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ARCHITECTURAL ENGINEERING & BUSINESS
PART TWO
APRIL 1929
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"THE FERRO-CONCRETE STYLE"
A REVIEW BY
CLIFFORD WAYNE SPENCER

If the new style of architecture which is undoubtedly now in the process of development is to have a permanent place in the annals of architectural history, it is evident that it will have to be known by some less transitory and more descriptive name than any of those now in general use. In centuries to come it will doubtless seem highly incongruous to speak of a style of architecture developed in the first half of the twentieth century as the "moderndistic" or "contemporary" style. In choosing a definite and permanent name for this type there is much to be said in favor of calling it "the ferro-concrete style," since it is largely by the use of this combination of materials that the new effects are made possible. All the great traditional styles of architecture have had their inception immediately following the discovery of new materials or of new methods in the use of materials which were old. By the use of iron and steel in connection with concrete the chief structural limitation of the traditional styles has been overcome,—that of not being able to build extensively in the third dimension. Due to the nature of materials available, it was necessary to build vertically,—one stone or one brick above another, so that all the emphasis was necessarily placed on the vertical treatment. Now, however, by the use of reinforced concrete it is possible to extend unsupported members horizontally for much greater distances, and since all good design must conform to construction possibilities, an entirely new field in architectural design is thus opened up. The ability of modern engineering science to ascertain accurately the supporting power of structural members affords unlimited opportunities to the present-day designer.

The slowness of architects, especially in this country, to take advantage of these opportunities is probably due to a rather general, erroneous belief that concrete is not adaptable to aesthetic treatment in design. The book entitled "The Ferro-Concrete Style," by Francis S. Onderdonk, should do much in correcting this mistaken opinion, since merely to glance at the illustrations is enough to impress one with the fact that so far as form is concerned, use of reinforced concrete has no limits. This fact is brought out by illustrations of such remarkable examples as a garden statuette showing a gracefully poised figure, with wings, rendered in concrete and steel, and another illustration showing a pavilion suspended in mid-air with no means of support other than the stairway leading up to it. The author points out that it is generally true that those living at the times of great achievements remained ignorant of their advent, and that the general public, as well as the majority of architects, do not now realize that we are witnessing the birth of a new architecture, and that the false opinion in the minds of many as to the design possibilities of concrete is due to the habit of considering the limitations of concrete design as identical with those of wood form construction. As a matter of fact, using wood centering is only one of many ways of shaping concrete, and many of the others are much more suitable from a design point of view. One of the valuable features of the work is that while the design possibilities are given greatest importance, the text matter gives much technical and practical information as to the up-to-date methods of handling this adaptable material.

The author of the work was born in New York, but he spent 20 years of his life in Europe, where he received his architectural training and devoted much time to investigating the possibilities of ferro-concrete architecture. He is now a member of the faculty of the College of Architecture of the University of Michigan, so it may be said that his viewpoint is international, which adds greatly to the interest and value of the work. France, the country in which Gothic architecture had its greatest development, seems to have taken the lead in using the new style of design, and the examples of ferro-concrete work found there and in Germany, as well as in some of the other continental states, are generally much more advanced than those found in America, although a great deal has been done in the Pacific coast region. True, a great deal of the so-called modern work is trashy and has been done by those who have not sufficient background to do good work in any material, and yet there are plenty of good examples to point the way to a rational development and to show the possibilities latent in the style. Many of the illustrations in this volume are chosen with a view to showing that which is bad as well as what is worthwhile, and the text explanation as to why certain things constitute poor design will give a good basis for developing an appreciation of the good in this new architectural style.

Perhaps the two most characteristic features of the ferro-concrete style as yet developed, and features that are destined to play a most important part in its future development, are the use of concrete tracery and the parabolic arch. Concrete tracery has been used considerably both on our own Pacific coast and in Europe, and it offers a great many new possibilities in the decorative treatment of wall surfaces. The tracery is formed of reinforced concrete in an unlimited variety of pattern, and the apertures are often filled with glass, thus taking the place of windows and achieving very beautiful effects both in the daytime and at night when they are lighted from within. This concrete tracery is being used in residence work as well as in more monumental buildings such as the Bahai Temple at Wilmette, Ill., which is to
"School Building Programs in American Cities"  
By N. L. ENGELHARDT  
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are, as examples of mural decoration, among the finest, if not the finest, in the world today. They are certainly the best of the period, that golden age of art, of which the divine Raphael was the guide and shining light. As the same artists were employed on both the Vatican Loggia and the Villa Madama, and as the work at the Villa was executed after the completion of the decorations in the Vatican, the artists had, of course, profited from their experience and perhaps from kindly criticism. We in this later age may be over-critical, but many of the criticisms that can be leveled against the Vatican decorations cannot be made against those in the Villa Madama.”

Libraries of Italy and the continent which have been delved into to enrich this volume have apparently yielded some remarkable facts. In his historical notes, the author in referring to them says: “We may well surmise that, were it not for a number of original drawings and plans that have, from time to time, been identified as bearing upon its genesis and construction, the Villa Madama would have had little interest apart from its marvelous interior decoration. These drawings, few though they be, and altogether inadequate for a complete understanding of the splendid project of Cardinal Giulio de Medici, are nevertheless of untold value. For they are intimate documents bearing upon the planning and decoration of what, had it been completed, would have been the most sumptuous villa of the Italian Renaissance.” It would appear that the Villa Madama may be considered not only as an almost perfect example of the Italian villa of the Renaissance, but also as the most important example of the mural paintings of that period, particularly as representing the work of Raphael and his assistants. And Mr. Greenwood has gone into these matters carefully. He notes that, “when Bramante died and Raphael was made architect of St. Peter’s, two worthy assistants were given him,—men whose knowledge and talent had already been appreciated by Bramante. These two were Giuliano San Gallo and Fra Giocondo. As a matter of fact, Raphael had several talented architects around him besides these, not the least being Antonio and Aristotile San Gallo. It was in 1516 that Antonio San Gallo joined him. As this was the date when, so far as we can ascertain, the Villa Madama was first projected, and a large plan of the Villa designed by Antonio has been identified at the Uffizi, we need have no hesitation in affirming that, while Raphael may have inspired the first designs for the Villa and watched the work closely, it is to Antonio San Gallo that we must give the honor as its architect. From other plans existing in the Uffizi we know that we must also add the names of Battista and of Antonio, the younger. From 1516 to 1521 the work proceeded, and though only a part of the project as originally planned by San Gallo was actually completed, the plan seems to have been followed so closely that, as Causse says, ‘the architect who was the author must have also superintended the execution.’” And Mr. Greenwood is not without his prophetic vein. He is particularly pertinent, in this reviewer’s estimation, where he calls attention to the inconsistency in our great architecture of today in the lack of application of correspondingly great mural treatment therein. It is difficult to wholly agree with the author where he says “we need a greater demand for mural decoration to give
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stimulus to artists and to arouse their latent powers.” The present-day disuse of murals in our buildings has its cause rooted in something deeper. What we do need today is perhaps, first of all, architects with a feeling for fine and significant wall decoration. The result of their foresight and cooperation would doubtless be a healthy stimulus to the work of our contemporary painters. There is no lack of painters, but there is undoubtedly a lack of understanding, of cooperation between these men and successful architects of our period. If there are to be great murals painted to adorn the fine free spaces of our public buildings today, it is undeniably from the hands of the architects that opportunities for this work will be given,—not primarily from the hands of building committees. This in spite of the fact that there have probably been notable examples where it was the painter’s initiative which created his own opportunities,—witness Raphael of Italy of the sixteenth century and Diego Rivera of Mexico today.

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The Architectural Forum
O rapid has been the development of civic and commercial aeronautics that it has already reached the point where its further growth is largely dependent upon the provision of adequate ground facilities in the form of landing fields, airports, and the many types of accommodations that must be provided for the care of airplanes, pilots, passengers, and cargo. It is only within the last year or so that American cities have awakened to the fact that they must provide airports immediately if they are to benefit by the stimulation which aviation can give to commerce, industry and transportation.

In a bulletin issued in the fall of 1928,—less than six months ago,—the United States Department of Commerce listed fewer than 400 airports either completed or actually under development, exclusive of those used for military and naval forces. During an address presented before airport interests at the aviation show in New York in February, Colonel Harry H. Blee, Chief of the Airways and Airports Section of the Department of Commerce, said that there were approximately 1,000 airports then actually in use or under construction, and that about 1,000 others were being studied by chambers of commerce, municipalities and other interests with a view to selecting sites, arranging finances and otherwise preparing for active work. He qualified the statement by saying that even these figures were not reliable because they were changing daily. Estimates of the amount of money being expended in this new field are likewise vague for this same reason. Figures covering the last year and a half showed the enormous amount of $300,000,000 already spent or pledged for airport development, and a forecast was made that at least $500,000,000 would be spent in the next year and a half for such work. If these figures are out of date today, they are merely conservative, and undoubtedly a few years hence will be insignificant compared to the amount of money being expended annually for ground facilities to serve air transportation systems and the use of private aeroplanes for recreation and commuting.

Here is a vast new field of activity that involves very important problems in architecture, engineering and city planning. What have architects done to take their logical place in this new work? A recent bulletin published by the Department of Commerce lists 28 organizations or individuals rated as airport designers and constructors. Of these 28 not over four or five are architects or engineers serving in a purely professional capacity on design problems. The others are former aviators who have entered this new field or construction organizations that have seized the opportunity to capture desirable contracts of this character, and in a few instances companies that have been formed to advise professionally on airport designs, calling themselves "airport engineers." No implication is intended in this statement that the 23 or 24 organizations, exclusive of established architects and engineers, are not qualified for the work they are engaged upon; it is merely significant that so few well trained and well established architects and engineers or city planners have yet achieved recognition in this field.

Architects, engineers and city planners can and must solve America's airport problems. They are already trained for this work. They alone have the background needed to handle such operations in a constructive and farsighted manner, and they lack only an appreciation of some basic aeronautical requirements. Even these requirements are rapidly becoming public property through the dissemination of information by the Airways and Airports Section of the Department of Commerce, the National Aeronautical Association, the National Advisory Committee for
Aeronautics, and other organizations of like character.

There is a close parallel between the present-day development of airports and the early expansion of railway transportation systems and terminals in this country. The passenger stations and terminals that were built a half-century ago were badly designed structures, not adapted to serve the enormous expansion in railroad traffic that subsequently followed. They were designed poorly (from the present-day point of view) largely because there was little precedent for planning such structures and because few people could visualize the requirements that were subsequently imposed upon them. Within recent years hundreds of millions of dollars have been spent to revamp, reconstruct and often re-locate not only important terminals but literally thousands of minor railway stations to adapt them to modern needs.

The modern airport, like the railway station, will become a gateway to the city which it serves. It must possess dignity and quality in keeping with its important civic character. There is already a very noticeable tendency for some airport developers to create structures of more or less temporary character which will rapidly become obsolete and inadequate to meet the requirements of air traffic. In fact many of America's existing airports are comparable to a railroad terminal consisting of a round house, track yards and a freight shed which also houses the ticket office and waiting room. Out of the hundreds of millions of dollars to be expended for airport development in the immediate future, a very substantial proportion will be wasted through obsolescence if the problem is not immediately attacked in a broad way and if an effort is not made to visualize future requirements and to provide for them in the initial layout and construction of airport facilities. This has already occurred at Croydon, England, where structures which cost some $600,000 have been scrapped and replaced by modern buildings costing over a million dollars. Even the famous Tempelhof airport at Berlin, undoubtedly the finest airport in the world today, has been undergoing constant evolution for the past several years to meet the rapidly expanding air traffic of which it is the center. Comparatively few American airports have yet been carefully planned to provide for expansion at the rate already experienced by the leading European airports. Most of them have started with merely landing fields, and their structures have grown haphazardly. There is not even general consensus of opinion as to the proper method of developing American airports, and in some cases municipalities have leased parts of the landing areas they control to air transportation systems which have erected their own structures without any regard to the others or to the general utility of the field.

Such conditions are regrettable but perhaps inevitable at this stage. It is a fact that the development of commercial aeronautics has been so rapid that the ground problems which have been created have multiplied far more rapidly than they have been solved. It is essential that airport design be considered with the intelligence and foresight that has been applied to aerodynamics and the design of flying machines. Architects, engineers and city planners, trained to solve planning problems of this magnitude, must turn their attention to airports, not only for the sake of commercial and civic aeronautics but because here is a new field of business which they should logically develop.

Undoubtedly the very recent announcement of the Lehigh Airports Competition among architects and engineers for the design of a modern airport is the most significant move that has been made to bring architects, engineers, and city planners into public notice as the logical persons to guide the future development of America's airports. This competition is sponsored by the Lehigh Portland Cement Company of Allentown,
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The Waiting Room in the Croydon Airport, Showing Time Indicators and Weather Map

Entrance to Airport Administrative Buildings, Croydon, England. Control Tower on Left

Pa., which has posted $10,000 in prize money to be awarded those supplying the 14 best designs which are submitted. The competition has been planned with the utmost care and under the guidance of some 25 recognized authorities in the four fields of architecture, engineering, city planning, and aeronautics. The preliminary work which had to be accomplished in order to formulate a sound competition program is in itself of considerable interest to architects, because it was necessary to touch upon every phase of airport layout and facilities and to attempt to visualize the hitherto undeveloped possibilities for the arrangement of airport units, in order to give the competitors free rein to work out new and ingenious solutions of the problem without being hampered by the often unsatisfactory precedents which the world's existing airports now constitute. Some of these matters will be touched upon later. The competition is exceedingly timely and should prove of the utmost value to the architectural and engineering professions and to city planners, as well as to the entire aeronautics industry.

A number of people prominent in public life, including William P. Mac Cracken, Jr., Assistant Secretary of Commerce for Aeronautics; F. Trubee Davison, Assistant Secretary of War; Senator Hiram Bingham; former Postmaster General, Harry S. New; Dr. Samuel S. Stratton, President of the Massachusetts Institute of Technology; and others, have indicated their interest in this competition because of its potential value in stimulating airport development. In commenting on the work of the committee, Mr. Mac Cracken said:

"Build the bird house and the birds will come is an old saying, but it is more true of human beings than it is of our feathered friends.

"The character and attractiveness of America's airports have a direct relation to the people's interest in the growth of air traffic, public and private. The degree to which any community can participate therein is directly in proportion to the provision which that community makes for getting airplanes in and out of the air. In other words, it means bigger and better airports and more of them. Any municipality which overlooks today's great opportunity for providing for air traffic of not only the future but of the present, will be found in the same position as those which refused to accept the railroad in pioneer days.

"The airport architecture which is being developed by the Lehigh Airports Competition will be of particular help to American municipalities in solving their airport problems. It should, therefore, command the good will of all forward-looking people."

The company in sponsoring this competition has entirely removed any possibility of there being a commercial aspect by giving the program committee and the competition management carte blanche authority to establish the requirements of the competition in whatever manner will be of the greatest value to the competitors and to municipalities, air transport companies, flying clubs, chambers of commerce, and others interested in the creation of future airports. It is a farsighted gesture for the benefit of many interests, from which the sponsors expect no return other than added good will and prestige. Roland D. Doane, representing the company, has merely asked that the competition drawings indicate the structures as though built of Portland cement products where feasible, admitting reinforced concrete construction, concrete blocks, or stucco over other sound and permanent structural materials.

When this competition was first proposed it immediately became apparent that the program could be prepared only after a great deal of study of the character and the facilities demanded in
a complete, well appointed airport. It was then decided to obtain the advice and counsel of leading architects, engineers, city planners, and aeronautics experts through the medium of a program committee to which would be entrusted the preparation of the competition program and subsequent oversight of the entire contest. Harvey Wiley Corbett, is general chairman of the program committee, and Francis Keally is the professional adviser. The architectural section of the committee includes Mr. Corbett as chairman, Raymond M. Hood, Professor William A. Boring, Dean of the School of Architecture, Columbia University; Parker Morse Hooper, Editor of The Architectural Forum, and Mr. Keally. Engineering matters bearing upon airport design were considered by an engineering section headed by Morris Knowles, of Pittsburgh. Other members of this section are Francis Lee Stuart, one of America's outstanding engineers specializing in port, terminal, and transportation work; Harold M. Lewis, Executive Engineer of the Regional Plan of New York and its environs; Gavin Hadden, and Colonel Willard Chevalier, Publishing Director of Engineering News-Record.

Airport planning is so definitely a part of city and regional planning in the relationship of airports to other transportation methods and to the communities they serve, that it was quite essential to have guidance on these problems. At the same time it was recognized that municipal, state, and county authorities are keenly interested in airport design and location. In consequence, a third section of the program committee was organized, headed by George B. Ford, city planner, as chairman. The membership of this group includes E. P. Goodrich, city planning consultant to the Chinese government, who is now in China planning airports as a means of expanding aërial transportation systems in that country in lieu of the slower and more expensive extension of the national railway system; Fred C. McLaughlin, Mayor of White Plains, N. Y., and President of the New York State Conference of Mayors and of the Westchester County Federation of Planning Boards; Samuel P. Wetherill, Jr., President of the Regional Planning Federation of the Philadelphia Tri-State District; and Harold Buttenheim, Editor of American City.

Necessarily, the most vital matter in the formulation of a competition program as well as in the actual designing of any airport is the need for solving practical aeronautical problems. The aeronautics section, headed by Dr. George W. Lewis, Director of the National Advisory Committee for Aeronautics, as chairman, was thus organized to secure the counsel of men representing every leading aeronautical organization as well as the practical management of commercial and municipal air terminals. The membership of this committee includes Porter Adams, Chairman of the Executive Committee, National Aeronautic Association; Major John Berry, Manager of Cleveland Municipal Airport; Colonel Harry H. Blee, Chief, Airways and Airports Section, Department of Commerce; L. K. Bell, Secretary of Aeronautical Chamber of Commerce; Colonel Paul Henderson, Vice-president, Transcontinental Air Transport, Inc.; Charles S. (Casey) Jones, President Curtiss Flying Service; Ernest Jones, Aeronautics Expert, Department of Commerce; and Harry Schwarzschild, Editor of Airports. The problems considered by these four sections of the competition program committee are the problems which face any architect, engineer, or city planner undertaking the design of a well equipped air terminal, and a brief discussion of the more vital matters may prove of interest.

**Site Requirements for Airports**

There is a universal feeling that airplanes will be so developed in the future that they can land
Hangars at the Ford Airport, Dearborn, Mich.

and take off in less space than is now required. Undoubtedly, this is true, and the progress already made, including the development of the autogiro abroad, will probably make it possible in the future to utilize less landing area than is now necessary. On the other hand, it must be remembered that there will be an equivalent expansion in the use of planes, not only for commercial transportation, but by private owners for recreation and commuting, and as this growth takes place, more planes will arrive and take off simultaneously, requiring correspondingly larger areas for maneuvering. Furthermore, it has already been demonstrated that the establishment of an airport stimulates realty values in the locality and leads to development of vacant land nearby with industrial plants associated with the aeronautical industry, with homes, and with all of the structures which naturally congregate around any center of transportation, such as hotels, stores, and amusement places. Thus, when the boundary of an airport site is once established, it is exceedingly difficult to expand the site by acquisition of adjacent vacant land, because in a few years increased values make such land out of reach for airport use, or what vacant land there was when the airport was established becomes developed with more or less costly structures which cannot be removed. Consequently, it is important to take as much land as possible when an airport is first established and to maintain control of the entire area in order to provide for future needs as well as to give an adequate, effective landing area for present-day airplanes.

It is not necessary to discuss in detail the permissible minimum sizes for flying fields. The United States Department of Commerce, through its Airways and Airports Section, publishes bulletins which are available to architects, engineers, and others interested, in which these dimensional requirements are discussed and a rating system is established. Colonel Harry H. Blee, chief of this section of the department and a member of the Lehigh Airports Competition Program Committee, in considering this matter felt it advisable to recommend an effective landing area of 3,500 feet in all directions, but at the same time he said that this is in excess of the space required for the highest airport rating. In other words, while 2,500 feet in each direction or even shorter runways, will suffice for minor airports and emergency landing fields, it is good judgment to take the largest area available up to approximately a square mile.

The gross area consists of three major space units, the first of which is the landing and take-off area which is wholly free from obstructions of any kind, and it is this part of the field which should be as large as circumstances will permit. Modern airplanes have a safe gliding angle of 7 to 1 and can gain altitude in approximately the same ratio. Hence, the effective landing area must be protected by the second space unit, which may be termed a marginal strip. The marginal strips must have a width which is seven times the height of any building or other elevated obstacle bordering on the landing field. It is perfectly feasible to utilize these marginal strips in various ways, providing the structures erected upon them do not project above a line having a 7 to 1 starting at the edge of the effective landing area. Such space may be used for parking automobiles and for mooring planes which do not require hangar protection, as well as for playgrounds, outdoor restaurants, parks, and various other types of concessions and amusements. In fact, the marginal area may be developed to produce an important revenue to the airport, for all of the European airports experience a steady flow of visitors who come to watch the flying activities. Over weekends from 10,000 to 12,000 persons regularly visit the Tempelhof field in Berlin to patronize the beer garden, the promenades, and the amusements while they watch transport
planes arrive and depart. The third section of the site is that part reserved for the important airport structures which will be mentioned later and which must be separated from the effective landing area by the same type of marginal strip which protects the other borders of the field. This vacant space, however, between the airport buildings and the landing field, is usually reserved for the maneuvering of planes, and is not available for public use.

The ideal airport must permit airplanes to land and take off into the wind at all times. Theoretically, the field should provide runways or lanes in all directions, even though the prevailing wind in any given locality may be predominantly from one quarter. Experienced flyers find no difficulty in landing into a quartering wind, but it is exceedingly difficult to land a plane crosswise with the wind. It is practicable, therefore, to have runways or landing strips in eight directions, equivalent to the four cardinal and four quarter points of the compass.

The problem of developing the field surface for landing and take off is one of the most difficult and expensive matters that is encountered in creating an all-purpose airport. Perfect drainage is essential at all times, and particularly for spring conditions, when the ground is thawing. When funds permit, it is of course vastly better to have the entire landing area surfaced or paved uniformly, but today the expense of such preparation is quite prohibitive. For some years to come, therefore, it will be necessary to provide landing strips or runways especially prepared for the landing and take off of planes, but these must be absolutely flush with the adjacent unpaved areas and as level as possible. The arrangement of these runways should be such as to allow the maximum number of planes to depart and arrive simultaneously without danger of interference or collision. It is also important that the runways as well as the entire field be surfaced with a material which will make artificial lighting for night flying effective at minimum cost.

Airport Structures

The modern airport must be conceived as a transportation terminal and must be equipped to handle passengers, mail, express, and even freight. It must also provide for private planes which do not operate on schedule, and for sightseeing planes which use the port as a base of operations. The required structures to serve these functions may be divided into three basic groups, exclusive of the accessory buildings which are desirable but not essential to the airport proper. These three groups include the terminal facilities, caring for passengers and cargo; hangars for the care of planes; and service units for housing maintenance equipment, supplies, and possibly also the personnel of the field.

At Miami there is probably the most completely
appointed terminal building yet erected in the United States. It was designed by Delano & Aldrich, architects. It contains a passenger concourse or waiting room with the usual ticket offices, check room, public toilet facilities, newsstands, and other concessions associated with the ordinary railroad passenger station. The main floor is so arranged as to control passengers arriving by plane from Cuba, for inspection by immigration, customs, and health authorities. This feature suggests that every airport in the United States may ultimately become a possible port of entry, for flights have already been made from Mexico to northern points in the United States, and from Canada to southern and western points. This building also provides offices for the air transport officials, and on the second floor, overlooking the flying field, there is a large dining room adjacent to an open air terrace which is a wonderful vantage point from which to observe the arrival and departure and the maneuvering of airplanes.

This building, more completely than any other, suggests the character of the ideal terminal structure for an airport. An important feature of such a building, unless provided for in a separate unit, is a control room, commanding an unobstructed view over the entire airport from which an operations executive can exercise complete control over all activities on the field. This control room is usually elevated above surrounding buildings, generally in the form of a low tower above the roof line of the highest structure, and it adjoins a radio and communications room equipped to maintain contact with other airports in all directions and by radio with planes in the air. These units constitute the nerve center of the airport and are vital to its operation because it is necessary to prevent planes from landing, especially at night or in fog, when others are about to depart, and to notify planes en route of other machines flying in their general directions to minimize the possibility of collision in mid-air and to aid them in keeping to their courses. Undoubtedly also the modern air terminal must provide post office facilities and a sub-station, although at present the Post Office Department does not consider these elements essential because the present custom is to remove air mail by motor trucks direct from the planes to existing post offices.

Another requirement of the well designed terminal building is provision for the safety and protection of passengers using private or transport aeroplanes. There should be some type of covered runway leading from the waiting room to the loading point for planes which is so devised as to prevent the passengers from getting in the way of whirling propeller blades. At a separate point there should be similar provision for protecting arriving passengers from inclement weather and for keeping them under control until
they have passed the immigration and customs authorities if the plane happens to have come from a foreign port. Separation of these two loading and unloading points is desirable. It is also essential to have the entire flying field protected by a suitable wall or fence which will keep unauthorized persons and often stray animals from the field and permit the control of even those using private planes in their entrance and egress from the flying area.

The second group of structures, the hangars, needs little discussion, because the functions of hangars are well understood. They require unobstructed floor space, good lighting, and should be fireproof, weatherproof and easily heated. In some European airports hangars are made two stories in height, using a ramp to reach the upper floor, and it is possible that the reverse will be true of some future airports having part of the storage space below ground. The most difficult problem in hangar design is to provide the vast doorways necessary for the admission of large planes. After much study the Lehigh Airports Competition Program Committee suggested some openings 125 feet wide by 20 feet in clear height, and others for smaller planes 90 feet and 100 feet in width and 18 feet and 19 feet respectively in clear height. These requirements may change as transport planes become larger, but for the present they will house the typical units now contemplated or in use.

The third group of buildings includes fire and ambulance stations with quarters for emergency crews and garages and storage buildings for trucks, tractors, snowplows, rollers, grass cutters and other equipment needed for the care and maintenance of the fields. A gasoline and oil filling station is an important requirement to this group. Frequently the tanks are buried underground and supply lines are run to pumps near the hangars or to underground receptacles located in concrete aprons on the fields themselves. These sub-surface filling points are covered by manholes which can be lifted and the fill pipes withdrawn so that when the covers are replaced planes can run over the surfaces without difficulty. There must also be provision for housing the field personnel, but this may be provided for outside of the airports proper or in parts of hotels which are mentioned under the heading of “accessory structures.”

The arrangement and grouping of these various units constitute a problem that has not yet been solved with a certainty that the ultimate plan has been discovered. In some airports the hangars are separate units, and in others they are grouped together as elements of a large structure. In some places they are adjacent to the passenger terminals, and elsewhere they may be separate from these units for considerable distances. It is essential to provide a well paved and practically dustproof apron connecting the hangars and the loading
point at the passenger terminal for maneuvering planes either under their own power or by means of tractors and for warming up motors where the wind stream from the propellers will not throw up a cloud of dust. If the flying field is of adequate size and the buildings can be separated from the field by a sufficient marginal strip as already noted, their precise relationship to the flying area seems to be of secondary importance, and their location is largely governed by the highways and other means of communication between the port and the city which it serves. If the field is of limited area and the runways are of minimum length, it should be considered essential that no buildings be located opposite the end of any runway, and particularly that they should not be in the direction of the prevailing winds.

**Accessory Structures**

Under this head fall a number of possible units which have already found their place in well established European airports but which may not be absolutely essential to port operation. First of these is a hotel. At Croydon, England, a 200-room hotel has been erected near the airport buildings and has proved successful. It has been found that many visitors to the field use its extensive restaurant facilities, which overlook the flying area, and that passengers frequently use it as headquarters from which they make visits to the surrounding country during interruptions to their air travel. Such a building may also provide accommodations for pilots and the ground personnel of the field as well as provide apartments for the important officials and executives of the field and the air lines which converge there.

Under this heading also fall all types of concessions and amusements as well as parking spaces for visitors' automobiles, outdoor restaurants, motor bus and rapid transit stations, stores and shops. Undoubtedly commercial activities of these various sorts will contribute to the support and maintenance of airports, and their control by the airport owners is economically desirable.

**Other Requirements in Airport Design**

Night lighting is one of the first essentials for the well equipped airport. The subject needs little discussion here, however, because the problem does not influence the architectural development of an airport to any great extent, and because the subject is quite fully covered in publications issued by the Department of Commerce and other authorities. Adequate lighting involves border lights to indicate the margins of the field; air beacons; an illuminated wind direction indicator; danger lights on all surrounding obstructions; and flood lights to illuminate the field for landing and take off. Every airport must be identified by huge signs visible from the air and preferably illuminated at night. These may be on the roofs of units or other buildings on the field itself or

![Building of the Oberweisenfield Airport, Berlin](image-url)
even on adjacent buildings in the vicinity, with arrows pointing to the airport itself. Here again the Department of Commerce has established recommendations and requirements which are easily followed. The wind direction indicator referred to, sometimes called the "wind-tee," is something like a mammoth weather vane with its flat surface horizontal so as to be visible from the air and to constantly point the direction of the prevailing wind.

One of the major problems in airport design involves locating the field with relation to adjacent highways and transportation facilities. The amount of traffic ultimately to be expected at airports suggests the desirability of having a broad plaza, such as may be found adjacent to the better planned railway terminals, which will care for the traffic converging at the passenger terminal and give this structure a proper and dignified setting.

Editor's Note. We are indebted to Mr. Harry Schwarzschild, Editor of Airports, for giving us permission to publish here many photographs from his personal files.
CHOOSING THE STRUCTURAL SYSTEM AND MATERIAL

BY

THEODORE CRANE

ASSOCIATE PROFESSOR OF BUILDING CONSTRUCTION, YALE UNIVERSITY

PART I—BUILDING FRAMES

In looking over the vast quantity of printed matter dealing with the subject of building materials, one can hardly fail to be impressed by the amount of study and research which has been expended in this field. If an architect is considering the use of a particular type of construction, there are usually technologic papers, textbook references or society reports bearing upon its value. Very little attention, however, has been given to that aspect of the subject which might be called “comparative construction,” that is, the relative value of materials and systems.

To make the matter clear, let us consider a very simple illustration,—the choice of a floor system. Every textbook on reinforced concrete describes the so-called “beam and slab” and “girderless” designs. An architect’s office is flooded with manufacturers’ literature illustrating any number of proprietary methods of construction. The architect’s problem, however, is not the detailed study of a particular system, but the selection of the most suitable type for the conditions existing. With this in mind, these articles have been written to point out the individual characteristics of various materials and systems, as affecting their use, and to suggest methods of arriving at a satisfactory choice in structural work.

The first question of this nature, and a question which can usually be very easily answered, is regarding choice between bearing walls and skeleton construction.

In most cases the problem is purely economic, and the thickness of bearing walls, where such are employed, is governed by the requirements for stability rather than by the strength of the materials in compression. Under the New York building code, which represents in this particular those of our larger cities, brick masonry laid in Portland cement mortar is allowed to take a working load of 250 pounds per square inch, Portland cement concrete 500 pounds, and sandstone masonry 400 pounds. These stresses are seldom critical in bearing walls. The limit of economy is determined rather by the wall thicknesses required for various heights and unsupported areas. For instance, a building of the residence class, under 75 feet in height, would require, under the New York code, 16-inch walls for the uppermost 25 feet, 20-inch walls for the next lower 35 feet, and 24-inch walls below.

Compared to these requirements, a 12-inch panel wall, supported at each floor level by a structural steel or reinforced concrete spandrel, is usually more economical, all things considered, for fire-resistant construction over three or four stories in height, and for garages or industrial buildings of even lesser height. The use of structural steel frames for one-story buildings is often desirable to meet the requirements of certain industries, and although still in an experimental stage, the application of steel sections to the construction of dwellings has interesting possibilities for classes of work where economy is a chief consideration. These uses of steel are, however, the exception, and its particular function is in the frames of comparatively tall buildings.

For this type of work the practice of a few years ago of employing columns built up of plates and angles has largely given place to the use of solid rolled sections, normally two stories in height and designed to carry the load of the lower story. A comparatively recent development is the use of column sections, five to six stories in height, for the support of reinforced concrete floors. Finding that two-story lengths were impracticable and desiring to use a heavy H-section through the lower stories in order to save floor space, these long columns fitted with angles at each floor level have been successfully used for buildings of 10 to 20 stories, to support stone-concrete floors of girderless design. This type of column construction, as built in New York, usually calls for a reinforced concrete section through the upper stories of the building, which is carried down until the size becomes objectionable. For
example, let us consider that the upper eight floors and roof of a 14-story building are supported by reinforced concrete columns. Under the New York code these would probably be of hooped section in the two upper stories and of spiraled design below. Even the latter, however, would require a gross diameter of about 2 feet, 6 inches, when carrying large bays subjected to light manufacturing loads. If this were considered to be a limiting size, the fifth story columns would then be designed with rolled steel cores of H-form, the sections being based on the loads which the fifth story columns are required to support and plates added to take the increments due to the floors below. The gross column size, 2 feet, 6 inches, would then be the same in all of the remaining lower stories.

Such a combination of structural steel and reinforced concrete makes it possible to utilize the advantages of each material, now that the mechanical difficulty of field erection has been solved by obtaining long sections from 60 to 75 feet in length. With this one important exception, however, the structural steel frame, or the reinforced concrete frame offers two distinct alternatives in the field of skeleton construction. For buildings of certain classes the choice is obvious; factories and warehouses with heavy floor loads ranging from 125 to 300 pounds per square foot and of comparatively low height can generally be built more cheaply with reinforced concrete than of structural steel. Office buildings, hotels and apartments, 15 stories or more in height, can usually be built more cheaply with steel frames. But we must not place too much confidence in such broad generalizations. The tallest concrete building in the United States is the recently completed Master Printers' Building in New York, which has 20 stories. In this case the use of concrete showed a very substantial saving over steel. Let us investigate the conditions. A live load of 250 pounds per square foot was required on all floors; the plan of the building was adaptable to a girderless floor system, which is extremely economical for heavy industrial loads. As the conditions of occupancy demanded that headroom be computed to the bottoms of girders in a beam and slab design, their elimination permitted several additional stories in the same total height of building. Furthermore, the lighting was better with girderless construction, and the cost of sprinkler installation was about 25 per cent less.

The same solution has been worked out economically in the case of several other structures erected in New York during the last year. For example, there are the Appraisers' Stores Building, 11 stories high, with 250-pound live load; a service station for the Packard Motor Company, eight stories high, with 150-pound live load; and the building at 653-659 Eleventh Avenue, 14 stories high, with 200-pound live load. These were all concrete-framed buildings employing structural steel cores in the lower stories of the interior columns and with girderless floor systems of spans varying from 20 feet x 20 feet to 31 feet, 6 inches x 33 feet. If we are to assume, as would seem reasonable, that these operations represent an actual trend in design, it is probably safe to say that reinforced concrete frames, particularly where a girderless floor system can be used, are well adapted to comparatively heavy loads for buildings even up to 20 stories in height.
Structural steel is particularly suited to light loads and tall buildings. Although we have approximately 650 reinforced concrete structures in this country that are ten or more stories in height, the vast bulk of such work is of steel. Under the New York code a structural steel frame with cinder-concrete “arches” is a very economical type of construction for normal designs based on office loading of 60 pounds per square foot throughout typical floors. For buildings of over 20 stories in height, steel has practically no competitor in any part of the country. Below that height, offices, hotels and apartment houses in New York are built almost exclusively of steel with cinder-concrete floor arches. In many western cities, on the other hand, even where material prices are no more favorable to use of concrete, the latter has been widely and successfully used for work of this class. Trade conditions and the tendency to follow the established custom of one’s own locality, would often appear to play a larger part than the matter of comparative costs.

Second only to the matter of live load, the architectural plan of a building plays an important part in the choice of construction. One of the great structural advantages of reinforced concrete, as ordinarily used, is its monolithic character, permitting assumptions of continuity in design. When the architectural arrangement lends itself to a series of continuous bays of approximately the same size, the use of a reinforced concrete frame may be an economical solution for even light loads and, as previously mentioned examples indicate, will almost always be suitable for heavy loads. The matter of continuity will not, ordinarily, make any difference in the depth of beams or girders, in beam-and-slab construction, but it will save anywhere up to 35 per cent of the reinforcement that they require. Reinforced concrete is particularly suitable for buildings that permit a column spacing that results in square or nearly square bays. As a large proportion of the cost of concrete work is expended on the construction of forms, this material is most economically used for buildings whose structural members can be standardized. The importance of this principle can be judged by the fact that on typical work one set of forms serves in turn for the structural members of each floor, often being used as many as ten times. Neither is it usually desirable to reduce the sizes of beams supporting a roof construction, as the surplus concrete is more than offset by the saving in not changing the forms.

The ideal spans, in both reinforced concrete and structural steel, vary between 18 and 24 feet, depending upon the live load and the type of floor construction employed. In most buildings outside of the industrial and commercial classes, the columns have to follow the room arrangement, and it is seldom possible to use the most economical spacing. As far as practicable, the designer should start with the primary element of a floor system, such as the slab, and lay out his typical floors to use each member to best advantage. We have an excellent example of this principle applied in most New York buildings now under construction. The city code permits cinder-concrete slab or “arches,” as they are called, to be used on spans up to 8 feet. A minimum thickness of 4 inches is specified for floors. The designer’s problem is then to locate the floor beams, which support the slabs, as closely as possible to the 8-foot limit. As it works out very well to frame the beams into the girders
at the third points of the girder spans, we have a column spacing which approaches 24 feet if we wish to fully develop the strength of our 4-inch slab which the building code requires.

This same principle can be applied to other matters in the design of structural frames. A 3\(\frac{3}{4}\)-inch thickness of stone-concrete, which is the minimum allowed for roof construction under the present New York code, when fully continuous will carry a 43-pound superimposed load between beams placed on 10-foot centers. The limit of the 4-inch stone-concrete slab, when supporting a 100-pound live load, is 8 feet, 6 inches when fully continuous and 7 feet, 9 inches for end spans. The weight of reinforcement per square foot of floor area naturally increases as the column spacing is increased. For example, a girderless floor system designed under the two-way requirements of the New York code, to support a superimposed load of 125 pounds per square foot, would require 1.85 pounds of steel per square foot of floor area with bays 16 feet square; 2.35 pounds for bays 20 feet square, and 3.10 pounds for bays 24 feet square. These figures are based on full continuity. Considering the cost of footings and columns, the most economical bay would probably be about 18 feet square. Considering the loss of floor space occupied by the columns, the present practice is to space them about 20 feet on centers, probably a little over rather than less.

For long spans of 40 feet or more, reinforced concrete can be used in either arch or truss construction. Such designs have been cleverly executed both in this country and abroad, but if economy is the governing factor, steel should be used in most problems of this nature encountered in building construction. There is even a tendency to use concrete girders on shorter spans where structural steel would be more economical.

Consider, for example, that it is required to span a distance of 34 feet between masonry walls. If we assume a uniformly distributed load of 100,000 pounds and a floor system capable of giving lateral support, a structural steel girder 24 inches deep and weighing 120 pounds to the linear foot will meet the requirements of the American Institute of Steel Construction. If headroom is not important, we could probably obtain a 28-inch
section, weighing 112 pounds per linear foot, which would also serve the purpose. In reinforced concrete, a T-beam section, economically designed, would have a total depth of about 36 inches, a width of 14 inches, and approximately 1,650 pounds of steel if computed at working stresses of 650 and 18,000 pounds per square inch for the concrete and steel, respectively. Even these large proportions would have to be greatly increased unless the floor system chosen by the designer provided an adequate thickness of concrete to act as a compression flange. It is also true that the weight of large concrete beams and girders may easily be 20 or 25 per cent greater than that of steel, including fireproofing.

These facts would favor the use of a structural steel frame, or bearing walls with structural steel interior framing, for buildings requiring wide spans. Balconies, such as are found in many auditoriums, may also influence the designer in his choice of structural frame, as such can usually be more expeditiously and economically built in steel than in reinforced concrete.

The question, however, is too often decided by making merely a relative estimate of the costs of labor and materials, both based upon the same design. A valid comparison cannot be obtained in this way. As far as the architectural requirements permit, comparative estimates should be based on designs which employ the type of material under investigation to its fullest advantage. Reinforced concrete is particularly suited to some forms of architectural expression, and even if it is not possible to actually "express" the feeling of concrete in the form or ornamental features of a building, it is entirely practicable to reserve its use for types of construction which are easily built of this material. The same should be true of structural steel; many architectural offices use steel sections more as a matter of habit than as the result of analytical comparison. Not a few designers look upon concrete as suitable for industrial work, but hardly to be considered for other types of buildings except in floors and footings and as a fireproofing material. On the other hand, there are sections of the country where concrete frames are very widely used for buildings of moderate height even with comparatively light loads. A study of relative costs, as influenced by local conditions, does not seem to justify this difference in practice. From these data, and many similar considerations, we can be fairly confident that both the structural and architectural character of a building should play an important part in determining the type of skeleton to be used.

The design of the reinforced concrete members forming the structural frame of a building is very largely influenced by the code or standard accepted by the designer, and it is not the province of this journal to treat of matters pertaining to the details of structural engineering. The architect is seldom interested in determining the number of stirrups in a concrete beam any more than he is concerned with rivet spacing on structural connections. It is important, however, to know that concrete beams of T-section require about 1 inch in depth for every foot of span; if the beam is of rectangular section, there being no concrete floor serving as a flange, 1 3/4 inches would be a fair estimate. These figures are based on economical design for normal conditions and could be reduced by increasing the reinforcement if the additional cost were warranted. The width of the web of a concrete T-beam should be between one-half and one-third of its total depth, including the slab. Rectangular beams are usually about one-half as wide as they are deep.

Columns composed of concrete reinforced with only vertical rods are allowed under most codes, to sustain concentric loads computed as 500 pounds or 600 pounds per square inch on the "effective concrete section," the value depending upon the quality of the mixture. The effective concrete section should be taken as the net area,
exclusive of the steel, allowing 2 inches outside of the reinforcement for purely fireproofing purposes. Some codes, such as that at present in force in New York, allow the effective area to be taken as the gross column section, deducting only the space occupied by the reinforcement, which seldom exceeds 1 per cent of the area. The total supporting capacity of the column is then computed, in either case, by adding to that of the concrete the carrying value of the reinforcement, which is considered to support 7,500 pounds or 7,200 pounds per square inch when used respectively with 500-pound and 600-pound concrete.

Although the design of columns with only vertical reinforcement is pretty well standardized, there is no uniformity in regard to spiraled columns. Unfortunately there is some slight justification for computing their sustaining value on several entirely different principles. These have been picked up by the authors of our various building codes and combined with a variety of limiting percentages applied to both the amount of spiral and of vertical reinforcement. Although the present situation is an amusing commentary on our knowledge of this branch of structural engineering, or rather a reflection upon our ability to apply what little we do know, the matter is too technical to be of interest to the average architect. Suffice it to say, that under the New York code a spiraled column, economically designed with 1 per cent of vertical steel and 2 per cent of spiral, can be considered to support 1,466 pounds on each square inch of the core enclosed by the spiral. In other more benighted sections of our country this same column would be permitted to carry only 971 pounds on each square inch of the core. These absurd differences, although more pronounced in the field of concrete design, exist in the ordinances governing use of other materials. There seems to be no particular reason why structural grade steel of exactly the same quality should be considered to carry a working stress of 16,000 pounds per square inch in one city and 18,000 pounds in a neighboring city. The proper remedy for these inconsistencies lies in an honest attempt to make municipal codes conform with good practice. The specifications and suggested regulations promulgated by the American Concrete Institute, The American Institute of Steel Construction, and the building committees of the Department of Commerce, contain much valuable information which could be applied to advantage.

Footings. The study of comparative construction as applied to footings offers an interesting field for the architect who desires to control the major decisions in connection with the structural work, without going into the details of engineering. For all buildings of skeleton construction, whether of steel or reinforced concrete, the problem of footing design is merely to choose the most
Reinforced Concrete Frame of Building Shown on Opposite Page
Hentsz, Reid & Adler, Architects

Economical means of distributing the concentrated loads of the columns over an area sufficiently large to bring the load per square foot within the safe bearing capacity of the soil. Foundations upon rock involve one aspect of this same problem, and the use of wood, concrete or steel cylinder piles is only to increase the soil capacity. Independent footings, rectangular and preferably square in plan, of stepped or pyramidal pattern, are normally used to support the interior columns of a building and are also economical for exterior columns of skeleton structures, if there is space outside of the building line to permit concentric design. The chief problem is to choose economical footings for exterior columns when there is little or no space available beyond the building line. With the exception of a type known as the "buttress footing," and not widely accepted, the choice falls on either a continuous, a cantilever or a combined footing.

A continuous footing, which is nothing other than an inverted beam loaded with a soil reaction of usually from 6,000 to 8,000 pounds, and supported by the columns, will probably be the most economical if the area available without eccentricity is sufficient to carry the column load. For example, if we are permitted a projection of 1 foot beyond the faces of the columns, which we will assume as the building line, and if the basement columns are 2 feet thick, we can make the footing beam 4 feet wide and still have its axis directly below the column centers. If the column spacing is 20 feet, we then have 80 square feet of available bearing area for each column. If the safe soil load is 6,000 pounds, this type of footing is capable of supporting a column carrying 480,000 pounds with some small deduction for the weight of the footing beam.

The next choice, usually resorted to where no projection is permitted beyond the faces of the columns, and referred to as the "cantilever" footing, is merely the application of a device for overcoming the tendency of the exterior columns to fall outwards owing to the fact that their footings cannot be centered beneath them owing to the proximity of the property line. The design, in this case, is similar to that of an interior, concentric footing but a concrete or steel beam, called a "strap," is built connecting each exterior footing with the nearest interior footing. The strap balances the eccentric moment and holds the exterior footing in equilibrium.

The third choice for the footings of exterior columns adjacent to property lines is called the "combined" footing. Instead of employing a strap, as in the cantilever design, a heavy, continuous slab forms the footing for an exterior column and the nearest interior column. As the name implies, this is merely a joining, or combining of the two footings and is resorted to when
Typical Design of Reinforced Concrete Footing for Isolated Columns of either Structural Steel or Concrete; the Stepped Type is Preferable

it is necessary to overcome eccentricity in an exterior column and use the entire area between columns for bearing purposes. When possible, combined footings are built rectangular in plan and extend toward the interior of the building a sufficient distance to insure that the center of reaction of the footing area coincides with the center of load between columns. If such extension is not practicable, owing to the interference of an elevator well, or some similar obstruction, the portion of the footing supporting the interior column, which is usually carrying a heavier load than the exterior, is widened with the result that the footing slab is trapezoidal in plan.

Footings on piles follow these same classifications and are designed in exactly the same way except that the individual pile reactions replace the uniform load assumed as the safe bearing capacity of the soil. Footings resting on rock are designed for loads varying from 15 to 40 tons per square foot, depending upon its hardness. Under our tall steel structures the typical billet and grillage design has become the general practice for foundations carried to hard rock. Where it is necessary to obviate vibration, such as that due to the movement of trains, specially designed vibration mats, composed of layers of lead and sheet asbestos, are employed at the bases of columns supporting buildings over railway tracks.

The next step in planning the structural design of a building is the choice of the floor construction. This subject will be covered in a succeeding article in The Architectural Forum for May.

The illustrations of footings are from "Concrete Building Construction," by Theodore Crane.
WINTER CONSTRUCTION AND SUPERINTENDENCE

BY

LEICESTER K. DAVIS

THE trials of keeping winter construction going smoothly and on unbroken schedules are over. The vigilance required to meet the attacks of cold and ice and snow has settled down to being a far less difficult matter. It is a good time in which to make a check-up of results secured during that short but difficult period, and for architects and builders to consider the effectiveness of their combined efforts in keeping winter activities going at high levels of efficiency and economy.

The records of superintendence will doubtless settle many questions, show the wisdom of using precautionary specification clauses, and justify closely coupled contacts that follow each step and stage of construction most likely to be adversely affected by winter’s influence. The purpose of all architectural superintendence is constructive, not destructive,—the obviating of faults which if not discerned in their early stages result in piling up those disconcerting “extras” always associated with elaborate correction or replacement of work not up to required standards.

The difference between supervision and superintendence is not, perhaps, as fully appreciated as it should be. The former term deals mainly with using precautionary specification clauses, and justifying closely coupled contacts that follow each step and stage of construction most likely to be adversely affected by winter’s influence. The purpose of all architectural superintendence is constructive, not destructive,—the obviating of faults which if not discerned in their early stages result in piling up those disconcerting “extras” always associated with elaborate correction or replacement of work not up to required standards.

The difference between supervision and superintendence is not, perhaps, as fully appreciated as it should be. The former term deals mainly with results and passes judgment according to standards established for completed work; the latter follows more closely each unit of work throughout its progress, giving attention to immediate materials and methods, as well as taking into account those supplementary elements not strictly within the province of the specifications. Supervision stresses final responsibility; superintendence performs a more cooperative service, which begins at the beginning and keeps on to final completion. All architects may not agree upon this grouping of relations, but many do, and it is from the point of view of those who do that distinction is here made in describing the more important specific methods with which architectural superintendents should be thoroughly familiar in order to render the cooperation which contractors welcome and by which owners benefit.

Reading through many notes made during interviews with representative architects, I have been impressed by unanimity of their opinions in regard to winter superintendence. All seem to be agreed on:

1st: The need of many and frequent architectural contacts with winter work at every stage.

2nd: The value of familiarity with the precautionary methods developed by various trades.

3rd: The necessity of forecasting procedure in regard to conditions under which each phase of construction shall go on.

4th: The good to all concerned of thorough understanding between the architect, contractor and owner as to the powers and responsibilities of the architect or his representative in advising or requiring specific forms of structural practice.

5th: The benefits which result from carefully worked out methods by which accurate progress reports of superintendence may be kept for incorporation within a permanent record for current and future reference.

Most architects with whom I have talked emphatically recommend employment of a “clerk of the works” for all construction of any size that extends through the winter months, this individual to be selected by the architect and to be under his direction with services paid for by the owner, and to have duties, powers and remuneration covered by contractual clauses. Maintaining superintendence of this character is a regular procedure in many offices. In others the office personnel includes a “field man” who is assigned, at an extra charge, to work during all or certain winter stages.

Perhaps the first preliminary consideration of the architect in his approach to problems of winter construction should be the preparation of an outline which indicates how his contacts shall be governed. A comprehensive plan, worked out well in advance of the cold weather period, is sure to be of assistance in preventing otherwise puzzling twists and turns. Such an outline need not be elaborate. It should be built about only those definite phases of the work most likely to be seriously affected by lack of proper precautionary methods. It should cover uncertain points with clear indication of possible contingencies and directions regarding the manner in which they should be provided for.

In this schedule of defence, one might well start from a list of materials and uses having definitely known requirements for protection, classifying with each the possible circumstances to be faced. In an analysis of this kind, proper protective ways and means almost automatically suggest themselves for situations that might not be thought of until a crisis in construction had arrived. At this preliminary stage the value of cooperation by an experienced winter constructor will often be extremely valuable, since what are sought are not merely descriptions of “textbook happenings,” but rather those out-of-the-ordinary run of things which happen once in a blue moon,
and which sooner or later may happen again.

One architect with whom I have discussed the subject has made a series of "pre-structural conferences," as he calls them, with winter-seasoned contractors a routine matter, even before specifications are ready for bids. This practice he considers especially important where the construction schedule is to include a part or all of the winter months. By frankly explaining his purpose to prospective bidders, he has gained information regarding precautionary methods which has not only aided subsequent superintendence but has also clarified sections of his specifications covering winter performance. In an outline such as that here referred to, several divisions are quickly established. The first of these will very likely deal with those elements of the structure upon which superintendence should be most thoroughly concentrated. Next, logically, follows the storage of material prior to its use; next, the methods to be employed during and following such use; finally, there will be the general standards of winter practice and the specific forms of protection best suited to the locality and the type of structure. Included in this last should be provisions for "potentials,"—those things which probably will not occur, but which may.

Structural safety is, of course, one of the prime factors with which superintendence should deal at any time of year. There must be assurance of soundness in the bones and sinews upon which a building depends for ability to carry its load. And these, in practically all modern construction are steel, concrete and brick. Erecting steelwork in winter requires few departures from the routine of other seasons, except perhaps extra provisions for workers subjected to hazards and discomforts of weather, wind and bitter temperature.

Construction of concrete and masonry, on the other hand, calls for more carefully worked over methods. The aggregate that slushes to December wall and floor and column forms, and the courses of brick that rise steadily despite numbing January days, are propositions very different from like work carried on in fair and warmer months of the calendar. Winter concrete is a finicky jade, and she exacts very definite forms of attention at equally definite stages of preparation, application and setting. In order to make sure of final structural dependability in concrete, superintendence by the architect or his representative is of the utmost importance from the start to the finish of operations. Freezing temperature is concrete's greatest enemy,—one that is present from the minute the dumped sand and gravel start on their way to the mixer. Therefore the architect's plan of superintendence should include a check-up on provisions made for heating, while actual superintendence should see that the means provided are adequately employed.
Supports Ready for Tarpaulins. The Frames Must be Sturdy to Withstand High Winds. There Should be Projection to Insure Space for Ample Circulation of Warmed Air About the Exteriors of Forms

The warming of sand and gravel before they reach the mixer must be thorough and constant,—on small work, by the heat from wood-fired pipes traversing the mass, and on larger work, having considerable tonnage, by spreading the mass over and around grilles or coils of perforated steam pipes, so placed that distribution of warmth is evenly made throughout the material. The mixing water should be kept at tested temperature by a steam nozzle run into the water barrel at the mixer.

These are but preliminaries. It is after the mix reaches the forms that the closest watch must be kept against laxity in maintaining protection of the concrete as it attains the final set. Protective methods for concrete have become pretty well standardized. It is the duty of the architectural superintendent to see that they are employed at the right time and in the right way. Before winter concrete work is begun, the architect and his contractor should be satisfied that apparatus adequate in type and capacity is ready to operate as soon as forms are built. The number and sizes of tarpaulins required should be carefully figured. The methods by which they are to be hung and lashed should be determined. Salamanders in number sufficient to maintain correct temperature under the most trying conditions produced by a record cold snap should be provided. Heat holes in floor and ceiling forms should be properly prepared and spaced for control of covered areas above slabs. The distributive outlets from main steam lines should be placed at the most strategic points.

No matter how well protective equipment is selected, its proper use is imperative. The handling of tarpaulins should be carefully supervised. Their placing should be such that definite areas are included, with perhaps a number of sections throughout the structure treated as localized units, each having its own form of heating apparatus, this obviating risks that always attend the attempt to spread a volume of warmth over a large area in parts of which temperature is certain at times to be lowered perilously close to the danger line. Extra precautions should be exercised wherever structural safety is particularly essential.

Winter superintendence should insist upon a record of day and night temperatures, and with these should be included readings taken frequently at the bases of exterior columns and under the canvas above floor slabs, in order to prove beyond all doubt that protection is being kept at a constant level.

Contractors specializing in winter concrete have worked out well defined rules by which are determined the efficiencies of various types of apparatus used for temperature control. As examples of these, in one locality the protective efficiency of top covers on reinforced concrete
Concrete Faults Due to Improper Winter Precautions. The Criss-cross Cracks Shown Extend Clear Through the Body of the Slabs

beam and girder construction in ordinary winter weather has been figured at 48 hours as standard for time before coverage should be removed, 96 hours being the minimum for side curtains. Flat slab construction, with more protection required, calls for extension of the protective period. The efficiency of salamanders has also been calculated, it having been determined, for example, that in northern sections temperatures of from 60 to 80° may be maintained by one salamander to every 300 square feet of floor. Heat holes, which permit transmission of warmed air from areas below slabs to the upper surfaces of the slabs, are figured in a similar manner. Each of these auxiliary units should permit circulation of warmed air over approximately 300 square feet of properly "topped" area during average winter weather. Should temporary radiation by steam be utilized in place of or in addition to salamanders, it also can be handled according to rule.

Whatever methods are decided on, their application to the work in hand should be understood by the architect when planning and forecasting the duties involved by winter supervision. If unusual conditions are encountered, the plan should be flexible enough to deal with them. The thing of main importance, so far as architectural responsibility is concerned, is to be sure that the most effective forms of protection are provided and conscientiously employed. Conditions will naturally occur in which necessity of the moment may demand radical departure from original intent, and in such cases, the supervising architect must act quickly and with decision fortified by judgment. Many architects, if in doubt as to justification of a change in method, feel that the responsibility should be placed squarely upon the contractor, final acceptance being based upon tests for structural dependability.

On a recent large industrial project, a decided innovation in the protection of winter-poured concrete floors came to my attention. It may or may not suggest use under similar conditions. In this particular locality it was standard winter practice to cover concrete floors with layers of marsh hay until the set had passed all risk of freezing. In repeated cases the architectural supervisor detailed to the work found that the feet of laborers who spread the hay caused marks and depressions which actually impaired the structural quality of the finished slabs. In addition to this, tufts of hay and other debris became imbedded in the mix as it set, necessitating a "burn off" with fired gasolene before sleepers for the final floor could be placed. The supervisor had used a rather daring remedy by deliberately leaving the wet surface exposed until a skin of ice formed, strong enough to bear a laborer’s weight without footprinting. Marsh hay was then applied in the usual way, thawing out the ice sheath before there had been penetration of cold sufficient to injure the body of the floor. Seemingly the only effect from this treatment was a slight flaking away on the surface, possibly to an average depth of 1-16 inch, but the architect should decide whether to allow use of such questionable methods.

Essentials on which to be satisfied in supervising the winter care of concrete are:

1. Assurance that proper types of apparatus are on hand to provide adequate and constant working warmth for material before going to the mixer, properly warmed mixing water, immediate exclusion of freezing temperature from forms until all risk is passed by the set.
2. Assurance that all apparatus is properly placed and working.

Leaving concrete, we come to brickwork, perhaps the next most important structural element to be safeguarded. In general, the protective measures for temperature control surrounding use of concrete apply to winter brick building. Tarpaulins, salamanders, steam lines, radiation as independent units or in combination, are util-
Temperature Control Assured by Tarpaulin "Top­ping" of Upper Surfaces of Concrete Floor Slabs. The Manner in which Such Protection is Carried Out Should be Carefully Checked. Note the Snug Overlap Given Exterior Tarpaulins.

ized in much the same way for both materials. With brick, moisture becomes an added factor which winter protection must take into account. Wet brick for summer, dry brick for winter, is the rule. That section of the superintendence outline should begin with the storage of brick at the site. Obviously brick should not be piled helter-skelter as it is delivered from the truck; but should be stacked and covered over by sheds or canvas in a manner that protects sides as well as edges against contact with the weather. The ideal way in which to store brick awaiting use is within one of the areas kept warm by salamanders or other heating apparatus. This serves not only to keep it away from snow or rain but also prevents absorption of atmospheric moisture.

It is well established practice to lay all brickwork at temperature well above freezing point. As with concrete, the materials which go into brick mortar should be prepared and mixed where temperature control is assured.

Inside brickwork seems to offer no great problems where adequate protective measures are planned for and employed. Care in checking temperature to keep it at constant working point is, of course, essential. The desire for comfortable warmth on the part of the bricklayer is an aid in securing proper temperatures for laying brick. With brick laid outside the zones of temperature control, more closely coupled contacts are required than with inside work. Outside joints, which may freeze and "pop", carry a decided winter risk. Various anti-freezing compounds at the disposal of the contractor are valuable when speed of erection is a pressing need. Nothing, however, seems to quite fill the bill as well as good old fashioned mortar, applied with cleanly struck joints, and thin enough to permit compacting that assists in a final set which prevents there being cracking or leaky walls.

Many experiments have been carried out in an endeavor to find an ideal cold weather mortar. A test result and recommendation were published some time ago by the National Lime Association. The Association's report said that "lime cement mortars are least affected by cold weather when mixed to a formula of 1 part cement, 2 parts lime and 9 parts sand." The advantages stressed in its favor are: increase in tensile and compressive strength under low temperature; plasticity and ease in handling during winter weather; ease in proportioning; and low cost. The architect should investigate the mortar mix thoroughly. It has become widely accepted practice to defer laying outside brickwork in winter when a falling temperature reaches 34°, and to begin only when a rising temperature has reached that point. Brickwork known to have been frozen should not be built upon until most thoroughly thawed out, and portions in which frozen mortars might later cause disintegration should be torn out and replaced. Outside brickwork in
All-over Coverage Given a Municipal Pier which Was Completed on Scheduled Time Through a Winter of Record Cold and Snow. Behind the Tarpaulins, a Carefully Worked out Radiation System Provided the Requisite Heat

winter should be protected by tarpaulins for three days after laying, with temperature maintained well above 32°. So much for winter brick and brickwork as they must of necessity be treated here.

As winter construction progresses, various auxiliary structural elements begin to play their parts. Not all of them, by any means, require special winter consideration. But those in which water is used should be on the list of those that demand use of precautionary methods. More and more tile work is being used in the architectural-structural scheme of things, and when in winter its application becomes extensive, cold weather precautions must be taken. Temperature has an important bearing upon the enduring success of the winter-laid tile. Experienced tile contractors know that tiles set at or below freezing point will sooner or later come down of themselves. A conscientious rule of practice regards 50° as the ideal temperature for setting tile in winter, with maintenance at about that point for 48 hours after the tiles are in place. Work should stop immediately when the thermometer registers close to 32°.

Exterior tile work should never be carried on when there is even a remote possibility of there being freezing weather. Anti-freezing compounds are not very popular with most tile men. Those with whom I have talked discourage their use, claiming that results have not been satisfactory and that staining of the tile face is likely to occur. Tile body, like that of brick, absorbs moisture readily, and in winter, tiles should be kept as dry as possible before application, within areas where working temperature is maintained.

Plastering is another phase of work which should be safeguarded against too low a temperature. Luckily, plastering is usually done when winter construction has reached the semi-finished stage, when necessary temperature is easily provided and kept constant.

With a clearly defined plan of procedure to follow, effective winter superintendence is not difficult for the thoroughgoing architect. The measure of its success depends largely upon having a clear idea of what is to be encountered, of knowing in advance the reactions of given materials to winter conditions if left to themselves, and of knowing what must be done to prevent these reactions from taking place.

In an article such as this some mention should be made of the effect of winter superintendence upon the attitude of the craftsman toward his work. The success of winter construction is not wholly dependent upon adherence to rules and standards for the storage and handling of material. Securing the comfort, safety, and team spirit of the men who do the work, from the pick and shovel gang on up the line to division foremen, should be a substantial part of the architect's superintendence plan. In his contacts he should be on the alert for any difficulties which might impair morale, and be quite as frank with recommendations for their correction as he is in matters of purely structural interest. I know the stimulus which follows an architect's mingling with rank and file of workers on a cordial common ground; the impetus that follows his showing more than an impersonal interest in a craftsman's efforts; the support he receives when it is understood that he is there to do his part in creating a structural success for everyone concerned.
BUILDING PROMOTION FROM THE BUILDER’S STANDPOINT

BY WILLIAM A. STARRETT

WHAT THE TRUE BASIS OF PROMOTION SHOULD BE. FINANCING METHODS, GOOD AND BAD

It is needless to say that I was flattered to receive an invitation to come to Chicago, particularly to speak to architects. We in the East feel that the leadership in sound promotional ideas comes out of the West.

One such idea is that of financing buildings by the issue of so-called “leasehold bonds.” In the State of New York, and I believe in two other states in the Union, securities that are founded on leaseholds are not accepted by fiduciary institutions as investments for trust funds, thus limiting the use of this method of financing, which is, when soundly planned, about the best and most advanced form of real estate security.

There is a legitimate and alluring field of endeavor for those interested in architecture and building in connection with the financing of building projects. We builders and architects hear of and see many that are meritorious. We know the great increment in value that comes about through our active participation in worthy projects. It is well, however, to remember that we hear most of the successful cases of building promotion, and that very little is said about the unsuccessful. We can always point to examples where great profit has accrued; but we should not forget that the path of this whole matter of promotion is strewn with wrecks of failure, and that bankruptcy courts silently carry on, without front page publicity, the foreclosure enforcement of liens.

Land Worth What It Can Be Made to Produce. Now the true basis of promotion is really the putting together of two valuable components of a creative enterprise. We have on the one hand a piece of land, either vacant or encumbered by obsolete buildings that must be destroyed in order that the land may realize its economic value; and we have on the other hand a brilliant conception of a great improvement which might be made,—the land to be worth so much and the building erected to be worth so much. The sum of those two will be so much; and no matter what it costs, within those reasonable limits that we here discuss, there has been an increment the minute the key turns in the doorway it is opening. Therein lies the lure to the promoter and the legitimate profit in the thing we are here considering.

Now, here is a thing builders and architects are tremendously concerned in, because we help to create that happy combination by bringing together an unproductive or absolutely unimproved piece of land and the highest possible improvement for that piece of land. It would be an impertinence in the presence of real estate experts to suggest a short cut in the matter of appraisals, for we have all used land appraisals of other generations and running down even to very modern times;—that method of calculation which compares what another piece of land cost with that of land under consideration, without reference to the earning power of the newer project. Out of such a circumlocution of appraisal, we finally come to the solemn moment when the appraiser grudgingly says that our project is worth only about so much. However, I dare to pronounce a bit of dictum as a short cut for the whole thing, by saying that land is worth what it can be made to produce. If you want to be very meticulous in your definition, you may go on to say: “What it can be made to pay over a period of years”; but it is all said in those few words;—land is worth what it can be made to produce,—its earnings. And therefore the builder and the architect, in their skillful, constructive activity, create a part of that increment.

“Cost” and “Value” Defined. Now, this brings us to the crossroad which might be regarded as a dilemma, and sometimes taxes the consciences of us who may not think carefully and cleanly (I should say clearly) in these matters. The difference that must be recognized, and the first thing, is the difference between cost and value. Cost, however, is the sum of those actual outlays of cash necessary to produce and complete the whole; that is cost of the operation. The value of the operation is the complete thing,—the cost increased by creative effort that has been put into the operation by the work of the builder and the architect.

The Wrong Sort of Promotion. Promoters are of so many different kinds that one must almost define it every time he uses the word. Considering that type of promoter whom I should describe as reckless, but who calls himself a conservative, we think of him as reaching down into the very bowels of the building business, and with prospective values and deferments in payment, he ponders on that as a possible ground upon which to build his slender project. He thinks of engaging the efforts of the architect and the builder, and then reaches over the shoulders of both and proposes to engage the profits and the support of all the subcontractors involved. I have found this to be the case,—I am not speaking of territory
with which I am not familiar, but in my own part of the country we find that the greatest mistake among promoters is that which leads a promoter to think that he can reach over the shoulders of the architect and builder and assess the subcontractor for a large percentage of the cost of the work. Here is the way that thing works, speaking for my own part of the country. Take items like structural steel, elevators and perhaps one or two other major items, and you find concerns vending those materials are able to take any part of the financing they say they will take. It is also to be observed that they carefully scrutinize the terms, and prices generally run correspondingly high. Beyond that, there is in the whole industry running down the line, a tendency to lean on the architect and the general contractor for advice, or rather for assumption of advice, concerning the taking of securities. There are 50 or 60 or sometimes as many as 75 subcontractors that enter into the making of a large, complicated, metropolitan structure. You have a great army of those people, ready to take any kind of paper offered, as a portion of their profit. Now what happens? If I could show you into the treasury departments of a dozen of the leading builders of this country, you would find a very sinister state of affairs. You would find there men who promised to take anything in the way of paper and deferments, who are suddenly confronted with the fact that, after all, arithmetic on their books will not produce dollars,—and this is one of the fruitful sources of bankruptcy. Men not skilled or versed in this matter of deferred payments agree to take almost anything, and thereby damage and demoralize their own industry by these rash promises, which, of course, meet a judgment day sooner or later. I think, therefore, that one of our pernicious growths in this matter of promotion is the feeling that there lies, in the subcontractor, an almost untapped source of wealth. As a matter of fact, it doesn’t lie there at all. It is detrimental and pernicious to undertake to extract by means of promises of subcontractors, part of the financing requisite for such operations.

We all know, in this swift transition that has passed through the business, that borrowing is necessary for metropolitan development, and indeed it has become one of the fundamental sources of our strongest outlets for capital. Insurance companies for years made loans when skyscrapers were early being introduced; they did it with a considerable amount of what they then thought was risk. It has turned out, of course, as we know now, that there was no risk to it. Nevertheless, there is every credit due to those early institutions for the courage and forward-looking point of view that made possible the financing of these earlier constructions, when, as I have said and as many of you remember, buildings of even 12 stories were regarded as dangerous. More recently in the development, however, we have come upon the investment banker, or rather he has come upon us, and he has come out of a certain situation. In moments of pessimism I sometimes think no new idea ever entered the minds of the comptrollers of insurance companies after the year 1900. The absurd point of view, arising out of that ancient fetish that occurred with the first skyscraper and was met by the courage of that time, has made the lender feel that he is extending a tremendous favor to the borrower, even though the security were as high as it is in conservative lending. Of course, being of that class which benefits by borrowing, I naturally whoop it up for anything that produces larger loans. Nevertheless, I want to say that there is a responsibility there that I think has never been squarely met by the so-called orthodox lending institutions, and that is this responsibility: When an owner (and let’s call him also a promoter, because we are also speaking of that) has found a project meritorious, creative, needed and necessitous, if you please, and goes to an orthodox lending institution, and is told that his estimates are too high for advice, or rather for assumption of advice, concerning the taking of securities, there are 50 or 60 or sometimes as many as 75 subcontractors which benefits by borrowing, I naturally whoop it up for anything that produces larger loans. Nevertheless, I want to say that there is a responsibility there that I think has never been squarely met by the so-called orthodox lending institutions, and that is this responsibility: When an owner (and let’s call him also a promoter, because we are also speaking of that) has found a project meritorious, creative, needed and necessitous, if you please, and goes to an orthodox lending institution, and is told that his estimates are too high for advice, or rather for assumption of advice, concerning the taking of securities, there are 50 or 60 or sometimes as many as 75 subcontractors, who are suddenly confronted with the fact that, after all, arithmetic on their books will not produce dollars,—and this is one of the fruitful sources of bankruptcy. Men not skilled or versed in this matter of deferred payments agree to take almost anything, and thereby damage and demoralize their own industry by these rash promises, which, of course, meet a judgment day sooner or later. I think, therefore, that one of our pernicious growths in this matter of promotion is the feeling that there lies, in the subcontractor, an almost untapped source of wealth. As a matter of fact, it doesn’t lie there at all. It is detrimental and pernicious to undertake to extract by means of promises of subcontractors, part of the financing requisite for such operations.

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banker has rendered an inestimable service to architecture and the building industry. Cities everywhere have been benefited by the splendid vision and foresight of those investment bankers; and if we can point to an occasional failure, we can also point to a great number of successes.

Sound Projects Should Be Encouraged. We are here together at least for one brief evening, taking to ourselves the virtue of being creators, and it seems a proper occasion to make a mighty protest in favor of the reliable, well organized, capable architect and the builder. These people, as I have said through the burden of this talk, do a great creative thing. It is scandalous that they should be subjected to the losses and disappointments and be pushed out on the end of the limb at the very last quarter of these creative enterprises, in reality and truly carrying the burden of the risk. That's what happens when you put your fees in as part of the enterprise. There is a mission in the whole architectural profession. The architects and the builders are really doing a creatively helpful thing and are entitled to a rightful share of the emoluments of the project by reason of their having taken the great risk involved. We can almost talk unionism when we get on that subject, though we are not going to do it; but I say, as of other matters connected with the ethics of these two professions, that there is no greater field of effort, no more fruitful field of effort, than the constant, everlasting harping on that particular thing, and a demanding on behalf of architects and builders, of a fair share of emoluments of the enterprise, they having really assumed the major risk therein.

This business of promotion is also new; just think of it! We can all hark back to those days, here in Chicago, when a 15-story building was really a city wonder. The evolution and metamorphosis of the whole industry have precluded the possibility of getting down to a code of standard practices, but I think the time has come, and in fact enough has been developed out of the many great metropolitan structures that have already been built, for us all to find out what the standards,—at least the major standards,—of practice should be. It starts with questions of credit, questions in which bankers can help, questions in which realtors and bankers can take a sympathetic interest. Their attitude toward the high ethics of these two professions will in the end tend to stabilize the business. We want promoters. A promoter is a most valuable factor in the economic forward progress of this country. The wrong kind of promoter is just as wrong as you want to make him, and the good, legitimate producer, who sees the values to be created by putting together the unimproved land and sound, well-thought-out building projects, is an asset and institution of great value to us. My whole urge in the matter is this: With these fundamentals perhaps a little better understood, there could be no better objective for all of us concerned than to stand out for a higher, more ethical and properly fashioned standard for promotion; for the exposing of flimsy, unsound promotion and enterprises.

There is a back-kick in all of this promotion business, which need hardly be referred to. It is the last straw that always breaks the camel's back. Builders have an old saying: “All money lost in building is lost in laying the thresholds.” That has particular significance with reference to unestimated items such as delayed receipts of rentals, unexpected necessary expenses that come up in connection with renting, etc., disappointments that are only temporary, in connection with renting during the first months of a building's occupancy. We must consider not only the value created between the cost of the vacant lot and the finished building, but also those items of expense necessary for the closing of that last gap, and the provision for them demanded of the promoter, so that those investments we make of our fees and time in the equity, will be productive in accordance with the great effort which we put into it.

Editor's Note. This article by the vice-president of Starrett Brothers, New York, is based on his address recently given before the Chicago Chapter of the American Institute of Architects.
THE PAINTING PROBLEM AND ITS SOLUTION

BY

W. C. WOODYARD

HIGHER standards in living conditions have demanded a correspondingly greater refinement of finish and decoration. Whether it be the home, the school, or place of business, we find ourselves taking a fleeting, momentary pride in its exterior architecture, while living all day inside with decorated walls and woodwork. These may produce a refining influence, foster esprit de corps, and inspire pride, or the opposite reactions, disappointment and depression. The value of this idea is well illustrated in the modern skyscraper. Almost without exception the 35 fine Chicago office buildings built in recent years have been trimmed in genuine mahogany or walnut. Almost without exception, the wood carries a highly polished, piano cabinet finish. One of the largest lessees of Chicago loop property, in specifically demanding a piano-like finish, declared it to be one of the differentiating marks between an "A" and a "B" class building. This trend toward refinement of finish and decoration in the office building, the theater, the school, and particularly in the modern home, is so evident as not to require elaboration. The value of attractive and effective surface protection is accepted. It is easy to visualize the result desired, and comparatively easy to define what is expected, but the problem of getting these results is a matter of interest if not of perplexity to the architectural profession.

It is the purpose of this article to analyze the factors contributing to this perplexing situation, with the hope of suggesting a tried and proved policy which will insure more uniformly satisfactory results. With proper procedure, we may deal, first, briefly with the situations which reflect lack of understanding and thoroughness, and secondly, more comprehensively, with the situations in which apparently sound theory has not vindicated itself in practical results. Careless and unstudied specifications deserve only passing mention. Obviously, it is only human that a painting contractor would readily take advantage of one who reveals an inadequate knowledge of requirements. Such specifications lead to costly bartering on the job,—bartering in which the architect and the client invariably lose. We are not warranted in condemning painters as a class, and assuming dishonesty on their part. The whole problem is frequently dismissed in this manner, and unfairly so. We shall make more constructive progress, for the purpose of this discussion at least, if the architect assumes responsibility for the situation and for the improvement thereof.

It is recognized that no trade offers the possibilities for evasion, substitution, and dishonest practice that the painting trade does. Sufficient reason, therefore, to tighten up all along the way in the method of specifying, contracting, and supervising painting work. This is the only way to give the better contractor, who takes a pride in his work, a chance. In general, pride in workmanship is an inherent quality in all of us. It is unreasonable and unfair to assume, therefore, that the painter is not motivated by a desire to do good work. If, however, there is evidence to the contrary, and one will search deep enough for the cause, it will frequently be found that the painter is forced by circumstances to depart from his ideal in order to survive. The better painting contractors will welcome the tightening-up policy which will enable them to do a type of work more satisfactory to all concerned. The "human factor," or the reaction of the painting contractor to specifications and superintendence, is all-important in considering this problem. The painter is a very human, understanding sort of fellow. As a matter of fact, when he makes up his bid he usually has to take into consideration three things,—first, the plans and specifications; secondly, the architect involved, and what he is likely to exact or fail to exact; and thirdly, how far his competing bidder is likely to go in discounting both of these factors. Too often, instead of being given a definitely lined-up proposition, the painter is asked to gamble in competition with others confronted with the same alternative. The general contractor contributes to the unsatisfactory situation by seemingly being interested only in the lowest possible figure, and the only hope for the trustworthy painter lies in a more careful definition, enforcement, and discrimination among painting contractors on the part of the architect.

Now, we may logically turn to certain constructive suggestions which a broad survey of painting problems reveals as the more outstanding causes for unsatisfactory results. Specifications should be varied according to the cost of the building and the general line-up of the investment. A greater proportionate decorative expenditure is expected, for example, in a $60,000 residence than in an ordinary apartment building yielding a moderate income. In the latter case, a decorative result approaching in appearance the effect secured in the $60,000 residence is desired at a considerably smaller expenditure,—and it is possible to secure it. However, the curtailed specification is usually more difficult to write. The element of serviceability is necessary to both projects. It is true,
and generally so accepted, that there is no economy in letting down on the quality of materials used. This would result in a very negligible saving,—a saving that would prove very expensive in the long run. The quality of materials, in fact, looms more important in the curtailed job. A five-coat rubbed enamel job may be cut down to a four-coat eggshell or a three-coat enamel job if necessary. The proper selection of coating in a three-coat enamel job is very important. Likewise the size, three coats of paint, glazed and starched wall coating job may be cut down in the extreme case from six coats to two coats,—a coat of primer and a coat of paint. In each instance it is not claimed that an equivalent job is secured, but a decorative effect approximating the more perfect finish is had, and if the best materials are used, it is one that is reasonably durable and serviceable. On a large apartment hotel recently, an architect wrote a curtailed painting specification, specific as to requirements in coats and materials, that was practically fool-proof. He emphasized to the six contractors he had bid on the work that it represented exactly what was wanted. There was less than a 7 per cent differential between the highest and the lowest bid. It is not an uncommon experience for the highest figure to be double the amount of the lowest figure. This represents a pretty large difference in appraisal of what is desired or will be exacted. It relegates the bid to a gamble. It represents a rather important need of the "tightening-up" process heretofore alluded to.

The practice of cutting bidders down to a price, likewise offers a poor investment. We need not expect to get more than we pay for. It is far more logical and business-like to change the specification, know exactly what one is going to get, and be in a position to insist on the terms of the contract. Of all the evils in connection with the painting problem, the one most complained of is substitution of cheaper materials for those specified. This may be done in an underhanded way, such as displaying boldly a few cans of the specified materials and actually using cheaper materials from barrels, refilled cans and the like, or it may be more above-board,—in out and out requests for approval of other goods. In the latter event, regardless of how represented, the material offered for approval is practically always cheaper in price and quality.

We must first look to the specifications for improvement in this regard. Here again, the human factor plays a prominent part, and the manufacturer's representative can play a constructive role. Let us trace the reaction of various types of specifications. First, consider the specifications calling for several brands "or equal." On the face of it, it appears theoretically sound. It is intended to leave the matter open to competition. It must be recognized, however, that materials such as paint, varnish, enamel and lacquer, with their complex chemical make-up, are not "equal" in quality or performance. The paint industry exists on a highly scientific basis necessary to meet the ever-increasing demand for a greater variety of paint finish. Products made from the same basic ingredients frequently differ widely in qualities of finish and durability. The large expenditures for laboratory research and control, which constitute quite an item in this age, have found their justification in a greater refinement of finish, flexibility of use, and durability of results. A manufacturer establishes a reputation for progressive research and integrity of purpose. Competition in quality fosters research, whereas an accepted theory of equality would prevent progress. Added to that is the fact that usually one or two of the brands included are cheaper, which automatically makes them the standard of materials for the specification, and nullifies any value in including the higher priced brands. Furthermore, it tends to eliminate possible cooperation from the manufacturer's representative. The representatives of the manufacturers mentioned may be successively stalled off if the contractor chooses to be evasive. In any event, the salesman selling the job, whether it be of the grades specified or otherwise, is entirely indebted to the painter for the business and is likely to be in no position to cooperate effectively with the architect in the interest of the finished result.

We may go from this type of specification to the other extreme. Unquestionably, the exclusive specification offers the most definite proposition for the bidder; likewise a definite basis, an obligation in fact, for the manufacturer's representative to interest himself in the result which should be secured with his materials under the provisions of the specifications. This system has proved to offer the best investment and protection for the client. The plan, however, is objectionable to many because it does not leave the matter sufficiently open to competition. It is frequently maintained that the manufacturer would use this advantage to hold up the price to the contractor. That contention, however, is not substantiated by fact, and where made it should be carefully run down. The larger manufacturers have so many jobbers and independent, overlapping methods of distribution in the various communities that they create competition within their own representatives' ranks and make it practically impossible for the painter to be held up on price. Furthermore, it would not be sound business tactics for the enlightened, reputable manufacturer in this age to be so shortsighted as to take advantage of an ex-
clusive specification if it were in fact in his power to do so under his distributing arrangement.

However, if we seek a specification that offers a uniform standard of materials for each contractor to bid on, which provides for competition, which definitely eliminates the bartering for approvals after the contract is let, let us consider this plan. Definitely specify the product which you believe best adapted for the work, as you would probably do if you were writing a specification for your own home, incorporating as a part of your specification these clauses: "The bids to be considered must include a bid on goods herein specified, but the contractor may submit alternate bids on materials which he considers fully equal to those specified, provided he appends the name of the manufacturer and explicit designation of each product he offers as a substitute, stating the amount to be added to or deducted from his bid for such substitution. The architect reserves the right to award the contract to the lowest bidder on the goods specified or on any accepted substitutes proposed in the alternate bids submitted as just explained. After the award is made, no substitution of materials for those mentioned in the accepted bid will be permitted."

The basic bid on the standard set up commits all contractors to one figure on exactly the same thing, permitting a fair comparison of figures. The architect is not put on the defensive, later on after the contract is let, with requests to approve this or that material, the purpose of which request is usually to offer a saving to the contractor. If there is a saving to be made in the use of an alternate, architect or owner should get the benefit of the saving. How often is there an allowance offered with the request for an approval under the open specification? Furthermore, the matter is definitely settled when the contract is let. The numerous time-consuming requests for approvals are obviated. It is not left to the superintendent on the work to pass on materials, as is frequently the case. Best of all, it is a protection to the better element among the painting contractors who prefer to use the better grade products but hold mental reservations regarding the grades of goods some of their competitors would try to put across if they got the contract.

We cannot deal comprehensively with the painting problem without some reference to superintendence of the work. The plan and specifications may be worked out most painstakingly, and their effect be completely lost, as is so often the case, by laxity and lack of system in their enforcement. We cannot hope to deal with the subject of superintendence in an entirely adequate manner in this article of small extent, but these suggestions to the architect's superintendent may prove helpful:

1. Definitely familiarize yourself with the scope of the specifications, particularly as regards coats and materials.

2. Learn definitely from the office what materials are to be used if the specifications are not explicit. Check up definitely with the office any details regarding which there is uncertainty, such as color, decorative schemes, etc.

3. Make brief outline of specifications in your notebook, particularly the sequence of coats and materials to be used.

4. Go over the specifications and details of the work with the painter when he first comes on the site. It is essential that both know that each understands which is to be done.

5. Provide the painter with a room for storage of painting materials, retaining a key to the lock of the door.

6. Make regular inspections of storage room, taking care to identify contents of unlabeled cans. Reject and have removed immediately from the site materials not in accordance with the specifications. Look for the original seals on goods.

7. In the early portion of the work, observe opening of a new can and application of each coat for at least one room to establish a standard result for the entire work.

8. Check painting work regularly, requesting information as to the particular coat being applied and record data in note book for later use.

9. Be as careful in the check-up toward the end as at the beginning.

We have made only scant mention of the manufacturer's representative, and the part he can play in improving painting conditions. If he is a product of the modern school, which increasingly demands a more thorough and technical knowledge of the business, he can prove to be quite an asset. Ask him for suggestions in connection with specifications. If you are specifying and using his products, feel perfectly free to insist on his following up the work and cooperating in getting a creditable result. You have a right to expect his interest to be more than in a sale of gallons of material; he should be interested in selling results.

We have gone to some length to suggest a tightening-up process as a means of improving painting work. We have suggested taking into account the human factor and making it more difficult to discount the intent of the specifications. These steps are necessary if the better element in the painting contracting business is to triumph. The better painting contractors will give a sounder investment, and will give added meaning to the common slogan of the paint industry: "Save the surface and you save all!"
SOUNDPROOFING APARTMENT HOUSES—PART ONE

BY

V. L. CHRISLER
ASSOCIATE PHYSICIST, U. S. BUREAU OF STANDARDS

SOUND insulation is one of the most important details to be considered in building hotels, apartment houses, and office buildings. In the past little consideration has been given by architects to this necessary requirement. There is, however, on the part of the people who occupy these buildings, a growing demand for sufficient sound insulation to ensure a reasonable degree of privacy. Sounds which come through the ceilings are especially annoying to the person hearing them. In many cases the noises coming from adjoining apartments finally get on the nerves to such an extent that a tenant moves, though his apartment may be satisfactory in all other respects.

Up to the past four or five years there has been little reliable information available on this subject, and our present knowledge as to what is the best type of construction is somewhat limited. Many people have thought they had a perfectly satisfactory type of construction, and some buildings which they completed were pronounced satisfactory. Possibly the next building, which was constructed as nearly as possible in the same manner as the others, would be a complete failure. On account of this uncertainty and in order to get comparative data on different types of construction, the Bureau of Standards several years ago constructed a special building (Fig. 1) in which measurements could be made determining numerical values for the sound insulation of different types of construction. Most of the common types have been tested, and considerable work has been done in making various modifications in wall and floor construction so as to get the necessary degree of sound insulation. The problem as a whole is very interesting, as there seem to be so many unknown quantities that it is generally impossible to predict with any degree of certainty whether or not a partition will be a better sound insulator if certain changes are made in it. Owing to the work which has been done during the past three or four years, it is possible to make a much better guess than when the work was started, but there are still many elements of uncertainty.

It may be of interest to consider some of the factors which enter into the transmission of sound through a partition and to see how they may be controlled. To begin with, suppose we consider a sheet of metal which is fastened over a hole in a wall. If a source of sound is placed on one side of this sheet of metal, the sound energy is carried to the metal by the air, and the sheet is set in vibration. This in turn sets the air on the other side in vibration, and the sound energy is thus transmitted from one side to the other. By studying the sound transmission through a number of sheets of different metals, it has been found that the weight per unit area is, generally speaking, the most important factor. It is not the only factor, for a sheet of lead will transmit sound more than a sheet of iron or aluminum of the same weight. This difference is not large enough, however, to be of much practical importance.

In studying these thin sheets of metal, a very surprising result was found. A year or so ago a few double masonry walls were built and were found upon test to be quite effective as sound insulators. In fact the conclusion was reached that air was the best filling material. Sabine also reached the same conclusion. From these results it was then expected that two sheets of metal separated by an air space would be a much better sound insulator than a single sheet of metal. Much to everyone's surprise, it was found by experiment that two sheets of aluminum with a \( \frac{1}{3} \)-inch air space between them transmitted almost as much sound as a single sheet of material. It thus became evident that the behavior of a double masonry wall was different in kind rather than in degree from that of a partition composed of two thin metallic sheets. The thin sheets of metal apparently need something in the air space between them to help damp out the vibrations. Filling materials, such as hair, felt, cotton and balsam wool, were tried and found effective.

From these results and other measurements on walls, there may be drawn some conclusions which appear to be more or less general. As long as a wall is constructed of masonry and is more or less homogeneous, the sound insulation is almost proportional to its weight per unit area. This means that to get a proper degree of sound insulation the wall must be excessively heavy. To avoid this we may split the wall into layers, and in some way try to damp out the vibrations and prevent them from passing from one layer to another.

One such method which has been devised is to hang the wall and ceiling surfaces on springs which are attached to the main part of the wall. The springs are supposed to act as shock absorbers for an automobile. They must be of just the right strength and stiffness, so that the wall surface can vibrate without transmitting too much energy to the main part of the wall. This principle was illustrated in some of the first measure-
ments that were made at the Bureau of Standards on stud partitions. One partition was covered on both sides with expanded metal lath and a very thin scratch coat of gypsum plaster. The second panel was as nearly identical as possible, except that it had both a scratch coat and a brown coat of gypsum plaster. When the measurements were completed, the results were found to be somewhat surprising. The panel with the scratch coat only was found to be the best sound insulator. An examination of the two panels showed that the panel having only the scratch coat had a surface so thin that it had no rigidity and could easily be moved back and forth between the studs for perhaps an eighth of an inch without exerting an appreciable force on the studs. The panel having both the scratch and brown coats had a more rigid surface and could not be moved so easily; hence a force exerted on this surface was also exerted in considerable measure on the stud, and was thus transferred to the other side.

The reasons are now apparent why the scratch coat was the best insulator. It had sufficient mass in its surface to prevent the sound setting up vibrations of sufficient force, so that the air between the studs would act as a good tie, as in the case of thin sheets of metal; also the damping in such a surface is fairly large, and the energy would not be carried very efficiently to the stud and hence to the other surface. Moreover, what little energy was carried through was not sufficient to produce any great amount of vibration in the other side, as the movements produced in the stud were but slight, and the opposite scratch coating was not stiff enough to be set into vibration by small movements of the stud. In the case of the panel having the scratch and brown coats, the sound waves which set the first surface in vibration caused the second surface to vibrate also, as this surface was stiff enough to form a rather rigid connection with the studs and thus could be put into vibration by a small motion. From this experiment we see that if the surface can be attached to the main part of the wall so that it is free to vibrate without transmitting too much of the energy to the wall, we have an ideal condition. To accomplish this, one company which is specializing on sound insulation, is supporting wall surfaces on the special spring mentioned here. By another method which is on the market the wall surfaces are supported on small metal chairs, which are lined with felt. In addition to this a lining of hair felt is used between the main wall and the plaster surface. Neither of these particular types of construction has been tested by the Bureau of Standards, but it is expected that either should give good results.

A special type of masonry wall which has been tested in several different combinations by the Bureau of Standards, and which promises to give very satisfactory results at relatively slight increase in cost over ordinary construction, consists

Fig. 1. Special Building of the Bureau of Standards for Testing Sound Insulation.
of a masonry core of 4-inch hollow clay tile or brick turned on edge for the center portion. If the wall is a load-bearing wall, a heavier construction could be used and probably still better results be obtained. At the time the masonry wall was laid, wires were placed in the wall so that wooden furring strips could be tied to the wall 16 inches on centers. The plaster base was nailed to these furring strips, and plaster was applied in the ordinary manner. For the plaster base expanded metal lath was used with tar paper behind it to prevent the plaster from forming a bond with the masonry core. Two different kinds of fiber board and a gypsum plaster board were also used as a plaster base. Where there was a direct comparison, the fiber and plaster boards showed a slight advantage in sound-insulation value over the metal lath as a plaster base. This difference was not large enough to be of much importance, and was probably due to the fact that the plaster was only half an inch thick over the boards while it was seven-eighths of an inch thick when metal lath was used, and as a result gave a somewhat heavier surface.

When the panels were in place, conversational tests were made as well as a determination of the reduction factor. In every case it was found that a conversation carried on in an ordinary tone of voice was barely audible to a listener on the other side, provided he was listening intently, but that he was unable to understand anything that was said; also that if there were the slightest noise in the room he was in, the listener failed to detect any sound from conversation on the other side of the panel. Attempts were also made to carry on a conversation through these panels by shouting. In this case one could always hear the other person, but as a rule failed to understand anything that was said. Compared with the walls in many apartments, this is a decided improvement. It should also be borne in mind that the rooms in which these tests were made had bare concrete walls and were so situated that no distracting noises entered from the outside. If they had been rooms in an ordinary apartment, where there were draperies and furniture to absorb part of the sound, and if there had been some noise due to traffic or other causes, the panels would have given still better results.

A very interesting illustration of the effect of absorbing material was found when a box was built and lined with some very absorbent material. There were some plate glass windows in the box, and when a person was on the inside his lips could be seen to move, but as a rule unless he raised his voice slightly no sound could be heard. The person on the inside, however, could hear every word said by anyone outside.

A practical use of this might be made in offices where typewriter noises come through thin partitions and are annoying. If considerable material is placed in the room where the noise originates, it is sometimes possible to reduce the intensity to such an extent that the partition becomes satisfactory, and the noise is no longer disturbing. There is also a second advantage to use of such a treatment. The intensity of the noise being reduced makes the room much better for those working in it. Where tests have been made it has been found that this increases the efficiency of workers.

Up to the present we have considered only airborne noises. Noises due to impact form another class. They are among the most difficult to insulate, and are at the same time highly annoying. From experience we all know that a noisy machine often sounds almost as loud in the room below as in the room where it is located. To experiment with noises of this kind, a special machine (Fig. 2) has been built by the Bureau of Standards. It consists of a set of five rods which are raised in succession by a set of cams. The speed of the cams is such that one rod is allowed to fall every fifth of a second. On a wood floor it is quite noisy—sufficiently so that it is rather trying to hold a conversation with anyone in the same room. Where there were wood joists there was some reduction of the noise transmitted through the partition, but it was still decidedly annoying. Some contractors build a so-called “floating floor” by using a fiber board, and then laying the finish floor on top and nailing through the fiber boards. This form of construction was tested to determine if such a structure was an improvement, and somewhat to the experimenters’ surprise (although the results might have been expected), the structure transmitted exactly the same percentage of sound within the limit of experimental error as did the
structure before the fiber board was added. In other words, the vibrations were carried through the nails and destroyed any effect due to the fiber board. This applies to both air-borne and impact noises. In the next attempt a rough sub-flooring was laid and on top of this was placed fiber board, on which nailing strips were placed, and on this the finish floor. This will be referred to as a "floating floor." Details have not been worked out as to how these nailing strips should be fastened, but it is not believed that it will be difficult to do this and still preserve what sound insulation is gained. For air-borne noises, such a structure is quite satisfactory. Under usual conditions a conversation carried on in an ordinary tone of voice is not audible through it. For impact noises, however, the structure was rather disappointing. It was to some extent an improvement, but footsteps could be easily heard.

The next attempt was to separate the ceiling from the floor joists. This gave about the same results, although not quite as good as the single set of joists and floating floor. A floating floor was then added. This combination gave the best results that were obtained with wood joists and was very satisfactory as far as air-borne noises were concerned. It still needs improvement in regard to insulating against impact noises. In fact, at this point in the investigation the conclusion was almost reached that the most practicable way to prevent noise coming through from the floor above was to minimize the noise being produced. This can always be done by using carpets or rugs. Cork tile and rubber tile are also good, and even linoleum is much better than a bare wood floor. After considering this type of construction still further, it is hoped that possibly some type of double ceiling will help and that it will be possible to prevent ordinary impact noises from coming through and being annoying. Further work will be done along this line in the near future.

The other type of flooring which was studied was masonry. When impacts were allowed to fall directly on the masonry, the noise in the room below was practically as loud as in the room where the machine was situated. A floating floor was then added, with decided improvement. Finally a suspended ceiling was placed, and this gave the best results which have been obtained. For air-borne noises this is probably the best panel that has been tested. For one of the listening tests a radio loud speaker was used. The loud speaker was driven somewhat harder than is usually customary for home use, and even then when listening through the panel it was impossible to tell whether someone was talking over the radio or an orchestra playing. In fact it is doubtful whether a person could have been sure that the radio was going. It is certain that if the test had been made anywhere except in a room which was absolutely quiet, the radio could not have been heard. For impact noises it was not as good, but was quite an improvement. The noise from the impact machine was distinctly audible, but not loud enough to be readily noticeable if two people were talking in the room. A practical method of fastening the nailing strips remains to be worked out, as in the tests just described, they were simply laid on the fiber board. From some experiments on brick walls it is believed that these strips can be nailed or lagged to masonry at intervals so as to prevent their bowing up without affecting the sound insulation.

From all this it is evident that the best form of sound insulation for masonry which has been found would be constructed somewhat in this way. What might be called the "core" of the building would be built in the customary manner, that is, with the walls and floors of masonry. From this point the procedure would be different. Each room has been formed by this rough masonry, and inside of this the finished surfaces are to be built. Instead of plastering directly on the masonry to form the wall and ceiling surfaces, this part should be furred out so that the finished plaster surfaces are not in direct contact with the masonry. In the same way the floor should be of a floating type. In other words, we might picture it as a box within a box, the inner box being attached to the outer in as few places as possible, and these connections should not be any more rigid than is necessary. Exactly how these connections should be made to get the best results is rather a difficult matter to decide and needs more investigation.

For wood construction, the progress has not been as encouraging as for masonry. This is possibly due to the fact that sounds do not pass through most types of wood construction as easily as through masonry, and therefore the incentive for improvement has not been as great. Use of staggered studs and staggered floor and ceiling joists has been suggested as a good method of construction. The laboratory tests do show an improvement in such cases, but not as large as was expected; and it is a question whether the improvement is sufficient to justify the additional cost. Another method is to use fiber board between the studs and lath. The improvement in this case was not as great as had been hoped for. Work is still being done along this line, and it is hoped that a satisfactory solution will be obtained which will not necessitate an expensive installation.

In all of the laboratory work done, one impor-
tant factor has had to be ignored, and that is water pipes, soil pipes, electric conduits, gas pipes, etc. All of these form excellent paths by which sound may travel, and they may frustrate all attempts at sound insulation unless care is taken to install them properly. One suggestion might be made about noisy water fixtures. To begin with, a fixture should be bought which is as quiet as possible. Even then fixtures are often noisy if the water pressure is quite high, and considerable energy has to be dissipated as the water flows through. This often sets the fixture and with it the pipe in vibration which can be heard in all of the adjoining rooms. It is practically impossible to insulate against such sounds, but it is relatively simple to prevent their being produced by installing a reducing valve where the water enters the house and reducing the pressure so that it shall not exceed five pounds per square inch at the fixtures. To secure a good flow of water this necessitates a somewhat larger pipe than usual. Doors and other openings also present problems which have to be dealt with according to their individual cases. Ventilation pipes also present problems. One rather costly mistake in planning an apartment building came to the writer's attention. The bathrooms were built directly over one another. As there were no outside openings, the ventilation was taken care of by a shaft into which there was an opening from each bathroom. As a result, a person standing in one bathroom could hear everything that went on in all of the other bathrooms, since the ventilating shaft acted as a speaking tube. As a result of this the owner was unable to keep tenants in the apartments, and he has spent several thousand dollars trying to remedy this faulty construction, but with only partial success.

The foregoing is intended to be only a brief outline of the work that has been done on sound insulation and to suggest some of the things that are to be avoided. It is not felt that this article would be complete unless a brief reference were made to results of laboratory tests which have been published. Unfortunately, these figures do not give absolute results, such as can be obtained for heat insulation, but depend on the manner in which the measurements were taken and also to some extent on the rooms in which the measurements were taken. For this reason it is rather difficult to compare results made by different observers. If comparisons are to be made between different panels, it is rather desirable that all of the results to be compared should be made by the same observer. It is also desirable to call attention to the form in which the results should be published. Most of the laboratory measurements on sound transmission are made by using a telephone or microphone to pick up the sound energy which is to be measured. These instruments measure sound on what we shall call the "physical" scale. But the most universally used instrument for detecting sound and estimating its intensity is the ear, and unfortunately the ear scale is not the same as the physical scale. As the intensity of sound increases steadily on the physical scale, the response of the ear fails to keep pace with the increasing energy of the sound waves, but is in fact proportional to the logarithm of that intensity. For example, two sounds of intensity, 10 and 100, as measured on the physical scale, would seem to the ear to have the ratio of 1 to 2, the common logarithms of 10 and 100. And because of the almost universal use of the ear as a means of detecting sound, it is advisable to express the results of the experiment on the ear scale.

This method of expressing results presents some difficulties. While the relative sound transmission of two panels is always the same on the physical scale, no matter how loud the sound which seeks transmission, this is apparently not the case on the ear scale. A numerical example, given in this table, will illustrate this point. We consider two walls, A and B, of which A transmits 1/1000 and B 1/100 of the incident sound energy, measured on the physical scale:

<table>
<thead>
<tr>
<th>Intensity of Sound on Far Side of Wall</th>
<th>Intensity of Sound Transmitted:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Scale</td>
<td>Wall</td>
</tr>
<tr>
<td>----------------</td>
<td>-----</td>
</tr>
<tr>
<td>1,000,000</td>
<td>A</td>
</tr>
<tr>
<td>10,000</td>
<td>A</td>
</tr>
<tr>
<td>100</td>
<td>B</td>
</tr>
</tbody>
</table>

From this it may be seen that while A is 10 times as good as B (in the physical scale), no matter what the original intensity of the sound may be, the ear estimates A as twice as good as B for a faint sound, and both A and B as nearly the same (ratio 4/3) for a louder sound.

We should therefore be cautious about the use of such phrases as "twice as good a sound insulator"; the point that should be emphasized (in advertising or otherwise) is not whether one material is twice as good as another under some special condition but whether it gives sufficient sound insulation under conditions as are usually prevailing to reduce the sound to a point where it will not be annoying. This means that to make a satisfactory installation one should know approximately the intensity of the noise he is trying to insulate against and approximately how good a sound insulator is the type of structure that he proposes to build. It is hoped that these suggestions will be of benefit, and that they will aid in the building of better apartment houses.
FEBRUARY construction contracts awarded in the 37 states east of the Rocky Mountains show a 12 per cent decline from January of this year and a 22 per cent decline from February, 1928, according to figures provided by the F. W. Dodge Corporation. The total valuation of this February construction, $361,273,900, covers a period of four days less than the January totals, but there seems to have been approximately the same daily construction volume as that existing since the beginning of 1929. Combining the figures for January and February, 1929 gives a total of $771,241,800 and represents a decrease of 14 per cent from the 1928 construction for that period.

The district consisting of New York state and northern New Jersey, with a February total of $74,985,900, showed a falling off of 26 per cent from January of this year and 46 per cent from February, 1928. In the central west the total construction for February of $99,321,000, here again, was below the figure of the previous month by 12 per cent and below that of February, 1928 by 35 per cent. The only other district which showed a decrease for February, 1929 was that including the southeastern states, which had a total of $34,-266,700, which is 12 per cent below the figures for February, 1928, and 9 per cent below the January, 1929 total. In the New England states construction was the highest ever recorded for this month. The total for the month of February was $26,430,700.

In the middle Atlantic states the value of construction started during February amounted to $50,689,700, an increase of 3 per cent over that of the preceding month and 9 per cent above the total for February, 1928. The Pittsburgh district showed an increase of 22 per cent over February, 1928, but its total of $50,298,500 was 12 per cent below the figures for January, 1929. This same condition existed in the northwestern states where the February contracts, $3,746,500, were 70 per cent higher than for February, 1928, but 40 per cent below the January, 1929 figure. The February contract total for the 37 states show that 36 per cent of all construction represented residential buildings, 19 per cent commercial buildings, 16 per cent public works and utilities, and 16 per cent industrial projects. Contemplated projects reported during February reached the total of $772,621,600 for the 37 states. This is 6 per cent less than the amount of contemplated work reported during January of this year and 18 per cent less than that reported for month of February, 1928.

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 SUPERVISION OF CONSTRUCTION OPERATIONS
BY
WILFRED W. BEACH
THE FIRST DAY ON THE JOB—(Continued)

Editor’s Note. Mr. Beach here continues the consideration of “The First Day on the Job,” Chapter 4 of which appeared in the February issue of THE ARCHITECTURAL FORUM.

Regarding saving by the waiving of a bond, the architect was known to be greatly in favor of so doing, as he regarded the unnecessary addition of 1½ per cent to the cost of a building to be quite unwarranted, except only as a pure matter of insurance. If it had been a private owner, the superintendent was quite sure that, with such a high class contractor, the architect would approve the saving, but, this being public work, the question was entirely one for the board to decide. It was obvious that the architect could not in any way be held for any of the contractor’s deflections, although the architect and superintendent would do their best to see that the contractor fulfilled the terms of his contract and met all his obligations pertaining thereto. It was thereupon decided that if a surety company could be found that would underwrite the architect’s form of bond, such bond would be accepted; otherwise the board would consider doing without one. The agent was persuaded to send a night letter to his company, with the result that a bond in acceptable form was promptly forthcoming and all was well in that particular.

Returning to the site after lunch, the contractor was found directing his new foreman, starting work on temporary buildings, but it was apparent that neither had thought to consult the specifications on the subject:

“TEMPORARY OFFICE BUILDING. The Contractor shall, immediately after award of contract, provide a substantial, weatherproof building at the site, containing an office for the Superintendent, of at least 120 sq. ft. of floor area and fitted with movable sash on each open side, substantial door (with butt, latch and cylinder lock), table for blueprints, desk with drawers, locker, stool and two chairs, all as directed by the Superintendent and at the expense of the Contractor, who shall provide heat and light for same.

“CONTRACTOR’S OFFICE at the site shall be a substantial, weatherproof building, properly heated and lighted and appropriately furnished. It may be under same root with Superintendent’s office, with partition separating. The Contractor’s office shall be the proper place of deposit for all copies of all drawings and specifications and for all his file records pertaining to the work. It shall also be the proper place for delivery of all orders and instructions to the Contractor. The Contractor or his Foreman shall be constantly in charge of same during working hours and shall maintain (on shelf accessible to the Superintendent) a telephone, served and listed by the local exchange, all at the Contractor’s expense. Free use of the telephone shall be granted to Representatives of Contractors, Subcontractors, Owner and Architect, except that the Contractor may require reimbursement for tolls on long distance calls. He may also have a pay telephone installed for the use of others. The Contractor’s office shall not be used for the storage of equipment or materials nor as a loafing place.

“MATERIAL SHEDS. The Contractor shall provide at least 3 shelter sheds where directed, separate or under one roof, each containing 260 sq. ft. (or more) of floor area, and of substantial weatherproof construction, with hinged door to each shed, and a window on each exposed side. Each door shall be fitted with hasp and staple and brass padlock with necessary keys. The Superintendent will assign space in these sheds according to his best judgment.

“TOILET CONVENIENCES for all persons employed on the work shall be constructed and maintained by the Contractor in accordance with City ordinance and State laws, properly lighted and heated and kept clean and sanitary, satisfactory to Superintendent and local Authorities.”

Being set right on these subjects, the contractor and his foreman next proceeded to “stake out” the building in accordance with the plot plan, erecting substantial batterboards at each of the four corners. Fig. 7 illustrates the customary and proper manner of setting batterboards, which should be located far enough back of the edge of the excavation to be out of the way of teams and trucks. The boards are nailed to substantial stakes driven well into the ground and notches are cut in the upper edges as shown. “C” and “H” are on lines of outside surfaces of basement walls; “B” and “I” mark the inside surfaces; “A” and “D,” and “G” and “J” are the outside lines of the footings; and “E” and “F” are the limiting lines of the excavation. Cords stretched from these notches to corresponding notches in boards at opposite corners afford lines from which a plumb-bob can be dropped and lines or points in the excavated portion be correctly located. Thus, plumbing down from intersection at point “L,” the contractor locates the corner of his excavation at “K.” If it is desired to prove the square of the corner at “L,” one can use the simple rule of “the square of the hypotenuse is equal to the sum of the squares of the other two sides of a right-angled triangle,” measuring 40
feet in one direction from the corner, 30 feet in the other direction and 50 feet across the hypotenuse. This should be done with great care, as the variation should not be more than \( \frac{1}{2} \) inch in 100 feet.

Here is the superintendent’s report of the first day’s activities at the site:

- **Work day:** No. 1.
- **Force worked:** 10 hours.
- **Weather conditions:** Finest.
- **Temperature:** 78° to 82°.
- **Number and kind of workmen employed:**
  - **General Contractor:** 6 carpenters and 1 foreman.
  - **Excavating Contractor:** 6 men with teams, 1 foreman, 1 steam shovel man.

Work today consisted of:
- Taking out trees and shrubs; protecting trees and walks; starting stripping loam; bringing on steam shovel; starting to stake out the building and put up sheds.

Cause of delays, if any:
- Contractor submitted bond on bond company’s printed form which was rejected. He was notified he could continue work as trespasser until bond is settled. He is proceeding with that understanding. Board is to meet tonight to consider subject.

Drawings and information needed:
- Contractor needs two complete sets of working drawings at once; one on cloth.

Daily letter:
- Job started 2 days ahead of schedule without authority, but weather too fine to stop it. Contractor’s liability insurance policy is No. 283,576 in .......... Co. Grading subcontractor was ordered to get policy at once; promised for tomorrow. Job telephone, electric and water supply ordered in. Permit applied for; said to be a matter of form on public buildings.

To this, the superintendent added his room address for regular mail and the address of the job for receiving telegrams and special delivery letters.

**CHAPTER 5**

**BEGINNING THE WORK**

After the first day’s preliminaries at the site, the morning of the second day proved a busy time for the superintendent. First, he found that the subcontractor for grading had changed his mind about getting a liability insurance policy,—simply refused to do so, intimating that he considered the demand for it to be only attempted graft on the part of the member of the board of education who was agent for such insurance. He claimed further that the law did not require such insurance to be carried by employers who were financially responsible. To this the superintendent rejoined that it was not a question of law but of contract requirements, and that the policy must be forthcoming, quite regardless of who might be the agent. Here appeared the chairman of the building committee of the board, accompanied by the principal of the high school. This board member and the general contractor added the weight of their counsel to that of the superintendent, as a result of which the grading contractor finally agreed to secure a policy from an-
other agent, and a copy of the application was handed the superintendent a little later in the day.

In discussing the work with the board member and high school principal, two matters of vital importance developed. One was that the school man had been delegated by the board to act as its representative on matters pertaining to the new building during intervals between board meetings; the other, that another board member, who was also a member of the town planning commission, had an idea that the building, located on a hillside with a fine prospect to the south, would look better and have a still finer view if raised about 3 feet higher than shown by the drawings. Decision on this was deferred, pending the next visit of the architect, due the following Monday, but the other matter was not one that could be either deferred or disposed of. The intervention of such an "agent" in building programs is not unusual and is a fruitful source of friction in too many instances. In the case of private work or that of a corporation, the agent is frequently looking more to his own interests than to those he represents, as a result of which the superintendent finds him presently aligned with one or more of the contractors to the detriment of the work. Even on public work, the agent, with no apparently dishonest intent, may be heard criticizing the architect and his documents as much as he does the performance of the various contractors. His relation to the work is only semi-official, with no definite limitations and, unless he is a very unusual individual, he is much more of a nuisance than a help. Having no real authority, it is nevertheless difficult for him to avoid assuming the semblance of it, especially if he be, as in this case, a school official accustomed to dictating to his subordinates. It is difficult to understand why, after employing an architect to conduct their operations, owners should consider it necessary to inject a personality whose very employment means merely an added problem to be dealt with. If a superintendent is compelled to face it, he had best "cultivate" the incumbent and trust that he will not prove a deliberate trouble maker.

This man had started being officious the preceding day, before the arrival of the superintendent, by directing the grader to have the slip-scrapers dump the top soil into a small ravine that required filling. This error was corrected, and the loam was ordered piled on high ground where it would be subject to minimum wash from storm water, as provided in the specifications:

"TOP SOIL. At beginning of excavating, the black earth at surface shall be removed to a depth of 9" to 12" over the building site and piled on premises where directed by the Superintendent, to be distributed as required before completion of the work."

Neither the school man nor the grader had thought to consult the specifications on such a minor matter, but the incident was of value as initial proof that there should be but one head to the work.

The superintendent and the principal also reviewed other specification paragraphs especially applicable at the beginning of the work:

"PERMITS for building construction, street obstruction and water connection shall be taken out by the Contractor before operations are started. He shall pay all fees for same, including inspection fees and cost of all water used for the work of others, as well as for his own operations."

"PROGRESS PHOTOGRAPHS shall be taken by a professional photographer at the expense of the Contractor at intervals designated by the Architect, 12 negatives in all, on 8" x 10" plates. Three prints from each negative, mounted on linen with binding margins, together with the negative, shall be delivered promptly to the Superintendent by the Contractor, in each case."

"LINES AND LEVELS. The Owner will have lot lines and restrictions established and a copy of survey provided on which same are indicated, also stakes and marks evidencing same, together with a permanent bench mark conveniently located. The responsibility for all other lines and levels necessary for proper location and erection of the building and appurtenances rests with the Contractor who shall employ a competent instrument man."

"USE OF PREMISES. (From Art. 42 of A. I. A. General Conditions.) The Contractor shall confine his apparatus, the storage of his materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the Architect and shall not unreasonably encumber the premises with his materials."

"PROPERTY CONFINES. The Contractor shall limit the storage of his materials and the operations of his employees as prescribed in Art. 42 of the General Conditions and shall not infringe upon storage and operating space assigned to others. The Contractor has no authority to permit the use of any portion of the premises by anyone, except for business connected with the construction in which this contract is concerned."

"EXCAVATING IN GENERAL. The Contractor shall provide all excavating for basement, areas, etc., all to the various depths required. Hand excavating for pits and footing
trenches is included with foundation work. Excavations shall extend 2' 0" outside of all basement wall planes and to 9" below finished planes of various basement floor levels. Work shall start at one end of the building, as directed by the Superintendent, and shall proceed uniformly to the opposite end, completing as it progresses, so that the first end can be turned over to concrete workers without waiting for entire excavating to be completed. The work shall be so laid out and conducted as to produce no conflict between concrete workers, trench diggers and those working on remaining excavating."

Taking stock of these matters in the order quoted, the superintendent learned that application had been made for a building permit and that a set of prints had been filed with the local building department, that the issuance of a permit in due time was to be expected as a matter of course, but that nothing had been done about water supply or the first progress photograph. He insisted that the contractor give these subjects immediate attention and that he also arrange at once for the requisite telephone service.

The foreman and an assistant were continuing the work of staking out the building, the former making use of a surveying instrument. The contractor satisfied the superintendent that he, the foreman, could qualify as the "competent instrument man" demanded by the specifications. The superintendent later verified this, as well as the accuracy of the instrument and the work done by it.

Meanwhile, a carload of cement had arrived on the tracks, and the contractor was anxious to unload it, to avoid paying demurrage. He asked permission to have it stacked on the shed floor and have it covered with tarpaulins. Reference was made to the specifications, wherein clauses were found pertinent:

"ALL CEMENT, except where otherwise specifically stated, shall be approved Portland, properly tested before using. It shall conform in all particulars to the latest standards and tests of the American Society for Testing Materials. Samples shall be taken as directed. Each car lot shall be stored separately and plainly marked for identification.

"Cement shall be stored in the water- and weather-proof shed, provided by the Contractor (as elsewhere specified), with floor well up from the ground. None may be used that has been exposed to weather nor from bags showing water marks or caking."

The contractor, in view of these restrictions, was directed to leave the cement on the tracks while the shed was rushed to completion. Four samples were taken from the car lot and sent to the architect's office for testing, the brand being one known to be acceptable to him. The manufacture of Portland cement has reached such a degree of standardization and excellence that metropolitan architects and contractors seldom have cause to reject more than an occasional sack that has met with accident. Cement for use in cities is always subject to testing, and hence it is safest and most economical for the manufacturers of this commodity to ship none that might fail to meet requirements. This is not so in rural districts, where most of the cement sold (other than that shipped in car lots for road work or large buildings) is first stored in lumber yards, then distributed in small parcels to local builders who have no desire to test and no convenient facilities for so doing. Such cement should be carefully watched, as it is not unusual for it to fail under test. It may have been originally bought at a bargain because of its inferiority. There is always a chance that a country dealer will try to unload some of it on such work as this school, in a real or pretended emergency, hence the wide awake superintendent will keep an eye on it and should warn both the dealer and contractor that no such old or stored cement is to be used under any circumstances; and it would therefore be expedient for the dealer to make sure that he has enough of the right material on hand at all times.

The location of sheds and the dumping of top soil led to a general discussion of the contractor's yard layout. Together, he and the superintendent evolved a working plan for all temporary storage and facilities, as shown by the plot plan, Fig. 8. The superintendent's interest in this phase of the work has to do only with seeing that provision is made for storage space for minor contractors' materials, and that temporary buildings and heavy materials are not so placed as to be in the way of trenching for sewer and other piping. In this case, the available space was ample for all purposes, but in a more confined location, considerable ingenuity must be exercised in designing a temporary layout of maximum efficiency and in avoiding friction between all contractors demanding accommodation. It will be noted that this contractor arranged to have his sand and gravel dumped on the paving, to avoid the expense of building a floor, as would have been his alternative under the specifications. Materials to be first used from storage piles, such as floor tile and common brick, were piled as close in as possible. Floor tile (for first floor only) would be used before the hoist would be placed in service. Thereafter, brick and wall tile, in limited quantities, could be unloaded close to the hoist.
Larger areas were allotted to items requiring sorting and re-handling, such as lumber, cut stone and reinforcing bars. Temporary drives were combined with the future service driveway to afford maximum communication at minimum distance, inasmuch as these roadways had to be maintained for several months and might be very muddy at times. For this latter reason, the contractor was given permission to start hauling cinders for use as temporary paving for these drives with the understanding that such cinders as were still in fit condition could later be used as underbed for walks and permanent driveway.

In the afternoon of this second day, the contractor suggested a trip to the gravel pit from which he expected to secure both sand and gravel, using the latter "pit-run." In fact, he admitted having gambled on such intent and had reduced his bid several hundred dollars on the chance. Before leaving the premises, the superintendent wrote an order to the contractor to hold his excavating 3 feet higher than shown on drawings, pending arrival of the architect and his decision on the proposed change in the building grade.

The necessary instructions on this subject were passed on to the grading contractor who was also informed as to the proper amount of material to be left on the premises for finished grading. Enough stripping of top soil had been done for the steam shovel to get into action, hence it and the auto trucks were already working to capacity.

En route to the gravel pit, the superintendent consulted his specifications and re-read the paragraphs on the subject of aggregates:

"SAND. Fine aggregate shall consist of sand having hard, durable grains, free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances. It shall be well graded in size up to \( \frac{3}{4} " \)."

"COARSE AGGREGATE shall consist of crushed rock or gravel having clean, hard, strong, durable particles, free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter. It shall be well graded from \( \frac{3}{4} " \) to \( \frac{3}{4} " \) for fine concrete and from \( \frac{3}{4} " \) to \( 2 " \) for mass concrete. If gravel is used, it shall be screened to size and
washed if, in the opinion of the Architect, such treatment is indicated. "Occasional pieces larger than 2" will be permitted in mass concrete, provided that same are entirely embedded in wet concrete and have no surface closer than 6" to outside plane of the mass."

"STORAGE. Sand, stone and gravel shall be deposited only on paving or suitable planking; never on bare ground."

The pit was found to be one long disused and recently re-opened, evidently for this particular work. The stripping had disclosed a good bed of gravel lying between the surface stratum and one of fine sand. Both stand and gravel appeared to be of good quality. The chief difficulty was evidently going to be the task of keeping the fine and coarser aggregates separate and at the same time free from droppings and wash from the overlying earth. This latter, the contractor proposed to effect by using hand excavating for the gravel and following with a steam shovel and a portable sifting plant that would deliver sand of proper fineness. The stripping was to be kept well back from the pit, and proper watersheds maintained to fend off storm water. The superintendent appreciated the contractor's effort to hold down costs and expressed himself as being quite willing to cooperate wherever possible, keeping always within the intent of the contract. If pit-run gravel of suitable character could be delivered at the building site at a cost of about $1.75 a yard, and the sorted material at an additional 50 cents, the contractor would be sufficiently under the local price of $4 a yard for crushed rock to have justified his gamble. The gravel would probably contain too high a percentage of sand, the which could be equalized, as he explained, by the admixture of the indicated amount of coarser material.

It is evident that the superintendent was going out of his way to help the contractor and equally evident that he was running the risk of making later trouble for himself by the necessity of closely watching the ratios of sand and gravel. It would have been much easier and safer for him to have pointed out the advisability of having a washing and grading plant installed before beginning to haul material from the pit, but this would have raised the cost of coarse aggregate to about that of the crushed rock. It is likely that the more cautious course would have been that adopted by the majority of superintendents of experience, but this man was imbued with the idea that, if he would go somewhat out of his way in the matter of cooperating with the contractor at this stage of the work, he would find himself repaid later on; so he tacitly approved the contractor's arrangements and took samples of the sand and gravel and expressed them to the home office.

The two then drove to a brickyard to inspect common brick and partition tile for which contract had been made, subject to approval. They found three grades of each, separately piled,—"kiln-runs," "selects" and "culls." Another grade, termed "standards," was not shown. In this grade, only the very poorest and softest had been culled out. The superintendent was told that the material used by local contractors was generally "kiln-run," but that it was then being culled to comply with his strict specifications. The superintendent gave provisional approval of the selects but cautioned the contractor that such approval was made conditional by this paragraph of the specifications:

"'APPROVAL' AND 'ACCEPTANCE' in these specifications, unless otherwise stated, mean approval and acceptance by the Architect; but no acceptance by the Architect shall bind the Owner in case of proven defective work or other clear violation of the contract; nor will approval of material or equipment before same is brought on the premises be held to constitute acceptance, in case such items are found not to comply with specification."

Three samples showing the range of select common brick were also sent to the express office. The next stop was at the lumber yard, merely, as the contractor explained, "to get acquainted." The fact that the lumber dealer was also a member of the board of education appeared to embarrass him not at all as a purveyor of materials to the school building. Both he and the contractor showed considerable surprise, however, when the superintendent expressed a desire to see the stock of No. 1 white pine lath. They thought he was looking a long way ahead. This was admitted, and the stock of various grades of lath inspected. The best grade showed signs of having been on hand a long time, which was explained by there being but little call for it, contractors generally saving the few dollars per thousand difference in price by ordering the cheaper grades (perhaps claiming that the No. 1 grade was not to be had). The superintendent suggested that such extremity be avoided on the school work by ordering well in advance, which the contractor agreed to do, receiving a further hint to the effect that this architect considered metal lath to be the only adequate substitute for No. 1 white pine.

Inspection of wood lath is always a matter for the close scrutiny of the superintendent, when they are called for. No. 1 white pine lath are generally specified by architects where wood lath are indicated, because of the impression that no other wood can back a good plaster surface quite
so well. Obviously, this grade is only carried in yards where the demand warrants buying full car lots, or where possible, part loads of “mixed” cars. Contractors and supply dealers will seemingly exert themselves more to substitute something else for these lath than to effect any other evasion of a given contract. Usually the lath is not delivered until the lathers are on hand to apply it, and the inspector must then either compromise or delay the work. Hence our introduction of the subject thus early in the procedure.

Many instances could be cited to indicate how far contractors and dealers will go in their endeavors to evade the exactions of a No. 1 white pine lath specification. In one such case, a young clerk-of-the-works was induced to pass a carload of other lath because the No. 1 white pine “was not to be had in that market.” But that market happened to be in the Black Hills, where such lath are a local product, hence the members of the building committee were up in arms when they saw the lath from outside being unloaded, and wired the architect to set the matter right. This he did by dismissing the superintendent and taking advantage of the specification clause which permitted the owner to refuse “accepted” material that was manifestly not up to requirements.

Another instance was that of a bank building being constructed under a “cost-plus” contract. The builder had purchased his lath as part of his lumber hill from a dealer who happened to be a director in the bank. Three months later, when ready for the lath (this was in 1920, when prices were advancing by leaps and bounds), the builder was informed that he would have to use a cheaper grade, as the No. 1 were not to be had for less than $18 per M. To this the builder demurred as he had bought them for $8.50 per M. But the dealer naively contended that he could not be expected to store them indefinitely at the price quoted. So the builder offered to pay storage, but found that the dealer had sold the lath to others at a fat second profit. Later, in the absence of the builder, the dealer told the other directors about the dilemma, omitting to mention that the lath had really been ordered and sold at the lower price. He insisted that he would not cut his prices to favor an “outsider” but, to accommodate his bank, would deliver the lath for $15 per M., if the order were signed then and there, ahead of another threatened rise, which was done. The dealer said nothing further of the matter until the time of final reckoning, when it amused him to divulge the particulars of the deal.

It developed on the school project with which we are dealing that our forehanded superintendent “started something.” An immense amount of gossip anent an outstanding construction opera-
illustrate the points discussed in his daily reports.

The end of the first week recorded five and one half work days of excellent progress. Stripping of top soil had been completed, and the excavating was well under way. A concrete plant was being installed at the upper end of the site, and the carload of cement had been stacked in the nearby shed, which was being covered with 1-ply, hard-surfaced roofing felt. The office building was being similarly completed, and a shed was being erected for the shelter of workmen and their tools; a fourth shed had been decided upon by the contractor, for the use of subcontractors, in preference to permitting them to share the space in his tool shed. Another crew of carpenters was constructing forms of a standard size for use in building the basement walls. Two crews of linemen were running wires for telephone and electric supply. The water main had been tapped, and a 3/4-inch supply was being run on top of the ground to a point near the concrete plant. Several loads of pit-run gravel had been dumped on the paving above the concrete plant, and the delivery of this material was going forward rapidly, but no sand or graded coarse aggregate had come from the pit. A carload of reinforcing bars had been unloaded in the space assigned for their sorting and storage.

Saturday, weather being fair, the excavating machine and dump trucks continued in operation throughout the afternoon, the other trades "knocking off" at noon. When the shovel reached the level where the contractor had been told to stop, 3 feet above that organically intended, the shovel man advanced the claim that he would lose money if his machine could not work continuously. This the superintendent admitted, but pointed out that he was merely working overtime to his own advantage, and that the status of the work at Saturday noon was supposed to be identical with that at the beginning of work on Monday morning, when the architect would be on hand to render a decision. The shovel man thereupon continued as directed without further argument, admitting that the remaining three hours would not make much difference.

Before leaving the site that night, the superintendent saw to it that a small diverting trench for storm water was dug in the sod above the excavation. He also inspected the cement shed and found that the carpenters had left without completing the waterproof covering. In spite of the fine weather, he insisted that the covering be completed. This was attended to personally by the general foreman and carpenter foreman. It was well that they did, for a severe storm of rain and wind occurred on Sunday and continued through-out the night and until Monday noon. On Sunday afternoon the architect was advised by telephone to defer his visit until Tuesday, which he did. Meanwhile, stock was taken of the damage done at the site. Fortunately, it was not serious. The cement shed proved tight, but the diverting ditch had been insufficient for the purpose, and the excavation was a sad mudhole. A controversy arose between the general foreman (his employer being absent) and the excavating contractor as to who should provide a power pump. The excavator claimed he had figured only on excavating,—was not in the pumping business. The foreman contended that the subcontract had been awarded for the excavating as specified, to which the other rejoined that he had bid "on the plans" and hadn't seen the specifications.

Both parties had already learned to respect the judgment of the superintendent, but he insisted that it "wasn't his funeral" and referred them to the specification clause directly applicable:

"SPECIFICATION DIVISIONS. For convenience of reference, this specification is divided into various headings and subheadings, but such divisions do not make the Owner or Architect responsible for the limitations of the contract of any subcontractor, each of which contracts shall be dependent upon its own definite confines, regardless of specification divisions."

Many metropolitan architects omit this clause from their specifications and insist that their divisions do govern the limitations of a contractor's understandings with his "subs," but it is a custom full of inconsistencies and fraught with much danger. In this case, it would have made an issue out of a matter which was merely a cause of argument. To settle it, the superintendent cited the two paragraphs in the specifications applicable. Under "Supplementary General Conditions," he found:

"STORM WATER and water from springs and pipe leaks shall not be allowed to stand in the excavations or basement or other parts of the building, but shall be adequately guarded against by ditching, draining, pumping or other approved means."

And, under "Excavating":

"PUMPING. All parts of the excavations shall be kept free from standing water from any source (as specified under Supplementary General Conditions), for which purpose the Contractor shall provide hand or power pumps of needed capacity until drainage connection to sewer is made available."

(To be continued in the May, 1929 issue of THE ARCHITECTURAL FORUM.)
It's the WATER SUPPLY that writes the Specifications

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*For Hot and Cold Water Lines*
M A R K S t h a t C E R T I F Y —

C R O D O N


The C R O D O N mark is your assurance of dependable CHROMIUM PLATING

In the sense that STERLING typifies solid silver, so CRODON assures solid dependability in Chromium plate.

There are very logical reasons why Architects should be familiar with the CRODON mark... what it means... what it assures... why it warrants their good will:

Chromium plating is an art. It has very distinct standards of quality. Uniformly successful application is a definite goal... on this, the usefulness and dependability of the finished product is proved... its value judged.

This is what CRODON means:

It means the sum-total of long years of intensive pioneering and research work by the Chromium Corporation of America. It means Chromium plate at the fullest stage of its development... applied according to the most rigid specifications... It means that final results are definitely known.

CRODON is the mark of the practical —the seal of achievement... It is your assurance of satisfaction.

Manufacturers of fixtures and fittings who are licensed to use the CRODON Process of Chromium plating and to attach the CRODON tag to their products, are peculiarly representative of the country's most noteworthy designers and producers. A complete list of these licensees will be gladly sent to you on request by our Service Department.

C R O D O N

TRADE MARK REG. U. S. PAT. OFF.
THE CHROME PLATE

Chromium Corporation of America, 120 Broadway, New York City

Branch Offices and Plants: 4645 W. Chicago Ave., Chicago, Ill. — 114 Sansome St., San Francisco — 3125 Perkins Ave., Cleveland, O. — Waterbury, Conn.
Faucets are the vital spots of plumbing

Let Mueller Bronze guard the "vital spots"

Beautiful as the modern bathroom in color is—one danger still lurks, waiting to pounce on the unwary. Unless this same perfection of design and workmanship is matched in the quality of the plumbing fittings—all this other skill and artistry has been wasted.

Mueller plumbing appurtenances in everlasting bronze give lasting, dependable service for the "vital spots."

A Style for Every Need . . . .
Each with Extra-Heavy Bowl . .
The Simple Madden Valve . . . .
And Clow Sure-Scouring Action

There are more than 48 styles and sizes of Clow Madden Automatics. No other closet approaches them for completeness.

All Clow Madden Automatics carry the extra heavy Adamantose bowl—weighing as high as 60 pounds—far heavier and stronger than the average. Moreover, this twice-fired Adamantose ware absorbs no stains, shows no cracks or checks.

The heart of any closet is the valve. The Madden Valve has no weights or contraptions. It can't forget to flush. When the seat is down the closed top tank fills—when the seat raises with the user—the Madden Valve lets loose a cleansing flood of water.

And, because of the well-designed bowl interior, every part from rim to trap receives an equally high pressure flush.

Clow Madden Automatics guard health, guard costs, as no other closet can.

James B. Clow & Sons, 201-299 North Talman Avenue, Chicago

Clow Madden Automatic
Forty-Eight Styles, Heights and Types to Meet Your Requirements
MODERN BUILDINGS DESERVE MODERN FIXTURES OF NICKEL SILVER

Semi-institutional structures such as the new Mutual Benefit Life Insurance Company Building in Newark, N.J., are built to endure for generations. Every detail in their construction must conform to the highest standards of architectural quality. It is significant, therefore, that the builders selected Solid Nickel Silver plumbing fixtures manufactured by Meyer-Sniffen...

Solid Nickel Silver possesses a characteristic hardness that adds to the wear-resistance of valve seats. Its permanent, silver-like lustre compares favorably with the appearance of Pure Nickel and other high Nickel alloys. It is easy to keep clean and spotless even when subjected to severe use.

...The specification of Solid Nickel Silver sanitary equipment is the logical way to insure beauty, permanence and highest quality. For the most modern type buildings, plumbing fixtures of Solid Nickel Silver have no substitute.

"Diamond Metal is the name used by The Meyer-Sniffen Co. to identify its Nickel Alloy used in manufacturing Nickel Silver plumbing fixtures. This is a solid white metal and contains a high percentage of Nickel."
PARIS couturières started it. Women’s scanty attire brings the need for more heat in homes than is comfortable for woolen-clothed men. Isn’t it time we faced this problem?

"Father," said the daughter of a New York architect, "when the house is warm enough for Mother and me, you compare it with an oven. John opens windows. When it is cool enough for you and John, all I can do is wear a fur coat.

"Why can’t there be a heating system that will make an ‘oven’ of the drawing room, and provide the temperature you wish in your library and in John’s room? You ought to know . . . ."

He did know, but had never realized how completely this modern problem is overcome by Hoffman Controlled Heat.

Hoffman Controlled Heat brings comfort to every member of the family. It delivers to each room as much or as little heat as is required, without effect on the temperature of other rooms. In each room, a finger touch commands the radiator to give off full heat, three-quarters heat, half heat, one-quarter heat or none at all. This system automatically adjusts itself to the hour-to-hour need for heat. Only as the call for heat increases does the supply of steam accumulate. There is no waste.

Hoffman Controlled Heat requires only a few ounces of pressure to heat a large home, one pound to heat great buildings, even in zero weather. Owners of buildings, large and small, have kept close check-ups on fuel costs—reported drastic savings.

No matter what standard boiler and radiators you specify, whether the boiler is to be fired by coal, oil or gas, it is a simple matter to add the equipment that makes it Hoffman Controlled Heat. This equipment places automatic controls over boiler and radiators at every necessary point assuring the owner amazingly safe and flexible operation.

This modern system is guaranteed in writing by a long-established, conscientious maker, to operate perfectly for years. Hoffman Specialty Company also offers expert engineering counsel.

This radical time-tested advance in heating methods has aroused the interest of many architects. We shall be glad to mail you without obligation, a copy of our new booklet, describing in detail the operation of Hoffman Controlled Heat. You are cordially invited to write for your copy. Address Hoffman Specialty Company, Inc., Dept. EF-4, Waterbury, Connecticut. You will get it promptly.
A HOME BUYER quickly recognizes the up-to-date character of bathroom equipment, if it provides facilities for washing comfortably in running water. No installation offers this advantage in more efficient form than the Wolff double faucet, shown in detail in the inset below.

The fittings are so accurately made that only a very light pressure of the fingers is necessary to move the side levers. It is easy, therefore, to make a very fine adjustment of the hot and cold supply so as to obtain the exact mixture desired. The waterways are unusually large, assuring an abundant flow.

Little or no explanation is needed to impress a client with the advantages of this installation. The discomfort of using separate hot and cold faucets alternately, one too hot and the other too cold, is an annoyance which everyone wishes to escape.

Another advantage. The space usually occupied by the second faucet can be used for drinking water. Three kinds of water with only two faucets.

This installation is typical of the up-to-date character of the entire Wolff line of plumbing fixtures—brass, enamel and vitreous. The bathtubs, lavatories and closet bowls are made in a variety of attractively matched tints, and the handsome brassware is exceptionally durable, due to the unusually high percentage of copper in its analysis.

The selection of Wolff lavatory trimmings is extremely wide; three examples are shown below. These and all other Wolff "DURO" brass fixtures are obtainable Durochrome or nickel plated, as desired.

Catalog and full particulars on request

WOLFF

SUPERIOR PLUMBING FIXTURES

WOLFF CO. • Established 1855 • General Offices: 2058 W. Fulton Street, CHICAGO • Branches and Distributors in All Principal Cities
Years of public usage mean nothing to Douglas Solid Nickel Silver plumbing fixture fittings. Long after the plating of ordinary fittings has been worn away by constant polishing and after they have become unsightly, you will find Douglas Solid Nickel Silver fittings looking like new. The reason is that Douglas Solid Nickel Silver is an alloy of at least 20% nickel and has the tensile strength of tough bronze. The color is identical with Nickel Plate and is solid all the way through.

When architects specify fittings of this kind they may be assured of the best that can be had and that their selection will reflect credit.

Remember that Douglas Solid Nickel Silver fittings are not plated, that they are carefully machined and that each fitting has been tested under water pressure.

A request will bring you descriptive literature by return mail.

DOUGLAS SOLID NICKEL SILVER FITTINGS

-Stand-the Test of Time

Burcombe County Court House, Asheville, N. C.
Millburn-Heister, Washington, D. C.
Architects
Sluder Bros., Asheville, N. C.
 Plumbers

DOUGLAS

Plumbing Fixtures

THE JOHN DOUGLAS COMPANY

CINCINNATI, OHIO
Colored fixtures rent apartments

EASIER rentability—that, according to accumulating evidence, is the immediate result of the installation of Kohler colored fixtures in apartments. The new beauty of these fixtures stimulates spoken advertising that travels fast and far.

In the El Tovar apartments, Detroit, more than 90 per cent of the apartments were rented before the building was completed. Mr. Jacob P. Sumeracki, president of the Michigan Land & Home Corporation, the owners, gives much of the credit to the Kohler colored fixtures, which, he says, "have a strong appeal, resulting in quicker rentals."

**Moderate Extra Cost**
The use of these fixtures brings such a handsome advertising return that even a considerable extra cost would be more than offset. As a matter of fact, however, the added cost is very reasonable and represents only a minor addition to the cost of the complete bathroom.

Kohler colored fixtures are made in patterns covering such a wide price range that they may be included in the plans for almost any apartment, hotel, or private dwelling. This is true of kitchens and laundries as well as bathrooms. Many architects are developing the kitchen as an especially attractive room by the use of Kohler sinks in color.

**Seven Colors and White**
With seven colors to choose from the architect has free scope for his creative ability. The Kohler colors are noted for their delicacy, so they lend themselves perfectly to the designing of rooms of taste and refinement.

All Kohler fixtures—both vitreous china and enameled ware—are made in one place under admirable conditions of product-control, so the color harmony of a Kohler installation is assured. Kohler brass fittings add the finishing touch of quality to such an installation.

You are invited to visit a Kohler display room and study at your leisure the possibilities of this distinguished ware... May we send you the new Kohler book offered in the coupon below?

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Please mail this coupon to
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Youth insurance for bathrooms

POLISH.
SHINE.
RUB. And the more elbow-grease goes into keeping ordinary bathroom fixtures shiny, the sooner they go into a decline and begin to show their age.

Not so with the brilliantly beautiful new Speakman fixtures in chromium plate. The finish never wears through. They need absolutely no polishing. They never tarnish. They will be just as young and brilliant in 1939 as they are today. Home owners can be proud of the beauty they give their bathrooms for a long lifetime.

May we suggest that you look into the virtues of the Speakman Artline family—for showers, lavatories, bathtubs and kitchen sinks? They have been called the most beautiful fixtures made today. They are a triumph of graceful design, delicate yet rugged construction, and admirable artistry.

SPEAKMAN COMPANY
Wilmington, Del.
This is just a golf ball. It has nestled in sand traps and plopped into water hazards. As far as we are concerned, there is just one significant thing about it—its diameter.

Here we have an ordinary water closet. Every day its like go into homes and buildings by the hundreds. This closet will pass government health requirements.

But observe what happens when the golf ball is flushed through the trapway of this water closet. Either it sticks in the trap and stops up the closet, or else it goes through with scarcely a hair’s breadth to spare.

Now see what happens when the golf ball is flushed through Maddock’s nationally known toilet, the Improved Madera. It comes through with space to spare. It could rattle around in the trapway like an egg in a tea cup. Is this significant?—emphatically yes!

One of the most important functions of today’s toilet is to dispose safely of modern sanitary pads. The toilet whose trapway is so small as to scarcely pass a golf ball is obviously unsuited for the purpose, and is almost certain to give trouble.

The Improved Madera, with its powerful, quiet flushing and oversize trapway, will dispose quickly, safely of sanitary pads. Judge for yourself whether or not this is of importance to the woman of refinement!*

To this outstanding superiority, add: a long soil-proof seat with large opening, complete water coverage below seat opening, the finest fittings, dazzling Durock surface. Thomas Maddock’s Sons Co., Trenton, N. J.

*For homes or buildings in which the sanitary pad is not a problem, Maddock offers the Madbrook, with long bowl and seat, large water area. Also the dependable Maderno.
The handsome appearance of this tasteful 1929 design harmonizes admirably with the new Art Line and Colonial Style fixtures now being sold by leading manufacturers.

THE IMPERIAL BRASS MANUFACTURING COMPANY
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Sales Representatives in All Principal Cities

THE CUTLER MAIL CHUTE
In its perfected form is the outcome of long experience, and is designed to meet the requirements of public use under Postoffice Regulation. It is simple and substantial in design and construction, durable in finish, and has an Architectural quality which is appreciated and much commended by Architects.

Full information, details, and specifications on request.

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GENERAL OFFICES AND FACTORY
ROCHESTER, N. Y.

MINERAL WOOL
The Perfect Insulator

for Year Round Protection

Prospective home owners can greatly reduce the upkeep of their homes and add untold comfort by insisting that they be properly insulated. Mineral Wool, placed in the walls, floors and rafters of a building, will keep it many degrees warmer in Winter and cooler in Summer, in addition to making it thoroughly sound proof. Its first cost is its last cost—and this is quickly offset by the saving it effects in Winter fuel. Mineral Wool is a sanitary, indestructible, entirely mineral material, easy to apply and low in cost. We will gladly send you a free sample of Mineral Wool and our illustrated booklet upon request.

U. S. MINERAL WOOL CO.
280 Madison Avenue, New York
Western Connection: COLUMBIA MINERAL WOOL CO., South Milwaukee, Wis.
The Improved

Quiet

SI-WEL-CLO

Not Only Sanitary

but Hygienic

The Si-wel-clo, like all Te-pe-co closets, has always embodied the latest advances of sanitary engineering. The quietness of its operation has always been an acceptable attribute of this closet de luxe.

The Improved Si-wel-clo is unquestionably the greatest advance in water closet construction of recent years. It is the most comfortable, hygienic, sanitary and quiet closet that has ever been devised. The decided dip in the rim elevates the front and rear of the bowl opening, minimizing the possibility of soiling.

The Si-wel-clo is typical of the entire line of Te-pe-co All-Clay Plumbing Fixtures—closets, baths, lavatories, etc.—sanitary, durable and of irreproachable distinction.

Folders describing this closet combination in detail will be forwarded on request.

The TRENTON POTTERIES COMPANY

TRENTON, NEW JERSEY, U. S. A.
National Showroom—New York City
101 Park Ave., Entrance on 41st St.
Branch Offices: Boston, Philadelphia, Chicago
Export Office: 115 Broad Street, New York City

Our Guarantee

We, of The Trenton Potteries Company, make but one grade of ware—the best that we can produce—and sell it at reasonable prices. We sell no seconds or culls. Our ware is guaranteed to be equal in quality and durability to any sanitary ware made in the world. The Te-pe-co Trade Mark is found on all goods manufactured by this company and is your guarantee that you have received what you paid for.

TE-PE-CO

ALL-CLAY PLUMBING FIXTURES
Ammonia or carbon dioxide gas, escaping from leaky joints in theater refrigeration systems, may give audiences a thrill they don’t want—may start a panic that proves disastrous. Such conditions are unknown where Reading 5-Point Pipe is used, because the better threading of Reading Pipe means joints that stay tight permanently.

Made of Genuine Puddled Wrought Iron, Reading 5-Point Pipe gives you all five of the qualities you need to insure complete dependability. It gives you these qualities in a measure not known to any other single pipe material! Properly bent, Reading 5-Point Pipe can be installed wherever you are using ordinary pipe.

Genuine Puddled Wrought Iron—made by puddling together pure pig iron and silicious slag in the furnace—is the only wrought iron that has stood the test of time. We protect you from substitutes by placing the Reading name, date of manufacture and cut-in spiral knurl on every length of Reading 5-Point Pipe.

READING IRON COMPANY, Reading, Pennsylvania
Atlanta Baltimore Cleveland New York Philadelphia
Boston Cincinnati St. Louis Chicago New Orleans
Buffalo Houston Tulsa Seattle San Francisco
Detroit Pittsburgh Ft. Worth Los Angeles
Use This Free Sarco Engineering Service

The above reproduction of a blue print is a typical example of the service the Sarco Engineering Department is constantly rendering the trade. It shows an installation of the Sarco Return Trap and Vent Valve which assures a steady water line and prevents cracked boilers. This manner of connecting Vent Valve and Return Trap guarantees the ready return of water to boiler and assures proper venting of air from the system. The design of the Vent Valve prevents air from entering system while operating below atmospheric pressures.

Our Engineering Department will send you a free copy of this blue print with full particulars upon request or will be glad to supply you with FREE details showing other SARCO methods of handling heating problems. Write for them today.

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183 Madison Ave., New York, N. Y.

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Without charge or obligation, please send the following:
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FOR BETTER HOT WATER CIRCULATION

On hundreds of successful installations the HYDROLATOR has definitely proven its ability to circulate hot water at greatly increased speed. Overcomes practically all forms of sluggish circulation. Write for Bulletin 828-H showing the various uses to which architects and engineers may put this device.

JANETTE MANUFACTURING COMPANY, Dept. A4
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DEALER CORRESPONDENCE INVITED

FAMOUS USERS OF KEWANEE HIGH PRESSURE WATER SYSTEMS

DEL-MONTE

MORE proof that only a Kewanee will do. Back in 1919, the California Packing Company, Merced, California, packers of famous Del-Monte Brand food, installed a Kewanee High Pressure System at their Mt. Eden factory. Since then two other High Pressure units have been installed in other parts of their factory. Today—all are "going fine."

From modest bungalow to large estate there is a Kewanee High Pressure System to suit every need. Over 200 models of High Pressure water supply, electric light and sewage disposal plants are made by Kewanee. Also a full line of Centrifugal Pumps and Deep Well Turbines from the small $69.50 outfit to those which fit wells from 12" to 36" in diameter.

Kewanee will show you how to save dollars and trouble. Write for data.

KEWANEE PRIVATE UTILITIES COMPANY
442 S. Franklin Street Kewanee, Illinois

There is Only One HYDROLATOR
"W"hy do we have to look at the installation cost rather than the pipe cost?"

"Because freight, labor, fittings, and overhead, are all necessary elements in the cost of a pipe system. They are not lessened by using cheap pipe. Some of them, on the contrary, may be increased.

"Replacements are usually more expensive than new work. Freight, hauling, and overhead enter, just as they did in the first place. Labor often is doubled and trebled. And besides that, walls, floors and partitions may have to be torn out, and repaired after the job is finished. Carpenters, plasterers, painters, and decorators have to be reckoned with, as well as pipe fitters.

"In a factory, if some of these troubles are absent, there are others equally severe. Difficulty in getting at leaky pipes, overtime charges, interrupted operation, idle time of machines and men, delayed production—these are common experiences. Pipe failures are extremely costly."

"But the whole system would not fail all at once!"

"True, it would not go to pieces all at once, like the 'one hoss Shay'. But whether all at once, or little by little, when pipes break down they have to be replaced, and it certainly doesn't cost any less to do a thing piecemeal than all at one time. We are discussing, not the exceptional utter collapse, but the usual, disheartening expense of continual replacements when short-lived pipe is used."

***

Thorough studies have been made, covering the experience of many pipe users, in different places, through a long term of years. A Byers bulletin on the Installation Cost of Pipe gives facts and figures. Send for a copy.

A. M. BYERS COMPANY
Established 1864
Pittsburgh, Pa.
The treads of such stairway installations must combine durability and an abrasive surface-grip with pleasing appearance and comfortable use. Those of Alberene Stone qualify with a plus rating on each of the four counts.

A special quarry-selected hard stone is used. It has the workability which characterizes soapstone, and a hardness and abrasive content which give it definite advantages.

Tiles of the same character, either of regular dimension or ashlar pattern laid are admirable for hallways and landings.

The Company’s new brochure, Architectural Alberene, has a series of illustrations which are full of practical suggestions.

ALBERENE STONE COMPANY
153 West 23rd Street, New York City
Branch Offices—BOSTON, CHICAGO, PHILADELPHIA, NEWARK, N.J., PITTSBURGH, CLEVELAND, RICHMOND
Quarries and Mills at Schuyler, Va.
The New York Municipal Building exemplifies the art, craftsmanship, and excellent materials that went into its construction... Among which was rust-resisting ARMCO Ingot Iron, used in the form of Herringbone Metal Lath. Architects: McKim, Mead, and White.

Design Freely... and know it will conform

WITH pure ARMCO Ingot Iron as the sheet metal to be used, you can design the most complex motifs... with the satisfaction of knowing that every line can be faithfully reproduced.

ARMCO Ingot Iron is made pure to endure. Yet from this same purity comes remarkable ductility; the ductility that enables you to trust your designs to a competent sheet metal craftsman with the assurance that they will be reproduced faithfully.

From simple gutter to ornate cornice or marquise, there is a gratifying measure of beauty and protection when you specify ARMCO Ingot Iron.

If you have a sheet metal problem, our Development Engineers can tell you just what you can achieve with ARMCO Ingot Iron. Ask the office nearest you for this cooperation. There is no obligation.

THE AMERICAN ROLLING MILL COMPANY
Executive Offices, Middletown, Ohio
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The First Church of Christ Scientist, Atlanta, Georgia, is a typical example of the adaptability of ARMCO Ingot Iron for architectural sheet metal construction. This pure iron expresses freely the artistic cornice design of Architects Robinson and Dougherty, while its durability has protected their specification for 16 years without repair or replacement. The dome is also covered with rust-resisting ARMCO Ingot Iron, installed in 1913.
HOFFMAN MOTO-HEATERS...

Hoffman Moto-Heaters are an improved type of unit heaters, scientifically designed and made in accordance with the highest engineering standards.

Architects and heating engineers will find in Hoffman Moto-Heaters a product that insures maximum efficiency at lowest cost per B. T. U.

Hoffman Moto-Heaters can be specified with the assurance that they will fully measure up to rated capacities and will give years of satisfactory service without leakage or other mechanical troubles.

Made in both suspended and floor mounted styles, in a complete range of sizes for all industrial and commercial heating requirements.

Every heater tested at 1,000 pounds hydrostatic pressure and guaranteed for 200 pounds operating pressure. Furnished with Super-Fin heating surface. Copper tubes are united to header by fusion of metal, to prevent danger of leakage.

HOFFMAN HEATING SPECIALTIES FOR ALL TYPES OF STEAM INSTALLATIONS

The addition of these two new products marks another forward step in making the Hoffman line more complete. In Hoffman Valves, Hoffman Controlled Heat Equipment, Hoffman Moto-Heaters and Hoffman-Economy Pumps, architects and heating engineers are now offered a reliable line of heating specialties for residences and all types of commercial and industrial buildings. The selection of complete Hoffman equipment simplifies specifications, insures complete engineering counsel and avoids divided responsibility.
HOFFMAN-ECONOMY PUMPS

Condensation Pumps — Compactly designed and sturdily constructed, Hoffman-Economy Condensation Pumps meet every requirement of efficiency and dependability. Mounted on heavy cast iron base and driven by a powerful motor of standard make and size. Removable cover gives access to all working parts without breaking pipe connections.

Vacuum Pumps — The Hoffman-Economy Vacuum Pump is a highly efficient and reliable unit for the rapid removal of air and condensate from heating systems. Vacuum producer is of the jet type—the simplest and best known method. No close clearances on pump; no danger of water overflowing to floor in event of electrical failure. Pump operates efficiently even in handling very hot water, and can "pull" high vacuum. There is a Hoffman-Economy Pump for every type of heating job.

Send Coupon for New Catalogues
Catalogues and engineering data on Hoffman Moto-Heaters and Hoffman-Economy Pumps will gladly be sent upon request. Fill out attached coupon and mail today.

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Please send catalogue on

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destructive to property and dangerous to life, are handled in acid-proof Duriron fans as safely as pure air is in fans of other materials.

Duriron fans exhaust efficiently fumes from chemical laboratories and corrosive processes in any volume up to 5000 cubic feet per minute.

Bulletin No. 140-B (A. I. A. File No. 30dl) should be in your files. Write for it.

THE DURIRON COMPANY,
DAYTON, OHIO
Another Monel Metal Installation

Modern as tomorrow

The world-wide reputation of the Battle Creek Sanitarium is at the same time a benefit and an obligation. It is a benefit because it draws patients from the four quarters of the globe. It is an obligation because an institution with such a reputation must employ only the finest and most modern equipment.

It is natural, therefore, that the major departments of the Battle Creek Sanitarium should be Monel Metal equipped.

Monel Metal is the preferred material among modern hospitals. It has received the endorsement of hospital executives because it offers a combination of properties available in no other material—it is rust-proof, corrosion-resistant, durable. It has no coating to chip, crack or wear off. Its beautiful, silvery lustre is permanent.

In advising hospitals regarding their equipment requirements, you are absolutely safe in recommending Monel Metal. Its dependable high quality has been demonstrated by its many years of economical service in well-known institutions.

Send for architectural folders on hospitals

See our exhibit at the Architectural and Allied Arts Exposition, Grand Central Palace, New York City, April 15th to 27th.

Monel Metal

The International Nickel Company, Inc.

67 Wall Street, New York N. Y.
Insured Forever
Against Cracks
Spalls or Breaks

COWING
Pressure Relieving
JOINT
Patented Sept. 1, 1925

Facades of height, plain or ornamented, need positive insurance against cracks or spalls.

The COWING PRESSURE RELIEVING JOINT is giving such protection to many world famous buildings.

This neat and eternal joint zones a building into story heights. It delivers exact and automatic compensation for all destructive stresses thrown on the facing material by temperature changes, compression of steel and imposed loads.

It saves the mortar joints and eliminates frequent tuck pointing—it will not squeeze out—it lasts as long as the building.

Write for our illustrated booklet.

The Mather Tower
Herbert H. Riddle, architect
Lieberman and Hein, Engineers
Cowling Pressure Relieving Joint Co.
160 N. Wells St. - Chicago, Ill.

WEILPUMPS
A COMPLETE LINE
For every building requirement


WEIL PUMP COMPANY
Manufacturers of Better Centrifugal Pumps
215-17 W. SUPERIOR ST., CHICAGO
PHONE: SUPERIOR 9815
It has been said that in many instances, “An institution is but the lengthened shadow of one man”. So with today’s building wonders... they are shadows of great men’s ideals... shadows of the age... today’s age... a combination of beauty and efficiency. Famed architects and engineers, fully anticipating future needs... plan to the most minute detail the mechanical parts, blending the practical with their ideals of beauty and efficient design. Thus, each part of the equipment of today’s structure, each part of the shadow, is a reflection of masters of their craft. Specifications are rigid... inspections are critical... materials are selected for worth, for reputation, for dependability.

The American Insurance Union Citadel, Columbus, Ohio, pictured above, joins the shadows of the age—fully prepared to meet the service demands of many years to come.

When the tubular material was decided upon for this fine structure, the specification for the major pipe tonnage read “NATIONAL”—America’s Standard Wrought Pipe (Butt-weld sizes 3/4 to 3-inch, made Scale Free)
PERMANENCE IN PUBLIC BUILDINGS

The average building is a municipal monument. It is constructed to serve several generations. Materials very properly are chosen with an eye to permanence as well as beauty.

It is significant that many important public structures contain United Hollow Metal Doors and Trim. The Civil Courts Building, of St. Louis is a recent case in point. Not only will the efficient United Elevator Enclosures in the building be serving faithfully a generation from now, but their beauty will be unmarred by time. Should fire ever come, they will protect the shaft openings against its spread.

Write for complete information on United Hollow Metal construction. It is comprehensive and complete.

THE UNITED METAL PRODUCTS CO.
CANTON, OHIO
OFFICES IN ALL PRINCIPAL CITIES

"Hotel Planning and Outfitting"

EDITED BY
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NO WELDS IN STRESS—one piece of steel—expanded—without rivets, bolts or welds in shear or tension—these are the features responsible for the rapid gain in Bates-Truss Joist popularity.

A simple I-beam section is expanded into a lattice truss web. The expansion increases the depth of the beam—the truss materially increases its strength. The points of contact of the lacing and flange members are simply unsheared portions of the original plain web. By this process, all defective beams are automatically eliminated.

Contractors, engineers, builders should all know about the Bates Expanded Steel Truss. We have prepared a book giving complete information. A copy will be mailed to you upon request.

Bates Expanded Steel Truss Co.
Graceful Interiors... the result of beautiful walls achieved with STAY-RIB.... A MILCOR PRODUCT

Graceful interiors are among the loveliest charms of today's homes. And the architect plays an artist's part in achieving them. For beautiful walls are commonly a matter of construction.

Decorative interiors require a wall and ceiling construction that will last the life of the building without cracking. STAY-RIB metal lath assures this permanence.

The modern architect completes the interior ensemble with Milcor Expansion Metal Casings for door and window openings, and with Milcor Expansion Corner Beads for exposed corners and inside angles.

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MILWAUKEE CORRUGATING COMPANY, Milwaukee, Wisconsin

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Steel Buck for enhancing interior beauty,
we will mail it to you. Write us.

KALMAN STEEL COMPANY
The beautiful Sir Francis Drake Hotel in San Francisco is indeed an honor to the famed navigator of the sixteenth century for whom it is named. Carnegie Steel Company is also honored that Carnegie Beams were selected to form the steel framework. From coast to coast, architects, engineers and builders have enthusiastically welcomed these new sections and their contribution to steel construction.

In garages, factories, bridges, subways, schools, churches, apartments, hotels and great towering skyscrapers, Carnegie Beams are imparting to structural steel a new efficiency. Their parallel flanges simplify fabrication and erection. Their great strength permits the use of lighter sections, resulting in considerable economy in steel tonnage. Their constant-depth columns present opportunities for substantial savings, both in the drafting room and on the job.

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"These Oil Burners paid for themselves" ~ ~

Vick's Chemical Company gets "perfect satisfaction" with Johnson automatic oil burning equipment.

A high standard of efficiency has been set at the Philadelphia plant of the Vick Chemical Company, where exacting temperature control is essential in the manufacture of Vick's VapoRub. The superintendent of this factory writes:

"We have used the equipment for about two years with perfect satisfaction, during which time the saving in fuel and labor alone has been more than enough to pay for our two installations, aside from eliminating all the dust and also the storage space for coal."

There is no longer any necessity for boiler room extravagance. Heat supplied by Johnson Oil Burners is efficient because there is no waste in banking fires; no unburned fuel to fall into the ash box. Fuel is burned only when heat is needed. Labor costs are reduced because one man can easily take care of an entire battery of boilers. Ash removal expense is entirely eliminated.

For Every Heating and Power Purpose

In homes, large buildings, factories and industrial plants Johnson oil burning equipment is receiving enthusiastic endorsement from coast to coast. Johnson Rotary Burners, with either manual, semi-automatic or full automatic control, are made in three styles and six sizes—giving a range of from 250 to 27,800 square feet of steam radiation or the equivalent. We also manufacture natural draft, whirlwind, low pressure air and steam atomizing oil burners; also electric and steam driven oil pumping and preheating equipment.

And each product, fully guaranteed, is the result of more than 23 years experience in the exclusive manufacture of oil burning equipment. Our Engineering Department will be glad to help you in the solution of your heating or power problems.

Separately Bound Copies of our Catalogue in Sweet's for drafting room use will be mailed on request.

Awarded Gold Medal, Sesqui-Centennial Exposition, Philadelphia, 1926, for "Excellence of workmanship and completeness of design"
Setting a good example of "Life Insurance"... .

The Traveler's Insurance Building in Hartford provides ideal indoor working conditions—because it has an ideal system of ventilation. Good ventilation is life insurance—without premiums! The "Traveler's" sets a good example.

In this beautiful building the health of outdoors is brought to the indoor worker. 385,333 cubic feet—over 14 tons—of outdoor air is circulated every minute... air that has been filtered clean... controlled air... warmed to precise temperatures.

Twelve Sturtevant "Silentvane" Fans are used... five "blowers" and seven "exhausters"—with capacities from 9,800 to 52,000 C.F.M.

Sturtevant Ventilating Equipment has enjoyed the endorsement of architects and engineers for many of the most outstanding building achievements.

Plants at: Berkeley, Cal.—Camden, N. J.—Framingham, Mass.—Galt, Ontario Hyde Park, Mass.—Sturtevant, Wis. Offices in Principal Cities

Sturtevant
HEATING-VENTILATING AND
POWER PLANT EQUIPMENT
New aid to help you make
the modern small home perfect

Just announced—ready for delivery May 1st—is this newest member of the Spencer family.

It is the smallest of all Spencers, designed and made as a result of a steady and increasing demand for a heater that would supply the luxury of low cost steam, vapor or hot water heat to homes that now use less efficient heating systems; and those are the small homes of America.

This new beauty that dots our towns and suburbs flows from the architect's pen. The small home of today is modern in conception, beautiful in design, and as practical as skill and art can make it. One thing has been lacking to make these new small homes perfect—and that was modern heat at low cost.

Now comes this newest Spencer Heater to add that last practical touch which your small homes need to make them perfect. Like all Spencers, this newest heater is made with the Magazine Feed first introduced by Spencer, and with the Gable-Grate that is sloped to let fire burn up-hill. Now your clients—those who buy and build the small homes you design—may have automatic steam or hot water heat at a maintenance cost even lower than the heating systems of the past.

All Spencer Heaters burn the small size fuels that are so low in cost, such as No. 1 Buckwheat anthracite, coke, semi-bituminous and graded bituminous coal. For even the smallest home, this new Spencer Heater will provide steam heat in a guaranteed amount at the lowest possible cost for fuel.

Spencer Heaters, as you no doubt know, are made both in cast iron sectional and steel tubular types for homes and buildings of any size or character. Write for illustrations, specifications and guaranteed ratings. Spencer Heater Company, Williamsport, Pa.
Now that the Cost of clean Air has been brought so low the Use of forced Air Ventilation without Filtration is economic WASTE!

There was a time—only a few years ago—when filtered air for building ventilation was considered impractical because of its cost. Then came the manually cleaned unit filters, first introduced by Midwest, showing definite savings in redecoration and maintenance as applied to buildings of the finer sort.

Following this came the automatic, self-cleaning filters and a swiftly expanding field of application.

But it remained for Midwest and the discovery of "Controlled Air Flow" to make filtered air available to all types of buildings using forced air ventilation. Today filtered air represents the last word in heating and ventilating progress and is as much a part of our modern civilization as filtered water and refrigerated foods.

Midwest Model 8V

Midwest Air Filters
BRADFORD, PA.

Office in Principal Cities

Man learned to keep impurity from the water he drinks

Man learned to keep impurity from the food he eats

Man learned to conduct heat from one place to another
THE success of a fireplace is not all architectural. The method of construction is of vital importance. The illustration is the second of a series of interesting European fireplaces.

The H.W. COVERT COMPANY, 243 E. 44th St., N.Y.
Quiet operation is vital in every ventilating system... long life always pays dividends... The Sirocco Fan, as improved and refined over a period of thirty years, has always been built on the slow speed principle. It delivers more air per revolution than any other type fan of the same size. In addition to quiet operation, slow speed means freedom from vibration, long life and dependable operation. Complete catalog and technical data may be obtained from any American Blower Branch Office... without obligation.

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO CO., LIMITED, WINDSOR, ONT.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

American Blower

VENTILATING; HEATING; AIR CONDITIONING; DRYING; MECHANICAL DRAFT
MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881
—nor can you justly discourage him on the ground of the old-fashioned "experimental period." For underlying the style element in the arrangement of rooms is a modern heating principle which makes Trane concealed heating a genuine engineering achievement. With this equipment, the owner obtains a heating efficiency and a flexibility of control never possible before.

These advantages were inherent in the design of the original Trane Concealed Heater. Today the latest Under-Window model also arouses the enthusiasm of the trade as a practical heating unit for universal application. Contractors wanted a complete unit, with nothing extra to buy. Here they have it! Here is a one-man installation, from unloading the truck to screwing on the front panel. And the entire front panel comes off at the turn of a few screws, so they can have access to "the works" at any time.

You can look to Trane for the same progressive leadership in concealed heating which has built the reputation of Trane Heating Specialties and other Trane products. The same sort of practical, common-sense improvements have recently been made in the Trane Bellows Packless Valve. Tension arrangement to hold valve in position, regardless of vibration—non-rising stem—interchangeable wheel and lever handle—improved appearance—guide to relieve strain on the bellows when opening or closing. Before you recommend any part of a heating system except the boiler and piping, investigate Trane's recent developments.
Designed to give permanent satisfaction—

— and it does!

Hardinge installations, whether large or small, domestic or industrial, give perfect service and satisfaction year after year.

Precision-built in two distinct models — both Domestic and Industrial — in 9 different sizes and combinations, enable specific treatment for any heating problem.

Dependable, economical, quiet, carefree — you can safely specify Hardinge Fuel Oil Heat for any building "from bungalow to skyscraper."

HARDINGE FUEL OIL HEAT

Hardinge Brothers, Inc.
Manufacturers of Precision-Built Machines for 38 Years

FACTORY BRANCH:
CHICAGO
Michigan Ave., at Ohio St.

Factory and General Offices:
4149 Ravenswood Avenue
CHICAGO

FACTORY BRANCH:
BOSTON
843 Beacon Street
These *Extras* Eliminated
If Original Equipment Had Been

**ROBRAS 20-20** THROUGHOUT

In each of these New York apartments, ROBRAS 20-20 Radiators were concealed in the walls of the principal rooms. In less important rooms old-fashioned radiators were used, under the mistaken impression that they might bring about possible economies.

The error of this conclusion was discovered as soon as the apartments were sold or rented. Practically all of the new owners or lessees *demanded* ROBRAS 20-20 Radiators, out-of-sight, and out-of-the-way, in the balance of their rooms.

You can well imagine the trouble and extra cost this entailed. If ROBRAS 20-20’s had been installed throughout originally, both owners and tenants would have been saved the expense and exasperation of changing the existing radiators.

Again, suppose a case where tenants, educated to ROBRAS 20-20 Radiators, discovered the old-fashioned radiators throughout. Think of the complication entailed in changing the existing radiators on the *entire* job!

The safest course today is, at the start, to install ROBRAS 20-20 Radiators in-the-wall, out-of-sight and out-of-the way. Then every one is satisfied.

**ROME BRASS RADIATOR CORPORATION**

**ONE EAST FORTY-SECOND STREET**

**NEW YORK CITY**
When your clients ask about OIL HEAT

Architects, contractors and heating engineers who recommend Williams Oil Heat are assured of having their judgment endorsed by homeowners as sound and wise.

Williams Oil-O-Matic heats more homes than any other oil burner—more than 80,000 owners give Williams Oil-O-Matic their whole-hearted approval. They know the efficiency of Oil-O-Matic from practical experience.

Entirely Automatic—Thoroughly Dependable

Efficient—unusually quiet—entirely automatic—thoroughly dependable and thrifty in the use of its economy fuel, Williams Oil-O-Matic is the master of all domestic heating problems. Controlled by a reliable thermostat that maintains precise temperatures, Oil-O-Matic gives even, healthful warmth. Readily installed in any heating system.

For small homes and bungalows, Williams Dist-O-Matic gives the same dependable, healthful warmth as Oil-O-Matic for larger homes. Williams Dist-O-Matic is easy to buy and economical to operate in any heating system, whether hot water, warm air or steam.

Your clients may buy any Williams product on easy payment plans. Have you our Oil-O-Matic Architects Manual on file in your office? Write for it today—it will be sent without charge.
THE Wall Cabinet Heater—built only by Modine—conforms to the most exacting demands of modern room decoration, but its cost makes it the most economical installation where utility is the prime consideration.

Because of the inclined position of its enclosed copper radiator, it extends only a few inches from the wall and is particularly desirable where space economy is necessary. It is the ideal radiation for smart shops, department stores, offices, hospitals, apartments and homes.

Complete information on Modine Cabinet Heaters and Modine Wall Type Cabinet Heaters will be sent on request.

MODINE MANUFACTURING COMPANY
1718 Racine Street
RACINE, WISCONSIN

Originators of COPPER RADIATION

Manufacturers of MODINE UNIT HEATERS
a Rockefeller Foundation contribution to the University of Chicago, which realizes the original intention of including for this institution a building devoted solely to religion and its exercises.

In 1918, Mr. Bertram Grosvenor Goodhue of New York was commissioned as the architect to design the Chapel. Mr. Goodhue's design for the Chapel placed the tower over the crossing, and after his death in April 1924 before any construction had been started, the University conferred with the Bertram Grosvenor Goodhue Associates, the firm who had undertaken to carry on and complete Mr. Goodhue's work.

The building as built is from the drawings of the Bertram Grosvenor Goodhue Associates which they consider as a modification of Mr. Goodhue's original conception; the tower being entirely redesigned and placed over the transept, and the front elevation and divisioning of windows being considerably modified.

All of the craftsmanship in this building, including the Skinner organ, is of American artisanship, and breathes the spirit of the craftsmanship of the Old World.

The design of the Chapel displays the progressive spirit of the architects—the Bertram Grosvenor Goodhue Associates—imbued with the spirit of the master—Bertram G. Goodhue—and portrays in New World fashion, the Gothic tradition of the Old World.

Visitors are permitted each day to enter and view the imposing interior; likewise at services on Sunday and evenings during the week when it is especially impressing and soul inspiring.

A monument indeed to endowment kindness, and the consummate of church thought and architecture . . . . .

JOHNSON SERVICE CO., MILWAUKEE, WIS.
The design of every building is influenced by FUEL...

... Even the basement plan cannot be completed until the fuel to be used in the building is determined.

If it is Coal—You know what to figure on—receiving the coal, storing the coal, moving the coal to the heating plant, removing the ashes, disposing of the ashes.

If it is Gas—There is nothing to do but to bring a pipe into the Basement from the gas main— but the cost is high.

If it is Oil—The basement plant is much the same as when gas is used. You do not have to provide space for coal and ashes activities. A tank, either in the basement, or underground, outside the building contains the fuel supply.

Architects’ Manual on Automatic Oil Burners

The use of this manual as a guide makes the preparation of the heating plans and heating specifications a simple task.

Installation and Maintenance

The May Oil Burner, the tank, and all necessary pipes and automatic controls are installed by authorized May Oil Burner Corporation dealers.

Here is the certificate which we present to each individual who has successfully completed a course of instruction in the production laboratories of the May Oil Burner Corporation, at Baltimore, Maryland.

This 68-page manual of information for architects on Oil Burners contains text matter, floor plans, sections, and photographs, as well as the complete regulations of the National Board of Fire Underwriters for the installation of Oil Burner equipments.

MAY OIL BURNER CORPORATION
3500 E. BIDDLE ST., BALTIMORE, MD.
The majority of modern hotels, hospitals, clubs, restaurants, cafeterias, lunch rooms, etc., possess a highly efficient kitchen equipment, the latest in scientific methods of cooking apparatus, which is first in sanitation, neat in its appearance, efficient and satisfactory in operation. The Firebrand Kitchen Equipment Company of Chicago has manufactured a gas steamer which produces amazing new cooking results, improved flavor, tenderer food, with less food waste and less gas consumption. Keenly, it is one of the finest steamers on the market. It quickly saves its cost in fuel economy, and is supreme in cooking quality. This catalog issued by the Firebrand Kitchen Equipment Company fully illustrates Firebrand standardized kitchen equipment, such as, coffee urn, steam tables, urn stands, dish warmers, work tables, coolers, dish tables,—in other words, a fine line of all cafeteria, lunch room, restaurant and hotel equipment.

MACOSTIC ENGINEERING CO., Cleveland, "Macoustic Sound Control," Dependable data on acoustics.

Good acoustics, providing clear and distinct hearing in every section of an interior, is of prime importance. The modern theater, with its large spans, high ceilings, distant reflecting surfaces, extensive use of hard plaster ornamentation, live orchestra, powerful organs and varied programs demands a positive and uniform degree of good hearing under all audience conditions. Many interiors of modern office buildings are acoustically treated, at great expense, after occupancy because tenants demand quiet, workable offices, free from distracting noises. The Catter of typewriters, adding machines and other mechanical equipment, is not only distracting to employees but offensive to patrons. This booklet will explain Macoustic, its engineering service, its application, and its decorative possibilities and will give other data.

CHICAGO PUMP COMPANY, Chicago. "Fire Pumps." An excellent brochure on the important subject of pumps.

Because of the heavy responsibility placed upon a fire pump, each part in its makeup must necessarily be of the best. Insurance Underwriters' tests are so severe that only a truly reliable pump will pass examination. Fire pumps are used for reducing fire hazard in office buildings, theaters, hotels, clubs, factories and many other types of buildings. They are also used by municipalities and subdivisions. The primary reasons for installing fire pumps are the protection of life and property; a reduction in insurance rates because of reduced fire hazard. Chicago Pump Company Fire Pumps have met the Underwriters' severe tests, and in fact the "Chicago" Fire Pump was the first half-bearing fire pump to pass Underwriters' tests. Typical layout diagrams are shown in this booklet, and a short description of the "Chicago" Fire Pumps will quickly show why they are desirable for fire protection work, and why they are so widely used.


Because of poor or unscientific construction of buildings' walls and roofs, it has been conservatively estimated that the fabulous sum of $450,000,000 is wasted in fuel every year in the United States. Our present structures are causing annual leakage costs of literally millions of dollars' worth of heat. The house of the future will be scientifically built from the standpoint of heating. The idea of heat insulation from the standpoint of comfort is primitive, perhaps the most notable of early methods of securing it being use of the "wattle and daub" construction of the New England colonists, who filled the open spaces between uprights in their houses with a mixture of straw and mud. Primitive methods are still used today, and a degree of comfort is secured by both the Eskimo and the South Sea Islanders by the application of natural insulation principles. In this bulletin one will find data on correct and efficient insulation, and the advantages of using Flax-li-num insulation.


WALLAPER MANUFACTURERS' ASSOCIATION OF THE UNITED STATES, "Wallpaper." Dr. Faber Birren of Chicago, in a recent article in "The Modern Hospital," has said that it has been demonstrated that color has a definite psychological effect on the sick. The successful application of color demands more than an average amount of attention, particularly when regarded in emotional demonstrations. There are, according to Dr. Birren, two purposes to be served by the use of color in the hospitals. One of these is to effect a positive reaction on the part of the patient and the other is to create a general atmosphere of cheerfulness for its aesthetic and visual appeal.

THE MACOMBER STEEL COMPANY, Canton, O. "Hangar Design for Airports." A booklet on the subject.

The development of aviation and air transportation has been so extremely rapid for the past few years that it has introduced new problems to the building industry. Now airport owners, cities, towns, transportation companies and private owners are greatly interested in hangars, especially hangar designs for airports. This booklet, which is based upon the economic and efficient use of Massillon Standardized Steel Building Products, to meet the individual requirements of all projects, describes how hangars can be built economically. The Macomber Steel Company, with its standardized "Massillon" products has adapted itself to furnishing a prompt and efficient service in the complete steel requirements for hangars. To fill the need of hangar construction design and to offer its efficiency to airship owners, this "Hangar Design" booklet has been made available and should have wide circulation among architects.

THE CORCORAN MANUFACTURING CO., Cincinnati. "Corcoran One-Piece Steel Bathroom Cabinets." It is needless to say that the bathroom is a place of cleanliness and sanitation. Every one of its fixtures should be of the highest and most perfect sanitation and cleanliness. "Corcoran One-Piece Steel Cabinets" are described in this brochure. The primary motive of the manufacturer has been to provide a line of cabinets radically improved and of outstanding superiority over any product of its kind on the market today. These cabinets are designed in one integral piece of steel,—no cracks, no seams, no welded joints, no raw edges. The beautiful lustrous finish can be kept spotlessly clean with soap and water. Round corners inside and out are first aids to sanitation and cleanliness. The booklet will give all details of the Corcoran One-Piece Steel Bathroom Cabinets, details which interest architects.


To such a pitch of luxury have we come that, unless we tread on gems in our bath, we are dissatisfied." Thus spoke Seneca in commenting on the magnificence and luxurious appointments of the palaces of cleanliness and pleasure that were a part of ancient Rome. As a matter of fact, in the early years, while America was struggling, a bath was a rare treat. In the first place, there was no water in the house, and the preparation of the bath was a task that took a long time. The smaller children could sit in the tub, but poor father had to stand up, dip a sponge in the water, which was taken from the backyard pump, and then squeeze it out on his chest. That was a primitive form of shower. Then someone, who was regarded as eccentric, suggested a bath a day. "Impossible," said someone; "shocking," said others; and "it isn't healthy," said some. So even legislators passed a law against so absurd a practice. But it came anyway. This booklet will ask one: "Why be ashamed of your bathroom?" and will describe many ways to beautify it.
Home builders are now asking

Which is the Best Oil Burner?

instead of

SHALL WE INSTALL OIL HEAT?

It has come to be the exception, rather than the rule, for an architect's client to debate the advisability of heating his home with oil.

His only question now is, "Which is the best oil burner to install?"

We know of no better answer than Electrol's record of satisfactory service in many of the country's finest homes... A fine product serving a fine clientele.

Electrol owners know the meaning of "oil heat at its best." They know, for the first time, the satisfying comfort of automatic oil heat, electrically controlled. They have found an oil burner which keeps on operating year after year, with practically no attention whatever. Heating troubles are a thing of the past.

Such dependability of operation and performance can only come from a combination of engineering principles, materials and construction that are right, and from proper installation by dealers who have proven their ability to fit Electrol to each type of heating plant and to service the burner throughout its life.

Electrol is All-Electric—Entirely Automatic—and exceptionally Quiet. There is no gas pilot light. None is needed. The entire operation of the burner is under the automatic supervision of The Master Control which stands watch night and day, like a living sentinel, regulating the flow of oil, timing the ignition and governing combustion.

Electrol is made in models for homes and buildings of all types and sizes. Wherever it is sold, you will find complete oil heating service backed by a sound, large and growing manufacturing organization.

We shall be glad to mail description and complete details of this finer oil burner, on request.

ELECTROL INCORPORATED
179 Dorcas Street, St. Louis, U. S. A.

KNOW ELECTROL BY THE HOMES IT HEATS
Residence of Mr. Norman B. Comfort, St. Louis County, Missouri

ELECTROL
The OIL BURNER with The Master Control

LISTED AS STANDARD BY THE UNDERWRITERS' LABORATORIES, AND BEARS THEIR LABEL • MEMBER OF THE OIL HEATING INSTITUTE
REVIEWs AND ANNOUNCEMENTS


Appreciation of the value of orderly and architectural appearance in business quarters has brought about quite a number of changes in equipment of department stores. Some years ago the most complete equipment included overhead "carriers" or "conveyors" from sale counters to cashiers' cages, this system having supplanted use of messengers, cash boys or cash girls. But this system of carriers, with its overhead wires wholly visible, is now regarded with little favor, and there has come into use the system by which transactions with cashiers are conducted by means of tubes. This large folder explains and illustrates the planning of the cashier's receiving station of a large establishment. It shows the arrangement of files for quick reference to important data; the locations of those who authorize charges to individual accounts; the receiving and dispatching stations; and the stations of the supervisors of different sections. Half-tones from actual photographs show the appearance of these individual departments with their operators at their posts.

SHANKLIN MANUFACTURING CO., INC., Springfield, Ill. "Better Awnings." Their effect on a building's appearance. A building seen from the outside, most of the time gives an appearance of bareness and seems to be rather dull, while the interior is well ornamented. All this could be easily overcome by giving a small distinctive and colorful touch to that building at home by adding awnings to windows. That home shall have personality and distinctiveness of character. They will keep the house cool in summer and well ventilated. The "Shady-way" awning, which is manufactured by the Shanklin Manufacturing Co., is a new type of double-purpose awning that operates easily from the inside, serving as a shade and an awning,—cheerful, beautiful colored awning, that make the home, apartment, hotel, public building sparkle with life and attractiveness and insures cool, comfortable well ventilated rooms. Awnings all modern necessity, especially now when it's so easy and inexpensive to equip the home or buildings with smart serviceable roller "Shady-way" awnings. This illustrated booklet will tell all about it, and prove that it is a great utility for office structures, hotels, public buildings and homes.

NATIONAL LAMP WORKS, Cleveland. "Picture Projection with Mazda Lamps." Their use for motion pictures. The use of motion pictures in fields outside of the playhouse, is becoming widespread. So popular is this form of presentation that, together with slide projection, it has brought about a new technique in education and has become a valuable aid in selling and in home recreation. In the business field, motion pictures of a manufactured product have proved of great benefit in selling, with the result that firms are providing their representatives with motion picture films and projectors. Projectors of the portable type, using either the 35 mm. film or the 16 mm. film, are light in weight and give screen illumination sufficient for this service. Much fascination of home motion picture entertainment is experienced from showing pictures of one's family, friends or children at play and so on. The 35 mm. film is sometimes used for this purpose. To meet the needs of the various fields of motion pictures and stereopticon projection, there has been made a group of lamps especially adapted for these services. Maximum satisfaction is realized when each element in the projection system is designed and adjusted for the incandescent light source. In this bulletin these subjects are therefore discussed: (1) The optical principles in the projection of pictures by means of Mazda lamps. (2) The properties of the component optical elements. (3) Projector equipment. The use of Mazda lamps for the projection of motion pictures is attended by numerous advantages. They are simple and economical in operation; they consume a minimum amount of electrical energy, and they produce neither fumes nor gases, all being important advantages.

John Stafford White is to be addressed at 521 Irving Avenue, Glendale, Cal.

Carl C. Tallman has opened new offices at 733 West Edwin Street, Williamsport, Pa.

H. Silverstein announces the opening of new offices at 191 Joralemon Street, Brooklyn.

Frank O. Barber is occupying new offices in the Deadrick Building, Knoxville, Tenn.

Elmer Grey announces the resumption of his practice at 832 West Fifth Street, Los Angeles.

Arthur J. Widmer & Associates, Inc., announce the opening of offices at 4903 Delmar Avenue, St. Louis.

William C. Halbert, Jr., announces his removal from 11 North Avenue to 202 North Avenue, New Rochelle, N. Y.

Clarence J. Veillette, 1044 Noble Avenue, Bridgeport, Conn., desires the publications and samples of manufacturers.

Leonard J. Toole, Builders' Building, Charlotte, N. C., desires the samples and publications issued by manufacturers.

Announcement is made of the dissolution on January 31, 1929, of the firm of Purdy & Davis, 350 Madison Avenue, New York.

The Associates of A. L. Pillsbury announce the change of the firm's name to Lundeen, Hooton, Rouzen & Schaeffer, with offices in the People's Bank Building, Bloomington, Ill.

On January 1, 1929, Oren Thomas joined the firm of Proudfoot, Rawson & Souers. The new firm name is Proudfoot, Rawson, Souers & Thomas, and its offices are at 810 Hubbell Building, Des Moines, Iowa.

Announcement is made of the dissolution of the firm of Purdy & Davis. Raymond J. Purdy will continue the practice of architecture at 350 Madison Avenue, New York, and William H. Davis has opened offices at the same address.

Corrections. Page 210 of the advertising section of The Architectural Forum for February, 1929, carried an illustration of the exterior of the chapel recently completed for the University of Chicago. Credit for the designing of the chapel should have been given to Bertram Grosvenor Goodhue and the Goodhue Associates as architects.

In the article entitled "Church Organ Installations," by Emil Praeger, of the Office of Mayers, Murray & Phillip, Architects, the illustration on page 449 should have been entitled "Organ Case, Pipes Not Exposed, Chancel Wall, Trinity English Evangelical Lutheran Church, B. G. Goodhue and B. G. Goodhue Associates, Architects." Also, the illustration shown on page 450 should have been entitled "Organ Screen, Pipes Not Exposed, At Rear of Altar, Epworth-Enclisid M. E. Church, Cleveland, Mayers, Murray & Phillip and Walker & Weeks, Associate Architects". These captions were transposed through a typographical error in making up the March issue of The Forum.

VAN RENSSLEAER P. Saxe, C.E.
Consulting Engineer

STRUCTURAL STEEL
CONCRETE CONSTRUCTION

Knickerbocker Building Baltimore

248
AGAINST
RAIN ++ SNOW ++ MOISTURE

WALLS that are treated with Sonneborn's Hydrocide Colorless Waterproofing are sealed against every weather condition.

More and more architects are adding to the efficiency, life and beauty of their buildings by specifying this permanent waterproofing liquid.

Hydrocide penetrates deeply into brick, stone or cement, depositing a true water-repellent and caulking the pores permanently. It prevents discoloration, thereby preserving wall beauty.

Will not run in hot weather or crack in cold, as it contains no paraffin.

Let us tell you about the famous buildings that are Hydrocide-protected.

Some other Sonneborn Products

LAPIDOLITH—the original concrete floor hardener.
LIGNOPHOL—the penetrating preservative for wood floors.
CEMCOAT—A tough, durable, washable wall coating that stays white after other paints turn yellow.

L. SONNEBORN SONS, INC.
114 FIFTH AVENUE NEW YORK
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The success of the Unit Heater depends almost entirely upon its heating surface—and it is for this reason that the leading engineers are selecting Arcoblast Heaters. From a careful study of its wide variety of applications, both Unit Heater manufacturers and Heating engineers have found Arcoblast meeting the most exacting demands.

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3. Non-Corrosive.
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5. Minimum Weight Without Impairing Strength.

The heater is composed of staggered rows of metallicly attached fin-wound copper tubes expanded into two cast-iron tube sheets which, with the tapered design cast-iron header bodies flange-connected to the tube sheets, form the supply and return headers.

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Heaters are furnished in two types as follows:
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