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MOTOR OPERATED MACHINE UNIT

Filed Oct. 12, 1926

4 Sheets-Sheet 1

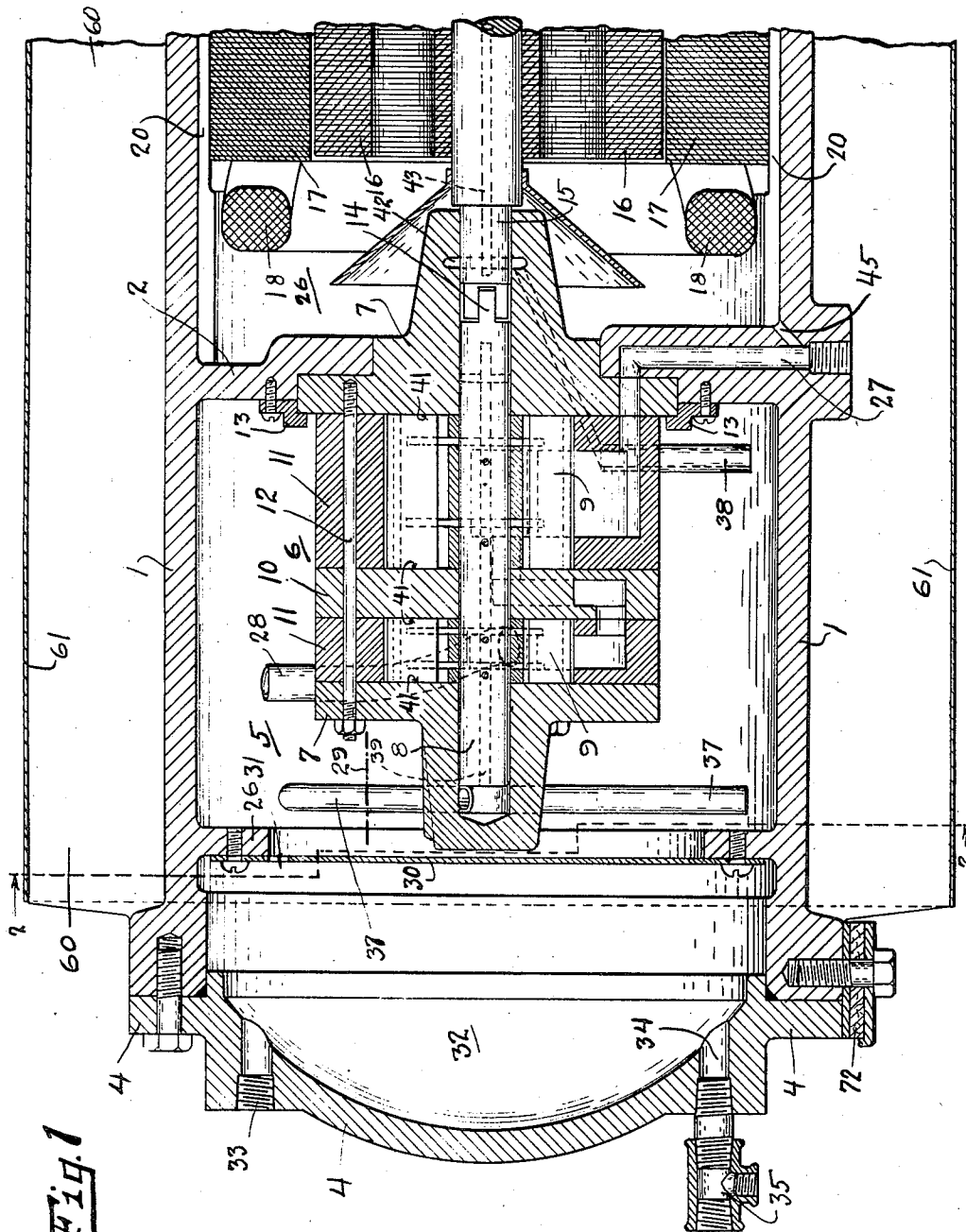


Fig. 1

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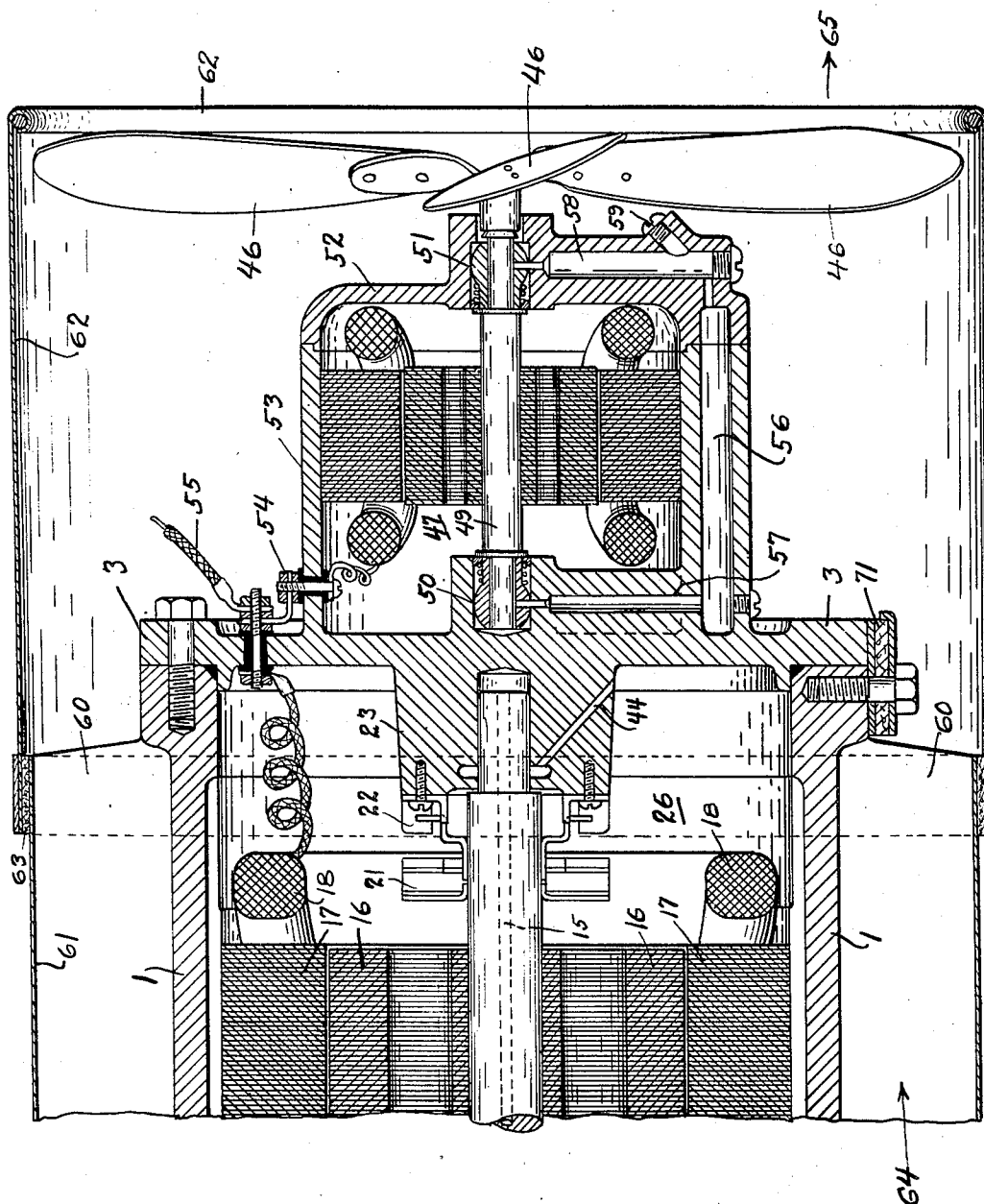


Fig. 1A

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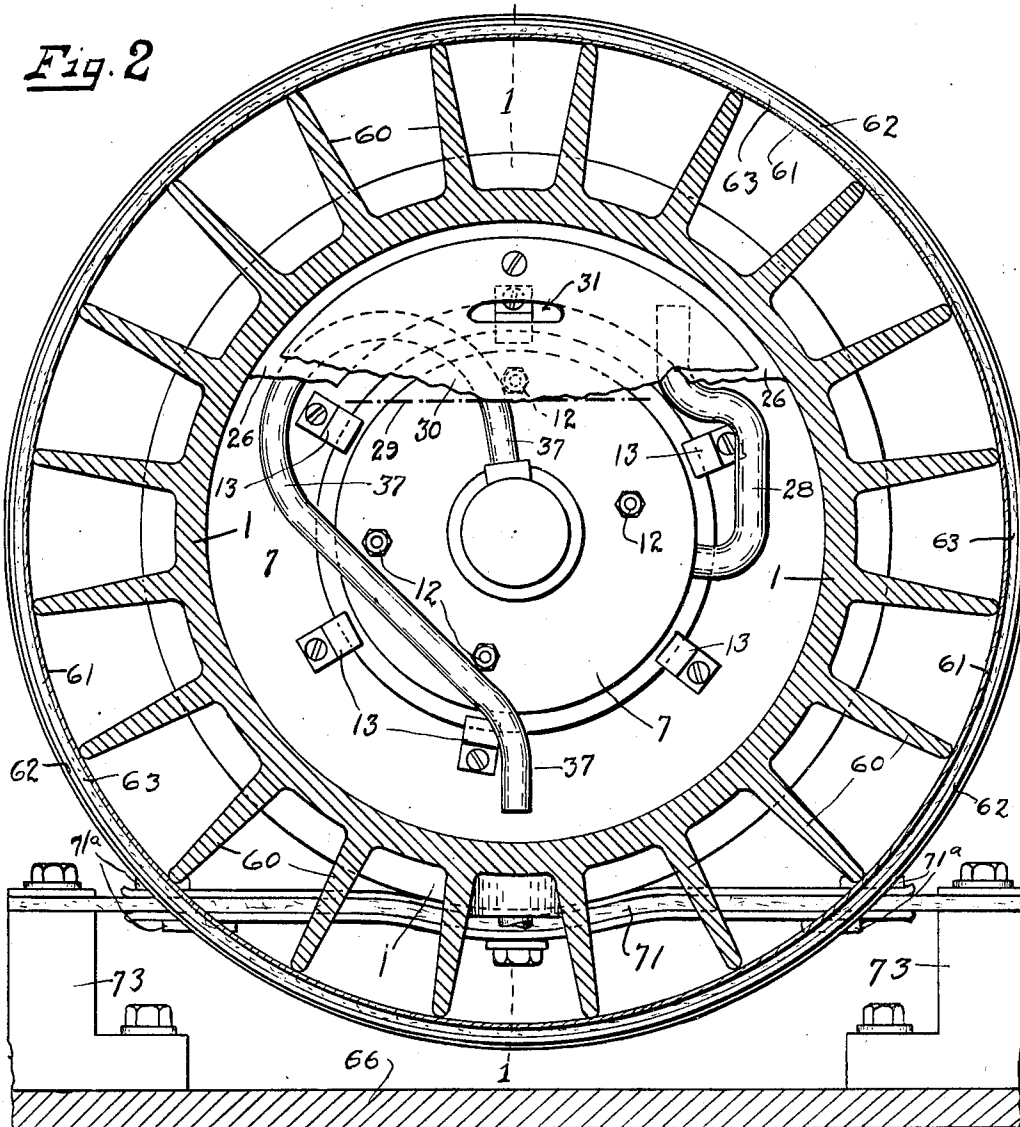
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Fig. 2



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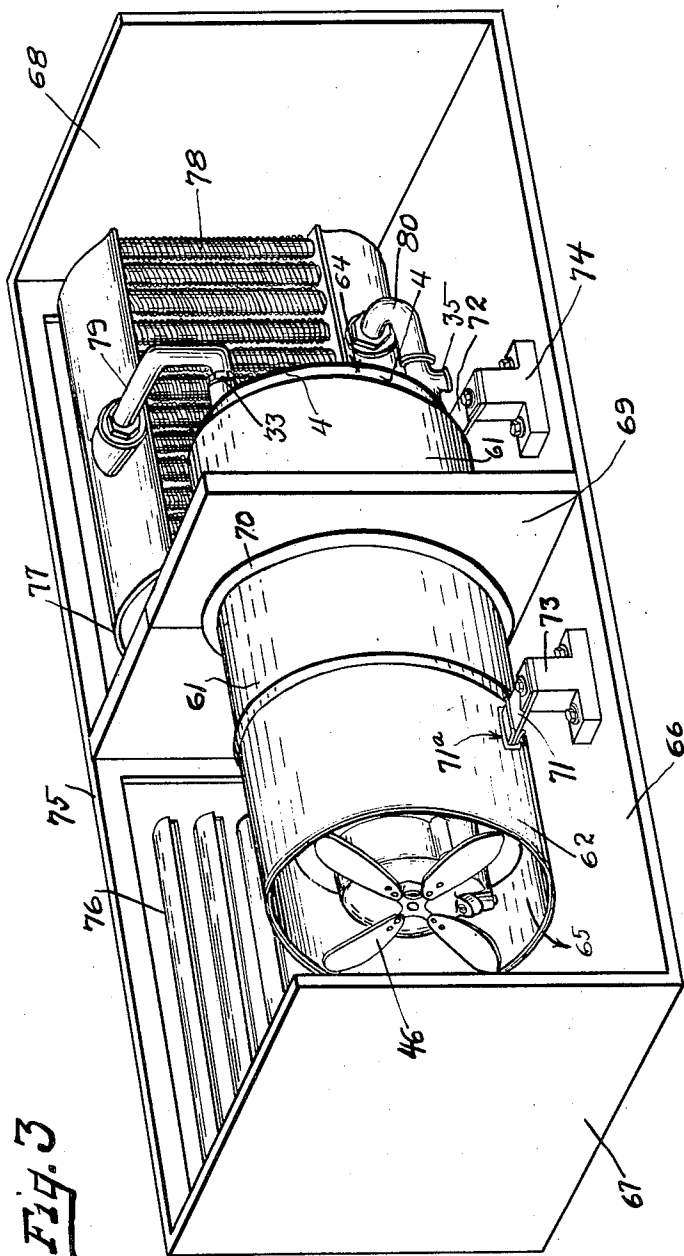
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MOTOR OPERATED MACHINE UNIT

Application filed October 12, 1926. Serial No. 141,213.

This invention relates to a combination and arrangement of units of apparatus and the principles thereof may be applied to a variety of purposes.

The invention described and covered herein is the outgrowth of the development of apparatus for use in a mechanical refrigeration machine and more specifically this invention pertains thereto.

One object of this invention is to provide a combination of motor and pump which may be used for a variety of purposes.

Another object is to provide a combined motor and pump structure in which all belts and gearing between the motor and pump are eliminated.

A further object is to provide a combined motor and pump with an enclosing housing therefor whereby the stuffing box usually surrounding the pump shaft is eliminated.

A further object is to provide external cooling means such as a fan mounted so as to cool the aforesaid casing.

A still further object is to accomplish a major assembly of apparatus whereby a plurality of cooperating unit structures may each be independently and separately assembled and tested before being associated with its cooperating units and whereby any unit may be removed from the major assembly in toto for replacement purposes.

A still further object is to provide a method of mounting the major assembly whereby noise and vibrations thereof are not transmitted to the refrigerator box, for example.

A still further object is to provide a novel method of lubricating the moving parts of all the assembled units.

Other objects and improvements will more fully hereinafter appear.

This invention is shown and will be described as applicable to a compressor for machine refrigeration apparatus, and is particularly advantageous for use in the small units commonly employed with household refrigerators now in extended use. However, the same may be applied to other apparatus by those skilled in the arts.

My invention may be understood by reference to the accompanying drawings, wherein

Figures 1 and 1A represent a vertical section through the assembled units of the compression or "high-side" of the refrigeration machine unit embodying my invention;

Fig. 2 is a cross section in the plane of the line 2—2 of Fig. 1; and

Fig. 3 is a perspective view of the compression or "high-side" of a refrigeration machine mounted in a container which may form the lower portion of a refrigerator, this container having the top and one side thereof removed to facilitate illustration.

1 denotes a casing, preferably tubular in form, having integral therewith an inwardly extending flange forming a partition 2.

Within the chamber 5 is located a pump or compressor unit 6 consisting of the end plates 7 supporting and forming bearings for the shaft 8 carrying the necessary pump rotors 9, the pump illustrated being of the rotary type although any other form of pump may be used. The body portions 10 and 11 of the pump 6 are secured together and to the end plates by any suitable means such as bolts, one of which is indicated at 12.

The construction and operation of the pump unit is not described in detail. I have shown one form of a two-stage rotary compressor type pump by way of illustration, but any other form of pump may be substituted within the scope of the invention covered by the present application.

The foregoing pump may be assembled and tested as a separate unit from the other portions of the cooperating apparatus hereinafter described. When ready for service this unit pump structure is placed within the chamber 5 and secured in position therein with the bearing 7 extending through the aperture provided in the partition 2. Any suitable securing means may be used, such as the clamps 13 secured to the partition 2 by means of screws as shown and spaced around the periphery of the end plate 7.

The end of the shaft 8 is splined, as indicated at 14, to engage the splined end of the shaft 15 upon which is mounted the rotor 16 of an electric motor (an alternating current motor is shown). The field poles of the motor are indicated at 17 as provided with

windings 18. The casing 1 has a plurality of ribs 20 upon which the field or stator of the motor is pressed or otherwise secured. The motor shaft carries the movable portions 21 of the usual centrifugal starting switch, the stationary portions of which are indicated at 22 as mounted upon the bearing 23 which projects inwardly from the head 3 of the casing 1. This head also carries the terminals of the windings 18 of the motor, one of which terminals is shown at 24 as insulated from the head 3. The described motor unit drives the pump unit heretofore described.

I do not describe in detail the construction and operation of the electric motor as this may be of any suitable construction. I have shown a known form of split-phase alternating current motor, but it is obvious that any other motor may be used within the scope of my invention.

The motor and pump assembly may be used as part of a refrigeration system in which event the assembly is connected to a condenser and an evaporator or "low side", as will be hereinafter described.

The intake for the pump is through the duct 27 and the outlet or exhaust thereof is indicated at 28, which is within the chamber 5. Accordingly, the pump is located in what may be termed the pressure chamber 5.

It will be assumed that the motor and pump assembly are part of a refrigeration machine system that is properly charged with a liquid refrigerant such as ethyl chloride and a lubricant such as a heavy oil. The oil is introduced into the pressure chamber 5 to the level indicated by the dot and dash line 29 where it is maintained by means of the baffle plate 30 that is secured to the flange 26 on the interior of the casing 1. The baffle plate 30 does not contact with the entire flange 26, but leaves an opening 31 at the top of the chamber 5. The refrigerant in a gaseous state enters the pump through the duct 27, is compressed in the pump and discharged from outlet pipe 28 into the chamber 5, at which time it is commingled with the lubricant. It is desirable to separate the lubricant from the refrigerant and this is accomplished in the above described structure substantially as follows:

When the compressed refrigerant is discharged into the chamber 5 the lubricant being heavier than the compressed gas will fall to the bottom of the chamber. The free gas particles pass through opening 31 as will be hereinafter described. The pump casing will be warm, due to the friction of the moving parts therein and the heat of compression. The lubricant will come in contact with the heated body of the pump which will cause the refrigerant to immediately boil off from the lubricant and, in turn, pass through the opening 31.

In other words, a constant distillation of

refrigerant out of the body of lubricant surrounding the pump will take place, thereby maintaining the body of lubricant at the desired density. It will also be observed that this method of separation of the refrigerant from the lubricant is advantageous over any method of mechanical separation because it is a fractional distillation method insuring actual chemical separation of the refrigerant from the lubricant.

The head 4 is spaced from the plate 30 so as to form a chamber 32 in which liquid refrigerant collects. The chamber is provided with openings 33 and 34 by means of which the chamber is connected to any suitable form of condenser, to be hereinafter referred to. The opening 34 is also connected to any suitable form of expansion valve and the evaporator (not shown) by means of the T connector 35.

I will not describe in detail the refrigeration cycle as this is well known and any known system may be used with the pump and motor structure herein disclosed. However, the method of lubricating the pump and motor is important and is as follows:—

The body of lubricant surrounds the pump. Two pipes 37 and 38, which communicate with the bearings in the end plates 7, extend into the body of lubricant.

By reason of the pump discharging into the chamber 5 there is pressure on the surface of the lubricant. Consequently lubricant is forced up the pipe 37, into the bearing in the associated end plate 7, through the hole 39 in the shaft 8 and through transverse holes 40 to the inner surfaces 41 of the pump and through the bearing in the opposite end plate 7. The hole 39 does not extend into the spline 14. Where a rotary pump is used, the described system of lubrication also forms the seal for the pump.

Lubricant is also forced up the pipe 38 into the bearing in the associated end plate 7. The bearing is provided with an annular groove 42 which communicates with a hole 43 in the motor shaft 15 by means of a transverse hole, not shown. Lubricant is forced into the bearing 23 in the head 3 and the oil leaves the bearing via duct 44, finding its way to the bottom of the chamber 26 from whence it is drawn into the suction duct 27 through the aperture 45 communicating therewith, and ultimately returned to the main body of lubricant in the chamber 5. The hole 15 does not extend into the spline 14.

By the foregoing arrangement a constant circulation of lubricant is maintained through the pump and motor bearings, insuring positive and efficient lubrication at all times, and as there is no stuffing box on the pump shaft open to atmosphere, no refrigerant or lubricant can be lost.

When the motor and pump have been operating and operation is discontinued, a pres-

sure exists in the pump chamber and a partial vacuum in the motor chamber. The pressure on the oil will force the same into the motor chamber if the siphon therebetween is not broken. By having the pipe 37 of semi-elliptical shape with the two ends thereof projecting into the oil and the connection therebetween extending above the level of the oil, the siphon action is broken and the oil is not forced into the motor chamber.

The cooling of the motor and pump is accomplished by means of a fan 46 which is driven by a suitable electric motor 47, the armature shaft 49 thereof being supported in bearings 50 and 51.

Bearing 50 is supported in the end plate 3 but has no communication with the chamber 26 which is connected to the suction side of the pump. Bearing 51 is supported by the end plate 52 that is mounted upon the casing 53 of the motor 47. The casing 53 may be formed integral with the head 3 if desired. Suitable terminals, one of which is shown at 54, are provided for the fan motor and these terminals may be connected to the pump motor terminals in multiple so that one main connection 55 will serve for the terminals of both motors. Both motors are controlled by the same thermostatic means which may be of any of the types commonly employed for such purposes.

The lubrication of the fan motor is accomplished by providing a reservoir 56 filled with lubricant and communicating with the ducts 57 and 58 leading respectively to the bearings 50 and 51. The ducts are supplied with the usual wick oilers or other means for supplying lubricant to the bearings. The reservoir 56 is filled through the screw capped opening 59.

The pump and motor casing may be provided with suitable radial fins 60, and around these fins is placed an outer casing or shroud 61. The shroud may have an extension 62 enclosing the fan, with suitable packing 63 therebetween. By this arrangement an air current generated by the fan will be drawn into the space between the casing 1 and the shroud 62, as indicated by the arrow 64 and discharged in the direction of the arrow 65, thereby cooling the pump and motor chamber.

The above described unit, shown completely in Fig. 1, may be mounted in a refrigerator box of the usual type. In Fig. 2, the bottom portion of a box is shown and comprises a container consisting of the base 66, the ends 67 and 68 and a partition 69. The top and one side of this container have been omitted for convenience in showing the interior arrangement of parts.

The pump and motor unit are supported in the partition 69 by means of a packing strip 70, preferably of suitable resilient material. Additional supporting means are provided

for the shroud 62 and its associated parts. These supports are in the nature of cradles connected at 71 and 72 respectively on opposite sides of the partition 69. The elements 71 and 72 may be of any suitable resilient material and I have found leather straps to be effective. Strap 71 extends through openings in the shroud 62 and is secured to the casing 1. The strap 71 extends through the opposite side of the shroud 62 (not shown in the drawings) and the opposite ends of the strap 71 are supported upon pillars or blocks 73, one only of which is shown in the drawings.

A resilient packing 71a surrounds the strap 71 where it extends through the openings in the shroud 63.

Strap 72 is also secured to the end of the casing 1 outside of the shroud 62 and is supported on opposite sides of the shroud upon pillars or blocks 74, one only of which is shown in the drawings.

The resilient mountings for the pump and motor unit and the associated shroud prevent vibrations from being transmitted to the container and the refrigerator and vice versa.

The front 75 of the box-like container is provided with a plurality of openings indicated at 76, 77 respectively on each side of the partition 69. The condenser 78 is so positioned in front of one set of these openings that the air drawn through the openings in front of the condenser will pass therethrough and into the space between the casing 1 and the shroud 62 as heretofore described. The air is discharged into the opposite compartment of the container, passing out through the openings 76 therein, thereby maintaining a constant circulation of air for cooling purposes.

The condenser 78 is connected to the motor and pump assembly by means of pipes 79 and 80, the pipe 79 being fitted into the opening 33 in the head 4 and the pipe 80 being fitted into the T connector 35 (Fig. 1).

The gases which are discharged from the pipe 28 into the chamber 5 and the gases which are distilled off from the body of lubricant pass through the opening 31, through the opening 33 and pipe 79 into the condenser 78, where the refrigerant is converted into a liquid. The liquid refrigerant is led from the condenser 78 by means of the pipe 80 into the chamber 32 where it is stored. In the refrigeration cycle the condensed refrigerant extends into an evaporator through an expansion valve, neither of which are shown, the connection for the expansion valve being from the T 35 and the return line from the evaporator being connected to the duct 27. Since these constitute no part of the present invention no description thereof is given.

The ribs 60 and 61 surrounding the casing are so designed and proportioned that a mini-

num amount of condensation of refrigerant takes place in the pressure chamber 5, the entire system being so designed and the parts so proportioned that the gaseous refrigerant is almost all condensed in the condenser 78.

5 The condenser 78 may be either supported on the motor pump unit by means of pipes 79 and 80 or independently supported on resilient means of the same general character as that used for supporting the pump and
10 motor unit.

In describing the assembly of the complete unit shown in Figs. 1 and 1A, attention has been directed to the fact that each of the
15 motors and the pump may be assembled and tested as independent units before being inserted in the casing 1. Furthermore, in the event of repairs it is only necessary to remove the particular unit that needs repairing rather than disassembling the complete
20 machine in order to reach the part which needs repairing. Accordingly, where the terms "unit pump" or "unit motor" are used, it is intended to include a unit which may be
25 assembled and tested independently of the parts with which it is to be associated.

Modifications may be made in the arrangement and location of parts within the spirit and scope of my invention and such modifica-
30 tions are intended to be covered by the appended claims.

I claim:

1. The combination with a pump and a motor, of a casing therefor adapted to radiate
35 heat therefrom, a shroud about said casing, means for causing a current of air to flow between said casing and shroud, and a condenser outside said casing connected to receive fluid from said pump and be cooled by
40 said air current.

2. The combination with a pump and a motor, of a casing therefor adapted to radiate heat, a shroud about said casing, a condenser
45 mounted independently of said casing and outside thereof and connected to receive fluid from said pump, and a cooling fan and motor therefor mounted upon said casing and causing a circulation of air over said casing and
condenser.

3. The combination of a motor, a pump, a casing therefor, a box-like container, a partition in said container embracing said casing, and means for causing a circulation of
50 air from one side of said partition to the other whereby said air will pass over and cool said casing.

4. The combination of a motor, a pump, a casing therefor, a shroud about said casing, a box-like container, a partition in said container embracing said shroud and casing and
60 means for causing a circulation of air from one side of said partition to the other between said shroud and casing.

5. The combination of a motor, a pump, a casing therefor, a shroud about said casing,

a box-like container, a partition in said container embracing said shroud and casing, and a motor driven fan in said shroud for causing a circulation of air from one side of said partition to the other between said shroud and casing. 70

In testimony whereof I affix my signature.

HARRY R. VAN DEVENTER.

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