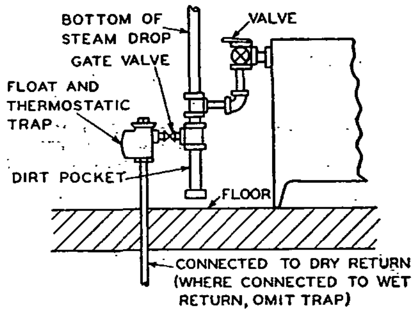

Fig. 13. Detail of Drip Connections at Bottom of Down-Feed Steam Drop

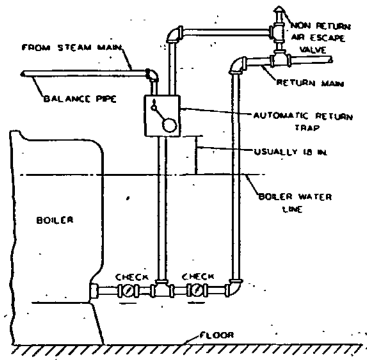

Fig. 14. Typical Connections for Automatic Return Trap

Two-Pipe Vacuum Systems

Vacuum systems operate under conditions of both low pressure and vacuum, but employ the vacuum pump to insure maintenance of sub-atmospheric pressures in the return piping for all operating conditions. The pump thus assists the supply steam in overcoming the resistance of the system piping and insures rapid circulation and even heating. The system may operate transiently with sub-atmospheric pressure in the supply piping during the time the rate of steam generation is equivalent to or less than the total connected load.

A typical two-pipe vacuum system is illustrated in Fig. 15.

The return risers are connected in the basement into a common return main which slopes downward toward the vacuum pump. The vacuum pump withdraws the air and water from the system, separates the air from the water and expels it to atmosphere, and pumps the water back to the boiler or other receiver, which may be a feed-water heater or hot well. It is essential that no connection be made from the supply side to the return side at any point except through a trap. The return system should provide unrestricted gravity flow of the condensate and air to the pump receiver

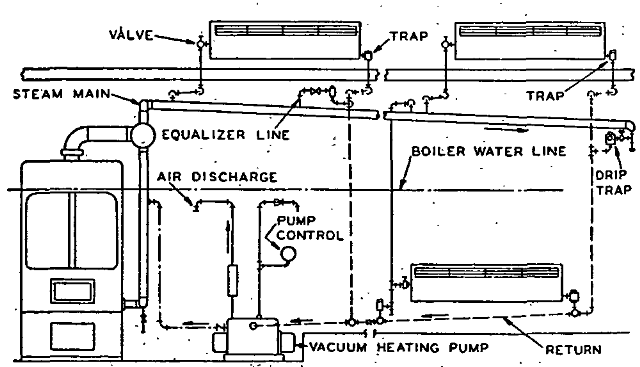

Fig. 15. Typical Two-Pipe Vacuum Pump System

so that the vacuum differential may be more uniformly applied throughout the return system. In some instances, load conditions make it necessary to drop the return below the level of the vacuum pump inlet before this pump can be reached. This can be taken care of when using a vacuum pump by installing a float controlled auxiliary accumulator tank, pitted if necessary, just ahead of the vacuum pump inlet as shown by Fig. 16. The auxiliary tank as shown still permits an uninterrupted gravity flow from all return lines, but it does reduce the vacuum on the returns by one inch Hg for every foot of lift. The lift should be limited to 5 ft.

Lifts should be avoided, but on individual mains near the end of the system a lift fitting may be employed. Fig. 17 shows a single step lift, which may be used up to 5 ft of lift. When the lift is greater but does not exceed 8 ft, it should be divided into two lifts shown in Fig. 18. It is preferable to use commercial stock sizes of lift fittings, but if these are not available in the sizes required a satisfactory lift connection can be made from standard pipe fittings as shown by Fig. 19. When a lift assembly requires a union, it should be installed in a horizontal run. The use of a

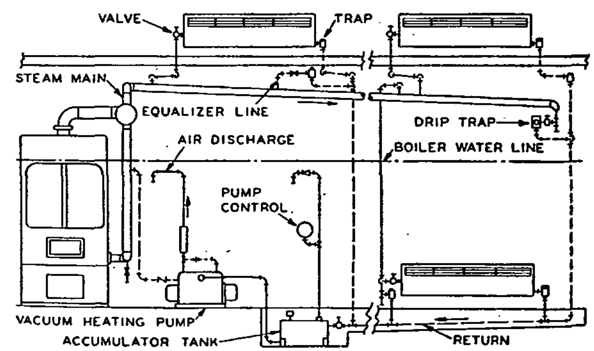

Fig. 16. Accumulator Tank Installation in Typical Two-Pipe Vacuum Pump System

lift in any part of the system results in slower heat-up as well as interrupted return of the condensate from the section ahead of the lift. Lift fittings should not be used in place of an auxiliary tank in the return main at the inlet to the vacuum pump receiver.

A condensate pump may be used as a mechanical lift where severe outlying lift conditions cannot be avoided. This may be piped into the system as shown by Fig. 20 in such a manner as not to interfere with the normal functioning of the vacuum pump and without loss of vacuum on the returns preceding the condensate pump.

TWO-PIPE SUB-ATMOSPHERIC SYSTEMS

Sub-atmospheric systems are similar to vacuum systems but, in contrast, provide control of building temperature by variation of the heat output from the radiators. The radiator heat emission is controlled by varying the pressure, temperature and specific volume of steam in circulation. These systems differ from the ordinary vacuum system in that they maintain a controllable partial vacuum on both the supply and return sides of the system, instead of only on the return side. In the vacuum system, steam pressure above that of the atmosphere exists in the