return main is not always essential, though in many cases it is a useful auxiliary.

Steam is prevented from entering the return main by thermostatic traps or other means of resistance on the return ends of the heating units and at drainage or venting points on the supply mains. There are no air valves, as such, on the heating units. With vapor systems the amount of vapor admitted to each heating unit is under throttle control at each supply valve. In addition some proprietary systems have a method of balancing steam flow by the use of an orifice with a fixed area proportioned in accordance with the size of each heating unit, while others use a supply valve which is of standard size and has an orifice that may be adjusted for each individual heating unit. In many of them the pressure in the supply main is under self-contained, automatic control.

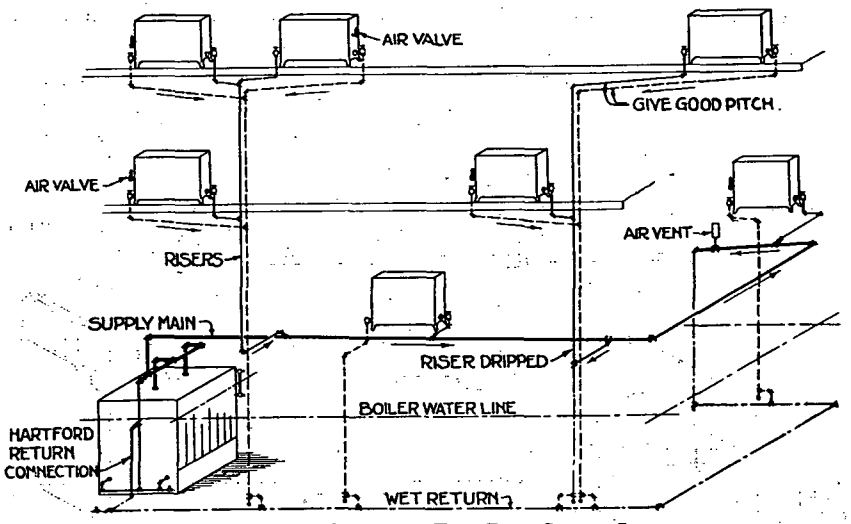

FIG. 3. TYPICAL AIR-VENT TWO-PIPE STEAM SYSTEM

Although in any type of two-pipe system the condensation from the heat-emitting units returns through separate piping, the condensation from radiator branches and risers must return through these pipes counter to the steam. The velocity of steam flow in such pipes must be kept below a certain maximum or this water will be held up until it accumulates in sufficient quantity to produce objectionable sounds and to interfere with proper circulation.

Table 11 gives the maximum capacity and velocity of steam for two-pipe risers as determined by the Research Laboratory.

Table 12 is for comparatively small vapor systems. One ounce pressure drop may be understood to mean that the water in the vertical pipe, which drains the end of the supply main, will stand about 2 in. higher than the water line in the boiler under normal conditions.

Table 13 shows the pipe sizes for larger vapor systems than those in

Table 12. Using these sizes, the water in the vertical pipe, which drains the end of the supply main, will stand about 4 in. higher than the water line in the boiler under normal operation.

Table 14 shows the pipe sizes for vapor systems where a still greater difference in water line may be allowed between that in the boiler and in the return drop-pipe under normal operation. Where the basement is high and where all heaters are well above the water line, and where they do not have unusual condensing power, these sizes are permissible. The difference here is 4 oz., or approximately 8 in.

Vacuum Pump Systems

Fig. 5 shows a typical vacuum system of steam heating, using a pump which handles both the air from the system and the water of condensation

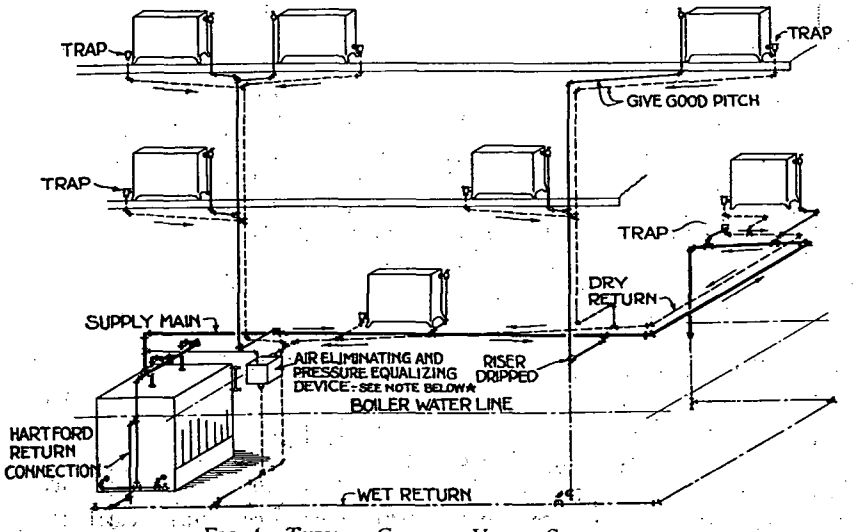

FIG. 4. TYPICAL GRAVITY VAPOR SYSTEM

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

from it. With such arrangements a wide difference in pressure between that in the supply main and that in the return main is permissible. A greater temperature range within the system than that obtainable with vapor systems is insured. Heaters may be below the water line of the boiler, and even may be lower than the level of the pump, though such an arrangement generally should be avoided.

Table 15 gives approved pipe sizes for vacuum pump systems of comparatively small size, with a pressure drop not exceeding 4 oz., or a rise in the return connection of about 8 in., which, of course, easily can be overcome by the vacuum pump.

Table 16 gives pipe sizes for larger systems in which the vacuum pump is expected to maintain a greater suction, the allowable rise in the return connection being about 16 in.