vidual orifices in the tubes, by distributing plates and orifices in the steam header, or by perforated internal steam-distributing pipes extending into the individual tubes. The latter arrangement has the advantage of distributing the steam throughout the length of each tube, and is conducive to uniform temperature of delivered air. The tendency of condensate to freeze at the bottom of the coil with cold entering air and light heating loads, is also minimized. This is especially valuable for outside air preheaters.

Water Coils

The performance of water coils, for heating or cooling, depends on the elimination of air from the system and proper distribution of water. Air

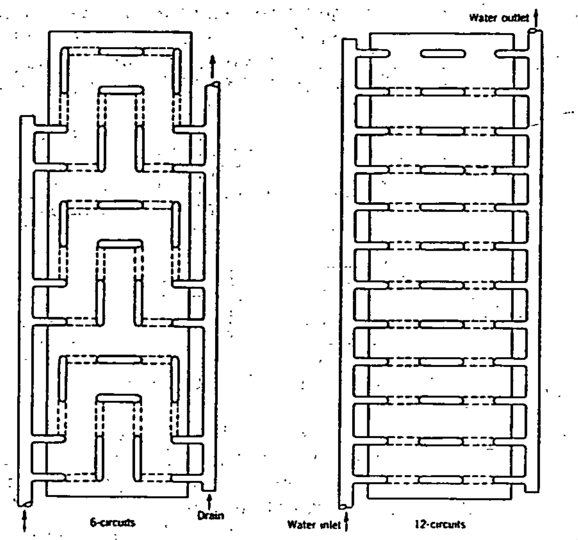

Fig. 2. Various Water Circuit Arrangements

elimination is taken care of in the system piping as described in Chapter 22. To assure a pressure drop sufficient for adequate distribution, but at the same time to provide against excessive pumping head where large water quantities are handled, water coils are provided with various water circuit arrangements. For instance, a typical coil 18 tubes high and 6 tubes deep in the direction of air flow can be arranged for 6, 9, 18, 24, or 36 parallel water circuits, as conditions may require. Orifices in individual tubes are occasionally employed, but are usually unnecessary as the resistance of individual water circuits is generally sufficient to effect a satisfactory distribution. In precooling coils using well water, where there may be considerable sand and other foreign matter in the water, provision for cleaning of individual tubes is of advantage. It is important to arrange water coils for complete drainage (see Fig. 2). The drains are usually provided in the water piping at the coil header.

Direct-Expansion Coils

Coils for volatile refrigerants present more complex problems of fluid distribution than do water, brine or steam. It is desirable that the coil

be effectively and uniformly cooled throughout, and necessary that the compressor be protected from entrained, unevaporated refrigerant. There are two types, namely, flooded systems, and thermal expansion valve systems, as shown in Figs. 3 and 4. In a flooded coil, the circulation is similar to that in a water tube boiler. The liquid is maintained at the proper level by the action of a float regulator as shown in Fig. 3. The thermal expansion valve system depends upon the thermal valve automatically feeding just as much liquid to the coils as is required to maintain the superheat at the coil suction outlet within predetermined limits, which vary from about 6 to 10 deg. The thermal valve arrangement is in common use for the type of coils covered by this chapter, while the flooded system is rarely used.

With the flooded system the refrigerant distribution through the tubes depends on properly selecting the length of the feeds, and the head of liquid imposed upon the liquid inlets. No auxiliary distributing devices are required. With the thermal valve system, there are two factors to consider.

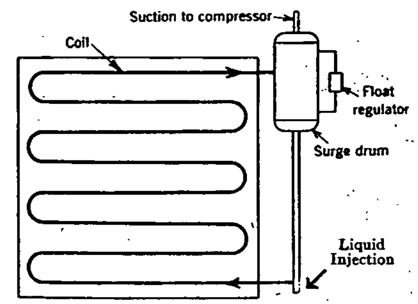

Fig. 3. Direct-Expansion Coil with Flooded System

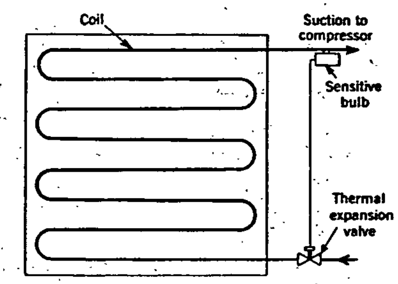

Fig. 4. Direct-Expansion Coil with Thermal Valve System

There must be, generally, more than one refrigerant feed through the coil per thermal valve to keep the pressure drop through the refrigerant circuit within practical limits, and to reduce the corresponding penalty in increased evaporating temperature. At the same time the coil must be so arranged that the required suction superheat can be attained with a minimum sacrifice in the performance of the coil as a whole. It is general practice to attain this superheat within the coil itself, and not by the use of external heat exchangers or other auxiliary devices.

With thermal expansion valves it is advantageous to keep the pressure drop through the refrigerant feeds as low as possible. The feeds are laid out to expose each to the same mean temperature difference so that it handles the same refrigerating load. Here, a distributing means is imposed between valve and coil liquid inlets to divide the refrigerant equally among the feeds. Such a distributor must be effective for distributing both liquid and vapor, because the entering refrigerant is a mixture of the two. Fig. 5 shows three typical types of distributors. In distributor A the liquid and gas mixture from the thermal valve is led tangentially into a chamber. The coil feed connections extend outward radially at the top of this chamber. In distributor B the refrigerant is discharged at a high velocity through a central jet against the end plate, forming a uniform mixture of gas and liquid within the distributor, from which individual connections are led as shown. In type C the refrigerant enters at high velocity from