

April 18, 1950

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2,504,528

REFRIGERATION APPARATUS

Filed Sept. 6, 1944

2 Sheets-Sheet 1

FIG. 1.

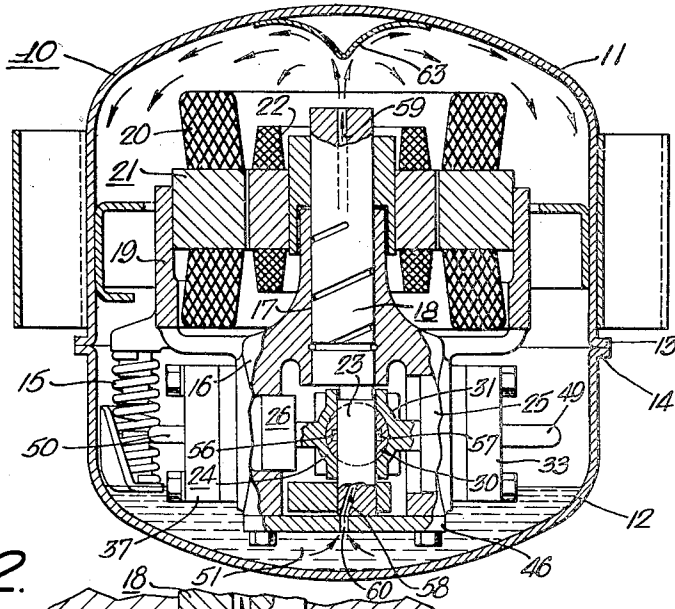


FIG. 2.

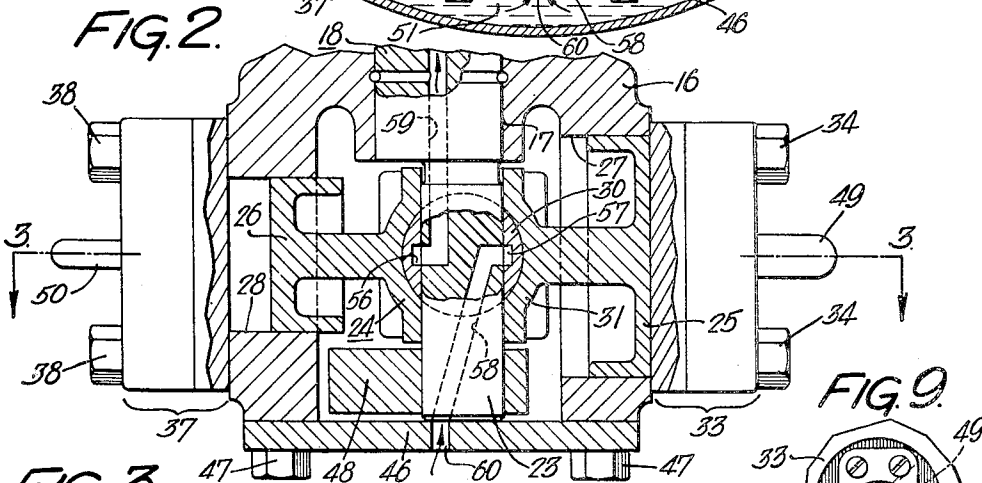


FIG. 3.

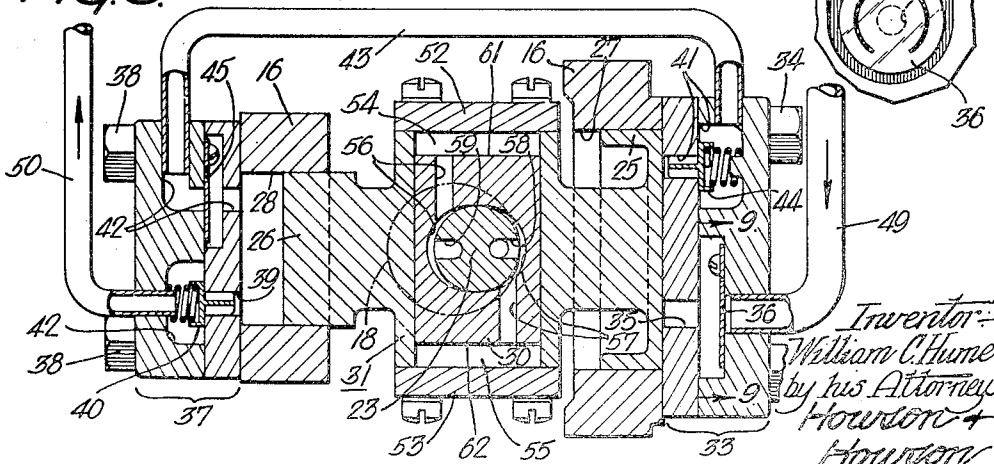
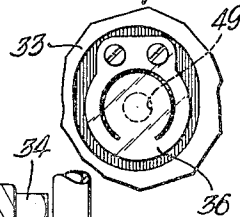


FIG. 9.



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FIG. 5.

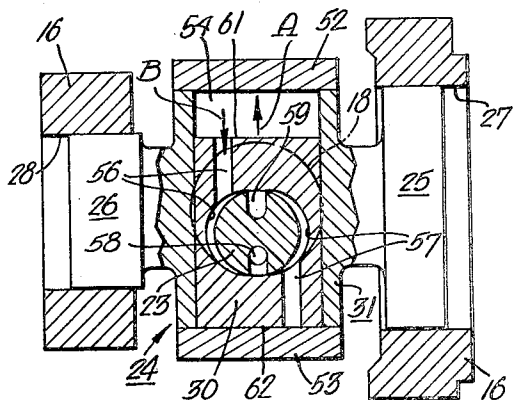


FIG. 6.

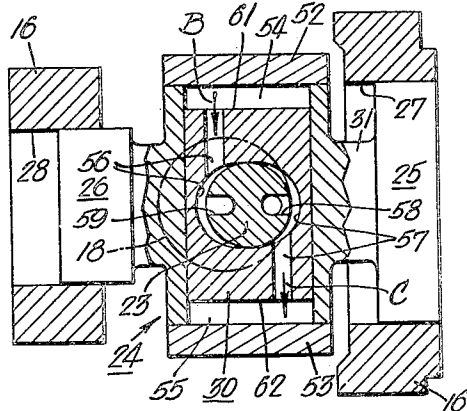


FIG. 7.

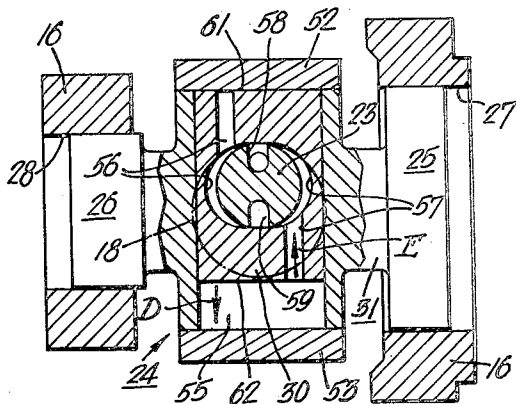


FIG. 8.

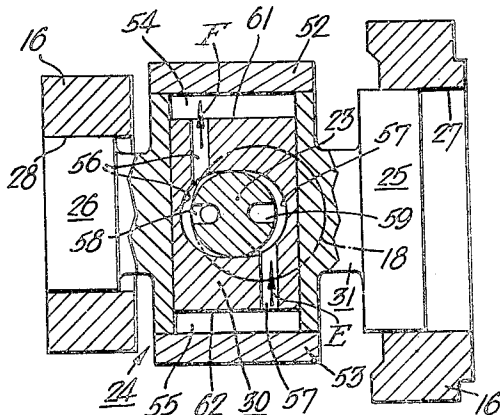
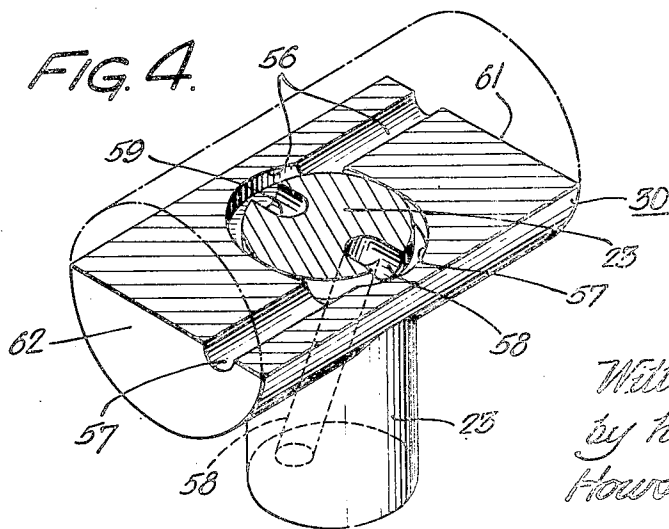


FIG. 4.



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## UNITED STATES PATENT OFFICE

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## REFRIGERATION APPARATUS

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mesne assignments, to Philco Corporation,  
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Application September 6, 1944, Serial No. 552,888

3 Claims. (Cl. 230—206)

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The present invention relates to motor-compressors, more especially of a type adapted for use in refrigerating systems.

More specifically, the invention pertains to motor-compressor units of the hermetically sealed type, and has for one of its objects the provision of improved means for effectively cooling the unit and for lubricating the moving parts thereof, said means avoiding the use of intricate mechanism and involving no material change in the basic structure of the unit.

Another object of the invention is to provide an arrangement whereby existing parts of a sealed motor-compressor may be employed for forcibly pumping a lubricating medium, such as oil, from a permanent supply to various moving elements of the motor-compressor for cooling and lubricating the same.

Still another and more specific object of the invention is to provide an arrangement whereby the cross slide member of a Scotch-yoke-drive type of motor-compressor unit may be utilized as a pumping member for withdrawing oil collected in the sump within the motor compressor housing and discharging the oil under pressure in the form of a spray internally of said housing for cooling the unit.

A motor-compressor made in accordance with the invention is characterized by the absence of specially designed and intricate pump mechanisms which have heretofore been incorporated in motor-compressor units of the aforesaid type to cool and lubricate the same, and by the utilization of the movement of a normal element of the motor-compressor mechanism to perform functions which heretofore have required the provision of such specially designed and intricate pump mechanisms.

Other objects and characteristic features of the invention will be apparent from the following description and accompanying drawings, in which:

Figure 1 is a transverse sectional view, partly in elevation, of a hermetically sealed motor-compressor unit incorporating an embodiment of the present invention;

Figure 2 is an enlarged detail of the lower portion of the motor-compressor mechanism shown in Figure 1;

Figure 3 is a section taken substantially along line 3—3 of Figure 2;

Figure 4 is an enlarged sectional detail view, in perspective, illustrating a cooperative port arrangement;

Figures 5 through 8 are somewhat diagram-

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matic representations of the mechanism in successive positions in the operating cycle; and

Figure 9 is a fragmentary sectional view taken on line 9—9, Figure 3.

In the drawings, I have chosen to illustrate the invention as applied to a two-stage twin piston type hermetically sealed motor-compressor unit, but it is to be understood that the invention is applicable also to other types of motor-compressor unit, such as the single or multiple stage type employing either single or multiple pistons, so long as the connection between the motor and compressor components includes a Scotch yoke drive or a drive including a cross-slide member.

Referring to the drawings, and more particularly to Figure 1, the motor-compressor unit shown, includes a shell or housing 10 comprising a pair of opposed bowl or dome-shaped members, 11 and 12, sealed together, preferably by welding, about abutting peripheral flanges 13 and 14.

Mounted within the housing 10 upon a plurality of resilient supports, one of which is indicated at 15 in Figure 1, is a main frame 16 provided with a central vertical bore forming a bearing 17 for a shaft 18. The frame 16 is provided with upstanding wall portions 19 for supporting the stator 20 of an electric motor 21. The rotor 22 of the motor 21 is located within the stator and is rigidly secured to the upper end portion of the shaft 18.

The shaft 18 is provided with an eccentric portion 23 depending from the end of the shaft and having its vertical axis offset horizontally relative to the normal axis of said shaft. This eccentric, as more clearly shown in Figures 2 and 3, is adapted to cooperate with a Scotch yoke assembly 24 for reciprocating a pair of horizontally opposed pistons 25 and 26 in low and high pressure cylinders 27 and 28, respectively, formed in the lower portion of the frame 16. The Scotch yoke assembly includes a slide member 30 connected with the eccentric 23 to move therewith and to be thereby reciprocated transversely in a space within the body 31 of the Scotch yoke assembly, which body carries the pistons 25 and 26.

The low pressure cylinder 27 is provided with a cylinder head 33 secured to the frame 16, by means, for example, of machine screws 34. As more clearly shown in Figure 3, the cylinder head 33 is provided with an inlet port 35 normally closed by means of a reed valve 36 of the usual type. The high pressure cylinder 28 is likewise provided with a cylinder head 37 secured to the

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frame 16, for instance by means of machine screws 38 and, as also more clearly shown in Figure 3, has an outlet port 39 normally closed by means of a spring actuated valve 40.

The low and high pressure cylinders 27 and 28 are adapted to communicate with one another and for that purpose the cylinder heads 33 and 37 may be formed with ports 41 and 42 respectively, a duct 43 extending between and connecting said ports, for instance in the manner indicated in Figure 3. The portion of the port 41 opening into the low pressure cylinder 27 is preferably closed by means of a spring actuated valve 44 and the portion of the port 42 opening into the high pressure cylinder 28 is preferably closed by means of a reed valve 45.

A cover plate 46, which forms a bearing for the lower end portion of the shaft eccentric 23, is suitably secured to the frame 16, by means, for example, of machine bolts 47. A suitable counterweight 48 may be conveniently attached to the lower end portion of the eccentric 23 to properly balance the same during its rotating motion.

In the mechanism described above, vaporized refrigerant is withdrawn from the evaporator of the refrigerating system (not shown) through a suction line 49 during the suction stroke of the piston 25 which causes the reed valve 36 to open and to admit the vaporized refrigerant into the low pressure cylinder 27 through the port 35. During the compression stroke of the piston 25, when the piston 26 is simultaneously undergoing its suction stroke, the vaporized refrigerant previously drawn into the low pressure cylinder 27 is initially compressed to a relatively low value and this initially compressed vaporized refrigerant is passed through the valved port 41, duct 43 and valved port 42 into the high pressure cylinder 28 where the initially compressed vaporized refrigerant is finally compressed to a relatively high value during the compression stroke of the piston 26. From cylinder 28 the finally compressed vaporized refrigerant is forced through the valved port 39 through the discharge tube 50 into the condenser (not shown).

Reciprocation of the pistons 25 and 26 takes place by reason of the function of the scotch yoke connection between the motor and compressor components of the unit in the manner now to be described. Upon completion of the electric circuit to the motor stator 20 in response, for example, to demand for refrigeration within the food compartment of the associated refrigerator (not shown), the resulting rotation of the rotor 22 in turn rotates the shaft 18 to cause a corresponding rotation of the eccentric 23 in an orbital path about the axis of the shaft 33. This movement of the shaft eccentric causes a similar movement of the slide member 30 in which movement the said member reciprocates within the scotch yoke body 31 as the latter, with the pistons 25 and 26, are reciprocated in and between the cylinders 27 and 28.

As is customary in motor-compressors of the hermetically sealed type, a body of lubricant preferably an oil heavier than the refrigerant employed in the system, is contained in a sump 51 at the bottom of the housing 10. Oil from the sump 51 is generally used to lubricate the moving parts of the unit, and heretofore special designed pump units have been associated with the motor-compressor assembly to force the oil under pressure to various parts of said assembly for lubricating and cooling the same.

In accordance with the present invention, oil

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is forced under pressure to various portions of the motor-compressor unit for lubricating and cooling purposes, but this is accomplished without the use of a specially designed pump unit. According to the invention, means is provided whereby the normal movement of an existing part, specifically the slide member 30 of the scotch yoke assembly 24, may be utilized to effect the pumping of the oil. To that end, head plates 52 and 53 are provided to close the opposite ends of the space within the scotch yoke body 31 thereby forming pump chambers 54 and 55 in the latter, and ports 56 and 57 are formed in the slide member 30, which communicate respectively with the chambers 54 and 55 and which terminate at their inner ends in recesses in the member 30 at opposite sides respectively of the eccentric 23 as illustrated. The said inner ends of the ports 56 and 57 are disposed to register with bores 58 and 59 in the shaft 18. The bore 58, as more clearly shown in Figures 1 and 2, extends downwardly to the bottom of the shaft eccentric 23 and registers with an aperture 60 extending through the cover plate 46 and opening into the oil sump 51 within the compressor housing 10. As best seen in Figure 1, the bore 59 extends upwardly through and to the top of the shaft 18. Because of this construction, the portions 61 and 62 of the slide member 30 act as twin pistons in the chambers 54 and 55 respectively.

In operation, the member 30, and associated elements as described above, functions as an oil circulating pump. The oil is drawn in through the bottom of the shaft eccentric 23, into the cross slide chambers 54 and 55 alternatively and from these chambers is forced up through the shaft 30 to be sprayed within the compressor housing 10 for cooling purposes. If desired, a suitable baffle plate 63 may be provided at the top of the housing 10 opposite the discharge end of the bore 59 to assist in distributing the oil.

The mode of operation may be better understood from consideration of the various positions illustrated in Figures 5 through 8. In the position shown in Figure 5, the slide member 30 is about to start its movement in the direction indicated by the arrow A. Assuming that the pump is primed and the chamber 54 is filled with oil, it will be apparent that as the slide member 30 moves through the position shown in Figure 6 towards the position shown in Figure 7, the oil in chamber 54 is forced through the port 56, as indicated by the arrow B and through the bore 59 which then is in communication with said port 56. At the same time, oil in the sump 51 (Figure 1) is drawn in through the bore 58 and discharged into the chamber 55 through the port 57 as indicated by arrow C in Figure 6. Upon reaching the position shown in Figure 7, the slide member 30 reverses its direction of movement and proceeds to move in the direction indicated by arrow D so that as the slide member moves through the position shown in Figure 8 towards the initial position shown in Figure 5 to complete the cycle, the oil accumulated in the chamber 55 is forced out through the port 57 as indicated by arrow E and through the bore 59 which by that time communicates with said port 57. During this reversed movement of the slide member 30, oil from the sump 51 (Figure 1) is taken in through the bore 58 and discharged into the chamber 54 through the port 56 as indicated by the arrow F in Figure 8 so that the cycle of operation above described may be repeated.

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From the foregoing description, it will be noted that the flow of oil through the cross slide ports reverses every 180° of rotation. It is likewise to be noted that some of the oil passing through the bore 59 may be used to lubricate the shaft bearing and for that purpose a duct may be provided as shown at 64 in Figure 2 to communicate with the spiral groove 65 (Figure 1) about the shaft 18. It is also to be noted that, as more clearly shown in Figure 2, the bore 58 is so disposed that the oil is taken into the center line of rotation of the shaft and is discharged eccentrically so that automatic priming of the pump is accomplished.

It will now be apparent that I have provided a simple and effective arrangement whereby proper cooling and lubrication of a hermetic motor-compressor unit may be effected without the use of separate pumping mechanism, the arrangement being such that pumping of the oil for cooling and lubricating purposes is effected by utilization of the movement of normal element of the motor-compressor construction.

It is to be understood that the aforescribed embodiment of the invention is subject to modification within the scope of the appended claims.

I claim:

1. In a motor-compressor unit of the type comprising a sealed housing, a lubricant sump in said housing and a lubricant-circulating system, a motor and a compressor mounted in said housing, a motor shaft, a scotch-yoke connection between the shaft and the compressor including a cross-slide member having a socket and a crank pin on the shaft engaged with said socket, a housing for said cross slide forming therewith a cylinder and piston assembly, a port in said pin connected with the sump, a second port in said pin connected with said system, and a port in each end of said slide arranged to register with said pin ports and, as the pin rotates in the slide, to register respectively and simultaneously with said ports and alternately therewith so as to effect a substantially continuous flow of lubricant from the sump to said system.

2. In combination, a rotary shaft, a reciprocatory member, a cross slide having a socket, a crank pin on the shaft engaged in said socket, a housing on said member for the cross slide, said housing and cross slide forming a cylinder and

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piston assembly, a source of fluid, a circulating system for said fluid, a port in said pin connected with said source, a second port in said pin connected with said system, and a port in each end of said slide arranged to register with said pin ports and, as the pin rotates in the slide, to register respectively and simultaneously with said ports and alternately therewith so as to effect a substantially continuous flow from the source to said system.

3. A refrigerant compressing unit comprising a housing having a lubricant sump and enclosing a motor and a compressor, the motor including a rotatable shaft having lubricant passages and provided with an eccentric portion, the compressor including reciprocable piston means having a yoke providing a chamber, a cross-slide member received in said chamber for reciprocation therein and having a socket disposed in engagement with the eccentric portion of the motor shaft so that rotation of said shaft and its eccentric portion imparts a reciprocating motion to said member which in turn imparts a reciprocating motion to the yoke and piston means, and port means cooperatively disposed in the eccentric portion and slide member whereby reciprocating motion of the latter effects pumping of the lubricant from said sump to said chamber for discharge through the mentioned lubricant passages.

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