pools always cause objectionable noise. Radiators with this system usually require that the supply valve be all-open or all-closed, since any intermediate valve-position is likely to cause interference with the necessary return of condensation.

It should be emphasized that in any part of a system in which water from the heating units returns counter to the steam the velocity of the steam must be kept below the point where it will seriously interfere with the returning water. The maximum allowable velocity of steam for satisfactory operation has been determined by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS Research Laboratory. Table 5 gives the maximum allowable capacity and velocities of flow for up-feed one-pipe risers while Table 6 gives the maximum capacity and velocity for horizontal pipes with various pitch.

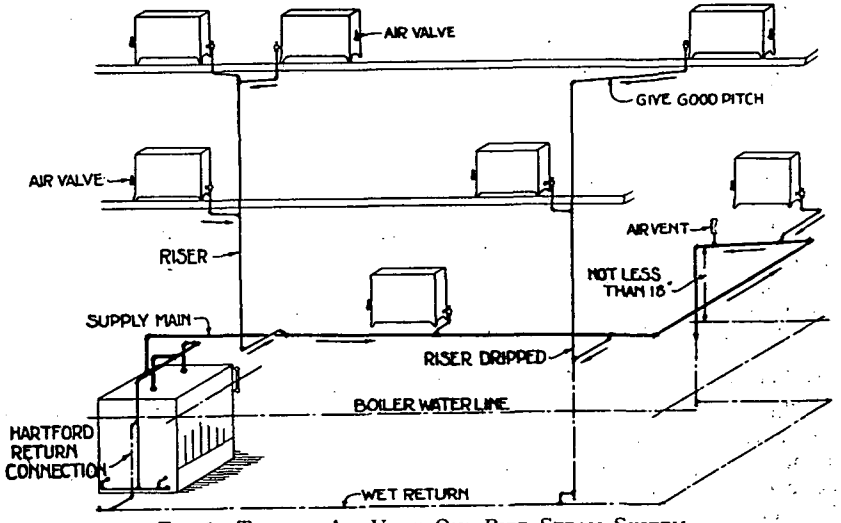


FIG. 1. TYPICAL AIR-VENT ONE-PIPE STEAM SYSTEM

Since the maximum velocity must not be exceeded in any part of the system, if silent and satisfactory operation are desired, care should be exercised to eliminate obstructions due to poor pipe, lack of or faulty reaming and improper use of pipe *dope*.

Table 9 is to be used in designing one-pipe systems up to 200 ft. equivalent length of run. For designing larger one-pipe systems where uniform distribution of steam to all parts of the building is difficult to obtain, Table 10 shall be used.

Air-Vent One-Pipe Down-feed System

The air-vent one-pipe down-feed system illustrated in Fig. 2 is a modification of the one-pipe up-feed system and the same tables apply to it as for the up-feed system. The branches may leave the overhead main from the top, in which case the condensation drains at the end,

or the branches may leave the overhead main from the bottom, in which case each branch drains the condensation, and in which case the installation of eccentric fittings in the overhead main may be avoided. The illustration indicates no drain at the base of the main supply riser. When this riser is more than very few feet from the boiler a connection from the bottom of the riser into the wet return should be made.

Air-Vent Two-Pipe System

Two-pipe systems, Fig. 3, require separate supply and return mains and a separate supply and return connection for each heating unit. Like one-pipe systems, they require air valves on heating units and mains. The steam connection may be either at the top or the bottom of the unit, but the outlet is always at the bottom so that all condensation will drain through this to the return mains.

The return connection from each heating unit preferably should be

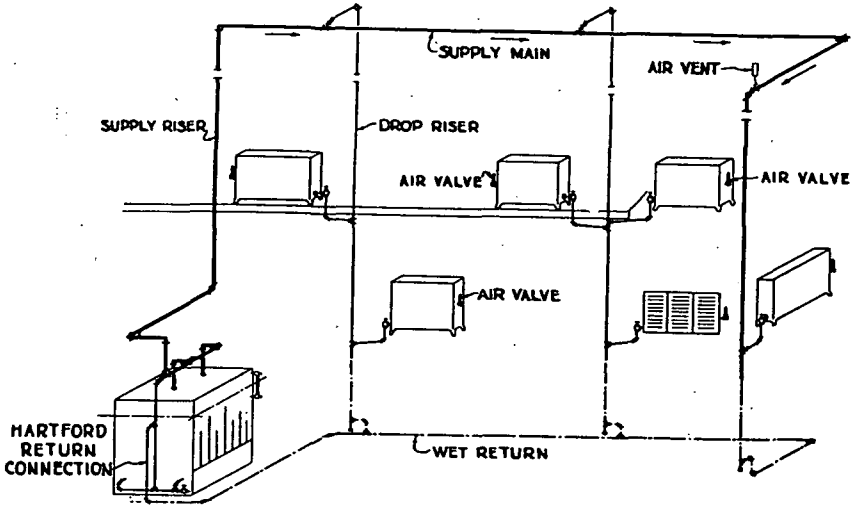


FIG. 2. TYPICAL AIR-VENT ONE-PIPE DOWN-FEED STEAM SYSTEM

carried separately to a wet return below the water line of the boiler. Valves are required on the steam connection and on the return connection to each heating unit. The use of dry returns with air-vent, two-pipe systems, employing manual shut-off valves or check valves on the return connections to the heating units should be avoided. The air-vent two-pipe system is obsolete.

Vapor System

Fig. 4 illustrates a vapor system. The device at the end of the dry return main is usually of a proprietary nature. Its function is to vent the air and in some cases it prevents the reentry of air. Some of these devices are designed to maintain a constant differential between the pressure in the supply main and the pressure in the return main. A wet