HEATING & VENTILATING

AIR CONDITIONING

for . . .

engineers and contractors controlling the design, specification, installation and maintenance of heating, ventilating and air conditioning.

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FOR NOVEMBER, 1940

VOLUME 37 **NUMBER 11**

MEMBER

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NASH VAPOR TURBINE HEATING PUMPS REQUIRE NO ELECTRIC CURRENT.

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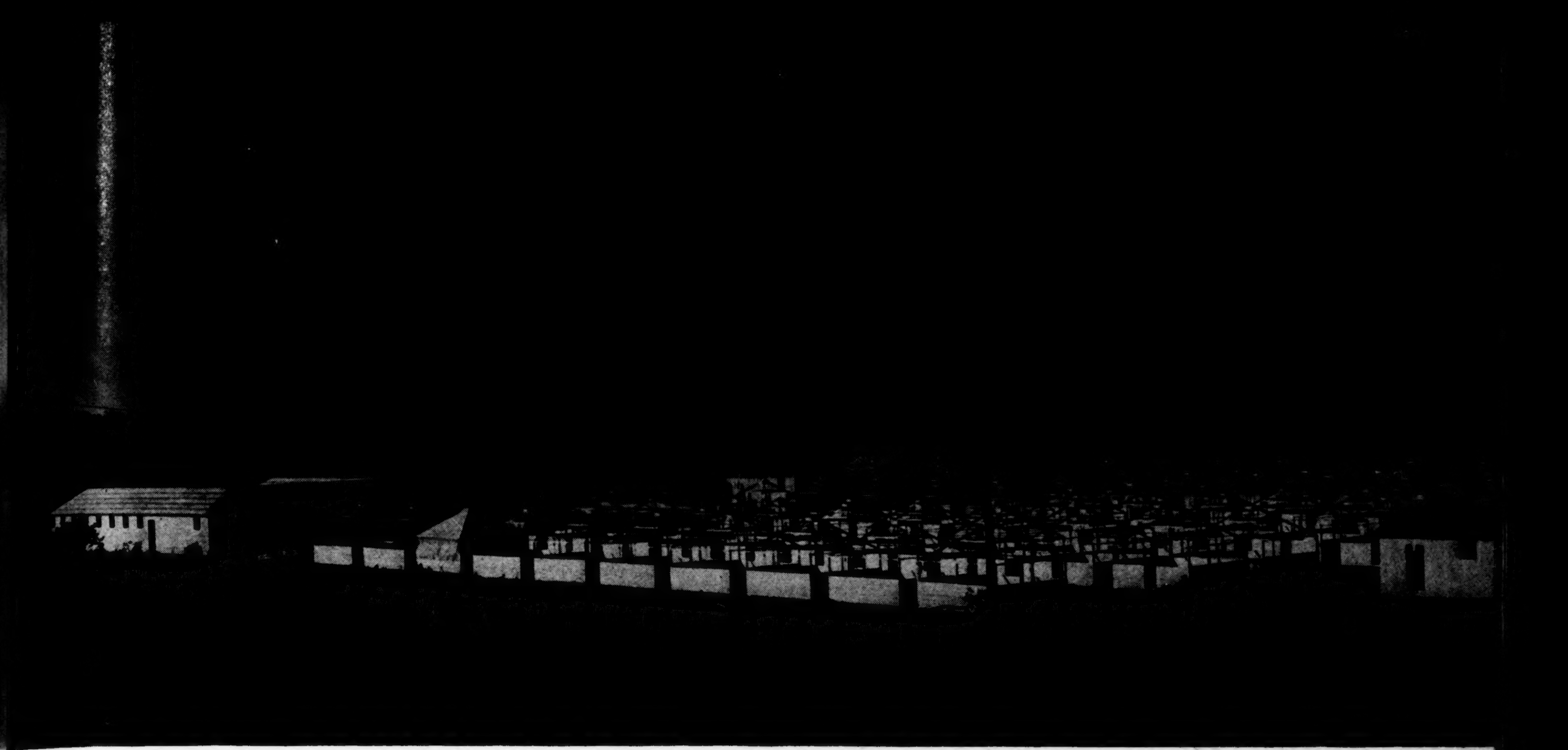


How to Get Defense Housing Business

NEEDED — $700,000,000 WORTH OF DEFENSE HOUSING!
FUNDS ALREADY AVAILABLE — $299,000,000!
STATUS OF PROJECT — CONTRACTS BEING LET DAILY!

WITH a building program of such astronomical proportions at hand, it is only natural that those affiliated with the heating, ventilating and air conditioning industries should be firing a barrage of such questions as these:

"How can we cooperate with this program—and share its benefits?" "What types of heating and ventilating are contemplated?" "Where do we start?" "Whom do we see?" "What do we do next?"

To answer these questions and the many others they inspire, it is necessary first to have a general picture of the vast scope of the program—then an understanding of the procedure of the various governmental agencies entrusted with its execution.

Focal point of the entire program is the office and staff of C. F. Palmer, Housing Coordinator of the National Defense Advisory Commission, located in the Lafayette building at Washington, D. C.

"The office of Coordinator," Mr. Palmer explains, "was made a part of the National Defense Commission and the task of that commission is to see that the Army and Navy get what they need, when they need it, with no ifs, ands, or buts.

"We must see that not a single rivet in a destroyer is delayed for lack of a skilled workman because he couldn't find a place to live. We must see that the production of airplanes does not slow down because decent housing can't be had when needed."

The program, in the main, includes housing for families of enlisted personnel; for families of civilian employees in the Army and Navy; for such single civilian employees of the Army and Navy as have to be provided with housing; for single employees and for families of employees in privately-owned industries engaged in the production of defense materials.

Construction of the 200,000 needed family units, at a total estimated cost of $700,000,000 (at a maximum of $3500 each, including land and utilities) is being assigned by the Housing Coordinator to five sources of housing: (1) private housing, (2) RFC equity purchasing plan, (3) Federal Works Agency, (4) USHA, and (5) the Armed Forces.

Although private industry is assigned that four-sevenths of the program probably of greatest interest to the heating and ventilating industry for the reason that it will embody the higher priced housing units, current interest among those intent on participating in the program centers upon the building classifications in which Congress has authorized expenditures of $299,000,000 of government funds.

FWA Has $140,000,000

Of primary interest to the industry is the $140,000,000 made available during October to the Federal Works Agency by the Lanham Bill. The Bill authorizes construction of housing facilities for civilian defense workers, but specifies that such housing shall be undertaken by FWA only after it is clearly demonstrated that private industry is not interested in or equipped to provide the temporary type of housing contemplated under this section of the program.

Although the Lanham Bill, as passed by Congress, makes available $75,000,000 by appropriation and $75,000,000 in contract authorizations, the total actually available for current construction is reduced to $140,000,000 by repayment of $10,000,000 which the President advanced to RFC Mortgage Company to launch the emergency housing program.

As this was written no allocations of this Lanham Bill fund had been made and at the offices of FWA and the National Defense Housing Coordinator it was reported that none can be made until the following steps have been taken:

1. The Housing Coordinator must determine whether or not private industry is equipped or disposed to construct the contemplated projects;

2. If suitable arrangements cannot be made with private industry, the President may announce that a "need" exists, and authorize expenditure of the funds; and

3. The Federal Works Administrator will then assign administration of the fund and construction of the projects to such existing agencies, other than Army or Navy, as may be best equipped to complete each specific project. At this stage of the negotiations it can only be assumed that Public Buildings Administration will be assigned an important part of the fund; that Farm Security may come in for a share where housing may possibly have a future rural use and that WPA will be available for construction of facilities.

Mass Purchasing Planned

A most important departure from usual Government buying procedure is under consideration by FWA and its affiliated PBA. This innovation contemplates the purchase of mass quantities of bathtubs, plumbing fixtures, electric refrigerators, ranges, heating units and similar equipment.

Just what this procedure may mean to the manufacturer of central heating plants cannot be foretold at this time, for the contemplated projects under the Lanham Bill are in the nebulous stage of providing only for no-basement housing in single-family, two-family, four-family and eight-family units. The proportion of multiple-unit structures finally decided upon will obviously determine to what extent manufacturers of central heating plants will be affected.

What to Do—Lanham Bill Projects

1. *Equipment Manufacturers:* Although the type of heating units to be required is not as yet fully decided, a sufficient volume of business is at stake to warrant either correspondence or a visit to Washington to make certain the manufacturer's product is eligible for consideration.

It is likely that any purchase made, no matter what agency is allotted funds, will be made on the basis of Government Procurement Division Schedules (standard government specifications). Only equipment meeting these specifications will be regarded as eligible. Materials offers should be submitted to Walter J. Kackley, Office of the Supervising Engineer, or to G. Underwood, consulting architect, Public Buildings Administration, 7th and D. Streets, S.W., Washington, D. C. Mr. Underwood is directly in charge of heating and plumbing and will be active in specifying types when final designs are decided upon.

2. *Consulting Engineers:* Since Lanham Bill civilian defense housing will be constructed by general contractors under cost-plus-fixed-fee contracts, it would appear that close contact with contractors likely to bid on such projects will offer the only means of keeping in direct contact with developments.

While it may thus appear that consulting engineers and sub-contractors are somewhat insulated from direct contact with project developments at Washington, the tremendous volume of building in the offing should be sufficient to discourage general contractors from any marked tendency to attempt to recruit specialists for organizations of their own from an already hard-pressed man market.

3. *Contractors:* Contractors desiring to be "on the list" when Lanham Bill projects come up for consideration should write at once to Federal Works Agency, Public Buildings Administration, Washington, D. C., for "Contractor's Qualification Questionnaire," Form J-96.

Filing of this questionnaire will place on record, with all parties likely to become interested, the contractor's qualifications and his statement of intention to participate in the program.

$46,762,500 Army Program

Still in the blueprint stage, but expected to serve as a guide for the larger Lanham Bill projects, is the $46,762,500 defense housing program assigned to the Public Buildings Administration by the U. S. Army. Funds for this program are now available through the Army's share of the $100,000,000 Army-Navy defense housing appropriation approved by Congress.

Designated to date are 70 projects located in 28 states, Hawaii and Puerto Rico. Eight projects, consisting of 1,950 dwelling units, will be for the occupancy of civilian defense workers and the balance for married Army personnel.

Construction, under the direction of Public Buildings Commissioner W. E. Reynolds, will be arranged by negotiated contracts with general contractors under the cost-plus-limited-fixed fee plan.

The extent of the heating and ventilating problem facing PBA Architect Gilbert Stanley Underwood is apparent when it is realized that sites extend from the tropics to the Canadian border (with Alaska as a further possibility), with attendant variations in heating requirements.

Starting point is a no-basement house having two bedrooms, living room, kitchen-dining-room and bath, with varied floor plans to permit combinations of two, four, six and eight units. Also being studied is the problem of present and future need.

Where the need is purely temporary, pre-fabricated construction is definitely intended, with the thought that at the close of the emergency period, the dwellings can be taken apart and sold to private individuals whose needs they meet. A simple form of heating is indicated for this construction, but insulation manufacturers may find in this construction a vast outlet for materials adaptable to pre-fabricated construction. Allen Stevens, procurement division, Public Buildings Administration, Washington, D. C., is in charge of matters pertaining to pre-fabricated construction.

When advice of local housing authorities indicates there will be a future need for the defense housing facilities, permanent construction of frame, masonry or poured concrete is contemplated. Again the one-eight unit rule applies, with resultant variation in heating requirements. Puzzling among the many problems of multiple construction with central heating is, "Who pays the fuel bill and tends the furnace when the emergency is over and the defense houses are offered to private owners?"

While admitting that the varied problems of climate, available fuel and possible future use are taxing the ingenuity of its staff, PBA officials contend the organization's long experience in constructing post offices and Federal buildings in all parts of the United States and its possessions is serving as a yardstick that will result in satisfactory and practical solutions.

Directly supervising the PBA overtime drive to complete plans and specifications for the Army projects are Louis A. Simms, Supervising Architect and Neal A. Melick, Supervising Engineer, each a veteran of more than 30 years' service.

Construction Procedure

Following is the procedure under which PBA will negotiate contracts for the Army's $46,762,500 program:

1. The PBA will deal only with general contractors. The names of 1500 who have expressed interest in the projects are on file at the office of Walter J. Kackley, Office of Supervising Engineer, Public Buildings Administration, Washington, D. C. Others desiring to have their names added to the list should write to Mr. Kackley for "Contractor's Confidential Questionnaire," Form J-96;
2. When a project is ready to release, the list of contractors will be checked and those listing the project site as within their sphere of operations will be selected for further consideration;
3. Names selected are reviewed by a PBA committee of construction engineers. The contractor whose qualifications appear most satisfactory is notified and invited to visit Washington for further examination and to negotiate a contract;
4. Contracts so negotiated are reviewed by W. E. Reynolds, Commissioner of Public Buildings, and if satisfactory are given final approval by John N. Carmody, Federal Works Administrator; and
5. Construction proceeds immediately, with the general contractor responsible for materials and the performance of sub-contractors—subject to the approval of PBA inspectors selected from the construction engineering staff.

Mass purchasing of kitchen, bathroom and heating units will probably be given its first trial in PBA's Army projects—the Government contracting with suppliers; shipments and invoices to be sent to general contractors. As in the instance of the Lanham Bill projects, PBA procurement officials are urging manufacturers to take immediate steps to insure eligibility of products likely to fall within the mass purchasing plan.

Navy Projects Under Way

Sharing a $100,000,000 Congressional appropriation with Army and the Maritime Commission, the Navy is currently rushing plans to create $44,240,000 worth of housing for married enlisted and civilian personnel, according to late figures from the office of Lt. Commander I. A. Bickelhaupt, in charge of projects in the District of Columbia and Arlington, Va.

Four contracts for housing, at San Diego and Long Beach, Calif., Norfolk and Newport News, Va., have already been let by the Bureau of Yards and Docks, Navy Department, Washington, D. C., in charge. The cost-plus-a-fixed-fee plan of negotiated contracts was utilized on the foregoing projects and will be the policy of the Navy on others under the current program. Two present exceptions are for housing at Mare Island, Cal., and Portsmouth, N. H., where projects contemplated prior to Congressional action on the fixed-fee plan were financed through the U. S. Housing Authority. Bids are now being received on these projects.

As is the case with Army construction and that proposed under the Lanham Bill, the question of heating is still in the discussion stage in most instances, with the question of unit or central heating hingeing upon climatic conditions of the sites and final determination of the form of the family units.

Unlike PBA-supervised construction, the Navy has announced no plans for mass purchasing. Buying of its materials and equipment becomes the responsibility of general contractors, with the approval of Navy supervising officers, under the Navy's building plans.

Typical Example, Navy Projects

Probably typical of the general procedure to be followed in Navy contracts are the three housing projects now being planned for Washington, D. C., and vicinity. One 300-family unit of temporary buildings will be constructed within the city limits of Alexandria, Va., for employees of the Naval Torpedo Station at that city. A second unit of 300 permanent dwellings will be erected near Bellevue, D. C., for enlisted personnel of the nearby Naval Air Station, while 300 temporary structures will be built in the same locality for employees of the Naval Gun Factory at the Washington Navy Yard.

The style of heating equipment for these structures has not been decided upon, although preliminary work has proceeded to a point where contracts may soon be negotiated, it was explained by the Public Works Officer of the Washington Navy Yard. Central heating plants are not excluded, he said, but the leaning seems to be toward unit systems.

Warm air and hot water systems are both under discussion, as are coal and oil. Warm air seems to have the upper hand at present, although operating cost studies now under way are expected to influence the final decision.

The problem of an equitable division of heat costs in multiple dwellings is again mentioned by Navy Construction officers as a possible reason for unit heating in small low-cost units. The Navy also differentiates sharply between permanent and temporary structures in figuring its heating requirements, and is apparently endeavoring to meet President Roosevelt more than halfway in his recent suggestion that an attempt be made to keep per-family expenditures down to $2700.

The Navy, it was explained, is endeavoring to keep its per unit cost down to $3000, although the maximum set in enabling legislation is $3500, including utilities, lawns, sidewalks and landscaping.

Navy Bidding Requirements

In seeking to participate in the Navy housing program, manufacturers and sub-contractors must look to the general contractor as the outlet for services, equipment or supplies. In order to be considered for the Navy's cost-plus-a-fixed-fee negotiated contracts, the general contractor must file names and other required data with the Contact and Liaison Section, Bureau of Yards and Docks, Navy Department, Washington, D. C.

Field of Private Industry

While the very existence of a cash fund of $290,000,000 for emergency housing cannot help being of benefit to manufacturers of certain types of heating and insulating materials or equipment, the foregoing summary of the intended simplicity of Army, Navy and civilian workers' programs, it is to private industry's assignment that manufacturers must turn as an outlet for the more pretentious units of heating and air conditioning.

"To private industry," comments Defense Housing Coordinator Palmer, "is assigned the major portion which can pay commercial rates or corresponding purchase payments where the need is considered to be a permanent one. In most areas this private portion is being taken up at various rates by building and remodelling dwellings.

"FHA Mortgage Insurance and Building and Loan Association, often members of the Home Loan Bank Board system, are important factors in this field. We are establishing a current inventory to see how completely this market is being supplied. Every step in the program is designed to forestall any definite influence which would prevent private industry from fulfilling its obligation and making the most of its opportunity.

"Private capital is being encouraged to act by leaving to it the entire field of housing for sale. Governmental operations are now confined to rental projects. In most cases, the rent per month will be higher than the installment under the monthly purchase plan.

"Furthermore, we are guarding against over production. As private industry expands its housing operations, it is intended that the Government's correspondingly will contract."

In the great "private industry" classification visualized by Coordinator Palmer, the expanding pocketbooks of a great middle class will be demanding new comforts in exchange for their emergency-created dollars. While the current emergency is expected to produce far fewer millionaires than the last, there seems little doubt that thousands of skilled workers, technicians and specialists will climb to new income levels.

The result, the Defense Advisory Commission forecasts, will be a steadily increasing demand for finer apartments and more comfortable homes.

In this field the individual's taste and income will be the deciding factor—with modern heating and air conditioning occupying as large a place as it cares to create for itself through intelligent advertising and merchandising.

RFC Equity Purchasing Plan

The allocation of $10,000,000 to RFC Mortgage Company provides equity capital so that work on housing project can be commenced immediately in areas where the need to house workers engaged in national activities is acute and is not otherwise being met.

These funds can be supplemented by $40,000,000 through the proceeds of mortgages on such projects insured by FHA under Section 207 of the National Housing Act, making a total of $50,000,000 immediately available. This plan is designed to produce houses more quickly than can otherwise be done with subsequent resale of equities as rapidly as possible.

Land contracts and options have already been signed in some instances. Active negotiations are proceeding in 14 areas on both Coasts where there is reasonable likelihood that these rental developments can be absorbed permanently into community patterns.

USHA and Local Authorities

In the case of defense housing needed for families of low income, unable to pay commercial rents, and particularly for families of enlisted personnel and low-income industrial workers, where competent local housing authorities exist and where funds are available, it is proposed to make use of such local authorities and of the U. S. Housing Authority. Thus the type of housing best adapted becomes a part of the orderly growth of the community because it is developed and operated by local people who know the needs and desires of the families they serve.

A Five-Way Business Stimulus

While the heating, ventilating and air-conditioning industry may find that certain phases of the National Defense housing program offer little opportunity for service or for profit, a coordinated program of such magnitude cannot help but introduce new thousands to the satisfaction of better living conditions and to fan their desires for even greater improvements.

America's progress is the result of a national desire for better things, and a form of government making possible the realization of that desire. The defense housing program, an early step in a campaign to protect those liberties for which the Nation was founded, may in itself prove the cradle of a reborn people, appreciative of their opportunities and determined to enjoy them to an extent permitted in no other country in the world.

Theory vs. Practice

The Sun as an Aid to Heating

By T. W. REYNOLDS

THE writer has found that many a house with a maximum orientation to the sun can be heated with much less radiator surface than our figures give; that if you tell a housewife that a given room on the sunny side requires more radiator surface she will tell you, much to your surprise, that the room in question is the best heated room in the house. Many engineers will immediately attempt to kill such a statement by saying there is no sun at night, though they do not add that the sun effect continues for a long time after sundown due to the heat absorbed by walls and furniture.

Sun heat has a considerable effect in lowering the heat requirements of public garages with their large areas of roof and also with the heating of stores. In the case of stores, heat loss computations usually add up to more radiator surface than we can find room to install, due to the large amount of glass and to the assumptions we have made as to frequent air change, so that we cross our fingers and end up by installing only what we can get in the available space, yet with satisfactory results. No doubt this comes about because there is so much glass for the sun to shine through, with very little air crack in proportion to glass area, and because of the contributory heat effect from stored goods and from much display lighting, and finally because there is not so much air change as we thought, as in colder weather there are fewer customers using the doors and a greater tendency to keep the doors closed.

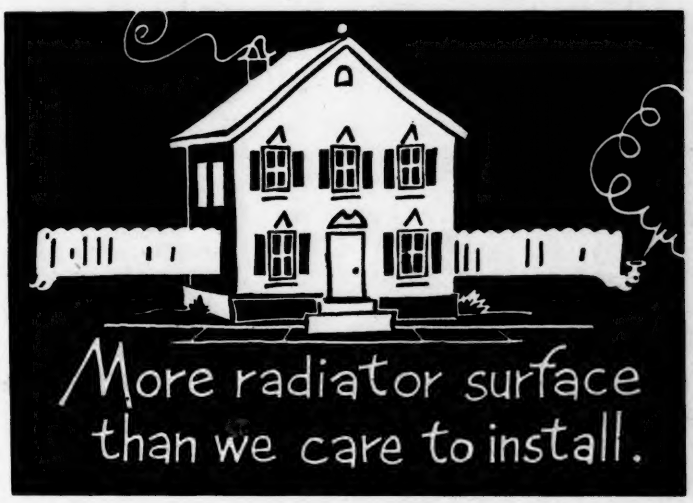
Sun heat acts in opposition to the cooling effect of wind and low outdoor temperatures by warming outside surfaces above room temperature. Such heat, if of long duration, may be absorbed by wall and glass to the point where inside surfaces warm the air in the room, and dependent upon the heat absorbing capacity of the wall, may continue its influence for some time after the sun has passed on. Thus, upon occasion, one will note cigar smoke rising along the glass while at some other time the smoke will lower.

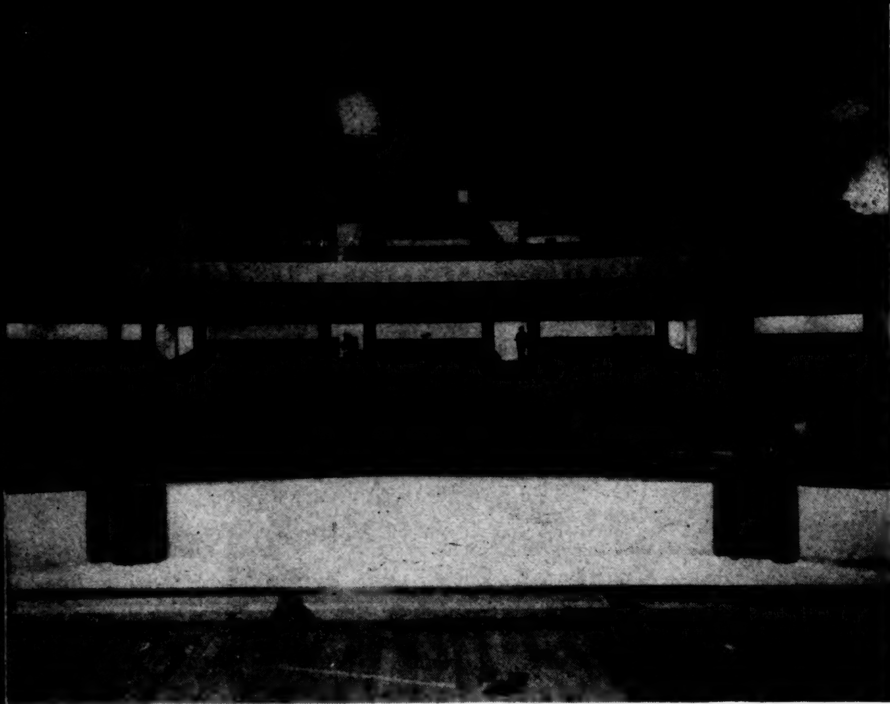
The writer recalls one trouble job where the temperature within the house was down to 50F so that the most comfortable place for making the necessary radiation calculations was found to be out on a sun porch, which, though without radiators, was nevertheless comfortably heated by the sun during the day.

Unoccupied houses are devoid of all comfort while making heating calculations in the winter months. In such cases one may find the second floor to be the most comfortable place in which to work, due to sun effect on the roof, especially if the roof is flat.

Sun warmed furniture is more comfortable to sit upon than the furniture in a room without sun where the radiators quickly warm the air and then rely on this air slowly to warm the furniture. A thermostat shuts off the fire based upon surrounding air temperature and is not affected by the temperature of furnishings, except as these lower the temperature of the air so as to bring on the burner until in time some measure of equilibrium may be reached. There is also the factor that quite often the rooms which are occupied while the sun is on them, and which rooms might ordinarily be considered as not satisfactorily heated at other times, are not the rooms which are occupied in the evening, and are therefore, after all, satisfactorily heated for the purposes of usage.

It is interesting to compare the house of today with that of thirty years ago as to heat storage capacity. The house of former days was built with more wood, wood that had a chance to dry and remain as installed without shrinking away and letting the air in, and with large windows through which the sun poured in, while the furnishings were of a less expensive nature for the sun to fade. There were chairs and a sofa all of shiny horsehair, but in general the furniture was massive and there were plenty of curios, pictures and what nots in all available spaces. Contrast this picture with the setting of today with with its few simple, light pieces of modern furniture, walls free of all hangings, and shades well drawn to protect the furnishings from the sun.





Air Conditioning

Ceiling inlet grilles and rosette type inlets under the balcony are shown in this view for completion of the project.

AN architectural effort to approach acoustical perfection has been the aim in the design of the million and a half-dollar Kleinhans Music Hall opened in Buffalo October 12. This purpose has resulted in a curiously proportioned, egg-shaped building of Mankato stone combined with Roman and tapestry brick in reddish buff. The hall is windowless, fronted with a reflecting pool and having a port cochere at each side; otherwise, it is a monument of sound, plain and unadorned architecture. It is attractively set in a residence district, facing a circular intersection of streets through a vista of old trees. The building, made possible through the generosity of the late Mr. and Mrs. Edward L. Kleinhans, supplemented with PWA funds, is to be the permanent home of the Buffalo Symphony Orchestra and a center for all the musical life of the city.

The interior consists of two auditoriums, the Chamber Music Hall at the front seating 650 and the Main Auditorium to the rear, with its balcony, seating 3000 people. In both these rooms the walls have been broken back at intervals as a sound directional device. The walls are plaster on metal lath surfaced with flexwood, beautifully grained. At intervals on the walls of the big auditorium there are strips, and in the Chamber Music hall grouped squares of perforated transite backed by sound absorbent material and the front of the balcony is also finished with perforated transite to minimize reverberation.

There are no hanging lights of any sort, the ceiling being smooth plastered, except for a continuation of the wall breakbacks, with many small openings through which light sifts down from built-in units above.

The narrow faces of the wall breakbacks are utilized in some instances for wall lighting. A wide lobby separates the two auditoriums. Everything is on a curve. There are no straight lines where they can be avoided throughout the building. A foyer and two lounges on the mezzanine floor, several committee rooms, a practice room for the orchestra, dressing rooms, and a lounge and bar under the Promenade, are included. This Promenade is a circular passage back of the stage in which structural glass is used. The orchestra pit can be elevated to enlarge the stage.

Heating is accomplished by a steam vacuum system of circulation using temperature controlled radiation and *tube within a tube* copper heating surface in the ventilating air stream.

Air conditioning is provided for the two auditoriums and is arranged to operate with wet chilled water cooling coils in a spray chamber, with outside air when in usable condition or with tempering coils and spray chamber humidification. All the air is filtered, whether obtained from outside or through recirculation. This arrangement, with the variable fan speeds, makes it possible fully to regulate the temperature and humidity and to control the amount of air to meet requirements of correct conditioning of the concert and auxiliary spaces.

There are four supply fans, two which supply 90,000 c.f.m. of air to the Auditorium through ceiling grilles arranged in the breakback vertical faces in the ceiling and through anemostats in the ceiling under the balcony.

The grille bars are horizontal and deflect the air at 22½° and 45° downward from the horizontal, ranging from back to front of the ceiling in seven rows toward the stage. The ceiling height averages 42 ft. above the floor.

A similar arrangement is made in the Music Chamber which is supplied with a single 26,000 c.f.m. fan. These fans are operated with variable speed three phase motors with a 50% speed reduction which allows a wide range in operation to meet temperature and population requirements. The fourth supply fan of 24,000 c.f.m. capacity is a constant speed fan supplying the lounges, bar and other auxiliary rooms which may be in use with either concert section.

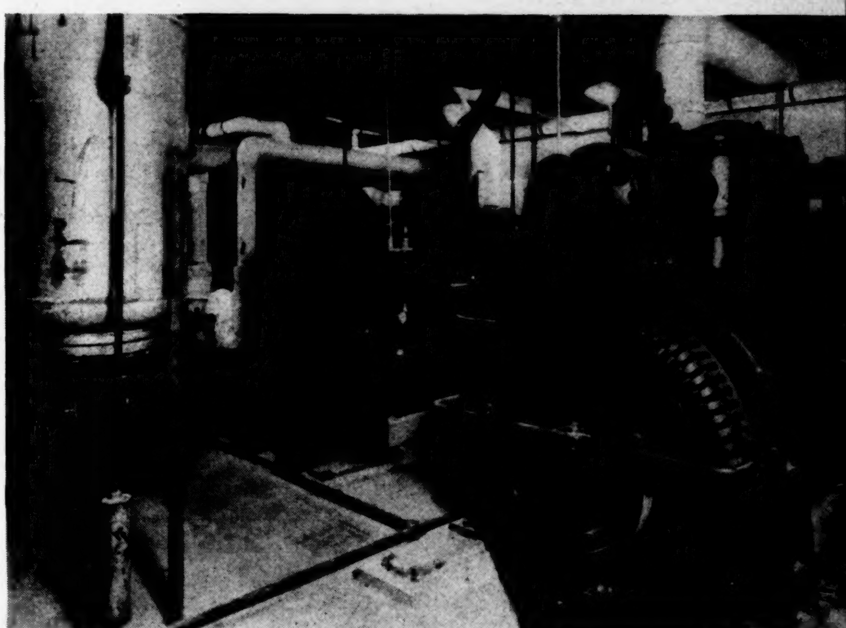
Dampers under pneumatic switch control, automatic static pressure dampers and automatic electro-pneumatic controlled outside dampers are provided with each supply fan, and any desired amount of outside and recirculated air can be set up by the gradual damper switches.

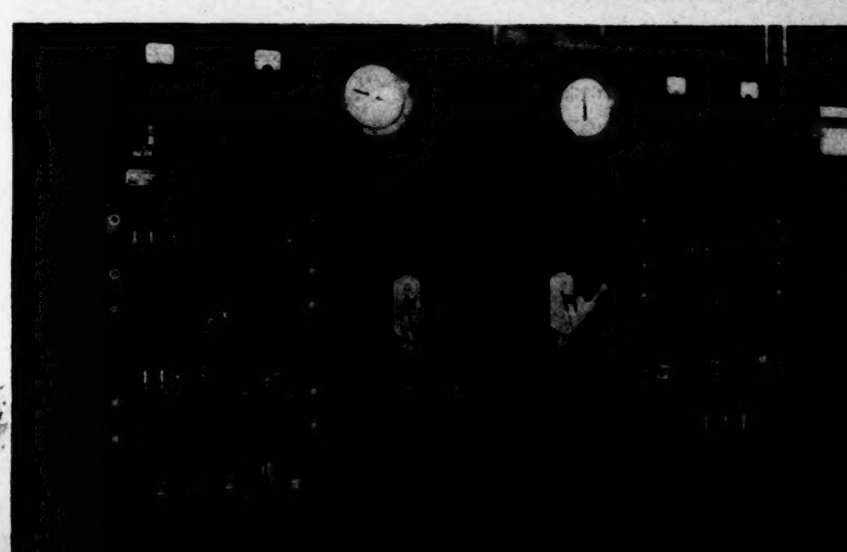
The refrigerating equipment consists of a 125-ton and a 75-ton freon compressor, each driven by a synchronous motor. A heat interchanger is used to cool the circulating chilled water which is pumped by two

Buffalo's New Kleinhans Music Hall

Acoustical perfection was the aim of the designers of the million and a half dollar Kleinhans Music Hall opened in Buffalo October 12. This aim affected the air conditioning which is provided for the two auditoriums and which is here described.

By M. C. BEMAN†





motor driven centrifugal pumps from the compressor room located in the basement in the rear of the building to the two main supply fan rooms located at each side in the rear of the Auditorium under the roof, and to the front basement where the Music Chamber and the auxiliary supply fans are located.

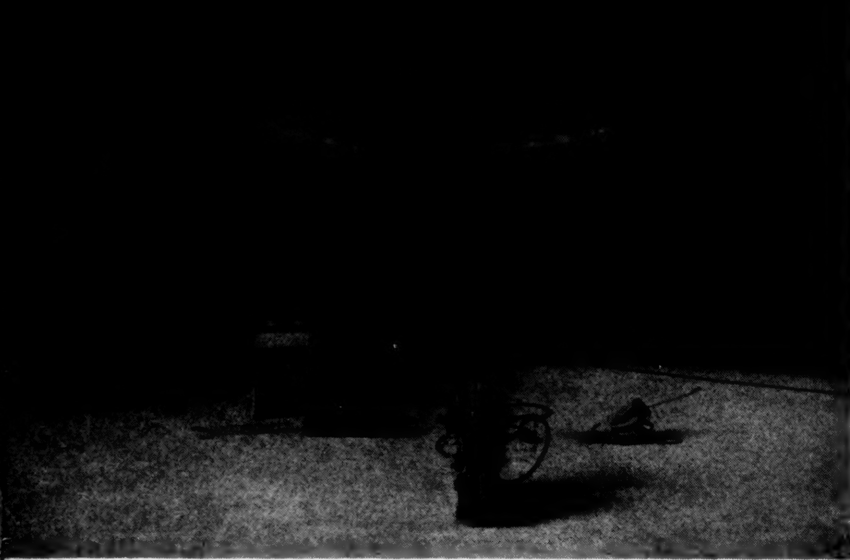
The refrigerating machine condenser, using unreclaimed city water for cooling, the synchronous motor and refrigeration machine control board, together with the automatic compressor controls are all located in the compressor room. This room is ventilated with an exhaust fan and also contains an indicating and recording instrument to record temperature and humidity of outside and inside conditions as a guide and check on operation of the air conditioning plant.

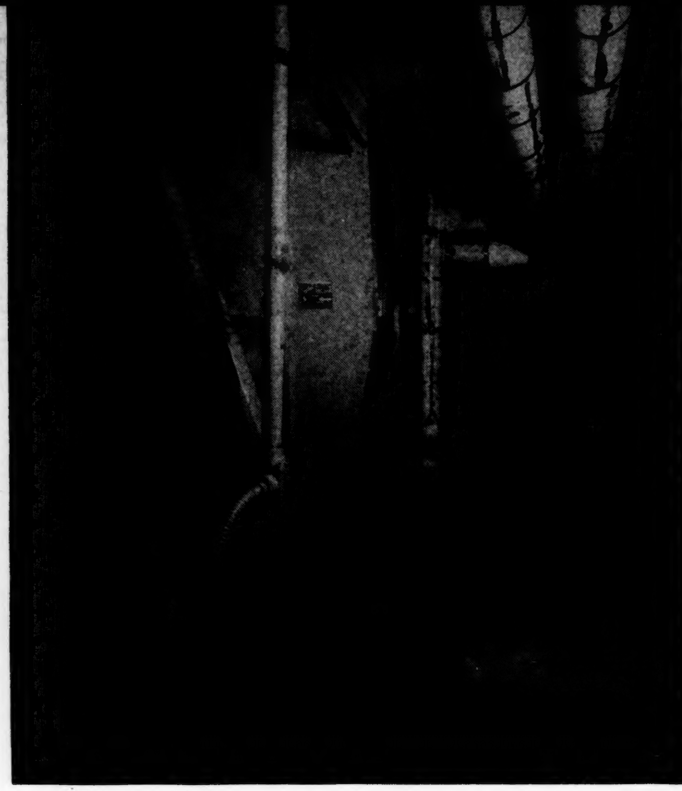
In addition to the four supply fans, there are exhaust fans—one to operate in conjunction with each supply fan, arranged to exhaust the supply fan to outdoors or to return all or any part of the air to the supply fan. To this end, three of these fans are provided with variable speed motors and can be operated at speeds to correspond with the supply fan operation. The other exhaust fans, which operate at constant speed, exhaust air from toilets, auxiliary rooms and compressor room. A large exhaust fan is installed to remove smoke from the Music Chamber when necessary and there is a smaller one to exhaust smoke from the Promenade and Lobby.

The two large exhaust fans serving the Auditorium handle 76,000 c.f.m. of air through floor vents under the seats which discharge into a plenum chamber un-

†Beman & Candee, Consulting Engineers, Buffalo, N. Y.

(Top) Arrangement of attic ducts and main steam supply to fan heaters. (Center) The 75-ton and 125-ton compressors and synchronous motors which chill the water for cooling. (Bottom) Control board for the motors. At the right is the wet and dry bulb recorder giving recordings of conditions produced at each supply fan.





(Above) The Chamber Music Hall looking toward the stage. Air enters at ceiling in same manner as in large Auditorium. Stage and front exhaust grilles and the convectors can be seen. (Right) One of the main supply fans for the main Auditorium distributing at 45F into attic distribution ducts. Note chilled water piping to cooling coils near the stairs. Spray pump is located at floor while the fan control and starter are at the right.

der the carpeted floor from which the two exhaust fans draw the air.

The Music Chamber exhaust fan takes air through two large exhaust grilles in rear wall, two in side walls and through return ducts and grilles in the face and at the back of the stage. The exhaust fan corresponding to the auxiliary supply fan feeding air to the smaller rooms and sections of the building is a constant speed fan and in several of the rooms served is attached to the combination in and out anemostats which are used in the lower ceilinged rooms.

Every fan motor is protected electrically by an across-the-line starter with overload and under voltage protection and the starter includes the disconnect switch for the circuit.

The inlet velocities used through the Auditorium ceiling grilles are between 450 and 500 ft. per min. while the exhaust vents in the floor which are also provided in the balcony floor, range around 200 ft. per min.

The duct work necessary to carry out the distribution and control of air is somewhat intricate and these difficulties are increased by the oval shape of the building. Duct work is of copper-bearing galvanized steel and the many crossings of ducts and details of unusual shapes and connections should be seen to realize the problems solved in suitably housing this part of the work.

At the outlet of the main fans, the ducts are lined with absorbing felt to overcome any objectionable air or fan blade noise which would carry in the ducts and interfere with the musical effectiveness of the building. The fan outlet velocities have been limited to 1300 ft. per min. when operating at full capacity and it will seldom be necessary to operate at such speed.

Steam for the heating and ventilating systems is produced by two 214-hp. National welded steel boilers fired with two pressure type Lammert-Mann oil burners using No. 6 oil. The oil is pumped from two 5000-gallon tanks equipped with Paracoil type hot water heating coils which are heated by interchangers supplied by hot water from boilers. To start the burners, electric heaters are provided for each boiler to supply heated oil until the oil in tanks is sufficiently heated to be pumped to burners.

An air compressor supplying air at 50 lb. is provided for each burner so that, with the oil under pressure from the pump, together with high air pressure available, the oil is mechanically broken up and burned efficiently in the furnace.

Stack temperature, electric eye, time delay, re-starting controls are all used while both electric ignition and gas pilots are used to start burners. The sequence of the air and oil supplies are under timing control and the oil is only admitted to the boiler furnace when all control safety requirements are satisfied. Oil burners are located at the back of the boilers, leaving the entire front of the boilers free of apparatus, and firing doors available for observation of combustion.

Heating, ventilating, and air conditioning was designed by Clyde R. Place of New York and developed by Beman & Candee of Buffalo. The heating and air conditioning contractor was the Quackenbush Co., Buffalo. Sheet metal work was by Engelhaupt & Co., Buffalo. Fans and spray chambers are by Buffalo Forge Co. Refrigerating equipment, by the Vilter Co., was installed by George H. Drake, Inc., of Buffalo. Other equipment makers include: pneumatic temperature control, Minneapolis-Honeywell Co.; vacuum pumps and heating specialties, C. A. Dunham Co.; circulating pumps, Taber Pump Co.; radiators and convectors, U. S. Radiator Corp.; grilles, Waterloo Register Co.; rosette type air inlets, Anemostat Corp. of America; filters, Airmaze Corp.; heating surface, John J. Nesbitt, Inc.; synchronous motors, Electric Machinery Co.; other motors, Armor Electric Mfg. Co.; starting equipment, Monitor Controller Co.; rubber motor and fan mountings, Buffalo Forge Co.; small motor and fan mountings, Vibration Eliminator Co.; boilers, National Radiator Corp.; oil burners and controls, Lammert-Mann Co.; recording instruments and electric remote thermometers, Brown Instrument Co.; and absorbent felt, Johns-Manville.

Economical Dust Control with Low Resistance Exhaust Systems

By F. F. KRAVATH†

PART 2—HOOD AND BRANCH CONNECTIONS AND IMPORTANCE OF EFFICIENT ELBOWS

ONE of the important items making up the total resistance against which flow must be maintained is the resistance at the point where the hood joins the branch pipe. It is essential that the air be allowed to enter the branch pipe without unnecessary crowding, since it is this crowding which produces the phenomenon called *vena contracta,* a contraction in the cross-sectional area of the actual air column making it somewhat less than the pipe cross-sectional area. This together with various other types of hoods or transition pieces are shown in Fig. 3, as well as the actual resistance in per cent of the velocity pressure corresponding to the velocity of flow in the branch pipe. The following formula expresses the relation between velocity and velocity pressure.

$$V = 4006\ (VP)^{1/2}$$

where

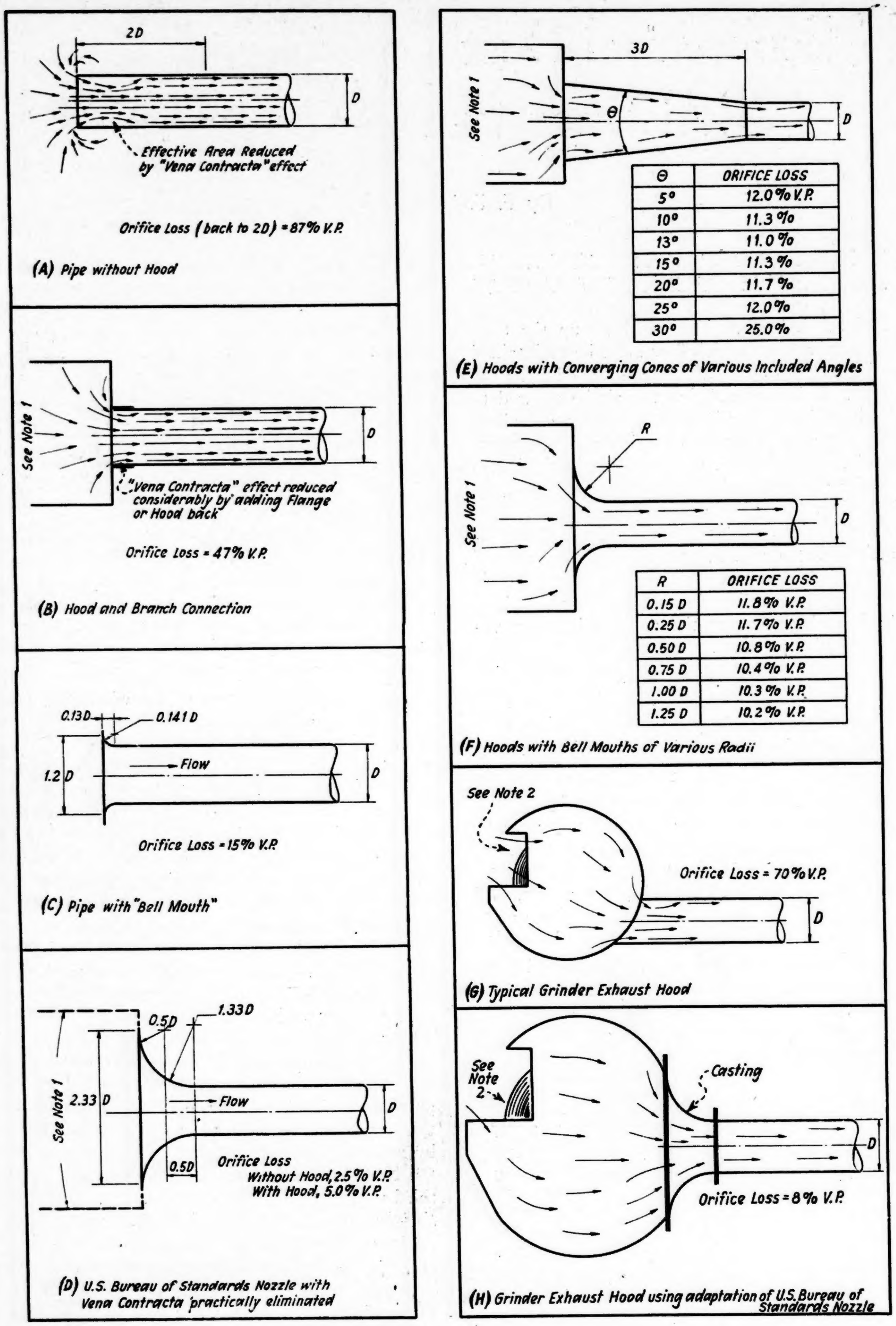
V = Velocity in f.p.m.,

VP = Velocity pressure in inches of water gauge.

Thus, if our branch pipe velocity were 4000 f.p.m., our velocity pressure, from the formula, would approximate 1 inch water gauge. If the resistance through the hood can be reduced from 65% of the velocity pressure to 15%, or a saving of 50% of the velocity pressure, this saving of ½ inch water gauge may well constitute anywhere between 5 and 25% (roughly) of the entire resistance of the system, and hence, a similar power saving. The savings become even more spectacular as the branch pipe velocity is increased. Referring to Fig. 3, and comparing illustrations "a" and "c," we notice the startling advantage of the bell mouth entrance over the plain ended pipe. Here, the respective orifice losses are 15% of VP for the bell mouth and 87% for the other or a difference of 72% of VP. Less startling, but almost as desirable is the difference in hood orifice losses between "b" and "d," "e," or "f." The type of connection as pictured in "b" is very commonly seen throughout industry. Notice the reduction in resistance, however, if we reduce the crowding effect by adding transition pieces of the converging cone or bell types. The converging cone is relatively cheap and easy to build and is practically as efficient as the bell mouth of illustration "f." It, however, has the disadvantage of having a relatively low velocity zone at the juncture with the hood, so that material which might be borne by the higher branch pipe velocity, may be precipitated here if the cone joins the hood horizontally, as shown. If, however, the cone is placed vertically or at some angle greater than the sliding angle of the material on steel, the bad effects of precipitation can be avoided. While the bell mouth of "d" or "f" cannot be readily formed out of sheet metal without dies, or unless a number of individual cones of differing included angles are joined together, they can be cast quite readily if there are enough machines to be equipped to justify the construction of a pattern. However, if a pattern is to be made, it should be made to the specifications of the National Bureau of Standards nozzle. There are standard cast iron bell mouth flanged fittings available for steam or hydraulic use which, if of the correct size, would be quite satisfactory. While there is little difference between the angular variations of the converging cones between 5° and 25°, as regards the orifice losses, as we approach 30° we notice a distinct change. Here the resistance is more than twice that of the 25° cone. Examining illustration "e," we notice that there are two points where the vene contracta phenomenon can occur, these being at the juncture of the hood and cone, and at the point where cone and branch pipe come together. When the included angle is small, the crowding occurs mainly at the hood juncture, being almost non-existent at the branch juncture. As the included angle increases, the crowding at the front of the cone decreases while the crowding at the rear increases. As we approach 30°, the rate at which the resistance decreases at the hood juncture becomes negligible, while the rate at which it increases at the branch pipe becomes quite marked. The 60° included angle cone is very slightly more efficient than the plain ended pipe, so the practical significance of the converging cone ceases at around 30° and it should not be used beyond this point. Illustrations "g" and "h" show the relative orifice losses of the plain and bell mouth branch connections as applied to a typical grinder hood. The resistance loss through a hood of this type can be reduced from 70% to 8% of the branch pipe velocity pressure by proper application of the National Bureau of Standards nozzle. Hence, our third maxim (3) *Always use the most efficient connection between hood and branch pipe.*

Since all systems will have elbows, collars, joints, and varying sections, it is necessary that we follow the best practice in the design and construction of these elements so that no unnecessary resistance is added to our total. Fig. 4 illustrates the comparative resistances of differently proportioned elbows. It can be seen that the square or mitered type of round or rectangular elbow is an extremely inefficient piece. The formation of eddy currents at the outside corner due to shock, and beyond the inside corner due to the vena contracta

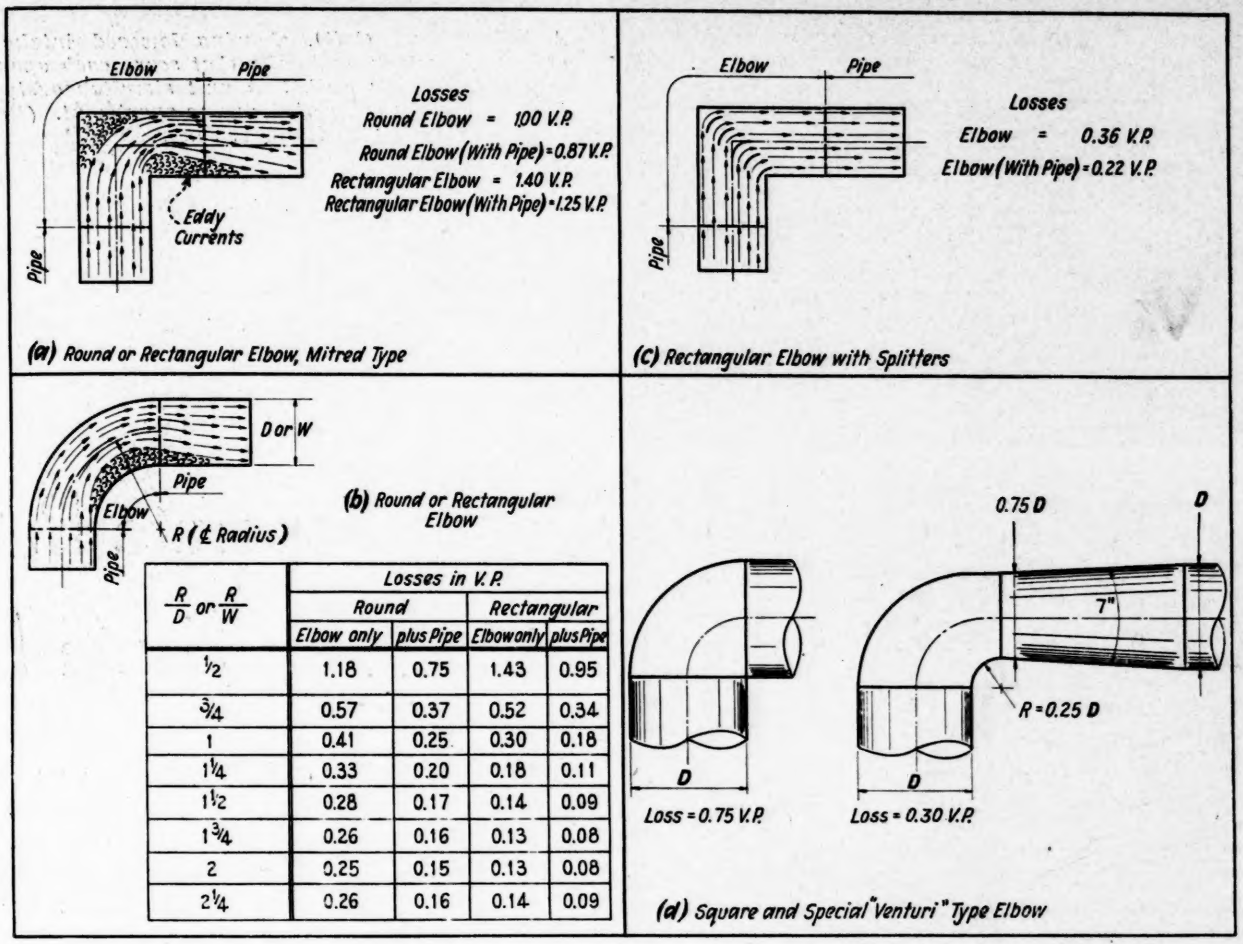
†Office Engineering Division, the Panama Canal.



Θ	ORIFICE LOSS
5°	12.0% V.P.
10°	11.3%
13°	11.0%
15°	11.3%
20°	11.7%
25°	12.0%
30°	25.0%

R	ORIFICE LOSS
0.15 D	11.8% V.P.
0.25 D	11.7% V.P.
0.50 D	10.8% V.P.
0.75 D	10.4% V.P.
1.00 D	10.3% V.P.
1.25 D	10.2% V.P.

Fig. 3. Illustrating hood types, branch connections and orifice loss or resistance through each, expressed in percent of branch pipe velocity pressure. Note 1. Area at face of hood at least 10 times area at "D". Note 2. Hood face area equals approximately 6 times area of branch pipe at "D". Data from Air Conditioning & Engineering by American Blower Co.; Industrial Dust by Drinker & Hatch; Fan Engineering by Buffalo Forge Co.; Fundamentals of Design, Construction, Maintenance and Operation of Exhaust Systems, by American Foundrymen's Ass'n. and University of Illinois Bulletin No. 52.



$\frac{R}{D}$ or $\frac{R}{W}$	Losses in V.P.			
	Round		Rectangular	
	Elbow only	plus Pipe	Elbow only	plus Pipe
½	1.18	0.75	1.43	0.95
¾	0.57	0.37	0.52	0.34
1	0.41	0.25	0.30	0.18
1¼	0.33	0.20	0.18	0.11
1½	0.28	0.17	0.14	0.09
1¾	0.26	0.16	0.13	0.08
2	0.25	0.15	0.13	0.08
2¼	0.26	0.16	0.14	0.09

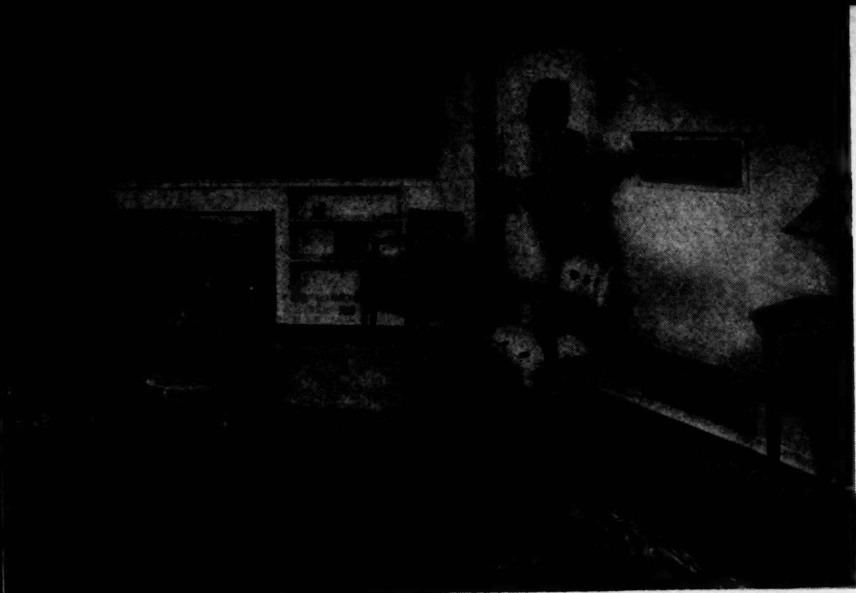
Fig. 4. Losses in various types of elbows.

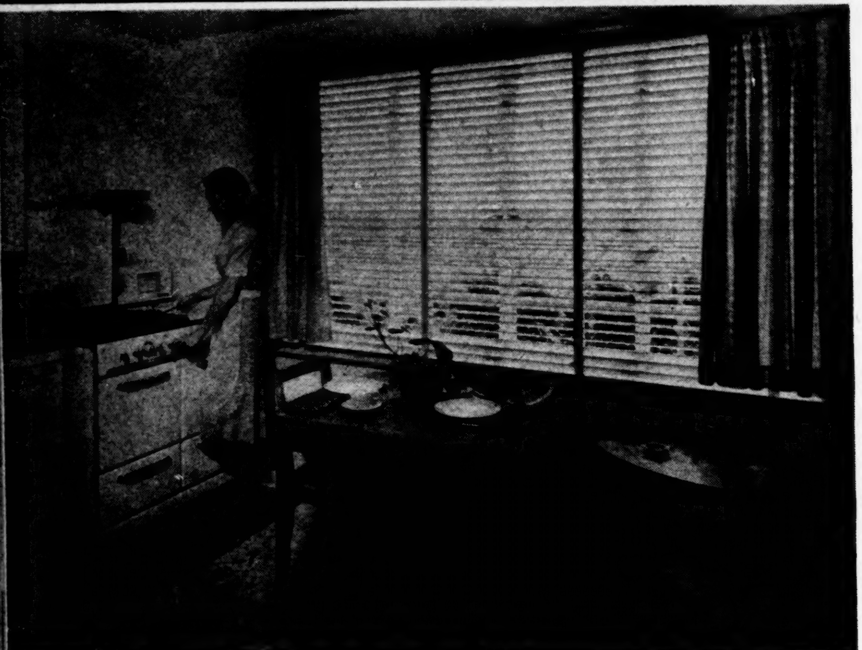
effect accounts for the high resistance losses of the various adaptations. Immediately below is shown the standard elbow. Referring to the R/D ratio of ½, in which there is no throat radius, but where the outside radius is equal to the diameter of the pipe, we note that the loss encountered in this elbow, with pipe following the elbow for at least three to four diameters, is equal to 0.75 VP. The mitered elbow had a loss of 0.87 VP, hence, it is apparent that the sharp outside corner causes a shock loss of approximately 0.12 VP, while the sharp inside corner is responsible for the remainder. Referring again to the standard elbows, we notice that as the centerline radius increases up to a maximum value of 2-pipe diameters, the resistance loss becomes less. Above 2-pipe diameters, as we increase, the loss increases. This is probably due to the fact that the vena contracta effect caused by the inside or throat radius or curvature becomes a minimum with the centerline radius equal to 2-pipe diameters, while the loss due to pipe friction increases as the centerline radius increases, being, naturally, a function of the length of travel or periphery.

Another interesting point to be noted in these charts is the effect of pipe both before and after the elbow in reducing the resistance losses. The effect of an actual enclosure around a diverging air stream, such as exists in the exit end of any elbow, is to cause a more rapid return to the original pipe size. This, in turn, causes the air column at the exit of the elbow to be somewhat greater than would be the case if discharge were made directly to the atmosphere. To illustrate further, an air jet, exclusive of induced air, has an expansion of approximately 3 degrees included angle. This represents the maximum expansion of an unconfined uninterrupted stream of air upon emission from a pipe. Yet, if this diverging air column is enclosed in a 7-degree included angle cone, the column will expand at the increased rate without the formation of eddy currents at the pipe surface.

In the use of rectangular elbows, it is very often desired to use the square elbow for the sake of appearance or convenience in getting around obstructions. In order to minimize the resistance loss, it is advised that splitters or guide vanes be installed as illustrated. By the use of these vanes both the shock loss and the vena contracta are considerably reduced with the result that the resistance loss of the elbow is reduced from 1.25 VP to 0.22 VP. In the use of round piping, very often space precludes anything but a square or mitered type of elbow. Illustrated is the venturi type of elbow, which while able to fit into the same space that the mitered elbow of the same diameter would take, reduces the resistance loss of the piece from 0.75 VP to 0.30 VP. By using a tapered or reducing elbow with the exit end diameter equal to ¾ of the inlet diameter, by providing a throat radius of ¼ the pipe diameter, and by adding a diverging cone of from 3 to 7 degrees included angle, the vena contracta losses are considerably reduced. Hence, maxim (4) *Always use the most efficient elbow possible.*

[In next month's issue Mr. Kravath will discuss branch junctions and changes in pipe sizes.]





A living room (left), showing lowered intake and supply grilles of the gas wall-units that serve each apartment. Built into the dividing wall, this unit simultaneously directs heat to an adjoining room of the same apartment. (Below) Typical kitchen, showing modern gas range.

Separate Bathroom for Santa Monica

A SEPARATE bathroom heating system, independent of the general room heating system, is one of the notable departures from the orthodox in the design of the swank new Shangri-La Apartment Hotel in Santa Monica, Calif.

The Shangri-La, an ultra-modern $400,000 structure of revolutionary design, was the first apartment house project of its size to be completed in the Los Angeles metropolitan area since 1929. Designed on a super deluxe scale, planned in layout and appointments to cater to high-bracket income tenants, the seven-story building embraces structural features new to the west coast apartment-hotel field.

The exterior design of the concrete and steel building is defined as "modern with a classic note." Its location, overlooking Santa Monica Yacht Harbor and the Pacific Ocean, influenced the use of a unique design, which is most striking at the rear. To obtain full advantage of the sea view, the building was designed with no interior corridors. All apartments have the living rooms and bedrooms at the front, with kitchens and bathrooms overlooking a spacious rear patio. Instead of being entered from interior corridors, as is customary in the usual apartment house, Shangri-La apartments are entered from open galleries on every floor at the rear of the L-shaped structure.

The exterior gallery plan and the complete elimination of inside hallways is new to the west coast, and new, too, it is believed, to the United States as a whole. The architect claims that while a few buildings in South America and Europe vaguely resemble the Shangri-La in some features no other building known equals it in all its planning and arrangement.

The building contains no wood except in doors, door frames and shelving. Glass brick finds plentiful use in lobby, reception room and other public rooms. For earthquake and soundproofing purposes eight-inch concrete walls extend across the building between each apartment.

The Shangri-La is heated throughout by gas. Gas is used for room heating, bathroom heating, water heating, cooking and refrigeration.

The management finds that the dual heating systems for bathrooms and living rooms are regarded by tenants as one of the most desirable attractions. Installation of the independent bathroom heating system was predicated on the premise that for many years the planning of heating accommodations for bathrooms has been approached from the wrong angle. It is pointed out that in most private residences and apartments the bathroom is heated by the same system that serves the balance of the home or apartment building. Be it a central heating plant in the basement or a wall or floor space unit, it is said, neither system adequately and quickly gets bathroom temperature to a comfortable level when it is most desired—early in the morning. Consequently, the design incorporates recommended independent heating arrangements for all bathrooms so that they would be assured of continuous comfortable temperature, day and night, irrespective of the temperature in adjoining living and bedrooms.

In their consideration of the type of heating best suited to the purpose, the planners selected a gas-fired heating plant for the bathrooms. It consists of a central gas-fired boiler supplying heat to convectors mounted in the wall of each bathroom.

In deciding upon the kind of heating equipment for

A striking view of the rear of the building showing the system of exterior corridors which give access to apartments on the various levels. The building has no interior corridors. (Below) Looking across the beautifully-appointed lobby of the Shangri-La Apartments.

Heating System Apartment

other rooms in the apartments the designers gave considerable thought to the peculiarities of local temperature variations as well as to the heat requirements of tenants. There is considerable temperature variation in Southern California seacoast cities. The evenings are invariably cool, and even on summer nights some heat is desirable.

In selecting the heating system for other rooms of the apartments, the designers considered the varying desires of tenants in the matter of temperature. A heating system was sought that would permit elderly persons to maintain temperatures of 82 to 85F in their apartments, if so desired, while young people in an adjoining one did without heat at all, if that suited their wishes. The ultimate selection was thermostatically-controlled, vented, gas-fired wall units in each of the 63 apartments on the first five floors, and forced air, gas-fired wall units in five more elaborate apartments on the sixth floor and the two penthouses on the roof. The wall units in the lower-floor apartments are about evenly divided among single-face, for heating one room, and dual-face for directing heat into two rooms simultaneously.

The units are mounted into wall spaces 52½ in. high, 28 in. wide and 9¼ in. deep, have a flue diameter of 4 inches, and two intake and output grilles each 10½ by 22 inches. The input rating of each unit is 36,000 B.t.u., and the output 25,200 B.t.u. per hour. They have an over-rate capacity of nearly double the cubical content of the rooms to be heated, being designed to heat 4,000 sq. ft. of room area, whereas the average apartment in the building contains 1820 cu. ft. A four-stage valve permits manual control at *high, medium, low* or *off,* which makes for an effective range of room temperature regulation.

Each unit also has thermostatic control at the cold-air intake to close gas inflow when normal room temperature is reached. The Shangri-La management sets the thermostats to cut off gas at 75F, but on request adjusts the controls as desired by the individual tenant. This automatic control at the cold-air intake is regarded as a desirable feature from the management's standpoint in that it protects the building owner, who furnishes the utilities, against the practice of tenants leaving the gas on while absent from the apartment. The thermostats are installed so that tampering by tenants is impossible.

Larger apartments on the sixth floor and in the two penthouses are equipped with forced air wall heaters, which supply filtered air, automatically controlled. These units are convertible for circulating cool air in summer.

An elaborate vent system, which serves both types of wall heaters, was installed. A total of 16-vent stacks were required adequately to vent the heaters, mantel gas logs, gas radiators and gas stoves. The set-back style of construction above the sixth floor complicated the installation of the vents, and made it necessary to install individual vents for the fifth and sixth floor units and for the penthouses.

The architect for the project was William E. Foster, Beverly Hills; bathroom heaters and gas boiler were installed by Ross Plumbing Co., Los Angeles; room units were those of and installed by Andrews Heater Co., Los Angeles, who likewise installed the vent system; forced air units were installed by Hartman Sheet Metal Co., Hollywood.

Wall Heat Loss Back of Radiators

By EARL C. WILLEY†

DURING the past few years there has been a trend toward the recessing of steam and hot water radiators in the outside walls of houses. Most of those who are connected with heating are aware of the greater loss of heat to the outside when the wall section is made thinner. However, there seems to be a great number of contractors and engineers who treat carelessly the insulation of outside walls when recessed radiators have reduced the resistance for heat flow.

The wall directly back of a radiator is subjected to a very high heat. Because the temperature difference between the inside and outside wall is a direct factor in calculating the heat loss it becomes evident that there is more loss at that point than at any other place in a room. Doubly important then is the matter of insulating the wall when in recessing the heating unit the wall thickness has been lessened.

There are two general types of heating units used for recessing in the outside wall——the common cast iron radiators and the fin type convector heaters. There have been differences in opinion between the proponents of the radiator type and convector type heaters as to the relative loss of heat to the outside. It was to determine this relation that the following experiment was instigated.

The investigation involved building the apparatus shown in Fig. 1. Two identical sized wall sections were made. The walls were the conventional type wood construction consisting of 2 x 4 in. studding, shiplap siding, heavy building paper, and cedar siding. Outside of these wall sections was built a box enclosure of identical size which was insulated by double thicknesses of one-half inch insulating wall board. In the top of each box was placed a thermocouple for measuring temperature. Also a very small fan was placed in each box (not shown in drawing) which kept the air in motion so that the temperature would not be affected by natural stratifying of the air streams.

The two heating units were recessed as shown in the drawing. The steam line was connected so that steam entered both units simultaneously. Each unit was provided with a steam trap which was in turn provided with a container for measuring the condensation.

On one box was installed a convector-type heater, 30 inches long and 24 inches high. Catalog rating of this unit was 29 sq. ft. E.D.R. In the other box was installed a four tube, 18 section radiator, 22 inches high, with a catalog rating of 28.8 sq. ft.

Note that the convector unit is enclosed in a sheet iron case. This case had a 20-gage wall between the convector element and the outside wall. To offset this condition a 20-gage sheet iron was placed in the same relative position behind the radiator.

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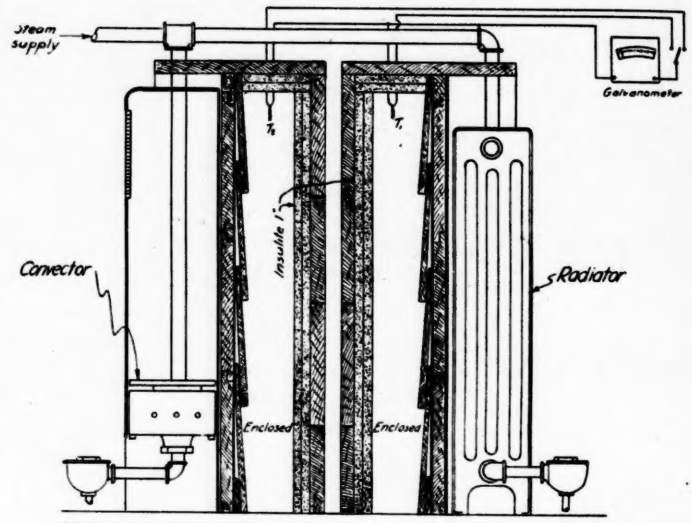


Fig. 1. Test set-up showing the arrangement of identical test chambers, one with a convector and the other with a radiator.

The general procedure of the test was to admit steam to the two units simultaneously and then record the rise in temperature of the air in the boxes. This air was warmed from heat which escaped through the typical outside wall sections. Fifteen separate runs were made varying in length from two to six hours. At the end of each run the condensate was weighed. This gave a check on the relative amounts of radiation in action in each case.

Each run was made on a different day with starting conditions cold and uniform. The condensation measured at the end of each run showed that the two radiators were condensing almost identical amounts of steam. The catalog rating of the radiator was slightly less then the convector, so the results from the tests would indicate that the radiator was slightly underrated in the catalog. However, the heating units were so near the same size that the results of the heat losses through the outside walls could be compared from the data directly.

An analysis of the resulting curves (Fig. 2) shows that the heat passing through the outside wall of the radiator set-up began to raise the temperature of the box enclosure at a high rate. There was not much change in the rate of flow for about an hour, after which the curve began to flatten out. This is a natural result caused by the smaller temperature differences on the sides of the walls. The convector unit showed a much less rate of increase in heat loss and the curve began to flatten out much more quickly. On one eight-hour run these curves continued from this point on an almost horizontal line. The room temperature in this test would have some influence on the rise of temperature in the test boxes. However, the rise of room temperature was not caused to any great degree from the radiators. The room was quite large and its temperature was influenced more from outside weather conditions.

No measure was made of the actual B.t.u. heat loss in each case. However, the results show that there is considerable loss and that adequate provision should be made for insulation in proportion to the type of unit used.

The amount of insulation to use would depend largely on the type of wall construction, the design temperatures and the heat transfer coefficient of the insulating material to be used. For example let us assume that a radiator is to be placed against an ordinary wood construction wall (not recessed) consisting of lath and plaster, 2 x 4 in. studding, shiplap, paper and cedar siding similar to the test wall used in the above experiment. A wall of this type has an average heat transfer coefficient U (overall coefficient) = 0.25 B.t.u. If the radiator used had about four square feet of surface exposed to the wall and the average temperature on the inside wall was 200F with 0F temperature outside, then there would be about 200 B.t.u. per hour heat loss through the wall at this point. At the same time the remainder of the walls in the room having a maintained temperature of 70F would only be losing 70 B.t.u. per hour on a similar sized surface.

If this same radiator were recessed and the lath and plaster removed, the heat transfer coefficient of the remaining wall would be about U = 0.45 B.t.u. Then the heat loss on four square feet of surface would be about 360 B.t.u. per hour. To compensate for the lath and plaster and air space of the original wall it would require using at least one-half inch thickness of glass wool, hair felt or other similar insulation material with a heat transfer coefficient of K = 0.25.

Although this experiment showed that the convector units were not as guilty of losing heat through the outside wall as the radiators it still remains a great source of heat loss and should be provided with insulation.

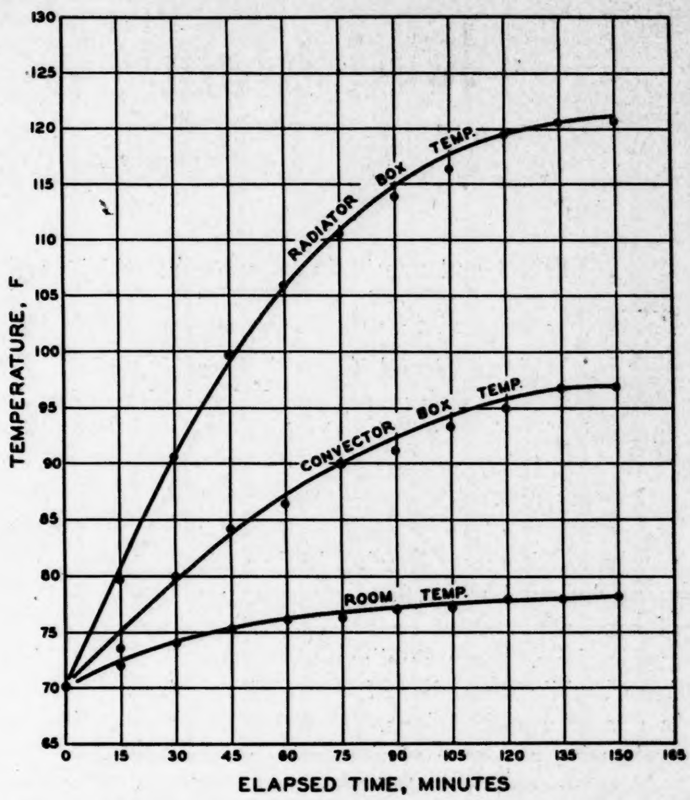


Fig. 2. Relative temperatures in the two test boxes and room at different elapsed times after the beginning of the test.

The radiator loses most of its heat by the radiated rays and for this reason it is a good plan to place some bright surfaced metal directly behind it to reflect these rays toward the room.

The idea of recessing of the heating units, of course, is to get them out of sight and out of foot room. In the ordinary 2 x 4 in. studded wall when sufficient insulation is used to take care of the heat loss, there is so much thickness added that the recessing idea is nearly defeated. Often this may be cared for in new buildings by planning ahead and using 2 x 6 in. studding in the walls which will be affected.

A Fallacy About Poison Gas

The British Ministry of Home Security has announced that there appears to be a widespread belief that in city streets a poison gas cloud is not dangerous above a height of about 30 feet from ground level. This idea, which is quite wrong, according to *The Heating and Ventilating Engineer*, is most commonly encountered in connection with ventilation problems where it appears to be assumed that if the air intake of ventilated plant is not less than 30 feet from the ground, there will be no danger of gas being drawn into the shelter.

The misconception may be based on the fact that war gases are heavier than air, but it must be remembered that immediately the gas is released it is quickly diluted by a very large volume of air, so that at a relatively short distance from the source of dispersion there may be only one part of gas in many thousand parts of air. In such circumstances the density of the gas cloud is much the same as that of air. The chief factor in the behavior of a gas cloud is, therefore, the air currents which direct its movement. The movement of air currents in streets is complex so that, apart from the fact that a gas cloud drifting slowly along a street may be poisonous at a height of at least 30 feet, in certain conditions the cloud may actually be carried up the side of a building. In cities, therefore, it should never be assumed that a gas cloud will not be poisonous at any particular height, though in general the concentration may be expected to be highest at ground level.

The same publication reports that a British standard specification for light-locks at entrances to buildings was issued some time ago. Since that time many factories and office buildings have had to be in use during black-out hours in warm weather, and the ventilation of the buildings has given rise to many problems. It has been necessary to obstruct the windows and other openings in such a way as to provide a light trap without interfering with ventilation.

Copies of this specification may be obtained from the British Standards Institution, Publications Department, 28, Victoria Street, London, S.W.1, price 8d.

Heating and Ventilating Equipment Well Represented at Power Show

HEATING and ventilating equipment will be well represented at the forthcoming 14th National Exposition of Power and Mechanical Engineering, which will be held at Grand Central Palace, New York, December 2-7. With more than 275 exhibitors already enrolled, the show will be the largest exposition of its kind since 1930, considerably outrunning the last show two years ago.

A preview of the classified list of products reveals nearly 400 items embracing basic and auxiliary equipment designed to perform all the steps in the process of converting latent energy into all manner of useful applications. Many appliances are offered in competing forms, while a number of the exhibitors have products in several classifications. Thus the show affords comprehensive coverage of the entire power field.

Heating and ventilating are essential adjuncts of most industrial applications of power and the principal products in many institutional power plants. It is not surprising, therefore, to find among the advance reservations of space well over one hundred exhibits planned directly to cover the closely related requirements not only of heating and ventilating, but also air conditioning and refrigeration.

More than fifty exhibits will embrace unit heaters, blowers, motors, fixed and variable speed drives, coils, piping, valves, ducts, indicating and recording instruments for measuring temperatures and pressures and automatic control devices applicable to both temperatures and pressures.

Air conditioning apparatus will be well represented with over forty exhibits, while there will also be almost the same number of items in the line of refrigerating equipment, according to the advance indications.

Naturally a large proportion of products on display will be associated with the combustion of fuel and generation, control and distribution of steam. Many of them will represent a wide range of sizes and capacities, adapting them to a variety of applications in plants of all sizes from the larger central stations down to and including burners and boilers for use in private homes. Coal, oil and gas fired appliances are all included.

No less wide from the standpoint of the generation and use of steam is the range of control apparatus: heat exchangers, reducing valves, flow-meters, automatic regulating devices monitored by temperature or pressure, such as governors and thermostats.

I. E. Moutrop (left), Chairman, Advisory Committee, and Charles F. Roth, Manager, 14th National Exposition of Power and Mechanical Engineering, discussing plans for the forthcoming Exposition.

Exhibits in the line of power plant construction and maintenance occupy a substantial amount of space on the plans of the forthcoming show. There are numerous exhibits of metals and alloys specially developed to meet the ever changing needs of the power plant; refractories in the form of brick, precast panels and cements; sheet metal specialties in the way of panels and other housings, conduits, insulating materials and processes. There is also a long line of material handling equipment, piping, pipe fittings, valves, pipe cutting and pipe cleaning appliances, sheet metal cutting and pipe bending machinery and tools, threading machines and tools, belting, gaskets and packing.

Two factors render the Power Show peculiarly advantageous to executives, consulting and operating engineers, purchasing agents and plant maintenance men at this particular time. One is the great amount of new construction that is going on, and the even greater amount in prospect for the next two years. The other is the expansion and rearrangement of existing plants, especially in the industrial field.

The Power Show provides a marketplace for the exchange of information and the visualization of products and appliances that are keeping pace with progress. In presenting modern power plant practice from every angle in physical form, it complements the opportunities for professional advancement offered by the meetings of the American Society of Mechanical Engineers, whose dates are coincident with those of the show.

More than 40,000 engineers, executives and operating men are expected to visit the Palace this year, a large proportion of them holding executive positions. Hours during which the exposition will be open have been altered somewhat from previous shows, for the benefit of visitors and exhibitors alike. Opening at 2 p.m. on Monday, December 2, and at 11 a.m. during the remainder of the week, the Palace will be closed each night at 10 o'clock, except Wednesday and Saturday, when the closing hour will be 6 o'clock.

Like all the National Power Shows since the first one was held in 1922, the 14th exposition is being conducted by the International Exposition Company, with permanent headquarters in Grand Central Palace. Charles F. Roth is president of the company and manager of the show.

PROFITS IN AIR

INTERNATIONAL BUSINESS MACHINES CORP.

installed new paint spray booths, exhausted more air than formerly, needed more outside air units for air make-up. How this was done by installing unit heaters is explained by the author.

By HARRY G. MURPHY†

THE Metal Finishing Department of the International Business Machines Corporation was improved by the installation of new water wash spray booths of a greater capacity than previously used. This gave rise to the need of more outside air units in the building to balance the increased quantity of exhausted air if drafts were to be avoided in the building.

It was found that it would be necessary to supply 66,000 c.f.m. of outside air in addition to the existing outside air supply system. Floor space was not available for locating units in the department without long ducts to supply the air, along with the interference encountered in an attempt to run ducts in the ceiling. As the spray booths occupied both sides of the building, the most logical way of introducing the air seemed to be through the skylights in the center of the room.

This was successfully done by raising four skylights and installing filters in place of the glass on the sides, and suspending a fresh air unit heater from the curbing of each of the four available skylights. Featherweight variable temperature unit heaters were selected for the job. Each unit has a capacity of 16,500 c.f.m. and is capable of heating air from —10 to 70F, with steam at 2 lb. pressure. Each unit is equipped with a non-ferrous fan wheel and explosion proof motor, and required fourteen 20 x 30 in. cloth type cleanable filters. Temperature control is obtained by face and bypass dampers, and self-acting controls built into the unit heater, with a thermostatic bulb located in the air stream. Ducts or deflectors on the units were not necessary, as the air is directed into the room in an area where there are no workmen.

The photographs show the filters and air intakes on the roof and a ceiling view of the unit heaters. The system has been in operation for some time and has been quite satisfactory. Although daylight was not an important factor on this job, a portion of the skylight area is still available.

†Scranton, Pa., Representative, L. J. Wing Mfg. Co.

Fig. 1. How the skylights appeared when raised with filters in place of the glass on the sides.

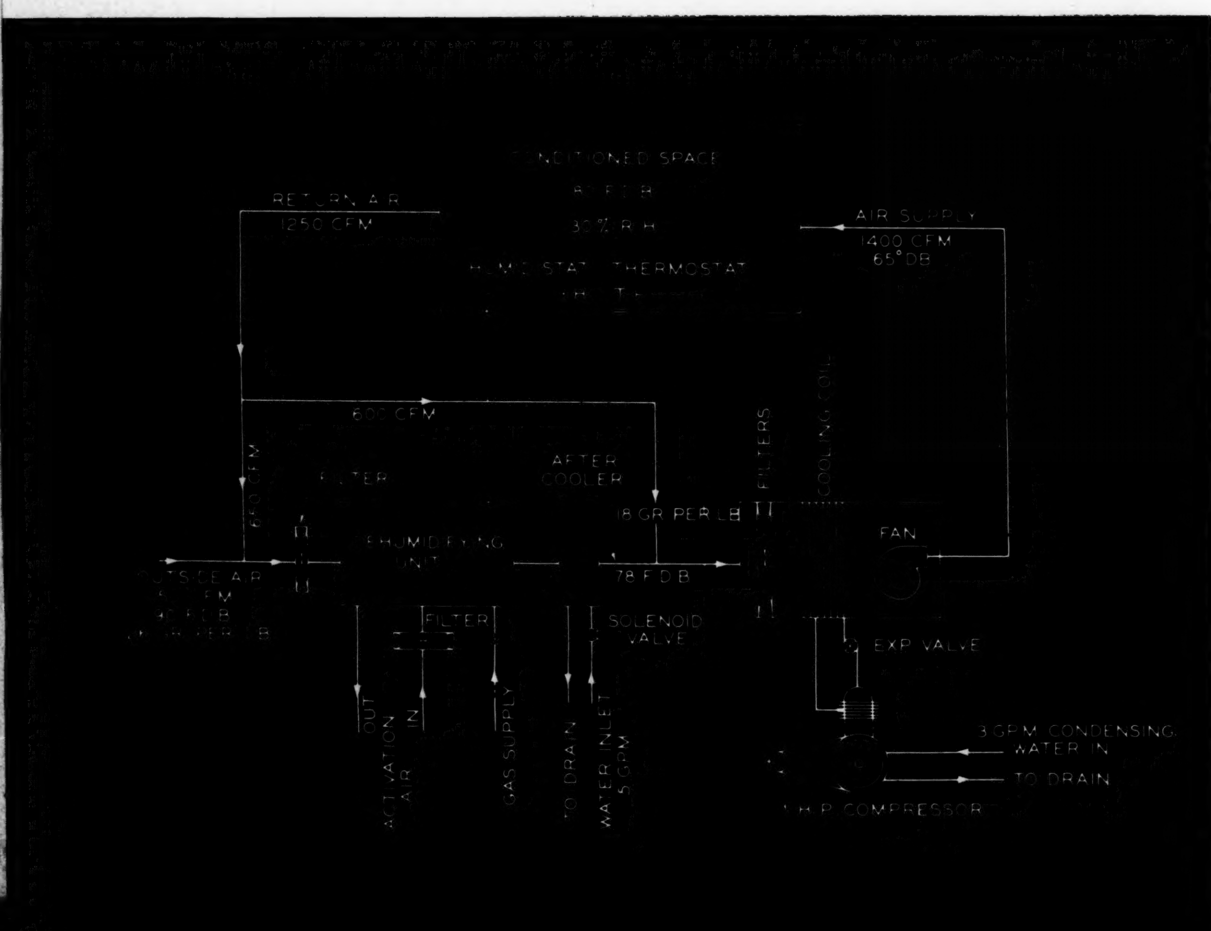
Fig. 2. Unit heater installed under the skylight to heat outside air admitted through skylight.

THE KOLLSMAN INSTRUMENT CO.,

aviation instrument manufacturer, installs an air conditioning system to prevent frost and moisture from forming on its aviation instruments while they are being tested by U. S. Army inspectors.

THE Kollsman Instrument Company, Division of the Square D Co., Elmhurst, N. Y., manufactures a variety of aviation instruments such as altimeters and direction indicators and is one of the leaders in this field. One portion of the plant is devoted to inspection. Here the instruments are subjected to various special tests including a *cold test* which is conducted by U. S. Army inspectors. The Army has inspectors on duty at all times for inspection purposes. In the *cold test* the instruments are subjected to temperatures as low as minus 40F. When the instruments are removed from the refrigerated space condensation of moisture from the air takes place on the instruments and this moisture freezes. Naturally, this causes considerable inconvenience because the instruments are hard to handle and cannot be read.

The condensation of moisture in spring and fall is not enough to cause serious inconvenience, but in the summer it is unbearable. Consequently it was desirable to maintain a dew point temperature in the room that would correspond to spring and fall weather. In addition, since a total of 15 men work in the room, their comfort had to be considered. A condition of 80F D.B. and 30% relative humidity was decided upon



Schematic diagram of air conditioning equipment installed in the instrument test room. Air conditioning equipment is designed to maintain 80F D.B. and 30% R.H. year round to prevent the condensation of moisture on instruments taken from the —40F test space.

because it was felt that any lower dry bulb temperature would result in discomfort due to exit and entrance shocks and the possibilities of drafts. Outside design conditions were 90F D.B. and 126 grs. per lb.

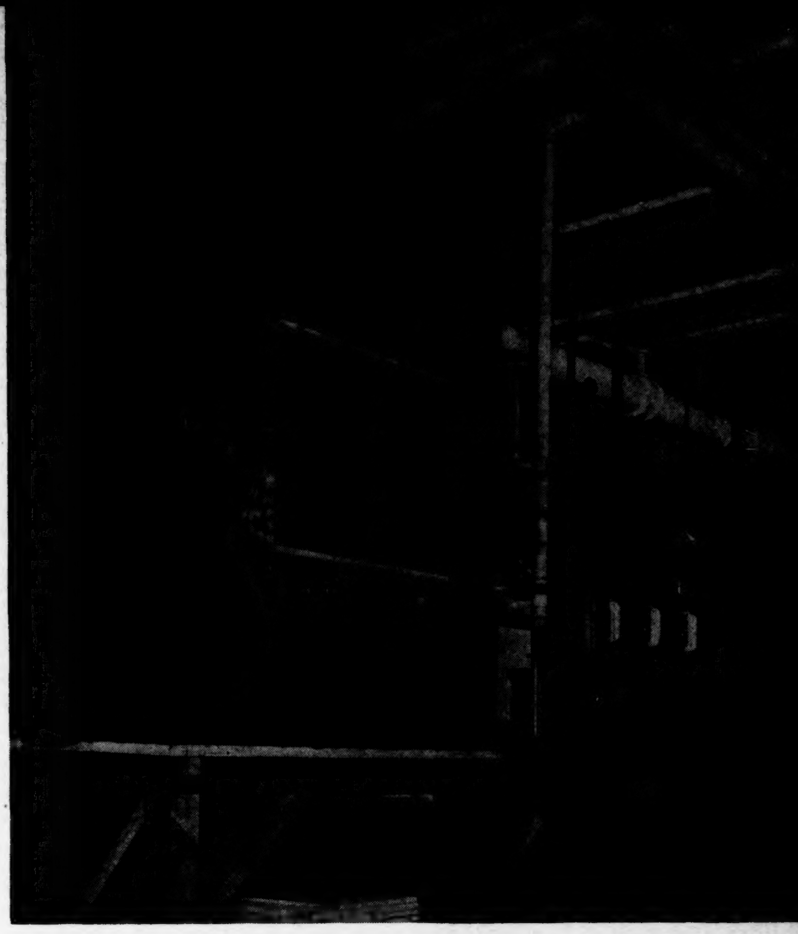
To insure exact humidity control and to provide flexibility a split system was installed. This system employs a silica gel dehumidifier for moisture removal and a refrigeration condensing unit for sensible heat removal. The flow diagram of the system is illustrated in the accompanying diagram.

The dehumidifier has a moisture removal capacity of 16 lb. per hr. under the conditions of the job while water cooled condensing unit is rated at 1 H.P. It is to be noted that the dehumidifying unit and aftercooler handles the internal latent load and the fresh air load, while the compressor handles only the internal sensible load. A humidistat located in the room controls the dehumidifier to maintain a constant humidity while a thermostat controls the operation of the compressor. This system has the advantage of being able to maintain a low dew point under any combination of latent and sensible load without the use of reheat.

Some pertinent data on the job follows:

1. **Estimated internal sensible load....18,000 B.t.u. per hr.**
2. **Estimated internal latent load ......15,000 B.t.u. per hr.**
3. **Fresh air load .... 9,000 B.t.u. per hr.**
4. **Gas consumption ....150 cu. ft. per hr.**
5. **Water consumption ....8 g.p.m.**
6. **Power consumption ....2.3 Kw. hr.**

The inspection room measures 45 x 15 x 12 ft. high. The equipment is located outside of but adjacent to the conditioned room. To conserve floor space the equipment is located on a platform measuring 4 x 12 ft. and 5 ft. off the floor.



Dehumidifying unit which is capable of removing 16 lb. weight in moisture per hour from the air supplied to the test room. The conditioning system maintains a low dew point without the use of re-heat.

Effect of Draft on Stoker Operations

In a recent talk before the Coal and Stoker Institute at Indianapolis, Walter Knox, Director of the Koppers Coal Research Laboratory, presented some interesting data on the effect of drafts on the operation of coal stokers. The tests were conducted on a small steam boiler, stoker-fired, and equipped with automatic draft regulators. Three identical tests were run with three different draft settings, a low draft of 0.02 in., a medium draft of 0.07 in., and a high draft of 0.12 in. Each test took five and one-half days and included a continuous run, various intermittent runs, and *hold-fire* runs. During the entire five and one-half days the fire was not touched.

The tests showed that the difference in efficiency between the low and high draft operation was approximately 10% in favor of low draft. Mr. Knox pointed out, in a small home this might not seem too important for, if with the proper setting 10 tons of coal were burned, then with the excessive draft only one ton more would be used. However, if the installation was in an apartment house using 100 tons of coal per year, an excessive draft would cause the use of 10 tons more than was necessary. This is a sizable excess cost to the owner.

Another advantage of low draft was that during the off periods less heat was given off by the coal and less coal was burned than when high draft was used. Also it was found that on low draft, the stoker produced more heat during the on periods of operation than was produced with the high draft. Still other advantages of low draft were that it gave the best clinker formation and that there was, roughly, 40% less flyash on the boiler tubes.

When the stoker was operated for a considerable period on the *hold-fire* control, it was found that the pick-up was decidedly best with low draft. In fact, it was noted that the steam pressure went up almost instantly after a week-end of *hold-fire* at low draft, while for the excessively high draft it was ten minutes before any steam was raised.

In connection with this talk Mr. Knox showed a motion picture which gave a continuous pictorial record of fuel performance during combustion and taken during the test.

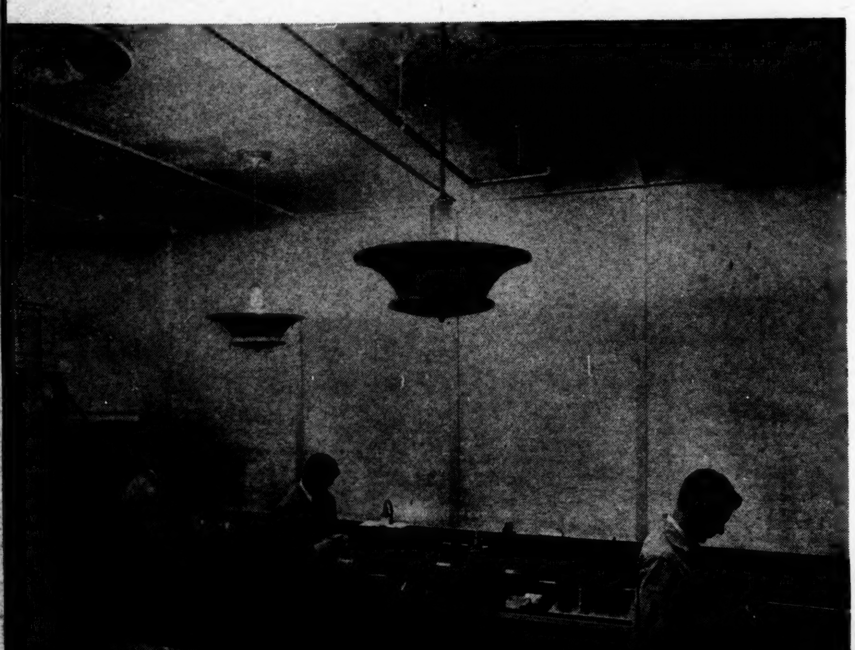
Heald Machine Company

air conditions a portable gauge and inspection room which is used to calibrate gauges and to check ball and roller bearings.

THE Heald Machine Company of Worcester, Mass., has built a gauge, or inspection, room which has been carefully air conditioned to maintain constant temperature. It is used for checking all ball and roller bearings of the different types which are purchased outside for installation in the wheelheads of the machine tools built by this company. This checking takes place when the bearings are withdrawn from raw stores and before going into the finished stores, whence they are issued for the sub-assembly of wheelheads. In addition all other gauges used in the machine tool building operations are checked in this room, including ring, plug and other gauges.

As the bulk of the work done in this room consists of checking the anti-friction bearings which go into the wheel heads its location is determined by the location of the wheelhead assembly department. In a large machine shop like this it is constantly necessary to rearrange the various machine tools used for production, as every machine shop superintendent knows, and for this reason the location of the wheelhead department is changed from time to time. Consequently it is necessary to change the location of the gauge, or inspection, room just about as frequently in order to keep it adjacent and convenient to the wheelhead department.

Air conditioned gauge and inspecting room at Heald Machine Company. Diffuser in ceiling at top left. Cabinet for quick cooling at lower left.



The size of this gauge room is 20 ft. by 20 ft. by 11 ft. high. The walls and ceiling are of fiber board painted with aluminum paint. The air conditioning equipment is located on the roof of the room. It consists of a Trane cooling and filtering unit which discharges air into the room from a diffuser on the ceiling. A Carrier 1 ton refrigerating unit is also located on the roof of the room which is connected with the cooling element of the Trane unit, as shown in the diagram. This keeps the temperature of the gauge room at 72F, plus or minus 1F. In cold weather it may not be necessary to operate the refrigerating unit, which is controlled by a thermostat in the room. However, it is never necessary to heat any of the make-up air as it is taken from under the saw-tooth roof where it is always at least 72F even on the coldest days.

As stated, the cooled air enters the room from the diffuser in the ceiling. It leaves through a duct behind a cabinet at one corner. Whenever a quantity of ball or roller bearings, or other items, come in for testing they are placed in this cabinet. As the circulation of air is rapid in there they acquire the room temperature more quickly in the cabinet than they would if just placed on one of the benches. In fact a half hour in this cabinet is sufficient, whereas in other parts of the room it might take twice as long for the items to reach the proper temperature. The quantity of make-up air is controlled by a damper in the in-coming duct at the filtering and cooling unit. Filtering of the air is considered very necessary in order to keep down dust in the gauge room to a minimum. On the other hand, control of humidity is not important here, although it never actually reaches a very high degree because of the leakage around the door to the room and the amount of make-up air used.

By providing this air conditioned room it is possible to test the purchased ball and roller bearings under the same conditions that they were tested by the manufacturers, and to provide a comparable basis for acceptance or rejection. It also provides standard conditions for testing the gauges used in production.

Fig. 1. Ventilation system for wood heel covering process. An air flow of 80 c.f.m. through perforated plate removes 50% of vapors by local exhaust. Remainder arising from adjacent stages is simultaneously diluted to below 200 p.p.m.

Air Dilution in Industrial Ventilation

By W. C. L. HEMEON†

The author classifies industrial ventilating systems into two kinds: (1) local exhaust systems which remove dangerous vapors, fumes, or dusts, and (2) general ventilating systems which, by supplying outside air, so dilute the air that the contamination of fumes, dusts or gases is reduced to a point below the dangerous level. Since his articles deal with the dilution mechanism in industrial ventilation he is concerned primarily with the second type of system. Mr. Hemeon's article is replete with numerous examples showing the basis of design of general ventilating systems. The article is up-to-the-minute on available data and at the same time extremely practical. The succeeding parts of this article will appear in subsequent issues.

NEW problems in industrial ventilation engineering have been posed in recent years by increased knowledge in the field of industrial toxicology. The qualitative side of industrial toxicology preceded the quantitative aspects and for a long period it was known that various substances occurring in industry were toxic when absorbed into the human body before much was known as to what minimum quantities might result in occupational disease.

In the earliest days of the science, toxic effects were largely thought of in terms of ingestion into the gastro-intestinal tract. As the industrial branch of toxicology developed, it became apparent that the inhalation of toxic fumes, vapors and dust was of much greater importance as a mode of access to body organs and industrial hygiene became in large measure a science dealing with the purity of industrial atmospheres.

Accompanying the development of standards of air purity has come a corresponding increase in the use of microchemical methods of analyzing air for the small quantities of atmospheric contaminants significant to a study of occupational poisoning. Today, industrial hygiene laboratories exist in many state departments of health and labor, and in some private organizations, with the equipment necessary to measure the amounts of such substances in the atmosphere.

The list of maximum allowable concentrations of various toxic substances that might be found in industrial atmospheres given in Table 1 has been tentatively adopted by the Massachusetts Dust and Fume Code Committee and, although lacking many data, is one of the most complete compilations available. Compiled[1] largely from authoritative researches, some of these figures are based on elaborate statistical studies, others on experiments with animals and still others on inferences from various toxicological and chemical data.

When larger concentrations than these are found by analysis in any industrial atmosphere a hazard to health is usually deemed to exist and the need for improved ventilation or other measures of control indicated. Where such toxic substances are involved, state agencies and others concerned with control of industrial health hazards will judge the worth of a ventilation system on the basis of resulting air purity. Where many state regulations have served a useful purpose in the past in specifying certain minimum standards of excellence in the details of construction of exhaust systems and minimum air flow rates as judged by suction measurements at hoods, these must obviously be limited to those industrial operations that recur frequently and about which considerable is known ventilation-wise. The trend is definitely to specify the end result required of a ventilation system in terms of maximum allowable concentration of the substance in the air. It is, accordingly, the task of the ventilation engineer to design exhaust systems with such definite objectives in view.

The attitude regarding maximum allowable concentrations, all too common among those concerned with the design and construction of ventilation systems, is one of incomprehension of any connection between those standards and the design of the system. At best many understand it as an instrument of approval or condemnation after completion, and those who will guarantee their system to meet specifications for air purity are very uncommon. Such a state is, of course, intolerable. It is the purpose of this paper to deal with cer-

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[1]Elkins, H. B., "Toxic Fumes in Massachusetts Industries," *Industrial Medicine*, October, 1939.

TABLE 1.

MAXIMUM ALLOWABLE CONCENTRATIONS OF VARIOUS TOXIC SUBSTANCES

SOLVENTS	PARTS PER MILLION	GASES	PARTS PER MILLION
Amyl acetate	400	Arsine	1
Aniline	5	Ammonia	100
Benzol	75	Carbon monoxide	100
Butyl acetate	400	Chlorine	1
Carbon bisulfide	15	Formaldehyde	20
Carbon tetrachloride	100	Hydrogen cyanide	20
Dichlorbenzene	75	Hydrochloric acid	10
Dichlorethyl ether	15	Hydrogen fluoride	3
Ether	400	Hydrogen sulfide	20
Ethylene dichloride	100	Nitrogen dioxide	10
Methanol	200	Ozone	1
Monochlorbenzene	75	Phosphine	2
Naphtha, gasoline	1000	Sulfur dioxide	10
Nitrobenzene	5		
Tetrachlorethane	10	METALLIC COMPOUNDS, FUMES— MILLIGRAMS PER CU. METER	
Tetrachlorethylene	200	Cadmium	0.1
Toluol	200	Chlorodiphenyl	1.0
Trichlorethylene	200	Chromic acid	0.1
Turpentine	200	Lead	0.15
Xylol, coal tar naphtha	200	Mercury	0.1
		Pentachlornaphthalene	0.5
		Trichlornaphthalene	5.0
		Zinc oxide fume	15.0

tain aspects of this problem in terms of the engineering principles involved.

Types of Ventilation

Industrial ventilation systems fall into two broad classes: (a) Local exhaust—the method in which the offending dust, fume or vapor is drawn into an exhaust system at its source before it can escape into the surrounding atmosphere; and (b), general ventilation, which might descriptively be termed ventilation-by-dilution, the system in which fresh air is caused to enter the working space, and by mixing with the contaminated air dilutes the contaminant to a lower concentration.

Local Exhaust—Local exhaust systems are of two types, (1) those in which the source of contamination is partially or completely enclosed and the inward velocity of air induced by the exhaust is a force preventing the escape of air-borne substance outward and (2) those in which the source of contamination is not enclosed, usually because of practical difficulties, and one depends for control on an exhaust inlet located a short distance away, creating a current of air of sufficient velocity at the source to direct it without interruption into the exhaust inlet.

Controlling Air Velocity—In both cases a current of air induced by the exhaust system serves to overcome escape tendencies and the magnitude of the velocity required just to overcome such a tendency is the *controlling air velocity*. They vary according to the nature of the process and are dependent in large measure on the degree of agitation of the air at the source of contamination.

Since stray convection currents commonly range from 25-50 ft. per min., controlling air velocities less than 50 ft. per min. will practically never be adequate to capture contaminants completely at their source. Where the nature of a process is such as not to create violent air currents at the source, controlling air velocities are commonly between 50 and 100 ft. per min. and it is frequently possible to estimate, roughly, values that are adequate in these low ranges. Otherwise recourse must be had to mental comparison with other similar processes for which values are known, or to the use of an experimental probing hood. Although controlling velocities are of paramount importance in local exhaust systems, published data are still meagre.

Enclosed Local Exhaust—For enclosed processes the necessary volume of air (cubic feet per minute) is the product of the area of opening in the enclosure, A (in square feet), and the controlling air velocity, V (in feet per minute),

$$Q = AV,$$

a well known relationship. This calculation is applicable to such systems as spray booths, hoods over lead pots, abrasive blasting chambers, etc. (although in the latter example another consideration enters, namely, the necessity for maintaining adequate visibility within the room).

Non-Enclosed Local Exhaust—When the source of contamination is not enclosed and is separated from the exhaust inlet by a short distance, the following formula applies:

$$Q = V(10x^2 + A), \quad \text{(Equation 1)}$$

where Q = cubic feet air per minute,
V = controlling air velocity, feet per minute,
x = distance from source to face of hood (feet), and
A = area of hood opening, square feet.

This is an extremely valuable and practical tool, although its use is not so widespread as it deserves. It will be referred to later but the bulk of this paper will deal with other than local exhaust since the latter has been adequately treated in other publications.

Ventilation by Dilution

This method of ventilation involving, usually, the use of propeller type fans in outside walls is frequently abused largely because the quantitative aspects are rarely considered. Consequently, frequent failure to control a situation has led to blanket statements that this method of ventilation is never adequate where toxic materials are involved. Experience and arithmetic indicate otherwise.

The designer's specifications for a ventilation system of the *dilution type* is summed up by a statement of the cubic feet of air per minute required and location of fans. Occasionally other factors require consideration.

The air capacity required should be calculated on a basis of the quantity of contaminating substance to be diluted and on the concentration to be attained. The principle is an obvious one and is applied in connection with the ventilation of garages and vehicular tunnels where the rate of carbon monoxide discharge is estimated and the air flow computed on the basis of dilution to a definite maximum concentration, usually 100 parts per million. It is, nevertheless, not a commonly applied principle in industrial ventilation.

The factor of air distribution is also of great importance in those cases where a workman is continuously stationed close to the source of contamination. In order for dilution methods to be effective in protecting that worker, the exhaust outlet or air supply must be so located that all the air employed in the ventilation passes through the zone of contamination. This aspect is treated more fully later.

Objectives—It will be apparent from the foregoing that one does not expect to reduce concentrations to zero by this method of ventilation. One must, however, have some desirable fixed objective.

The appropriate objective when dealing with toxic substances should be reduction to concentrations not exceeding the maximum allowable for protection of health and the figures given in Table 1 cover many of the toxic substances commonly found in industrial atmospheres and about whose toxic properties something is known. Obviously the engineer must learn, first, the identity of the vaporous substances to be controlled and then the maximum allowable concentrations. When the prospective purchaser of an exhaust system is himself uncertain on these points, the information must be obtained elsewhere and state or federal industrial hygiene agencies are in a position to furnish it.

Example: The following example illustrates the application of these principles. Suppose a rubber cementing operation contaminates the air of a workroom with benzol vapor by evaporation of that liquid from the cement, and we wish to decide whether general ventilation by propeller fans in windows is a practical method of control. First we must fix our objective. Reference to Table 1 informs us that concentrations of benzol vapor should not exceed 75 p.p.m., and we therefore set a concentration of 50 p.p.m. as an appropriate objective.

The next step is to determine how much solvent vapor is being formed every minute, and this we can readily do by measuring the amount of cement consumed and learning the proportion of benzol contained in it. Let us assume that in our case it is found to be 1 gallon of liquid benzol in 8 hours, or 1 pint per hour. It is easy to compute that this quantity of benzol will produce 4.7 cu. ft. of vapor per hr., or 0.078 c.f.m. Since this must be diluted to 50 p.p.m. (1 part in 20,000 of air), we calculate by simple arithmetic that 1560 c.f.m. would accomplish this result. This we conclude is a reasonable volume of air and, there being no special difficulties of distribution, the method is therefore considered feasible.

This type of calculation will indicate immediately whether ventilation by dilution is practical or not in a given case. If the required air volume is too great, it is apparent that local exhaust of some kind must be relied on at least partially. Note in this case that the quantity of benzol consumed is quite small.

Calculating Amounts of Vapor from Liquid Solvents

The quantity of vapor formed by evaporation of a given amount of liquid solvent is readily calculated by dividing the weight in pounds by the molecular weight of the solvent and multiplying by 400, the latter representing the approximate number of cubic feet of undiluted vapor formed at room temperature, by 1 pound-mol of substance.

Volume of vapor (cubic feet) =

$$\frac{\text{Lbs. liquid solvent} \times 400}{\text{Molecular weight}} \quad \text{.................. (2)}$$

Volume of liquid solvent is converted into pounds by referring to the specific gravity of the solvent. (1 pint of water weighs 1.04 lbs.)

These quantities have been computed for the common toxic solvents listed in Table 1 and are set forth in Table 2 for the reader's convenience:

TABLE 2. VOLUME OF VAPOR AT ROOM TEMPERATURE PRODUCED BY EVAPORATION OF DIFFERENT SOLVENTS.

No.	Solvents	Cubic Feet Vapor Per Pound Solvent	Cubic Feet Vapor Per Pint Solvent
1.	Amyl acetate	3.1	2.8
2.	Aniline	4.3	4.6
3.	Benzol	5.1	4.7
4.	Butyl acetate	3.5	3.2
5.	Carbon bisulfide	5.3	6.9
6.	Carbon tetrachloride	2.6	4.3
7.	Dichlorbenzene	2.6	3.6
8.	Dichlorethyl ether	2.8	3.4
9.	Ether	5.4	4.0
10.	Ethylene dichloride	4.0	5.3
11.	Methanol	12.5	10.4
12.	Monochlorbenzene	3.6	4.1
13.	Naphtha, gasoline	4.0-5.0	3.0-3.8
14.	Nitrobenzene	3.3	4.1
15.	Tetrachlorethane	2.4	4.0
16.	Tetrachlorethylene	2.4	4.1
17.	Toluol	4.4	3.9
18.	Trichlorethylene	3.0	4.9
19.	Turpentine	3.0	2.7
20.	Xylol, coal tar naphtha..	3.8	3.5

Practical Applications

The following practical applications deal with processes that occur commonly in industry and are discussed in some detail as much for the interest of data and conclusions reached as for illustration of the varying methods of analyzing such problems.

A. Wood Heel Covering

Wood heels for women's shoes are commonly covered with sheet celluloid for decorative purposes. Women do this work, sitting side by side at benches, usually in rooms walled off with fireproof partitions. The operation is entirely manual, the only tools being a heel vise, scissors for trimming and a small cement brush. Celluloid covers previously cut to shape are soaked in a solution of methanol (wood alcohol) and water (75% methanol) contained in small covered pans which renders them soft and pliable. A few softened covers are removed as needed and placed dripping with methanol on a cloth pad resting on the bench from which, one at a time, they are taken and applied to the face of the heel. The finished heel is then placed on the bench.

A study of atmospheric conditions in these establishments has revealed that concentrations of methanol vapor in the workroom air range as high as 900 p.p.m. in spite of the fact that all rooms studied were provided with ventilation of a sort in the form of propeller fans in the windows.

General Objectives—A study of the ventilation requirements of such rooms revealed that the following conditions must be met by any exhaust system:

1. Methanol concentrations should not exceed 200 p.p.m. (Table 1).

2. Higher than usual workroom temperature (80F average) must be maintained, due to characteristics of the process; hence, maximum economy must be exercised in quantities of air exhausted.

3. More than usual care must be taken to avoid drafts, because women, lightly clad and engaged in sedentary work, are especially sensitive to them. Moreover, the fireproof rooms are usually constructed of a size only slightly larger than is needed for benches which results in location of doorways, through which supply air enters, close to seated workers.

Determining Significant Stages of Evaporation—It was apparent from careful inspection of the process that methanol might evaporate during any or all of the stages enumerated in Table 3. The proportion of methanol evaporated in each stage was determined by measuring the loss in weight of covers sampled at each step in the process when permitted to dry in the air:

TABLE 3. PROPORTION OF METHANOL EVAPORATING IN DIFFERENT STAGES OF WOOD HEEL COVERING PROCESS.

Description	Grams Alcohol Solution Per 100 Grams Dry Cover Material	Per Cent of Total Alcohol Evaporated
Dripping wet from soaking pan	45.2	
As taken from pad for application to heel	32.2	Up to time of applying to heel.....29
As taken from finished heel	27.7	During manipulation 10
Air dry	None	After heel placed on bench 61

The results showed that most of the evaporation occurs from covers on the bench, before and after manipulation, and that only one-tenth evaporates during actual application with celluloid cover in the workers' hands.

Design of Ventilation System—These results immediately suggest local exhaust applied to each of the two important sources of vapor. Further analysis of the data, however, proves this to be an unnecessary elaboration.

From the observation that each celluloid cover carries about 0.67 grams of methanol and that covers were used at a rate of about 145 per minute, it is determined that 97 grams or 0.213 lbs. of methanol per minute is consumed, which is equivalent to 2.7 cubic feet of methanol vapor per minute (from data of Table 2).

To dilute this quantity to 170 p.p.m. parts of air (allowing a small margin below 200 p.p.m.), there would be required 160 cubic feet of air per minute, per worker.

$$\frac{2.7 \times 1{,}000{,}000}{170} = 160 \text{ c.f.m.}$$

Further scrutiny of the problem indicates, however, that important economies would be realized by providing a weak local exhaust at a single point at each worker's station to withdraw vapors from the freshly finished heels, specifically by exhausting air through a grille in the bench top on which the heels would be placed. The effect of this would be to remove at the point of origin 50% (the data in Table 3 indicate that it might be as high as 61%) of the total vapors formed leaving 50% or 1.35 c.f.m. to be diluted to 170 p.p.m. by the air supply to the room, the same air that in subsequently passing through the bench grille acts to remove the remaining vapors by local exhaust. An air flow of only 80 c.f.m. per worker would be sufficient for this purpose.

Application of Equation 1 for local exhaust inlets informs us that velocities of 40-50 ft. per min. will be induced at the critical distance of 2 inches from the grille with an air flow of 80 c.f.m. (grille area, 1.6 sq. ft.). These velocities will be adequate since the baffling effect of the clustered heels will nullify the effect of stray convection currents in the spaces between them where vapors originate. Thus we are assured that an effective local exhaust action over the grille will be realized with the 80 c.f.m. estimated on the previously described basis.

Test Results on Actual Installation—An exhaust installation built according to the specifications outlined above was made for a wood heel covering room in

TABLE 4. RESULTS OF TESTS FOR VAPOR CONCENTRATIONS (METHANOL) IN A WOOD HEEL COVERING ROOM, COMPARING DESIGN FIGURES WITH ACTUAL RESULTS AFTER INSTALLATION OF EXHAUST SYSTEM.

	Conditions Prior To Adequate Installation	Design Figures	Test Results After Installation
No. of workers	104	104	104
Concentrations of methanol in working atmosphere	800 p.p.m.	170 p.p.m.	145 p.p.m.
Air flow each station average	?	80 c.f.m.	90 c.f.m.
Proportion total vapors removed by local exhaust	—	50%	52%
Concentrations of methanol in duct	—	—	300* p.p.m.
Average production methanol vapor, 104 workers	—	2.70 c.f.m.	2.44* c.f.m.

*In duct from 58 work stations (104 in entire room)
Average air flow in this leg, 78 c.f.m. per station

$$78 \times \frac{300}{1{,}000{,}000} \times 104 = 2.44 \text{ c.f.m. vapor}$$

which 104 women work. Air analyses before and after installation enabled checking computed results with actual results and demonstrate that preliminary careful consideration of the factors discussed can result in accurate design. Comparative figures are given in Table 4.

This method of ventilation (see Fig. 1) effected the desired result with a total air flow of only 9000 c.f.m., whereas at least double that quantity would have been required by simple dilution-ventilation. In the latter case, heating requirements would have been impossible to meet without additional equipment, not to mention greater cost of fuel. As a matter of fact, the workroom was warmer during the winter season with this system in operation than it had ever been with the system of propeller fans located in windows halfway up to the ceiling and exhausting smaller quantities of air. This is a result of withdrawing air nearer the floor (bench tops were about 30 inches high) where air is naturally cooler.

Electric Heat for Boston's New Concertorium

Electricity is used to heat the group of chambers beneath the great platform of the new Concertorium or open air concert shell on the Charles River Esplanade, recently completed for concerts given by the Boston Symphony Orchestra and other noted Boston musical organizations.

Beneath the platform of the shell, which can accommodate 250 musicians with their instruments, large choral groups and a $22,000 organ, is a series of rooms. These include two conductors' rooms, dressing rooms with showers, a rehearsal room, instrument room, storage and shop rooms, control room, public toilets, men's and ladies' lounges.

Electric Blast Heaters

Two 30 kw. blast heaters deliver through filters, under pressure of a blower, hot air for the various rooms. There are also fifteen wall heaters all thermostatically controlled, ranging from 1,000 to 3,000 watts each for supplementary heating. Two 40-gallon electrically-heated water tanks furnish hot water for the showers and lavatories.

Outside air is drawn through filters at about ground level and fed through the ducts, the corridors receiving heat from grilles on the upper walls of the rooms. Exhaust air is discharged into the corridors through grilles at floor levels and drawn by exhaust fans up through an invisible stack to be discharged at the center of the concertorium roof. The intake fan has a capacity of 3500 c.f.m., but only about 2300 c.f.m. are used. There is no recirculation, and no humidification. Air from the toilets is discharged separately to the outside, turning on of the light in the room starting up the motor of the discharge fan.

Insulation

One of the rehearsal rooms beneath the center of the great stage is a foot below the water level of the nearby Charles River, but the river water pressure is kept out by a one-inch waterproof lining. Walls, ceilings and floors of all the rooms and corridors have a cork insulation which takes care of sudden temperature changes of the walls, which are faced with a highly polished terrazzo. Floors are also of this material.

In the showers thermostats located behind the hot water supply automatically shut it off when it reaches the highest safe temperature. Airtight doors are of the silent closing type. The heating system not only provides comfort for all the musicians but also protects the many instruments that are stored in the building.

This Concertorium is the only one of its kind in the world and contains many structural and other features never before used in any of the few music shells in existence. Designed by Richard Shaw and known as the Edward Hatch Memorial, it cost some $277,000 and was built from a fund left by the late Maria E. Hatch of Boston, replacing two former unsatisfactory temporary structures used for similar outdoor concerts.

It is located on the Storrow Embankment of the Charles River Esplanade, or parkway, and faces a grass plot that can accommodate 60,000 listeners. In fact more than one concert has had an audience of 40,000, all within excellent hearing distance of the music. This grass plot will eventually become a great amphitheatre with benches.

The shell weighs a total of 400,000 tons. Its exterior is of 75% granite and 25% smoky quartz and it is believed that this is the first time this latter stone has been used to any extent in building. It was found by experiment that it is very sound absorbent, so that when people walked on the terrace surrounding the shell their footsteps could not be heard.

Teakwood, set in rings in a herringbone design, lines the interior of the dome of the shell down its sides, in ten rings, circled by a bronze rim. This wood was covered with a special stain that contains phosphorus, so that when the shell is lighted up inside the dome sparkles like a setting of diamonds. The reflecting rings that hide the lighting fixtures were given an acid bath that makes them stand out in a soft gray. Dimensions of the shell interior are 80 feet width by 34 feet depth and 45 feet height.

Engineering of the heating and ventilating was done by Joseph Higgins. Engineer for the architect was Walter Roach. Thomas O'Connor Company was general contractor. Heating and lighting equipment and layout was engineered by P. N. Rugg of the Boston Edison Company. Wolverine Equipment Company supplied and installed the electric heating units.

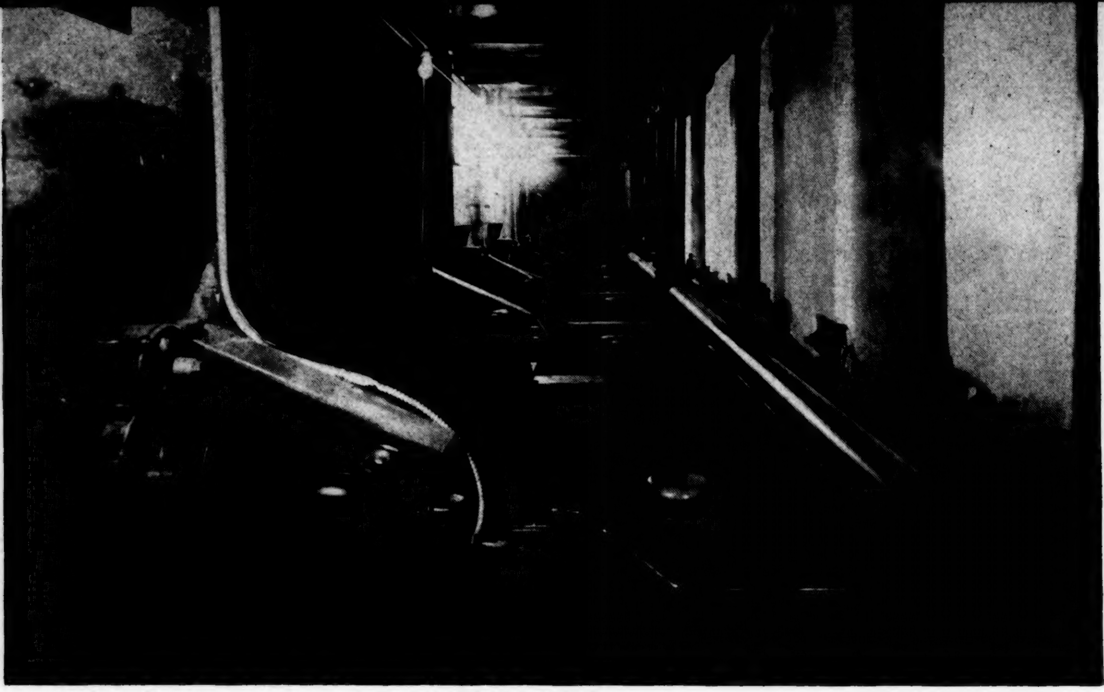


Fig. 1. Aisle behind the boilers showing the coal bin and stoker driving mechanism at the left and the rear of the boilers at the right.

Flexible Heat, Lowered Fuel Costs Result from Stoker Installation

By T. A. MARSH†

The author describes a 5 unit boiler-stoker heating plant installed by Cincinnati Street Railway, with $3500 per year savings in fuel and labor, additional space made available, and more satisfactory heating conditions resulting.

THE outstanding feature of the boiler room herein described is the combination of stoker and coal handling equipment.

While large boiler plants have much latitude in the selection of and investment in coal handling equipment, the reverse is the case in plants burning less than 5000 tons of coal per year. It is always a problem of where it is justifiable to abandon the wheelbarrow method and utilize mechanical coal handling equipment. Manual handling of coal costs approximately 25 cents per ton, is dirty, and detracts from best operation. Smaller plants, however, have not been justified in the investment for coal handling equipment. Many schemes have been improvised for coal handling in small plants, but the problem heretofore has not had a sound solution.

The Avondale Garage and Car House of the Cincinnati Street Railway at Reading Road and McMillan Streets, has found a solution to this problem. This plant covers an area of over two acres of ground. The buildings are of brick construction 200 ft. by 460 ft., one story high, and at times house 65 street cars, and 100 motor coaches.

Due to the large number of doors of a size to admit street cars and motor coaches, it is necessary to have an unusually large amount of heating capacity to keep the space comfortable for workmen. The heat loss of the building is 7,500,000 B.t.u. per hour at 0F. The building is on the site of an obsolete power plant of the Cincinnati Street Railway Company. This original building was converted into the principal motor coach garage. The heating plant in service until this present one was installed, consisted of one 250 hp. water-tube boiler left from the old power plant. This boiler was fired by a stoker of a design of many years ago. This single boiler was unsuitable to the load, necessitating extreme underrating operation in the spring and fall and heavy overloads during December. Both these points of operation were wasteful of fuel. In addition, the arrangement of coal handling and ash disposal entailed an undue amount of labor and the boiler required continuous attention during the heating season.

In 1939 it was decided to put in a new heating plant, because of obsolescence of the old unit and also because of high fuel and labor costs. The objectives were reduction of heating costs without sacrificing space used for motor storage. This indicated that the boiler room would be below floor level.

The equipment selected was five fifteen-pound pressure 29-hp. steel boilers as shown in Fig. 2. These boilers were set in line. At the rear of the boilers and parallel to the line of fronts a coal bunker was installed, receiving its coal through manholes in the street. Chain drive stokers were installed from the rear of the boilers. By means of extended worms, which are integral parts of the stokers, the coal is conveyed directly from the coal bunker to the stoker retorts within the fireboxes

†Central Division Engineer, Iron Fireman Mfg. Co., Cleveland.

of the boilers, Fig. 3. The entire driving mechanism, motor, forced draft fans, and combustion regulators are set in a well lighted accessible space between the rear of the boilers and the coal bunker wall, Fig. 1.

The net effect of this boiler room is cleanliness and free accessibility to the front fire doors for fire cleaning with no interference of stoker mechanism whatever.

The stoker regulation consists of a pressure regulator, relay, five low-water cutoffs, and five linestarters. The stokers are operated from steam pressure with the one pressure regulator controlling any one, any combination, or all five stokers.

A low-water cutoff is installed on each boiler, and is so wired that in case of low water it will stop only its individual stoker without affecting any one of the other four.

The job is wired for the use of line-voltage aquastats to maintain constant water temperature in the boilers. When these aquastats are installed, at some future date for service hot water, each aquastat will control its individual stoker without affecting any of the other stokers, regardless of how many are in operation at the time. Each stoker is provided with an automatic air volume regulator on the discharge duct of the forced air fan. These devices are integral parts of the stokers and maintain a correct air to fuel ratio. The number of units gives flexibility and permits the operation of individual units at best efficiency by using more or less units in service as required by load demands. Three boilers are used during temperatures of 20 to 30F. During zero weather four boilers are used, thus providing one reserve boiler.

The job is wired to receive an outside temperature control, although this has not as yet been installed. This control would act as thermostat without affecting any of the control functions mentioned above.

The steam outlet from each boiler is 6 in. in diameter connecting to a main header 10 in. in diameter. An unusually simple and clean cut system of piping is installed. The entire piping system is coded in colors as follows: Steam lines, maroon; return lines, brown; water lines, blue; and electric lines, aluminum.

Typical sets of observations of operating conditions with three boilers in service are shown in the accompanying table.

Fig. 2. The five 29 hp. Fitzgibbons steel boilers installed in the plant of the Cincinnati Street Railways. Each boiler has a McDonnell & Miller low-water cut-off.

Features of and results obtained by this modern design of heating plant are:

Automatic coal handling equipment, incorporated in stoker design, required no separate investment.

Satisfactory heating of the entire building.

A reduction in fuel and labor cost of $3500 per year. The saving actually obtained during the operating season of 1939-40 was 16% in excess of the estimated saving in spite of an unusually severe winter as regards number of degree days.

Provision of added storage space for 11 additional motor coaches by locating the boiler room below the grade level.

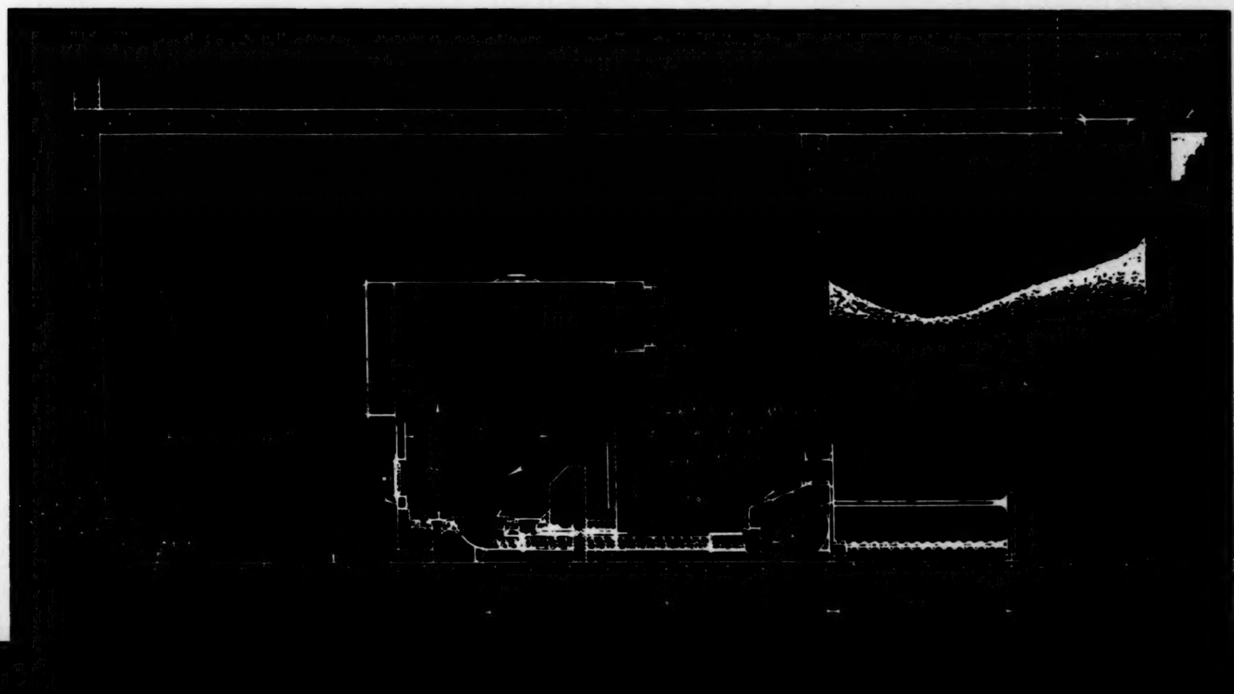
The entire design of boiler room, selection of equipment and plant layout were made and carried out under the direction of J. A. Noertker of the Cincinnati Street Railway Co.

OPERATING DATA ON BOILERS

Observation	Boiler Number		
	1a	2b	3
Overfire Draft, In. Water	0.12	0.09	0.11
CO_2, Per Cent	13.3	14.03	13.8
Stack Temp., F.	358	387	387
Coal Speed	3	3	3
Efficiency, Per Cent c	—	83.4	83.3

a Average of six readings.
b Average of three readings.
c Calculated by heat balance method.

Fig. 3. Side elevation of one of the five boiler-stoker installations. The Iron Fireman stokers are installed from the rear of the boilers.



Current Problems in Wall Condensation

By L. V. TEESDALE†

Studies of condensation in walls are reported in this article, abstracted from a paper presented at the Centennial Meeting of the National Mineral Wool Association last spring.

WE at the Forest Products Laboratory are concerned principally with the prevention of condensation that may occur within walls or in attic spaces, where the presence of moisture may lead to many undesirable after-effects. Such after-effects not only increase maintenance costs but may also shorten the life of the structure. Because of the numerous combinations of materials that may be used for wall constructions and for numerous other worthwhile reasons, we have found it expedient to apply our study principally to walls rather than attics. With few exceptions, information gained from walls can be applied to attics and roofs.

This method used in studying the condensation problem at the Laboratory involves two types of exposure: one is the steady state, the other is the variable state. Under steady state conditions wall panels are erected in openings between two rooms. One of the rooms is maintained at a fixed temperature and humidity, such as commonly used in homes, and the other is cooled by refrigeration and held at some lower temperature, usually 20F below zero. Conditions measured under steady state are: heat loss through wall, total vapor loss through wall, and moisture content pick up in the panel both during and after test. The moisture entering the panel is generally considerably in excess of the amount of moisture gain and the difference indicates the amount of moisture passing through the panel. Two panels can be tested at one time. The tests run for about 40 days and may be run at any time during the year.

The variable state studies are conducted in a special frame house having all walls exposed to normal outdoor weather changes but protected from exposure to the sun. Inside temperatures and humidities are automatically controlled at 73F and a relative humidity of 40%. Test panels are built in the exterior walls. Means are provided for removing a section of sheathing for current weighings to determine the moisture content and to observe any moisture accumulation within the stud space or on the insulation, sheathing paper, or siding. Conditions measured under variable state are: temperature gradient through the wall, moisture content of sheathing, rate of accumulation during cold weather, and redrying during following spring and summer. Observations are made on cold snaps and warm periods as they occur, conditions that may cause water seepage from under siding and also conditions that might contribute to subsequent paint failures attributed to moisture.

Since this building is subject to actual weather conditions the results obtained during a mild winter will not be the same as those obtained during a severe winter with numerous periods of very cold weather. The past winter has been ideal for the variable state study because of its combinations of fairly steady temperatures for days at a time combined with rather wide fluctuations both high and low. These fluctuations lasted for sufficient time to exert an influence upon the test panels which could be measured. There are 32 panels in the test house representing different combinations of insulation, various types of vapor barriers, some good, some poor, and some panels without vapor barriers. Before the beginning of the heating season the sheathing samples were placed in a constant humidity room and brought to a common moisture content slightly lower than the summer equilibrium moisture content of the sheathing in the test house. They were replaced in the test house at the beginning of the heating season and weekly tests made to record the change in moisture content.

In all panels there was a gradual pick up in moisture content, very slow in those having barriers and slightly faster in those having no barrier. In panels having no barrier the pick up was, in general, proportional to the difference in temperature, inside and out. Starting when the outside temperature averaged about 40F the maximum moisture content reached was a little greater than 60% about the first of April. The most rapid pick up occurred about the middle of January when the average temperature for a week was 2F above zero. After the first of April the average temperature outside rose high enough to prevent further accumulation and the sheathing started to redry. However, it will be several weeks before this sheathing will have dried to 20%, a moisture content below which decay does not progress.

The panels protected with the more effective type of barriers also showed a gain in moisture content when the outside temperature was about 40F and these panels continued to pick up moisture slowly until about January 1 by which time the sheathing had reached a moisture content of about 11 to 12%, in some cases nearly 15%. The rate of pick up had very little bearing upon the outside temperature as long as the average was below 35F. January was a rather cold month with an average temperature of 11F and had two subzero cold snaps. The moisture content of the protected material remained almost stable during January and part of February but later in February during less severe weather picked up slightly, enough to raise the average moisture content about 1% above that of January 1. This same tendency towards stabilizing of moisture content was reflected in the test panels having less effective barriers. For example, barriers of low resistance allowed the sheathing to pick up to a moisture content approaching 30% or more before it appeared to stabilize. However, each fluctuation in temperature caused a fluctuation in moisture content. Ac-

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tual stabilization would mean that the moisture passing out of a wall is equal to that entering from the warm side. The point of stabilization is directly affected by the resistance to vapor movement offered by the materials used on the exterior of the building as well as that on the inside. Our studies have only included wood siding and we would expect that brick veneer, stone veneer, and stucco would change the point of stabilization somewhat. Some other types of wall coverings appear to have a very high resistance to vapor movement. Roofing materials generally have very high resistance and consequently roof spaces and attics will usually require ventilation in addition to vapor barriers to carry away such vapor as actually passes the barrier.

Our tests show that in walls having open stud spaces there will be a higher moisture content at the bottom of the panel than at the top. This is expected since the circulation in the space would be upward on the warm side and downward on the cold side. At the inner face of the sheathing the highest temperature and lowest humidity occur at the top of the wall and the lowest temperature and highest humidity at the bottom of the wall. In walls having fill insulation, however, we find that the highest moisture content occurs consistently at the top of the wall. No satisfactory theory can now be offered to explain the cause but it is quite possible that the differences in temperatures between the top and bottom of the wall play some part in creating the conditions that cause these moisture differences.

In steady state studies in which sub-zero temperatures are generally used ice forms on the inner face of the sheathing in unprotected panels. The moisture pick up in the sheathing during the period of test is comparatively small. In variable state studies similar types of panels will also collect ice during severe weather but after a few days at very low temperatures the weather moderates, the ice melts and soaks into the sheathing. Moreover the sheathing continues to increase in moisture content during any period when the temperature of the sheathing is a few degrees below the dew point temperature of the room. Of course there is a maximum moisture content that the sheathing will reach. Also as the moisture content increases the pressure head between sheathing and outside increases and consequently the flow outward increases. Hence the rate of pick up decreases as the moisture content increases until eventually the outleakage will equal the inflow. This same condition applies to the protected panels where the maximum moisture content reached is generally inversely proportional to the resistance of the vapor barrier. With the good barriers the sheathing attained a moisture content of from 12 to 15%. With the less effective barriers it attained about 30%, and unprotected sheathing in some cases exceeded 60% and was still increasing as late as April 1. Apparently such panels had not reached a condition of stabilization.

Two methods of ventilation have been tried but the results were disappointing. In one method the walls were filled with blown insulation by a commercial applicator. The holes through the sheathing paper and sheathing were left open when the siding was replaced. Apparently these openings would not let enough vapor pass outward since the moisture content of the sheathing picked up to over 30%. Some panels had 1- by 2-inch furring strips over the sheathing with siding over the furring strips. The furred space was open top and bottom for ventilation. During moderate weather the sheathing did not pick up appreciably in moisture content but during cold snaps vapor passed through the wall into the ventilating space faster than it could be carried away. Consequently it gathered in the space as frost and ice, gradually closing the space and stopping all ventilation. When the weather moderated the ice melted and ran out from under the siding. Of all the methods used, vapor barriers on the warm side of the wall seem to offer the most promise in protecting walls against condensation problems and effective barriers properly installed appear to keep the moisture accumulation within safe limits under all ordinary exposure conditions.

Grumman Aircraft Erecting "Black-Out" Plant

A two million dollar windowless aircraft plant is now being erected at Bethpage, L. I., by The Austin Company, engineers and builders, for the Grummau Aircraft Engineering Corporation. The building is being constructed without windows to make it invisible from the air at night and will be finished on the exterior with non-reflecting materials to make it adaptable to camouflage for daytime concealment.

The factory, involving nearly a half million square feet of floor space and designed for the manufacture of fighting naval aircraft on a mass production basis, is scheduled for completion in 121 working days.

While the plant was designed without windows to make it invisible at night, this type of construction also makes possible improved working conditions and greater efficiency for twenty-four hour operation during the fulfillment of national defense contracts. The air conditions in the plant can be controlled more easily since the large glass areas and considerable air infiltration through windows is eliminated.

Three thousand tons of structural steel will be required for the plant which will have a heavily insulated roof, a wood block floor, and outside walls of selected red brick faced on the inside with acoustic block. The building is being elected on a 53-acre farm recently acquired by Grumman directly adjacent to its present site at Bethpage. The company's total acreage is now about 180 acres and includes a landing field. The new plant is expected to employ approximately 4000 persons and a parking area with a space for 2000 cars is to be provided.

A sound recording system with loud speakers in all parts of the plant and parking areas will be utilized for fire alarm signals, intra-plant communication and paging. At lunch time the system will carry musical recordings.

How to Determine Size and Cost of Freon Lines

By WILLIAM PARKERSON

Six charts designed to make possible the quick and easy selection of the proper size freon refrigerant lines for air conditioning systems are presented in this article. The charts also give information on refrigerant velocities and cost of lines. These charts are based on data and formulas derived in the first part of this article which appeared in last month's issue.

FROM the evaporator coil to the compressor, there is a drop in pressure along the suction line, due to kinetic friction. From the compressor to the condenser, there is a drop in pressure along the hot-gas line. From the condenser to the evaporator, there is a drop in pressure along the liquid line. These pressure drops may, for convenience, be represented by saturated-vapor temperature-equivalents. This liberty is exercised herein. Now, in designing refrigerant lines, the engineer must select a conservative pressure drop (or a conservative saturated-vapor temperature-equivalent) to be used along the line being designed. For the purpose of constructing the families of curves herein, 2F has been selected as conservative. This is equivalent to a pressure drop along the hot-gas and liquid lines of 3.8 lb. per sq. in. and along the suction line, 1.8 lb. per sq. in.

Now, if we return to equation (21) and substitute t = 2 we have

$$T = \sqrt[1.8]{\frac{2}{XZL}} \qquad (22)$$

Obviously, other things being equal, the capacity of a line will increase as "L" decreases. Thus, the capacity of a line will continue to increase until nothing is left of the line but the elbows therein. In other words, until "L" becomes equal to "L_e" in the equation, $L = L_m + L_e$.

Therefore,

$$T_{max.} = \sqrt[1.8]{\frac{2}{XZL_e}} \qquad (23)$$

In this discussion, we have agreed to use six elbows per line, making

$$L_e = 6 \times 30d \div 12 = 15d$$

and

$$T_{max.} = \sqrt[1.8]{\frac{2}{XZ15d}} \qquad (24)$$

Maximum capacities for various line sizes and operating conditions, calculated from equation, (24), have been plotted on the several curve sheets, Figs. 1 to 6, as Locus of Maximum Capacities. These values hold for lines having *six elbows* only and would not be correct for lines having either more or less than six.

All of the arguments thus far presented and all of the curves developed herein, are based on a simple refrigerant piping system consisting of a single line between each two of the units and a single pair of connections at the compressor, at the condenser, and at the evaporator.

However, as often as not, one or more of the main refrigerant lines break down into two or more branches at the connections to the units. For the convenience of the designing engineer, Table IX has been prepared. The values given therein may be verified on the curves as follows:

A 3⅛ in. O.D. suction line of 71 ft. equivalent length is good for 60 tons of refrigeration, according to curve Fig. 2. Subtracting the allowance of 44 ft. for elbows leaves a length of straight pipe of 27 ft. If the line splits into two branches each carrying 30 tons, the indicated line size for 27 ft. of straight pipe is 2⅝ in. and this selection is confirmed when we add to the 27 ft. the allowance of 37 ft. for elbows, making a total equivalent length of 64 ft. Likewise, if the main line splits into three branches each carrying 20 tons, the line size of each branch should be 2⅛ in. O.D.

Whenever the expansion valve in any refrigeration system is elevated above the receiver, it is necessary to sub-cool the liquid refrigerant below its saturated-vapor temperature in order to prevent the creation of flash gas in the liquid line and the consequent troublesome decrease in the expansion valve capacity. The amount of sub-cooling necessary to accomplish this purpose is 3F for each 10 ft. of expansion-valve elevation. Thus, if the expansion is to be elevated 40 ft. above the receiver, the liquid refrigerant must be sub-cooled 12F before it starts on its upward journey. Otherwise, flash-gas difficulties will surely develop at the expansion valve.

Refrigerant Velocities

Velocity is a vital factor in the design of refrigerant lines, though few of the tables, charts, or curves in present use give the engineer any idea of the velocities toward which his line design is tending. Velocity reaches its peak of importance in the design of a line in which a refrigerant vapor is traveling vertically upward. For here the velocity of the vapor must be sufficient to sweep upwardly, against the force of grav-

TABLE IX.—EQUIVALENT LINE SIZES FOR MULTIPLE LINES OR CONNECTIONS, IN.

1 Line	⅝	⅞	1⅛	1⅜	1⅝	2⅛	2⅝	3⅛	3⅝	4⅛	5⅛
2 Lines....	⅝	⅞	⅞	1⅛	1⅜	1⅝	2⅛	2⅝	3⅛	3⅛	4⅛
3 Lines....	⅝	⅝	⅞	⅞	1⅛	1⅜	2⅛	2⅛	2⅝	2⅝	3⅝

NOTE: In the first part of this article the viscosity in centipoises should have been indicated by n rather than by z in the table of symbols. Z, in turn, should have been defined in the table as "See Tables IV, V, VI." Other changes are n in place of π in Tables IV, V, and VI and in Table VII the last column should be headed $30\ d/_{12}$.

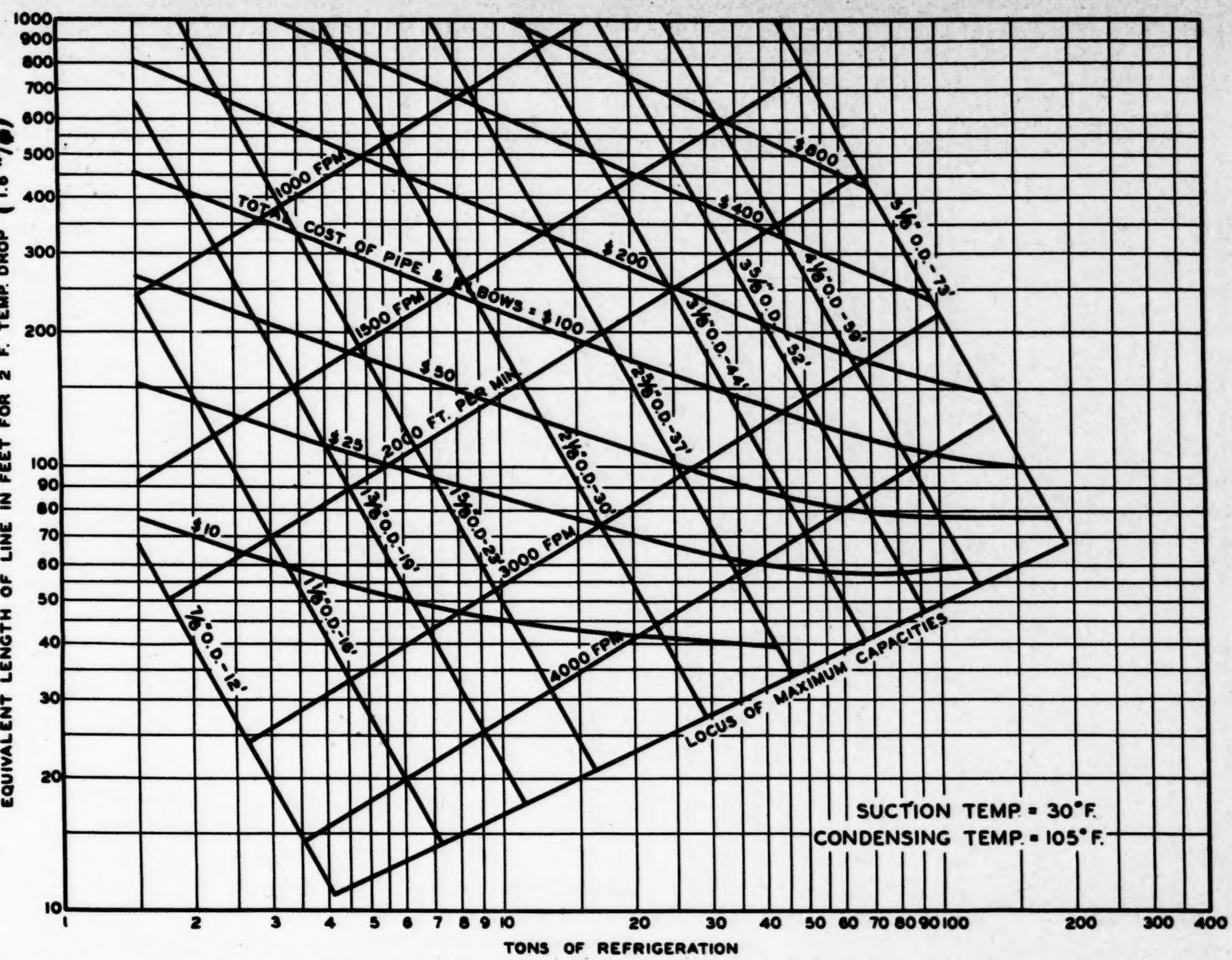


Fig. 1. Suction line design curve for freon. The 2F temperature drop is a saturated temperature equivalent of the pressure drop. The equivalent length equals the length of the straight pipe plus six elbows.

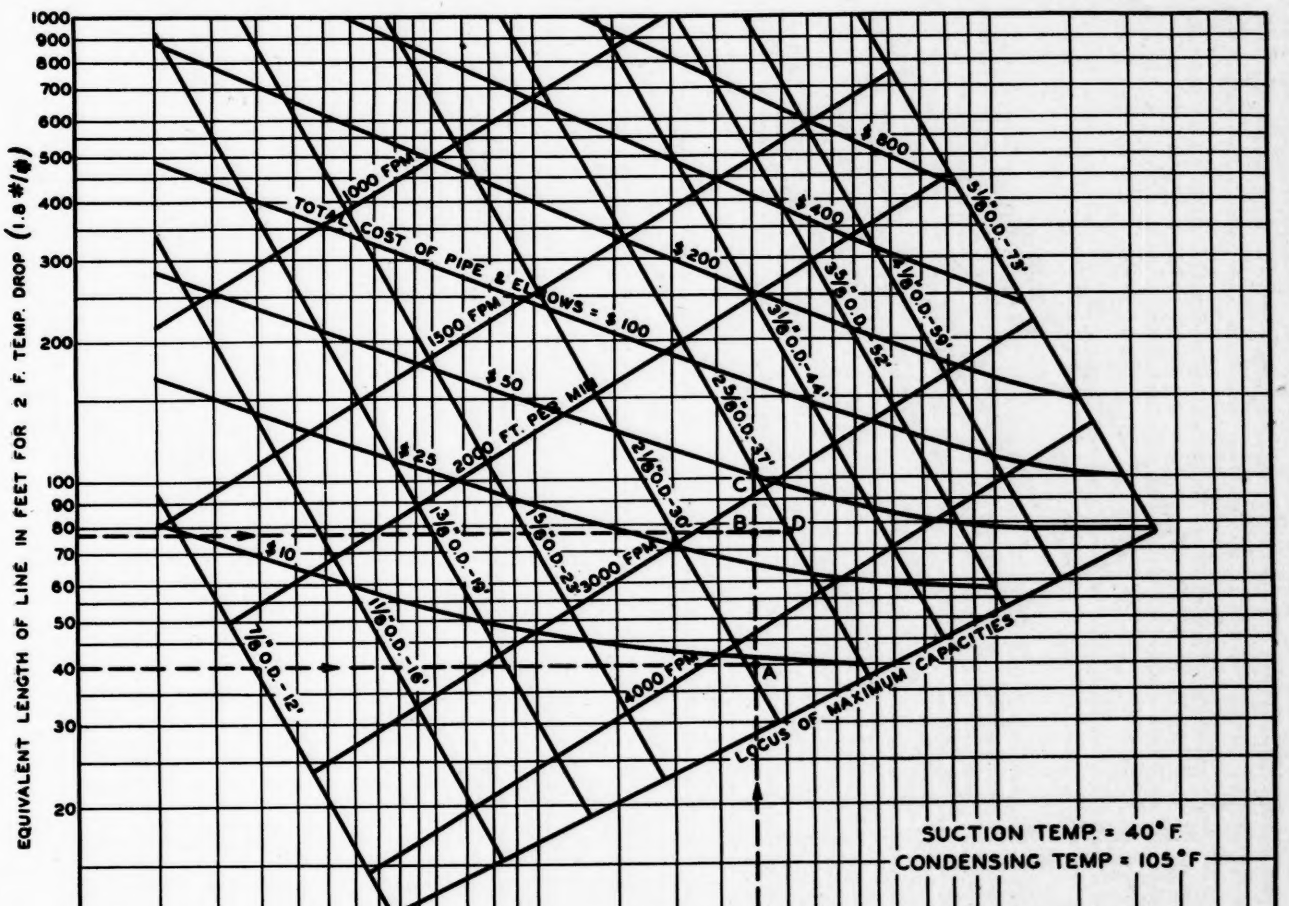


Fig. 2. Suction line design curve for freon. Typical problem: suction temperature at evaporator 40F, suction temperature at compressor 38F, tons of refrigeration 30, length of straight pipe 40 ft. Solution: At point "A" indicated line size = 2⅝ in. O.D. Add for six elbows, 37 ft. Equivalent length of line = 40 + 37 = 77 ft. At point "B" line size = 2⅝ in. O.D. At point "C" gas velocity = 2850 f.p.m. At point "D" cost of pipe and elbows = $34.

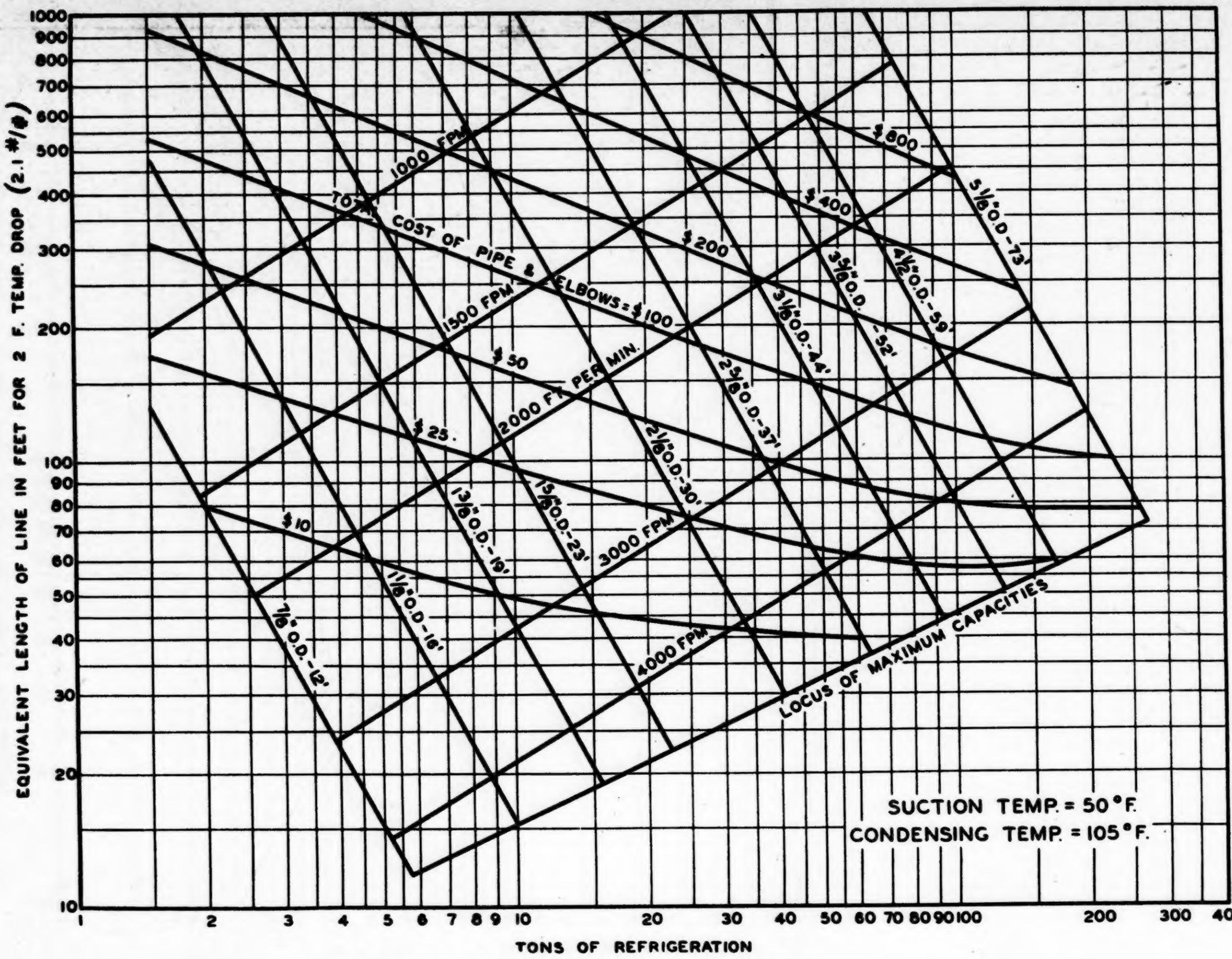


Fig. 3. Suction line design curve for freon.

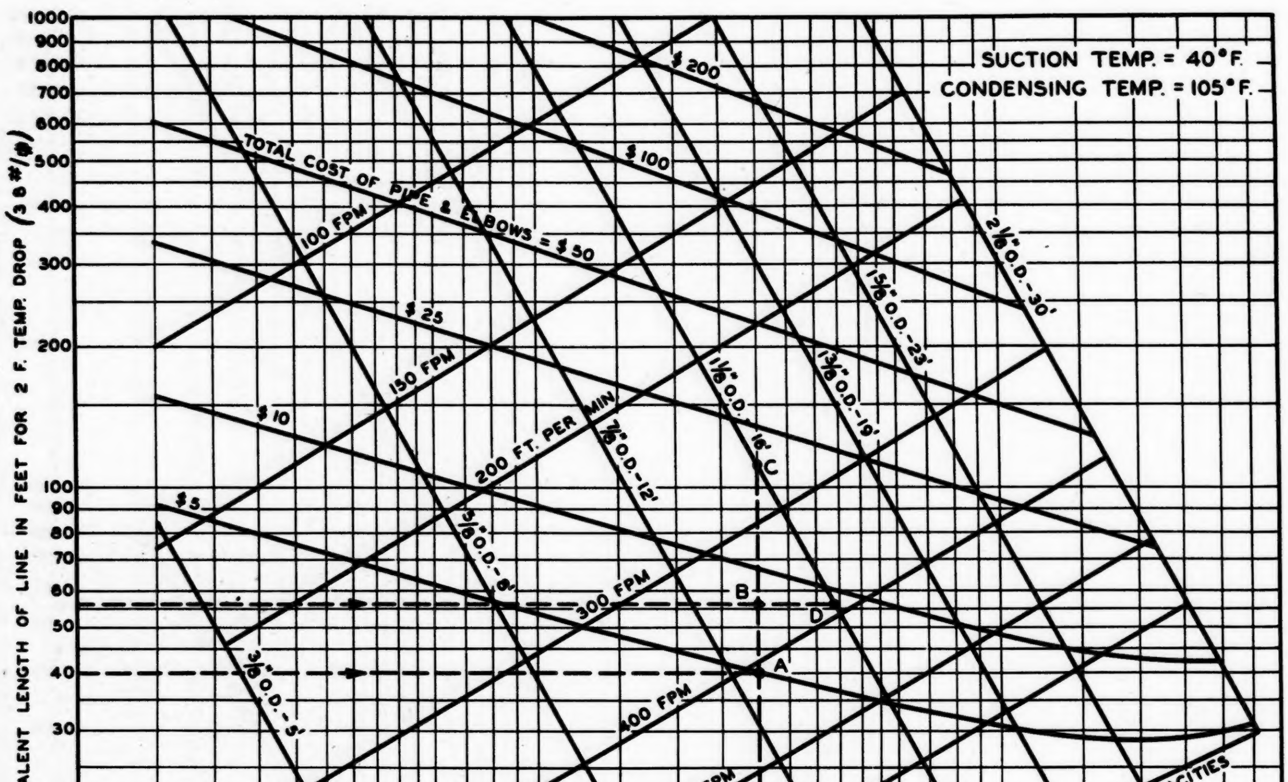


Fig. 4. Liquid line design curve for freon. Problem: liquid temperature at condenser 105F, liquid temperature at exp.-valve 103F, tons of refrigeration 30, length of straight pipe = 40 ft. Solution: At point "A" indicated line size = 1⅛ in. O.D. Add for six elbows 16 ft. Equivalent length of line = 40 + 16 = 56 ft. At point "B" line size = 1⅛ in. O.D. At point "C" liquid velocity = 270 f.p.m. At point "D" cost of pipe and elbows = $9.

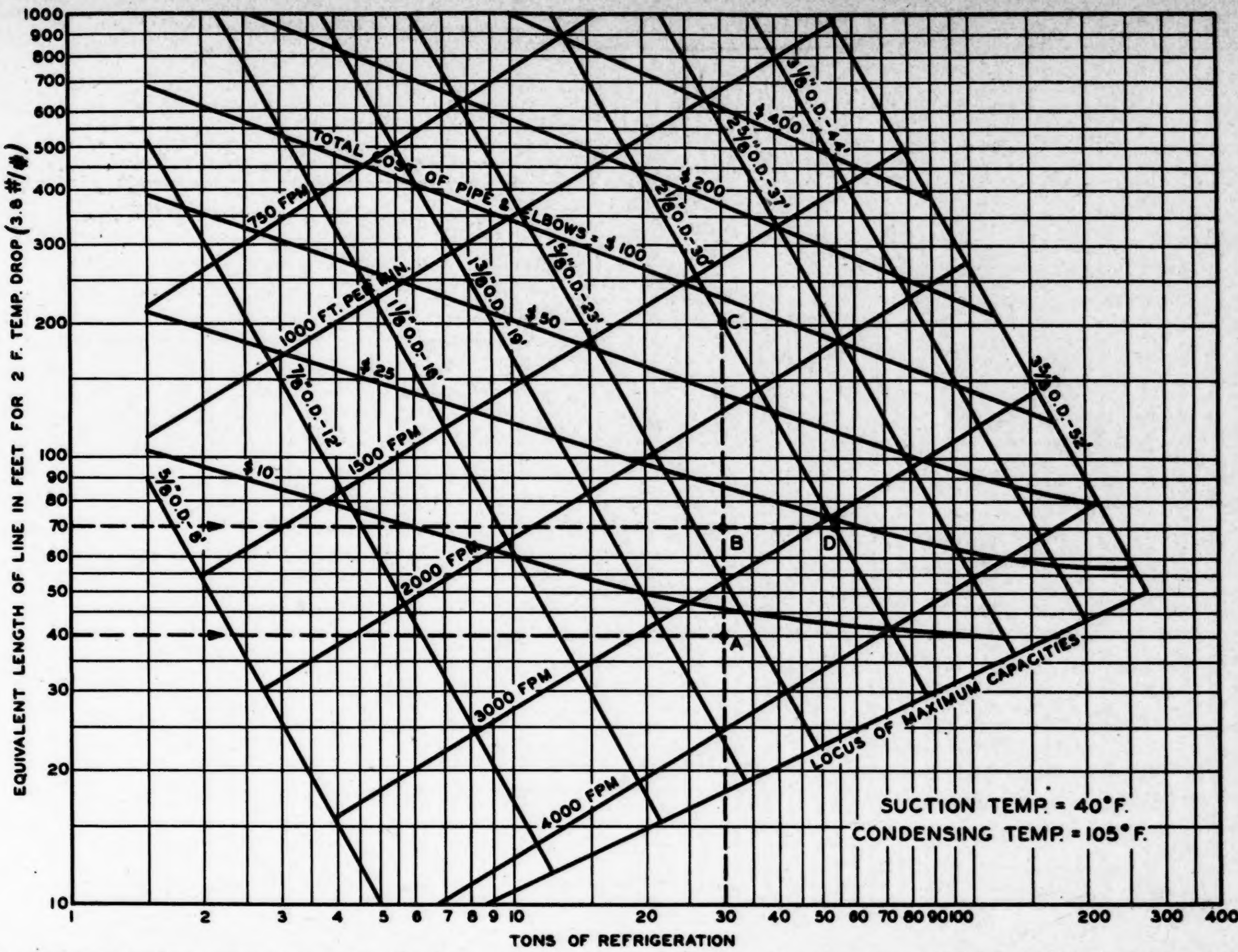


Fig. 5. Hot gas design curve for freon. Problem: discharge temperature at compressor 107F, conditioning temperature at condenser 105F, tons of refrigeration 30. Length of straight pipe 40 ft. Solution: At point "A" indicated line size = 1⅝ in. O.D. Add for six elbows 30 ft. Equivalent length of line = 40 + 30 = 70 ft. At point "B" line size = 2⅛ in. O.D. At point "C" gas velocity = 1650 f.p.m. At point "D" cost of pipe and elbows = $23.

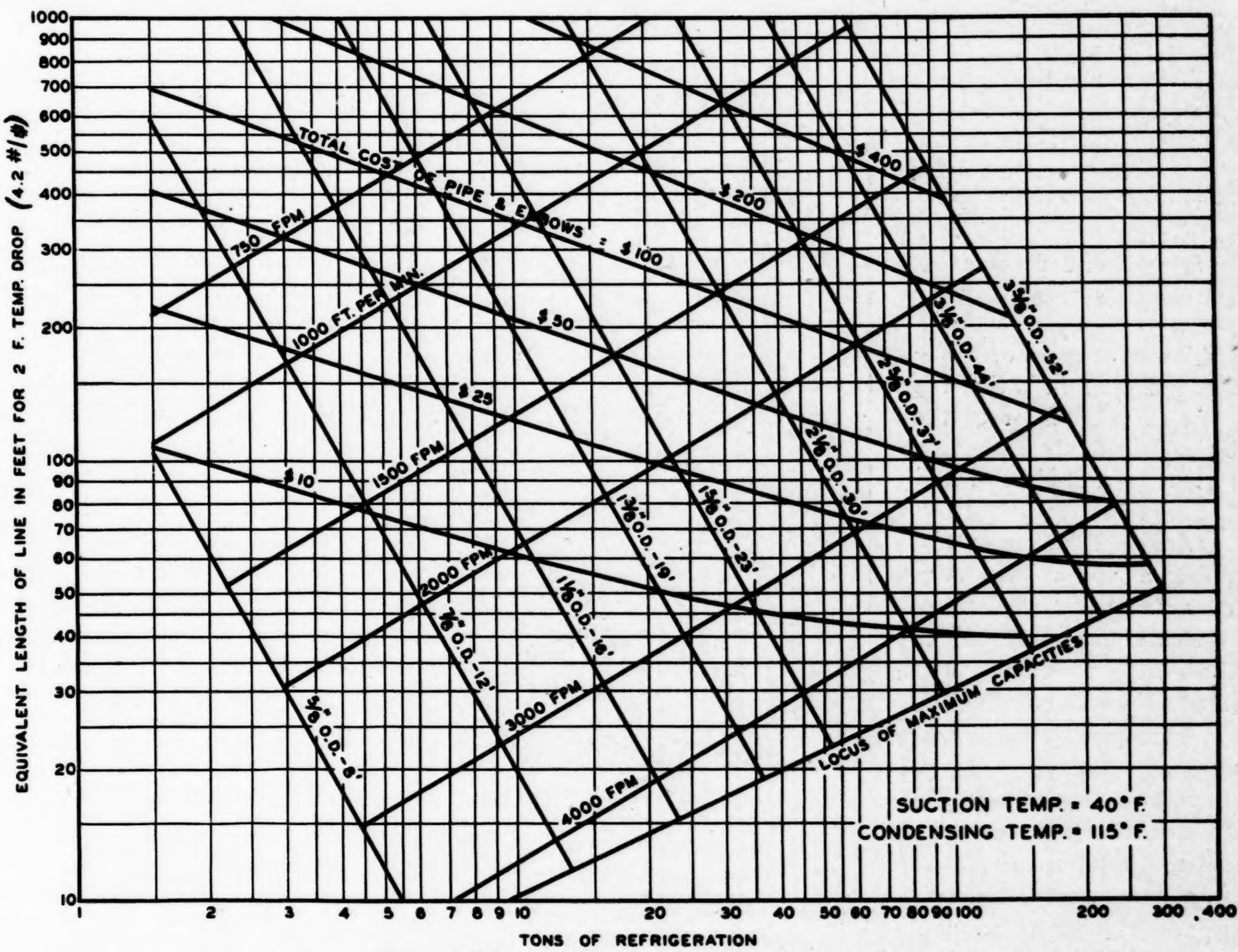


Fig. 6. Hot gas line design curve for freon.

ity, the droplets of entrained oil. Otherwise, the oil will gravitate against the slow-moving vapor and ultimately cause serious oil-lodgment trouble. The minimum safe velocity for an up-moving vapor is in the neighborhood of 1000 f.p.m., though no definite limitation is believed to have been established. Perhaps this is a subject worthy of further research! In any event, velocity information must surely be presented on any *complete* set of curves for refrigerant line design.

Now $S = V \times M \div A$ and substituting equation (5), we have,

$$S = \frac{200TV}{HA} \quad \text{.......................... (25)}$$

Using equation (25), values of "V" taken from Tables IV, V, and VI, values of "A" taken from Table II, and values of "H" from Table III, equivelocity lines may be drawn across the families of curves (Figs. 1 to 6) already developed. Thus, inverting equation (25),

$$T = \frac{HAS}{200V}$$

and assuming a velocity of 2000 f.p.m., we have, for the conditions of Fig. 2,

	H	A	V
	TABLE III	TABLE II	TABLE IV
1⅛ in. O.D.	50.31	.0057	.792
4⅛ in. O.D.	50.31	.0830	.792

from which,

$$1\tfrac{1}{8} \text{ in. O.D. pipe } T = \frac{50.31 \times 0.0057 \times 2000}{200 \times 0.792} = 3.62$$

$$4\tfrac{1}{8} \text{ in. O.D. pipe } T = \frac{50.31 \times 0.0830 \times 2000}{200 \times 0.792} = 52.7$$

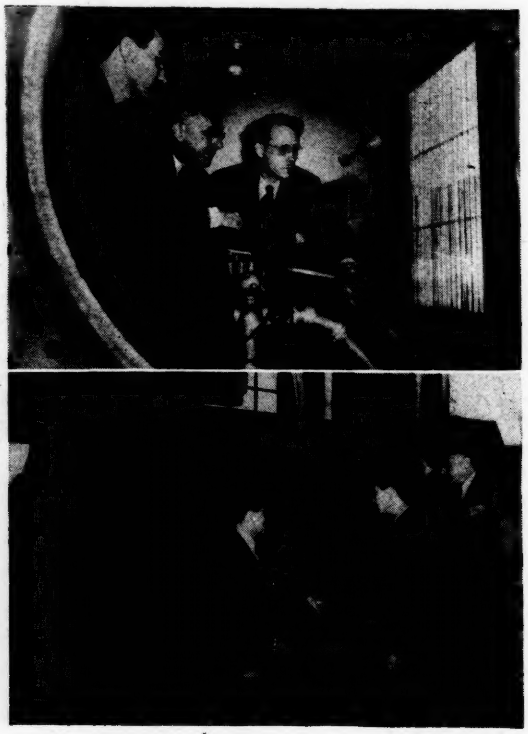
Both of these points may be located on the curve in Fig. 2.

(Next month the author will present information on how the cost of material lines was determined and show how the charts are applied to practical problems.)

Test Chamber Simulates Stratosphere Air Conditions

Airplanes are destined to fly higher and higher. In fact, the substratosphere international service between North and South America inaugurated recently with one-day trips between New York and the Panama Canal marks only the beginning of such flights. These trips which are now being made are flown in four-engine all-metal low wing monoplanes, designed to travel at 15,000 to 20,000 ft. above the earth. These planes will normally operate with a supercharging of 2½ lb., the differential between outside atmospheric pressure at the high altitudes and the inside pressure at ordinary flying altitudes. The advantage of flying at 15,000 to 20,000 ft. is that the pilots can override most of the earth's surface conditions, have a wide margin of altitude and find smoother air in which to fly with steadier winds and higher speeds. Still higher altitudes have even more advantages and will almost entirely eliminate earth's surface conditions, such as storms, and will enable the maintenance of much higher speeds with lower power consumptions.

In preparation for a great extension of such flying, research engineers who designed the Boeing Stratoliners, conditioned for altitude, have now equipped themselves with a strato-chamber that can reproduce all the conditions of high altitude flights for test purposes without going outside the laboratory.



A strato-chamber in which air conditions in the stratosphere can be duplicated. This chamber is in use in the Boeing plant. Shown in upper view, left to right, Dr. W. Randolph Lovelace and Dr. Walter M. Boothby, both of the Mayo Clinic, who developed the BLB oxygen mask for high altitude flights, and J. B. Cooper, research engineer.

This chamber, seen in the lower of the accompanying photos, is a 3-ton steel tank, divided into two compartments and equipped with air pumps, pressure controls, recording instruments and even a dry-ice refrigerating plant that duplicates the temperature at 30,000 ft. above sea level.

The upper view shows a portion of the chamber which simulates the interior of a high flying plane. It can accommodate several observers and is equipped with controls and instruments, duplicating a set outside the chamber to enable the research engineers to *fly* within a few minutes to any desired altitudes.

One use to which the chamber is being put is to further the development of altitude conditioning systems, such as used on the present Stratoliners when they fly in the upper reaches of the atmosphere. A control unit similar to that used on the regular liners is installed for testing, and may be seen between the three men in the upper photo. These are Research Engineer James B. Cooper (right), Dr. W. Randolph Lovelace (left), and Dr. Walter M. Boothby.

Radiator Heat Research Program to Open with Hot Water Study

AT a three-day meeting held at the University of Illinois Oct. 9-12 final arrangements were made for the first winter's testing program at the new Institute of Boiler and Radiator Manufacturers' six-room Research House now under construction at the University. The house will be used in a long time research program for improvement of house comfort through steam and hot water heating. One-pipe forced circulation hot water will be the first method studied. The research project will be carried on by the Engineering Experiment Station of the University in co-operation with the Institute of Boiler and Radiator Manufacturers.

The house is a typical six-room small home, about 90% complete, is located near the campus. The house is of brick veneer construction, and will be completely furnished as a home. Measuring instruments, to indicate temperature and moisture conditions, are built into the structure. It is claimed to be the best-equipped house of its kind in the world.

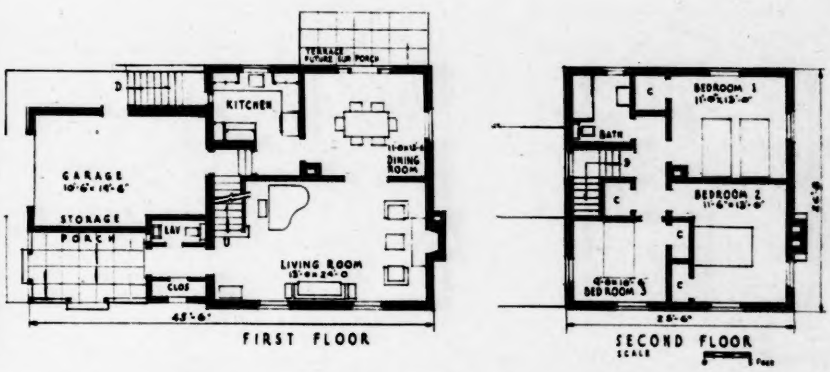
At the three-day meeting of the Institute's advisory committee and university engineers, the committee approved plans for the immediate program, inspected the Research House, and decided to defer its formal opening until late in the year.

Increased comfort and efficiency in winter and year-around air conditioning of low-cost houses is expected from the program. Various heating systems, types of boilers and radiators, and other equipment will be studied under actual use conditions. In summer, the house will be used for cooling research.

One hundred thermocouples have been permanently embedded in walls, roof, and other parts of the house to measure the temperature from a central control panel. About 150 additional thermocouples will be installed to measure temperatures of the air and various portions of the heating system. Moisture in many parts of the structure will be measured by 75 other electrical units placed in the structure. Eight recording thermometers, and various other recording instruments also, will be used during research activities.

Walls are equipped with removable panels to facilitate changes of equipment. The house has both an internal and an external chimney. Radiators for the first test will be recessed into the walls, with reflecting insulation behind them.

Members of the Institute of Boiler and Radiator Manufacturers group who gathered at the university were: R. E. Ferry, New York, general manager of the Institute; L. N. Hunter, Johnstown, Pa., research and development engineer, National Radiator Corporation; J. F. McIntire, Detroit, vice-president, U. S. Radiator Corporation; H. F. Randolph, Utica, N. Y., vice-president, International Heater Company; S. K. Smith, Westfield, Mass., H. B. Smith Company. A member of the research committee not able to attend the meeting was J. P. Magos, Chicago, director of the research laboratories, Crane Company.



Members of the advisory committee of the Institute of Boiler and Radiator Manufacturers at the University of Illinois, where they inspected the I-B-R Research Home (floor plans and sketch shown) and laid plans for a long-time research program in co-operation with the University's Engineering Experiment station. Committee members present are: (front, left to right) L. N. Hunter, chairman, R. E. Ferry and S. K. Smith. (Rear) H. F. Randolph and J. F. McIntire.

Summer of 1940 Milder than '39, Degree-Hour Data Show

SINCE the number of variables which affect the summer air conditioning load is high and since the dry-bulb temperature of the outside air is of much less importance among the other variables than it is in connection with winter heating, it is doubtful if any one single factor can be used to show load proportionality for different types of buildings in the summer as it can in winter with the degree day.

However, where there is little internal load, either sensible or latent, such as in residences, some such simple proportionality may exist. Research indicates that the load unit for residences for summer may be the summer degree hour above 85F.

The figures below show the number of degree-hours for the past summer for a number of cities.* To obtain them, 85 was subtracted from the hourly temperatures for each hour it was over 85F, and the results totaled for the periods.

The first six columns of figures are the degree hours totaled for each of the summer months of 1940. The seventh and eighth columns show the total number of degree hours experienced during the whole summer for both 1940 and 1939. The ninth and tenth columns show the seasonal totals for each of the cities for the hottest and coolest summers of the past nine years.

Of the 31 cities tabulated, 14 showed a hotter summer this year than last, 16 indicated a milder summer in 1940 than in '39, with insufficient data on one city.

*Maximum, minimum, and average seasonal totals of summer degree hours are included in both tabular and map form in the Air-Conditioning Engineers' Atlas, by Strock and Hotchkiss, The Industrial Press, 148 Lafayette St., New York. Price, $2.

SUMMER DEGREE-HOURS (ABOVE 85 F.)*
TOTAL, SUMMER OF 1940

City	Apr.	May	June	July	Aug.	Sept.	Total, Apr. 1 to Sept. 30			
							1940	1939	Max. Yr.	Min. Yr.
Baltimore	0	40	237	1225	56	48	1606	1532	2178	1080
Birmingham	0	63	160	706	730	565	2224	1811	3906	1811
Bismarck	0	30	77	753	539	298	1697	1247	4264	1033
Boston	0	0	25	223	1	0	249	316	734	210
Buffalo	0	0	5	3	39	0	47	36	113	11
Chicago	0	0	85	726	57	35	903	831	1797	337
Cincinnati	0	27	125	959	470	144	1725	1167	3344	704
Cleveland	0	0	1	251	21	0	273	294	710	142
Columbus	0	11	159	1032	351	102	1655	1430	2797	854
Des Moines	0	32	286	1356	232	146	2052	2351	6560	1502
Detroit	0	0	22	674	73	24	793	801	1879	340
Fort Wayne	0	0	30	636	328	82	1076	1002	2741	353
Grand Rapids	0	2	28	585	142	11	768	814	1901	455
Houston	4	131	489	1094	1370	748	3837†	4484†	4484	2895
Indianapolis	0	1	156	1218	859	155	2389	1466	4432	671
Kansas City	28	35	214	274	—	No Data	—	5177	12399	2562
Memphis	0	7	285	622	679	349	1942	2638	4657	2057
Milwaukee	0	0	13	503	0	9	525	691	1090	233
Minneapolis	0	3	99	864	110	40	1116	1040	3017	1040
New Orleans	7	48	454	661	671	452	2293	2740	3450	2067
New York	0	0	24	282	4	4	314	250	560	75
Philadelphia	0	12	79	747	38	19	895	770	1340	577
Pittsburgh	0	7	34	324	75	13	453	457	1126	293
Portland, Ore.	0	7	168	46	292	6	517	793	851	174
Richmond, Va.	0	66	177	757	24	27	1051	1327	2453	938
St. Louis	8	42	281	1141	619	458	2539	2337	8361	2285
San Diego	67	0	0	0	0	7	74	419	419	0
San Francisco	0	0	0	0	0	0	0	197	197	0
Savannah	19	94	673	1059	625	407	2877	3109	3494	2260
Toledo	0	2	25	559	89	39	714	705	2064	580
Washington	0	54	212	880	45	44	1235	1336	1945	1192

*Computed from data made available through the cooperation of the U. S. Weather Bureau.
†Including a few degree-hours in March.

Corrosion Inhibitors for Air Conditioning Equipment Found Effective

By JAMES H. WILSON† and EDWARD C. GROESBECK†

Perhaps the simplest way of retarding corrosion in air conditioning equipment is to treat the water with chemicals which act as corrosion inhibitors. While a number of chemicals have been recommended for this purpose, many plant engineers have found by experience that the substances vary considerably in their effectiveness. To learn which chemicals are most effective the authors have conducted a series of tests, the results of which are given in this article which is based upon an article by the authors in the Journal of Research of the National Bureau of Standards.

WITH the increasing use of air conditioning during recent years, the protection of the equipment against corrosion is becoming increasingly important. If suitable precautions are not taken to guard against the losses from corrosion, parts of the system become badly corroded and require replacement in a very short time. This is especially true in industrial regions, where the normal contamination of the air with acid-forming gases, as oxides of sulfur and carbon, is relatively high. The presence of chlorides in the atmosphere of some localities is also conducive to corrosion.

Painting the equipment to prevent its deterioration is often resorted to, but this is not entirely satisfactory, since corrosion occurs at breaks in the paint film and serious damage to the metal parts may result before it is visible to one inspecting the set-up. There are also parts which it is not feasible to paint, such as the interior of the pipes or other inaccessible parts.

Two possible methods of reducing the losses from corrosion suggest themselves. One of these is the careful selection of the materials of construction to secure maximum resistance to corrosion; the other is the treatment of the water by the addition of suitable chemicals which will inhibit the corrosive attack. The present investigation was directed toward a study of the latter phase of the subject.

It has been known for many years that certain chemicals, when added to water even in small amounts, will retard corrosion of iron immersed therein. The usual explanation for this is that the chemical produces a film on the surface of the iron which prevents the corrosion reaction from proceeding.

Chemicals Used

In this study none of the ready-made mixtures sold commercially as inhibitors was used nor was any attempt made to simulate commercial inhibitors by making up mixtures of this kind. Instead, the chemicals which form the basis of such inhibitors were used. These chemicals were (1) sodium dichromate, (2) sodium silicate, (3) sodium phosphate, and (4) sodium carbonate.

The solutions were prepared by dissolving a weighed amount of the appropriate chemical in Washington city water and the compositions of the solutions used in 14 different corrosion-inhibiting treatments are given in Table 1.

TABLE 1.—SUMMARY SHOWING CONCENTRATION OF INHIBITORS AND pH OF SOLUTIONS IN THE VARIOUS WATER TREATMENTS USED

Run No.	Concentration of Inhibitor	pH
1	200 ppm of sodium chromate (a)........ 100 ppm of sulfate; 500 ppm chloride (b)	8 to 9
2	100 ppm of sodium chromate (a)..........	8 to 9
3	500 ppm of water glass..................	8 to 9
4	500 ppm of sodium metasilicate..........	8 to 9
5	200 ppm of sodium dichromate (a)...... 100 ppm of sulfate; 50 ppm of chloride (b)	4 to 5
6	500 ppm of sodium disilicate............	8 to 9
7	500 ppm of sodium phosphate........... 50 ppm of sodium hexametaphosphate....	8 to 9
8	500 ppm of water glass................ 100 ppm of sulfate; 50 ppm of chloride (b)	4 to 5
9	100 ppm of water glass..................	8 to 9
10	100 ppm of sodium metasilicate..........	8 to 9
11	500 ppm of water glass............... 100 ppm of sulfate; 50 ppm chloride (b)	8 to 9
12	100 ppm of sodium phosphate............	8 to 9
13	Untreated water	8 to 9
14	100 ppm of sodium carbonate............	8 to 9

(a) An alkaline solution has been designated as chromate and the same solution in an acid solution as dichromate.

(b) The chloride and sulphate additions were made to simulate contamination of the water as it occurs in service.

Six ferrous sheet materials were used throughout the test. These materials were (1) a copper-bearing steel, (2) an open-hearth iron, (3) an alloyed open-hearth iron, (4) a low-alloy steel, (5) a wrought iron of the new *synthetic* type, and (6) a hand-puddled wrought iron.

Results

The average loss in weight obtained in each of these water treatments is shown graphically in Fig. 1. The loss in weight is the average of duplicate determinations for each of the six ferrous sheet materials used. The height of the solid blocked-in areas in Fig. 1. represents the loss in weight occurring in the specimens which were totally immersed in the liquid flowing at the rate of 5 linear feet per minute. The height of the cross-hatched areas represents the average loss in

†National Bureau of Standards, Washington, D. C.

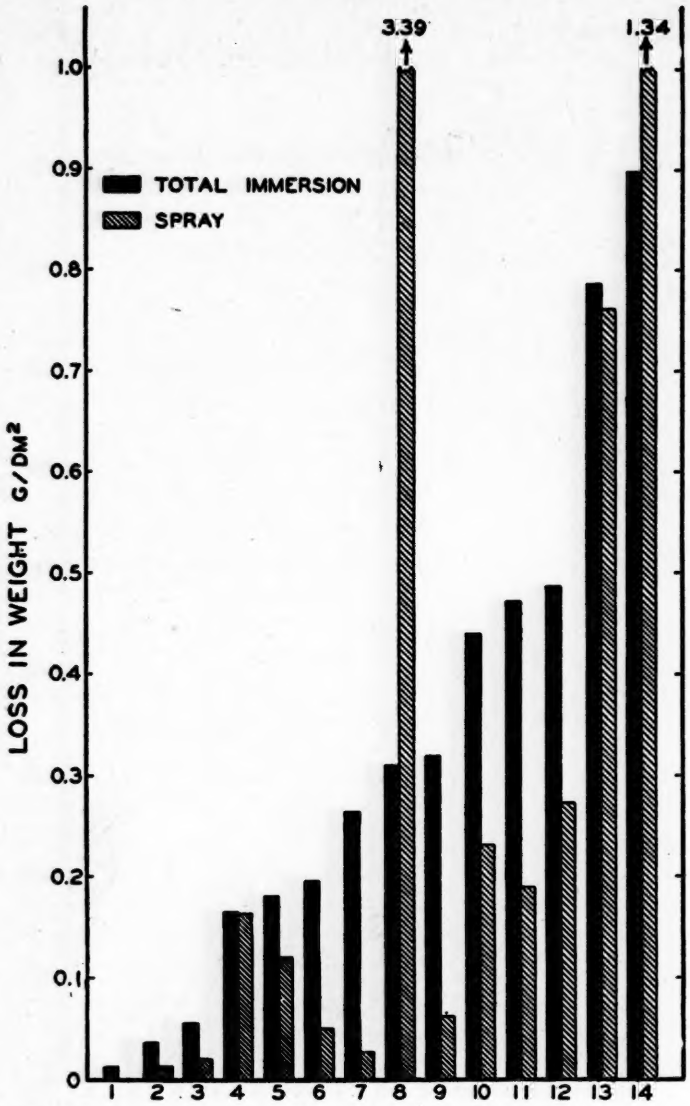


Fig. 1. Chart showing the average loss in weight for the period of 14 days of the six materials tested, using the water treatments listed in Table 1.

weight of the specimens exposed to a spray for the different runs indicated.

The data (Table 1 and Fig. 1) support certain generalizations concerning the effectiveness of the inhibitors tested and the relative initial corrosion resistance of the materials.

The treatments may be arranged in the following order of decreasing ability to prevent corrosion of ferrous metals under the conditions used: (a) sodium chromate (or dichromate), (b) sodium silicate, (c) sodium phosphate, and (d) sodium carbonate. The last-named chemical was without value in the concentration of 100 ppm.

A striking difference in the rate of corrosion of specimens exposed in total immersion as compared with those subjected to the spray occurred in run 8, in which the inhibitor consisted of 500 ppm of water glass in a solution with a pH of 4 to 5 and contaminated by sulfate and chloride impurities. The explanation of this apparent disagreement was that under the total immersion conditions a gelatinous coating, evidently insoluble silicic acid, covered the specimens and protected them from corrosion. This coating was from 1/16 to 1/8 in. thick and was easily visible on the specimens. Formation of this coating was prevented on the spray specimens, so that corrosion proceeded normally.

The effect of this coating on the corrosion also accounts for the greater loss in weight of the totally immersed specimens of run 11 than of those of run 8.

However, in most of the runs, the loss in weight was greater for the specimens immersed in the slowly moving liquid than for those specimens exposed to the spray. It is thought that the reason for this difference was that the spray washed off all loose corrosion products, so that most of the surface was maintained approximately in its original condition. This action tended to keep the anodic areas at a minimum. On the other hand, in the flow tubes the motion of the liquid was so slow that the corrosion products were not removed rapidly but were slowly carried down the surface of the specimen, thereby stimulating corrosion at a point immediately below that at which it started. As this process continued, the anodic areas increased in extent. Thus, at the end of a run, the corrosion on the im-

TABLE 2.—COMPARATIVE MERITS OF INHIBITORS IN CREVICE CORROSION, WITH AN APPROXIMATE WIDTH OF CREVICE OF 0.03 INCH

(Average loss of weight determined on 6 types of ferrous sheet in test runs of 14 days' duration, arranged in the same order as in Table 1)

Run No.	Concentration of Inhibitor	pH	Average Loss In Weight For 14 Days: Total Immersion (Flow, 5 Ft./Min.) Mg./Dm.²	Spray Mg./Dm.²
1	200 ppm of sodium chromate .... 100 ppm of sulfate; 50 ppm of chloride (a)	8 to 9	54	...
2	100 ppm of sodium chromate	8 to 9	51	21
3	500 ppm of water glass	8 to 9	88	52
4	500 ppm of sodium metasilicate	8 to 9	133	260
5	200 ppm of sodium dichromate .... 100 ppm of sulfate; 50 ppm of chloride (a)	4 to 5	239	109
6	500 ppm of sodium disilicate	8 to 9	183	125
7	500 ppm of sodium phosphate .... 50 ppm of sodium hexametaphosphate	8 to 9	63	137
8	500 ppm of water glass .... 100 ppm of sulfate; 50 ppm of chloride (a)	4 to 5	221	537
9	100 ppm of water glass	8 to 9	129	289
10	100 ppm of sodium metasilicate	8 to 9	246	323
11	500 ppm of water-glass .... 100 ppm of sulfate; 50 ppm of chloride (a)	8 to 9	150	293
12	100 ppm of sodium phosphate	8 to 9	327	431
13	Untreated water	8 to 9	309	730
14	100 ppm of sodium carbonate	8 to 9	262	598

(a) The chloride and sulphate additions were made to simulate contamination of the water as it occurs in service.

mersed specimens was in the form of long narrow streaks, whereas that on the spray specimens occurred at individual points on the surface as pits.

Corrosion in Crevices

Corrosion is often more severe within small crevices than on flat surfaces of the same piece. Observations on the corrosion in crevices were therefore included in each run to determine whether serious corrosion might develop from this cause. The results are given in Table 2.

It will be observed that the order of relative merit in which the inhibitors were placed by loss in weight resulting from crevice corrosion was, with a few exceptions, similar to that in which they were placed by the simple immersion or spray tests. Some corrosion occurred in the crevices of all the specimens as compared with a practically complete absence of corrosion in the total immersion and spray specimens of runs 1 and 2. On the other hand, in those cases in which the inhibitor was not especially efficient and a comparatively large amount of corrosion normally would occur on an exposed surface, the resulting corrosion products soon filled the crevice and further corrosion was arrested.

In several of the runs the width of the crevice was varied from a few thousandths of an inch to approximately 0.05 inch. It was found that the corrosion loss was approximately proportional to the width of crevice. The corrosion occurring in these crevices started along the medial longitudinal line of the specimen, this being the most inaccessible region for the replenishment of the solution and its dissolved oxygen. However, on continuing the run, this crevice slowly became filled with corrosion products, so that the total loss was a function of the available space within the crevice.

Summary

This study has disclosed a number of generalizations on the corrosive properties of water which has been treated with small amounts of corrosion-inhibiting chemicals. Some of the more important of these trends are listed in the following summary:

1. All of the inhibitors tested, with the exception of 100 ppm of sodium carbonate, decreased the rusting of iron or steel.

2. The order of decreasing efficiency of the inhibitors studied in the concentrations used, was (a) chromates, (b) silicates, (c) phosphates, and (d) carbonates.

3. In the case of the sodium silicates tested, the results indicated that the higher the ratio of SiO_2 to Na_2O, the greater was the inhibiting action.

4. Although some differences were noted in the initial corrosion resistance of the various kinds of iron and steel used, in most cases this was slight in comparison with that produced by a change in the inhibitor.

5. The distribution of corrosion, especially in the spray, was more uniform in the presence of an inhibitor than it was in its absence.

6. In the case of all the inhibitors used, corrosion to some extent occurred in crevices but it failed to occur on flat, uniformly exposed, metal surfaces in two instances. However, with inefficient inhibitors, the rusting was less in the crevices than on the fully exposed surface. In this case, the amount of corrosion appeared to be a function of the available space within the crevice.

Ventilation Blowers Installed in U. S. "Mosquito" Fleet

Each of two new Torpedo Boats, the PT3 and PT4, built by the Fisher Boat Works of Detroit, is equipped with three Ilg direct-connected blowers to vitalize the air for the crew of eight and to remove odors and cooking fumes. The motor on each blower is mounted on the wheel to avoid friction and noise and to save the space and weight required by a coupled motor mounted on a separate pedestal.

Tests on the Detroit River indicate that these new members of the "Mosquito Fleet" attain speeds of 40 knots. Each boat is fitted with two machine gun mountings, is designed to fire two torpedoes at one time and is powered by two 1200 hp. Packard motors.

Costing $100,000 apiece, the boats will combine with two similar craft being built in Miami, Florida, and others constructed in New Orleans and Philadelphia to form an experimental fleet covered by the $15 million appropriation for torpedo boats and sub chasers.

Number of Degree-Days for September, 1940

HEATING & VENTILATING begins its thirteenth year of publishing degree-day data for various large cities. Forty-six cities have been added to those previously published, making a total of 116 cities listed below.

City	Degree-days Sept., 1940
Albany, N. Y.	173
Alpena, Mich.	192
Atlanta, Ga.	41
Atlantic City, N. J.	62
Baker, Ore	200
Baltimore, Md.	49
Binghamton, N. Y.	177
Birmingham, Ala.	26
Bismarck, N. D.	127
Boise, Idaho	155
Boston, Mass.	111
Buffalo, N. Y.	137
Burlington, Vt.	215
Cairo, Ill.	46
Canton, N. Y.	202
Charles City, Iowa	134
Charlotte, N. C.	41
Chattanooga, Tenn.	70
Cheyenne, Wyo.	172
Chicago, Ill.	106
Cincinnati, Ohio	95
Cleveland, Ohio	119
Columbia, Mo.	70
Columbus, Ohio	106
Concord, N. H.	189
Concordia, Kan.	54
Davenport, Iowa	81
Dayton, Ohio	115
Denver, Colo.	71
Des Moines, Iowa	81
Detroit, Mich.	131
Dodge City, Kan.	55
Dubuque, Iowa	114
Duluth, Minn.	188
Eastport, Me.	296
Elkins, W. Va.	184
El Paso, Tex.	0
Erie, Pa.	125
Escanaba, Mich.	220
Evansville, Ind.	81
Fort Smith, Ark.	32
Fort Wayne, Ind.	123
Fort Worth, Tex.	7
Fresno, Calif.	4
Grand Rapids, Mich.	135
Green Bay, Wis.	158
Greensboro, N. C.	59
Harrisburg, Pa.	103
Hartford, Conn.	149
Helena, Mont.	159
Huron, S. D.	95
Indianapolis, Ind.	87
Ithaca, N. Y.	188
Kansas City, Mo.	58
Keokuk, Iowa	73
Knoxville, Tenn.	50
La Crosse, Wis.	123
Lander, Wyo.	125
Lansing, Mich.	181
Lincoln, Neb.	65
Little Rock, Ark.	33
Los Angeles, Calif.	0
Louisville, Ky.	69
Lynchburg, Va.	67
Madison, Wis.	144
Marquette, Mich.	204
Memphis, Tenn.	31
Milwaukee, Wis.	134
Minneapolis, Minn.	116
Nantucket, Mass.	101
Nashville, Tenn.	51
New Haven, Conn.	106
New Orleans, La.	1
New York, N. Y.	64
Norfolk, Va.	26
Northfield, Vt.	291
North Platte, Neb.	60
Oklahoma City, Okla.	21
Omaha, Neb.	72
Oswego, N. Y.	177
Parkersburg, W. Va.	109
Peoria, Ill.	95
Philadelphia, Pa.	53
Pittsburgh, Pa.	99
Pocatello, Idaho	181
Portland, Me.	175
Portland, Ore.	48
Providence, R. I.	106
Pueblo, Colo.	50
Raleigh, N. C.	50
Reading, Pa.	95
Reno, Nev.	160
Richmond, Va.	62
Rochester, N. Y.	136
Roseburg, Ore.	61
St. Joseph, Mo.	65
St. Louis, Mo.	42
Salt Lake City, Utah	58
Sandusky, Ohio	110
San Francisco, Calif.	36
Sault Ste. Marie, Mich.	228
Scranton, Pa.	159
Seattle, Wash.	60
Sioux City, Iowa	82
Spokane, Wash.	81
Springfield, Ill.	67
Springfield, Mo.	89
Syracuse, N. Y.	177
Tacoma, Wash.	93
Terre Haute, Ind.	77
Toledo, Ohio	124
Trenton, N. J.	86
Utica, N. Y.	193
Washington, D. C.	61
Wichita, Kan.	42
Yakima, Wash.	38

INDUSTRIAL HEALTH HAZARDS

In designing ventilating systems for various types of industrial plants the problem sometimes arises in an engineer's office of determining, frequently at a distance, just what types of dust, fumes or odors might be encountered in a specific industry. It is to assist in this problem that this data sheet has been designed. The information covers a somewhat wider scope than ventilation alone in that it deals with all industrial health hazards, including infections, pressure abnormalities, high light intensities, radioactive compounds, and a few other hazards not directly associated with ventilation. On the whole, though, most of the hazards are those which are concerned, at least to some extent, with industrial ventilation.

Due to space limitations the information has been presented in the form of two tables. To use the table refer to Table 2 and opposite the type of industry find the number or numbers of hazards involved in that particular industry. The numbers are keyed to the hazard in Table 1.

Example: What type of hazard would be encountered in an electrotyping plant?

SOLUTION: Referring to Table 2, opposite Electrotyping will be found the numbers 6-49-64. In Table 1 opposite 6 is found acids; opposite 49, lead and compounds; and opposite 64, plating solutions. All of these hazards are liable to be found in an electrotyping plant and the engineer can determine in advance or at a distance the probable need for ventilation.

This data sheet is a rearrangement of data presented through the courtesy of the Connecticut State Department of Health which issued this information in a large check list entitled "Potential Industrial Health Hazards."

Table 1—Potential Industrial Health Hazards

(Numbers are keyed to Table 2.)

(IN THE LISTINGS BELOW, NOC INDICATES NOT OTHERWISE CLASSIFIED)

1	Abnormalities of Pressure	27	Dust (Asbestos)	54	Methanol
2	Abnormal Temperatures and Humidities	28	Dust (Free Silica)	55	Methyl Chloride
3	Acetaldehyde	29	Dust (Inorganic)	56	Noise
4	Acetone	30	Dust (Metals, Metalloids, etc.)	57	Nitrobenzene
5	Acetylene	31	Dust (Organic)	58	Nitrogen Oxides
6	Acids	32	Dyes and Inks	59	Nitro and Amine Compounds
7	Acrolein	33	Ethyl Ether	60	Oils (Mineral, Paraffin, Cutting, etc.)
8	Alcohols (NOC)	34	Ethylene Dichloride	61	Paints and Lacquers
9	Alkalies	35	Ethylene Trichloride	62	Phenol
10	Ammonia	36	Excessive Dampness	63	Phosphorus and Compounds
11	Aniline	37	Fatigue	64	Plating Solutions (NOC)
12	Anthrax	38	Fluorine and Compounds	65	Poisonous Plants
13	Antimony and Compounds	39	Foodstuffs	66	Radioactive Compounds
14	Arsenic and Compounds	40	Formaldehyde	67	Rubber Accelerators
15	Benzol	41	Friction and Tension	68	Silver and Compounds
16	Bromine and Compounds	42	Fumigants and Insecticides	69	Soap Solutions, Glue, etc.
17	Cadmium and Compounds	43	Hairdressing Preparations	70	Solvents (NOC)
18	Carbon Dioxide	44	Halides	71	Sulfur Chloride
19	Carbon Disulfide	45	Hydrogen Sulfide	72	Sulfur Dioxide
20	Carbon Monoxide	46	Illuminating Defects	73	Synthetic Resins
21	Carbon Tetrachloride	47	Illuminating Gas	74	Tar and Allied Substances
22	Chlorine	48	Infections	75	Tetrachloroethane
23	Chloroform	49	Lead and Compounds	76	Toluol
24	Chloronaphthalene	50	Light Intensities	77	Turpentine
25	Chromium and Compounds	51	Manganese and Compounds	78	Xylol
26	Cyanides	52	Mechanical Irritations	79	Zinc and Compounds
		53	Mercury and Compounds		

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INDUSTRIAL HEALTH HAZARDS

Table 2—Hazards Likely to be Found in Various Industries

Product or Type of Business	Probable Hazard (Figures Refer to Table 1)
Abrasive Products Mfg.	28-29-49-69
Advertising Signs and Novelties Mfg.[1]	4-6-9-14-15-21-25-26-28-29-31-32-35-40-49-53-54-60-61-62-64-66-69-70-73-76
Airplane and Airplane Parts Mfg.	1-4-5-6-9-15-17-20-25-26-28-29-30-35-49-50-54-56-58-60-61-64-69-70-75
Aluminum Ware Mfg.[2]	6-28-29-30-56-60
Analytical Chemists	6-9-10-15-21-22-33-40-45-53-58-70
Arms Mfg. (Small Arms)	6-9-20-25-26-28-29-31-40-44-49-53-56-60-61-62-64-73
Artificial Silk Mfg.	2-6-9-19-32-36-45-49-72
Asbestos Goods Mfg.	15-27-40-62-70-74-76
Automobile Dismantling[3]	49-60
Automobile Accessories and Service Stations	6-20-49-54-60
Automobile Body Mfg.	15-25-49-61-70
Automobile Garages or Repair Shops	6-9-20-41-49-54-60-61-70
Automobile Radiator Mfg.	6-20-49-60
Battery Mfg.	6-49-74
Beverages Mfg.	9-36-69
Bootblacking or Hat Cleaning Estabs.	11-15-20-21-32-57-70
Brass or Copper Goods Mfg.	2-6-9-15-17-20-25-26-28-30-35-41-46-49-60-61-64-70-79
Breweries	2-18-31-36-62
Brush or Broom Mfg.	9-12-22-31-32-40-61-69-72-73-74
Button Mfg.	6-9-26-31-40-49-53-61-62-64-70-73
Cable and Wire Insulating	15-21-24-27-29-31-49-67-74
Cable and Wire Mfg.	20-49-60
Caisson Work	1-28-29-36-46
Candy Mfg.	39
Carbon Paper or Typewriter Ribbon Mfg.	15-32
Carpet or Rug Mfg.	12-14-31-32-48-69-70
Ceramics Mfg.	2-20-28-29-36-37-47-49-50
Chemical Mfg.[4]	6-9-10-29-31-40-58-62-67-69-70-74
Chemical Mfg.[5]	6-9-14-19-26-28-32-40-44-49-58-63-67-72-76
Chemical Mfg.[6]	3-6-8-9-10-11-15-16-19-20-21-22-23-26-31-32-33-34-35-40-44-45-49-51-53-54-55-57-58-62-67-70-71-72-74-75-76
Cigar and Cigarette Mfg.	31-41
Cleaning and Dyeing Estabs.	9-10-15-19-21-32-34-35-54-69-70
Clock and Watch Mfg.	6-9-25-26-28-29-30-35-49-60-61-64-66-73
Coke Mfg.	2-10-15-20-31-45-62-72-74-76-78
Contractors[7] (NOC)	20-28-29-36-41-49-55-60-61-65-69-72-74
Cosmetics and Dentifrices Mfg.	4-8-29-60
Dairy Products Mfg.	2-18-36-41
Distillery	2-8-18-54
Drug Preparation Mfg.[8]	6-9-14-15-19-29-31-49-53-54-60-62-70-71-79
Electric Apparatus and Fixtures Mfg.	6-9-15-21-25-26-28-29-40-41-49-53-60-61-62-64-70-73
Electric Light and Power Plants[9]	20-36-49-53-65
Electroplating	2-6-9-10-14-15-17-19-21-25-26-35-44-49-53-58-64-70
Electrotyping	6-49-64
Explosives Mfg.[10]	3-4-6-8-9-10-22-25-31-40-49-53-54-58-59-62-63-70-76
Exterminating and Fumigating	26-40-42-72
Farming or Gardening[11]	12-14-15-26-29-31-48-49-62-65
Fertilizer Mfg.	6-7-9-10-15-26-29-31-38-48-63-72
Food Preparation and Handling	2-7-10-12-31-40-48-69-72
Foundries, Non-Ferrous	2-6-7-14-17-20-28-29-30-49-50-72-79
Foundries, Ferrous	2-6-7-20-28-29-30-50-72
Fur Handling[12]	12-14-31-32-48
Furniture Mfg.	6-9-15-25-26-28-31-49-54-61-69-70
Garbage Works[13]	6-7-9-10-22-31-48-69
Gas Works	6-9-10-15-20-26-41-45-62-72-74-76-78
Gasoline and Oil Bulk Stations	15-41-49-60
Glass Products Mfg.	2-3-6-9-10-14-26-28-29-40-49-50
Gold Leaf Mfg.	30-41
Hairdressing and Barbering	41-43-69-70
Hardware Mfg. (NOC)	2-6-9-14-17-20-21-25-26-28-29-30-35-38-44-46-49-53-60-61-64-69-70-73-79
Hat Mfg.[14]	2-6-15-20-31-32-36-48-53-69-70
Hat Mfg., Straw	22-31-32-40-61-69-70
Hatters Fur Mfg.	6-9-12-14-21-31-48
Ice Mfg. and Harvesting	2-10-18-36-37-72
Instrument Mfg.[15]	6-9-25-26-28-29-30-35-53-60-61-64-70-73
Jewelry Mfg.	6-9-25-26-28-29-30-31-41-46-53-58-61-64-70-73
Junk[16]	31-49-60
Laundries	2-9-10-20-22-36-48-69
Lead Works[17]	[5]20-30-49-60
Leather Goods Mfg.	4-15-31-32-61-69-70
Leather Mfg.	6-9-10-11-12-14-15-25-26-31-32-36-40-45-48-49-62-69-70-72-76
Leather, Imitation, Mfg.	4-11-14-15-25-31-32-49-70-73-76
Machine Shops[18]	2-6-20-26-29-49-56-60-70-79
Machinery Mfg. (NOC)	6-9-10-17-20-21-25-26-28-29-30-44-49-57-60-61-64
Mattresses and Bedsprings Mfg.	9-29-31-60-61
Metal Goods Mfg.	6-9-15-20-25-26-28-29-30-35-49-60-61-64-70-79
Musical Instruments Mfg.	6-9-26-31-35-49-60-61-64-69-70-73
Office Machinery Mfg.	6-9-17-20-25-26-28-29-30-31-49-60-61-64-69-70-73
Paint, Varnish and Lacquer Mfg.	2-4-6-8-9-14-15-17-21-25-29-30-31-34-49-54-61-70-75-76-77-78
Painting	4-11-14-15-21-25-41-49-54-61-70-74-75-76-77-78
Paper and Pulp Mfg.	2-6-9-14-22-31-32-36-40-45-48-72-73
Paper Goods Mfg.	6-9-40-60-61-62-69-74
Photo-Engraving	6-9-14-15-32-44-46-49-64-70
Photography	6-9-25-46-66-77
Printing[19]	6-9-11-14-15-20-25-30-41-44-46-49-53-54-58-64-70-75
Quarrying and Mining	2-20-28-29-36-41-46-48-59
Rolling Mills, Non-Ferrous	2-6-20-30-41-56-60
Rolling Mills, Ferrous	2-6-20-30-41-56-60
Rubber Goods Mfg.	2-4-6-9-11-13-14-15-19-21-25-29-31-32-35-37-41-49-54-67-70-71-72-75-79
Sewage Disposal Plants	10-18-22-36-45-48
Ship Building	2-6-9-20-22-31-49-56-60-61-70
Shoe and Shoe Sundries Mfg.	4-8-10-15-19-21-29-31-32-33-44-53-54-69-70-76
Silverware Mfg.	6-25-26-29-30-35-53-58-60-61-64-68-70
Smelting and Refining of Metal	2-6-9-14-17-20-26-29-30-38-45-49-51-53-58-63-72-79
Soap or Soap Powder Mfg.	6-7-9-10-15-28-29-31-36-40-45-48-54-62-69
Sporting Goods Mfg.	4-6-9-10-15-20-25-26-28-29-30-31-32-35-49-60-61-69-70
Steel and Iron Fabrication	20-49-50-56-58-61
Stone and Mineral Products Mfg.	28-29-56
Stores	10-39-41-48-69
Synthetic Resins and Products Mfg.	4-8-31-32-40-54-58-62-70-73-76
Textile Mfg.	2-6-9-19-20-31-32-41-45-46-48-49-69-70
Textile Finishing[20]	6-9-10-11-14-17-20-21-22-25-31-32-36-40-62-69-70-71-72
Textile Goods Mfg.	4-20-31-32-46-52-54-69-70
Tobacco Handling	2-14-15-20-26-31-36-42-49-65
Tool Mfg.	6-9-20-25-26-28-30-35-49-60-61-64-70-73
Toys	4-6-9-15-25-26-28-30-31-40-49-60-61-62-69-70
Transportation and Equipment Repairing	20-29-50-56-60-61-70
Welding	6-20-29-30-38-49-50-58
Wood Products Mfg.	4-8-28-29-31-41-49-54-61-70-74

[1]Plants making product not composed exclusively of wood, metal, or celluloid.
[2]Where product is made from sheet aluminum excluding rolling or smelting operations.
[3]Including the salvage or junking of parts.
[4]Where the materials are of slight toxicity.
[5]Where the toxic materials spread into the room air.
[6]Where the toxic materials are within completely enclosed spaces.
[7]All kinds of contracting.
[8]Including medicine and pharmaceutical preparations but not including the manufacturing of the ingredients.
[9]All operations.
[10]Including manufacturing involving explosives in any way.
[11]Including spraying.
[12]Excluding hatters' fur.
[13]Including rendering and incineration.
[14]Excepting straw or cloth hats.
[15]Professional or scientific instruments.
[16]Including old metal and rag sorting.
[17]Sheet, pipe, and shot, excluding smelting.
[18]Including forging but excluding foundry operations.
[19]Including publishing, lithographing and allied industry.
[20]Including bleaching and dyeing but not cleaning and dyeing.

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ABSTRACTS of Current Papers, Books and Pamphlets

Hazards in Linoleum Manufacturing

Serious hazards existed in the manufacture of linoleum from the time of its invention. The hazards are of a type common to many industries—dust, abnormal temperature, toxic vapors from solvents, and poisonous compounds.

The heart of the linoleum manufacturing process lies in the making of the linseed oil cement in which metallic driers are used to speed up the drying rate. The handling of these driers, many of which are poisonous, has always been a health hazard. Exhaust hoods at the weighing scales, the compulsory wearing of air line respirators, the insistence on cleanliness of persons and premises, and the periodic examination of the men engaged in this work are the precautionary measures taken.

The preparation of cork flour for linoleum is a hazardous operation, not only from the ever present possibility of dust explosions, but also from the exposure of the mill stone cutters and dressers to the inhalation of a highly siliceous dust. Huge granite mill stones, weighing approximately 5,000 pounds each, are used to grind the cork into a flour of 50 mesh to dust fineness. These mill stones are received with a flat surface, necessitating the cutting of the grinding plane in the plant. Then, too, the fine mesh to which the cork is ground, required frequent dressing of the mill stone grinding surface. The men engaged in this stone cutting and dressing would normally be working in an atmosphere filled with high silica dust. To reduce the hazard in this operation, air exhausts are attached to the cutting tools, the wearing of the air line respirators is compulsory, and chest x-rays are made on men not only before they are assigned to the work but also periodically so long as they remain on such work.

The preliminary mixing of linoleum composition is done in heavy machines of the bread mixing type. Linseed oil cement, cork flour, wood flour, pigments and mineral fillers are charged into the machines from the floor above. The weighing and handling of these various materials, all of which, except the cement, are dry and in powdered form, has always created excessive dust in the working area. Late in 1934, the Armstrong Cork Company embarked on an intensive and systematic health hazard elimination program. Upon the completion of a survey, steps were taken immediately to correct the hazardous conditions revealed. The engineering department completed the design and specifications of the equipment for one of the three major mixing operations. The first installation, completed in early 1936, resulted in such a marked improvement in working conditions that the remainder of the program was pushed forward as rapidly as possible. Today well over $100,000 has been invested for equipment for dust removal alone. A somewhat smaller sum has been spent for the elimination from working areas of vapors and irritating gases.

From the angle of the use of paint, the chief health hazard occurs in the cleaning of paint containers and paint applying equipment. Strong caustic solutions are so destructive to the blocks required for printing linoleum designs, that a solvent cleaner is essential. At one time the highly inflammable and toxic benzol was the cleaning agent in general use. Today benzol has been almost entirely replaced by other solvents in our paint cleaning solution. Exhaust hoods carry away the solvent vapors so effectively that a recent check revealed a vapor concentration well under the toxic limit in the atmosphere of this area.

[*"Some Health Hazards in the Manufacture of Linoleum," by E. J. Kessler. Published in Safe Practice Bulletin No. 74 of the Workman's Compensation Bureau, Department of Labor and Industry, Harrisburg, Pennsylvania. Paper cover, 8½ x 11 in.; 11 pages. Available on request.*]

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Soot in Oil Fired Boilers

When an oil fired boiler is operated continuously at "stand-by" conditions, a thin layer of soot is deposited on the boiler heating surfaces. Usually the deposit will be too slight in amount to seriously affect either efficiency or capacity of the boiler, but due to poorer heat transfer the stack temperature will rise. This rise in temperature may be as much as 40F for a decrease in efficiency of as low as 1% and 200F for a decrease in efficiency of 5%.

The danger in this condition is that if the boiler operator or service man should attempt to lower the stack temperature by decreasing the firing rate of the burner rather than by removing the soot, the capacity of the boiler may be so seriously affected that it cannot heat the building satisfactorily.

In one test reported on by the Bureau of Standards when the efficiency decreased from 67.3 to 63.0% due to soot, the output was decreased from 136,137 B.t.u. per hr. to 70,840 B.t.u. per hr. when the stack temperature was kept at 600F.

[*"Effect of Soot on the Rating of an Oil-Fired Heating Boiler," by R. S. Dill and P. R. Achenbach. Report BMS54, National Bureau of Standards, Washington, D. C. Paper cover; 8½ x 11 in.; 4 pages. For sale by the Superintendent of Documents, price, 10 cents.*]

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Painting Handbook

The findings in more than 20,000 actual analyses of painting problems have been compiled in condensed form to make up this painting handbook.

The first section of the book is devoted to discussions of the preparation of various types of surfaces, followed by suggestions of the correct paints to employ as priming coats, secondary coats and finishing coats. Among the surfaces considered are brick, concrete, woods and metals of all kinds, and special surfaces such as felt, tar paper, linoleum, glass and slate.

The conditions to which painted surfaces are subjected are analyzed in the second section. The action upon painted surfaces of acids, salts, dyes, moisture, oil, grease, fumes, living organisms, temperature and climatic changes are concisely and clearly presented, and recommendations are made for proper surface coverings.

This is followed by a *general* section which gives invaluable information concerning the drying times of various paints, their heat resistance, light reflecting qualities, and other factors that are indispensable for the painter. Also included in this section are tables to assist in estimating regular and irregular surface areas of all shapes. This, together with the formula for arriving at the annual-foot-cost-paint rating (cost-per-square-foot-per-year-of-service), should help take the guess work out of painting problems.

[*"Maintenance Painting Handbook." Published by the Industrial Paint Clinic of the American-Marietta Company, 43 East Ohio St., Chicago, Ill. Heavy paper cover, 5 x 7 in., 119 pages. Available on request from the American-Marietta Company.*]

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Air Sterilization

To gain information regarding the most effective way of preventing air-borne bacteria coughed by one patient from reaching another, a laboratory room was converted into a small model ward. The air-changing system was designed so that the air could be circulated at the rate of one to twelve times an hour. Any proportion of fresh air from 10 to 90 per cent could be introduced.

It was not feasible to have doors across the front of the cubicles, so a curtain of ultraviolet rays was used instead. Germicidal lamps were used. These are low pressure mercury vapor lamps in glass which transmits ultraviolet rays. They are tubular, measure 18 inches in length and 1 inch in diameter and operate at 60 volts.

Usually, broth cultures of Bacillus prodigiosus were sprayed from a fine glass atomizer. Occasionally cultures of Bacillus coli or Sarcina were used instead.

Air Changing Only—When the air-changing system was not used the bacteria produced by two minutes' spraying disappeared from the air within 64 min. The rapid decrease in the number of bacteria is due to several causes, such as their dropping to the floor, dilution with the air of the rest of the room and dilution by natural infiltration of outside air. The air-changing system was then turned on at the rate of four air changes per hour, 50 per cent of the air being fresh. The same culture of bacteria was again sprayed for two minutes. The air changing reduced the number of bacteria in the air much faster than when no ventilation was used. This of course was not surprising, as about 6,400 cubic feet of bacteria-laden air was being forced out of the room in an hour.

Sterilization of Air in Ducts with Ultraviolet Rays.—To investigate the possibility of using recirculated air in hospital wards, four of the ultraviolet lamps were mounted end to end along the duct which carried the used, or recirculated, air back to the cubicles. The duct was approximately 12 inches by 12 inches (30 by 30 cm.) and was lined with mat-finished aluminum foil.

In the first test the polluted air passed the lamps at the rate of 200 linear feet a minute. This was sufficient to change the air in the room four times an hour. Ninety-seven to 99 per cent of the bacteria were killed by passing one lamp. When the rate of air flow was increased to 450 linear feet a minute, the four ultraviolet lamps killed from 96 to 99 per cent of the bacteria passing down the duct.

Ultraviolet Ray Curtain and Ultraviolet Lamps in Ducts, With and Without Air Changing. — In these tests we thought it wise to use four ultraviolet lamps in the ducts and all the lamps on the cubicle partitions. One experiment was performed with all the lamps on but with no air changing and a second with all the lamps on and with four changes of air an hour (50 per cent fresh air). These tests showed that four air changes per hour did not reduce the effectiveness of the ultraviolet lamps. Previous tests had shown that one change per hour did not reduce it either. When the air changing was increased to nine changes per hour (50 per cent fresh air), the lamps did not seem to be as effective.

It appears therefore that as long as the air motion is slow, the effectiveness of the lamps remains the same, but if the air motion is rapid, many organisms are able to pass through the barriers.

Conclusions

1. Barriers of ultraviolet rays produced by sterilizing lamps are effective in preventing the spread of artificially introduced bacteria (B. prodigiosus) from cubicle to cubicle in an experimental room.

2. Such lamps are very effective in killing bacteria in air ducts.

3. The lamps on the cubicle partitions are very effective when the air movement is slow and less so when the air movement is rapid.

[*"Air Contamination and Air Sterilization," by E. Chant Robertson, M. Elizabeth Doyle, Frederick F. S. Tisdall, Lewis R. Killer and Francis S. Ward. Published in the American Journal of Diseases of Children, November, 1939. Pages 1023-1038. Price, single copies, 85 cents. American Medical Association, 535 North Dearborn St., Chicago.*]

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Industrial Health Series

These are a series of bulletins issued from time to time on the causes and prevention of various industrial hazards. Each bulletin gives specific information on the industrial source of the hazard, tells how it occurs, lists the warning signs, explains what to do about the hazard and discusses means of prevention.

The bulletins presented so far are entitled as follows: No. 1, Industrial Skin Diseases; No. 2, Anthraco-Silicosis; No. 3, Arsenic Poisoning; No. 4, Carbon Monoxide Poisoning; No. 5, Chromium Poisoning; No. 6, Mercury Poisoning; No. 7, Lead Poisoning; No. 8, Benzol (Benzene) Poisoning; No. 9, Silicosis;

No. 10, Wood Alcohol Poisoning; No. 11, Chlorinated Solvents; No. 12, Carbon Bisulphide Poisoning; No. 13, Carbon Dioxide Asphyxiation; No. 14, Nitrous Fumes Poisoning; No. 15, Metal Fume Fever; No. 16, Ammonia Poisoning; No. 17, Manganese Poisoning; No. 18, Injury From Acids and Alkalies; and No. 19, Hydrogen Sulphide Poisoning.

[*"Industrial Health Series." Published by the Division of Labor Standards, U. S. Department of Labor, Washington, D. C. Paper bound, 3½ x 6 in., 4 to 8 pages. For sale by Superintendent of Documents, Washington, D. C. Price, 5 cents each.*]

Industrial Health Hazards

An increasingly important branch of ventilating practice is the one devoted to the elimination of dusts, vapors and gases from industrial plants. Engineers and contractors engaged in this work have a frequent need for specific information on the properties of these substances in order to correctly design and install such systems. Much of this information can be found in this book which gives, in a condensed and usable form, data on some 62 various fumes and vapors. Information presented on each substance includes: name and chemical formula, occurrence and uses; properties; clinical symptomatology in man; physiological response of man to various concentrations; physiological response of animals; standards; and method of estimation. Also included is a section on air sampling.

[*"Manual of Industrial Health Hazards," by Joseph B. Ficklen. Published by Service to Industry, Box 133, West Hartford, Conn. Cloth bound, 6 x 9 in., 176 pages. Price, $4.*]

BRIEF REVIEWS

Heating Estimations. A two-part bulletin on the estimation of heating loads. The first part is devoted to a graphical solution of heating problems and includes a large chart which makes it possible to determine the heat loss of a room without calculations when the surface area, overall transmission coefficient and temperature difference are known. The second part includes a chart which makes it possible to select the proper radiator size when the heat loss is known. [*"A Graphical Solution of Heating Problems," by R. M. Johnston and John Lewis Dilworth. Engineering Experiment Station Series No. 45, bulletin of the Virginia Polytechnic Institute, Blacksburg, Va. Paper cover, 6 x 9 in., 45 pages plus a large chart. Limited number of copies available for free distribution from the Engineering Experiment Station, Virginia Polytechnic Institute.*]

Arc Welding. A series of lessons on arc welding for use of students in trade schools and technical colleges as well as welding apprentices. This material is reprinted from Part II of the book "Arc Welding and How to Use It." [*Practical Lessons in Arc Welding." Published by The Hobart Brothers Company, Box EW-65, Troy, Ohio. Paper cover, 5½ x 8 in.; 98 pages. Price, 50 cents.*]

Business Records. This pamphlet is designed to fit the needs of a busy executive who wants to hand over to his subordinates the problem of preserving records and storage space. It supplies the answers to the following four questions which he will immediately ask: 1. Why should business records be preserved? 2. What material should be selected for preservation? 3. How should records be preserved? 4. When should preservation be undertaken? It sets up a schedule which can be put into effect economically by most firms to preserve their most important records. It also contains a discussion of the current practices of such firms as an advertising agency, a bank, a department store, two public utilities, a railroad, and several types of manufacturing concerns. [*"The Preservation of Business Records," by Ralph M. Hower. Published by The Business Historical Society, Baker Library, Soldiers Field, Boston, Mass. Copies available on request from The Business Historical Society.*]

Mechanical Catalog. The 1941 Edition of the ASME Catalog which includes a manufacturers' directory and list of trade names. [*"ASME Mechanical Catalog and Directory, 1941." Published by the American Society of Mechanical Engineers, 29 W. 39th St., N. Y. Cloth Bound, 8½ x 11 in. Price, $3 to nonmembers.*]

Price Management. A working manual for executives who must make decisions relative to prices or costs. [*"Scientific Price Management," by Allen W. Rucker. Published by The Eddy-Rucker-Nickels Co., Harvard Square, Cambridge, Mass. Simulated leather cover 10 x 12½ in. 22 pages and 6 charts. Price, $5.*]

Paper Testing. The present Technical Association of Paper and Pulp Industries standard of 65% relative humidity for testing printing paper and other paper products, according to the authors, seem to have had its origin in the textile industry of England. Textile weaving, particularly wool weaving, is facilitated by an atmospheric moisture of 60 to 75% relative humidity. In this paper, the authors advance a number of reasons why 50% relative humidity would meet American conditions more satisfactorily, and give a better indication of paper performance in use. [*"What Humidity Percentage Should be Standard for Paper Testing?" by M. S. Kantrowitz and Ernest W. Spencer. Published in the Paper Industry and Paper World, Fritz Publications, Inc., 59 E. Van Buren St., Chicago, Ill., April, 1940. Price, single issues, 25 cents.*]

Stokers. A brief manual designed to give an outline of stoker installation practice for the salesman, installation man, and serviceman. It is not intended as a textbook but rather as a handy reference for use in the field. For this reason the contents are divided into three general sections as follows: Selection, Installation, and Service. [*"Domestic Anthracite Stokers, Selection, Installation, and Service," bulletin L37. Published by the Anthracite Industries Laboratory, Primos, Delaware County, Pa. Paper cover; 6x9 in.; 16 pages. Available on request; write to Anthracite Industries.*]

NEWS OF THE MONTH

Plumbing Industry's Commercial Standards Accepted by Gov't.; Move Result of Work of Industry Committee and NADC

WASHINGTON — That commercial standards filed by heating, plumbing, and allied industries may become yardsticks for Government purchases of such equipment for the defense housing program is forecast by reports of initial activities of the industry committee formed September 5 at Cleveland to serve as liaison agency between the National Defense Advisory Commission and the 14 sub-divisions of the heating and plumbing industries.

By agreement between the industry committee and the Construction Division of the National Defense Advisory Commission, the plumbing industry's filed commercial standards are already being written into defense project specifications and indications are that other commercial standards existing within the industry will soon be given NADC approval.

Adoption of the plumbing industry's standards, with its implication that other industry standards will be approved, is a direct result of contacts between NDAC and the industry committee headed by George E. Hoffman, manager of the plumbing and heating department, Crane Co. By correspondence and in person, Mr. Hoffman's committee, including a representative of each of 14 sub-divisions of the plumbing and heating industry, is in constant touch with the ever-changing construction picture in Washington.

When questions pertaining to plumbing and heating are encountered by NDAC executives, the matter is immediately referred to Mr. Hoffman, who relays the query to the sub-divisional industry chairman affected. Authorized to speak for his section of the industry, the sub-division chairman is able to place authentic data in the hands of the commission with a minimum of delay.

The significance of the adoption of the plumbing industry's commercial standards—and the inference that approval of others will be forthcoming—is best understood when it is recalled that all Government purchases are made in accordance with Federal Specifications are listed in Standard Stock Catalog, price list No. 75. (Copies of the stock catalog, listing titles and prices of all standard specifications followed by Government Procurement Agencies, can be secured without cost by writing the Superintendent of Documents, United States Government Printing Office, Washington, D. C.)

Although Federal Specifications are usually written as a result of experiments made by the National Bureau of Standards, it is frequently noted that requirements vary slightly from practices or specifications accepted as standard with the industry involved. Thus, although the basic specifications might be identical, the apparently slight exceptions have been known to limit the number of possible bidders, slow down production schedules in the plants of successful bidders, and even to cause rejections of finished products which would be regarded as entirely acceptable to a commercial buyer.

Revision of an official "Federal Specification" is often a laborious process. Conversely, NDAC approval of a commercial standard will doubtless serve as a "blanket revision" of a given specification, in the interest of eliminating bottlenecks that might interfere with defense deliveries.

C. V. Fry Elected by Boston NDHA

BOSTON—Members and guests of Boston Section, National District Heating Association, gathered at the gate house of the Boston Edison Company's Edgar Station in Weymouth Oct. 22, to inspect the new 1200-lb. steam installation by which the Edison Company supplies process and heating steam to the new Procter & Gamble Company's plant, across the river from the Edison plant.

The afternoon inspection trip was followed by an evening session at which M. D. Engle presented to Col. W. D. Boyden the national award of Honorary membership. The dinner was followed by a discussion of papers presented at the national convention.

Officers for the ensuing year were elected as follows: chairman, C. V. Fry; vice-chairman, M. A. Ulbrich; treasurer, M. A. Edwards; secretary, F. C. Myer; executive committee, L. K. Spink, Morrill Dakin, D. F. Cavanaugh and C. G. Young.

Sponsors Automatic Heat Contest

BUFFALO—A contest to stimulate public interest in automatic house heating is being jointly sponsored here by the Air Conditioning Council of Western New York, Buffalo Oil Burner Association and Buffalo Stoker Association.

Ten prizes will be awarded for the best answers to the question: "Why Is Automatic Home Heating Preferable?" The first prize is a $100 certificate acceptable as cash by dealers.

Air Hygiene Symposium Planned to Study Defense Worker's Health

PITTSBURGH—The fifth annual meeting of Air Hygiene Foundation, scheduled at Mellon Institute here, Nov. 12-13, will insist that the health of workers is as important as health of soldiers in girding America. Defense production, it will contend, demands the defense of employee health.

Prof. Philip Drinker of Harvard will head a symposium highlighting health safeguards in the mining, mechanical and chemical industries which bear the brunt of preparedness production. It will be recalled that in World War I, eight to nine men were busy in the mills keeping one soldier supplied at the front.

Besides Prof. Drinker, chairman of the Foundation's engineering committee, participants in the symposium include:

Capt. Ernest W. Brown, senior medical officer, Brooklyn Navy Yard, "Industrial Hygiene and the Navy in National Defense"; Dr. P. A. Neal, National Institute of Health, "The U. S. Public Health Service in the Defense Program"; Dr. Howard W. Haggard, Yale University, noted health writer, "Noxious Gases"; Dr. Carey P. McCord, Detroit, director, Industrial Health Conservancy Laboratories, "Health Protection in Electric Welding."

L. Metcalfe Walling, administrator, division of public contracts, U. S. Labor Department, will outline health requirements on government contracts under the Walsh-Healey Act.

William P. Yant, research director, Mine Safety Appliances Company, Pittsburgh, will talk on the protection of civilians in war time, especially from dangerous gases.

Reports will be made on findings from Foundation-supported researches on industrial health problems, by Dr. L. U. Gardner, director, The Saranac (N. Y.) Laboratory, Dr. Eliot R. Clark, University of Pennsylvania, and Prof. Drinker.

Dr. A. J. Lanza, New York, chairman of the Foundation's medical committee, will report on industrial hygiene developments during the past year.

Derwent Elected by Gas Group

ATLANTIC CITY — W. E. Derwent, Rockford, Ill., vice-president of the Geo. D. Roper Corporation, was elected president of the Association of Gas Appliance and Equipment Manufacturers at the organization's annual meeting held here October 7. He succeeds Frank H. Adams.

160 Spaces Sold for All-Industry Refrigeration and A.C. Exhibition, Refrigerating Equipment Association Told at Meeting

French Lick—Seventy per cent of member companies were represented at the fall meeting of the Refrigeration Equipment Manufacturers Association held here October 9-11.

The first day was devoted to meetings of the various Association committees, as well as to meetings of the respective relations committees of REMA and the other associations who participate with it in the All-Industry Refrigeration and Air Conditioning Exhibition. Details were completed for the attendance promotion work for the coming All-Industry Exhibition in Chicago in January.

On October 10, the business of the Association got under way with the call to order by E. A. Vallee, vice-president and sales manager of Automatic Products Company and president of the Association. Following the first address by Philip P. Gott, manager of the trade association department, U. S. Chamber of Commerce, N. J. MacDonald, vice-president, The Thomas and Betts Company, delivered an address on "The Wholesaler—Our Partner in Business," enumerating the elaborate plan which his company has adopted in assisting its wholesalers.

Probably one of the most important committee reports was that presented by William C. Allen, vice-president, Modern Equipment Company, and vice-president of the Association. His committee recommended the adoption of some clarifying amendments in the procedure of the Association's "Information Service on Distribution Outlets" through which the Association assembles and furnishes information with respect to the manner in which the various members have classified, according to the functions which they perform, the distribution outlets with whom they have been doing business, and to furnish credit and other pertinent information concerning such outlets. After a thorough explanation by Mr. Allen of the proposed amendments to the plan it was unanimously voted to approve the changes recommended.

On Friday morning, two interesting papers were presented; the first, on "Requisites for Success in a Jobbing Business," by J. W. Baillie, secretary-treasurer of Detroit Lubricator Company, was a valuable contribution to the wholesaler in assisting him to check up on his own business operations. Stuart G. Phillips, advertising manager, Dole Valve Company, did an excellent job in presenting "Cold Facts and Hot Ideas—What Advertising Can Do for You," giving some unique and interesting ideas on the value of advertising to the manufacturer and how the fullest advantage can be taken of all forms of publicity, ranging from trade paper advertising down to trade show exhibits.

At the conclusion of these two papers, several important committee reports were made. M. W. Knight, sales manager of Peerless of America, and chairman of the exhibition committee, reported that already 160 exhibit spaces had been taken for the All-Industry Exhibition next January. John Wyllie, chairman of the RSES relations committee, presented his report and particularly stressed the cordial relations existing between the two associations and the desire upon the part of the RSES to maintain this relationship.

At the 1940 Fall Meeting of REMA

Left to right, top row: M. W. Knight, Peerless of America, Inc.; Ivan Corcoran, Square D Company; Otto C. Wilk, The Weatherhead Company; L. F. Blough, White-Rodgers Electric Co.; M. E. Miller, Peerless of America, Inc.; E. J. Zoll, Chicago-Wilcox Mfg. Co.; J. M. Dumser, Chase Brass & Copper Co.; Fred Riggin, Jr., Mueller Brass Co. Fifth row: H. T. McDermott, secretary, RSES; G. E. Graff and A. J. Meyer, Ranco, Inc.; A. B. Newton, Minneapolis-Honeywell Regulator Co.; G. Russell Whippo, The Weatherhead Co.; E. C. Eickhoff, Chase Brass & Copper Co.; G. A. Burns, president, RSES; David L. Fiske, secretary, ASRE. Fourth row: John Wyllie, Jr., Temprite Products Corp.; F. K. Smith, Tecumseh Products Co.; J. A. Strachan, Kerotest Mfg. Co.; L. C. McKesson, Ansul Chemical Co.; Clark Bridgman, The Bush Mfg. Co.; Barrett Scudder, Jas. P. Marsh Corp.; C. H. Benson and Wm. A. Leonard, The Imperial Brass Mfg. Co.; Frank J. Gleason, Copeland Refrigeration Corp.; H. W. Jarrow, Jarrow Products Corp.; Third row: M. R. Oberholzer, L. H. Gilmer Co.; M. H. Pendergast, Modern Equipment Corp.; J. Norbert Ott and C. V. Gary, Henry Valve Co.; F. J. Hood, Ansul Chemical Co.; S. R. Robinson, Bonney Forge & Tool Works; F. A. M. Dawson, Jobbers-Manufacturers Relations Committee; C. C. Ryan, Dole Refrigerating Co.; K. B. Thorndike, Detroit Lubricator Co.; Second row: Phil. B. Redeker, Business News Publishing Co.; J. W. Krall, Detroit Lubricator Co.; J. E. Jernberg, Mills Novelty Co.; W. C. Allen, Modern Equipment Corp.; R. M. Van Vleet, Cutler-Hammer, Inc.; Robert LeBaron, Virginia Smelting Co.; F. R. Pond, Jobbers-Manufacturers Relations Committee; Front row: R. M. McClure, REMA secretary; W. D. Keefe, Fedders Mfg. Co.; Attorney Hammond E. Chaffetz; Stuart G. Phillips, The Dole Valve Co.; Philip P. Gott, Chamber of Commerce; N. J. MacDonald, Thomas & Betts Co.; E. A. Vallee, Automatic Products Co.; J. S. Forbes, Superior Valve & Fittings Co., and George Taubeneck, Business News Publishing Company.

Winnipeg Chapter Elects Charles

Winnipeg — Fred L. Charles, manager of Walsh & Charles, Ltd., this city, was recently elected president of the Manitoba chapter, ASHVE, at the annual meeting in the Ft. Garry Hotel here. Other officers for 1940-41 are as follows: vice-president, R. L. Kent, manager of Trane Co. of Canada, Ltd.; secretary, Ivan McDonald, manager of Minneapolis-Honeywell Regulator Co., Ltd. (re-elected); board of governors, G. C. Davis, of Northern Public Service; E. F. Munn, architect; and F. L. Chester, manager of W. G. Chester Co., Ltd.

House Building at Pre-1929 Level

Washington—Production of single-family homes in the United States in 1940 will be close to the average number built annually during the 1920-29 decade and will be the highest in twelve years, according to Federal Housing Administrator Stewart McDonald.

X-Ray Room Is Air Conditioned

PORTLAND, ME.—What is perhaps the first special air conditioning for an X-ray room in a hospital, certainly the first of its kind in New England, was recently installed at the Maine Eye & Ear Hospital by Associated Engineers and M. B. Bowen & Son of this city.

Due to the fact that it is necessary to keep windows in the room closed and screened whenever X-ray photographs are taken, which makes ventilation a serious problem, when coupled with the fact that the room is directly over the boiler room of the hospital, it was found necessary to install a one-ton, self-contained air conditioning unit. This has brought great relief to the technicians and physicians engaged in this work.

The unit is mounted on pipe framework in a small office adjacent to the main X-ray room, since its location in the workroom itself would interfere with operation of the X-ray machine. The discharge and return grilles are located on the opposite wall in the X-ray room, with a short connecting duct through the partition wall.

Dimensions of the X-ray room are approximately 18 x 20 x 10 ft., and the design and conditions permitted a temperature reduction of 12F with 50% relative humidity. The unit is remarkably quiet, and while noise is an important factor in any hospital, no sound can be detected in the X-ray room while the air conditioning unit is operating.

Discharge and return grilles are located together, approximately 8 feet from the X-ray machine, with discharge grille deflected upward to pass air over the X-ray equipment, due to the rather low ceiling. Approximately 70% of the air is recirculated. Discharge grilles are 10 in. below the ceiling and returns 18 in. Average temperature maintained is 70F. Since there are no anaesthetics used in this room, it was possible to recirculate a large percentage of the air, thus reducing the fresh air intake and the power load. Since the condenser is mounted on a spring frame no soundproofing was nceessary.

A.C. Lab for Ordnance Testing

PITTSBURGH—The Pittsburgh chapter of the ASHVE met October 14, with the subject of Air Conditioning in National Defense discussed by L. W. Cordrey and William H. Reed,

Lieut. Rush A. Bowman, Army Ordnance Department, spoke on the subject of Precision Instruments and Gauge Block Testing. A new laboratory has been set up for this purpose at Carnegie Tech. Air conditioning plays a vital part in this work.

House Building Highest in Decade

MINNEAPOLIS—New house construction in 310 leading American cities in 1939 totaled the highest in value and volume in ten years, according to the annual national house building survey of Investors Syndicate completed and made public October 1.

"Volume of new homes last year was more than ten times (10.4) the 1934 total, the low for the decade," explained C. J. Ryan, of the company. "Value of these new residences was almost ten times (9.8) the low total hit in 1934."

Contributing substantially to these record-breaking figures was the smallness of the advance, only four-fifths of one per cent, in average cost per person provided with new housing over the preceding year.

"Rapidity of residential construction last year, the fifth successive year to record gains, is emphasized," said Mr. Ryan, "by the fact that both value and volume increase were the largest year-to-year rise during the decade."

The cities included in the survey, located in 41 states and the District of Columbia, have a population, according to the 1940 preliminary estimate of the U. S. Bureau of Census, of 49,134,705, or 37.4 per cent of the population of the United States. This group includes the 92 cities with a population of 100,000 or more.

A.C. Urged for Post-Operative Rooms

PHILADELPHIA — Importance of the role of air conditioning in surgical operations was emphasized by Dr. Murray B. Ferderber, research fellow in industrial hygiene at the University of Pittsburgh School of Medicine, in an address during the 90th annual convention of the Medical Society of the State of Pennsylvania held here Sept. 30—Oct. 5 at the Bellevue-Stratford Hotel.

Stressing the necessity of air conditioning adjoining recovery rooms as well as surgical operating rooms, Dr. Ferderber, who is an engineer as well as a physician, declared that "the attention of the medical profession has been drawn to the hazards of surgery performed in extremely hot weather; but in our haste to make conditions suitable for the surgeon we have neglected to a certain extent the desirable conditions necessary for the post-operative patient."

A recovery room next to the operating room is "quite necessary to continue the care of the operated patient," Dr. Ferderber asserted, "because the dangers in the hours after are far greater than those during surgical procedures."

Agreement on Gas Law Reached

LOS ANGELES—Mutual co-operation toward solving the problems which currently divide Los Angeles gas utility firms and gas heater manufacturers on the question of a city ordinance for gas heating units was pledged by officials of the Southern California Gas Co. and the Southern Counties Gas Co. at the October meeting of the Los Angeles Institute of Gas Heating Industries.

E. K. Strickland, sales promotion engineer of the Southern California Gas Co., and H. L. Warren, sales research engineer of the Southern Counties Gas Co., met with the Institute members. Both have been active since the middle of 1939 in drafting a proposed venting ordinance for gas heaters, which is still in process of formulation. Mr. Strickland reported that agreement had been reached on the main issues of the gas company sponsored ordinance, but that some disagreement still prevails on minor points. He stated that the gas companies feel the urgent need of an ordinance defining certain minimum practices of installation, safety and adequacy for furnace installations, such as the Institute is drafting. He announced that the gas companies are sympathetic to the Institute's aims for preparing an ordinance for governing heater installations and were prepared to cooperate fully in achieving the goal.

Mr. Warren declared that the gas companies were primarily interested in the adequacy of a given furnace for a given job, because most accidents result from over-firing.

Mize Addresses Buffalo Chapter

BUFFALO—The Western New York chapter, ASHVE, opened its Fall meeting season in the University Club here October 14. Clarence A. Gifford, newly-elected president, presided.

Principal speaker of the evening was Senior Meteorologist Ralph C. Mize of the Buffalo Weather Bureau who gave an interesting talk on Alaska. Comparing the temperature of Alaska and the United States, Mr. Mize said the year-around temperature of Juneau is only five degrees below that of Buffalo.

Weston Addresses Boston Groups

CAMBRIDGE, MASS.—A joint meeting of the Air Conditioning Bureau and Massachusetts chapter of the ASHVE was held Oct. 23 at the Massachusetts Institute of Technology, the first fall gathering for both organizations. The guest speaker was Arthur Weston, chief engineer of the Massachusetts State Department of Health, who spoke on "Registration of Professional Engineers in Massachusetts."

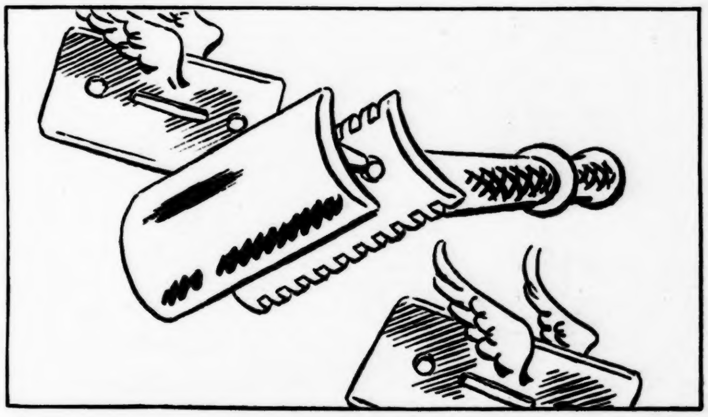
Guide to a Merry Xmas for plant engineers

1 Install Dust-Stop* Air Filters and you'll be a real Santa Claus to every worker in your plant. Dust-Stops cost approximately 1-cent per CFM to install, including frames; approximately 1/10th-cent per CFM, when filters need changing.

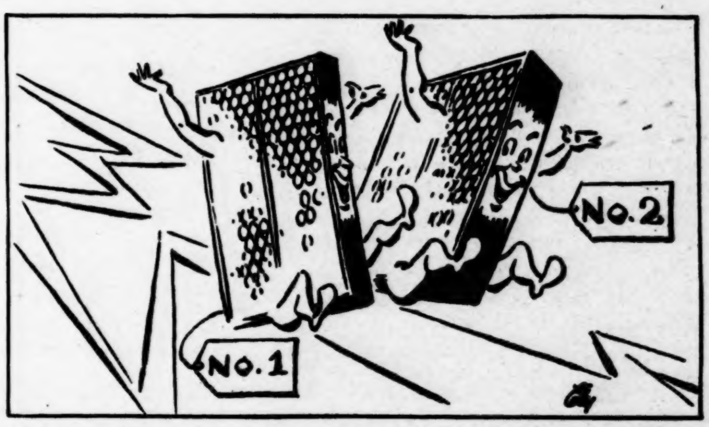
2 And you'll never have this dream about filter fires with Dust-Stops. Don't forget—Dust-Stops are safer, because the all-glass filtering medium, Fiberglas* fibers, and the patented adhesive will not support combustion.

3 And brother, the interference Dust-Stops put up against dirt passage is wonderful! Capacity: 2 CFM per square inch of area at 300 FPM. Resistance: (in inches of water gauge per inch of depth) .045 to .050 clean, and .11 to .12 dirty. They stop virtually all "nuisance" dusts.

4 Nobody can put you behind the "8" ball, because of bleeding. For Dust-Stops don't bleed. The filtering adhesive will not deposit tiny droplets in the ducts or on the walls. And of course they also eliminate the fire hazard from oil in the duct system.



5 Changing Dust-Stops is as easy as changing a razor blade. No skilled labor required. This replaceable filter fits all types of air handling systems. It eliminates recharging, draining, expert supervision, and the need to keep a supply of spares.



6 So give yourself a Merry Xmas and an Economical New Year by installing replaceable Dust-Stops. Your supply of No. 1 (1-inch) and No. 2 (2-inch) will come promptly from your air conditioning manufacturer, jobber or dealer. Or write: Owens-Corning Fiberglas Corporation, Toledo, Ohio.

FIBERGLAS* DUSTOP* AIR FILTERS

*T. M. REG. U. S. PAT. OFF.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio

DIRECT CANADIAN INQUIRIES TO FIBERGLAS CANADA, LIMITED, OSHAWA, ONTARIO

Space Now Available for OBI Show

New York—Space reservations can now be made for Oil Burner Institute's National Oil Burner Progress Exhibition to be held at the Commercial Museum, Philadelphia, March 17-22. In announcing the general opening of space, C. F. Curtin, Secretary of the Institute, urged manufacturers of oil burners, manufacturers of oil burning accessory equipment, including air-conditioning, fuel oil companies and other eligible exhibitors to be sure to engage sufficient booth space now by communicating with him at 30 Rockefeller Plaza.

According to Mr. Curtin the exhibition will feature oil burner heating, cooking, power and air-conditioning equipment. He added that Oil Burner Institute extends to the oil burner industry and allied industries an invitation to exhibit and to attend the annual convention of the Institute to be held in conjunction with the exhibition. Indications are that space will be rapidly engaged. Exhibitors taking two booths are entitled to a 5% discount, and those taking three booths or more, to a 10% discount. The exhibition will be open free to the public.

Directors of OBI met at the New Yorker Hotel October 7, following meetings of the executive committee October 5-6. President Ray G. Whipple presided. Following discussion regarding OBI's course in connection with the national defense program a committee was appointed to study the subject.

Mr. Whipple called attention to the Oil Burner Progress Exhibition and reported that progress was being made with the standards program, that the Commonwealth of Massachusetts had adopted the commercial standard, and that steps are under way to include natural draft burners in the standard.

The Bacharach Industrial Instrument Company, Pittsburgh, was elected to membership in the associate division of OBI.

1600 Compete in Slogan Contest Sponsored by Buffalo Council

Buffalo — The Air Conditioning Council of Western New York opened its Fall season in the University Club with the presentation of prizes for the recent air conditioning contest conducted here and an instructive talk by Paul B. Zimmerman, vice-president of Grace & Bement Co., Detroit.

Edwin R. Cooney, president of the Council, opened the meeting. Walter P. Davis, executive secretary of the Council, reported on activities of the organization since last May.

He outlined the air conditioning contest launched in August, calling for answers to the question: "I Like to Shop in an Air Conditioned Store Because. . . ." Mr. Davis said 1600 returns were received of which about 1500 qualified. He then presented prizes to the first four prize winners who were guests of the Council.

Mr. Zimmerman, guest speaker of the evening, paid high tribute to the Western New York Council for taking the lead in organized air conditioning throughout the country. He impressed upon members the importance of organization in promoting an infant industry like air conditioning.

"You have a difficult job ahead," he said, "but your horizon is a broad one. The air conditioning business has been kicked around somewhat. But like every new enterprise, it must first go through the development stage."

He said the air conditioning business has now passed from the engineering stage to the commercial stage. "The commercial mind has taken hold of the product and, not knowing as much about it as the engineer, there naturally is confusion. In these two cycles of every new development, many people go out of business."

Commercial people must realize that it is necessary to pool their interests in the marketing of air conditioning, Mr. Zimmerman declared. Competition will follow after this is established.

Fleisher Discusses A.C. and Defense

New York—The significance of air conditioning in national defense, including its place in air raid shelter design, was discussed by Walter L. Fleisher, vice-president of the ASHVE, before the local chapter of that organization October 21. Mr. Fleisher's talk followed the inauguration of Charles S. Pabst, as president of the chapter. He succeeds O. O. Oaks.

In addition to Mr. Pabst, the officers of the chapter for the 1940-41 season include Joseph Wheeler, Jr., vice-president; W. M. Heebner, treasurer, and T. W. Reynolds, secretary. Board of governors consists of Mr. Oaks, Harry L. Baker, Jr., R. A. Wasson, H. H. Bond and C. S. Kohler.

Mr. Fleisher's address covered in detail the results of the Society's research investigations, materials and apparatus required to produce results, sensible and latent heat of the human body, fresh air required, odor and noise effects, effect of sunlight on cooling and heating, savings in summer and winter by insulation, double glazing and orientation, dangerous health conditions, air motion and comfort, origin of heat sources and their dissipation, reduction of air requirements from 30 c.f.m. per person to 10 c.f.m. with its reduction of the cost of theatre air conditioning by more than 50%, why people are more comfortable at higher temperatures, higher air velocities due to improvements in the design of ducts and their outlets, and how the health of the worker can be protected from heat and moisture without undue expense.

Caldwell Addresses ASHVE Group

Los Angeles—A talk by P. G. Caldwell, special products director of the General Electric Co., featured the October meeting of the Los Angeles chapter of the ASHVE. Mr. Caldwell discussed and demonstrated special measuring devices.

(Left) Walter P. Davis, executive secretary of the Air Conditioning Council of Western New York, presents a $75 merchandise certificate to Mrs. Sarah Schier, first prize winner in the Council's recent air conditioning contest. (Center) Edwin R. Cooney (left), president of the Air Conditioning Council of Western New York, is shown with Paul B. Zimmerman, guest speaker at the Council's opening Fall meeting. (Right) Left to right, Clarence A. Gifford, president of the Western New York chapter, ASHVE, Walter Voisinet, past president, and Roswell Farnham, past president of both the Air Conditioning Council and the ASHVE.

Heating 26% of FHA Modernizing

WASHINGTON — Modernization and property improvement loans numbering 77,882 for $31,202,473 were reported to the Federal Housing Administration under the National Housing Act during October, a gain of 42.2% in number and 43.5% in amount over loans reported in October, 1939, according to FHA administrator Stewart McDonald.

Analysis by type of improvement of the Title I loans made from July, 1939, through September, 1940, also was announced by Mr. McDonald, 655,312 loans for $277,942,565 being made during the 18-month period.

The totals and ratios by type of improvement for which the major portion of the loan was to be used follow: New construction, 3.5% of the number and 11.9% of the amount; additions and alterations, 13.4% of the number and 18.1%; heating, 26.2% of the number and 22.1% of the amount.

Stove Heat Paper on ASME Program

NEW YORK—Keynoting better living and greater industrial progress through engineering, the sixty-first annual meeting of The American Society of Mechanical Engineers, to be held in New York, Dec. 2-6, with meeting headquarters at the Hotel Astor instead of the Engineering Societies Building, is expected to attract to it about 5,000 engineers and executives from the United States and Canada. More than 100 technical papers will be presented by leading experts in the field. To accommodate all these papers, 44 simultaneous sessions are being scheduled, including six on Monday evening, Dec. 2.

Among the papers to be presented are "New Design of Wood-Burning Stove," by Frederic W. Keator and Lauren Seeley, Yale University, New Haven, Conn.; "Pressure Loss Formulas for Centrifugal Dust Collection," by Marcel A. Lissman and Franklin Miller, Western Precipitation Co., Los Angeles; and "Recent Experience in the Application of Wet Type Dust Scrubbers," by A. W. Anthony, Jr., Pease-Anthony Equipment Co., Cambridge, and R. V. Kleinschmidt, Stoneham, Mass.

Ask One-Pipe Heater Ordinance

BUFFALO—Immediate amendment of the pipeless-heater ordinance to compel owners of buildings to provide an outlet for fumes from heaters before renting apartments was recommended to the Health Board by Assistant Chief Inspector Frank E. Trumble. The board voted to ask the corporation counsel to draft the necessary law. Mr. Trumble's recommendation was contained in a report on the circumstances surrounding the death of a young man believed to have been caused by a pipeless-heater.

Chimney Code Study to be Prepared

CHICAGO—Sponsored by the National Board of Fire Underwriters and authorized and undertaken by the American Standards Association standards council, a project known as Building Code Requirements for Chimneys and Heating Appliances is being organized to study and recommend standard requirements for construction of chimneys and fireplaces; special construction for smokestacks or fuels for steam boilers or other furnaces; location and protection of smoke pipes, steam pipes, warm air ducts and vent flues; permanent mountings, clearances and other protection for heating producing appliances and their appurtenances.

A committee has been formed, known as "A52—Building Code Requirements for Chimneys and Heating Appliances."

The organizations represented on this committee are: American Gas Association; American Institute of Architects; ASHVE; American Society of Mechanical Engineers; Associated Factory Mutual Fire-Insurance Companies; Building Officials' Conference of America; Committee of Ten—Coal & Heating Industries; FHA; Heating, Piping, Air Conditioning Contractors National Association; Federal Works Agency; U. S. Housing Authority; International Association of Fire Chiefs; National Association of Building Owners and Managers; National Association of Sheet Metal Contractors; National Board of Fire Underwriters; National Bureau of Standards; National Fire Protection Association; National Lumber Manufacturers Association; National Warm Air Heating and Air Conditioning Association; Oil Burner Institute; Structural Clay Products, Inc.; Uniform Building Code Association; and the U. S. Department of Agriculture, Bureau of Agricultural Chemistry and Engineering.

Credit Men Plan Congress in South

NEW YORK—Preparations are being made for the New Orleans Credit Congress of the National Association of Credit Men, to be held in May, 1941. The plumbing and heating industry is represented by a separate division of the Congress, headed by R. L. Griffiths, International Heater Co., Utica, chairman.

Other officers of the plumbing and heating division, elected at the Toronto meeting last May, are: F. G. Phillips, Globe Machinery & Supply Co., Des Moines, and Vernon Mondinger, American Radiator-Standard Sanitary Corp., New Orleans, vice-chairmen; C. J. Barnett, Grinnell Co., Inc., Charlotte, N. C.; F. D. Bartlett, Tay-Holbrook Co., San Francisco; and J. A. Ritchie, Crane Co., Cleveland.

Warm Air Group Plans Convention

COLUMBUS, OHIO—One of the features of the 27th annual convention of the National Warm Air Heating and Air Conditioning Association, to be held at the Hotel Statler, Detroit, Dec. 10-11, will be the activities of the "Air Information—If You Please Committee." Six members of the Association who have been elected to the Committee will sit at the round table on the platform and answer questions which are asked from the floor and previously presented in written form.

A yardstick for the evaluation of a forced warm air heating system will be presented in complete and published form by Professor S. Konzo, chairman of the Joint Yardstick Committee, and F. G. Sedgwick, chairman of the Research Advisory Committee.

Robert K. Thulman of the Federal Housing Administration will discuss the yardstick from the consumer angle while Frank E. Mehrings, chairman of the Publicity and Merchandising Committee, will interpret the yardstick from the marketing angle.

Canadians May Hold Own Meeting

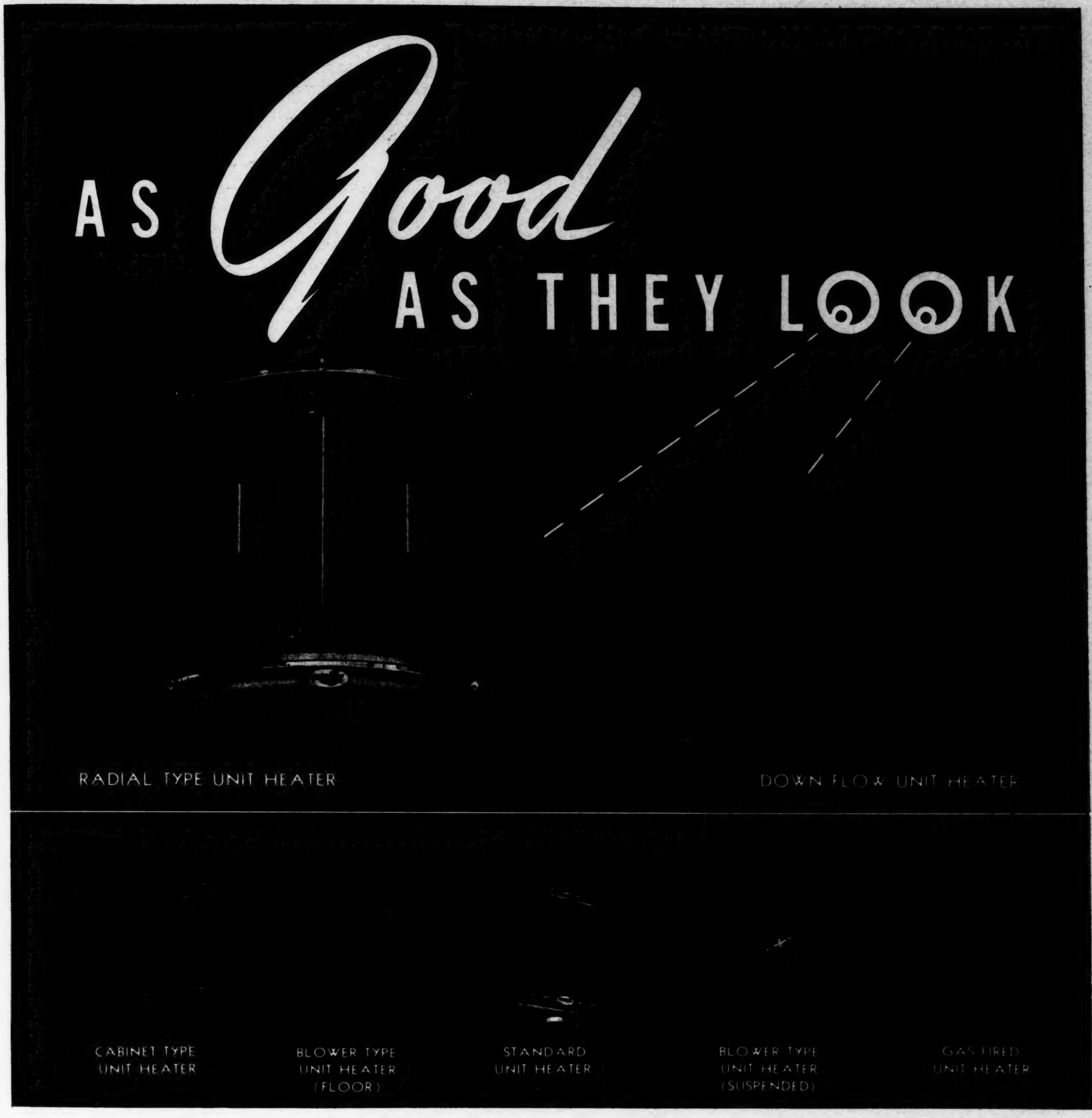
TORONTO — The October meeting of the Ontario chapter ASHVE was featured by an Information Quiz Broadcast with W. C. Kelly, Iron Fireman Mfg. Co. of Canada, Ltd., as announcer. The broadcast was arranged by the papers committee under chairman J. P. Fitzsimmons and had five sitting members, A. Brittain, Jr., Jack Jenkinson, A. T. Jones, Robert Bayles and Alfred W. Wood with E. R. Gauley of Sanitary Engineer as the quiz master. Queries covered every phase of the field.

The resignation of F. E. Ellis, vice-president, was regretfully received. Cyril D. Tasker, Ontario Research Foundation, replaces Mr. Ellis in this office. A. G. Ritchie also retired from the chairmanship of the greeters' committee and was replaced by Stanley A. Jennings, Trane Co. of Canada, Ltd.

Owing to certain difficulties surrounding attendance of the annual meeting of the Society to be held in Kansas City, a Canadian meeting in the spring has been suggested. If the plans go through, members from the western New York Chapter will be invited.

1939 Fuel Oil Production Up

WASHINGTON—According to the 1939 Census of Manufactures, U. S. fuel oil production last year showed a gain over 1937, the last previous Census year, by nearly 750 million gallons. Fuel oil produced in 1939 was 19,983,006,278 gallons, as compared with a 1937 total of 19,243,713,721 gallons.



McQuay designers have given new beauty to Unit Heaters. The handsomely styled McQuay Line has real eye appeal, and more than that, McQuay Unit Heaters are as good as they look. • The McQuay Down Flow reclaims wasteful "stratified heat" and forces warmed air down into the working zone over a wide area. • The new Radial Type, an exclusive McQuay development, provides wide uniform heat distribution, lower installed cost and new economy of operation. One Radial Heater can be used in place or two or more standard units, providing lower installed cost and effecting important savings in piping expense as well. • McQuay and only McQuay offers a complete line of Unit Heaters. There is a Unit Heater for every application. • The new McQuay catalog describes this complete line and shows you its many definite advantages. Write McQuay, Inc., 1619 Broadway Street, Minneapolis, Minnesota. Representatives located in all the principal cities.

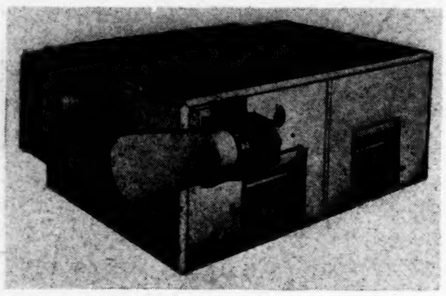
McQuay INC.

Air Conditioners . . . Air Conditioning Coils . . . Blast Coils . . . Blower Coolers . . . Comfort Coolers . . . Cabinet Radiation . . . Concealed Radiation . . . Evaporative Condensers . . . Indoor Cooling Towers . . . Ice Cube Makers . . . Icy-Flo Accumulators . . . Refrigerating Coils . . . Room Coolers . . . Unit Heaters . . . Unit Coolers . . . Water Cooling Units

NEW EQUIPMENT

Dry Zero Air Conditioner Housing

NAME—Lindsay structure housing.
PURPOSE—For housing unit coolers, factory-built central-station plants and miscellaneous air conditioning equipment such as washers, sprays, dehumidifiers and filters.
FEATURES—Manufacturer states that air conditioning units can be erected of Lindsay structure in all sizes and styles. Standard materials are fabricated to within ½ in. of any desired dimension. Materials are marked to facilitate erection and it is said that no cutting or fabrication is necessary. Standard parts can be finished in either square or rounded corners while frames or doors are fastened directly to frame or spot welded to the panel sheets. Insulation can be placed between the walls and lining by gluing

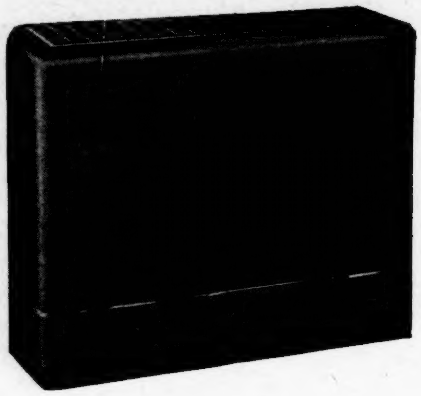


Air conditioner unit with Lindsay structure housing.

the material to panels and framing. Manufacturer states that this type of construction represents a radical departure from conventional methods and that the structural strength of the sheets as well as the framing is made available by pulling the sheets into tension between the framing members. This tension is said to bind the entire structure rigidly together so that the completed unit gives the appearance of a finished job. Sheets are fastened to the framing with simple wrenches.
MADE BY — *Dry-Zero Corporation, Chicago, Ill.*

Johns-Manville Insulation

NAME—L-W Superex.
PURPOSE—For insulating at temperatures up to 1500F.
FEATURES — This material is furnished in both block and piping covering form. It is of the moulded diatomaceous silicate type and is said to be light in weight, weighing only 20 lb. per cu. ft. Blocks are furnished in 3, 6, 9 and 12 in. widths in standard lengths of 18 and 36 in., and in thicknesses from 1 to 4 in. Pipe insulations are supplied in standard sizes in sections 3 ft. long and 2½ in. thick.
MADE BY—*Johns-Manville, 22 East 40th Street, New York, N. Y.*



For spot heating.

McQuay Cabinet Unit Heater

NAME — McQuay cabinet type unit heater.
PURPOSE—For spot heating in vestibules, stairways, halls as well as shops and stores.
FEATURES—Unit heater is available in three styles, wall type, floor type and suspended model. It is equipped with two quiet operating fans and all piping and electrical connections are made within the cabinet. Cabinet is made of steel with baked enamel.
MADE BY—*McQuay, Inc., 1619 Broadway N.E., Minneapolis, Minn.*

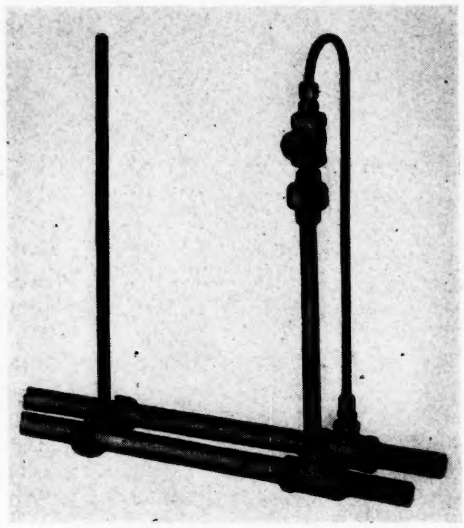
Paragon Automatic Heating Control

NAME—Interval Timer.
PURPOSE—For stopping automatically after a pre-set time, equipment such as air conditioning units, automatic heaters and attic fans.
FEATURES — These interval timers are timed and operated by a slow speed, self-starting synchronous motor, equipped with a silver contact switch. A setting is made by turning pointer away from zero to a desired time, thus closing a load circuit and starting a time operation. Settings may be made between 45 minutes minimum and 9½ hours maximum. For use with 115 volt 60 cycle.
MADE BY—*Paragon Electric Switch Company, 37 W. Van Buren St., Chicago, Ill.*

For timing equipment operation.

Spraying Systems Humidifying Nozzle

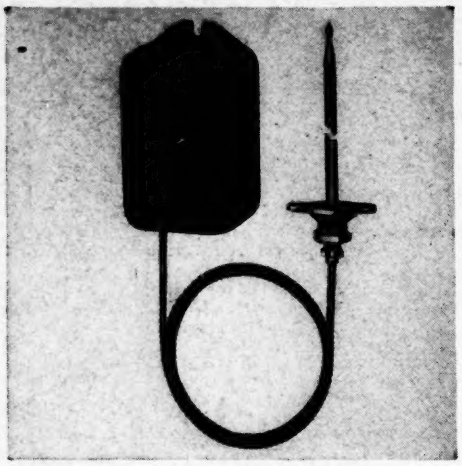
NAME—Humidifying nozzle.
PURPOSE — For adding moisture to air.
FEATURES — A group of these nozzles are mounted at the ceiling level with the water level maintained slightly below the nozzle levels by means of a float controlled tank. Compressed air is controlled by a solenoid operated valve actuated by a humidistat. Manufacturer states that the system is foolproof and cannot drip for when the air supply is shut off water will drop back to the controlled level.
MADE BY — *Spraying Systems Co., 4021 W. Lake St., Chicago, Ill.*



For adding moisture to air.

Iron Fireman Anthracite Commercial Stoker

NAME—Iron Fireman series 35, commercial anthracite stoker.
PURPOSE — For burning anthracite coal in commercial boilers.
FEATURES—Stokers are of the "poweram" underfeed type which uses a metering type worm to deliver the coal from the hopper to the retort and reciprocating coal distributors in the base of the retort to deposit the coal uniformly. The coal is burned on inclined reciprocating grates which gradually move the burning fuels from the retort towards the ash pit. Air for combustion is supplied by a forced draft fan through air ports in the grate bars. Ash is shoveled or hoed from pits to ash doors in the boiler front.
SIZES AND CAPACITIES—Nine sizes with capacities ranging from 25 to 140 boiler hp.
MADE BY — *Iron Fireman Manufacturing Company, 1305 S. W. Twelfth Ave., Portland, Ore., and Cleveland, Ohio.*



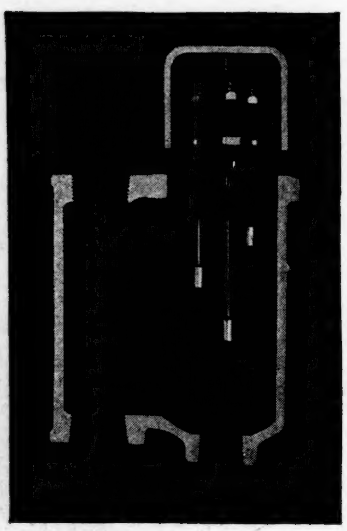
Remote bulb thermostat.

Barber-Colman Microtherm

NAME—Remote bulb Microtherm.
PURPOSE—A proportioning thermostat for controlling the temperature in hot water tanks, air conditioners, driers, and similar equipment.
FEATURES—This instrument is said to bring the many advantages of Barber-Colman's Micro control to situations where the requirements call for a motor operated valve or damper to be positioned accurately and quickly in accordance with load variations. The remote bulb and bellows assembly are hydraulically formed while the volume of liquid and conducting surfaces are balanced to give the minimum ambient temperature effect. The bulb is furnished with a mounting flange suitable either for immersion or duct mounting. Thermostats for two-position control and for floating control are also available.
MADE BY—*Barber-Colman Company, Rockford, Ill.*

Johnson Boiler Water Controls

NAME—Boiler water controls, types E and S.
PURPOSE—For maintaining boiler water at a safe level by starting boiler feed pumps whenever the water level falls below a predetermined minimum.



Electrode holder as used on Johnson water and boiler water controls.

FEATURES—Each of these models uses a motionless electrode control which is made up of two electrodes of different lengths suspended in a chamber which can be mounted right on the water glass column. When the boiler level falls below the longer electrode an electrical circuit is disturbed which through a relay starts the pumps in operation and keeps them pumping until the water in the boiler reaches the short electrode. Model E will start single phase electric motors as large as 1 hp. while for polyphase or larger single phase size motors it functions as a pilot circuit to operate a starter. Model S is used to control an electric steam supply valve.
MADE BY—*Johnson Corporation. Three Rivers, Mich.*

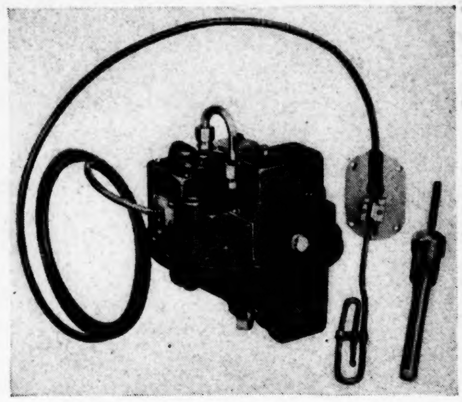
New Type C Anemostat.

Type C Anemostat

NAME—Type C Anemostat.
PURPOSE—For introducing air into rooms without drafts.
FEATURES — This modified type C Anemostat functions in the same manner as the preceding type C. However, the following improvements have been made: (1) the diameter of the outer cone has been reduced from a dimension approximately three times the neck diameter to a dimension approximately two times the neck diameter. Because of the smaller outer dimension, the ceiling opening will be correspondingly smaller. (2) The outer cone is finished with a moulded edge, to prevent smudging and streaking of the ceiling, while (3) the unit is said to be sturdier because the outer cone is strengthened by the moulded edge.
MADE BY—*Anemostat Corporation of America, 10 East 39th St., New York, N. Y.*

White Rodgers Gas Valve

NAME—White Rodgers gas valve.
PURPOSE—For controlling the flow of gas.
FEATURES—This device combines a diaphragm gas valve and a hydraulic

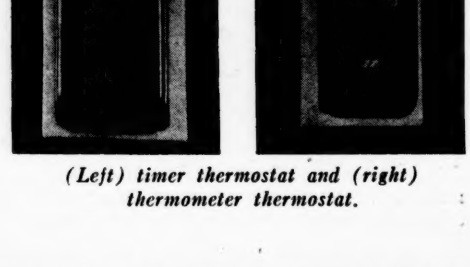


White Rodgers gas valve.

action mechanical limit control in one unit. Manufacturer states that complete safety is assured at all times because normal operation of the limit control is not affected by electric power failure or by normal opening of the valve. Diaphragm valve is of the puff bleed type providing almost instantaneous shut-off of bleed upon burner ignition. It has an automatic re-cycling feature which, if the valve is opened manually, will return it to normal operation upon resumption of power service. Types for both warm air and hot water are available.
MADE BY—*White Rodgers Electric Company, 1209 Cass Avenue, St. Louis.*

General Controls Thermostat

NAME—Timer thermostat and thermometer thermostat, series T80.
PURPOSE—For regulating room temperatures.
FEATURES — The thermally responsive mechanism is the large thermostat cover itself. Manufacturer states that intimate contacts between cover and bi-metal operates the thermostat and the bi-metal differential is but ¼F. Thermostat is equipped with a plastic base to thermally isolate the thermostat from the wall. The setting knobs are on the surface of the thermostat cover. There are three thermostats in this line, a regular thermostat, a thermometer thermostat and a timer thermostat. The thermometer thermostat has a visible bi-metal thermometer while the timer thermostat is equipped with a 13-hour clock.
MADE BY — *General Controls Co., Glendale, Calif.*



(Left) timer thermostat and (right) thermometer thermostat.

NEW TRADE LITERATURE

Air Washers. A standard size, 28-page Bulletin No. 3142-A on Buffalo air washers. Gives information on the various types of Buffalo air washers together with details of construction, sizes, capacities and dimensional data. Among the types of washers described are static washers, air washers, central conditioning cabinets and special equipment for air conditioning applications. Buffalo Forge Company, Buffalo, N. Y.

Heating Coils. Standard size, 20-page catalog, No. 4540 on the Young fan blast units for air conditioning and industrial applications. Gives information on design and construction, sizes, capacities, dimensions, method of selection and sizing diagrams. Young Radiator Co., Racine, Wis.

Humidifiers. An 8-page illustrated educational bulletin entitled, "Facts You Should Know About Humidification." Discusses the cause and cure of troubles accompanying dry air during the winter heating season. Among the tables is one listing the desirable relative humidity. A catalog section contains data on the new line of Armstrong steam type humidifiers. Armstrong Machine Works, 846 Maple Street, Three Rivers, Mich.

Radiator Heating. An 8-page standard size bulletin listing twenty advantages of radiator heating over warm air heating. Burnham Boiler Corporation, Irvington, New York.

Steam Traps. A standard size, highly informative book of 40 pages entitled, "How to Choose a Steam Trap." Book contains a considerable amount of valuable information on selection of steam traps for such applications as unit heaters, pipe coils, and heating surfaces, fan system heating surfaces, steam jacketed kettles, autoclaves, submerged surfaces, hospital, kitchen and laundry equipment, steam purifiers and steam mains. Also includes information on trap installation, operation and maintenance. The book concludes with a catalog section giving information on Anderson traps. Free when requested on company letterhead. V. D. Anderson Company, 1935 West 96th Street, Cleveland, Ohio.

Underground Steam Lines. A standard size, 8-page Bulletin No. 4013 on Ric-wiL insulated pipes for underground steam lines. Gives details of construction, outstanding features and sizes. Also shows a number of typical installation photographs. Ric-wiL Company, Cleveland, Ohio.

Unit Coolers. A standard size, 8-page condensed catalog AC-300 giving specifications, dimensions and performance data on Fedders unit coolers for comfort cooling. Also includes data on Fedders high capacity thermostatic expansion valves and superheat thermometers. Fedders Manufacturing Company, Inc., Buffalo, N. Y.

Unit Heaters. A four-page, standard size catalog, No. 2540 on the Young vertical flow unit heaters. Gives information on construction, capacities, dimensions and application. Young Radiator Co., Racine, Wis.

Vacuum Heating Pumps. An 8-page standard size Bulletin 404 on the Whittington vacuum heating pumps. Presents information on construction, capacities, sizes, and installation of Whittington vacuum heating pumps. Also includes partial list of installations. Whittington Pump & Engineering Company, Indianapolis, Ind.

WITH THE MANUFACTURERS

Charles Demuth & Sons, formerly located at 112-07 New York Blvd., Jamaica, N. Y., have moved to their new factory at Denton Ave., Garden City Park, N. Y. The firm consists of Charles Demuth, who has been engaged in heating, ventilating and air conditioning for nearly half a century, and his three sons. The new factory is modern in every respect, is air conditioned and equipped with the latest machinery for the manufacture of the firm's air distributors and additional items soon to be announced.

Iron Fireman Mfg. Co. has purchased a second plant in Portland, Ore., which will be operated in conjunction with its main plant there. Other plants are located in Cleveland and Toronto. Machine tools are already being installed and production will begin by Jan. 1. The new plant will manufacture parts for the Boeing Aircraft Company, now filling national defense air contracts amounting to more than $130 million.

Jackson Moistening Co., Inc., formerly of Fall River, Mass., has moved its factory and sales office to 424 Woonasquatucket Ave., No. Providence, R. I.

Charles N. Rink

McQuay, Inc., Minneapolis, Minn., has appointed *C. N. Rink* as manager of its Air Conditioning Coil Division. After receiving his mechanical engineering degree from Cornell, Mr. Rink was associated with Buffalo Forge Company at Buffalo and Atlanta, for seven years in research, design, testing and finally as sales manager in Atlanta. For the past three years he has been manager of the Murray Company of Atlanta, contractors and distributors of heating, ventilating and air conditioning equipment.

H. H. Robertson Co., Pittsburgh, furnished Robertson ventilators and ducts for the paint spray areas in Building "C" of the Glenn L. Martin Company plant at Middle River, Md. This equipment was designed to remove the paint fumes from the area and the installation was described in detail in the September, 1940, issue of HEATING & VENTILATING.

Shell Oil Company, Inc., New York, N. Y., has appointed *Dr. Ralph T. Goodwin,* nationally prominent fuel oil technologist, as manager of fuel oil sales. Dr. Goodwin's appointment has been made as part of a current decentralization move combining the eastern and midwestern producing and marketing units of the company. He will be in complete charge of tractor, diesel, domestic, industrial and bunker fuels, kerosene and petroleum coke sales everywhere east of the Rockies. A graduate of the University of Southern California, he assumed charge of the chemical division of the U. S. Bureau of Aircraft Production after the war. From 1923 until 1932 he engaged in extensive research work in petroleum chemistry. In 1932 he joined Shell to organize a fuel oil department at St. Louis, Mo. After serving four years as head of Shell's newly organized fuel oil sales department here, Dr. Goodwin was transferred to New York to direct fuel oil sales for the eastern territory.

Williams Oil-O-Matic Heating Corp., Bloomington, Ill., announces that *W. A. Matheson* has re-joined the company in the newly-established post of assistant to the president. Since February, 1937, Mr. Matheson has been in charge of the New York office for the Delco Heat Division of General Motors Sales Corporation. Previous to his General Motors connection, Mr. Matheson had spent more than ten years in various Williams activities. He was branch manager of the Portland, Ore., office of the Williams distributor for the Pacific northwest. From Portland he went to Philadelphia where he spent additional time in the oil burner field. Next came his appointment as manager of Williams Chicago branch. Mr. Matheson's chief duty will be to coordinate factory activities so that they will prove of greatest benefit to the dealer and sales organization. At present, he is dividing his time between office and field to lay the groundwork for the 1941 merchandising program.

Young Radiator Co., Racine, Wis., has appointed *A. D. Lynch* as personnel director. Mr. Lynch was formerly personnel director of J. I. Case Company of Racine. The company has also appointed *Boyce W. Knight*, who since early in the year has been doing special survey work for the Company, as special representative in the Middle West territory to serve the Tractor, Truck and Industrial Radiator Division. Mr. Knight's headquarters are at the Company's main office and plant at Racine.

COMING EVENTS

DECEMBER 2-7. 14th National Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York, N. Y. For information write Charles F. Roth, president, International Exposition Company, Grand Central Palace, New York.

DECEMBER 3-5. Winter meeting of the American Society of Refrigerating Engineers to be held at the Hotel Commodore, Lexington Avenue and 42nd Street, New York, N. Y. For information write David L. Fiske, Secretary, ASRE, 37 West 39th Street, New York.

JANUARY 13-16, 1941. Third Refrigeration and Air Conditioning Exposition to be held at Stevens Hotel, Chicago.

JANUARY 27-29, 1941. 47th Annual Meeting of the American Society of Heating and Ventilating Engineers to be held at Hotel Muehlbach, Kansas City, Missouri, with Kansas City as Host Chapter.

MARCH 17-22, 1941. National Oil Burner Progress Exhibition of oil heating and air conditioning equipment, Commercial Museum, Philadelphia. Further information available through C. F. Curtin, Oil Burner Institute, 30 Rockefeller Plaza, New York.

JUNE 16-20, 1941. The Pacific Heating and Air Conditioning Exposition, Exposition Auditorium, San Francisco, Cal. Managed by the International Exposition Company, Grand Central Palace, New York.

JUNE 16-20, 1941. Meeting of the Heating, Piping and Air Conditioning National Association, San Francisco, Cal.

JUNE 16-20, 1941. Summer meeting of the American Society of Heating and Ventilating Engineers, to be held in the Civic Center Auditorium, San Francisco, Cal.

JUNE 23-27, 1941. Annual meeting and exhibit of the American Society for Testing Materials. Palmer House, Chicago, Ill. For information, write Society at 260 So. Broad St., Philadelphia, Pa.

H&V'S PHOTOS

PAGE 19—Wide World Photos, Inc., New York.
PAGE 37—Brooklyn Union Gas Company, Brooklyn, N. Y.
PAGE 53—(Upper and lower right) Plumbing and Heating Industries Bureau. (Lower left) University of Illinois.
PAGE 57—Ilg Electric Ventilating Company.