3. Adhesive or dry type filters for cleaning the air (optional).
4. A heating element usually of special design and intended for low pressure steam.
5. Motor and fan assembly.
6. Mixing chamber where warm and cold air streams are brought together.
7. Outdoor air inlet and recirculating air mixing damper (optional).
8. Discharge grille or diffuser.
9. Temperature control arrangement.

## Functions and Features

The primary functions and features of a unit ventilator are:

1. To supply a given quantity of outdoor air for ventilation or to mix indoor and outdoor air. (See A.S.H.V.E. Ventilation Standards, Chapter 46.)

2. To warm the air to approximately the room temperature if the unit is intended for ventilation only, or to a higher temperature if it is intended to take care of all or a part of the heat transmission losses from the room.

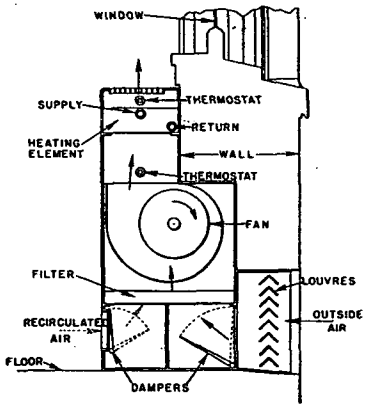


FIG. 8. TYPICAL UNIT VENTILATOR SHOWING ONE OF MANY ARRANGEMENTS OF DAMPERS AND HEATING COILS

3. To control the temperature of the air delivered so as to prevent both cold drafts and overheating. (See Chapter 33.)

4. To deliver air to the room in such a manner that proper distribution is obtained without drafts.

5. To recirculate room air for the purpose of heating or promoting comfort when ventilation is unnecessary. (Ordinances should be consulted.)

6. To perform all its functions without objectionable noise.

7. To clean the air properly.

In general the features of this type of unit are quite similar to those given for unit heaters.

## Ratings

Unit ventilators are customarily furnished with two ratings, one established by anemometer readings and the other by condensation. The latter is for standard air. For the former, capacities vary from 750 to 10,000 cfm. Each size may be equipped with radiators for various rates





TABLE 3. TYPICAL CAPACITIES OF UNIT VENTILATORS FOR AN ENTERING AIR TEMPERATURE OF ZERO

| Cubic Feet of Air Per Minute | | Total Capacity in Square Feet, Equivalent Direct Radiation | Capacity Available for Heating the Room, Square Feet Equivalent Direct Radiation | Final Air Temperature (Deg Fahr) |
|---|---|---|---|---|
| Anemometer Rating | Condensate Rating | | | |
| 750 | 500 | 214 | 56 | 95 |
| 1000 | 750 | 320 | 84 | 95 |
| 1260 | 1000 | 427 | 112 | 95 |
| 1560 | 1250 | 534 | 141 | 95 |

of condensation, to give different final temperatures for a given air capacity and entering temperature, thus enabling the engineer to select the unit best adapted to the heating and ventilating load. Relatively low final temperatures are conducive to the smallest temperature variation throughout a room. Table 3[6] shows the air handling capacities by the two methods of rating and also approximate heating data.

If no direct heating surface (radiation) is installed, the combined heating and ventilating requirements must be taken care of by the unit ventilators, and the total heat to be supplied is obtained by means of the following formulae:

**When all of the air handled by the unit is taken from the outside,**

$$H_t = 0.24\,W\,(t_y - t_o) \tag{1}$$

$$W = d\,60\,Q \tag{2}$$

$$t_y = \frac{H}{0.24W} + t \tag{3}$$

*where*

$d$ = density of air, pounds per cubic foot.
$H$ = heat loss of room, Btu per hour.
$H_v$ = heat required to warm air for ventilation, Btu per hour.
$H_t$ = total heat requirements for both heating and ventilation, Btu per hour $= H + H_v$.
$Q$ = volume of air handled by the ventilating equipment, cubic feet per minute.
$t$ = temperature to be maintained in the room.
$t_o$ = outside temperature.
$t_y$ = temperature of the air leaving the unit.
$W$ = weight of air circulated, pounds per hour.
0.24 = specific heat of air at constant pressure.

From Equations 1, 2 and 3:

$$H_t = H + 0.24\,d\,60\,Q\,(t - t_o). \tag{4}$$

*Example 1.* The heat loss of a certain room is 24,000 Btu per hour, and the ventilating requirements are 1000 cfm. If the room temperature is to be 70 F and all air is taken from the outside at zero, what will be the total heat demand on the unit if it is required to provide for both the heating and ventilating requirements (combined system)?

*Solution.* $H = 24{,}000$; $d = 0.075$; $Q = 1000$ cfm; $t = 70$ F; $t_o = 0$ F.

[6] A.S.H.V.E. Standard Code for Testing and Rating Steam Unit Ventilators (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932, p. 25).