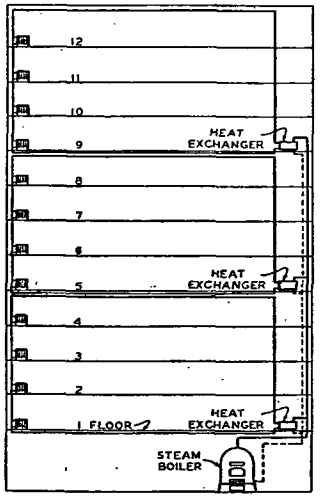

FIG. 17. VERTICAL ZONING OF HOT WATER HEATING SYSTEM IN A 12-STORY BUILDING

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 *A.S.M.E.* 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.

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 exchangers supplying heated water to each zone.

CHAPTER 22

RADIATORS AND CONVECTORS

Heat Emission of Radiators and Convectors, Radiators, Convectors, Ratings of Radiators and Convectors, Effect of Operating Conditions, Heating Effect, Heating Up Radiators and Convectors, Enclosed Radiators

RADIATORS and convectors are heat emitting units used in steam and hot water heating systems for supplying heat by radiation and convection to a room. The function of any radiator or similar device is the maintenance of occupancy comfort through the control of the mean radiant and air temperatures in the area. Since heat losses through the various parts of the structure constantly tend to lower these temperatures below the comfort point, the radiator or convector should be so placed and regulated that its output will replace the losses when and where they occur. If 80 percent of the room heat loss occurs through a cold wall or window area, then 80 percent of the input should be introduced in or directed toward that area.

The term *radiator* refers to a unit which emits the larger part of its heat by radiation and includes cast-iron radiators, baseboard radiation and pipe coils. Cast-iron radiator types may be column, large-tube, small-tube or wall. Baseboard radiators may be of the radiant cast-iron type, radiant-convector cast-iron type, or finned-tube type. The last type, however, is actually a convector.

The term *convector* refers to a unit which emits the greater portion of its heat by convection. It includes such units as conventional convectors in which a heat emitting element of either cast-iron or of the finned-tube type is enclosed in a cabinet, but may also be of the unenclosed finned-tube type.

HEAT EMISSION OF RADIATORS AND CONVECTORS

Most heating units emit heat by *radiation* and *convection*. An exposed *radiator* emits roughly half of its heat by radiation, the amount depending upon the size and number of sections. In general, a thin radiator, such as a wall radiator, emits a larger proportion of its heat by radiation than does a thick radiator. When a radiator is enclosed or shielded, the proportion of heat emitted by radiation is reduced. The balance of the emission occurs by conduction to the air in contact with the heating surface, and this heated air rises by circulation due to convection, and transmits this warm air to the space which is to be heated.

Convectors transfer the smaller proportion of their heat to the room by radiation. Since most of their heat is transferred by convection, the heat emission is dependent upon the vertical distance between the heating element and the outlet grille at the top of the convector cabinet.

The output of a radiator or convector can be measured only by the heat it emits and is generally expressed in units of: Btu per hr; *Mbh* (1000 Btu per hr); or in equivalent direct radiation (240 Btu per hr for steam or 150 for water radiation). Ratings are based upon specified test conditions.