THE ARCHITECTURAL FORUM
IN TWO PARTS
ARCHITECTURAL ENGINEERING & BUSINESS
PART TWO
JULY 1928
R-W Unit Control
safest and best
for elevator doors

By standardizing on Richards-Wilcox elevator door hardware, thereby centralizing the control and the responsibility, you provide the maximum in safety, service and satisfaction. A complete line for every requirement — hangers, checks, closers, interlocks, electric door operators.

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Low absorption characterizes all hard-burned, dense Natco Hollow Building Tile. Moisture won't seep through; won't be taken up from drying plaster, stucco, or mortar, weakening it; won't be absorbed to freeze in winter, disintegrating the wall.

In every wall of Natco Double Shell Tile moisture stops are automatically established, that break all vertical and bed joints. Dampness finds no thoroughfare.

Whether you use Natco Header Backer, in connection with brick facing; Natco Double Shell Load Bearing in connection with stucco; Natco Tex-Tile or Combed Face, for finished face walls; you'll find that with these double shell units in Natco's Complete Line of Hollow Building Tile, you can build walls that effectively resist the passage of moisture—stop it where it starts.

NATIONAL FIRE-PROOFING COMPANY


Branch Office:
New York, Flatiron Bldg.; Chicago, Builders Bldg.;
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National Fire Proofing Co. of Canada, Ltd., Toronto, Ontario.

DAMPNESS FINDS "NO THOROFARE" WHEN IT ENCOUNTERS NATCO

The wall illustrated is built of Natco Tex-Tile, a hollow building tile with a texture face as beautiful as the finest tapestry brick, and furnished in a range of attractive shades. Natco Tex-Tile walls are strong, self-insulated, moisture resisting, require no painting, repairs or maintenance, are unaffected by the elements, are permanently attractive and permanently satisfactory.

NATCO
THE COMPLETE LINE OF HOLLOW BUILDING TILE
The superiority of Truscon O-T (Open Truss) Steel Joists for fireproof and soundproof floor construction has been demonstrated time after time. Established performance recommends these Joists for important architectural projects.

Truscon Steel Company
Youngstown, Ohio
Warehouses and Offices in all Principal Cities
Established 1903
A Pile driven with 82' 6" leads

that require two flat cars to move it from one position to another is no everyday sight on a foundation job. But this is typical of the special equipment developed by this organization for rapid, effective pile driving—the same organization that developed the famous Raymond Method of pouring concrete piles into driven, spirally reinforced tapering steel shells and leaving each shell in the ground.

RAYMOND CONCRETE PILE COMPANY
NEW YORK: 140 Cedar Street
CHICAGO: 111 West Monroe Street
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"A form for every pile
A pile for every purpose"

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BULKHEADS AND DOCKS
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A high and wide firebox lets the air penetrate the blazing fuel and mingle with the flames so that combustion is perfectly completed. And this is another Kewanee feature of 40 years standing which definitely insures lower heating costs.
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A trio of Van Craftsmen completing a bank of Van Ranges.

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 REGARDLESS of size or type of heating installation—the Milwaukee Valve Company has systems and specialities that work economically and efficiently.

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Emergency Lighting
for a single
OPERATING ROOM...
An Entire THEATRE

This lighting protection
is adaptable
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Exide-equipped emergency lighting fits any building plan. It can be installed for just those rooms that must have protection against light failure. Or it can be used to protect every room in the building. Battery units are available in sizes that exactly suit the job.

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Exide Batteries for emergency lighting are made by the world's largest manufacturers of storage batteries for every purpose. Theirs is the knowledge and experience of forty years of battery making. The outstanding qualities of the Exide Battery for emergency lighting are: (1) power dependability, (2) long life, (3) freedom from trouble, (4) low first cost, (5) low operating cost.

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Exide EMERGENCY LIGHTING BATTERIES
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The value of space jumps by a tremendous percentage, when it is supplied with daylight.

Grauer new type roof lighting is as solid in construction as the walls. Raised above the roof as in the illustration, or flush with the roof and used as a floor, or set at an angle,—safety is absolute for those on it or below it.

Grauer Transparent Roofing for offices and shops (specified by many leading architects) assures trouble-proof lighting for decades—leak-proof, fire-proof, burglar-proof. Grauer Sidewalk Lights give the same service to your basements,—greatly increasing the income, with just a little upkeep trouble or expense.

Let us tell you more about it in our “Skylight Bulletin” and “Sidewalk Light” Bulletin.

Albert Grauer & Co.
1408-17 th ST. DETROIT, MICH.

Illustrated specifications of Grauer Products are in Sower’s Architectural Catalog.
Heggie-Simplex Boilers Reach New High Peak of Popularity

Sales of Heggie-Simplex Steel Boilers continue to climb at an ever-increasing pace—sales for the first quarter of this year having exceeded last year's volume for the same period by 95%! This in spite of the fact that previous demand for these time-tested units had already made Heggie-Simplex one of the largest boiler manufacturers in the country. This year's remarkable sales increase is but further proof of the rapidly growing recognition which these scientifically built units have won as the most modern of heating boilers.


HEGGIE-SIMPLEX
ELECTRIC-WELDED STEEL HEATING BOILERS
Suggest the Kernerator for Garbage and Waste Disposal

Once Overlooked, They Can Never Have It

Kernerator convenience or garbage-can drudgery? Right "on your boards" you decide this question for your client. For the Kernerator must be built in — it cannot be installed later. And for that reason, we urge you to suggest it, as hundreds of America's leading architects and builders do.

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The Kernerator costs nothing to operate (the waste itself being fuel for its own destruction). It requires but a few minutes' attention weekly. It handles all waste — not only garbage, but tin cans, crockery, paper, sweepings and the like. Metal and glass objects are flame-sterilized for removal with the ashes. It is the original, flue-fed incinerator, built by the pioneers of the industry.

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172 Gas Refrigerators
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Architects of great new apartment house
specify Electrolux for every apartment

One hundred and seventy-two families... people accustomed to all the refinements of modern living... will occupy the magnificent apartment building at 106th St. and Broadway, New York City.

The architects anticipated the exacting requirements of the prospective tenants. For automatic refrigeration, they specified Electrolux!

Its startling new principle... heat that freezes... gives Electrolux indisputable advantages over all earlier methods of refrigeration. A tiny gas flame does all the work... maintains an even, constant cold at the temperature desired.

There are no moving parts. It is perfectly silent. It never wears out. And it is absolutely safe. Yet, with all these advantages, Electrolux is amazingly inexpensive to operate... and it costs no more to install than other refrigerators of equal insulation and storage capacity.

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Prevent cutting concrete floors by installing Orangeburg Underfloor Duct System when building

Many structures, especially office buildings, must be planned without definite knowledge of the points at which electrical outlets will be required. In other cases a few outlets are wanted at first, more later on.

Whether the position of outlets and their number is known exactly, or is entirely conjecture, the use of an Orangeburg Underfloor Duct System settles simply, economically and for all time the whole matter of floor outlets for every type of electrical service—light, power, bell, or telephone.

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Whether of Fibre or Metal, the system provides a tunnel or ductway for wires which may be opened at any point by merely drilling a small hole in the floor. This system once installed, with parallel lateral runs at intervals of five or six feet and header runs at much greater intervals, amply provides for all future electrical equipment and relocation of existing equipment.

Johns-Manville, sole selling agents of the Orangeburg Underfloor Duct System, maintain an engineering staff who offer their services without obligation to architects and consulting engineers to assist them in planning their layouts. Specify an Orangeburg Underfloor Duct System for every building of permanent construction.

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Units that “dovetail” into your plans...

No matter what size or shape of kitchen you are planning, you may be certain of this: there are Kitchen Maid Units to “dovetail into your plans.” In a unique degree, these units offer variety and flexibility.

Select one unit or any number. Each is complete in itself—may be installed singly or as part of a unit combination—in recess or against the wall.

There are large units for spacious homes—compact units for kitchenettes. All are built of seasoned hardwood lumber—by America’s largest exclusive makers of built-in kitchen equipment.

Kitchen Maid Units are the only equipment providing sanitary rounded inside corners, smooth five-ply doors, and concealed hinges. They are finished in choice of Cactus Green, Dove Gray, Lama Tan, Travertine Ivory and Shasta White.

Despite their excellence of design, materials and workmanship, these standardized units cost no more installed than old-fashioned built-in cupboards. Coupon brings catalogue, dimensional drawings, prices.

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Send for full reports of these Masonite Tests

MASONITE’S co-efficient of heat conductivity per inch thick per hour is 0.328 (flat plate test made by Armour Institute).

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Full reports of these tests, a sample of Masonite, and the Masonite book of Specifications and Details will be sent promptly on request. Address:

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G-E gearless elevator motor

GENERAL
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.
Outstanding Contributions by General Electric to Elevator Control

1. A system of automatic speed regulation, maintaining through a simple device high schedule speed during rush hours, while facilitating accurate landing.

2. A system of automatic control of acceleration and retardation, resulting in minimum time consumed, combined with maximum comfort.

3. Development of motor and control design for utmost simplicity and lowest maintenance.

4. A simplified and accurately responsive system of automatic leveling for building owners who require the highest grade of elevator service.

Automatic Speed Regulation

An original contribution to elevator operation is the G-E system of automatic speed regulation. A simple, sturdy, rotating device is secured to the generator of the variable-voltage set, without added relays. This system, applied to high-speed gearless traction elevators, obtains both the maintenance of high uniform speed under full load—insuring the handling of maximum traffic during rush periods—and at the same time automatically compensates for gravity and momentum at landing speeds, so as to produce constant drift and make accurate landings possible with simple car-switch control.

The following manufacturers of gearless traction elevators use G-E gearless elevator motors with G-E elevator control exclusively:

- American Elevator and Machine Co., Inc., Louisville
- Baker Iron Works, Los Angeles
- Gurney Elevator Co., New York
- Montgomery Elevator Co., Moline
- Pacific Elevator Co., San Francisco
- Pitt Engineering Co., Chicago
- Warner Elevator Manufacturing Co., Cincinnati
MODERN construction calls for modern methods. The Bates-Truss Joist is of one piece steel without rivets, bolts or welds in shear or tension.

In the patented Bates construction, no material is cut from the web of the original structural section. The process simply transforms the web of an I-beam section into an expanded lattice truss web. By this method, the depth of the beam is increased and the strength is far greater than in the former I-beam. The points of contact of the lacing and flange members are simply unsheared portions of the original plain web.

In construction you should know all about the Bates Expanded Steel Truss. A copy of the Bates-Truss Joist catalog with complete loading tables will be sent you upon request. It is an engineering treatise on joists.

The expanded section is covered by basic commodity and process patents, owned, controlled and operated under exclusively by this company.
Keeping An Eye On the Future

Permanency in construction — the goal of future building supremacy — is today calling for the adaptation of higher quality and more permanent building products. To follow through with the architect in meeting this forward trend, Kalman builds and offers a wide range of products — products that are made according to the latest proven methods and are of a quality that best reveals the true intent of the architect’s rendering.

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For these Four Reasons

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I T'S wasteful to spend more for toilet paper service when the Onliwon system offers you the best at low cost.

Beautiful cabinets—in a variety of types, carefully built . . . never out of order.

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ARCHITECTURAL Design in Concrete
By T. P. Bennett, F. R. I. B. A.

The great utility of concrete as a material for building lends importance to any work which deals with its use. Already centuries old, with its splendid durability and permanence amply demonstrated by structures of many kinds which have already been used for ages, concrete is one of the most valuable of all the substances used in building and engineering of every kind. Its very adaptability and workability give it a value possessed by few if any building materials, and its value is often enormously increased by the use with concrete of steel reinforcing which adds a strength which it never possessed before. “Reinforced concrete has earned its front rank position among materials for permanent construction because of its intrinsic merits. Its fireproofness protects life and property; its strength and safety are increased by its monolithic nature; and its permanence is proved by long use.”

The text of this work dwells in detail upon the working of concrete; details of construction; continuous vertical support; verticality; monolithic concrete; concrete vaulting; textures; “crazing”; and treatments; and other subjects of importance to the architect, engineer or builder concerned with concrete. It sums up and presents the experience of many successful workers in concrete construction. The volume deals with concrete and with its design as influenced or governed by its construction. Its authors have been fortunate in selecting admirable examples of the use of the material, and the work contains, among a large number of illustrations, views of residences, tall structures such as hotels, theaters, power houses, or office buildings; bridges, aqueducts, retaining walls and walls of other kinds. The views are of work in more than one country, for there are illustrations of buildings in England, France, Belgium and Germany, as well as many of structures in the United States.

Text and 100 Plates; 8½x11 ins. Price $10

ROGERS & MANSON COMPANY, 383 MADISON AVENUE, NEW YORK

Any book reviewed may be obtained at published price from THE ARCHITECTURAL FORUM
eminent steel engineers and builders with a large amount of classified and tabulated data most convenient for rapid and effective use. In the first part are standard specifications for the manufacture, properties, inspection, testing, stresses, and fabrication of structural steel for buildings, and a complete fireproofing specification defining fire temperatures and hazards and the materials and application of insulation. The maximum live loads and various allowances permissible for different parts of a building are given, and there is a concise history of the development of steel and iron with valuable data concerning their physical properties that are of importance to every designer. The accompanying code of standard practice is intended to eliminate those errors, misunderstandings, losses and delays that so often occur in the relations between engineers, architects, builders, contractors, dealers and owners; it makes fair definitions and provisions governing most cases subject to misunderstanding or variation, such as requirements for plans, specifications, bids, and contracts, classification of materials and members, workmanship and standard practices, inspection, delivery, delays and extra work.

Part Two commences with an admirable discussion of the properties of sections, followed by 70 pages of important mathematical tables including Moments of Inertia, Areas and Weights, Engine Loadings, Deflections, Functions of Numbers, Trigonometrical Formule and Tables, Decimal Equivalents and Lengths of Circular Arcs. Part Three is devoted to general building materials, their strength and specific gravities and to the properties of American Standard Yard Lumber and Timber, Safe Loads for Timber, Columns, Unit Stresses for Structural Lumber and Contents of Storage Houses. Part Four is a comprehensive and thorough treatise of Structural Shapes and Details with clear and concise explanations and examples of specification formula illustrated with diagrams and tables that describe, explain and emphasize the essential considerations and methods of determination and selection and computation for structural shapes and members with data so conveniently arranged that a great amount of fundamental information can be quickly secured by inspection. Angles, Channels, Base Plates, Rivets and Bolts are treated in general, and very convenient comparative tables are given of American Standard, Carnegie, and Bethlehem Beams and a Summary of them, also of Bethlehem, Carnegie, Plate and Angle, and Plate and Channel Columns. This work gives a maximum of the most universal and indispensable working information in the most convenient form for rapid use, with a minimum of computation or studying of requirements and applications. It cannot fail to be a great time-saver and promote greater facility and higher quality of design and more economical, safe and rational use of steel for all structural purposes. It combines in one handy volume most, if not all, of the information needed by the steel designer and much for the designer's use at desk or drawing table.

American Architecture

By Fiske Kimball

Written for the layman as well as for the architect, Mr. Kimball presents a survey of American architecture from its first beginnings in the seventeenth century to its latest achievements in the twentieth. Mention of no important detail is omitted, and the carefully prepared text is accompanied by well selected illustrations in half-tone.

262 pages, 5½ x 8½ inches

Price $4

ROGERS & MANSON COMPANY
383 Madison Avenue • New York
The above shows Russek's Fifth Avenue store in New York City. To the right will be seen the York refrigerating equipment provided to maintain a controlled and guaranteed temperature in the fur storage. The lower right picture shows the fur vault with racks and garment hangers, as well as the mezzanine—in this vault is maintained, at all times, the required low temperature by York apparatus for the furs, fine garments and fabrics stored therein.

A mechanical refrigerating system for fur storages and vaults is a necessity in the modern department store—necessary in order that furs and fine garments may be properly protected against the ravages of the moth during the Summer season.

York engineers have made a special study of the requirements of this particular and exacting field.

To architects and builders contemplating the subject of fur storage facilities, the York Engineering Department offers a definite assistance—write us stating your problem. No obligation—only opportunity.
THE prolonged effort by certain groups of citizens to save Central Park from the state of neglect and deterioration into which it has fallen, and the present activities of the city to restore the park, give a certain timely interest to the second volume of "Forty Years of Landscape Architecture." The Sage Foundation—Regional Plan Committee in making a contribution toward the cost of this publication, recognize its value as a statement of the original policies and ideals in matters pertaining to the design and administration of Central Park. It is a careful piece of research into the choice of site and design, and of the mere location of the park in its relation to the rectangular street plan.

Early discussions of possibilities are fully related, as are the details of construction and management and the political history during the period from 1850 to 1880, in which the firm of Olmsted & Vaux was officially connected with the work. Chapter XIII, written by F. L. Olmsted, Jr., constitutes an act of filial devotion expressed in a rationalistic defense of his father's theory as embodied in his first important work. It is, besides, an effort from the heart to erect bulwarks for the defense of the romantic, naturalesque style against the ever-increasing trend, plainly evident, toward classicism.

In publishing many of the written communications and reports of F. L. Olmsted, Sr. to the park commissioners, it has been the evident intent of the editors to select those which would emphasize the definite purpose of the designer and to illustrate his methods of control and management, upon which the successful accomplishment of his ideal so largely depended. His conception of the function of Central Park is thus expressed by his son: "The dominant and justifying purpose of Central Park was conceived to be that of permanently affording, in a densely populated central portion of an immense metropolis, a means to certain kinds of refreshment of the mind and nerves, which most city dwellers greatly need and which they are known to derive in large measure from the enjoyment of suitable scenery." What suitable scenery may be is clearly a matter of personal feeling, but it was the belief of the designers that the naturalesque landscape style as developed in England seemed to fulfill this definite purpose, and we see in it the prevailing romantic tendency which existed in all forms of art at that time. That these landscape qualities were attained with a high degree of effectiveness under difficult conditions is a remarkable achievement, and gives strong testimony to the devotion and ability of those who planned the park and are responsible for its design.

The history of the first 30 years of Central Park shows the necessity (if the original ideal is to be maintained) not only of adequate financial support but of a more or less autocratic control on the part of those responsible for its maintenance. To what degree the Olmsted theory of the character and function of Central Park can be maintained under present conditions depends upon the feeling of the patrons of the park, and F. L. Olmsted, Jr. has elsewhere expressed his belief...
Dixon's Silica Graphite Paint used for all maintenance after gruelling tests

Structural work—iron and steel—in a giant train shed such as this, is very much "between the devil and the deep blue sea." For, on the outside it is exposed to the elements and extremes of weather conditions, and on the inside it is being subjected hourly to the attacks of steam, cinders, smoke, corrosive gases, and fumes which hundreds of locomotives are belching forth.

The Boston Terminal Company tried out a good many so-called protective paints. They found only one that would stand up for years under their extreme conditions—Dixon's Silica Graphite Paint. Naturally, Dixon’s has become the standing specification for all maintenance work around this great terminal.

Dixon's Silica Graphite Paint and Red Lead Graphite Primer have consistently demonstrated their superiority for the protection of all structures, (both wood and steel) and for many indoor purposes. These paints are impervious to moisture and strongly resistant to heat and chemical corrosion. They positively will not crack or "dry out." Made in one quality only,—Dixon's—the best—supplied in 6 colors, also Red Lead Graphite Primer, and Aluminum Graphite.

Yes, Dixon's comes in several serviceable colors

Many people think of Dixon's Silica Graphite Paint as unattractive. Actually it gives a fine durable semi-gloss finish, and it may be had in three tones of gray, dark red, green and black. There is also Dixon's Aluminum Graphite Paint for a silver-grey heat-reflecting finish.

Get the full story of Dixon's Silica Graphite Paint by sending for Booklet No. B-224 today!

JOSEPH DIXON CRUCIBLE COMPANY
JERSEY CITY, NEW JERSEY
Established 1827

DIXON'S SILICA GRAPHITE PAINT
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that the park is out of harmony with its surroundings and cannot simulate rural scenery when skyscrapers are always in view. The demand by many people for children's playgrounds and the necessities of automobile traffic are indications of encroachment upon an area in the city which was designed for a purpose in its nature wholly incompatible with these things, and they are additional reasons for the present difficulty of fitting the rationalized conception to the facts. Wide thoroughfares and supervised neighborhood recreation grounds are recognized necessities, scantily provided in New York and sadly missed. As long as Manhattan suffers from these defects in its physical equipment, Central Park will continue to be in danger of injury, if not of actual destruction, which as a matter-of-fact has actually been begun in the Heckscher Playground. Judging from appearances, too many of the users of the park today are not appreciative of the qualities which are the essence of its character, and others resent the restrictions which are so necessary to preserve the rural type of scenery. Scenes soft and lovely of this kind are not suitable for congested populations or for intensive use.

One is led by Mr. Olmsted's argument to suppose that money and skill can restore the refreshing "verdurousness" of the original pastoral and romantic scenery, but the question arises, why do it if it means that the public must view this "verdurousness" through iron fences as if they were monkeys looking out from a cage, and if a large force of trained keepers must be on hand to prevent any use of attractive corners and wide meadows? When the preservation of the park is accomplished, what will be done to compensate New Yorkers for the loss of many of the much longed-for forms of recreation which the designers expected to provide, but which will be impossible in a perfectly preserved scene? Idle contemplation from the other side of a fence is no compensation to most people,—to those who frequent Central Park.

On the whole, the book has tended to strengthen the conviction in the mind of the reviewer that the perpetuation of the original plan is incompatible with present needs and political conditions. The automobile and skyscraper age has brought about changes which inevitably affect the plan and nature of a naturalesque park when the number of users is so great that the beauty of the naturalesque scene is destroyed by their very presence. For some the point is soon reached; for others it may never be reached, because they may prefer the crowd to the verdure. The refreshment of the spirit, whether one prefers crowds or verdure, may be the same, the choice depending entirely upon one's predilections for romantic dreaming or for hard-minded contemplation of things as they are and must be, but if a compromise can be made so that a large part of the naturalesque woods and meadow can be preserved and large additional facilities be provided for walking, for gatherings, and for the freer use in certain parts, both the soft- and the hard-minded may be partially satisfied. Lacking this reasonable compromise, it is safe to predict the destruction of the park by complete formalization.

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THE DELAWARE RIVER BRIDGE

PAUL PHILIPPE CRET, ARCHITECT

From a Preliminary Sketch by F. Walter Taylor

The Architectural Forum
THERE lurks in humanity, whose curious role has always been that of the destined antagonist of nature, a persistent dissatisfaction with nature’s inert obedience to its own laws; a dissatisfaction that is active and noble in certain aspects, and in others, foolish and blind,—the source of human power and of human weakness in equal parts. What, for instance, is this paradoxical attitude of mind which combines a clear perception of the laws of progress with a stubborn tendency to look backward, and to see in the past the ideal toward which society ought to be—and is not—proceeding?

Thomas Huxley once observed that Herbert Spencer’s idea of a tragedy was a “Theory killed by a Fact.” But Spencer was not advancing a mere theory when he defined evolution (that is to say, progress) as the development of the homogeneous into the heterogeneous. He was describing a fact which must, indeed, have been observed long and frequently before his own time for his statement of it to be accepted with such delight as a brand new Truth. In our enlightened day, the high school graduate can glibly inform us that the tendency of all natural organic development is from unity to multiplicity of function, from the homogeneous to the highly differentiated; the full grown man, contemplating our world, and comparing it, by the light of history, with the worlds of other civilizations, sees the law operating in every field of life and action. But it is a law of incessant change, eternally bringing to birth new conditions, eternally forcing him to new adjustments, new ideas, new problems; he is uncomfortable and uncertain, and oppressed at times with an impatient nostalgia for the familiar past. Yet nowhere does he see any example of nature contradicting itself, changing its mind midway, as it were, and remitting the pitiless pressure which forces him on to the future, and to experiences which he cannot foresee.

In this century, when human society finds itself feverishly conscious of its own extraordinary complexity, the idea of a reunion of the separated and highly differentiated parts of its own machinery becomes a dream in which restless and confused imaginations seem to find a fitful repose. A generation whose vast demands upon itself have split the old professions into multitudes of professions, and multiplies them daily with fresh needs for specialization, dreams of its superman who will unite in a supreme genius the knowledge that every day becomes more intricate and more detailed. And the dream becomes all the more cherished as the hope of its realization becomes more futile.

In the year 1747 the institution of the Ecole des Ponts et Chaussées in Paris signalized the definite division of the hitherto united professions of engineering and architecture into two distinct professions. Up to that time the engineer, as a specialist in building problems, did not exist. The great bridge builders, for instance, of the seventeenth and eighteenth centuries,—Ducerceau, the Mansarts, Gabriel, Gauffrey, Pitrou, and Peronnet (who was the creator of the modern stone bridge),—were architects primarily, trained in architecture, which included what we would now call engineering as one of its branches. That they were masters in both fields is amply proved; the Chapel at Versailles, the Ecole Militaire, the Place de la Concorde testify to their ability as architects; the Pont Neuf, the Pont Royal, the bridge at Blois, and the bridges of Peronnet, which have served as models throughout Europe, to their skill as engineers. Occasionally they had their failures,—as is illustrated by a story at the expense of Jules Hardouin Mansart, which has furnished consolation and a certain ignoble pleasure to several generations of rising architects; the same Mansart, incidentally, whose collaboration with Frère François recalls the tradition of the “freres pontifs,”—the brotherhood of bridge builders of the middle ages. Mansart had built a bridge across the Loire. Some time later, when he was at the court of Louis XIV, an official from the district appeared at court for an interview with the king. At the end of the audience, Mansart, whose childish vanity or love of praise was a well known weakness, struttied up to the official and inquired:

“And how goes the bridge?” “Well,” replied the other drily, “at the rate at which it was going when
I left, it is probably at Nantes by this time.” Nevertheless, however we may relish a story that restores such men to the human scale, it is to these consummate masters of an ambidextrous profession that we look backward. Their bridges of stone, sturdy and beautiful, will outlast our bridges of steel, and their stately and ample building is not easily surpassed.

At the same time, it must be remembered that their problems were not our problems; nor could they have foreseen, even dimly, the conditions that have developed since their time. Within the last 60 or 75 years the development of steel as a factor of construction has given rise to the necessity for mathematical calculation so complicated and so highly specialized as to have become an individual profession in itself; and every branch of engineering has grown and been subdivided in turn, so that today it is not simply “the engineer” but the mechanical engineer, and the electrical engineer, and the structural engineer, etc., each a specialist in a profession as distinct from other professions of the same family as architecture is from engineering. For a single man to attempt to make himself master of the entire field of modern mechanical mathematics would be little short of lunacy. How, then, can the architect, faced every day with the growing complexity of his own work, hope to unite the necessary proficiency in mechanics with the necessary proficiency in his own province? The increasing diversity of taste in plan-
rung and in the use of materials and the necessity of directing a large staff of minor artisans and tradesmen force him to forget even such mathematics as he has learned in order to devote himself exclusively to the problem of aesthetics.

No, it is futile to look backward. Not only has the unity of the old profession been severed, but with each day the hope of reuniting the separate departments of architecture and engineering becomes more vain. Nevertheless, the two professions remain complementary to each other,—individual, impenetrable each to each, yet indissolubly connected, for good or ill. Such is the situation that has given rise to a complaint that is widely made today.

It is argued that this "division of labor" and intense specialization in two professions that are basically interdependent, must entail a serious disadvantage: namely, an inevitable absence of unity,—the unity which is the *sine qua non* of aesthetic value,—in a construction which cannot be conceived as a whole, and worked out in every organic detail in the mind of a single creator. However convincing the argument may sound, the remedy of the evil is not likely to be found in the reappearance on a super-scale of the architect-engineer; but, on the other hand, the evil itself may not be as real as it seems. It is even possible that so far from being a menace to an aesthetic ideal, this division, which has given rise to a powerful new influence in modern

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**Preliminary Sketch of Anchorage, by F. Walter Taylor**

**General View of the Bridge from the Water Front**

Paul Philippe Cret, Architect
construction, may be the source of a renewed beauty, of an architecture more chaste and vigorous than we have known for many years.

In the full tide of the Victorian age,—that bewildering era when beauty, unhappily confounded with an idea of genteel falsehood, was believed to lie in the successful dissimulation of truth, when “polite” language was a tangle of ladylike euphemisms, and homely objects of utility were monstrously disguised to resemble anything under the sun but what they really were,—Taine remarked that strength and dignity of design were attained not by dissembling but by emphasizing structural purpose. The observation was less a forecast of a new ideal of beauty than a redefinition of a vital element of beauty, which has always been present in fine examples of architectural design. In recognizing the possibilities of beauty latent in the sheer mechanical frame of a construction, we have discovered nothing new. The “new” influence that has come from modern mechanics, from the creation around us of forms evolved by the effort to realize absolute utility and absolute economy, has simply aroused us to a fresh realization that “the laws of number are the laws of order and reason,” and that beauty is as much the child of cold reason as of imagination. The Greeks knew this, and the Egyptians before the Greeks; the great architects of later times were those who had not forgotten it.

Le Corbusier says: “The Engineer, inspired by the law of economy, and guided by mathematical calculation, brings us into harmony with the laws of the Universe.”

But in the enthusiasm which many of us feel for the austere and logical forms which are developed by mechanical mathematics, and in the reaction against the mawkish, the illogical, the senselessly elaborated and meaningless architecture that has been developed out of a feeble sentiment for the “quaint,” and a timid respect for popular taste, we must guard against a tendency to make a fetish of the rigid forms that are produced by pure mechanics. “Dum vitant stulti vitia, in contraria currunt;”—foolish people, while they are avoiding one vice, rush upon its opposite.

In the cold, simple, and intensely practical forms that have been created to meet the clear-cut demands of utility, there are logic and clarity; in them we see the vigorous starkness of purpose fulfilled, to the exclusion of every other objective. But though we look upon them with a sense of intellectual satisfaction, it is without emotion. We recognize in the concrete expression of mechanical law, the presence of the self-same laws that control and direct universal forces. But though the imagination is stirred, it is not satisfied. Logic and clarity and strength, although they are elements of the beautiful, are not all there is to beauty. Until they are emphasized by subtle modifications of lines and structural proportions,—until a sense of harmony, of rhythm and accent fuses them into an aesthetic unit, they remain mute; they are seen, but they are not felt. To quote again what M. Louis Dimier has said: “The necessities of construction, even supplemented by what M. de Baudot calls economic and social necessities, will never suffice to build an edifice. For of course these ideas have only a limiting and corrective value; they are not creative and fruitful. What is fruitful is the conception of form; it is design which emanates neither from geometry
nor from mechanics, but from the imitative arts.”

In brief, the architect is not relieved of his task. Architecture remains an art, serving an intense and ineradicable human craving, which art alone can satisfy. Moreover, an architecture which is deduced solely from the necessities of construction is not architecture, because it is not art,—it fails completely to evoke the emotional values latent in a mere manifold of mechanical factors. “Architecture begins where the calculations end.”

Thus we return to the aesthetic problem. The architect and the engineer must perform a sort of duo, each contributing his share of special knowledge in the creation of a structure which is to be both a mechanical unit and an aesthetic unit. To the engineer, the proof of the value of his work lies solely in its durability and precise fitness for a utilitarian purpose. “Esthetics are not in his line.” Yet it is he who gives the skeleton of the construction. Obviously, therefore, the architect is limited by mechanical conditions imposed upon him from the beginning. Nevertheless, he must control these limitations, and with them, rather than in spite of them, express an organic harmony of design between the mechanical and architectural factors of the structure. “The architect, by establishing a relationship of forms, realizes a pervading order which is the pure creation of his mind; by these forms, he affects our senses intensely, arousing the perception of plasticity; by the relationships which he creates, he awakens in us profound resonances, he gives us a sense of order which one feels to be in accord with the order of the universe, and which we perceive as beauty.”

The entire mechanical unit must be intensely realized by the architect before he can endow it with character and significance,—animate it so that it speaks to the imagination and stirs the emotions. Then he may begin his labors, mindful of the truth that Taine has noted,—that strength and dignity of design are attained not by dissembling, but by emphasizing structural purpose. Furthermore, the mechanical restrictions themselves are not wholly inflexible, and the mechanical solution is not necessarily arrived at independently of all aesthetic consideration. The mathematician, working to reconcile a number of mechanical conditions, may find not one, but several solutions,—all equally adequate to meeting the requirements. Obviously there arises a question of choice which may be guided not by mechanical, but by aesthetic considerations. Again, details, such as the shape and thickness of certain beams, or the proportions between certain parts of the steel structure which have no bearing on the mechanical adequacy, can be determined according to their relation to the architectural problem. Details,—yes; because a fundamental change is not necessary to render a form significant; but the knowledge that must be drawn on, to effect these minor changes, so vital to the beauty of the whole, is gathered only after long training in aesthetics.

Thus, the architect, collaborating with the engineer, finds that even in the construction of the framework itself, he can exert an influence toward the architectural design that he is to develop. On the other hand, for him to ignore the influence of the mechanical design would be a fatal step in the direction of defeating the whole aesthetic purpose. He cannot allow himself to forget, for instance, that the “spirit” of a steel form is not the “spirit” of
Flag Pole Base and Lamps

Lighting Standard at Philadelphia Plaza

Anchorage Pylon from a Side Street

Sketch of a Coat of Arms for Pylon

Delaware River Bridge, Details

Paul Philippe Cret, Architect
tion of structural function must be sought, as where the angle of opposing lines can accent the sense of powerful resistance to strain, or where the massing and modeling of stone or concrete can convey an intensified feeling of solid and immovable repose. The architect must have no fear of simplicity; he must have the daring to sacrifice the facile common-
vesture that reveals rather than in a garment that conceals.

In the end, the problem reduces itself to the necessity for a sensitive perception of the character and spirit of metal construction. Up to a point we may cling to the rules; but beauty is an outlaw, eluding the grasp of intellect or of industry, and yielding only to an incommunicable instinct in man which is as lawless as itself. The dogmatist who seeks too conscientiously to obey the canons of an aesthetic theory will fall as far short of achieving a beautiful thing as the indifferent and slipshod workman. There is no justice in art, and the artist knows no conscience but his own instinct. But it is this instinct which, violating law in a spirit of holiness, brings into being the new forms, which, strange and disturbing as they may be at first, in time are seen to be eloquent expressions of a true perception.

And, finally, it should be remembered that to the creative mind, every change and displacement that time and circumstance develop are elements that enrich rather than limit the means of creation. The creative instinct remains a constant force, strong enough to encounter even the problems that it views with alarm, and insistent enough to master them.

The illustrations accompanying this article are from photographs and drawings of the Delaware River Bridge between Philadelphia and Camden, and of the University Avenue Bridge in Philadelphia. They were selected to illustrate an attempt to harmonize the stonework with the steel construction, and to give architectural value to the steel forms without having recourse to useless members or ornament. It was thought by both the engineers and the architect that, in most cases, ornamentation does not readily become an integral part of the design, but remains, as it were, “tacked on,” detracting from the austere beauty of the steel members.

The architect wishes here to acknowledge that his collaboration with the engineers of the Delaware River Bridge, Messrs. Ralph Modjeski, Chairman of the Board; George H. Webster; and Lawrence A. Ball; and with the engineers of the University Avenue Bridge, Messrs. Vogelson, Chief of the Bureau of Engineering; and Noyes, Engineer of Bridges; has been of great assistance to him in restraining the tendency of the architectural “Old Adam” to relapse into too much architecture; and also that his constant intercourse with men of the highest professional merit was a most pleasant experience to him. He realizes that his contribution to the common undertaking is of small value compared with theirs, and claims only the merit of having tried earnestly to understand their points of view in this worthy achievement.

Statistical Data:

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Sketch of Main Piers, University Avenue Bridge, Philadelphia
Paul Philippe Cret, Architect

Drawn by J. H. Hough
ILLUMINATION IN THE PHILADELPHIA MUSEUM OF ART

BY
C. E. WEITZ
ELECTRICAL ENGINEER

ALL of the treasures handed down to us from the past appeal to just one of our senses,—sight. The prime essential in museums, therefore, is that the objects of art may be well seen; this, of course, means that they must be well lighted. As we contemplate art or architecture, we find that each historic period wrote its own chapter, and our present viewpoint is a composite of lessons from the past. In the matter of lighting, however, though the subject is as old as the human race, very little can be safely taken from the past. Modern illumination is a new art, born of the science of the present generation. Its progress is measured in years, not in centuries.

Natural Daylight versus Artificial Daylight. While it is possible to design a building with primarily daylight illumination, it may mean a considerable compromise architecturally. Efforts in this direction have resulted in a distinct type of modern factory building with glass walls, but such a departure would hardly be considered for any building of the monumental type. Furthermore, the lighting requirements of an art museum are such that natural daylight illumination is limited to some extent to that obtained from skylights. With skylight construction, elaborate louver systems are essential to control the direct sunlight and also to overcome the natural tendency toward a maximum illumination on the floor rather than on the walls. Such skylight and louver installations are not only expensive initially but they inevitably impose severe restrictions on the design of the artificial lighting system. The large areas of skylight make the room hot in summer and give rise to expensive heat losses in winter. Questions of leakage, and of the cracking of glass, due to constant expansion and contraction, necessitate an efficient system of maintenance. Again, the latest researches have shown that the fading and discoloration of the pigments in paintings can be minimized, if not eliminated altogether, by the use of artificial light. It was logical, then, that those who have given the art museum problem the most thought should have reached the conclusion that provision of artificial lighting, with its constant quality and 24-hour availability, should be the first and foremost element as far as illumination is concerned.

Daylight Illusion. An illusion of natural daylight in the Philadelphia Museum is obtained through the use of “daylight” incandescent lamps, exclusively. These lamps, with their blue glass bulbs, correct the light of ordinary bulbs to a color not coldly white but of a hue which approximates that of natural light indoors which has been mellowed somewhat by window draperies and the tone of the interior decorations of the room. Nearly one thousand lamps are used to light the portion of the museum now completed. The lamps range in size from 60 to 1000 watts, each definitely and designedly contributing its part to the lighting ensemble. Some are used in floodlight projectors above artificial skylights, others in coves concealed in ceiling ledges, while

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Fig. 1. Plan Showing Fenestration Unrelated to Interior
The function of light is to reveal, and as such it should seem to pervade the whole. It should quietly play its part rather than intrude itself upon us. It was with this conception that the lighting problem of the various galleries of the new Philadelphia Museum was undertaken. No matter what words are used to describe the lighting effects, the lighting was planned not to introduce any mystic or esoteric effects, but purely as an unconscious illusion of normal daylight as an unobtrusive part of the whole. Let it be said further, however, that the technique employed is new and unusual, simply because usual methods have often left much to be desired in contributing the subtle but all-important part light should play. The most conspicuous feature of the lighting is the absence of those faults which most of us have been led by long experience to feel are necessary evils of a paintings display,—too strong a light, too weak a light, or dazzling light thrown back from the surfaces of the paintings by reflections of the light sources themselves. How refreshing to find these customary faults non-existent in the Philadelphia Museum! One writer described the lighting as one “of soft, steady daylight everywhere. While the sky was a sooty gray outside, with no hint of the sun, within the rooms a clear, diffused illumination gave the illusion of a June day, with the sun behind light,
friendly clouds,—and done in such a fashion as to reveal the witcheries of carved panels and painted canvases which transported visitors to the far-off days of the Georges." And that is the effect which those planning the lighting strove to secure. They sought to have the lighting as natural as possible in the many galleries as well as in the period rooms, and it was obtained by unusual arrangements of lighting devices. To supplement some settings, additional light was so directed as to render the most advantageous viewing of the displays.

Five Systems Employed. The portion of the Museum opened to the public for the first time in the latter part of March, consists of a section along the north and east sides of the third or main floor. The main hall at present consists of a series of four temporary galleries, occupying a space approximately 30 by 180 feet; the northeast wing comprises three main sections,—a central series of large and small galleries flanked on either side by a series of period rooms. The arrangement of the various galleries is shown in Fig. 1. The lighting for the galleries has been designed specifically as a part of the architectural treatment, which divides into five general types.

Lighting the Temporary Galleries. The large temporary galleries along the north side are partially ceiled with glass, through which comes a glow of light, soft and diffused. A typical gallery is shown in Fig. 2. Each skylight section is boxed in by a large housing, painted white inside to reflect the light from a number of daylight lamps within. These lamps are mounted well above the glass to give an even distribution of light and to avoid casting apparent bright spots on the skylight. But little dependence, however, is placed on the skylights for the strong, steady light that is essential for the gallery walls. Consequently only enough light comes through the skylight to make the glass softly luminous. Bounding the glass ceiling area on all four sides are beams dropped a foot below the ceiling and extending both lengthwise and crosswise of the room about 5 feet from the walls. In general appearance these beams are no more than supporting members of the ruling structure, but their primary purpose is to form the housing for the source of the gallery wall illumination. The sides of these drop beams toward the walls are of stippled glass sections behind which are concealed projectors so adjusted as to direct a flood of white light on the picture areas. These projectors, each using a 200-watt daylight lamp, are spaced 2 to 3 feet apart along the beams and are mounted on swivel joints for aiming as desired (Fig. 3). Each plays its own part in the lighting of a definite portion of the wall area of the galleries.
Fig. 6. Location of Projectors Behind the Clerestory Lunettes

Three Small Galleries Have Artificial Skylights.
In the wing adjoining the large temporary galleries there are three small galleries,—D, N, and I, shown in Fig. 1. They are paneled in velvet of royal scarlet, warm golden brown, and glossy gray. These galleries have skylight construction, but being of smaller sizes do not permit or require the exact lighting treatment just described. Instead, the skylight is the only source of light, but unusual emphasis is given the paintings on the walls by a battery of 28 floodlights above each skylight on all four sides. Each floodlight has a concentrated distribution of light, and is directed at the desired angle toward the walls rather than toward the floor, so that the paintings are adequately lighted and the wall coverings glow with natural velvety luster. A typical gallery of this construction is shown in Fig. 4, while a view of the equipment installed is shown in Fig. 5.

Cove Lighting for Rotunda Dome.
The rotunda, which forms the central portion of the northeast wing, is lighted from a concealed cove at the base of the vaulted dome,—daylight lamps, of course. But aside from an effect that is striking, the application is not at all uncommon. This lighting does, however, emphasize the delicate colorings and patterns in the ceiling, while the dome is crowned by a luminous panel behind which can be placed spotlights to highlight statuary in the niches which face a life-sized bronze of Washington standing at the center of the rotunda floor (Fig. 10).

Thousand-Watt Projectors Light Clerestory Galleries.
The clerestory galleries, as the name implies, have high arched ceilings as in the nave of a church, with semi-circular windows high up along each side. These galleries join the rotunda on either side. The larger of the two is 26 by 28 feet, and has three windows on each side. Each window is divided into seven radial sections fitted with ribbed glass. Behind the center panel of each window, on both sides of the room, are 1000-watt projectors which direct a cross-spread of light upon the picture area of the opposite wall. The other six panels of each window are backed up with a sheet metal housing within which are several 200-watt daylight lamps to make the entire window luminous. Fig. 6 shows where the projectors are located. A view of one of these galleries is shown in Fig. 7. The effect is that of natural daylight streaming in through the clerestory.

Unusual Lighting Methods in Period Rooms.
Perhaps the most unusual treatment is manifest in the period rooms,—particularly so if we seek to emphasize the departure from architectural precedents so increasingly necessary if the full potentiality of lighting is to be gained. There are four English rooms of the period from 1724 to 1754, taken in their entirety from Sutton-Scarlsdale and Wright-
Fig. 7. Clerestory Lunettes in Large Gallery

ington Hall, also a room from Treat House, Upminster, and a Tower Hill room. There are four American rooms, one from the Powel house, Philadelphia, where Washington, Lafayette, and Franklin stopped when they came to Philadelphia. There, too, dashing British officers entertained, while Washington and his men lay at Valley Forge. Another room is from the Derby house, Salem, and there are two Pennsylvania Dutch rooms from the Muller house, Millbach, Pa.

These rooms indicate the scope and excellence which will make the new Museum famous throughout the world of art. They are originals, transplanted with meticulous care to this new and stately building which crowns Philadelphia's acropolis. There are the golden brown fumed oak wainscotings of Sutton-Scarsdale with the tragic, deathless loveliness of Lady Hamilton looking down from one great canvas, surrounded by other Romneys, Gainsboroughs, and Raeburns of the McFadden collection. Since these rooms are set bodily within the walls of the Museum, use of natural daylight alone was impracticable; still, if the rooms were to retain their character and charm, the daylight effect was necessary. Strong shafts of direct sunlight through these windows, while producing a very natural effect, might be bright enough to obliterate details of paintings along certain sides of the rooms. When these rooms were reconstructed within the Museum, a small space was provided between the building's walls and the outside walls of the rooms. This allows some diffusion of natural daylight to filter in through the inner windows, but by dropping white curtains outside the rooms' windows a soft diffused artificial light is reflected into the rooms. Daylight lamps mounted around the outer edges of the window frames direct their light to these curtains, and this is particularly true of the Tower Hill Room, giving a pleasing daylight effect. In this case, as will be noted by reference to the plan shown in Fig. 1, the windows actually look out upon the walls of the temporary gallery which have been curved around and direct into the room the light from concealed lamps.

Though such a scheme creates the illusion of natural lighting, it is not satisfactory as the primary lighting in those rooms. To light, effectively and unobtrusively, the wainscoting and the paintings which grace the walls, a scheme similar in principle to that described for the temporary galleries is used. Instead, however, of beams dropped from the ceiling to conceal supplementary equipment, we find a unique departure from architectural precedent. In order to accommodate floodlight projectors to light the walls predominantly, the architects have, in effect, taken a sharp knife and cut through the ceilings about 4 feet from the walls all around. Then the
inner edges of this incision are bent down about 6 inches, leaving the central portion of the ceiling in a gracefully curved arch. This allows a band of stippled glass to be inserted,—or a cove, if one will,—into the ceiling, behind which are mounted floodlights which sweep the walls. The drawing in Fig. 9 shows this, while Fig. 8 shows the lighting results as obtained in the Sutton-Scarsdale Room.

The question was asked of Mr. Borie, one of the architects, how, in architects' parlance, this type of ceiling would be designated. He naively answered, "Plaster." And, so it seems, the Philadelphia Museum shows architectural departures in reference to illumination results at almost every turn. This pioneering spirit in an architectural way evidences faith in the plans of the lighting of the Museum.
THE STRUCTURAL FRAME OF THE NEW TEMPLE EMANU-EL BUILDING

BY
EUGENE W. STERN
CONSULTING STRUCTURAL ENGINEER

The structural frame of the new Temple Emanu-El building in New York is principally of steel construction, but portions are of reinforced concrete as well as masonry, the material chosen being that best adapted to suit the particular condition.

General Description. The structure is in reality a group of three buildings,—the Temple proper, the Beth-El Chapel, and the Community House. The Temple proper is a large auditorium, 100 feet by 176 feet, seating in all 2,500 people, of whom over 2,000 are accommodated on the main floor and the remainder principally in the west gallery. All seats are so placed as to provide a view of the ark and the pulpits. Of the total length of the auditorium, about 25 feet are taken up by the sanctuary, which is separated from the main body of the auditorium by an arch about 40 feet in width.

To the north of the Temple is the Beth-El Chapel, about 50 feet by 100 feet, a two-domed structure with a separate entrance from Fifth Avenue. This chapel has been planned to seat about 325 persons, the only gallery being a small choir gallery at the west end.

To the east of Temple Emanu-El is the Community House, which is an eight-story building, 100 feet deep. The main body of the structure is about 50 feet in width and has an entrance vestibule and elevator tower, placed on the 65th Street side between the Temple and the Community House. The tower is about 175 feet high to the top of the stonework. The Community House contains, on the ground floor, a large auditorium; on the second floor, the offices of the Temple and the library; and on the next five floors, classrooms; while the eighth floor includes the rabbis' studies, trustees' room, etc.

Temple Emanu-El. The nave of the Temple is 77 feet wide, 147 feet, 6 inches long, and 103 feet high, from floor to ridge of ceiling. The columns supporting the trusses are built in the form of a trussed frame 8 feet deep, designed to carry 30 pounds per square foot horizontal wind pressure. The roof trusses, spaced 27¾ feet apart, have trussed top chords, the tops of which are in the plane of the roof and the bottoms in the plane of the ceiling, as may be seen in these illustrations. The bottom chords of these trusses are horizontal members and are exposed. The web members of the trusses are not visible, being hidden by the ceiling, as they are in the space between the ceiling and the
The Main Roof Trusses

roof. This design of truss, having a system of triangular web members which supports both the roof and ceiling, is readily analyzed for stresses, being statically determinate, and was quite the most economical design that would meet the conditions of the problem. The walls are of masonry, reinforced concrete and brick faced with limestone, and are self-supporting, except the clerestory, which is carried on reinforced concrete girders at a level of 61 feet above the first floor. These girders are supported on reinforced concrete columns.

The front of the building on Fifth Avenue has a reinforced concrete frame and arch, 108 feet high, from the street level to the roof, which carries the load of the roof to the foundations. The stone facing supports itself and is anchored to the concrete. In the basement of the Temple there is a banquet room, of 50 feet clear width between the columns which support the main floor. By using a cantilever system of floor beams it was possible to support the first floor on 20-inch beams about 9 feet on centers.

Bracing. Adequate bracing, both vertically and horizontally, has been provided, some of which is temporary and will be removed after the reinforced concrete and masonry work of the enclosing walls are completed. In general, the bracing consists of 1-inch rods with turnbuckles, and struts made of two channels riveted together in the form of a T.

Chapel Beth-El. The structural frame of the Chapel is quite simple, there being nothing unusual in the problem of supporting the roof and the domed
ceiling, which is hung from trusses. The decorative masonry of the interior is practically all self-supporting or carried on reinforced concrete construction.

Community House. This building is eight stories in height and is designed for a future extension of two stories. The first story provides an auditorium with gallery, and it was, of course, necessary to have this space free of exposed columns. To accomplish this all the interior columns which carry the upper floors were supported at the third floor on a system of trusses, whose depth is the full story height of the second story. There are three trusses 14 1/4 feet deep and one plate girder 10 feet deep, which support the framing of all floors above the auditorium. These trusses, therefore, carry heavy loads, and one of them has a span of 47 1/2 feet and supports 1100 tons. In the design of these trusses the details are so arranged that in all field connections the rivets are in double shear, thus reducing the number of field rivets to a minimum, and allowing the use of smaller gusset plates at the connections,—an important matter, inasmuch as door, corridor, and window openings had to be provided for in the design of the web system of these trusses. In Truss T-1 the main top chord compression member is a box section made up of four 15-inch channels, 55 pounds per foot, with 22-inch cover plates 1 3/4 inches thick. All steel trusses and connections of columns to trusses were assembled in the shop, and all holes for field connections were reamed or drilled through the solid metal. This proved to be very satisfactory in every way and saved materially in the cost of erection, as
DIAGRAM OF STRUCTURAL FRAME OF THE AUDITORIUM
TEMPLE EMANU-EL, NEW YORK
ROBERT D. KOHN, CHARLES BUTLER AND CLARENCE S. STEIN, ASSOCIATED, ARCHITECTS
EUGENE W. STEIN, CONSULTING STRUCTURAL ENGINEER
the pieces were fitted together in the field without any reaming or drifting.

Floor Construction. Owing to the difficulty of obtaining clean anthracite cinders in New York, it was deemed undesirable to use cinder concrete in the floors. Stone concrete of $1:2:4$ mix, and combination tile, one- and two-way systems, and reinforced concrete floors have been used throughout. In the Temple the main floor slab is $4$-inch reinforced concrete, supported on steel beams spaced about 9 feet apart, the reinforcing consisting of $\frac{3}{8}$-inch round bars spaced about 5 inches on centers placed diagonally in two directions so as to accommodate the openings for ventilating sleeves. The roof consists of a $3\frac{1}{2}$-inch reinforced concrete slab on which there is a 2-inch layer of nailing concrete in which are 2 by 3-inch wood nailing strips spaced about 2 feet apart, to which the covering of copper is attached. In the Chapel Beth-El the floor construction is entirely of reinforced concrete with reinforced concrete girders and hollow tile concrete ribbed floor slabs. The floors of the Community House are similar, consisting of one- and two-way hollow tile and concrete ribbed slab systems on steel girders.

Robert D. Kohn, Charles Butler and Clarence S. Stein, associated, were the architects, and Mayers, Murray & Phillips the consulting architects. The author was the structural engineer. The structural design of the building was planned solely to meet the architectural and structural requirements.
GENERAL VIEW OF STRUCTURAL FRAME
TEMPLE EMANU-EL AND COMMUNITY HOUSE
CHOOSING AND SPECIFYING LUMBER

BY

G. E. FRENCH and A. T. UPSON

ENGINEERS, NATIONAL LUMBER MANUFACTURERS' ASSOCIATION

LONG before King Solomon called on Hiram of Tyre for cedars of Lebanon and sent four score thousand woodsmen into the mountains of Judea to cut and hew timbers for his temple, wood was one of the most extensively used and important building materials. It still is. Not until the second decade of the twentieth century, however, was there available exact knowledge of its physical and mechanical properties.

Today conditions are different. As a result of the present keen competition, which is the life of modern business, lumber manufacturers, lumber distributors, engineering organizations, and research departments of the federal government have seen fit to lift the mystic veil enshrouding the properties of wood so that it may be compared property for property with competing materials. With this have come lumber standardization, plans for grade marking lumber, better merchandising, and the free advisory and consulting service of organized lumber manufacturers for the specifiers and consumers of their products in matters of lumber specification, procurement, and utilization. The aim of this article is to place before architects the technical information developed through research by such organizations as the American Society for Testing Materials, the U. S. Forest Products Laboratory, the Department of Commerce, and various trade associations, in a form that will be of practical assistance to them in the selection of woods, the designing in wood, and in writing the subsequent specifications. Wood is a product of nature, and no two creations of nature are exactly alike. Between the extremes there is considerable difference. The variations in lumber, except in rare instances, are readily discernible, however, so that it is possible to select, sort, and grade wood for a particular use with the assurance that the material will give satisfactory service. It is this service, this selection of the right kind, the proper grade, the right size of lumber for each of a multiplicity of uses, that is claiming the closest attention of progressive lumbermen, and this service is being offered the architect today.

Structure of Wood. Wood is a highly complex material, composed of masses of various types of tube-like cells. Some of these cells are thin-walled and adapted to the passing of liquids in the growing tree; others serve as food storage cells; and still others function primarily as strength tissue. Most of these cells have their long axes parallel to the main axis of the tree. In some species, however, as high as 25 per cent of the cells may have their long axes at right angles to the main axis, extending out like radii from the pith or center of the tree. These are known as "wood rays" and play an important part in the properties of wood. They also impart the beautiful figure to quarter-sawn boards of such woods as the oaks and gums. These variations in cellular structure, these anatomical differences, are responsible for the character and individuality of our different species of woods. It is due to these characteristic cellular differences that some species have a beautiful figure or grain, that some are resistant to impact, that some have great stiffness, that some are resonant, and that still others are capable of being bent and shaped into many forms, all demonstrating wood's great adaptability.

In the hardwoods or broad-leaved trees, such as oaks, maples, birches, elms, and basswood, the mixture of various types of cells is rather heterogeneous throughout each annual layer of wood laid down about the tree, though some have more uniformity than others. In the softwoods or needle-leaved trees, such as the pines, spruces, and firs, there is considerable uniformity in the type of cells. In the springwood they are usually large and thin walled. Later in the year the cells formed are smaller in diameter and have much thicker walls. The percentage of summerwood thus formed in Douglas fir and southern yellow pine, is readily discernible to the unaided eye, and is one of the most accurate criteria by which to judge the relative strength values of pieces of either species. Structurally there is little difference between sapwood, the living portion of the wood in a tree, and heartwood, the matured portion; and contrary to general belief, there is practically no difference in mechanical properties of otherwise similar materials. Sapwood is less resistant to decay than heartwood, but incidentally it is more readily treated with artificial preservatives. Straight-grained material, so desirable where strength is required, has the long axes of the cells parallel to two adjacent sides of the board or timber into which it is cut. Frequently the direction of these fibers is not parallel to the axis of the board, due either to the distortion of the fibers around a knot, that portion of a branch contained within the trunk of a tree; or to improper manufacture in the sawmill. Such material is termed "cross-grained," and when the slope of grain is pronounced it is unsuitable for use in heavy duty construction. The limits of permissible cross grain are defined in structural grading rules.

Knots in lumber may be either "tight" or "loose." Knots formed during the growing life of a branch are tight because of the close union between the fibers of the branch and those of the stem. When the branch dies, this close bond or union ceases, and the tree merely grows around the stub of the dead
branch. This type of knot is known as "loose" or "not firm," inasmuch as such knots may fall out during lumber seasoning processes. Knots in a quarter-sawn surface of a board are termed "spike" knots because of their long, slender appearance. Knots on a flat or plain-sawn board are oval or round. The locations and sizes of knots in material where strength is of primary consideration are important and always rigidly controlled by inspection rules. Lumber may contain other defects, some of one kind in one species, of another in others. Many of these have little no damaging effect on the use of the piece, because their prevalence is also rigidly controlled by grading rules.

Dryness of Lumber. Lumber manufacturers today are devoting more thought, more skill, and more technical study to the seasoning of lumber than to any other one problem in its manufacture, due to the close relationship existing in wood between the degree of dryness and its various physical and mechanical properties, and suitability for various uses. When a tree is cut in the forest, sapwood may contain a greater amount of water by weight than wood substance. In the heartwood, water may be present to the extent of from 30 to 50 per cent of the oven dry weight of the wood. Boards cut from such material immediately begin to lose their moisture by evaporation. The percentage of water retained in the board depends entirely upon the humidity of the air to which it is subjected. In air with a relative humidity of 90 per cent, lumber will have an average moisture content of 22 per cent; at 60 per cent relative humidity, a moisture content of 12 per cent; and at 30 per cent relative humidity, a moisture content of 6 per cent. If the humidity of the surrounding air changes materially, then the moisture content of the lumber changes also. The rate at which this change takes place depends to some extent on the species involved, the protective coating of the wood, the dimensions of the piece in question, and the temperature and circulation of the air in contact with the wood. It is slow in any event. Change in moisture content is important as far as the properties of lumber are concerned. Loss of moisture below 25 per cent of the oven dry weight of the wood is associated with a decrease in size but with an increase in strength properties. The converse of this also holds true. The rate of change in moisture and method of change is also important. Too rapid a change in moisture content may cause uneven drying with subsequent warping or checking. The seasoning of lumber is, as a result, work which must be carefully supervised.

Frequently heard these days is the complaint "lumber is not seasoned as it used to be." It isn't! It is seasoned far better by the better mills of today than ever before. It is done accurately and under the supervision of skilled operators. There are two real reasons for the complaints mentioned. One of these is that many builders refuse to pay the slight additional cost of properly seasoned lumber and take chances with green lumber. Another reason is that the conditions to which lumber is subjected in the modern home are far more exacting than ever before. It is easy to recall the period when one or two rooms in a house were heated by a stove in the winter and the rest of the rooms were cold. Humidities were not low, and air-dried lumber would change but little even in the heated rooms during the winter. Living standards have changed. It is now quite generally the custom to heat all of the house to 70 or 75°. Relative humidities of 30 per cent or lower obtain for long periods with subsequent loss of moisture and shrinkage of wood not properly seasoned for these new conditions. It is not that lumber is poorer than it used to be or that it is not seasoned well; it is usually the fault of some individual who refuses to study the influence of this new era of well heated homes upon the requirements for dwelling houses. Lumber must be properly seasoned to stand the new conditions. Lumber conditioned by the manufacturer for particular uses can be shipped a long distance in box cars without appreciable changes in moisture content. Considerable responsibility therefore rests with the retail distributor and with the contractor. Kiln-dried flooring and finish should always be stored in closed, rain-proof sheds. If a few steam coils are present, so much the better. Such stock should not be taken to a building until the windows and doors are in and the plaster has lost most of its moisture. If such precautions are taken, joints in the trim will remain tight and snug. Floors will not open up or squeak. The good service expected of lumber will be had.

Durability. The question, "what is the length of life that may be expected of wooden buildings?" cannot be answered in a simple statement of the number of years. Much depends on the species used, the possibility of there being insect and fungus attacks, mechanical injury and wear, the conditions under which it is used and permitted to be used, and so on. In Sweden lumber has long been abundant and extensively used as a building material. Today there are many Swedish buildings, built entirely of wood, put up in the latter part of the seventeenth and in the eighteenth centuries. Along our eastern coast in the older settled parts of this country there are many wooden structures from 100 to 200 years old. Frequently it is not deterioration of the material which determines the life of these buildings. A large number of our old houses have been torn down to make way for new buildings with modern improvements and conveniences, or for business structures. Obsolescence, therefore, accounts for much of the change from one type to another, from one material to another,—not depreciation of the material itself. The long natural life of some species, such, for example, as cypress, redwood, the cedars, and others, even under adverse conditions, is proverbial. The life of certain other species under conditions favorable to decay, is shorter. The sapwood of practically all species is not as resistant to
Decay. This may be caused by any one of several fungus organisms. These organisms put out thread-like roots or *hyphae*, which pierce the cell walls, rendering the wood first brash and, in the most advanced stages, worthless. Decay can develop only where the temperature is satisfactory, where there is sufficient moisture, and where there is a certain amount of air. If any one of these three conditions is not favorable, fungi cannot develop. In normal building practice one condition that can be readily controlled is the supply of moisture. It is impossible for decay to develop in timber the moisture content of which is below 20 per cent if the fungi have no outside source of available water. Air-dry material, in any of the well developed sections of this country, will have less than 20 per cent moisture content. The problem therefore is to design structures so that moisture will drain quickly from all portions of the wood members and as far as possible to provide for a circulation of air around such members. This free air movement will keep the lumber below the critical moisture content. It is likewise important to see that wood members of structures do not come in contact with other wood members which are in contact with a supply of water unless the latter are treated with a preservative.

Preservation of Wood. Fortunately, scientific research has provided us with practical means for arresting the progress of decay or entirely preventing it, even under most adverse conditions, in woods normally not resistant to decay. This is brought about by rendering wood toxic to decay by impregnating it with a preservative material. There are two general types of preservatives on the market,—those which will not leach out of treated material even though such material be soaked in water for long periods of time, and those which will leach out if permitted to remain in water for an extended period. Creosote is the outstanding example of the non-leaching preservative. It is the most commonly used preservative in this country at present and is efficient against both fungus and insect attack. There are various methods of applying it, depending on the species of wood and the use for which it is intended. It is perhaps unnecessary to discuss it in detail here, but full information can be secured from the American Wood Preservers Association, 10 South La Salle Street, Chicago. A disadvantage of creosote is that it is oily and black. It should not be used where people will rub against it, nor should it be used where it is the intention to paint the wood. Where these two qualities are not objectionable, creosote is usually the preservative preferred at the present time in this country,—a preservative widely used.

Zinc chloride, a common preservative, second in importance to creosote, will leach out of treated material under certain conditions. It is, however, effective against both insects and fungi. Wood treated with it is clean and can readily be painted. Other meritorious preservatives such as certain salts, zinc meta-arsenite, and sodium fluoride, are also used in this country. Any of these preservatives will give splendid results when properly used. Zinc chloride, certain salts and sodium fluoride should not be used where treated material is subjected to a continuous leaching action of water. Under such conditions, creosote, zinc meta-arsenite, or a similar preservative should be used. Paint has long been considered a preservative by the layman. As a matter of fact, paint is not a preservative in the sense that it renders wood immune to fungus and insect attack. It does have preservative action in that it retards the weathering of wood exposed to the elements, protects it to a large degree from mechanical wear, and retards the absorption of water from the air. If a sufficient amount of moisture is present in the wood before painting, decay can progress behind the finest coat of paint. No plans or specifications for permanent wood construction should be considered unless they have been carefully checked to insure all members against decay, either through cutting off all sources of moisture necessary for the development of decay-causing organisms, or through the specifying of either naturally decay-resistant woods or properly treated material for members where hazard due to decay is otherwise unavoidable.

Mechanical Properties. In the selection of the kind of lumber for a given purpose, two considerations should be given precedence over the factor of cost. Consideration should be given, first, to securing members of the proper species and dimensions to satisfy the demands of strength and stiffness. Next should come attention to those requirements other than stress values, such as hardness and nail-holding strength which must be met in the design of the project. During recent years the U. S. Forest Products Laboratory has carried on an exhaustive series of tests of all commercial domestic species of lumber. A large number of these tests were made of small, clear pieces. To determine the influence of knots, shakes, checks and other types of defects, however, a sufficient number of tests were made of timbers of large sizes to establish the relation of these defects to strength properties. These data were used in the establishment of American standards for structural grades, generally accepted by the trade. The stress values in Tables 1 and 2, included here, determined by the U. S. Forest Products Laboratory, have been accepted by the American Society for Testing Materials, the American Railway Engineering Association, and the Bureau of Standards of the Department of Commerce. It is to be noted that different values are recommended for timbers of the same grade and species for different locations with respect to degree
TABLE 1
ALLOWABLE UNIT STRESSES FOR STRUCTURAL LUMBER AND TIMBER

<table>
<thead>
<tr>
<th>Species of Timber</th>
<th>American Standard Grade</th>
<th>Bending Stress</th>
<th>Compression Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Usually wet</td>
<td>Continuously dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4&quot; &amp; 5&quot;</td>
<td>6&quot; &amp; 8&quot;</td>
</tr>
<tr>
<td>Cedar, western red</td>
<td>Select</td>
<td>670</td>
<td>750</td>
</tr>
<tr>
<td>Cypress, red</td>
<td>Common</td>
<td>570</td>
<td>600</td>
</tr>
<tr>
<td>Douglas fir</td>
<td>Common</td>
<td>680</td>
<td>720</td>
</tr>
<tr>
<td>Douglas fir (Coast type)</td>
<td>Select</td>
<td>1050</td>
<td>1165</td>
</tr>
<tr>
<td>Fir, (commercial white)</td>
<td>Select</td>
<td>620</td>
<td>700</td>
</tr>
<tr>
<td>Hemlock, west coast</td>
<td>Select</td>
<td>800</td>
<td>900</td>
</tr>
<tr>
<td>Hemlock, eastern</td>
<td>Select</td>
<td>680</td>
<td>720</td>
</tr>
<tr>
<td>Larch, western</td>
<td>Select</td>
<td>710</td>
<td>800</td>
</tr>
<tr>
<td>Oak, (commercial white &amp; red)</td>
<td>Select</td>
<td>600</td>
<td>640</td>
</tr>
<tr>
<td>Pine, southern yellow</td>
<td>Select</td>
<td>1000</td>
<td>1200</td>
</tr>
<tr>
<td>Pine, Norway</td>
<td>Select</td>
<td>710</td>
<td>800</td>
</tr>
<tr>
<td>Cali, Idaho &amp; no, white, lodgepole, pondera, sugar</td>
<td>Select</td>
<td>670</td>
<td>750</td>
</tr>
<tr>
<td>Pines, lodgepole, pondera, sugar</td>
<td>Common</td>
<td>570</td>
<td>600</td>
</tr>
<tr>
<td>Redwood</td>
<td>Select</td>
<td>710</td>
<td>800</td>
</tr>
<tr>
<td>Spruce, red, white, Sitka</td>
<td>Select</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>Tamarack, eastern</td>
<td>Select</td>
<td>680</td>
<td>720</td>
</tr>
</tbody>
</table>

TABLE 2
SAFE LOAD IN POUNDS PER SQUARE INCH OF CROSS SECTIONAL AREA OF SQUARE AND RECTANGULAR TIMBER COLUMNS (Dry Locations)

<table>
<thead>
<tr>
<th>Species of Timber</th>
<th>American Standard Grade</th>
<th>Ratio of Length to Least Dimension L/d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>L/d 10</td>
</tr>
<tr>
<td>Cedar, western red</td>
<td>Select</td>
<td>700</td>
</tr>
<tr>
<td>Cypress, red</td>
<td>Select</td>
<td>560</td>
</tr>
<tr>
<td>Douglas fir (Scrib, western)</td>
<td>Select</td>
<td>1100</td>
</tr>
<tr>
<td>Hemlock, west coast</td>
<td>Select</td>
<td>980</td>
</tr>
<tr>
<td>Hemlock, eastern</td>
<td>Select</td>
<td>720</td>
</tr>
<tr>
<td>Fir, com', white</td>
<td>Common</td>
<td>560</td>
</tr>
<tr>
<td>Oak, white and red</td>
<td>Select</td>
<td>1000</td>
</tr>
<tr>
<td>Pines, Cali, Idaho &amp; no, white, lodgepole, pondera, sugar</td>
<td>Select</td>
<td>750</td>
</tr>
<tr>
<td>Pine, southern yellow</td>
<td>Select</td>
<td>1258</td>
</tr>
<tr>
<td>Douglas fir (Coast type)</td>
<td>Select</td>
<td>1175</td>
</tr>
<tr>
<td>Pine, Norway</td>
<td>Select</td>
<td>800</td>
</tr>
<tr>
<td>Pine, Scrib, red, white and Sitka</td>
<td>Select</td>
<td>800</td>
</tr>
<tr>
<td>Douglas fir (Mountain type)</td>
<td>Select</td>
<td>800</td>
</tr>
<tr>
<td>Redwood</td>
<td>Select</td>
<td>1000</td>
</tr>
<tr>
<td>Tamarack</td>
<td>Select</td>
<td>1000</td>
</tr>
</tbody>
</table>
of dryness. In moist situations, treated material should be used to prevent decay. Tests have shown that creosote in itself does not weaken wood perceptibly, although the strength of wood can be influenced by carelessly treated processing techniques. These strength data are of particular value to the architect. They have been reworked, for example, into tables showing the permissible maximum spans for joists and rafters of different sizes in the different species. These are obtainable from the National Lumber Manufacturers’ Association, Transportation Building, Washington. Careful use of these authentic stress values in the designing of buildings leads to real economies, because the maximum utility value of lumber is realized.

Frequently factors other than the stress value listed in Tables 1 and 2 have an important bearing on the practicability of a given species for a given use. The degree to which it will “work” when in place, the ease with which it can be worked with tools and can be glued, its hardness, and its nail-holding strength, frequently determine the suitability of a wood for a given purpose. Wood from this angle is presented in Table 3. These observations are based on actual tests in the laboratory and the judgment of men long experienced in the use of wood. Attention is particularly called to the footnotes attached to Table 3 as an aid in the proper interpretation of the table. The Roman numerals do not necessarily indicate degrees of difference, and the values should be used with judgment. A sample piece full of knots, for instance, will not work as well as a clear specimen of any species listed.

### TABLE 3

<table>
<thead>
<tr>
<th>Species</th>
<th>Specific Gravity</th>
<th>Valuation Rank in Over-all 80</th>
<th>Side Hardness</th>
<th>Ability to Hold Nails in End of Piece</th>
<th>Workability</th>
<th>Nail Holding Power</th>
<th>Ease With Which Wood Can Be Glued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash, white</td>
<td>.52</td>
<td>12.6</td>
<td>1320</td>
<td>1</td>
<td>I</td>
<td>I</td>
<td>III</td>
</tr>
<tr>
<td>Aspen</td>
<td>.36</td>
<td>11.1</td>
<td>460</td>
<td>H</td>
<td>IV</td>
<td>H</td>
<td>IV</td>
</tr>
<tr>
<td>Brasswood</td>
<td>.33</td>
<td>15.8</td>
<td>450</td>
<td>II</td>
<td>IV</td>
<td>I</td>
<td>V</td>
</tr>
<tr>
<td>Beech</td>
<td>.34</td>
<td>16.2</td>
<td>1190</td>
<td>II</td>
<td>H</td>
<td>I</td>
<td>V</td>
</tr>
<tr>
<td>Birch, yellow</td>
<td>.54</td>
<td>16.8</td>
<td>1120</td>
<td>II</td>
<td>H</td>
<td>H</td>
<td>I</td>
</tr>
<tr>
<td>Cherry, black</td>
<td>.47</td>
<td>11.5</td>
<td>1020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chestnut</td>
<td>.40</td>
<td>11.6</td>
<td>580</td>
<td>I</td>
<td>I</td>
<td>IV</td>
<td>I</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>.37</td>
<td>14.1</td>
<td>480</td>
<td>IV</td>
<td>IV</td>
<td>I</td>
<td>IV</td>
</tr>
<tr>
<td>Cucumber</td>
<td>.44</td>
<td>13.6</td>
<td>790</td>
<td>II</td>
<td>IV</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Douglas fir (coast)</td>
<td>.45</td>
<td>12.6</td>
<td>810</td>
<td>II</td>
<td>III</td>
<td>III</td>
<td>I</td>
</tr>
<tr>
<td>Fir, balsam</td>
<td>.34</td>
<td>10.8</td>
<td>500</td>
<td>III</td>
<td>IV</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Fir, western white</td>
<td>.35</td>
<td>10.2</td>
<td>460</td>
<td>III</td>
<td>IV</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Hemlock, eastern</td>
<td>.28</td>
<td>10.4</td>
<td>490</td>
<td>III</td>
<td>III</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Hemlock, west coast</td>
<td>.38</td>
<td>11.6</td>
<td>620</td>
<td>II</td>
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<td>I</td>
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</tr>
<tr>
<td>Larch, western</td>
<td>.48</td>
<td>13.2</td>
<td>870</td>
<td>IV</td>
<td>III</td>
<td>III</td>
<td>I</td>
</tr>
<tr>
<td>Pine, Calif, white</td>
<td>.28</td>
<td>10.0</td>
<td>460</td>
<td>I</td>
<td>I</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Pine, Idaho white</td>
<td>.39</td>
<td>11.5</td>
<td>420</td>
<td>II</td>
<td>I</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Pine, lobolly and shortleaf</td>
<td>.50</td>
<td>12.6</td>
<td>860</td>
<td>II</td>
<td>III</td>
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<td></td>
</tr>
<tr>
<td>Pine, longleaf</td>
<td>.55</td>
<td>13.3</td>
<td>1020</td>
<td>H</td>
<td>III</td>
<td>III</td>
<td>I</td>
</tr>
<tr>
<td>Pine, Norway</td>
<td>.44</td>
<td>11.5</td>
<td>690</td>
<td>II</td>
<td>III</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Pine, ponderosa</td>
<td>.38</td>
<td>10.0</td>
<td>460</td>
<td>I</td>
<td>I</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Pine, sugar</td>
<td>.36</td>
<td>8.4</td>
<td>460</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine, white</td>
<td>.36</td>
<td>7.8</td>
<td>470</td>
<td>I</td>
<td>I</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Redwood</td>
<td>.41</td>
<td>6.3</td>
<td>520</td>
<td>I</td>
<td>I</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Spruce, red &amp; white</td>
<td>.37</td>
<td>12.0</td>
<td>540</td>
<td>II</td>
<td>II</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Spruce, Siskiyou</td>
<td>.34</td>
<td>11.2</td>
<td>530</td>
<td>II</td>
<td>IV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(1)* Based on green volume and oven-dry weight.

(2) Side hardiness load in pounds required to imbed a ball .444 inches in diameter one-half its diameter in wood.

(3) Represents a gradation from those woods which possess the greatest ability to stay in place under conditions of actual use (Class I) to those species which do not possess that quality to the same extent.

(4) Represents a gradation from those woods that can be worked with comparative ease (Class I) to those which present some difficulties in this respect (Class IV). These are approximate values only.

### Commercial Sizes of Lumber

A lack of appreciation of the manufacture of lumber on the part of the layman has been responsible for much questioning as to why the American Standard 1-inch yard board is 25/32 of an inch thick when dressed. The lumber manufacturer sets his saw, for example, to cut logs into boards exactly 1 inch thick. Due to the unavoidable variation in every mechanical operation, however, some pieces may be just under and some just over 1 inch thick. Before these boards are wanted by the consumer, they must be seasoned and usually brought to both uniform size and smooth finish. In these operations of sawing, seasoning, and dressing, 7/32 of an inch of lumber is required. The board originally 1 inch thick is hence 25/32 of an inch thick when it reaches the consumer, seasoned and dressed and ready for use. The seasoning process, however, increases the
strength of wood to such a degree that the wood, lost in smoothing the surfaces of a board is compensated for. The dressed board of 25/32 of an inch is therefore as strong as a 1-inch green board, and in addition is smoothly finished, ready for use. The development of standard sizes for commercial lumber is recent, begun in the year 1922 under the direction of the Secretary of Commerce at the instigation of leaders in the lumber industry. Previous to that time the lumber sizes of one association did not necessarily correspond with the sizes of another. Much depended on local conditions. The owners of some mills saw fit to manufacture heavy lumber. Others preferred to manufacture thinner material. Standardization has reconciled these differences, and it is now possible to order and secure lumber manufactured to American Standard sizes from mills in any part of the country. The economies made effective by this standardization of lumber sizes, to the manufacturer, to the distributor, to the archtect, and to the consumer, are quickly apparent.

The green or nominal sizes and the dressed sizes of American Standard yard lumber are given in Table 4. The dressed dimensions for structural lumber are 3/8 of an inch less than the nominal sizes for material from 2 to 4 inches in thickness and 7 inches or less in width. For widths of 8 inches or more of lumber 2 to 4 inches thick, and in lumber of all dimensions 5 inches and thicker, the dressed sizes are 3/8 inch less than nominal. Uniform workings for flooring, siding, ceiling, partition, and dressed and matched material, and standardized patterns for mouldings are both incorporated in the American Standards. The mouldings present good architectural design and are economical to produce. They are known as the "7,000 Series," and catalogs can be obtained on request from local lumbermen or from the National Lumber Manufacturers' Association.

**Measurement and Shipping Provisions.** Not only do the American Standards for Softwood Lumber cover manufacture, sizes, patterns, and workings as just discussed, and such lumber qualities or grades as will be described later, but they also cover the important features of universally accepted commercial species and nomenclature; uniform methods of description, measurement, and tally; practical shipping provisions; and standard association inspection services. Some of these aspects of the national standards for lumber enter into specification writing and are therefore of direct interest to the architect.

**Grades of Yard Lumber.** The untold value of our timber resources lies not alone in their vastness and the fact that they can be and are being renewed, but in the quality and the great variety of different species of trees. There are, in fact, 1,177 different known trees making up our forests. Of these 480 grow to merchantable size. Many produce lumber of similar characteristics, quality, or utility value, bringing about the recognition in commerce of 60 or more individual species or groups of different species of hardwoods, and 30 or more individual species or groups of similar species of softwoods. This gives the architect and the consumer of lumber a wide variety from which to select the woods most suitable for his needs. The very fact, however, that there are so many quality woods available, each varying in one or more properties from the others, made the standardization of grades of softwood yard lumber more difficult than the unification of yard lumber sizes or any of the other aspects of lumber standardization so far described. In fact, variations in methods of manufacture, in inherent quality, and in prevailing types of defects, give rise to differences in general utility value among the soft-

<table>
<thead>
<tr>
<th>TABLE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMERICAN STANDARD LUMBER SIZES</strong></td>
</tr>
<tr>
<td>(The thicknesses for any one item apply to all widths for that item, and the widths for any one item to all thicknesses for that item.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rough Green Sizes</th>
<th>Dressed Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thickness</strong></td>
<td><strong>Width</strong></td>
</tr>
<tr>
<td><strong>Inches</strong></td>
<td><strong>Dimensions</strong></td>
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<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Finish</strong></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
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<td></td>
<td>5</td>
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<tr>
<td></td>
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<tr>
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</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td><strong>Common boards and strips</strong></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
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<tr>
<td></td>
<td>3</td>
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<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Dimension and joists</strong></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
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<tr>
<td></td>
<td>4</td>
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<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Bevel siding</strong></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td><strong>Rustic and drop siding (D. &amp; M.)</strong></td>
<td>9</td>
</tr>
<tr>
<td><strong>Ceiling</strong></td>
<td>10</td>
</tr>
<tr>
<td><strong>Partition</strong></td>
<td>11</td>
</tr>
<tr>
<td><strong>Shiplap</strong></td>
<td>12</td>
</tr>
<tr>
<td><strong>Dressed and matched</strong></td>
<td>13</td>
</tr>
</tbody>
</table>

**Notes:**
- **Green Sizes:** The untold value of our timber resources lies not alone in their vastness and the fact that they can be and are being renewed, but in the quality and the great variety of different species of trees. There are, in fact, 1,177 different known trees making up our forests. Of these 480 grow to merchantable size. Many produce lumber of similar characteristics, quality, or utility value.
- **Dressed Dimensions:** The green or nominal sizes and the dressed sizes of American Standard yard lumber are given in Table 4. The dressed dimensions for structural lumber are 3/8 of an inch less than the nominal sizes for material from 2 to 4 inches in thickness and 7 inches or less in width. For widths of 8 inches or more of lumber 2 to 4 inches thick, and in lumber of all dimensions 5 inches and thicker, the dressed sizes are 3/8 inch less than nominal. Uniform workings for flooring, siding, ceiling, partition, and dressed and matched material, and standardized patterns for mouldings are both incorporated in the American Standards. The mouldings present good architectural design and are economical to produce. They are known as the "7,000 Series," and catalogs can be obtained on request from local lumbermen or from the National Lumber Manufacturers' Association.
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  - The untold value of our timber resources lies not alone in their vastness and the fact that they can be and are being renewed, but in the quality and the great variety of different species of trees. There are, in fact, 1,177 different known trees making up our forests. Of these 480 grow to merchantable size. Many produce lumber of similar characteristics, quality, or utility value.
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TABLE 5
SYNOPSIS OF AMERICAN STANDARD LUMBER BASIC
GRADES FOR YARD LUMBER

<table>
<thead>
<tr>
<th>Grade</th>
<th>Quality</th>
<th>Chief Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Select</td>
<td>Practically free from defects</td>
<td>Highest type of natural finished interior trim and woodwork, or flooring in some woods, of ceiling and partition, and of exterior siding.</td>
</tr>
<tr>
<td>B Select</td>
<td>Small defects, principally knots or small pitch pockets, and slight manufacturing defects.</td>
<td>Excellent quality of natural finished interior trim and woodwork, and the highest type in many woods; excellent flooring and for other interior uses, and for painted exterior trim and siding.</td>
</tr>
<tr>
<td>C Select</td>
<td>Slightly more and slightly larger defects than in B Select; none causing waste or detracting from a finished appearance when painted.</td>
<td>Best quality painted interior trim and woodwork; exterior uses, and often serviceable for natural finished interior trim.</td>
</tr>
<tr>
<td>D Select</td>
<td>More and larger defects than in C Select; none causing waste or detracting from a finished appearance when painted.</td>
<td>Universal grade for those uses always painted, and particularly where only one side and two edges of the piece show.</td>
</tr>
</tbody>
</table>

No. 1 Common

Tight-knotted, sound stock with size of defects and blemishes limited, and essentially as perfectly manufactured as Select lumber, but always usable without waste. Suitable for the highest type of general utility and construction, both in boards and dimension; and in products such as flooring, ceiling, and siding for interior uses not required to exceed of highest quality.

No. 2 Common

Allows somewhat larger and coarser defects than No. 1 Common, mostly tight with occasional loose knots and decay and decayed, and some imperfectities in manufacture, and usable without waste. Suitable for general utility and construction purposes both in boards and dimension; and the most suitable grade for construction not of the highest type, or of a temporary character.

No. 3 Common

Allow a larger and coarser defects than No. 2 Common, and occasional knots, holes, decay, and waste. Permits some waste in its use. Suitable for temporary construction, and in some woods for sheathing and similar purposes in the best construction.

No. 4 Common

Admits the coarsest defects, such as decay, holes, and permits waste in its use. Suitable for many uses but not of particular interest to the architect.

No. 5 Common

Must hold together in ordinary handling.

woods which, it was found, could not be completely reconciled by standardization.

Prior to lumber standardization, manufacturers sorted lumber according to their own ideas and markets. Often the definitions and terminology of grades were indefinite and unlike. From this rather chaotic state, groups of manufacturers producing a limited number of woods compiled and published association grading rules for their own woods. This was the first step toward national standardization and represented the great improvement over conditions obtaining early in the history of the lumber industry. With these association grading rules as a guide in the lumber standardization movement, which was instituted and carried on by all branches of the industry itself under the encouragement and auspices of the Secretary of Commerce and with the aid of the Department of Agriculture, basic grade classifications applicable to all softwoods cut into yard lumber and factory lumber were formulated. Association grading rules have now been brought into general conformity with these basic classifications, so that all commercially important softwoods are now available in American Standard grades.

**Specifying the Correct Grade.** Along with grades of structural lumber described here, yard lumber grades are of vital interest to the architect. Yard grades are based on the number, size, and character of the defects permissible in each piece. These are determined by the requirements of the majority of uses for each grade. The use-value of different woods is dependent upon the respective physical and mechanical properties and methods of manufacture, prevailing types of defects, etc., of the different woods. Consequently, in making selection of the proper wood or woods and the most suitable quality for a given use, the architect must take both the grade of the lumber and the utility value of the wood into consideration. The foregoing discussion and tabular data are designed to supply information on the comparative utility values of the different woods. As a guide to the architect in selecting the general grade quality of material applicable to his needs, Table 5 has been prepared. It is an amplification of the American Standard basic grade classifications for yard lumber and describes in general terms the character of each yard grade of the commercially important softwoods and some of its chief uses.

**Grades of Structural Lumber.** The American Standards also incorporate basic provisions for the selection and inspection of softwood dimensions and timbers where working stresses are required. The grading of such material is different from the grading of yard lumber, in that not only are the number, form, and size of defects considered but also their location with respect to the different faces and ends of the pieces. In addition, the comparative density of the material is important. The influence of defects gives rise to two basic structural grades,—Select and Common. More serious limitations are placed on defects permissible in the former than in the latter. When, however, the factor of density is added, two more grades are made possible, one of which, besides being of Select material, is dense, and the other, besides being of Common material, can likewise be dense. The Standards now provide for three of these grades,—Dense Select, Select, and Common. Dense Select material is the highest grade. It must average either on one end or the other, six rings of annual growth per inch, and in addition one-third or more summerwood. If 50 per cent is summerwood, 5 rings per inch are sufficient. It is found only in southern pine or Douglas fir, and is requisite for uses where great strength
and stiffness are required, such as for bridge timbers, beams and posts in heavy timber mill constructed buildings, etc. The second grade is Select. It must have the rings of the Dense grade but not the summerwood. It is suitable for a large number of general construction purposes, and is available in all softwoods producing structural material. The other American Structural grade is Common and is not selected for either number of rings per inch or per cent of summerwood. It is suitable for a great many structural uses where strength is a consideration but not a prime requisite. It is also available in all structural woods. The density rule of rings per inch and percentage of summerwood may also be applied to material otherwise of Common quality, giving rise to a grade of Dense Common.

The importance of the effect of certain defects and their location in the piece varies, however, according to the character of the use. The limitations with regard to permissible defects are somewhat different, therefore, in material used as joists or planks, as beams or stringers, or as posts or timbers.

These different use requirements are likewise recognized in the American Standards, so that in each of the three Standard grades just mentioned there are three so-called use-grades of the character just described. The employment by the architect and lumber specifier of the proper structural grade, therefore, requires judgment.

Advisory and Consulting Service. Progressive lumber manufacturers throughout the country have realized for some time that if lumber is to render its maximum service, they must make available to the architect who specifies lumber, technical advice and consulting service of a staff of engineers and specialists familiar not only with the problems of the users of lumber but also versed in the properties and uses of lumber in their various special fields. During the past year such a group of trained men has been brought together. An expert is stationed in each region to discuss the architect’s problems, to advise in regard to the kind and size of lumber, the sources of good lumber, and the proper way to specify and procure it.
THE UNIVERSITY OF DENVER STADIUM

W. E. & A. A. FISHER, ARCHITECT
GAVIN HADDEN, CONSULTING ENGINEER

THE University of Denver Stadium, shown in the accompanying illustrations, has at present about 31,000 permanent seats for football and track games. The structure is built in two parts, located on opposite sides of the arena, and the completed west side alone seats about 25,000 spectators. With the completion of the east side, therefore, the capacity will be increased to about 50,000 seats, and still further increases may readily be made, temporarily or otherwise, at the ends of the arena.

The design of this structure shows the modern tendency to differ widely from such ancient examples as the Roman Colosseum or the Panathenaic Stadium in Athens to meet more adequately the conditions and requirements of the modern games for which it is principally used. Not long ago there was a definite architectural prejudice against the division of a monumental structure of this kind into two separate parts without making physical and structural connection at one end or at both ends of the arena. Such connections were regarded as necessary for the attainment of unity in design, and it is only recently, comparatively speaking, that the realization has been reached that the field or arena itself is properly the central feature of the design. The arena itself, with its playing field and running track, forms a connecting link between the two structures, just as surely as the nave of a cathedral may form the connecting link between two lofty disconnected spires. Still further departure from ancient precedent is found in the form of the completed part of this structure. Spectators at football games, for whom this structure is primarily intended, generally desire seats located as close as possible to the 50-yard line of the gridiron and as close as possible to the center of the field. This has resulted in principles which determined previously the design of such structures as the Cornell Crescent at Ithaca, the Brown Stadium in Providence, and also more recently the Dyche Stadium at Evanston, and the Municipal Stadium at Asbury Park. The exterior wall, which in plan forms a circular curve centered
GENERAL PLAN, DOTTED LINES SHOW POSSIBILITY OF ENLARGEMENT
Entrance to Portals

Gate and Entrance

on the middle of the football field, terminates the rising tiers of seats and thus forms a curved skyline which is the most distinctive feature of the arena, particularly well suited to the use of reinforced concrete, of which the structure is built. Still further distinction is added to the skyline curve in its exterior elevation by the continuous succession of ascending and descending arches piercing the outside wall.

An interesting lesson has been learned from recent use of the stadium, which serves still further to prove the soundness of this design. The private boxes, as shown clearly in the plan, are located in two longitudinal rows, part way up the stand, extending approximately from goal line to goal line. There has been so much demand for the centrally located boxes, and so little demand for those nearer the...
ends, that it indicates definitely that the same general principles might well be followed in box location as in the location of the ordinary seats, placing a proportionally greater number of boxes opposite the central part of the field. The drawing of the cross-section of the stadium shows that the first row of seats is close to the level of the track and field. This enables the spectators to obtain a good view of all runners on the running track, even though this first row of seats is located close to the boundary of the track; this arrangement of seats at the same time reduces the distance of the average and maximum view at football games. The running track itself was designed according to the best practice, developed and improved from experience elsewhere, and the excellence of the results was attested by the
records attained at the very first of the track meets. The entrances and exits are located in two longitudinal rows at intermediate elevations on the deck. The upper portals are fewer in number than the lower and serve only the upper part of the deep central portion of the deck. As all except one of the lower portals are reached by ramps extending up from the ground under the structure, nearly all the spectators can go to and from their seats with comparatively little exertion, the only steps being those located in the aisles in the deck. The circulation facilities have been carefully designed to provide safety, comfort and convenience, and the entire stadium can be emptied of a capacity crowd in a few minutes without there being undue congestion.

Other interesting features of this structure, some of which are shown in the illustrations, are the press box, with its many conveniences; the players' boxes; the expansion joints; the drainage system; and the extensive use for interior rooms which has already been made of a large part of the space under the seating deck. In addition to the space required for the ramps and passages for the circulation of spectators, the completed part of the structure houses spectators' toilets, rooms for players, a large lounge room, coaches' and trainers' rooms, a laundry and dry room, a caretaker's room, administration offices, and a dining room and kitchen for training tables. One important use of the stadium is for civic events, some of which may require only a small stage or arena, and the form of the structure makes it also particularly advantageous for such purposes, since a majority of the seats are concentrated within a small distance of one spot.
VIEW OF THE STADIUM FROM THE FIELD

VIEW IN A ROOM UNDER STADIUM SEATS
DUE to changed economic conditions, planning the average house today presents to the architect a problem entirely different from what it did a generation ago. Today the architect's responsibility is not limited to supplying artistic design, style or appearance; these must be provided, of course, but along with them he must consider the increased demand for modern facilities for health and comfort. Nor is it enough that the architect provide only such of these facilities as are demanded by his client. He must also anticipate the needs of his client and tactfully call attention to them, all of which is strictly in keeping with the modern demand for service and the trend of modern practice.

The growing desire for comfort and efficiency has been more pronounced with reference to the planning of the medium priced house than with the larger and more expensive residence. The reasons underlying this demand are obviously brought about by the rise and rapid increase in the number of a class of highly specialized technical workers,—the doctor, the lawyer, the professor, the engineer, the department head, the junior executive, etc.—in a word, the great class of men who are trained but who have to work at small salaries during the earlier years of their careers. They belong to the class whose incomes range from $5,000 to $15,000 a year, a group which, income tax returns show, has grown enormously in the last decade. The medium priced home represents, usually, the life-long ideal of these people. It has been the goal of the man and his wife, usually a well bred woman, since the days when the salary had to be carefully budgeted, to make it cover the monthly expenditures. Enduring the discomforts of living in quarters in a district where rents were commensurate with the size of the pay check, a man of this type and his wife have had the thought of home constantly before them. "When we build a home of our own" has been a daily phrase in their household. All of their dreams have centered about it. They have worked and economized for years in order to achieve it. Happiness, to these people, is symbolized by "a home of our own."

The architect should remember, in dealing with this type of clients, that he is not dealing primarily with the man. He is dealing with the man and his wife,—and the wife is going to have a great deal to say in the matter. Naturally, planning a home for them entails more than style or design. They want the artistic, of course, but that is not all; first of all they want comfort. During the years of discomfort which the wife has undergone in rented houses, she has formulated a very definite idea of what a home of her own was to be when she and her husband could afford to build it. She has subscribed to magazines which deal with home building, and from them she has learned a great deal about style and various types of architecture, home equipment and planning. In her mind's eye she has already built the home about which she now consults the architect, and she demands that he give her something which agrees with it. In order to do this, the architect must attack the problem of home planning from the wife's point of view. In other words, he must begin with her three major considerations: comfort, style and efficiency. The arrangement of all the rooms, in fact, must be made to conform to her artistic taste and her demand for modern convenience.

The plan of the house in general must be such that it saves her or her servants as many steps as
possible. The kitchen must be conveniently located with reference to both front and rear entrances; the bathrooms must be convenient to the bedrooms. There must be a lavatory on the first floor, located so that the children can get to it and to their play room without going through the main rooms of the house when they come in from out of doors. There will be no left-handed sink in her kitchen; interior doors will swing the right way; the cupboards will be located in the most convenient places; there will be an incinerator, and the modern electric refriger-ator will conform to her desire to reduce the num-ber of necessary steps to a minimum. There must be a sufficient number of base plugs in the proper places for floor lamps, vacuum cleaner, iron, toaster and other electrical appliances. Ornate mouldings which catch dust and are difficult to clean must go into the discard. Interior door sills are no longer desired, because of the hindrance they present to cleaning, and the danger they represent in tripping. Modern heating cabinets skillfully concealed in the paneling or beneath windows and cupboards may replace the ugly, old radiators, for the modern woman has read about them and wants them.

She demands proper ventilation and frequently is familiar with the various devices that have been created to improve it, particularly in the kitchen and in the sleeping rooms. Women, particularly those who read the current magazines, have become fairly well versed in knowledge of modern home management, and their education in this direction is reflected very noticeably in architecture. She knows about insulating the house against the winter cold. The heating plant is not a mystery to her; she knows that she can heat economically without the shoveling of coal. Thus it is the business of the architect to be well posted on the devices which have been de-signed to make the house more comfortable, more efficient and more liveable. Architects must know what all these devices are, what they provide, and what it costs to install them, and they must be able to tell their clients in detail just what they will accom-plish; and while it is not the duty or even the func-tion of the architect to attempt to promote the in-stallation of these devices, it is his business to give the client what he or she wishes, and it is his duty for the sake of his profession to be able to assist the client in properly planning the house and to safe-guard him or her against overlooking things which the architect knows will be wanted when the new house is completed and occupied.

Such a house must be equipped with all modern devices, both those in general use today and those which will be generally demanded tomorrow. Of all the defects or inconveniences which may creep into a finished modern house, probably the worst is im-proper heating. Defective heating may be brought about by lack of radiation, not enough boiler capac-ity, improper distribution of radiation, or lack of heat control. The steady development of the prin-ciple of heat control has brought this country to a point where almost everyone has heard of automatic heat regulation and the assurance it gives of health and comfort. A few years ago the average man or woman planning a medium priced house would never have thought of asking for automatic heating con-trol. In the last four or five years particularly, it has shown a remarkable growth. People have come to recognize the regulator as a device which will render comfort, and in climates where sharp temper-ature changes are frequent, people understand that the uniform temperature assured through automatic heat regulation is a real protection to health.

Many people have heard of automatic heat regu-lation but are not entirely familiar with its prin-ciples. They do not understand that even though heat regulation is not immediately contemplated, the wiring at least should be installed at the time the house is wired for electricity, thus saving bother and worry at some later date. The architect must be able to explain in detail just how an automatic heat regulator can be installed in the house. The family may have one or two small children for whose health the mother is very much concerned. Dr. C.-E. A. Winslow, Professor of Public Health, Yale Uni-versity, has shown that childhood illnesses and the incidence of contagious diseases are closely corre-lated with room temperatures. In an extensive study of the subject he found that children kept in rooms in which the temperature was above 68° Fahr. showed a much greater susceptibility to disease than did children kept in rooms where the temperature was maintained at 66° or 68°. The results of research have been widely published in women's magazines, and a woman of the type being considered here is probably familiar with them.

Devices which have to do with refrigeration, con-trol of humidity, ventilation, heat regulation, etc., are coming into general demand among modern home builders. The last five years have seen this demand double, treble and quadruple. The architect, therefore, who is keeping abreast of the progress of his profession, must familiarize himself with the best and latest that is being offered, for their impor-tance in the home is coming to be looked upon as fully as great as the importance of design or dec-oration. Comfort and health are assuming impor-tance in daily life. They are becoming major con-siderations in home planning. The architect, there-fore, must consider them and place upon them the emphasis which they are receiving in the minds of this generation. Economic conditions have given rise to higher standards of living. Demands must be catered to, and architects must know and meet them.
OFFICE PRACTICE

THE ARCHITECT'S BUDGET

AN ADDRESS BY

EDWIN BERGSTROM

THE SIXTY-FIRST CONVENTION OF THE AMERICAN INSTITUTE OF ARCHITECTS, HELD IN ST. LOUIS, MAY 16-18, 1928

ARCHITECTURE is a busy profession. Without doubt there enter into it more of business and detail of business administration than enter into any other profession. It is not a true profession in the sense that the other fine arts are professions. The musician, painter and the sculptor create with their own hands their finished art, but the architect would make a sorry showing if he should build his dreams. Of all professions, his alone must depend upon others to give form and substance to his art. Architecture is further differentiated from the other professions. The architect creates his art to satisfy a definite need; the sculptor and painter to satisfy their own imaginations. There must be definite need for his creation before the architect can begin his work of art, and simultaneously there must be furnished a sum of money, with which and within which the architect must work.

Architecture, we know, is a collaborative profession, a coordination of efforts to create a work of art to fulfill a definite need within a definite cost. The mind of the architect must interpret the need from another mind, apply it to his imagination, translate the concept to other minds, and direct still other hands to give it form and substance and make it fulfill the need for which, and satisfy him for whom, it was created. Nor is this all. We hear a great deal about the delightful collaboration with the other arts, but no one stresses the less delightful collaboration with the countless laws and ordinances and rules and regulations and codes and municipal authorities. It is trite to reiterate these things, but merely to do so proves how inherent an element of architecture must work.

There are still a few architects who can practice architecture in its simplest terms,—and how delightful that is! But a civilization so complicated as ours, so essentially urban in its thoughts, requires for its comfort, if not for its needs, so many material things that a superman could not be expected to have knowledge of them all. Yet the architect must know and coordinate all these material things and bring about a synchronized collaboration of the trades in order that the work of each will be properly incorporated in his conception.

All this collaboration is expensive. Each collaborator must be compensated and derive a profit for his labor, and the architect, too, must live. Mostly there is little left after the architect has paid his collaborators. To create his art the architect must act as architect, engineer, agent, trustee, supervisor, buyer, collaborator, coordinator, executive, and administrator,—obviously he cannot collect a fee for each function, nor does any fee he receives ever seem to be an adequate fee, in the general run of things.

With these myriad responsibilities and duties the architect must conduct a business, no matter how much he desires to suppress that idea. How he conducts it, will be the gauge of his business standing. Generally he gives his time so freely to others that he has little of it left for the intensive study of his own business and its cost. He does not watch his production and other costs with the care that good business demands. He is prodigal of his time and wasteful of his money. Engaged in a business which is notable for its fluctuations and quick upsets in volume, the architect is seldom adequately prepared for reverses and prolonged periods of stagnation. When business is good he must expand and build up an organization; overnight he is compelled to disband it and to economize,—fortunate if he can do this. How often we see the successful architect wearing himself out finding commissions to keep his organization going. He becomes a slave to it,—and finds himself in the anomalous position of working to keep his draftsmen busy and his overhead paid, with nothing left for himself but worry and strain and what fame may come of an artistic success.

Of all professional men, the architect should be most concerned with costs. Usually the architect is more familiar with building costs than he is with the costs of carrying on his profession and creating his art. How many architects know what it really costs them to get to the point where working drawings can be begun or even preliminary sketches made? How many know what working drawings cost, sheet by sheet, job by job? How many know what supervision costs,—supervision adequate to ensure the workmanship and materials to which the owner is entitled? How many know what these costs should really be? With what other costs can they be compared?

As an impractical dreamer, the architect is accepted by the business world; as a business man to whom it would entrust the spending of its money, he has not the entire confidence of that world.

Standardization of architecture is an abomination; standardization of procedure and accounting of the business of architecture is very helpful to success. The Institute has not developed a standard form of accounting whereby an architect may ascertain by actual comparison with other architects what true costs should really be.
costs should be. Architects in the United States, in the aggregate, are receiving fees of not less than $80,000,000 per year. I have not the slightest doubt that more than 10 per cent of that sum is wasted annually by the architect in his own offices through neglect and failure to apply sound business methods.

Orderliness in design is axiomatic with the architect; orderliness in his business and in his time is not so fixed a virtue. The artist points thumbs down on schedules and budgets and anything regular or regulated, yet these things are essential to good business. They are necessary to conserve time; they are imperative if we would not waste our money. Our most limited and most precious asset is time. To conserve it is a duty we owe to ourselves and to our families. Our business day should be organized and every hour of it scheduled. Each day we have things to do. We should list them in the order of their importance, with the most important at the top, and then tackle and do each of them in turn and in that order. We must work against time. We should set aside each day so much time for the drafting room; so much for specifications, for accounting; so much for supervision; so much for conferences and callers; for correspondence; for reading on architecture, construction and the allied arts; and, lastly but most important, for constructive thinking about our business. So far as possible, we should fix positive and regular hours, especially for our conferences, calls and correspondence and our thinking. We should make those hours the same for each day. Regularity and regular hours must be acquired, no matter how monotonous or distasteful it may be to do so. That you can be found in your office each day at the same time for conferences, calls and callers is a sound business asset; it gives you a business standing, and you have created an invaluable credit.

Do not let one period overlap the other, nor let callers disturb you except within the hours you have set for conferences. Keep telephones away as well, if you have a tactful secretary. Arrange conferences to fit your schedule of time; you will be surprised how this can be done without losing the commission. Your time may be as valuable as your client's. Your time may be as valuable as your client's.

I repeat,—conserve your time; schedule your hours exactly. Begin this when you begin your practice, when it seems unimportant to do so. The habit established in the lean years will be worth innumerable dollars when you become busy, and of inestimable value to your health and happiness. You will be surprised how much more quickly your decisions will be given; how much more concentrated will be your thinking; how much more time you have for the amenities of life and for your family, if you have found and use the secret of conserving your time and making it work for you. Above all, do not let anything persuade you to give up the hour of constructive thinking about your business. Take that hour early in the day if you can, when you are fresh. It is the most necessary hour of the day to you! Do nothing but think; if you have no very definite problem, think just the same. Let nothing interrupt you.

Budgeting our time is perhaps the most important thing we can do to ensure our business success. Budgeting our finances is the next most important thing to do. Once you have learned to conserve your time, and have acquired the habit of regulated and regular thinking, the budgeting of your finances will come naturally and inevitably. The budget is the control, and the means of lower costs in producing your drawings and documents. Men work for money and for glory. Money means profits, and profits are the reasons for business. I do not speak of profits in the pure accounting sense. Profits can be ensured only by insisting that cash outgo always shall be less than cash income. Business is conducted at present on a monthly basis; if your total expenditures have been less than your cash income, month by month, your business has made a profit. If there is no profit, you run the risk of financial embarrassment, loss and failure. The budget should control the distribution of all money you receive into your business. If you hold within that budget, it ensures cash profits.

To make your financial budget, you must first know costs. To fix the price which you should charge for your services, you must know costs. To know costs, you must first determine expenses.

The architect should fix a salary for himself, as a fundamental element of expenses. Salaries are for the expenses of daily living; profits for investment and surplus. Salaries should be considered as income; profits may be considered as capital. Salaries should be paid regularly month by month; profits must be deducted in cash from each payment received by the architect before any part of that payment is used for any other purpose. Profits are illusive; if not deducted first, they have a way of disappearing altogether. It is fundamental to set aside profits first. Profits should be banked separately from other funds, as savings. One-half of the profits should be considered as business surplus and be kept in the business and invested in first class securities. One-half may be considered as dividends and invested in securities or real estate or such other forms of investment as may please you. Income derived from the investment of surplus should be added to surplus; income from dividends should be put back into capital, but it may be added to salary.

Costs are direct expenses plus distributed expenses. Expenses are direct when they can be definitely identified as having been incurred solely for any item of costs; they are distributed expenses when they cannot be definitely identified as a proper charge against any single item of costs. An expense should be considered as a distributed expense only when the cost of determining the direct charge would be greater than would be the margin of error if the expense were arbitrarily segregated into parts and each part made a direct charge to the item. Expenses should be distributed monthly. Distributed expense is ordinarily called "overhead."

Costs in the business of architecture fall into five
major divisions: (1) Development Cost, incurred prior to the time when the contract between the owner and architect is executed; (2) Production Cost, incurred to produce the preliminary sketches, working drawings, specifications and contract documents; (3) Supervision Cost, incurred in the field during construction; and (4) Administration Cost, incurred for general office expenses. These four become the cost divisions of the budget. Development Costs, Production Costs and Supervision Costs are always direct charges. Administration Costs are always overhead and are distributed to the other three major cost divisions. Each major cost division may also have its own overhead to be distributed within itself. The fifth major division of the budget is Profits. Profits plus Development Cost, plus Production Cost, plus Supervision Cost, plus Administration Cost, equal total business income. Set up the fifth division first in the budget; deduct it from income. What is left of income are costs. This is fundamental.

The next step is to fix these Costs in money. When that is done, if the costs so fixed prove to be greater than the balance you have left of income after deducting Profits, you can do either of two things—reduce costs or face a loss of profit. A loss of profit will start you on the way to worry, fear and insolvency; to reduce costs may mean lowering the quality of service you render your client. If you lower the quality of your service, your action will affect the standing of the entire profession, affect your own standing, and clearly indicate that a day of reckoning is in the offering. You cannot do either of these things if you would preserve your business integrity, protect your family and ensure your own happiness and that of others dependent upon you. You may lessen, but not forego, the Profits. Therefore, Profits being fixed, if you cannot reduce major costs without lowering quality of service, it is evident that the income is too small and must be raised.

Unalterably this means that for business success in the profession, costs must be accurately determined and should be locally and nationally comparable, and profits must be stable and maintained. Quite plainly, too, it indicates that our present system of fees is unscientific and fundamentally inaccurate. I believe and hope that there will come a period of comparing our costs. Inevitably, this will lead to the discarding of the present fee system of charges and the adoption of a method of charging for services which will be fundamentally and economically sound. I believe this would be a true service which the Institute could render to the profession, and that it would go far to eliminate the enormous economic waste and the inequitable charges for services that now obtain in the profession.

How are these four major costs fixed? An accurate estimate for budget purposes cannot be had except through years of experience. The beginner in the practice of architecture at present has no basic data available to permit him to fix these costs at all accurately. This information should be available to him, in some form. If it were, he could start his business and professional life on an economically sound basis. This would be good for the profession at large. The "infant mortality" in our profession, is unduly large. Perhaps it might be reduced by the right economic start. Budget costs should be built up, item by item, into an aggregate total and not vice versa. The more accurate the items, the less the contingency for failure.

- Development Costs vary greatly and cannot be standardized. They should include every item of expense chargeable to a project prior to the signing of the contract with the client. Advertising of every form, dues to business organizations, all such kinds of expenses as the architect would not incur if he did not think it would help his business, should be charged to it. Immediately any development expense is incurred looking toward securing a commission, the tentative project should be set up on the books as an account and given an account number. Development expenses incurred in getting that commission should be charged directly to that account so far as practicable, and it should be charged with its share of the development overhead and its proportion of Administration Costs. If the salary of the architect has been properly apportioned between the Development, Supervision, Production and Administration Costs, the Development Cost will be quite accurately determined. I guarantee that every one of you who does not so keep his accounting will be astounded at the cost of procuring commissions. The Development Costs should be charged each month to the tentative project. When the contract for services is signed, the Development Cost heretofore charged to the tentative commission, becomes a direct charge, to become a part of its final cost; otherwise. Development Costs should always be charged off periodically.

I seem to have wandered into accounting, a subject not within the limits of this paper, but one which should be amplified and determined before an accurate budget can be set up.

Production Costs are kept in some form or other by every architect. Usually he figures up his outgo for draftsmen and other tangible items, adds something for overhead, and carries the total as a cost. This can be only approximately right. Production Costs can be closely estimated and fixed for budget purposes. Immediately the contract with the owner is signed, the architect should use his hour of constructive thinking to plan the progress of the work through his office. During that hour and others like it he should plan the drawings to be made and list and give a number to each. He should plan what is to be placed on each drawing. This list of draw-
ings, marked with its estimated number of drafting hours, goes to the drafting room and should not be varied from nor other drawings be made unless they become absolutely essential. Once the sheets are so planned, with the proper cost data at hand, the probable expense of making each sheet can be quite accurately fixed. In no other way can Production Costs be set up with any pretense to accuracy. If this procedure or some other system as accurate is not followed, a budget cannot be set up. To follow this procedure is to set a firm control on drafting, and only thus can drafting room expenses be maintained within the budget estimates. Too much care cannot be exercised by the architect in preparing the Production Costs for the budget.

Supervision Costs are the easiest to estimate. The direct expenses of superintendents, clerks, inspectors, testing, reports, and traveling, are easily determined items. The principal distributed expenses within this major division of cost are the architect’s salary and the allocation of the Administration Costs which have been transferred to its Supervision Costs. These are usually estimated too low, principally because the supervision and superintendence furnished by the architect in the usual run of things is woefully inadequate.

Administration Costs are not difficult to determine. All items of Administration Expense are overhead and must be distributed. Therefore they should be kept as few in number as possible. By applying the rule for determining overhead, this is quite easily done, and the distributed charges can be made much smaller in volume than is usually likely to be the case.

Each of the five major items of the budget is thus determined. To go further into their makeup is impossible in this paper, except in one instance. In each of the four major cost divisions, set up a cash reserve. This is the safeguard of your budget. It must be sufficient to cover your errors of judgment in making up the budget, and sufficient to cover the additional expenses which will creep in, in spite of the best made budget. Set aside this cash reserve in each division out of the first income received; if not all, at least its full proportion. I said before, first deduct profits from income,—now I say, deduct cash from the balances in each major cost division and set it aside as a cash reserve in each division. Make this reserve what you think is right, then usually double it. It is better to be right than sorry. Keep these reserves intact as cash to the close of the work so far as you can. Each raid you make on these cash reserves is a barometer of the condition of your costs. If you maintain these reserves intact, your profit is assured. These cash reserves should guarantee money for current operations at all times.

Such is the Architect’s Budget.—a budget of his time and of his finances. In the budget of his time, the hour of constructive thinking is just as important to time as the cash reserve is to finance. Therefore, I repeat, budget your time, budget your finances, set aside your hour of thinking, your profits, your cash reserves. They form a guarantee of your success.
DEVELOPING SKETCH PLANS FOR SMALL HOUSES TO MEET BUDGET REQUIREMENTS

BY

C. STANLEY TAYLOR

PROBABLY the most difficult problem encountered in normal architectural practice is the development of plans for small houses which can be successfully built within predetermined cost limits. The average client seeking a small house usually has very limited funds available for his purpose and usually has ideals all out of line with his budget limitations. To reconcile the owner's conception of room sizes, plan and arrangements and general architectural design to a rigidly restricted cost limit is the familiar and unwelcomed task of every architect engaged in the domestic architectural field. No matter how far apart the client's tastes and the size of his pocketbook may be, it is distinctly the architect's responsibility to help him secure a house that will meet his needs without plunging him into serious financial difficulties.

Frequently an architect is commissioned to design a small house without any definite cost limit being established by the owner, beyond an admonitory warning that he does not want to spend too much for his home. The owner's main thoughts are centered around matters of style, room sizes and arrangement, and little conveniences he hopes to incorporate in the plans. The owner's wife has dreamed of this new home; her thoughts are mostly of color schemes, architectural features and very practical housekeeping equipment. Costs are in the background until the architect, having faithfully developed sketches which seem to meet his client's wishes, is asked what the house will cost. Then trouble usually starts; the architect is often accused of extravagance or of ignorance of costs; eventually the sketches must be redrawn on a totally new basis with less confidence and good will on both sides, and at a loss to the architect of the good talent and time wasted. The better method is to discuss costs at once and to fully acquaint the owner with the nature of the problem he presents and with whatever necessity there may be for making some concessions in his space requirements or in his cost limits before sketches are undertaken. A frank and complete discussion of this troublesome matter, even before the architect is actually commissioned for the work, is far more advantageous to the owner and architect alike than its neglect until after the client is committed to a program beyond his means, or before the owner's ideas are so fixed with respect to the type of house he desires that he often makes an unwise investment.

Sketch Plans Made to Meet a Definite Budget
R. C. Hunter & Bro., Architects
acquires a reputation for integrity and skill which ultimately will carry him farther in this field than the architect who permits his client to overlook his actual financial limitations for the sake of procuring a house that pleases his fancy without respect to its cost. The architect who completes any project after a long series of struggles and arguments with his client is seldom recommended to others in a like position. He earns a reputation for being an extravagant designer, no matter how much care he has exercised to keep the costs fairly close to the owner's ideas. Even a 5 or 10 per cent overrun may result in serious dissatisfaction on the part of a client who has established at the beginning of the undertaking his actual financial limitations, whether or not the architect is aware of his maximum allowance. A 5 per cent saving within the owner's original budget, on the other hand, will usually leave a lasting favorable impression with the client and will lead him to frequent commendation of the architect's talents and good judgment, and earn for the latter a prestige which may become the foundation for an extensive and steady practice.

Of course, it may be argued that the small house field is never profitable; that it is one which architects enter only as a means of establishing themselves in business; and that a reputation for economical building in this field merely leads to more commissions of this unprofitable type without opening up fields of larger endeavor. It is undoubtedly true that small house architecture for the standard minimum fee is actually burdensome to the architect. A higher fee must be charged in order to pay the cost of well developed plans and adequate supervision. The architect who completes any project after the client is seldom recommended to others in a like position. He earns a reputation for being an extravagant designer, no matter how much care he has exercised to keep the costs fairly close to the owner's ideas. Even a 5 or 10 per cent overrun may result in serious dissatisfaction on the part of a client who has established at the beginning of the undertaking his actual financial limitations, whether or not the architect is aware of his maximum allowance. A 5 per cent saving within the owner's original budget, on the other hand, will usually leave a lasting favorable impression with the client and will lead him to frequent commendation of the architect's talents and good judgment, and earn for the latter a prestige which may become the foundation for an extensive and steady practice.

Aside from the ethics of the situation and the architect's moral obligation to render a complete and intelligent service to his clients who must build with-
factory and open discussion of costs throughout the project. No troublesome details enter into the problem at this stage. The whole picture is viewed broadly, and the architect is usually permitted at once to either increase the budget limitations or to prepare sketch plans which will definitely fall within a predetermined cost regardless of the room sizes necessary to achieve this end. If a hopeless situation is encountered, the client may be lost for the moment, but the architect has wasted no time, and in the long run has made a friend who is more than likely to come back when his financial situation is improved or is almost certain to recommend the architect to others; this is far better for the client than if he foolishly undertakes the construction of a house under the guidance of a less ethical designer and pays the severe penalty of considerably exceeding his budget limitations.

At this stage the architect can usually also introduce a discussion of financing methods and may frequently enable an owner to find means of borrowing funds, permitting him to have the house he desires without requiring an initial investment beyond his means and without unduly burdening himself with financing and carrying charges. A sound knowledge of the mortgage market is invaluable to the architect engaged in this work. Assuming that the first discussion has resulted in an approximate agreement as to the size and cost of the finished structure and that the architect has been engaged to prepare sketch plans, he is then committed to a program of carrying out his design work on a basis that will insure his client of a reasonable margin of safety when contract figures are ultimately secured. Again cubic foot cost figures are used as the guide, and the margin of safety is secured by adopting in the early stages a unit which is large enough to permit considerable variation in final details. If the architect is accustomed to building for 50 cents per cubic foot, it is best to compute the maximum volume that can be built within the established budget on a basis of from 53 to 55 cents per cubic foot. The gross volume thus established is then translated in the sketch plans by converting volume to square foot floor areas and using these as a guide for the general dimensions of the floor plan.

Reconciling these volume and area limitations to the development of a successful and workable plan requires the exercise of a great deal of ingenuity and skill. Usually in small house architecture the space problem compels relatively low cost construction in addition to the efficient use of every square inch of floor area. Low cost construction in turn calls for simplicity in plan arrangement and for the adoption of an architectural style which may be consistently followed using low cost materials and stock designs for windows, doors and both exterior and interior trim. It involves the use of carefully planned systems of mechanical equipment, including the concentration of plumbing lines, the careful distribution of radiators, and the selection of an efficient and inexpensive heating plant as well as the careful placement of electrical outlets. A thorough knowledge of building materials is an essential part of the architect's equipment; and equally thorough knowledge of practical construction methods is valuable in preparing drawings and specifications that will permit economical construction without sacrificing quality and
durability. Fortunately, the architect who is a close student of small house design and construction is finding himself constantly assisted in his efforts to provide maximum volume within reasonable cost limits through the introduction of new materials and construction methods. The building field is rapidly being enriched with new products which save space, make possible more rapid construction, or which actually cost less than the usual materials, the use of which has prevailed through custom for many years. Insulating products are being introduced which combine the functions of sheathing and a plaster base in one material. Thin partitions are being developed permitting plastering on both sides of the partition core composed of a single structural material. New composition flooring materials are showing economy over the more expensive tiles for bathrooms and kitchens, and some of these are even taking the place of higher grades of hardwood flooring; stock patterns of windows, doors and standard trim are being so vastly improved in design as to find ready acceptance by architects in place of specially detailed items which not only contribute to the cost of the structure but add to the architect's burden in preparing the drawings and supervising their construction and installation. Marked improvements are being made in heating systems; and quality plumbing fixtures are available which contribute to space saving and to economical installation. The importance of keeping closely in touch with introduction of new materials and new developments cannot be over-estimated for the architect who is to succeed in the small house field.

Unfortunately, the greatest aid in planning small houses within limited budget requirements must be developed by the architect for himself through experience. Cubic foot cost figures are not available through any medium of exchange on a basis which makes them reliable and useful to those not fully familiar with all the circumstances surrounding the particular building upon which they were developed. Undoubtedly the time will come when a standard system of maintaining cubic foot costs will come into general use. This system will not only report the cost based upon a uniform method of computing volume, but will require that the figures be accompanied by a detailed outline of the features of the building and of the construction materials employed, so that others may properly interpret the figure when applying it to other structures of similar or varied nature. For the present, the architect can rely only upon figures developed in his own practice. The adoption and maintenance of a uniform system for figuring cubic foot costs from completed buildings will soon provide the office with data of constantly increasing value.

The basic requirements for a cubic foot cost record system, proved by experience approximately correct, are:

(a) The volume of each building must be computed on a uniform basis. A standard system for figuring volume should provide for a quick method of measuring the volume of footings and foundations and a standard method of adjusting the volume of open porches and minor structures. Footings are usually figured by taking the basement area and multiplying it by 1 foot of depth below the finished basement floor. Open porches are usually figured at from one-third to one-half of their volume if outside the main walls of the building and at their full volume if within the main walls. Bay windows, dormers and other minor architectural features are figured at their full volume in careful computations or are neglected when they do not exceed 3 or 4 per cent of the total volume of the structure. A standard system on this point should be established.

(b) A uniform basis for computing cost is of vital importance. The cost normally should include builder's fee or profit and represent the total cost of construction including all subcontracts, but should be exclusive of architect's fee and of items not directly pertaining to the cost of the building itself, such as grading, planting, driveways, walks and detached garages. If possible, cubic foot cost should invariably be figured on the basis of actual contracts awarded, so as to eliminate the confusion developing through extra costs chargeable to changes made by the owner during the construction period or to unforeseen contingencies which might arise through encountering rock in the foundation work or through delays due to strikes or other extraordinary causes.

(c) The figure given should be accompanied by the date upon which the general contract was awarded, for this usually indicates the prices at which materials and labor are purchased. In a fluctuating market a variation in the date of six months might make a difference of several per cent in a building's cost. Location is of equal importance, unless the architect's practice is entirely confined to a restricted area.

(d) The record should contain a brief description of these major points: total volume; total cost; approximate area of ground floor plan (and if possible the actual size of the ground floor to indicate the approximate perimeter); general style of architecture; construction of exterior walls; mechanical equipment; total number of rooms and baths; and finally, the record should contain a statement as to whether the general quality of construction was (a) low cost, (b) moderate or average cost, or (c) extra quality. Every one of these details is important. The consistent maintenance of a system of records of this type by many architects engaged in this field would form a basis for a most invaluable exchange of data through the architectural press. Eventually, such an exchange will be accomplished, and when this occurs architects will be able to estimate with increasing accuracy the cost of buildings from their sketch plans and will render improved service to their clients through eliminating the grave danger of exceeding budget limitations, with all the difficulties involved.
MECHANICS' LIENS

BY
CLINTON H. BLAKE, JR.

THE mechanics' lien is an American invention. Formerly in England and in this country there prevailed, and still prevails in England, what is known as the "common law." This is nothing more or less than the law of precedent built up not by statute and the enactment of laws but by the decisions of the courts. When, for example, in the early days of English law, one person trespassed upon another's land, the latter applied to the courts for damages, and the courts, considering the general common sense of the case, declared that the person trespassing must pay damage to the man upon whose land he came, on the theory that the land owner was entitled to the enjoyment of his land without being compelled to allow others to use it. When a similar case next arose, the court followed the precedent thus set down in the previous decision, and so in time this rule of law as to trespass became established.

The same course was applied to all other legal questions which arose, and the law was laid down by these precedents, and the law which they established became known as the "common law." In America the common law was originally in force and is still in force in various jurisdictions. Gradually, however, we departed from observance of the common law custom and built up a body of statutory law. The tendency today, as every student of legislation knows, is to cure everything possible by legislation, and an appalling number of statutes are being constantly enacted, accordingly.

One of the fruits of this statutory development was the "mechanics' lien" legislation. Its inception dates back to 1803, when the first mechanics' lien law, apparently, was adopted by the state of Pennsylvania. For some time the mechanics' lien statutes were directed solely to the protection of mechanics and had none of the broader provisions for the protection of workmen, subcontractors and materialmen which now generally characterize them. Gradually the idea of protecting by lien all those who had contributed materially to the enhancement of the real property involved. At the same time it must be understood always that the mechanics' lien is fundamentally a claim against the property, rather than a claim against the owner of the property personally. The theory upon which all of the lien statutes,* substantially without exception, proceed is that the property of the owner has been enhanced in value by the labor of those claiming the liens and that therefore it is equitable and proper that the property should be subjected to a lien for the amounts due them.

Owner's Liability. Radical as this legislation is in one sense, it has nevertheless in its development recognized that it would be unfair to expose the owner to a lien claim without strict limitations as to amount and liability. In the better jurisdictions, two main limitations will be found. In the first place, the lien must be predicated upon the consent of the owner, express or implied, that the work be done; in the second place, ordinarily, the total amount recoverable on lien claims will not be allowed to exceed the total unpaid balance due to the contractor at the time the liens are filed. The reasonableness of each of these limitations is obvious. If a lien could be established for work done without the consent of the owner, it would be possible for claimants to do work on his property which he has not wished to have done and then subject the property to a lien for the value of the work. If, also, it were possible to hold the property for all sums due without regard to the unpaid balance of the contract price, the owner would be repeatedly placed in a position where, having paid to the general contractor or other contractors substantially the full value of the improvement made, he finds that his property is subject to liens for a large proportion of the total cost, due to the failure of the contractors to take care of their subcontractors or materialmen.

The provisions of the New York lien law and the decisions of the New York courts on this point are typical of the sounder point of view. The lien law in this connection provides that:

"If labor is performed for, or materials furnished to, a contractor or subcontractor for an improvement, the lien shall not be for a sum greater than the sum earned and unpaid on the contract at the time of filing the notice of lien, and any sum subsequently earned thereon. In no case shall the owner be liable to pay by reason of all liens created pursuant to this article a sum greater than the value or agreed price of the labor and materials remaining unpaid, at the time of filing notices of such liens, except as hereinafter provided."

The New York Court of Appeals, in considering this same point, has decided that:

"The settled construction of the Lien Law is that,
except in case of fraud, the owner cannot, under any of its provisions, be compelled to pay any greater sum for the completion of a building than by his contract he has agreed to pay. The effect of the statute is simply to take from the owner money actually owing by him on his contract and to apply it in payment for the labor and materials which subcontractors or materialmen have contributed toward the performance of the same contract."

In other words, the mechanics' lien, under this rule, attaches primarily to whatever sum, if any, at the time the lien is filed may be due to the contractor. In many of the states, the lien of the subcontractor is based upon the legal theory of "equitable subrogation." This, translated into plain English, means merely that by the lien there is transferred to the lienor the claim of the contractor against the owner up to the amount of the balance then due or which may become due thereon.

**Owner's Consent.** With regard to the consent of the owner upon which the lien, as already noted, must under the usual rule be predicated, there is a wide divergence in the provisions of the various lien statutes. The principle is generally recognized as sound, but the states differ materially in the degree of consent or approval which their legislatures and courts interpret as sufficient to bind the owner. It has been stated broadly that some contract to which the owner is a party and which covers the work for which the lien is claimed is a necessary prerequisite to the validity of the lien. This does not mean, however, that to sustain the lien, there must be a written contract signed by the owner covering the work and embellished with legal acknowledgments and seals. The contract may be formal or it may be informal. The consent of the owner may be expressed most definitely in writing, or it may in some cases be implied. There must, however, as a general rule, be some understanding on the basis of which, whether by express agreement or by implication, the courts can say that the owner has approved, adopted or ordered the work. It will be in every case a question of fact dependent upon the peculiar facts of that case.

In the limited space here available, it is impossible to discuss in detail the variations between the different state statutes, and the legal interpretations by the varying states of facts which are held to constitute an agreement by the owner that the work be done. It may be stated broadly, however, that the tendency has been and is to be increasingly liberal in the interpretation of what constitutes a contract by the owner sufficient to sustain a lien. Some statutes require that such a contract shall be in writing. More and more, however, the states are recognizing the right of the lienor to sustain his lien in the absence of a written contract. Where this right is recognized, the courts or statutes proceed upon the assumption that the owner might contract for the work or approve it by implication just as surely as if he had made a formal contract. If it can be shown that the owner has consented that the work be done and has allowed it to be proceeded with, without objection and with his approval, this conduct on his part in many of the states is construed as an agreement by him that the work be done. Even in the jurisdictions which have most clearly recognized an implied consent by the owner as sufficient to sustain the lien, the lienor cannot safely predicate his lien upon the mere fact that the owner knew that improvements were being made and did not object to them. In some cases this might be sufficient to subject the property to the lien, and in some it might well be insufficient. For example, in New York it has been held that the mere general consent of the owner that a lessee in possession of the premises may at his expense make alterations and repairs, does not constitute within the meaning of the New York statute that "consent" by the owner which is necessary to sustain a lien; and that the fact that the owner knows that the work is going forward and even expresses satisfaction with the progress made and the work done does not subject the property to a lien, where he is in the position of a landlord and has no control or supervision over the performance of the contract. On the other hand, it has been held by the New York courts that a lien can be sustained in a case where a tenant has ordered work done and the plans for the work have been submitted to and approved by the owner.

This whole question of consent by the owner is difficult and somewhat technical. Where the work is done at the order of the owner himself, there can be no question. Where, however, the work is done without such an order but by the order of a tenant, the validity of the lien will depend in most states, and certainly in New York, upon the ability of the one asserting it to establish with reasonable clarity the fact that the owner knew of the work, that he approved it and consented to its being done, and that his course was such as to amount to an implied agreement on his part that it should be done.

The Court of Appeals of New York, on this question of consent, has thus stated the requirements: "While it is doubtless true that the consent required by the Lien Law need not be expressly given, but may be implied from the conduct and attitude of the owner with respect to the improvements, which are in process of construction upon his premises; still the facts from which the inference of a consent is to be drawn, must be such as to indicate at least a willingness on the part of the owner to have the improvements made, or an acquiescence in the means adopted for that purpose, with knowledge of the object for which they are employed."

* * * *

"We may, therefore, fairly deduce from the decisions of this court upon the question now under consideration these various propositions: (1) That
no express consent is necessary on the part of the owner in order to bring the case within the statute providing for mechanics' liens. (2) That a consent may be implied from the conduct and attitude of the owner with respect to the improvements which are in process of construction upon his premises.

(3) The facts from which the inference of consent is to be drawn must be such as to indicate at least a willingness on the part of the owner to have the improvements made or an acquiescence in the means adopted for that purpose, with knowledge of the object for which they are employed. (4) The omission of the owner to object to improvements made upon his premises by a tenant, when he has knowledge of the circumstances under which they are being made, is always an important fact bearing upon this question.

On the other hand, the same court has laid down the rule that, in order to establish under the statute a consent by the owner, it must be shown that his consent has been an "affirmative affirmation" in procuring the making of the improvement or that the owner had possession and control of the premises affected by the improvement and consented to it in the expectation that he would reap the benefit of it. The fact that the owner actually receives the benefit will go far to establish the fact that he has approved the work in the expectation that he will receive this benefit. If, being informed of the intended improvement and knowing that the work is being carried on, he stands by and allows it to go forward and receives the benefit of it, his consent will ordinarily be implied and the lien sustained. On the other hand, it has been held that it is not necessary that he should actually eject the contractor as a trespasser to escape lien liability, and that, if he forbids the performance of the work, his consent will not be implied, because he has not taken ejectment proceedings or physically removed the contractor from the property.

**Performance of Contract.** Assuming that the necessary contract by the owner or approval and consent by the owner have been established, it is necessary that the lienor establish a number of other fundamental points to sustain the lien. The lienor must prove in the first place that he has performed his contract, or that the owner has prevented his performing it or waived any failure to perform which there may have been. Performance in this connection does not mean performance to the point of perfection. The courts here invoke the rule of "substantial performance." If the work has been substantially completed in all essential particulars, the lien will be allowed and will not be defeated because some minor defects or omissions are apparent. If a few fixtures, for example, have been omitted, the value of which can easily be determined and is relatively small, the contractor will be granted his lien for the full amount less a reasonable allowance for making good the existing omissions. In the second place, the lien must be filed within the time limited by law, which time, of course, will depend upon the statute applicable in each state and will vary in accordance with the differing state laws.

**Approval of Work.** Where other conditions are present, as for example, where the approval of the architect is a condition precedent to recovery by the contractor or where, in the case of a municipal lien, a departmental approval or certificate is required, the contractor must produce the required approvals or certificates before he can sustain his lien. In a word, he must, in order to sustain it, produce the same proof which the courts would require him to produce in establishing the indebtedness of the owner in a suit by the contractor against him under the contract, if no lien had been filed. The lien is merely an additional remedy in the nature of security and does not give to the contractor the right to recover, in the absence of proper legal proof and evidence that the work has been done and that the value of the work is the amount which he claims.

Probably the greatest variation between our state lien laws is to be found in those provisions of the laws which have to do with the liens of subcontractors and materialmen. In some states they are granted direct liens by statute. In other states their liens are on the basis of "subrogation," which I have already mentioned. Where this doctrine is in effect, the subcontractor or materialman, to establish his lien, must show that the contractor with whom he dealt was himself entitled to a lien, and that there still remains due some unpaid balance from the owner to the contractor which can be applied to the satisfaction of the lien.

When we come to the subcontractors or materialmen of a subcontractor, we are naturally getting still farther removed from the primary obligation between the owner and the original contractor. For many years, those with whom the subcontractor dealt were considered too far removed from the building operation to be accorded any lien rights. The liberalizing process which we have noted, however, has in large measure removed this bar, and today those performing labor or furnishing materials to the subcontractor may now generally successfully avail themselves of lien protection.

**Limitations Imposed.** State legislatures have generally recognized, however, the danger of throwing open too widely the lien door to the entire line of subcontractors and materialmen and have, in the wording of the lien statutes, set up safeguards and limitations which must be observed, if the lien is to be sustainable. In some cases it is provided that the contract must be recorded. The recording of it may be essential to the lien of the contractor himself, or to the lien of the materialmen or subcontractors, according to the particular statute involved. In New Jersey, if the contract and specifications are filed in the office of the county clerk of the county in which the work is being done and before the work is commenced, the liability of the owner will be limited to the contractor, and the subcon-
tractors and materialmen will be precluded from enforcing mechanics' liens. It is important that this provision be held in mind by architects practicing in New Jersey and that they advise owners before the work is commenced to file the contracts and specifications, so as to secure this protection. There has been some question under the New Jersey decisions with respect to the effect of filing the contract after the work has been commenced. Under the more recent decisions, the only safe course to follow is to have the papers filed before any work whatever has been done. Otherwise, even if the filing takes place after an insignificant portion of the work has been done and before the work on which the lien is claimed has been commenced, the owner may not be able to set up the filing as a bar to the lien claim. For example, if the excavation for the cellar has been started before the filing date, a carpenter whose work has not been commenced until after the filing has taken place may nevertheless, it seems, assert a lien and plead that the filing of the contract and specifications is ineffectual because it did not take place before the commencement of the work.

Architect's Lien Rights. The liberal tendency which has been responsible for broadening the scope of the lien laws so as to take in subcontractors and materialmen and the others whose work has contributed to the improvement of the property involved, has been responsible also for extending the protection of the lien laws to architects. Under the earlier laws, the architect had no lien rights. As the laws developed, it was held that, to the extent of the value of services performed by him in the nature of supervision, he might maintain a lien. Gradually this right in many of the states has been extended and amplified. The next step was to grant to the architect a lien for the full amount of his services, including the preparation of the plans and specifications, provided he had supervised the work. Having reached this point, it was entirely logical and equitable that the statutes should be so amended and interpreted as to give to him a right to file a lien, whether he had supervised the work or not, provided that the work performed by him had benefited the property and been used in connection with its improvement.

This rule has been definitely established in New York state. Under the present lien law in that state, the architect may file his lien for the agreed or reasonable value of his services in preparing the plans or specifications, even if he has not been called upon to supervise the work. Of course, if his contract has required him to supervise the work and his failure to do so has been due to a breach of the contract on his part, a different question is presented. To establish his lien, he must show that he has performed his contract and, if he has breached it, naturally his right to the lien will fail in consequence. The next logical step will doubtless be a provision which will give to the architect a lien for the preparation of plans and specifications for the improvement of real property, even if the work is not proceeded with. In fact, efforts have already been made in New York to amend the lien law to this end. There is much to be said for the suggestion. The architect who has, at the request of an owner, prepared plans and specifications, has certainly done work for the improvement of the real property. If the owner elects not to use the plans and specifications, it may well be urged that he should not, by the mere failure to use them, be able to deprive the architect of his lien right. In order to assert this right, the architect should, however, be compelled to show, in all fairness, that the plans and specifications as prepared are such as were ordered by the owner and then they are in proper form. Doubtless the argument which has prevented this final extension of the law with respect to architects is that to so amend the statute would open the door in some cases to unjust claims and encourage the preparation of plans without proper authority, for the purpose of forcing an owner to make payment for them under threat of having his property encumbered by a lien. There is something to be said for this point of view. On the other hand, the lien on the property can always be removed on the filing of a bond. Where this is done, the bond takes the place of the real estate as security, and the matter can then be thrashed out in court and the property left free from the lien.

Probably the chief reason that the architect has not been given the right to assert a lien where the building has not been proceeded with arises from a failure of the state legislature to properly appreciate the difference between the character of the services rendered by the architect and the services rendered by the ordinary contractor or materialman. Obviously, a contractor or materialman cannot be a party to the improvement of real property, unless the project is actually undertaken. If the work is not started, he is not called upon to perform labor or furnish materials. With the architect it is different. If he has agreed to prepare plans and specifications and does prepare them, he has immediately made available to the owner material which can be used for the improvement of the property. He has, in fact, performed labor for the improvement of the property and improved it in the sense
that he has laid out the scheme for the work of improvement and the specifications under which it is to be carried forward. Under a statute which gives a lien for work done "for the improvement of real property," as distinguished from work done "in the actual improvement of" real property, services of this character might well, and logically, be made the basis of a lien. It is a question of time only, I think, before this result will be secured, in some jurisdictions at least.

*Jurisdictional Difficulties.* It must be borne in mind at all times that the lien statutes vary materially according to the jurisdiction in which they are in force. No lienor can safely file a lien in one state on the basis of the requirements of another state. There is as much difference between the lien laws of the various states as there is between the divorce laws of the various states. While many of the considerations which have led to the agitation for a uniform divorce law do not, of course, apply to lien legislation, there is much to be said in behalf of the proponents of a uniform lien law. Increasingly, under modern industrial conditions, contractors and materialmen and architects, also, are being called upon to perform services in states other than the states in which their offices and chief activities are centered. If a uniform law could be made available, it would greatly simplify lien procedure.

In this connection, the Department of Commerce, through "The Standard State Mechanics' Lien Act Committee" has been active. It has just issued, as I write, a second tentative draft of a proposed uniform mechanics' lien act, and submitted it for general consideration and comment. The Act as submitted is well worth the reading of every architect, and shows clearly the careful consideration which the Committee has been giving to this subject. Special consideration has been given to the problem of how best to secure the protection of the owner against liens and at the same time fairly recognize the rights of the contractor and materialman. Various remedies have been suggested and, as is natural, some have tended to make the owner a collection agency for subcontractors and materialmen, and others, on the contrary, to set up too stringent provisions for his protection. Much good, will, I am sure, result from the work of this Committee and, if, with the cooperation of bodies such as the American Institute of Architects and associations of contractors, it should bring about a uniform law so drawn as to be liberal and yet not over-radical, the result would do much to simplify a somewhat confused situation. Certainly it would bring about a far more accurate understanding of lien legislation and of the respective rights of the owner, contractor, materialman and architect in connection with it.

*The Architect's Interests.* Pending the dawn of the millennium in this respect, the practicing architect will do well to acquaint himself generally with the provisions of the lien laws applicable in the jurisdiction in which his practice is carried on. He should do this both in his own interest and in the interests of his clients. He may wish to avail himself of the protection of the law, and in every project of any size he will be called upon to consider his client's protection in any event. The more thoroughly he understands the provisions of the lien law, the more competent he will be to advise his client and to protect the latter's rights and interests. It may perhaps be true that his legal duty in this connection will be accomplished if he suggests to his client that the latter should have his attorney advise him in connection with any lien considerations and the steps to be taken under the contract for his protection against liens. On the other hand, the architect whose conception of his duty is somewhat broader and who goes out of his way to advise his client and to protect him from lien complications, will build up, as a result, good will and confidence on the part of his clients, the benefits of which cannot easily be over-estimated.

In any event, the architect should see to it, in drafting the contract and specifications and in advising with respect to them, that the owner is protected by the insertion of proper provisions for the withholding of the final payment and for the submission by the contractor, with his requisitions, of statements and receipts showing the payments made to subcontractors and materialmen. If the architect certifies payments without these precautions and allows the owner, on the basis of these certifications, to pay out monies to the contractor when the contractor has not in turn properly taken care of his subcontractors or materialmen, he may well be held to account by the owner for negligence. The only safe course for him to follow is to exercise special care throughout the operation in checking the outstanding claims of subcontractors and materialmen and in being entirely satisfied with respect to the condition of their accounts, before issuing certificates. The architect is in a position to protect the owner in this connection. This protection he should be diligent in giving, as a fulfillment of the obligation which he owes and as a matter of ordinary good business in his own interests for it is to his own interests to have a good reputation.
FOR two consecutive months all construction records in the 37 states east of the Rocky Mountains have been broken, according to reports of the F. W. Dodge Corporation. In April, building and engineering work contracted for in these states (representing about 90 per cent of the total country) amounted to $643,137,100. In May the total was $668,097,200. Only six times prior to April have the month’s totals exceeded $600,000,000, these being in August, 1925, March and August, 1926, and March, April and June, 1927. Similarly, the totals for the year to both April and May constituted new records. In April the total for the first four months of the year was $2,128,204,100, which exceeded the month’s totals exceeded $600,000,000, these being in August, 1925, March and August, 1926, and March, April and June, 1927. Similarly, the totals for the year to both April and May constituted new records. In April the total for the first four months of the year was $2,128,204,100, which exceeded the values for the similar period to 1927 by 6 per cent. In May the year’s total rose to $2,796,301,300, which is 9 per cent over the first five months in 1927 and 7 per cent over the same period in 1926.

In April three sections of the country saw records broken; the New England States, where the value of construction for the month was 9 per cent over last year and 10 per cent over last month; the Middle Atlantic States, where two large contracts totaling $27,300,000 were largely responsible for an increase of 40 per cent over April, 1927, and 47 per cent over March, 1928; and the Central Western States where April totals for this year were 13 per cent over April, 1927, and 7 per cent over last month. In May four districts broke all former records for the month. New York state and northern New Jersey showed a 22 per cent gain over the preceding month and a 33 per cent increase over the same month last year. The expenditure of $184,555,000 in contracts made this also the highest monthly total since December, 1926. The New England States continued to show unusual activity, with a May total of $60,229,800, which is the record monthly total for the district, and which represented an increase of 30 per cent over April, 1928, and of 45 per cent over May, 1927. The Middle Atlantic States also established a new record for May with $76,937,300 worth of contracts, which was 38 per cent ahead of May, 1927, but was 25 per cent under the total for last month, for reasons already indicated. In the Central Western States the total, $192,868,300, was a 27 per cent increase over May, 1927, and 3 per cent ahead of April, 1928. For the 37 eastern states, analysis of the month’s totals shows that 43 per cent of all contracts in April and May were for residential construction. Increased activity in public works, industrial and commercial buildings is indicated in these interesting figures.

These various important factors of change in the building situation are recorded in the chart given here: (1) Building Costs. This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) Commodity Index. Index figure determined by the United States Department of Labor. (3) Money Value of Contemplated Construction. Value of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corp., and Engineering News-Record. (4) Money Value of New Construction. Total valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) Square Foot Area of New Construction. The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost, which is determined, first by the trend of building costs, and second, by the quality of construction.
THE silence which settled over the little group of tourists in a corner of an ancient and lovely cathedral was shattered by the exclamation: “I wonder how much the damned thing cost!” So are many of our dreams shattered when measured by the modern standard of value—money!

The only way in which the architect’s ideas can find tangible and concrete expression is by means of drawings and the written word in the form of specifications. Drawings are limited almost entirely to their function of illustrating the design and dimensions of each individual portion of the work. The specifications are capable of expressing accurately the multitude of conditions which require consideration to carry out the architect’s ideas in conformity with modern methods of transacting business. An essential qualification of a specification writer is the ability to obtain the best possible value for the money available. In this respect he bears a striking resemblance to the purchasing agent, and like him should be thoroughly familiar with the market conditions affecting building materials. The specification writer should also be an expert on the qualities and grades of the multitude of materials which enter into the construction of a building. The selection of the proper material for a given purpose is the result of years of experience and the proper contacts with authorities on the various phases of building construction.

A specification which has been loosely compiled and which contains meaningless paragraphs will add to the cost of the building, for the reason that it will create a condition where the owner will pay for many things which he will not receive. Under these conditions, an experienced contractor will estimate to cover himself from loss, no matter what the architect’s future interpretation will be. When a specification is carelessly compiled and indicates that the architect is ignorant of the proper administration of a building project, the contractor will often feel that he can “crash the gate,” and again the owner will pay for many things which he will not receive. Many contractors work on the theory that the best defense is a good offensive; therefore, when a carelessly compiled set of specifications and a poor set of plans are encountered, these contractors will take the aggressive to protect their interests, generally with considerable success, so that again the owner will pay for many things which he will not receive.

The architect’s position in the modern business structure is sound and conforms to the established economic theory that design, plan and supervision should be detached from that of execution. The architect’s position can be maintained only while he works in conformity with this economic principle, which should result in the preparation of carefully compiled specifications and accurately detailed plans, so that the contractor will confine his energy to execution only and will not invade the architect’s and engineer’s sphere of design and selection of materials. The success of a project will depend generally upon a logical plan and a scientific and business-like selection of materials, with the element of cost balanced against desirability for the purpose. The cost of a product should include the initial cost plus the cost of maintenance. The money spent in the construction of a building becomes an item of overhead which will be chargeable to the taxpayer, tenant, merchant or manufacturer, depending upon whether the building is for public use, tenant use, sales, or manufacturing purposes. Successful business executives are constantly striving to legitimately reduce overhead, for the reason that this charge must be added to the price of the commodity which will be manufactured or sold. If this overhead charge is excessive, it will impose a handicap on the commodity when in price competition with one which enjoys an overhead charge of lesser amount. This economic theory is not inconsistent with good architectural design, because it conforms exactly to the theory that good architecture should accurately express the purpose for which the building was constructed. Our modern architectural design at its best recognizes this theory, and is producing truly American architecture which accurately expresses the spirit of the age and the purposes for which buildings are constructed. A specification carefully compiled will take into consideration each and every angle from which the building can be appraised, so as to cover and include all contingencies. A specification so compiled will earn the respect of all affected and will form an instrument used as a means of trade and agreement to the end that all affected will enjoy its protection. This type of specification definitely establishes the liabilities of each individual affected, to the end that the operation will proceed smoothly to completion to the satisfaction of all concerned. This should be the ideal of all specification writers.

The most desirable material for a given purpose is frequently not the most expensive material. The familiar expressions: “Do not use nickel-plated lath,” and “Do not gold-plate the job,” express the thought. If the market is carefully investigated, there will be revealed the fact that considerable sums of money can be saved without injuring the character of the work in any respect, and in fact often improving it. Buildings in which expensive materials are used in service and"storage portions are victimized generally by carelessly compiled specifications with the familiar clauses: “All trim shall be mahogany”; “All floors shall be terrazzo”; “All
halustrades shall be bronze as per detail; and similar clauses which the supervisor interpreted exactly as written, irrespective of the location. The value in quality and money between the different grades of a given material should always be kept in mind, as very often the difference in price between the different grades is out of all relation to the difference in quality between them. This condition is due largely to the specification writer's requiring the very best grade of a given material in almost all instances, which results in a demand which causes a premium to be placed on the particular grade, while a slightly inferior grade, perfectly suitable for the purpose, will clutter the market. As an example, the difference in price between “A” dense heart rift yellow pine flooring and “B and better” dense heart rift yellow pine flooring, is out of all relation to the price difference between them. The price difference between “AA” quality window glass and “A” quality is out of all relation to the quality difference. A light of double thick “AA” quality window glass, 24 inches by 30 inches, has been quoted at $1.56 at warehouse, New York. A light of “A” quality glass has been quoted at $1.05. The difference in quality between these two grades of glass is so slight that it cannot be established by the average supervisor of construction. Expert graders of glass will not agree on more than 70 per cent of the “AA” quality glass. “A” dense heart rift long leaf yellow pine flooring 13/16 of an inch thick, has been quoted in the metropolitan territory at $1.30 per thousand. “B and better” dense heart rift yellow pine flooring has been quoted at $1.10 per thousand. These prices cover flooring delivered at the site. There is very little difference between these two grades, as “B and better” flooring contains 50 per cent of the “A” quality. Therefore, in ordinary cases the “B and better” would be the logical flooring to use, as the differences are of such a nature that they cannot be detected except by an expert. Similar and more exaggerated examples could be given at length.

When considering the item of cost, it is well to bear in mind that the difference in prices of raw materials will not bear the same relation when incorporated within the building. Let us consider an ornamental metal grille. The price difference between rough cast bronze and cast iron is about 10 to 1, whereas the price difference between the same grille in cast iron and bronze would be about 4 to 1, the proportion being cut down for the reason that the cost of the models and patterns would be the same in either case. It is possible to design an ornamental metal grille so that the cost of the model and pattern, coupled with the item of breakage for cast iron, would be so great as to compensate for the price difference between the metals. These examples are given to illustrate the proportional differences in cost between materials delivered at the site and the same materials incorporated within the building.

Example. Wrought iron pipe will cost approximately 40 per cent more than steel pipe. The cost of the pipe material for a plumbing system on an 11-story office building was 25 per cent of the cost of the entire piping system, exclusive of the finished plumbing fixtures, which reduced the percentage cost of the wrought iron pipe over steel pipe to 7 per cent in place, the percentage of additional cost being reduced for the reason that the items of labor, valves, pipe covering, painting and similar work were the same in either case.

Example. A light of double thick “B” quality window glass, 14 inches by 18 inches, will cost about 20 cents at the warehouse. A light of ½-inch or ¾-inch polished plate glass of the same size will cost about 52 cents at the warehouse, which is 160 per cent more than the double thick “B” quality glass. It will cost approximately 20 cents to glaze either light of glass, or 40 cents for the “B” quality and 72 cents for the plate glass, a price difference of 80 per cent between them.

Example. Strip copper in sheets is worth 25 cents per square foot based on 16-ounce copper. Galvanized iron is worth 5½ cents per square foot in sheets, which is less than one-fourth of the cost of the copper. Plain copper cornice or moulded work will cost approximately 65 cents per square foot in place. The same work in galvanized iron painted would cost approximately 40 cents a square foot,—about two-thirds of the cost of the copper work. When other materials are involved it will frequently be found that the cost differences between the two classes of work will not be anywhere nearly as great as if the other materials were not involved. For instance, galvanized iron skylights are quoted at approximately $1.20 per square foot, whereas copper skylights are quoted at approximately $1.70 a square foot. In this case the difference between them will be reduced, due to the fact that the other materials, such as, glass, puttying, labor, painting, etc., are the same in either case. For this reason galvanized iron skylights, except for highly speculative work, is a poor buy. The specification writer should investigate very carefully the element of cost, as it affects all substituted or sub-standard materials. He should carefully analyze and check all statements made in relation to the ultimate costs of these materials. I am quite familiar with more than one case where substituted and sub-standard material will cost in place as much as the standard material which they were designed to replace. When asking for prices, the price quoted will very often be f. o. b. factory, when it is customary to quote the same material in place. The price will often be quoted so as not to include some essential item of finish which will materially increase the price.

The materials used in the construction of a building can be roughly divided into two portions,—one raw materials, and the other manufactured materials. Raw materials, which comprise generally wood and stone in their multitude of sub-divisions, are products of nature, and as such are not subject to adulteration or alteration in quality, except such as
will occur during growth or formation. The specification writer and the supervisor of construction should be thoroughly familiar with the various kinds and grades of these materials and their adaptabilities for different purposes; for this reason it is unimportant from whom these materials are purchased. Steel, cement, copper and tin may also be classed under this heading, for the reason that their quality is stabilized by the equipment and resources behind them. When specifying manufactured materials, a different condition occurs, for the reason that the processes of manufacture are technical, and it is difficult to establish the quality of a given material without laboratory tests. When called upon to specify paints, asphalts, waterproofing compounds, mastic and rubber flooring, etc., it is better to spend energy investigating the manufacturers and to select one of recognized standing and integrity and then let him take care of the responsibility for the success of the material. Questioning whether it were possible to determine the quality of two kinds of rubber tile outside of a laboratory, I consulted with three experts on rubber and two purchasing agents, and they all agreed that it was not possible to establish the quality of the two rubber floor tile outside of a laboratory, despite the fact that there is a 60 per cent price difference between them. The company behind products of this nature is of more importance than the product itself. To prevent any question in the estimator's mind as to whether the material specified is the proper material for the purpose, it is important that proper selection be made, so that the product and grade will be logical for the purpose.

To bring out the various questions which should be answered before selecting a given material, these examples are given:

**Brick Work.** There are two basic types of brick, common brick and face brick. Common brick has been defined as a "moulded solid unit of burned clay, the standard size of which is 2 1/4 by 8 inches, not specially treated to produce either color or texture." Face brick can be defined as "a solid unit of burned clay specially treated to produce either color or texture." This treatment may consist of varying the burning methods or by adding substances to the clay to produce special color effects. The grading of common brick varies with the locality. In the metropolitan district, which consists of New York and adjacent territory, bricks are graded as: Light Hard or Salmon Brick; Hard Burned Hudson River Common Brick; and Lammy or Arch Brick. Light Hard or Salmon Brick are brick somewhat underburned and of lighter color than the regular run, but are sufficiently strong for ordinary use, except that they will not stand exposure to the weather. Hard Burned Hudson River Common Brick are the standard brick normally sold, and upon which all market quotations are based. Lammy or Arch Brick are the overburned brick which are often darker in color than the regular run, and are usually misshapen, varying from a slight degree to what are sometimes called "swelled" or "burst" brick. Physically, these brick are equal to the standard brick, except that their shape is distorted, and their use is usually confined to the exterior facing of the building to obtain architectural effects. The demand for these bricks often causes a premium to be placed on them.

Probably the best known common brick is the "Harvard" brick, so called because of its extensive use in the buildings of that university. Harvard brick is a New England common brick, and is a moulded open-yard, water-struck, wood-burned brick, sorted for color and handled with tongs. There is a definite trend back to use of common brick for facing purposes, due to the various architectural effects which are possible with the use of the different grades of common brick. Face brick, as we now know it, is a comparatively modern product, and does not possess the architectural background that common brick possesses, and it is not as economical, either in the cost of the brick itself or in the cost of laying. Many effects can be obtained with common brick by the use of the different bonds of brickwork and the use of different jointing. Instead of using special headers for effect, the heads can be broken off, which will cause a difference of texture and color with the stretcher brick. Investigation will reveal many other effects possible with common brick which will reduce the cost of the work materially.

Face brick is manufactured in various colors and textural effects, and in addition it will vary considerably in physical properties. The specification writer should look carefully into the cost of laying the different types of face brick, as those which have a very low rate of absorption are what a brick layer calls "floaters," and will cost considerably more to lay than brick with a relatively high rate of absorption. It is now becoming generally known that a brick with fair absorptive qualities will help produce a dry wall, due to the fact that it will bond better to the mortar and that the water will mushroom across the face of the brick and allow the heat and sun to absorb the moisture through the brick, whereas a brick of low absorptive value will not bond well to the mortar, and the water will find its way through the mortar joint into the interior, as it cannot be absorbed through the brick. The best grade of face brick is generally selected for color and mechanical properties, brick of one shade and perfect mechanical properties being the most expensive. This class of brick is often desirable for the interior of a building, but it should be used rarely for the exterior facings, due to the fact that it is not considered proper to produce a dead wall of one shade. Also a brick of perfect mechanical properties leaves much to be desired in the texture and general effect of the wall surfaces. With these considerations in mind, much can be saved in the selection of the face brick.

In laying brick, the character of brickwork has considerable to do with the cost of the finished work.
Face brick laid from an outside scaffolding is very much more expensive than brick laid from an inside scaffold, or “overhand brickwork” as it is known in the trade. Face brick should always be laid from outside scaffolds, for the reason that the mason can see what he is doing and can judge the effect of his work. When laying the brick from the inside of the wall, the mason cannot see whether the joints are plum or not, nor can he judge the effect of the work he is doing. The estimator for brick work is interested to know whether all the headers used in Flemish, English, Dutch or cross bond will be through headers, or whether every third or fourth header will be a through header. It is customary to have the same number of headers in this class of work as would be used in common brickwork, with every sixth course a full header bonded to the backing. Care should be used to carefully specify all special angle brick, ground brick or moulded brick, and exactly where they will occur; if not, the contractor will assume that standard brick clipped on the site will be used for these purposes.

The cost of the different classes of common brick will vary considerably in the locality in which the brick is purchased. It will also vary considerably depending upon the demand for the particular kind of brick. At the present moment in the neighborhood of Newark, Lammy or Arch Brick have been quoted as high as $40 per thousand, when the standard Hard River Brick were being quoted at $18 per thousand delivered at site. The difference in cost of the various classes of common brick is so variable that it should be obtained from local dealers in the different localities. There are some sections of the country where common brick are not selected but are delivered as kiln run, which is just as they come from the kiln run, with no selection at all. The New England Brick Manufacturers’ Association are grading their brick now as Merchantable Brick, consisting of 50 per cent suitable for facing and 50 per cent suitable for backing; Common Face Brick, consisting of brick from the body of the kiln suitable for facing; Selected Common Face Brick, consisting of brick specially selected to meet architects’ specifications; and backers, which consist of all brick suitable for backing-up purposes. The grading went into effect January 1, 1928. Face brick will vary considerably in price and to such an extent that it is almost impossible to furnish any definite price data in relation to them. It is, therefore, important that the specification writer consult with the local face brick dealer for information in connection with the prices on face brick.

Cut Stone. There are various types and grades of stone used for building purposes. The type and kind of stone will vary somewhat in the locality in which the stone will be used. Limestone is used to a far greater extent than any other stone for building purposes, and for this reason it will be used as an example of some of the considerations which should be given to the question of cut stone when specifying. There are various grades of limestone. The standard grades are: Select Buff, Select Gray, Standard Buff, Standard Gray, and Variegated. The cost of limestone will vary according to the grade specified, the first named being the most expensive and the other grades in the order listed. There are also some special grades of limestone where unusual veins of stone are encountered in the quarry. A very hard grade of limestone is also quarried, which is suitable for door sills and exterior steps. It is well to keep in touch with the local stone yards so as to be familiar with the price variations between the different grades. All of the grades mentioned, with the exception of the hard limestone, have about the same physical properties, so that the selection of the particular stone for a given purpose should be for effect desired and not on a price basis, unless price is the dominant factor. Variegated stone has been used with considerable success for buildings of Gothic architecture, whereas select buff is more suitable for Classic architecture.

Here is a price list on the different grades of Indiana limestone, and is the cost per cubic foot of the stone in blocks, f. o. b. cars New York:

<table>
<thead>
<tr>
<th>Grade of Stone</th>
<th>Scabbled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statuary Buff</td>
<td>$1.92</td>
</tr>
<tr>
<td>Select Buff</td>
<td>1.67</td>
</tr>
<tr>
<td>Standard Buff</td>
<td>1.57</td>
</tr>
<tr>
<td>Coarse Buff</td>
<td>1.42</td>
</tr>
<tr>
<td>Rustic Buff</td>
<td>1.42</td>
</tr>
<tr>
<td>Select Gray</td>
<td>1.57</td>
</tr>
<tr>
<td>Standard Gray</td>
<td>1.47</td>
</tr>
<tr>
<td>Coarse Gray</td>
<td>1.32</td>
</tr>
<tr>
<td>Variegated</td>
<td>1.47</td>
</tr>
<tr>
<td>Old Gothic</td>
<td>1.32</td>
</tr>
</tbody>
</table>

Contractors in the metropolitan territory are estimating limestone at about $5.25 per cubic foot for ashlars, and approximately $5.50 for plain moulded work. This will give some idea of the relation that the cost of the stone delivered will have to the cost of the stone in place. The finish of limestone has a bearing on the cost. Stone used just as it comes from the saw or planer is the least expensive, while special hand-tooled effects are the most expensive. Between these two extremes there are many desirable finishes, such as shot sawed; tooled; planer finished, with the edge of the tool broken to create the effect of hand-tooled work when set. Various finishes can be used upon the same building with good effect. About 30 years ago, prior to the general use of machinery for finishing and sawing stone, this work was almost always done by hand, and machine-cut stone was not considered the proper thing among the architects of the day. It was during this period and earlier that rusticated ashlar was in vogue. This type of work would be extremely expensive today, because it would have to be hand-finished after it was sawed, unless there were enough scrap around the quarry to supply the particular demand. When specifying cut stone, it is important
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to specify who will furnish the anchors. It is also important to specify the thickness of the ashalr and whether the ashalr will be back-checked at the columns, window jambs and corners, or whether the 4-inch ends of the ashalr can show at these points. When electric or other outlets occur on columns, it is important to indicate these on the details and specify that these should be cut or drilled by the stone contractor, which can easily be done at the shop. If these outlets have to be drilled at the site, considerable expense will result.

Carpentry and Mill Work. An investigation should be made of the kinds and grades of timber which are used locally. Wood used extensively in certain localities will be cheaper than in localities where it is not stocked. Along the eastern Atlantic sections, particularly along the shipping points, there is a considerable quantity of Douglas fir timber. In other localities yellow pine will be in demand. Care should be taken that the proper and exact grade for a given purpose is specified and that this grade be according to recognized established grading rules. These rules should be investigated so that the proper grade be selected for a given purpose. The difference in price between Prime long leaf dense yellow pine and Select Structural dense long leaf yellow pine is out of all relation to the quality difference between them. Ninety-nine per cent of Prime would grade as Select Structural. When specifying yellow pine, it is well to specify the locality in which the timber shall be cut. For instance, very little virgin growth yellow pine is cut in the eastern states, with the exception of a small portion of Florida. By far the best pine comes from Mississippi, Louisiana or Texas. The quality difference between this lumber and the second growth lumber in the eastern states may make it well worth while to specify the western lumber, as this is virgin timber having a slower growth, and therefore it is more dense in structure. The lumber industry maintains what is known as "inspection service," by which at a slight fee the lumber delivered can be re-inspected so that the architect may be sure that the lumber delivered is what is specified. In case of dispute as to the grade of lumber delivered, it is customary to require an inspection, in which case the loser generally pays the cost, which is in the neighborhood of 50 cents a 1000 board feet. Many architects are unfamiliar with the standard sizes of rough lumber as it comes from the saw mills, and do not seem to have a clear idea of the sizes it will be after it is kiln dried and finished ready for the building. Lumber for mill work is sold by the inch, and the price quoted will be per 100 lineal feet, so that when quoting $1.50 an inch for a particular kind of wood, that means $1.50 per square inch of cross section of stock from which the moulding will be cut per 100 lineal feet, and not the cross section of the actual size of the moulding. Therefore, it is very important for the detailer and specification writer to bear in mind standard sizes of finished lumber, which are about as given here.

Rough lumber will be sawed in the mill to the thickness of 5/6 inch, 3/4 inch, 1 inch, 13/2 inches, 2 inches, 23/4 inches, 3 inches, 4 inches, 5 inches, and in 2-inch units for thicknesses thereafter. The widths will be in units of from 2 inches up to 14 inches, the narrow boards being more numerous than the wide boards. Lengths in lumber will run in even feet from 6 to 16 feet, though more 8-, 10- and 12-foot lengths can be had than the 14- and 16-foot lengths. The thicknesses of the lumber quoted are in the rough stock as shown. These thicknesses will shrink or work off in the manufacture, so that 1-inch lumber will finish approximately 13/16 inch thick; 2-inch lumber 13/4 inches thick; and 23/4 inches thick will be worked from thicker lumber. The shrinkage in width will vary with the different woods, so that when a 3/4-inch moulding is detailed it will require a 13/4-inch stock to produce it. Sash in doors are 13/6 inches, 13/4 inches, 23/4 inches and 23/4 inches thick. If large quantities of a given moulding are required, it will cost no more to have this moulding detailed and specially run than to use a stock pattern. But if a small quantity of a given moulding is required, it is much better to use a stock pattern in order to save the set-up charges. It is unwise to specify that window boxes will be made of clear white pine or cypress throughout, with Georgia pine pulley stiles and parting strips. Such a frame would be a waste of money, the requirement being that the sills, outside mouldings and exposed portions of the box be of white pine; the pulley stiles and parting beads being yellow pine, and the rest of the frame of good, sound, merchantable lumber free from large, loose knots, shakes or similar defects. In specifying the size of the pulleys, it is wise to get a sample and lay it over the detail and see whether the center of the sash cord will actually fall in the center of the box. If the pulley is too large or too small, the weight will drag against either side of the boxed frame. I find very few draftsmen who pay any attention to this when detailing. Window frames and sash should always be detailed. Few stock frames and sash are made that are really substantially built and weatherproof. By detailing them, a greater variety of sizes can be obtained as well as a stronger and better frame and sash.

The exact character of interior finish should be clearly specified. The types generally required are: "Straight Mill Run Job," which consists of the trim being delivered in lengths and then put together at the site; a "Made Up Job," which consists of the door jambs, window and door trim, mantels and similar work built complete in the shop and delivered ready to set in place in one unit; a "Mill Cabinet Job," which requires the assembling of fine grade veneering, trim, wainscots, etc., in the mill, building up in complete units, and delivering it at the site where the carpenter sets it up and the painter finishes it; a "Strictly Cabinet Job," which requires the complete construction of all of the woodwork in the
shop of the cabinet maker. It also covers the building up of the special veneerings which are required to produce the effect desired.

When a fine cabinet project is encountered, it is always well to select the exact flitches of the wood beforehand from a reputable hardwood dealer. These woods are then filed in the architect's office and are referred to by name, grade and sample, so that the cabinet maker will know exactly the type and kind of wood to estimate upon. It is particularly important to take care of this item in rare woods, for the reason that there is a great difference of opinion as to what might be required. For instance, when specifying English Oak the question is whether oak from England is required, in which case a tree is selected in which the sap has stopped running and which is about dead. Wood of this type costs considerably more than what is known as Commercial English Oak, and this same principle rules in more or less degree with all types of hardwood. It is, therefore, important to consult with a hardwood broker and select the exact wood wanted for this type of work, and to obtain comparative prices.

Summary. An attempt has here been made by means of a few examples to give some idea of the different conditions which must be considered before the preparation of a specification for a given trade. The examples by no means cover all of the considerations. They are merely intended to give some idea of the procedure required to establish just what should be used for a given purpose. The specification writer should carefully consider the far-reaching effects of his specifications and should remember that the element of cost can never be disregarded but that it affects the earnings not only of the developer of the project, but the multitude of people in all walks of life who invest in modern mortgage bonds. It also affects the tax-payers in various communities where public buildings are being built. To keep faith with these people and at the same time to erect proper buildings, calls for the very best and for all of the efforts that an architect has at his command. This responsibility must be met and should not be shirked, for if the architect does not rise to leadership and assume this responsibility, it will be assumed by others not as capably trained or as well fitted for the work, to the end that the control of specifying will gradually pass out of the hands of the architect, which will seriously affect the practice of architecture in America.
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Made by Kohler at Kohler, these and other new products in the Kohler line of plumbing brass share the admirable quality and workmanship for which Kohler enameled and vitreous china ware are known, and make it possible for the architect to specify Kohler quality for the entire installation . . . Read the Kohler of Kohler News for monthly announcements of important developments in the field of fine plumbing fixtures.

KOHLER, Founded 1873, KOHLER, WIS. · Shipping Point, Sheboygan, Wis. · Branches in Principal Cities

KOHLER of KOHLER
Plumbing Fixtures
FAUCETS ARE THE

MUELLER All Metal Chromium Plated Combination Sink Faucet

In the best modern manner, the new Mueller G-2766 All Metal Chromium Plated Sink Faucet with plain swing spout, pedestal and soap dish is the proper finishing touch for a fine plumbing job. Cast in Mueller Brass, containing an unusually generous proportion of copper, this fitting is finished with Mueller Chromium Plate. The mirror-like surface is harder, does not scratch, tarnish or need polishing and gives a more positive contrast when installed on a fixture, either white or in the new colors.

The removable soap dish and index top lever-handles are all metal.

ARCHITECTURAL ENGINEERING AND BUSINESS Part Two
When science and craftsmanship go hand in hand

Mueller laboratory control of materials during every stage of manufacture, governed in strict accordance with accepted scientific principles and tests, gives a uniformly high quality to all finished products. This is further assured by the fact that the Mueller organization and workmen have specialized in the manufacture of brass goods for plumbing service since 1857.

Today, Mueller fittings—vital spots of plumbing—are made for every outlet.

MUELLER CO., (Established 1857) Decatur, Illinois
World's Largest Manufacturers of Plumbing Brass Goods
Branches: 101 Park Ave., Architect's Bldg. New York Dallas Los Angeles San Francisco
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BEAUTY as ageless as a fine cut gem

The new, superlatively beautiful Artline group adds new laurels to the name of Speakman.

Its graceful, fluid lines are a distinguished achievement in design. Its finish is the new, mirror-bright, silvery chromium plate. Not only has this finish a richness and beauty worthy of the finest modern bathroom, but it is absolutely permanent. It can never darken, film over or tarnish. It never needs polishing.

Speakman Artline fixtures are truly ageless. You can specify them for showers, baths, lavatories and kitchen sinks. Complete specifications sent on request.

Speakman Company
Wilmington, Del.
Hospital plumbing must have a stout heart. It gets no days off — Sunday brings no fewer hours of work.

With this in mind, Clow builds hospital plumbing stronger and heavier than usual.

Moreover, Clow equipment is designed by specialists who know the needs of hospital plumbing—the most specialized field of all. Many special brass fixtures are made to order by Clow.

Above is the Hospital Receiving Bath—fitted with Clow brass.

Norwegian Lutheran Deaconess Hospital and Institute
Minneapolis, Minnesota
Architect: Alban & Fischer
Plumber: Shaw & Co.

JAMES B. CLOW & SONS, 201-299 NO. TALMAN AVE., CHICAGO
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CLOW
PREFERRED FOR EXACTING PLUMBING SINCE 1878
What's the Difference Between a Genuine Vitreous China Urinal Stall and an Ordinary One?

The same difference that you would understand in considering a water closet or lavatory made of anything but Genuine Vitreous China.

The superiority of vitreous china over other materials being well known—the advantages of specifying Douglas urinal stalls are apparent.—Bear in mind they will not craze or discolor, that they are easily kept clean and absolutely impervious.

Write for Catalogue and list of Buildings where the Genuine Douglas Vitreous China Urinal Stalls are being used.

Manufactured by
The John Douglas Co.

Makers of High Grade Plumbing Fixtures

A Sectional Piece of Douglas Vitreous China Urinal
A Sectional Piece of the Ordinary Urinal

General Office: Cincinnati
Factories: Cincinnati, O.

Trenton, N. J.
A business building buys on a business basis

In equipping the new Clark Building in Pittsburgh, the builders bought on a business basis. Nothing but equipment of known value was approved. Jenkins Valves were installed throughout the heating system, and in the plumbing as well. They include Iron Body Globe Valves and Bronze and Iron Body Gate Valves. Architects in every section of the country serve their clients well by insisting on Jenkins Valves, by making sure that their specification writers are using the Jenkins figure numbers. This practice not only insures exactly the right valve for each service, but acts as an effective double check against substitution.

Jenkins Valves
Always marked with the "Diamond"
Since 1864
IF THE Exdite Welling cost as much as the highest priced closet on the market, it would still be an economical purchase. But when you consider the combination of low cost and valuable improvements, you will appreciate why Exdite Welling appears on so many specifications.

Here are a few reasons for its popularity:

1. Oversize outlet passage insures the passing of objects which clog most closets.
2. Extra large water surface. With the strong, positive action the user is assured a clean bowl after every flush.
3. No better tank fittings are made. They are as near trouble-proof as possible.
4. China connection removes the last trace of metal.
5. All-white TE-PE-CO Seat.

THE TRENTON POTTERIES CO.
Trenton, New Jersey, U.S.A.

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TRENTON, NEW JERSEY, U.S.A.
VERLASTING is the bright, new appearance of “CRODON” plated plumbing fixtures. Their brilliant lustre is permanent. Plated with “CRODON”, bathroom, kitchen and washroom fittings forever retain their beauty and look of cleanliness. Neither tarnish nor corrosion attack “CRODON”. It needs no polishing—an occasional wiping keeps it mirror-bright. Seven times harder than nickel, it defies wear indefinitely.

Because of their beauty and economy, “CRODON” plated plumbing fixtures are being installed in an ever-increasing number of new hotels, apartments, hospitals, office buildings and homes. Manufacturers and jobbers now carry them in stock or can have fixtures “CRODON” plated for you in their shops or our own.

Our service department would welcome an opportunity to give you full information about “CRODON” plated faucets, flush valves, shower sprays, mechanical stoppers, builders hardware or other metal fittings. If estimates for any building project are desired we will gladly refer you to our licensees.

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4645 West Chicago Ave., Chicago, Ill. — 3125 Perkins Ave., Cleveland, Ohio — and at Waterbury, Conn.
Metal and Thermit Corp., Aguate, South San Francisco, Cal.
The glazed Chinese wall paper in this spirited bathroom was the palette which suggested its color range: The lacquer red of the glass enclosed shower, the peacock green of the tile and the mirror trim, the Sarancolin marble of the gold-legged Neumar lavatory and Neumar dressing table, the Java tan porcelain enamel of the Tarnia bath standing free of the walls. Many other color schemes and a variety of room arrangements are illustrated with pictures and blue prints in *New Ideas for Bathrooms*. A special architect’s edition of this handsome helpful book has been prepared, containing forty-eight pages and detailed descriptions and data for twenty out-of-the-ordinary bathrooms. It will be sent to you on request, without any obligation. Ask the Crane branch in your city or write the general office.
A generation ago the public taste approved of lightning rods, cheese-box houses and bath tubs mounted on eagles’ claws clutching croquet balls.

Today the architect is no longer forced to pocket his pride and specify such horrors. Manufacturing standards and public taste have changed for the better and advertising has helped to do it.

National advertising featuring the Improved Madera by Maddock is today telling people frankly what constitutes a good hygienic toilet. The architect can now specify it knowing that it will be welcomed by his client as a lifetime toilet of unsurpassed sanitation and beauty.

THOMAS MADDOCK’S SONS CO.
TRENTON, N. J.

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Church Sani-White and Sani-Black Seats are recognized nationally as the leading toilet seats made. They are described in detail in our illustrated, 100-page architects' catalog.

Whether you specify Church Seats or not, this catalog merits a permanent place in your reference library. It will be of definite value to you in determining which types of toilet seats meet most completely the needs of every building—hospitals, hotels, office buildings, industrial and public buildings as well as apartments and private homes.

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ARCHITECTURAL ENGINEERING AND BUSINESS  Part Two

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Fisher Building, Detroit
Architect — Albert Kahn
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Light-weight—easily handled when stored or put back into windows.
Extruded Aluminum Frame with perfect welded corners.
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Any finish desired,—bright or dull aluminum, or any applied color.

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The alloy used in the manufacture of Orange Aluminum Screens was developed for our use by the Aluminum Company of America, and is exclusive with the Orange Screen Company. It is one of the strongest non-ferrous alloys—lightness, great tensile strength, elasticity, and rigidity—it is unsurpassed for metal screen frame construction.

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and Floor Coverings
It seems to be a matter of general practice nowadays for architects to include a complete laundry department in the original plans for hotels, hospitals, and institutions.

For they know that such a department, operated under the building's own officials, always pays its own way. They know, too, that a surprisingly large number of these laundry departments are "American" equipped—from washers to presses.

The "American" engineers who planned the laundry department in the Fort Shelby Hotel, at Detroit—as well as scores of others, large and small—will be glad to confer with you about institutional laundry practice. They will show you blue-prints and sample layouts—give you helpful information about equipment and floor-space requirements. Surely you will want to avail yourself of this "American" service.

THE AMERICAN LAUNDRY MACHINERY COMPANY
Norwood Station, CINCINNATI, OHIO

THE CANADIAN LAUNDRY MACHINERY CO., LTD.
57-93 Sterling Road, Toronto 3, Ont., Canada

Agents: BRITISH-AMERICAN LAUNDRY MACHINERY CO., LTD.
1 Underhill St., Camden Town, London, N. W. 1, England
ON THE DIETETIC LABORATORY TABLE TOPS 
ARNOT-OGDEN HOSPITAL, ELMIRA, N. Y.

While this laboratory has for its purpose the dietetic instruction of nurses, it also teaches another lesson. It teaches the importance—the beauty—the value—of cleanliness. In all hospital work, there is nothing of more importance than cleanliness.

Attractive-looking Monel Metal surfaces help to impress the lesson of cleanliness on the minds of junior hospital workers. In this laboratory, they can see with their own eyes, just how easily Monel Metal can be kept spotlessly clean.

They also see how resistant it is to corrosion, denting, scratching and all kinds of abuse. They learn through their own experience that Monel Metal will not rust and that it has no coating to wear off.

In the executive offices of the hospital they know all these things—and more—about Monel Metal. They know that because Monel Metal has all these desirable properties, that it also has the virtue of being economical—that it saves cleaning labor and that it also reduces replacement costs.

Architects who are called upon to specify materials for laboratory or other working surfaces can profitably give consideration to the many advantages of Monel Metal.
Selected List of Manufacturers' Publications
FOR THE SERVICE OF ARCHITECTS, ENGINEERS, DECORATORS, AND CONTRACTORS

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

ACOUSTICS
R. Guastavino Co., 40 Court St., Boston
Acoacoustol Plaster, Brochure, 6 pp., 10 x 15¼ ins. Important data on a valuable acoustical material.
U. S. Gysonum Co., 85 W. Monroe St., Chicago, III.

AIR FILTERS
Staytowel Filter Corporation, Rochester, N. Y.
Protectometer High Efficiency Industrial Air Filters. Booklet, 20 pp., 8½ x 11 ins. Illustrated. Data on valuable detail of this equipment.

BANK VAULTS
Maconber Steel Co., Canton, Ohio.
Bank Vault Reinforcing. Folder, 8 pp., 8½ x 11 ins. Designing Data and Insurance Rating.

BASEMENT WINDOWS
Gemfire Steel Company, Youngstown, Ohio.

BATHROOM FITTINGS
A. P. W., Page & White, 2135 N. Clark St., Chicago.
Owion for Fine Buildings. Folder, 8 pp., 8½ x 6 in. Illustrated. Describes Owion glazed porcelain.
Architects' File Card. 8½ x 11 in. Illustrated. Filing card on Owion fittings.
Cabinets and Fixtures. Booklet, 33 pp., 8½ x 11 in. Illustrated. Catalog and price list of fixtures and cabinets.

BRICK
American Face Brick Association, 1751 Peoples Life Building, Chicago, III.
Skintled Brickwork. Brochure, 15 pp., 8½ x 11 ins. Illustrated. Tells how to secure interesting effects with common brick.

CEMENT—Continued
Town and Country Houses of Concrete Masonry. Booklet, 19 pp., 8½ x 11 ins. Illustrated.
Parts About Concrete Building Tile. Brochure, 16 pp., 8½ x 11 ins. Illustrated.
The Key to Fire resistant Homes. Booklet, 20 pp., 8½ x 11 ins. Illustrated.
Design and Control of Concrete Mixture. Brochure, 32 pp., 8½ x 11 ins. Illustrated.
Concrete in Architecture. Bound Volume. 60 pp., 8½ x 11 ins. Illustrated. An excellent work, giving views of exteriors and interiors.

CONCRETE BUILDING MATERIALS
Colbe Products Company, Chicago, New York, Los Angeles.
Designing Concrete for Workability as Well as Strength. Brochure, 8 pp. Illustrated. Data on a new improved workability in concrete is secured without excessive quantities of water.
Economic Value of Admixtures. Booklet, 32 pp., 6½ x 9½ ins. Reprint of papers by J. G. Pearson and others before 1924 American Concrete Institute.
Bonding Surfaces on Concrete. Booklet, 12 pp., 8½ x 11 ins. Illustrated. Deals with an important detail of construction.
Dovetail Anchor Slot Co., 148 West Ohio St., Chicago.
Dovetail Masonry Anchoring System. Folder, 4 pp., 8½ x 11 ins. Illustrated. Data on a system of anchoring masonry to concrete.
Kosmos Portland Cement Company, Louisville, Ky.
High Early Strength Concrete. Using Standard Kosmos Portland Cement. Folder, 1 pp., 8½ x 11 ins. Complete data on securing high strength concrete in short time.

CONCRETE COLORINGS
The Master Builders Co., 7065 Euclid Ave., Cleveland,
Dychrome Concrete Surface Hardener in Colors. Folder. 4 pp., 8½ x 11 in. Illustrated. Data on a new treatment.

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

Northwestern Expanded Metal Products, 1224 Old Colony Building, Chicago, Ill.

Waterproofing and Damp Proofing Specification Manual. Booklet, 18 pp., 8½ x 11 in. Illustrated. A study of building materials of a number of different kinds and the roofing materials adapted for each.

Gemfire Steel Company, Youngstown, Ohio.

DAMPPROOFING
The Master Builders Co., 7065 Euclid Ave., Cleveland,

Dampproofing
Philip Carey Co., Lockland, Cincinnati, Ohio.
Architects' Specifications for Carey Built-Up Roofing. Booklet, 8 x 10½ in., 24 pp. Illustrated. Complete data to aid in specifying the different types of built-up roofing to suit the kind of roof, construction to be covered.

Carey Built-Up Roofing for Modern School Buildings. Booklet, 8 x 10½ in., 32 pp. Illustrated. A study of school buildings of a number of different kinds and the roofing materials adapted for each.

Northwestern Expanded Metal Products, 1224 Old Colony Building, Chicago, Ill.

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Northwestern Expanded Metal Products, 1224 Old Colony Building, Chicago, Ill.
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS

DOORS AND TRIM, METAL

The American Brass Company, Waterbury, Conn.


Genfire Steel Company, Youngstown, Ohio.

Fireproofing Handbook, 85 x 11 in. 32 pp. Illustrated. Gives methods of construction, specifications for materials, suggestions for the installation of fireproof metal sewer, lathe, steel, Thrussit solid partitions, steel joists, studs, window frames, doors, etc.

North Western Expanded Metal Co., 407 South Dearborn St., Chicago, Ill.

A. I. A. Sample Book. Volume 11, 76 x 11 in. Contains actual samples of several materials and complete data regarding their use.

FLAGSTONES


FLOORING (CHEMICAL)

Master Builders Co., Cleveland Ohio.


Sonnenberg Sons, Inc., 115, 116 Fifth Ave., New York, N. Y.

Lapidolith, the liquid chemical hardener. Complete sets of specifications for every building type in which concrete floors are used, with descriptions and results of tests.

FLOORS—STRUCTURAL

Truscon Steel Co., Youngstown, Ohio.


Structural Gypsum Co., 111 West 9th Street, N. Y.


FLOORING


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


Armstrong's Linoleum Layers Book, 1927. Catalog, 85 x 11 in. 272 pp. Complete information on the use of linoleum for offices, stores, etc., with reproductions in color of suitable patterns, also specifications and instructions for laying and securing.


Quality Sample Book, 85 x 11 in. Showing all gauges and thicknesses of the Armstrong line of linoleums.

THE Jennings Sewage Ejector is of the pneumatic type. That is, air, compressed to the necessary working pressure by a Nash Hytor Compressor, is used as the motive power to pump the accumulated sewage from a pot to the sewer.

Two distinctive improvements in ejector design are to be noted. Air is compressed, delivered, and used only when required. There is no air storage tank. Nor any need for one.

Air valves are avoided. At best, such valves are intricate devices likely to get out of order. They are known to leak during idle periods, causing a serious waste of costly high pressure air. The use of high pressure air reduced for low pressure ejector service is an inefficient practice.

By avoiding complicated air valves and the difficulties they involve, the Jennings Sewage Ejector makes possible simpler, more economical operation. Write for Bulletin 67.

THE NASH ENGINEERING CO.
12 Wilson Road, So. Norwalk, Conn.

Bulletins promptly mailed on request. State whether you are interested in: return line and air line heating pumps—condensation pumps—compressors and vacuum pumps for air and gases—standard and suction centrifugal pumps—house service pumps—sewage ejectors—sump pumps.

Jennings Pumps

Nash Hytor Air Compressors supply compressed air to Jennings Sewage Ejectors.
SELECTED LIST OF MANUFACTURERS’ PUBLICATIONS—Continued from page 174

FURNITURE—Continued
of an approved method for installing Bloxomend in gymnasiums, armories, drill rooms and similar locations where maximum
Albert Grauer & Co., 1408 Seventeenth St., Detroit, Mich.
Granger Glass Manufacturing Co., Chicago, III., 4 pp., 8½ x 11 in. Data on a valuable form of flooring.
Thomson Bros. & Co., 165 W. Wacker Drive, Chicago.
Better Floors, Folder, 4 pp., 11½ x 17¼ ins. Illustrated. Floors in reinforced concrete buildings.
Linoleum Patterns, Brochure, 10 pp., 8½ x 11 ins. Illustrated. Deals with fine assimilation of floor coverings.
Linoleum Flors, Booklet, 45 pp., 8½ x 11 ins. Illustrated. Linoleum Data and Specifications for Architects. Illustrated.
Structural Gypsum Corporation, Linden, N. J.
Gypsum Freer Fireproof Floors, Brochure, 36 pp., 8½ x 11 ins. Illustrated. Data on floors.
U. S. Gypsum Co., Chicago.
Pyrotherm Floor Tile, Folder, 8½ x 11 in. Illustrated. Data on building floors of hollow tile and tables on floor loading.
Quarry Tiles for Floors. Brochure, 8 pp., 8½ x 11 ins. Illustrated. A brochure on quarry tiles for floors. Illustrated booklet indicative of the scope, character and decorative possibilities of quarry tiles for floors in interior of different historic styles.

HARDWARE—Continued
Forged Lanterns by McKenney. Brochure, 6 x 9 ins. Illustrated. Describes a fine assortment of lanterns for various uses.
Hardware for the Home. Booklet, 24 pp., 8½ x 11 x 6 ins. Deals with residence hardware.

HEATING EQUIPMENT
American Boiler Co., 604 Russell Street, Detroit.
Heating and Ventilating Utilities. A binder containing a large number of valuable publications, each 8½ x 11 in., on those important subjects.
American Radiator Company, The, 40 West 40th St., N. Y. C.
Ideal Rollers for Oil Burning. Catalog 8½ x 11½ ins. 36 pp. Illustrated in 4 colors. Describing a line of Heating Rollers especially adapted to use with Oil Burners.
Ideal Arcola Radiator Warmth. Brochure 8½ x 9¼ ins. Illustrated. Describes a line of one-piece baseboard radiators 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.

James B. Clow & Sons, 554 S. Franklin St., Chicago.

C. A. Dunham Company, 450 East Ohio Street, Chicago, Ill.
Excelsior Products Corporation, 119 Clinton St., Buffalo, N. Y.
The Fulton Sylphon Company, Knoxville, Tenn.
Sylphon Temperature Regulators. Illustrated brochures, 8½ x 11 ins., dealing with general architectural and industrial applications; also specifically with application to steam and hot water systems. Sylphon Heating Specialties. Catalog No. 200, 192 pp., 8½ x 11 ins. Important data on heating.

Illinois Engineering Co., Racine Ave., at 21st St., Chicago, Ill.
Vapor Heat Bulletin 21, 8½ x 11½ ins. 12 pp. Illustrated. Describing new and original data on Vapor Heating. Rules for computing radiation and a table for figuring heat requirements, together with temperature of steam and vapor at various pressures, also description of Illinois Vapor Specialties.
S. T. Jackson Inc., Harvey, Calif.

Kewanee Boiler Corporation, Kewanee, Ill.
Kewanee on the Jet. Catalog 8½ x 11½ ins. 80 pp. Illustrated. Showing installations of Kewanee boilers, water heaters, radiators, etc., with each page illustrating a typical installation.
Catalog No. 79, 6 x 9½ ins. Illustrated. Describes Kewanee Firebox boilers with specifications and setting plans. Catalog No. 79, 6 x 9½ ins. Illustrated. Describes Kewanee power boilers and smokeless tubular boiler specifications with boilers.
May Oil Burner Corp., Baltimore.

Milwaukee Valve Co., Milwaukee.
MILVACO Vacuum & Vapor Heating System. Nine 4-½, 8½ x 11½ ins. Illustrated. Important data on heating. MILVACO Vacuum & Vapor Heating Specialties. Nine 4-½, 8½ x 11½ ins. Illustrated. Deal with a valuable line of products and applications used in heating.

Modine Mfg. Company, Racine, Wis.

Molby Boiler Co., Inc., New York and Jersey City.
Molby Heating Boiler. Booklet, 24 pp., 4 x 9 ins. Illustrated. Deals with well known line of boilers.
When Positive Control Is IMPERATIVE

THE power of the mighty ocean liner triumphs over raging winds and bounding waves.

At the pier, where she meets the most exacting limitations to her every movement, her engines are useless and the small sturdy tug must nose her into her berth.

It is an object lesson in the application of accurate scientific control to the government of great forces.

Sylphon Automatic Control of temperatures or pressures of air, liquids or gases has proven itself an economic necessity and has been an important factor in the promotion of human health and comfort and industrial progress.

Sylphon Instruments by satisfactory performances over years of uninterrupted periods of service have won a widespread approval and a diversified employment not attained by any others.

The name Sylphon on a Temperature or Pressure Regulator is an assurance of positive, safe and everlasting efficiency. It signifies a guarantee backed by the resources of the largest manufacturer of thermostatic instruments in the world.

They provide safe control of fuel oil burners, and the Sylphon Damper Regulator, now factory equipment on thirty-five leading makes of boilers, affords comfort and fuel saving in countless homes.

Some possible application of Sylphon Temperature or Pressure regulation comes to your mind. Let our engineers assist in solving your particular problem—all without obligation on your part. We welcome correspondence. Just mail coupon or write if you prefer.

THE FULTON SYLPHON COMPANY, Knoxville, Tenn., U. S. A.
Dept F. Sales Office: New York, Chicago, Philadelphia, Boston, Detroit. All Principal Cities in the U. S. A.

Gentlemen:
We are interested in the application of Sylphon Control to

Name
Company
Address
City

State
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 176

HEATING EQUIPMENT—Continued

Chimney Construction. Booklet, 26 pp., 6 x 9 ins. Data recom-
mended by National Board of Fire Underwriters.

Nash Engineering Company, South Norwalk, Conn.

No. 61. Describing Jennings Hydromizer, a line of Vacuum Heating Pumps, electrically driven, and supplied in standard sizes for different classes of insulation.

No. 62. Describing Jennings Hydromizer of Condensation Pumps, sizes and shapes, and equivalent direct radiation.


Insulation of Roofs to Prevent Condensation. Illustrated book-
et, 7% x 10% ins. 36 pp. Gives full data on all available types of roof insulation.

Floor Filler for Pipe Covering. Made in accordance with A. I. A. rules.

"The Cork Liner Makes a Comfortable Home."


Phillip Carey Co., The, Cincinnati, Ohio.

Carey Science Kitchen Products. Catalog. 6 x 9 ins. 72 pp. Illustrated.

Coffin Products Co., 1230 South Hope St., Los Angeles.

The Insulation of Boilers. Booklet, 8 pp., 8% x 11 ins. Illustrated. On insulating the boiler, walls, breakings, and stacks to reduce amount of radiation.

Heat Insulators. Booklet, 8 pp., 8% x 11 ins. Illustrated. On approved types of insulation.

Sil-O-Cel Insulation Materials and Allulon. Folder, 16 pp., 8% x 11 ins. Illustrated. Important data on insulation.

Structural Gypsum Corporation, Linden, N. J.


JOISTS

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

Catalog No. 4. Booklet, 32 pp., 8% x 11 ins. Illustrated. Gives details on types of joists, installation tables and specifications.

Geno Steel Company, Youngstown, Ohio.

Steel Joists. 8% x 11 ins. 32 pp. A. I. A. File Number 138C.

Illustrated. Complete data on various types of joists including construction details and specifications.

KITCHEN EQUIPMENT

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

Hotels, Restaurants and Cafeteria Applications of Monel Metal. Booklet, 8 pp., 8% x 11 ins. Illustrated. Describes use of Monel metal in equipment which in Monel Metal is used, with service data and specifications.

McDougal Company, Frankfort, Ind.

Kitchens for Homes and Apartments. Booklet, 22 pp., 8% x 11 ins. Illustrated. Gives details on types of equipment and sources of equipment.

File Folder. Sheets and specifications useful in preparing kitchen layouts.

Domestic Science Kitchen Units. Brochure, 8 pp., 8% x 11 ins. Illustrated. Deals with flexible line of kitchen equipment.

Pick & Company. Albert, 208 W. Randolph St., Chicago, Ill.


School Cafetaria. Booklet, 4 pp. 8% x 11 ins. Illustrated. The design and equipment of school cafeterias with photographs of installations, lists of equipment, and standard units.

LABORATORY EQUIPMENT

Alberene Stone Co., 153 West 22nd Street, New York City

Booklet describing types, sizes, and sources of laboratory equipment, shower partitions, stair treads, etc.

Duriron Company, Dayton, Ohio.

Duran Acid, Alkali and Rust-proof Drain Pipe and Fittings. Booklet, 8% x 11 ins., 20 pp. Full details regarding a valuable form of piping.

LANTERS

Tudorhunter, Arthur. 119 E. 57th St., New York.

Hand Wrought Lanterns. Booklet, 8% x 11 ins. 20 pp. Illustrated in Black and White. With price list. Lanterns appropriate for exterior and interior use, designed from old models and meeting the requirements of modern lighting.

LATH, METAL AND REINFORCING

Geno Steel Company, Youngstown, Ohio.

Herrington Metal Lath Handbook. 8% x 11 in. 32 pp. Illustrated. Standard specifications for Cement Stucco on Herrin-
gone. Rigid Metal Lath and interior plastering.

National Steel Products, Inc. catalog.

Better Walls for Better Homes. 16 pp., 7% x 10% ins. Illustrated. Metal lath, particularly for residences.

Steellex for Floors. Brochure, 24 pp., 8% x 11 ins. Illustrated. Combined reinforcing and form for concrete or gypsum floors and roofs.

Steellex Data Sheet No. 2. Folder. 8% x 11 ins. Illustrated. Steellex for floors on steel joists with round top chords.

Steellex Data Sheet No. 3. Folder. 8% x 11 ins. Illustrated. Steellex for steel floors on steel joists with flat top flanges.

Steellex Data Sheet No. 1. Folder. 8% x 11 ins. Illustrated. Steellex for wood floors on wood joists.

Northwestern Expanded Metal Co., 1234 Old Colony Building, Chicago, Ill.

Northwestern Expanded Metal Products. Booklet, 8% x 10% ins., 20 pp. Fully illustrated, and shows different products of this company, such as Kno-burn metal lath, 26th Century Corrugated, Plastasey and lamp lath channels, etc.

Longspan 1/4-inch Rib Lath. Folder 4 pp., 8% x 11 ins. Illustrated. Deals with a new type of rib lath.

A. I. A. Sample Book. Round volume, 8% x 11 ins. Contains actual samples of several materials and complete data regarding their use.
Insulation of Roofs a Profitable Investment

ONE of the advantages of insulating a roof with Armstrong's Corkboard is the protection it affords the top floor from summer heat.

This feature is of particular importance in office buildings and apartment houses where the space under the roof is used for offices or living rooms. Ordinary roofings have little resistance to the transmission of heat, and air spaces between the roof and the ceiling are of little value. As a result, top floors are usually unbearably hot in summer, a totally unnecessary condition which can be easily corrected by insulating the roof with a single layer of Armstrong's Corkboard.

The insulation of roofs with Armstrong's Corkboard is not only a distinct advantage, but a profitable investment financially. It makes top floors comfortable winter and summer and, therefore, desirable the year round, and increases their rental value.

An important consideration in the insulation of such roofs is the specification of an adequate thickness which should be from 1 to 2 inches. Corkboard insulation has this advantage, that it is made in 1, 1½, and 2-inch thicknesses and can, therefore, be applied in a single operation and at low labor cost as compared with thin materials built up to these thicknesses. Armstrong Cork & Insulation Company, 132 Twenty-fourth St., Pittsburgh, Pa.; McGill Bldg., Montreal; 11 Brant St., Toronto 2, Ont.

For Your Files

Complete information regarding the use and resultant advantages of Armstrong's Corkboard on building roofs is given in a standard illustrated catalog of 8½ pages entitled "Armstrong's Corkboard for the Walls and Roofs of Buildings." A copy will be sent on request.

Armstrong's Corkboard Insulation

- for the Roofs of All Kinds of Buildings -
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 178

MILL WORK—Continued

Roddis Doors, Catalog G. Booklet, 183 pp., 8½ x 11 in. Complete list of doors for various uses.

Roddis Doors for Hospitals. Brochure, 15 pp., 8½ x 11 in. Illustrated, giving data on hospital doors.

Roddis Doors for Hotels. Brochure, 15 pp., 8½ x 11 in. Illustrated, giving data on hotel and apartment buildings.

MORTAR AND CEMENT COLORS

Clinton Metallic Paint Co., Clinton, N. Y.

Clinton Mortar Colors. Folder, 8½ x 11 in. 4 pp. Illustrated in color, gives full information concerning Clinton Mortar Colors, including directions for use.

Color Card. 6¼ x 9¼ in. Illustrates in color the ten shades in which Clinton Mortar Colors are manufactured.

Something new in Broc, 6¼ x 9¼ in. Illustrated. An interesting folder on the use of coloring matter for stucco-coated walls.

ORNAMENTAL PLASTER


Architectural and Decorative Ornaments. Cloth bound volume, 38 plates; 9 x 12 in. 18 plates. Price, $10.00. A complete catalogue of fine plaster ornament.

Hurt Building. Atlanta; Senior High School and Junior College, Convinging Proof. 3¾ x 6 in. 8 pp. Classified list of buildings finished.

It Has Been Imitated. Folder, 4 pp., 10 x 13 ins. Data in an illustrated work on decorative plaster ceilings.

The Pergola Catalog. 7¾ x 10 in. 64 pp. Illustrated. Contains views of pergola lattices, garden furniture in different kinds.

Column Catalog, 7¾ x 10 in. 32 pp. Illustrated. Contains illustrations of columns and installations.

Continued

ARCHITECTURAL ENGINEERING AND BUSINESS

Part Two
The fine things which owners and architects are saying about the Electrol Automatic Oil Burner might imply that it is high in price. ... Such is not the case. Electrol is priced within reach of all. Regardless of the size of your client's home or purse, there is an Electrol that sells at a price he can afford. A model for every heating requirement.

You undoubtedly know that automatic oil heat, in its highest development, supplies a degree of home comfort far ahead of other heating methods—with conveniences which are almost priceless. ... But if your mind still carries any unanswered questions on oil heating, a careful consideration of Electrol features and records of performance will give you a new conception of how dependable an oil burner can be. Quiet. Economical in operation. All-Electric... Entirely automatic. Never the need to turn a hand — yet every room always at the desired temperature, no matter how cold or changeable the weather.

The Oil Burner with The Master Control

Electrol, with its Master Control, has made dependable automatic heat a certainty. The Master Control watches over every phase of the burner's operation day and night, like a living sentinel, regulating the flow of oil, timing the ignition and governing combustion.

Wherever Electrol is sold you will find a complete oil heating service backed by a sound, large and growing manufacturing organization. Whenever you specify Electrol you know that the burner will be correctly installed. The men who do the work have been carefully trained at the factory.

Purchase of Electrol can be financed along with the financing of the new building. ... Let us send you the Electrol Regulation A. I. A. Folder containing full information and all details on Electrol Oil Burners. Or, if you prefer, consult the Electrol Sales and Service Representative in your city. Electrol, Inc. of Missouri, 179 Dorcas St., St. Louis.

Electrol is accorded the enthusiastic praise of owners everywhere. It has given them a new conception of how dependable an oil burner can be.

This Coupon is for Your Convenience.

Electrol Inc. of Missouri, 179 Dorcas St., St. Louis, U. S. A.

Gentleman: Please send the Electrol Regulation A. I. A. Folder.
Name ..........................................
Address ..........................................
City ........................................ State
SELECTED LIST OF MANUFACTURERS’ PLUMBING EQUIPMENT

PARTITIONS—Continued

PUMPS

American Brass Company, Waterbury, Conn.

American Rolling Mill Company, Middletown, Ohio.

American Redding Products Corp., Booklet, 16 pp., 6 x 9 in. Data on dredge pipe.

Clow & Sons, James B., 534 S. Franklin St., Chicago, Ill.

Catalog "A", 4 x 8 in. 700 pp. Illustrated. Shows a full line of steam, gas and water works supplies.

Cohoes Rolling Mill Company, Cohoes, N. Y.

Catalog, Booklet, 48 pp., 5 x 7 1/2 in. Data on wrought iron pipe.


Duriron Acid, Alkali, Rust-proof Drain Pipe and Fittings. Booklet, 4 x 6 1/2 in., Illustrated. Important data on a valuable line of pipe.

National Tube Co., Frank Building, Newark, Pa.

"Fuscola" Bulletin No. 2. Corrosion of Hot Water Pipe, 8 1/2 x 11 in. 24 pp. Illustrated. In this bulletin is summed up the most important research dealing with hot water systems. The text matter consists of seven investigations by authorities on corrosion in hot water supply lines.

"National" Bulletin No. 3. The Protection of Pipe Against Internal Corrosion, 8 1/2 x 11 in. 20 pp. Illustrated. Discusses various causes of corrosion, and details are given of the development of a coating system for eliminating or retarding corrosion in hot water supply lines.

"National" Bulletin No. 25. "National" Pipe in Large Buildings, 8 1/2 x 11 in. 88 pp. This bulletin contains 254 illustrations showing roughing-in measurements, etc. of prominent buildings of all types, containing "National" Pipe, and considerable engineering data of value to architects, engineers, etc.

Modern Welded Pipe. Book of 88 pp. 8 1/2 x 11 in., profusely illustrated, tells about hallowe and line weighings of the important operations in the manufacture of the pipe.

PLASTER

Best Quality, Keene’s Cement Co., Medicine Lodge, Kans.


In Volume Two, Bulletin, 20 pp., 6 1/4 x 9 1/4 in. Illustrated. Describes origin of Keene’s Cement and views of buildings in which it is used.

PLUMBING EQUIPMENT


Catalog S. W. C. Booklet, 95 pp., 7 1/2 x 10 1/2 in. Illustrated. Data on Sanitary-White and Sanitary-Black toilet seats.

Clow & Sons, James B., 534 S. Franklin St., Chicago, Ill.

"G" M. 8 1/2 x 11 in. 264 pp. Illustrated. Shows complete line of plumbing fixtures for Schools, Railroads and Industrial Plants.

Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Catalog, 8 1/2 x 11 in. 80 pp. Illustrated.

Plumbing Suggestions for Industrial Plants. Catalog, 4 x 6 1/2 in. 24 pp. Illustrated.

Plumbing the Small Bathroom. Booklet, 5 x 8 in. Discusses planning bathrooms of small dimensions.

John A. Roeblings Mfg. Co., Trenton, N. J.


Another Douglas Achievement. Folder, 4 pp. 8 1/2 x 11 in. Illustrated. Data on new types of fixtures for each.

Brochure, 60 pp. 8 1/2 x 11 in. Illustrated. Deals with fixtures for hospitals.

Duriron Company, Dayton, Ohio.

Duriron Acid, Alkali and Rust-proof Drain Pipe and Fittings. Booklet, 8 1/2 x 11 in., 20 pp. Full details regarding a valuable form of piping.

Eljer Company, Ford City, Pa.

Complete Catalog, 334 x 664 in. 304 pp. Illustrated. Describes fully the complete Eljer line of standardized vitreous china plumbing fixtures, with diagrams, weights and measurements.

Imperial Brass Mfg. Co., 130 W. Harrison St., Chicago, Ill.

Warrous Patent Flush Valves, Doublet Water Closets, Liquid Seal Trap, Standard Mangles 8 1/2 x 11 in., 136 pp., loose-leaf catalog, showing roughing-in measurements, etc.

Maddox-Lindsay Company, Thomas, Trenton, N. J.

Catalog K. 1016 x 789 x 242 pp. Illustrated. Complete data on clay and porcelain plumbing fixtures with brief history of Sanitary Pottery.

Speckman Company, Wilmington, Del.

Catalog K. Booklet, 130 pp., 8 1/2 x 10 1/2 in. Illustrated. Data on showrooms and equipment details.

PUMPS

Chicago Pump Company, 2300 Wolfram St., Chicago, Ill.

Complete line of pumps covering handy data. Individual bulletins, 8 1/2 x 11 in., on bilge, sewage, condensation, circulating, fire fighting and sanitary flow lines.

Kennede Private Utilities Co., 442 Franklin St., Kewanee, Ill.


The Trane Co., LaCrosse, Wis.

Catalog "A", 175 pp. Illustrated. Complete data on all important types of pumps.

PUBLICATIONS—Continued from page 180

RAMPS

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

Building Garages for Profitable Operation. Booklet, 8 1/2 x 11 in. 16 pp. Illustrated. Discusses the need for modern mid-city parking garages, and describes the Hill Murray Motoramp system of design, on the basis of its superior space economy and features of operating convenience. Gives cost analyses of garages of different sizes, and calculates probable earnings.


REFRIGERATION

The Fulton Sylphon Company, Knoxville, Tenn.

Temperature Control of Refrigeration Systems. Booklet, 8 pp., 8 1/2 x 11 in. Illustrated. Data on the use of refrigeration equipment and supplies.

REFRIGERATORS

Lorrillard Refrigerator Company, Kingston, N. Y.

Lorrillard Refrigerator for hotels, restaurants, hospitals and clubs. Brochure, 43 pp. 8 x 11 in. Illustrated. Data on the use of refrigeration equipment and supplies.

REINFORCED CONCRETE—See also Construction, Concrete

Genfire Steel Company, Youngstown, Ohio.

Self-Setting Handbook. 8 1/2 x 11 in. 36 pp. Illustrated. Methods and specifications on reinforced concrete floors, walls and floors with a combined form and reinforced material.

Trucson Steel Company, Youngstown, Ohio.

Shearing Stresses in Reinforced Concrete Beams. Booklet, 8 1/2 x 11 in. 10 pp. Illustrated.

North Western Expanded Metal Company, Chicago, Ill.


Longspan 31/2-in Rib Lath. Folder 4 pp., 8 1/2 x 11 in. Illustrated. Data on the use of reinforced concrete lathes.

ROOFING


Specifications, Gensao Standard Triland Lake Asphalt Built-up Roofing. Booklet, 8 x 10 1/2 in. Gives specifications for use of several valuable roofing and waterproofing materials.

The Barnett Company, 40 Retford St., New York City.

Architects’ and Engineers’ Built-up Roofing Reference Series; Volume IV: Duct Drainage Systems. Brochure, 63 pp. 8 1/2 x 11 1/4 in. Gives complete data and specifications for many details of roofing.


Bird’s Roofs. Folder, 16 pp., 3 1/2 x 5 in. Illustrated. Data on roofing materials.

Philip Carey Co., Lockland, Cincinnati, Ohio.

Architects’ Specifications for Carey Built-up Roofing. Booklet, 8 x 10 1/2 in. 24 pp. Illustrated. Complete data to aid in specifying and estimating on different types of built-up roofing to suit the kind of roof construction to be covered.

Carey Built-up Roofing for Modern School Buildings. Booklet, 8 x 10 1/2 in. 36 pp. Illustrated. A study of school buildings of a number of different kinds and the roofing materials adapted for each.

Hein Roofing Tile Co., 1925 West Third Avenue, Denver.

Plymouth-Shingle Tile with Sprocket Hips. Leaflet, 8 1/2 x 11 in. Illustrated. Shows use of English shingle tile with special hips.

Italian Promenade Floor Tile. Folder, 2 pp., 8 1/2 x 11 in. Illustrated. Floor tiling adapted from that of Davanzati Palace, Mission Tile, Leaflet, 8 1/2 x 11 in. Illustrated. Tile such as are used in Italy and southern California and in Georgian Tile, Leaflet, 8 1/2 x 11 in. Illustrated. Tiled as used in old English and French farmhouses.


"Ancient" Tapered Mission Tiles. Leaflet, 8 1/2 x 11 in. 4 pp. Illustrated. For architects who desire something out of the ordinary, this leaflet has been prepared. Describes briefly the "Ancient" Tapered Mission Tiles, hand-made with full corners and designed to be applied with irregular exposures.

Structural Gypsum Corporation, Linden, N. J.

Relative Effectiveness of Various Types of Roofing Construction in Preventing Condensation of the Under Surface. Folder, 4 pp. 8 1/2 x 11 in. Important data on the subject.

Grystone Pre-cast Fireproof Roof. Booklet, 48 pp., 8 1/2 x 11 in. Illustrated. Information regarding a valuable type of roofing.

U. S. Gypsum Co., Chicago.

Pyrobar Roof Construction. Booklet. 8 x 11 in. 48 pp. Illustrated. Gives complete data and specifications for many details of roofing.

Pyrosoil Roof Construction. Folder, 8 x 11 in. 11 pp. Illustrated. Covers use of roof surfacing which is poured in place.

SANDB CHAIN

Smith & Egge Mfg. Co., The Bridgeport, Conn.

Chain Catalog. 6 x 9 1/2 in. 24 pp. Illustrated. Covers complete line of chains.

SEWAGE DISPOSAL

Kewanee Private Utilities, 442 Franklin St., Kewanee, Ill.

Specification Sheets. 7x4 in. 104 pp. 40 pp. Illustrated. Detailed drawings and specifications covering water supply and sewage disposal systems.
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THE BRUNSWICK-BALKE-COLLENDER COMPANY - CHICAGO
Selected List of Manufacturers’ Publications—Continued from page 182

Store Fronts—Continued

Davis Solid Architectural Bronze Sash. Set of five sheets, printed on tracing paper, giving full size details and suggestions for designing special bronze store front construction.

Kawneer Company, Niles, Mich.

Store Front Suggestions... Booklet, 36 pp., 6 x 9 in. Illustrated.

Kawneer Solid Bronze Store Fronts.


Details of Kawneer Copper Store Fronts.

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

Kawneer Construction in Bronze or Copper. Booklet, 54 pp., 8 1/2 x 11 in. Illustrated. Complete data on the subject.

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

Introducing Extruded Bronze Bulletin, 8 1/2 x 11 in. Folder, 4 pp., 8 1/2 x 11 in. Illustrated. Contains full sized details of store front construction.

Zour Drawn Metal Co., Chicago Heights, Ill.

Zour Safety Key-Set Store Front Construction. Catalog, 8 1/2 x 11 in. 60 pp. Illustrated. Complete information with details sheets and installation instructions convenient for architects’ files.


Terra Cotta


Color in Architecture. Revised Edition. Permanently bound volume 9 1/2 x 12 in., containing a treatise upon the basic principles of color in architectural decoration and illustrating early European and modern American examples. Excellent illustration.

Present Day Schools. 8 1/2 x 11 in. 32 pp. Illustrating 42 examples of school architecture with article upon school building design by James O. Betelle, A. I. A.

Better Banks. 8 1/2 x 11 in. 32 pp. Illustrating many banking buildings in terra cotta with an article on its use in bank design by Alfred C. Bossom, Architect.

Tile, Hollow


Standard Wall Construction Bulletin 174. 8 1/2 x 11 in. 70 pp. Illustrated. Complete information with detailed sheets and installation instructions convenient for architects’ files.

Kawneer Construction in Solid Bronze or Copper. Booklet, 64 pp., 8 1/2 x 11 in. Illustrated. Shows different types of Kawneer Solid Copper Store Fronts.

International Store Front Construction.

Catalog, 8 1/2 x 11 in. 26 pp. Illustrated. Contains full size details of store front construction.


Quarry Tiles for Floors. Booklet, 119 pp., 8 1/2 x 11 in. Illustrated. General catalog. Details of patterns and trim for floors.

Art Portfolio of Floor Designs, 9 1/2 x 12 in. Illustrated in colors. Patterns of quarry tiles for floors.

Valves

Cranes Co., 836 S. Michigan Ave., Chicago, Ill.

Cranes Co., 836 S. Michigan Ave., Chicago, Ill.

Catalog, 8 1/2 x 11 in. 88 pp. Illustrated.

Jenkins Bros., 80 White St., New York.

The Valve Behind a Good Heating System. Booklet 4 1/2 x 7 1/2 in. 16 pp. Color plates. Description of Jenkins Radiator Valves for steam and hot water, and brass valves used as boiler connections.

Jenkins Valves for Plumbing Service. Booklet 4 1/2 x 7 1/2 in. 16 pp. Illustrated. Description of Jenkins Brass Globe, Angle Check and Gate Valves commonly used in home plumbing, and Iron Body Valves used for larger plumbing installations.

Venetian Blinds


Venetian Blinds. Booklet, 7 in. 10 in. 34 pages. Illustrated. Describes the “Burlington” Venetian blinds, method of operation, advantages of installation to obtain perfect control of light in the room.
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Lockland, Cincinnati, Ohio

“A Roof for Every Building”
SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 184

WATERPROOFING—Continued

Sonneborn Sons, Inc., L., 116 Fifth Ave., New York, N. Y.
Pamphlet. 36 x 9 1/2 in. 8 pp. Explanation of waterproofing principles. Specifications for waterproofing walls, floors, swimming pools and treatment of concrete, stucco and mortar.

Toch Brothers, 110 East 41st St., New York City,
Specifications for Dampproofing, Waterproofing, Enameling and Technical Painting. Complete and authoritative directions for use of an important line of materials.

The Vortex Mfg. Co., 1978 West 37th St., Cleveland, Ohio.
Par-Lock Specification "Form D" for waterproofing surfaces to be finished with Portland cement or tile.

Par-Lock Specification "Forms E and G" membrane waterproofing of basements, tunnels, swimming pools, tanks to resist hydrostatic pressure.

Par-Lock Waterproofing. Specification Forms D, E, F and G, Sheets 8 1/2 x 11 ins. Data on combinations of gun-applied asphalt and cotton or felt membrane, built up to suit requirements.


WEATHER STRIPS

Athey Company, 603 West 60th St., Chicago.
The Only Weatherstrip with a Cloth to Metal Contact. Booklet, 16 pp., 8 1/2 x 11 ins. Official Bulletin of Approved Products. Investigating Committees of Architects and Engineers.

WATERPROOFING

The Kawneer Company, Niles, Mich.
Kawneer Solid Nickel Silver Windows. In casement and weight-hung types and in drop-down transom type. Portfolio. 12 pp., 8 1/2 x 11 ins. Illustrated, and with demonstrator.

Lupton Pivoted Sash, Catalog 12-A. Booklet, 48 pp., 8 1/2 x 11 in. Illustrates and describes windows suitable for manufacturing buildings.

WINDOWS

The Kawneer Company, Niles, Mich.

Lupton Pivoted Sash, Catalog 12-A. Booklet, 48 pp., 8 1/2 x 11 in. Illustrates and describes windows suitable for manufacturing buildings.

WINDOWS—CASEMENT

Crittall Casement Window Co., 10911 Hear Ave., Detroit, Mich.
Catalog No. 22, 9 x 12 in. 76 pp. Illustrated. Photographs of actual work accompanied by scale details for casements and composite steel windows for banks, office buildings, hospitals and residences.
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ALBERENE STONE

SELECTED LIST OF MANUFACTURERS' PUBLICATIONS—Continued from page 186

WINDOWS, STEEL AND BRONZE—Continued


Truscon Steel Co., Youngstown, Ohio.

DRAFTING ROOM STANDARDS. Book, 8½ x 11 in., 120 pages of mechanical drawings showing drafting room standards, specifications and construction details of Truscon Steel Windows, Steel Lintels, Steel Doors and Mechanical Operators.


WOOD—See also Millwork


American Walnut. Booklet. 7 x 9 in. 45 pp. Illustrated. A very useful and interesting little book on the use of Walnut in Fine Furniture with illustrations of pieces by the most notable furniture makers from the time of the Renaissance down to the present.

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

Curtis Companies Service Bureau, Clinton, Iowa.


An attractive advertisement for Douglas fir.

West Coast Lumber Trade Extension Bureau, Seattle, Wash.

"Durably Douglas Fir; America's Permanent Lumber Supply." Booklet, 32 pp., 7 x 11 ins. Illustrated. Complete data on this valuable wood.


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INTERIOR woodwork during the Colonial and early Federal periods was exactly what is demanded for "Colonial" interiors today. The character of workmanship in the colonies insured craftsmanship of excellent quality, and this, together with design carefully studied from the simpler contemporary English work, resulted in woodwork which it would be difficult to improve upon. For this reason close study is being made of such old American interiors as still exist, and measured drawings make possible the reproduction today of much of the finest woodwork of the seventeenth or eighteenth century. These forms, while they involve not a little subtlety in the details of design, demand merely the use of simple mechanical processes which are not beyond the skill of any reasonably proficient woodworker, sometimes of an ordinary carpenter. Stenciling of floors, together with notes on the colors originally used. It is a volume which in its practical usefulness will be of great value to architects whose work involves much use of early American interior design.

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THE Dunham Differential Vacuum Heating System is controlled by laws as definite as the cosmic forces which govern the earth in its journey around the sun, or which cause to function in harmony the millions of stars comprising the "spacious firmament on high."

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The Flamingo Hotel, 5510 South Lake Shore Drive, Chicago, is an interesting example of the great rigidity and strength of reinforced concrete construction.

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The Flamingo was started September 17, 1926—the concrete structure was completed January 16, 1927.

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Engineer: Bert M. Thorud
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Rail Steel Bar Association
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The photographs shown here were taken during the installation of Havemeyer Bars in the Mail Order Building of Sears, Roebuck & Co., Boston. George C. Nimmons, Architect; Hegeman & Harris Co., Contractors.

HAVEMEYER REINFORCING BARS are proving their advantages on this large SEARS, ROEBUCK job

Splendid construction speed is being maintained by Hegeman & Harris Co., Contractors, on the new building for Sears, Roebuck & Co., in Boston and Cambridge, Massachusetts.

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Two separate reinforced concrete buildings designed by George C. Nimmons, Architect, are using 4661 tons of Havemeyer Bars. The large mail order building in Boston required 4200 tons. The rest were used for the retail store in Cambridge.

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Those responsible for the accuracy of specifications in an architect's office well know the value of having reliable directions for use of a building material ready at hand when specifications for that particular material must be prepared. This useful folder, which is of a form and size for placing directly in an architect's data files, covers use of this widely known type of Bird roofing, of two weights ("Standard" and "Extra Heavy") and for use whether applied over sheathing or over concrete or tile. The sheets deal with the correct preparation of the foundation surface, with the important details of flashings about chimneys or walls, and with the application of the different substances which go to the building up of the roofs.


Wiring necessary for various uses of electricity in buildings demands the furnishing of adequate strength, and a little more for safe margin, but instances are many in which strength of structures far in advance of anything which could possibly be required has tended to discourage building by adding unnecessarily to its cost. This brochure is a helpful study of varying degrees of strength required in mortar used in masonry. It considers also the cost of materials and the cost of labor, since the amount of masonry upon which the ability of the mortar used is based makes plain the fact that lime mortar continually increases in strength. It greatly changes in nature and in dimensions, and to such a standard changes in lime that it is absolutely necessary to electricians and electrical contractors, but it also possesses a high value to architects and their specification writers, as well as others interested in wiring.


Supplying structural strength in building materials, important as it is, can, and frequently is, overdone. Good building demands the furnishing of adequate strength, and a little more for safe margin, but instances are many in which strength of structures far in advance of anything which could possibly be required has tended to discourage building by adding unnecessarily to its cost. This brochure is a helpful study of varying degrees of strength required in mortar used in masonry. It considers also the cost of materials and the cost of labor, since the amount of masonry upon which the ability of the mortar used is based makes plain the fact that lime mortar continually increases in strength. It greatly changes in nature and in dimensions, and to such a standard changes in lime that it is absolutely necessary to electricians and electrical contractors, but it also possesses a high value to architects and their specification writers, as well as others interested in wiring.

PORTLAND CEMENT ASSOCIATION. "Concrete Masonry Construction." Important data on the subject.

Recent years have witnessed a phenomenal increase in the use of concrete block, building tile, and concrete brick. The rapidly growing popularity of these concrete building units has not been confined to any particular type or class of construction, but extends throughout the field of residential, commercial and public structures,—wherever the advantages of permanent and fireproof buildings are understood and applied. Many types meet the requirements of different building purposes and construction is due in a large measure to its general adaptability for construction purposes. It is employed regularly for the construction of exteriors, load-bearing walls, curtain walls and partitions. Individual units meeting standard specifications are capable of carrying from 10 to 30 times the loads ordinarily imposed upon them in building construction, thereby providing wall strength substantially in excess of usual requirements. This booklet gives much useful information on the value of concrete masonry construction, and it discusses important details regarding actual building, details which are made plain by diagrams. It also gives the specifications recommended for use of these materials by the Portland Cement Association.

NATIONAL BUILDING UNITS CORPORATION, Philadelphia. "Sound Absorption of Cinder Concrete Units."

The works on acoustics as well as the articles or essays on the subject which are published by the architectural and construction publications deal to a great extent with the surfaces of interior walls; less is said regarding the materials of which walls are constructed, though logically this would seem to have a decided bearing on the matter. This valuable study of the subject deals with the sound-absorbing characteristics of cinder concrete building units and particularly with the outcome of tests made at the University of Toronto to ascertain the coefficient of sound absorption for cinder blocks, plain or else covered with plaster of different types. The tests were made in building of several kinds and intended for many widely different uses.

BONDED FLOORS COMPANY, INC., New York. "Gold Seal Treadlite Floor." Excellence had by their use.

Improvement in no variety of building material has been more marked during the past few years than in flooring. The demand of architects and interior decorators for flooring materials which would possess character, dignity and a high value to architects and their specification writers, as well as others interested in wiring.

RODDIS LUMBER AND VENEER COMPANY, Marshfield, Wis. "Roddis Doors."

The manufacture of doors for buildings of different kinds has been developed into a business of large proportions. The time has passed when it was supposed that a fine door must necessarily be made of one thickness of wood; scientific methods have evolved a method of using various thicknesses of carefully selected wood, soft or hard, treated by certain processes, and then so treated with glue under pressure and surfaced with veneers that they are not only far superior to the old fashioned door but are calculated to withstand the wear to which doors in many places are subjected. This brochure describes the highly interesting business of manufacturing Roddis doors,—gathering the raw material from many different sources, and constructing and building them under conditions that before a finished door is ready for use. The brochure illustrates and describes many different types of doors.

CONCRETE SURFACE CORPORATION, 342 Madison Avenue, New York. "Bonding Surfaces on Concrete."

Architects and builders accustomed to working with concrete know the difficulty (and importance) of securing a strong and dependable bonding between a concrete structure and the stone, marble, brick, stucco, or other material which is used as a "facing." The top surface or form-fin of a poured slab is likely to be so rich in cement that it is perpetually thirsty for water, and being thus active it constantly changes into lime, and its contents surrounding the sand grains, creating a binder which is even more permanent than the units it holds in place, a highly important factor in masonry.
You need not light a cigarette or trail a truck to know that fire burns up and coal rolls down. You need not hunt for tables of statistics to know that the one big item in the up-keep of a house or building is the annual cost of heat.

Yet you probably never realized to what extent these two, simple, natural laws can be put to work to help you save your clients money, and increase his good will, unless you know the Spencer.

**Flat grates and sloping gables**

Before the advent of the Spencer, it was necessary to confine specifications to flat grate heaters, automatically compelling your client to buy the most expensive fuels and feed them to the heater the hardest way. Flat grate heaters require fuel in large sizes, and must be surface fed. Spencer Heaters are built especially to burn the smaller sizes of coal and coke, with the Gable-Grate that is sloped to make the fire burn up-hill. The water-jacketed Magazine holds a 24-hour fuel supply that feeds by gravitation to the Gable-Grate as fast or as slow as the fire requires.

Save home owners the tiresome trouble of firing a "boiler" many times a day. Save big building owners the cost of a night fireman. Save everybody who owns a building, as much as half his annual bill for heat. Spencer Heaters are designed, tested and proved for burning No.1 Buckwheat anthracite at half the cost of larger sizes, and for burning by-product pea coke or any non-coking, graded fuel, at proportionate savings, and they have been doing just that for more than thirty years.

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Spencer Heaters are patented. They are guaranteed. Their capacities are guaranteed. You need not allow for over-rating. Spencers have paid for themselves, and are now making net annual savings for home and building owners everywhere. Specify them in any building, from skyscraper to bungalow, to save your clients money on the biggest up-keep item in their annual budget. Write for illustrations, specifications and guaranteed capacities of the new Spencer Heaters. Spencer Heater Company, Williamsport, Pa.
Widespread pollution of bathing beaches has without doubt had much to do with popularizing the outdoor or inground swimming pool. Unless the same objection was urged against the bathing beach were to be brought against the swimming pool, however, it was necessary of course that there be found some means of purifying and keeping purified the water with which it is filled. Invention and sanitary science have brought this about, and it is not now only quite possible but also comparatively simple to so treat the contents of a pool that it is as pure as the water which science and skill unite in supplying to drinking fountains.

This booklet, for example, issued by a firm widely known for its excellence, deals with systems for cleansing water. The booklet arrives in data important to architects as well as owners of public or private bathing pools.

Building a practical storage vault calls for the taking of certain well-defined precautions. Not only must its wall, roof and floor be built of materials having sufficient fire-resisting qualities to withstand action of a severe fire, but the same walls, roof and floor must possess such heat insulating qualities as will prevent destruction of the contents by high temperatures transmitted to the vault's interior.

Again, the foundations, or if not the foundations then the structural steel supports on which it rests, must be so protected that they will uphold the vault and protect it against injury from the impact of falling building members and other failures that may occur in the building as well. One more necessary detail is the use of properly protected doors, an excellent line of which is illustrated and described in this brochure, the booklet also giving data on vault construction. An entire page is devoted to listing banks and other buildings where Diebold Fireproof Vault Doors are in use. The booklet contains highly important data.

Building a practical storage vault calls for the taking of certain well-defined precautions. Not only must its wall, roof and floor be built of materials having sufficient fire-resisting qualities to withstand action of a severe fire, but the same walls, roof and floor must possess such heat insulating qualities as will prevent destruction of the contents by high temperatures transmitted to the vault's interior. Then again, the foundations, or if not the foundations then the structural steel supports on which it rests, must be so protected that they will uphold the vault and protect it against injury from the impact of falling building members and other failures that may occur in the building as well. One more necessary detail is the use of properly protected doors, an excellent line of which is illustrated and described in this brochure, the booklet also giving data on vault construction. An entire page is devoted to listing banks and other buildings where Diebold Fireproof Vault Doors are in use. The booklet contains highly important data.

EXPERIENCED HOUSEKEEPERS have been known to say that no single modern invention—not even the electrically operated iron—has brought quite the satisfaction to the householder that has followed the use of the dishwasher. This brochure, one of the many issued by the Kohler Company, deals with its "Electric Sink," which quickly performs what used to be drudgery three times each day. The Electric Sink comes in many patterns and numerous sizes. Set in a built-in counter, it is a metal cylinder with a thousand perforations. Through these thousand openings these jets beat upon the tines of every fork. This 'spray tower'—circulating over 300 gallons of water a minute—is unique. It is a Kohler invention. No other method is so instantly and so effectively. Because of it, in the Electric Sink the dishes are not submerged, even partially, in dishwater. No "high-water" mark can be left—no greasy deposit. There is not stirring or centrifugal action of the water which might slight the dishes in the center of the compartment. The Electric Sink washes all of the dishes, and it washes them beautifully clean. The booklet should be in the equipment files of the office of every architect and most engineers.

SOLVAY PROCESS COMPANY, Syracuse, N. Y. "Solvay Calcium Chloride in Concrete Construction."

Architects, engineers and builders whose work involves use of concrete know the value of a material which hastens the hardening of concrete without affecting adversely its final set and strength. This brochure dwells upon the advantages which follow the use for this purpose of calcium chloride. It also gives the results of many tests of the material made in connection with Portland cement by the U. S. Bureau of Standards, the American Society for Testing Materials, U. S. Engineers, and Lewis Institute. Solvay Calcium Chloride is a dry, white, flaky chemical, extremely hygroscopic, and it dissolves in water almost instantly. It not only gives early strength and hardness to concrete but at the same time densifies it, makes it more thoroughly waterproof, and aids in making the concrete resist freezing at winter temperatures. The booklet quotes a paragraph from a bulletin issued by the Portland Cement Association:

"The only chemical recommended as an addition to the mixing water is Calcium Chloride. This material possesses the property of lowering the freezing point of water and accelerating the setting of the concrete. It is used by being dissolved in the mixing water, in which it is readily soluble."
LIGNOPHOL is a penetrating preservative for wood floors

ARCHITECTS and Engineers will be interested in this letter, shown here. It proves Lignophol is no mere surface dressing. This penetrating preservative gets into the interior wood cells and fibres, filling them with natural life-giving gums and oils.

Lignophol protects new and old wood floors against splintering, cracking, warping and rotting.

Linseed oil, shellac, varnish and so-called preservatives cannot do this. They quickly evaporate or wear away and must be renewed ever so often.

You can assure your clients that Lignophol for a period of years will keep their floors looking new and strong. They will appreciate its economy when they know that it saves considerable money that would otherwise be expended in frequent renewals and repairs.

Lignophol Wax Finish—for floors in residences, apartments and for dance floors. Produces a medium or high polish. Already contains wax and need only be polished six hours after applied.

Lignophol is manufactured in four standard colors: Natural, Light Brown, Medium Brown and Dark Brown. Easily and quickly applied with long-handled or flat, wide brush at minimum labor cost. One application lasts for years.

Be sure to specify Lignophol—a Sonneborn Product.

L. SONNEBORN SONS, Inc.
114 Fifth Avenue, New York
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