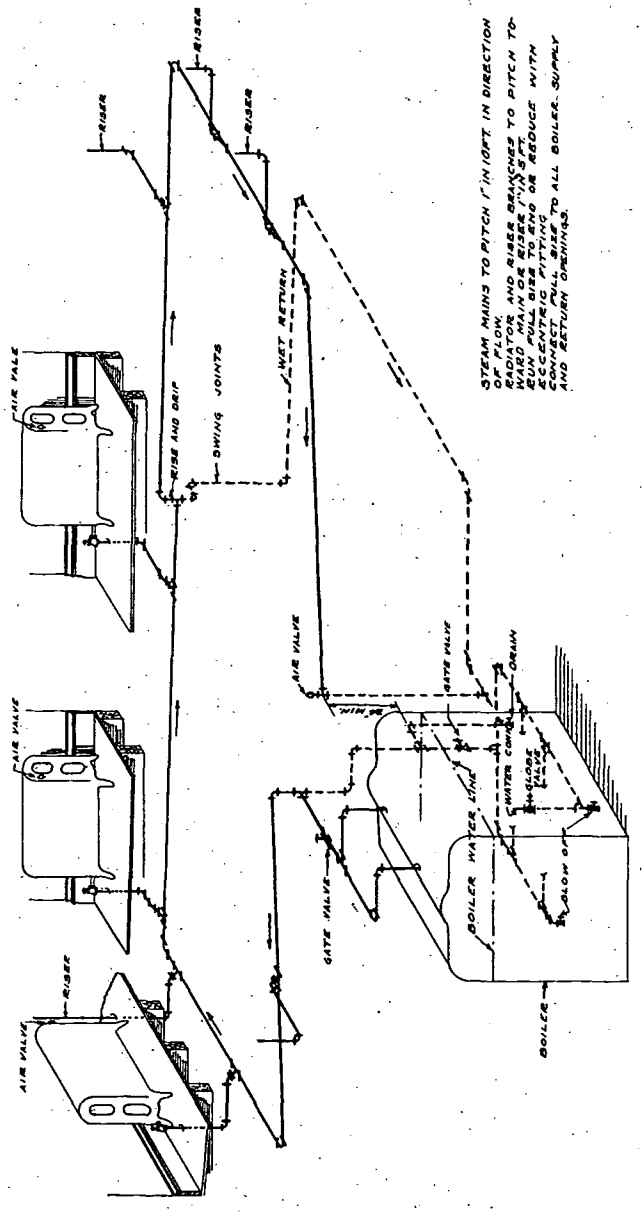

FIG. 17. ONE-PIPE CIRCUIT GRAVITY RETURN SYSTEM

Length of Run

The length of run must not only include the actual linear feet of straight pipe, but also the proper allowance for fittings, valves and other items which cause drop in pressure.

Pressure Drop

In the matter of pressure drop there are, theoretically, several factors to be considered, including: the initial pressure, the pressure required at the end of the line, fluctuations in the initial pressure, the distance between the bottom of the lowest radiator and the water line of the boiler (where the condensation is to be returned by gravity), the extra load on the system during heating-up periods, and the critical velocity of the steam (especially in risers and branches where the steam and condensate flow in opposite directions), and in other lines where high velocities are objectionable from the standpoint of noise, or the entrainment of condensate.

With a high initial pressure it is theoretically possible to allow much greater drops in pressure if there is sufficient distance between the lowest radiator and the water line of the boiler in a gravity system or if the condensate is returned to the boiler by mechanical means. In attempting any very great drops in pressure, the following practical difficulties present themselves:

1. If the system is designed to secure the same drop in pressure for each unit of radiation (including those nearest, as well as those farthest from the source of supply) the velocity necessary to equalize these drops in the shorter runs will be so high that serious trouble will be encountered from noise and the entrainment of the condensate.

2. If the system is so designed as not to equalize these pressures, the condensate returning from radiators near the source of supply will be at a correspondingly higher temperature than that from radiators farthest from the source of supply, thus causing re-evaporation and pressures in the return system with consequent backing-up from one radiator to another, the holding-up of the return and the filling of the return lines, with too large a percentage of steam instead of condensate.

It has been found, therefore, that while it may be theoretically possible to design a system for relatively large pressure drops, it is generally more satisfactory to design all steam heating systems on the basis of a low initial pressure and reasonably low total drops in pressure. The matter of fluctuations in pressure should be taken into consideration wherever the steam is to be supplied directly from the boiler, to the radiators at boiler pressure and the system should be designed to operate properly with the lowest pressure under which the boiler may operate.

The extra load which the system is required to carry during heating-up periods depends somewhat upon the actual length of time through which the building will be allowed to cool between the heating periods, but more largely upon the length of time which will be allowed for heating the building up at the beginning of each of these periods. In any case, the rapidity with which air is removed from the radiation either by free venting to the atmosphere or by mechanical return line systems will largely determine the rapidity with which steam must be supplied. With reasonably free venting, the steam supply requirements during the heating-up period may run as high as 300 per cent of the normal maxi-