COOLING MOTOR COMPRESSOR UNIT OF REFRIGERATING APPARATUS

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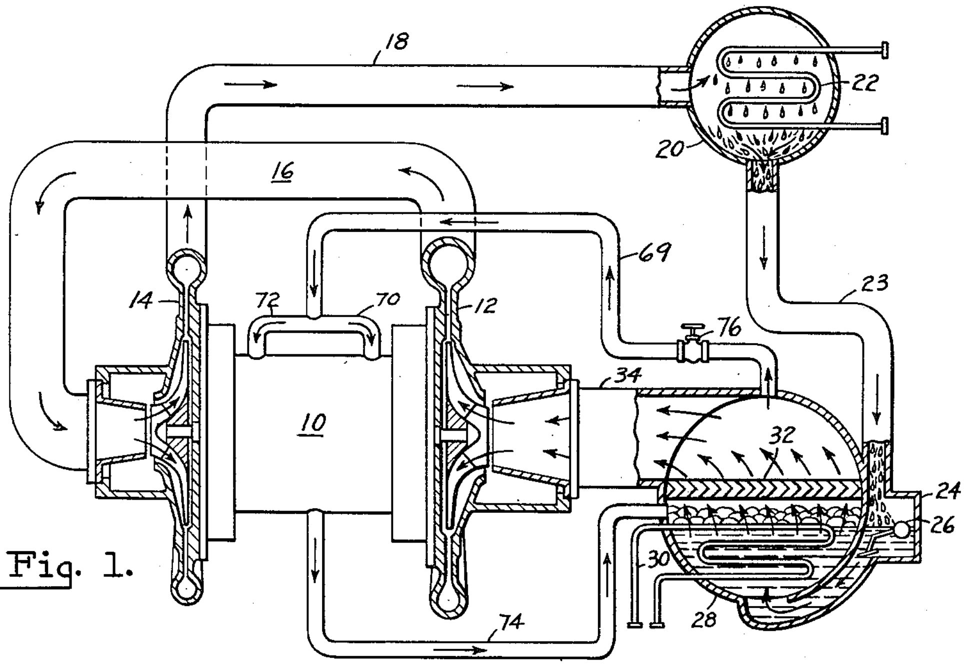

Fig. 1.

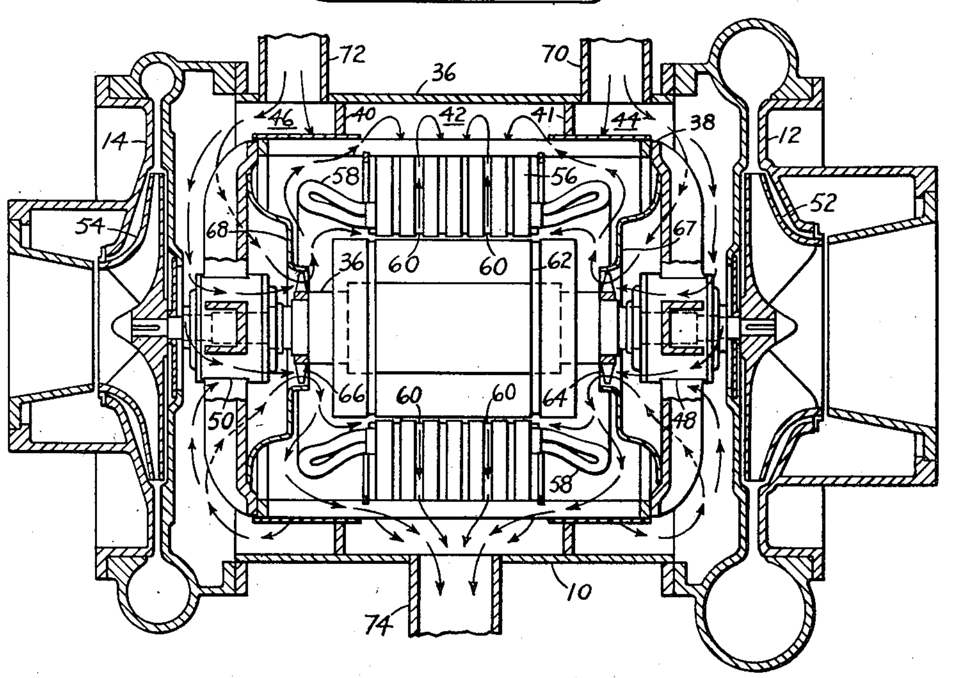

Fig. 2.

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COOLING MOTOR COMPRESSOR UNIT OF REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus of the type including a motor-compressor assembly, and particularly to apparatus in which the motor and compressor are housed in a sealed unit.

It is an object of this invention to provide means for cooling the motor using the refrigerant of the apparatus as a heat exchange medium.

It is another object of the invention to provide fans on the motor shaft for causing a circulation of refrigerant gas from the evaporator to the motor casing, thence over the rotor and stator of the motor, and thence back to the evaporator.

It is another object of the invention to provide passageways in the motor casing to conduct refrigerant gas in two streams to the ends of the motor to flow first over the bearings and with each stream then separating into two streams one of which flows over the stator winding and the other of which flows through the gap and outwardly through passageways in the stator.

Other objects and advantages of the invention will appear as the specification proceeds to describe the invention with reference to the accompanying drawings, in which—

Figure 1 is a partly diagrammatic view of the refrigeration apparatus of my invention.

Figure 2 is a cross-sectional view of the motor-compressor assembly taken on an axial plane.

Referring now to Figure 1, an electric motor 10 has at one end a first compressor stage 12 and at the other end a second compressor stage 14. A cross-over pipe 16 conducts gas from the discharge of the first stage 12 to the inlet of the second stage 14. The gas discharged from the second stage 14 flows through a pipe 18 to a condenser 20. The condenser 20 may be of the shell-and-tube type in which cooling water flows through the tubing 22 and the refrigerant is in the shell outside the tubes. Refrigerant liquid condensed in condenser 20 flows by gravity through pipe 23 to a float chamber 24. Float 26 in float chamber 24 opens and closes to control the flow of refrigerant liquid to an evaporator 28 which is also of the shell-and-tube type in which the secondary refrigerant liquid such as water or brine flows through the tubing 30 and the refrigerant is in the shell outside the tubing 30. The secondary refrigerant liquid circulates between the evaporator 28 and the cooling load served by the refrigeration apparatus to transfer heat from the load to the evaporator 28. In removing heat from the secondary refrigerant, the refrigerant in the evaporator 28 boils forming gas which passes through the liquid eliminator 32 and thence into the suction pipe 34 of the evaporator to the inlet of the first stage compressor 12.

The motor 10 has a fluid tight casing 36 secured in fluid tight relationship to compressor housings 12 and 14. A motor frame 38 is supported in said fluid tight casing 36 by a pair of rings 40 and 41 which divide the annular space between motor frame 38 and said fluid tight casing into a central chamber 42 and end chambers 44 and 46. Motor frame 38 has bearings 48 and 50 which rotatably support a shaft 36. Shaft 36 extends at one end into compressor housing 12 and has impeller 52 secured thereto. The other end of shaft 36 extends into housing 14 and has impeller 54 secured thereto. A stator 56 is secured to the motor frame 36. Stator 56 has the usual windings 58. A plurality of radial passageways 60 extend through the stator 56. A rotor 62 is mounted on shaft 36 to rotate therewith. Rotor 62 rotates within stator 56 and has an outside diameter slighly less than the inside diameter of the stator 56 to provide a gap between the rotor 62 and stator 56. Fans 64 and 66 are mounted on shaft 36 to rotate therewith. Shrouds 67 and 68 direct the gas into the fans 64 and 66. Fans 64 and 66 cause a flow of refrigerant gas from evaporator 28 through pipe 69 to branch pipes 70 and 72 which in turn conduct the gas to the end chambers 44 and 46 respectively.

After the gas has traversed its path through the motor 10, as will be described in detail below, it flows from the motor 10 through pipe 74 and returns to the evaporator 28 at a point above the liquid level.

The flow of gas through pipe 69 may be manually controlled by valve 76. If desired valve 76 may be of the thermostatic type in which a temperature sensing bulb is mounted in the gas stream leaving the motor 10.

The gas, having entered the motor 10 through pipes 70 and 72, flows to end chambers 44 and 46 from which it is conducted by shrouds 67 and 68 to fans 64 and 66, respectively. On leaving the fans 64 and 66 part of each stream flows over the winding 58 and into the central chamber 42 and part of each stream flows into the gap between the rotor 62 and stator 56 and then outwardly through the radial passageways 60 in the stator 56 and into the central chamber 42. Central chamber 42 thus collects the gas flowing over the windings 58 and the gas flowing from the radial passageways 60 and conducts the gas to the pipe 74.

It is thus seen that the gas space above the tubes in the evaporator provides a dependable source of low temperature gas for motor cooling. When the unit is started after a long shut down, the temperature of the gas will be approximately that of the ambient temperature, and it might have a temperature in the range of about 70° to 90° Fahrenheit. Although gas at this temperature will remove heat from the motor 10, operation of the compressor will almost immediately reduce the pressure in the evaporator and the temperature of the gas will quickly drop to the operating temperature which is usually in the range of about 40 to 55 degrees Fahrenheit.

The gas returning to the evaporator 28 from the motor 10 through pipe 74 is superheated because it has removed heat from the motor. This superheated gas mixes with the gas in the evaporator 28 which tends to have small drops of liquid suspended therein. The superheated gas from the motor transfers some of its heat to the gas in the evaporator with result that drops of liquid suspended therein are evaporated and the danger of droplets of liquid being carried over into the compressor through pipe 34 is minimized.

While the apparatus disclosed and described herein constitutes a preferred form of the invention, yet it will be understood that the apparatus is capable of alteration without departing from the scope or spirit of the invention, and that all modifications that fall within the scope of the appended claims are intended to be included herein.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In refrigerating apparatus, the combination of an evaporator for vaporizing refrigerant, a condenser for liquefying refrigerant, a compressor for circulating refrigerant through said evaporator and condenser, a substantially cylindrical casing in fluid tight contact with said compressor, a motor frame in said substantially cylindrical

casing and spaced with respect to said substantially cylindrical casing, partitions between said frame and said substantially cylindrical casing dividing the space therebetween into a central chamber and two end chambers, a stator secured to said frame and having radial passageways therein communicating with said central chamber, bearings secured to each end of the frame, a shaft and rotor assembly rotatably mounted in said bearings, said shaft and rotor assembly extending into said compressor, an impeller in said compressor, said impeller being secured to said shaft and rotor assembly, fan means secured to said shaft and rotor assembly for moving gas from said end chambers into said radial passageways and thence into said central chamber, means for conducting gas from said evaporator to said end chambers and means for conducting gas from said central chamber to said evaporator.

2. In refrigerating apparatus, the combination of an evaporator for vaporizing refrigerant, a condenser for liquefying refrigerant, a centrifugal compressor having an inlet connected to receive refrigerant from said evaporator and a discharge chamber connected to transmit refrigerant to said condenser, an annular motor casing secured in fluid tight engagement with said compressor, a generally annular motor frame in said annular motor casing, annular rings between said motor frame and said motor casing to support said motor frame in said motor casing, said annular rings being arranged to divide the annular space between said motor frame and said motor casing into a central chamber and two end chambers, a stator mounted in said motor frame opposite said central chamber, said stator having radial passageways extending therethrough, bearings in each end of the motor frame, a shaft and rotor assembly rotatably mounted in said bearings, said shaft and rotor assembly extending into said compressor, an impeller in said centrifugal compressor, said impeller being secured to said shaft and motor assembly, means for conducting refrigerant from said evaporator to each of said end chambers, fans secured to said shaft and rotor assembly for moving the refrigerant gas from said end chambers through the gap between said stator and rotor and outwardly through the radial passageways of said stator into the central chamber and means for conducting refrigerant from said central chamber to said evaporator.

3. In refrigerating apparatus, the combination of an evaporator for vaporizing refrigerant, a condenser for liquefying refrigerant, a compressor for circulating refrigerant through said evaporator and condenser, a substantially cylindrical casing secured in fluid tight contact at one end with said compressor, a motor frame in said substantially cylindrical casing and spaced with respect to said substantially cylindrical casing, partitions between said frame and said substantially cylindrical casing defining a central chamber and two end chambers, a stator secured to said frame, bearings secured to each end of the frame, a shaft and rotor assembly rotatably mounted in said bearings, said shaft and rotor assembly extending into said compressor, an impeller in said compressor, said impeller being secured to said shaft and rotor assembly for rotation therewith, fan means secured to said shaft and rotor assembly for moving gas from said end chambers over the surfaces of said stator and thence into said central chamber, means for conducting gas from said evaporator to said end chambers and means for conducting gas from said central chamber to said evaporator.

4. In refrigerating apparatus, the combination of an evaporator for vaporizing refrigerant, a condenser for liquefying refrigerant, a centrifugal compressor for circulating refrigerant through said evaporator and condenser, a substantially cylindrical casing secured in fluid tight contact at one end with said compressor, a stator secured in said casing, bearings secured to said casing, a shaft and rotor assembly rotatably mounted in said bearings, said shaft and rotor assembly extending into said compressor, a centrifugal impeller in said compressor, said impeller being secured to said shaft and rotor assembly, spaced radial baffles in said casing and surrounding said shaft and rotor assembly to form passageways in said casing extending from the central portion of the periphery of said casing inwardly to said shaft and rotor assembly and thence outwardly to the end portions of said casing, conduit extending from said evaporator to the central portion of said casing, conduit extending from the evaporator to the end portions of said casing and fans secured to said shaft and rotor assembly and extending into said passageways for moving gas from the evaporator into said passageways and thence back to said evaporator.

References Cited in the file of this patent

UNITED STATES PATENTS

1,448,700	Seidner	Mar. 13, 1923
1,652,134	Thomson	Dec. 6, 1927
2,249,882	Buchanan	July 22, 1941