Dec. 30, 1952 L. J. DANIEL 2,623,365

REFRIGERATOR PUMP

Filed July 14, 1947 2 SHEETS—SHEET 1

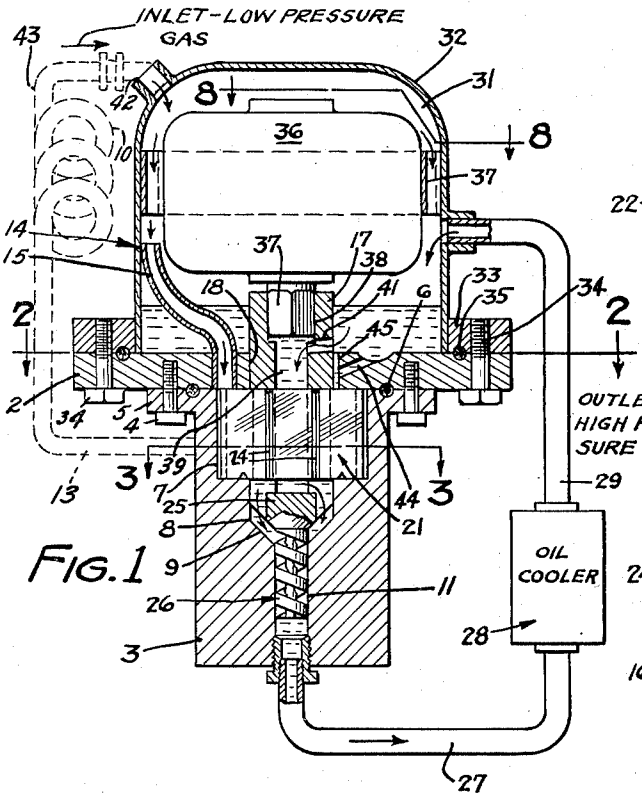


FIG. 1

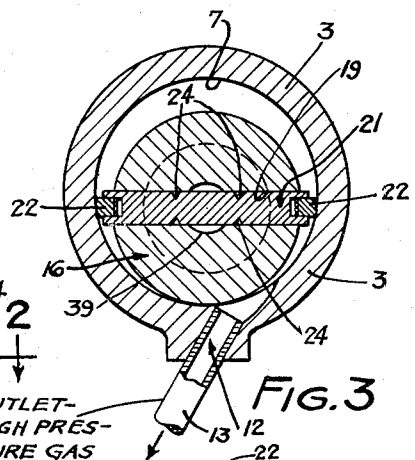


FIG. 3

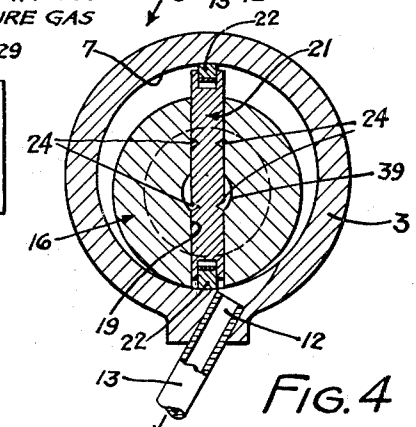


FIG. 4

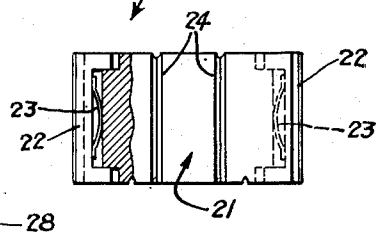


FIG. 5

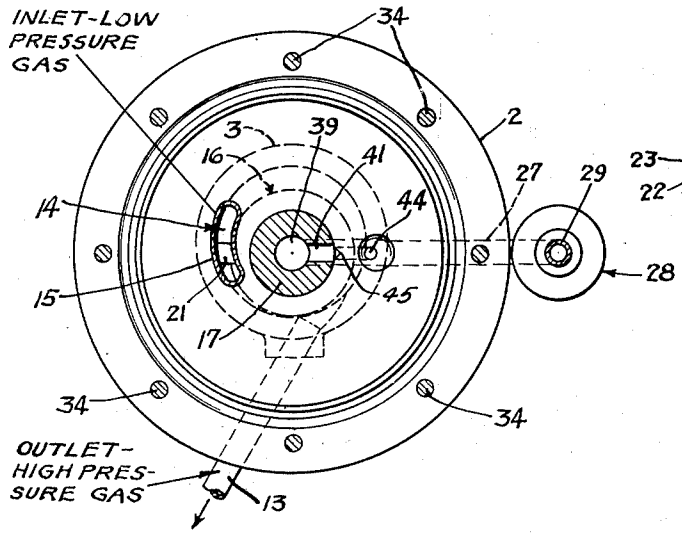


FIG. 2

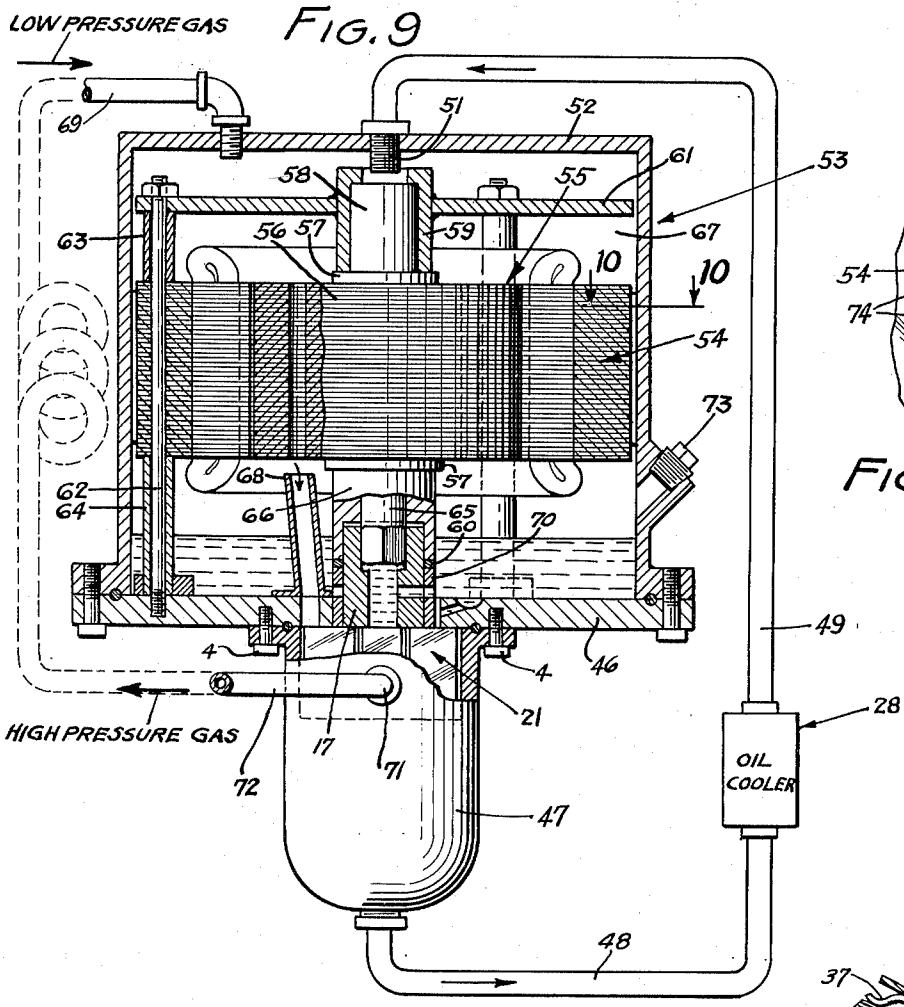
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FIG. 9



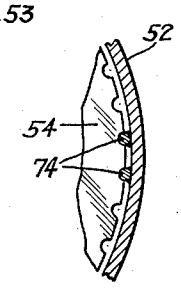


FIG. 10

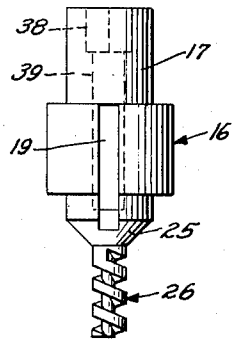


FIG. 6

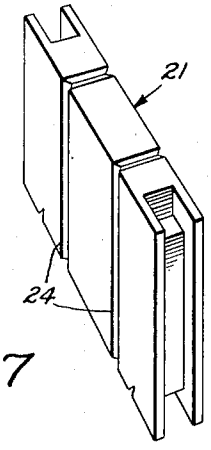


FIG. 7

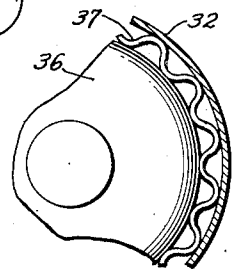


FIG. 8

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REFRIGERATOR PUMP

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5 Claims. (Cl. 62—117.7)

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This invention relates to new and useful improvements in refrigerator pumps, and more particularly to such pumps of the rotary type adapted for use in connection with domestic and commercial refrigerators for circulating the usual refrigerant fluid through the usual coils of the refrigerator.

One of the important objects of the present invention is to provide a refrigerator pump which is small and compact in size, has maximum capacity for its size, and which is so constructed that it may readily be embodied in compressors of various types and sizes.

A further object is to provide a refrigerator pump which presents the utmost in simplicity and construction, comprising few working parts and all such parts being so interconnected and supported as to require a minimum of care, and whereby the pump may be operated at maximum capacity at long intervals without failure and servicing.

A further object is to provide a sealed refrigerant pump unit, including a motor and a high pressure pump which are directly connected to one another, and the motor being contained within a casing forming a sealed chamber, and the pump being similarly enclosed within a suitable housing whereby there is no danger of leakage of the lubricating oil circulated through the moving parts of the apparatus, nor the refrigerant gases, and the sealed motor casing and pump housing being detachably secured together whereby they may readily be detached from one another to inspect or make necessary repairs thereto, when necessary, and whereby most repairs may be made on the job, thereby dispensing with the necessity of having to return the entire apparatus to the factory or a distant repair shop, as is now customary with conventional equipment of this general type now in common use.

Other objects of the invention reside in the unique construction of the pump body and motor housing whereby the entire apparatus may be made very compact, and whereby all working parts of the device are contained within a sealed chamber; in the unique mounting of the motor and its connection with the rotor; in the means provided for constantly circulating a suitable lubricant or bore whenever the pump is operated to circulate the refrigerant fluid; and in the construction of such a pump which readily lends itself for mounting in conventional refrigerators with a minimum of effort and labor and which may be assembled as a complete unitary sealed

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structure to facilitate the handling of the pump in storage and also in the installation of such pumps in domestic and commercial refrigerators.

Other objects of the invention will appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown, as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a vertical sectional view through the completed pump, showing the simple construction thereof;

Figure 2 is a sectional plan view on the line 2—2 of Figure 1;

Figure 3 is a sectional plan view on the line 3—3 of Figure 1;

Figure 4 is a view similar to Figure 3, showing the piston blade of the rotor disposed in right angular relation to the position shown in Figure 3;

Figure 5 is a view showing the single piston blade removed from the rotor and partially broken away to more clearly illustrate the construction thereof;

Figure 6 is a view showing the rotor removed from the apparatus and with the piston blade omitted;

Figure 7 is a perspective view of the piston blade without its sealing elements;

Figure 8 is a detail sectional view substantially on the line 8—8 of Figure 1, showing only a portion of the motor and its housing and the means for spacing the motor from the housing;

Figure 9 is a vertical sectional view similar to Figure 1, showing a pump of slightly different construction; and

Figure 10 is a sectional plan view on the line 10—10 of Figure 9, showing the means for spacing the stator laminations from the wall of the housing, to provide an air circulating passage between the housing wall and the stator.

The novel compressor or refrigerator pump herein disclosed, as illustrated in Figure 1, is shown comprising a suitable supporting plate 2 to which a body 3 is secured by suitable bolts 4, the upper portion of said body being provided with an annular flange 5 for receiving the bolts 4.

In its preferred form the body 3 is preferably cylindrical in cross section, as will be understood

by reference to Figures 3 and 4. A suitable sealing element 6 is interposed between the flange 5 and the supporting plate 2 to provide a leakproof joint therebetween, as is customary in devices of this general type.

The body 3 is shown provided at its upper end with a suitable enlarged bore 7 which extends downwardly from the top of the body 3 and terminates at its lower end in a relatively smaller bore or chamber 8, shown having a cone-shaped bottom wall 9. A cylindrical bore 11 of reduced size extends downwardly from the chamber 8, and serves as a cylinder for an oil circulating pump, as will subsequently be described.

An important feature of the present invention resides in the construction of the means for circulating the refrigerant fluid through the bore 7 and the usual compressor coil 10 of a refrigerator, indicated in dotted lines in Figure 1 of the drawings.

As best shown in Figures 3 and 4, the bore 7 is provided with an outlet or discharge opening 12 having one end of a conduit 13 connected thereto the opposite end of which is connected to the high pressure side of the compressor coil 10 of the refrigerator. An upright conduit 15 has its lower end secured in the supporting plate 2 in direct communication with the upper end of the bore 7. The upper end of conduit 15 provides an elevated intake 14 through which the low pressure gas returning from the compressor is drawn into the pump chamber or bore 7, as will subsequently be described. See Figure 1.

The means provided for thus circulating the refrigerant fluid through the apparatus is shown comprising a rotor, generally designated by the numeral 16. The rotor is provided at its upper end with a hollow shaft extension 17 received in a suitable bearing 18 in the supporting plate 2. The rotor has a transverse slot 19 therein which intersects the axis of the rotor, as best illustrated in Figures 3 and 4. By reference to these figures it will be noted that the rotor is of smaller diameter than the diameter of the bore 7, and that the rotor is eccentrically disposed within the bore 7 with its periphery substantially engaging the wall of the bore 7 adjacent to the discharge opening 12.

A single vane or piston blade 21, preferably of unitary construction, is mounted in the slot 19 in the rotor and extends the full height of the rotor, as shown in Figure 1. Suitable combination sealing and wear elements 22 are provided at the ends of the piston blade 21 and are movable relatively thereto. Suitable spring elements 23 constantly hold the sealing elements 22 in engagement with the wall of the bore 7, thereby to seal the connections between the ends of the blade 21 and the wall of the bore 7, as will be readily understood by reference to Figures 3 and 4. Oil circulating grooves 24 are shown provided on the side faces of the blade 21 to facilitate lubricating the blade, which relatively moves in the slot 19 of the rotor, when the rotor is rotated in the operation of the pump.

Secured to and depending from the rotor 16 is a conical extension 25 adapted to be received in the bore 8, as shown in Figure 1. A spiral piston 26 is secured to and depends from the portion 25 into the relatively smaller bore or cylinder 11, shown in Figure 1. The piston 26 serves to circulate a suitable liquid lubricant such as oil, through the rotor and its supporting bore or cylinder 11, when the pump is in operation, whereby the rotor is constantly supplied with an adequate supply of oil which, in addition to lubricating all moving parts, also serves to seal the joints between the moving parts.

One end of a suitable conduit 27 is in communication with the lower end of the cylinder or bore 11, and its opposite end may be connected to a suitable cooling unit 28 of conventional design, for cooling the oil received from the pump, as will be understood. A second conduit 29 connects the opposite end of the cooling unit 28 to a motor chamber 31 shown provided by a suitable housing 32 having its lower marginal edge secured to an annular member 33 which serves as a flange whereby the housing 32 may be conveniently secured to the supporting plate 2 by suitable bolts 34. An annular sealing element 35 is shown interposed between the flange 33 and the plate 2 to seal the connection therebetween.

A suitable electric motor 36 is mounted within the housing 32 and is shown axially disposed therein by suitable spacing elements 37, best shown in Figure 8. The spacing elements provide free circulation of the refrigerant gas between the motor and the wall of the housing, as indicated by the arrows in Figure 1. The motor 36 preferably has a fluid-tight casing whereby the introduction of the low pressure gas and oil into the housing will not in any way jeopardize the operation of the motor 36.

The motor is shown having a square shaft extension 37 received in a correspondingly shaped socket 38 provided in the upper end of the shaft extension 17 of the rotor 16. A bore 39 leads from the socket 38 downwardly through the shaft extension 17 to the slot 19 in the rotor, and a horizontal duct 41 establishes communication between the lower portion of the chamber 31 and the bore 39 in the shaft extension 17. The lower portion of the motor chamber serves as an oil reservoir, as indicated in Figure 1. Thus when the pump is operated oil is circulated from the oil reservoir through the shaft extension 17 and the ducts 24 provided in the opposed faces of the rotor vane 21. The chamber 31 is provided at its upper end with a low pressure gas intake, generally designated by the numeral 42 to which one end of a conduit 43 is connected. The opposite end of conduit 43 is connected to the low pressure or discharge side of the compressor coil 10. Oil ducts 44 and 45 may be provided in the supporting plate 2 for conducting a portion of the oil directly onto the top of the rotor to assume adequate lubrication thereof.

In the operation of the novel apparatus herein disclosed, the motor 36 is started whereupon the rotor, which is connected directly thereto, will be rotated simultaneously with the motor. Such rotation of the rotor will cause refrigerant fluid to be drawn into the bore or cylinder 7 from the motor chamber 31 by the action of the piston blade 21 because of the eccentric disposition of the rotor 16 within the bore 7. The low pressure gas is drawn into the chamber 31 through the inlet 42, and from the chamber 31 the low pressure gas is drawn into the pump bore 7 through the conduit 15, where it is compressed and discharged from the pump through its tangentially disposed outlet 12 into the compressor coil 10 in the form of a high pressure refrigerant gas.

Simultaneously, oil is drawn into the top shaft extension 17 through the duct 41 by the action of the spiral piston 26, such oil being constantly circulated through the bearing of the rotor, conduit 27, cooling unit 28 and conduit 29 and back to the oil reservoir in the bottom of the motor chamber 31, thereby providing an adequate sup-

ply of lubricating oil to all moving parts whenever the pump is operated.

The unique orientation of the parts of the apparatus is important in that it makes it possible to provide a refrigerant pump in the form of a sealed unit which is self-contained, is compact, and is so constructed that it may readily and quickly be embodied in various types of refrigerators at a minimum cost. It will be noted by reference to Figure 1 that the apparatus comprises very few parts, particularly moving parts, and its construction is such that all parts are readily accessible in the event it becomes necessary to overhaul or replace any of the parts of the pump unit.

In Figures 9 and 10 there is shown a compressor pump of slightly different construction, the main distinction residing in the construction of the motor for operating the rotor.

The pump shown in Figure 9 comprises a supporting plate 46 corresponding to the plate 2 shown in Figure 1. A pump body 47, corresponding to the body 3, in Figure 1, is secured to the plate 46 by similar bolts 4, and a conduit 48 leads from the bottom of the body 3 to a cooling unit 28 similar to the one shown in Figure 1. The upper end of the cooling unit 28 is connected to one end of a conduit 49, the opposite end of which is connected to a fitting 51 provided in the upper wall 52 of a suitable housing 53, which, in this instance, in addition to providing an enclosing housing for the upper portion of the apparatus, also provides a supporting frame for the usual stator 54 of an electric motor, generally designated by the numeral 55.

A rotor 56 is secured to a shaft 57, the upper end 58 of which is shown mounted in a suitable bearing 59 provided in a plate 61 which constitutes a portion of the supporting structure of the motor 55. By reference to Figure 9, it will be noted that the plate 61 and stator 54 are supported from the main supporting plate 46 by suitable studs 62 and spacers 63 and 64. The lower end portion 65 of the motor shaft 57 is shown coupled to the upper end portion 17 of the pump rotor 16 in a manner similar to the structure illustrated in Figure 1, whereby the rotor 16 is driven directly with the motor 55, when the latter is operated. A suitable sleeve member 66 is shown fitted over the rotor shaft extension 17 and has its lower end supported on a thrust ring or bearing 60 positioned upon the upper end of a bearing sleeve 70 having its lower end secured in the supporting plate 46. The upper end of the sleeve member 66 engages the enlarged portion 57 of the rotor shaft whereby the weight of the rotor is carried by the sleeve 66 on the thrust ring 60, it being understood that the sleeve 66 rotates with the rotor of the motor.

The intake to the pump from the motor chamber 67 is shown at 68, and the low pressure gas is drawn into the motor housing or chamber 67 from the compressor coil 10 through a conduit 69 similar to the conduit 43 shown in Figure 1. The high pressure refrigerant gas developed in the pump is discharged therefrom through the outlet 71 and into the conduit 72 which leads to the intake side of the usual coils of the refrigerator, not shown, as is well known. A filler plug 73 may be provided in the housing 52 through which a suitable lubricating oil may be introduced into the housing, as will be understood.

The operation of the apparatus shown in Figure 9 is substantially identical to that shown in Figure 1, the main distinction residing in the construction of the motor. In Figure 1 there is shown an integral motor unit which may be furnished in its completed form independently of the remaining parts of the apparatus, whereas the motor shown in Figure 9 is embodied in the construction of the housing 52 and other parts of the apparatus, as will be understood. The stator 54 is supported in spaced relation to the cylindrical wall of the housing by suitable means such as rod-like spacers 74, shown in Figure 10.

If desired, suitable springs or cushion elements, not shown, may be utilized in lieu of the spacing sleeves 63 and 64, to absorb vibration, should it be deemed necessary. In other words, by mounting the motor within a sealed housing as herein disclosed, and connecting it directly to the pump by a single slip-type coupling, the sealed unit, including the motor and pump, will be extremely silent in operation and is self-lubricating which are highly desirable features in a refrigerator unit of this general type.

It will be apparent to those skilled in the art that I have accomplished at least the principal objects of my invention, and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that my invention is not limited thereto.

I claim as my invention:

1. A compressor pump comprising a body having a cylindrical bore provided with intake and discharge openings, means forming an oil reservoir, a rotor eccentrically disposed in said bore and having a hollow shaft extension at its upper end, a motor connected to said shaft extension, a single piston blade mounted for relative movement in the rotor and having its ends sealingly engaging the cylindrical wall of the bore, an oil circulating pump in the lower portion of said body comprising a reduced bore extending downwardly from said enlarged bore and forming a cylinder, a spiral piston secured directly to and operable with the rotor to constantly circulate a lubricant downwardly through said hollow shaft to lubricate the rotor and piston blade, and a conduit for conducting the lubricant back to the oil reservoir from the oil pump.

2. A compressor pump comprising a body having an oil reservoir therein and an enlarged cylindrical bore provided with intake and discharge openings, a compressor coil in communication with said bore, a rotor eccentrically mounted in said bore and having a hollow shaft extension at its upper end, a motor connected to said shaft extension, a single double-acting piston blade in said rotor made operable by the eccentric action of said rotor to circulate a refrigerant gas through said compressor coil, an oil circulating pump in the lower portion of said body comprising a reduced bore extending downwardly from said enlarged bore and forming a cylinder, a spiral piston secured to and operable with the rotor to constantly circulate a lubricant through said hollow shaft to lubricate the rotor and its piston blade, and a conduit for conducting the lubricant back to the oil reservoir from the oil pump.

3. A compresser pump comprising a body having an oil reservoir and an enlarged cylindrical bore provided with intake and discharge openings, a compressor coil in communication with said bore, a rotor mounted in said bore and hav-

ing a hollow shaft extension at its upper end, a motor connected to said shaft extension, means establishing communication between the reservoir and said enlarged bore, said rotor having a transverse slot therein, a single piston blade mounted in said slot and operable by rotation of said rotor to circulate a refrigerant gas through the compressor coil, an oil circulating pump in the lower portion of said body comprising a reduced bore extending downwardly from said enlarged bore and forming a cylinder, a spiral piston secured to and operable with the rotor to constantly circulate a lubricant through said hollow shaft to lubricate the rotor and pump means therein.

4. In an apparatus of the class described, a housing having means for supporting a motor therein, said housing being closed at its upper end and having its lower end mounted upon and secured to a supporting plate in sealtight relation thereto and whereby the lower portion of the housing may serve as a reservoir to contain a liquid lubricant, a cylindrical body detachably secured to the bottom side of said plate and depending therefrom, said body having an enlarged bore therein adjacent to said plate, an upright conduit having its lower end in communication with said enlarged bore and having its upper end in communication with said housing above the oil level therein, a compressor coil having its discharge end in communication with the upper portion of said housing above the oil level and having its intake end in communication with said bore, a rotor eccentrically mounted in said bore and having a hollow shaft extension rotatably supported in said plate and extending upwardly into said housing and connected to the motor shaft, the diameter of said rotor being less than the diameter of said bore, said rotor having a transverse slot therein disposed in the axis of said rotor, a single piston blade movably mounted in said slot and having its opposed ends sealingly engaging the wall of said bore and cooperating

with said wall and the periphery of said rotor to provide diametrically disposed compression chambers, an oil pump in the lower portion of said cylindrical body having a conduit connecting its discharge end with said housing above the oil level therein, whereby oil circulated from the oil reservoir through the shaft bearing in said plate is returned to the housing above the oil level, said piston blade serving as a double acting pump to continually circulate a refrigerant gas through the compressor coil when the apparatus is in operation.

5. An apparatus according to claim 4, wherein the hollow shaft extension of the rotor has a slip fit with the motor shaft to permit complete detachment of the pump body from the supporting plate of the housing, including the rotor and oil pump.

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