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C. E. L. LIPMAN

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MOTOR COMPRESSOR UNIT FOR REFRIGERATING APPARATUS

Filed April 3, 1933

2 Sheets-Sheet 1

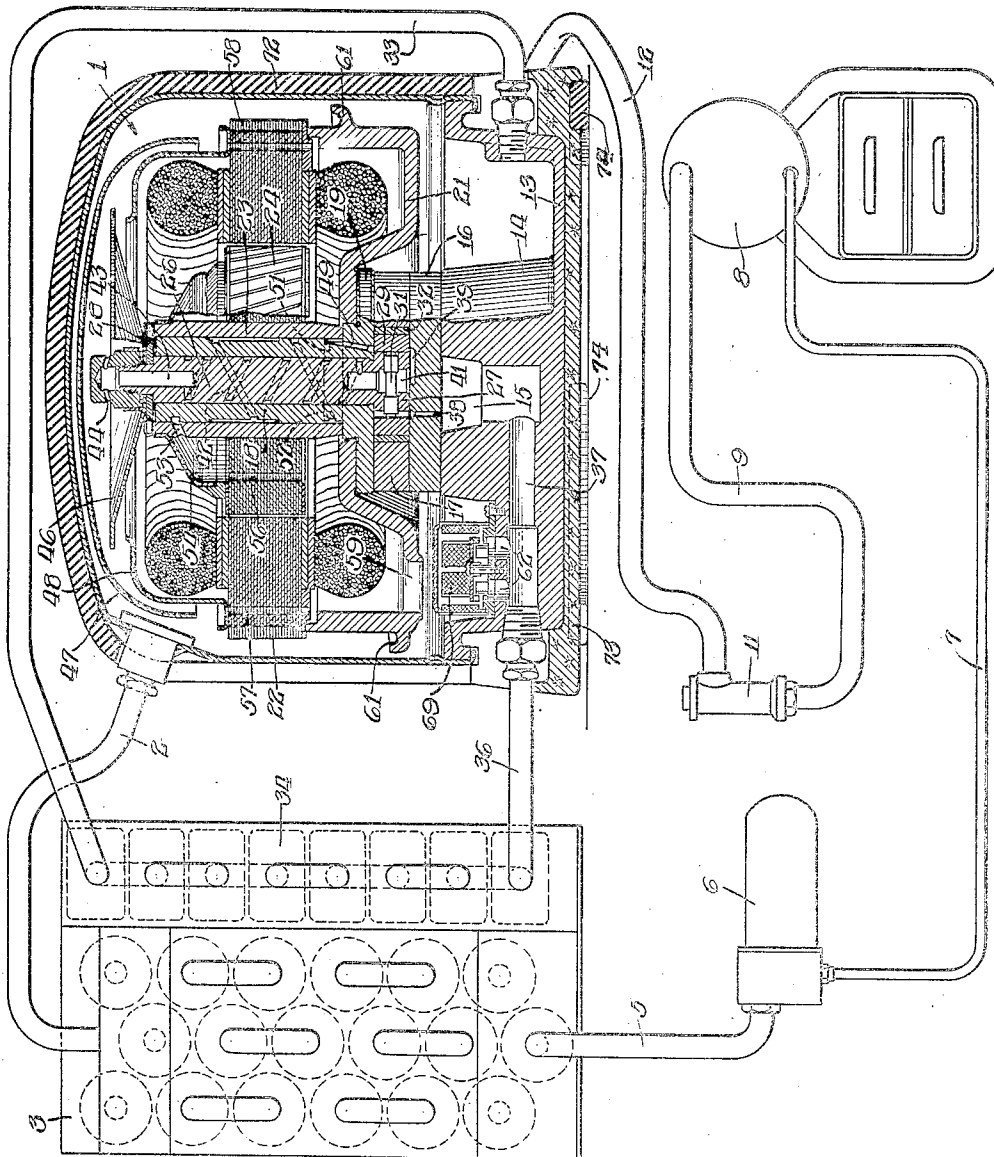
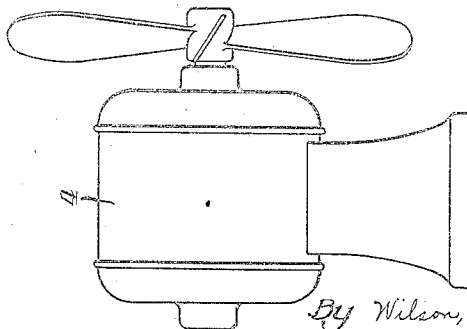


Fig. 1.



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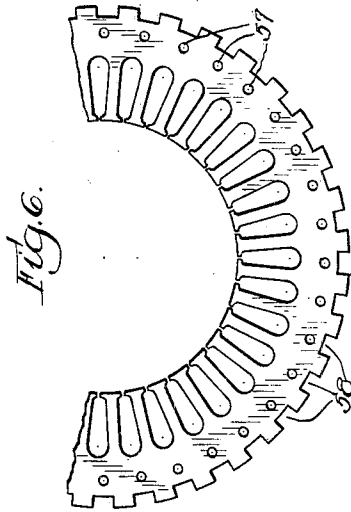
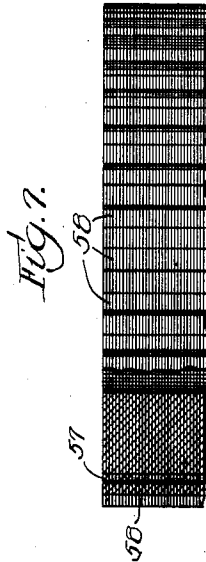
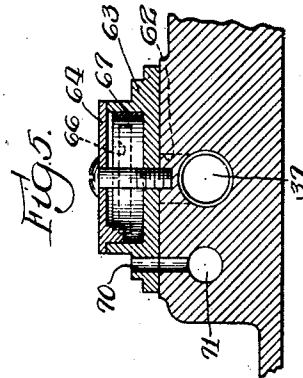
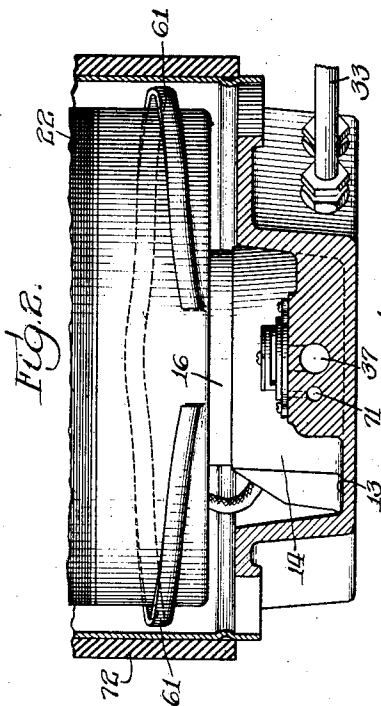
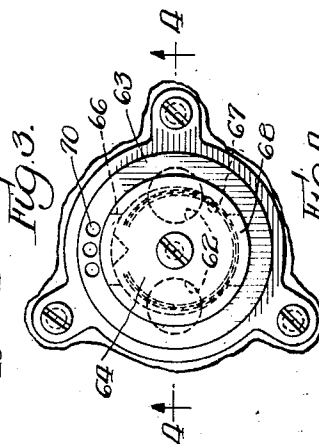
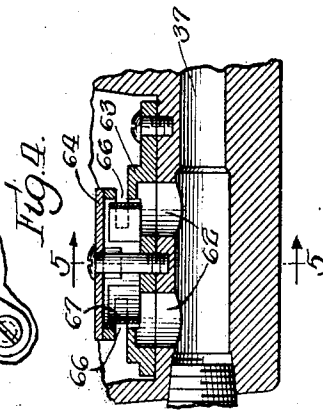
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MOTOR COMPRESSOR UNIT FOR REFRIGERATING APPARATUS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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MOTOR-COMPRESSOR UNIT FOR REFRIG-
ERATING APPARATUSCarl E. L. Lipman, Chicago, Ill., assignor to Lip-
man Patents Corporation, Chicago, Ill., a cor-
poration of Delaware

Application April 3, 1933, Serial No. 664,123

11 Claims. (Cl. 230-207)

This invention relates generally to refrigerat-
ing apparatus particularly adaptable for house-
hold refrigeration, although it will be manifest
that many of the novel features of my invention
are capable of embodiment in apparatus suitable
for purposes other than that of refrigeration.

More specifically my invention relates to her-
metically sealed refrigerating units in which the
lubricating oil is utilized to lubricate and cool
the driving motor, a portion of the oil at least
being cooled to remove the heat units absorbed
therein.

An object of my invention is to provide means
automatically operable to control the cooling of
the oil in such a manner as to maintain or quick-
ly restore a proper working temperature of the
unit which will prevent overheating of the mo-
tor, and also prevent undue absorption of re-
frigerant in the oil.

Another object is to improve the motor con-
struction so as to facilitate the absorption of
heat units therefrom by the circulating oil and
thereby increase the life and efficiency of the
motor.

Other objects and inherent advantages of my
invention will be appreciated as the same become
better understood from an examination of this
specification and claims in connection with the
accompanying drawings therein.

Fig. 1 is a schematic view of a complete re-
frigerating apparatus with the motor compressor
unit shown in section.

Fig. 2 is a fragmentary section of the base
of the motor compressor unit with the oil strain-
er removed.

Fig. 3 is a plan of the thermostatically con-
trolled valve.

Fig. 4 is a vertical central section through the
thermostatically controlled valve taken approx-
imately along line 4-4 of Fig. 3.

Fig. 5 is a vertical section through the ther-
mostatically controlled valve taken approximate-
ly along line 5-5 of Fig. 4.

Fig. 6 is a fragmentary plan of the motor
stator, and

Fig. 7 is a fragmentary side elevation of the
motor stator.

Referring now to the drawings in more detail,
and particularly to the diagrammatic lay out
shown in Fig. 1, reference character 1 indicates
generally the hermetically sealed unit in which
the operating parts, all in the apparatus to be
described, are disposed and into which the com-
pressor discharges the refrigerant compressed
thereby. The refrigerating medium is delivered

from the sealed casing through a pipe 2 to a
condenser 3 cooled by fan 4 which may also cir-
culate air through the unit 1, if desired, from
which the condensed refrigerant is conveyed by
a pipe 5 to a float chamber 6, and thence through
pipe 7 to an expander or evaporator 8 from which
the expanded refrigerant is conducted through
pipe 9, check valve 11, and pipe 12 to the suc-
tion side of the compressor.

It should be understood that while I have il-
lustrated a conventional flooded type of refrig-
erating system, including an evaporator, any
other type of system including an expansion valve
or expander may be employed if the system is
operated on some other principle than the flooded
system principle.

The motor compressor unit shown in section
(Fig. 1) comprises generally a base 13 providing
an annular oil sump and having a central table
14 shaped to provide a central oil well 15 in
the interior thereof. The table constitutes a
support for a pump housing comprising a disc
or base plate 16 formed in the bottom of the
housing, and an annular member 17 forming the
side walls of the housing and provided with a
central bore constituting the rotor chamber. A
tubular standard 18 having a bottom flange 19
which constitutes the top plate of the rotor cham-
ber is seated upon the top of the annular mem-
ber with the tubular standard rising upwardly
therefrom. Upon the flange 19 an annular spider
21 is supported which carries the stator 22 of
the electric driving motor.

The standard 18 serves as the journal bearing
for both the rotor of the electric driving motor
and the shaft of the pump so that the rotor
and compressor or pump are coaxially disposed.
A rotor sleeve 23 carrying the rotor structure 24
surrounds and is journaled upon the periphery
of standard 18. The compressor rotor shaft 26 is
formed integrally with the pump and compressor
rotor 27, and is journaled within standard 18
concentrically with sleeve 23. The upper por-
tion of shaft 26 above standard 18 is squared to
receive a driving disc 28 provided with radially
projecting arms which engage in slots formed
in the upper end of sleeve 23 whereby a direct
but laterally adjustable driving connection be-
tween the rotor sleeve and the pump shaft is
accomplished.

The rotor of the pump and compressor is dis-
posed eccentrically within the bore of the rotor
housing and is provided with a plurality of
radially disposed blades 29 adapted to reciprocate
radially in the rotor. The blades are maintained

at all times a predetermined distance apart by pin 31 extending transversely of the rotor between the blades. The length of the abutment pins is such that the outer ends of the blades which are provided with sealing members 32 will always be maintained in contact with the surrounding walls of the rotor housing. As one blade is forced inwardly during rotation of the rotor, the corresponding blade will be forced through the rotor and against the opposite wall.

The gas to be compressed by the pump is admitted in the usual manner to the cylindrical bore around the rotor before being connected thereto by suction pipe 12. The admitted gas is compressed by the rotation of the blades and discharged through an outlet port, not shown, and finally discharged into the interior of the sealed casing.

For lubricating and cooling the motor and compressor unit, I have provided a continuous lubricant circulation system in which the lubricant serves for lubricating the compressor and also sealing the same, as well as to cool the stator and/or rotor of the driving motor.

It is understood, of course, that a sufficient amount of oil is placed in the unit and settles to the sump from which it is piped by conduit 33 into an oil cooler or radiator 34 from which it is piped by conduit 36 to the well 15 through a duct 37 formed in the base. Oil will be sucked into the pump through a duct 38 extending from well 15 and leading to the space between the inner ends of the blades and the outer periphery of the pump rotor, the latter constituting the inlet for the oil pump which, in the present instance, is the compressor, the inner ends of the blades being used for circulating the oil and the outer ends being used for compressing the refrigerant.

The oil is discharged under pressure from the pump partly through an oil port 39 communicating with a central bore 41 formed in the lower end of shaft 36, which bore communicates with a spiral oil groove 42 formed in the peripheral surface of the shaft to lubricate the latter. The upper end of spiral groove 42 communicates with a central bore 43 formed in the upper end of shaft 26 communicating with lateral ports 44 which direct the oil outwardly upon a separating and distributing disc 46 which separates what refrigerant might be included in the oil and throws the oil outwardly between an outer cap or shield 47 and an inner cap or shield 48 which directs the oil over the peripheral margin of stator 22.

Another portion of the oil discharged by the pump passes upwardly through a duct 49 which communicates with an annular groove 51 formed in the outer peripheral surface of standard 18 and which communicates with a spiral groove 52 which terminates at its upper end in a lateral duct 53 which directs the oil outwardly beneath a cap or shield 54 carried by the upper face of the motor rotor and which directs the oil downwardly through vertical apertures 56 formed in the rotor.

The stator is provided with vertical apertures 57 through which the oil passing between caps 47 and 48 is directed. The periphery of the stator may also be serrated or grooved as at 58 to provide additional channels for conducting oil in intimate contact with the stator whereby greater cooling effect is obtained. The latter are particularly effective when the quantity of oil passing between caps 47 and 48 is too great to be conducted by apertures 57, which are quite

small, and flows over the peripheral rim of cap 48. The latter condition is also likely to occur when the oil is quite cool and consequently fairly thick.

The oil flowing through apertures 56 and 57 collects in the bottom of spider 21 and passes out through a port 59 formed therein. The oil passing over the outer periphery of the stator and through channels 58 is collected by an annular inclined trough 61 surrounding the spider and having its two ends terminating adjacent port 59.

To maintain the lubricating oil at a sufficiently high temperature to prevent absorption of refrigerant therein, the circulation of the oil through the cooling radiator 34 is controlled. For this purpose duct 37 is provided with a pair of side outlets 62 communicating with the oil sump in the casing. These ports are controlled by a thermostatic valve shown more particularly in Figs. 3, 4 and 5, and comprising a valve body 63 secured over ports 62 having an interior chamber closed by a cap 64. The body is provided with a pair of side outlets or ports 66 communicating with the sump in the casing, the ports being disposed below the normal oil level in the casing.

The ports are arranged to be sealed by a bi-metallic closure member 67 in the form of a ring secured at its mid point to a fixed abutment 68 and having its end portions free to expand when the ring is heated to a predetermined temperature to seal ports 66. The thermostatic valve is disposed below port 59 and the ends of trough 61 so that the warm oil delivered over and through the stator and rotor of the electric motor will be delivered upon the thermostatic valve. The screen 69 (Fig. 1) is secured to and surrounds the thermostatic valve to strain the oil prior to its entering into the valve and thus prevents any foreign matter from affecting the operation of the valve.

In operation the valve functions to permit warm oil to be circulated from the sump through the pump and over the motor, that is, when the oil in the casing reaches a temperature sufficiently low so that there is danger of refrigerant being absorbed therein, the oil is by-passed directly from the motor through the thermostat valve to the suction side of the pump. When the oil reaches a temperature sufficiently high so that there is no danger of refrigerant being absorbed in detrimental amounts, valve 67 closes ports 66 and the oil is circulated through the oil cooler 34. It will be apparent that when valve 67 is open the pump will draw this warm oil through the valve rather than the cool oil from the cooler for the reason that the viscosity of the cool oil is greater than that of the warm oil, and the friction afforded by the pump line between the pump intake and the cooler tends to impede oil flow from the cooler to the pump. When, therefore, the thermostat valve is open, permitting a flow of warm oil under gravity to the suction side of the pump, little, if any, cool oil will be pulled through the cooling coils.

A separate inlet port 70 and duct 71 (Figs. 2 and 5) is provided to permit warm oil being utilized for seal oil at all times, which oil comes in direct contact with the gas in the compression chamber of the compressor. To assist in maintaining constant temperature and completely insulating the motor compressor unit both as to heat and noise, the unit is provided with an insulating cap 72 for the dome 47 and an insulating cover 73 for the base. The unit stands upon three arcuate feet 74.

From the foregoing description it will be apparent that I have not only provided for circulation of the lubricating oil in a manner which insures intimate contact of the oil in heat-absorbing relation to both the stator and rotor but have also provided means for controlling or regulating the circulation of oil through the unit and oil cooler in such a manner as to assure a substantially constant temperature in the unit to prevent absorption of the refrigerant in the lubricating oil. Other novel features and their resultant advantages will be apparent to those skilled in the art, and to whom it will also be obvious that changes may be made in the details of construction without departing from the spirit and scope of this invention.

I claim:

1. An apparatus comprising a casing, a pump within said casing, an electric motor within said casing, a driving connection between said motor and pump, means for delivering oil through certain of said pump and motor bearings and into heat absorbing contact with the stator of said motor, and means for delivering oil through other of the pump and motor bearings and into heat absorbing contact with the rotor of said motor.

2. An apparatus comprising a casing, a pump within said casing, an electric motor within said casing, a driving connection between said motor and pump, means for delivering oil through certain of said pump and motor bearings and into heat absorbing contact with the stator of said motor, means for delivering oil through other of the pump and motor bearings and into heat absorbing contact with the rotor of said motor, and means for cooling all of the oil passing over said motor.

3. An apparatus comprising a casing, a pump within said casing, an electric motor within said casing, a driving connection between said motor and pump, means for delivering oil through certain of said pump and motor bearings and into heat absorbing contact with the stator of said motor, means for delivering oil through other of the pump and motor bearings and into heat absorbing contact with the rotor of said motor, means for cooling all of the oil passing over said motor, and thermostatically controlled means for regulating the cooling of said oil.

4. An apparatus comprising a base, an electric motor, a pump, a driving connection between said motor and pump, an oil distributor above said motor, means for delivering oil from said pump to said distributor whereby the same is distributed over said motor, a shield disposed in proximity to but spaced from said distributor for directing the distributed oil into contact with the motor stator, a case associated with said base to provide a sealed enclosure within which said pump, motor, distributor and shield are disposed, means for dissipating heat removed by said oil from the motor, thermostatically controlled means for regulating the dissipation of heat from said oil, and a collector associated with said stator arranged to collect the oil distributed into contact with said motor stator and direct it over said thermostatic control.

5. An apparatus comprising a base, an electric motor, a pump, a driving connection between said motor and pump, an oil distributor, means for delivering oil to said distributor whereby the same is distributed into contact with the motor stator, said stator being provided with passages through the interior to permit flow of the oil there-

through, a case associated with said base to provide a sealed enclosure within which said pump, motor and distributor are disposed, means for dissipating heat removed by said oil from the stator, thermostatically controlled means for regulating the dissipation of heat from said oil, and a collector associated with said stator arranged to collect the oil distributed into contact with said motor stator and direct it over said thermostatic control.

6. An apparatus comprising a hermetically sealed casing adapted to contain compressed fluid and a quantity of lubricant, a compressor and an electric motor for operating the same disposed within said case, a cooling element connected to receive lubricant from said case, thermostatically controlled means for controlling the flow of lubricant to said cooling element, means for conducting lubricant to a point above said motor, means for distributing said lubricant over said motor so that it may return by gravity in intimate heat absorbing relation with the motor and back into the lower portion of said case, and means for collecting the portion of the distributed fluid and directing it into contact with said thermostatic control.

7. An apparatus comprising a hermetically sealed casing adapted to contain lubricant, a pump and an electric motor disposed within said casing, means for directing lubricant from the pump into heat absorbing contact with the motor to absorb excess heat units therefrom, a lubricant cooling device exteriorly of the casing, a connection through which lubricant is delivered from the lower part of the casing to said device, a connection through which the cooled lubricant is delivered from said device back to the pump, a thermostatically controlled by-pass valve through which lubricant may be delivered directly from the casing to the pump, and means for collecting lubricant heated by the motor and directing the same against said valve whereby the opening and closing of the valve is controlled by the temperature of said collected lubricant to vary the amount of lubricant circulated through said cooling device and thereby regulate the temperature of the apparatus.

8. An apparatus comprising a sealed casing providing a lubricant sump, a pump and a driving motor therefor located within the casing, means for directing lubricant delivered by the pump into heat absorbing contact with the motor to cause the absorption of excess heat units from the motor by said lubricant, means comprising a closed lubricant circuit including a cooling device for cooling the lubricant which is withdrawn through said circuit from the sump and returned to said pump, a thermostatically controlled by-pass valve adapted to establish direct communication between said sump and the suction side of said pump, and means for collecting the lubricant heated by said motor and directing the same into thermal relation with said thermostatic valve to thereby regulate the circulation of lubricant through said cooling device.

9. An apparatus comprising a casing providing an oil sump, a pump and an electric motor within the casing, a driving connection between the motor and pump, means for directing oil delivered by the pump into heat absorbing contact with the motor to cool the motor, a cooler for removing from the oil the excess heat units absorbed from the motor, a conduit connecting the sump to the inlet of the cooler, a conduit connecting the outlet of the cooler with the suction side

- of the pump, said suction conduit being provided with a port opening into the sump, and thermostatically controlled means associated with said port for permitting a direct flow of oil from said sump to the suction side of said pump when the temperature of said oil is below a predetermined minimum, said pump being connected to circulate oil through said cooler when said thermostatic means is closed.
- 10 10. An apparatus comprising a casing, a pump and an electric motor disposed therein, an oil cooler, a pipe for conducting oil from the casing to the cooler, a pipe for conducting cooled oil from said cooler to the pump, a port for establishing communication between said casing and the pump intake through which oil may be delivered directly from the casing to the pump and a thermostatic valve controlling said port, said valve being influenced by the temperature of the oil in said casing to permit direct flow of oil from the casing to the pump under low temperatures and to prevent such direct flow and cause flow through said cooler under high temperatures, whereby the temperature of the oil delivered by the pump is regulated, and means for directing said oil into

heat absorbing contact with said motor to cool the same.

11. In a refrigerating apparatus, the combination of a casing member providing a lubricant sump in the lower portion thereof, an electric motor including a stator member and a rotor member mounted within said casing, a vertically disposed shaft supporting said rotor member, a lubricant circulating pump driven by said shaft and having inlet and outlet ports, means for dividing the lubricant under pump pressure into a plurality of streams, means for conducting all of the lubricant discharged by the pump to an elevation above said motor from which elevation both of said streams are separately returned under the influence of gravity to said sump, means for directing the lubricant of one of said returning streams into heat transferring relation with one of said members, independent means for directing the lubricant of the other of said returning streams into heat transferring relation with another of said members, and means whereby heat units transferred from the motor to said lubricant may be delivered from the casing.

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