for handling both the condensation and the air, provided the air finally can be eliminated at some other point in the return system.

For high pressure systems the same kind of traps may be used as with vacuum systems, except that they must be constructed for the pressure used. If the air is to be eliminated at the return header of the unit, a high pressure air valve can be used; otherwise the air may be passed with the condensate through the high-pressure return trap.

The connections for steam and return piping to unit heaters must always be calculated on the basis of the high heat emission or condensation rate of such devices, usually by reducing the heat to be supplied to square feet of equivalent radiation by dividing by 240, and then using the pipe-size tables given in Chapter 32.

ALL-ELECTRIC UNIT HEATERS

The foregoing discussion relates generally to units in which steam, vapor, or hot water are used as the heating medium. On rare occasions electrical resistances are used as the heating element. These are applied only where electric power is abundant and cheap and where other forms of fuel are scarce and expensive. (See Chapter 38).

DIRECT-FIRED UNITS

A recent development in gas burning equipment is the direct-fired industrial unit heater. These heaters are of the warm air type and are equipped either with fans or with blowers which cause the air to pass over the heating surfaces at a fairly high velocity and then direct the warm air in to the space to be heated in such a way as to give a positive distribution of the heated air. As is the case with the steam fed unit heaters, the gas fired appliances may be used for heating stores, shops, warehouses, etc. They usually are suspended in the space to be heated and in most instances leave the entire floor and wall area free for commercial use. Partial or complete automatic control also may be secured on appliances of this type. This type of heater is often used for temporary heat during building construction or where the installation of a steam or hot water plant is for some reason not justified.

TURBINE-DRIVEN HEATERS

Where high pressure steam is available it is sometimes used to drive a steam turbine direct-connected to the unit heater. The exhaust from this turbine, reduced in pressure, is then passed into the heating coil where it is condensed and returned to the boiler.

INDUSTRIAL USES

In addition to their prime function of heating buildings, unit heaters may be adapted to a number of industrial processes, such as drying and curing, with which the use of heated air in rapid circulation with uniform distribution is of particular advantage. They may be used for moisture absorption, such as fog removal in dye-houses, or for the prevention of condensation on ceilings or other cold surfaces of buildings in

which process moisture is given off. When such conditions are severe, it is necessary that the heaters draw air from outside in enough volume to provide a rapid air change and that they operate in conjunction with ventilators or fans for exhausting the moisture-laden air. (See discussion of condensation in Chapter 7).

Information on the control of unit heaters will be found in Chapter 14.

UNIT VENTILATORS[2]

A unit ventilator must be pleasing in design because it is generally used where it must harmonize with the furniture or with the decorative scheme. It consists usually of a rectangular steel cabinet finished with an enameled surface and containing the following necessary or optional parts:

1. Outside air inlet.
2. Inlet damper for closing the opening to the outside air inlet when the unit is not in use.
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. (No mixing chamber is normally provided where sectional type heating units are used).
7. Outdoor air inlet and recirculating air mixing damper (optional).
8. Humidifying arrangement[3] (optional).
9. Device for ozonizing air (optional).
10. Discharge grille or diffuser.
11. Temperature control arrangement.

The primary functions of a unit ventilator are:

1. To supply a given quantity of outdoor air for ventilation or to mix indoor and outdoor air.
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.
3. To control the temperature of the air delivered so as to prevent both cold drafts and overheating.
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 when ventilation is unnecessary, or to partly recirculate it, mixing inside and outside air.
6. To perform all its functions without objectionable noise.

In addition to these functions, unit ventilators frequently are arranged so that the air supplied may be cleaned by means of filters of either the dry or viscous type. If filters are used, the proper allowance must be made for the increased resistance offered to the air flow. Humidifiers in unit ventilators are optional.

1. *Air Supply for Ventilation.* The outdoor air supply for ventilation is brought about by motor-driven fan or fans operated at comparatively

[2]A roof ventilator is sometimes termed a *unit ventilator*. For information on roof ventilators, see Chapter 4.

[3]If the unit includes provision for control of humidity, it is usually called a *unit conditioner*. See Chapter 12.