

July 17, 1934.

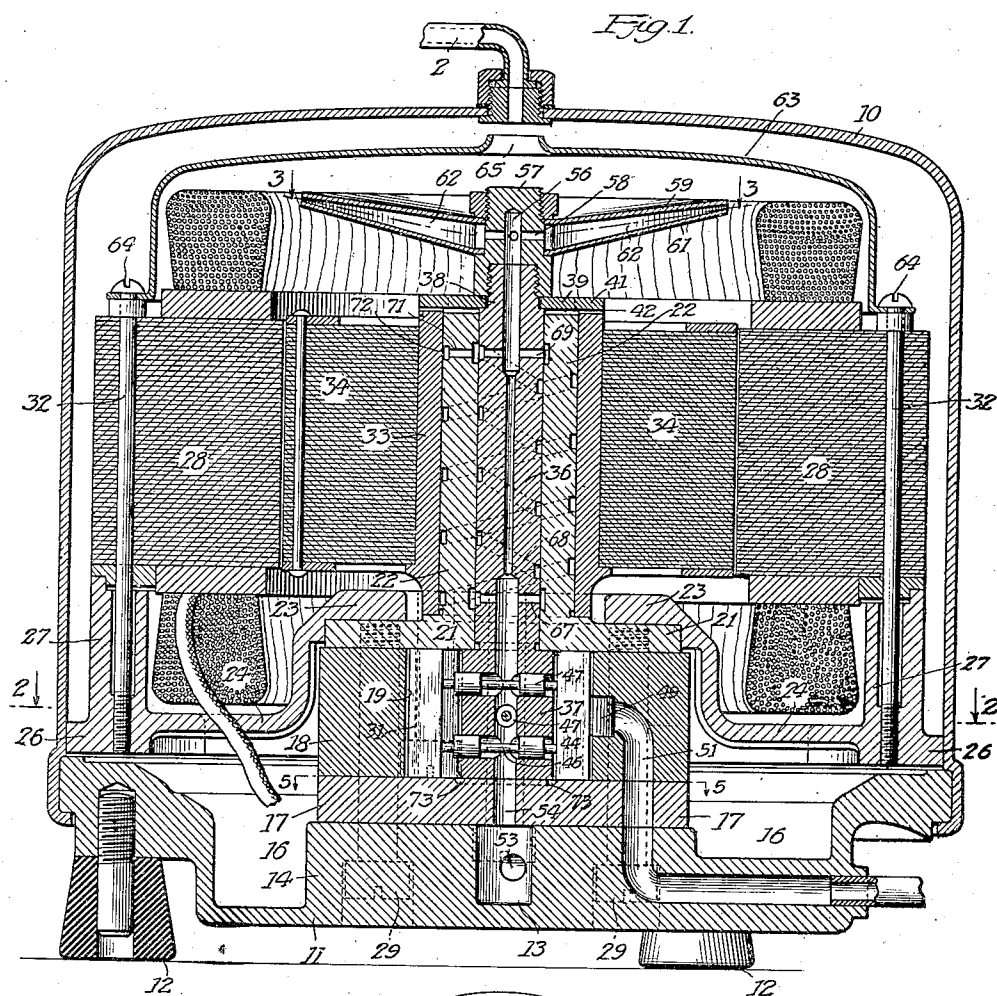
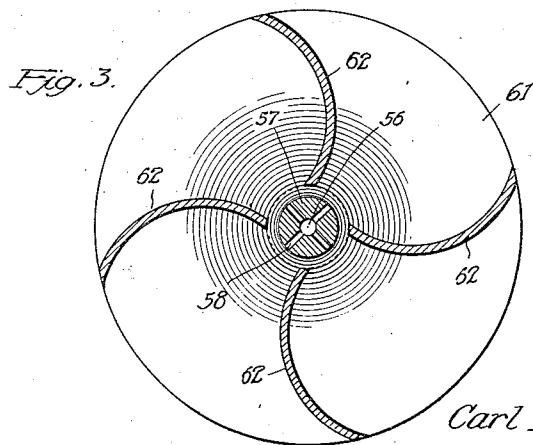
C. E. L. LIPMAN

1,967,034

MOTOR COMPRESSOR UNIT

Filed May 19, 1930

3 Sheets-Sheet 1



Witness:
R. B. Davison

Inventor
Carl E. L. Lipman

By *Wilson, Donnell, McAnna & Rehn*
Attys.

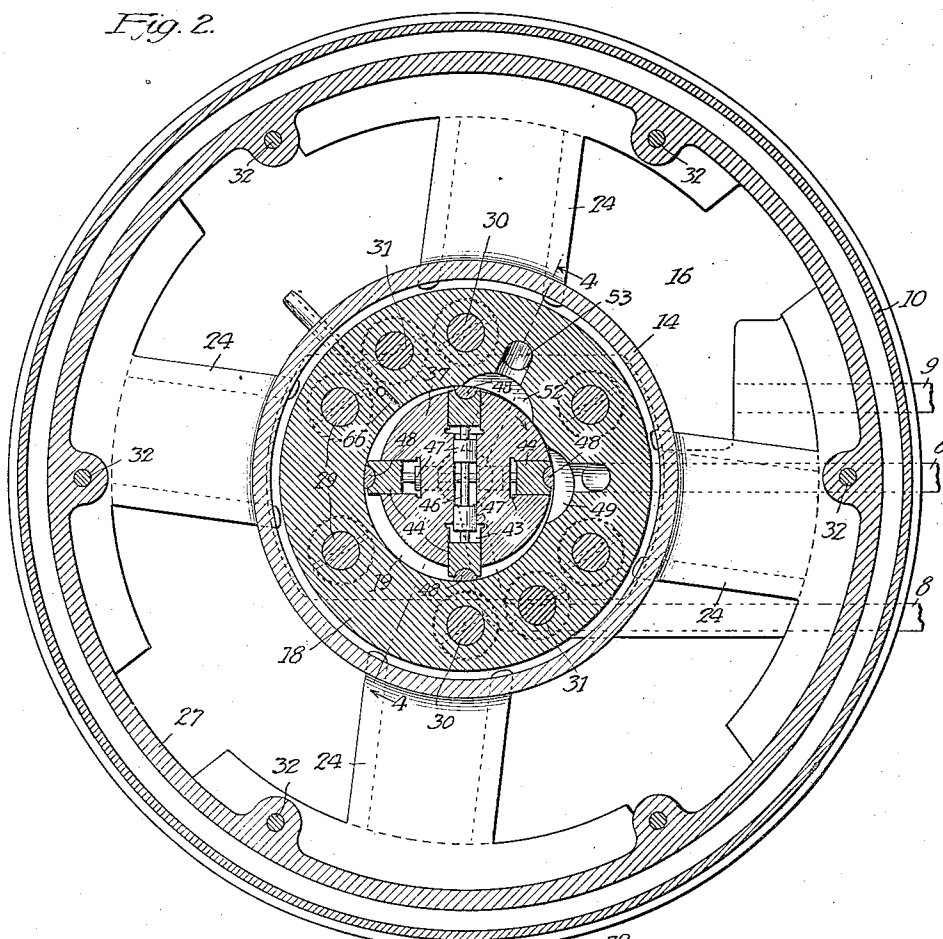
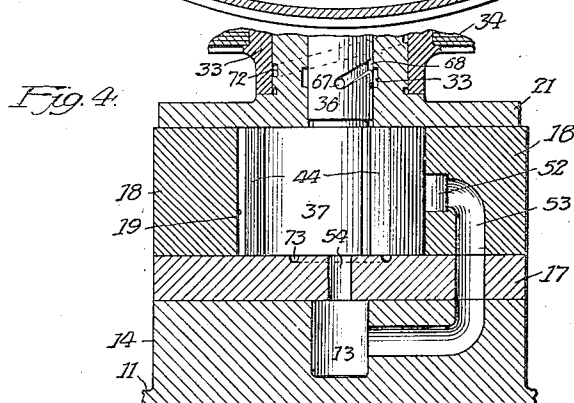
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C. E. L. LIPMAN
MOTOR COMPRESSOR UNIT

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3 Sheets-Sheet 2



Inventor
Carl E. L. Lipman

Witness
AB Davison

By Wilson, Lowell, McCanna & Rehm
Attys.

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3 Sheets-Sheet 3

Fig. 5.

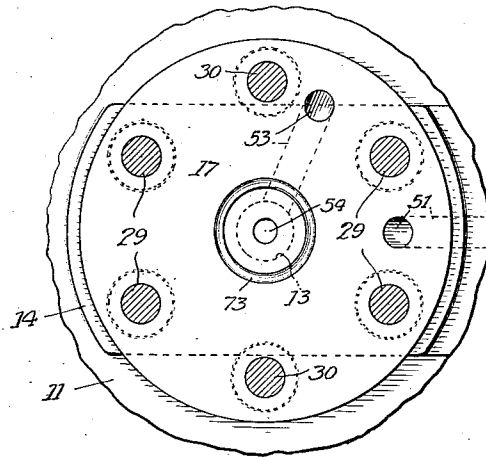
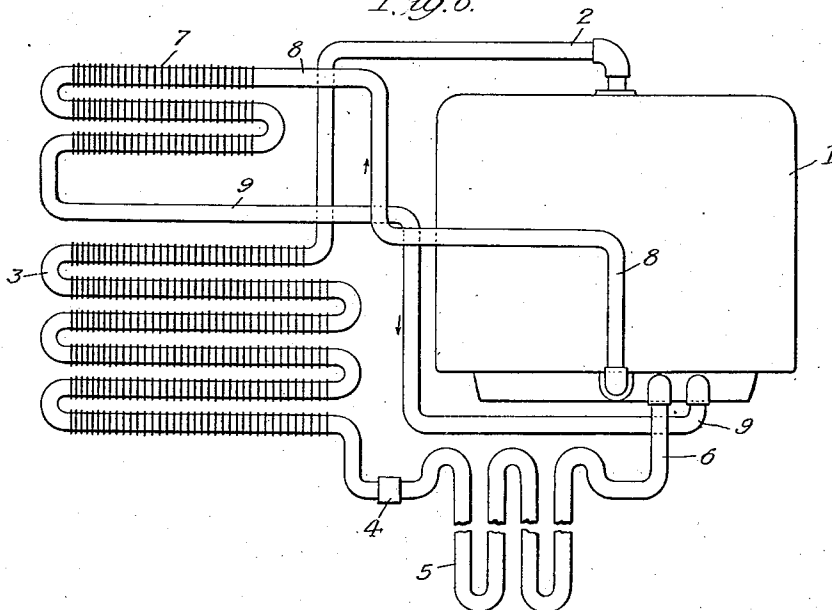


Fig. 6.



Inventor
Carl E. L. Lipman.

Witness
R. B. Dawson.

By Wilson, Dowell, McCanna & Rehm
Attys.

UNITED STATES PATENT OFFICE

1,967,034

MOTOR COMPRESSOR UNIT

Carl E. L. Lipman, Chicago, Ill., assignor to Lipman Patents Corporation, Chicago, Ill., a corporation of Delaware

Application May 19, 1930, Serial No. 453,590

11 Claims. (Cl. 230—207)

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.

A refrigerating apparatus embodying the general type of motor compressor unit herein disclosed is shown in my prior application Serial No. 428,286, filed February 14, 1930, in which the general combination is claimed and in my application Serial No. 535,638, filed May 7, 1931, containing generic claims to the motor pump unit. The present application pertains to improvements upon the motor pump unit disclosed in the aforementioned applications.

One of the features of novelty of my present invention resides in the hollow motor compressor shaft through which both the compressed refrigerant and the cooling oil are delivered from the compressor, whereas in the motor compressor units of my prior pending applications the compressed refrigerant with a small amount of sealing oil was delivered directly into the chamber or casing surrounding the motor and compressor and the circulated cooling oil only, together with a small amount of refrigerant, was delivered to the compressor and rotor bearings for lubrication purposes and then returned to the upper end of the compressor shaft for distribution over the motor for cooling purposes.

Another feature of my present invention resides in the distributor at the upper end of the motor shaft which is of improved construction over the distributors disclosed in my pending applications.

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 section through a unit embodying my invention,

Fig. 2 is a horizontal section on line 2—2 of Fig. 1,

Fig. 3 is a horizontal section on line 3—3 of Fig. 1,

Fig. 4 is a sectional view on line 4—4 of Fig. 2,

Fig. 5 is a sectional view on line 5—5 of Fig. 1, and

Fig. 6 is a schematic view of the unit and the parts associated therewith.

Referring to the drawings and first to Fig. 6

showing diagrammatically the entire refrigerating system, there is shown diagrammatically a sealed motor compressor unit 1 in which the operating parts of my apparatus to be later described are enclosed. The compressor 1 delivers through pipe 2 the refrigerant under pressure to a condenser 3 which serves to cool and liquefy the compressed refrigerant. From the condenser 3 the liquefied refrigerant passes to an expansion valve 4 and to an evaporating unit 5 from which the refrigerant is withdrawn through suction line 6 to the compressor. It should be understood that while I have illustrated a conventional type expansion valve and expansion coil as an evaporating unit any other type of evaporator may be employed, such as flooded type evaporator.

The lubricating oil which is circulated as a cooling medium as well as a lubricating medium is cooled by an oil radiator 7 which is connected to the oil sump of the unit by a pipe 8 and to the suction side of the pump by a pipe 9.

The unit itself, disclosed more in detail in the remaining figures of the drawings is hermetically sealed by a casing 10 and comprises a base 11 adapted to be supported on feet 12 preferably formed of rubber or other vibration absorbing material. The base is formed to provide a central well 13 formed in a table 14 rising centrally from the bottom of the base and surrounded by a depressed portion forming an oil sump 16, the latter being separate and sealed from the well 13.

A pump housing is supported upon the table, the housing comprising a disc or base plate 17 forming the bottom of the housing, an annular member 18 forming the side walls of the housing and provided with a central bore 19 forming the rotor chamber and a top plate 21 which also constitutes the base of a tubular standard 22 rising from the base. Upon the base 21 an annular spider 23 is supported, the webs 24 of the spider carrying upon their outer ends a ring 26 equipped with a plurality of upstanding posts 27 upon which the stator 28 of the electric motor is supported. The plate 11, disc 17, housing 18, and top plate 21, are all rigidly fastened together when assembled by four bolts 29 shown particularly in Fig. 1. The base 11, disc 17, housing 18, top plate 21, and spider 23 are independently secured together by bolts 30. The housing 18, plate 21 and spider 23 are also secured together by additional cap screws 31. The stator of the motor is secured to the posts 27 by bolts 32.

The standard 22 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 co-axially disposed and connected by a direct driving connection which however, as will later be 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 33 carrying the rotor structure 34 surrounds and is journaled upon the periphery of the standard 22.

The weight of the sleeve and supported parts of the rotor is supported by the lower end of the sleeve upon the standard base 21. The shaft 36 for the pump and compressor which is formed integrally with the pump and compressor rotor 37 is journaled within standard 22 concentrically with the sleeve 33. The weight of the rotor and shaft rests upon the base plate 17 of the pump and compressor housing. The upper portion of the shaft 36 above standard 22 is provided with a squared portion 38 constructed to fit within the squared opening of a driving disc 39 which is formed with radially projecting arms 41 each seated in a correspondingly shaped slot 42 formed in the upper end of the sleeve 33. It will be apparent that the disc 39 forms a direct driving connection between the rotor sleeve and the pump shaft, but that because of the slidable relation between the members no lateral movements or thrusts of the sleeve can be transmitted to the shaft.

The rotor 37 of the pump and compressor is disposed eccentrically within the bore 19 of the housing, as will be apparent from Fig. 2. The rotor is provided with a plurality of radially disposed blade receiving sockets 43 for the reception of reciprocating blades 44 adapted to reciprocate radially in said slots. In the illustrated form of my rotor I have shown four oppositely disposed slots and blades and it should be understood that a greater or lesser number may be employed if preferred.

The blades are maintained at all times a predetermined distance apart by abutment pins 46 extending transversely of the rotor between the blades, each pin being equipped with enlarged bearing portions 47 slidably fitting within transverse bores connecting oppositely disposed sockets 43. The length of the abutment pins are 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 rotation of the rotor, the companion blade will be correspondingly forced through the rotor and outwardly against the opposite wall. The outer end of each of the blades is provided with a sealing element 48 adapted to form contact with the surrounding walls of the bore.

The gas to be compressed by the pump is admitted to the cylindrical bore around the rotor through an elongated intake port 49 (Figs. 1 and 2) formed in the wall of the bore intermediate its top and bottom. This port is connected through a passage 51 to the intake or suction line 6. The admitted gas is compressed by the rotation of blades 44 and is discharged through the outlet port 52 from which it is conducted through a duct 53 extending through housing 18, plate 17, and base 11 into well 13.

From the well 13 the compressed refrigerant passes upwardly through a central bore 54 which extends upwardly through the center of the plate 17, rotor 37, shaft 36, and communicates with a central bore 56 formed in a cap member 57 threadedly secured to the upper end of shaft 36. The

cap 57 is bored transversely as at 58 to establish communication between bore 56 and spaces between two superimposed baffle plates 59 and 61 joined by four curved vertical vanes 62 extending therebetween (Figs. 1 and 3). The baffle plates 59 and vanes 62 serve to change the direction of flow of the compressed refrigerant and to direct the same laterally toward the sides of the compressor unit into the collection chamber formed by a cap or housing 63 attached by screws 64 to the stator of the motor. The distributing head formed by baffles 59 and 61 and vanes 62 serves to separate any lubricant that may be included in the refrigerant as it is discharged therethrough. The cap 63 is provided with a central aperture 65 through which the compressed refrigerant may pass into the conduit 2 which enters through the top of the sealing casing 10.

For lubricating and cooling the motor and compressor unit I have provided a continuous circulation system in which the lubricant serves for lubricating the blades, the sealing elements and the walls of the chamber with which the sealing elements contact. The oil also serves the purpose of forming a seal to prevent leakage of the gas past the blades. It is understood of course that a sufficient amount of oil is placed in the unit and settles to the sump 16 from where it is piped by conduit 8 to the oil radiator 7 and from there by piping 9 to inlet 66 into the bore 19 at a point preceding the discharge outlet 52. Oil will thereby be sucked into the pump and discharged under pressure with the compressed gas. The size of the oil inlet 66 of course determines the amount of oil taken in by the pump. The oil thus taken in serves both to seal and lubricate the pump as well as lubricate the other moving parts, as will be explained.

The compressed gas and lubricant pass through the discharge outlet of the pump through conduit 53 into well 13 and pass upwardly through the center of shaft 36. Shaft 36 is provided with oil ducts 67 extending transversely through the shaft and connecting with spiral oil grooves 68 extending around the outer periphery of the shaft. The shaft is also provided with transverse ducts 69 which communicate with a duct 71 through standard 22 which establishes communication with a spiral groove 72 extending around the outer periphery of standard 22.

In order to prevent oil which may seep behind the blades from locking the blades, the plate 17 is provided with an annular groove 73 which establishes communication between both ends of each of the sockets 43. From the foregoing it will be seen that the bearings of the motor and compressor will be lubricated by the oil which comes up the center of the unit with the refrigerant and is thrown outwardly by centrifugal force. The compressor is utilized to positively circulate the oil through the unit and through a cooling element. The oil in the sump of the unit is subjected to the pressure of the compressed gas above the oil in the unit, which pressure also aids in the circulation of the oil through the radiator 7.

The operation of the system when assembled is believed to be obvious and will be briefly summarized. The parts are assembled as previously mentioned, a sufficient amount of refrigerant such as SO₂ and lubricating oil being inserted and sealed in the unit. When current is connected to the stator of the motor the rotor thereof will rotate about standard 22, and through disc 39 will drive the compressor rotor 37 carrying blades 44. The connection between the mo-

tor and compressor is of a flexible nature and permits independent movements of the motor and pump shaft. The revolving blades 44 of the pump suck in refrigerant through intake port 49 and lubricant through port 66 discharging the mixture under pressure through duct 53 and up through the center of the motor shaft. The refrigerant under pressure will pass upwardly through the shaft whereas the greater portion of the lubricant will be thrown out and serve to lubricate the bearing parts. The gas passing upwardly will travel through pipe 2 into condenser 3 where it will be cooled and liquefied. From the condenser 3 the liquefied gas will be delivered to expansion valve 4 and through the evaporating unit 5. From the evaporating unit the spent gases will be returned through pipe 6 to inlet port 49, thus completing the cycle.

The lubricant, most of which will pass through ducts 67 and 69 and some of which will pass between the baffles 59 and 61 will practically all drain back into sump 16, from which it will be forced and sucked into the radiator 7 through pipe 8 and will be withdrawn from the radiator 7 through pipe 9 by the action of the pump, thus completing the cycle of the lubricating fluid.

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

I claim:

1. An apparatus comprising a tubular supporting standard, a sleeve surrounding and journaled on said standard, a motor including a rotor and stator surrounding said sleeve, the rotor being carried by the sleeve, a rotary pump having a hollow shaft extending through said standard, and means for driving said shaft from said sleeve, the discharge side of said pump being connected to the interior of said hollow shaft to discharge therethrough.

2. An apparatus comprising a tubular supporting standard provided with a base, a sleeve surrounding and journaled on said standard and supported upon said base, a motor including a rotor and stator surrounding said sleeve, the rotor being carried by the sleeve, a rotary pump having a hollow shaft extending through said standard, means for driving said shaft from said sleeve, the discharge side of said pump being connected to the interior of said hollow shaft to discharge therethrough, and means secured to the upper end of said shaft to direct the discharge therefrom transversely thereof.

3. 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 hollow shaft journaled within said standard, spiral grooves surrounding said shaft and said standard and communicating at their inner ends with the interior of said shaft, means for supplying oil to the working chamber of said pump, said oil being discharged from said chamber through said hollow shaft, driving connections 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.

4. An apparatus comprising a hollow standard, a sleeve journaled on said standard, a rotor of an electric motor carried by said sleeve, a rotary pump having a hollow shaft journaled within said standard, the discharge side of said

pump being connected to the interior of said hollow shaft, means for supplying oil to the working chamber of said pump, a driving connection between said sleeve and said shaft at one end of said standard, means including said hollow shaft for delivering oil from said pump to the interior and exterior of said shaft and said standard to lubricate the bearing surfaces thereof, and a disc carried by the upper end of said shaft for distributing the product discharged from said pump and deflecting the lubricating oil content thereof over said motor.

5. An apparatus comprising a standard, a sleeve journaled on said standard, a rotor of an electric motor carried by said sleeve, a rotary pump having a hollow shaft journaled within said standard, the discharge side of said pump being connected to the interior of said hollow shaft, means for supplying oil to the working chamber of said pump, a driving connection between said sleeve and said shaft at one end of said standard, means for delivering oil from said pump to the interior and exterior of said shaft and said standard to lubricate the bearing surfaces thereof, and a pair of spaced discs carried by said shaft, the space between said discs being in communication with the hollow interior of said shaft to receive the entire discharge therefrom, said discs serving to deflect the discharge from said shaft and direct a portion thereof over said 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 having a hollow shaft journaled within said standard, the discharge side of said pump being connected to said hollow shaft, means for supplying oil to the working chamber of said pump, a driving connection between said sleeve and said shaft at one end of said standard, means for delivering oil from said pump to the interior and exterior of said shaft and said standard to lubricate the bearing surfaces thereof, a pair of spaced discs carried by the upper end of said shaft, and vanes between said discs dividing the space therebetween into a plurality of passages, the space between said discs being in communication with the hollow interior of said shaft and arranged to receive the entire discharge therefrom and direct a portion thereof over said motor.

7. An apparatus comprising a casing provided with an oil sump therein, a tubular supporting standard disposed above said oil sump, a sleeve surrounding and journaled on said standard, a motor including a rotor and a stator surrounding said sleeve, the rotor being carried by the sleeve, a rotary fluid pump having a hollow shaft extending through said standard, means for driving said shaft from said sleeve, and an oil duct connecting said oil sump to the working chamber of said pump, the discharge side of said pump being connected to the interior of said hollow shaft to discharge oil and fluid, said shaft having transverse ducts therethrough in communication with the interior of said shaft and the outer bearing surface thereof to conduct a portion of the lubricant included with the discharge from said pump to the outer surface of said shaft.

8. An apparatus comprising a casing provided with an oil sump therein, a tubular supporting standard disposed above said oil sump, said standard being provided with a base, a sleeve surrounding and journaled on said standard and supported on said base, a motor including a rotor and a stator surrounding said sleeve, the rotor being carried by the sleeve, a rotary fluid pump

having a hollow shaft extending through said standard, means for driving said shaft from said sleeve, and an oil duct connecting said oil sump to the working chamber of said pump, the discharge side of said pump being connected to the interior of said hollow shaft to discharge oil and fluid therethrough.

9. An apparatus comprising a casing provided with an oil sump therein, a tubular supporting standard disposed above said oil sump, a sleeve surrounding and journaled on said standard, a motor including a rotor and a stator surrounding said sleeve, the rotor being carried by the sleeve, a rotary fluid pump having a hollow shaft extending through said standard, means for driving said shaft from said sleeve, and an oil duct connecting said oil sump to the working chamber of said pump, the discharge side of said pump being connected to the interior of said hollow shaft to discharge oil and fluid, said shaft having transverse ducts therethrough in communication with the interior of said shaft and the outer bearing surface thereof to conduct a portion of the lubricant included with the discharge from said pump to the outer surface of said shaft, said standard also having transverse openings therethrough to conduct lubricant from the outer surface of said shaft to the outer surface of said standard.

10. An apparatus comprising an electric motor, a compressor connected thereto, said compressor including a hollow shaft, a casing enclosing said compressor and motor and providing a sump for the collection of fluid in the casing, a connection from the sump to the working chamber of said compressor and a connection from the discharge side of said compressor to the interior of said hollow shaft, said shaft extending to a point adjacent the top of said motor for delivering the discharge from said compressor over said motor, and means for distributing the discharge over the motor so that heat units generated by the motor will be absorbed by said fluid during the return thereof by gravity to the sump.

11. In a compressor, the combination of the field, an armature of a motor, a fixed post on which the armature is mounted, said post and armature comprising elements constituting a compressor, said post having inlets through the bottom and side thereof and having an outlet at its top for compressed gas and lubricating oil, a cap connected to the armature and covering said outlet, a horizontally arranged length of pipe in said cap, through which the gas and oil are caused to pass, said pipe acting to project the oil by centrifugal force out of the line of travel of the gas.

CARL E. L. LIPMAN.

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