Oct. 9, 1962 J. L. DITZLER 3,057,172

SYSTEMS FOR COOLING MOTORS OF REFRIGERANT COMPRESSORS

Filed April 3, 1961

Fig. 1.

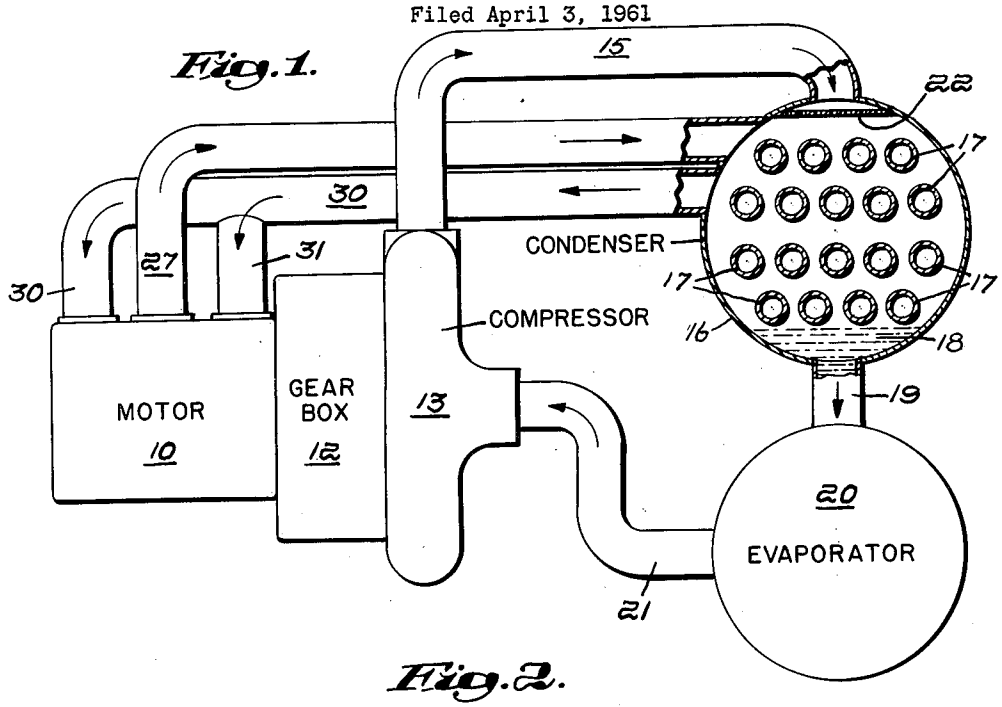
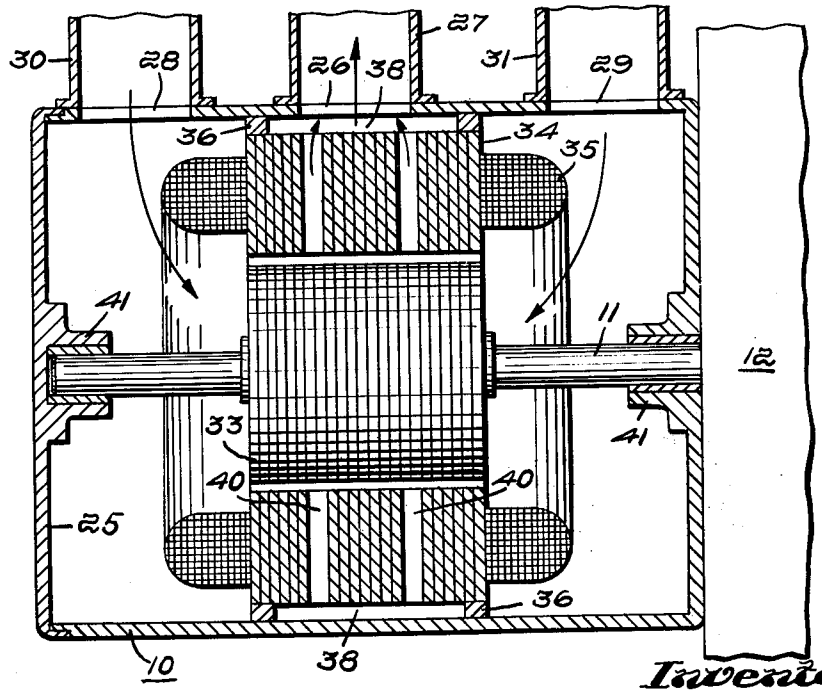


Fig. 2.



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SYSTEMS FOR COOLING MOTORS OF REFRIGERANT COMPRESSORS

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This invention relates to hermetically-sealed, refrigerant compressor-motor units, and has as an object to cool the electric motors within and used for driving the compressors of such units, with saturated refrigerant gas.

It is the general practice to cool the electric motors of hermetically-sealed, compressor-motor units with suction gas passing from associated evaporators to the suction sides of the compressors. Disadvantages of such motor cooling systems are that the suction gas is heated by the motors so that the compressors and their condensers have to be larger than they would be if suction gas was not used to cool the motors.

This invention takes saturated refrigerant gas from a condenser, cools the motor of the associated compressor-motor unit with the saturated gas, and then returns the gas to the condenser. Using this motor cooling system, the size and the efficiency of the associated compressor are not affected.

This invention will now be described with reference to the annexed drawings, of which:

FIG. 1 is a side view, with the condenser in section, of a refrigeration system embodying this invention, and

FIG. 2 is an enlarged cross-section through the motor of FIG. 1.

An electric motor **10** has its rotary shaft **11** connected to a conventional speed-increasing gear-box **12** which drives a conventional, centrifugal, refrigerant compressor **13**. The outlet of the compressor **13** is connected by tube **15** to the top of the interior of a shell-and-tube condenser **16** which contains spaced-apart, horizontal rows of tubes **17** through which water is circulated. The interior of the bottom of the condenser **16** is connected by a tube **19** to a conventional shell-and-tube evaporator **20** used as a water chiller. The outlet of the evaporator **20** is connected by a tube **21** to the inlet of the compressor **13**.

Above the uppermost row of tubes **17** within the condenser **16** is a perforated baffle **22** for causing the discharge gas to be distributed uniformly across the upper row of tubes **17**. There is a pool **18** of condensed refrigerant liquid in the bottom of the condenser **16**.

The electric motor **10** has a casing **25** with a circular opening **26** in the center of its top which is connected to one end of a tube **27**, the other end of which is connected to the interior of the condenser **16** to one side of and above the uppermost row of the tubes **17**. The casing **10** has a pair of circular openings **28** and **29** in its top near its ends, and which are connected to ends of tubes **30** and **31**, respectively. The other end of the tube **31** opens into the tube **30**, and the other end of the latter connects with the interior of the condenser **16** between the uppermost row of tubes **17** and the adjacent lower row of tubes **17**, and to one side of the latter.

The motor **10** has a squirrel-cage type of rotor **33** on its shaft **11**, and has a stator **34** and a stator winding **35** around the rotor **33**. The stator **34** is supported from the casing by annular bars **36** which also space the stator from the casing to form an annular passage **38** around the stator, the center of which is aligned with the center of the central opening **26**. The stator **34** has radial passages **40** connecting the annular space between the rotor and the stator with the annular passage **38**. The casing **10** has end bearings **41** for the shaft **11**.

In operation, the compressor **13** draws gas from the evaporator **20**, compresses this gas, and pumps the compressed gas into the top of the condenser **16** where it condenses to a liquid which is supplied to the evaporator **20** which would include conventional expansion means. The gas entering the condenser would not, of course, be completely condensed until it nears the bottom of the condenser, so that the gas below the uppermost row of tubes **17** of the condenser, would be gas which would be saturated with liquid refrigerant. This saturated gas passes through the tube **30** under its pressure, aided by the skin friction of the rotor **33** acting as a centrifugal pump, passes through the tubes **30** and **31** into the ends of the casing **10**, passes through the open ends of the stator winding **35**, over the surface of the rotor, through the radial slots **40** in the stator, into the annular passage **38**, and then through the tube **27** to the interior of the condenser above the connection of the tube **30** to the condenser. The gas leaving the motor through the tube **27** is, of course, superheated by its absorption of heat from the motor.

The condenser used in the cooling system of this invention would have to be larger than it would if the motor were not cooled, but no larger than a corresponding condenser used in a system for cooling a motor with suction gas, but the size and efficiency of the associated compressor would not be affected.

What is claimed is:

1. In a refrigeration system including a compressor, a shell-and-tube type of condenser having within its interior a plurality of vertically spaced-apart rows of gas cooling tubes, a discharge tube connecting said condenser above the uppermost row of said rows with the discharge side of said compressor, an evaporator, a liquid tube connecting the bottom of said condenser with the inlet of said evaporator, a suction tube connecting the outlet of said evaporator with the suction side of said compressor, an electric motor having a rotor connected to said compressor, said motor having a stator around and spaced from said rotor, having a casing around said stator with an annular passage between said casing and stator, said stator having radial slots extending therethrough aligned with said annular passage, said casing having an end passage between one of its ends and the adjacent end of said motor and connecting with the space between said rotor and stator, said annular and end passages having a partition therebetween for preventing gas from flowing from said end passage into said annular passage except through said space between said stator and rotor and said radial slots, the combination of a tube connecting said end passage with said interior of said condenser between said uppermost row of tubes and said bottom of said condenser for supplying saturated gas from said condenser into said end passage, and a tube connecting said annular passage with said interior of said condenser above where said last mentioned tube connects with said interior of said condenser for supplying gas heated by said motor into said condenser.

2. In a refrigeration system including a compressor, a shell-and-tube type of condenser having in its interior a plurality of vertically spaced-apart rows of gas cooling tubes, a discharge gas tube connecting said condenser above the uppermost row of said rows with the discharge side of said compressor, an evaporator, a liquid tube connecting the bottom of said condenser with the inlet of said evaporator, a suction tube connecting the outlet of said evaporator with the suction side of said compressor, an electric motor for driving said compressor, said motor having a rotor connected to said compressor, having a stator around and spaced from said rotor, having a casing around said stator with an annular passage between said stator and casing, said stator having radial slots extending therethrough aligned with said annular passage, said casing having an end passage between one of its ends and the

adjacent end of said motor and connecting with the space between said stator and rotor, said annular and end passages having a partition therebetween for preventing gas from flowing from said end passage into said annular passage except through the space between said rotor and stator and said slots, the combination of a perforated baffle in said condenser between said uppermost row of tubes and where said discharge gas tube connects with said interior of said condenser, a tube connecting said interior of said condenser between said baffle and said uppermost row of tubes and said annular passage for

supplying gas heated by said motor into said condenser, and a tube connecting said end passage and said interior of said condenser between said uppermost row of tubes and the next adjacent lower row of tubes for supplying gas saturated with liquid into said end passage.

References Cited in the file of this patent

UNITED STATES PATENTS

2,768,511 Moody ---------- Oct. 30, 1956
2,793,506 Moody ---------- May 28, 1957