

April 21, 1959

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2,883,101

ROTARY COMPRESSOR

Filed April 16, 1956

FIG. 1

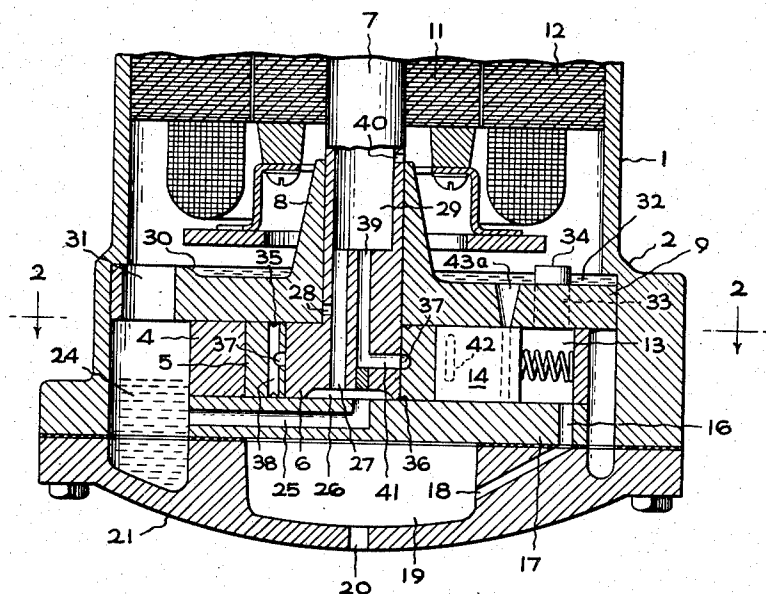


FIG. 2

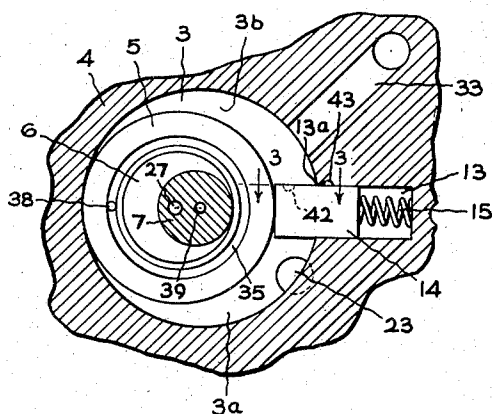
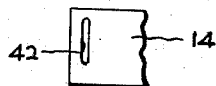


FIG. 3



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ROTARY COMPRESSOR

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Application April 16, 1956, Serial No. 578,399

1 Claim. (Cl. 230—207)

This invention relates to rotary compressors and more particularly to lubrication of the various components of the rotary compressor.

One form of rotary compressor commonly used in refrigeration systems includes an annular chamber within which there is disposed a rotor driven by an eccentric. Rotation of the eccentric is provided by a rotary drive shaft supported by a bearing which forms a portion of one end wall of the annular chamber. A slot is formed in one side wall of the annular chamber and a blade positioned slidably in the slot and biased into engagement with the periphery of the rotor divides the compressor into high and low pressure sides. The eccentric rotation of the rotor in the annular chamber effects compression of a vaporous refrigerant which is drawn into the chamber through a suitable intake port on one side of the blade and discharges compressed refrigerant through a discharge port on the opposite side of the blade.

In order to lubricate properly the bearing surfaces supporting the shaft and other rotating surfaces of the rotor, it is necessary to prevent high pressure refrigerant from leaking around the edges of the rotor and along the sides of the rotor where it can enter and replace the lubricant on these surfaces. When high pressure refrigerant leaks into the bearing surface, it is necessary to employ an extremely high pressure lubrication pumping system in order to maintain the proper pressure levels to assure lubrication of the bearing.

One object of the present invention is to provide improved means for preventing gas from leaking around the sides of the rotor and interfering with the proper lubrication of the shaft bearing.

Another object of the invention is to provide improved means for bleeding off high pressure leakage gas from around the sides of the rotor and venting this gas into the hermetic casing in such a manner that it does not interfere with normal operation of the compressor.

A more specific object of the invention is to provide a series of passageways in the rotor and shaft for bleeding off high pressure gas leakage from around the sides of the rotor and venting it into the hermetic casing.

It is a further object of this invention to provide an improved device for continually replenishing the supply of lubricant within the chamber in order to maintain the proper seal between the rotor and the chamber walls.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of the invention there is provided within a hermetically sealed casing a compressor unit having an annular chamber and a rotor eccentrically rotatable within the chamber. A slot formed in one side wall of the annular chamber carries a recip-

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rocable blade which is biased into engagement with the periphery of the rotor thereby dividing the chamber into high and low pressure sides. A shaft supported by bearings disposed in one or both end walls of the annular chamber is provided for driving the rotor, and contains a cavity which is vented into the main portions of the hermetic casing. In order to prevent high pressure gas from leaking along the rotor sides and into the bearings, annular channels are provided around the sides of the rotor member connecting with passageways within the rotor which, in turn, communicate with the cavity in the drive shaft and through which high pressure gas is bled off from along the sides of the rotor and vented into the hermetic casing. A further aspect of the present invention is the provision of a groove formed in the reciprocating blade which aligns with an oil supply passage during the retracted portion of its stroke thereby taking on a charge of oil. Then, during the extended portion of its stroke, the blade dumps the oil within the annular chamber, thereby continually replenishing oil within the chamber.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

Fig. 1 is a side elevation view, in section, of a hermetic refrigerant compressor incorporating an embodiment of the invention;

Fig. 2 is a partial plan view taken along the line 2—2 of Fig. 1; and

Fig. 3 is a partial elevation view of the blade with its oil metering groove, taken along line 3—3 of Fig. 1.

Referring to the drawing, there is shown a hermetic compressor including a hermetic casing 1 in which is disposed a refrigerant compressor unit 2 having an annular chamber or compression chamber 3 defined within a cylinder or housing 4. Disposed for rotation within the chamber 3 is a rotor 5 which is driven by an eccentric 6 formed as an integral part of the drive shaft 7. A bearing 8, which with its supporting frame 9 define the upper end wall of the annular chamber 3, supports the shaft 7 for rotation by the rotor 11 of the motor unit 12.

As better seen in Fig. 2, a radial slot 13, which communicates with the chamber 3, is provided in the cylinder or housing 4. Positioned slidably in radial slot 13 is a blade 14 which is biased into engagement with the rotor 5 thereby dividing the chamber 3 into high and low pressure sides 3a and 3b. Upon rotation of the rotor 5, the blade 14 reciprocates back and forth within slot 13. In the present modification, the blade 14 is biased into contact with the rotor 5 by means of a spring 15 and also by high pressure gas ported into the radial slot 13 behind blade 14. The gas is ported into the radial slot through a passage 16 in the bottom plate 17 which defines the bottom end wall of the chamber 3. Passage 16 connects with passageway 18 which communicates with the high pressure gas discharge chamber 19 formed in end cap 21. High pressure refrigerant is directed into the discharge chamber 19 through a suitable passage (not shown) in the bottom plate 17 communicating with discharge port 23 of the chamber 3. From the discharge chamber 19, high pressure refrigerant passes through the outlet port 20 to a line leading to a condenser (not shown).

In order to provide a source of lubricating oil for the various bearing surfaces of the compressor unit, there is employed a reservoir or body of oil 24 in the lower portion of the hermetic casing. A passage 25 in the bottom plate 17 provides an access for the oil to the bottom of the eccentric 6 on the lower end of the drive shaft 7. For the purpose of pumping lubricant to the bearing 8 which is disposed above the body of the oil 24, a cen-

trifugal pumping arrangement is provided, including a lubricant passage in the shaft 7 having its lower or inlet end at the center of rotation of the shaft below the oil level in the reservoir 24. In the modification shown, there is a horizontal radially extending groove which with the bottom plate 17 forms a radial passage 26. In connection with radial passage 26 is vertical passage 27 parallel to but offset from the vertical axis or center of rotation of the shaft. By this arrangement oil entering the radial passage 26 through the passage 25 in the bottom plate 17 is subjected to centrifugal force set up by the rotation of the shaft which cause the oil or lubricant to flow upwardly along the vertical passage 27. Lubricant flows through an oil port 28 which connects the vertical passage 27 with the surface of bearing 8.

In accordance with the present invention the low pressure lubricant pumping arrangement described above is designed to provide an amount of lubricant in excess of that normally required for proper lubrication of the bearing. The excess oil accumulates in a cavity 29 which extends into the upper portion of the drive shaft 7, and is forced by centrifugal force against the inner surfaces of the cavity 29, whereupon it flows upwardly and out the oil escape port 40 in the shaft 7 positioned at a point above the bearing 8. Gravitational forces cause the excess oil to flow down the outer surfaces of bearing 8 into the upper surface of the bearing supporting frame 9 from where most of it returns to the main reservoir 24 through a suitable channel 31 in the supporting frame 9. A slight embossment 30 around the oil return channel 31 causes oil to collect upon the upper surface of the supporting frame 9 before spilling over into the return channel 31. This portion of the supporting frame surface is designated the intermediate oil reservoir 32, the function of which will be later described.

A compressor of this type is adapted to be connected into a refrigerant system to receive suction gas from the evaporator directly to the interior of the hermetic casing, with the refrigerant gas substantially filling the space within the casing. A gas inlet port 33 leading to the low side 3b of the compression chamber 3 is provided within the bearing supporting frame 9 through which refrigerant is drawn for compression within the chamber 3. A suitable barrier or tube 34 is provided within the gas inlet port 33 to prevent oil which collects on the intermediate oil reservoir 32 from entering the gas inlet port 33.

With the case at a low or suction pressure, it is necessary to prevent high pressure gas from leaking around the sides of the rotor 5 and into the surface area of the bearing 8. To avoid this, a pair of continuous annular leakage gas bleed off grooves 35 and 36 are formed on the side faces of the rotor member 5. Joining the annular grooves 35 and 36 with an annular channel 37 machined into the inside diameter of the rotor is a relief or outlet passage 38. A second longitudinal passageway 39 located centrally within the shaft has a port 41 which communicates with the annular channel 37 on the inside diameter of the rotor 5. By this arrangement, high pressure gas leaking along the sides of the rotor is bled off through the annular grooves 35 and 36 and from there through the passageway within the rotor into the centrally located passageway 39 within the shaft, whereupon it escapes along the cavity 29 within the shaft 7 into the main portion of the casing through a vent or port (not shown) in the upper section of the drive shaft 7. By this venting arrangement, the high pressure gas is prevented from passing inwardly along the rotor faces toward the shaft and the bearing surface beyond the annular grooves 35 and 36 on the side faces of the rotor. This enables the use of a low pressure oil pump, such as the centrifugal pumping arrangement described above, since the lubricating oil does not have to be forced against the high pressure gas leakage along the rotor sides.

High pressure gas leaking along the sides of the rotor

into grooves 35 and 36 carries with it a considerable amount of oil from within the compression chamber 3 itself. A certain quantity of oil also passes from the compression chamber with the discharge gas through the discharge port 23 in the bottom plate 17. Proper operation of the compressor unit makes the replenishment of this lost oil a necessity. In order to provide this function, a groove or oil discharge cavity 42 is provided in one side of the blade 14 a short distance from the leading edge of the blade which engages the rotor 5. When the blade is in its retracted position within slot 13, the discharge cavity 42 is in direct alignment with an oil passage 43 formed in one side of the radial slot 13 and leading to the outer surface of the bearing supporting frame 9 and communicating through oil port 43a with the intermediate oil reservoir 32. At this point the discharge cavity 42 is completely sealed from the chamber 3 by the side of the radial slot 13 to prevent escape of gas. It also, while in this position, fills with oil which flows from the intermediate oil reservoir 32 through the oil passage 43 into the cavity 42. Then as the blade goes forward into the compression chamber 3 the groove or discharge cavity 42 is uncovered and dumps its oil into the compression chamber itself. The present embodiment of the invention shows the groove 42 formed upon the low pressure side of the blade 13 and, as best shown in Fig. 3, the groove 42 is so positioned that it begins a short distance below the upper edge of the blade and terminates a short distance above the bottom edge of the blade. Material remaining above and below the groove on the blade will provide a continuous sliding surface to facilitate the reciprocation of the blade and prevent knocking between the groove 42 and the slot inlet corner 13a.

It is to be understood that the above type of oil metering system does not depend upon whether the compressor unit involves the use a low pressure case or a high pressure case, since the oil delivery into the compression chamber only depends upon the reciprocation of the blade 14. Lubricating oil could be introduced into the discharge cavity 42 through use of means other than from a reservoir and an oil passage located directly above the blade, and the applicant does not desire the invention to be limited to the particular form shown and described.

By the present invention there has been provided a low cost lubrication arrangement which insures the requisite lubrication of the bearing by providing means for bleeding off the high pressure gas and oil leakage past the sides of the rotor and eliminating the requirement for the forcing of the lubricating oil against the high pressure gas and oil leakage at the bearing surface. This invention has its greatest utility in those types of compressor arrangements using a "low side case" where the hermetic casing is filled with suction gas that is at a low pressure compared to the high pressure discharge gas and, consequently, where there is a great tendency for leakage of high pressure gas into the low pressure area within the casing. Since more than the normal amount of oil will be carried off with the leakage gas in the use of this system, the invention also contemplates the use of the oil metering device for replenishing the oil supply within the compression chamber. The advantage of such an oil metering system is that it utilizes functional parts already present in the compressor's system and requires no costly innovations or changes in the system in order to provide a replenishment of the lubricant to the compression chamber.

While there has been shown and described a specific embodiment of the present invention, it is to be understood that the invention is not limited to the particular form shown and it is intended, by the appended claim, to cover all modifications within the spirit and scope of the invention.

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What I claim as new and desire to secure by Letters Patent of the United States is:

A hermetically sealed rotary refrigerant compressor comprising a hermetic casing containing a low pressure refrigerant vapor, a motor positioned in the upper portion of said casing, a compressor unit positioned in the lower portion of said casing and including a cylindrical compression chamber, a rotor eccentrically rotatable within said chamber, a shaft extending downwardly from said motor into said compressor unit, an eccentric portion on said shaft extending into said rotor for driving said rotor during rotation of said shaft, said shaft having a passage which communicates in the upper portion of said casing with said low pressure refrigerant vapor, said passage having an inlet port extending to the circumference of said eccentric portion of said shaft, a bearing supporting said shaft and forming one side wall of said compression chamber, lubricating means for supplying lubricant to said shaft bearing surface, and means for bleeding off high pressure gas leaking along the sides of said rotor toward said shaft bearing surface, said bleed off means comprising a continuous annular groove formed around each side of said rotor and completely encircling said eccentric in said rotor, an outlet passage extending

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through said rotor and connecting with each of said annular grooves, an annular channel formed on the inside diameter of said rotor, said annular channel connecting with said outlet passage through said rotor and communicating on its inward side with said inlet port on the circumference of said eccentric portion at all times during rotation of said eccentric portion so that leakage gas is bled through said annular bleed off grooves and said rotor outlet passage around said bearing surface into said hermetic casing.

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