural lighting in broad terms, we have:

(a) Certain activities, that is to say, certain rooms, require top lighting. In some cases a maximum sky zone is required. In other cases the sky zone should be definitely limited, the glass set within definite limiting angles with respect to the horizontal, and the glazed area of roof so placed with reference to the floor area as to provide maximum luminosity near a definite wall or portion of the room.

(b) Certain activities, that is to say, certain rooms, are equally well served with light source from top, sides and, in a few cases, from the end of rooms. Under this latter group some activities require high, side or end light. With a few, adequate illumination without special direction as to source is all that is needed.

Temperature. Figures indicate the average temperature required.

Heating and Ventilation. (a) Natural ventilation is far more economical than mechanical in point of first cost and cost of operation. The values involved in a structure of this character are of a necessity large.

(b) The adequate natural ventilation of rooms of the shape, area and volume under consideration requires the provision of windows in the two side walls. Such windows should be reasonably near the floor; but they may be much smaller in area than those which would serve for lighting.

(c) Certain rooms, by reason of the nature of occupancy, must be mechanically ventilated. For example: shower rooms, spectators' galleries, rooms which require solid wall areas for games.

From the above it follows that that type plan in which corridors serve rooms upon either side must be eliminated from consideration wherever natural ventilation is to be used. Obviously, the entrance to such rooms must be secured by a corridor system so arranged as not to cut off cross circulation of air.

Net Area. Figures represent net area required. In the case of calisthenics, for example, the area is a function of the size of class. In the case of games it is "regulation." The height noted is the height required in the games. In other cases it is assumed and is therefore subject to some modification. Any modification that might be made would not materially affect the total volume.

Net Volume. See the above. The figures represent "interior" or room volumes.

Gross Volume. Figures in this column represent broad assumptions as to the additional volumes required for enclosing walls, floor and roofs. The allowance range from 33 per cent to 60 per cent of the net volumes according to span, etc. In addition to these allowances for structural features, further allowances are noted later to cover halls, stairs, etc., together with foundations.

Efficiency. Under this head and self-explanatory subhead the figures indicate the relative efficiency of the several elements in serving the student body under the assumptions already made as to use. The relation between "efficiency per game" and "efficiency per day" indicates the "turnover" of use. They thus serve to check the assumption, for example, as to the number of basketball courts to be provided and the number of students assumed to use the courts daily.
WORKING DETAILS FOR GYMNASIUMS

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SOME will come in on the crest of the wave and many will not. If you wish to ride the business upcurve, you're going to need men—experienced executives for your organization; technical men, engineers, research and production men. Never was there a better time than now to engage good men. The past months have made available surprisingly well-qualified executives, engineers and technicians who, in normal times, would never be found.

The National Engineering Societies and the A.T.A.E stand ready to help solve your manpower problems.

When you are in need of industrial and technical executives, professional engineers, or technicians—communicate with—Engineering Societies Employment Service: New York Office—Walter V. Brown, Manager, 31 West 39th Street; Chicago Office—A. Krauser, Manager, 205 West Wacker Drive; San Francisco Office—Newton D. Cook, Manager, Room 715, 77 Post Street.

Should your requirements be for business or trade executives, write:—American Trade Association Executives, 45 East 17th Street, New York, N. Y.

This service is the contribution of these professional organizations to Industry.
IN SEVERE HOSPITAL SERVICE

Solid Nickel Silver plumbing fixtures

"LOOK BETTER LONGER"

Read carefully this letter from the Gallinger Municipal Hospital and you'll discover why many institutions prefer Solid Nickel Silver plumbing fixtures. Being a tough, white Nickel alloy...solid clear through...they “look better longer” under severe service conditions.

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Gallinger Municipal Hospital, Washington, D. C.

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Miners, refiners and rollers of Nickel...sole producers of Monel Metal.
ANOTHER SOUTHERN HOTEL THINKS OF GUESTS’ COMFORT AND CHOOSES WESTCO TURBINE PUMPS

KIMBALL Straight-Line-Drive ELEVATOR MACHINES

Whether You Build on Main or Broadway . . . Investigate

A machine of simplicity and compactness, these Kimball Straight-Line-Drive Machines are powerful—noiseless and vibrationless.

Made with motor and machine aligned and bolted together as one integral unit there can be no misalignment of units—or improper meshing of gears—all wearing points are housed and run in oil.

There is a Kimball Elevator Machine made for your requirements. Write for information.

KIMBALL BROS. CO.
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Westco Turbine Pumps for Booster Service and Brine Circulation

EVEN hotel manager knows how much a generous, lively supply of water means to the discriminating guest. ** The Hotel Jefferson Davis is WESTCO equipped throughout. These pumps unfailingly circulate an abundance of fresh water even when all of the rooms are occupied. Westco Turbine Pumps are also employed for circulating brine in the refrigerating system of this fine, modern hotel. ** Trouble-free performance, economy and wide operating range have proven Westco to be the ideal pump for booster service and brine circulation in tall buildings.

** The satisfaction of so many users coupled with an ever-increasing demand for Westco Turbine Pumps indicates that a fast-growing majority find Westco to represent the ultimate in small pump values. Write for complete descriptive and performance data.

WESTCO TURBINE PUMPS

HEAVY STARTING DUTY
For High Inertia or Friction Loads

Where heavy-starting-duty conditions must be met—as in large refrigerating machines, compressors, plunger pumps, etc.—the high static torque of Century Type SCH Double Squirrel Cage Motors often makes it possible to use a motor of smaller horse-power of this type in place of a higher rated normal torque single squirrel cage motor... An additional economy results from their use because, when thrown directly across the line, they draw about 10% less current than the corresponding normal torque single squirrel cage motors. Hence, within N. E. L. A. starting current rules, 30 horse-power and smaller sizes may be used without current-limiting starting equipment.

Century Squirrel Cage Motors are built in standard sizes from 1/4 to 250 horse-power.

CENTURY ELECTRIC COMPANY
1806 PINE STREET • ST. LOUIS, MO.
40 U. S. and Canadian Stock Points and More Than 75 Outside Thereof
BLOXONEND
A BETTER FLOORING FOR GYMNASIUMS, SCHOOL SHOPS, HAND BALL AND SQUASH COURTS, PLAYROOMS


BLOXONEND
IS SMOOTH, HANDSOME, DURABLE, RESILIENT AND SAFE—NO SPLINTERS

East Side High School, Paterson, N. J. Shops floored with 6,400 square feet of Bloxonend. Fanning & Shaw, Architects.

BLOXONEND
IS MANUFACTURED, SOLD, LAID AND GUARANTEED BY ONE ORGANIZATION

Bloxonend is furnished in 8 ft. flooring lengths 2½ inches thick. The end grain fibres form its surface eliminating the hazard of splinters. It lays smooth with tight joints. Can be made as resilient as required. No rigid cementing to subfloor.

Nearly two million square feet of Bloxonend have been installed in many of the finest educational institutions in America. It is specified in this service by most all prominent school architects. Write for architectural specification and sample.

CARTER
BLOXONEND FLOORING
COMPANY
KANSAS CITY, MISSOURI—“IN SWEETS”

BLOXONEND
Lay's Smooth FLOORING Saves Smooth.

Swift as Light

The switch is the only moving, wearing part on a panelboard. ® Switches are sturdy, positive and last. Extremely simple, they have no tiny parts to weaken under strain. They give service day after day, year after year, unfailingly.

This great measure of quality is duplicated in every part of ® Panelboards. They last as long as the building where they are installed and are popularly known as "The Sign of a Better Job."

The ® man will give ready and able help in all panelboard and switchboard problems. Send for the ® Catalog.

Frank Adam
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Atlanta, Ga., L. A. Crow.
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The switch is the only moving, wearing part on a panelboard. ® Switches are sturdy, positive and last. Extremely simple, they have no tiny parts to weaken under strain. They give service day after day, year after year, unfailingly.

This great measure of quality is duplicated in every part of ® Panelboards. They last as long as the building where they are installed and are popularly known as "The Sign of a Better Job."

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The powerful, dependable vacuum created by the Spencer Motor-driven Vacuum Producer located in the basement, removes all dust and dirt so quietly and conveniently that most of the cleaning can be accomplished during the day.

The Spencer System used for cleaning boiler tubes often saves the cost of the installation the first year.

Special equipment for cleaning swimming pools is also available.

Special data available to Architects

Mention the type of building and we will send complete information.

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HARTFORD, CONNECTICUT CENTRAL CLEANING SYSTEMS REPRESENTATIVES IN 50 CITIES
It’s surprising what a difference a HAMLIN Sound-Proof Door Makes

**NOISE on this SIDE**

**ODORS**

**DUST**

**MOTHS**

**AND DRAFTS CANNOT PASS THROUGH**

Have you received your copy of

PUBLIC BUILDING PROJECTS

Locating and defining an expenditure of more than one billion dollars to be made for new public building construction planned in the year 1931?

Included in it is a chapter on SALES PROCEDURE as it relates to Federal, State, County, and City Projects.

_A copy will be mailed to interested architects and sales and advertising executives free upon request._

THE ARCHITECTURAL FORUM
521 Fifth Avenue, New York City
Question: What are some of the factors of economy and convenience in the institutional laundry layout?

Answer:

As in all laundries, the equipment should be so placed that the soiled work will enter at one end of the imaginary flow line and leave finished at the other—without backtracking. Therefore, the problem of delivery to the laundry, the dispatch in handling and the resultant economy are important.

Chutes from one or more well chosen locations on each floor, delivering their loads to the correct point in the laundry plant, are recommended. Even where an upper floor houses the equipment, and the service elevator does not have access to the proper starting point, it may still carry the loads above the laundry floor so that sloping chutes or conveyors may transfer them laterally by gravity. These should be lined smoothly, of fire-proof construction, free from harboring disease germs—with top-hinged, fire-proof, self-latching doors.

The chutes must be generous.

Two feet square, or more, to avoid jamming. Where not vertical, the slope should not exceed 40° to vertical. The terminal should be a long uncovered curve.

Close coupling between the boiler and engine rooms and the laundry, ample hot and cold water, and drainage arrangement are factors of efficient operation. Level and capacity of sewer must be known. Space should be provided for a heat exchanger to save the BTU in the hot waste waters. If the sewer level is too high for the washroom floor, the exchanger may pump-feed the hot wastes sufficiently high to drain properly into the sewer.

This problem of economies, of which the above is but a brief discussion, is one on which the Troy Advisory Service can render valuable assistance.

Consult Troy for this aid. There's no obligation.

TROY LAUNDRY MACHINERY CO., INC.

TROY LAUNDRY MACHINERY

SINCE 1879... THE WORLD'S PIONEER. MANUFACTURER OF LAUNDRY MACHINERY

Troy-equipped Laundry, Essex Country Isolation Hospital, Belleville, N. J.
WHERE crises call for surgical skill and...

LIGHT

WHEN the crisis arrives in a critical case... a delicate operation is being performed... light is a vital necessity. So, to guard against lightless intervals handicapping surgeons and doctors, Westinghouse Nofuze panelboards were installed in Christ Hospital, Cincinnati.

If an abnormal overload opens the circuit, the nearest attendant can restore service promptly and safely. It is not necessary to wait for an electrician to replace a fuse—a mere flip of the handle and the circuit is closed. Further, even in the dark, the opened circuit control can be easily found—the breaker handle is mid-way between "on" and "off".

Prompt restoration of service is important, too, in office buildings or factories, where lightless intervals mean lost production and lost production spells higher overhead and smaller profits. Keep lightless intervals to the minimum in duration and frequency by specifying Westinghouse Nofuze panelboards for every type of building.

Service, prompt and efficient, by a coast-to-coast chain of well-equipped shops

Westinghouse

TUNE IN THE WESTINGHOUSE PROGRAM OVER KDKA, KYW, WBZ AND ASSOCIATED N. B. C. STATIONS SUNDAY EVENINGS.
Selected List of Manufacturers’ Publications

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

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

ACOUSTICS
R. Guastavino Co., 40 Court Street, Boston.

MANUFACTURES (AKOULTOLITH Tile and AKOULTOLITH Platers) and Timbrel Arch Construction. Brochures, 14 pages, 8½ x 11 ins. Illustrated.

ASH HOISTS
Gillis & Geoghagan, Inc., 544 West Broadway, New York.
G & G Telescopic Hoist catalog, 8½ x 11 A. I. A. Standard Classification 301, contains complete descriptions, method of selecting correct model to fit the building’s needs, sized drawings showing space requirements and specifications.

ARCHITECTURAL BRONZE AND IRON
The Kawneer Company, Niles, Mich.
4-page folder, 8½ x 11 ins. A. I. A. File No, featuring Ornamental Bronze and Iron. This folder is included in Catalog Portfolio “N” which contains 4-page folders featuring Store Fronts, Doors, Windows, Architectural Bronze and Iron and Architectural Metal Mouldings.

ARCHITECTURAL METAL MOULDINGS
The Kawneer Company, Niles, Mich.
Large Sheet folded to 8½ x 11 ins, featuring various Mouldings. This sheet is included in Catalog Portfolio “N” which contains 4-page folders featuring Store Fronts, Doors, Windows, Architectural Bronze and Iron and Architectural Metal Mouldings.

ASH HOISTS—TELESCOPIC
Gillis & Geoghagan, Inc., 544 West Broadway, New York.
G & G Telescopic Hoist catalog, 8½ x 11 A. I. A. Standard Classification 301, contains complete descriptions, method of selecting correct model to fit the building’s needs, sized drawings showing space requirements and specifications.

BRICK
General Catalog, 16 pp., 8½ x 11 ins. Illustrated. Bradford Red. Folder, 8 pp., 3 x 8 ins. Illustrated.

CABINET WORK
Henry Kleis & Co., 25 Grand Street, Elmhurst, L. I., N. Y.

CARPETS
Collins & Aikman Corporation, 25 Madison Ave., New York, N. Y.

CEMENT
Louisville Cement Co., 215 Guthrie St., Louisville, Ky.

Portland Cement Association, Chicago, Ill.

Concrete Masonry Construction. Booklet, 48 pp., 8½ x 11 ins. Illustrated. Deals with various forms of construction.

CEMENT—Continued

DAMPPROOFING
Minwax Company, Inc., 11 West 43d St., New York.
Complete Index of all Minwax Products. Folder, 6 pp., 8½ x 11 ins. Illustrated. Complete description and detailed specifications.

DOORS
The Kawneer Company, Niles, Mich.
4-page folder, 8½ x 11 ins. A. I. A. File No. featuring Metal Doors. This folder is included in Catalog Portfolio "N" which contains 4-page folders featuring Store Fronts, Doors, Windows, Architectural Bronze and Iron and Architectural Metal Mouldings.

J. G. Wilson Corporation, 11 East 38th St., New York City, N. Y.
A 72-page catalog on Rolling Steel Doors and Shutters, including specifications, dimensions and other data including illustrations of installations and drawings.

Two catalogs on Sectional Doors Operating Overhead, contain complete information, including photographs, details, specifications and an outline of their many uses.

DOORS AND TRIM, METAL
The American Brass Company, Waterbury, Conn.
Ancona Architectural Bronze Extruded Shapes. Brochure, 180 pp., 8½ x 11 ins. Illustrating and describing more than 2,000 standard bronze shapes of cornices, jamb casings, mouldings, etc.

William Bayley Co., 147 North Street, Springfield, Ohio.
Bayley Tubular Steel Doors. Brochure, 16 pp., 8½ x 11 ins. Illustrated.

Kalman Steel Company, Chicago, Ill.
Kalman Steel Company, Chicago, Ill.
Finishing Door Openings. A.I.A. file holder with 20 loose-leaf sheets of details and specifications.

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

Truscon Steel Company, Youngstown, Ohio.
Copper Alloy Steel Doors. Catalog 110. Booklet, 48 pp., 8½ x 11 ins. Illustrated.

DOORS—SHOWER BATH
The Kawneer Company, Niles, Mich.
Folder 8½ x 11 ins. A. I. A. File No. featuring our Welded Shower Stall Doors. This folder is included in Catalog Portfolio “N” which contains 4-page folders featuring Store Fronts, Doors, Windows, Architectural Bronze and Iron and Architectural Metal Mouldings.

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

DRAINAGE FITTINGS

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

Name ........................................ Business ...........................................
Address ...........................................
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 107

ELECTRICAL EQUIPMENT

Bryant Electric Co., Bridgeport, Conn.
Catalog No. 30. Complete catalog of wiring devices 894 x 1094 ins. 132 pp.
An Electrical Specification. Contains information and data useful in connection with the writing of electrical specifications. Illus.
trated. 8½ x 11 ins. 11 pp.
The Bryant Home of Ideas. Contains data and suggestions useful in connection with residence wiring 8½ x 11 ins. 16 pp.
"KeNEX" and "HouNEX" Bulletin No. 5129. Contains data and specifications pertaining to devices for use in connection with the hanging of lighting fixtures, making such fixtures portable or removable, solided joints being eliminated. 8½ x 10 ins. 6 pp.
The Electric Stowage Battery Co., Philadelphia.

General Electric Co., Merchandise Dept., Bridgeport, Conn.
The House of a Hundred Comforts. Booklet, 40 pp., 8½ x 10½ ins. Illustrated. Dwells on importance of adequate wiring.

Ward Leonard Electric Co., Mt. Vernon, N. Y.
Mobile Color Lighting. Booklet, 12 pp., 8½ x 11 ins. Illustrated. A publication important to architects and engineers.

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, 12 pp., 8½ x 11 ins. Illustrated. Deals with an important detail of elevator mechanism.
Modern Electrical Equipment for Buildings. 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 7229.”

Beauty; Power; Silence; Westinghouse Fans. (Dealer Catalog 43.) Brochure, 16 pp., 8½ x 11 ins. Illustrated. Valuable information on fans and their uses.
Westinghouse Commercial Cooking Equipment (Catalog 280). Booklet, 32 pp., 8½ x 11 ins. Illustrated. Equipment for cooking on a large scale.

Electrical 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 leaflet, 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 leaflet, 8½ x 11 ins. Illustrated. Full details of machines, motors and controllers for these types.

REQUEST FOR CATALOGS

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

108 THE • ARCHITECTURAL • FORUM • JUNE • 1931
AND IN THE GOLDEN TRIANGLE

... 42 buildings are Jennings-equipped

Among the many buildings in the City of Pittsburgh which are served by Jennings Pumps, 42 are located in the Golden Triangle section.

Here, as elsewhere, the advanced design, and the trustworthy performance of Jennings Vacuum Heating Pumps, Jennings Centrifugal Pumps, Jennings Sump Pumps and Jennings Sewage Pumps make them the first choice of architects, engineers and building owners.

NASH ENGINEERING COMPANY
12 WILSON ROAD • • SOUTH NORWALK, CONN.

Jennings Pumps
FURNITURE
American Seating Co., 14 E. Jackson Blvd., Chicago, Ill.
Kittinger Co., 1853 Elmwood Ave., Buffalo, N. Y.
Kittinger Club & Hotel Furniture. Booklet, 20 pp., 8¼ x 9½ ins. Illustrated. Deals with line of furniture for hotels, clubs, institutions, schools, etc.

GREENHOUSES
William H. Lutton Company, 267 Kearney Ave., Jersey City, N. J.

HARDWARE
P. F. & F. Corbin, New Britain, Conn.
Early English and Colonial Hardware. Brochure, 8½ x 11 ins. An important illustrated work on this type of hardware.
Colonial and Early English Hardware. Booklet, 48 pp., 8½ x 11 ins. Illustrated. Data on hardware for houses in these styles.
Corbin Door Closers, 8½ x 11 ins. A description of the principles of design and performance of Corbin door closers.
Automatic Exit Fixtures, 8½ x 11 ins. A catalog of hardware for exit and entrance doors to auditoriums.
Cutter Mail Chute Company, Rochester, N. Y.
Cutter Mail Chute Model F. Booklet, 4 x 9¼ ins., 8 pp. Illustrated.
Richards-Wilcox Mfg. Co., Aurora, III.
Distinctive Elevator Door Hardware. Booklet, 96 pp., 10½ x 16 ins. Illustrated.
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 ins. Hardware intended for garage use.
Famous Homes of New England. Series of folders on old homes and hardware in style of each.

HEATING EQUIPMENT
American Blower Co., 604 Russell St., Detroit, Mich.
Heating and Ventilating Utilities. A blender containing a large number of valuable publications, each 8½ x 11 ins., on these important subjects.
American Radiator Company, The, 40 West 40th St., N. Y. C.
Ideal Boilers for Oil Burning. Catalog, 8½ x 11½ ins., 36 pp. Illustrated. Describes a central all-on-one-floor heating plant with radiators for small residences, stores, and offices.
How Shall I Heat My Home? Brochure, 16 pp., 8½ x 11½ ins. Illustrated. Full data on heating and hot water supply.
In-Airid, the Invisible Air Valve. Folder, 8 pp., 3½ x 6 ins. Illustrated. Data on a valuable detail of heating.
The 999 ARCO Packless Radiator Valve. Folder, 8 pp., 3½ x 6 ins. Illustrated.

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

HEATING EQUIPMENT—Continued
James B. Clow & Sons, 534 S. Franklin St., Chicago, Ill.
D.G.C. Trap & Valve Co., 1 East 45st., New York, N. Y.
Cryer Radiator Control Valve. Brochure, 8½ x 11 ins., 12 pp. Illustrated. Explains operation and advantages of this radiator control valve on two-pipe vapor, vacuum or gravity steam systems.
C. A. Dunham Company, 40 East Ohio St., Chicago, Ill.
Dunham Return Heating System. Bulletin 109, 8 x 11 ins. Illustrated. Covers the use of heating apparatus of this kind.
Dunham Built Dwyer Unit Heaters. Booklet, 31 pp., 8½ x 11 ins. Illustrated.
Type M Dunham-Built Dwyer Unit Heaters. Bulletin No. 400, 8½ x 11 ins., 6 pp. Illustrated. Description of a compact cabinet type heating unit.
Type D Dunham-Built Dwyer Unit Heaters. Bulletin No. 280, 8½ x 11 ins., 16 pp. Illustrated. This type is equipped with two fans so that when full capacity is not required, only one motor need be operated.
The Fulton Syphon Company, Knoxville, Tenn.
Syphon Temperature Regulators. Illustrated brochures, 8½ x 11 ins., dealing with general architectural and industrial applications; also specifically with applications of special instruments.
Syphon Heating Specialties. Catalog No. 200, 192 pp., 3½ x 6¼ ins. Important data on heating.
Hoffman Specialty Company, Inc., 25 West 46th St., New York, N. Y.
How to Lock Out Air, the Heat Thief. Brochure, 48 pp., 5 x 7½ ins. Illustrated.
Janette Manufacturing Company, 556 West Monroe Street, Chicago.
How to Lock Out Air, the Heat Thief. Brochure, 48 pp., 5 x 7½ ins. Illustrated.
Kewanee Boiler Corporation, Kewanee, Ill.
Kewanee on the Job. Catalog, 8½ x 11 ins., 40 pp. Illustrated. Showing installations of Kewanee boilers, water heaters, radiators, etc.
Kewanee Boiler Corporation, Kewanee, Ill.
Catalog No. 28, 6 x 9 ins. Illustrated. Describes Kewanee Fire- box Boilers with specifications and setting plans.
FROM TOP FLOOR to TRACK LEVEL cork insulates

Chicago's Merchandise Mart

ARMSTRONG'S cork products serve a wide variety of uses in Chicago's huge new Merchandise Mart. Some of them are shown on this page.

Corkboard in cold storage rooms seals in low temperatures. Cork Covering on brine and ammonia lines protects against loss of refrigeration. Corkboard insulates the fresh air intakes from surrounding rooms. On the ceiling of the track level, a 2" layer of Corkboard shuts out winter's cold from the upper floors of the building.

Installed under machinery, Armstrong's Vibracork absorbs vibration and muffles the noise that it causes. In the waiting room, Corkboard is used to line the radiator recesses in the walls, and to prevent the loss of costly heat. The radio station on the roof of the building enjoys comfortable temperatures at all times—thanks to cork. And cork promotes health by maintaining proper temperatures in cold water lines, refrigerators, and soda fountain equipment.

Armstrong engineers are at your service for consultation on any installation involving the use of cork. Address Armstrong Cork & Insulation Company, 900 Concord Street, Lancaster, Pennsylvania.

Armstrong Cork & Insulation Company
CORKBOARD . . CORK COVERING . . VIBRACORK . . CORKOUSIC . . INSULATING BRICK
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued

HEATING EQUIPMENT—Continued
Catalog No. 79, 6 x 9 ins. Illustrated. Describes Kewanee power boilers and smokeless tubular boilers with specifications.
McQuay Radiator Corporation, 35 East Wacker Drive, Chicago, Ill.
McQuay Visible Type Cabinet Heater. Booklet, 4 pp., 8½ x 11 ins. Illustrated. Cabinets and radiators adaptable to decorative schemes.
McQuay Concealed Radiators. Brochure, 4 pp., 8½ x 11 ins. Illustrated.
McQuay Unit Heater. Booklet, 8 pp., 8½ x 11 ins. Illustrated. Gives specifications and radiator capacities.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
The Modustat, a self-contained automatic room temperature control valve for individual radiators. Leaflet, 4 pp., 8½ x 11 ins. Illustrated.

Modine Copper Radiation. Booklet, 28 pp., 8½ x 11 ins. Illustrated. Deals with industrial, commercial and domestic heating.
A Few Short Years. Folder, 4 pp., 8½ x 11 ins. Illustrated. Heating for garages.
Dealing in Heating. Folder, 4 pp., 8½ x 11 ins. Illustrated. Industrial Heating. Folder, 4 pp., 8½ x 11 ins. Illustrated.
Modine Unit Heater. Folder, 6 pp., 8½ x 11 ins. Illustrated.

Nash Engineering Company, South Norwalk, Conn.
Bulletin 88. Booklet, 4 pp., 8½ x 11 ins. Illustrated. Describes in detail the Unit Type Motor Driven Jennings Condensation Pump.

National Radiator Corporation, Johnstown, Pa.
The Crimson Flame. Folder, 4 pp., 8½ x 7½ ins. Illustrated.
Contesto Brings Comfort to Your Home. Folder, 12 pp., 8½ x 11 ins. Illustrated.
Aero, the National Radiator Sizes and Ratings. Booklet, 16 pp., 3 x 7¼ ins. Illustrated.

Sabroe Company, Inc., 183 Madison Ave., New York City, N. Y.
Steam Heating Specialists. Booklet, 6 pp., 6 x 9 ins. Illustrated. Data on Sabroe Scaleless Supply Valves and Radiator Traps for vacuum and vapor heating systems.

Spencer Magazine Feed Heaters. Catalogue No. 31, 26 pp., 8½ x 9 ins. Illustrated.
One Church Service That No One Sees. Booklet, 15 pp., 8½ x 11 ins. Illustrated.

U. S. Blower & Heater Corporation, Minneapolis, Minn.
Blowers, Heaters and Washers. Booklet, 66 pp., 8½ x 11 ins. Illustrated.


HOISTS, TELESCOPIC
Gillow & Griswold, Inc. 355 West Broadway, New York.

HOSPITAL EQUIPMENT
Bryant Electric Co., Bridgeport, Conn.
Catalog GM. 7 x 10 ins., 16 pp. A booklet illustrated with photographs and drawings, showing the types of light for use in hospitals, as operating table reflectors, linoleum and multilite concentrators, ward reflectors, bed lights and microscopie reflectors, giving sizes and dimensions, explaining their particular fitness for special use.

The International Nickel Company, 67 Wall St., New York, N. Y.
Hospital Applications of Monel Metal. Booklet, 8½ x 11½ ins., 10 pp. Illustrated. Gives types of equipment in which Monel Metal is used, reasons for its adoption, with sources of such equipment.

INCINERATORS
Jones-Greyer Incinerators. Folder, 4 pp., 8½ x 11 ins. Illustrated.

INSULATION
Insulation of Roofs to Prevent Condensation. Illustrated booklet, 7½ x 10½ ins., 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 ins. 32 pp. Illustrated.

JOISTS
Kalman Steel Company, Chicago, Ill.
Fireproof Floor and Roof Construction. Booklet, 8 pp., 8½ x 11 ins. Joists, lath and accessories.

KITCHEN EQUIPMENT
The International Nickel Company, 67 Wall St., New York, N. Y.
Hotels, Restaurants and Cafeteria Applications of Monel Metal. Booklet, 8½ x 11½ ins., 32 pp. Illustrated. Gives types of equipment in which Monel Metal is used, with service data and sources of equipment.

LABORATORY EQUIPMENT
Albersen Stone Co., 153 West 23rd Street, New York City.
Booklet, 8½ x 11½ ins., 36 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 11½ ins., 30 pp. Full details regarding a valuable form of piping.

Maurice A. Knight Company, Kelly Ave., Akron, Ohio.
Acid Proof Laboratory Equipment. 48 pp. Catalogue, 8½ x 11 ins. Illustrated.

LATH, METAL AND REINFORCING
Kalman Steel Company, Chicago, Ill.
Fireproof Building Products. Booklet, 20 pp., 8½ x 11 ins. Lath, fireplace accessories, beads, etc.

Milcor Steel Co., Milwaukee.

Milcor Metal Ceiling Catalog. Booklet, 28 pp., 8½ x 11 ins. Illustrated. Data on metal ceiling and wall construction.

REQUEST FOR CATALOGS
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Rust is waste. The tiny red brown particles that mark the ever present tendency of iron to return to its natural state, unimportant as they seem, cost the world one billion dollars every year.

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In this age of waste elimination, Toncan Iron Pipe deserves full consideration by architects, builders and owners. Write for further details.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES: YOUNGSTOWN, OHIO
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 112

LATH, METAL AND REINFORCING—Continued


Steeltex for Floors. Booklet, 24 pp., 8 1/2 x 11 in. Illustrated.

Steeltex Data Sheet No. 1. Folder, 8 pp., 8 1/2 x 11 in. Illustrated. Steeltex for floors on steel joists with round top chords.

Steeltex Data Sheet No. 2. Folder, 8 pp., 8 1/2 x 11 in. Illustrated. Steeltex for floors on steel joists with flat top flanges.

Steeltex Data Sheet No. 3. Folder, 8 pp., 8 1/2 x 11 in. Illustrated. Steeltex for folders on wood joists.

Truscon Steel Company, Youngstown, Ohio.

LAUNDRY MACHINERY

The American Laundry Machinery Company, Norwood Station, Cincinnati, Ohio.
The Laundry in the Hotel, Hospital, School, Club, Office Building ... even in the large Residence. Brochure, 28 pp., 8 1/2 x 11 in. Arranged in convenient file folder. Illustrated. Contains many lines of prominent in laundry installations.

Tru-ly Laundry Machinery Co., Inc., 9 Park Place, New York City.
Laundry Machinery for Large Institutions. Loose-leaf booklet, 50 pp., 8 1/2 x 11 in. Illustrated.

Laundry Machinery for Small Institutions. Loose-leaf brochure, 50 pp., 8 1/2 x 11 in. Illustrated.

Accessory Equipment for Institutional Laundries. Leather bound brochure, 50 pp., 8 1/2 x 11 in. Illustrated.

LAIGHTING EQUIPMENT

The Frink Co., Inc., 309 Lexington Ave., New York, N. Y.
Catalog 415, 8 1/2 x 11 in., 46 pp. Photographs and scaled cross-sections. Specialized bank lighting, screen and partition reflectors, double and single desk reflectors and Polarlite Signs.

Klingel Bros. Universal Electric Stage Lighting Co., Inc., 331 West 39th Street, New York, N. Y.
Catalogue No. 36, 24 pp., 8 1/2 x 11 in. Illustrated.

Industrial Lighting Equipment. Booklet, 32 pp., 8 1/2 x 11 in. Illustrated.


Ways of Illuminating Football Fields. Folder, 8 1/2 x 11 in. Illustrated.

A New Contribution to the Joy of Swimming. Folder, 8 pp., 8 1/2 x 11 in. Illustrated.

LOCKERS

Durabilt Steel Locker Co., Aurora, Ill.
Steel Storage Equipment for the Modern School Shop. Catalogue, 14 pp., 8 1/2 x 11 in. Illustrated.

MAIL CHUTES

Cutler Mail Chute Company, Rochester, N. Y.
Cutler Mail Chute Model F. Booklet, 4 x 9 1/2 in. Illustrated.

MANTELS


MARBLE

The Georgia Marble Company, Tate, Ga.; New York Office, 1328 Broadway.
Why Georgia Marble Is Better. Booklet, 6 1/2 x 9 in. Given analysis, physical qualities, comparison of absorption with granite, opinions of authorities, etc.

MARBLE—Continued

Convincing proof, 21 1/2 x 6 in. 10 pp. Classified list of buildings and memorials in which Georgia Marble has been used, with names of Architects and Sculptors.

Rutz Building, Atlanta; Senior High School and Junior College, Muskegon, Mich. Folders, 4 pp., 8 1/2 x 11 in. Details.

METALS

The International Nickel Company, 67 Wall St., New York N. Y.
Mond Metal Primer. 8 folders, 4 pp., 8 1/2 x 11 in. Illustrated. Valuable data on use of monel in kitchens, laundries, etc.

MILLWORK

Klein & Co., Inc., 11 East 37th St., New York, N. Y.
Two Driwood Interiors. Folder, 4 pp., 8 1/2 x 9 in. Illustrated. Use of moulding for paneling walls.

A New Style in Interior Decoration. Folder, 4 pp., 6 1/2 x 9 in. Illustrated. Deals with interior woodwork.

Driwood Period Moldings in Ornamented Wood. Booklet, 28 pp., 8 1/2 x 11 in. Illustrated.

How Driwood Period Moldings in Ornamented Wood Set a New Style in Decoration. Folder.

PAINTS, STAINS, VARNISHES AND WOOD FINISHES

Minwax Company, Inc., 11 West 42nd St., New York.
Color Card and Specifications for Minwax Brick and Cement Coating. Folder, 4 pp., 8 1/2 x 11 in. Illustrated.

National Lead Company, 111 Broadway, New York, N. Y.
Handy Book on Painting. Book, 55 x 35 in., 100 pp. Gives directions and formule for painting various types of wood, plaster, metals, etc., both interior and exterior.


Came Lead. Booklet, 6 x 8 1/2 in., 12 pp. Illustrated. Describes various styles of lead came.

PARTITIONS

Circle A. Products Corporation, New Castle, Ind.
Circle A. Partitions Sectional and Movable. Brochure. Illustrated. 8 1/2 x 11 in., 32 pp. Full data regarding an important line of partitions, along with erection instructions for partitions of three different types.

Irving Hamlin, Evanston, Ill.
Hamlinized Folding Partitions Made from Hamlin’s Evanston Soundproof Doors, Sectional and Movable. Folder, 4 pp., 8 1/2 x 11 in. Illustrated.

Hauserman Company, E. F., Cleveland, Ohio.
Movable Steel Partitions for sub-dividing office and industrial space. Folders on complete line, 8 1/2 x 11, giving full data on the different types of steel partitions of details, elevations and specifications. Also 40-page Architects’ Partition AIA—28A, containing 20 full page plates of practical office layouts.

Hollow Steel Standard Partitions. Various folders, 8 1/2 x 11 in. Illustrated. Gives full data on different types of steel partitions, together with details, elevations and specifications.

Henry Klein & Co., 25 Grand Street, Elmhurst, L. I., N. Y.
Telesco Partitions. Catalog, 8 1/2 x 11 in., 14 pp. Illustrated. Shows typical office layouts and Telesco partitions, the latest type of partition that can be erected.

Telesco Partitions. Brochure, 24 pp., 8 1/2 x 11 in. Illustrated. Detailed instructions for erecting Telesco Partitions. Complete instructions, with cuts and drawings, showing how easily Telesco Partition can be erected.

Improved Office Partition Co., 25 Grand St., Elmhurst, L. I., N. Y. (See Henry Klein 9; 12.)

The Mills Company, Cleveland, Ohio.
Mills Metal Partitions. Booklet, 8 1/2 x 11 in. Illustrated. Installation data and details.

Partitions. Booklet, 7 x 10 in., 12 pp. Illustrated. Describes complete line of track and hangers for all styles of sliding parallel, accordion and flush-door partitions.

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PROVIDING the necessary space and locating the expansion loops on heating risers has ever been a problem for the Architect and Engineer. In many cases the appearance of the exterior as well as the interior of a building has been greatly affected. Detail drawings of hung ceilings or allotted space for expansion loops entail much work for the draftsman and complicates the building plans. Extra materials are necessary and additional labor cost is added to building cost. The offset or drop in the ceiling is unsightly and unnecessary.

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SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 114

PARTITIONS—Continued

Telesco Office Partition. 25 Grand St., Eimhurst. L. L. N. Y. (See Henry Klein & Co.)

J. G. Wilson Corporation. 11 East 38th St., New York City, N. Y. Selectifold and Rolding partitions also Light Retarding Rolling Shutter, Thirty-two page catalog with illustrations, specification details, etc.

PLUMBING EQUIPMENT—Continued

Scovill Manufacturing Company, Watervile, Conn.
Scovill Flush Valve Catalogue. 40 pp., 85x x 11 ins. Illustrated.

Spokane Company, Wilmington, Del.

Catalog B. Booklet, 130 pp., 85x x 11 ins. Illustrated. Data on showers and equipment details.

PNEUMATIC TUBE SYSTEMS

12 pp., 85x x 11. Illustrated booklet of tube systems for retail stores and other buildings.

4 pp., 85x x 11. Data Sheet showing schematic diagrams for hotel, bank, factory and wholesale buildings, table of sizes, space requirements and preliminary layout steps. A. I. A. 35k1.

PUMPS

C. A. Dunham Co., 430 East Ohio Street, Chicago, Ill.
Dunham Vacuum Pump. Booklet, 16 pp., 85x x 11 ins. Illustrated.

Nash Engineering Company, South Norwalk, Conn.
Bulletin 52. Brochure, 6 pp., 105x x 7 ins. Illustrated in color. Devoted to Jennings Standard Centrifugal Pumps for house service, boosting city water pressure to supply top stories, for circulating warm water, etc.


REFRIGERATION

The Fulton Syphon Company. Knoxville, Tenn.
Temperature Control of Refrigeration Systems. Booklet, 8 pp., 85x x 11 ins. Illustrated. Deals with cold storage, chilling of water, etc.

REINFORCED CONCRETE—See also Construction, Concrete

Kalman Steel Company, Chicago, Ill.
Building for Permanence. Booklet, 8 pp., 85x x 11 ins. Reinforced Concrete. Includes data for decorative concrete.

Truscum Steel Company, Youngstown, Ohio.
Shoring Stresses in Reinforced Concrete Beams. Booklet, 85x x 11 ins., 12 pp.

ROOFING

Johns-Manville Corporation, New York.

Ludowici-Celadon Company, 104 So. Michigan Ave., Chicago, Ill.
“Ancient” Tapered Mission Tile. Leaflet, 85x x 11 ins., 4 pp. Illustrated. For architects who desire something out of the ordinary this leaflet has long been prepared. Describes briefly the “Ancient” Tapered Mission Tile, hand-made with full corners and designed to be applied with irregular exposures.

Milcor Steel Co., Milwaukee.
Milcor Architectural Sheet Metal Guide. Booklet, 72 pp., 85x x 11 ins. Illustrated. Metal tile roofing, skylights, ventilators, etc.

Milcor Sheet Metal Handbook. Brochure, 128 pp., 85x x 11 ins. Illustrated. Deals with rain-carrying equipment, etc.

SEWAGE DISPOSAL

Nash Engineering Company, South Norwalk, Conn.
Bulletin 67. Booklet, 16 pp., 105x x 7 ins. Illustrated in color. Describes Type A Jennings Sewage Ejector for handling Un­screened sewage and raising it from basements below sewer level.

Bulletin 103. Brochure, 16 pp., 105x x 7 ins. Illustrated in color. Deals with small size Type B Jennings Sewage Ejector.

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SCREENS

American Brass Co., The, Waterbury, Conn.
Facts for Architects About Screening. Illustrated folder, 9\% x 11\% ins., giving actual samples of metal screen cloth and data on fly screens and screen doors.

Athey Company, 601 West 65th St., Chicago, Ill.
The Athey Perennial Window Shade. An accordion pleated window shade, made from translucent Herrington woven Canton cloth, which raises from the bottom and lowers from the top. It eliminates awnings, affords ventilation, can be dry-cleaned and will wear indefinitely.

STEEL PRODUCTS FOR BUILDING

Bethlehem Steel Company, Bethlehem, Pa.
Steel Joists and Stanchions. Booklet, 72 pp., 4 x 6\% ins. Data for steel for dwellings, apartment houses, etc.
Bethlehem Structural Shapes. Bound volume, 368 pp., 4\% x 6\% ins., illustrated.

The Kawneer Company, Niles, Mich.
Folder with A.I.A. File No. featuring new Shower Door, furnished in Solid Bronze, Chromium Plated or Solid Nickel-silver.

Lincoln Electric Company, Cleveland, Ohio.
Studies in Structural Arc Welding. Series of plates, 8\% x 11 ins. Illustrated, deals with design of arc-welded buildings, details and specifications.

Steel Frame House Company, Pittsburgh, Pa. (Subsidiary of McClinic-Marshall Corp.)
Steel Framing for Dwellings. Booklet, 16 pp., 8\% x 11 ins. Illustrated.
Steel Framing for Gasoline Service Stations. Booklet, 8 pp., 8\% x 11 ins. Illustrated.

The Art of Welding of Structural Steel. Brochure, 32 pp., 8\% x 11 ins. Illustrated. Deals with an important structural process.

STONE, BUILDING

Indiana Limestone Company, Bedford, Ind.
Volume 1. Series B. 6 x 9 ins., 36 pp. Illustrated. Giving general information regarding Indiana Limestone, its physical characteristics, etc.
ILCO RIPLSTONE. 8\% x 11 ins., 56 pp. Illustrated.

STORE FRONTS

The Kawneer Company, Niles, Mich.
Folder, 8\% x 11 ins., featuring recent store front installations and suggested designs.


TELEPHONE SERVICE ARRANGEMENTS

All Bell Telephone Companies. Apply nearest Business Office, or American Telephone and Telegraph Company, 195 Broadway, New York.
Planning for Home Telephone Conveniences. Booklet, 32 pp., 8\% x 11 inches. Illustrated.

TIMBREL TILE VAULTS

R. Guastavino Co., 40 Court Street, Boston.
Masonry acoustical materials (AKOUSTOLITH Tile and AKOUSTOLITH Planter) and Timbrel Arch Construction. Brochure, 14 pages, 8\% x 11 ins. Illustrated.

TILE, STRUCTURAL CLAY

Nateo Vitreous Bulletin No. 168. 40 pp., 8\% x 11 ins. Illustrated. Shows color charts, sizes and shapes, actual installations, etc.
Nateo Header Backer Tile Bulletin. 8\% x 11 ins. 4 pp. Illustrated.
Nateo Unibacker Tile Bulletin. 8\% x 11 ins. 4 pp. Illustrated.

FLINT FAIENCE & TILE CO., Flint, Mich.

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Faience Tiles for Bathrooms. Folder, 4 pp., 8\% x 11 ins. Illustrated. Ask for Form A-303.
Flintcraft Files. Folder, 4 pp., 8\% x 11 ins. Illustrated. Machine-made floor or wall tile. Ask for Form A-360.
Hanley Quarry Tile. Folder, 4 pp., 5 x 8 ins. Illustrated.

TRUSSES

McKeown Bros. Company, 533 South Easter Avenue, Chicago.
Truth in Architecture. Folder, 4 pp., 8\% x 11 ins. Illustrated. Dealing with use of trusses of wood.

Factory Built Bowstring Trusses. Folder, 4 pp., 8\% x 11 ins. Illustrated.
Timber Trusses. Folder, 4 pp., 8\% x 11 ins. Illustrated.

VALVES

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

Jenkins Brothers, 81 White Street, New York.

Walworth Company, Statler Office Building, Boston, Mass.
Walworth Valves, Fittings and Tools, Catalog 88. Bound Volume giving data on a wide variety of details.

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SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 118

VENETIAN BLINDS

Columbia Mills, 221 Fifth Avenue, New York.

VENTILATION

American Blower Co., Detroit, Mich.

Duriron Company, Dayton, Ohio.

Herman Nelson Corporation, Moline, Ill.

WATERPROOFING

Minwax Company, Inc., 11 West 42nd St., New York.
Waterproofing Stadia. Folder, 4 pp., 8½ x 11 ins. Illustrated. Transparent Waterproofings for All Masonry Walls and Surfaces. Folder, 4 pp., 8½ x 11 ins. Illustrated.

Data Sheet on Membrane Waterproofing. Folder, 4 pp., 8½ x 11 ins. Illustrated.

WEATHER STRIPS

Adhey Company, 605 West 65th St., Chicago, Ill.
The Only Weatherstrip with a Cloth to Metal Contact. Booklet, 16 pp., 8½ x 11 ins. Illustrated. Data on an important type of weather stripping.

WINDOW GLASS

Pittsburgh Plate Glass Company, Grant Building, Pittsburgh, Pa.
Fenestro Window Glass With the New Flatter Surface. Booklet, 16 pp., 8½ x 11 ins. Illustrated.

WINDOWS

William Bayley Co., 147 North Street, Springfield, Ohio.
Bayley Pivoted Windows Screened. Booklet, 8 pp., 8½ x 11 ins. Data on screening and window ventilation.

WINDOWS, CASEMENT

Detroit Steel Products Co., 2250 E. Grand Boulevard, Detroit.
Fenestra Casements. Booklet, 14 pp., 8½ x 11 ins. Illustrated. Discusses casements, particularly for residences.

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WOOD FINISH

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

WINDOW SCREENS

William Bayley Co., 147 North Street, Springfield, Ohio.
Bayley Pivoted Windows Screened. Booklet, 8 pp., 8½ x 11 ins. Data on screening and window ventilation.

WINDOWS, STEEL AND BRONZE

William Bayley Co., 147 North Street, Springfield, Ohio.
Bayley Steel Window Inserts. Brochure, 9 pp., 8½ x 11 ins. Illustrated. Suggestions on correct use of inserts.

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


Continual Steel Windows and Mechanical Operators. Catalog 120. Booklet, 32 pp., 8½ x 11 ins. Illustrated.

WINDOWS, CASEMENT—Continued

Fenestra Screen Casements. Brochure, 16 pp., 8½ x 11 ins. Illustrated.
Decorating With Casements. Booklet, 28 pp., with insets in color 6 x 8½ ins. Deals with use of decorations, particularly draperies, with casement windows.

Casement Window Hardware. Booklet, 24 pp., 8½ x 11 ins. Illustrated. Shows typical installations, detail drawings, construction details, blueprints if desired. Describes AIR-way Multifold Window Hardware.


List of Parts for Assembly. Booklet, 8½ x 11 ins., 16 pp. Full lists of parts for different units.
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Genasco Trinidad 10-year Bonded Roofing with smooth surface. Guaranteed ten years by The United States Fidelity and Guaranty Company, Baltimore, Maryland.

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City, State:

Check here if you are an Architect ☐, Contractor ☐, Merchant Builder ☐, or Draftsman ☐, and additional material will be sent you.
Lowest Cost Automatic Heat

There are two costs in connection with every heating plant installation: initial cost and operating cost. Of these, the operating cost is by far the more important, because it is continuous. Spencer Magazine Feed Heaters furnish automatic heat at lowest cost by burning clean, safe, dependable No. 1 Buckwheat Anthracite. In localities where hard coal is not so readily available, small size by-product Coke may be used at a marked saving. As proof of Spencer saving we will gladly supply you with figures showing the Cost Per Square Foot of Cast Iron column radiation, or equivalent, using Spencer Automatic Heat. Spencer Magazine Feed Heaters are built in sizes, capacities guaranteed, to meet the heating requirements of buildings of every size and type. Write for descriptive literature.

Spencer Heater Company, Williamsport, Pennsylvania

Spencer Magazine Feed Heaters

for steam, vapor or hot water
Pillars of Strength

Ever higher, ever mightier, man rears his edifices above the cities' congestion. Every added foot of height should justify itself in the cold reasoning of business. Steel has assumed the burden of carrying man's visions aloft with a prudent regard for his pocketbook. C. B. SECTIONS, an important advance in the art of building, are now produced for the benefit of the Central West on a new mill just completed in Chicago.

Illinois Steel Company
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
208 South La Salle Street, Chicago, Ill.

C. B. SECTIONS

JUNE 1931 • THE • ARCHITECTURAL • FORUM
Why risk customers' dissatisfaction and unprofitable service calls by specifying vacuum valves that you cannot guarantee against spitting, hissing and leaking. Especially when there is a valve so constructed that these annoyances are impossible — No. 2 Hoffman Vacuum Valve.

In addition to the exclusive double air-lock, Hoffman Valves incorporate another patented feature — separate channels for air and water. These insure quick, noiseless venting of air, and positively prevent water leakage through the vent port.

How these channels (found only on Hoffman Valves) work is shown by the following simple illustrations:

No. 1 — If for any reason water completely fills a No. 2 Hoffman Vacuum Valve, the float rises and closes the port. The valve is now a sealed chamber which air must enter before water can run out.

No. 2 — Air starts to enter through O, and water starts to run out of siphon. But note the difference: instead of bubbling through water as in other valves, the air is compelled to move through special channels, pushing the water ahead of it until these channels are free of water.

No. 3 — Air is collecting at top of valve and an equal amount of water has run out. Notice particularly that the port remains closed until the air channels are completely cleared of water.

No. 4 — Enough water has run out to permit the float to drop and open the port. But now the outlets of the air channels are above the water line in the valve. There is no water in the path of the air. No matter how forcefully air may be driven into the valve, it cannot blow water out of the open port.

The snap action of the float diaphragm insures a wide-open or tightly closed port — the valve will not close before venting is complete. And the perfect siphon provides for quick drainage.

Before a No. 2 Hoffman Vacuum Valve is complete, 279 operations of hair-line precision are made. Every step of manufacture is rigidly tested. That's why we can guarantee these valves to give efficient, service-free operation for five years. Send today for our booklet that shows you exactly why No. 2 Hoffman Vacuum Valves are superior in every way. Hoffman Specialty Company, Inc., Dept. EF-31, Waterbury, Conn.
It is a far cry from the little red schoolhouse of our fathers' time to the magnificent new 40-story Cathedral of Learning of the University of Pittsburgh. This imposing structure not only typifies the advance in education, but the great progress in building construction as well. It is fitting indeed that in the City of Steel, its University should be housed in the most spectacular contribution Steel has made to this generation . . . the skyscraper.

CB Sections, representing the most recent improvement in structural steel, were used in the construction of the Cathedral of Learning. A vast number of important educational structures throughout the country testify to the popularity and merit of CB Sections.

Charles Z. Klauder, Architect
H. G. Balcom, Structural Engineer
McClintic-Marshall Corporation, Fabricators
John L. Mulkin Construction Company, Erectors
Stone & Webster Engineering Corporation, Supervision of Construction
BANK of MANHATTAN BUILDING
New York City

Architect: H. Craig Severance
Associate Architect: Yasuo Matsui
Engineers: Purdy and Henderson
Contractors: Starrctt Bros., Inc.

Framework of Bethlehem Wide-Flange Structural Shapes

BETHLEHEM STEEL COMPANY

General Offices: Bethlehem, Pa.
District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Buffalo, Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago, St. Louis.
Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu.
Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.
How Johnson Control Is Applied To This Impressive New Building

Added to the very many notable buildings equipped with Johnson Control is the new Los Angeles Stock Exchange. Four separate systems of air conditioning are in this building: supplying the Trade Room, Two Clearing House Sections and the general offices extending from the sixth to the eleventh floors. All are under The Johnson System Of Control.

The dry and wet bulb temperatures on each system are controlled by Johnson Wet Bulb Thermostats, located in the fresh air intakes and operating the fresh air and return air dampers in unison.

The temperature of the water in the dehumidifiers is controlled by a Johnson Three-Way Valve in the pump discharge, operating from a Johnson Dry Bulb Thermostat. In addition, a Johnson Three Branch Four-Way Pneumatic Switch is located in the engineer's office, by which these valves are operated manually when desired.

Included in this installation is the standard Johnson Thermostat Control on the radiation and the ventilation throughout the building: automatically maintaining each section and room at the temperature desired, regardless of the weather conditions out-doors; and producing a large saving in heating cost per year by preventing the usual overheating and heat waste ... and the excessive, unnecessary fuel consumption thus resulting.

JOHNSON SERVICE CO. 149 E. Michigan MILWAUKEE, WIS.

LEHIGH SELECTS SARCO for the
"LAST WORD IN COLLEGE LABORATORIES"

The magnificent James Ward Packard Laboratory of Engineering, recently dedicated at Lehigh University, has been aptly described as "the last word in college laboratories."

It was only natural that, in selecting the equipment for this model institution, those who designed it and those who will work in it should insist upon proven superiority in performance for every piece of equipment.

It was logical also that, in selecting the heating system, these men should turn to Sarco. Our factory is near the University and for years we have enjoyed the cooperation of the faculty. Our product has frequently been tested there—they just knew they could depend on Sarco.

You, too, will have no hesitation in specifying Sarco Radiator Traps, Inlet Valves and accessories when you know us better. Our new catalog No. AK-40 will get us acquainted. May we send it?

Sarco Company, Inc.
183 Madison Avenue, New York, N. Y.

Branches in Principal Cities
Sarco Canada Limited
Federal Building, Toronto, Ont., Canada

Sarco Heating System

Built to a Quality Standard

THE ARCHITECTURAL FORUM • JUNE 1931
Installation of two Illinois forced draft chain grate stokers under 100 H.P. boilers at the Ames High School, Ames, Iowa. They were selected for 150% maximum rating, on 9,000 BTU as fired Iowa screenings.

NOW

THERE IS A 50-250 H.P. CHAIN GRATE STOKER

» » » » with the outstanding operating characteristics of the standard size Illinois Stoker

Architects and engineers have long been familiar with the Illinois Chain Grate Stoker for boilers over 250 H.P.—the stoker that has a world-wide reputation for producing steam at the least cost... for burning any coal, from any district, with consequent savings... for smokeless operation... for high efficiency whatever the load conditions.

Many architects have said: "Why don’t you let the smaller boilers also benefit from the exclusive features you have developed for the larger sizes?"

Now that smaller stoker is available—an Illinois "chip off the old block" that is only 14" from top to bottom chain strands, for boilers in the 50 to 250 H.P. range. It is ideal for low-set boilers, requiring little or no excavation and adding low construction cost to low operating expense.

Our illustrated booklet shows some remarkable operating data on this stoker. We'll be glad to send you a copy for your files.

ILLINOIS CHAIN GRATE STOKERS

JUNE 1931 • THE ARCHITECTURAL FORUM 131
KERNER INCINERATOR COMPANY, Milwaukee. "Ker-norator for Waste Disposal."

So great is the amount of refuse and garbage from large cities that when it is tossed out to sea and dumped or, what is even worse, dumped into such water courses as rivers, lakes or bays, it results in widespread pollution of beaches and shores, to say nothing of producing consequences which are much more serious. Of course all this garbage originates in individual homes or buildings, and if the evil were remedied at its source, the problem would cease to exist. This constitutes a powerful argument for destroying garbage at its source, the problem would cease to exist. If every household worked out what is described as almost the final word for the fume ducts. But in this Antioch College laboratory work, use of rust-resistant Armco Ingot Iron for all duct work. The ducts were further protected inside with three coats of Bakedite paint and one of Eternium. There are 103 rooms in the entire building, among which 27 rooms are equipped with fume ducts in addition to the ventilating system. The construction and design of this fume duct system present several novel and yet entirely practical features.

REVIEWS OF MANUFACTURERS' PUBLICATIONS


To suggest new uses for its excellent system of using light for advertising purposes, and to show uses to which it is being put in different parts of the world, Claude Neon Lights, Inc., issue an interesting publication. The particular number to which attention is directed is that dated September-October, 1930. Its illustrations show many striking and novel uses to which the Neon Lights are being put for every imaginable purpose. The installations illustrated are in every part of the United States, and many of those shown are in foreign parts,—Paris, Havana, Australia, Japan and China. Two pages, at the middle of the brochure, show some of the plants creating Claude Neon displays of different kinds.

NATIONAL FIREPROOFING CORPORATION, Pittsburgh. "Especially for the Communication Field."

So accustomed are people today to the smoothly functioning telephone and telegraph service that thought is seldom given to the vast amount of equipment and maintenance necessary for giving such service. When the overhead wires which years ago disinstered and even darkened the narrow streets of downtown New York were then felt that a great advance had been made, but such has been the growth of telephone and telegraph service since then that what was a marvel at that time is regarded as merely routine now. This brochure deals with the clay tile units necessary for building the miles of conduit required to carry these underground wires. In effect, constantly improved service is being given the public who are receiving it and the objective of the great telephone and telegraph companies supplying it. Service without interruptions or delays—service at low cost—permanent and mutually profitable. Such an objective is not won without a struggle,—without proper consideration to the wire and cable lines, those arteries of speech, the vital blood vessels of commerce. Metropolitan and foreign parts,—Paris, Havana, Australia, Japan and China. The particular number to which attention is directed is that dated September-October, 1930. Its illustrations show many striking and novel uses to which the Neon Lights are being put for every imaginable purpose.
An Announcement to the Public in The Saturday Evening Post
May 30, 1931
of Major Importance to Architects

MINNEAPOLIS-HONEYWELL ANNOUNCES
The MODU STAT
Automatic Orifice System of
Individual Room Temperature Control

This news means AUTOMATIC UNIFORM TEMPERATURE for each individual room of LARGE BUILDINGS, an ideal long hoped for by architects, engineers, owners, managers and tenants.

You spend an evening in a hotel room—and spend most of the evening shuttling from chair to window to radiator trying to keep the room even partially comfortable. You put in a day—at the office and adding perplexity to the lives of the janitor, the building force, the manager, even the owners.

Your irritation with large building room heating is almost as great as that of heating men. They have tried for years to find some thoroughly satisfactory way to control the temperature of each room automatically at the comfort level the occupant desires. They ask for results and reliability, at a cost appropriate to the purpose.

This challenge to automatic heat control engineers has now been met. Minneapolis-Honeywell engineers, who have made and installed and standardized perfectly for public buildings, offices, hospitals, schools, hotels, apartments, large residences Modustat, developed in laboratories with unmatched facilities, perfected and field tested for two years by engineers whose ability and experience has made the name of Minneapolis-Honeywell the sign of final dependability on automatic heat controls for every specialized form of domestic and factory heating, and industrial processes.

Every man who plans, owns, operates, manages, or occupies any building larger than an average-sized residence is invited to mail the coupon for the book which tells how the Modu-stat was developed, and how it operates automatically to maintain the desired, uniform, comfortable temperature in each room.

THE MINNEAPOLIS-HONEYWELL MODU STAT
Automatic Orifice System of Individual Room Temperature Control for public buildings, offices, hospitals, schools, hotels, apartments, large residences

MINNEAPOLIS-HONEYWELL REGULATOR CO.
2740 Fourth Ave. So., Minneapolis, Minn.

JUNE 1931 • THE ARCHITECTURAL FORUM
THE SARCO COMPANY, INC., 183 Madison Avenue, New York.

"Sarco Heating Specialties."

The building up of an efficient heating system is largely a matter of choosing appropriate details and using them in the proper way. Heating equipment has been so developed that, as someone has said, it operates with a smoothness which almost seems to be directed by human intelligence. This brochure describes and illustrates the valuable line of heating accessories or specialties made and sold by the Sarco Company, Inc.—radiator traps, packless valves, radiator valves, air eliminators, receivers, combination floats, thermostatic traps, etc. "For the convenience of architects and contractors, Sarco maintains a competent force of practical heating engineers, who are available for consultation as to the best system to suit given conditions. They will be glad to assist clients with special details of application and to furnish information, based upon long and varied experience, upon any phase of vapor or vacuum heating. Sarco also maintains an organization of service engineers whose duty it is to see that entirely satisfactory service is obtained. All Sarco products are guaranteed against defects in material or workmanship, and may be returned within one year from date of purchase, for free repair or replacement, if a defect should be found. Sarco vacuum and vapor heating systems are installed in many hundreds of the finest commercial, public and industrial buildings in the country. Sarco specialties are specified by the foremost architects and heating engineers. They may be used with confidence.

STRUCTURAL GYPSUM CORPORATION, Linden, N. J.

"Gypsteel Floor and Ceiling Construction."

With the development of modern building upon a vast scale there have come many revisions of standards and considerable re-defining of terms which have been long used. So with the word "fireproof," for there is probably no material which is absolutely immune to damage from fire long continued. "As architects, engineers, and fire underwriters know, mere incombustibility is but one of several essential qualifications for a satisfactory fireproofing material. To perform its proper function in a modern building, such a material must be more than incombustible. It must be fire-resistive, possessing a degree of non-conductivity of heat that will effectively protect the supporting structural steel work from injury by fire that could exist in the building. It should also possess a sufficiently low coefficient of expansion in order to facilitate maintenance of the floor in a state of perfect fireproofing. With the development of modern building, the floor is no longer considered a separate element, but an integral part of the building. The materials to be used in floor construction must be selected with the thought that these materials will have to perform their proper function under the most severe conditions of fire, water, and load. Complete automatic temperature control of heating units and certain dampers of the ventilating system is provided for all purposes. The ventilating for the entire building will consist of 10 separate air supply fan systems and an equal number of mechanical exhaust systems, each system constituting a complete unit in itself. Eight of the air supply units are equipped for air cooling; the other two supply air to corridors and main group chorus rooms in the dressing room sections of the arena. The mechanical exhaust systems provide for the removal of air from dressing rooms, toilet rooms, janitor closets, utility work rooms, and from projection rooms. Ventilating is accomplished by washing the air with cold water. This cold water is pumped at the rate of 3,000,000 gallons per day. The water goes to a sewer immediately after it is used for air cooling and washing."
You can NOW SPECIFY

Standardized Monel Metal Sinks

for the homes you are planning

Standardized construction and quantity production have brought beautiful Monel Metal kitchen sinks, once the luxury of the few, within reach of millions of average homes!

It means that your clients' kitchens can now bask in the cheerful beauty that only Monel Metal sinks can impart... beauty that merges with every color and scheme of decoration. It means that women may enjoy sinks that always look bright and new in spite of hard daily service.

For the new standardized Monel Metal kitchen sinks set a new high water mark of convenience and durability, as well as attractiveness. Smooth as glass and corrosion-resistant, with no dirt catching corners or seams, they are easy to clean and keep clean. Strong as steel and rust-proof, with no coating to chip off, they stand hard use. Monel Metal is solid clear through — the lustrous, silvery appearance of Monel Metal can never wear away.

Standardized Monel Metal kitchen sinks cost little more than sinks made of less durable materials. On display at leading plumbing showrooms. See them today — and write for descriptive literature and specification details.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York, N.Y.
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<td>Warren Webster &amp; Company</td>
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<td>Wood Engineering Co., Gar                                             Fourth Cover</td>
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<td>York Ice Machinery Corporation</td>
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The new Montgomery Ward headquarters and retail building is another famous structure reinforced with rail steel bars—produced to meet high standards by—

- Buffalo Steel Company, Tonawanda, N. Y.
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Mills in Canada:
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For further Information write
Rail Steel Bar Association, Builders Bldg., Chicago

FAMOUS BUILDINGS

RAIL STEEL

for concrete reinforcing
COMPACT
Carbondale Air Cooler

Above: the Carbondale Air Cooler which by means of direct expansion helical coils uses the refrigerating effects of the compact 6-ton Carbondale Ammonia Compression System at the left, to cool the air for the two fur storage rooms.

... Protects Furs in storage

... Protects Furs in storage

ALL air cooling is not for comfort. The Erie Dry Goods Company, Erie, Pa., uses it for killing in their two fur storage rooms. Moth worms, and other ravagers of furs and fabrics become dormant and soon die when exposed to the freezing temperatures produced by Carbondale Air Cooling Equipment.

Proper control of temperatures and humidity is finding ever increasing use in promoting human comfort . . . improving manufacturing processes . . . providing storage for perishable products. In every conceivable application you will find Carbondale Refrigeration rendering dependable service. Carbondale's success is the result of more than mere refrigerating machinery. It is the engineering of the proper equipment to fit a specific need that produces the economical refrigerating installations for which Carbondale is known.

Whatever you need, if refrigeration plays a part you will find that it pays to consult Carbondale's Engineering Staff.

THE CARBONDALE MACHINE CO.
Carbondale, Pa. Branches in principal cities

Carbondale Refrigeration

ABSORPTION AND COMPRESSION AMMONIA
SYSTEMS AND CO., COMPRESSION, SYSTEMS
CARBONDALE AMMONIA COMPRESSION REFRIGERATING SYSTEMS USE WORTHINGTON "FEATHER VALVE" COMPRESSORS
In these illustrations, access doors cut into the panel fronts allow easy access to supply valves. If valve is located at top of radiator, a cleverly concealed hinged opening is made in the grille.

One outstanding feature of McQuay Radiation is its wide range of application: totally concealed with plaster front... completely recessed with panel front... partially recessed with panel front... cabinet type on legs. All types are engineered to diffuse heat in the modern way.

Note the installations illustrated here. One is wholly recessed, the other partially, though both use a baseboard cut-out for inlet air. And both, built to fit a particular type of interior construction, combine beauty, cleanliness, and utility in the highest degree.

A complete set of catalogs, suitably bound, illustrating and describing all types of McQuay Radiation, will be sent at your request.
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the permanence of Brass

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Frederick L. Ackerman, New York, Architect
Dall, Hayden & Treat, New York, General Contractor
Jameison, McKinney Co., Ithaca, Plumbing Contractor

Balch Hall...the new Women's Dormitory at Cornell University. Finely conceived. With strength of line...with the forever modern casement...and pleasing pattern of wall and roof. Here, too, is the charm of something built to endure.

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It may be another Balch Hall for which you are now drawing plans. It may be a home, large and rambling, or small and compact.

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Always there is the plumbing...and for plumbing that endures...Revere Brass Pipe.

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