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REFRIGERATING APPARATUS

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FIG. 1.

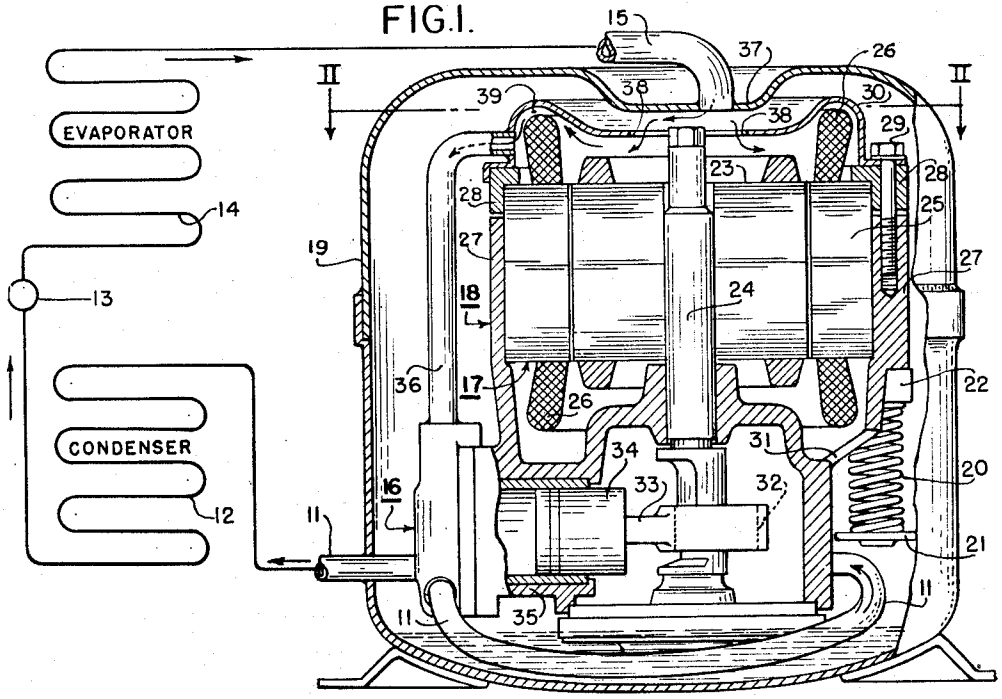
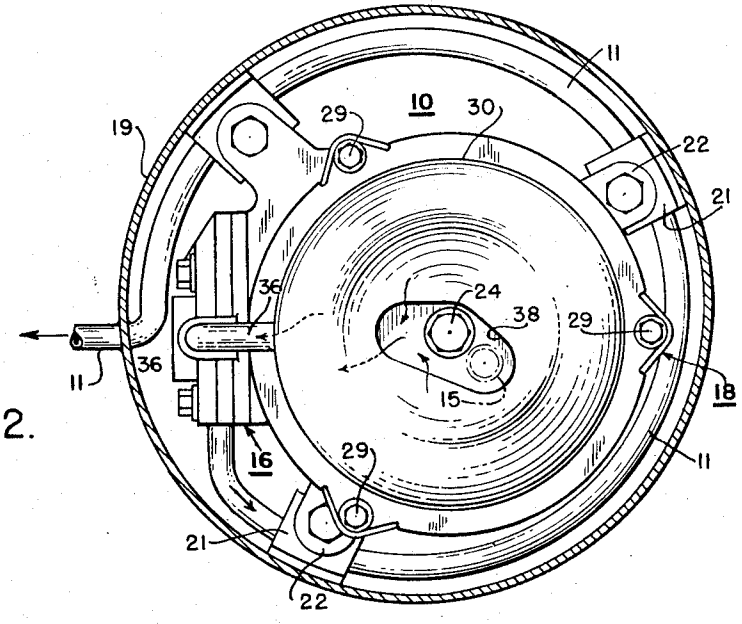


FIG. 2.



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REFRIGERATING APPARATUS

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This invention relates to a motor-compressor unit for refrigerating systems and particularly to a unit resiliently supported in a fluid-tight casing and wherein the motor is cooled by refrigerant vapor flowing to the compressor.

The objective of the invention is improved performance of the motor-compressor unit, and this objective is achieved by the use of a novel arrangement for confining and directing vaporous refrigerant over certain portions of the motor-compressor unit and away from other portions of said unit on its way to the inlet of the compressor.

In accordance with the invention, that end of the motor which is not enclosed by a frame is enclosed by a cover or hood that is in communication with the compressor inlet through a tube. This cover is disposed close to the wall of the motor-compressor casing, which is provided with means for returning vaporous refrigerant to the casing. The cover has an inlet opening therein through which refrigerant, and particularly the cool refrigerant vapor entering the motor-compressor casing, is drawn by the compressor. The cover, in cooperation with the motor-compressor frame, confines refrigerant flow over and around the motor components, for the purpose of cooling the motor, and directs the main body of refrigerant flow away from other warm portions of the motor-compressor unit, such as the compressor cylinder, the hot gas discharge line, and the pool of lubricating oil in the casing.

The invention affects the operation of the motor-compressor unit in two ways, each of which increases the pumping capacity of the unit. In the first place, the motor is cooled more effectively, enabling the motor to carry increased loads without overheating. Secondly, cooler, and consequently more dense, refrigerant vapor is delivered to the compressor inlet, so that a greater quantity of refrigerant is compressed with each stroke of the compressor piston.

Other objects, advantages and features of the invention will be apparent from the following detailed description in which reference is made to the accompanying drawings forming a part hereof, and wherein:

Fig. 1 shows diagrammatically a refrigerating system incorporating a motor-compressor unit constructed in accordance with this invention, the unit being shown in vertical section; and,

Fig. 2 is a plan view of the unit with the top of the casing removed.

The motor-compressor unit referred to generally by the reference numeral **10** is a part of a refrigerating system which also includes a discharge conduit **11**, a condenser **12**, an expansion device **13**, an evaporator **14** and a suction conduit **15**. The expansion device **13** may be of any suitable type known in the art, such as a capillary tube or a thermostatic expansion valve.

The refrigerating system as a whole operates in the usual manner of such apparatus, the refrigerant gas compressed by the motor-compressor unit **10** being conveyed

through the discharge conduit **11** to the condenser **12**, wherein the same is condensed. The liquefied refrigerant then flows through the expansion device **12** which reduces the pressure thereof. In the evaporator **14**, the liquid refrigerant is vaporized by heat extracted from the substance to be cooled and the vaporized refrigerant flows through the suction conduit **15** to the motor-compressor unit, wherein the same is re-compressed and re-circulated.

The motor-compressor unit **10** includes a compressor **16**, a motor **17** and a frame **18** for maintaining the compressor and the motor in operative relation to one another. The frame also provides bearing supports for the movable elements of the motor and the compressor. The compressor, the motor and the frame are resiliently supported within a fluid-tight casing **19** on three helical springs **20**, one of which is illustrated in Fig. 1. The springs **20** are of a compression type and are disposed vertically between casing mounted brackets **21** and lugs **22** projecting outwardly from the frame **18**.

The motor **17** comprises a rotor **23** mounted on a vertical axis shaft **24** and a stator **25** having windings **26** projecting from opposite ends thereof. The stator **25** is received in a tubular portion **27** of the frame **18** and is secured in place therein by a clamping ring **28** which is secured to the frame **18** by several bolts **29**. The bolts **29** also pass through the rim of a cup-shaped cover or hood **30** which encloses the end of the stator **25** and the windings **26** thereon which are not enclosed by the tubular portion **27** of the frame **18**. The other end of the stator **25**, i.e., the end near the compressor **16**, is at least partially enclosed by the frame **18**, although there are one or more openings **31** provided in this region of the frame **18** which allow lubricating oil to drain from the frame into the bottom of the casing **19** which forms a reservoir for lubricating oil.

The compressor **16** is driven by the motor **17** through shaft **24** which has an eccentric **32** thereon near its lower end. The eccentric **32** imparts reciprocating motion to a connecting rod **33** and a piston **34**, the latter of which moves in a cylinder **35** formed as a part of the motor-compressor frame **18**. The piston **34**, in moving back and forth in the cylinder **35**, draws vaporous refrigerant into the compressor **16** through an inlet pipe **36** and discharges compressed refrigerant through the discharge line **11** which extends through the wall of the casing **19**. The inlet pipe **36** connects the inlet of the compressor **16** with the interior of the cover **30** enclosing the remote end of the motor **17**.

The suction conduit **15** of the refrigerating system extends through a depressed region **37** in the top wall of the casing **19** and admits refrigerant to the interior of the casing. This cool refrigerant is utilized for cooling the motor **17** and is drawn by the compressor **16** through an inlet opening **38** provided in the cover **30**, over the end windings **26** at the upper end of the motor, and over portions of the rotor **23** and stator **25** of the motor before entering the inlet pipe **36**.

It will be noted that, although there is no direct connection between the suction conduit **15** and the compressor inlet pipe **36**, i.e. the conduit is independent of the motor cover **30**, and though the entire internal volume of the motor-compressor casing **19** is at substantially compressor inlet pressure, the cool incoming refrigerant is made to flow over portions of the motor **17** and then directly into the compressor **16** without being given the opportunity to come in contact with other warm portions of the motor-compressor unit, such as the compressor cylinder **35**, the discharge line **11** which contains hot compressed gas, and the pool of oil in the bottom of the casing **19**. The motor **17** is thus effectively cooled and

the pumping capacity of the compressor **16** is increased because the compressor is handling cooler and, consequently, more dense refrigerant vapor than it would if the refrigerant were first warmed by contact with the above-mentioned warm portions of the unit.

Several detailed features which contribute to the overall improved performance of the motor-compressor unit are embodied in the unit illustrated in the drawing. One of these features concerns a relationship between the motor end cover **30** and the adjacent wall of the motor-compressor casing **19**. Preferably, the motor and compressor are so supported in the casing **19** as to dispose the cover **30** in closely spaced relation to the wall of the casing **19** through which vaporous refrigerant enters from the suction conduit **15**. It will also be noted that the central wall portion of the cover **30** is depressed to conform at least partially to the depressed region **37** of the wall of the casing **19**. This depression in the cover **30** is effective to guide refrigerant issuing from the suction conduit **15** into the inlet opening **38** in the cover. In addition, this cover configuration provides an annular recess **39** on the inside cover **30** which at least partially receives the windings **26** at the remote end of the stator **25**. This annular recess **39** functions as a restricted flow passage for confining the flow of cool vaporous refrigerant closely about the windings **26** of the stator.

It will also be noted that the compressor inlet pipe **36** is connected to a peripheral, or side wall, region of the motor end cover **30** so that refrigerant must flow over and around the stator windings **26** before entering the inlet pipe.

It can be readily appreciated that the cover inlet opening **38** is preferably made larger than the area of the suction conduit **15** at its discharge end to insure that the major portion of the refrigerant issuing from the suction conduit **15** will find its way through the opening **38** into the area beneath the cover **30**. The supporting springs **20** for the motor **17** and the compressor **16** permit movement and vibration of these components of the unit when the unit is operating, so there is relative movement between the inlet opening **38** and the discharge end of the suction conduit **15**. For this reason, the inlet opening **38** is preferably shaped like the vibration or movement pattern of this end of the motor **17** so that there will always be at least a part of the opening **38** opposite the discharge end of the suction conduit **15** during operation of the unit.

From the above description it will be seen that this invention provides a relatively simple and inexpensive arrangement for insuring effective cooling of the motor of a motor-compressor unit that is resiliently supported within an enclosing casing. Moreover, the provision of an efficient flow path for the motor cooling refrigerant enables the compressor to work with cooler refrigerant and, consequently, pump a greater quantity of refrigerant.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. An enclosed motor and compressor unit for a refrigerating system comprising a compressor, a motor for driving the compressor, said motor including a rotor and a stator, a frame for supporting said compressor and said motor in operative relation to one another, said frame including a portion adapted to receive said stator in a manner to at least partially enclose the end of the stator near the compressor and to expose the end of the stator remote from said compressor, a cover for the exposed end of said stator and the corresponding end of said rotor, said cover having a refrigerant inlet opening therein, tubular means providing communication between the interior of said cover and the inlet of said compressor, a common fluid-tight casing for the compressor, the motor and the frame, means for resiliently supporting said frame in said casing, and means independent of said cover for admitting vaporous refrigerant to the interior of said casing in the vicinity of the inlet opening in said cover.

2. An enclosed motor and compressor unit for a refrigerating system comprising a compressor, a motor for driving the compressor, said motor including a rotor and a stator, a frame for supporting said compressor and said motor in operative relation to one another, said frame including a portion adapted to receive said stator in a manner to at least partially enclose the end of the stator near the compressor and to expose the end of the stator remote from said compressor, a cup-shaped cover secured to said frame for covering the exposed end of said stator and the corresponding end of said rotor, said cover having a refrigerant inlet opening therein, tubular means providing communication between the interior of said cover and the inlet of said compressor, a common fluid-tight casing for the compressor, the motor and the frame, means for resiliently supporting said frame in said casing, and means provided in a wall of the casing near the inlet opening in said cover and independent of said cover for admitting vaporous refrigerant to said casing.

3. An enclosed motor and compressor unit for a refrigerating system comprising a compressor, a motor for driving the compressor, said motor including a rotor and a stator, a frame for supporting said compressor and said motor in operative relation to one another, said frame including a portion adapted to receive said stator in a manner to at least partially enclose the end of the stator near the compressor and to expose the end of the stator remote from said compressor, a cup-shaped cover secured to said frame for covering the exposed end of said stator and the corresponding end of said rotor, said cover having a refrigerant inlet opening in a central wall portion thereof, tubular means providing communication between the interior of said cover and the inlet of said compressor, a common fluid-tight casing for the compressor, the motor and the frame, means for resiliently supporting said frame in said casing with said cover in closely spaced relation to a wall of said casing, and means provided in said wall of the casing near the inlet opening in said cover and independent of said cover for admitting vaporous refrigerant to said casing.

4. An enclosed motor and compressor unit for a refrigerating system comprising a compressor, a motor for driving the compressor, said motor including a rotor and a stator having windings extending from opposite ends thereof, a frame for supporting said compressor and said motor in operative relation to one another, said frame including a portion adapted to receive said stator in a manner to at least partially enclose the windings at the end of the stator near said compressor and to expose the windings at the end of the stator remote from said compressor, a cup-shaped cover mounted on said frame and having said exposed windings of said stator disposed therein, said cover having a refrigerant inlet opening in a central wall portion thereof, tubular means connecting the inlet of said compressor to said cover in a peripheral region of said cover, whereby vaporous refrigerant entering said inlet opening in said cover is confined to flow around and in contact with said exposed stator windings in passage to the inlet of the compressor, a common fluid-tight casing for the compressor, the motor and the frame, means for resiliently supporting said frame in said casing, and means independent of said cover for admitting vaporous refrigerant to said casing near the inlet opening in said cover.

5. An enclosed motor and compressor unit for a refrigerating system comprising a compressor, a motor for driving the compressor, said motor including a rotor and a stator having windings extending from opposite ends thereof, a frame for supporting said compressor and said

motor in operative relation to one another, said frame including a portion adapted to receive said stator in a manner to at least partially enclose the windings at the end of the stator near said compressor and to expose the windings at the end of the stator remote from said compressor, a cup-shaped cover having an inwardly depressed central wall portion providing an annular recess in said cover, said cover being mounted on said frame and having said exposed windings of said stator disposed at least partially within said annular recess, said cover having a refrigerant inlet opening in said central wall portion thereof, tubular means connecting the inlet of said compressor to said cover in a peripheral region of said cover, whereby vaporous refrigerant entering said inlet opening in said cover is confined to flow around and in contact with said exposed stator windings in passage to the inlet of the compressor, a common fluid-tight casing for the compressor, the motor and the frame, means for resiliently supporting said frame in said casing, and means for admitting vaporous refrigerant to said casing near the inlet opening in said cover.

6. An enclosed motor and compressor unit for a refrigerating system comprising a compressor, a motor for driving the compressor, said motor including a rotor and a stator having windings extending from opposite ends thereof, a frame for supporting said compressor and said motor in operative relation to one another, said frame including a portion adapted to receive said stator in a manner to at least partially enclose the windings at

the end of the stator near said compressor and to expose the windings at the end of the stator remote from said compressor, a cup-shaped cover having an inwardly depressed central wall portion providing an annular recess in said cover, said cover being mounted on said frame and having said exposed windings of said stator disposed at least partially within said annular recess, said cover having a refrigerant inlet opening in said central wall portion thereof, tubular means connecting the inlet of said compressor to said cover in a peripheral region of said cover, whereby vaporous refrigerant entering said inlet opening in said cover is confined to flow around and in contact with said exposed stator windings in passage to the inlet of the compressor, a common fluid-tight casing for the compressor, the motor and the frame, means for resiliently supporting said frame in said casing with said cover in closely spaced relation to a wall of the casing, and means provided on said wall of the casing for admitting vaporous refrigerant to said casing near the inlet opening in said cover.

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