

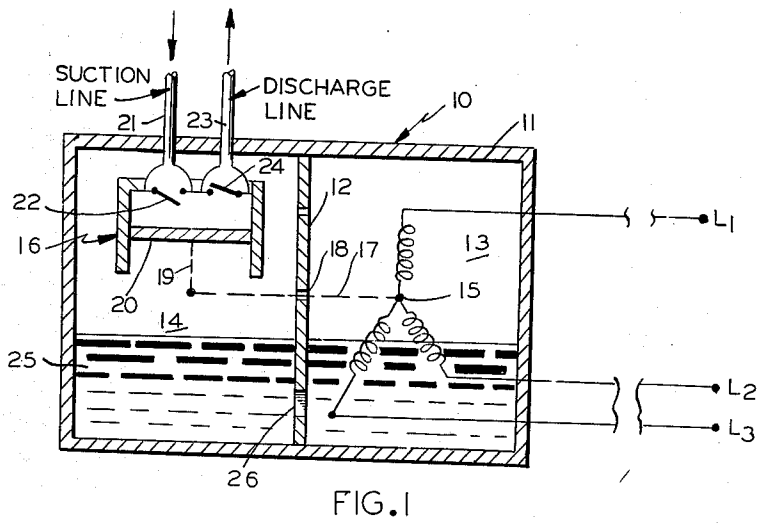
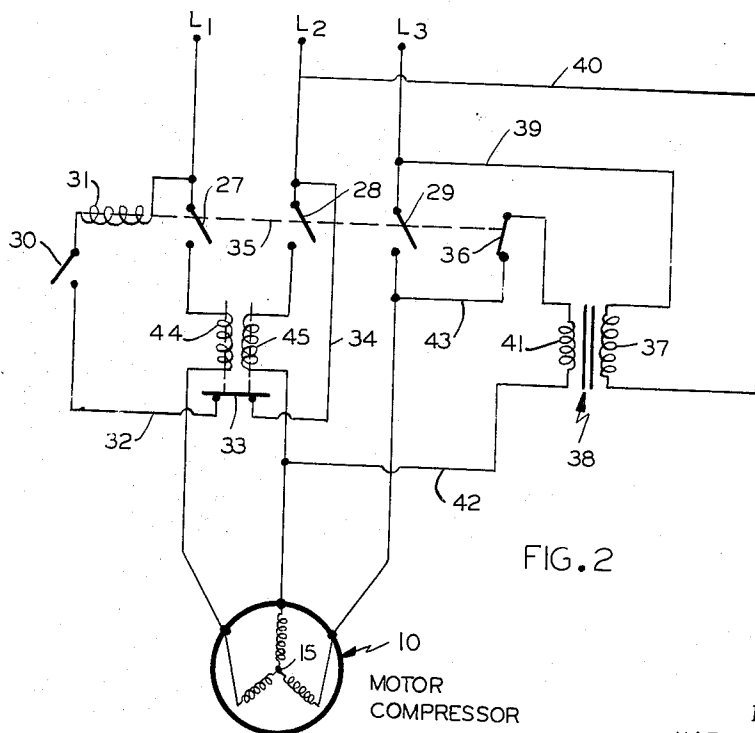
Sept. 28, 1965

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3,208,237

REFRIGERATING APPARATUS

Filed Sept. 27, 1957



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3,208,237

REFRIGERATING APPARATUS

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Filed Sept. 27, 1957, Ser. No. 686,653
10 Claims. (Cl. 62-498)

The invention relates to refrigeration and more particularly to a heating system for a compressor for preventing the absorption of refrigerant by crankcase oil when the compressor is not in operation.

It is well known that certain refrigerants are soluble in oil. When the compressor of a refrigeration system containing such a refrigerant has been shut down and the pressures in the various elements of the system are equalizing and the temperatures of these elements are approaching those of the surroundings, the refrigerant will dissolve (or be absorbed) in the oil. Starting of a compressor containing a relatively large amount of dissolved refrigerant in the oil will result in damage to the compressor because foaming of the oil-refrigerant mixture will prevent proper lubrication. To overcome this occurrence, crankcase heaters have been used in the past to keep the crankcase oil warm during shutdown periods. However, this required the mounting of additional equipment on the compressor which was costly in both materials and labor. It is with the prevention of crankcase oil dilution during the compressor shutdown in a simple, inexpensive and efficient manner that the present invention is concerned.

It is therefore the main object of the present invention to provide a system for heating the oil in the crankcase of a compressor during shutdown which requires a minimum of equipment because the heating system utilizes certain portions of the motor construction.

Another object of the present invention is to provide a system for heating the compressor crankcase oil during compressor shutdown which can be installed on existing motor-compressor units with a minimum of effort and expense. Other objects and attendant advantages of the present invention will readily be perceived hereafter.

The present invention relates to a construction for preventing crankcase oil dilution by refrigerant during compressor shutdown of a motor-compressor unit and comprises a source of electric current, circuit means coupling said motor to said source for selectively causing operation of said motor, and means for impressing a reduced voltage across said motor when it is inactive for heating the oil in the crankcase to prevent dissolving of refrigerant therein. The present invention will be more fully understood when the following portions of the specification are read in conjunction with the accompanying drawings wherein:

FIGURE 1 is a schematic representation of a motor-compressor unit embodying the present invention; and

FIGURE 2 is a schematic wiring diagram of a circuit which may be used to practice the present invention.

Reference is now made to FIGURE 1 which discloses a motor-compressor unit 10 having a casing 11 and a partition 12 therein which divides the unit into a motor compartment 13 and a compressor compartment 14. A motor 15 is mounted in motor compartment 13, and a compressor 16 is mounted in compressor compartment 14. Motor shaft 17 extends through a suitable aperture 18 in partition 12 and is suitably coupled to link 19 which is connected to piston 20 of compressor 16. A suction line 21 having a valve 22 therein communicates with compressor 16. A discharge line 23 also communicates with compressor 16 through valve 24. As is well known in the art, when link 19 moves piston 20 downwardly, valve 22 will open to permit gas from suction line 21 to enter the compression chamber of compressor 16, and when link

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19 moves piston 20 upwardly, valve 24 will open to permit compressed gas to leave the compression chamber of compressor 16 and enter discharge line 23.

Compressor lubricating oil 25 is located in a sump or crankcase in the lower portion of compressor chamber 14. Suitable lubricating apparatus (not shown) is provided for conveying the lubricant to the various parts of the compressor, as required.

As stated above, the present invention prevents the dissolving of refrigerant in the crankcase lubrication oil 25 by heating this oil during periods of compressor shutdown. To achieve this, a reduced voltage is impressed across the windings of compressor motor 15. The heat generated in this manner will keep the lubricating oil sufficiently warm during periods of compressor shutdown to prevent dissolving of excessive quantities of refrigerant in the oil. As shown in FIGURE 1, an aperture 26 may be provided in partition 12 so that the oil in the compressor chamber 14 will flow into the motor chamber 13, to immerse a portion of the windings of motor 15. Alternatively, the aperture 26 may be dispensed with so that oil does not flow into motor chamber 13. In this case, the heat generated by the windings of motor 15 will be conducted through casing 11 so as to heat the oil 25 in compressor chamber 14 by conduction.

In FIGURE 2 there is shown an electrical circuit which is capable of impressing a reduced voltage across the windings of motor 15 during periods of compressor shutdown in order to keep lubricating oil 25 warm. Motor 15 is adapted to be coupled across a suitable source of electric current L_1 , L_2 , L_3 through switches 27, 28, and 29. When it is desired to start motor-compressor unit 10, master switch 30 is closed to complete an electrical circuit from line L_1 through solenoid coil 31, switch 30, lead 32, relay armature 33 and lead 34 to line L_2 . When solenoid coil 31 is energized in the foregoing manner, a suitable mechanical linkage 35 will cause switches 27, 28, and 29 to close to provide current to motor 15 of motor compressor unit 10.

It will also be noted that a switch 36 is also affixed to link 35. This switch is closed when switches 27, 28, and 29 are open and vice versa. Switch 36, when closed, energizes the heating circuit. As can be seen, this switch is closed only when motor compressor unit 10 is not in operation.

The circuit for impressing a reduced voltage across the windings of motor 15 when the latter is not in operation operates in the following manner: The primary winding 37 of a transformer 38 is coupled across lines L_2 and L_3 by leads 39 and 40. The secondary winding 41 of transformer 38 is coupled across lines L_2 and L_3 by leads 42 and 43, the latter containing switch 36.

It can thus be seen that when master switch 30 is closed, motor compressor unit 10 will be energized but switch 36 will be opened and thus transformer secondary coil 41 will be de-energized. When master switch 30 is opened, switch 36 will be closed and thus transformer secondary coil 41 will be energized to impress a reduced voltage across the windings of motor 15 to keep the oil in the crankcase warm, as described above.

An alternate construction (not shown) which may be used to cause a reduced voltage to be impressed across the motor windings when switches 27, 28, and 29 are open comprises resistors (not shown) placed across each of at least two of the switches 27, 28, and 29. Thus when the switches 27, 28, and 29 are closed they will shunt the flow of current through the resistors. However when the switches are open, current will pass through the resistors and the latter will cause a voltage drop which causes a reduced voltage to be impressed across the motor windings, this reduced voltage causing the motor windings to generate heat.

It will be noted that lines L_1 and L_2 contain relay coils 44 and 45, respectively, therein which are adapted to actuate armature 33. These relays are for causing motor 15 to stop in the event of an overload. It can be seen that in the event there is an excessive amount of current flowing through relay coils 44 and 45 armature 33 will be pulled upwardly so as to break the flow of current to relay 31. When this occurs, switches 27, 28, and 29 will assume the open positions shown in the drawing so as to de-energize motor 15, and switch 36 will assume the closed position shown in the drawing to provide a low voltage across the windings of motor 15 to keep the oil in compressor chamber 14 warm. Instead of using relays 44 and 45 any other suitable type of current disrupting device may be utilized.

While I have described preferred embodiments of the present invention, I desire it to be understood that it may be otherwise embodied within the scope of the following claims.

I claim:

1. A construction for preventing dilution by the refrigerant of oil in a motor-compressor unit wherein the motor windings are in the oil in heating relationship with the oil comprising a source of electric current, circuit means coupling said motor to said source for selectively causing operation of said motor, and means associated with said circuit means for impressing a voltage across said motor when said motor is inoperative whereby said oil is heated to substantially prevent the refrigerant from dissolving therein.

2. A compressor construction comprising: a motor, a compressor coupled to said motor for compressing a gaseous substance, a sump in said compressor for containing lubricant miscible with said gaseous substance, circuit means for impressing a voltage across the motor to operate said motor, said motor being in heat exchange relation with the sump, and means for impressing a reduced voltage across said motor for substantially preventing dilution of said lubricant in said sump by said gaseous substance when said motor is inactive.

3. A method of operating a motor-compressor unit adapted to compress a gaseous substance capable of diluting the lubricant in the compressor, in which a part of the motor is immersed in the lubricant, comprising the steps of selectively applying a first voltage across said motor to cause said motor to actuate said compressor to compress said gaseous substance, and applying a reduced voltage across said motor sufficient to heat said motor to prevent substantial dilution of said gaseous substance when said motor is not running.

4. In a compressor the combination of a casing, a compression mechanism in said casing for compressing a refrigerant, means in the casing for lubricating said compression mechanism including a sump containing oil, a motor connected to said compression mechanism, said motor having a winding in heat exchange relation with the oil in the sump, a source of electric current, circuit means coupling said motor to said source including a master switch for selectively causing operation of said motor, and means for impressing a reduced voltage across said winding when the motor is inoperative to heat the oil in the sump and thereby prevent substantial dilution of the refrigerant in the oil.

5. A compressor, according to claim 4, wherein the motor winding is immersed in the oil in the sump.

6. A compressor, according to claim 5, wherein the means for impressing a reduced voltage across said winding includes a transformer.

7. A compressor, according to claim 6, wherein the means for impressing a reduced voltage includes a switch

for energizing the transformer when the master switch is actuated to stop the motor.

8. In a refrigeration system wherein refrigerant is compressed, condensed and evaporated as it circulates in the system, a compressor for compressing the refrigerant preparatory to circulating the refrigerant in the system, an alternating current motor for driving said compressor, said motor being in heat exchange relation with the compressors, a source of alternating current for energizing the motor circuit, and means for establishing low amperage current flow through the motor winding during the off cycle of said motor whereby the motor winding serves as a heater for supplying heat to said compressor and migration of refrigerant in the system to said compressor is avoided.

9. In a refrigeration system wherein refrigerant is compressor, a source of alternating current for energizing the system, a compressor for compressing the refrigerant preparatory to circulating the refrigerant in the system, an alternating current motor for driving said compressor, said motor being in heat exchange relation with the compressor, a source of alternating current for energizing the motor circuit, and means for establishing low amperage current flow through the motor winding during the off cycle of said motor whereby the motor winding serves as a heater for supplying heat to said compressor and migration of refrigerant in the system to said compressor is avoided, said means including a step-down transformer with the primary winding tapped into the source of alternating current and with the secondary winding in circuit with the motor winding, and switch means for interrupting the flow of current from said source directly to the motor winding and for placing the secondary coil of the transformer in circuit with the motor winding.

10. In a refrigeration system wherein refrigerant is compressed, condensed and evaporated as it circulates in the system, a compressor for compressing the refrigerant preparatory to circulating the refrigerant in the system, an alternating current motor for driving said compressor, said motor being in heat exchange relation with the compressor, a source of alternating current for energizing the motor circuit, and means for establishing low amperage current flow through the motor winding during the off cycle of said motor whereby the motor winding serves as a heater for supplying heat to said compressor and migration of refrigerant in the system to said compressor is avoided, said means including switch means for interrupting the flow of current from said source directly to the motor winding, and a dropping resistor for shunting the current around said open switch during the off cycle of the compressor motor.

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EDWARD J. MICHAEL, *Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,208,237

September 28, 1965

Karl M. Gerteis

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 6, for "appartus" read -- apparatus --;
line 10, for "crankcake" read -- crankcase --; column 3, line
45, for "appling" read -- applying --; column 4, lines 16 to
18, for "compressor, a source of alternating current for
energizing the system," read -- compressed, condensed and
evaporated as it circulates in the system, --.

Signed and sealed this 3rd day of May 1966.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents