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A REFRIGERATION COMPRESSOR
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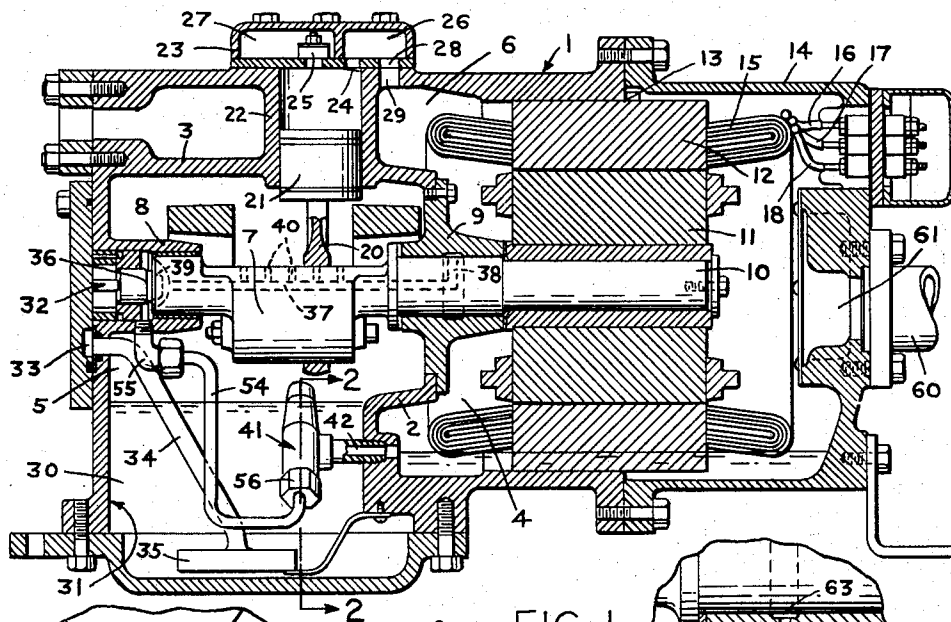


FIG. 1

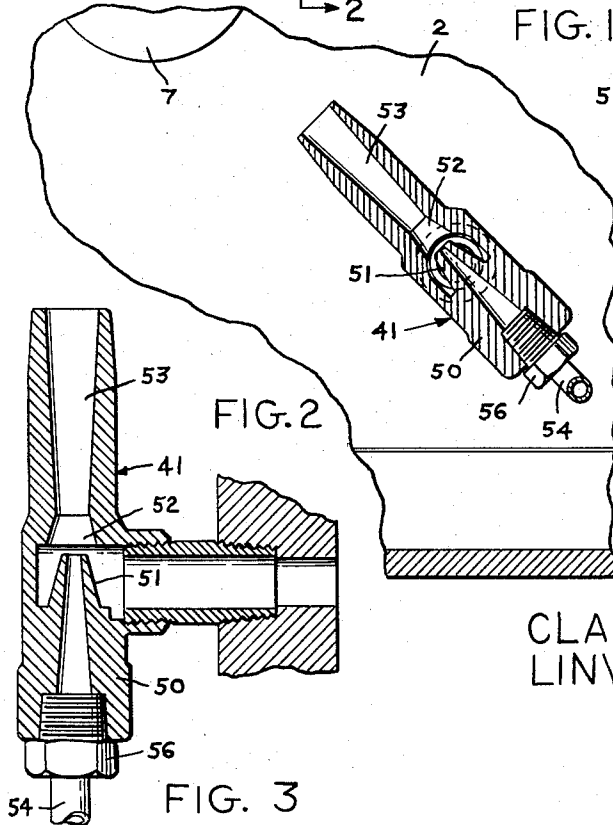


FIG. 2

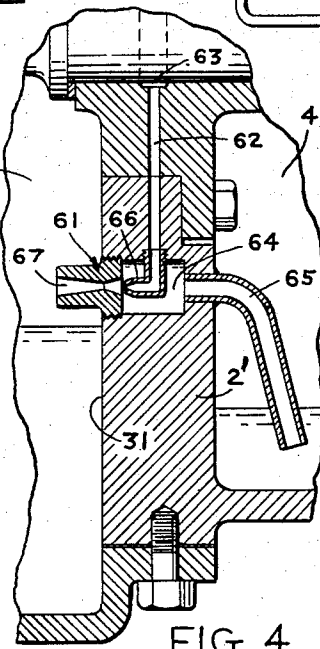


FIG. 4

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JET EJECTOR LUBRICANT RETURN MEANS FOR A REFRIGERATION COMPRESSOR

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This invention relates generally to refrigeration compressors either of the open or hermetically sealed type and more particularly to a means for returning lubricant from the motor compartment to the main crankcase of the refrigeration compressor.

Reciprocating compressors used in modern refrigeration cycles are generally driven by a constant speed electric motor.

In many refrigeration cycles utilizing such compressor-motor units, the refrigerant will be dichlorodifluoromethane or some similar type of refrigerant which refrigerants are miscible with the lubricant fluid used for lubricating the reciprocating compressor bearings and other moving parts. Accordingly, these compressor-motor units are constructed so that the motor compartment which communicates with the suction manifold will be separated from the main crankcase for the compressor for the following purposes:

- (a) To suppress foaming of oil
- (b) Prevent oil and refrigerant slugging, and
- (c) Permit filtering of the oil entrained in the returning refrigerant gas

and any oil that collects in the motor compartment, either from the returning refrigerant or from leakage through the crankshaft bearing is returned to the main crankcase by some suitable means.

Accordingly, it is an object of the present invention to provide an inexpensive positive means for returning lubricant from the motor compartment to the main crankcase reservoir by utilizing an ejector in combination with the normal lubricant pressure which ejector communicates with the motor compartment at the oil level desired and discharges into the main crankcase reservoir.

Further objects and advantages of the invention will become evident from the following description with reference to the accompanying drawings, in which:

Figure 1 is a vertical section partly in side elevation showing the invention.

Figure 2 is an enlarged view of the ejector means shown on line 2—2 of Figure 1.

Figure 3 is an enlarged vertical section of the ejector means showing it connected to the partition between the motor compartment and the main crankcase.

Figure 4 is a fragment of a compressor-motor unit showing a modified form of the ejector means and transverse partition.

Referring more particularly to the drawings, Figure 1 shows a compressor-motor unit including a casing generally designated 1 divided by a transverse partition 2 and an axially disposed bulkhead 3 into a motor compartment 4, a crankcase compartment 5 and a suction manifold 6 which communicates freely with the motor compartment.

A crankshaft 7 supportably mounted in bearings 8 and 9 disposed respectively in the end of the casing 1 and in the partition 2 is provided with a jackshaft as at 10

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which extends through the partition into the motor compartment 4. Fixedly connected about the jackshaft 10 is an armature 11 which is disposed relative a stator 12 mounted on the inner wall of the motor compartment section of the casing 1 by means of a stop-shoulder 13 which holds it in longitudinal position. An adaptor hub 14 is detachably connected to the casing for easy access to the armature and stator, respectively, and to form the outboard portion of the motor compartment 4.

Current is passed to the coil 15 of the stator 12 by means of the current conducting lines 16, 17 and 18, in turn connected to a source of power, not shown, in the manner well known in the art.

When current is passed through the stator the armature is caused to rotate and since it is fixedly mounted on the jackshaft it also rotates the jackshaft 10 and the crankshaft 9.

Connected to the crankshaft is a connecting rod 20 having a piston 21 at the end remote from the crankshaft-connected end. The piston is slidably disposed in a cylinder 22 formed transversely of the casing 1 and the axial partition 3 along an imaginary radial line perpendicular to the centerline of the crankshaft. The piston is reciprocated in the cylinder on rotation of the crankshaft. It will be understood that while only one cylinder is shown that the present invention is equally applicable to a multi-cylinder compressor-motor unit.

The cylinder opens on the outer wall of the casing 1 and mounted about this opening is the head 23 which has a suction valve 24 and a discharge valve 25 formed therein to provide communication between the cylinder and a suction inlet chamber 26 and also the cylinder and a discharge outlet chamber 27. The suction inlet chamber 26 communicates through ports 28 and 29 with the suction manifold 6 so that when the piston 21 is reciprocated in the cylinder fluid from the motor compartment 4 and suction manifold will pass into the suction chamber and through the suction valve on the downward or outward stroke of the piston and from the cylinder through the discharge valve to the discharge outlet chamber on upward or inward stroke of the piston.

Lubrication system

The bearings and other moving parts of the compressor relating to the crankshaft and piston assembly are lubricated by any suitable lubrication system.

Thus, in the present form of the invention the crankcase is shown as having lubricant 30 disposed in a reservoir generally designated 31 formed at the lower portion of the crankcase. This lubricant is pumped from the reservoir by means of any suitable type of rotary pump generally designated 32 which takes its suction through the suction inlet 33 and suction line 34 having a filter 35 about the opening thereof which is disposed at the lowest portion of the reservoir. The filter is utilized to prevent sludge and other foreign particles from passing with the lubricant fluid into the suction inlet for the pump. The pump is provided with a discharge outlet 36 which communicates through a common duct or passage 37 with the respective transverse passages 38 and 39 which feed the bearings 7 and 8, respectively. Other transverse passages 40 throw fluid onto the connecting means for the connecting rod 20 and other moving parts of the crankcase and piston assembly, all of which is clearly shown in Figure 1 of the drawings.

This form of the invention as above described is known in the art and is described to show the conventional arrangement to which the present invention is applied. As can be visualized through Figure 1, the lubricant level shown in the crankcase compartment 5 is higher than that in the motor compartment 4. Lubricant is continuously

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collected in the motor compartment from at least two sources, namely, the returning refrigerant and leakage from the bearing 8. Due to blowby which maintains the pressure in the crankcase above that of the motor compartment, it is necessary that some positive means be provided for returning the fluid from the motor compartment 4 to the reservoir 31 formed in the crankcase compartment.

Ejector means

This is accomplished by means of an ejector generally designated 41 which has its suction inlet 42 connected to the partition 2 so that the inlet is disposed at that predetermined point in the partition for maintaining the level of collected oil in the motor compartment at the desired level. The ejector is clearly shown in Figures 2 and 3 of the drawings as comprising a body portion 50 having a nozzle 51 disposed anterior of the suction chamber 52 which communicates with the suction inlet 42 for the ejector. The suction chamber communicates with the discharge outlet 53 which is disposed as shown in Figure 1 to discharge motive fluid onto the moving parts of the crankcase and piston assembly. The motive fluid is delivered to the ejector 41 by means of a feed line 54 connected by any suitable connecting means 55 to the pump 32 at one end and at the other end by any suitable connecting means 56 to the nozzle end of the body portion 50 of the ejector 41. Thus, means are provided to deliver motive fluid through the nozzle 51 into the discharge chamber 53 of the ejector in the manner well known in the art.

Since the compressor motor unit forms a part of a refrigerant cycle, Figure 1 also shows that the refrigerant fluid is returned to the unit through a line 60 which communicates with an opening 61 formed in the adapter 14.

This point in the motor compartment is on the side of the motor remote from the ejector means 41. Accordingly, the returning lubricant in order to reach the suction manifold 6 must pass through the motor to the lower pressure side of the motor and thence out of the motor compartment into the suction manifold 6, passages 28 and 29, suction chamber 26, and suction valve 24 to the cylinder 22. In passing through the motor it acts to cool the motor and in addition the drop in pressure will cause lubricant entrained therein to separate out in the motor compartment, which fluid is collected in the lower portion of the motor compartment as shown in Figure 1.

Operation

In operation, when current is passed to the stator and the crankshaft made to rotate as above described, not only will the piston 21 be reciprocated in the cylinder 22 but the rotary pump 32 will also rotate.

Rotation of the pump 32 passes fluid through the suction line 34, the suction inlet 33 through the pump 32 and then to its discharge outlet 36, in turn connected through lines 37, 38 and 39 to the respective bearings 7 and 8 and other moving parts. In addition, the pumped lubricant passes through connection 55, line 54 to the nozzle end of the ejector 41 where it is discharged through the nozzle as the motive fluid for entraining and moving the collected lubricant from the motor compartment 4 through the suction inlet 42 to the suction chamber 52 whence it is discharged through the discharge chamber 53 back to the reservoir 31 formed in the crankcase compartment 5.

Although the above described form of this invention shows the ejector as disposed in the crankcase compartment, it is believed clear to those skilled in the art that by using exterior lines, the ejector means could be disposed on the outside of the motor compartment at the desired point for maintaining the level of the collected fluid and still discharge its lubricant into the reservoir formed in the crankcase compartment without departing from the scope of the present invention.

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Modified form of ejector means

Figure 4 shows a fragment of a compressor-motor unit similar to that above described. It differs, however, in that the partition 2' is modified to provide means for forming an ejector generally designated 61 therein and to provide a passage 62 which communicates through annular chamber 63 with the lubricant passage which feeds the main bearing designated 8 in the form of the invention shown in Figure 1. All remaining portions of this illustrated form of the invention are deemed to be identical with that above described and accordingly they have not been illustrated further.

The ejector means 61 includes a suction chamber 64 having a suction inlet 65 extending into the motor compartment 4. The suction inlet is in the form of an elongated bent pipe which can be adjusted to extend a predetermined point in the motor compartment at which it is desired to maintain the level of collected lubricant fluid.

A nozzle element 66 is mounted in the suction chamber 64 to communicate with the passage 62 for receiving the motive fluid for operating the ejector means.

Motive fluid passed from the passage 62 to the nozzle elements 66 is discharged through a discharge chamber 67 into the reservoir portion 31 of the crankcase 5.

Since the discharge chamber 67 also is in communication with the suction chamber 64 when the fluid is passed to the discharge chamber it acts to move the collected lubricant in the motor compartment 4 by positive differential pressure from the motor compartment to the suction chamber and thence through the discharge chamber back to the reservoir in the crankcase 5.

In either form of the invention the ejector means creates a positive differential pressure and it acts to maintain the level of collected lubricant in the motor compartment at whatever predetermined point it is set in the partition 2 relative the level of the lubricant in the motor compartment.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a compressor-motor unit to be used in a refrigerant cycle, a casing, a partition in said casing forming a motor compartment and a crankcase compartment, a lubrication system for said unit, ejector means having an inlet and an outlet operatively connected to said lubrication system to receive motive fluid therefrom, said ejector means communicating with the motor compartment at a predetermined point for maintaining the desired level of collected lubricant in said motor compartment when the refrigerant cycle is in operation.

2. In a compressor-motor unit to be used in a refrigerant cycle, a casing, a partition in said casing forming a motor compartment and a crankcase compartment, means in said casing forming a suction manifold communicating with said motor compartment, a lubrication system for delivering lubricant fluid under pressure to the moving parts of said compressor, ejector means having an inlet and an outlet operatively connected to said lubrication system to receive motive fluid therefrom, said ejector means having a suction inlet, and means connecting the suction inlet of said ejector means to the motor compartment at a predetermined point for maintaining the desired level of collected lubricant in said motor compartment when the refrigerant cycle is in operation.

3. In a compressor-motor unit to be used in a refrigerant cycle, a casing, a partition in said casing forming a motor compartment and a crankcase compartment, means in said casing forming a suction manifold communicating with said motor compartment, a lubrication system for the compressor portion of said unit including a pump for delivering lubricant under pressure, ejector means including a suction inlet, means connecting said suction inlet with the motor compartment at a predeter-

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mined point for maintaining the desired level of collected lubricant in said motor compartment, inlet means on said ejector providing communication between said ejector means and said pump to pass motive fluid to said ejector means when the refrigerant cycle is in operation, and outlet means on said ejector for returning mixed motive fluid and collected lubricant to said lubricator system.

4. In a compressor-motor unit to be used in a refrigerant cycle, a casing, a partition in said casing forming a motor compartment and a crankcase compartment, means in said casing forming a suction manifold communicating with said motor compartment, a lubrication system for the moving parts of the compressor portion of said unit, and ejector means including a nozzle element, inlet means connecting said nozzle element to the lubrication system to pass motive fluid thereto, said ejector means having a suction inlet disposed to communicate with said nozzle element, means connecting said suction inlet to the motor compartment at a predetermined point for maintaining the desired level of collected lubricant in said motor compartment when the refrigerant cycle is in operation, and said ejector having outlet means for returning lubricant to said crankcase.

5. In a compressor-motor unit to be used in a refrigerant cycle, a casing, a partition in said casing forming a motor compartment and a crankcase compartment, means in said casing forming a suction manifold communicating with said motor compartment, a lubrication system adapted to deliver lubricant under pressure to the moving parts of the compressor portion of said unit, ejector inlet means disposed in said crankcase compartment, means on said ejector for connecting said ejector means to the pump to pass motive fluid thereto, said ejector means having a suction inlet connected through the partition at a predetermined point for maintaining the desired level of collected lubricant in said motor compartment when said refrigerant cycle is in operation, and said ejector having an outlet means for returning mixed motive fluid and collected lubricant to said lubrication system.

6. In a compressor-motor unit to be used in a refrigerant cycle, a casing, a partition in said casing forming a motor compartment and a crankcase compartment,

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means in said casing forming a suction manifold communicating with said motor compartment, a lubrication system adapted to deliver lubricant under pressure to the moving parts of said compressor portion of the unit, ejector means disposed in said partition, inlet means and outlet means providing communication between said ejector means and the lubrication system to pass motive fluid to the ejector means, said ejector means having a suction inlet disposed to communicate with the motor compartment at a predetermined point for maintaining the desired level of collected lubricant in said motor compartment when the refrigerant cycle is in operation.

7. In a compressor-motor unit as claimed in claim 4 wherein said unit includes a crankshaft, a connecting rod connected to said crankshaft, and said ejector means is disposed in the crankcase compartment to discharge lubricant at approximately the point of connection between the crankshaft and the connecting rod.

8. In a compressor-motor unit for a refrigerant cycle, a casing, a partition in said casing forming a motor compartment and a crankcase compartment, a motor in said motor compartment dividing the compartment into an inboard end and an outboard end, means in said casing forming a suction manifold in communication with the inboard end of said motor compartment, means for returning refrigerant from said refrigerant cycle to the outboard end of said motor compartment, a lubrication system for passing lubricant under pressure to the compressor portion of the unit, ejector means having an inlet and an outlet operatively connected to said lubrication system for receiving motive fluid therefrom, said ejector means connected to the inboard end of the motor compartment at a predetermined position to maintain collected lubricant in the motor compartment at a desired level and to maintain a pressure differential between the inboard and outboard end of said motor compartment whereby returning refrigerant will pass through the motor to the suction manifold when the refrigerant cycle is in operation.

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