the thermal valve and is discharged against the end plug in which the individual liquid feeds are closely arranged. These distributors can be used in either vertical or horizontal position. There are also other types of headers such as the centrifugal and weir type. The individual liquid connections from the distributor to the coil inlet are commonly made of small diameter tubing, and are all of the same length and diameter in order to impose the same friction between the distributor and the coil. Since the thermal valves act in response to the superheat at the coil outlet, this superheat should be produced with the least possible sacrifice of active evaporating surface. Sometimes a single thermal valve is used per coil. In other cases, multiple valves are used, with the coil divided across the air flow or parallel to the air flow as shown in Fig. 6. The arrangement of Fig. 7

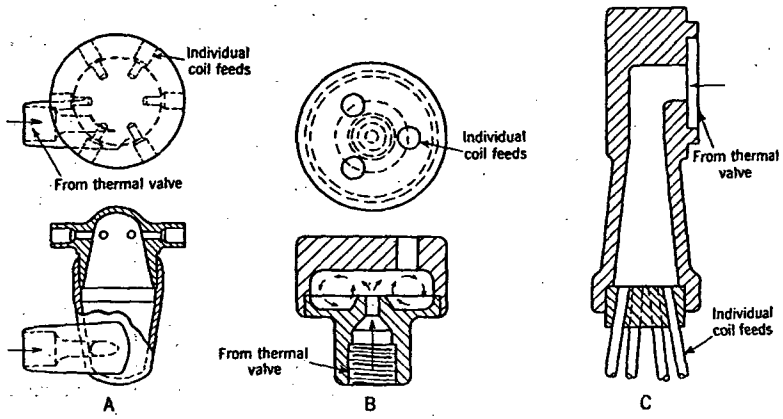

FIG. 5. TYPES OF REFRIGERANT FEED DISTRIBUTING HEADS

should be avoided, since it offers the disadvantage of unequal load on the two parallel circuits.

Flow Arrangement

The relative directions of flow of the air outside the tubes and the medium within them, influence the performance of the surface. There are three types of relative flow in common use. Fig. 8A shows parallel-flow in which the air and the medium in the tubes proceed through the coil in the same direction. Fig. 8B shows counter-flow in which the medium in the tubes proceeds in a direction opposite to the flow of air. Fig. 8C shows cross-flow in which the air and the medium in the tubes pass at right angles to each other. The counter-flow arrangement is almost universally used in brine or water coils to take advantage of the highest possible mean temperature difference for given entering water and air temperatures. It is also commonly used, in coils fed with volatile refrigerant, to take advantage of the higher air temperature for superheating the leaving gas. In deep coils, however, it is sometimes advantageous to use parallel flow from second row to last row, and then to complete the circuit by passing through the first row to take advantage of the higher air temperature for superheating. Complete evaporation and superheating of the refrigerant are essential to proper operation of the thermal expansion valve. Cross-flow is common

in steam heating coils, the temperature within the tubes being substantially uniform, and the mean temperature difference the same whatever the direction of flow, relative to the air. Cross-flow is to be avoided in coils with volatile refrigerants, because of unequal loading of parallel circuits, and the danger of short circuiting of liquid refrigerant which disturbs proper functioning of the thermal expansion valve.

Applications

Heating coils in field assembled banks are used for a number of purposes as described in Chapter 30. They may be arranged with the air flow

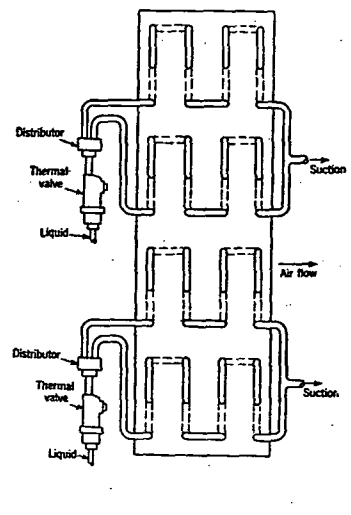

FIG. 6. ARRANGEMENT FOR FACE CONTROL

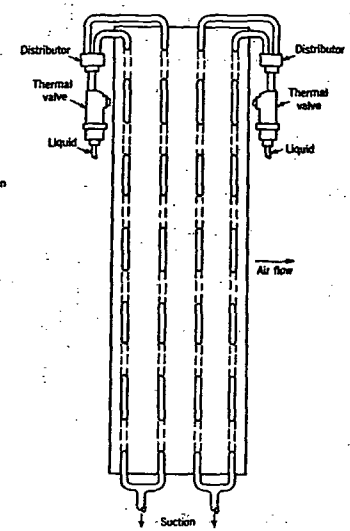

FIG. 7. ARRANGEMENT FOR DEPTH CONTROL

vertical or horizontal, although the latter is more common. For steam heating, the coils may be set with the tubes vertical or horizontal. In the latter case the coil should be sloped to provide for condensate drainage. Because of the multi-circuit feed arrangement and the necessity for avoiding air and water pockets, water heating coils are generally arranged with the tubes horizontal. Certain precautions must be taken against freezing. Where steam coils are used with entering air below freezing temperature, throttling the steam supply may cause freezing of the condensate in the bottom of the coil, if the tubes are of the variety not provided with internal distributing pipes or an equivalent arrangement.

There are coils available having inner distributing tubes, and having the supply and return headers cast in one piece. In this type of coil the condensate that forms in the outer tube has resulted from steam fed from the inner tube orifices. This condensation flowing back along the warm inner tube is prevented from freezing. A wide range of modulation at very low temperatures without danger of freezing, is therefore obtained. As an added precaution, with both steam and water coils, the outside air inlet