

peratures prevail in the working space. Not only operators have been affected under these conditions but also the output of the individual machines. Best results are obtained when the radiators are placed under the windows and adjacent to doors to the outside. The air heated by the radiators under the windows, rises, mixes with the cold infiltrating air from the windows, circulates across the ceiling, gradually settles to the floor, is drawn up by the radiator and the cycle continues. The advantage of placing radiators adjacent to the door is that the infiltration at this point is compensated for, the infiltrating air being warmed before it enters the heated space.

Placing a radiator close to an outside wall heats the wall immediate behind the radiator, but the infiltrating air through this wall absorbs this heat in part, the rest being used to compensate for the transmission losses through the wall.

#### SPECIFICATION CLAUSES

Specifications for radiation should contain the following clauses:

1. Manufacturers must guarantee that the heat emission per radiator shall not fall below the values given in Tables 18 to 30.
2. Radiation must be free from flaws on surface and leaks at nipple connections, and guaranteed to stand a hydrostatic test of not less than 100 lb. per sq. in.
3. Radiation must be thoroughly cleaned of all core sand, and if for vapor or modulation steam systems must be washed out and the openings plugged before shipment.
4. Radiation must not be placed where dirt can get into the interior and if to be placed in the weather or damp location must be given a priming coat of paint before shipment or immediately upon delivery at location.
5. Long or low radiators should be crated, and the crating not removed until placed in final location.
6. Radiators supported from the wall or ceiling shall be supported on steel or wrought iron hangers.

### CHAPTER III

## STEAM HEATING SYSTEMS

**P**IPING systems for steam heating are broadly classified as one-pipe, two-pipe, vapor, and vacuum systems, with either gravity or mechanical circulation.

*One-pipe systems* have but one connection to the radiator, the air being ejected through air valves on the end opposite this connection. In this system the condensation from the radiators returns to the boiler through the supply risers and either through the steam main, Fig. 16 or through a wet return receiving the drip from the heel of each riser or radiator connection, Fig. 17.

*Two-pipe systems* have two connections to the radiators, one for steam, the other for condensation, air being ejected through air valves as in the one-pipe system. Fig. 18 shows a two-pipe gravity return system.

*Vacuum systems* employ a vacuum return pump to produce a vacuum in the system and return the condensation to the boiler. This system is thus essentially, a mechanical circulation system.

*Vapor or air return systems* are two-pipe systems in which all the air is returned from the radiator through a dry return to a central point from which it is ejected from the system. This system may or may not use thermostatic traps on the return end of the radiators and the pressure used is generally not over a few ounces. Graduated supply valves on the radiators may or may not be required. Fig. 19 shows a two-pipe return line vacuum and vapor systems, which may operate either as a return line vacuum system, an automatic return line vapor system or as a gravity return vapor system and shows the principle of connecting up any one of these three types.

This system has many variations, employing various specialties which are usually patented, and determine the name of the patented system. Owing to their specialized nature, none are illustrated here but catalogue data on several systems are given in this volume.

*Gravity circulation* is the term used to indicate any system where the condensation returns to the boiler by natural flow. Wherever this is the case a certain differential must be allowed between the water line in the boiler and the low point of the steam main and the dry return in order to allow for pressure drop in the piping system. This differential is usually from 18 to 30 in.

*Mechanical circulation* indicates any system where the condensation is returned to the boiler by means of a pump. It is used where some of