are other forms of distributors the above are typical examples. 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. Where conditions require a coil which is thin in the direction of air flow, with large quantities of air per ton of refrigeration, the temperature difference between leaving air and refrigerant is large and it is, therefore, practical to feed the coil in the direction of the air flow as shown in Fig. 6. If the refrigerant temperature

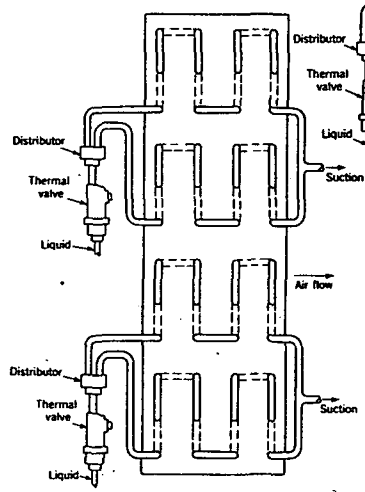


FIG. 8. ARRANGEMENT FOR FACE CONTROL

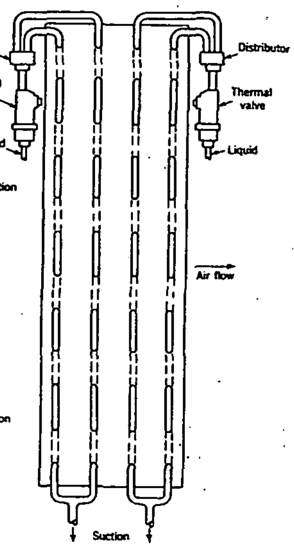


FIG. 9. ARRANGEMENT FOR DEPTH CONTROL

is high and the air quantity per ton low so that the leaving temperature difference becomes small, it is expedient to arrange the circuits so that the refrigerant is brought back to the air inlet side of the coil to take advantage of the large temperature difference at that point for superheating, as in Fig. 7. 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 it as shown in Figs. 8 and 9. The arrangement of Fig. 9 has the disadvantage of unequal load on the two parallel circuits. The choice between face or thickness division is dictated by the type of automatic temperature and humidity control used.

## Flow Arrangements

The relative direction of flow of the air outside the tubes and the media within them influences the performance of the surface. There are three





types of relative flow in common use. Fig. 10A shows *parallel flow* in which the air and the medium in the tubes proceed through the coil in the same direction. Fig. 10B shows *counter-flow* in which the media in the tubes proceed in a direction opposite to the flow of air. Fig. 10C shows *cross-flow* in which the air and heating or cooling media pass at right angles to each other. *Parallel-flow* is often used in coils fed with volatile refrigerant as it is characterized by a fall of refrigerant temperature in direction of air flow due to the pressure drop through the refrigerant circuit. *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 also used in very thin coils with brine or water or volatile refrigerants, it being impractical to arrange these coils any other way. The *counter-flow* arrangement or some modifications of it is used almost universally in

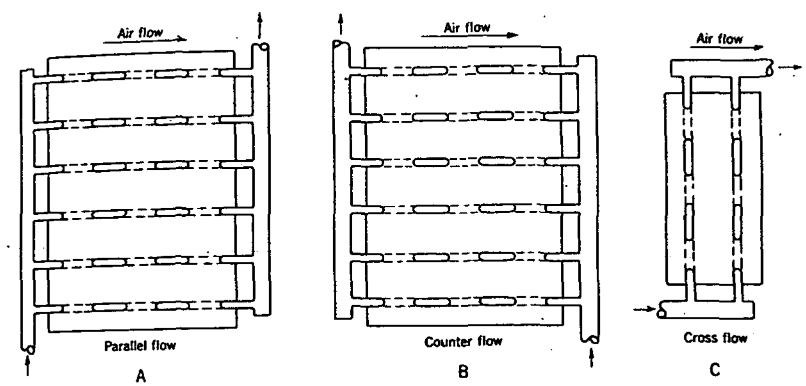


FIG. 10. FLOW OF MEDIA IN TUBES IN RELATION TO AIR FLOW

brine or water coils which are deep in the direction of air flow, to take advantage of the highest possible mean temperature difference for given entering water and air temperatures. *Counter-flow* is frequently used in coils fed with volatile refrigerant to take advantage of the higher air temperature for superheating the leaving gas. This arrangement permits complete evaporation of the refrigerant and proper operation of the thermal expansion valve.

## Applications

Heating coils in field assembled banks are used for a number of purposes as described in Chapter 21. They may be arranged with the air flow 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