Sept. 22, 1959 F. E. LA FLAME 2,905,372

MOTOR COMPRESSOR UNIT

Filed June 13, 1956 2 Sheets-Sheet 1

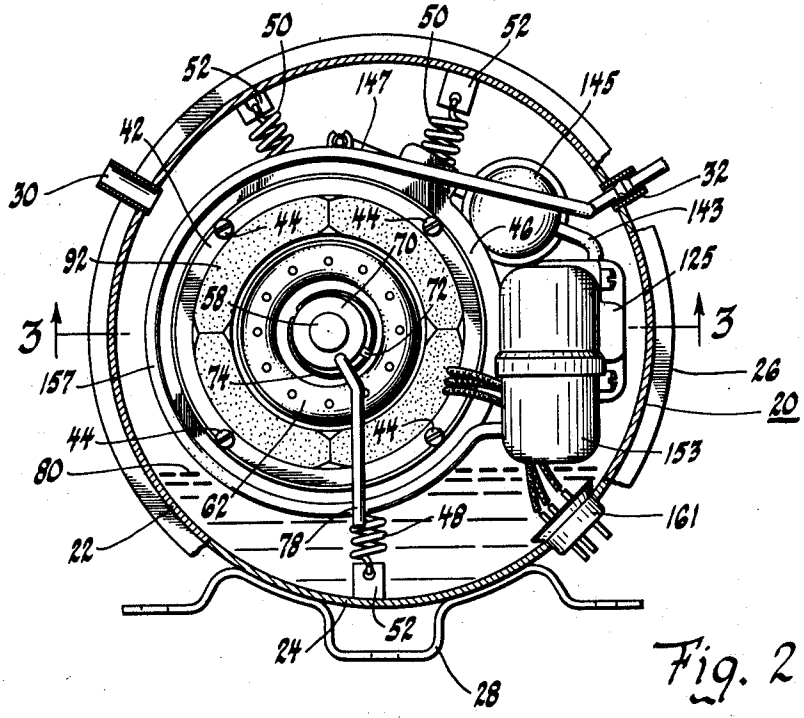


Fig. 2

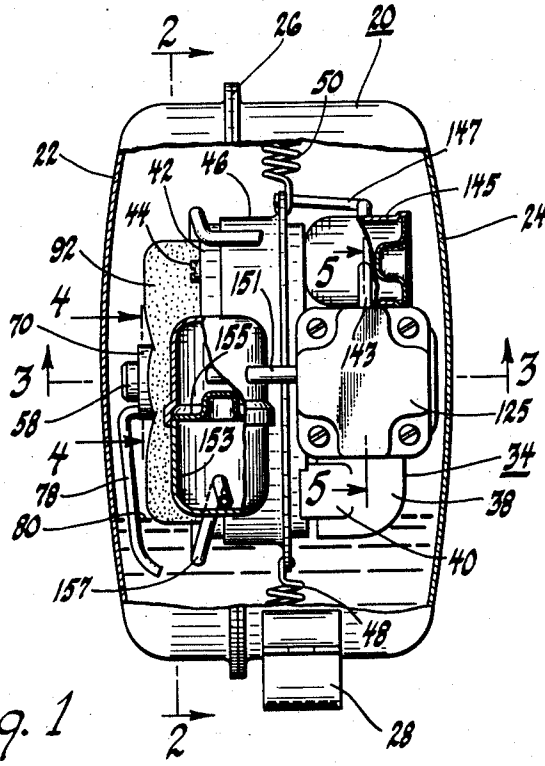


Fig. 1

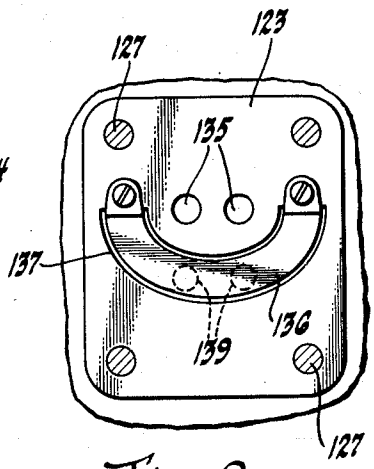


Fig. 8

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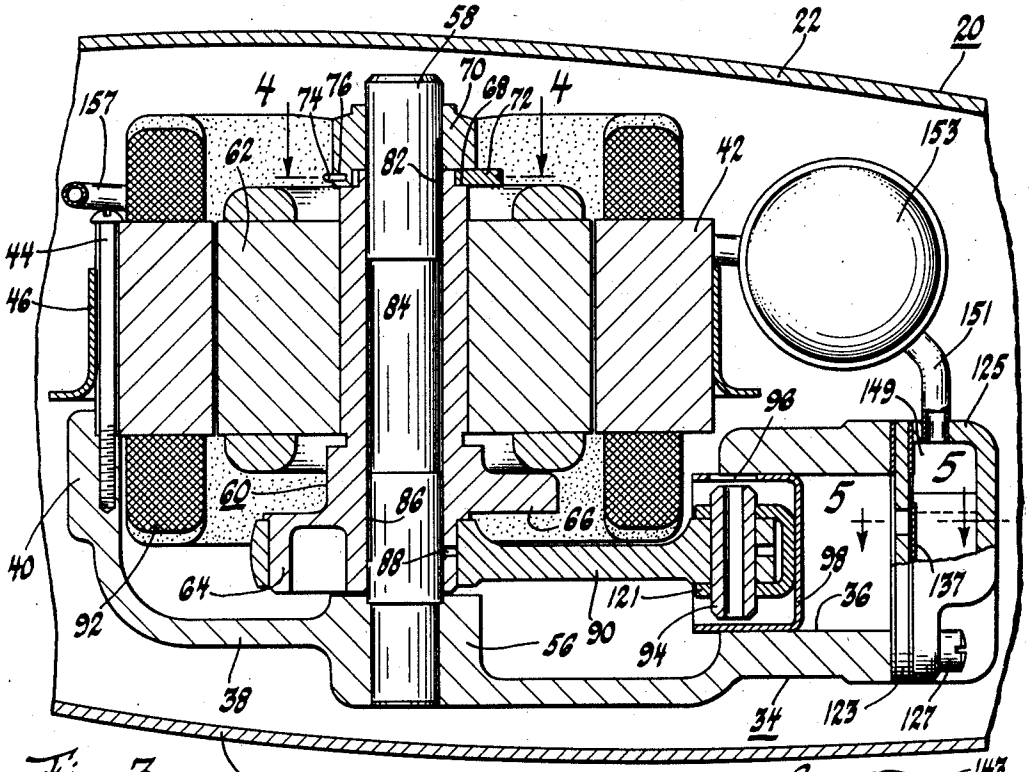


Fig. 3

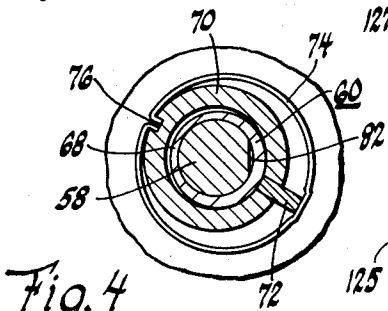


Fig. 4

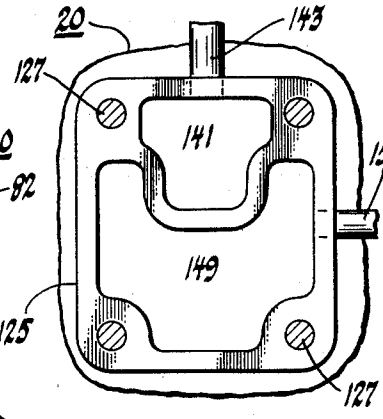


Fig. 6

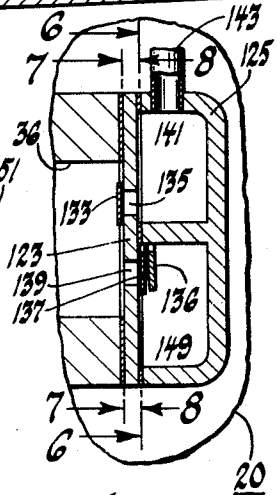


Fig. 5

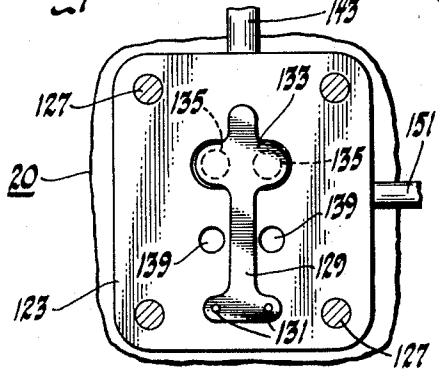


Fig. 7

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2,905,372

MOTOR COMPRESSOR UNIT

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Application June 13, 1956, Serial No. 591,155

5 Claims. (Cl. 230—58)

This invention relates to refrigerating apparatus and more particularly to sealed motor-compressor units.

It is an object of this invention to provide a compact sealed motor-compressor unit which is constructed in such a way that the parts are easily and inexpensively made and assembled and in which the alignments of the working parts are easily maintained in mass production.

It is another object of this invention to provide a compact, quiet sealed motor-compressor unit which is constructed in such a way that high quality and freedom from difficulties may be attained despite a low manufacturing cost.

These and other objects are attained in the form shown in the drawings by providing a simple extension of the cylinder casting for connection with the motor-stator. The casting also supports in cantilever fashion one end of a stationary shaft. A hollow shaft is rotatably mounted upon the stationary shaft and provided with an eccentric which reciprocates the piston within the cylinder. Within the stator is the motor rotor fixed to the hollow shaft. Mufflers are provided in the inlet and outlet of the compressor. The stator is supported upon three tension springs in a Y arrangement within the sealed casing.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a view in elevation, partly in section, of a sealed motor-compressor unit embodying one form of my invention;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a horizontal sectional view taken along the line 3—3 of Figures 1 and 2;

Figure 4 is a fragmentary vertical sectional view showing the oil pump taken along the line 4—4 of Figures 1 and 3;

Figure 5 is a fragmentary sectional view showing the valves and cylinder head taken along the line 5—5 of Figures 1 and 3;

Figure 6 is a fragmentary sectional view showing the cylinder head taken along the line 6—6 of Figure 5;

Figure 7 is a fragmentary sectional view showing the inlet valve taken along the line 7—7 of Figure 5; and

Figure 8 is a fragmentary sectional view showing the outlet valve taken along the line 8—8 of Figure 5.

Referring now to the drawings and more particularly to Figures 1 and 2, there is shown a sealed motor-compressor unit including an outer casing 20 formed of two pan-shaped pressed sheet metal housing members 22 and 24 which have their flanges 26 in contact and welded together. The sealed casing 20 is supported by a formed metal strap 28 providing a relatively rigid mounting. This strap is welded to the casing 20. The casing 20 has an inlet fitting 30 and an outlet fitting 32. Within the casing 20 is a cylinder casting 34 containing the cylinder 36 and provided with an integral pan-shaped extension 38 having four symmetrical upstanding projections 40 provided with shoulders. The motor stator 42 is

mounted end-wise upon the shoulders of the four projections 40 and fastened by four long screws 44 which thread into the projections 40 as shown in Figure 3. The stator 42 has pressed thereon a flanged sheet metal ring 46 having its flange connected by one lower tension spring 48 and two upper tension springs 50 to the casing 20. The inner ends of the springs hook into the adjacent portions of the flange of the ring 46 and into the adjacent L-shaped brackets 52 which are fastened to the inner wall of the outer casing. The connections are made in such a location that the three springs extend along lines extending in a Y fashion to the center of gravity of the entire sprung mass within the sealed casing 20. This minimizes the transmission of vibration and noise from the working parts to the casing 20.

The cylinder casting 34 also includes a boss 56 into which is placed in cantilever fashion the one end of a stationary shaft 58. For ease of assembly and minimizing of alignment difficulties the other end is left free of support. A hollow shaft 60 is rotatably mounted upon the stationary shaft 58. The hollow shaft 60 has the motor rotor 62 pressed thereon at a particular location to cooperate with the stator 42 to form an efficient electric motor.

The hollow shaft 60 also includes an eccentric 64 and a counterweight 66 located between the eccentric and the rotor 62. Because of the light weight of the aluminum connecting rod 90 and the thin sheet metal piston 98, no other counterbalancing is required. The upper end of the hollow shaft is provided with an eccentric shoulder 68. Press fitted onto the top of the stationary shaft 58 is an oil pump housing member 70 having an annular recess in its lower face concentric with the shaft 58 which fits over the eccentric shoulder 68 upon the hollow shaft 60 to form an eccentric type oil pump. The housing element 70 also has a notch receiving a divider block 72 which is resiliently held in engagement with the eccentric shoulder 68 by a circular spring 74. This wire spring 74 surrounds the housing 70 and has its end portions bent at right angles and lodged within the notch 76 upon the housing 70 diametrically opposite the divider block 72. The inlet side of the oil pump is provided with an inlet tube 78 extending down below the oil level 80 within the casing 20. This tube 78 connects into the pumping chamber of the oil pump located at one side of the divider block 72 and connecting into the pumping chamber within the housing 70.

The stationary shaft 58 is provided with a flat 82 on one side which carries the lubricant discharged from the pumping chamber to an undercut portion 84 in the center of shaft 58. Continuing from the undercut portion 84 but diametrically opposite the flat 82 is another flat 86 which conducts lubricant through the lower portion of the hollow shaft 60. The eccentric portion 64 of the hollow shaft 60 is provided with an oil hole 88 which receives oil from the flat portion 86 to lubricate the bearing surface of the eccentric 64.

The eccentric 64 is so made that it together with the hollow shaft 60 and rotor 62 can be placed on the stationary shaft 58 and inserted into the large end bearing of a light weight die cast aluminum connecting rod 90. The die cast connecting rod 90 has both ends offset so that the intervening portion will clear the protruding windings 92 of the stator 42. The opposite end of the connecting rod is pivotally mounted upon the piston pin 94 which is slipped through the aperture 96 in the skirt of the light weight sheet metal piston 98 through aligned apertures in the U-shaped member 121. This U-shaped member 121 is welded to the head of the piston 98. The piston 98 may be drawn into a cup shape out of sheet metal. The piston 98 and the connecting rod 90 are placed within the casting 38 before the stationary

shaft is pressed in place and before the hollow shaft is placed on the stationary shaft. The oil pump housing 70 with the divider block 72 and the spring 74 is press fitted onto the shaft 58 after the hollow shaft 60 is in place. The piston pin bearing and the cylinder 36 are lubricated by oil which is thrown off the eccentric 64 during its rotation. The splashing of the lubricant within the casing also will lubricate the cylinder walls 36.

The valve plate 123 and the cylinder head 125 are bolted to the cylinder by the four screws 127. The valve plate includes a reed-type inlet valve 129 having locating and fastening pins 131 at one end and an enlarged portion 133 at the opposite end resiliently covering the two inlet ports 135. On the opposite side of the valve plate 123 is a U-shaped reed valve 137 which is adapted to cover the ports 139 to provide an outlet valve. A thick metal stop 136 of similar shape but curled away from the valve 137 is fastened to the plate 123 along with the valve 137. The inlet ports 135 connect to the suction chamber 141 in the cylinder head 125. This suction chamber 125 is connected by the tube 143 to the suction muffler 145 having one end closed by a wall having an inwardly extending boss in the shape of a thimble. This muffler 145 connects to the suction inlet tube 147. This tube is held by the flange of the ring 46. This muffler provides a reservoir for the incoming gas and thereby reduces any noise due to the intermittent drawing of the suction gas into the cylinder 36.

The compressed gas is discharged intermittently from the cylinder 36 through the discharge port 139 past the valve 137 into the discharge chamber 149 in the cylinder head 125. This chamber 149 is connected by the tube 151 to the discharge muffler 153. This discharge muffler 153 is formed of oppositely turned cups having their flanges nested. A dividing wall 155 is fitted in between the flanges and provided with a thimble shaped boss containing a single aperture in the cylindrical wall portion. This effectively silences the discharge. Extending from the bottom of the discharge muffler 153 is the discharge tube 157 which continues therefrom around the stator 42 to the discharge fitting 32. The end of this discharge tube 157 is flared and fits tightly within the fitting 32. A soldered connection may be readily made by fitting a similarly flared end oppositely into the fitting 32 and flowing sufficient solder therein to seal the joint.

The windings 92 of the stator have their terminal conductors connected to a lead-in bushing 161 providing an external three prong connection to the motor control circuit.

One very desirable advantage of the construction is that it enables the motor and compressor to be assembled together outside the sealed unit and tested before it is enclosed in the sealed unit. This makes it possible to detect faulty operation when it can still be readily observed and corrected.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A motor-compressor unit including a member provided with a cylinder and a stator mounting portion, a motor stator mounted upon said stator mounting portion, a stationary shaft having one end cantilever mounted in said member and being otherwise free of support, a hollow shaft rotatably mounted upon said stationary shaft and having an eccentric portion thereon, a piston within said cylinder operatively connected to said eccentric, and a motor rotor fixed to said hollow shaft, a lubricant pump housing element fixed to the opposite end of said stationary shaft, the adjacent end of said hollow shaft being provided with an impeller cooperating with said housing element.

2. A motor-compressor unit including a one piece casting provided with an integral cylinder and a stator mounting portion, a motor stator mounted upon said stator mounting portion, said integral cylinder having its axis transverse to said stator and located beyond the periphery of the stator with a substantial portion of the cylinder overlapping a portion of the stator, a motor rotor within the stator, a piston within said cylinder, shaft means connected to the rotor provided with a connecting rod bearing, and a connecting rod having offset bearings connecting with said connecting rod bearing and with said piston, the center line of a portion of said rod between the offset bearings being offset from a line connecting the centers of the offset bearings away from said stator.

3. A motor-compressor unit including a one piece member provided with a cylinder and a stator mounting portion and a connecting portion extending generally laterally from the portion of said cylinder farthest from said stator mounting portion and connecting said stator mounting portion and said cylinder, a motor stator mounted upon said stator mounting portion, a stationary shaft having one end cantilever mounted in the connecting portion of said member and extending therefrom toward said stator mounting and being otherwise free of support, a hollow shaft extending from said connecting portion toward said motor stator and being rotatably mounted upon said stationary shaft and having an eccentric portion thereon, a piston within said cylinder operatively connected to said eccentric, and a motor rotor fixed to said hollow shaft.

4. A motor-compressor unit including a one piece member provided with a cylinder and a stator mounting portion and a connecting portion extending generally laterally from the portion of said cylinder farthest from said stator mounting portion and connecting said stator mounting portion and said cylinder, a motor stator mounted upon said stator mounting portion, a stationary shaft having one end cantilever mounted in the connecting portion of said member and extending therefrom toward said stator mounting and being otherwise free of support, a hollow shaft extending from said connecting portion toward said motor stator and being rotatably mounted upon said stationary shaft and having an eccentric portion thereon, a piston within said cylinder operatively connected to said eccentric, and a motor rotor fixed to said hollow shaft, and means fixed to the opposite end of said stationary shaft for holding said hollow shaft thereon.

5. A motor-compressor unit including a one piece member provided with a cylinder and a stator mounting portion, a motor stator mounted upon said stator mounting portion, a stationary shaft having one end cantilever mounted in said member and being otherwise free of support, a hollow shaft rotatably mounted upon said stationary shaft and having an eccentric portion thereon, a piston within said cylinder operatively connected to said eccentric, and a motor rotor fixed to said hollow shaft, a casing enclosing said member and stator and cylinder, and two separate tension spring means extending upwardly in at least two different directions and a third tension spring means extending downwardly between and connecting said casing and said stator for resiliently supporting said member within the casing.

References Cited in the file of this patent

UNITED STATES PATENTS

1,738,719	Morse	Dec. 10, 1929
1,915,165	Ramclau	June 20, 1933
2,028,985	Mahon	Jan. 28, 1936
2,043,215	Smith et al.	June 2, 1936
2,349,845	Cody	May 30, 1944
2,483,007	Higham	Sept. 27, 1949
2,740,578	Benson et al.	Apr. 3, 1956