UNIT SYSTEMS*

Unit systems consist of an individual unit incorporating all the apparatus necessary for providing, directing and controlling the necessary volume of air heated to the proper temperature for the purpose. Two types are in common use, one for public building work and the other for factory and industrial installations.

All unit heating and ventilating devices consist essentially of small fans connected closely with heat radiating surfaces. Steam or hot water usually is used for heating, and electric motors usually are used for power.

Public Building Work

A unit heating and ventilating machine intended for public building work consists usually of a small rectangular steel cabinet, enclosing the following essential parts:—

1. A fresh air inlet.
2. An air filter.
3. A motor and fan assembly.
4. A radiator or heating element.
5. A cold air or by-pass chamber.
6. Mixing chamber.
7. Air discharge outlet.
8. Fresh air and recirculating control damper.
9. A by-pass or temperature control damper.

Note.—Both the recirculating control damper and the by-pass damper can be manually operated, or the recirculating control damper may be pneumatically controlled from some remote point. The by-pass or temperature control damper can be automatically operated on room temperature by means of thermostatic motor in connection with the use of any pneumatic automatic temperature control system. (See also Chapter XIII.)

When the fresh air inlet damper is open the fresh air is drawn immediately from out of doors, having the dust and dirt removed by means of the air filters. From this point the air is driven by means of the motor and fan assembly and forced up through the machine, using either polyphase, alternating current or direct current motor.

All of the air may be driven through the radiator to be heated and thence to the room, or all of the air may be driven through the cold air or by-pass chamber and thence to the room, or part of the air may be driven through the radiator and part through the cold air chamber in any desired proportion, depending upon the position of the by-pass damper.

The closing of the fresh air damper simultaneously opens the recirculating grille at the floor line, so that there is a free path for the air to circulate by gravity through the radiator. Thus, when the motor is not operating and the fresh air damper is closed, the radiator of the unit becomes an enclosed direct radiator, functioning in the same manner, as any other enclosed direct radiator. By starting the motor during heating-up period in the morning, the air may be drawn from the room at the floor line, heated, discharged, recirculated, reheated and redischarged, this process continuing until the room has reached the desired temperature, thus effecting a tremendous saving in time and fuel in preparation of the room for occupancy.

With this system of ventilation, the air outlets for the room serve strictly in the capacity of vents to permit of displacement and they

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should be small, with as little exhausting effect as possible. Under such conditions their location is unimportant further than that they be placed at or very near the floor. In the typical layout they are usually placed in the wall opposite the fan unit.

In school work where it is desired to circulate air through adjoining wardrobes, room outlets should be in low panels of doors or near floor in partitions. Wardrobe outlets may be either at floor or ceiling. The latter arrangement is usually preferable from a purely ventilation standpoint but the former provides a better heating effect. By such a plan direct radiation may usually be omitted from such rooms. When half doors or no doors are used between class-rooms and wardrobes, outlets from the latter must be at the floor.

With the mechanical unit ventilation system exhaust fans or aspirating coils in vent flues are neither necessary nor desirable, it being the idea to force the air out of the rooms under back pressure. Where the outlets are properly proportioned this has an inflation effect that retards infiltration and assists in diffusion. One vent for each machine is sufficient and both the grille and flue should have a net free area of about 18 sq. in. for each 100 cu. ft. of air delivered per minute by the ventilator.

In order to carry out the principle of diffusion and get proper results from the unit system of ventilation, consideration must be given to the number, size, location and general application of the mechanical ventilators. With a correctly designed system and proper equipment, good diffusion will be effected if the frequency of air change in the room ventilated is equivalent to five or more volumes per hour but the extent to which the desirable effect of air motion is present will be governed both by the frequency of air change and the ceiling height.

On the same principle that underlies the necessary distribution of direct radiation there is a limit to the amount of air which can be distributed from a single point in ventilation work if good results are to be expected. Practical experiments seem to indicate that this limit is about 1500 cu. ft. per min. with this type of apparatus. In a practical way this determines the number of unit machines to be used in a given case. Where the very best results are desired it is recommended that the capacity of any single machine be limited to 100 cu. ft. per min. per foot of ceiling height.

Mechanical unit ventilators should be located centrally on the outside wall of the room which they serve. Corner locations are liable to result in inefficient and unbalanced distribution. In fact, under adverse conditions, drafts may result from such a location.

Unit ventilators may be recessed but they should never be enclosed or concealed. Not only are enclosures liable to affect the perfection of diffusion, but from a practical standpoint they interfere with proper care and attention by rendering the machine inaccessible. Moreover, there is a certain psychological value to an exposed machine. The occupants quickly learn its purpose and operation with the result that they appreciate its value and see that it is operated and properly cared for.

No single mechanical unit ventilator should be made to serve more than one room by the extension of ducts from the outlet, since this is contrary to all the basic principles of the system. Adjacent rooms, if