The art and science of building is, like all Gaul, divided into three parts. One is the planning and design of buildings; another concerns their financing and proper construction; the third involves the use and maintenance of buildings by those for whom they were constructed. Technically, architects may deal with only one of these three parts. But even the technical success of architectural practice depends upon a thorough understanding of the basic effect that site, financing and specific uses have on every problem of planning and design. Such things, being out of the architect's direct province, require interpretation in his own terms. This is a job for a professional journal; and the policy of American Architect is dedicated to it. The basis for this policy of interpretation is an understanding of the building industry in all its many phases coupled with the ability to translate those phases into the language of the architect. In every issue of American Architect are interpretations of vital issues and events that are tending to link the architectural profession closer and closer with the other factors of the construction industry. The interpreter advances progress. To advance architecture American Architect is interpreting—for every member of the profession—the progress of important questions of the building hour.
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FOR JULY 1934
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The new Personal-Service Elevator is in every way an Otis elevator. It is sturdy and dependable and with proper care will give years of trouble-free service. Its virtue lies in simplicity of construction, adaptability to installation in existing buildings, and moderate price—for it can be purchased for the price of a good motor car. . . . Otis Elevator Company—offices in all principal cities.
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ARTHUR E. DORE, Architect, Hackensack, New Jersey.

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IN PLANS FOR NEW AND REMODELED HOMES
WHEN YOU MODERNIZE Make the Walkways Safe!

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FOR JULY 1934
What a Break

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It is an interesting conjecture... particularly as we advance further and further into the Age of Concrete. In Europe, today, and in America many designers are throwing off the shackles of old materials to work in concrete: a material capable of the widest latitude in the composition of masses... of infinite variety in surface textures... and of color.

Here, for instance, are notable examples of concrete's adaptability to varied architectural classes: one, the traditional Spanish... the other, the modern.

PORTLAND CEMENT ASSOCIATION

ROOM 267 • 33 WEST GRAND AVENUE • CHICAGO, ILLINOIS
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The Architect’s Part in the National Housing Program

BY BENJAMIN F. BETTS. A.I.A.

THROUGH the National Housing Act the Government will stimulate needed remodeling and modernization of existing houses and the construction of new houses. To encourage private money to enter this field, the Government will guarantee a portion of the loans.

The Reconditioning Division of the Home Owners Loan plans a similar reconditioning program. Action of this kind as a means of revitalizing the building industry and thus stimulating general business has been advocated by American Architect since September, 1933.

To the architectural profession this building program presents an unusual opportunity to demonstrate the economic and practical value of its services. These values cannot be demonstrated unless the profession is allowed to participate in the program and unless it stands willing to do so if given the opportunity.

The first step toward participation requires the correct presentation of the value of architectural service to the Government officials in charge of the program; to private lending agencies; and to the public who will apply for loans. Nationally, this would appear to be a function of the American Institute of Architects. Locally, it must be accomplished through Institute Chapters and other architectural organizations or individuals.

The second step implies willingness on the part of architects to make inspections and give advice on the basis of a consulting fee. The profession must adjust its business methods to meet the situation and it must be prepared to provide a service of a type warranted by the nature of the work and commensurate with the public’s ability to pay.

Two types of service will undoubtedly be required. In certain cases a report and opinion as to the value, need and soundness of the proposed work will suffice. In others the service normally furnished by architects will be needed.

Sound building will be, as always, essential to protect money invested in this building program. Any use of public funds will make this especially important. All work should, therefore, be executed under the direction of qualified experts skilled in good planning, local building values and sound building. These experts are architects.

News reports emanating from Washington state that money will be paid to contractors on behalf of home owners but no mention is made of the architect as a part of this program.

Let the Government publicly acknowledge the fundamental value of architectural service and insist, at least, upon an architect’s report accompanying every mortgage application.
The National Housing Act

By Miles L. Colean, A.I.A.

The National Housing Act, in its broad implications of effect upon the home credit structure and upon trends in building and neighborhood development, should have a more profound bearing upon the future of the architectural profession than any piece of legislation that might be named. If the objects of the Act are to any reasonable extent achieved, an increase in building activity in both alteration and new residential work should be evident fairly rapidly. Beyond this lie the possibilities of a mortgage system maintained in its liquidity, and more sensitive to the needs of the market than it has been possible to attain in the past. Booms may be averted, but a steady flow of activity in economically healthy communities should be possible.

THE ACT, as passed, is divided into five parts. The first sets up the Federal Housing Administration for the purpose of exercising the principal functions of the Act. This part also provides for the insurance of private loans made "for the purpose of financing alterations, repairs, and improvements to real property." All types of buildings are, therefore, included in the program; and the scope of the character of improvements may be safely left to the architect who through several years of enforced inactivity has watched the ravages of depreciation upon the country's buildings. The maximum loan so insured is $2,000, and all loans will be required to be repaid on an amortized basis. Rates of amortization interest, etc. will be determined by the Administration.

The second part of the Act establishes, under the jurisdiction of the Housing Administrator, National Mortgage Associations, which are private institutions of large capital created for the purpose of buying mortgages of the type described. The function of these associations is thus a rediscount function, aimed to maintain the liquidity of the primary lending agencies.

The fourth part provides for the insurance of savings accounts in Savings and Loan Associations of a character similar to that now prevailing for accounts in Savings Banks.

AMENDMENTS TO EXISTING LEGISLATION are contained in the last section of the Act. Among them are the broadening of the lending powers of the Home Loan Bank where insured mortgages are involved, the extension of credit for reconditioning to farmers through the Farm Credit Administration, the empowering of member banks of the Federal Reserve System to make mortgages under the provisions of the new act and to make construction loans where a mortgage commitment has been given by an acceptable agency.

It is in the functions of the Administration in regard to the issuance of insurance upon personal credit for modernization purposes and upon mortgages that architects are most interested. Special emphasis must be placed upon the point that under this Act no money is lent by the government. The Administration merely insures loans made, under certain restrictions, by private agencies, and, fur-
thermore the Administration does not deal directly with the public but only with those private lending institutions whose loans it insures. In this it is different from the other governmental agencies in the housing field. The Home Owners' Loan Corporation, for instance, makes direct loans to that class of the public whose mortgages are in distress or to such distressed home owners whose houses need repair; while the Emergency Housing Corporation of the Public Works Administration makes direct loans and grants for slum rehabilitation projects, designed particularly for the class of family which can not pay an economic rent.

The Administration as set up under the Act is concerned with solvent owners and with self-sustaining projects, and with these it is concerned only through the medium of loan insurance and the control which it may exert through that medium. This indirect relation to the actual construction it intends to foster implies that such control as the Administration may exert upon the character of the work done is an indirect one. This does not mean that the control, though indirect, need be lax, for the Administration, operating as it must, with public funds, is clearly under a strict obligation to see that the risks it assumes are reasonable risks amply covered by its premiums. It means something more than this. It implies that for the satisfactory functioning of this new agency and for the broadest effectiveness of the new low cost financing, communities in all parts of the country must cooperate in working out standards of design and construction particularly suitable to their own conditions, in accepting a type of zoning that is more than the wishful thinking of the speculator, and in encouraging stable and integrated neighborhood and community development.

In this the Administration may do much, but the communities themselves can do more. No control, no direction set in Washington can be effective if it is not felt to be the general desire of the community to which it is applied, so that, in the final analysis, the social benefit to be derived from the Act depends upon the alertness of informed opinion within each town and city. It is, without question, the architects as a group, who are best fitted to persuade their communities of the importance of land planning as against speculative subdivision, of orderly development, of good design and good building. Communities which do respond to such opinion and which can evidence careful planning, healthy neighborhood developments, sound construction, and good architecture will obviously be among the best insurance risks; and it is reasonable to expect that in such communities insurance will be most freely and cheaply granted, with the result of easier credit and increased building activity.

**BY ACTING AS A GROUP**, therefore, to improve local standards, architects stand to profit as individual practitioners. From the provisions of the Act dealing with the insurance of modernization credit, the first effects upon building activity should be produced. The amount of deferred maintenance during the depression period has reached amazing proportions, and a means of establishing credit should produce a large volume of work from this source. Architects may complain that the limit of insured loans for alterations and repair does not permit them profitably to engage in this program. The answer is that they can if they will realistically face the problems presented, organize their work as much as possible by neighborhoods, work efficiently, and gauge their fees to the character of the service performed. It must also be remembered that the limit to the amount of a loan is not a limit to the size of the job where the owner has other sources of funds, as may frequently be the case.

To refrain from active participation will, moreover, tend to confirm an opinion, unfortunately neither limited in its acceptance nor so far very effectively combated by the profession, of the superfluity of architectural service except upon work of elaborate and expensive character. On the other hand, to assume leadership in it both as individuals and as professional groups is to seize an opportunity of impressing upon the public the value and importance of the architect's advice. Here, as in the program as a whole, the architect is well fitted to balance the cost of a proposed improvement against the value which will accrue from it to the owner's property, to see that work proposed is of a beneficial and economic character, and, while discouraging the expenditure of funds in neighborhoods which are deteriorated or threatened with rapid deterioration and upon buildings which have become social and (Continued on page 140)
The Sixty-Sixth Convention of The American Institute of Architects

WASHINGTON, D. C.—MAY 16, 17, 18

THREE outstanding accomplishments marked the sessions of the sixty-sixth annual convention of The American Institute of Architects held in Washington, D. C., May 16, 17 and 18. Of most general interest to architects—in or out of the Institute—probably is the fact that the Architects’ Small House Service Bureau—endorsement of which by the Institute has long been a subject of heated controversy—was divorced from any affiliation with the Institute. Of equally important significance was the attitude of the convention regarding an increase in membership. The conviction of both officers and members is that sound growth of architectural organization lies in the ability and willingness of the Institute to expand its ranks to include architectural societies already in existence and operating independently as local groups.

Third in significance—at least so far as it reflected the sense of architectural thought—was a discussion of the public works situation involving the architects’ part in governmental expenditures. The convention officially did little to help the problem beyond approving the report of the Public Works Committee as read by its Chairman, Louis Labonne, and passing a resolution protesting against intrusion of Government’s agencies into the field of architectural practice.

The actual accomplishments of the convention were polite, mild-mannered and general in nature. Throughout the ranks of delegates, however, was a strongly militant attitude toward many of the questions that were so pacifically settled. The matter of the Architects’ Small House Service Bureau, for example, did not even draw forth a discussion much less any debate. William Stanley Parker, long one of the Bureau’s staunchest proponents, personally offered the resolution removing the Institute’s endorsement of the Bureau, on December 31st, 1934.

Handclapping was desultory; cheers were entirely absent. Disappointment of delegates who had anticipated a “fight” on many important questions was apparent; and even from high official circles the opinion was expressed that the convention had missed an opportunity to take a forceful stand on important national

(Continued on page 136)
Reclaimed by Remodeling

HORACE W. PEASLEE, ARCHITECT

Skillful remodeling can reclaim almost any sort of dilapidation and develop for owners a high degree of value and satisfaction. The cabin of Mr. George Odell, near Washington, D. C., was reclaimed for approximately $3,000. The center portion was an old log cabin, covered with siding. Siding was removed, the logs painted and new frame wings added. Reclaimed materials were used where possible.
CABIN OF GEORGE ODELL ON GREAT FALLS ROAD, WASHINGTON, D. C. HORACE PEASLEE, ARCHITECT
Two center houses reclaimed from a tenement-like row in Georgetown, D. C. Right-hand one, (plans above) for Charles Bittenger, cost approximately $10,000. Has new gas furnace and plumbing; exterior, warm gray walls, pale lavender trim. Left-hand one, for Mme. von Aschberg, cost approximately $8,500. Exterior, dull buff walls, grey-green trim. Plans similar to above.
Alterations in Georgetown, D. C. The house on the left, for Antoinette Funk, was not changed structurally, but merely refinished by exposing brick walls and by changing cornice and window details. It is now painted oyster white. Reclamation of the house on the right, for George Dubois, cost approximately $7,000. Exterior is finished with gray stucco and white trim. Hatched lines indicate changes in plan.
FOR JULY 1934
Shown at the 49th Annual Exhibition of The Architectural League of New York

On facing page: above, Main Court of the Avery Memorial, Hartford, Conn.; Morris & O' Connor, architects; below, house of Mrs. Richard B. Fudger, Beverly Hills, Calif.; Roland E. Coate, architect. This page: top, University Avenue Bridge, Philadelphia, Pa.; Paul P. Cret, architect; left, design for gate post; J. Kiselewski, sculptor; above, cork over-bar panel carved by T. Weidhaas.
Cass Gilbert, 
Architect 
1859-1934 

BY CHARLES MOORE 
Chairman, The Commission of Fine Arts 

Cass Gilbert died on the eve of giving to a waiting public two structures of the highest rank—the United States Supreme Court Building in Washington and the building for the Federal Courts in New York City. Death robs his ears of popular acclaim. This is spoken of as a catastrophe. On reflection one recognizes that already the artist has enjoyed the satisfaction of creation. He has had his opportunity. He has exercised a lifetime of study and experience. He has looked upon his last work (the epitome of everything he has done before); and it was good. Good—not perfect.

In the Roman Pantheon is inscribed this epitaph to the reputed architect of the Villa Medici: “Flamininus Vacca, who in the works he executed never satisfied himself.” To the architect the completed edifice is an autobiography wherein are recorded, first, the struggle to create in his own mind an ideal of function expressed in terms of beauty; then his wrestling to coordinate all those warring elements, both human and material, concerned with the realization of that ideal. Only the artist knows and intensely feels his dependence on the cooperation of those who have striven with him loyally, understandably, with heart and brain and hand, to carry out his conception.

Herein lies the real satisfaction of the artist. Public recognition is but an added joy. Often it comes slowly. It takes time and thought to understand and appreciate the whys and wherefores of decisions many and rejections innumerable. Critics may at pleasure build their evanescent castles in Spain. Artists must deal with materials fixed for all time in form and substance.

From impressive state capitol to vast warehouses, essentially utilitarian, Mr. Gilbert has worked, adorning everything he touched. In the epoch-making Woolworth Building he grasped firmly and solved adequately the New York problem of the skyscraper. Its sheer beauty transcends architectural style. Twenty years ago it was the tallest structure in the world. Today its height is exceeded by five buildings in New York City; but it still stands royally as the queen, surpassed in grace and dignity by none. Architecture has been likened to music. “The mounting chords of the Stabat Mater,” said Mr. Gilbert to me, “kept sounding in my mind while I was piling up that building.”
Decorative possibilities of colored linoleum for both floor and walls of recreation rooms as developed by the Decorator’s Bureau of Congoleum-Nairn in the showroom of the A. H. Stiehl Furniture Co., New York. In the diagram: 1. dark, mottled green; 2. light tan jasper; 3. dark tan; 4. light gray; 5. dark brown; 6. dark slate gray. The use of linoleum in sub-surface rooms is not recommended by manufacturers unless the original walls and floors are thoroughly waterproofed and then furred.

**Basement Recreation Rooms**
Ceiling: orange and blue striped canvas to conceal piping. Floor: black and red asphalt tiles. Walls: hand-painted plaster with occasional grotesque figures in flat modeling. Surface is slightly stained and waxed. Cellar windows concealed with leaded bull's-eye glass sash. Doors opposite bar open to utility control valves and panels. Bar is equipped with refrigerator.
Floor: slate. Walls: original stone-work, plastered over rough spots. Ceiling: whitewashed planking between rough-hewn oak beams. Woodwork, including doors and trim: wire-brushed oak

TAPROOM.

HOUSE OF FRANCIS BLOSSOM
FAIRFIELD, CONNECTICUT
HENRY C. PELTON, ARCHITECT
Floor: heather-brown tile, waxed. Walls and ceiling: hewn logs, waxed finish in natural color. Wall logs laid in white mortar. Fireplace: gray, rough-cut local stone. The room was finished by owner with local day labor.

TROPHY ROOM,
HOUSE OF NELSON S. TALBOT
DAYTON, OHIO
PEABODY, WILSON & BROWN, ARCHTS.
BASEMENT LOUNGE, HOUSE OF DR. KINGSLEY ROBERTS, GREENWICH, CONNECTICUT. G. PIERS BROOKFIELD, ARCHITECT
Space was formerly a boiler room. Necessary new work made most walls double thick, old work forming pine-paneled wainscot ledges under windows. Windows open underneath a porch; artificial light is indirectly reflected from boxed-in panels to simulate daylight. Room is heated, ventilated and air conditioned from unit near pantry. Floor: random variegated slate. Woodwork: clear pine, antiqued with solution of potassium permanganate and walnut crystals, then waxed. Plaster of walls and ceiling: slightly irregular, antiqued by smoke from turpentine soaked rags. Beams: oak, adzed on job. Fireplace ledges: quarry tile.
BASEMENT LOUNGE, HOUSE OF DR. KINGSLEY ROBERTS, GREENWICH, CONNECTICUT, G. PIERS BROOKFIELD, ARCHITECT
Floor: teak planks, waxed. Walls: painted plaster. Woodwork: pine, charred to produce an effect of mellow age. Beams are built-up to conceal pipes. Plaster ceiling is curved for the same purpose and also to reflect indirect lighting from cornice slots on long sides of the room. Fireplace will take logs four feet long which can be stored in a concealed closet near it. The closet also conceals a radio having a remote control. Double doors lead to a large hall used in conjunction with this room. Hall has a slate floor and pine paneled walls

SOCIAL ROOM, HOUSE OF HANNIBAL C. FORD
GREAT NECK, LONG ISLAND, NEW YORK
GEORGE W. CONABLE & LEON H. SMITH
ASSOCIATE ARCHITECTS

RECREATION ROOM
HOUSE OF RICHARD C. GRANT,
DAYTON, OHIO
PEABODY, WILSON & BROWN, ARCHITECTS
POLHEMUS AND COFFIN, ARCHITECTS

GARAGE AND STABLE GROUP

ESTATE OF JESSE ISIDOR STRAUS, MT. KISCO, NEW YORK

Photographs by Harold Haliday Costain

Construction, frame throughout except back of garage and first floor walls of groom's cottage which are whitewashed rubblestone. Exterior finish, shingle. Cost, in 1929, approximately $45,000
PLANS AND ELEVATIONS OF GARAGE AND STABLE GROUP
ESTATE OF JESSE ISIDOR STRAUS, MT. KISCO, NEW YORK
POLHEMUS AND COFFIN, ARCHITECTS
ARCHITECT: PROFESSIONAL OR BUSINESS MAN

Much argument ensues and much confusion exists over the question of whether the architect is a professional man or a business man. Everyone probably agrees that the practice of architecture is a profession. At the same time it is difficult to see how any one can carry on a practice and not be a good business man. Doctors and lawyers are professional men; and many of them are astute business men as well. And you may be sure that the successful architects are also good business men. The confusion apparently exists in the failure to distinguish between the professional-business man and the individual who commercializes architecture. Doctors, dentists and lawyers face competition similar to that of an architect. But these other professions are continually waging relentless campaigns to safeguard those who do maintain reasonable standards of practice.

ANOTHER STEP IN THE RIGHT DIRECTION

In June of this year the New York Society of Architects instituted a program of awards to schools of architecture, by which special ability in building construction shown by students will be recognized. The Society states that the purpose of this special recognition is to stress the importance of proficiency in the utilitarian side of architecture and building construction. Architectural students and the public have too long been led to think that architects are solely concerned with beautiful buildings. It is about time to impress both with the fact that architects are no less important in the case of practical plans, specifications and the erection of buildings than they are in the matter of aesthetic building design.

ROBERT D. KOHN RESIGNS FROM PWA

News of Robert D. Kohn's resignation as director of the PWA housing division comes as no surprise to those well informed on the housing situation and sensible to the PWA's policies on housing activities. For many months it has been apparent that the set-up of the housing division itself precluded any chance of practical success. The difficulties under which Mr. Kohn labored were inherent ones and resulted in inefficiencies for which Mr. Kohn can be held blameless. All who know his high personal integrity and keen administrative ability will deplore the way in which his resignation was announced. It was subordinated to news that administrative methods of the housing division were under investigation, thus carrying a clumsy implication of misconduct and indirectly reflecting upon the entire architectural profession of which Mr. Kohn is such an able representative. It is an unfortunate implication, to say the very least. A candid survey of Mr. Kohn's work and efforts of architects throughout the country to cooperate with the PWA would show that nothing could be further from the true state of affairs. The only just criticism of Mr. Kohn must be levelled at his poor judgment in not resigning sooner a position which embarrassed him from the administrative standpoint and jeopardized from the start the results of the undertaking.

BRING DOWN THE HIGH COST OF BUILDING

High building costs will delay recovery of the building industry. It has been known for some time that the cost of building has been too great. Reduction of costs is a real problem for the industry to solve—if it can be solved. Low wages are not necessarily the answer. Increased efficiency in construction methods is not the whole answer. New construction methods may be the solution. It may prove better to develop methods using highly skilled labor at high wages than to attempt to reduce costs through a combination of low wages and construction short-cuts. There is a good argument for high wages. They mean more money in circulation, greater confidence in business and hence more building.

LET THE ARCHITECT WRITE THE PROGRAM!

Should an architect accept his client's building program without question or should he make his own investigation and submit an independent, comprehensive scheme? As an expert in planning and construction, with special facilities and training to determine building requirements, it is logical that the architect should make his own investigation and write the program for the client. Most owners have long considered their building problem and have formulated a good conception of their needs. But,
To the Editors

with a limited knowledge of building, their program is usually incomplete. Often it is fundamentally wrong. Thus the program for the average building too often becomes a combination of an owner’s idea of what he thinks he wants and an architect’s more experienced recommendations. As a professional advisor it is plain that the architect should, in every case, make his own independent investigation of the client’s building needs. If this results in a program identical with the client’s, well and good. If the two are not the same, the client should be so informed and desirable adjustments should be made. This is clearly a duty of the architect and one of the best possible ways of developing a satisfied clientele.

ARCHITECTS LIKE IT ANYWAY

THE Journal of the Royal Institute of British Architects for June had this to say about AMERICAN ARCHITECT Reference Data on “Thermal Insulation of Buildings”: “A useful section on Thermal Insulation which ties off into an advertisement of ‘Reynolds Metallation’—a reference advertisement of Reynolds Metals Company which is good for an advertisement but must not be confused with the more valuable material in the article proper which contains among much else of interest a table showing the heat insulating capacities of a variety of forms of wall and roof construction.”

Unfortunately the editor of the Journal did not know two pertinent facts: First, that this reference article, like all others in our series, was prepared without consideration of the advertisements published with it. The text was completed and then checked by leading technicians and authorities before the Reynolds Metals Company even became interested in advertising their product in the issue. The second fact is that this advertisement was designed to show that advertising can be as useful and reliable as the editorial content of a professional journal.

Instead of subordinating editorial ideas to advertising exigencies, we are trying to encourage advertisers to lift their story to the high standards that make the editorial content and layout of AMERICAN ARCHITECT successful. It is pleasant to report that several hundred architects have written to us praising the reference article and encouraging the further development of reliable reference advertising.

NEW BUILDING CODES ARE NEEDED

TODAY’S demand for lower construction costs in the face of rising costs of labor and building materials brings sharply into focus the need for building code revisions. Most building codes have been based upon the theory that a minimum standard of acceptable construction must be specified. In general the effect has been to encourage construction that was no better than the code required; to retard development of better and more economical construction methods; and often to place a severe cost penalty on building owners forced under code provisions to pay for excessive structural requirements. The fundamental purpose of the building code is to assure public safety. The desired objective is performance and not specification. Code revision to that end would encourage development of new, safe, economical construction methods. Equally desirable is the better unification of building code provisions. Codes of two adjacent communities in the State of New Jersey, show, for example, a 25 per cent difference in roof load requirements. One or the other must be excessive or inadequate. Architects in every community know whether or not local building codes are what they should be; and professionally they have a vital interest in them. It would be a constructive effort for groups of architects everywhere to study their local codes and secure such revisions as may be necessary to keep the codes abreast of scientific developments, thus permitting progressive construction economies.

A GOOD SALES POINT

AFTER a building is completed the most important elements of the structure are concealed. The actual materials and workmanship that went into the building are records not available to the average person. Seller or buyer must too often depend largely upon surface indications to determine the value of the building. Size is no reliable criterion of worth. But—the wise owner who employed an architect has a valuable set of documents in the plans and specifications. With them he can demonstrate what is behind paint and plaster. If the architect supervised the construction, it should be sufficient assurance that specifications were followed and that workmanship was what it should have been. That is a good argument upon which to sell architectural service. It is a logical basis upon which to determine building value.

FOR JULY 1934

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ELY JACQUES KAHN, ARCHITECT

ENTRANCE DOOR OF THE YARDLEY SHOP

BRITISH EMPIRE BUILDING, ROCKEFELLER CENTER, NEW YORK

Photographs by Rotan
Door and show window frames: bronze. Show window floors: Botticino marble. Side walls of windows: mirror. Lighting is entirely from overhead, recessed panels. Entrance door was designed and executed by Kantack, Inc.
Steel and plate glass are the most important structural materials used in this experimental building at A Century of Progress, called "Crystal House" and designed by George Fred Keck and Leland T. Atwood, architects. All framing is on the exterior; all walls are entirely of glass; trim is metal; floors, rubber tile; and closets are replaced by movable wardrobes. All rooms are air conditioned from a central shaft supplied by units on the first floor. Above: View of exterior. Right: Study - living room.

Trends and Topics

* Fanfare accompanying passage of the National Housing Act served to obscure news that Congress also had appropriated an additional $200,000,000 for use in the reconditioning Division of the Home Owners' Loan Corporation. This brings to the impressive total of $400,000,000, a sum that HOLC officials will lend to house owners for repairs, remodeling and modernizing in sums ranging from $200 to $2,000. To architects this should be significant news, for of all the Federal Government's alphabetical brood, the HOLC has most quickly recognized the value of architectural service as insurance against poor construction work. The operating manual of the HOLC Reconditioning Division together with a supplementary memorandum lists the functions of State Architects Advisers and their assistants, of which there will probably be about 1,000, according to Pierre Blouke, Architect Adviser to the HOLC. Architects may be used to develop plans, specifications and consultation or merely in a supervisory capacity as required. In any case they will be retained on a fee basis. Fees for supervisory service are set at a minimum of 1 percent of the reconditioning construction cost and in
Above, the Parthenon, showing the restoration of the columns in the North Peristyle. On facing page, a corner of the Parthenon through the inner columns of the Propylaea

Builders in Search of a Civilization

BY CHARLES HARRIS WHITAKER

Photographs by the author

ONCE one has arrived on the summit of the Acropolis, the number and variety of questions may be endless. Pedants and lovers of hard-and-fast dates and tight fitting historical sequences will want to know how the Doric order came to Athens and why the refinements of curvature, the metope and triglyph, guttae and fluting. No importance attaches to the answers even though they could be found. They only matter to putterers. The Parthenon rests simply on the post and lintel; and all builders had known that method for at least five thousand years. The Athenian builders undoubtedly carried over some useless parts as echoes of wood forms that once expressed use. Builders of all ages changed their forms slowly and by the simple process of trial and error.

Looking through the inner columns of the Propylea at the two temples ahead it is suddenly borne in upon one that all such questions are trivial; that history is inevitable only up to the tick of the clock; that the Present lasts no longer than that tick; that the Future is the one thing with which it is of any use to have concern. All the rest is Past and makes up history—the refuge of cowards. It takes courage to face the Future—that adventure that begins with each swing of the pendulum.

To the right, between the inner columns of the Propylea, one sees the Parthenon. The noble au-
sterity and majesty of the mass are accentuated by its position on the highest point of the Acropolis. From the moment one leaves Athens until one at last sets foot on the floor of the Portico, one climbs and looks upward. The builders of that day knew that the first principle of building is site.

The Parthenon is so many things that one is for the moment quite overcome. Some time will pass ere one sees it not only as the work of ten or more years, but also as the fruit of a century of patient trying and testing, during which generations of craftsmen in Asia Minor, Sicily, Italy and Greece sought to bring the temple to a form that entirely pleased them. At least we must so assume if we accept the usual historical version of the Parthenon as the greatest of all Greek buildings. It is so easy, however, in thus accepting to give credit to the men whose names have come down to us by the very imperfect historical method—Calligrates, Ictinus, Phidias, and Pericles—and so easy to forget, by the same historical process—twisted and distorted to suit the vanities of a profession or the theories of culture—the long procession of faithful building craftsmen. Year by year, century by century they played with form and grew to become ever more and more sensitive to the harmonies and proportions for which the very materials seemed to cry out.

Had it not been for this great host of stone-cutters—even though the bulk of their services were at the command of king and priest—there would have been no Parthenon. It sprang from no single mind. Rather was it the fruit of a slowly ripening experience over a century and more of trial and error. Year after year the builders studied the result of their labor, looked at it, lived with it and noted what pleased them and what did not.

Even as the pyramid builders of Memphis fitted limestone slab casings—with a precision that has never been surpassed—to give the appearance of a single stone to the symbolic sun-reflecting surface, so did the Athenian builders join their blocks and drums with infinite pains. They, too, wanted the Parthenon fabric to look like a monolith. Nothing else would befit the noble and gracious temple. Though no more than a mystical and momentary abode, it had to be a fitting dwelling place for immortals. The Company at Olympus was very much alive. It wanted no heretical tombs in which to await a hereafter!

Even so, why all the refinements of curvature and entasis? They involved an incredible labor as one can easily see. Why? We shall never know. Were they merely to correct the illusions of perspective? Or may we believe that the builders wrought them because of their sheer love and knowledge of organic form? Had they looked through and beyond the material in which they worked—looked, as it were, inside of Nature herself, noted her process of growth and the form that never failed to serve the purpose to see the truth that she hid from the eye by the appearance she gave to the form? Might it be that the Athenian craftsmen could not be satisfied with a mere rectangular precision? That was never Nature's way.

Standing by the ruins of the South Peristyle, where fragments of wall and columns lie as they fell under the Venetian bombardment, it would be easy to come to such a conclusion. Here, if one is sensitive to presences, one may feel the spiritual attendance of a great army of craftsmen. The thought of them is the larger part of the comfort and serenity that flow from ruins. In these, where sun, wind and rain have long bathed and cleansed, those fixed ideas that the building was meant to proclaim and impress are gone. The command, once set forth in symbols that spoke their meaning more clearly than do our shuffling words and symbolic trickeries of today, has disappeared. The marble has regained its purity!

One is no longer asked to believe in the gods or to quail before the unknown. The ruins set one free to mingle with the builders and to hear the clink of hammers and the sounds of voices. Here craftsmen once worked. They were making a building of two rooms, two porticos and a four-sided peristyle. The dominating element was the lintel. It governed the spanning of all spaces and openings. The form grew naturally into a rectangle in which, after years and years of experiments, the final relationship of the parts was being worked out.

The real way to approach a building problem has never changed from that day to this. We have simply messed and muddled the building process by accepting, as the determining factor, a series of monetary operations and considerations that have no more to do with building, or with the natural process of emerging from barbarism into civilization, than the moon has to do with green cheese.

E Very now and then, the craftsman's way of looking at the building process seems to break through the tough hide of illusions in which man loves to encase himself. Thus the spirit of "modern architecture"—referring to the principle of organic structure and not to the idea that architects have developed a new high-pressure salesmanship—is merely the attempted rebirth of the instinct for workmanship. That was what animated the builders of the Parthenon and all other builders before and after it, up to the time of the Renaissance when the creative builder was pushed out of the picture.

Today we call this attempted rebirth "modern," because it satisfies our ego. In reality, it is as though the Goddess of Building were once again pointing out the way—not to the waste and folly of the historical style process, but to the principle on which style rests which is the organic growth of form.

Louis Sullivan, in the 70's, with his magic and challenging formula "form follows function" gave dramatic utterance to the law of all growth and stated the ancient craftsman's common-sense approach to a problem of building. It was the same truth that Schinkel jotted down in his diary in 1824.
The great German classic architect, after seeing the new industrial buildings in Manchester, cried out, "Every age has left a record of its style of building. Why shouldn't we try to find one for ourselves? Emphasize structure by its articulation; use materials frankly; no useless parts; all clear and natural."

It was the engineer who began to unmask the snobbery and pretense of architecture as an historical process. Crystal Palace, Brooklyn Bridge and Eiffel Tower announced the rebirth of the law of organic order in structure, just as Schinkel worked it out in his design for a new department store in 1827. The engineer, however, had come into possession of new materials. The whole theory of loads, strains and stresses became completely transformed. Careless of form as an aesthetic factor the engineer began to find a fine form by his unconscious obedience to the law of organic growth. Every technician, feverishly exploring the new field of machine industry, was likewise obeying the law more and more in the search for efficiency. When he accepted efficiency as a technical end he came to a form. It was only when efficiency was measured in monetary returns that form became a mixture of novelty and dullness.

In reality there is nothing, from a needle to a battleship, that does not find its right form—suited to use and purpose—by following the law of organic growth. Buildings cannot be made in the same way because we have mixed structural technique with a maudlin aesthetic emotionalism. Now that the jumble has proved so costly, so wasteful, so loaded with debt and disorder, so mercilessly perverted by our antique pecuniary processes, it may be possible, in the not too far distant future, to return to the law by which the Parthenon—and every other good building—came into existence. Not one of the fictions we have devised for monetary purposes has the slightest relation to a normal building process or to the law of organic growth. These fictions merely represent our stupid way of contriving debt and disorder; and although they are not likely to be changed over night, there can be no "modern architecture" in any genuine sense until the art of building becomes subordinated to the law of organic growth. This means something far more than the
... The ruins set one free to mingle with the builders and to hear the clink of hammers and the sounds of voices. Here craftsmen once worked. Above, the Acropolis from the West, showing the Propylaea, Temple of Nike Apteros and the West front of the Parthenon. On the facing page, the North Peristyle of the Parthenon from the Naos, showing the reconstruction of the columns. At the extreme left are the columns of the Propylaea.

The law of organic growth as we observe it seems so vast as to be incomprehensible. Yet it is simply and naturally observed without question by every organism save man. No other organism builds so stupidly as does he. Every other organism allows the form of its building to grow out of the function. If this is offered as a proof of the stupidity of man, I, for one, would not challenge the assertion. Man is the one organism that loves to live in an unreal world and to teach his children by a process that is based wholly on unreality. The more he becomes what he calls civilized, the farther he moves away from reality.

Building, in itself one of the realest of processes, has become the strangest of unreality. So deeply has it become involved with the land debt and monetary measuring processes—not one of which has the remotest relation to the manner in which any honest craftsman sets about his work—that it plunges society not into order, but into disorder. Our method of making and arranging buildings defies every natural law. What wonder that the architect-spokesman for the new governmental Housing Department at Washington recently stated publicly that the majority of the people of the United States have no adequate house in which to live? What wonder that the Emergency Committee in New York discovered
and announced that some 2,000,000 people are liv­ing in fire-traps? Even by making a due allowance for rhetorical exaggeration, one may still ask—
“What price architecture?”

If we have courage to look at the Spirit of Modern Architecture as a revelation or a Voice that would point out a truth, we shall have to re­member that revelations do not argue. They reveal. They challenge. The Spirit of Modern Architec­ture tells us to abolish school methods that sent thousands of young men into a world about whose realities they knew nothing; sent them into it with the belief that architecture was for the service only of those who had the price; sent them out with no effort to tell them the truth about the means by which the builders were being driven to write one of the most disheartening records that ever came from a race.

To hope or to suppose that there is to be a re­vival of the “prosperity” or of the outlook and methods that produced the present building chaos of financial discord and disorder is merely to admit that we are incapable of laying a course that will lead to civilization. The spirit of modern architec­ture is the challenge to a complete revision of all the old ways—the challenge to think in new ways and with a new purpose.

On the Acropolis the shadows lengthen. The roofs of Athens fade into the same soft veil that steals about Hymettos. All outlines are losing their edges; and the Western hills that enclose Phaleron and Salamis are silhouetted in a dying golden radiance. Above the Propylæa hangs a brilliant burnished cloud, as though Jove had sent a blessing for the end of the day. Amidst the silence and the deepening shadows one seems to stand where the waves of man’s long groping break softly on the Athenian strand, like lingering lappings of a long unrest.

Over and over again the builders have been ready to make a home for a civilization that should endure and grow wise and gather a beauty such as men have never known. Over and over again there were be­ginnings, but never more than beginnings. The real work for the builders is still ahead of them, but only as the will to civilization can overcome the will to chaos.

Architecture, after all, is only the pen that traces and records the social basis and cultural develop­ment of a people as they flow by a given point in what they call Time. How strange it is that the very people who cause the record to be written are so little interested in looking at it or in reading the one indelible record that cannot ever be falsified.
THE CULMINATION OF CLASSIC BUILDING ART

New camera studies by Charles Harris Whitaker that present, from a fresh, un hackneyed point of view, three famous monuments of ancient Greece that have stood as masterpieces of perfect building for nearly twenty-five centuries. These pictures of the Erechtheion, the Choragic Monument of Lysicrates and the Parthenon are new and dramatic records of the Greek craftsmen's mastery of the Classic building art. On this page is the Erechtheion from the West.
The Erechtheion (B.C. 420-393). Above, East Portico from within the ruins. On facing page, detail of the Caryatid Porch from the South-East.
Above, the Erechtheion from the West through the columns of the Propylaea. On facing page, the Choragic Monument of Lysicrates (B.C. 335). Surrounding it is twentieth-century Athens; towering above are the ancient stones of the Acropolis.
The Parthenon, (B.C. 454-438), greatest of all Greek monuments. Above the South Peristyle. On facing page, Eastern façade through which passed the great processions.

AMERICAN ARCHITECT . JULY 1934
South Peristyle of the Parthenon looking West. At the right are the walls of the Naos.
BUILDINGS are built for people. Yet in many of them this obvious fact seems to have been forgotten. In too many instances dimensions and clearances of all sorts are arbitrarily fixed with no attention to the detailed requirements of space in reference to the human inhabitants of the building. As a result furniture is often uncomfortable, spaces are cramped, built-in equipment is tiresome to use. These conditions need not be. One reason for them may lie in the lack of ready reference to accurate graphs of human dimensions.

To provide such a reference these charts were prepared. The conventionalized human figure represents the average in size and conformation; and the dimensions indicating limits of spatial needs in rest or action illustrate graphically a variety of basic clearances necessary to assure comfortable "head-room," "knee-room," "standing-room," "reaching distance," etc. These basic figure scales can be useful in determining minimum width and heights of passageways and compartments of various sorts. They will be found helpful in locating shelves and counters of built-in cabinets and are particularly to be consulted for proper clearances in the design of furniture, especially that type which is built as part of the structure itself.

About half of the diagrams constitute "working drawings" of the human figure and dimensional extremes that influence architectural planning and design. The remainder illustrate applications of the comfortable spatial needs to several commonly met furniture and fixture problems.
Diagrams A, B, C and D on the preceding page and E, F, G, I, L and M on these two pages establish basic limiting dimensions of the average human figure in all positions ordinarily to be considered in building design. They control minimum dimensions for passages, corridors, etc., doorways or other openings. Diagrams G and H indicate controlling dimensions for comfortable chairs and tables. Applications of clearances are shown in Diagrams J, K, N and O. Diagram H indicates that desirable footroom fixes 42 inches as the minimum desirable table width. For a chair height of 18 inches a table height of 29 inches should be a minimum to preserve a desirable clearance of 11 inches between table top and chair seat. Chairs—movable or stationary—should not be spaced closer than 27 inches center to center as shown in Diagram N. A center-to-center spacing of 30 inches is more desirable. Diagram O establishes correct dimensions for a lunch counter with footrail and movable stools.
The Geometry of the Human Figure—When furniture is built-in, ease and convenience of getting seated is important. The front edge of fixed seats must never project under the table; and the seat depth should not be less than 15 inches, exclusive of the 3-inch slope of the back. These points are indicated in Diagram R which shows desirable clearance dimensions of a built-in breakfast nook or restaurant booth. Space in excess of the 64-inch minimum width should be added to the table width to maintain the desired relation between table edge and seat width. In Diagram P knee room is assured by the 11-inch counter overhang and the slope of the counter face. Chairs are fixed but revolving as in Diagrams Q and S. Elbow room should not be less than 27 inches, as illustrated in Diagram N on preceding page.
Construction Contracts Should Control Builders' Liability

HOW far is a contractor liable for defects and deficiencies in the work? To what extent is he a guarantor that the work, as he performs it, shall be safe and satisfactory for the purpose involved? These are questions with which every practicing architect is confronted repeatedly and about which his clients will seek advice. The ordinary rule is that, where a contractor has undertaken to carry out a given job, he assumes the risks incident to the performance of the work and is liable for any defects and deficiencies therein.

There is another angle to the problem, however, which is presented by a decision of the Supreme Court of Nebraska (State v. Commercial Casualty Ins. Co., 248 Northwestern 807). Issues in this case arose on an action against the surety on the contractor's bond to recover damages alleged to have been caused by the contractor's breach of the contract in failing to provide materials of sufficient tensile strength, for not safeguarding the work against expansion and for other alleged shortcomings. Under the contract the owner's engineers were made supervising agents with power to reject any material or work that does not comply with the terms of the contract and authorize the engineers to approve and issue final certificate. The contract contained ambiguities and contradictions. One clause provided that steam pipes should be capable of carrying 250 pounds pressure to the square inch. The plaintiff contended this amounted to a warranty that the pipes would be suitable for this purpose. On the other hand, the contractor claimed that the contract called for specific materials and a specific manner of construction. He claimed that, if he followed the contract in these particulars, he was performing his full duty and was not required to decide whether the pipe line as specified would be sufficient for the purpose contemplated. Another similar claim was that the tie rods and limiting poles should have been installed over various expansion joints. No provision had been made in specifications or details for such rods or bolts.

In deciding the case, the Court laid down a number of interesting rules relative to the obligations of a contractor under these conditions, the effect of an architect's or engineer's certificate of approval and the effect of specifications, plans and contract upon the contractor's liability.

Among other things, the Court held as follows:

"Where a contract for the construction of a steam pipe line makes the engineers of the owner supervising agents with power to reject any material or work that does not comply with the terms of the contract and authorizes the engineers to approve and issue final certificate, such certificate of approval by the engineers constitutes at least prima facie evidence that the work has been performed according to the contract. . ."

"It is a rule that, where there are general and special provisions in a contract relating to the same thing, the special will control over the general provisions; and, if the contract is fulfilled according to the special provisions, the contractor has fully complied with the terms of his contract. Whether the pipe line, as designed by plaintiff's engineers, and the specific material required and manner of construction were sufficient were questions on which the contractor was not required to pass judgment. His duty was to perform and fulfill the contract according to the specific terms and directions therein. . ."

"Where plans and specifications for an improvement are prepared by engineers of the owner, who are to inspect and supervise the construction and see to it that materials are furnished and work performed in accordance with the specifications, or-
ordinarily the contractor is not liable for the sufficiency of the specifications, but only for the skill with which he performs the work and the soundness of the materials used by him."

In connection with the last point, the Court cited a Minnesota case as follows:

"Where a contractor makes an absolute and unqualified contract to construct a building or perform a given undertaking, it is the general, and perhaps universal, rule that he assume the risks attending the performance of the contract, and must repair and make good any injury or defect which occurs or develops before the completed work has been delivered to the other party. But where he makes a contract to perform a given undertaking in accordance with prescribed plans and specifications, this rule does not apply. Under such a contract he is not permitted to vary from the prescribed plans and specifications even if he deems them improper and insufficient; and therefore cannot be held to guarantee that work performed as required by them will be free from defects, or withstand the action of the elements, or accomplish the purpose intended."

The Court further cited, with approval, cases decided in other states. One Maryland court held in substance that, if the contract prescribes materials chosen by the owner or his representative and the contractor is given no choice respecting them, no construction of the contract will be upheld which imposes upon the contractor an understanding that materials chosen will meet demands which may be made upon them; that even a general guarantee of the work for a period subsequent to completion will not be so construed as to place upon the contractor a liability for something which really is the result of a mistake or a miscalculation in the plans of the architect. Consistent with this holding, the decision referred to a New York case, where it was held that a building contractor who guaranteed that a roof would be water-tight was nevertheless not bound to do more than the specifications required.

Referring to the question of the expansion joints, the Court said:

"Plaintiff contends that the expansion joints should have provided for a greater expansion, or that there should have been more joints. The specifications in the contract indicate just how many and where the expansion joints should be placed, and provide for an expansion of not to exceed 5 inches for each joint. In this respect, the contractor complied with the terms of the contract. If the expansion for each joint were insufficient, or if there should have been more expansion joints placed in the line, this was not the fault of the contractor. It was the defect in the plans and specifications, provided by plaintiff's engineers."

It is apparent that the theory upon which courts have proceeded is that ordinary liability of a contractor is definitely modified where he is required under the contract to do work in accordance with a method and to provide materials of a character definitely specified in his agreement with the owner. This is in accordance with sound sense and fair dealing.

On the other hand, it should be borne in mind that a contractor may be under some obligation, when as a man skilled in construction work he should know from a mere examination of the specifications and plans that the work provided for will not be safe or proper. In such a case he should make known this fact to the owner and either refuse to proceed with the work as set up or make it clear that he is doing so at the owner's risk and without responsibility for defects which may develop or injuries which may result. Where defects are of such a nature that personal injuries or substantial property damage may result, the contractor should, of course, refuse to be a party to the building operation, unless he can in some way protect himself from any resultant liability.

It should also be borne in mind that each case will be decided upon the basis of the particular contract involved in that case. For instance, the status of a contractor guaranteeing that a roof will be water-tight—as in the case above referred to—might be completely different were the contract provisions slightly changed. I have often found it advisable, in drafting contracts, to provide specifically that irrespective of any of the other provisions of the contract—the contractor shall perform and provide whatever work and materials might be necessary to insure to the owner a building absolutely water-tight in all respects. When such a clause is embodied in the contract there can be no ambiguity; and the fact that certain materials and construction are elsewhere called for will not release the contractor from his liability to provide a completely water-tight job.

These decisions merely emphasize the importance of wording the construction contract to eliminate ambiguity and to place upon a contractor, in a way which will be fair both to him and the owner, an obligation to carry out the work in a manner which will give the desired result. Ambiguities and uncertainties in contracts must inevitably lead to confusion, to controversy and to loss.

It is not advisable for the architect to assume the obligation of advising the owner as to legal matters or as to the legal form of a contract. The architect will do well, in his own interest, to make clear to the owner that any important construction contract—whether or not prepared by the architect—should be reviewed by the owner's own attorney. Naturally the architect will offer advice regarding architectural phases of the agreement. He probably will prepare a suggested form. But if the form is not one which has already been approved and decided legal—such, for example, as the standard A. I. A. form—the architect may well avoid a responsibility with respect to it that would lie beyond the scope of his professional training and duties.
PAUL HYDE HARBACH AND
JAMES WILLIAM KIDENEY, ARCHITECTS
CENTRAL HIGH SCHOOL, AMHERST, NEW YORK
Photographs by George A. Ostertag

Construction: central portion, steel skeleton, concrete floors; wings, bearing walls, steel trussed roofs. Exterior: buff gray brick with slashed joints. Trim, buff limestone. Roof, variegated slate. Wood work, warm brown. Metal work, copper, weathered to rich brown
CENTRAL HIGH SCHOOL, AMHERST, N. Y.
PAUL HYDE HARBACH AND
JAMES WILLIAM KIDENEY, ARCHITECTS

On facing page: above, entrance to gymnasium; below, panoramic view of entire school plant
A National Campaign for the Architect that will . . .

Tell the public about architectural service

Get recognition of the architect in Government and private building programs

Promote immediate building and modernization

Aid professional organizations and individual architects with local advertising campaigns

THE National Housing Act, providing more than three billions of dollars for encouragement of new building has been passed. Coming on top of the already discernible gains in general business reported in all sections of the country, it is assured that the building industry is on the threshold of better times.

American Architect has pioneered in advocating recognition by the Federal Administration of the importance of the building industry as a means of stimulating economic recovery. In doing so this magazine has vigorously championed the architect as a necessary part of any building program. Now American Architect is launching a national campaign in cooperation with the magazines with which it is affiliated to promote immediate building and modernization and to urge that the architect be prominently and definitely represented in both the Government's program and in private plans for renovation and new construction. The Hearst newspapers with more than five million daily circulation are cooperating with American Architect.

The objective of this campaign is to inform the general public as to the value of architectural service and to create a demand for that service on buildings of all types, particularly—in view of the importance of the National Housing Act—in the residential and remodeling fields.

The names of the cooperating publications furnish convincing evidence of the powerful influence which the program will have in moulding public opinion so that it will be favorable to the architect and of the general benefits that will come to the entire profession as a result. American Architect's publicity program will be carried out through cooperation of the Stuyvesant Building Group of which this magazine is a member and which includes also, House Beautiful combined with Home and Field, and Town and Country.

The last named are consumer magazines read monthly by thousands interested in home building or remodeling. Good Housekeeping, an affiliated magazine, with a monthly circulation of nearly two million, is entirely in sympathy with the program and is conducting its own editorial campaign to stimulate new building and modernization and to promote the architect's service. Many influential newspapers which recognize American Architect as a leader of architectural thought and as a source of real and accurate news, will cooperate and are now vigorously supporting the National Housing movement in several different ways.

Among the main features of American Architect's national campaign to advance interest in the architect and the value of his services will be the production of a booklet developed by American Architect editors. This will be offered to the public through advertisements in journals of national circulation. It may be distributed also by architects themselves upon application to American Architect.

The booklet, entitled "When You Build . . ." by Benjamin F. Betts, will tell the prospective owner how he can be assured the greatest value, pleasure and satisfaction from the money he will spend for his building operation. It will explain how an architect works as the logical agent to insure this desired result. For the owner it will point out ways to avoid the common pitfalls of poor planning and shoddy construction; and for the architect it will present to the prospective owner practical reasons for retaining professional advice upon every phase of a building problem.

But if American Architect's national program
When
YOU BUILD...
You should get the greatest value, pleasure and satisfaction for the money you spend.

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Leadership in the building industry is admitted to be one of the greatest of today's needs. It is possible for architects to assume this leadership today, but it is possible only by energetic and properly coordinated action of organizations and individuals.

is to be most effective, it must be backed up by intensive local activities of individual architects and professional organizations. Some of the ways by which architects can capitalize locally the value of a national program are:

1. Use American Architect articles as the basis for sales arguments to individual clients.
2. Distribute the booklet “When You Build . . .” to prospects and to others, who, at some future time may be in a position to build.
3. Advertise the value and availability of architectural service in local newspapers.
4. Contact local newspaper editors with a view toward publishing architectural news of all kinds, including articles on the economic and planning phases of house building or remodeling.
5. Use every opportunity to promote good architecture by explaining what it is and how it can be obtained. This can be done in speeches or illustrated lectures before civic societies, clubs, and schools.
6. Work with local city organizations in developing campaigns of civic improvement, even if it merely takes the form of a clean-up campaign.
7. Cooperate in developing local model exhibits of new building and modernization projects.
8. Present a radio program to inform the public about the economic and planning sides of home building, repair and modernization. This might well be done under sponsorship of some financial agency with money to lend in the building field under one of the provisions of the National Housing Act.
9. Work with officials of banks, mortgage companies and building and loan associations to make retention of registered architects a requirement for the granting of building loans.

Thus the local architect can bend his efforts in cooperating with the campaign of the Stuyvesant Building Group. American Architect stands ready to assist local organizations in any way that may prove practicable; and although it is obviously impossible for the magazine actively to sponsor or direct local efforts, its Editors will be glad to give advice to any architect or organization seeking it.

Leadership in the building industry is admitted to be one of the greatest of today's needs. It is possible for architects to assume this leadership today, but it is possible only by energetic and properly coordinated action of organizations and individuals.
Heating, Cooling and Air Conditioning

AMERICAN ARCHITECT REFERENCE DATA

Number 12, July, 1934
AIR conditioning should be looked upon as merely an extension of the problem of heating and ventilating buildings. Instead of providing a comfortable temperature during cold weather only, it extends the comfort season all through the year. It also enhances comfort and aids health by controlling the quality of the air.

Considered in this way, air conditioning falls within the province of architectural practice to about the same extent as the design of heating installations. Average sized projects, including practically all residential work, may be designed by the architect. Special problems of any sort, and all projects of large size, should be developed by a competent consulting engineer collaborating with the architect.

The purpose of this article and its reference data is two-fold: First, to provide a sound background knowledge of methods of designing complete air conditioning systems of any size or character, to enable the architect to collaborate effectively with consulting engineers and manufacturers of equipment; second, to provide simplified methods of selecting appropriate equipment for winter, summer or all-year air conditioning of residences, small stores or offices, and other normal projects that the architect may have to undertake without employing counsel.

TRENDS AND OBJECTIVES

It is already evident that even the simplest heating installation will eventually be expanded to provide winter air conditioning (which embraces (1) heating, (2) humidification, (3) air motion, and (4) air cleaning). Therefore, any heating plant designed or modernized today should at least be readily adapted to future development into a winter air conditioning installation, even if the owner is not aware of the manifold advantages of the more advanced equipment. Otherwise early obsolescence will endanger the investment.

Similarly the demand for summer comfort is expanding so rapidly it will soon become common practice, rather than occasional practice, to equip dwellings, offices and many types of commercial and institutional buildings for summer air conditioning. This embraces (1) cooling, (2) dehumidification, (3) air motion, and (4) air cleaning. Since two of these four functions, air motion and air cleaning, are common both to winter and summer air conditioning, it is obviously the dictate of wisdom and foresight to plan even the simplest heating or winter air conditioning installation so it may eventually be expanded to provide summer comfort and convenience as well.

Leading authorities uniformly predict that all-year air conditioning will become as commonplace as central heating plants are today. Most of them further believe that the standards for summer comfort will be as rigid as those now governing the winter season, requiring summer air conditioning of all rooms that are heated in winter. Why, they say, should people demand the ability to move freely about a building in winter, with all rooms at a comfortable temperature, and then tolerate being confined to one or two rooms that are comfortably cool in the summer?

The ultimate objective of all heating and cooling projects is, therefore, all-year air conditioning. With this objective in mind, the data presented hereinafter will assist the reader to select equipment for any individual aspect of air conditioning (heating, cooling, humidification, dehumidification, air motion or air cleaning) with due respect for the ultimate adaptation of the equipment to provide all-year comfort conditioning.

STANDARD CONDITIONS TO BE MET

The conditions to be attained for maximum human comfort under normal circumstances, and the range of variation sometimes encountered are expressed in the following "design" standards. If the equipment selected will satisfy these requirements, its operation may be adjusted to suit the great majority of occupants.

Heating Equipment should be capable of maintaining an indoor temperature of 72 F in all ordinary living quarters, offices and rooms where occupants are sedentary, regardless of outdoor temperatures. Temperatures for special rooms and com-
**SIMPLE DEFINITIONS OF ESSENTIAL AIR CONDITIONING TERMS**

**Dry-Bulb Temperature** is the temperature of air as indicated by a thermometer of standard type.

**Wet-Bulb Temperature** is the lowest temperature which a wetted body will attain when exposed to an air current. It is measured by a standard thermometer having its bulb wetted by water and exposed to vigorous air circulation.

**Effective Temperature** is an arbitrary composite index of the effect on the human body of a combination of temperature, humidity and movement of air. It has been experimentally determined and is used as an index to air conditions which affect human comfort.

**Dew-Point Temperature** is the temperature at which air would become fully saturated (100% relative humidity) with its present moisture content. Its importance in air conditioning lies in the fact that when air containing a certain amount of moisture is cooled below its dew-point temperature, part of its moisture content is condensed. This makes it possible to dehumidify air by refrigeration.

**Relative Humidity** is a measure of the quantity of water vapor in a given body of air expressed as a percentage of the total amount of water vapor the same air would contain at the same temperature if fully saturated. It should be noted that the amount of water vapor in saturated air varies with the temperature of the air.

**Sensible Heat** is heat that raises the temperature of a body which absorbs it. It is measured by a standard thermometer.

**Latent Heat** is heat that is absorbed or given off by a substance when changing its state from solid to liquid or gas, or vice versa without changing its temperature. It is important in air conditioning as the heat required to evaporate water for humidification purposes and the heat released by water vapor when condensed in the dehumidifying process.

**British Thermal Unit** is substantially the quantity of heat required to raise 1 lb. of water one degree F. (from 63 to 64 F.). It is expressed as Btu and is the measure of quantity of heat as distinguished from pressure of heat, which is temperature.

**Degree-Day** is a unit representing a difference of one degree Fahrenheit existing for one day between the average indoor and outdoor temperatures. The standard degree-day is based on an average indoor temperature of 65 F. Degree-day tables are based on Weather Bureau records and reflect both the number of days in a heating season and the number of degrees Fahrenheit through which a building must be warmed during that season.

**Equivalent Direct Radiation** is that amount of heating surface which will give off 240 Btu per hour. It is used for measuring the capacity of radiators, convectors, and boilers as an alternate for their output in Btu. By definition equivalent direct radiation applies to steam temperatures, but custom employs an equivalent direct radiation for hot water radiation equal to 150 Btu per hour. Unless hot water radiation is specified, E. D. R. always refers to steam heating equipment.

**Adsorption** designates the property of certain substances to condense water vapor without themselves being changed either physically or chemically. Silica-gel, activated alumina and some other materials will take up and condense considerable quantities of water vapor from surrounding air at normal temperatures and will then release it again by evaporation when heated.

**Absorption** connotes the property of certain substances to condense water vapor without themselves being changed either physically or chemically. Silica-gel, activated alumina and some other materials will take up and condense considerable quantities of water vapor from surrounding air at normal temperatures and will then release it again by evaporation when heated.

Summer conditions are listed in Table 1. Temperature should be measured 30" from the floor and the temperature difference per foot of height from floor to ceiling should not exceed .75 F.

**Humidifying Equipment** should be capable of maintaining a relative humidity of 40% indoors during the heating season when outdoor temperatures are above 35 F if windows are single glazed, and 0 F if windows are suitably double glazed. When outdoor temperatures fall to these points, condensation may prove troublesome on glass areas and it is preferable to tolerate lower indoor humidities during the intervals of severe weather. The theoretical winter comfort zone is shown in Table 2, which indicates in bold face type the optimum Effective Temperature range in relation to dry-bulb temperature and relative humidity. Note that summer requirements differ from those ideal in winter.

**Air Motion** should be maintained in the winter heating season at a rate that will assure uniform distribution of heat (within .75 F temperature difference per foot of height) at all times. Since neither radiators, convectors nor gravity warm air systems will provide such circulation when cool or cold, some form of blower or fan equipment is usually desirable to maintain adequate air motion. Such devices are essential to air cleaning. See Table 3 for recommended air changes.

In summer, air motion requirements depend upon related comfort equipment. When used with me-
chanical refrigeration, fans or blowers should be capable of circulating the air in the cooled space at least 3-6 times per hour. When used for evaporative cooling they should be able to change the air 6-10 times per hour. When used for night air cooling (either attic fans, central fans or both) they should be able to completely change the air 30 to 35 times per hour.

The temperature, velocity and method of introducing air must be such as to obviate drafts. Warm air should never exceed 150 F and preferably should not exceed 140 F. The difference in temperature between cooled air and the room temperature into which it is introduced should not exceed 5 F if it enters horizontally below the breathing zone, 10 F if above the breathing zone, or up to 20 F if wide diffusion can take place, as in theaters, before the cooled air reaches the occupants.

Air Cleaning Equipment should be able to remove from air circulated by fans or blowers substantially all dust, pollen, soot and grit, and substantially all smoke or perceptible odors. Since air cleaning requires mechanical air motion, the type and over-all effectiveness of equipment is dependent upon the volume and frequency of mechanical circulation and the design of the filters or washers employed. Velocity through filters should not exceed 800 f.p.m. over the gross face area of the filter and the resistance to the flow of air should range between 3/8 and 3/4 inches of water pressure.

Cooling Equipment should be capable of lowering temperatures indoors not over 15 F below the prevailing outdoor temperature. This is the maximum cooling effect that can be tolerated for health as well as comfort. Cooling is seldom required until outdoor temperatures exceed 80 F and equipment need not cool the interior of normally occupied space below 75 F. The range of cooling effect required for comfort is, however, directly related to the concurrent indoor relative humidity; hence cooling cannot be considered alone.

Dehumidification Equipment must be related to cooling equipment (or vice versa) so that the resultant Effective Temperature (see definitions) will be approximately 60° E.T. for winter heating and 71° E.T. for summer cooling. Summer comfort may result from dehumidifying alone, or cooling alone within a narrow range, or by both in varying proportions within the total range of summer comfort control. It is therefore possible to place emphasis on either cooling or dehumidifying capacity (according to local climatic conditions) and to use the other as an adjunct of the dominant equipment. See Table 4 for the permissible range of dry-bulb temperature and relative humidity which will fall within the proper Effective Temperature range.

Automatic Control of heating, cooling or air conditioning is one of the prime essentials of comfort. Human comfort exists within a remarkably narrow range and is affected by temperature, humidity and air motion. It is beyond the normal skill of laymen to manually control these variables to maintain comfort conditions even if convenience and economy of operation are left out of consideration. Hence it is essential that equipment be so balanced in design and so governed by sensitive automatic controls that the foregoing standard conditions will be maintained regardless of changes outdoors, and with a minimum of attention.

Characteristics of Available Equipment

The selection of heating, cooling and air conditioning equipment would be comparatively simple if there were not so many different ways of accomplishing the desired results. Each basic type of equipment has advantages and limitations. No one type is universally adaptable to all types of buildings and to all climatic conditions. The following section, therefore, is devoted to a condensed summation of the principal characteristics of various types of equipment. Its purpose is to review the field rapidly so that detailed study for any given project may be immediately confined to the two or three types which appear best suited to the project requirements.

HEATING

Warm Air Heating, using ducts for the distribution of heat from a central source, is readily adaptable to winter, summer and all-year air conditioning, because its prerequisite is the circulation of air from the heated or conditioned space through the central plant where it can be treated as required. Gravity warm air heating plans may readily be converted to mechanical forced air circulating systems by the addition of a fan or blower, and to winter air conditioning by the further addition of an air washer or filter and a humidifier. Similarly, summer cooling equipment can be added by suitable enlargement of the central duct system.

The use of warm air heating is limited by the resistance developed in excessively long ducts and by the space required to house large ducts or plenums required to transport the air any considerable distance. Warm air heating is therefore primarily adapted to dwellings and other relatively small buildings. It should be noted, however, that ventilating systems, frequently installed in schools, churches, auditoriums and theaters, are adaptable to warm air heating and complete air conditioning.
Piped Distribution Systems, employing steam, vapor or hot water as the heating medium, have a number of advantages for heating purposes, but are less readily adapted to air conditioning. The advantages of piped distribution systems are that heat may be transported long distances from a central plant, sections of the building may be zoned or subjected to localized control, the space required for distribution lines is relatively small, and uniformity of heating effect is readily assured by good design of the installation.

The adaptation of these systems to either winter air conditioning, summer air conditioning, or all-year air conditioning is made somewhat difficult by the fact that radiators and convectors are not normally equipped to provide air motion, air cleaning or proper humidification. Therefore, piped distribution systems usually require the installation of unit blowers, humidifiers and air cleaners in each space or zone that is to be completely conditioned in winter.

Summer air conditioning requires the use of unit coolers with their own fans and air cleaners. Some cooling may be done by piping cold water through existing radiation if the system is designed for heating with hot water and the radiators are equipped with drip pans and drains to remove condensation. Some auxiliary method of maintaining air circulation is then required for adequate diffusion.

Therefore, buildings having piped distribution systems require a multiplicity of units if the entire structure is to have all-year air conditioning; but individual spaces may be readily conditioned by the use of such units without any major modification of the central heating plant.

Combination Systems use both direct radiation and indirect warm air heating. They have a central steam or hot water boiler, connected by normal piping lines to direct radiators in spaces where heating alone is required, and to indirect heating elements in one or more systems of warm air ducts serving spaces where air conditioning is required.

The advantages inherent in the combination system are: (a) Parts of the structure, such as service areas, kitchens, garages, storage space, and bathrooms or toilets, may be heated by radiators and
isolated from the return duct systems where objectionable odors would otherwise be recirculated through the apparatus. (b) Widely separated sections of a building that are to be completely air conditioned may have independent systems of ducts with local indirect heating units. (c) The central heating plant may be used all year to provide domestic hot water or to supply any summer steam demand.

The combination system is readily adapted to existing warm air heating systems, and to the conversion of parts of piped distribution systems to localized air conditioning of special zones or groups of rooms.

In residences, for example, the combination system may include direct radiation in the garage, kitchen, servants' quarters, and bathrooms, and may use a basement central air conditioner and duct distribution serving all of the main living quarters and bedrooms. The boiler may be operated all year for domestic hot water and possibly for steam-jet refrigeration.

In commercial buildings, space rented for restaurants, banking quarters or other special purposes, or special groups of offices, may be air conditioned with units of suitable capacity located remotely from the main boiler room, and the rest of the building may be efficiently heated by the usual radiation. Even where the entire building is to be completely air conditioned, it is often more economical to divide the building into sections, each equipped with its own blowers, duct systems or air conditioning equipment, than to have one central system installed in the basement. The individual zones can then be served by steam lines carried long distances through the building in a minimum of space, and the main boiler plant may also provide power or steam for a central refrigeration plant.

**Boilers, Furnaces and Fuels** should all be selected with due regard to present or future air conditioning requirements. Automatic operation is highly desirable in all small heating installations for reasons already given. Only large plants that are constantly attended may be manually operated with reasonably satisfactory results. Therefore, the boiler or furnace originally selected should either be equipped with an oil burner, gas burner or automatic stoker, or should be readily adapted to such units when opportunity affords.

Consideration should be given to the use of the main heat source for domestic hot water and possibly for steam-jet refrigeration. Warm air furnaces seldom provide a satisfactory means of heating the domestic hot water supply in winter, and cannot be operated for this purpose during the summer season. When it is thus necessary to have a separate domestic hot water source, advantages are often gained by selecting a unit using the fuel employed for winter heating.

Both steam and hot water boilers may be equipped with indirect heaters for supplying domestic hot water, and both types of plants may be operated all year for this purpose by cutting off the distribution lines in summer. This change-over from winter to summer operation is more readily made with steam than with most hot water systems because the former may be automatically controlled so that no steam is generated in summer, while the typical hot water system requires some form of shut-off valve to prevent circulation of hot water during this period. Steam boilers may also be used to operate steam-jet refrigerating equipment, but in this case also the heating mains must be provided with suitable valves.

**HUMIDIFICATION**

A CHARACTERISTIC of most man-made heating systems heretofore employed is that they do not provide for the maintenance of the proper amount of moisture in the heated air. No heating system in common use, whether warm air, steam, vapor or hot water, meets this deficiency unless humidifying equipment is especially provided. The amount of moisture required to maintain satisfactory relative humidities indoors varies widely according to climatic conditions, but there is no section of the country where at some part of the heating season humidification is not essential to satisfactory air conditioning.

**Methods of Humidification** include: (a) evaporation of water in heated pans or while passing over heated surfaces; (b) exposing extensive water surfaces to large volumes of air in motion; (c) the mechanical atomization of water into a fine mist; and (d) forcing air to pass through sprays of water.

It should be understood that the evaporation of water by any method requires the absorption of heat, and this heat must either be introduced into the water or else it will be taken from the air by the evaporation process. There is, therefore, a heat load to be considered whenever humidification equipment is employed.

In selecting humidifying equipment consideration should be given to the character and cost of water. Evaporative-type humidifiers leave a sludge or hard sediment when the water supply contains mineral salts. This sediment, however, can usually be removed by periodic cleaning of trays or evaporating surfaces throughout the winter heating season. The atomization method is not usually affected by the content of the water, but where recirculating spray equipment is used there is danger of clogging the spray heads if sediment is not first filtered from the water, or if the orifices are not large enough to permit sediment to pass through. Where water is costly the evaporative, atomizing and recirculating spray methods have the advantage as they do not waste water. The spray method as used in ordinary air washers also serves to clean the air. In some units the water is filtered and used over again but in others it is wasted to the sewer.
Dual Purpose Humidifiers offer some economy in equipment cost. Air washers are commonly employed for humidifying purposes; the necessary heat of evaporation being taken from the air unless warm water is used in the sprays. They are similarly used for cooling and dehumidifying purposes by employing refrigerated water. Evaporative coolers are actually humidifiers employed for summer cooling effect in climates where the outside relative humidity is below permissible summer standards; hence they may be used as a part of both winter and summer air conditioning equipment.

Control of Humidification should be automatic to the highest possible degree. It can be effected in four ways: (1) By balancing the capacity of the humidifier to the heating plant so that the amount of moisture evaporated is approximately proportioned to the amount of heat supplied. This method fails to recognize variations in outside relative humidities; hence it is far from being a precise or normally satisfactory control. (2) By interconnected thermostats of the wet-bulb and dry-bulb types arranged to maintain the proper differential between wet-bulb and dry-bulb temperatures. (3) By the direct use of humidists controlling the operation of the humidifying sprays or the supply of water to evaporators or atomizers. Humidists are not as sensitive or accurate as thermostats; hence their control is not so precise. (4) By the use of a thermostat controlling the temperature of the air leaving the spray chamber before it is reheated or mixed with warm and circulating air. This control is precise because the air leaves the spray chamber 80 to 90% saturated and at substantially the temperature of the water; hence by governing the temperature of the leaving air and by the use of thermostatic controls on the reheaters or mixing dampers, both the final temperature and the final humidity are readily controlled.

Automatic controls of any type should be capable of manual adjustment to reduce humidities temporarily when excessive condensation appears on windows.

### COOLING

**Here** are five basic methods of comfort cooling: by ice, by electric refrigeration, by steam vacuum refrigeration, by evaporative cooling, and by the use of fans to air-cool the interior of buildings at night as a means of retarding the effect of solar radiation in the daytime. The characteristics of each type follow:

**Ice Cooling** requires relatively inexpensive equipment consisting usually of an ice storage tank or cabinet, a means of melting the ice with water or air, and a means of forcing the air directly into the rooms, or the cooled water through suitable heat exchangers which indirectly cool circulated air. Equipment is available for both central cooling and unit room cooling. The operating cost of such equipment depends largely upon the delivery cost of ice in bulk and the frequent charging of the ice container. The chief disadvantage of ice cooling lies in the fact that daily requirements must be estimated in advance and suitable delivery arrangements made. This constantly reminds the owner of the cost of operating his cooling equipment and consequently tends to minimize its use under conditions when an automatic plant would readily be permitted to operate. Also, shortage of ice compels a shut-down.

**Electric or Compression Refrigeration** may be used in two ways: first, by the direct expansion of the refrigerant in cooling coils or unit coolers through which air is circulated, or, second, by the indirect cooling of water and the use of this chilled water in the form of sprays for cooling air or for piping throughout the building to direct radiation. With either method of applying electric refrigerating equipment there is a further choice as to whether

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**TABLE 4—RECOMMENDED SUMMER INDOOR AIR CONDITIONS**

<table>
<thead>
<tr>
<th>OUTDOOR TEMP [Deg. Fahr.]</th>
<th>INDOOR AIR CONDITIONS WITH DEW-POINT CONSTANT AT 57 F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Dry-Bulb Temp.</td>
<td>II Dry-Bulb Temp.</td>
</tr>
<tr>
<td>95</td>
<td>80.0</td>
</tr>
<tr>
<td>90</td>
<td>78.0</td>
</tr>
<tr>
<td>85</td>
<td>76.5</td>
</tr>
<tr>
<td>80</td>
<td>75.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIVE HUMIDITIES (PER CENT)</th>
<th>Effective Temperatures (Degrees Fahrenheit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>69.3</td>
</tr>
<tr>
<td>35</td>
<td>69.1</td>
</tr>
<tr>
<td>40</td>
<td>68.5</td>
</tr>
<tr>
<td>50</td>
<td>70.0</td>
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<tr>
<td>55</td>
<td>71.5</td>
</tr>
<tr>
<td>60</td>
<td>71.0</td>
</tr>
</tbody>
</table>

Bull face indicates theoretical ideal Effective Temperatures for summer.
### TABLE 5—WINTER CLIMATIC CONDITIONS IN THE UNITED STATES

<table>
<thead>
<tr>
<th>STATE</th>
<th>CITY</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Max. No. Of Precipitation. Rate, in Inches Per Day</td>
<td>Min. No. Of Precipitation. Rate, in Inches Per Day</td>
<td>Max. No. Of Precipitation. Rate, in Inches Per Hour</td>
<td>Min. No. Of Precipitation. Rate, in Inches Per Hour</td>
<td>Average No. Of Precipitation. Rate, in Inches Per Week</td>
<td>Average No. Of Precipitation. Rate, in Inches Per Month</td>
<td>Average No. Of Precipitation. Rate, in Inches Per Year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ala.</td>
<td>Mobile</td>
<td>20</td>
<td>2.41</td>
<td>8.3</td>
<td>N</td>
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<td>120</td>
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<tr>
<td></td>
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<td>2.72</td>
<td>8.6</td>
<td>N</td>
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<td>149</td>
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<tr>
<td>Ariz.</td>
<td>Phoenix</td>
<td>15</td>
<td>2.58</td>
<td>3.9</td>
<td>E</td>
<td>1404</td>
<td>134</td>
</tr>
<tr>
<td></td>
<td>Flagstaff</td>
<td>5</td>
<td>2.99</td>
<td>6.7</td>
<td>SW</td>
<td>7145</td>
<td>203</td>
</tr>
<tr>
<td>Ark.</td>
<td>Fort Smith</td>
<td>-10</td>
<td>3.05</td>
<td>8.0</td>
<td>E</td>
<td>3214</td>
<td>157</td>
</tr>
<tr>
<td></td>
<td>Little Rock</td>
<td>0</td>
<td>2.92</td>
<td>9.9</td>
<td>NW</td>
<td>2811</td>
<td>152</td>
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<tr>
<td>Cal.</td>
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<td>7.2</td>
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</tr>
<tr>
<td></td>
<td>Los Angeles</td>
<td>30</td>
<td>1.93</td>
<td>5.1</td>
<td>NE</td>
<td>1504</td>
<td>132</td>
</tr>
<tr>
<td>Colo.</td>
<td>Denver</td>
<td>-10</td>
<td>3.05</td>
<td>7.4</td>
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<td>5873</td>
<td>191</td>
</tr>
<tr>
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<td>Grand Junction</td>
<td>5</td>
<td>2.99</td>
<td>5.6</td>
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#### Notes:
- Figures in Column 6 computed by dividing the degree-days in the heating season by the difference between the average outdoor temperature from October 1st to May 1st and 70 F. outdoors.

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the compressor shall be water cooled or air cooled. If air cooled, the compressor must be located outside of the room to be cooled, but with water-cooled units the compressor may be installed within the space being conditioned. This affects the choice of unit summer air conditioners, and this choice in turn may be influenced by the cost of water consumed by the condenser. For further details regarding electric refrigerating equipment, see AMERICAN ARCHITECT Reference Data No. 3—Mechanical Refrigerating Equipment—November, 1932.

Steam-Vacuum Refrigeration has only recently come within the field of normal architectural practice, having hitherto been adapted to relatively large installations requiring special engineering design. Today steam-jet refrigerating units are available in sizes small enough for use in the larger residences or equivalent store, restaurant or commercial and institutional structures.

The underlying operating principle is based upon the fact previously noted that when water is evaporated, heat is absorbed. A jet of steam under high...
velocity is used to create a vacuum in a container that is equipped with spray nozzles from which city water at ordinary washer temperatures is diffused in the form of a fine mist. Under the high vacuum conditions prevailing within the chamber, evaporation takes place at relatively low temperatures producing a chilling effect similar to that developed at normal atmospheric pressures. The recirculating water entering at perhaps 55°F, is chilled to a temperature of 40°F to 45°F and this cooled water is therapeune circulated for air conditioning purposes in exactly the same manner as cold water produced by electric refrigeration or ice melting. However, the vapor thus produced within the spray chamber and the steam used in the jet have to be withdrawn and condensed. This requires the use of additional water as in the case of water cooled electric refrigeration condensers, but more water is required in the steam-vacuum process. A similar process uses no steam, creating the vacuum with centrifugal exhausters.

The choice of vacuum refrigeration as compared with electric refrigeration therefore depends upon several factors: (a) the cost of water, (b) the cost of generating steam, and (c) the cost of electric current. Where water costs are very high, cooling towers are usually employed to cool the water used in the condensers and thus permit it to be reused over and over again except for that which is lost in the cooling tower. These cooling towers are available in two types: the familiar outdoor type which may take the form of a roof superstructure or a spray cooling pond, and the indoor or hosed type which employs a fan or blower.

The space required for a more complete description of vacuum jet refrigerating equipment and the various types of cooling towers that may be used with it, is hardly warranted in this discussion, because in larger plants the problem requires the services of a competent consulting engineer, and the smaller plants offered by manufacturers are properly balanced in design so that the architect need not concern himself with the details of their composition. The choice between vacuum and electric refrigeration is largely a matter of carefully balancing the several cost elements above mentioned, plus the initial cost and the probable life of the apparatus. In the case of vacuum refrigeration there are no moving elements employed in the refrigerating process itself; the mechanical equipment consists solely of a condensation removal pump and, in some types, an exhaust fan.

Gas Refrigeration warrants consideration in areas where there is a low cost gas supply. At present gas refrigerating units of the absorption type (similar to domestic gas refrigerators) are not in commercial production in sizes suitable for air conditioning loads, as the chief interest in the use of gas for air conditioning purposes has largely centered around dehumidification by the adsorption process as will be developed later.

Evaporative Cooling is a practical and low cost method of comfort cooling in climates where the outdoor relative humidities prevailing throughout the cooling season are below those required for summer comfort. In such locations the addition of moisture to the air is permissible and, therefore, evaporative cooling is logical as well as effective.

Evaporative coolers are similar to air washers and consist of a spray chamber through which the indoor air is constantly circulated. A part of the spray water, which is at substantially the same temperature as the entering air, is evaporated and draws its heat of evaporation from the air, cooling it. At the same time it increases the moisture content or relative humidity of the outgoing air. Evaporative cooling is low in cost and requires a minimum of equipment. It should not be attempted where prevailing outdoor relative humidities equal or exceed those shown in Table 4(a) as representing desirable summer cooling conditions.

Fan Cooling should not be confused with the cooling effect produced by vigorous air circulation. The latter does not lower temperatures but simply increases the rate of evaporation of body moisture and thereby produces a cooling effect upon the body, just as a summer breeze on a sultry day may make high temperatures more bearable.

Fan cooling, as considered here, uses cool night air to lower the temperature of the building mass. All materials absorb and hold heat. During warm days the interior building surfaces, and even the furniture and fixtures, are warmed and retain this heat for some time after the air itself becomes cooler. In most sections of the United States nighttime temperatures are considerably below day temperatures throughout the summer season. Fan cooling takes advantage of this fact to thoroughly ventilate the interior of a building during the night period, thereby removing as much as possible of the heat retained by the building mass before the next period of daytime heat arrives.

This night cooling effect can be secured without the use of any fans or other equipment if the windows of a building are kept open from about six o'clock in the evening until six in the morning and are then closed and sunny windows shaded during the daytime. Since this is not practical in all buildings fans are used to augment natural circulation.

In residences fans are located in the top floor or attic, and the attic stairway or other suitable opening becomes a duct for conveying the air from the lower floors through the fan to the outside. The fan capacity should be such as to change the air in the space to be cooled from 30 to 35 times per hour.

The advantage of this method is that it may reduce the cooling load on mechanical refrigerating equipment possibly 60% or more of what would be required if nighttime cooling were not employed. The chief disadvantage of this method is that it makes no provision for cleaning the large volume
of air passing through the dwelling. People who suffer from hay fever or asthma may find their condition aggravated by the dust brought in, whereas normal methods of air conditioning using filters or washers usually offer a high degree of relief to these sufferers.

A system that avoids this difficulty but that requires oversize filter or air-washer capacity and abnormally large ducts employs the usual central heating or cooling unit fan and filter equipment with an auxiliary attic fan. The basement fan is then arranged to introduce outside air at nighttime instead of recirculating the indoor air, and the attic fan serves to remove the air thus introduced.

In any case, the cost of operating these blowers should be checked against the cost of operating systems using normal quantities of cooled air.

**Automatic Control of Cooling** introduces a factor not present in thermostatic control of heating. Experience indicates the total temperature drop during the summer period should never exceed 15 F and rarely should exceed 10 F if persons move from the cooled building to out-of-doors at frequent intervals. Thus in summer it is necessary to maintain a limited temperature difference, not a constant temperature. Furthermore, summer comfort is so definitely a product of both dry-bulb temperature and relative humidity that the desired effective temperature range can only be maintained when all three factors—outdoor temperature, indoor temperature and relative humidity—are properly correlated.

While the type of controls necessarily varies according to the kind of summer air conditioning equipment employed, the general principle underlying this three-part control is to use a differential thermostat to keep the temperature difference within proper bounds and then to control the indoor relative humidity in relation to the indoor temperature either by means of wet- and dry-bulb thermostats, by so-called "effective temperature" control devices, or by a hygrostat integrated with suitable thermostats.

**DEHUMIDIFICATION**

There are two practical methods of dehumidifying air. One is to cool the air below the dew-point temperature. At this temperature the air is saturated and below it the excess moisture is condensed and leaves the air in the form of dew. The other method is to pass the air over substances or through liquids that have such an affinity for moisture as to mechanically or chemically remove a large percentage of the air-borne vapor.

Before discussing these methods in detail it is important to remember that when moisture is given up by air, heat is released. This is the same amount of heat that is absorbed when water is evaporated. Dehumidification, therefore, produces heat which must be removed by cooling equipment just as humidification requires heat which must be added to the load of the heating plant. This heat is called latent heat as distinguished from the heat we can feel, which is termed sensible heat.

It is also important at this point to recall the fact that summer comfort is dependent upon both dry-bulb temperature and relative humidity. Consequently, in producing summer comfort in a section where prevailing humidities are excessively high, the equipment must have greater dehumidifying capacity than is necessary in areas where outdoor relative humidities are low. These factors all have an important bearing on the selection of suitable equipment.

**Dehumidification by Cooling** is a method commonly employed where refrigerating equipment is available or where the local water supply does not exceed 45 or 50 F. Under this process the air is chilled below its dew-point temperature where its moisture content is reduced by condensation, and then is reheated to a temperature that may be introduced into the conditioned space. This reheating is accomplished in either of two ways: (a) by the actual application of heat through tempering coils, or (b) by mixing the cold dry air with a suitable amount of unconditioned, recirculated air.

This method of dehumidification is applied in two principal ways. Where air washers are used as dehumidifiers the spray water is reduced in temperature below the dew-point temperature of the entering air. Normally, spray waters are maintained at around 45 F. The action of the spray is practically instantaneous in removing the excessive moisture content of the air, and the heat released is absorbed by the spray water rather than by the air, which leaves the washer at a temperature close to its dew point.

The other method is to pass air over refrigerated coils or heat exchangers. When this is done, moisture is condensed upon the cold surfaces and is carried off into the drain.

**The Adsorption Method** makes use of the property of certain substances, notably silica-gel and activated alumina, to mechanically withdraw water vapor from air. Latent heat released by this adsorption process is imparted to the air, thereby warming it so that the air passing through this type of dehumidifier must be cooled by some other means.

The means usually employed to cool the air again is the evaporative cooling method previously described. The effectiveness of silica-gel and activated alumina in adsorbing moisture is used to dry air considerably below that required for comfort purposes. The addition of moisture through the evaporative cooling process can thereby be tolerated. Where water costs are high the evaporative cooler may be equipped with an indoor or outdoor cooling tower as described for steam-vacuum refrigeration, but where water costs are low, the excess water used in the cooler is wasted.
A feature of this process is that the silica-gel or activated alumina must be freed of the water it withdraws from the air, which is done by heating the material in a chamber separated from that in which the adsorption process takes place.

The development of equipment employing the adsorption process of dehumidification has been temporarily retarded, but designs have passed the experimental stage and it is expected units will soon be marketed. Operating costs closely parallel those obtained with compression or vacuum refrigeration.

**AIR MOTION**

The two elements of complete air conditioning which are common to both summer and winter air conditioning are air motion and air cleaning, and these in turn are intimately related because air cleaning cannot be accomplished without air motion. While air motion sufficient for heating purposes might be, and frequently is, secured by gravity, the velocities developed are inadequate to meet air conditioning standards. Therefore, it may be assumed that power driven fans or blowers are essential elements in most summer or winter air conditioning installations.

The choice between a blower* and a fan for circulating air is almost wholly dependent upon the frictional resistance which the air stream must overcome in passing through ducts, filters or other kinds of equipment. Fans, typified by the ordinary desk fan or airplane propeller, can move large volumes of air at very low cost provided there is no appreciable static head or frictional resistance to overcome. They are most commonly used in free air. Blowers, operating on the centrifugal principle, can overcome very considerable static heads or frictional resistance, and are therefore used in most duct systems, and where filters, air washers, evaporative coolers or similar elements introduce a pressure or suction to be overcome by the blower.

In the selection of fans or blowers it is well to keep in mind that the volume of air to be moved and the velocity of air to be maintained for winter heating purposes may vary from that desired for summer comfort conditions. Where it is possible to use the same fan or blower for all-year air conditioning purposes, it is necessary to select blower equipment on the basis of maximum load, and to use variable speed motors or changeable pulley ratios so that the volume of air moved can be varied with seasonal requirements.

Another factor in selecting fans and blowers is quietness of operation. This involves the use of quiet-running motors (generally of special design adapted to meet these difficult conditions), and the operation of the fan or blower at relatively low tip speeds. Most of the noise caused by modern fans or blowers is due to the air itself rather than to the motor. A large blower operating at low speed will move as much air as a smaller blower at higher speed, but it will do so with less noise. Generally speaking, blowers are quieter than fans.

**Constant Vs. Intermittent Fan Operation** is one of the most important questions of air conditioning. Theoretically the maintenance of ideal air conditioning standards requires constant air motion, although the quantity of air to be moved will be less in the winter than in the summer. Some types of air conditioning equipment are designed to keep the fans or blowers in constant operation so that the only variables remaining to be controlled are temperature and humidity. The majority of equipment, however, relates the operation of the fan to the demand for heating or cooling effect, and does not maintain air circulation—and its concomitants, air cleaning and prevention of air stratification—unless the thermostat calls for heat in the winter or starts the cooling apparatus in action in the summer. Against the obvious advantage of maintaining a constant circulation and cleaning of air must be balanced the power cost of continuous operation. In the opinion of some authorities the periods of idleness under intermittent operation are not great enough to develop uncomfortable air stratification or "cold 70" in winter, or stagnation of enclosed conditioned space in summer.

**AIR CLEANING**

The two common methods of cleaning air are filtering and air washing.

Air filters are of several basic types: (a) fabric filters, consisting of layers of cloth, porous paper, or other woven or felted fabrics, (b) fibrous filters, usually consisting of pads of loosely held mineral or inert vegetable fibres, and (c) viscous filters, consisting of relatively coarse mineral and metal fibres coated with a viscous material to which dust and bacteria adhere as the air passes through the interstices in the mat.

The first two types are called dry filters and are cleaned either by shaking out the dust, by discarding the dirty filter material and replacing it with a fresh unit, or, in the case of cloth fabrics, by washing or vacuum cleaning the filter. Viscous type filters are renewed by washing the dirt-laden surface and recoating with fresh liquid which may be done periodically or as a continuous operation. It is a characteristic of most filters that their resistance to the passage of air increases as they accumulate dirt, but their efficiencies are high and their operating cost is relatively low.

Air washers remove dust, bacteria, little smoke and many air-borne odors by washing the air with fine sprays of water. Free water in the air is then removed by baffles or eliminator plates which are themselves wetted by the sprays. Dust or dirt not caught by the sprays themselves are caught by enforced impingement upon these wet surfaces.

The static head of an air washer is constant and it

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*For convenience, the word blower is used in this article to denote a centrifugal housed fan and the word fan to denote a disc or propeller type fan.*
has the advantage over filters of removing odors as well as much of the infinitely fine dust particles that might not be entrapped by a filter. Air washers may also perform other functions as humidifiers, dehumidifiers and evaporative coolers. Their chief disadvantages are: (1) cost of water and power required to operate them—important only where rates are high or with non-recirculating washers or where restrictions may be imposed upon the use of water during droughts. (2) The tendency to shut them off for long periods. Frequently the advantages of both types are combined by installing an air filter ahead of an air washer.

Capacity of Air Cleaning Equipment is directly related in practice to the volume of air moved by fans or blowers and is seldom determined by the cleanliness or dirtiness of the entering air. The surface area of filters and the size of air washers should be such that they can handle the maximum volume of air moved by the fan at a velocity not exceeding 800 ft. per minute at the filter face without introducing a static head over .25 in. water pressure.

How to Estimate Loads

BEFORE providing definite and simple rules for determining the various loads to be carried it is important to note the economic significance of thermal insulation, multiple glazing and weatherstripping in relation to heating and cooling. This subject was adequately covered in American Architect Reference Data No. 11, "Thermal Insulation of Buildings," May 1934, which should be read in connection with this study.

In evaluating the economic worth of thermal insulation in that article, heating loads only were considered and cooling loads neglected. In climates where the mean winter temperature is below 35 F. the selection of insulation methods for heating economy takes adequate care of summer cooling as well. Above that mean temperature the relatively higher cost of cooling makes it necessary to include cooling loads and their possible reduction in determining the amount of insulation showing the most satisfactory economies.

In addition to ordinary insulation, multiple glazing and weatherstripping, summer cooling loads may be profitably lessened by the use of awnings, shades and curtains on all windows exposed to direct sunlight. These will be evaluated later.

In the Reference Data on "Thermal Insulation of Buildings," heat losses to be reduced were estimated for the entire structure in order to simplify the study of insulation methods and materials. But in heating, cooling and air conditioning practice it becomes necessary to consider individual room units. Here, therefore, the rules of procedure are designed to provide data on individual room loads as well as total loads. These data will be referred to in American Architect Reference Data No. 13, to appear in September 1934, as a basis for selecting radiators, convector, registers, etc. and for computing pipe and duct sizes.

THE WORK FORMS

To save many unnecessary steps and extra calculations a set of work sheets of original design are presented on inserted pages. These sheets (which will be available in sets at low cost) have three distinct values:

1. They visualize the procedure established in the following rules.
2. They enable any architect or member of his force to make a complete set of calculations (without detailed engineering knowledge) that will establish the capacity required of any type of equipment used in heating, cooling or air conditioning. The economic chart enables the reader to compare the characteristics, investment and operating costs of various types of equipment to determine the one which best meets the project requirements.
3. They may be used by architects as standard forms for receiving competitive bids; by requiring competing manufacturers to submit their own calculations for capacity on a common basis. Otherwise the variations in method now used throughout the field may show such diverse results as to make a fair comparison of equipment difficult.

It is not necessary, however, to employ these exact forms in following the rules given below. Any set of computation sheets may be used to record the data. It is highly advisable, in any event, to record all calculations involved in each project.

MAXIMUM HEATING LOADS

THE total heating load of a building is made up of: (1) heat required to offset losses through walls, floors, ceilings or roof, including glass areas; (2) heat required to warm air introduced for ventilation purposes or by infiltration; (3) heat required to evaporate water for humidification; and usually (4) heat required in steam or water boilers to indirectly heat the domestic hot water. In certain projects, such as theaters and industrial plants, the total demand may be reduced by the body heat supplied by occupants and the heat generated by consumption of electricity and gas.

Data Required for computation of heating loads include:

(a) Local climatic conditions. See Table 5 for
data relating to winter conditions in major cities in the United States.

(b) Desired indoor temperature. See Tables 1 and 2.

c) Area of all walls, floor, ceiling or roof, and glass areas between heated and unheated space and volume in cubic feet of all rooms. These areas and volumes should be listed room by room and may be taken from drawings or by direct measurement of the building.

d) Coefficient of heat transmission of each type of wall, floor, ceiling and roof construction, and of all glass areas and doors. See American Architect Reference Data No. 11, "Thermal Insulation of Buildings," May, 1934, for coefficients of common constructions and for methods of determining the coefficients of any construction.

e) Infiltration of air in cubic feet, either computed from crackage of windows and doors, or based on assumed air changes. See "Thermal Insulation of Buildings" for complete data and Table 3 for air change data.

These data may be conveniently entered on the accompanying Form I—Individual Room Data—using as many such sheets or equivalent memoranda sheets as are required. The procedure in finding the maximum winter heating load per room is clearly indicated in Form I and is further established in the following rules.

RULE 1 . . . To find the maximum winter heat loss through walls, floors, roof, etc.:

1. Multiply the net area of each surface by its coefficient of heat transmission (Column II x Column III). The product is the heat transfer in Btu per hour per degree F for each area (Column IV or Col. VI).

2. Find in Table 7 the allowance to be added for wind and exposure for all outside surfaces. Apply this percentage to the item in Column IV, lines A to F inclusive and enter both percentage and amount in Column V. The sum of Columns IV and V is then entered in Column VI, which gives the total Btu per hour per degree F.

3. Multiply this by the design temperature difference in degrees F. For surfaces exposed to the outside, this design temperature difference (Column VII) is the difference between the desired indoor temperature and the outdoor design temperature. Where surfaces separate heated space from unheated space, such as basement or attic, it is customary to use half this temperature difference where the actual temperature of adjacent cold space is not known. Where floors are on the ground, the temperature difference may range from 5 F to 25 F. Multiply the total Btu per hour per degree F in Column VI by the design temperature difference in Column VII, and enter the total in Column VIII. This is the total maximum Btu per hour required to offset heat losses through these surfaces.

RULE 2 . . . To find the maximum winter heat loss through glass areas:

1. Multiply the gross area of all windows by the coefficient of heat transmission 1.13 for single glazing or .56 for double glazing to arrive at the loss through glass in Btu per hour per degree F. The areas are entered in Column II, the Coefficient U in Column III, and the product in Column IV (or Col. VI).

2. Add the proper allowance for wind exposure where required, and complete the computation, as in Rule 1.

Exposure allowances referred to in the preceding rules are based on experience and recognize two factors: Orientation and wind velocity. While some authorities neglect exposure allowances entirely, others believe their omission fails to recognize the extra heating burden carried by rooms having severe exposures; hence they are included in this procedure. The recommended allowances are shown in the following table:

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RULE 3 . . . To find the maximum winter heat load due to infiltration and ventilation:

1. Select from Table 3 the average air changes per hour for the given room and multiply the volume of the room in cubic feet by the number of air changes. This gives the total infiltration in cubic feet per hour. To this should be added any further supply of outside air purposely introduced for ventilation. (If it is preferred to actually compute infiltration by the more accurate crackage method, see "Thermal Insulation of Buildings," May, 1934). Enter the total infiltration and ventilation air volume in cubic feet per hour in Column II, line L.

2. Multiply the volume of air to be heated from Column II, line L by the factor .018 (in Column III) and enter the product in Column VI. The total thus entered is the heat required to warm the entering air in Btu per hour per degree F.

3. Multiply this total by the design temperature difference (Column VI x Column VII) to find the hourly heat load due to outside air, which should be entered in Column VIII.

The total of Column VIII is the maximum Btu required per hour to offset maximum heat losses and is the basis upon which radiation required by the room and total load of the building are computed. It is equivalent to what is called the Room Basic Factor (RBF) by the National Warm Air Heating and Air Conditioning Association and the Furnace Blower Manufacturers' Association, except that this factor is 1000 times greater; that is.
Maximum Heating Load of Building is found by adding together the hourly heat loss in Btu of all rooms. Form 3 provides a convenient place for listing the data for all rooms together. To use this form enter the room numbers and identifying names in Column I and the maximum Btu per hour (the total of Column VIII in Form I) in Column II. The sum of these individual room loads, shown in the total of Column II, Form 3, is the net heating load required by the building before adding piping and pick-up loads, humidification load and domestic hot water load (if any).

On the reverse side of Form 3 will be found methods for determining the proper size or capacity of a steam, vapor or hot water boiler, or warm air furnace, required to carry the total building load.

The Piping Load, representing loss from pipes and ducts in walls, floors, basement, etc., may be taken at 15% of the total room load if all pipes are well insulated; up to 60% if pipes are bare.

Domestic Hot Water Load should be determined from data in Table 8 as follows: Select the requirements in gallons per maximum hour for the number of families or fixtures involved and multiply by 1000 to find the maximum load in Btu per hour.

The Pick-up Load, which is literally extra capacity allowed for rapid heating after rooms have been permitted to cool, may be based on the following percentages of the total room load:

**Automatic oil, gas and stoker fired boilers, and furnaces** 25%

**Coal and coke, manually controlled**

- **Constantly attended** 25%
- **Intermittently attended, small** 50%
- **Intermittently operated (churches, etc.)** 50%

**Boiler Size** for steam, vapor and hot water boilers is based upon the sum of the total room load, including humidification load if any, piping and pick-up loads, humidification load and domestic hot water load (if any).

**TABLE 8 DOMESTIC HOT WATER REQUIREMENTS**

<table>
<thead>
<tr>
<th>KIND OF BUILDING</th>
<th>GALLONS PER DAY</th>
<th>GALLONS PER MAX. HR.</th>
<th>GALLONS PER AV. HR.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per Family</td>
<td>Per H.W. 65° F. H.</td>
<td>Per H.W. 65° F. H.</td>
</tr>
<tr>
<td>Small Residence</td>
<td>100</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Large Residence</td>
<td>150</td>
<td>75</td>
<td>15</td>
</tr>
<tr>
<td>High Class Apts.</td>
<td>200</td>
<td>100</td>
<td>25</td>
</tr>
<tr>
<td>Middle Class Apts.</td>
<td>150</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Low Class Apts.</td>
<td>100</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>High Cl. Trans. Hotel</td>
<td>200</td>
<td>85</td>
<td>10</td>
</tr>
<tr>
<td>High Cl. Res. Hotel</td>
<td>50</td>
<td>75</td>
<td>9</td>
</tr>
<tr>
<td>Av. Commercial Hotel</td>
<td>150</td>
<td>70</td>
<td>7</td>
</tr>
</tbody>
</table>

**RULE 4** To find Equivalent Direct Radiation (EDR) divide the heat load in Btu by 240 for steam or by 150 for hot water radiation systems.

Warm Air Furnace Size is determined by adding the total room load in Btu per hour, including the humidification load if any, and the piping load. Inasmuch as the domestic hot water load is rarely carried by warm air furnaces, this item is used separately to determine the capacity needed in a separate domestic hot water source. No allowance is made for pick-up load with warm air furnaces. Such furnaces are usually rated in total Btu per hour, but where used for mechanical warm air heating this rating is affected by the volume of air in cubic feet per minute to be heated. This must be determined by completing the data called for in Columns III, IV and V of Form 3, which are also used to find required fan or blower capacities. In American Architect Reference Data No. 13, to appear in September, 1934, there will be a more complete discussion of register temperatures and the significance of the procedure herein outlined.

**RULE 5** To find the capacity in cubic feet per minute required in a warm air furnace:

1. Choose register temperatures from Table 9, preferably between 130 and 140 F and enter in Column III, Form 3. Enter the corresponding factor in Column IV.
2. Multiply the data in Column III by the factors in Column IV. This shows the cubic feet
per minute required for mechanical warm air heating of individual rooms, the total being entered in Column V. The total of this column gives the total cubic feet per minute to be handled by the furnace.

These rules depend upon accepting the manufacturer’s rating of his equipment. The buyer should ascertain that these ratings have been established in accordance with accepted codes as follows: Gas burning equipment of all types, American Gas burning Manufactured Code; boilers, American Society of Heating & Ventilating Engineers Standard Code for Rating Solid Fuel Boilers; furnaces, National Warm Air Heating and Air Conditioning Association Code.

**FUEL CONSUMPTION**

**RULE 6** To find total fuel consumption per season or year:
1. Enter in Form 3, Column VI, the Btu per hour per degree F from totals of Column VI in Form 1 and find total Btu per hour per degree F for the building by adding this column.
2. Add to this the selected percentage allowance for piping load.
3. Multiply this sum by the number of degree-days for the locality (Table 5, Column V) and by 24 hours per day. The final product is the total Btu per season required for heating.
4. Find the average humidity load according to Rule 9.
5. Find the average domestic hot water load as follows: Find in Table 8 the gallons of water required per day for the required number of families or fixtures (Col. 1) and multiply by 1000 to convert to Btu per day. Multiply this by the number of days in the heating season if a separate source of hot water is used in summer, or by 365 days if the heating plant is operated all year for this purpose.
6. Add the totals obtained above (3, 4 and 5) to find the total Btu per season required for all purposes.
7. Divide this grand total by the calorific value of the fuel used as given by Table 10 (or as computed more accurately by the method described in “Thermal Insulation of Buildings”). The result is the total fuel consumption in tons of coal, gallons of oil or cubic feet of gas according to the fuel factor used.

**HUMIDIFICATION LOADS**

The capacity of humidification equipment needed to serve a given building may be determined by the following rule:

**RULE 7** To find the maximum quantity of water required per hour for humidification:
1. Enter on Form 3, Col. VII the total volume of air in cu. ft. per hour to be introduced into each room, taken from Form 1, Col. II, Line L, and find the total air introduced by adding this column.
2. Multiply this total by the number of grains of moisture to be added per hour from Table 5, Col. II. This gives the quantity of water in grains required under maximum load. To convert to gallons, divide by 58,100 (based on 7000 grains per pound, 8.3 lbs. per gallon).

Heat required to evaporate this water must be computed as part of the heating load, whether the heat is applied to the air or to the water. Proceed as follows:

**RULE 8** To find the maximum heat load due to humidification: Multiply the maximum grains of moisture required per hour (from Rule 7) by the factor .153. This gives the heating load in Btu per hour and should be added in calculating boiler or furnace size on the reverse of Form 3.

**RULE 9** To find the average heat load due to humidification: Take 50% of the maximum humidity heat load as found in Rule 8. This gives the average load per hour. Multiply this by the number of days in the heating season (from Table 5, Col. VI) and by 24 (hours per day) to get the seasonal load in Btu required for humidification. This should be used in calculating fuel consumption. See Rule 6.

**SUMMER COOLING LOADS**

The data required for determining summer cooling loads—and the required capacity of equipment—include:

(a) Areas of all outside walls and roof; areas of all floors, partitions and ceilings separating space to be cooled from warmer parts of the building and areas of outside doors. These should be entered in Form 2 as indicated.

(b) Area of all windows, skylights and glass in doors as a total. This should be entered in Form 2, line E. Also measure separately the area of all glass (Continued on page 97)
### Project Information

- **Outside Design Temperature**: [Input]
- **Inside Design Temperature**: [Input]
- **Outside Design Relative Humidity**: [Input]
- **Inside Design Relative Humidity**: [Input]
- **Prevailing Winds**: Direction, Velocity [Input]

### NOTES

- **Line**: [Input]
- **Exposure**: [Input]
- **ITEM**: [Input]
- **Areas, sq. ft.**: [Input]
- **Volumes, cu. ft. per hr.**: [Input]
- **Coefficients U. & Factors**: [Input]
- **Btu. per hour per degree F. (net)**: [Input]
- **Add for Wind and Exposure Amount**: [Input]
- **Total Btu. per hour per degree F.**
- **Design Temp. Diff.**: [Input]
- **Total Btu. (max. load)**: [Input]

### Room No.

- **Floor**: [Input]
- **Dimension**: [Input]
- **Ceiling Height**: [Input]
- **Volume - cu. ft.**: [Input]
- **No. Air Changes Due to Infiltration**: [Input]
- **Other Air Supplied - cu. ft. per hr.**: [Input]

#### Windows, Skylights, and Doors

- **Exposure**
  - **Exposed Wall**: [Input] sq. ft.
  - **Exposed Glass**: [Input] sq. ft.
  - **Exposed Doors**: [Input] sq. ft.
  - **Exposed Wall**: [Input] sq. ft.
  - **Exposed Glass**: [Input] sq. ft.
  - **Exposed Doors**: [Input] sq. ft.
  - **Cold Wall or Partition**: [Input] sq. ft.
  - **Cold Wall or Partition**: [Input] sq. ft.
  - **Glass & Skylights, no wind exp.**: [Input] sq. ft.
  - **Cold Ceiling or Roof**: [Input] sq. ft.
  - **Cold Floor**: [Input] sq. ft.
  - **Infiltration & Air Supply**: [Input] cu. ft./hr.

#### Totals

- **Exposed**: [Input] sq. ft.
- **Not Exposed**: [Input] sq. ft.

---

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### SOURCES OF DATA AND PROCEDURE

**Column II -** Take areas from plans or actual building. Infiltration equals volume of room in cubic feet, multiplied by air changes per hour; add air supplied for ventilation.

**Column III -** Coefficients of heat transmission \( U \) from AMERICAN ARCHITECT Reference Data No. 11, "Thermal Insulation of Buildings," or A.S.H.V.E. Guide.

**Column IV -** Product of Col. II multiplied by Col. III

**Column V -** Wind and exposure. South, east and west, 0%; north 15%; plus 10% for each and every side exposed to prevailing wind.

**Column VI -** Add exposure allowance in Col. V to Btu per hour in Col. IV. Also the product of Col. II by Col. III where no exposure allowance is added.

**Column VII -** Design temperature difference equals inside design temperature less outside design temperature. See Table 5. Where walls, ceiling or floor (lines G, H, J & K) separate heated from unheated enclosed space, use 1/2 design temperature difference for exposed surfaces. Where floor is on the ground, the temperature difference may range from 5°F to 25°F.

**Column VIII -** equals product of Col. VI x Col. VII.

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td>ITEM</td>
<td>Areas, sq. ft.</td>
<td>Volumes, cu. ft. per hr.</td>
<td>Coefficients ( U ) &amp; Factors</td>
<td>Btu. per hour per degree F. (net)</td>
<td>Add for Wind and Exposure</td>
<td>Total Btu. per hour per degree F.</td>
</tr>
<tr>
<td>ROOM No.</td>
<td>Floor...</td>
<td>Dimensions...</td>
<td>Ceiling Height...</td>
<td>Volume...</td>
<td>cu. ft.</td>
<td>No. Air Changes Due to Infiltration...</td>
<td>Other Air Supplied...</td>
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<tr>
<td>A</td>
<td>Exposed Wall</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Exposed Glass</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
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<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>D</td>
<td>Exposed Wall</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>E</td>
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<td></td>
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<td></td>
</tr>
<tr>
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<td>Exposed Doors</td>
<td>sq. ft.</td>
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<td></td>
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<tr>
<td>G</td>
<td>Cold Wall or Partition</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Cold Wall or Partition</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Cold Ceiling or Roof</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>Cold Floor</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Infiltration &amp; Air Supply</td>
<td>cu. ft./hr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>TOTALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WINDOWS, SKYLIGHTS AND DOORS**

<table>
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<tr>
<th>Exposed</th>
<th>No.</th>
<th>Size</th>
<th>Area</th>
<th>Net Exposed</th>
<th>No.</th>
<th>Size</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROOM No.</td>
<td>Floor...</td>
<td>Dimensions...</td>
<td>Ceiling Height...</td>
<td>Volume...</td>
<td>cu. ft.</td>
<td>No. Air Changes Due to Infiltration...</td>
<td>Other Air Supplied...</td>
</tr>
<tr>
<td>A</td>
<td>Exposed Wall</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>B</td>
<td>Exposed Glass</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Exposed Doors</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Exposed Wall</td>
<td>sq. ft.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>E</td>
<td>Exposed Glass</td>
<td>sq. ft.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Exposed Doors</td>
<td>sq. ft.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>G</td>
<td>Cold Wall or Partition</td>
<td>sq. ft.</td>
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<td></td>
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</tr>
<tr>
<td>H</td>
<td>Cold Wall or Partition</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I</td>
<td>Cold Ceiling or Roof</td>
<td>sq. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>J</td>
<td>Cold Floor</td>
<td>sq. ft.</td>
<td></td>
<td></td>
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<tr>
<td>L</td>
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<td>cu. ft./hr.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>M</td>
<td>TOTALS</td>
<td></td>
<td></td>
<td></td>
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</tr>
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</table>
# INDIVIDUAL ROOM DATA - SUMMER CONDITIONS

<table>
<thead>
<tr>
<th>Line</th>
<th>Exposure</th>
<th>ITEM</th>
<th>Areas, Volumes</th>
<th>Coefficients of Transmission U and Factors</th>
<th>Btu. per hour per degree F.</th>
<th>Design Temperature Difference</th>
<th>Total Heat to be Removed - in Btu. per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
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<tr>
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<td>II</td>
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<td>VI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ROOM No.**  
**Floor Dimensions** x x  
**Ceiling Height**  
**Volume** cu. ft.  
**No. Air Changes Due to Infiltration**  
**Other Air Supplied** cu. ft. per hr.

**ITEM**  
A Wall Exposed to Sun sq. ft.  
B Wall Exposed to Sun sq. ft.  
C Wall Exposed to Sun sq. ft.  
D North Wall or Warm Partition sq. ft.  
E Glass, Total Area sq. ft.  
F Sun Load Through Glass Btu/hr. (Compute as indicated below and enter max. load here)

**EXPOSURE**  
East  
South  
West  
Flat Skylights  
MAXIMUM SOLAR LOAD through glass = the sum of any Flat Skylight load and the greatest net load on any 1 wall.

**TOTAL SENSIBLE HEAT** per hour

**TOTAL, INCLUDING LATENT HEAT**

**SOURCES OF DATA AND PROCEDURE**

Column II - Data from plans or building, and project requirements.


Column IV - is the product of Col. II x Col. III.

Column V - Normal design temperature difference is outside design temperature (Table 6) less inside design temperature but should not exceed 10 to 15 F. To allow for sun effect on exterior frame and masonry walls under 8" thick exposed to sun, add 25 F. to normal design temperature difference; roofs of frame or light masonry, add 60 F.; roofs of heavy construction add 100 F.; ceilings under roof with space between not ventilated add 20 F. Where heavy masonry walls are in full shade deduct 5 F. from normal.

Column VI - is the product of Col. IV x Col. V. Also in lines K to N inclusive it is product of Col. II x Col. III.

Line E - Glass; Total Area - is the sum of all glass areas regardless of exposure to the sun.

Line F - Sun Load Through Glass - is computed as indicated on lines R to V inclusive. In extreme south decrease south exposure factor to 75; in north increase to 120. Lower factors may be used throughout where clouds are frequent. Deductions for shade: outside Venetian blinds 90%; awnings 75%; tree shade, light 40-60%; heavy 80-100%; inside Venetian blinds, shades 40%, draperies etc. 10-30%.

Line N - Other Heat Emitting Apparatus - should include stoves, ranges, steam tables, etc. emitting heat during summer period. For factors see Table II.

Line P - Moisture to be Removed in Grains per Hr. - equals cu. ft. of air per hr. (Col. II, line J) x number of grains to be removed per cu. ft. from Table 6, plus 1000 grains per occupant.
<table>
<thead>
<tr>
<th>Line</th>
<th>Exposure</th>
<th>ITEM</th>
<th>Areas, Volumes</th>
<th>Coefficients of Transmission $U$ and Factors</th>
<th>Btu. per hour per degree F.</th>
<th>Design Temperature Difference</th>
<th>Total Heat to be Removed in Btu. per hour</th>
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<td>Grains Moisture</td>
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<td></td>
<td></td>
<td></td>
<td>Occupants etc.</td>
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**ROOM No.**

<table>
<thead>
<tr>
<th>Floor</th>
<th>Dimensions</th>
<th>Ceiling Height</th>
<th>Volume</th>
<th>Room Name</th>
<th>No. Air Changes Due to Infiltration</th>
<th>Other Air Supplied</th>
<th>cu. ft. per hr.</th>
</tr>
</thead>
</table>

**A** Wall Exposed to Sun

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
<th>sq. ft.</th>
</tr>
</thead>
</table>

**B** Wall Exposed to Sun

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
<th>sq. ft.</th>
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</thead>
</table>

**C** Wall Exposed to Sun

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
<th>sq. ft.</th>
</tr>
</thead>
</table>

**D** North Wall or Warm Partition

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
<th>sq. ft.</th>
</tr>
</thead>
</table>

**E** Glass, Total Area

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
<th>sq. ft.</th>
</tr>
</thead>
</table>

**F** Sun Load Through Glass

<table>
<thead>
<tr>
<th>Btu/hr.</th>
<th>(Compute as indicated below and enter max. load here)</th>
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</table>

**G** Outside Doors

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
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</thead>
</table>

**H** Warm Floors

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
</tr>
</thead>
</table>

**I** Warm Ceiling or Roof

<table>
<thead>
<tr>
<th>sq. ft.</th>
<th>sq. ft.</th>
</tr>
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</table>

**J** Infiltration & Air Supply

<table>
<thead>
<tr>
<th>cu. ft./hr.</th>
<th>(Number)</th>
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**K** Occupants

<table>
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<th>Number</th>
<th>250.0</th>
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**L** Electric Lights

<table>
<thead>
<tr>
<th>Watts</th>
<th>3.415</th>
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**M** Electric Motors

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<th>Input in H.P.</th>
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**N** Other Heat Emitting Apparatus

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<thead>
<tr>
<th>O</th>
<th>TOTAL SENSIBLE HEAT per hour</th>
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<table>
<thead>
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<th>sq. ft.</th>
<th>Btu/hr.</th>
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**P** Moisture to be Removed

<table>
<thead>
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<th>Grains per hr.</th>
<th>.151</th>
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**Q** TOTAL, INCLUDING LATENT HEAT

<table>
<thead>
<tr>
<th>O</th>
<th>TOTAL, INCLUDING LATENT HEAT</th>
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</table>

| Btu/hr. | |

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**R** East

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<th>Room No.</th>
<th>Floor</th>
<th>Dimensions</th>
<th>x</th>
<th>Ceiling Height</th>
<th>Volume</th>
<th>cu. ft. per hr.</th>
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**S** South

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<th>x</th>
<th>Ceiling Height</th>
<th>Volume</th>
<th>cu. ft. per hr.</th>
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**T** West

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<th>Room No.</th>
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<th>Dimensions</th>
<th>x</th>
<th>Ceiling Height</th>
<th>Volume</th>
<th>cu. ft. per hr.</th>
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</table>

**U** Flat Skylights

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<th>Floor</th>
<th>Dimensions</th>
<th>x</th>
<th>Ceiling Height</th>
<th>Volume</th>
<th>cu. ft. per hr.</th>
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</thead>
</table>

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**V** MAXIMUM SOLAR LOAD through glass = the sum of any flat Skylight load and the greatest net load on any 1 wall =
### Total Loads - Winter and Summer Conditions

**Project:**

**Location:**

**Computations made by:**

<table>
<thead>
<tr>
<th>Room No.</th>
<th>Room Name</th>
<th>Max. Btu/hr.</th>
<th>Supply Air Temp.</th>
<th>Cu. ft. Air Circulated per hr.</th>
<th>Cu. ft. Air Circulated per min.</th>
<th>Cu. Air Temp.</th>
<th>Table IX</th>
<th>Total Btu./hr. including Latent Heat</th>
<th>Form I. Col. VI</th>
<th>Form I. Col. VII</th>
<th>Form I. Col. VIII</th>
<th>Form I. Col. IX</th>
<th>Form I. Col. X</th>
<th>Form I. Col. XI</th>
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**MAX. GAINS: WATER REMOVED PER HR.**

<table>
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<tr>
<th>Room No.</th>
<th>Room Name</th>
<th>Max. Gains</th>
<th>Water Removed per hr.</th>
<th>Form II. Col. I</th>
<th>Form II. Col. II</th>
<th>Form II. Col. III</th>
<th>Form II. Col. IV</th>
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**SUMMER CONDITIONS**

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<th>Room Name</th>
<th>Minimum Register Temp.</th>
<th>Table II</th>
<th>Max. Btu./hr.</th>
<th>Sensible Heat</th>
<th>Form II. Col. V</th>
<th>Form II. Col. VI</th>
<th>Form II. Col. VII</th>
<th>Form II. Col. VIII</th>
<th>Form II. Col. IX</th>
<th>Form II. Col. X</th>
<th>Form II. Col. XI</th>
<th>Form II. Col. XII</th>
<th>Form II. Col. XIII</th>
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**TOTALS**

<table>
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<tr>
<th>Room No.</th>
<th>Room Name</th>
<th>Max. Btu./hr.</th>
<th>Sensible Heat</th>
<th>Sensible Heat per degree F.</th>
<th>Total Btu./hr. per degree F.</th>
<th>Total Btu./hr. per degree F.</th>
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**COPIRIGHT 1934 AMERICAN ARCHITECT**
**CAPACITIES REQUIRED IN EQUIPMENT**

### BOILER, Steam, Vapor, Hot Water

1. Total Room Load, Btu/hr. (Form 3, Col. II)
2. Humidification Load, Btu. (See Humidifier)
3. Piping Load, 60% insulated - 60% bare of Item (1)
4. Pick-up Load, 25% - 50% of Items (1) and (2)
5. Domestic Hot Water Load (Gals. per hr. x 1000)
6. Total Boiler Capacity in Btu.

<table>
<thead>
<tr>
<th>Boiler Selected</th>
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</thead>
</table>

Humidification load, line 2, is maximum Btu. per hr. found in Humidifier calculation, line 4. Piping load varies with length of distribution lines and use of insulation on pipes. Pick-up load minimum for automatic and large heating plants; maximum for intermittently operated boilers, as in churches, schools. For domestic hot water load, see Table 8.

### FURNACE, Mechanical Warm Air

1. Total Room Load, Btu. (Form 3, Col. II)
2. Humidification Load, Btu. (See Humidifier)
3. Piping Load, 10% - 15% of Item (1)
4. Domestic Hot Water Load, if any
5. Furnace Capacity in Btu.
6. C.F.M. Air Required (Form 3, Col. V)

<table>
<thead>
<tr>
<th>Furnace Selected</th>
<th></th>
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</thead>
</table>

Furnace capacity is equal to maximum fan or blower capacity. Velocity thru filter should not exceed 800 F.P.M. and static resistance should range above 1/4" to 1/8" water pressure.

### REFRIGERATION, Mechanical

1. Total Btu. per hr. incl. latent heat (Form 3, Col. XII)
2. Cap. in Tons at 40 F. Evap. Temp. (Item 1 + 12,000)

<table>
<thead>
<tr>
<th>Compressor Selected</th>
<th></th>
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</thead>
</table>

Units may be rated in maximum Btu. per hr., line 1, or in tons, line 2. Rating should be based on 40 F. in evaporator regardless of actual evaporator temperature, in order to make a fair comparison of units. Above calculations include dehumidifier load only where unconditioned air is used to reheat or temper the air cooled to the dew-point temperature.

### FAN or BLOWER

1. Winter C.F.M. (Form 3 Col. V plus 15%)
2. Summer C.F.M. (Form 3 Col. XI plus 15%)
3. Auxiliary Night Air Fan

<table>
<thead>
<tr>
<th>Fans or Blowers Selected</th>
<th></th>
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</thead>
</table>

Select fan or blower on basis of maximum load, lines 1 or 2, and change fan speed during period of lightest load. Capacity of fan used for cooling with night air, if not operated as an auxiliary to summer circulating fan, equals volume of building in cu. ft. x 30 to 35 air changes per hr. divided by 60 to reduce to cu. ft. per minute. If used with central circulating fan deduct central capacity.

### FUEL CONSUMPTION

1. Total Btu./hr./deg. F (Form 3 Col. VI)
2. Ave. Piping Load (65% insulated, 60% bare of Item (1))
3. Ave. Heating Load Btu./hr./deg. F. (Add 1, 2)
4. Degree hours in season (Deg. Days x 24)
5. Heating Load, Btu. per season (Item 3 x Item 4)

<table>
<thead>
<tr>
<th>Average Btu. per season (Add 5, 6, 7)</th>
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</table>

Average humidity load, line 2, is average Btu. per season as found in Humidifier calculations, line 6. Degree days, line 5, obtained from Table 5. Domestic hot water load, line 7, is usually the all-year load; hence number of days is usually 365. If summer and winter loads are to be segregated, estimate number of days in heating season from Table 5.

### HUMIDIFIER, including Heat Load

1. Cubic ft. Air per hr. (Form 3, Col. VII)
2. Max. Grains Moisture to be added per cu. ft. (Table 5)
3. Total Max. Grains Moisture per hr. (Item 1 x Item 2)
4. Maximum Btu. per Hour (Item 3 x .153)
5. Average Btu. per hour (50% of Item 4)
6. Ave. Btu. per season (Item 5 x days in season x 24)
7. Max. Capacity in Gals. per hr. (Item 3 x 58,100)

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<thead>
<tr>
<th>Humidifier Selected</th>
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</table>

Humidifier capacity in grains of moisture per hr. is shown in line 3 and in gallons per hr. in line 7. This total may be applied to a single central unit or proportioned according to the volume of space to be conditioned by each one of several unit humidifiers. Maximum Btu. per hr., line 6, is required in computing fuel consumption.

### DEHUMIDIFIER

1. Max. Grains Water Removed /hr. (Form 3 Col. XIII)
2. Max. Capacity in Gals. per hr. (Item 1 + 58,100)

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<thead>
<tr>
<th>Dehumidifier Selected</th>
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Dehumidifiers are rated in maximum grains of water condensed per hr., line 1, or in gallons per hr., line 2. If absorption type dehumidifier is employed with an evaporative cooler, additional capacity is needed; see text.

### FILTER or AIR WASHER

1. Maximum Cu. ft. per min. (Blower capacity)
2. Velocity at Filter (not over 800) F.P.M.
3. Required Area at not over 25" Static Resistance

<table>
<thead>
<tr>
<th>Filter or Air Washer Selected</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

Capacity is equal to maximum fan or blower capacity. Velocity thru filter should not exceed 800 F.P.M. and static resistance should range above 1/4" to 1/8" water pressure.
# Economic Study of Available Equipment

**Project Requirements**

<table>
<thead>
<tr>
<th>Load from Form 3</th>
<th>Characteristics of Available Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOILER, Steam, Vapor, or Hot Water</strong></td>
<td>Make % Make % Model</td>
</tr>
<tr>
<td>Budget</td>
<td>Cost</td>
</tr>
<tr>
<td>Capacity in Btu./hr.</td>
<td></td>
</tr>
<tr>
<td>E.D.R.</td>
<td></td>
</tr>
<tr>
<td>Fuel (kind and grade)</td>
<td></td>
</tr>
<tr>
<td><strong>FURNACE, Mech. Warm Air (or Indirect Heater)</strong></td>
<td>Make Model Make Model</td>
</tr>
<tr>
<td>Budget</td>
<td>Cost</td>
</tr>
<tr>
<td>Capacity in Btu./hr.</td>
<td></td>
</tr>
<tr>
<td>Cu. Ft. per Min.</td>
<td></td>
</tr>
<tr>
<td>Fuel (kind and grade)</td>
<td></td>
</tr>
<tr>
<td><strong>HUMIDIFIER (S)</strong> (Where multiple units are used enter total capacity)</td>
<td>Make Model Make Model</td>
</tr>
<tr>
<td>No. Used</td>
<td>No. Used</td>
</tr>
<tr>
<td>Budget</td>
<td>Total Cost</td>
</tr>
<tr>
<td>Max. Grains Moisture/hr. evaporated</td>
<td></td>
</tr>
<tr>
<td>Static Resistance, inches water</td>
<td></td>
</tr>
<tr>
<td>Total water used, gals./hr.</td>
<td></td>
</tr>
<tr>
<td><strong>REFRIGERATION, Mechanical (including cooling coils)</strong></td>
<td>Make Model Make Model</td>
</tr>
<tr>
<td>Budget</td>
<td>Cost</td>
</tr>
<tr>
<td>Cap. in Btu/hr. at 40 F. Evap.</td>
<td></td>
</tr>
<tr>
<td>Tons, at 40 F. Evap.</td>
<td></td>
</tr>
<tr>
<td>Water for Condenser, gals./hr. at F.</td>
<td></td>
</tr>
<tr>
<td>Motor Horse Power (or lbs. steam/hr.)</td>
<td></td>
</tr>
<tr>
<td><strong>DEHUMIDIFIER</strong> (Cost may be incl. in Refrigeration)</td>
<td>Make Model Make Model</td>
</tr>
<tr>
<td>Budget</td>
<td>Cost</td>
</tr>
<tr>
<td>Max. Grains Moisture/hr. evaporated</td>
<td></td>
</tr>
<tr>
<td>Total water used, gals./hr.</td>
<td></td>
</tr>
<tr>
<td><strong>FAN or BLOWER</strong></td>
<td>Make Model Make Model</td>
</tr>
<tr>
<td>Budget</td>
<td>Cost</td>
</tr>
<tr>
<td>Cu. Ft. per Min.</td>
<td></td>
</tr>
<tr>
<td>Static Resistance, inches water</td>
<td></td>
</tr>
<tr>
<td>Motor Horse Power</td>
<td></td>
</tr>
<tr>
<td><strong>FILTER or AIR WASHER</strong></td>
<td>Make Model Make Model</td>
</tr>
<tr>
<td>Budget</td>
<td>Cost</td>
</tr>
<tr>
<td>Cu. Ft. per Min.</td>
<td></td>
</tr>
<tr>
<td>Static Resistance, inches water</td>
<td></td>
</tr>
<tr>
<td>Total water used, gals./hr.</td>
<td></td>
</tr>
</tbody>
</table>
TOTAL INVESTMENT AND ANNUAL OPERATING COST
of Winter, Summer or All-Year Air Conditioning Equipment

A. TOTAL INVESTMENT

<table>
<thead>
<tr>
<th>ITEM</th>
<th>No. Units</th>
<th>First Selection</th>
<th>Second Selection</th>
<th>Third Selection</th>
<th>Cost</th>
<th>Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler or Furnace</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter Conditioner Unit (s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Summer Conditioner Unit (s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>All-Year Air Conditioner (s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Humidifier (s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Refrigerating Equip.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Dehumidifier, if separate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Fans or Blowers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter or Air Washer</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Automatic Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil or Gas Burner, or Stoker</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate Dom. Hot Water Heater, if any</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation, Piping etc. or Duct Work, Registers, complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. ANNUAL OPERATING COST

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>Notes &amp; Sources</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUEL COSTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter Heating</td>
<td>Form 3, Fuel Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Domestic Hot Water</td>
<td>Form 3, Fuel Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorption Dehumidifier</td>
<td>Form 3 or Manufacturer</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TOTAL FUEL COST PER YEAR</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRIC POWER</td>
<td>KW Input, Hours Operated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fan or Blower Motors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigeration Compressor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil Burner or Stoker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating Pumps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL POWER COST PER YEAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATER CONSUMPTION</td>
<td>Av. Gals./hr., Hours Operated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidifier</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Washer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporative Cooler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigeration Condenser</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorption Dehumidifier</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling Towers</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>TOTAL WATER COST PER YEAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER COSTS</td>
<td>Lbs./hr., Hours Operated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam Consumption, where purchased</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter cleaning or replacements</td>
<td>According to Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance, Attendance, Ash Removal, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIXED CHARGES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td>Cost divided by yrs. of life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest on Investment</td>
<td>Cost x interest rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL ANNUAL OPERATING COST</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HOW TO USE THIS FORM

The purpose of this form is to provide a convenient means of comparing competitive items of equipment which are tentatively selected as being suited to the project. Unless an entire air conditioning plant is designed and constructed to meet the special conditions of the project, it must be expected that standardized units may offer slightly greater or slightly less capacities than are indicated by the computed loads. It is therefore desirable never to compare costs unless performance characteristics are compared at the same time. Use the face of this form as follows: In the first column under “Project Requirements” enter budget allowances in dollars and the loads as computed in Form 3. In the next three columns enter preliminary selections of equipment, with manufacturers’ ratings and contractors’ estimated cost installed. The reverse side of the form may be used to summarize total investment required by three combinations of equipment and to estimate annual operating cost of the most favorable combination as indicated. Note: Ordinarily HP Output of motors = KW Input.
exposed to the east, south and west, and all flat skylights, and enter in Form 2, lines R, S, T and U. By flat skylights is meant all skylights receiving direct sunlight; only sloping skylights facing the north should be omitted from sun load calculations, and even these should be included in the gross area of glass shown on line E.

(c) Infiltration and air supply. Determine as described in Rule 3, using summer conditions.

(d) Number of occupants normally in the room when cooling plant is operated. In residences due allowance should be made for guests when computing loads in living and dining rooms.

(e) Heating apparatus including wattage of lights (line L), horsepower of electric motors (line M) and such items as stoves, ranges, steam tables, etc., as listed in Table 11.

(f) Moisture to be removed from the air, part of which is due to excessive outdoor relative humidity and part to the moisture given off by occupants. See Rule 15.

(g) Coefficients of heat transmission U as in Form 1.

(h) Design temperature difference, which is the maximum outdoor design temperature (from Table 6, Col. I) less the desired indoor temperature (Table 4(a) Col. II). However, this difference should never exceed 15 F and rarely should exceed 10 F unless occupants remain in the cooled space several hours at a time, except as follows:

Walls and roofs exposed to sun develop higher temperatures than the air because of their absorption of solar heat. Therefore, the normal design temperature difference should be increased according to the construction: frame and masonry walls under 8" thick, exposed to sun, add 25 F; roofs of frame or light masonry, add 60 F; roofs of heavy construction add 40 F. Where heavy masonry walls are in full shade deduct 5 F. If uncooled and ventilated space intervenes between ceiling and roof, the normal temperature difference need not be increased; but if space between the ceiling and roof is not ventilated at least 20 F should be added to the normal design temperature difference.

With these data entered as indicated in Form 2 or its equivalent for each room under consideration, proceed as follows:

RULE 10 . . . To find the summer cooling load due to walls, ceilings, floors, and all glass areas (See Form 2, lines A, B, C, D, E, G, H and 1): Multiply the areas in square feet (Col. II) by the coefficients of heat transmission (Col. III; also identical with those used in Form I, Col. III) to get the Btu per hour per degree F (Col. IV). Multiply these products by the selected design temperature differences (Col. V) and enter the results as total heat to be removed in Btu per hour in Col. VI.

The Sun Load Through Glass is an important part of the summer cooling load. It is due to the property of glass to admit a very large part of direct solar heat, and must be clearly distinguished from the normal heat transfer through glass from the air on one side to the air on the other. Factors have been established experimentally which indicate the amount of heat passing through vertical and horizontal glass areas. These factors vary with orientation because incidence of the solar beams changes from morning through noon to evening. While this whole subject of sun load is highly controversial at present, the following procedure is recommended as being conservatively safe.

Since the sun effect is only on one wall at a time, or is at an extreme angle of incidence if it strikes two walls at a time, the maximum solar heat load on glass is taken as the greatest load on any one wall exposure plus the whole load on flat skylights.

RULE 11 . . . To find additional sun load through windows, skylights and glass in doors receiving direct sunlight:

1. Enter in Form 2, lines R, S, T and U, the sizes and total area of glass according to its orientation as indicated. Multiply by the factors 140 for east, 100 for south, 150 for west and 200 for flat skylights, as shown on this form. In the extreme south decrease south exposure factor to 75; in extreme north increase to 120. All these values are high enough for climatic conditions where bright sunshine normally accompanies high humidities and high temperatures. Where sun is frequently clouded

---

TABLE II—HEAT TRANSMISSION IN BTU OF VARIOUS KINDS OF EQUIPMENT

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>BTU per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lights and electric appliances</td>
<td>3.415</td>
</tr>
<tr>
<td>Electric motors</td>
<td>2.546</td>
</tr>
<tr>
<td>Electric ranges</td>
<td></td>
</tr>
<tr>
<td>Small burner</td>
<td>3.412</td>
</tr>
<tr>
<td>Medium burner</td>
<td>4.100</td>
</tr>
<tr>
<td>Large burner</td>
<td>7.700</td>
</tr>
<tr>
<td>Oven</td>
<td>10.236</td>
</tr>
<tr>
<td>Appliance Connection</td>
<td>2.250</td>
</tr>
<tr>
<td>Heating compart.</td>
<td>1.023</td>
</tr>
<tr>
<td>Natural gas fired equipment</td>
<td></td>
</tr>
<tr>
<td>Generally</td>
<td>1.000</td>
</tr>
<tr>
<td>Manufactured gas fired equipment generally</td>
<td>500</td>
</tr>
<tr>
<td>Natural gas bunsen burners</td>
<td>3.000</td>
</tr>
<tr>
<td>Manufactured gas bunsen burners</td>
<td>1.500</td>
</tr>
<tr>
<td>Natural gas fish-tail burners</td>
<td>5.000</td>
</tr>
<tr>
<td>Manufactured gas fish-tail burners</td>
<td>2.500</td>
</tr>
<tr>
<td>Restaurant coffee urns</td>
<td>1.600</td>
</tr>
<tr>
<td>Dish warmers</td>
<td>600</td>
</tr>
<tr>
<td>Steam tables</td>
<td>650</td>
</tr>
<tr>
<td>Restaurant range</td>
<td>100.000</td>
</tr>
<tr>
<td>Giant burner</td>
<td>12.000</td>
</tr>
<tr>
<td>Medium burner</td>
<td>9.000</td>
</tr>
<tr>
<td>Oven</td>
<td>1.000</td>
</tr>
<tr>
<td>Pilot</td>
<td>250</td>
</tr>
</tbody>
</table>

NOTE: Hood over ranges, steam tables and other kitchen apparatus will reduce their heat emission to the room by 70 to 80%.
on extremely warm humid days they may be re-
duced. The product is the gross heat load in Btu
per hour due to the solar heat entering through glass
when the sun is shining.

2. Select from Table 12 the proper percentage
allowances for shade cast by trees or buildings or
for the use of awnings, shades or curtains. Enter
as indicated on Form 2, compute the allowances and
deduct from the gross Btu per hour to find the
net sun load in Btu per hour. The total of the
skylight load and the greatest load on any one ex-
posure as shown in the last column should be en-
tered on line "v" and carried to line F in Column VI.

Summer Infiltration is computed as for winter infil-
tration (see Rule 3) except that the number of air
changes due to ventilation may vary in some cases.
Refer to Table 3. Enter the total cubic feet per hour
on Form 2, Col. II, line J and proceed as follows:

**RULE 12 . . . To find amount of sensible heat to be**

*removed from air introduced by infiltration and/or
ventilation:* Multiply the volume of air in cubic feet
(Col. II) by .018 and enter the product in Col. IV.
Multiply this product by the design temperature
difference (Col. V) and enter the total heat to be
removed due to outside air in Col. VI.

Heat Introduced by Occupants must be included in
the majority of projects. This heat takes two forms,
sensible heat which is recognized here, and latent
heat, which is considered later.

**RULE 13 . . . To find the heat to be removed due**

to body heat of occupants: Multiply the number of
occupants by 250 (Cols. II and III) and enter the
product as Btu to be removed in Col. VI. (This
factor means that 250 Btu per hour are emitted
by the average adult at rest at temperatures around
76-77 F. For men at hard work the body sensible
heat emission may range up to 460 Btu per hour.)

Heat Produced by Lights, Motors and Apparatus may
be readily calculated from the data given in Table 11.

**RULE 14 . . . To find the heat emitted by lights,**

*motors and other equipment:* Find the heat emitted
in Btu per hour in Table 11; enter the units in
Col. II and the factors in Col. III and the product
of these two in Col. VI. This product is the total
Btu per hour to be removed. Factors for lights in
watts and motors in horsepower input are included
in Form 2.

The Total Sensible Heat found by adding lines A to
N inclusive in Col. VI is the amount of heat to be
removed from the air in a room without reducing its
relative humidity. Since this has a bearing on
duct sizes and the cubic feet of air to be circulated
it should be summarized for all rooms on Form 3,
Col. VIII.

The Refrigeration Load, upon which the size of equip-
ment is based, is the sensible heat load plus the
latent heat load. The latter should be determined as
part of the dehumidifier calculations in accordance
with Rule 16 and entered inCols. II, III and VI of
Form 2. The grand total of Col. VI (line Q) should
be entered for each room to be cooled on Form 3,
Col. XII where the total Btu to be removed by
refrigeration equipment may be readily summed up.

The Evaporative Cooling Load is the sensible heat
load only, if it may be assumed the evaporative cool-
ing method is used where outdoor relative humidities
are low enough to permit their increase in the cool-
ing process. Table 6 shows such locations by a
minus quantity in Column III for the grains of mois-
ture to be removed per cubic foot of outside air.
The minus figures, actually representing the amount
of moisture that may be added per cubic foot of
air introduced, are then multiplied by the cubic feet
of air to be circulated (Form 3, Col. XI) and by the
factor .151. Then multiply this product by 60
to find the maximum Btu absorbed per hour by the
evaporation effected. If the total Btu absorbed
by evaporation equals or exceeds the cooling load
as shown on Form 3, Col. VIII, an evaporative
cooler may be used to carry the entire heating load.
When it does not balance the estimated cooling load,
the evaporative cooler must be supplemented by
mechanical refrigeration or an adsorption dehu-
midifier.

It should be noted that all of the air to be cir-
culated would be taken in from the outside. The
otherwise normal quantity of air indicated in Form
2, line J would be inaccurate for evaporative cool-
ing calculations. In most cases part of the air
would be taken through the humidifier and part of it
by-passed to prevent too great a rise in the relative
humidity of the total air circulated. The minimum
register temperature selected and entered in Form
3, Col. IX, should also be raised as high as pos-
able to increase the quantity of air circulated to the
maximum permitted by size of apparatus, ducts
and power requirements.

**DEHUMIDIFICATION LOADS**

The amount of moisture to be removed from the
air to bring the relative humidity down to the
required point is governed by two factors: (1) the
difference between the relative humidity of the out-
door air and the indoor design relative humidity, and
(2) the amount of moisture evaporated from the
bodies of occupants. The removal of this moisture
causes as much heat to be released as was originally
absorbed when it was evaporated. This latent heat
must be removed either by refrigeration, or, when
the adsorption method is employed, by repeating the
evaporating process as described previously.

When mechanical refrigeration is used the air
must be cooled below the dew-point temperature
(around 57 F) which may be below the tempera-
ture at which the cooled air should enter the con-
tditional space. Hence it must be reheated. This
reheating may be done with steam or hot water; but
in this case the refrigerating load must be computed
on a design temperature difference based on the
dew-point temperature. And to this extra cooling load must be added the cost of reheating.

The more logical method is to cool only enough of the air to the dew-point temperature to remove the greater part of its water vapor. Then this "superdry" and supercooled air is mixed with untreated air in such proportions that the air in the room will have both the desired temperature and the desired relative humidity. Where this method is employed the capacity of refrigerating equipment need not be increased beyond that computed for cooling alone, except for the latent heat to be removed due to dehumidification. This method being the more commonly used it is the only one developed in detail in these rules and work-sheets.

**RULE 15 ... To find the amount of moisture to be removed from the air (dehumidification):**

1. Find in Table 6, Col. III for the locality the maximum number of grains of moisture to be removed per cubic foot of outside air. Multiply by the number of cubic feet per hour introduced by infiltration and air supply (Form 2, Col. II, line J) to find the number of grains of moisture to be removed from the air before allowing for occupants.

2. To this total add the moisture evaporated from occupants which is found by multiplying the number of occupants by 1000. (This figure represents the number of grains of moisture evaporated per hour per adult at rest and is commonly used in cooling calculations despite the fact that men at hard work (at 77 F) may evaporate up to 5600 grains per hour.)

3. The sum of these two products is the total grains of moisture to be removed per hour. This should be entered in Form 2, Col. II, line P. Also enter in Form 3, Col. XIII, and add to get the total for the building. To convert to pounds, divide by 58.100. These conversions are significant only where equipment capacities are given in pounds of water or gallons instead of grains.

**RULE 16 ... To find the latent heat to be removed by refrigeration:** Multiply the total number of grains of moisture to be removed per hour (as found in Rule 15 and entered in Form 2, Col. II, line P) by .151. Enter the product as the latent heat to be removed in Btu in Col. VI, line P.

Where the adsorption method of dehumidifying is employed the significant factors are basically the same as those found above but are modified by the operation of the particular equipment selected. In addition to the net amount of moisture to be removed, the adsorption unit must also take up enough additional moisture to permit an evaporative cooler to absorb the total heat load without producing a final relative humidity above that established as acceptable. Manufacturers of such equipment should be consulted.

**WINTER AND SUMMER AIR CIRCULATION**

The selection of fans or blowers of a capacity adequate to maintain proper circulation of air in winter, summer or both, involves consideration of duct sizes, lengths and the resistance developed by bends, registers, etc. These matters will be discussed in detail in American Architect Reference Data No. 13, to appear in September, 1934.

However, an acceptable short cut method, based on adding a percentage allowance for distribution load, is presented in the following procedure:

**RULE 17 ... To find approximate fan or blower capacity required for winter and summer air circulation:**

1. For winter air circulation follow the procedure described under "Warm Air Furnace Size" using Form 3, Cols. II, III, IV and V and the data in Table 9. The total cubic feet of air per minute thus found not only represents the volume to be handled by a warm air furnace but also is the volume to be handled by the fan or blower before allowing for duct losses. Add 15% for duct losses.

2. For summer air circulation, first enter on Form 3 in Col. VIII the maximum Btu per hour of sensible heat (Form 2, Col. VI, line O) for each room. In Column IX and X enter the desired register temperature and its appropriate factor from Table 9. (See discussion of air motion for basis on which to choose the inlet air temperature and from this choose the factor corresponding to the temperature which is nearest to that established for design purposes.) Multiply the items in Col. VIII by the factors in Col. X and enter the products in Col. XI as cubic feet of air circulated per minute. Add 15% to total of Col. XI to find fan or blower capacity required in summer.

3. Select blowers or fans rated at the total cubic feet per minute (cfm) thus found for winter or summer conditions, when operating against an assumed static head of \(\frac{1}{4}\)" to \(\frac{1}{2}\)" of water unless the actual static head is known.

Note that where summer requirements exceed winter requirements it may be advisable to choose the fan on the basis of the maximum load and operate it at lower speeds in the winter. This may be done by changing pulley ratios or by using a variable or multi-speed motor.
**AIR FILTERS AND AIR WASHERS**

The selection of air filters or air washers is governed by the cubic feet of air to be cleaned per minute or per hour, and by the resistance to the passage of this air developed by the filter medium or washer sprays. Inasmuch as this resistance can be controlled within definite limits by increasing the area of the filter medium or the volume of the air washer chamber, the only data required upon which to base selection of equipment is (1) fan or blower capacity as determined by Rule 17 and (2) the permissible resistance or static head developed by the air cleaning device.

The determination of static head will be presented in *American Architect* Reference Data No. 13 to appear in September, 1934. A short-cut method of selecting equipment is to assume that the static head developed by the filter or air washer shall range between ⅛ and ⅛ inches of water pressure and that the velocity through filters or washers shall not exceed 800 ft. per minute.

**RULE 18 . . . To find the required capacity of an air filter or air washer:** Choose a unit rated by the manufacturer as capable of cleaning the volume of air to be handled by fans or blowers as determined by Rule 17, when the velocity through the cleaning mechanism does not exceed 800 ft. per minute over the gross face area of the filter, while developing resistance to the flow of air not exceeding 0.25 in. of water pressure.

---

**Economic Study of Equipment**

The loads or required capacities that have been computed by the methods described represent ideal project requirements. It is rarely possible to find standard units in commercial production which are rated at precisely the capacities called for in a specific project. This problem may be solved in larger buildings by designing each element to carry the designed loads and then building the equipment from such special designs.

One major factor in the selection of equipment is always the item of initial cost. The selection of equipment purely on a cost basis, however, is seldom sound because the cheapest equipment may involve high operating costs or may not perform in accordance with project requirements; while higher priced units may show a substantial economy in operation and perform with maximum satisfaction.

To assist in making selection which takes into consideration the essential factors of cost and performance it is recommended that Form 4 or its equivalent be used. In the first column under “Project Requirements” enter the computed loads or required capacities as developed in Form 3 and an apportionment of the total budget for heating, cooling and air conditioning between the various items of equipment involved. These values should be considered as 100% in rating the competitive equipment to be entered in the remaining three columns.

In these columns are spaces in which to enter the make and model number of tentatively chosen equipment and the contractor’s estimated cost of such equipment installed. Also enter the manufacturer’s rating of his equipment in the lines corresponding to the loads or capacities entered in Column I. If desired, these costs and capacities also may be compared to project requirements by expressing them in percentage form. For example, if the computed load on a boiler is 140,000 Btu and the budget allowance for this unit is $500, a boiler that would deliver 150,000 Btu rated capacity would be entered as delivering 107% of the designed load. If the cost is $550, it would show 110% of the budget allowance. A cheaper unit costing only $450 and indicated as 90% of the budget, might only deliver 130,000 Btu or 93% of the project requirements.

By listing tentative selections in this manner the owner may quickly decide where he can make logical savings below his budget, or where he should exceed the budget in order to secure adequate performance. Between various items of equipment of substantially the same cost, he can quickly see the desirability of choosing the one which will come closest to the needs of his building.

The reverse side of Form 4 provides a means for listing the total investment and for computing the annual operating cost. Under “Total Investment” it will be noted that there is one space for “Radiation, Piping, etc. or Duct Work, Registers Complete.” Here may be entered the contractor’s estimate for the complete heating or air conditioning installation outside of the units of equipment embraced in this article. A detailed study of these elements will appear in *American Architect* Reference Data No. 13, September, 1934.

The method of computing annual operating cost is self-evident. Space is provided here for only one computation. It is assumed that the comparisons made on the face of Form 4 and in the total investment summary will have reduced the choice to one combination of units that seems outstandingly advantageous to the buyer. If the selection will be influenced by operating costs, calculations of the latter should be repeated on a separate form.

Presenting the

QUIET MAY OIL FURNACE

With Dual Function—(1) Comfort Heat (2) Tankless Hot Water

New applications of well-tried principles of combustion engineering have produced the unique Quiet MAY Oil Furnace. Freedom from hampering precedent and the opportunity to design each part efficiently to serve a definite need, have produced an Oil Furnace having advantages never before offered in the domestic heating field.

The Quiet MAY Oil Furnace is introduced in two sizes with a rated output of 600 and 900 square feet of direct steam radiation at the boiler. A larger unit, rated at 1200 square feet, will be available shortly. Experience shows these sizes will meet over 90% of residential heating requirements. Even the smallest home can be served by one of these units as the design is such that the frequency with which the burner is operated determines the fuel consumption and total heat output. There is no loss of efficiency under lighter loads than the boiler rating. See Table 1 for complete ratings.

Compactness, low water line, and ability to pass through ordinary doorways simplify installation. See Table 2 for all dimensions and clearances.

Truly a dual purpose boiler—(1) comfort heat, (2) tankless domestic hot water. The basic design provides for domestic hot water both Summer and Winter—and this is accomplished without accessories or even need for a storage tank. A tankless domestic hot water heater under independent automatic control supplies ample water, all year round, without costly Summer shut-off valves even on hot water radiation heating systems.

Where heating system is of hot water radiation type, the water is heated by steam, using the novel invention, Quiet MAY Transfer Heater, above the water line of a steam boiler. High efficiency, no loss of water from the boiler, and exceptional control of heating effect result from this simple and logical departure from past practices.

Controlled warmth in the basement is offered by the special air heater built into the furnace cabinet. Closing a louvre in Summer shuts off this heat that is so desirable in Winter, especially where the basement is used for recreation.

A finely built furniture-steel cabinet, finished in grey and black with chromium plated trim, encloses all working parts and presents real beauty of design. All connections are made at the rear of the boiler. This is a revolutionary development not heretofore accomplished.

A PRODUCT OF MAY OIL BURNER CORPORATION, BALTIMORE, MD.
Facts About the New Quiet May Oil Burning Furnace

THE OIL BURNER MECHANISM is a development of the successful Quiet MAY Oil Burner which has been satisfactorily used all over the world for over ten years. It is of the pressure atomizing type with electric ignition, burning No. 3 oil. It has the famous Gerotor oil pump, genuine double sapphire-jeweled atomizing nozzle and all other features that have established the reliability of the Quiet MAY.

THE COMBUSTION CHAMBER is formed by the patented Quiet MAY Ther-MAY-Lator—a molded refractory cylinder having water passages that function as a little boiler within a big boiler. The small quantity of water within the Ther-MAY-Lator is quickly heated as soon as combustion starts; the water thus instantaneously heated is brought through a special channel to the water surface. Quick steaming results, giving rapid response to the call for heat.

AMPLE HEAT ABSORBING SURFACES are provided by the arrangement of the flue gas passages. The gases leave the combustion zone at the rear, pass forward around the Ther-MAY-Lator, and thence pass around the outside of the water shell before reaching the stack. Low stack temperatures result. No special chimney conditions are required.

THE TANKLESS HEATER supplies ample hot water Summer and Winter for domestic purposes. Its adequacy has been established by actual installations in various parts of the country. It is automatically controlled by a thermostatic device that operates the burner when the water temperature drops and stops it (unless the room thermostat is calling for heat) when the desired temperature is restored. Where peak demands for hot water are extremely heavy, a "built-in" tank-type heater of similar construction may be specified.

HOT WATER RADIATION HEATING SYSTEMS are served by this Quiet MAY Oil Furnace having a wholly new and practical "Transfer Heater" consisting of copper coils of special design situated above the water line in the steam dome. The boiler water does not flow through the hot water heating mains and radiators but remains in the boiler. At the same time the water circulating through the radiation system remains practically constant as it does not mix with the boiler water and, therefore, cannot inadvertently be boiled out of the furnace.

Two distinct advantages result: In the Summer the boiler can be operated below the steaming point to

A PRODUCT OF MAY OIL BURNER CORPORATION, BALTIMORE, MD.
supply domestic hot water, without either heating the house or requiring an expensive motor driven shut-off valve on each main riser. In Spring and Fall, when only a slight amount of heat is needed, more precise control of heat delivery can be effected by this transfer heater than by heating the water direct.

**BASEMENT HEATING** during the Winter season is provided for by means of a built-in warm air heater controlled by a door in the rear end of the cabinet. Part of the air circulating between the casing and the boiler is used to preheat air for combustion. The balance may be used to warm the basement, to make it more comfortable for recreation purposes, or to prevent cold floors above.

**WELDED STEEL CONSTRUCTION** is used for all parts of the boiler except the water heater and transfer heater coils. Coils of either type can be removed without taking down the boiler. The boiler is built to meet the A. S. M. E. specification and each boiler bears the Hartford Boiler Inspector's stamp.

**ATTRACTIVE APPEARANCE,** pleasing to the most meticulous home owner, is offered by the grey and black furniture-steel cabinet with chromium plated trim. All operating parts are completely concealed; even the necessary pipe connections and the stack flue connection are brought out at the back, leaving nothing to mar the simple clean lines of the cabinet.

A large access door with lock handle permits servicing the burner mechanism. The Quiet MAY Oil Furnace may be operated for test purposes without the cabinet, or the cabinet may be removed without disturbing any connections.

**INSTALLATION** is facilitated by (1) its compact size; (2) its ability to pass through normal size doorways; (3) its low water line, permitting use in basements with low headroom and allowing ample overhead space for piping; (4) simplified erection and handling on the job; and (5) the enforced necessity of making a correct piping installation because of the disposition of the return connections.

**SERVICING** has been reduced to an absolute minimum through the fact that the burner is designed and adjusted at the factory to operate at highest efficiency. No adjustment is ever necessary in the burner operation once the unit is installed, except a change in the atomizer if the grade of oil is changed. When the load is less than the rated load of the furnace, the burner operates less often, thus apportioning the fuel consumption to the load.

Quiet MAY Oil Furnaces are sold, installed and maintained by authorized factory-trained Quiet MAY Oil Burner dealers. Expert service is offered every user; installations may only be secured where these factory-trained service organizations are available.

---

A PRODUCT OF MAY OIL BURNER CORPORATION, BALTIMORE, MD.

FOR JULY 1934
Our Engineering Department has designed this advanced oil furnace. If these technical men can help you plan its incorporation in your projects, their services are available on request.

**TABLE I. CAPACITIES**

<table>
<thead>
<tr>
<th></th>
<th>Model S600—W960</th>
<th>Model S900—W1440</th>
<th>Model S1200—W1920</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOILER OUTPUT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Btu per hour</td>
<td>144,000</td>
<td>216,000</td>
<td>288,000</td>
</tr>
<tr>
<td>In EDR Steam</td>
<td>600</td>
<td>900</td>
<td>1,200</td>
</tr>
<tr>
<td>Water</td>
<td>1,440</td>
<td>1,440</td>
<td>1,200</td>
</tr>
<tr>
<td>DOMESTIC HOT WATER</td>
<td>180</td>
<td>270</td>
<td>360</td>
</tr>
<tr>
<td>MAXIMUM FUEL RATE</td>
<td>1.3</td>
<td>1.9</td>
<td>2.6</td>
</tr>
</tbody>
</table>

**TABLE II. DIMENSIONS AND RECOMMENDED CLEARANCES**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVER-ALL DIMENSIONS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Cabinet—Length</td>
<td>3'11&quot;</td>
<td>4'5&quot;</td>
<td>5'11&quot;</td>
</tr>
<tr>
<td>Width</td>
<td>2'5&quot;</td>
<td>2'9&quot;</td>
<td>2'111/2&quot;</td>
</tr>
<tr>
<td>Height</td>
<td>4'0&quot;</td>
<td>4'31/2&quot;</td>
<td>4'31/2&quot;</td>
</tr>
<tr>
<td></td>
<td>2'111/2&quot;</td>
<td>3'2&quot;</td>
<td>3'2&quot;</td>
</tr>
<tr>
<td><strong>DOOR WIDTHS ADMITTING BOILERS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As shipped</td>
<td>2'41/4&quot;</td>
<td>2'61/4&quot;</td>
<td>2'71/4&quot;</td>
</tr>
<tr>
<td>Gas passage cover with chimney connection removed</td>
<td>2'0&quot;</td>
<td>2'31/2&quot;</td>
<td>2'51/2&quot;</td>
</tr>
<tr>
<td>Both gas passage covers removed</td>
<td>1'10&quot;</td>
<td>2'01/2&quot;</td>
<td>2'3&quot;</td>
</tr>
</tbody>
</table>

**RECOMMENDED CLEARANCES**

<table>
<thead>
<tr>
<th></th>
<th>From Boiler</th>
<th>From Cabinet</th>
<th>From Boiler</th>
<th>From Cabinet</th>
<th>From Boiler</th>
<th>From Cabinet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service End</strong></td>
<td>3'0&quot;</td>
<td>2'01/2&quot;</td>
<td>3'0&quot;</td>
<td>2'01/2&quot;</td>
<td>3'0&quot;</td>
<td>2'01/2&quot;</td>
</tr>
<tr>
<td><strong>Observation End</strong></td>
<td>1'6&quot;</td>
<td>1'4&quot;</td>
<td>1'6&quot;</td>
<td>1'4&quot;</td>
<td>1'6&quot;</td>
<td>1'4&quot;</td>
</tr>
<tr>
<td><strong>Rear</strong></td>
<td>2'0&quot;</td>
<td>1'10&quot;</td>
<td>2'0&quot;</td>
<td>1'10&quot;</td>
<td>2'0&quot;</td>
<td>1'10&quot;</td>
</tr>
<tr>
<td><strong>Over-all Clearance</strong></td>
<td>7'31/2&quot;</td>
<td>7'31/2&quot;</td>
<td>7'31/2&quot;</td>
<td>7'31/2&quot;</td>
<td>8'51/2&quot;</td>
<td>8'51/2&quot;</td>
</tr>
</tbody>
</table>

**MAY OIL BURNER CORPORATION**

Factory and Executive Offices
Baltimore, Maryland, U. S. A.

NEW YORK
6 East 39th Street

CHICAGO
35 East Wacker Drive

BOSTON
1028 Commonwealth Avenue

PARIS
15 Rue de la Paix

A PRODUCT OF MAY OIL BURNER CORPORATION, BALTIMORE, MD.
Twin homes

but 37.3% difference in fuel consumed!

These homes are in Hasbrouck Heights, N. J. They were constructed from the same plans, at the same time, by a prominent building company of that town. They are equipped with the same make of high grade oil burner. In only one respect do they differ. . . . One home, saving 37.3% over the other in fuel cost, has a FITZGIBBONS Oil-Eighty Automatic Steel Boiler to supply heat, and with a FITZGIBBONS TANKHEATER to give year-round domestic hot water. The other, a standard make oil-burning, cast-iron boiler with an indirect hot water heater.

During the hard winter of 1933-34, the FITZGIBBONS Oil-Eighty Automatic kept piling up savings for its owner—and building lasting good-will for the oil burner with which it was cooperating. And it will keep on piling up savings indefinitely, giving its owner one year's free heat out of every four, on the basis of the heating cost in the other home.

Space does not permit of telling here why the Oil-Eighty Automatic can make this difference in oil burner performance. But BULLETIN AA will give all the details.

Write for a copy—today.

Fitzgibbons Boiler Company, Inc.
GENERAL OFFICES: 570 SEVENTH AVE., NEW YORK, N. Y.
Works: OSWEGO, N. Y.
BRANCHES AND REPRESENTATIVES IN PRINCIPAL CITIES

FITZGIBBONS OIL-EIGHTY AUTOMATIC

FOR JULY 1934
Air Conditioning

DEMANDS

Minneapolis-Honeywell

CONTROLS

RESIDENCE OF MISS GRACE SPIELMAN, MINNETONKA MILLS, MINN.

A simple but satisfactory low cost air conditioning system controlled by Minneapolis-Honeywell. Deep well water is used for year around air conditioning. A central control installed in the furnace governs the fan for circulating the air, both in summer and in winter, with a manual switchover. The water valve, which is in the fan circuit, can open only when the fan is running and is governed by the humidity controller.

FRANKLIN THEATRE . . . FRANKLIN SQUARE, LONG ISLAND, N.Y. The Minneapolis-Honeywell automatic controls installed on this central fan air conditioning system control the temperature in the theatre and the dew point of the air leaving the conditioner both summer and winter. Provision is also made for automatic changeover from summer to winter and visa versa. A minimum of fresh air is provided for according to the number of people in the theatre by the setting of a hand rheostat. A minimum of 30 damper positions is available.
The many applications and exacting requirements of air conditioning demand perfect control. Without adequate control, the effectiveness and efficiency of any air conditioning system is seriously impaired. There is a Minneapolis-Honeywell Control System for every air conditioning or cooling need in which each individual control is designed to accomplish its particular function with characteristic Minneapolis-Honeywell accuracy and efficiency. For complete satisfaction in meeting any desired air conditioning requirement, recommend and install Minneapolis-Honeywell Controls. They are backed by 49 years of experience and engineering research. The Minneapolis-Honeywell Engineer in or near your city is available for consultation with your engineer at all times, without obligation. Minneapolis-Honeywell Regulator Company, 2738 Fourth Avenue South, Minneapolis, Minn. Branch or distributing offices in all principal cities.
Important Improvements in Air Conditioning . . .

OF VITAL CONCERN TO EVERY ARCHITECT

CLARAGE Vortex Control and Clarage Constant Velocity Registers are two new and outstanding developments in air conditioning. They make possible decidedly improved results and marked economies in both first and operating costs.

Vortex Control, with its applications to systems protected by patent coverage, is a means of obtaining a variable capacity air conditioning system of the most efficient type and with least expense.

Constant Velocity Registers, with patents applied for, discharge the conditioned air at constant velocity regardless of volume changes. In other words, even though the system is operating as low as one-third capacity, these registers emit conditioned air at the same effective velocity as when the system is operating 100%.

By combining these two new improvements, we offer the CLARAGE VARIABLE CAPACITY, CONSTANT VELOCITY SYSTEM . . .

The operation of this system, under complete automatic control, fluctuates exactly in accordance with the demands placed upon it. ONLY the volume of conditioned air required by the sensible heat load existing at any given time is delivered. Any desired heating and humidifying effect can be accurately maintained in winter; any cooling and dehumidifying effect in summer.

The system is ideal for conditioning factory departments or entire plants, offices, theatres, schools, stores, auditoriums, hospitals, etc. It gives every economy of the older types of variable volume systems plus one more: fan operating economy produced by Vortex Control.

Every architect should have technical details on these Clarage improvements. THEY ARE IMPORTANT! Use the Coupon below!

WIDE EXPERIENCE: For more than two decades Clarage has been a leading producer of air handling and conditioning equipment—a pioneer. Clarage installations are many and successful—wide experience in air conditioning work.
Announcing
THE new GILBARCO
AUTOMATIC CONDITIONED-WARM-AIR UNIT

Nothing like it ever before offered for the small home! For old residences or new—you can specify the “Gilbarco” Conditioned-Warm-Air Unit with the positive knowledge that it does the heating job better—that it will provide faithful service year after year.

Along with complete automatic oil heating, this new “Gilbarco” Unit offers: (1) filtered air; (2) humidified air; (3) positive circulation of air replacing old style gravity circulation; (4) construction features far ahead of present day heating practice. You will appreciate its compactness—you will approve of its styling—you know its efficiency is assured by Gilbert & Barker design and engineering.

Send today for descriptive literature on this outstanding new “Gilbarco” development in automatic conditioned-warm-air heating.

YOUR COPY IS WAITING

Our new Architects and Engineers Manual contains 24 pages of the most helpful oil heating information ever presented to American architects. A copy is yours for the asking.

GILBERT & BARKER MFG. COMPANY
Springfield
Established 1863
Mass.

SEND THE COUPON TODAY! NO OBLIGATION.
"FREON"
provides cooling comfort in the nation's capital

This safe refrigerant is used for air-conditioning in the newest government buildings

When its new government buildings are completed, Washington, D.C., will be the most beautiful capital in the world.

These new buildings represent the finest in architectural design and structure, in modern equipment and conveniences. Naturally, they are air-conditioned. Air-conditioning provides pleasant, cool atmospheric conditions all year round, increases efficiency of government employees, and safeguards their health.

"Freon" is the refrigerant used. In fact, more than 5,000 tons of refrigeration effect will be created by means of "Freon" in the five buildings shown on this page. One of the buildings—The Department of Justice—is the largest air-conditioned building in the world.

"Freon" is non-toxic, non-flammable, odorless—affording maximum safety and comfort to employees.

These outstanding qualities of "Freon" make it the preferred refrigerant for household refrigerators, for air-conditioning in theatres, apartments, hotels, trains—and for air-conditioning and refrigeration in fur storage vaults, florists' shops, meat markets, libraries and museums. In fact, you can recommend "Freon" wherever safety of life and goods is all-important.

KINETIC CHEMICALS, INC., TENTH & MARKET STREETS, WILMINGTON, DELAWARE
Do you approve of "**STOCKPLAN**" HEATING PLANTS?

**CONSIDER THE FACTS THAT BOTH ARCHITECT AND HEATING ENGINEERS OUGHT TO FACE . . .**

The individually planned building...whether a 4-room gardener's cottage or a towering skyscraper...deserves an individually planned heating system. That's why Petro-&-Nokol automatic oil burning equipment deserves your special consideration. You are not restricted by the handicaps of a half dozen "ready-cut" models that differ only in capacity.

Examine the buildings on this page. You realize, at once, that no one type of oil burning equipment can possibly fit them all. Yet these structures are all heated by Petro-&-Nokol.

For domestic jobs alone, Petro-&-Nokol provides a range of radically different burners, because 29 years of oil burner building experience taught the thorough Petro-&-Nokol organization that variations in boilers and furnaces for house heating could never be satisfactorily fired by one simple burner in a mere range of sizes.

Petro-&-Nokol offers a complete line of over 66 models in domestic burners. And is recognized as the leading builder of heavy duty industrial and commercial burner equipment for hotels, apartments, stores, factories, office buildings, hospitals and institutions. Such installations, needless to say, demand sound engineering and demonstrated efficiency and economy.

Write for complete and comprehensive data.

**PETRO & NOKOL**

Domestic--Commercial--Industrial Oil Burners
Mfd. by PETROLEUM HEAT & POWER COMPANY
Stamford, Conn.

Oldest and Largest Organization exclusively devoted to Oil Heating

FOR JULY 1934
An Expression of Appreciation

To the Architects and Engineers of the United States and Foreign Countries, who, through their Research, Approval and use of Uni-Flo Products, have been responsible for our unprecedented success

Uni-Flo 5-Way Directional Air Flow Outlet

AIR DISTRIBUTION ENGINEERS and MANUFACTURERS SPECIALIZING IN PRE-DETERMINED AIR DISTRIBUTION OUTLETS

UNI-FLO CORPORATION, DETROIT, MICH.

Write for Catalog No. 22

1928 1929 1930 1931 1932 1933 1934

DOWN During the Depression
COMPARATIVE CONSTRUCTION VOLUME CHART TO JULY 1st, 1924 — BY YEARS

1931 1932 1933 1934

UP During the Depression
COMPARATIVE UNI-FLO VOLUME CHART TO JULY 1st, 1934 — BY 6 MONTH PERIODS
Burnham builds a New Oil Burning Boiler

Having Many Outstanding Features

You can use in its built-in design, practically any of the standard makes of oil burners. You no longer have to take a boiler you don't care particularly for, to get a burner you do.

Service Advantage

Furthermore, there's the distinct advantage with a Burnham of being able to use a certain burner, that is well serviced in one section where others are not.

You have the Burnham Boiler you want, and a local-sold and serviced burner that insures best results.

Economy Claims

Of course, every maker of boilers claim their's has outstanding economy features possessed by no others. We are no exception. The only possible difference may be, that we can come pretty close to backing up our claims with proofs.

Provisions for Safety Devices

In addition to which, it has provisions for various safety devices and automatic controls.

Practically Noiseless

And we discovered a way to almost completely hush noisy burners, and make quiet ones still quieter.

Appearance

It has a good-looking sound and heat insulated jacket—in fact it is rather elegant in its restrained colors.

To which we might add that for over half a century Burnham has been making cast iron boilers and for 20 years steel ones as well.

Burnham Boiler Corporation

Irvington, New York

Representatives in All Principal Cities of the United States and Canada
HIDDEN behind the stately walls of the Cathedral of St. John the Divine, New York City, lie many tons of Toncan Iron Sheets forming the indirect heating ducts.

For such service, in large structures and small, Toncan Iron is unsurpassed. Specification writers, delving into the records of Toncan Iron performance, know this to be a fact. Building owners, figuring cost against years of service, quickly arrive at the same conclusion.

The reason is easy to find. Toncan Iron is not an ordinary metal, but the direct result of experienced alloying practice. It is an alloy of refined iron, copper and molybdenum—carefully processed in the open hearth furnace—subjected to special ingot practice—and rolled to shape with far more than usual care and inspection with just one thought in mind—to make it more resistant to rust than any other ferrous material except the stainless alloys.

That's why users willingly pay a premium for Toncan Iron and wisely consider it money well spent—because experience has proved that its longer life and the lessened repair and replacement expense that always follow its use make for real economy in building operation.

A copy of "The Path to Permanence" will bring you more complete information.
AIR CONDITIONING with Kewanee BOILERS

The "heart" of every Air Conditioning System must be a good Boiler. The two air conditions contributing to our comfort in the greatest degree are Temperature and Humidity. The boiler is required—

To RAISE the temperature for heating and humidification.

To LOWER the temperature in cooling and dehumidification (as in the steam jet cooling equipment illustrated at the left).

So the boiler is the "Heart" of the system upon which efficient air conditioning service depends.

Kewanee Steel Boiler generating steam for steam jet air conditioning apparatus.

This is a gas burning boiler, specially insulated, generating high pressure steam in the same room which is being cooled.

There is a Kewanee the right size and type to insure trouble-free operation and complete satisfaction with the right kind of Air Conditioning System.

Kewanee Boiler Corporation
KEWANEE, ILLINOIS
BRANCHES IN SIXTY-ONE PRINCIPAL CITIES

For Buildings of Every Size

For COAL, OIL OR GAS

FOR JULY 1934
There is No Need to GUESS about Infiltration Losses when you specify MONARCH METAL WEATHERSTRIP

Maximum Certified Air Leakages take guesswork out of Heating, Cooling and Air Conditioning Calculations.

GUESSING at air infiltration means guessing at the size of heating, cooling and air conditioning equipment and guessing at results. The use of average values in calculations is inadequate. They class the worst with the best; they are poor substitutes for facts.

There is no guessing about air infiltration when you specify Monarch Metal Weatherstrip. For the performance of Monarch Metal Weatherstrip is accurately tested and published as Maximum Certified Air Leakage.

In the table at the right are Maximum Certified Air Leakage values for leading types of Monarch Metal Weatherstrips. These values may be relied upon in your calculations if you specify Monarch equipment. Do not use them for other makes of weatherstrip for Monarch performance is not matched by competitive equipment.

The amount of infiltration depends not only on wind pressure but upon the duration of that pressure. All records of average wind velocity necessarily include maximum winds of very short duration. Wind travel in miles per month or season is the most accurate gauge of infiltration. Monarch representatives will gladly give you local data on “Air Movement” and “Degree Miles.” Used with the Maximum Certified Leakage of Monarch Metal Weatherstrip in cubic feet per foot of crack per mile of wind velocity these figures will show exactly what infiltration losses will occur. The fuel savings directly due to the use of Monarch products can also be found accurately.

Every inch of Monarch Metal Weatherstrip is installed by factory-trained representatives who spend at least one year gaining experience in this work under expert supervision. There is only one authorized representative in each territory; hence there is no divided responsibility. When you specify Monarch, you are assured of Certified performance.

MONARCH versus Plain Window

<table>
<thead>
<tr>
<th>Wind Velocity</th>
<th>Plain Window</th>
<th>Monarch No. 400</th>
<th>% Infiltration Stopped by Monarch No. 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Miles per Hour</td>
<td>30.9 C.F.H.</td>
<td>2.43 C.F.H.</td>
<td>92.14%</td>
</tr>
<tr>
<td>10</td>
<td>78.5 C.F.H.</td>
<td>4.86 C.F.H.</td>
<td>93.81%</td>
</tr>
<tr>
<td>15</td>
<td>124.5 C.F.H.</td>
<td>7.29 C.F.H.</td>
<td>94.15%</td>
</tr>
<tr>
<td>20</td>
<td>171.6 C.F.H.</td>
<td>9.72 C.F.H.</td>
<td>94.34%</td>
</tr>
<tr>
<td>25</td>
<td>220.3 C.F.H.</td>
<td>12.15 C.F.H.</td>
<td>94.48%</td>
</tr>
<tr>
<td>30</td>
<td>274.1 C.F.H.</td>
<td>14.58 C.F.H.</td>
<td>94.68%</td>
</tr>
</tbody>
</table>

Performance of Typical MONARCH Metal Weatherstrips

in cubic feet of air leakage per hour, per foot of crack, per mile wind velocity.

<table>
<thead>
<tr>
<th>Monarch Type Number</th>
<th>For Application to</th>
<th>Type</th>
<th>Maximum Certified Leakage c.f.h. per foot crack mile wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>Double Hung Wood Sash</td>
<td>Interlocked</td>
<td>0.486</td>
</tr>
<tr>
<td>600</td>
<td>Inswinging Wood Casement</td>
<td>Spring Bronze</td>
<td>0.690</td>
</tr>
<tr>
<td>800</td>
<td>Wood Doors</td>
<td>Spring Bronze</td>
<td>0.631</td>
</tr>
<tr>
<td>806</td>
<td>Wood Doors</td>
<td>Spring Bronze</td>
<td>0.635</td>
</tr>
<tr>
<td>5200</td>
<td>Metal Casements (Solid sects.)</td>
<td>Special Spring Bronze</td>
<td>0.954</td>
</tr>
</tbody>
</table>

For test data by recognized authorities, local wind movement data, engineering services or name of nearest representative, write to MONARCH METAL WEATHERSTRIP COMPANY

6333 ETZEL AVENUE, ST. LOUIS, MO.
NOW COMES Air-Conditioned Heat
FOR FALL, WINTER AND SPRING

DELCO-HEAT CONDITIONAIR
A PRODUCT OF GENERAL MOTORS

Today's biggest news is air conditioning. Everyone is conscious of it—everyone is enthusiastic about it—and everyone wants it.

And now comes the newest advancement in air conditioning... Delco-Heat Conditionair, a product of General Motors.

This new engineering achievement truly signals a new era in modern home comfort. It provides fresh, air-conditioned heat during the eight to nine heating months every year when air conditioning is needed most. It purifies the air—removes bacteria and dust; humidifies the air to just the right amount of moisture; automatically heats the air; circulates healthful, even temperatures to every room—with a complete change of air every 10 to 15 minutes.

Equally important, Delco-Heat Conditionair, with all its new-day air conditioning features, actually costs less to operate. Unit construction and the utilization of the famous Delco-Heat method of burning oil, are the reasons.

For new home construction or the modernization of old homes, Delco-Heat Conditionair is ideal. The complete unit is enclosed in one beautiful, compact cabinet—and it will go into any low ceiling basement without tearing down doors and partitions.

Let us send you complete details and specifications. The coupon below will bring you our new brochure and architect's file.

Delco-Heat Conditionair
A PRODUCT OF GENERAL MOTORS

Here is the one complete line of automatic heating equipment for the modern home. It includes the wall-flame conversion oil burner; pressure type oil burner; oilboiler, with built-in water heater; air conditioning oilfurnace, gravity oilfurnace and an automatic hot water heater that produces ample hot water at an exceptionally low cost. Nothing is so important, in designing and installing oil heating equipment as experience. Back of every Timken Silent Automatic installation are nine years' experience, with more than 100,000 American homes. To assure trouble-free automatic oil heating at its lowest cost, specify Timken Silent Automatic. The Timken Silent Automatic Company, 100-400 Clark Ave., Detroit, Mich.

<table>
<thead>
<tr>
<th>TIMKEN OIL BOILER</th>
<th>CAPACITY (Total Connected Load)</th>
<th>Max. Oil Rate</th>
<th>Grade of Oil</th>
<th>Height of Water Line</th>
<th>Flue Size</th>
<th>Chimney Height Feet</th>
<th>Square Feet of Heating Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-8</td>
<td></td>
<td>600</td>
<td>11.0 lbs. 1 hr.</td>
<td>2</td>
<td>30</td>
<td>28</td>
<td>98.9</td>
</tr>
<tr>
<td>TA-125R</td>
<td></td>
<td>915</td>
<td>13.8 lbs. 1 hr.</td>
<td>2</td>
<td>30</td>
<td>34</td>
<td>98.9</td>
</tr>
<tr>
<td>TA-126R</td>
<td></td>
<td>1120</td>
<td>16.9 lbs. 1 hr.</td>
<td>2</td>
<td>30</td>
<td>30</td>
<td>98.9</td>
</tr>
<tr>
<td>TA-127R</td>
<td></td>
<td>1325</td>
<td>20.0 lbs. 1 hr.</td>
<td>2</td>
<td>30</td>
<td>30</td>
<td>98.9</td>
</tr>
</tbody>
</table>

Oil boilers: sectional cast iron boilers of special design. Oil furnaces: steel furnace with hot riveted and cold caulked seams, gas-tight. Furnace: steel cabinet of two tone green enclosing all instruments and controls used on boiler and furnace units.

TIMKEN Silent Automatic HEATING Provides a Complete Home Service

Oil boilers: sectional cast iron boilers of special design. Oil furnaces: steel furnace with hot riveted and cold caulked seams, gas-tight. Furniture steel cabinet of two tone green enclosing all instruments and controls used on boiler and furnace units.

TIMKEN Silent Automatic HEATING

Branches and dealers in principal cities. Ask for complete information and prices.
PERSONALS

• M. W. Kleinman of New York University, a pupil of Lloyd Morgan, was the winner of the National Competition for the 27th Paris Prize of the Society of Beaux-Arts Architects, awarded at a meeting of the Prize Committee on June 20th. The subject of the Competition was the design of an international athletic center and under the terms of the award Mr. Kleinman will spend 2½ years for study in Paris and for travel abroad on a stipend of $3,600. R. Ayers of Yale University and a pupil of Frederic C. Hirons was placed second. The Jury of Award was headed by Joseph H. Freedlander.

• Ralph T. Walker of Voorhees, Gmelin & Walker, architects, has been reelected President of the New York Chapter of the American Institute of Architects for the year 1934-35. Eric Kebbon was returned as Secretary, and Daniel P. Higgins continues as Treasurer of the organization.

• Joseph W. Radotinsky, formerly State Architect of Kansas, has resigned his position as State Architect and will devote his time to private practice at 702 Commercial National Bank Building, Kansas City. Manufacturers catalogs are requested.

• Childs & Smith have moved their offices to 430 North Michigan Avenue, Chicago.

• Benjamin H. Marshall and John A. Holabird, Chicago architects and Harvey W. Corbett and Ralph Walker of New York City have been chosen as the architectural members of a Jury for a bar competition being sponsored by the Brunswick-Balke-Collender Co.

• James F. Bly, Matthew W. del Gaudio, Arthur C. Holden, Harold Shreve and William Lescace have been appointed as professional advisors to the New York Municipal Housing Authority.

• The Perkins and Boring Fellowship, student honor in the School of Architecture of Columbia University, has been awarded for 1934 to Paul B. Schechter of Jersey City, N. J. The Fellowship carries an award of $1,800 and Mr. Schechter will spend the next year abroad. The second honors were awarded to Herman M. Cohn of New York.

• Clifford O. Boyce announces formation of a new architectural office under the name of Clifford O. Boyce and Associates, Architects and Engineers, with offices at 501 Reading Road, Cincinnati. Mr. Boyce formerly practiced independently with offices in the Chamber of Commerce Building, Cincinnati. Manufacturers' samples and catalogs are desired.

• The Edward L. Ryerson Fellowship in Architecture was awarded to William H. Buderus of the University of Michigan. The Fellowship is sponsored by the Foundation for Architecture and Landscape Architecture at Lake Forest, Ill.

• The business of the firm of A. B. Chamberlain & E. J. Prondzinski is now being carried on under the name of Edmund J. Prondzinski, Architect, at 107 South 4th St., Minneapolis, Minn.

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When you specify the

FAIRWEATHER AIR CONDITIONER

You are specifying fool-proof operation and PROVEN EFFICIENCY

Designed specifically for use with the warm air heating system.

Washes the air — and SCRUBS it. Humidifies. Filters the air. Circulates warmed or cooling air to every part of the home.

Has self cleaning air filter. The filter is always free of dirt, guaranteeing perfect cleaning and free unobstructed passage of air. Eliminates bother and expense of cleaning or renewing filters.

Operates entirely automatically and requires no care or attention throughout a season.

PROVEN highly efficient by constant rigid tests in an occupied residence.

Write for Complete Data

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And at Engleman's Cafeteria, Kansas City

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Refrigeration

Cools two dining rooms, seating 270 people, at an operating cost of 3/4 cent per person per meal. The management writes, "Due to this cool and even temperature, we found that our late Spring and early Fall business increased about 25 per cent. Our Summer business increased about 50 per cent. Another agreeable surprise was the cost of operation, which ran slightly under what you estimated." A Frick plant will do as well for you. Get literature and prices now.

Frick Company

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ICE MACHINERY SUPERIOR SINCE 1885

KITCHEN M/MN CAFETERIA SUHF: UNIT

Frick Enclosed Freon Compressor Available in Sizes to Meet All Air Conditioning Installations.

Elevation plan of Engleman's Cafeteria, showing layout of Cooling System installed by Olchoff Eng. Co., Frick Distributors at Kansas City.

- Howard Steitz announces removal of his office from 217 East Avenue to 10 Summer Park, Rochester, New York.
- K. R. Darrah, a student at Rensselaer Polytechnic Institute, Troy, N. Y., won first prize in the Sixth Annual Bridge Design Competition held by the American Institute of Steel Construction. George Pistey, of the same school, won second prize.
- Yasuo Matsui and F. H. Dewey and Co., architects and engineers, announce the removal of their offices from 350 Fifth Avenue to 10 East 40th Street, New York.
- Carl W. Denney announces the removal of his office from 443 S. Catalina St., Los Angeles, to 2610 Hermosita Ave., Glendale, Cal.
- Samuel Z. Moskowitz announces the removal of his office from 63 Hazle Street to Meyer Building, Public Square, Wilkes-Barre, Pa. Manufacturers' catalogs and literature are desired.
- Coffin & Coffin, architects, announce the removal of their offices from 522 Fifth Avenue to 125 East 46th St., New York City.
- Dwight James Baum, New York architect, was honored last month when Chancellor Charles W. Flint of Syracuse University conferred upon him the degree of Doctor of Fine Arts.
- Edmond J. Ryan, architect, of Chateaugay, N. Y., was awarded the first prize of $100 in a Box Design Contest recently held by the Koh-I-Noor Pencil Company, Inc. The second prize winner was Louis Edwards, Detroit.

ANNOUNCEMENTS

- The Cranbrook Academy of Art at Bloomfield Hills, Michigan has issued a particularly attractive announcement book for the year 1934-35. Courses in architecture, sculpture, painting and ceramics are part of the curriculum. Eliel Saarinen is the President and Director of the Architectural Department. Inquiries regarding the school should be addressed to Richard P. Raseman, Executive Secretary.
- Architects of western Massachusetts have formed an organization under the name of the Architectural Society of Western Massachusetts. Twenty architects are members of the newly formed society. House headquarters are at 22 Dwight St., Springfield, Mass. Harry M. Seabury is President and Henry J. Tessier is the Secretary-Treasurer.
- Columbia University School of Architecture will offer in the fall of 1934 a course in urbanism designed to meet the needs of architects, engineers, city planners and officials in charge of community projects. Dr. Carol Aronovici will be in charge.
- The Department of Architecture of the University of Washington is celebrating its twentieth anniversary this year. Carl F. Gould, first head of the department, will be among the speakers.
WESTLAND GREEN VEIN CREAM

Westland Green Vein Cream is taken from the Vermont Marble quarries at West Rutland, Rutland County, in the southern-central section of the state. It is one of the most delicately tinted of all Vermont Marbles, with shimmering traces of pale green, interlaced by emphatic veins of amber, running through a field of coral pink. It is adapted especially to interior use. Architects are invited to write for "Color Plates of Vermont Marble," which shows Westland Green Vein Cream and twenty-two other varieties in full color. Address: Vermont Marble Company, Proctor, Vt.
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Armstrong's Corkboard and Cork Covering are of special importance today in air-conditioning installations, as well as in the maintenance of proper refrigerating temperatures in new and remodeled breweries. Armstrong's Acoustical Products (Corkoustic and Ceramacooustic) and Armstrong's Vibracork are valuable aids in maintaining quiet. Armstrong's Temlok—a low-cost fibreboard—provides efficient insulation for walls and ceilings. And for high temperature insulation in stacks and furnaces, or for municipal incinerators, there's Armstrong's Insulating Brick.

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CORKBOARD - CORK COVERING
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TEMLOK INSULATION
The Antarctic home of Admiral Richard E. Byrd has walls only 4 1/4 inches thick, but layers of building paper, kapok, plywood, canvas and bright metal insulation make them proof against outside temperatures of 100 degrees below zero. The hut, a replica of which is being shown at A Century of Progress, measures 9 by 13 feet and is constructed of white pine panels fastened together with wooden pins and wire.

Trends and Topics of the Times

(Continued from page 41)

Secretary of the Treasury. The announcement of the Procurement Division is in line with the policy of employing private architects for public work, a procedure for which American Architect has for many years been a strong advocate.

- Windbracing design for tall buildings is a question now under investigation by the American Institute of Steel Construction. A study of the subject will be made at Ohio State University where a series of tests have been planned at the Engineering Experiment Station.

- Dean E. R. Bossange of the New York University College of Fine Arts says, "Thanks to science the architect is liberated from many limitations and is more free to dream than ever before. He must have creative imagination and a broad viewpoint. He must be more conscious of community requirements and social conditions, of problems of transportation and circulation. But above all, he must be capable of sensing and idealizing the human need."—From an article published in "Today."

- "Winning a client or winning a girl is the same process. Talk to them both in their own language Professional pomposity will win neither a job nor a neck!"—From "Quid Nunc," Architects' League of Northern New Jersey.

- Traveling exhibits of small houses are part of a service sponsored by a group of Los Angeles architects in cooperation with the Architects' Building Material Exhibit. The service has proved successful in educating the public to a more comprehensive idea of the value of architectural service in the building of even a very small house.

- Encouragement to architects can be found in the attitude of the Reconditioning Division of the Home Owners' Loan Corporation. Those in charge of this Division are publicly advocating that skilled architectural service be retained to assure full value of remodeling expenditures.

- Nails of paper, toughened by tremendous hydraulic pressure, have recently been announced by the Paper Foundation. Industry has long desired a nail that would not conduct electricity. Glass nails have proved too brittle, but the paper ones have the desired quality and are said to be so tough that they can be driven into a hardwood plank without bending.

- New scientific wonders were confidently forecast by a group of engineers at a dinner recently held in Chicago. Among them were: generation of electric power from wind and from solar energy; motors run by sunlight; developments that will make electric refrigeration, air conditioning, and appliances for household tasks economically available for every home; home teletype by radio with facsimile transmission of printed matter and pictures through the air so that receivers turned on at night will provide in the morning a complete story of what flashed through the atmosphere; elimination of slums and the greater beautification of cities; elimination of needless noise; cheap modern homes for the masses at a total cost of $2000; houses more beautiful, permanent and varied in plan, erected within one week;

F O R  J U LY  1 9 3 4
New Jersey architects are active in promoting development of county park systems. The map, prepared by Harry Lucht, was made for use of regional plan commissioners. Travel and art have become the main activities of Paul H. Smith since the depression. His card is an etching printed in sepia and measures about 2 by 3 inches.

a quick, cheap method of prefabricated "shell" construction for office buildings; and a host of other wonders long dreamed about and now on the road to solution. James Dalton, editor of "Motor" commenting upon the engineers' forecast aptly says, "When these greatest of skeptics tell what they actually are doing, they put tomorrow farther ahead of today than today is beyond yesterday."


- The Time-Saver Table of American Architect Reference Data, "Thermal Insulation of Buildings," published in the May issue was checked and then rechecked. Despite this we have discovered an error under Section VII. Per cent of heat transfer stopped by Type 2 of the bright aluminum foil insulations should have been 59% instead of 20% as given.

- There may be a publicity angle for architects in a recent Clean-up and Paint-up Drive in Cleveland, Ohio. 5,000 homes were visited. Requests were placed for 1891 jobs of painting and papering and 372 general renovating jobs. 52 owners wanted immediate furnace repairing done and 67 other families needed workmen on a permanent basis. With aggressive direction, architectural organizations might find a lot of work forthcoming from a similar house to house canvass.

- The Architectural Registration Law of Tennessee has been upheld by the Supreme Court. Justice Swiggart stated the opinion that the business of drawing plans and specifications for dwelling houses is a business which involves the public safety and health. Apparently this decision would make possible regulation of architectural practice under the police power of ordinary city governments.

- Visby—city of ruins and roses and walnut trees that were old when Columbus discovered America—is on the Isle of Gotland, off the coast of Sweden. The Gotlanders were a race of church builders to which the ruins of Visby are adequate testimony. Ruins and foundations indicate that there must have been at least twenty churches within the confines of the city. Today only one is in use. That the architects of the North were master builders is shown by the sturdy stone work comprising the ruins of St. Catherine's Cathedral which forms the subject of this month's frontispiece.

- Building ventilation is a subject long understood in principle and used by bees, according to Robert E. Martin, writing in Popular Science Monthly. A number of bees form a long line at the entrance of the hive. They beat the air with their wings keeping a current of air in motion until the proper temperature and humidity is felt in the interior.
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Provides adequate outlets for present and future needs . . . Easy and economical to install . . . The ideal underfloor wire-way system . . . Send for 24-page catalogue.

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for Heating, Cooling and Air Conditioning Computations as published in this issue opposite page 88

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- For receiving competitive bids on a comparable basis by requiring bidders to show their own load computations on these standard forms.
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**FORM:**

- Available in sets of single sheets, size 8½ x 11 inches, punch marked for standard three-ring binder; printed both sides in brown ink on strong white paper.

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<th>Description</th>
<th>Set of</th>
<th>Per 100 sheets</th>
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<tbody>
<tr>
<td>1</td>
<td>Individual Room Data—Winter Conditions</td>
<td></td>
<td>$8.20</td>
</tr>
<tr>
<td>2</td>
<td>Individual Room Data—Summer Conditions</td>
<td></td>
<td>$8.50</td>
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<tr>
<td>3</td>
<td>Total Loads, Winter and Summer Conditions</td>
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<tr>
<td>4</td>
<td>Economic Chart for Comparing Equipment</td>
<td></td>
<td>$8.25</td>
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</tbody>
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 standardized Neo-Angle Bath
409 ... In a 12-page booklet lithographed in color, Standard Sanitary Mfg. Company, Pittsburgh, presents its recently introduced Neo-Angle Bath. The features, advantages, uses and adaptability of this unit are graphically described. A group of bathroom plans suggests the varied arrangements to which this bath is adaptable.

 Fitzgerald's R-Z-U Boilers
410 ... In a 24-page catalog Fitzgerald Boiler Co., Inc., New York, presents its line of R-Z-U Firebox Boilers. General descriptions and illustrations, dimensions, specifications and ratings are given for the Hard Coal Type, the Smokeless Type, the Oil and Gas Type and the Stoker Type R-Z-U Boilers. Some typical installations are pictured.

The Gas Kitchen
411 ... The American Gas Association, New York, has issued a 36-page booklet on "The New Technique in Kitchen Work" which, while intended primarily for the consumer, contains data of interest to architects. Suggestions for modernizing old kitchens or planning new ones are described and illustrated. A Kitchen Planning Guide, having a floor plan form and small stickers representing kitchen units, provides a means of studying layouts. Illustrations and descriptions of the various gas appliances for cooking, refrigeration, hot water and house heating are included.

Reynolds Metallation
412 ... Reynolds Metallation and Reynolds Metallated Ecod Fabric are presented in a new booklet issued by the Reynolds Metals Company, New York. Methods of application and the varied uses of these insulating materials are fully described and illustrated. The booklet is bound with an actual sample of Reynolds Metallation, and also contains small swatches.

Gilbarco Automatic Oil Heating Equipment

Photo-Murals
414 ... The use of photographic wall is discussed in a 16-page booklet issued by Eastman Kodak Company, Rochester, N. Y. "Photo-Murals" are photographic enlargements, usually of large dimensions, used like wallpaper. Applications, typical installations, the possibilities of hand coloring, and cost range are included.

Modern Spandrel Designs
415 ... Aluminum Company of America, Pittsburgh, has issued a 24-page booklet which contains a portfolio of spandrel designs executed in Alcoa Aluminum. Notes on design considerations, methods of anchoring, and the proper installation of spandrels are included. Filing size: A. I. A. File 15-J.

Burnham Oil Burning Boiler
416 ... Burnham Boiler Corporation, Irvington, New York, has published a catalog illustrating and describing its new jacketed oil burning boiler for use with standard oil burners. Text is brief and presented in a non-technical manner. Many illustrations are in natural colors. A section is devoted to questions and answers which seek to anticipate the solutions to problems architects commonly encounter.

Galvannealed Sheets and Enduro Steel

Republic Steel Corporation, Youngstown, Ohio, has issued two new booklets: 417 ... Republic Galvannealed Sheets (Bulletin 120); 4-page folder containing description of characteristics, recommended applications, and tables of gauges and sizes in which these sheets are available.

418 ... Enduro 18-8 Stainless Steel (Bulletin 125): Presents latest data on Enduro 18-8 Stainless Steel and its four variations. Metallurgical and fabrication data, as well as a table of laboratory corrosion data, are given.

National Premier Steel Boilers
National Radiator Corporation, Johnstown, Pa., offers three new folders: 419 ... Form 178—National Premier Steel Boiler—Hand-Fired: Contains complete information on the 25 and 31 series steel boilers for hand firing. Specifications and ratings are given. 4 pages.

420 ... Form 177: Similar to above. Devoted to stoker-fired boilers.

421 ... Form 176: Similar to Form 178. Devoted to oil-fired boilers.

Selection of Cable

422 ... An 80-page reference book (GCA-1837) on "How to Select Insulated Cable" has been published by the General Electric Company, Schenectady. It presents all information required in determining the cable best adapted for a particular building, including applications within buildings. Methods of selecting.

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American Architect

New York City

Please have the following catalogs reviewed in this issue sent to me.

Numbers

I also desire further information about the new products described in this month's "New Materials and Equipment." (See pages immediately following this insert)

Numbers

I would like to have catalogs and information concerning the following products advertised in this issue. (See advertisers' list on following page).

Name

Firm name

Address

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Occupation

July 1934
conductor size, types of insulation and finish, tables of current capacities, thickness, wire gauges and dimensions, sizes of shipping reels and a bibliography are also included.

**CAPITOL BOILERS AND RADIATORS**

New catalogs offered by United States Radiator Corporation, Detroit, include the following:

423. Capitol Radiators: Contains data and illustrations on Capitol tubular, wall hung, wall cabinet, corner, angle, and curved radiators. Dimensions, assembly diagrams and heating surface data are given.

424. A series of five folders illustrating and describing Capitol Red Top and Black Top boilers. Ratings and dimensions are included.

**JOLLOITTE CORK PRODUCTS**

425. Complete information on the uses of Jolloitite Cork Products for insulation purposes for refrigeration, soundproofing, heat prevention, heat conservation, vibration deadening and condensation prevention is contained in a 20-page catalog issued by Mundet Cork Corporation, New York. Data, specifications, tables and charts for each insulation use are given.

**BRIGSTEEL SINKS**

426. In a series of single pages bound in a loose-leaf cover, Briggs Manufacturing Company, Detroit, presents its line of Brigsteel pressed metal sinks with porcelain finishes. Data include information on manufacturing methods, sizes, models, and fixtures. Several models are illustrated in natural color.

**DUREZ MOLDING COMPOUNDS**

427. The advantages, limitations and applications of Durez Molding Compound, a synthetic resin plastic material, are discussed in an 8-page folder issued by General Plastics, Inc., North Tonawanda, N. Y. Illustrations show a wide range of products which employ this material.

**COLORING COPPER, BRASS AND BRONZE**

428. An interesting monograph of 8 pages has just been prepared by the Copper & Brass Research Association, New York, on "Coloring Copper, Brass and Bronze." A new method for obtaining artificially the natural patina on copper is featured. The formulae are given for obtaining various color effects on copper and copper alloys, and also gives information on pickling solutions. A.I.A. File 15-B.

**CURTIS LIGHTING**

429. Curtis Lighting, Inc., Chicago, has prepared a booklet, "Lighting Features of A Century of Progress," which presents an analysis of some of the problems connected with the lighting of exhibits and special features at the World's Fair. Many illustrations showing lighting of buildings, exhibits, etc., are included.

**WESTINGHOUSE AIR CONDITIONING**

430. Air conditioning facts and installation data for architects are contained in publication SP 2007 issued by Westinghouse Electric & Mfg. Company, East Pittsburgh. This 24-page booklet contains illustrations and descriptions of typical installations and sections devoted to various types of conditioning units, condensing units, the mobilaire unit, and to steam-jet vacuum-cooling.

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New Materials and Equipment

Westinghouse Dishwashers

314M The Westinghouse Electric & Mfg. Company, East Pittsburgh, has entered the electric dishwasher field with the introduction of one cabinet and three portable type machines. The cabinet-type model combines an electric dishwasher, sink basin, and work top in a compact steel cabinet, and requires only 48”x25” floor space. A mixing faucet and double sink strainer are standard equipment. The portable models can be had either round or square, and are finished in ivory laquer with porcelain enamel covers. The entire line employs a washing process that uses ordinary soap chips and hot water. The dishes are washed in the suds for five minutes, double rinsed and thoroughly dried by evaporation. The interior of the dishwasher is self-cleaning.

G-E Air Conditioning Products

315M The General Electric Company, Schenectady, New York, announces a new and redesigned line of air conditioning products for domestic and commercial use. These units include portable room coolers, floor-mounted room coolers, wall-mounted room coolers, and suspended type store coolers; three new types of room air conditioners; and condensing units ranging from ½ to 20 horse-power in size.

Otis Personal Service Elevator

316M Otis Elevator Company, New York, has developed a personal service elevator especially designed for private homes. This new equipment is automatically controlled, works with a single push button and may be used in any residence equipped with standard alternating house current. It is designed for use in homes of three floors maximum and provides for a load of 650 pounds, at 35 feet per minute. The elevator is supported by a steel frame mounted on the basement floor, which relieves the building of unnecessary weight and reduces alteration expense. The car frame is steel; the elevator cars are of wood or steel in attractive designs or may be had unfinished for personal decoration. It is claimed that this elevator, completely installed, will cost no more than a better-class motor car.

Electrical Metallic Tubing

317M Steel and Tubes, Inc., Cleveland, have developed a new type of electrical metallic tubing that minimizes internal friction between conduit and cable. The inside of this tubing is processed, prior to forming and welding, so that the entire surface is covered with small, round, raised knobs resembling the tops of ball bearings. The cable travels over the tops of these knobs instead of being in continuous contact with the wall of the tubing. No threading is required.

Freon Compressors

318M A new line of enclosed-type Freon compressors, designed particularly for air conditioning work and ranging in size from 15 to 300 tons refrigerating capacity, is announced by the Frick Company, Waynesboro, Pa. Each machine is fitted with a force-feed lubricating system and is furnished with twin vertical cylinders, single acting. Either V-belts or direct synchronous motor drives are standard.

Metal Florduct

319M A new method of extending wiring across floor areas to free-standing furniture or other units, has been developed by National Electric Products Corporation, Pittsburgh. This electrical system, Metal Florduct, consists of an outlet extension cap and a run of Florduct—a raceway formed of two pieces, base and capping, standing 5/16 in. in height, with a gradual sloping ramp extending to the floor surface covering a width of 1½ in.
When is the contract fulfilled?

Legally, when the parties to it have done everything they agreed to do. But the manufacturer whose name on a piece of machinery has stood for quality and dependability for a half century or more, knows that his product must meet an implied obligation long after the technicalities of the contract are forgotten. Year after year it must perform at high efficiency and with low maintenance expense . . . year after year it must provide dependable and trouble-free service . . . year after year, throughout a long life of usefulness it must fulfill the unwritten guarantee which its name carries with it.

YORK ICE MACHINERY CORPORATION • YORK • PENNSYLVANIA
within the valve, easily removable or reversible, diverts the flow of water through either bubbler or glass filler as the handle is turned slightly in one direction or the other. The unit is adaptable to either city line connection or to water coolers.

Goodyear Rubber Flooring

323M A new rubber flooring manufactured in roll form, simplifying the installation of rubber floor covering in homes, is announced by The Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Compensating Heat Regulator

324M A new control device, called the Tritrol Regulator, which automatically varies the time of starting the heating system in the morning, and the time of shutting it down at night to compensate for changes in the outside temperature, has been introduced by Jas. P. Marsh Corporation, Chicago. During the day, this device maintains an intermittent flow of heat to the building, automatically adjusted by the weather. An even temperature is attained under all climatic conditions. The Tritrol Regulator is adaptable to all types of heating systems.

Conversion Burner

325M A low-price, pressure-atomizing type conversion oil burner, identified as the MW Emancipator, has been developed by the Heater Division of Motor Wheel Corporation, Lansing, Mich. Furnished in one model flexible enough for all domestic heating requirements, this burner has aluminum casings, a built-in silencer, radio interference eliminator, no exposed moving parts, and standard controls and accessories. It burns No. 3 oil, with a burner capacity of from 1.35 gals. to 4 gals. per hour.

Dualite Control for Freight Elevators

326M A new development in freight elevators, known as Dualite Control, has just been announced by the Otis Elevator Company. This is an improved type of constant-pressure, push-button control for slow-speed freight elevators. Operation from within the car is by means of an up or a down button. There is a single button at the landings for calling the car, and when this button is pressed the car moves either up or down to that floor, where it automatically stops.

Delco Heat Boiler

327M A completely automatic oil fuel heat boiler for homes and small commercial applications, operating with either steam or hot water systems, has been introduced by Delco Appliance Corporation, Rochester, New York. The boiler is of cast iron construction with extended surface fins to increase heating surface. Burner is of the mechanical pressure type with atomizing nozzle burning No. 3 oil. Entire unit is encased in a furniture-steel cabinet trimmed in chromium and finished in two tones of green.
Things You Didn't Learn in School

• BRICK GARDEN WALL
By James Ross
New York, N. Y.

Use of reinforced brickwork for two lower courses makes possible the construction of a brick wall without foundations except under supporting piers. These are spaced as required and carried down below the frost line. The main portion of the wall requires only 1 3/4 bricks per running foot. The construction is solid and economical.

• DRAFTSMAN’S HANDY TRAY
By Aldo Bottazzi
Corona, Long Island, N. Y.

A convenient place for keeping various grades of pencils, ink, erasers, thumb tacks, etc. can be made easily by anyone reasonably handy with simple tools. The tray shown in the sketch was made from a 4”x12” piece of wood. Holders for ink bottles and space for pen and thumb tack drawers can be made with a large auger and sharp chisels. Fastened to the wall, the tray is an aid in keeping a drawing board free from annoying odds and ends.

• STONE JOINTS
By George Mann
Baltimore, Maryland

Where vertical joints occur at large, long, abutting stones in lintels or copings and when it is impossible to form a proper tie at top or bottom, a practical connection can easily be made by placing an iron bar in the middle of the joint. Properly grouted this method will develop a connection of high strength.

• SIMPLE LOCK FOR A GATE
By William L. Jackson
St. Louis, Missouri

A sturdy gate lock can be made of two pieces of strap iron about 1 inch wide and 3/4 inch thick, an iron ring and a stout bolt. The sketch shows the method of assembly. The upper strap is bolted to the face of the post, bent around the corner and doubled back upon itself to receive the ring and bolt. The bottom strap, bolted to the gate, is a straight bar. The device can easily be made by a local blacksmith at little cost.

• BATHROOM HEATING UNIT
By Domenic Thomas Russillo
Providence, Rhode Island

To provide temporary bathroom heat, an experiment with copper tubing connected with the domestic hot water supply has proved successful. The tubing, bent as shown in the sketch, was placed in front of the usual radiator. When connected with the faucet of the lavatory, the tubing will radiate sufficient heat from running hot water to take the chill from the room. A shut-off valve should be installed on the side nearest the hot water heater.

• THREE-WAY SWITCH GUARD
By C. A. McGrew
Crafton, Pennsylvania

A brass guard over a three-way switch prevents turning lights on by mistake, but does not interfere with operation of the switch. It can be made from a discarded brass switch plate. As shown in the sketch, the strip is 3/4 of an inch wide, about 4 inches long and is bent to a radius about 3/4 of an inch greater than that of the switch lever. Sharp bends were made by holding the strip in a vise. Standard plate screws hold the guard in position.

American Architect will pay $5 for each suggestion published on this page.

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The Chase Lighting Fixture Catalog will fit your A. I. A. files. Typical pages are shown below.

The new Chase Lighting Fixture Catalog is ready for distribution to architects. In the opinion of those who have seen it, it is "artistically and practically the finest lighting fixture catalog ever printed." A complimentary copy has been reserved for your office and will be sent you on request. Kindly write Chase Brass & Copper Co., Inc., Lighting Fixture and Lamp Division, Chase Tower, 10 East 40 Street, New York.
The Readers Have a Word to Say

• UNCLASSIFIED COSTS

Editor, American Architect:

In a recent article published in the May American Architect (Small House Architecture on a Business Basis) the case for the architectural firm which obtains thirty or so small house commissions per year is stated most encouragingly. This bustling state of business is, however, not particularly typical of the average office today, except, perhaps, for those architects who have some connection with real estate or building enterprises per se. The architects who receive less than thirty commissions a year undoubtedly get a large percentage of their jobs from clients who desire to employ them quite as much for their putative ability in design as for their business acumen.

In estimating the cost of such service, when care is taken to fulfill the clients' legitimate expectations, certain items will appear which call for the expenditure of time and effort, but which cannot well be included in the normal professional fee (for instance, ten per cent for houses costing up to $10,000.) Possibly the architect, when considering his ledger as follows:

1. Time spent in advising strict adherence to the limited budget during process of construction, and/or time spent in advising the increase of that budget after careful consideration. Enter under heading of Disbursements for Education (Clients').

2. Effort put forth during accompanied supervision visits (there are always a large number of these in small house work) in engaging the clients in cheerful conversations as well as steering them past builders' hazards while making vigorous mental notes for later intimate discussions with the contractors. Enter under Disbursements for Advancement (Architect's, mental and physical).

3. Sketches made in surplus of the number a small job can carry economically in order to ensure a meeting of minds on questions of detail before working drawings can safely be issued. List under Disbursements for Advertising and count on at least ten per cent of them being admired by the clients' meter readers or their elderly relatives.

4. Time spent in overcoming surprising and illogical complexes, both visual and plastic, of the clients.

Fifty per cent of this charge may be eliminated by attention to item 3, the rest must be entered under the heading of item 1, subtitle, Psycho-aesthetic-therapy.

5. Effort put forth during the progress of the work in disabusing clients of the idea which most of their well-wishers will have built up for them in advance; namely that architects have unsound theories of construction, mysterious prejudices in design and imperfect ideas of the practical functions of a small house.

This item cannot be classified properly in any system of cost accounting, but is always enormously gratifying to the architect and should be entered under the heading of Profit and Loss, if any.

If the foregoing items are added to the usual cost sheets on the job and the appropriate sums are entered carefully, there is no doubt that the practice of architecture in the field of small domestic work may be made to show a most satisfactory profit.

—Elizabeth Coit, A. I. A., New York, N. Y.

• BETTER REGISTRATION LAWS

Editor, American Architect:

I BELIEVE your prediction correct that "the small house field ($5,000-$9,000) will be a major source of building business for years to come." But who shall do the architectural work is an open question with precedence seeming to favor the builder.

Generally speaking, the builder architect has had two very formidable arguments to present in his favor: first, that plans will be of little or no expense, and second, the more weighty argument, that financing within limitations will be done by him. The architect's refutation to these arguments is principally a reference to the superiority of his work with a question whether the builder is not over-charging for construction work due to the lack of proper competitive bids.

I am a firm believer that State registration laws for architects would do much to eliminate the unsatisfactory conditions, provided that such laws are properly written to serve the purposes intended. Unfortunately they are too often poorly constructed and permit of conflicting interpretations, such as our Ohio law. This is not sufficiently clear in its protective clauses to encourage local Building Departments to construe the law favorably to the profession, as was intended by the State legislature at the time of its passage.

The small city of Norwood (contiguous to Cincinnati) cannot be too highly commended for a recent action of its council passing a law supplementary to the State law, so written as to refuse building permits on plans prepared by other than registered architects for construction work in excess of a $4,000 valuation.

—Louis G. Dittoe, Architect, Cincinnati, Ohio.

• NATIONAL ORGANIZATION FOR BUILDING

Editor, American Architect:

THE precarious condition of our profession and the construction industry in general is too well realized to need extended words. A national body should be formed and should be so constituted that its efforts would be expended toward a well organized industry. There is not one of the great industries so lacking in organization and unity of purpose as that of building.

One of the chief aims of such a body would be, of course, the creation of an orderly and honest system of financing which would regain the confidence of the financing public and keep us out of the clutches of mortgage money sharks.

Perhaps the National Construction Council (if that is the exact name) is the best channel for such efforts. May be a new body should be formed. At any rate, the architectural profession should have a greater hand in shaping the industry.

The best definition of "Architecture" that I know is "Architecture is construction practiced as a Fine Art." Architects have always rested with the "fine art" and separated themselves from the rest of the definition. The NRA Code for the Construction Industry considers architects as a component part of that industry. Very well, let's go to it. Segregating ourselves merely retards ourselves and recovery.

—Harry R. Warren, Architect, New York, N. Y.
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Interesting store front finished with NEWMARBLE in Black and Gold.

Unique RU-BER-OID Product of Lustrous, Lasting Beauty Ideal for Interior Walls, too!

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NEWMARBLE, faithfully simulates the beautiful designs of marble. Both colors and designs are an integral part of each panel. It provides a lovely finish that is fire- and weather-resisting, durable, and easy to keep clean.

Panels are large in size, 32" x 48", but light in weight, about 2 lbs. to the square foot. They are easy to cut, fit and may be quickly installed at a remarkably low cost. NEWMARBLE Trim and Cap Moulding is available in blending or contrasting finishes in 4 and 6 in. widths. For further facts see Sweet's or phone any Ruberoid office.

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SEE 1934 SWEET'S ARCHITECTURAL CATALOGUES FOR JULY 1934
The Sixty-Sixth Convention of the A.I.A.

(Continued from page 12)

questions relating to the building industry of which every architect is so essential a part.

What colorful verbal duelling took place was centered about the question of the architect’s participation in work of the Federal building program and his recognition by official Washington as a professional man essential to the science of building. From the New York chapter came an emphatic resolution expressing dissatisfaction with the Federal building program and censuring those responsible for the executive direction and policies of the P. W. A. It was defeated; and in its place was passed a resolution of a milder tone, directing the Board of Directors to inform President Roosevelt of the national need for architectural services and to present him with a paper—ably composed by Electus D. Litchfield—outlining the architects’ position, their capabilities, and their non-recognition as valuable technicians by executives of the Administration.

In some measure this resolution paralleled that offered by the Committee of Public Works. Wind was effectively spilled from the sails of both resolutions by announcement that the Procurement Division, the Assistant Director of Public Works and the Supervising Architect had all agreed on a policy of employing private architects on all projects costing over $60,000.

Less dramatic convention actions were hidden under several excellent committee reports and their importance dimmed in the popular eye by a prosaic lack of discussion and perfunctory voting on resolution after resolution. The Committee on Standard Accounting was barely mentioned at the convention. Yet the work it has accomplished by preparing a manual of standard accounting practice for architects is of first rank importance. The manual is in the process of publication. It will be available shortly to all architects. If generally adopted, it cannot help but prove an effective method of determining a just series of charges for architectural services based upon known costs, thus removing at one blow the greatest hindrance to any satisfactory codification of architectural practices.

Of equal potential importance was the report of the Committee on Education of which Charles Butler is chairman. It presented a plan for preparation of candidates for architectural practice, linking an educational program—supervised by a “mentor” during the advanced stages—with registration examinations given under direction of the National Council of Registration Boards. Followed to a logical conclusion, such procedure would, in time, eliminate unfair competition for the architect by eliminating incompetence from architectural ranks. In addition it would tend to raise the standard of architectural practices and would, by centralizing approval of a candidate’s qualifications, coordinate now conflicting professional requirements and develop high technical standards comparable with those of the legal and medical professions.

In the sense that resolutions indicate the temper but not necessarily the action of any meeting, the convention concerned itself with important problems of economics. Collectively, delegates recognized the need for greater and more practical cooperation with financial organizations; they endorsed legislation tending to improve and strengthen the system of building finance and decided that a committee should be formed to promote such legislation. They recognized the need for basic surveys and for planning programs and pledged the assistance of the Institute in creating sound planning projects, properly staffed, officially directed and certified and restricted so as not to constitute unfair professional competition as regards scope and fees.

In particular the convention recognized the importance of adequate standards of materials and building methods in the erection of Federal buildings and resolved against extravagance but for “...combining utility, minimum maintenance expense and good construction which will make them a sound investment and worthy examples of good architecture...”

Delegates were gratified at the results of the Historic American Buildings Survey; they approved the efforts thus far of the Architects’ Code Committee and approved also the proposal that the fine arts be recognized by allotment of part of the appropriation for future public buildings. The Board of Directors had previously prepared a number of changes in the by-laws which were voted affirmatively. Most of them had to do with expansion of the Institute’s membership and the reduction of initiation fees and annual dues.
A notable occasion was the presentation by President Roosevelt of the Institutes' Medal of Honor to Ragnar Ostberg, famed Swedish architect, for the design of the City Hall at Stockholm. Apparently there was little sight-seeing this year, though a number of delegates and guests accepted invitations to visit the Williamsburg restoration project under the guidance of William G. Perry of Perry, Shaw & Hepburn, architects for the restoration.

Election results follow:

**OFFICERS:**
- President—Ernest John Russell, St. Louis, Mo.
- First Vice president—Charles D. Maginnis, Boston, Mass.
- Second Vice president—M. H. Furbringer, Memphis, Tenn.
- Secretary—Frank C. Baldwin, Washington, D. C.
- Treasurer—Edwin Bergstrom, Los Angeles, Cal.

**DIRECTORS:**
- Director, New England Division—Hubert G. Ripley, Boston, Mass.
- Director, New York Division—Stephen F. Voorhees, New York, N. Y.
- Director, Central States Division—Gerrit J. DeGelleke, Milwaukee, Wis.

To meet technical requirements, the Convention also elected the following Directors, who had been elected by the Board on account of the omission of the 1933 Convention:
- Director, Gulf States Division—Ralph H. Cameron, San Antonio, Tex.
- Director, Sierra Nevada Division—David J. Witmer, Los Angeles, Cal.

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**HONORARY MEMBERS:**
- Livingston Farrand, Ithaca, N. Y.
- Richard T. Haines Halsey, Annapolis, Md.
- Archer M. Huntington, New York, N. Y.
- Henry Sleeper, Gloucester, Mass.
- Mrs. Harry Payne Whitney, New York, N. Y.

**FOR JULY 1934**

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THE FOLGER
SHAKESPEARE LIBRARY

By Joseph Quincy Adams and Paul Philippe Cret. Published by the Folger Shakespeare Library, Washington, D. C. Illustrated. 72 pages; size 8 1/2 x 10 15/16; price $2.50, postage extra.

EXTENSIVELY publicized in architectural magazines and hailed as an innovation the Folger Shakespeare Library in Washington is one of the outstanding architectural showplaces of the Capital. This volume is a compilation of 36 full page plates, excellently illustrated, of the building's architectural design. As such it constitutes a monograph which most architectural practitioners will want. In addition the book contains an essay descriptive of the Folger Library collections and a description of the building itself by Paul Philippe Cret, the architect.

THE STORY OF ENGLAND'S ARCHITECTURE

By Thomas E. Tallmadge. Published by W. W. Norton & Co., Inc., New York, N. Y. Illustrated; indexed; 363 pages; size 5 1/2 x 8 1/8; price $4.00.

APPARENTLY there has been no comprehensive volume which has told the story of English architecture from the Roman and Saxon ruins to the present day. It has been Mr. Tallmadge's purpose to tell such a story in this book. In very completely indexed and attractively illustrated pages he has done this and its addition has included short sketches of England's most famous architects, much interesting material regarding the social history of each period. To architects Mr. Tallmadge is well known as a Fellow of the American Institute of Architects and the author of an earlier companion volume, "The Story of Architecture in America." His present book has been designed not only for the architectural student, but also for the travelling layman.

SCHÖNE RAUME, 2nd VOLUME

Published by Julius Hoffmann, Paulinenstrasse 44, Stuttgart, Germany. Illustrated. 104 pages; size 9 x 11 3/16; price RM 6.50.

THOSE who have admired the clean-cut interiors published in the foremost of the German architectural publications will find this latest publication of Julius Hoffmann more than interesting. Principally it consists of general interior views which strongly tend toward the most modern of up-to-date designs. The captions are written in German, but the excellent photographs together with plans and details make captions unnecessary to the average architect. The book should prove a practical inspiration to problems of contemporary interiors.

LADENBAU

By Adolf Schuhmacher. Published by Julius Hoffmann, Paulinenstrasse 44, Stuttgart, Germany. Illustrated. 165 pages; size 9 x 11 7/16; price RM 17.50.

IN these days of remodeling and unusual commercial display a book of store front photographs and details should prove a valuable addition to the libraries of architects everywhere. Such a book is Ladenbau. With the thoroughness characteristic of German publishers, the volume includes a great deal more material than its 165 pages would imply. Photographs are comparatively small, but the explanatory structural and design details are clear and large in scale. Illustrations indicate the wide scope of design possibilities, planning limitations and structural possibilities. To architects who read German the text will prove of additional interest. The value of the book lies primarily in the unusual completeness of its illustrated matter.

LOW COST HOUSING AND SLUM CLEARANCE

Published by School of Law, Duke University, Durham, N. C. 256 pages; size 7 1/2 x 10 3/4; price 60c—paper.

THIS subject fills an entire issue of a quarterly review published by the Duke University Law School and entitled "Law and Contemporary Problems." It treats of the housing prob-
CONSTRUCTION COSTS 1934 EDITION
Published by Engineering News-Record, 310 West 42nd St., New York, N. Y. Indexed; 96 pages; size 9 x 12; price $1.00—paper.

THIS latest edition of the Engineering News-Record's yearly cost analysis includes a survey of several basic commodities influencing construction costs and gives also a complete cost range of original basic data covering a period of twenty-three years. For some time the cost indices of the Engineering News-Record have been looked upon as one of the standards of the construction industry and architects will find the present volume valuable as a general book of cost trends.

THE PLANNING AND CONSTRUCTION OF SCHOOL BUILDINGS, THIRTY-THIRD YEARBOOK, PART I, OF THE NATIONAL SOCIETY FOR THE STUDY OF EDUCATION
Edited by Guy Montrose Whipple. Published by the Public School Publishing Company, Bloomington, Ill. 337 pages; size 6 x 9; price—cloth, $2.50, paper, $1.75.

MOST architects are familiar with the excellent research work that has originated in the National Society for the Study of Education. The present volume, the first of two parts devoted to a study of education and educational plants, is the product of a committee of the National Society for the Study of Education under the chairmanship of Dr. N. L. Engelhardt. The book includes a number of reports which expose the many sided problems of the planning and construction of modern schools. Although every bit of the committee's work has been attacked to achieve the most practical of solutions, there has been obviously an attempt to consider the school planned in the light of an educational ideal. In combination, therefore, the reports comprising the volume point toward the future improvement of school buildings in every department of their planning, design and construction.

ALL THE WAYS OF BUILDING
By L. Lamprey. Published by The Macmillan Co., 60 Fifth Ave., New York City; illustrated; Indexed; 278 pages; size 7 x 9 1/2; price $3.50.

ALTHOUGH there appears to be nothing childish in this author's treatment of her subject, the book is a children's story of architecture. The text primarily concerns a discussion of man as a builder and, since it is intended for twelve-years-olds, the chapters constitute stories of how people planned and constructed their buildings all over the world. It is profusely illustrated.
The National Housing Act

(Continued from page 11)

economic liabilities, to direct the movement in such ways as to have the best ultimate effect upon community development.

How soon a widespread demand for new dwellings will be felt, cannot be judged with accuracy from any existing data. Undoubtedly in many communities shortages of certain classes of dwelling are already evident. Where this is true, the type of financing required by the Act should permit new construction to proceed. Where a demand for new dwellings is not evident, at least the instrumentality will exist for their secure and economical financing when the need appears. On the whole, the probable market will be for houses and apartments for people of modest means. They should be buildings of substantial construction and simple, direct design, planned for the people who will use them and not cut down from the extravagant and fanciful layouts of well-to-do. They should, where possible, be planned in groups so that the landscape may be utilized to increase the attractiveness of the architecture, and so that the stability of a harmonious neighborhood can be added to the security of the mortgage system. All this requires of the architect a new point of view from that prevailing a few years ago. It makes new demands upon his skill and offers a new challenge and appeal to his imagination.

The market thus envisaged is one based upon need and utility rather than upon speculative profit. It is one considerably amplified as to the percentage of the total population it may hope to reach. It is a market which may be definitely related to principles of economic town growth. It is thus one which demands professional service of high character and which should offer a reasonable reward to architects who can understand its problems and who can adapt themselves to the conditions which it may impose.

DEATHS

• Cass Gilbert died suddenly in Brockenhurst, England, May 17th. He was 74 years old. He was born in Zanesville, Ohio, and after studying in the public schools of St. Paul, Minnesota and the Massachusetts Institute of Technology, he entered the office of McKim, Mead & White. He returned to St. Paul, opened his own office and gained national recognition by winning a competition for the design of the Minnesota State Capitol. At the turn of the twentieth century he won the competition for the U. S. Customs House in New York and moved east to establish a permanent residence.

Mr. Gilbert reached an eminence in the architectural profession equalled by few. His works are confined to no particular locality. They include many large public buildings through the country, some of the most notable being the Detroit Public Library, the Treasury Annex and the United States Chamber of Commerce Building, Washington, the Army Supply Base, Brooklyn, N. Y., the State Capitol of West Virginia, the New York Life Insurance Building, which replaced 

(Continued on page 143)
What Good Housekeeping is telling home owners in a bulletin on remodeling

THE VALUE OF THE ARCHITECT

WHAT HE GIVES YOU
WHAT YOU GIVE HIM

The "before" and "after" remodeling and renovating suggestions we publish in this folder merely indicate what can be done to make a good house more charming, more livable, more valuable.

There can be no one pattern for modernizing a house. Each house is individual. Each family has different ideas of comfort and convenience. Each modernization scheme should be individually, professionally studied.

The wise thing to do is to consult an architect. Since the American Institute of Architects is cooperating in the Good Housekeeping national remodeling movement, one of its members in your locality will be glad to advise you as to the most practical and economical way to achieve the results you desire. As the work progresses, he can supply you with the information required under the rules of the contest.

In these days, remodeling has become an important part of the architect’s work. His fee for his services is a moderate portion of the entire expenditure, and his experience will save you—by assuring you against mistakes and faulty material—the cost of his services.

He knows the desirable variations in the plan of a house. He knows how to plan the best arrangement and size of rooms. He can make valuable suggestions, as to how to make use of your attic, or how to change your dark basement into a well-lighted recreation room. He can advise you how best to accomplish your wish for more closet space or for an efficiently arranged kitchen and laundry; to make provision for good light and air.

He knows what modern materials can best be joined to the materials in your house in the work of renovation; he knows types and dimensions of all the different materials and fixtures that will enter into the work. He can inform you as to the latest approved equipment for lighting, heating, air conditioning, etc. His counsel will save you money and assure you satisfaction in the selection of building materials, plumbing, hardware, and other modern fixtures and supplies.

The architect, moreover, will advise you as to which of the several possible methods of modernizing is best for the property and for your pocketbook. He can appraise the value of your property and advise what you should spend to make a profit on your investment if you should sell the house. If you intend to secure a loan for your improvements, the judgment of the architect will carry weight with your bankers.

Four

If you would like a copy of the bulletin in which this appears, send for a copy of "Homes the Nation Will Honor". Address Good Housekeeping Bulletin Service, 57th Street at 8th Avenue, New York City.
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AMERICAN ARCHITECT
the old Madison Square Garden, and the Woolworth Building. This last, completed in 1913, stamped him as a pioneer in the field of tall building design. Mr. Gilbert was prominently identified with professional activities. He was Chairman of the Council of Fine Arts under President Theodore Roosevelt and a member of the Commission of Fine Arts under Presidents Taft and Wilson. He was a founder and one-time president of the Architectural League of New York, a president and fellow of the American Institute of Architects, a member of the American Academy of Arts and Letters and for seven consecutive years had been the president of the National Academy of Design.

- Robert Perry Rodgers died June 4th at Havre De Grace, Maryland. Mr. Rodgers, who was 39 years old, graduated from Harvard University and after the World War studied architecture in Europe and this country, later forming a partnership with Alfred Easton Poor. Together they won the competition for the design of the Wright Memorial at Kitty Hawk, N. C. Individually and as a member of the firm Mr. Rodgers was architect for many residences and various public buildings. He was a member of the American Institute of Architects.

- Miss Alice Mary Simpson, Assistant Secretary of the Architectural League of New York, died May 16th at her New York home. Miss Simpson, who was 64 years old, became associated with the Architectural League in the earliest days of its organization while she was studying painting in the New York Art Students’ League. Ever since that time she had been active in all the League activities as well as the cultural life of New York. At the Annual Meeting of the League on May 3rd of this year Miss Simpson was awarded the Allied Arts Prize known as the President’s Medal, in recognition of her services. Among other recipients of the Medal have been George W. Goethals, Joseph Urban and Julian Clarence Levi.

- Frank P. Allen, one of the oldest practicing architects in Michigan, died at Grand Rapids on March 16, 1934. Mr. Allen, who was 77 years old, was a partner in the firm of Frank P. Allen & Son for many years. The firm has done many important buildings throughout Michigan. Mr. Allen was a member of the American Institute of Architects and a member of the Michigan Society of Architects.

- Earl Hallenbeck died at his home in Syracuse, New York, on June 2nd. Mr. Hallenbeck was 58 years old and had been a member of the College of Liberal Arts of Syracuse University for 32 years. He attended Syracuse University in the late 1890’s and afterwards worked as an architect in New York City for several years.

- John A. Rogers died at Daytona Beach, Florida, June 2nd at the age of 63. In addition to being an architect, Mr. Rogers was well known as a painter and etcher and had formerly practiced his profession in Chicago, Illinois. He was a brother of James Gamble Rogers.
When the architect for Riverside School was selecting the floor for this handsome kindergarten, economy was not his main objective. Yet he specified Sealex.

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