July 8, 1947. G. MUFFLY 2,423,719

MOTOR-COMPRESSOR UNIT LUBRICATION

Filed Jan. 5, 1940 2 Sheets-Sheet 1

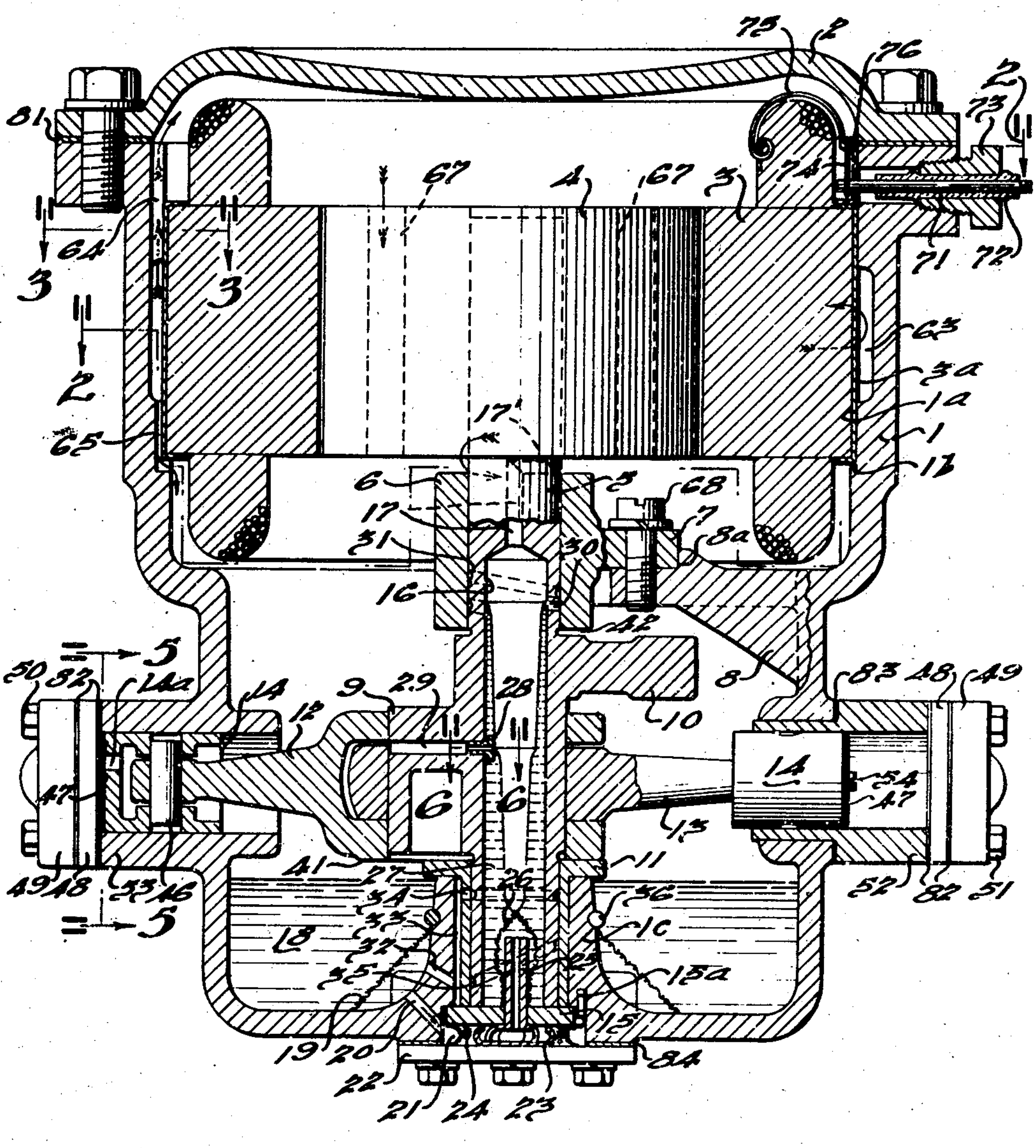

FIG. 1.

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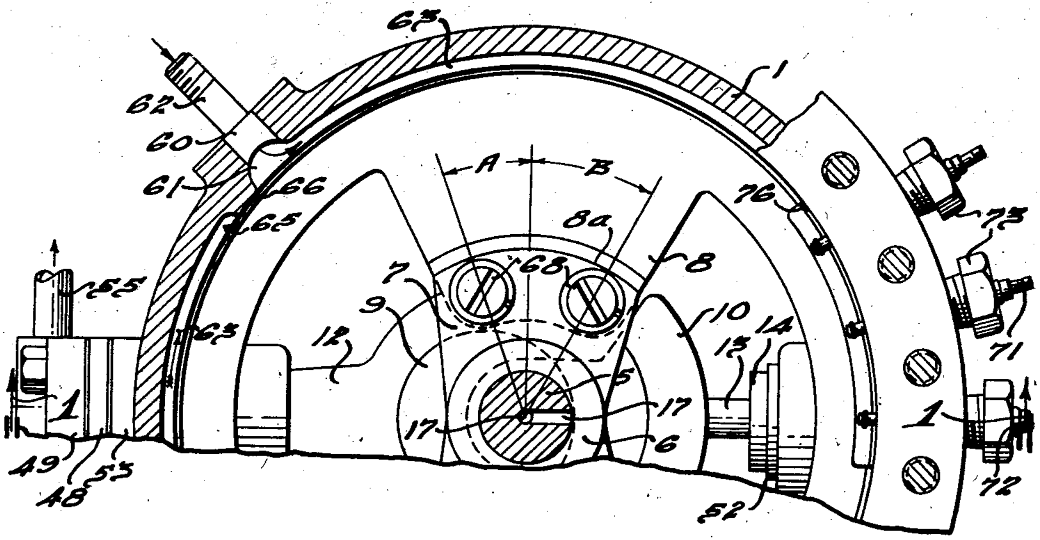
FIG. 2.



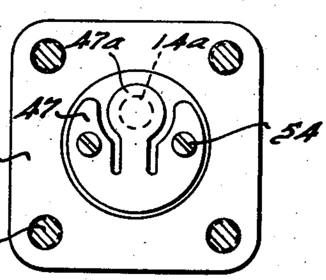


FIG. 5.

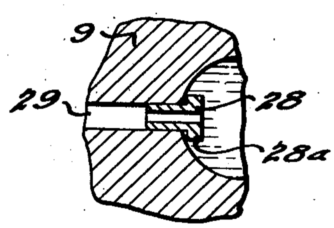


FIG. 6.

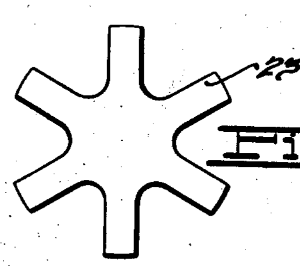
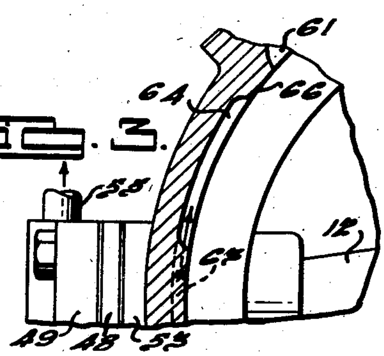


FIG. 4.

FIG. 3.



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MOTOR-COMPRESSOR UNIT LUBRICATION

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Application January 5, 1940, Serial No. 312,564

8 Claims. (Cl. 230—206)

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This invention relates to refrigerating mechanism and particularly to a sealed motor-compressor unit therefor, the principal object being the provision of a mechanism of this type that is simple in construction, efficient in operation and economical to manufacture.

Other objects of the invention include the provision of a motor-compressor unit particularly adapted for use in connection with refrigerating mechanism in which special provisions are provided for abstracting heat from the driving motor to prevent the same from becoming overheated; the provision of a motor-compressor unit in which the refrigerant introduced into the unit is caused to flow around the periphery of the motor stator before being liberated in the interior of the unit; the provision of a construction as above described in which the refrigerant after circling the periphery of the motor stator is then caused to flow downwardly through the rotor and between the rotor and stator to further effect a cooling of the same; and the provision of a construction as above described in which means are provided for separating out oil from the refrigerant before it is passed upwardly over the motor, and delivering such separated oil directly to the lower part of the housing.

Other objects of the invention include the provision of a novel form of lubricating means for the various parts of a motor-compressor unit; the provision of a sealed motor-compressor unit having means for lubricating the parts thereof so constructed and arranged as to keep the lubricant substantially out of contact with the rotor and stator of the driving motor; the provision of means for lubricating a sealed motor-compressor unit in which definite quantities of lubricant may be fed to different moving parts of the unit; the provision of a lubrication system for a sealed motor-compressor unit which eliminates the necessity of requiring any separate lubricant circulating mechanism; and the provision of a construction as above described in which a portion of an entrapped mass of lubricant is fed to the interior of one of the rotating parts of the mechanism and acted upon by centrifugal force therein to distribute the lubricant in measured quantities to desired points of discharge.

Further objects of the invention include the provision of a sealed motor-compressor unit having certain novel features of construction facilitating the manufacture and assembly of the entire structure whereby a more efficient, more reliable device is provided that may be readily

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and efficiently serviced and is relatively economical to manufacture.

The above being among the objects of the present invention the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which show a suitable embodiment of the present invention and in which like numerals refer to like parts throughout the several different views,

Fig. 1 is a vertical sectional view taken axially through a motor-compressor unit of my improved design;

Fig. 2 is a fragmentary transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary transverse sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a plan view of the supporting member for the thrust washer for the motor shaft in its original blank form and before being bent to shape;

Fig. 5 is an enlarged vertical sectional view taken transversely through one of the cylinders as on the line 5—5 of Fig. 1; and,

Fig. 6 is an enlarged fragmentary horizontal sectional view taken on the line 6—6 of Fig. 1.

Referring to the accompanying drawings and particularly to Fig. 1 it will be noted that the motor-compressor unit includes a cast main body portion or housing 1 having an open top end which is closed by a cover 2 through the use of suitable bolts or screws as shown. The housing 1 has an integral bottom wall centrally provided with an upstanding hollow boss 1c the bore of which extends through the bottom wall and is normally closed by means of the plate 22 in conjunction with suitable bolts or screws as shown. While the drawings show a unit having a vertical axis, it is to be understood that most of the features of this invention apply equally to an assembly having its shaft disposed at any other angle, in some cases employing means other than gravity for moving oil to the point from which centrifugal force moves it.

The upper end of the housing 1 is slightly larger than the lower end and is provided with a cylindrical bore 1a over the area where the stator 3 for the electric driving motor is adapted to be received. As will hereinafter be more fully explained a refrigerant circulating passage is formed between the periphery of the stator 3 and the housing 1 and for this reason the periphery of the stator 3 is preferably arranged to form a substantially fluid tight seal with the walls of the bore 1a. This may be accomplished in several ways as, for instance, by accurately machining the periphery of the stator 3 to the right size for a light press fit in the bore 1a where the periphery of the stator is of a continuous and unbroken nature; it may be accomplished by pressing a sheet metal or other sleeve into the bore 1a and then pressing the stator 3 into such sleeve; or it may be accomplished by surrounding the exterior of the stator with a light sheet metal or other sleeve of the required size to have a light press fit into the bore 1a. Where such sleeve is employed it is to be considered as a part of the stator 3 for the purpose of the present invention. The last described form is shown by way of illustration and the surrounding sleeve is indicated at 3a. Its location axially of the housing 1 is determined by means of a small step or shoulder 1b formed in the bore 1a and against which the lower end of the sleeve 3a is adapted to abut.

The rotor 4 for the driving motor is, of course, positioned within the stator 3 and concentric to it and is pressed upon the upper end of the drive shaft 5 which extends downwardly therefrom to a point within and adjacent the lower end of the hollow boss 1c on the bottom wall of the housing 1. Immediately below the rotor 4 the shaft 5 is mounted in a removable bearing 6 supported through its integral and oppositely extending lugs 7 upon the inner end of a pair of opposed and inwardly extending brackets or arms 8 formed integrally with the housing 1 at their outer ends. The peripheral surfaces of the lugs 7 are machined concentrically with the axis of the bearing 6 and the arcuate inner surfaces of shoulders on the arms or brackets 8 are machined to form a flat surface and an arcuate shoulder 8a or locating surface to insure the concentricity of the bearing 6 with respect to the axis of the housing 1 at all times. The lugs 7 are secured to the brackets 8 by means of screws 68 passing down through the lugs and threading into the brackets. The rotor 4 is provided with a plurality of vertical holes 67 extending downwardly therethrough, each disposed with its axis at the same distance from the axis of the shaft 5 as the axis of the screws 68 so that any one of the holes 67 may be brought into alignment with any one of the screws 68 and a screw driver projected down through any one of such aligned holes 67 to enable the screws 68 to be manipulated. As indicated in Fig. 2, the lefthand screw 68 is located on a line passing through the axis of the shaft 5 disposed at an angle A with respect to the vertical center line of such figure, while the righthand screw 68 is located on a similar line disposed at an angle B to the right of such vertical center line. Corresponding screws 68 which pass through the remaining lug 7 are similarly disposed, that is, the lefthand screw is disposed on a line extending at an angle A to the left of the vertical center line and the remaining screw 68 on a line disposed at an angle B to the right of the vertical center line. The angles A and B being different, it will be appreciated that there is only one position in which the bearing 6 may be assembled to the brackets 8 and this feature is of importance in view of the fact that the bearing 6 is preferably bored while secured in position in the casing 1 and may, therefore, be always returned to its original position after removal.

The lower end of the shaft 5 is rotatably received in a shouldered or flanged bearing bushing 1 which is pressed into the bore of the hollow boss 1c on the bottom wall of the casing with its shoulder or flange abutting the upper end of the boss and overlying the same.

The shaft 5 is provided with an eccentric 9 and a counterweight 10, preferably formed integrally therewith, as indicated. The counterweight 10 is shaped to permit it to be passed downwardly with the shaft 5 between the righthand margins of the brackets 8, as viewed in Fig. 2, and its radially outer surface is disposed at a smaller distance from the axis of the shaft 5 than the bore of the stator 3, so as to permit it to be passed through the stator 3. The angle between the lefthand margins of the brackets 8, as viewed in Fig. 2, is such and the inner ends of the brackets 8 are so shaped as to permit the eccentric 9 to be passed vertically through them with the shaft 5 positioned concentrically of the housing 1.

The weight of the shaft 5 and its rigidly connected parts, including the rotor 4, eccentric 9 and counterweight 10, is carried on a thrust disc or bearing 15, which is firmly clamped against the annular shoulder formed in the bottom portion of the bore of the hollow boss 1c by means of a deformable sheet metal part 23 and is prevented from turning by a pin 15a. The part 23 as originally blanked out is indicated in Fig. 4 and the various fingers thereof are then upwardly and inwardly bent as indicated in Fig. 1. Originally the vertical dimension of the part 23 is greater than that capable of permitting it to be received between the thrust disc 15 and the cover 22 so that when the cover 22 is screwed into place the fingers of the part 23 are sufficiently crushed down to permit its reception in the space provided. The material from which the part 23 is constructed is preferably of sufficient resiliency or deformability as to allow it to bend and to maintain the thrust disc 15 firmly pressed up against its coaxial shoulder in the bore of the boss 1c after repeated disassembly and re-assembly.

A pair of cylinders 52 and 53, here shown as diametrically opposed, are carried by the housing 1 at opposite sides thereof, the cylinders 52 and 53 are shown aligned with each other and with their common axis passing through the eccentric 9 midway the height thereof. The cylinder 52 in the construction shown is formed separately from the housing 1 and has a reduced inner end closely received in a corresponding opening formed for its reception in the wall of the housing 1. Two or more cylinders may be used and all removably attached like 52 if desired. The cylinder 53 in the particular construction shown is formed integrally with the housing 1. Each cylinder 52 and 53 is provided with a conventional valve plate 48 and cylinder head 49. In the case of the cylinder 53, its corresponding valve plate 48 and cylinder head 49 is secured to it by means of bolts 50 passing through the cylinder head and valve and threaded into the cylinder. In the case of the cylinder 52, bolts 51 passing through the corresponding cylinder head 49 and valve plate 48 also pass through the cylinder 52 and are threaded into the housing 1 not only to secure the cylinder head and valve plate to the cylinder, but also to secure the cylinder to the housing 1.

Each of the cylinders 52 and 53 is provided with a piston 14 reciprocally received therein and each piston is connected by means of a wrist pin 46 and connecting rod to the eccentric 9. The connecting rod 12 which connects the lefthand piston 14 with the eccentric 9, as viewed in Fig. 1, has a bifurcated or forked inner end receiving the upper and lower portions of the eccentric 9 therein and the connecting rod 13 which connects the righthand piston 14 with the eccentric is a straight type of rod the inner end of which is engaged about the eccentric 9 between the forks of the connecting rod 12. The lower face of the big end of the connecting rod 12 bears upon and is supported by the upper flanged face of the bearing 11, while the equivalent face of the rod 13 bears upon and is supported by the upper face of the lower forked arm of the rod 12. There may be two or more forked rods with or without the one straight rod, but preferably each forked rod has a bearing that straddles the center line of its piston on the eccentric 9, one rod having a thrust bearing on bushing 11 and each other one on another rod.

Although the particular type of piston and valve mechanism employed in connection with the cylinders 52 and 53 forms no part of the present invention and may be of any conventional type as, for instance, the type wherein the heads of the pistons are solid and a passage independently of the pistons communicates the compression space of each cylinder with the interior of the housing 1, for the purpose of illustration each piston 14 is shown as of the type having a gas passage 14*a* through the head thereof and, as best illustrated in Fig. 5, the head of each piston is fitted with a thin valve member 47 overlying the outer end thereof including a readily flexible portion 47*a* covering the corresponding gas passage 14*a* and cooperating with the gas passage 14*a* to provide a suction port. The valve members 47 are fixed to the head of the corresponding pistons 14 by means of screws 54 which, as illustrated in Fig. 1, project beyond the end of the corresponding piston. It will be understood that the valve plates 48 are preferably recessed for reception of the heads of these screws 54 so as to provide for minimum clearance between the heads of the pistons and their corresponding valve plates at the outer ends of the piston stroke in accordance with the conventional practice. The discharge valve plate 48 may be similarly or otherwise fitted with suitable or conventional valves and gas is pumped by the pistons through these valves into the cylinder heads 49 from which it may be conveyed by pipes or tubes 55, as illustrated in Fig. 2, through a suitable condenser and to an evaporator (not shown) of a refrigerating system in accordance with conventional practice.

After the refrigerant has been introduced into and expanded in the evaporator, it is conducted back into the housing 1 and delivered to the suction side of the piston 14 for recompression. In returning this expanded refrigerant vapor to the interior of the housing 1, it is caused to flow into the housing 1 in such a manner as to absorb heat from both the stator 3 and rotor 4 of the driving motor thus to prevent possible overheating of the same. In order to effect this result, the bore 1*a* which receives the stator 3 of the motor is centrally cut away to form a relatively wide and shallow groove or passageway 63 almost completely annular in form but interrupted in its circular continuity by means of a vertical wall or abutment 66, as best illustrated in Fig. 2, thus imparting to the passageway 63 the form of a split ring or circle. The housing 1 is provided with an inlet or suction port 60 extending therethrough which communicates with a short vertical recess 61 on the inner surface of the housing 1 at one end of the passageway 63. The housing 1 adjacent the port 60 is provided with studs 62 for attachment of a service valve or fitting on the suction tube (not shown) leading from an evaporator. At the opposite end of the passageway 63 the interior surface of the housing 1 is cut away to provide a vertical passage 64 providing open communication between such end of the passage 63 and the upper end of the housing 1 at a point above the stator 3. This is best shown in Figs. 1 and 3. Thus, refrigerant entering the port 60 is delivered to the recess 61 and then flows in a clockwise direction as viewed in Fig. 2 through the passage 63 between the stator 3 and the housing 1 until it reaches the abutment 66 and then flows upwardly through the passage 64 to the interior of the housing 1 above the stator 3 and rotor 4. This refrigerant then flows over the upper end of the stator and then downwardly through the space between the stator 3 and rotor 4 as well as through the openings 67 in the rotor 4 and into the lower portion of the housing 1, where it is again in position to be drawn through the pistons 14 and recompressed.

It will be appreciated that in drawing the relatively cold refrigerant in gaseous form from the evaporator and causing it to flow substantially completely around the outside of the stator 3 in relatively thin sheet-like form, and then causing it to flow up over the stator and then down between the stator and rotor and through the rotor, it will absorb a considerable amount of heat from the stator and rotor and efficiently serves as a means for preventing possible overheating of the motor.

Means is preferably provided for draining from passage 63 any liquid oil which is being carried through the system with the refrigerant and delivering it to the lower portion of the housing 1 without necessitating its being carried upwardly over the stator 3. This is desirable not only to prevent such lubricant from building up into a relatively solid body in the passage 63 and thereby interfering with the proper flow of refrigerant through the passage 63, but also to keep it out of contact with the windings of the motor. Separation of oil particles from the refrigerant and collection thereof on the housing wall in passage 63 is effected by centrifugal force. The draining is accomplished by providing a groove 65, shown in Figs. 1 and 2, in the interior wall of the housing 1 and connecting the discharge end of the passage 63 with the interior of the housing below the stator 3. In other words, the groove or passage 65 short circuits the discharge end of the passage 63 to the lower portion of the interior of the housing 1. Any liquid particles of oil in the refrigerant introduced into the passageway 63 tend to become separated out of the refrigerant vapor by coming into contact with and tend to cling to the interior walls of the passage 63, and gradually work around to the discharge side thereof and, upon reaching the area of the groove 65, will simply flow by gravity down the groove 65 and into the lower portion of the housing 1. The size of the passageway 65 while sufficiently large to take care of any usual volume of lubricant that might find its way into the passageway 63 still is sufficiently small as to permit only a limited volume of gaseous refrigerant to flow therethrough and thus does not materially cut down the normal flow of refrigerant upwardly from the discharge end of the passageway 63 through the passageway 64 into the upper portion of the housing as previously described.

The method of providing lubrication to the various wearing parts of the mechanism above described constitutes an important part of the present invention and is accomplished as follows. The bottom of the housing 1, and particularly that portion thereof below the lower edges of the cylinders 52 and 53, constitutes a lubricant reservoir and holds a body of oil 18 therein. The drive shaft 5 is provided with a bore 16 of relatively large diameter therein which extends from the lower end of the shaft 5 to a point preferably within the upper bearing 6. The upper end of the bore 16 is vented to the interior of the housing 1 by means of a vertical vent passage 17 extending upwardly to a point between the upper end of the bearing 6 and the lower end of the rotor 4 and which communicates with a transverse vent passage 17' which leads to the exterior of the shaft 5 at that point. The vent passages 17 and 17' are particularly brought out in Fig. 2. The bore of the boss 1c in which the bearing 11 is received is provided with a vertical groove 33 therein which extends from the shoulder against which the disc 15 abuts to the upper end of the boss. The groove 33 is communicated with the oil body 18 by means of a passage 32 through the boss. Adjacent its upper end the bearing 11 is provided with a hole or passage 34 therein in alignment with the groove or passage 33 and the exterior surface of the drive shaft 5, is provided with a spiral groove 35 in its surface, the upper portion of which sweeps over the passage 34. The passage 34 is below the normal level of the oil body 18 so that oil from the body in seeking its level flows under gravity through the passage 32, channel 33 and through the passage 34 to the surface of the drive shaft 5 within the bushing 11 and rotation of the shaft 5 causes the oil to be fed to the spiral groove 35 and carried downwardly between the shaft 5 and the bore of the bushing 11, thus providing a lubrication for the drive shaft 5 in the lower bearing 11 and also aiding in preventing the escape of oil from the bore 16 of the shaft 5 past the lower end of the shaft and the thrust disc 15, as will hereinafter be more apparent. The hand or pitch of the spiral or helical groove 35 will depend upon the direction of rotation of the shaft 5, the shaft 5 in the case shown being considered as turning in a clockwise direction as viewed looking down on top of the unit, and in such case the grooves 35 will be left-handed or will have a lefthand pitch.

The lower portion of the boss 1c in which the bearing 11 is received, is provided with a passage 20 therethrough connecting the lower portion of the oil body 18 with the chamber 21 formed between the lower face of the thrust disc 15 and the closure plate 22 so as to provide for the free flow of oil to the chamber 21. The thrust disc 15 centrally carries an upstanding tube 25 which projects upwardly into the bore 16 of the drive shaft to a point materially above the lower end of the shaft 5 but preferably upwardly to a point somewhat below the minimum level of the lubricant body 18. The tube 25 is suitably fixed and sealed to the disc 15. Thus, the oil in the reservoir or oil body 18 may flow freely through the passage 20 into the chamber 21 and then up through the tube 25 into the hollow interior of the lower end of the drive shaft 5 where, when the shaft 5 is not rotating, it will find a level corresponding with the level of the oil body 18 at a point above the top of the tube 25. The tube 25 thus has the effect of forming the lower end of the bore 16 of the drive shaft 5 into a standpipe from which no oil below the top of the tube 25 may flow downwardly through the tube 25 and back into the reservoir 18.

The bore of tube 25 may be of such diameter as to regulate the rate of oil flow into bore 16 of shaft 5, particularly in case the shaft is horizontally disposed. The centrifugal pumping of oil is effective in a shaft disposed at any angle.

When the unit is operating and the shaft 5 therefor rotating, this oil within the bore 16 is acted upon by centrifugal force and caused to assume the shape indicated at 27 in Fig. 1. That is, it is caused to climb the sides of the bore 16 in shell-like form of gradually decreasing thickness. It is this body of oil 27 that is employed to lubricate the wearing surfaces of the unit above the bearing 11, and provides a means by which a metered amount of lubricant may be fed to these other wearing surfaces. This metering of the body of oil 27 to the various wearing surfaces is accomplished by the use of metering or port tubes such as 28. These metering or port tubes 28 may be employed at any position in the bore 16 where it is desired to lead off lubricant to a wearing or other surface, except that none is required at the extreme top of the oil body 27, but in the present case only one such metering or port tube 28 is shown by way of illustration. This is shown at a position where it will lead off lubricant from the oil body 27 to the wearing surfaces between the eccentric 9 and the connecting rods 12 and 13 at an area adjacent the upper side of the connecting rod 13 and the upper fork of the connecting rod 12. The eccentric 9 for this purpose is provided with a radial passage 29 communicating the bore 16 with the exterior surface of the eccentric 9 at the point indicated and described. The port tube 28 is fitted into the inner end of the passage 29. As best indicated in Figs. 1 and 6, the metering or port tube 28 is in the form of an apertured plug pressed into the inner end of the passage 29 and its inner end is enlarged to provide a shoulder 28*a* which engages the walls of the bore 16 and limits radially outward movement of the tube 28 in the passage 29.

The amount of oil from the body 27 which may flow through the tube 28 is dependent upon two things, namely, the size of the bore in the tube 28 and also the depth which the radially inner end of the tube 28 is submerged radially in the body of oil 27. This last feature is controlled by the axial thickness of the shoulder 28*a* and usually will be such that it will lie slightly under the inner surface of the oil body 27 and the oil which passes through it will thus be more or less skimmed from the inner surface of the oil body 27 during operation of the unit. The oil which is skimmed off of the oil body 27 by the metering or port tube 28 will pass through the passage 29 to the wearing surfaces between the connecting rods and the eccentric and will also be thrown off radially into the bore of the cylinders 52 and 53 where it will lubricate the wearing surfaces of the pistons and cylinders and also the wearing surfaces between the pins 46 and the pistons 14 and the outer end of the rods 12 and 13 and the piston bosses. The oil that is fed out through the port tube 28 or other lubricant discharge opening from the oil body 27 is continuously replaced in the bore 16 by oil flowing into the bore 16 by gravity from the oil body 18. The port tube 28 may be readily inserted in place in the passage 29 from the bore 16 by means of a suitable tool prepared for that purpose.

The size of the bore 16 is preferably so proportioned with respect to the speed of rotation of the shaft 5 and its vertical, angular or horizontal arrangement that the oil body 27 will be elevated or moved to a point within the bearing 6, and within the portion of such bearing nearer its oil inlet the shaft 5 is provided with a radial passage 30 therethrough communicating the bore 16 with the exterior surface of the shaft within the nearer end of the bearing 6. The exterior surface of the shaft 5 within the length of the bearing 6 is preferably provided with a righthand (when the shaft turns in the direction previously assumed) spiral groove cut therein into which the passage 30 discharges and, accordingly, lubricant from the farther end of the body 27 will pass out through the passage 30 and into the groove 31 which will thus carry the lubricant over the wearing surface between the shaft 5 and bearing 6 to insure ample lubrication of the same.

Preferably some means is provided for constantly filtering the lubricant as it flows from the reservoir 18 through the passages 32 and 20. For this purpose a conical screen 19 may be provided between the boss 1c and the lower wall of the housing. The screen 19 may be fixed in position and in sealed relation at both upper and lower ends thereof with respect to the boss 1c and to the lower wall of the housing 1 by means of a split spring ring 36 snapped into a complementary groove formed in the exterior surface of the boss 1c. If desired, further filtering elements may be employed and one of these may take the form of an annular screen 24 of outwardly facing C-like section pressed between the outer lower margins of the thrust disc 15 and the cover plate 22. The height of the screen 24 in free state is greater than the space provided for it in the final assembly so that its opposite edges are crushed or sprung into dirt tight relation with respect to the disc 15 and cover plate 22 when the plate 22 is tightened into position. An additional filter element may take the form of a screen 26 surrounding the upper end of the tube 25 within the bore 16.

In order to provide electrical connection between power leads exteriorly of the unit and the windings of the motor, a hole is drilled through the housing 1 adjacent the upper end thereof as illustrated in Figs. 1 and 2 for each of the leads. An electrical conductor 71 projects through each of the holes. Each conductor 71 is imbedded and sealed in a sleeve 72 of suitable electrical insulating material which in turn is received and sealed centrally within a threaded plug 73. Each plug 73 is threaded in gas-tight relation into the outer end of the corresponding opening. The construction thus providing a gas-tight electrically insulated connection between the exterior and interior of the housing 1. The outer ends of the connectors 71 may be threaded or otherwise formed for connection to the usual electrical leads. Over the area where the inner ends of the conductors 71 project into the interior of the housing 1, an angle sectioned electrical insulating strip 76 is preferably provided through which the inner ends of the conductors project to the space between the windings of the stator 4 and the bore of the housing 1. The inner ends of the conductors 71 inwardly of the insulating strip 76 are preferably notched to receive connector spring clips 74 to which the corresponding leads 75 of the motor may be soldered or otherwise secured.

It will, of course, be appreciated that suitable gaskets are provided between all matching surfaces through which leakage might otherwise occur between the interior of the housing 1 and the atmosphere. The gasket 83 between cylinder 52 and housing 1 is made in various thicknesses, of which the proper one is selected to provide the desired clearance space between the piston and the cylinder head. A suitable set of gaskets is provided to permit this adjustment to be made.

Additionally provided are a gasket such as 81 between the cover 2 and the housing 1, gaskets 82 between the valve plates 48 and the corresponding cylinders and cylinder heads, gasket 83 between the cylinder 52 and the housing 1 and the gasket 84 between the plate 22 and the bottom wall of the housing 1. The construction thus affords a hermetically sealed motor compressor unit in which an efficient means is provided for absorbing heat from the driving motor to prevent possible overheating of the same in service, means for separating out liquid particles of lubricant from that portion of the stream of gaseous refrigerant employed for cooling the motor and delivering out the separated particles of liquid lubricant and short circuiting the passage thereof around the motor to the lower portion of the unit. It also provides a means by which an ample and fully controlled amount of lubricant may be fed to the various working parts of the unit without requiring the addition of any moving parts to the essential operating parts of the mechanism.

In assembling the motor compressor unit above described, it will be appreciated that the stator 3 may be pressed into place either before or after the rotor and its associated parts have been inserted. Before the rotor 4 is pressed upon the shaft 5 the bearing 6 is positioned on the shaft and the screws 68 inserted through the lugs 7. The pistons 14 and their respective connecting rods 12 and 13 are inserted into place and then the rotor 4 and shaft 5 are fed downwardly into the housing, the lower end of the shaft 5 is introduced into the bearing 11 and the eccentric 9 is guided into the large end of the connecting rods 12 and 13. The inner ends of the brackets 8 are sufficiently spaced from one another to permit the passage of the eccentric 9 therethrough when turned toward the left-hand cylinder 53, and the space between the opposite sides of the brackets 8 is sufficiently wide to permit the passage of the counterweight 10 therebetween as previously mentioned. As the parts are set into position the lugs 7 of the upper bearing 6 are brought into position above the inner ends of the brackets 8, the screws 68 are aligned with their corresponding openings in the ends of the brackets 8 and a screw driver is then introduced down through one or more of the holes 67 and the screws 68 are threaded into place. In this respect it will be recalled that because of the particular spacing of the screws 68 previously described there is only one rotatable position of the bearing 6 with respect to the housing 1 in which the screws 68 may all be threaded into their corresponding openings in the ends of the brackets 8. If the stator 3 has not already been introduced into place it may now be introduced, the leads 75 thereof connected to the connection 74, and the cover 2 secured in place. Obviously in dis-assembling the construction the stator 3 will be allowed to remain in position unless it is desired to remove it for repair or replacement.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. A motor-compressor unit comprising, in combination, a sealed housing, an oil sump in a lower portion of said housing, a vertical shaft rotatably mounted in said housing and having one end below the level to which said sump is filled with oil and its opposite end above said oil level, said shaft having a lengthwise hole therein extending from its lower end to a distance above said oil level, a wall extending across and closing said hole at a position below said oil level, said wall having an oil inlet port therein adjacent the axis of said shaft in communication with said sump, a conduit extending upwardly within said hole from said port to a point below said oil level, a bearing of said unit located at least partly above said oil level, an oil outlet passage from said hole to said bearing, a motor in the upper portion of said housing connected to said shaft for driving the same, and compression mechanism in the lower portion of said housing receiving driving movement from said shaft.

2. A motor-compressor unit comprising, in combination, a sealed housing, an oil sump in a lower portion of said housing, a vertical shaft rotatably mounted in said housing and having one end below the level to which said sump is filled with oil and its opposite end above said oil level, said shaft having a hole therein extending lengthwise thereof from its lower end to a distance above said oil level, a wall extending across and closing said hole at a position below said oil level, said wall having an oil inlet port therein adjacent the axis of said shaft and communicating with said sump, a conduit extending upwardly within said hole from said port to a point below said oil level, a plurality of bearings of said unit located at least in part above said oil level and at different heights with respect to said oil level, an oil outlet passage from said hole to a lower one of said bearings, a second outlet passage from said hole to a higher one of said bearings, a motor in the upper portion of said housing connected to said shaft for driving the same, and compressor mechanism driven from said shaft.

3. A motor-compressor unit comprising, in combination, a housing, an oil sump in a lower portion of said housing, a shaft rotatably mounted in said housing and having one end below the level to which said sump is filled with oil and its opposite end above said oil level, said shaft having a hole therein extending lengthwise thereof from its lower end to a distance above said oil level, a wall extending across said hole at a position below said oil level, an oil inlet port in said wall adjacent the axis of said shaft in communication with said sump, a plurality of bearings of said unit located at least in part above said oil level and at different heights with respect to said oil level, an oil outlet passage from said hole to a lower one of said bearings, a second outlet passage from said hole to a higher one of said bearings, said second passage having its inlet end at a greater radius from the axis of said shaft than the inlet of the first said passage, a motor in said housing connected to said shaft for driving the same, and compressor mechanism driven from said shaft.

4. In a motor-compressor unit of a refrigerating system, a gas-tight housing enclosing the working parts of said unit, a vertical shaft forming a driving connection between said parts, said shaft having an axially located longitudinal hole therein, a closure for the lower end of said hole, and a fixed tube leading into said hole through said closure axially of said shaft, said shaft, hole, closure and tube being so constructed and arranged as to lift oil within the shaft bore by virtue of centrifugal force.

5. A motor-compressor unit comprising, in combination, a housing, a motor and a compressor driven therefrom sealed in said housing, a common vertically directed shaft for said motor and compressor, an oil sump in a lower portion of said housing, said shaft rotatably mounted in said housing and having one end below the level to which said sump is filled with oil and its opposite end above said oil level, said shaft having a lengthwise hole therein extending from its lower end to a distance above said oil level and a vent passage leading from the first mentioned hole to an exterior surface of said shaft for the purpose of relieving gas pressure produced in said hole by the separation of vapor from the oil, a wall extending across said hole at a position below said oil level, said wall having an oil inlet port therein adjacent the axis of said shaft in communication with said sump, a conduit extending upwardly within said hole from said port to a point below said oil level, a bearing of said unit located at least partly above said oil level, an oil outlet passage from said hole to said bearing, a motor in the upper portion of said housing connected to said shaft for driving the same, and compression mechanism in the lower portion of said housing receiving driving movement from said shaft.

6. A motor-compressor unit comprising, in combination, a sealed housing, an oil sump in a lower portion of said housing, a vertically directed shaft rotatably mounted in said housing and having one end below the level to which said sump is filled with oil and its opposite end above said oil level, a bearing for said shaft, said shaft having a lengthwise hole therein extending from its lower end to a distance above said oil level, a screen surrounding said bearing, a disc providing a thrust bearing for the lower end of said shaft forming a wall closing said hole at the lower end of said shaft, said thrust disc having an oil inlet port therein adjacent the axis of said shaft in communication with said sump, a conduit extending upwardly within said hole from said port to a point below said oil level, a bearing of said unit located at least partly above said oil level, an oil outlet passage from said hole to said last mentioned bearing, a motor in the upper portion of said housing connected to said shaft for driving the same, and compression mechanism in the lower portion of said housing receiving driving movement from said shaft.

7. Refrigerating mechanism comprising, in combination, a compressor, a motor for driving said compressor, a vertical shaft connecting said motor and compressor, a gas-tight housing enclosing the moving parts of said motor and compressor, a bearing at the bottom of said housing for the lower end of said shaft, an oil reservoir in said housing surrounding said bearing, a screen surrounding said bearing, said shaft having a hole

therein extending from the lower end thereof upwardly therein, a disc closing the lower end of said shaft and providing a thrust bearing therefor, said shaft having a helical groove in that portion thereof embraced by the first mentioned bearing whereby to feed oil downwardly against said thrust disc to assist in sealing the joint between it and said shaft, and an oil passage leading into said first mentioned bearing from the annular space within said screen.

8. In a sealed motor-compressor assembly, in combination, a gas-tight housing enclosing the working parts of said assembly, a motor including a rotor located in said housing, a compressor having working parts driven by said motor and sealed from atmosphere by said housing, a vertically directed shaft connecting said motor and compressor for driving the latter, a bore in said shaft extending lengthwise of it for at least part of its length, a stationary wall closing an open end of said bore, an oil conduit extending through said wall into said bore at approximately the axis of rotation of said shaft, means for supplying oil to said bore through said oil conduit, and an oil outlet port leading from said bore for delivery of oil to a bearing surface of said assembly.

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