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Harris et al.

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[45] **Jan. 30, 1973**

[54] CRANKCASE EVACUATION AND OIL RETURN SYSTEM

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[73] Assignee: **Fedders Corporation,** Edison, N.J.

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[52] **U.S. Cl.** **184/6.16,** 184/6.5, 417/372, 417/902

[51] **Int. Cl.**.....**F01m 1/12**

[58] **Field of Search** .....417/372, 415, 902; 184/6.16, 184/6.5; 62/469, 470; 123/119 B

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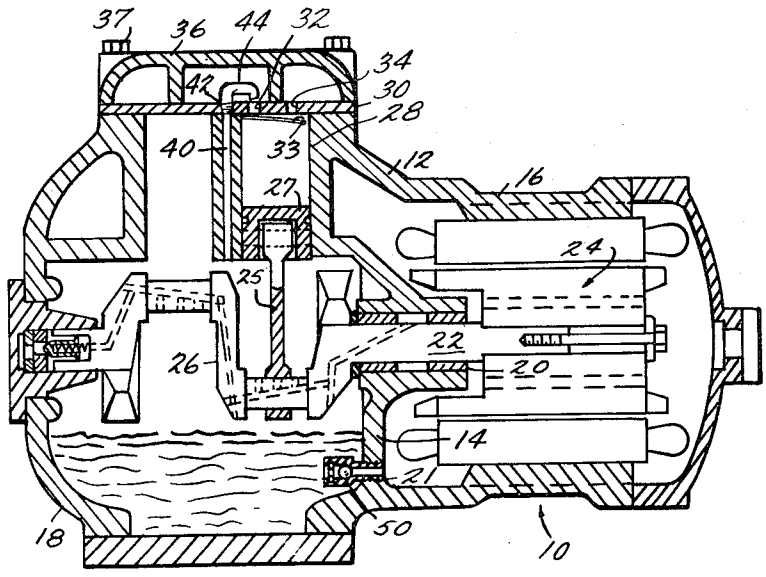
[57] **ABSTRACT**

A refrigeration motor compressor unit comprising a housing separated by a partition into a crankcase compartment and a motor compartment. The partition defines an oil return passage connecting the motor compartment with the crankcase compartment, the passage having a one-way check valve mounted therein which permits a flow of fluid to take place only from the motor compartment to the crankcase compartment. The crankcase compartment defines a plurality of cylinders adapted to receive pistons therein and has a valve plate having a plurality of apertures therein mounted to it, with at least one of the apertures being a suction port. A cylinder head is mounted to the crankcase housing and is constructed to define at least one suction chamber and at least one discharge chamber. The crankcase compartment housing defines a fluid equalizing passage having one end cooperating with the crankcase compartment interior and the other end cooperating with a suction chamber of the cylinder head. A conduit member is connected to the fluid equalizing passage to direct fluid passing from the crankcase compartment through the passage towards a suction port of the valve plate.

18 Claims, 5 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

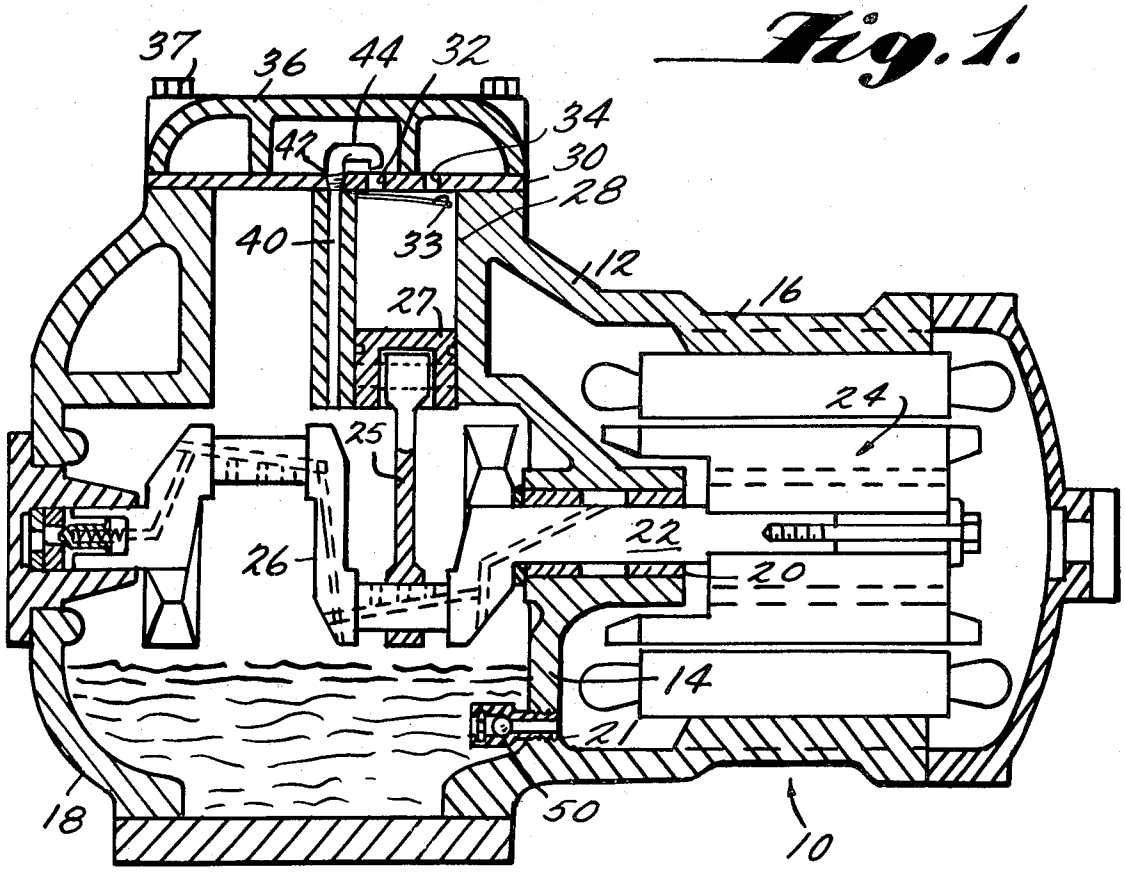

Fig. 2.

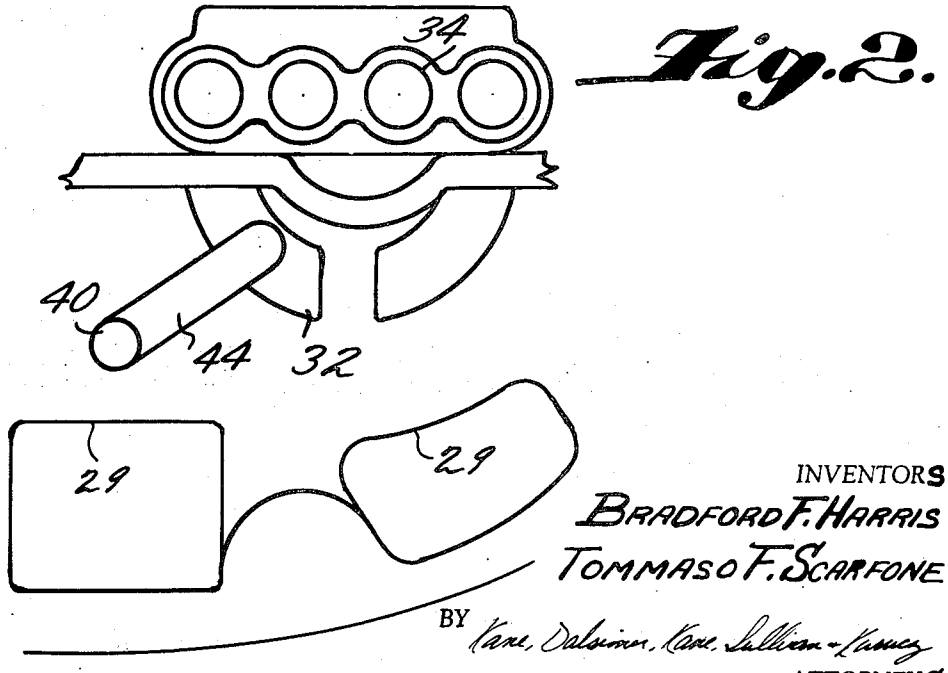

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Fig. 3.

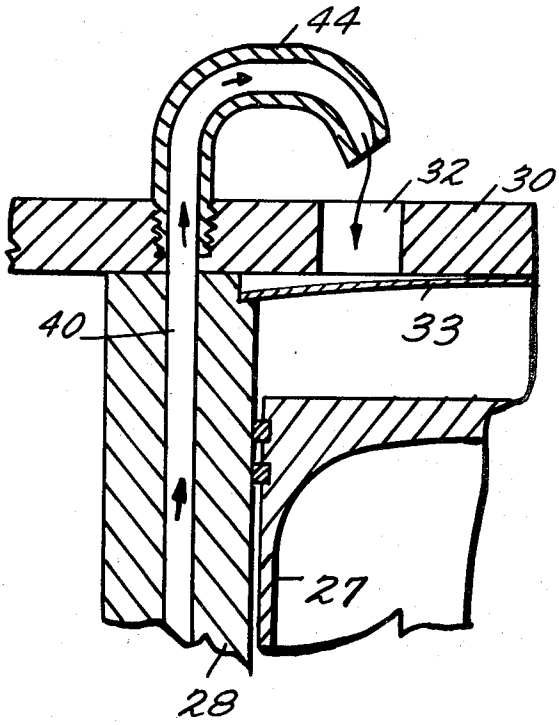


Fig. 4.

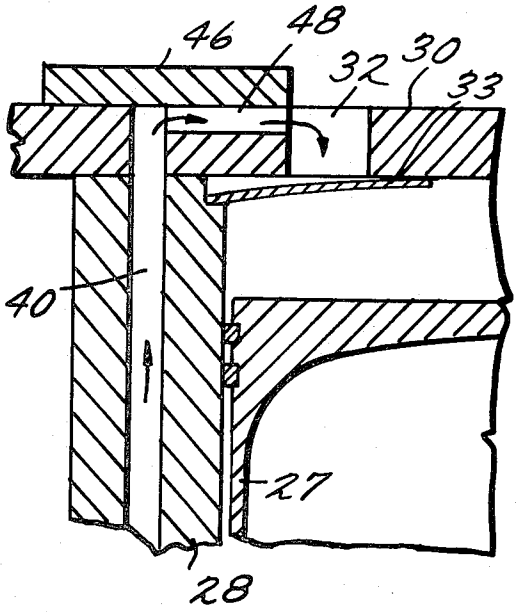
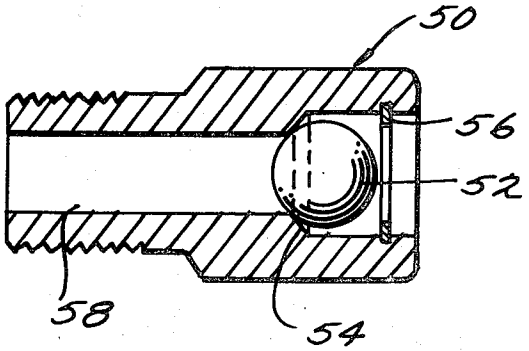


Fig. 5.



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CRANKCASE EVACUATION AND OIL RETURN SYSTEM

The invention generally relates to refrigeration systems and more particularly to means for maintaining proper lubrication of compressors.

In refrigeration systems utilizing self-contained motor compressor units in which the returning refrigerant is used to cool the motor and where oil is carried throughout the system, the crankcase pressure must be maintained at a sufficiently low or equal pressure relative to the rest of the system to permit the return of lubricant collected in the motor compartment to the crankcase. The lubricant with entrained refrigerant in the crankcase generally foams at the starting period of compressor action and the foamed oil tends to be drawn from the crankcase into the refrigeration system. In the crankcase, piston blow-by occurs which makes it difficult to maintain crankcase pressure at a sufficiently low level since the blow-by past the piston rings into the crankcase causes the crankcase to constantly have a higher pressure than the motor cavity. The oil or lubricant which has been lost from the crankcase travels through the system and returns with the suction gas, where it accumulates in the motor cavity. If there is no way of returning this oil to the crankcase, a condition may come about whereby the quantity of oil in the crankcase will be below a desired level, which can cause damage to the compressor.

It is known in the art to try to equalize the crankcase and the motor cavity pressure by using a conduit having a check valve therein which leads from the crankcase cavity to the intake manifold. Such prior art is disclosed in U. S. Pat. No. 3,123,287. It is also well known in the art to use a return check valve leading from the motor cavity to the crankcase to allow the lubricant to flow from the motor cavity to the crankcase.

In the present invention, the pressure between the motor cavity and the crankcase is continuously equalized by the use of an oil equalization passage and conduit means to assure that oil will be returned to the crankcase under all operating conditions by effective use of the pumping action inherent in reciprocating compressors.

This novel and improved construction for venting the crankcase and maintaining lubricant supply is accomplished by a simple, trouble free construction which does not interfere with the other portions of the refrigerating system.

Other features and advantages of the invention will be apparent from the following description of the embodiments of the invention as shown in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a hermetically sealed compressor showing an embodiment of the invention.

FIG. 2 is an enlarged partial planar view of the invention embodiment disclosed in FIG. 1 as seen when the cylinder head is removed.

FIG. 3 is an enlarged partial cross-sectional view taken of the embodiment disclosed in FIG. 1.

FIG. 4 is an enlarged partial cross-sectional view of another embodiment of the invention.

FIG. 5 discloses an enlarged cross-sectional view of the oil return check valve shown in FIG. 1.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to the drawings, the motor compressor unit is generally indicated at **10** and comprises a housing **12** separated by a partition **14** into a motor compartment **16** and a crankcase compartment **18**. The partition **14** has an aperture **20** through which a motor shaft **22** extends and an aperture **21** forming a passage which allows the motor compartment to communicate with the crankcase compartment. The shaft **22** is driven by the motor **24** positioned in the motor compartment, the motor being operated by a source of power not shown. Connected to the shaft **22** is a crankshaft **26** having connecting rods **25**, only one of which is shown, transmitting the drive from the crankshaft **26** to a piston **27**. Each piston **27** is disposed in a cylinder **28** of the compressor, as shown in FIGS. **1, 3** and **4**. A valve plate **30** covers a portion of the crankcase including cylinder **28** and has a plurality of apertures forming at least one suction port **32** and at least one discharge port **34**. A cylinder head **36** covers the valve plate **30** and is constructed to form at least one suction chamber **31** and at least one discharge chamber **35**. The cylinder head **36** is preferably mounted or secured to the crankcase compartment **18** by suitable means **37**.

Suction gas therefore passes from motor compartment **16** through suction passage **29** of valve plate **30** into suction chamber **31**.

The above description sets forth a standard hermetic motor compressor known in the art so that the invention can be described in relation to the parts of a standard motor compressor unit. In the preferred embodiment of the invention, a fluid equalizing channel or passage **40** is drilled or cast in the wall of the cylinder **28** so that passage **40** connects a cylinder head suction chamber with the crankcase compartment cavity. The valve plate **30** has an aperture **42** aligned with passage **40**, the aperture being threaded to receive a curved conduit member **44**. The conduit member **44** positively directs fluid flowing from the higher pressure area of the crankcase cavity toward suction port **32** and into the chamber of cylinder **28**. The conduit member **44** has one end threaded to cooperate and fit in the threaded valve plate aperture **42**. The other end of conduit member **44** is formed such that the crankcase fluid is directed towards suction port **32**, thereby utilizing the flow inducement created by the high velocity suction gas pressing around the tip of conduit member **44** into suction port **32**.

In the preferred embodiment the conduit member **44** is generally "U" or "J" shaped. If desired, a plate having a channel or passage therein can be substituted for the conduit member **44** so that the fluid passing from the crankcase is directed from passage **40** through the plate channel or passage toward or to the suction port **32**.

In an additional modification of the embodiment as shown in FIG. **4**, the valve plate **30** is suitably channeled or formed to interconnect with the passage **40** to direct the gas from the crankcase into the suction port. While the embodiment in FIG. **4** shows a plate **46** mounted to cooperate with valve plate **30** to form channel **48**, the valve plate body itself can be channeled to form a passage.

A one-way oil return check valve **50**, as shown in FIGS. **1** and **5**, is inserted in aperture **21** of the partition **14** so that lubricant can flow from the motor compart-

ment into the crankcase compartment. Preferably, both the check valve assembly **50** and aperture **21** are threaded so that the check valve assembly can be screwed into the partition aperture **21**. The check valve assembly **50** preferably has a ball **52** which can be seated in valve seat **54** and maintained in place by a retaining ring **56**. The ball **52** has a diameter which is slightly greater than valve channel **58** in the valve assembly and the interior diameter of the retaining ring **56** so that it is kept in place.

In operation of the invention, the reciprocating action of the piston **27** will cause refrigerant gas from the suction chamber to flow through suction port **32** and suction valve **33** into the cylinder chamber. As the piston **27** moves on the downward or suction stroke, reduction in pressure is reflected in conduit member **44** and passage **40** due to the high velocity of the suction gas through suction port **32**. Since passage **40** communicates with the crankcase, blow-by gas and refrigerant boiling out of the oil are evacuated toward the suction port **32** from the passage **40** and conduit member **44**.

When utilizing the invention, at all operating conditions, the pressure in the motor cavity **16** is higher than or substantially equal to the pressure in the cylinder head suction chamber. Evacuation of the blow-by gas through passage **40** assures that the crankcase pressure will be lower than the motor cavity, thus permitting oil or lubricant that has accumulated in the motor cavity to return to the crankcase through check valve assembly **50**.

The check valve assembly **50** has a ball **52** which will close against seat **54** when the pressure in the crankcase rises above the pressure in the motor cavity, thus sealing off the crankcase from the motor cavity. This condition will occur during either start-up or shutdown of the compressor.

The above invention is thus simpler and more efficient than previously used complex mechanical means utilized to evacuate the crankcase and differs in that it achieves a desired result from the effective use of the pumping action inherent in reciprocating compressors.

While the preferred embodiment of the invention has been disclosed, it is understood that the invention is not limited to such an embodiment since it may be otherwise embodied in the scope of the appended claims.

What is claimed is

1. A hermetic refrigeration motor compressor unit of the type having an oil return check valve passage leading from the motor compartment to the compressor crankcase compartment comprising a one-way check valve disposed in said oil return check valve passage to allow oil only to flow from said motor compartment to said compressor crankcase compartment, said crankcase housing defining a plurality of cylinders, a gas equalizing passage defined by at least one cylinder wall, said gas equalizing passage leading from the interior of said crankcase compartment to at least one suction chamber defined by a cylinder head mounted to said crankcase housing, a valve plate disposed between the crankcase housing and the cylinder head and having a suction port communicating the suction chamber with one of said cylinders, and conduit means connected to said gas equalizing passage to positively direct fluid from said crankcase compartment toward said suction port.

2. A hermetic refrigeration motor compressor unit as claimed in claim **1**, wherein said gas equalizing passage is positioned parallel to the axis of each cylinder into which the fluid flow is directed.

3. A hermetic refrigeration motor compressor unit as claimed in claim **1**, wherein said fluid passes through said fluid equalizing passage in response to the pressure of fluid in said crankcase compartment and the reciprocation of a piston movable in said cylinder.

4. A refrigeration motor compressor unit comprising a housing separated by a partition into a crankcase compartment and a motor compartment, said partition also defining an oil return passage connecting said motor compartment with said crankcase compartment, said crankcase compartment defining a plurality of cylinders adapted to receive pistons therein; a valve plate having a plurality of apertures therein mounted to said crankcase compartment, said apertures comprising at least one suction port, a cylinder head mounted to said crankcase compartment and constructed to define at least one suction chamber, a fluid equalizing passage defined by said crankcase compartment housing, conduit means connected to said passage to positively direct fluid flow from said crankcase compartment through said passage toward said suction port.

5. A refrigeration motor compressor unit as claimed in claim **4**, wherein one end of said fluid equalizing passage opens into the interior of said crankcase compartment and the other end of said passage opens into a suction chamber in the cylinder head.

6. A refrigeration motor compressor unit as claimed in claim **4**, wherein said fluid equalizing passage has one end cooperating with the interior of the crankcase compartment and the other end cooperating with said conduit means.

7. A refrigeration motor compressor unit as claimed in claim **4**, wherein said oil return passage has a one-way check valve mounted therein, said one-way check valve allowing fluid flow only from said motor compartment to said crankcase compartment.

8. A refrigeration motor compressor unit as claimed in claim **4**, wherein said conduit means comprises a curved tube.

9. A refrigeration motor compressor unit as claimed in claim **4**, wherein said conduit means is equipped with a discharge nozzle, said discharge nozzle being constructed to change the velocity of flow of fluid passing through said passage.

10. A refrigeration motor compressor unit as claimed in claim **4**, wherein said conduit means is a plate defining a passage, said plate being adapted to be mounted to said valve plate.

11. A refrigeration motor compressor unit as claimed in claim **4**, wherein said conduit means comprises a passage in said valve plate to direct fluid passing through said passage toward such suction port.

12. A hermetic refrigeration motor compressor unit comprising a housing divided by a partition into a crankcase compartment and a motor compartment, said partition defining an oil return passage connecting said motor compartment with said crankcase compartment, said crankcase compartment comprising a housing including a plurality of cylinders adapted to have pistons movably positioned therein, a valve plate mounted to said crankcase housing, said valve plate

having a plurality of apertures therein comprising at least one suction port and at least one discharge port, a cylinder head mounted to said crank-case compartment, said cylinder head defining at least one suction chamber, a fluid equalizing passage defined by at least one of said cylinder walls, said fluid equalizing passage having one end opening into said crankcase compartment and the other end opening into at least one of said cylinder head suction chambers, conduit means connected to said fluid equalizing passage to direct fluid from said passage towards a suction port of said valve plate in response to the suction stroke of a piston.

13. A hermetic refrigeration motor compressor unit as claimed in claim 12, wherein said fluid equalizing passage is also defined by said valve plate.

14. A hermetic refrigeration motor compressor unit as claimed in claim 12, wherein said conduit means comprises a curved tube member, said tube member being threadably mounted in said fluid equalizing passage to form fluid exit means.

15. A hermetic refrigeration motor compressor unit as claimed in claim 14, wherein said curved tube member is substantially "J" shaped.

16. A hermetic refrigeration motor compressor unit as claimed in claim 14, wherein said curved tube member is constructed to fit within a cylinder head suction chamber and to direct fluid flowing from said crankcase compartment through said equalizing passage toward a suction port in said valve plate.

17. A hermetically sealed refrigerant motor compressor unit comprising a housing, said housing defining a crankcase compartment including a plurality of cylinders adapted to have pistons mounted for movement therein and a motor compartment, a partition separating said crankcase compartment and said motor compartment with means to allow fluid flow from the motor compartment to the crankcase compartment and prevent fluid flow from the crankcase compartment to the motor compartment, a valve plate mounted adjacent at least one of said cylinders, said valve plate having a plurality of apertures therein, with at least one of said apertures being a suction port, a cylinder head mounted to said valve plate, said cylinder head defining a plurality of chambers, at least one of said chambers being a suction chamber, at least one of said cylinders defining a fluid equalization passage leading from said crankcase compartment interior to a suction chamber in said cylinder head, conduit means interconnected to said fluid equalization passage to direct fluid flowing from said crankcase compartment through said fluid equalization passage toward said at least one valve plate suction port in said cylinder in cooperation with the suction stroke of the piston, said conduit means comprising a curved tube member having one end positioned in a specific direction pointing towards said inlet port.

18. A hermetically sealed refrigerant motor compressor as claimed in claim 17, wherein said conduit means has a discharge nozzle changing the velocity of said fluid stream passing through said passage.

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