mostatic traps to the dry return. They operate at a few ounces pressure and above, but those with mechanical condensate return devices may operate at pressures upward of 10 lb atmospheric pressure. Other essentials are packless graduated valves on the radiators, thermostatic traps to drip the ends of steam mains or to vent them where they are dripped to a wet return, and means of venting the system to the atmosphere. In the simplest cases the vent consists of a ¾ in. pipe with a check valve opening outward. Certain systems employ special patented forms of vent valves, designed to allow the air to readily pass out of the system and to prevent its return. These systems contemplate control of the radiator by varying the opening of the graduated radiator valves. The boiler pressure is

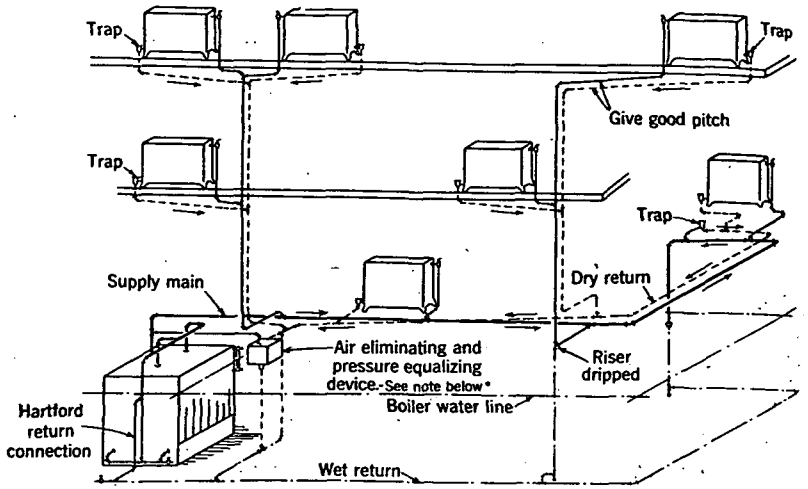

FIG. 10. TYPICAL UP-FEED VAPOR SYSTEM WITH AUTOMATIC RETURN TRAP[a]

[a]Proper piping connections are essential with special appliances for pressure equalizing and air elimination.

maintained at substantially constant pressure slightly above but close to atmospheric pressure.

These systems may be classified as (1) *closed systems*, consisting of those which have a device to prevent the return of air after it has once been expelled from the system, and which can operate at both super and subatmospheric pressures for a period of four to eight hours depending upon the tightness of the system and rate of firing, and (2) *open systems*, comprising those which have the return line constantly open to the atmosphere without a check or other means to prevent the return of air. The open systems are not so popular because they have the disadvantage of not holding heat when the rate of steam generation is diminishing. The two-pipe vapor system is shown in Fig. 10. Systems of this design should preferably be equipped with an automatic return trap to prevent water from backing out of the boiler and when so equipped have sometimes been known as *return heating systems*. In installing the return trap a check valve is inserted in the return main at a point near the boiler and a

vertical pipe is run up into the bottom of the return trap, which is usually located with the bottom about 18 in. above the boiler water line. Some traps are constructed so that they will operate when they are installed with their bottom as close as 8 in. above the boiler water line. On the other side of this connection a second check valve is installed in the main return just before it enters the boiler. Fig. 11 shows a typical connection for a automatic return trap.

Up-Feed Two-Pipe Vapor System

In the up-feed system the supply piping is carried to a high point directly at the boiler and is graded down toward the end or ends of the

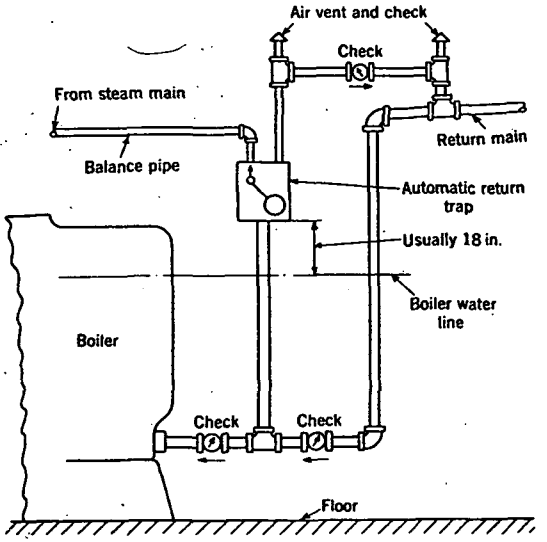

FIG. 11. TYPICAL CONNECTIONS FOR AUTOMATIC RETURN TRAP

supply main, each supply main being dripped at the end into the wet return or carried back to a point near the boiler where it drops down below the boiler water line and becomes a wet return. From this main, runouts are branched off to feed risers or radiator above, these being graded back toward the steam main; they are not dripped at the bottom of the riser, or toward the riser if the riser heel is dripped. Both types of connections are illustrated in Figs. 2 and 3.

The return risers are connected to each radiator on its return end through thermostatic traps. These are connected to the return main through runouts which slope toward the return main. The return main is run dry and slopes back toward the boiler. Wet returns, if used, are installed in the same manner as for one-pipe gravity systems. If the dry return becomes a wet return it should be vented at that point.