Rotary Compressors

In recent years rotary compressors, usually hermetically sealed, have become quite popular for fractional tonnage applications and are being designed in increasingly larger sizes. Of the various designs attempted, the single blade rotary compressor shown diagrammatically in Fig. 8 is the most popular. An eccentric driven rotor revolves within a housing in which the suction and discharge passages are separated by means of a sealing blade. When the rotating eccentric first passes this blade and the suction opening, the compressor suction space is very small. As the eccentric rotates, this crescent-shaped space becomes increasingly larger, thereby drawing in a charge of suction gas. When the eccentric again passes the blade, the gas charge is cut off from the suction inlet, compressed, and discharged from the compressor. Such rotary compressors are quiet in operation and reasonably free from vibration. In common with other types of hermetically sealed units, they have the advantages of comparatively low loss of refrigerant and sealed-in lubrication.

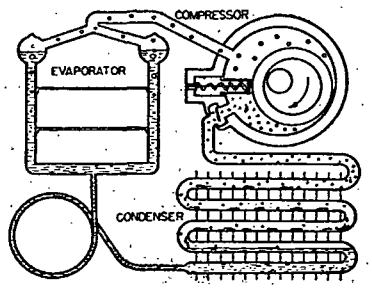


FIG. 8. DIAGRAMMATIC VIEW OF ROTARY COMPRESSOR WITH FLOODED EVAPORATOR AND CAPILLARY TUBE

Centrifugal Compressors

Centrifugal compressors are used with very low pressure refrigerants; usually both evaporator and condenser work below atmospheric pressure. Water and monofluorotrichloromethane (F-11) are the refrigerants commonly used in centrifugal machines.

Compression of the refrigerant is accomplished by means of centrifugal force; therefore, this type of compressor is inherently suitable for large volumes of refrigerant at low pressure differentials. Two or more stages are usually required and high speeds are necessary to obtain good efficiency.

The evaporator is usually constructed as an integral part of the centrifugal type condensing unit, to chill water which is then circulated to the air conditioning system. This is done because it would not be economical to pipe these large volumes of refrigerant any distance.

Centrifugal compressors, like reciprocating compressors, can be divided into two general types, open and enclosed. In general, the open type compressor is geared to the driving mechanism, and operates at higher speed than the driving motor or turbine. A modern, completely enclosed, direct-driven centrifugal compressor is illustrated in Fig. 9.

Centrifugal refrigeration compressors are particularly well suited to direct steam turbine drive because of their high operating speed. Water cooling equipment of one design is operated between 3500 and 4000 rpm for units developing 1000 to 2000 tons capacity, and from 7000 to 8000 rpm for units developing 100 to 200 tons capacity. However, a great many applications, particularly in the smaller sizes, are electric motor-driven and equipped with standard gear-type speed increasers. Centrifugal systems are particularly well adapted to large capacities (up to 3000 tons) although it is also possible to secure units as low as 50 tons in rating. Because centrifugal units operate best with refrigerants possessing a high specific volume, and because of the simplification of lubrication difficulties, they are frequently used for extremely low temperature applications. They are adaptable to a wide range of temperatures from −130 F to 50 F. One important advantage is their flexibility under varying loads, since units may be designed to operate with reasonable efficiency at capacities as low as 20 per cent of normal load.

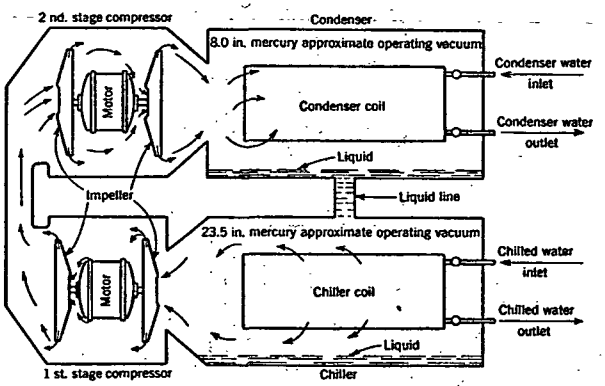


FIG. 9. ENCLOSED TYPE CENTRIFUGAL CONDENSING UNIT

Condensers

Condensers used for liquefying the refrigerant are of three general designs: (1) *air cooled*, (2) *water cooled*, and (3) *evaporative* (combination air and water).

1. *Air cooled condensers* are seldom used for capacities above 3 tons of refrigeration, unless an adequate water supply is extremely difficult to obtain, as, for instance, in railway air conditioning. Even on fractional tonnage installations, air is used as the condensing medium only where water is expensive, or where simplicity of installation warrants the higher condensing pressure, and consequent higher power costs than would be obtained using water as the condensing medium.

The conventional air cooled condenser consists of an extended surface coil across which air is blown by a fan. The hot discharge gas enters the coil at the top and, as it is condensed, flows to a receiver located below the condenser. Air cooled condensers should always be located in a well ventilated space so that the heated air may escape and be replaced by cooled air.

The principal disadvantages of air cooled condensers are the power required to move the air, and the reduction of capacity on hot days. This loss of capacity, due to high condensing pressures on hot days, requires that equipment of increased capacity