

**14 ● Why must the automatic return trap on two-pipe vapor systems be about 18 in. above the boiler water line?**

That height is necessary to overcome water line difference owing to pressure drop and friction in pipe and fittings.

**15 ● What is the difference between the systems illustrated in Fig. 10 and Fig. 13?**

The risers and the air eliminator in Fig. 13 are vented to atmosphere.

**16 ● What is the difference between a vacuum pump and a condensation return pump?**

The vacuum pump produces and maintains a vacuum in the return lines whereas the condensation return pump returns the condensation back to the boiler. The relation of the boiler to the heating units is such that the condensate will not return by gravity.

**17 ● What is the function of a trap?**

The usual function is to allow the passage of condensate and air and to prevent the passage of steam.

**18 ● Under what conditions is it advisable to use a combination float and thermostatic trap?**

Where unusual capacities are required, as on large mains or blast coils.

**19 ● Why should the discharge from high pressure traps not go directly into a vacuum return main?**

Because of its higher temperature, the high pressure condensate would immediately flash into steam in the vacuum main and cause difficulty with the vacuum pump.

## Chapter 32

### PIPING FOR STEAM HEATING SYSTEMS

*Flow of Steam in Pipes, Pipe Sizes, Tables for Pipe Sizing, One-Pipe Gravity Air Vent Systems, Two-Pipe Gravity Air Vent Systems, Two-Pipe Vapor Systems, Vacuum Systems, Atmospheric Systems, Sub-Atmospheric Systems, Orifice Systems, High Pressure Steam, Expansion in Steam and Return Lines, Piping Connections and Details, Boiler Connections, Hartford Return Connection*

THE design of a steam heating system should be considered under four headings, namely, (1) the details of the heating units, (2) the arrangement of the general piping scheme, (3) the details of connections, and (4) the sizing of the lines. Items 1 and 2 are covered in Chapters 30 and 31, respectively, while this chapter considers the two latter items.

The functions of piping are to supply the heating units with steam and to remove the condensation. In some systems both the air and condensation are removed from the heating units by the return piping. To accomplish this effectively, the distribution of the steam should be efficient and equitable, without noise, and the returns should be as short as possible. When air is handled its escape should be facilitated to the utmost since an air-bound system will not heat properly. Condensation takes place in a steam system not only in the heating units, but throughout the piping system as well, and the returns also condense any steam or vapor that may be contained. At the same time part of the condensation may flash back into steam when the vacuum or pressure in the return is considerably below the steam pressure.

It is essential that steam piping systems not only distribute steam at full load but also at partial loads, as the average winter demand is less than half of the demand in most severe outside temperatures. Furthermore, in heating up rapidly the load on the steam main may exceed the maximum operating load even in extreme weather, due to the necessity of raising the temperature of the metal in the system to the steam temperature. This may require more heat than would be emitted from the system itself after it once is thoroughly heated.

#### STEAM FLOW

The rate of flow of dry steam or steam with a small amount of water flowing in the same direction is in accordance with the general laws of gas flow and is a function of the length and diameter of the pipe, the density of the steam, and the pressure drop through the pipe. This relationship of flow of dry steam or steam with a small amount of water has been