Dec. 29, 1936. W. E. JOHNSON 2,066,177

LUBRICATING SYSTEM

Filed Oct. 24, 1935

Fig. 1.

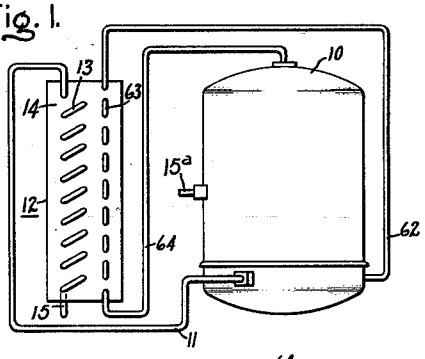


Fig. 2.

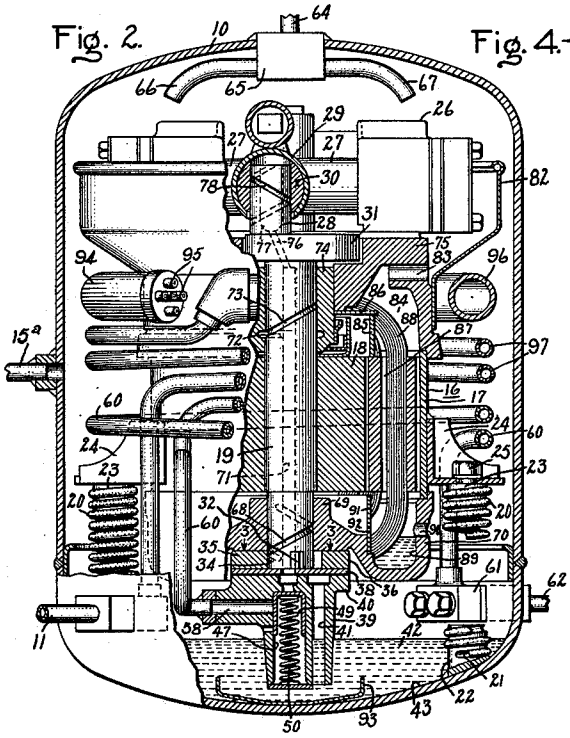


Fig. 3.

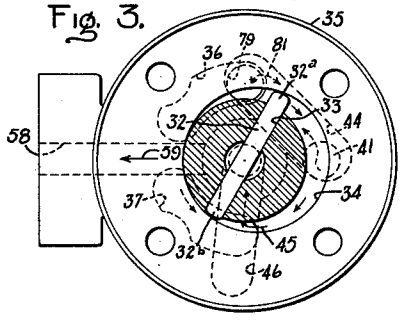
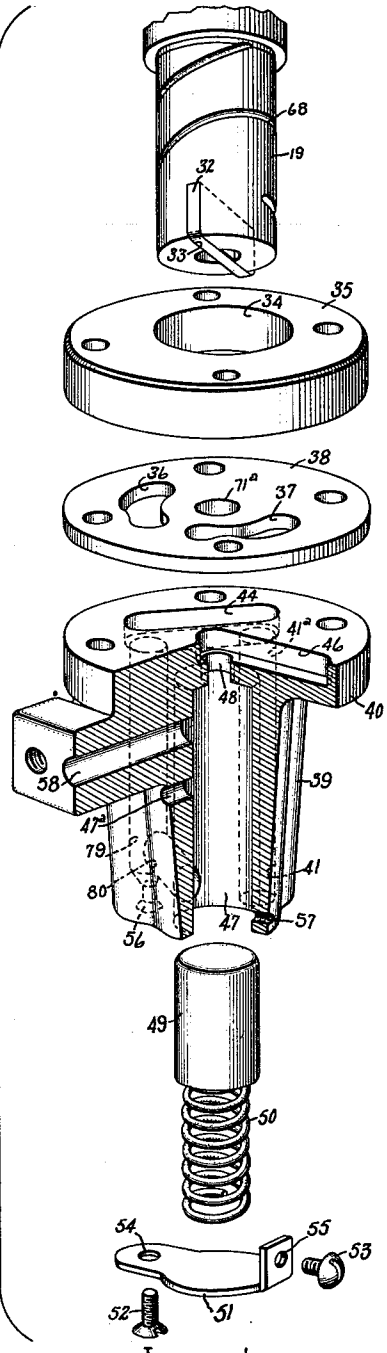


Fig. 4.



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Patented Dec. 29, 1936 2,066,177

UNITED STATES PATENT OFFICE

2,066,177

LUBRICATING SYSTEM

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Application October 24, 1935, Serial No. 46,569

12 Claims. (Cl. 184—6)

My invention relates to lubricating systems and more particularly to lubricating systems especially adapted for use in refrigerating machines.

It is frequently desirable to utilize a variable displacement pump to circulate oil or other lubricant in a refrigerating machine or the like because of the simplicity and efficiency of such pumps. By the term "variable displacement pump" I mean a pump which has a varying volume of discharge during each stroke or rotation of the impelling element thereof as contrasted with a constant displacement pump, such as a centrifugal pump which delivers a constant quantity of fluid during all parts of the cycle of operation of its impelling element. A variable displacement pump, such as a rotary pump having radially movable blades delivers a constant net volume of fluid when operating at constant speed, but the instantaneous rate of delivery varies periodically throughout each rotation or cycle thereof. The quantity of fluid passing into the pump also has a similar periodic variation. Such periodic variations in flow in the suction and discharge connections of a variable displacement pump set-up vibrations in the apparatus which frequently result in objectionably noisy operation.

It is an object of my invention to provide a lubricating system for a compressor or the like including a variable displacement pump and an arrangement for obtaining a uniform flow of lubricant in the suction and discharge connections of the pump.

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

For a better understanding of my invention, reference may be had to the accompanying drawing, in which Fig. 1 is a side elevation of a refrigerating machine provided with a lubricating system embodying my invention; Fig. 2 is a side elevation, partly in section, of the motor driven compressor unit of the refrigerating machine shown in Fig. 1; Fig. 3 is a detail view in section along the line 3—3 of the lubricant pump shown in Fig. 2; and Fig. 4 is an exploded perspective view of the lubricant pump and flow regulator shown in Fig. 2.

Referring to the drawing, I have shown in Fig. 1 a refrigerating machine including a motor driven refrigerant compressor contained in a cylindrical hermetically sealed casing 10 made of sheet steel, or the like, from which compressed gaseous refrigerant is supplied through a conduit 11 to an air cooled condenser 12. The condenser 12 includes a sinuous refrigerant circulatory conduit 13 mounted on a series of vertical heat conducting metallic fins 14. The compressed vaporized refrigerant passing through the condenser 12 is cooled by the forced circulation of cooling air over the surfaces thereof and is liquefied thereby. The refrigerant thus liquefied in the condenser 12 is supplied through a conduit 15 to a suitable evaporator or the like (not shown) located in a compartment to be cooled. The liquid refrigerant in the evaporator is vaporized by the absorption of heat and the refrigerant thus vaporized is returned through a conduit 15a to the motor driven compressor contained in the casing 10. This cycle is repeated and continued until the region in which the evaporator is located is cooled to a desired temperature.

As shown in Fig. 2, an electric driving motor 16, having a stator 17 and a rotor 18 carried on a vertical driving shaft 19, is mounted in the hermetically sealed casing 10 on a series of vertical helical compression springs 20. The lower ends of the springs 20 are fitted in helical grooves 21 formed in supporting studs 22 which are welded, or otherwise rigidly secured, to the bottom of the casing 10. The upper ends of the springs 20 are fitted in similar helical grooves formed in the plugs 23 which are secured to brackets 24 by bolts 25. The brackets 24 extend laterally from the sides of the stator 17 of the motor 16 and are welded, or otherwise rigidly secured, thereto. A two cylinder scotch yoke type refrigerant compressor 26 is rigidly mounted on the top of the motor 16 and the horizontally reciprocating pistons 27 thereof are driven by an eccentric crank pin 28 through a suitable yoke 29 and slide 30. The crank pin 28 is driven by the motor shaft 19 and is eccentrically located with respect thereto on the upper side of a counterweight 31 which is secured to the upper end of the shaft 19.

Lubricant is supplied from a variable displacement pump to the bearings of the driving motor 16 and compressor 26, and in addition lubricant is circulated thereby over the surfaces of the compressor and driving motor in order to cool the same. In the illustrative form of my invention, this variable displacement pump includes a radially movable impeller blade 32, which is slidably mounted in a slot 33 extending diametrically across the bottom of the motor shaft 19. The pump blade 32 rotates within a bore 34 formed in the substantially cylindrical pump cas-

ing 35. The inlet and discharge openings of the pump are formed by ports or openings 36 and 37 in a disk-shaped plate 38 which is secured to the bottom of the pump casing 35.

I provide an arrangement for obtaining a uniform flow of lubricant in the connections both to and from the variable displacement pump described above. This arrangement preferably includes a lubricant flow regulator, which periodically supplies additional quantities of lubricant to the inlet or suction side 36 of the pump near the end of the suction line. In this manner a constant rate of flow is had through the suction line toward the inlet side 36 of the pump, and the suction side 36 of the pump periodically receives excess lubricant supplied thereto by the regulator in accordance with the variations in the quantity of lubricant discharged from the pump. This lubricant flow regulator also preferably includes a spring biased piston 49 which is subjected to the pressure of the lubricant discharged from the pump and which in turn exerts a corresponding pressure on the body of lubricant, the latter pressure being utilized to supply an additional quantity of lubricant to the suction side 36 of the pump. Since from the construction of the pump the variations in flow of lubricant into the pump and from the same are synchronized, an additional quantity of lubricant is supplied to the suction side of the pump whenever the total rate of flow of lubricant into the pump is greater than the mean rate of flow and excess lubricant is periodically received from the inlet of the pump whenever the total rate of flow into the pump is less than the mean rate of flow. Consequently, my arrangement completely compensates for any fluctuations in the rate of flow of lubricant on the suction side of the pump and, as a result, the flow of lubricant from the main lubricant circuit to the suction side of the pump is uniform. In addition, an arrangement is provided which affords a space near the discharge port of the pump of periodically varying volume for receiving lubricant discharged from the pump at 37 when the rate of discharge exceeds the mean rate and for supplying lubricant when the rate of discharge is less than the mean rate. Consequently, the rate of flow of lubricant from the pump into the discharge line is also uniform.

In the illustrative form of my invention, my flow regulator includes a substantially cylindrical flow regulator casing 39 having a cylindrical flange 40 extending about the upper end thereof and secured to the lower side of the plate 38. A vertical passage 41 is formed in the casing 39, the lower end thereof opening below the surface of the lubricant 42 contained in a lubricant reservoir 43 formed in the bottom of the casing 10. The upper end of the vertical passage 41 communicates with an open slot 44 formed in the top of the casing 39. As best shown in Fig. 3, the slot 44 extends beneath a portion of the inlet port 36 formed in the plate 38. The vertical passage 41 and slot 44 formed in the casing 39 thus constitute an inlet or suction conduit for the pump through which lubricant flows from the reservoir 43 into the pump.

During the operation of the pump the blade 32 is rotated in a clockwise direction as viewed in Fig. 3. During such rotation the volume of the space behind the end 32*a* of the blade continually increases as the blade is rotated and lubricant is thus drawn through the inlet port 36 into the interior of the pump casing 35. Lubricant passes to the inlet port 36 through the suction conduit or passage 41 and slot 44 from the reservoir 43. The rate of flow of lubricant from the inlet port 36 into the interior of the pump behind the end 32*a* of the blade increases as the end 32*a* of the blade moves from the inlet port 36 around to a position in which the blade is substantially horizontal as viewed in Fig. 3. Upon continued rotation from this position, the volume of the space behind the blade 32*a* continues to increase, but at a lesser rate until the end 32*a* of the blade reaches the outlet port 37. Consequently, lubricant is drawn into the pump from the inlet 36 at a varying rate which increases during a first part of the movement of the end 32*a* of the blade, described above, and decreases during the latter portion of the rotative movement thereof. The lubricant thus drawn into the interior of the pump behind the end 32*a* of the blade is discharged therefrom by the opposite end 32*b* of the blade. The rate of discharge also varies periodically since the volume in front of the end of the blade 32*b* decreases at a gradually increasing rate until the blade reaches a substantially horizontal position, as viewed in Fig. 3, and then at a diminishing rate until the end of the blade 32*b* reaches the discharge port 37. At the latter point, all of the lubricant drawn into the pump behind the end 32*a* of the blade has been expelled therefrom by the end 32*b* of the blade. It will thus be seen that the instantaneous rate of flow of lubricant through the inlet and discharge ports 36 and 37, respectively, varies periodically with the rotation of the pump blade at 32.

As indicated by the arrow 45 in Fig. 3, the lubricant discharged from the pump passes therefrom through the outlet port 37 into an open slot 46 formed in the top of the casing 39. The slot 46 extends beneath a portion of the discharge port 37 in the plate 38 and communicates at its opposite end with a vertical bore 47 formed in the casing 39. The communication between the slot 46 and the bore 47 is formed by a passage 48 located at the top of the bore 47.

Lubricant is thus supplied under pressure from the pump to the interior of the bore 47 in the regulator casing 39 and forces a cup-shaped sheet metal piston 49 downwardly against the force exerted by a helical compression spring 50. The piston 49 is slidably mounted in the bore 48 and the spring 50 and piston 49 are retained in position within the bore 47 by a cover plate 51 which extends across the bottom of the casing 39 and closes the lower end of the bore 47. The cover plate 51 is secured in position by screws 52 and 53 which pass through the holes 54 and 55, therein, respectively, and are threaded in suitable tapped holes 56 and 57 formed in the casing 39. The piston 49 is thus forced downwardly against the spring 50 by the pressure of the lubricant supplied to the bore 47 until the end of a horizontal discharge passage 58 is uncovered. The lubricant in the bore 47 then flows therefrom through the passage 58, as indicated by the arrow 59 in Fig. 3, into a conduit 60 which extends about the motor 16 and communicates at its opposite end through a connecting box 61 with a conduit 62 located outside the casing 10. The lubricant then flows through the conduit 62 to a sinuous cooling conduit 63, which is supported by the heat conducting fins 14 of the refrigerant condenser 12. The sinuous conduit 63 is relatively long and contains a comparatively large body of lubricant.

The lubricant circulating through the cooling conduit 63 is cooled by the circulation of cooling air over the surfaces of the conduit and the surfaces of the heat conducting fins which are arranged in thermal contact therewith. The cooled oil is then returned through a conduit 64 to the upper portion of the casing 10. The conduit 64 communicates with a distribution head 65 within the casing 10 which is provided with laterally extending discharge nozzles 66 and 67. The lubricant discharged from the nozzles 66 and 67 flows downwardly over the surfaces of the compressor 26 and motor 16 in heat exchange relation therewith, as described more in detail below.

Lubricant is also supplied under pressure from the interior of the pump casing 35 to a helical lubricating groove 68 formed in the lower portion of the shaft 19, which groove opens into the pump cylinder bore 34. The surfaces of the lower bearing of the motor 16 are thus supplied with lubricant, this lower bearing being formed by an inwardly projecting portion 69 of a lower end shield 70 of the motor 16. Lubricant is also supplied from the pump under pressure from the slot 46 and through a hole 71*a* in the plate 38 into a vertically extending passage 71 formed in the center of the motor shaft 19 and which registers with the hole 71*a*. A portion of the lubricant flowing upwardly through the passage 71 formed in the shaft 19 passes therefrom through a laterally extending passage 72 into a helical groove 73 formed in the surface of the shaft 19 and lubricates the upper motor bearing. This upper bearing is of the sleeve type and includes a bearing sleeve 74 which is fixed in a bore formed in an upper end-shield 75 of the motor 16. The remainder of the lubricant in the passage 71 passes upwardly therefrom through a passage 76 into a passage 77 formed in the interior of the crank pin 28. The lubricant in the passage 77 flows out of the open top thereof and is carried through a helical groove 78 formed in the exterior surface of the crank pin 28 to the contacting bearing surfaces of the crank pin 28 and slide 30. Lubricant is thus supplied under pressure to the bearings of the motor 16 and refrigerant compressor 26.

I provide an arrangement for periodically supplying additional quantities of lubricant to the suction side of the pump near the end 41*a* of the suction conduit 41 and for periodically receiving excess lubricant supplied thereto in order that the lubricant 42 in the lubricant reservoir 43 shall flow at a uniform rate through the suction conduit 41 into the pump. The inlet port 36 of the pump communicates with the bore 47 on the lower side of the piston 49 through a vertical passage 79 formed in the casing 39 and a horizontal passage 80 formed therein. The horizontal passage 80 communicates with the lower portions of the passage 79 and bore 47. When the pump is in operation, the passages 79 and 80 are filled with lubricant and also the lower portion of the bore 47. This lubricant is in part supplied by the leakage of lubricant past the piston 49 in the bore 47. This lubricant in the passages 79 and 80 and the lower portion of the bore 47 is then forced to flow back and forth therein, as indicated by the arrow 81 in Fig. 3, in accordance with the oscillations of the piston 49. The piston 49 is caused to oscillate in synchronism with the periodic variation in flow of lubricant discharged from the pump since the volume of oil contained in the cooling coil 63 is sufficiently large that its inertia and friction tend to resist any oscillatory flow of lubricant in the cooling coil. The oscillatory flow of lubricant thus set up in the passage 79 by the oscillations of the piston 49 periodically supplies additional quantities of lubricant to the suction side of the pump and periodically receives excess lubricant supplied thereto. The oscillations are inherently so timed that the total rate of flow of lubricant into the inlet port 36 of the pump is greater than the mean rate of flow, whenever the rate of change of volume of the suction side of the pump is greater than the mean rate of change. Conversely, the total rate of flow of lubricant into the inlet port 36 is less than the mean rate of flow whenever the rate of change of volume of the suction side of the pump is less than the mean rate of change. In this manner, the lubricant flow regulator completely compensates for any fluctuations in flow on the suction side of the pump and the flow in the suction passage 41 from the oil reservoir 43 will in consequence be uniform. Thus, any disturbances in the flow of lubricant from the oil reservoir, are obviated as well as noise which would otherwise be caused thereby. In addition, the bore 47 and piston 49 form a space of variable volume above the piston, which receives excess lubricant from the pump when the rate of discharge is greater than the mean, and which supplies additional lubricant when the rate of discharge is less than the mean. Consequently, the rate of flow of lubricant to the cooling coil 63 is also substantially constant.

The volume of oil contained in the passages 79 and 80 and the lower portion of the bore 47 are preferably so proportioned in relation to the resilient characteristics of the spring 50 that the dynamic system composed of the mass of oil in these passages together with the mas of the piston 49 has a natural frequency substantially equal to the natural frequency of the oscillations imposed on the piston 49 during normal running of the motor 16. Since the motor 16 operates at a substantially constant speed during the normal operation thereof, it is possible to maintain a natural frequency relation or resonant condition noted during the normal operation of the machine. When this condition prevails, no force is required, except that required to overcome slight friction to actuate the piston 49 at the normal running speed and, consequently, there will be no first harmonic pulsations in either the inlet pasage 41 or in the cooling coil 63. Higher harmonics may be present, but their magnitudes are comparatively small and will not be disturbing.

A relief passage 47*a* extends through a side wall of the casing 39. This relief passage limits the downward movement of the piston 49 since, if the piston moves far enough down to uncover the relief passage, lubricant escapes therethrough and the pressure in the piston 49 is lowered.

In the operation of the machine, described above, the cooled lubricant which is discharged from the nozzles 66 and 67 in the upper portion of the casing 10 flows downwardly over the surfaces of the cylinders of the refrigerant compressor 26 into an outwardly flared cylindrical baffle 82, the lower portion of which is secured to the upper end-shield 75 of the motor 16. The lubricant thus accumulated in the baffle 82 flows through a passage 83 in the upper motor end-shield 75 into a reservoir 84 formed in the top of the motor 16. A vertical cylindrical baffle 85 is secured to the top of the motor stator 17 and surrounds the air gap between the rotor 18 and

stator 17. A horizontal disk-shaped baffle 86 is positioned on the top of the baffle 85 and the baffles 85 and 86 thus prevent lubricant within the reservoir 84 from entering the air gap between the rotor 18 and stator 17. The lubricant accumulated in the reservoir 84 flows downwardly through the winding slots 87 formed in the stator 17 and over the surfaces of energizing windings 88 which are arranged in the slots 87. The lubricant then flows from the lower ends of the slots 87 into a reservoir 89 formed by the lower end-shield 70 of the motor 16. An outlet opening 90 is formed in the side of the lower end-shield 70, but at a sufficient height from the bottom thereof so that lubricant is maintained in the reservoir 80 covering the lower end turns of the energizing windings 88. A cylindrical baffle 91 forms the inner wall of the reservoir 89, a small hole 92 being formed in the baffle 91 in order that any lubricant escaping from the oil groove 68 of the lower motor bearing into the space surrounded by the baffle 91 may flow into the reservoir 89. The lubricant escaping from the reservoir 89 through the outlet opening 90 flows into the main lubricant reservoir 43 in the lower portion of the casing 10 and mingles with the lubricant 42 therein. A cup-shaped baffle 93 is positioned in the lower portion of the lubricant reservoir 43 and surrounds the lower end of the suction passage 41 formed in the flow regulator casing 39 so as to prevent the entrance of dirt or other foreign matter into the pump. The lubricant, which is supplied to the surfaces of the crank pin 28, also flows into the baffle 82 which surrounds the upper portion of the motor 16 and compressor 26 and flows therefrom downwardly through the stator slots 87, as described above.

The hermetically sealed casing 10 contains vaporized gaseous refrigerant at low pressure which is drawn into a tubular intake muffler 94 through inlet openings 95 in the end thereof. The intake muffler 94 extends about halfway around the upper portion of the driving motor 16 and the vaporized refrigerant is supplied therefrom through suitable inlet valves to the compressor 26. Compressed vaporized refrigerant is then discharged from the compressor 26 through a tubular discharge muffler 96, which also extends approximately halfway around the upper portion of the driving motor 16. The compressed gaseous refrigerant then flows from the discharge muffler 96 through a helical discharge conduit 97 which extends about the driving motor 16 into the conduit 11 through which it is conveyed to the air cooled condenser 12. The compressed vaporized refrigerant is liquefied in the condenser 12 due to the absorption of heat therefrom by the cooling air flowing over the surfaces of the condenser 12. Liquid refrigerant is then supplied from the condenser 12 through an outlet conduit 15 to a suitable refrigerant evaporator located in the space to be cooled. The liquid refrigerant in the evaporator is vaporized by the absorption of heat from the interior of the compartment in which it is located and the refrigerant thus vaporized is returned through a conduit 15a to the interior of the casing 10. It will be noted that the conduit 15a communicates with the interior of the casing 10 above the level of the lubricant 42 therein. The interior of the casing 10 is thus maintained at substantially the same low pressure prevailing within the refrigerant evaporator.

From the foregoing, it will be seen that I have provided a lubricating system for a refrigerating machine which includes a simple easily manufactured variable displacement pump and an arrangement for insuring a uniform flow of lubricant from the reservoir 43 into the pump, as well as a uniform flow of oil from the pump through the cooling coil 63 and through the motor shaft passage 71 to the bearings of the motor and compressor.

While I have shown a particular embodiment of my invention in connection with a compression type refrigerating machine, I do not desire my invention to be limited to the particular construction shown and described and I intend, in the appended claims, to cover all modifications within the spirit and scope of my invention.

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

1. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, and means for periodically supplying additional quantities of lubricant to said inlet and for periodically receiving excess lubricant supplied thereto in accordance with the periodic variations in the quantity of lubricant discharged from said outlet of said pump to minimize variations in the rate of flow of lubricant through said suction conduit.

2. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, means including a discharge conduit for receiving lubricant discharged from said pump, means for periodically supplying additional quantities of lubricant to said inlet and for periodically receiving excess lubricant supplied thereto in accordance with the periodic variations in the quantity of lubricant discharged from said outlet of said pump to minimize variations in the rate of flow of lubricant through said suction conduit, and means for periodically supplying additional quantities of lubricant to said discharge conduit and for periodically receiving excess lubricant supplied thereto to minimize variations in the rate of flow of lubricant therethrough.

3. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, a second conduit communicating with said inlet port and containing an additional quantity of lubricant, and means for varying the pressure on the lubricant in said conduit in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump.

4. A lubricating system for refrigerant compressors or the like providing a substantially uni-

form flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, a second conduit communicating with said inlet port and containing an additional quantity of lubricant, and means including a spring biased piston subjected to the variations in pressure of the lubricant discharged from said outlet for varying the pressure on the lubricant in said second conduit in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump.

5. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, a second conduit communicating with said inlet port and containing an additional quantity of lubricant, means including a discharge conduit for receiving lubricant discharged from said pump, and means including a spring biased piston subjected to the variations in pressure of the lubricant discharged from said outlet for varying the pressure on the lubricant in said second conduit in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump and for periodically supplying additional quantities of lubricant to said discharge conduit and for periodically receiving excess lubricant supplied thereto to minimize variations in the rate of flow of lubricant through said discharge conduit.

6. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, an enclosure communicating with said outlet port and containing a body of lubricant of relatively large inertia, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, means for periodically supplying additional quantities of lubricant to said inlet port and for periodically receiving excess lubricant supplied thereto in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump to minimize variations in the rate of flow of lubricant through said suction conduit, and means for periodically supplying additional quantities of lubricant to said outlet port and for periodically receiving excess lubricant discharged therethrough to minimize variations in the rate of flow of lubricant from said pump to said enclosure.

7. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, an elongated cooling coil communicating with said outlet port and containing a body of lubricant of relatively large inertia, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, means for periodically supplying additional quantities of lubricant to said inlet and for periodically receiving excess lubricant supplied thereto in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump to minimize variations in the rate of flow of lubricant through said suction conduit, and means for periodically supplying additional quantities of lubricant at said outlet port and for periodically receiving excess lubricant discharged therefrom to minimize variations in the rate of flow of lubricant to said cooling coil.

8. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, an elongated cooling coil communicating with said outlet port and containing a body of lubricant of relatively high inertia, a second conduit communicating with said inlet port and containing an additional quantity of lubricant, and means including a chamber and a spring biased piston therein subjected to the variations in pressure of the lubricant discharged from said outlet port for varying the pressure on the lubricant in said second conduit in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump and for periodically receiving excess lubricant discharged from said outlet port and for periodically supplying additional quantities of lubricant thereto.

9. A lubricating system for refrigerant compressors or the like providing a substantially uniform flow of lubricant through said system comprising a variable displacement lubricant pump having inlet and outlet ports and discharging a periodically varying quantity of lubricant through said outlet port, means including a suction conduit communicating with said inlet port for supplying lubricant thereto, an elongated cooling coil communicating with said outlet and containing a body of lubricant of relatively high inertia, a second conduit communicating with said inlet port and containing an additional quantity of lubricant, and means including a chamber and a spring biased piston therein subjected to the variations in pressure of the lubricant discharged from said outlet port for varying the pressure on the lubricant in said second conduit in accordance with the periodic variations in the quantity of lubricant discharged from said outlet of said pump, said body of lubricant in said cooling coil and said piston having a combined natural frequency substantially equal to the frequency of said periodically varying quantity of lubricant discharged from said outlet of said pump.

10. An electric motor having a vertically disposed shaft, a hermetically sealed casing surrounding said motor, said casing having a lubricant reservoir formed in the lower portion thereof, a variable displacement pump driven by said shaft and secured to the bottom of said motor and having inlet and outlet ports, a flow regulator casing secured to said motor below said pump, said regulator casing having a bore therein communicating with said outlet port, means including a suction conduit for conveying lubri-

cant from said reservoir to said inlet port, and means including a piston slidably mounted in said bore and subjected to the pressure of lubricant discharged from said outlet port for periodically supplying additional quantities of lubricant to said inlet port and for periodically receiving excess lubricant supplied thereto in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump to minimize variations in the rate of flow of lubricant through said suction conduit and for periodically receiving excess lubricant discharged from said outlet port and for periodically supplying additional quantities of lubricant thereto.

11. In combination, an electric motor having a vertically disposed shaft, a hermetically sealed casing surrounding said motor, said casing having a lubricant reservoir formed in the lower portion thereof, a variable displacement pump including a blade slidably mounted on the lower portion of said shaft and driven thereby and a substantially cylindrical pump casing surrounding said blade and secured to the lower portion of said motor, a disk-shaped plate secured to the lower side of said pump casing and having passages therein forming inlet and outlet ports for said pump, a flow regulator casing secured to a lower side of said plate and having a vertical bore formed therein communicating with said outlet port, said flow regulator casing having a passage formed therein communicating with said reservoir and with said inlet port, and means including a piston slidably mounted in said bore and subjected to the pressure of lubricant discharged from said outlet port for periodically supplying additional quantities of lubricant to said inlet port and for periodically receiving excess lubricant supplied thereto in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump to minimize variations in the rate of flow of lubricant through said suction conduit and for periodically receiving excess lubricant discharged from said outlet port and for periodically supplying additional quantities of lubricant thereto.

12. In combination, a refrigerant compressor and an electric driving motor therefor having a vertically disposed shaft, said compressor and said motor having contacting bearing surfaces, a hermetically sealed casing surrounding said compressor and motor, said casing having a lubricant reservoir formed in the lower portion thereof, a variable displacement pump including a blade slidably mounted on the lower portion of said shaft and driven thereby and a substantially cylindrical pump casing surrounding said blade and secured to the lower portion of said motor, a disk-shaped plate secured to the lower side of said pump casing and having passages therein forming inlet and outlet ports for said pump, a flow regulator casing secured to the lower side of said plate and having a vertical bore formed therein communicating with said outlet port, said flow regulator casing having a passage formed therein communicating with said reservoir and with said inlet port, means including a piston slidably mounted in said bore and subjected to the pressure of lubricant discharged from said outlet port for periodically supplying additional quantities of lubricant to said inlet port and for periodically receiving excess lubricant supplied thereto in accordance with the periodic variations in the quantity of lubricant discharged from said outlet port of said pump and for periodically receiving excess lubricant discharged from said outlet port and for periodically supplying additional quantities of lubricant thereto, and means including a passage extending substantially throughout the length of said shaft for conveying lubricant under pressure to said contacting bearing surfaces of said motor and compressor.

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