

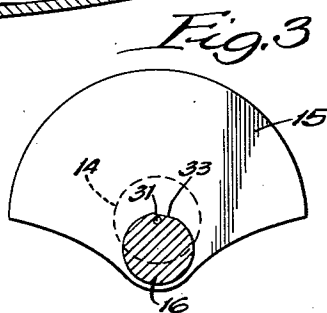
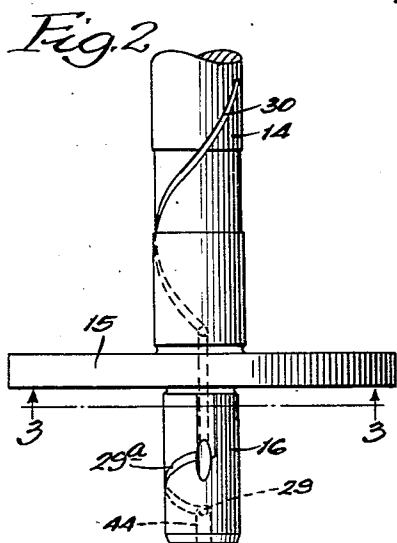
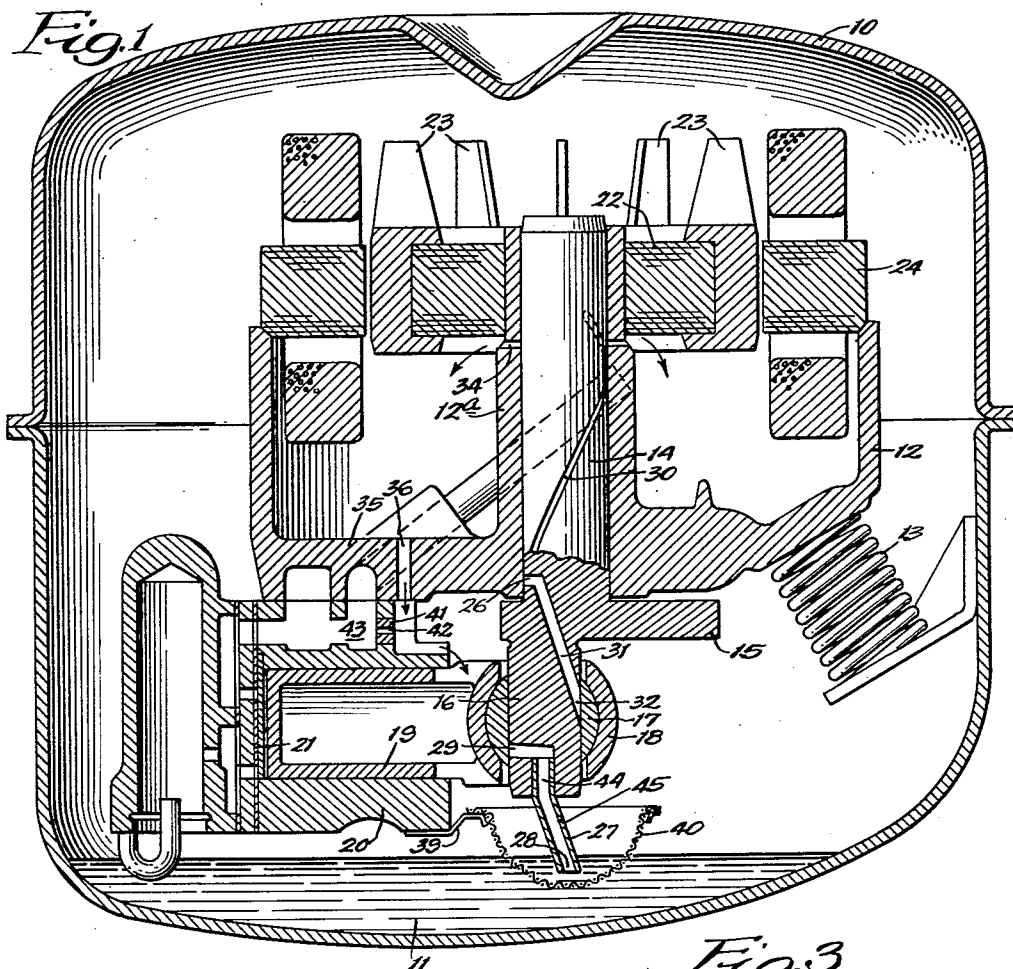
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COMPRESSOR AND LUBRICATING MEANS THEREFOR

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COMPRESSOR AND LUBRICATING MEANS THEREFOR

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6 Claims. (Cl. 230—206)

This invention relates to a compressor and lubricating means therefor. The invention is particularly useful in connection with the application of motor compressor units adapted for compressing or pumping fluids as, for example, for compressing a fluid used in refrigerating apparatus, such as Freon, methyl chloride, etc. It will be understood, however, that the invention is applicable to a variety of compressors and similar structures.

Compressors have heretofore been employed in which eccentric crank pins have been connected with pistons and in which oil passages have been in communication with a pool of oil in the shell of the compressor unit, the oil being moved through the passages by centrifugal pumping action. Patent No. 2,146,097, dated February 7, 1939, to Touborg, shows such a structure, capable of carrying the oil to a fair extent through the crank pin, but it has been difficult to carry oil effectively to higher points. This difficulty has been caused, at least in part, by the fact that particles of liquid refrigerant become entrained in the lubricating oil and as the oil moves up the passage, the surface of which is warmed by the friction of the crank pin moving within the crosshead, the entrained refrigerant vaporizes and vapor or gas so formed serves to break the continuity of the flow of oil in the passage, interrupting lubrication of the moving parts.

One of the main objects of the present invention is to provide effective means for lubricating the driving shaft and the bearing surfaces of moving parts of a compressor unit or similar structure, particularly the upper portions thereof. Another object is to provide means for preventing vapor that may become entrained in the lubricant from interrupting lubricant flow. A further object is to provide simple and efficient means for separating vapor from the lubricant and for removing vapor from the lubrication channels so as to permit an uninterrupted flow of lubricant to the surfaces of the moving parts. Other specific objects and advantages will appear as the specification proceeds.

The invention is shown in an illustrative embodiment by the accompanying drawing, in which—

Fig. 1 is a vertical sectional view of a compressor unit equipped with oil-feeding means and vapor separating means embodying our invention; Fig. 2, a broken side view in elevation of the vertical shaft and crank pin; Fig. 3, a sectional detail view, the section being taken as indicated at line 3—3 of Fig. 2.

Within the shell 10 is mounted a chassis or frame 12 which may be supported by a plurality of springs 13 or other means so that the lower portion of the chassis or frame is above the pool of oil. Within the frame 12 is mounted a vertical shaft 14 equipped with a weight member 15 and with an eccentric or crank pin 16. The crank pin 16 is mounted within a slide member or cylindrical crosshead 17 and the crosshead 17 is slidably mounted within the cylindrical yoke 18. The yoke 18 is sealed or otherwise secured to a piston 19 slidably mount-

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ed within a cylinder 20. The piston chamber is controlled by a wafer valve 21 of well-known construction and the frame provides the usual inlet and outlet passages communicating with the piston chamber. Since the frame and compressor unit structure is well-known in the art, it is believed that a detailed description herein is unnecessary. No claim herein is made to the compressor structure per se. The general organization and operation of the compressor unit is set out in detail in Touborg Patent No. 2,146,097, which issued February 7, 1939.

Suitable means for rotating the shaft 14 may be provided. In the illustration given, a rotor 22 is secured to the upper end of the shaft 14 and the rotor is provided with cooling vanes 23. A stator 24 is carried by the casing around the rotor 22.

The lower portion of the crank pin 16 is provided with a short vertical passage 44. Passage 44 extends upwards along the vertical axis of crank pin 16 and connects with a horizontal passage 29 extending to the lateral surface of the crank pin. An oil pickup tube 27, having a substantially uniform diameter throughout its entire extent and formed of heat conductive material is inserted and secured in the vertical passage 44, the tube being bent so that inlet 28 of the pickup tube 27 is substantially in alignment with the vertical axis of shaft 14. In the wall of the pickup tube 27 near the base of the crank pin 16 there is a small vent or aperture 45 directed toward and adjacent to the vertical axis of shaft 14.

The shaft and its crank pin are also provided with an inclined passage 31. The lower end of passage 31 is located on the surface of crank pin 16 at a point opposite and slightly above the outlet of the horizontal passage 29, and is connected therewith by a spiral groove 29a. The inclined passage 31 extends upwardly and terminates at outlet 26 in the surface of shaft 14. From the outlet 26 of the inclined passage 31 there extends upwardly along shaft 14 a spiral groove 30, as shown in Figs. 1 and 2, for leading oil upwardly about the shaft. The lower end of passage 31 is closer to the vertical axis of shaft 14 than the outlet 26, and a portion of the surface area of the crank pin is flattened at 33.

The inner frame portion 12a about shaft 14 is preferably provided near its top with an overflow passage 34 permitting oil to be fed from the top of passage 30 through overflow passage 34 and into a receptacle 35 provided by the frame 12. The oil within receptacle 35 flows downwardly through passage 36. Plug 41 contains an orifice 42, said orifice being of predetermined size, that connects with the suction chamber of the compressor and a portion of the downwardly flowing oil is drawn through this orifice. The balance of the oil in its downward flow follows the path shown in Fig. 1, flowing over and lubricating the walls of the piston 19 after which the oil flows to the bottom of the shell 10.

The cylinder 20 may be equipped with a bracket 39 for supporting a screen or filter 40 which extends about the inlet 28 of tube 27.

Operation

In the operation of the compressor apparatus, and more particularly the lubricating means thereof, shaft 14 is rotated by the operation of the rotor 22 and stator 24 and the eccentric 16 is rotated. In this operation, while the eccentric moves in a circular course, sliding the crosshead 17 back and forth and moving the yoke 18 and piston 19 back and forth, the intake portion of the pickup tube 27 remains substantially in line with the longitudinal axis of shaft 14, and rotates in the oil and liquid refrigerant mixture of pool 11. Since the pickup tube extends upwardly toward the vertical axis of crank pin 16

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and away from the vertical axis of shaft 14, centrifugal force produced by the rotation of the pickup tube causes fluid from pool 11, in which intake 28 is immersed, to flow upwardly into horizontal passage 29.

The liquid refrigerant in the oil and refrigerant mixture has a fairly low vaporization temperature so that the application of a small amount of heat causes the refrigerant to vaporize. As the fluid rises in tube 27 during rotation of the shaft 14 the frictional heat generated by the movement of the eccentric pin 16 relative to the slide member 17 and also the heat generated by the relative movement between the members 17 and 18 heats the oil and refrigerant mixture and causes the refrigerant to pass into a vapor state. The oil, being heavier than the vaporized refrigerant, is directed by centrifugal force away from the portion of the pickup tube closest to the vertical axis of shaft 14. The outward pressure created by the expanding vapor within the tube 27 having walls of uniform diameter, and the upward force produced by the oil moving upwardly under the influence of centrifugal force, expels the vapor through vent 45. Vapor which would otherwise tend to form bubbles and vapor-lock the lubricating system is thereby discharged to allow a continuous upward flow of oil for lubrication of the moving parts.

The oil thrown out through the passage 29 by centrifugal force moves upwardly along the groove 29a to the flat 33 and the lower end 32 of the inclined passage 31. The flat serves as a metering device to pass a portion of the oil upwardly along the surface of the crank pin 16 and thence downwardly to lubricate the surface between the crosshead 17 and the cylindrical yoke 18. The greater portion of the oil is carried by centrifugal force upwardly along the inclined passage 31, out the opening 26 and thence upwardly along the spiral groove 30. In its upward movement, the oil lubricates shaft 14. Upon reaching the top of groove 30 the oil flows downwardly through overflow passage 34, thereby lubricating the thrust bearing surfaces, and into receptacle 35 in the frame, thence through passage 36 past the plug 41 in which there is an orifice 42. The pressure differential between the side of the orifice exposed to the suction chamber 43 and the opposite side of said orifice, combined with the aspirator effect of the gaseous refrigerant passing the surface of the orifice plate exposed to the suction chamber, draws a metered quantity of the downwardly flowing oil through the orifice 42 and into the suction chamber 43 where it is picked up by the refrigerant to lubricate the surfaces of the suction and discharge valves and the forward bearing surfaces of the piston 19 and cylinder 20. The balance of the downwardly flowing oil passes across and lubricates the surface of the reciprocating piston 19 and then flows into the pool of oil at the bottom of the compressor shell.

While the oil mechanism has been described specifically in connection with a compressor unit, it will be understood the invention is applicable to other rotating devices in which it is desired to draw oil from a pool upwardly through rotating parts whose surfaces are to be lubricated. The lubricating area shown is, however, particularly useful in connection with a compressor of the construction shown.

While in the foregoing specification we have shown a specific lubricating device in considerable detail for the purpose of illustrating an embodiment of the invention, it will be understood that such details of structure may be varied widely by those skilled in the art without departing from the spirit of our invention.

We claim:

1. In a compressor unit having a shell provided with a chamber adapted to support a fluid mixture in the lower portion thereof, a substantially vertical shaft rotatably mounted within said shell, an eccentric crank pin provided at the lower end of said shaft, said crank pin having an upwardly extending passage at the lower por-

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tion thereof and communicating with the lateral surface of said crank pin at a point laterally spaced from the axis of said shaft, said crank pin being provided at the lower portion thereof with a fluid pickup tube communicating with said upwardly extending passage, said pickup tube being inclined downwardly and outwardly and toward the vertical axis of said shaft and having a lower fluid intake portion substantially in alignment with the vertical axis of said shaft, said pickup tube having a substantially uniform cross sectional area along its length and having a lateral aperture in the wall of said tube above the oil level in said compressor and disposed toward the vertical axis of said shaft, whereby, upon rotation of said shaft and said eccentric crank pin, fluid mixture is drawn upwardly by centrifugal force into said inclined pickup tube, the denser components of said mixture passing through said tube into said upwardly extending passage and the lighter components of said fluid mixture being forced through said lateral aperture.

2. The structure of claim 1, in which said crank pin has an inclined passage having an upper outlet in the surface of said shaft and a lower inlet in the surface of said crank pin, said lower inlet of said inclined passage being in general alignment with the vertical axis of said shaft, said crank pin also having a peripheral groove communicating with the lower inlet of said inclined passage and with said upwardly extending passage.

3. In a compressor unit having a shell provided with a chamber adapted to support a fluid mixture in the lower portion thereof, a substantially vertical shaft rotatably mounted within said shell, an eccentric crank pin provided at the lower end of said shaft, said crank pin having an upwardly extending passage at the lower portion thereof and having an outwardly extending passage communicating with the upper end of said upwardly extending passage and with the lateral surface of said crank pin, said crank pin being provided at the lower portion thereof with a fluid pickup tube communicating with said upwardly extending passage and having an inclined passage provided with an outlet on the surface of said shaft and with a lower inlet on the surface of said crank pin substantially in alignment with the vertical axis of said shaft, said pickup tube being inclined downwardly and outwardly and toward the axis of said shaft and having a lower fluid intake portion substantially in alignment with the vertical axis of said shaft, said pickup tube having a substantially uniform cross sectional area along its length and having a lateral aperture in the wall of said tube disposed toward and adjacent to the vertical axis of said shaft, said crank pin having a peripheral groove communicating with the lower inlet of said inclined passage and with said outwardly extending passage, and said shaft having a spiral peripheral groove communicating with the outlet of said inclined passage on the surface of said shaft.

4. In a structure of the character set forth, a shell providing a chamber adapted to support a lubrication mixture in the lower portion thereof, an inner frame supported within said shell, a substantially vertical shaft rotatably mounted in said frame and provided with an eccentric crank pin at the lower end thereof, a cylinder rigid with said frame having a piston movably mounted therein, and a driving connection between said crank pin and said piston, said crank pin being provided at the lower portion thereof with a downwardly and outwardly extending intake tube having a lower inlet portion substantially in alignment with the axis of said shaft, said crank pin also being provided with a lower passage therethrough communicating with the upper portion of the intake tube and terminating in an outlet on the lateral surface of said crank pin, the lower inlet portion of said intake tube being immersed in the lubrication mixture in the lower portion of the chamber so that centrifugal action causes the lubrication mixture to flow upwardly in said intake tube when said shaft and crank pin are rotated, and said intake tube having a substantially uniform cross

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sectional area along its length and having a lateral aperture in the wall of said tube disposed toward the vertical axis of said shaft for the escape of vapor displaced from said lubrication mixture.

5. The structure of claim 4, in which said crank pin has an upper inclined passage therein terminating on the lateral surface of said shaft and having an inlet on the lateral surface of said pin above and diametrically opposite the outlet of said lower passage, and means for providing a flow of lubricant from the outlet of said lower passage to the inlet of said inclined passage.

6. In a structure of the character set forth, a shell providing a chamber adapted to support a lubrication mixture in the lower portion thereof, a substantially vertical shaft rotatably mounted in said shell and provided with an eccentric crank pin at the lower end thereof, said crank pin being provided at the lower portion thereof with a downwardly and outwardly extending intake tube having a lower inlet portion substantially in alignment with the axis of said shaft, said crank pin being provided with a lower passage therethrough communicating with the upper portion of said intake tube and terminating in an outlet

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on the lateral surface of said crank pin, said crank pin having an upper inclined passage therein terminating on the lateral surface of said shaft and having an inlet on the lateral surface of said crank pin above and diametrically opposite the outlet of said lower passage, said crank pin also being flattened about the inlet of said inclined passage, means for providing a flow of lubricant from the outlet of said lower passage to the inlet of said inclined passage, and said intake tube having a substantially uniform cross sectional area along its length and having a lateral aperture in the wall thereof directed toward the vertical axis of said shaft for the escape of vapor from said lubrication mixture.

References Cited in the file of this patent

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