connection. Short radiators are sometimes connected for top supply and bottom return on the same end. When so connected, attention must be given to venting of air from the top of the radiator somewhat oftener than when bottom connections are used.

Unless used as heating surface, all piping, both flow and return, should be insulated.

All large systems should be provided with extra stop and drain valves, suitably located so that parts of the system may be isolated for repairs without making it necessary to drain the water from the entire system.

Relief Valve. The *ASME* Low Pressure Heating Boiler Code requires that all hot water heating boilers shall be equipped with a tested and rated relief valve having adequate capacity to match the gross output of the boiler. In order to comply with the requirement, relief valves must be connected to the top of the boiler and a discharge pipe must be connected to the relief valve and so arranged that there will be no danger of scalding attendants. The proper location of the relief valve is shown in Fig. 16.

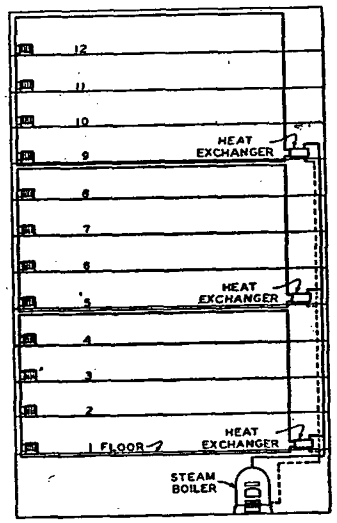

Fig. 17. Vertical Zoning of Hot Water Heating System in a 12-Story Building (*Provision should be made for expansion in each closed circuit.*)

ZONING

In large hot water systems, improved control and economy can be achieved by separating the systems into sections or zones (vertical or horizontal) which can be operated independently of each other. Variations in heat requirement of the different zones, as influenced by the exposure of the building, solar heat, weather conditions, heat from processes, type of occupancy, building chimney effect, etc., can readily be compensated for when heat can be supplied only where needed.

In tall buildings, vertical zoning such as shown in Fig. 17 not only provides the advantages of control and economy, but also reduces the water pressure in the system to that caused only by the number of floors served by each section. As shown in Fig. 17 a steam boiler can conveniently be used to supply steam to the heat exchanger supplying heated water to each zone.

HIGH TEMPERATURE WATER SYSTEM

General Considerations

The high temperature water system is a form of conveying heat using water as the medium, at temperatures well above 212 F and usually, in current practice, between 300 and 400 F. Water being a most satisfactory heat carrier, will transport heat over long distances with comparatively small line losses and without expensive equipment to maintain or replace.

With high temperature water the boiler, instead of generating steam, heats the water to a specified temperature and corresponding pressure. The water thus heated is discharged under pressure from the boiler into the system through a circulating pump designed for the high temperatures involved. The water is thus circulated in a closed circuit from the central station to the extended areas requiring heat and back again to the boiler. In this way the heat, whether for space heating or process work, is distributed efficiently and economically since any heat not usefully employed in the system is returned to the boiler for reheating and redistribution. Fig. 18 illustrates an industrial application of a high temperature water system.

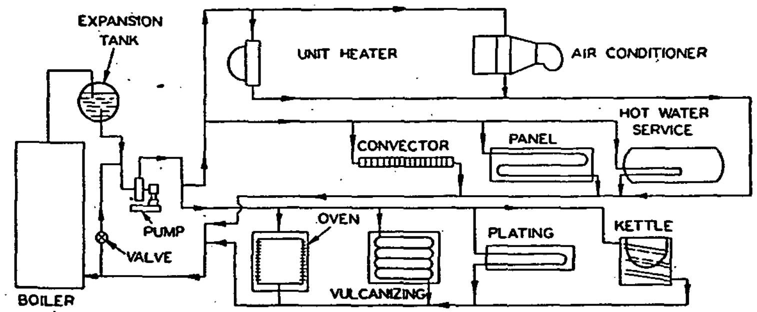

Fig. 18. Schematic Arrangement of Typical High Temperature Water System

Fundamental Principles

In high temperature water systems water is heated under pressure and its temperature is raised to that corresponding to the pressure imposed, which is above the evaporation point of water at atmospheric pressure. As the temperature of the water rises, the pressure in the system must also be raised to ensure that the pressure is always above the equivalent evaporation pressure.

In modern systems, the pressure can be maintained by using steam or a compressed inert gas. With steam, the steam space within the boiler or the steam space in an external drum or tank, which is also used as an expansion