

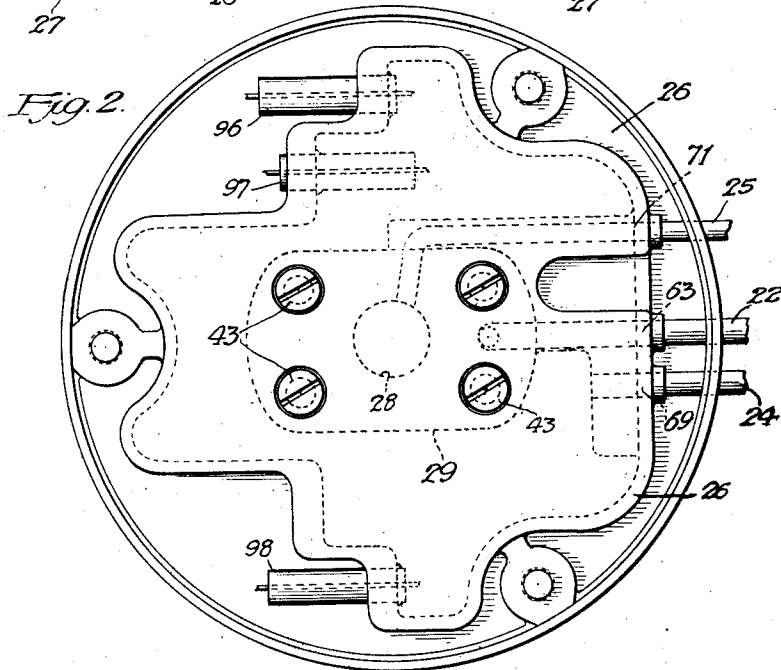
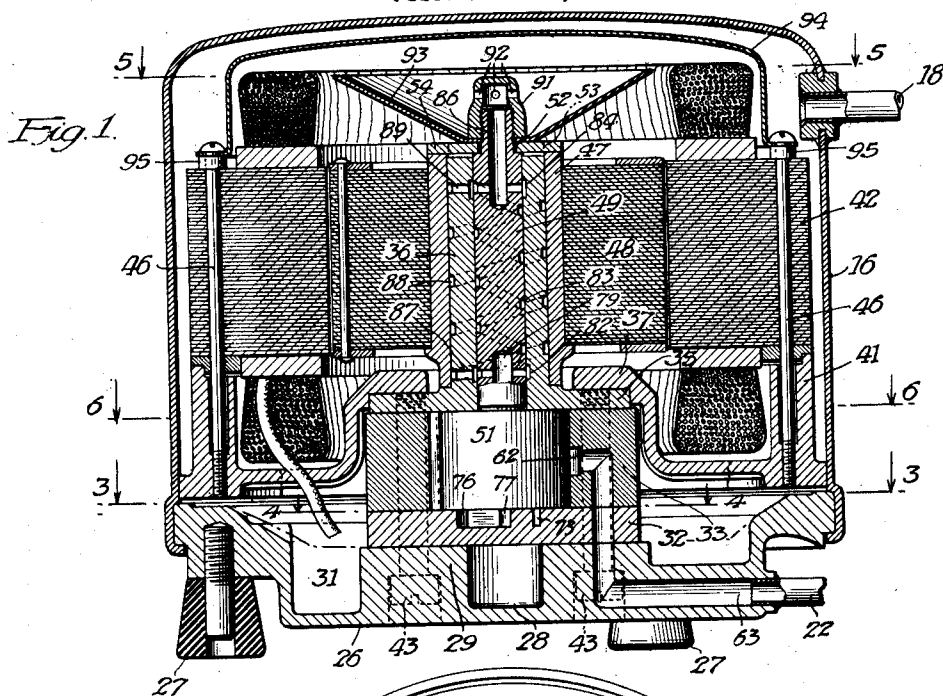
July 17, 1934.

C. E. L. LIPMAN
REFRIGERATING APPARATUS

1,967,033

Filed Feb. 14, 1930

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

Fig. 3.

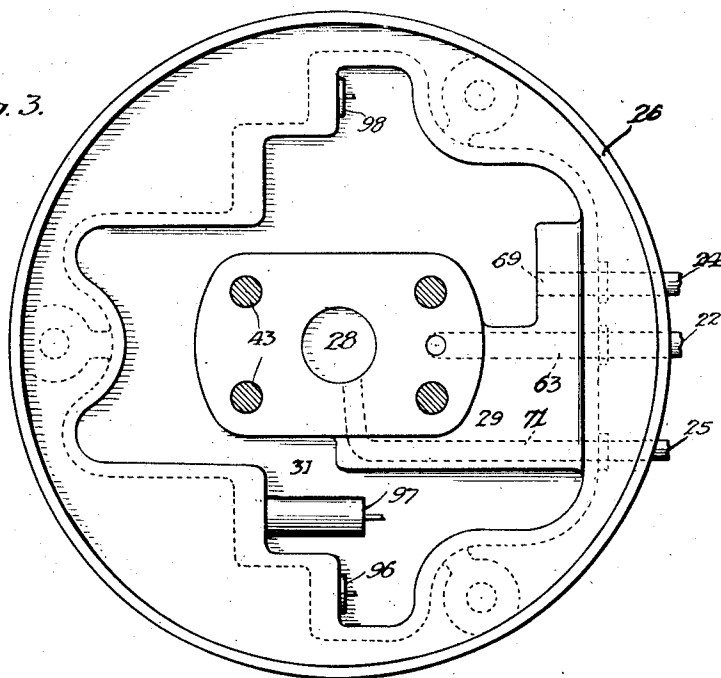
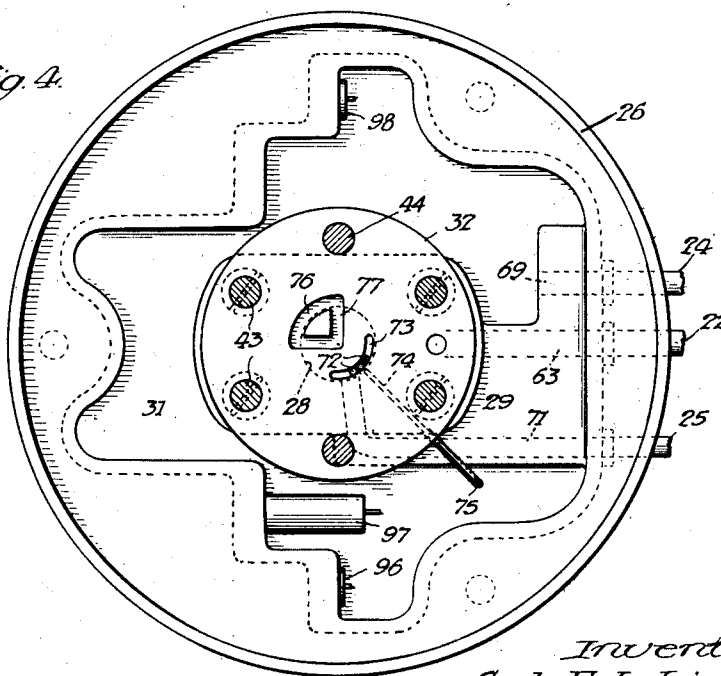


Fig. 4.



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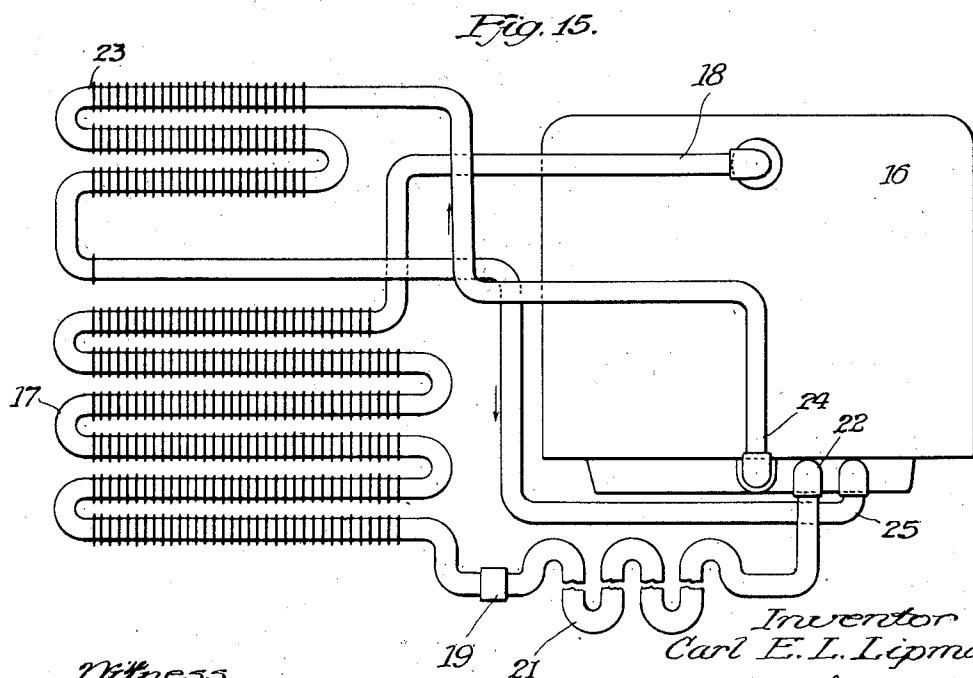
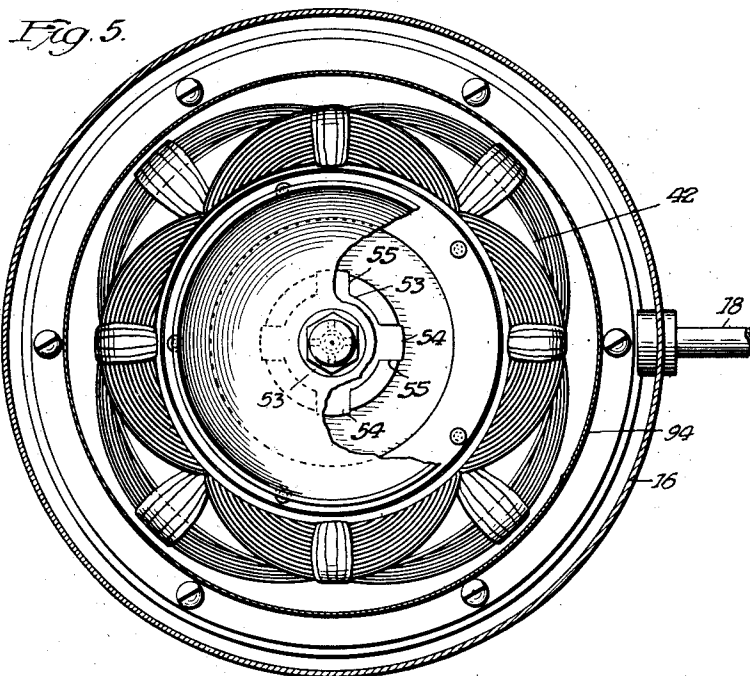
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5 Sheets-Sheet 3



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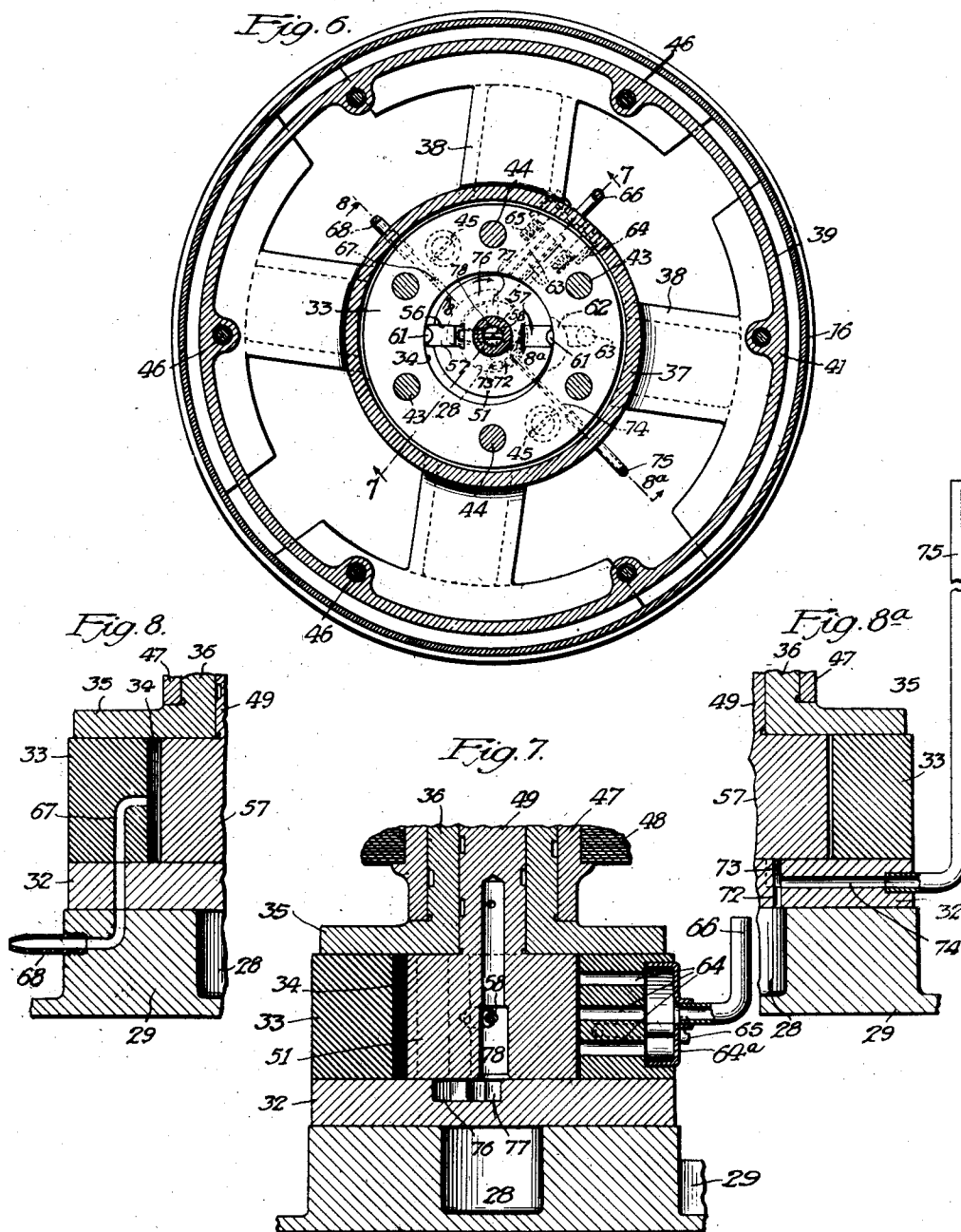
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REFRIGERATING APPARATUS

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5 Sheets-Sheet 4



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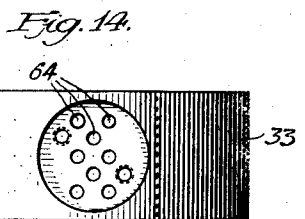
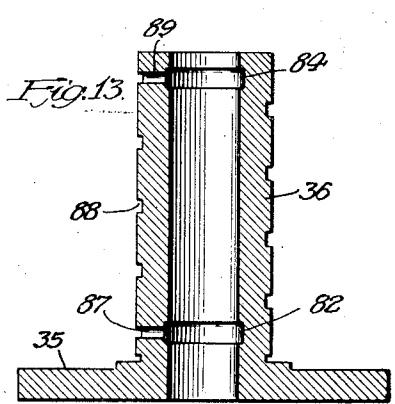
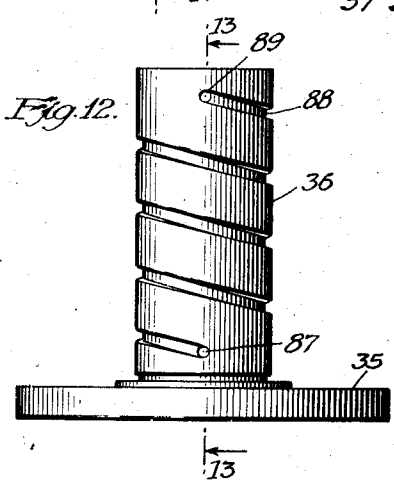
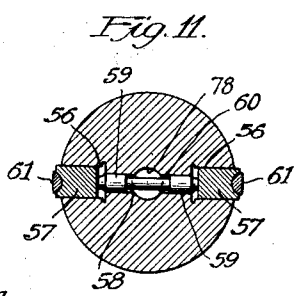
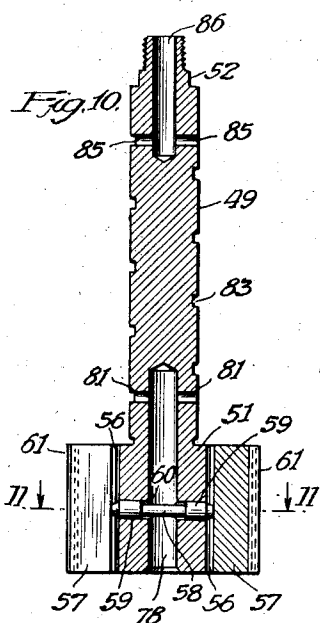
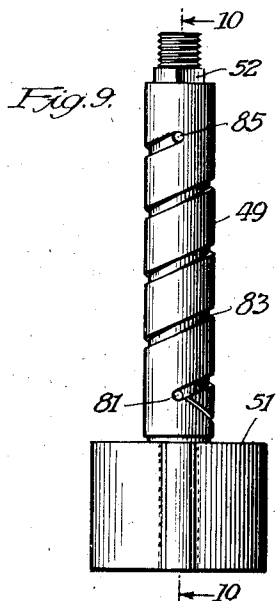
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REFRIGERATING APPARATUS

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

1,967,033

REFRIGERATING APPARATUS

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Application February 14, 1930, Serial No. 428,286

20 Claims. (Cl. 62—115)

This invention relates generally to refrigerating apparatus and while I have shown and described herein, as illustrative of the principles of my invention a refrigerating unit particularly adaptable for household refrigeration, it will be manifest that many of the principles and features of my invention are capable of embodiment in apparatus suitable for purposes other than that of refrigeration.

One of the purposes of my invention is to provide a unit embodying a motor, a compressor or vacuum pump, an oil pump, and driving connections, all combined and arranged in a novel and compact assembly which will occupy a minimum of space, which will be highly efficient in operation, which will be durable in use, and which can be economically manufactured and assembled.

Another object of my invention is to prevent overheating of the motor and the compressor by absorbing in a cooling fluid the heat generated by these elements when in use and circulating this cooling fluid in such a manner as, for example, through a heat dissipating device such as a radiator or coil by which the absorbed heat is dissipated to the atmosphere.

Another object of my invention is to prevent overheating of the motor and yet to provide means for maintaining the compressor at a substantially uniform temperature during both running and idle periods by absorbing in the cooling fluid only a portion of the heat generated by the elements of the unit. By this means the absorption of any substantial amounts of gas in the cooling medium is prevented.

Another advantageous feature of my invention contributing toward compactness and efficiency of the unit resides in the manner of mounting, supporting, and connecting the motor and pump or compressor, so that while concentrically mounted to occupy a minimum of space, the weight of neither is carried by the other and no lateral pull of the motor occasioned by any inequalities or imperfections in the rotor or stator or in the mounting thereof is transmitted to the pump or its shaft.

A further object is to provide a combined oil pump and gas compressor in which the same moving parts serve the dual function of pumping and circulating the cooling fluid and simultaneously inducing a partial vacuum in the suction side of the compressor and compressing and delivering under pressure the gas drawn into the compressor from said suction side.

Another object is to provide an apparatus in

which all of the moving parts will be insured adequate lubrication by the positive force feed delivery of lubricant thereto, thus promoting longevity of the apparatus.

Still another object is to insure against leakage or slippage of the gas within the compressor by providing an oil seal for the compressor blades, each seal being automatically replenished at each actuation of a blade.

A further feature resides in the fact that my invention contemplates the elimination of pounding or hammering in the oil pump by admitting with the oil on each suction stroke a small quantity of compressible gas, the compression of which eliminates knocking in the pump and contributes toward the efficiency and life of the apparatus.

Still another object is to provide an oil distributing device which not only insures the distribution of the oil over the motor for cooling purposes, but also tends toward the separation of the entrained gas from the delivered oil.

Other objects and many of the inherent advantages of my invention will be appreciated as the same becomes better understood from an examination of the specification and claims in connection with the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view through a unit embodying my invention;

Fig. 2 is a bottom plan view;

Fig. 3 is a horizontal sectional view on line 3—3 of Fig. 1;

Fig. 4 is a similar view on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view on the line 5—5 of Fig. 1;

Fig. 6 is a sectional view on the line 6—6 of Fig. 1 the stator windings being omitted;

Fig. 7 is a sectional view on the line 7—7 of Fig. 6;

Fig. 8 is a fragmentary section on the line 8—8 of Fig. 6;

Fig. 8a is a fragmentary section on the line 8a of Fig. 6;

Fig. 9 is a side elevation of the pump rotor and shaft;

Fig. 10 is a sectional view on the line 10—10 of Fig. 9;

Fig. 11 is a sectional view on the line 11—11 of Fig. 10;

Fig. 12 is an elevation of the hollow bearing standard;

Fig. 13 is a sectional view on the line 13—13 of Fig. 12;

Fig. 14 is a detailed side elevation of the pump housing; and

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Fig. 15 is a schematic view of the unit and the parts associated therewith.

Referring now to the drawings more in detail and particularly to the diagrammatic layout shown in Fig. 15, reference character 16 indicates generally the hermetically sealed unit in which the operating parts of my apparatus, to be later described, are disposed; 17 is the condenser of the refrigerating system to which compressed refrigerating medium is delivered through a pipe 18 communicating with the interior of the unit case near the top thereof; 19 indicates an expansion valve of any preferred construction, and 21 the evaporator or expansion coil of the system from which the refrigerant is withdrawn through the pipe 22 into the suction side of the compressor, as will be later explained. It should be understood that while I have illustrated a conventional expansion valve and expansion coil 21, the valve may be eliminated and another type of evaporator or expander employed if the system is operated on the flooded system principle.

23 indicates the oil cooling element which may be in the form of a coil, radiator, or other preferred form of heat dissipating device, this element being connected with the oil sump of the unit by a pipe 24 and with the suction side of the pump by a pipe 25.

The unit itself, disclosed more in detail in the remaining figures of the drawings, comprises a base 26 adapted to be supported upon feet 27 preferably formed of rubber or other vibration absorbing material, the base being shaped to provide a central oil well 28 formed in a table 29 rising centrally from the bottom of the base and surrounded by a depressed portion forming an oil sump 31.

A pump housing is supported upon the table, the housing comprising a disc or base plate 32 forming the bottom of the housing, an annular member 33 forming the side walls of the housing, and provided with a central bore 34 forming the rotor chamber and a top plate 35 which also constitutes the base of a tubular standard 36 rising from this base. Upon the base 35 an annular spider 37 is supported, the webs 38 of the spider carrying at their outer ends a ring 39 equipped with a plurality of upstanding posts 41 upon which the stator 42 of the electric motor is supported. The parts 29, 32, 33, 35 and 37 are all rigidly fastened together when assembled by a plurality of screw bolts 43 illustrated in Figs. 1 and 6, and the base plate 32 and top plate 35 independently secured to the housing member 33 by screw bolts 44 and 45 respectively. The stator of the motor is securely attached to its supporting posts 41 by a plurality of bolts or rods 46.

The standard 36 serves as the journal bearing for both the rotor of the electric motor and the shaft of the pump and compressor so that the rotor and compressor pump are coaxially disposed and connected by a direct driving connection which however, as will be later explained, is so constructed that no weight or lateral thrusts of the rotor will be transmitted to the pump shaft. From Fig. 1 it will be observed that a rotor sleeve 47 carrying the rotor structure 48 surrounds and is journaled upon the periphery of the standard 36, the weight of the sleeve and supported parts of the rotor however being supported by the lower end of the sleeve upon the standard base 35. The shaft 49 for the pump and compressor which is formed integrally with the pump and compressor rotor 51, as will be apparent from Figs. 9 and 10, is journaled within the standard 36 concentrically

with the sleeve 47, and the weight of the rotor and shaft rests upon the base plate 32 of the pump and compressor housing. The upper portion of the shaft 49 above the standard 36 is provided with a square shoulder 52 to receive the squared opening in a driving member 53 which includes radially projecting arms 54, each seated in a correspondingly shaped slot 55 formed in the upper end of the sleeve 47. It will be apparent that this member forms a direct driving connection between the rotor sleeve 47 and the shaft 49, but that because of the slidable relation between the member 53 and the sleeve, no lateral movements or thrusts of the sleeve can be transmitted to the shaft. This feature is of considerable practical importance because any lateral movements or thrusts of the rotor due to imperfections in the motor or side pull exerted by the stator upon the rotor, if transmitted to the pump rotor shaft, would induce misalignment, chattering, and wear, all detrimental to the efficiency, operation, and life of the apparatus.

The rotor 51 of the pump and compressor is disposed eccentrically within the bore 34 of the housing, as will be apparent from Fig. 6, and this rotor is provided with a plurality of radially disposed blade receiving sockets 56 for the reception of reciprocating blades 57 adapted to reciprocate radially in said slots. While I have shown for purposes of illustration a rotor provided with two oppositely disposed slots and blades, it should be understood that a greater number may be employed if preferred without affecting the principles of my invention.

The blades are maintained at all times a predetermined distance apart by an abutment pin 58 extending transversely of the rotor between the blades, the pin being equipped with enlarged bearing surfaces 59 slidably fitting within a transverse guiding bore 60 formed in the rotor.

The length of the abutment pin is such that the outer ends of the blades will always be maintained in contact with the surrounding walls of the rotor housing, and as one blade is forced inwardly during the revolution of the rotor, due to the eccentric relation between the rotor and housing, the companion blade will be correspondingly forced outwardly into contact with the opposite wall of the housing, with the result that sliding contact between the ends of the blades and the surrounding housing is maintained at all times and without the employment of springs or other yielding devices liable to get out of order and impair the operation of the apparatus.

The outer end of each blade is provided with a concavity extending from top to bottom thereof in which is disposed a sealing element 61 adapted to form the contact with the surrounding walls of the bore. These sealing elements are made of hardened steel or other wear resisting material and their outer bearing surfaces are formed on an arc having a radius equal to the radius of the housing bore. Each element is shaped to fit its concave socket so that it is free to oscillate therein upon rotation of the rotor, thereby enabling the sealing elements to automatically conform to the curvature of the surrounding walls and maintain a surface-to-surface contact therewith, notwithstanding the fact that the axis about which they rotate is not concentric with the axis of the cylindrical chamber in which they operate.

The gas thereby compressed is admitted to the cylindrical bore around the rotor through an

elongated intake port 62 (Fig. 6) formed in the wall of the bore intermediate its top and bottom, this port being in communication through a passage 63 extending through the members 33, 32 and the base 26 with the pipe 22 leading from the expander 21. The admitted gas is compressed by the rotation of the blades 56 and is discharged through the outlet ports 64, best illustrated in Figs. 7 and 14. A plurality of these ports is utilized in order to permit rapid and free delivery of the compressed gas with a minimum of resistance and after issuing from these ports the gas is collected in a chamber formed by cap or housing 64a attached by screws 65 or otherwise to the side of the housing 33 from whence the gas is delivered through a pipe 66 into the space around the electric motor, but above the oil level maintained in the unit. Cap 64a provides an expansion chamber or manifold which serves to muffle the noise of the discharged gas.

For the purpose of lubricating the blades, the sealing elements and the walls of the chamber with which these sealing elements contact, and for the further purpose of forming an oil seal to preclude leakage of the gas past the blades, I have provided, as shown in Figs. 6 and 8, for the admission of oil from the sump into the bore of the housing. With this end in view, a passage 67 is formed through the housing wall 33, the base 32 and the table 29 to establish communication between the oil sump 31 and the bore of the housing through which oil enters the housing for the purposes indicated. Preferably a small nozzle or tip 68 forming a continuation of the passage 67 is provided, the size of the opening through which determines the quantity of oil admitted. This quantity may be regulated by the substitution of tips having different size bores.

Rotation of the rotor 51 carrying with it the blades contacting the surrounding walls of the bore serves therefore to draw in gas through the passage 63 from the expander and to compress said gas and deliver it through discharge pipe 66 into the space within the unit above the oil level. The oil drawn in through passage 67 which serves to seal the blades and to insure lubrication of the moving parts is discharged with the compressed gas and drops back into the sump. While the rotor is employed in the present instance primarily as a compressor, it will be obvious that it may be used primarily as a vacuum pump without deviating in any respect from the principles of the apparatus.

The gas delivered under pressure by the rotor rises around the motor and is retained under pressure. The case 16 which has a sealed connection with the base 26 and in conjunction with the base forms an hermetically sealed inclosure for all of the operating parts of the unit. The gas collected within the case in the upper portion of the unit is delivered under pressure through the pipe 18 to the condenser 17 in the usual manner.

My improved rotor is designed not only to serve as a suction pump and a compressor, but also as an oil pump, and with this end in view, the reciprocation of the blades 57 in their slots is utilized to induct and eject oil into and from these slots at each revolution of the rotor.

The oil in the sump of the unit is of course subjected to the pressure of the compressed gas above the oil in the case 16 and this pressure causes the oil to flow from the sump through a

passage 69 in the wall of the sump to the pipe 24 through which it is delivered to the cooling element 23 and thence through pipe 25 back to passage 71 communicating with the central well 28. This well, as will be apparent from Figs. 7 and 8a, is periodically in communication with the blade slots 56 as the rotor revolves, the communication being established through vertical ports 72 which admit oil from the well to the space at the inner end of each blade 57 as this space, during the rotation of the rotor, passes the ports 72. For illustrative purposes three of these ports 72 are shown, each communicating at its upper end with an elongated groove 73 (Fig. 4) providing an elongated suction or intake port with which each blade slot establishes communication for a sufficient length of time to permit the space back of each blade to be filled with oil. The admission of oil at the inner sides of the blades serves the dual purpose of lubricating the blades and of forcing the blades outwardly against the surrounding walls of the housing bore, because, it will be recalled, the oil is admitted to these blade slots under the pressure existing within the case of the unit.

To preclude hammering of the blades resulting from forcing the blades inwardly against the relatively non-compressible oil when the intake port has been cut off, I provide for admitting with the oil a limited quantity of gas which, being mixed with the oil and relatively compressible, obviates undue strain upon the blades and insures smooth and even operation of the blades. The gas is admitted to one of the ports 72 through a passage 74 formed in the housing base 32, the outer end of the passage being connected with a breather pipe 75 extending upwardly between the periphery of the electric motor and the surrounding casing 68 to a point near the top of this case. The gas delivered through passage 74 into port 72 is admixed with the oil and enters the pump therewith for the purposes above indicated.

Upon further rotation of the rotor, the blade slots are successively brought into communication with an elongated arcuate discharge port 76, which, through radial channels 77 communicates with a central bore or passage 78 extending upwardly through the rotor and into the shaft 49, as will be apparent from Figs. 7 and 10. Radial passages 81 from this bore communicate at their outer ends with an annular groove 82 formed on the interior of the standard 36, and a spiral groove 83 in the exterior of the shaft 49 communicates at its lower end with the groove 82 and at its upper end with a similar groove 84 which in turn communicates through radial passages 85 with a bore 86 in the upper end of shaft 49.

The standard 36 is provided also with a radial passage 87 communicating at its inner end with the groove 82 and at its outer end with a spiral groove 88 formed in the perimeter of the standard and communicating at its upper end through a radial passage 89 with the groove 84. It will be apparent therefore that the oil delivered by the oil pump consisting of the reciprocating blades of the rotor flows from exhaust ports 76 through channels 77 into bore 78, thence outwardly through passages 81 into groove 82 from whence part of the oil is carried upwardly by the groove 83 in the shaft to lubricate the shaft journal and part of it flows through passage 87 into groove 88 and is carried upwardly in this groove by the surrounding rotating motor sleeve 47 to lubricate the motor journal, whereupon the oil delivered by

both grooves 83 and 88 is discharged at the upper end of the shaft through bore 86.

The upper end of shaft 49 is threaded to receive a cap nut 91 provided with radial distributing ports 92 through which the oil is delivered laterally from the shaft. This nut serves also to clamp in position a conically shaped oil distributor 93 which is carried by and rotates with the shaft so that the oil delivered through ports 92 into the distributor is thrown by centrifugal force upwardly and outwardly so as to be distributed over the electric motor.

To insure against all the oil flowing downwardly along the inner faces of the case 68 instead of downwardly over the motor windings as is desired, a shield 94 is employed which is carried and held in position by the fastening rods 46 of the stator, suitable spacing washers 95 being interposed between the stator discs and the shield as will be apparent from Fig. 1.

Operation

After the parts above described have been assembled and a suitable quantity of light oil has been introduced into the unit and the unit has been charged with a refrigerating medium, such as sulphur dioxide under the customary pressure, my invention operates in the following manner. Current is turned on to the stator of the electric motor in the usual manner, the motor leads being indicated on Fig. 2 of the drawing by reference characters 96, 97, and 98, the motor rotor carried by the sleeve 47 journaled upon the standard 36 revolves and through the flexible connection 53 directly drives the pump shaft 49 without transmission of either weight or lateral thrusts to the shaft. This shaft, journaled upon the interior of the standard 36, revolves the pump rotor 51 formed integrally therewith and disposed eccentrically within the bore 34 of the housing. The revolving blades 57 draw refrigerant from the expander through the elongated intake port 62 into the housing where it is compressed and delivered through pipe 66 into the unit case above the oil level. The oil which is drawn into the housing through the passage 67 from the sump to lubricate and seal the pump blades is discharged with the compressed gas through pipe 66 and falls back into the sump. The gas rises in the case from whence it is discharged under pressure through pipe 18 into the condenser.

Oil in the sump under the pressure of the gaseous refrigerant in the case flows through pipe 24 into the cooling element 23 where it is cooled and thence through pipe 25 back into the central oil well from which, together with a limited quantity of gas admitted through breather pipe 75, it is delivered into the inner ends of the blade slots of the rotor as these slots pass the elongated intake port 73. The inward movement of the blades induced by the eccentric relation between the rotor and surrounding housing forces the oil with its entrained gas from the blade pockets through the elongated discharge port 76, thence upwardly through passage 78 from which it is carried upwardly by the spiral grooves 83 and 88 to lubricate the journal bearings for the pump shaft and the sleeve of the electric rotor whereupon the oil is discharged at the top of the shaft into the distributor 73 by which it is distributed over the motor and flows downwardly over and around the motor to the sump from which it is recirculated through the cooling element. The heat generated by the motor and part of the heat generated by the compressor is absorbed by the

circulating oil and the absorbed heat units are carried to the cooling element where they are dissipated to atmosphere. The unit therefore may be located in any desired position and even imbedded in heat insulating material if desired, because the cooling of the unit is not dependent upon circulation of either a cooling fluid or air around the unit, but the parts are effectively cooled and the excess heat units removed and dissipated through the cooling element which is located remote from the unit itself and may be either water cooled or air cooled, as desired, although I have found that at ordinary atmospheric temperatures air cooling is adequate. By cooling the lubricating oil only and not the seal oil which enters the compressor chamber, the compressor is not cooled down below the desired temperature and accordingly the absorption of refrigerating gas is maintained at a minimum.

While I have shown and described a preferred embodiment of my invention, obviously the structural details illustrated may be varied within considerable limits without departing from the essence of the invention as defined in the following claims.

I claim:

1. A refrigerating apparatus comprising a closed casing adapted to contain a refrigerant under pressure and providing an oil sump, a housing within said casing providing a refrigerant compressor rotor chamber, a compressor rotor disposed within said chamber and provided with lateral blade receiving slots, a blade reciprocable in each of said slots, an electric motor disposed within said casing and connected to rotate said rotor, means for admitting refrigerant gas together with a restricted amount of oil into the chamber around the rotor, means for admitting oil together with a restricted amount of gas from the upper portion of said casing into said slots at the inner sides of said blades, said rotor being arranged to discharge refrigerant under pressure into said casing, a refrigerant circulating system connected to said casing and the suction side of said compressor, and means for delivering oil from said compressor into heat absorbing contact with said motor to enable absorption by said oil of heat units generated by said motor.

2. In a hermetically sealed refrigerating system containing lubricating oil and a refrigerant absorbable at low temperature in said oil, the combination of a compressor, an electric motor and a sealed case enclosing said motor and compressor and into which the compressed refrigerant is delivered by the compressor, the lower portion of the case providing a sump for the collection of said lubricating oil, and means for causing absorption by said oil of heat from said motor to maintain an oil temperature unfavorable to refrigerant absorption, said means including an oil pump and suitable conduits whereby oil is delivered into heat absorbing contact with said motor so as to be heated thereby.

3. In a hermetically sealed refrigerating system having a lubricant and a refrigerant absorbable at low temperatures in said lubricant confined therein, the combination of a compressor, an electric motor for driving the same, a sealed case enclosing said motor and compressor, a refrigerant circulatory system connected at one end to said case and at its other end to the suction side of said compressor, and means for establishing a lubricant temperature in the case unfavorable to the absorption of refrigerant by

the lubricant, including means for circulating the lubricant over and in heat absorbing contact with said motor whereby heat units generated by the motor are caused to be transferred to the lubricant.

4. A refrigerating apparatus comprising a hermetically sealed case containing refrigerant under pressure and a lubricant susceptible at low temperatures to absorption of substantial quantities of said refrigerant, an electric motor and a compressor mounted in axial alignment in said case and operatively connected together, the compressor being arranged to discharge into said case around the motor whereby pressure is created in the case, a refrigerant circuit including a condenser and an evaporator, connected at one end to said case and at the other to the suction side of said compressor, through which said refrigerant is circulated, means for circulating said lubricant over and in heat absorbing contact with said motor to effect a sufficient transfer of heat units from the motor to the lubricant to preclude overheating of the motor and maintain the lubricant above the temperatures at which refrigerant is readily absorbed thereby, said circulating means including a passage for delivering the lubricant from the compressor above the level of the motor to enable gravity flow of said lubricant in contact with said motor parts, and means through which said lubricant from the motor may be circulated to dissipate the excess heat units removed from the motor.

5. A refrigerating apparatus comprising a hermetically sealed case containing refrigerant under pressure and a lubricant susceptible at low temperatures to absorption of substantial quantities of said refrigerant, an electric motor and a compressor mounted in axial alignment in said case and operatively connected together, the compressor being arranged to discharge into said case around the motor whereby pressure is created in the case, a refrigerant circuit including a condenser and an evaporator, connected at one end to said case and at the other to the suction side of said compressor, through which said refrigerant is circulated, means for circulating said lubricant over and in heat absorbing contact with said motor to effect a sufficient transfer of heat units from the motor to the lubricant to preclude overheating of the motor and maintain the lubricant above the temperatures at which refrigerant is readily absorbed thereby, said circulating means including a passage for conducting the lubricant from the compressor, means for distributing said lubricant over the motor to enable gravity flow of said lubricant in contact with said motor parts, and means through which said lubricant from the motor may be circulated to dissipate the excess heat units removed from the motor.

6. An apparatus comprising a standard, a sleeve journaled on said standard, a rotor of an electric motor carried by said sleeve, a rotary pump including a shaft journaled within said standard, portions of said shaft being hollow, grooves interiorly and exteriorly of said standard communicating with the hollow portions of said shaft, a flexible driving connection between said shaft and said sleeve at one end of said standard, and means carried by the upper end of said shaft for centrifugally distributing oil delivered from said shaft over said motor.

7. An apparatus comprising a base providing an oil sump, a pump housing mounted on said base, a hollow standard rising from said housing,

a pump shaft journaled in said standard, an electric motor surrounding said standard and having the rotor thereof journaled on said standard but supported by said housing, a positive flexible driving connection between said rotor and said shaft, an oil distributor at the upper end of said shaft for distributing oil over said motor and directing the same into heat absorbing contact with the windings thereof, and means for conducting oil from the pump to the journal bearings of said rotor and pump shaft and to said distributor.

8. An apparatus comprising a housing providing a cylindrical rotor chamber, a rotor therein provided with radially disposed slots, blades disposed in said slots, an elongated arcuate intake port communicating with said chamber, a plurality of outlet ports communicating with said chamber, an intake port in the base of said housing through which oil is admitted to said slots at the inner sides of said blades, a breather pipe connected with said last mentioned port through which gas may be introduced with said oil, an exhaust port in the base of said housing, and means for delivering oil through said exhaust port to the bearings for said rotor.

9. An apparatus comprising a hermetically sealed case adapted to contain liquid and gas, a housing within said case provided with a bore, a rotor disposed within said bore and provided with radially disposed blade slots, a blade reciprocable in each of said slots, a motor for rotating said rotor, intake and discharge ports through the housing communicating with the housing space surrounding said rotor, means for delivering gas and a restricted amount of liquid from said case to said intake port, means for delivering liquid and a limited amount of gas from said case to the interior of said rotor at the inner ends of said blades, means for delivering said last mentioned liquid and gas to a point above said motor, and means for separating the liquid from the gas and distributing the liquid over said motor.

10. An apparatus comprising a standard, a rotor of an electric motor surrounding and journaled on said standard, a rotary pump including a shaft journaled within said standard, the upper and lower portions of said shaft being hollow, spiral grooves interiorly and exteriorly of said standard surrounding said shaft and said standard respectively and communicating at their ends with the hollow portions of said shaft, a flexible driving connection between said shaft and said rotor, means carried by the upper end of said shaft for centrifugally distributing oil delivered from the hollow upper portion of said shaft over said motor, and means for directing said oil into contact with the motor stator.

11. An apparatus comprising a closed case adapted to contain oil, a standard within said case, a rotor of an electric motor journaled upon said standard, a rotary pump having its shaft journaled within said standard, a cooling coil connected to receive oil from said case, a connection from said coil to the intake side of said pump, means for delivering oil from said pump to the interior and exterior surfaces of said standard and thence to the end of said shaft, and means for distributing said delivered oil over the motor into heat absorbing contact with the stator thereof.

12. An apparatus comprising a base providing an oil sump, a pump housing carried by said base, a rotary pump member within said housing, a pump shaft projecting from said housing, a

- standard rising from said housing within which said shaft is journaled, an electric motor having its rotor surrounding and journaled on said standard, a direct flexible driving connection between said rotor and shaft, an oil distributor carried by the upper end of said shaft, means for delivering oil through the motor pump bearings to said distributor, means for directing the distributed oil into heat absorbing contact with the motor, and means for cooling the heated oil. 80
13. An apparatus comprising a base providing an oil sump, a pump housing carried by said base, a rotary pump member within said housing, a pump shaft projecting from said housing, an electric motor having its rotor surrounding and disposed coaxially with said shaft, a direct driving connection between said rotor and shaft, an oil distributor carried by the upper end of said shaft, means for delivering oil from said pump to said distributor whereby the same is distributed over said motor, a shield disposed in proximity to said distributor for directing the distributed oil into contact with the motor stator, a case associated with said base to provide a sealed enclosure within which said pump, motor, distributor, and shield are disposed, and means for dissipating heat removed by said oil from the motor. 85
14. An apparatus comprising a compressor housing providing a rotor chamber, a rotor therein provided with slots each having radially reciprocable blades disposed therein, means for supplying fluid to be compressed to said chamber, means for supplying a restricted quantity of lubricant to said chamber, an exhaust port through which the lubricant and compressed fluid are discharged from said chamber, lubricant supply and exhaust ports communicating alternately upon rotation of the rotor with the inner portions of said slots, an electric motor connected to rotate said rotor, means for conducting lubricant from said lubricant exhaust port through the motor bearings, and means for directing lubricant into contact with said motor. 90
15. An apparatus comprising a base providing an oil sump, a pump housing mounted on said base, a hollow standard rising from said housing, a pump shaft journaled in said standard, an electric motor surrounding said standard and having the rotor thereof journaled on said standard but supported by said housing, a positive driving connection between said rotor and said shaft, an oil distributor at the upper end of said shaft for distributing oil over said motor and directing the same into heat absorbing contact with the windings thereof, and means for conducting oil from the pump to the journal bearings of said rotor and pump shaft and to said distributor. 95
16. An apparatus comprising a case providing an oil sump, a housing within said case, oil pumping and refrigerant compressing mechanism within said housing, an operating shaft projecting from said housing, an electric motor having its rotor surrounding said shaft, a flexible driving connection between said rotor and shaft, means for cooling the motor by inducing a gravity flow of oil in contact therewith to abstract heat units therefrom, said motor cooling means including an oil distributor for distributing oil above the motor, means for continuously delivering oil from said pump to said distributor during the operation of the motor, a deflecting surface arranged to direct the oil from the distributor into heat absorbing contact with the motor, and means for cooling the oil. 100
17. An apparatus comprising a closed case adapted to contain oil and a refrigerant, a shaft bearing within said case, a pump and compressor, a driving shaft therefor journaled in said bearing, an electric motor within said case having the rotor thereof connected to said shaft to drive the same, means for removing heat from the motor including means for continuously conducting oil delivered by said pump in quantities sufficient to absorb excessive heat units from the motor to a level within the case above the motor and means for distributing and directing said oil into heat absorbing contact with external portions of the motor, and means for cooling said oil. 105
18. An apparatus comprising a hermetically sealed case adapted to contain lubricant and refrigerant, an operating unit mounted in said case, said unit including a refrigerant compressor, a lubricant pump and an electric motor connected to drive such compressor and pump, motor cooling means including means for delivering above the motor continuously during the operation of the pump, lubricant discharged by said pump in sufficient quantities to cool said motor, means operated by said motor for distributing said delivered lubricant over said motor, means on the interior of said case for directing the distributed lubricant into heat absorbing contact with external portions of said motor and means exteriorly of said case for cooling said lubricant. 110
19. In a refrigerating machine, the combination of a motor including a rotor and a stator, a post on which the rotor is journaled, a compressor having a shaft journaled within said post, means for supplying oil to said compressor, means for conducting the oil from said compressor to the upper end of said shaft, means carried by said shaft for centrifugally distributing said oil over said motor, means for directing said distributed oil into direct heat absorbing contact with exposed surfaces of said motor for cooling the motor and means for abstracting from said oil heat units absorbed thereby from the motor. 115
20. An apparatus comprising a housing providing a cylindrical rotor chamber, a rotor therein provided with radially disposed slots and an axial bore extending through the rotor, blades reciprocable in said slots, an intake port through which the fluid to be compressed is introduced into said chamber, an outlet port through which fluid is discharged from the chamber, the base of said housing being provided with an arcuate intake port through which oil is admitted to said slots at the inner ends of said blades, and with an arcuate exhaust port through which said oil is discharged by said blades, and with a radially disposed channel connecting said exhaust port with said axial bore whereby the oil discharged by said blades is conducted through the rotor to the opposite side thereof. 120
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