A system equipped with such valves builds up a vacuum and holds the heat longer. With proper controls on the boiler, lower radiator temperatures can be maintained in mild weather, giving better plant efficiency.

12 ● What are the essentials of a two-pipe closed vapor system?

Packless graduated valves on radiators; thermostatic return traps on return and drips; an automatic return trap to prevent water from backing out of the boiler.

13 ● 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.

Chapter 16

PIPING FOR STEAM HEATING SYSTEMS

Operating Characteristics, Steam Flow, Pipe Sizes, Tables for Pipe Sizing, One-Pipe Gravity Air-Vent Systems, Two-Pipe Gravity Air-Vent Systems, Two-Pipe Vapor Systems, Vacuum, Orifice, Atmospheric and Sub-Atmospheric Systems, Steam Supply Sources, Piping Connections and Details, Boiler and Radiator Connections, Piping for Indirect Heating Units, Dripping

IT is important that steam piping systems not only distribute steam at full or *design* load but during excess and partial loads. Usually the average winter steam demand is less than half of the demand at the *design* outside temperature. Moreover, in rapidly warming up a system, the load on the steam main and returns may exceed the maximum operating load for severe weather and even in moderate weather due to the necessity of raising the temperature of the metal in the system to the steam temperature and the building to the design indoor temperature. Investigations of the return of condensation have revealed that as high as 143 per cent of the design condensation rate may exist under conditions of actual operation.

The functions of piping are to supply the heating units with steam and to remove the condensation as well as the air in the case of those systems where both air and condensation are returned. To accomplish this effectively, the distribution of the steam should be rapid, equitable and without noise. To attain this result the release of air from the system should be facilitated as much as possible, as an air bound system will not heat readily nor properly. In designing the piping arrangement for a steam system it is desirable to maintain equivalent resistances in the supply and return piping to and from a radiator. Arranging the piping so the total distance from the boiler to the radiation is the same as the return piping distance from the heating unit back to the boiler, tends to obtain such a result. The condensation which occurs in steam piping as well as in radiators must be drained to prevent impeding the ready flow of the steam and air. The effect of back pressure in the returns, and excessive revaporization such as occurs where condensation is released from pressures considerably higher than the vacuum or pressure in the return must be avoided.

The piping design of a heating system is greatly influenced by its operating characteristics. Heating systems do not operate under a fixed condition as they are continually changing due to variation in load. As the system is being filled with steam the pressure existing in various