refer to the equivalent capacity, of any of these types of heat-emitting units, in terms of the standard capacity of cast-iron radiation.

DESCRIPTION OF SYSTEMS

Piping systems for steam heating are broadly classified as gravity one-pipe, two-pipe, vapor and vacuum systems; the condensation returning to boiler by gravity or mechanical devices.

A few of the terms used in describing these systems are defined as follows:

A gravity system is one in which the water of condensation is returned to the source by the action of gravity.

A vacuum system is one which operates in whole or in part at pressures below atmospheric.

A vapor system is one which operates at low pressures and which employs devices for the limitation of pressure and for the control of the steam supply.

A down-feed or overhead system is one in which the supply main is above the level of the heating unit.

Up-feed systems are those in which the supply main is below the level of the heating units.

Supply mains are the pipes that convey the steam from its source to the branch risers of the heating units.

Branch risers are the pipes that convey the steam from the mains to the heating units or the condensate from the heating unit to the return main.

Return mains are the pipes that carry the condensate from the branch returns back to its destination. There are two kinds of returns, the *dry* and *wet*. The former is above the level of the water line of the boiler or its corresponding hydrostatic head and handles both air and water. It connects to a receiver where the air and water are separated. The *wet* return is below the level of the water line of the boiler or its hydrostatic head and handles only water.

The choice of gravity one-pipe, two-pipe, vapor or vacuum systems depends upon the requirements as to first cost, convenience, quality of service and local conditions. Theoretically, gravity one and two-pipe and vapor and vacuum systems are substantially on a par as to heating efficiency; that is to say, the major portion of the heat delivered is, or should be, dissipated by the heating unit.

It is essential that any system circulate steam uniformly throughout the entire installation, as too often certain defective features of a system will require that heat be kept on longer or to a greater degree than would otherwise be required to uniformly and satisfactorily heat the building. This will result in waste and overheating. The one important thing to be remembered in connection with all systems is that they shall circulate steam freely and uniformly to the heating units and remove and return condensation noiselessly.

One-Pipe Gravity Steam System.—The one-pipe system is generally the least expensive to install. It requires one combined supply and return

connection at the bottom of each heating unit to allow the condensation to flow back to the boiler in opposition to the incoming steam. There are many modifications of this system. The main should pitch down from the boiler in the direction of the flow of steam. The end of the main and some of the branch risers, if the run is long, should be dripped into the return line. If the return line is below the water line of the boiler they may be directly connected but should the return be above the water line of the boiler in this part of the system the main and branch risers should be dripped through water legs of sufficient length so that the steam pressure will not lift the water and blow steam through to the return main.

Air valves must be used on all heating units, also near the ends of mains

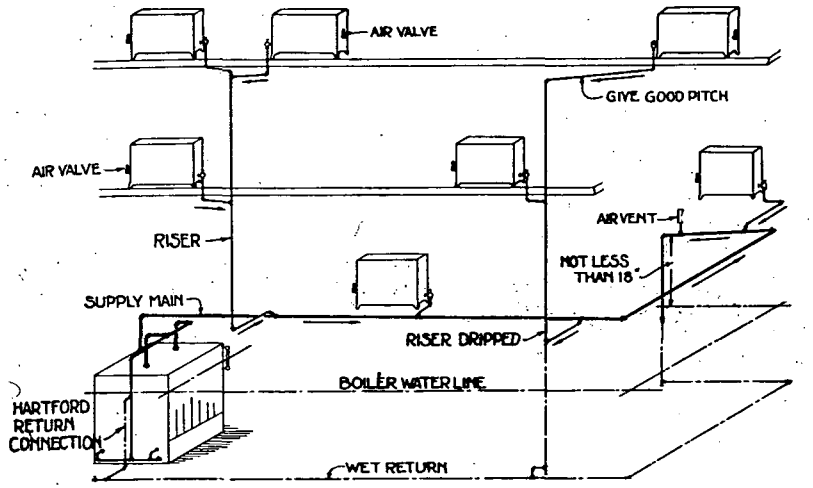

FIG. 1. TYPICAL GRAVITY ONE PIPE STEAM SYSTEM

before dropping below the water line. These valves may vent the air directly to the room or may be of a type that is connected to an air line pump which removes the air only and does not handle the condensation from the heating unit. Fractional control by means of valves on the heating units is not possible with one-pipe systems. During operation the heating unit supply valve must be either entirely open or entirely closed. This is necessary to prevent the retention of water and the noise due to intermittent inflow of steam and outflow of water that occurs when the valve is partly open.

This system is adaptable to automatic temperature control and is entirely satisfactory when properly designed, installed and operated.

Gravity one-pipe systems operating under slight pressures sometimes called vapor or vapor vacuum type are the same in design as to pipe sizes as the gravity one-pipe system, the only point of difference being the venting valves on the heating units and return main. These valves vent air from the system but prevent its return.