

Nov. 29, 1938.

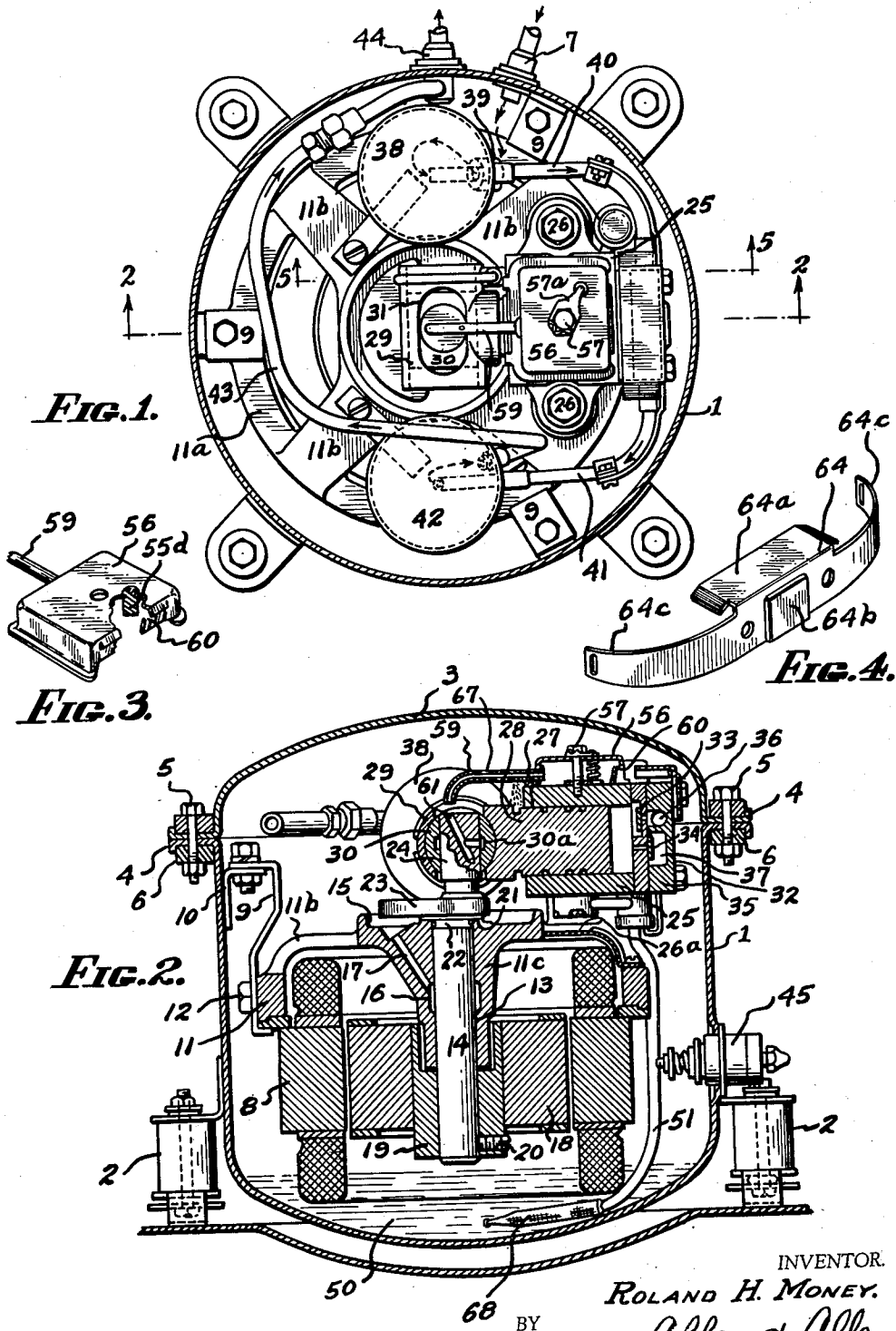
R. H. MONEY

2,138,664

COMPRESSOR AND LUBRICATING MEANS

Filed Jan. 21, 1937

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

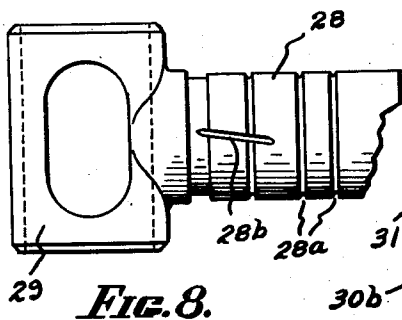


FIG. 8.

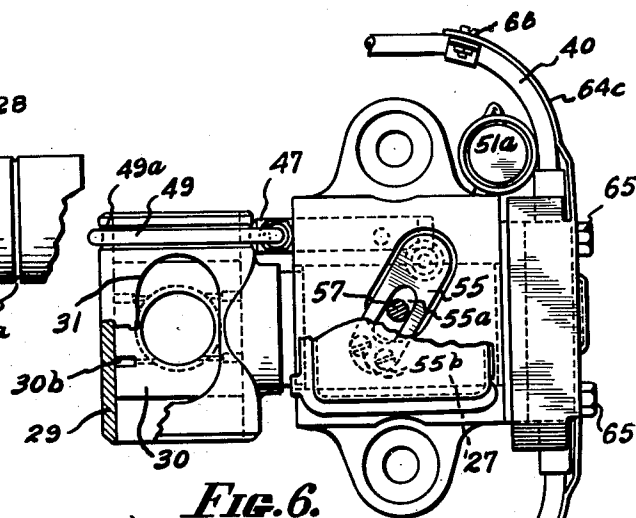


FIG. 6.

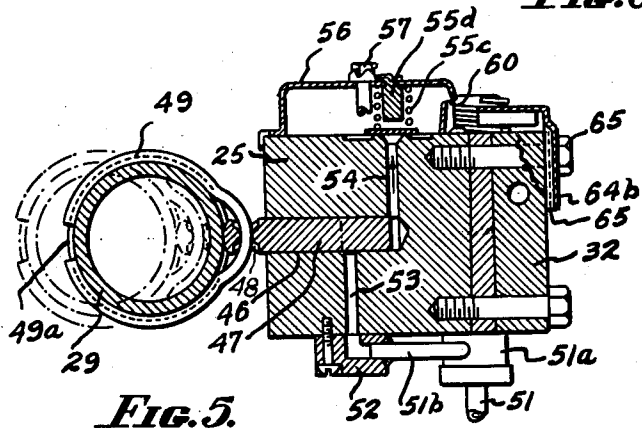


FIG. 5.

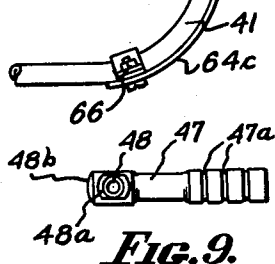


FIG. 9.

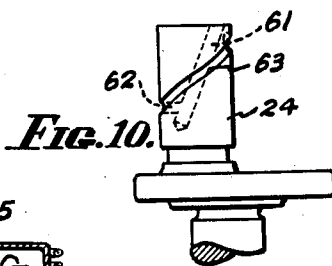


FIG. 10.

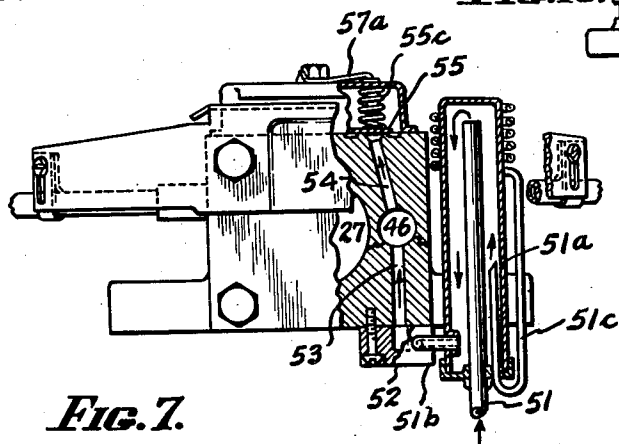


FIG. 7.

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2,138,664

COMPRESSOR AND LUBRICATING MEANS

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Application January 21, 1937, Serial No. 121,630

16 Claims. (Cl. 230—58)

This application is a continuation in part of my application, Serial No. 94,417, filed August 5, 1936, and bearing the same title.

My invention relates generally to the provision of lubricating means for compressors, and compressors having lubricating means; but I shall describe my invention in connection with a compressor for a domestic refrigerator, by way of an exemplary embodiment, it being understood that this is not a limitation on my invention. My invention is especially adaptable, as will hereinafter be clear, to the type of compressor enclosed within a housing, in which housing there is a motor for driving the compressor, a body of oil and the refrigerant itself.

The general objects of my invention may be summarized as having to do with the provision of a novel motor and compressor structure, a novel means for withdrawing lubricant from a reservoir thereof and delivering it to the various moving surfaces to be lubricated, a novel means whereby the lubricant is adapted to cool the compressor at the points where heat is developed therein, and the provision of these means in a simple, compact and inexpensive structure.

These and other objects which will be set forth or will be apparent to one skilled in the art upon reading these specifications, I accomplish by that certain construction and arrangement of parts of which I shall now describe the aforesaid exemplary embodiment. For a better understanding thereof, reference is now made to the drawings wherein:

Figure 1 is a plan view of my compressor with the housing cut away.

Fig. 2 is a vertical sectional view of the compressor taken along the lines 2—2 of Fig. 1.

Fig. 3 is a perspective view with parts cut away of an oil dome.

Fig. 4 is a perspective view of an oil deflector and distribution means.

Fig. 5 is a sectional view taken along the center line of the oil pump, namely the line 5—5 of Fig. 1.

Fig. 6 is an enlarged plan view of the cylinder and yoke construction.

Fig. 7 is an end view of the cylinder block and associated members, with parts in section to show the relationship of these members and the trap which is used in connection with the oil pump.

Fig. 8 is a plan view of the compressor piston.

Fig. 9 is a plan view of the oil pump piston.

Fig. 10 is an elevation of the upper end of the armature shaft showing the crank arrangement.

In the structure of my exemplary embodiment, there is a dome or housing into which the refrigerant, containing oil, is passed from the evaporator. This dome or housing contains a motor and a compressor, the piston of which is driven by the motor through a so-called Scotch yoke. In the cylinder block there is also a supplementary cylinder for the purpose of pumping oil. A small piston in this cylinder is coupled directly to the Scotch yoke for reciprocation. Oil, of course, collects in the bottom part of the dome or housing and a pipe leads from the oil reservoir to the supplementary or oil pumping cylinder, to which I have referred. Oil is drawn up by the pumping cylinder and is delivered to a small oil dome or casing on the cylinder block, where the oil tends in some measure, to cool the cylinder block. A portion of the oil is delivered from this casing through a suitable conduit to parts of the structure to be lubricated. Other portions of the oil are caused to flow down over the faces of the cylinder block, as will hereinafter be described, further to cool the cylinder block.

In Figs. 1 and 2 I have shown a casing or dome 1, designed to be resiliently mounted by suitable resilient members 2 (which do not need special description because they do not constitute a limitation on my invention) upon a suitable support, such as a compartment floor in a domestic refrigerator. A second casing member 3 forms, together with the first casing member, a completely enclosed dome in which the remainder of the parts hereinafter to be described are located. The two portions of the shell or casing may be flanged as at 4 and held together by bolts 5 engaging stiffening rings 6. This particular construction of dome is described in my co-pending application, Serial No. 63,765 filed Feb. 13, 1936. It, of course, does not constitute a limitation upon the invention herein described.

A suitable inlet for refrigerant is provided to the dome as at 7.

Interiorly of the dome the field structure of an electric motor is mounted by means of bracket members 9 to brackets 10 welded or otherwise fastened to the casing member 1. A motor frame member 11 is likewise fastened by bolts 12 to the brackets 9. This frame member is characterized by a solid external ring 11a and spider arms 11b, supporting a central member 11c. This member provides bearing surfaces as at 13 for the main shaft 14 of the device. It has a cup-shaped formation at the top, as shown at 15, so as to collect lubricant falling thereon.

In the bearing portion the member is grooved out as at 16 to provide a reservoir for lubricant, and this reservoir is connected to the cup 15 by a drilled passageway 17.

5 The armature 18 of the motor is fastened to a central boss 19 which in turn is pinned to the shaft 14 as by means of a set screw, or in any other suitable manner.

At the upper end of the portion 11c, there is 10 a thrust bearing surface 21 for the shaft 14 and its associated parts. An oil groove indicated at 22 is provided adjacent this thrust bearing, and is arranged so as to be lubricated from lubricant collecting in the cup 15. There is a head on the upper end of the shaft providing a pitman arm 15 23 to which the crank arm 24 is attached. The head preferably is so shaped as to provide counterweight means for the crank arm.

A cylinder block 25 is mounted as by means 20 of bolts 26 to a suitably shaped extension 26a on the motor frame 11, and is suitably drilled to form the cylinder 27. A piston 28 reciprocates in this cylinder and is attached to the sleeve 29 of a Scotch yoke member having an inner cylinder 25 30 longitudinally slidable therein and perforated to accept the crank arm 24. To accommodate the component of the motion of the crank arm longitudinally of the sleeve 29, the sleeve is slotted as at 31; hence as the shaft 14 30 rotates, the piston 28 is reciprocated in the cylinder 27.

I have shown the cylinder closed by a valve plate 32 having an inlet valve 33 and an outlet valve 34. A head 35 is provided for the cylinder, 35 and is shaped to form an inlet port 36 and an outlet port 37. As has been indicated, refrigerant from the evaporator of the system enters the dome through the fitting 7. From the dome it is drawn into a muffler 38 through an opening 39. 40 From the muffler it is passed by means of a tube 40 to the cylinder head 35 and to the inlet port thereof. Compressed by the action of the piston, it passes through the outlet port of the cylinder head to a tube 41 and to a second muffler 42, and 45 thence by means of a tube 43 to the exit fitting 44 of the dome.

In the particular embodiment of my invention herein described, I am using the dome as a low side dome, for the purpose of freeing the oil of 50 refrigerant and with the other attended advantages described in my co-pending application, Serial No. 121,631 filed January 21, 1937. The particular arrangement of connections, however, as well as the operating and valve construction of 55 the compressor proper, are not necessary limitations upon my invention, as will be clear; and they need not be more particularly described. It will likewise be understood by one skilled in the art that there are provided suitable means for 60 making electrical connections with the motor, as by means of terminal members surrounded by insulated sleeves and passing through the dome in pressure sealing relationship. One of these is indicated at 45 in Fig. 2.

65 As hereinabove indicated, I provide a supplementary oil pump in the construction shown, and this will be best appreciated from a consideration of Figs. 5, 6, 7 and 9. Here alongside the main cylinder 27, I have provided a small bore forming 70 a cylinder 46. A small piston 47 is placed in this bore and is arranged to be reciprocated by the scotch yoke. To this end, the piston 47 is perforated as at 48, and is held to the scotch yoke sleeve 29 by means of a spring band 49 or otherwise 75 as may be desired. The spring band pref-

erably engages a groove 49a in the scotch yoke sleeve as shown. In the construction illustrated, the edges of the piston 47 are rounded adjacent the perforation 48 as shown at 48a; and the end of the piston is preferably also rounded as at 48b, 5 where it comes against the sleeve 29. The sleeve of the scotch yoke has purely a reciprocating motion. Thus as the main piston 28 reciprocates, the supplementary piston 47 will likewise reciprocate in its small cylinder. The piston 47 may be provided with a series of oil grooves 47a.

As will be clear from Fig. 2 the lower part of the dome contains a body of oil 50. A tube 51 leads from this body of oil up to the oil pump, which I am now describing. By means of a fitting 52, this tube is effectively connected to a passageway 53 leading into the cylinder intermediate its ends. Another passageway 54 extends from the end of the cylinder through the cylinder wall, preferably at the top of the cylinder as 20 shown, where a suitable valve such as the flap valve 55 is provided. In the type of construction shown, no separate entrance valve is required, the piston itself during reciprocation cutting off the oil supply as will be clear from a consideration 25 of Fig. 5.

However, in order to maintain a suitable supply of oil adjacent the pump, I provide a trap, most readily appreciated from a consideration of Fig. 7. This trap comprises an elongated, closed housing 30 51a. The tube 51 extends as shown through the bottom of this housing to near the top thereof. The lower portion of the housing is connected by a short piece of tubing 51b to the fitting 52.

In order to prevent knocking in the oil pump, 35 I prefer to provide means for introducing into the oil as it enters the pump a small quantity of gas to act as a cushion or buffer. This is most conveniently accomplished by leakage means in connection with the trap. At 51c, I have shown a 40 capillary tube of ordinary character, one end of which enters the casing of the trap as shown and the other end of which is open to the gas in the dome. It will be within the skill of the worker in the art to control the effective restriction of this 45 tube on the passage of gas therethrough, so that a desired limited quantity of gas is introduced into the oil as it passes through the trap, say a volume of gas about ten per cent of the volume of oil being pumped, or one or two small bubbles 50 of gas on each stroke of the piston. The restrictive effect of any given capillary tube is conveniently controlled by cutting the tube to a given length. The tube is shown wound around the upper portion of the casing of the trap as a convenient method of disposing of its length, which 55 may be in the neighborhood of 20 inches.

As to the operation of the oil pump, it will be seen that after the piston 47 uncovers the opening of the passageway 53, oil will be drawn 60 through the pipe 51 and through the trap which has been described, from the oil supply 50 and into the cylinder 46 (the passageway 54 being closed by the valve 55). On the return stroke, the piston cuts off the passageway 53 as shown in 65 Fig. 5, thereby acting as its own valve; and the oil in the remaining length of the cylinder 46 is forced from the cylinder through the passageway 54, raising the flap valve 55.

To direct the flow of oil, a housing member or 70 oil dome 56 is fastened to the upper wall of the cylinder block 25 and encloses the flap valve. It may be held in place by a bolt 57 threaded into the cylinder block; or it may be otherwise fastened in place as desired.

The flap valve construction may be any desired. I have shown a particular type of flap valve comprising the plate 55, perforated as at 55a for the passage of the bolt 57. The valve member may be fastened by machine screws 55b to the cylinder block 25. The opposite end of it overlies the opening to the passageway 54, which may be suitably shaped, as shown most clearly in Figs. 5 and 7, to form a valve seat. This end of the flap valve may be held down if desired, by a compression spring 55c which surrounds a stud 55d riveted into the housing or oil dome. The member 57a, illustrated most clearly in Fig. 1, is a lock washer member for the bolt 57. The ends of it are bent up, as shown, so as to engage the bolt head; and the locking feature is derived from the engagement of a tine on the other end of the lock washer member in a depression in the riveted end of the stud 55d.

The oil passing the flap valve 55 collects in the housing or oil dome 56 and thereby tends somewhat to cool the cylinder block. It is delivered from the housing by means of a tube 58 connected to the housing and having a delivery conduit 59 as illustrated in Figs. 1 and 2. The rear of the housing is shaped to form a louvre 60. Oil is delivered to the Scotch yoke mechanism by means of the tube 59.

The crank arm 24, as most clearly shown in Figs. 2 and 10, is provided with a bore 61. The upper end of this bore is located on the axis line of the shaft 14 so that as the shaft rotates the opening to the passageway 61 will always be located directly beneath the opening of the spout or conduit 59 leading from the oil dome. The passageway 61 is connected by a short transverse passageway 62 to a helically arranged oil groove 63 on the outside of the crank arm 24. Thus oil delivered from the spout 59 will lubricate the bearing of the crank arm 24 in the interior member 30 of the Scotch yoke mechanism. This interior member may be grooved as at 30a (Fig. 2) to provide an oil reservoir.

In order to insure the lubrication of the bearing of the interior member 30 of the Scotch yoke in the sleeve 29, I provide the member 30 with deep oil grooves 30b. These grooves communicate with the slot 31 in the sleeve of the Scotch yoke mechanism which is thus lubricated.

Excess oil runs down and about the sides of the Scotch yoke mechanism and collects in the cup 15 where it lubricates the thrust bearing 21 and also the main bearing for the shaft through the passageway 17 and oil reservoir 16.

Since the pump disclosed is capable of pumping a large quantity of lubricant at relatively low pressure, it is entirely feasible to employ this lubricant to cool the cylinder and adjacent parts. To this end I have provided the louvre 60 hereinabove described so as to allow oil to leave the rear of the casing 56 and flow down over the cylinder walls. An oil deflecting member indicated at 64 in the various figures, and separately illustrated in Fig. 4, is fastened as by means of bolts 65, to the plate 32. A portion of it, 64a, overlies the upper part of the cylinder block assembly and receives oil flowing through the louvre 60. A rear portion 64b is embossed outwardly so as to provide a passageway 65 to direct oil downwardly over the rear of the cylinder block assembly. Excess oil runs out sidewise beneath the part 64a so as to cool other parts of the cylinder block assembly. The member 64 is preferably made with a pair of arms 64c, extending out sidewise and along the conduit members

40 and 41. They may be clamped to these conduit members as at 66. This relationship of parts causes oil to be carried outwardly and along the conduits so as to assist in cooling these.

Also I may, if desired, perforate the oil delivery spout 59 as at 67 (Fig. 2) to allow some of the oil to spray upwardly against the dome member 3 so as to be cooled in flowing down over the dome walls. This is not necessary when using a low side dome as described herein; but in some constructions it may be of value.

I preferably provide a strainer of fine screening on the oil inlet tube 51 as shown in Fig. 2 at 68.

The main piston 28 is preferably provided with the usual oil grooves 28a, and, near its forward end, with a transverse and slightly slanting groove 28b. The main piston is thus lubricated by oil flowing over the Scotch yoke.

In the way described, I have provided an efficient and large volume lubricating means at relatively low cost. The lubricant is not only delivered to the frictional surfaces very positively, but an excess of it is provided to cool the cylinder head.

It will be understood that my invention as hereinafter claimed may be applied to a wide variety of apparatus with such modifications as will be within the skill of the worker in the art to produce following the teachings herein. The specific apparatus which I have chosen for the purpose of an exemplary embodiment is not, therefore, a specific limitation on my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination in a device of the character described, a housing, a motor and a compressor therein, said compressor having a cylinder block, and said housing adapted to contain a quantity of oil, supplementary pump means in connection with said compressor to withdraw oil from said quantity, and oil accumulating means for maintaining a body of the oil so withdrawn in heat exchange relationship with said cylinder block, said last mentioned means comprising a reservoir housing attached to and covering substantially an entire wall of said cylinder block, and having means for releasing some of the oil so retained, so as to permit it to bathe other external surfaces of said cylinder block.

2. In a structure of the class described, a compressor comprising a cylinder block, a main cylinder therein and a supplementary cylinder therein, a main piston in said main cylinder and a supplementary piston in said supplementary cylinder, means connecting said two pistons, and means for reciprocating said connected pistons, said supplementary cylinder and piston comprising an oil pump and means for delivering oil from said pump to moving parts of said mechanism, said last mentioned means including reservoir means attached to said cylinder block for maintaining a body of oil in intimate heat exchange relationship with substantially an entire face of said cylinder block.

3. In a structure of the class described, a compressor comprising a cylinder block, a main cylinder therein and a supplementary cylinder therein, a main piston in said main cylinder and a supplementary piston in said supplementary cylinder, means connecting said two pistons, and means for reciprocating said connected pistons, said supplementary cylinder and piston comprising an oil pump, and means for delivering oil from said pump to moving parts of said mechanism, 75

- said last mentioned means including reservoir means attached to an external face of said cylinder block for maintaining a body of oil in intimate heat exchange relationship with said cylinder block, said reservoir means comprising a dome, said dome having a perforation permitting a portion of the accumulated oil to flow down over other external face portions of the cylinder block for cooling the same.
4. In a device of the character described, means for holding a quantity of oil, a motor frame, a stator mounted on said frame, a bearing in said frame, a shaft journaled in said bearing and a rotor mounted on said shaft, a compressor mounted on said frame, a driving connection between said shaft and said compressor, oil pumping means in connection with said compressor for withdrawing oil from said oil holding means, and delivery means from said oil pumping means for delivering oil directly to said driving connection, said motor frame having oil retaining means disposed beneath said driving connection for collecting surplus oil so delivered, and a conduit leading from said retaining means to said bearing for the lubrication thereof.
5. In a compressor structure, a cylinder block, a main cylinder in said block and a supplementary cylinder in said block, main and supplementary pistons respectively in said cylinders, driving means and Scotch yoke means constituting a power transmitting connection between said driving means and said main piston, and a power transmitting connection between said supplementary piston and said Scotch yoke, said supplementary cylinder having an inlet orifice intermediate the stroke of said supplementary piston and an outlet orifice at its end, a valve located exteriorly of said cylinder block, a dome over said valve and outlet means from said dome for delivering material pumped in said supplementary cylinder to said Scotch yoke.
6. In a compressor structure, a cylinder block, a main cylinder in said block and a supplementary cylinder in said block, main and supplementary pistons respectively in said cylinders, driving means and Scotch yoke means constituting a power transmitting connection between said driving means and said main piston, and a power transmitting connection between said supplementary piston and said Scotch yoke, said supplementary cylinder having an inlet orifice intermediate the stroke of said supplementary piston and an outlet orifice at its end, a valve located exteriorly of said cylinder block, a dome over said valve and outlet means from said dome for delivering material pumped in said supplementary cylinder to said Scotch yoke, said dome having an outlet orifice for delivering a portion of the pumped material to external faces of said cylinder block.
7. In combination a dome or housing, a motor frame mounted in said dome, a stator mounted on said motor frame, a bearing in said motor frame, a shaft in said bearing, a rotor mounted on said shaft, a cylinder block mounted on said motor frame, main and supplementary cylinders in said cylinder block, main and supplementary pistons respectively in said cylinders, a crank arm on said shaft, a Scotch yoke connection between said crank arm and said main piston, a driving connection between said Scotch yoke and said supplementary piston, oil inlet means to said supplementary cylinder, and oil outlet means therefrom adapted to deliver pumped oil to said Scotch yoke, said motor frame having adjacent said bearing cup shaped means for retaining oil delivered in excess to said Scotch yoke, and means for delivering said oil from said cup shaped means to said bearing.
8. In combination in a device of the character described, a dome, a motor, a cylinder block, main and supplementary cylinders in said cylinder block, main and supplementary pistons in said cylinders respectively, a driving connection between said motor and said main and supplementary pistons, said supplementary piston in its cylinder acting as an oil pump, means for delivering the oil pumped thereby directly from the oil pump to a position above said cylinder block, means for forcing a first portion against the inner upper wall of said dome for cooling said portion, and means for delivering a second portion to said driving connection for lubricating the same.
9. In combination in a device of the character described, a dome, a motor, a cylinder block, main and supplementary cylinders in said cylinder block, main and supplementary pistons in said cylinders respectively, a driving connection between said motor and said main and supplementary pistons, said supplementary piston in its cylinder acting as an oil pump, means for delivering the oil pumped thereby directly from the oil pump to a position above said cylinder block, means for forcing a first portion against the inner upper wall of said dome for cooling said portion, means for delivering a second portion to said driving connection for lubricating the same, and means for delivering a third portion of the oil so pumped to the faces of said cylinder block for cooling purposes.
10. In a compressor structure, a cylinder block, a main cylinder in said block and a supplementary cylinder in said block, main and supplementary pistons respectively in said cylinders, driving means and Scotch yoke means constituting a power transmitting connection between said driving means and said main piston, and a power transmitting connection between said supplementary piston and said Scotch yoke, said supplementary cylinder having an inlet orifice intermediate the stroke of said supplementary piston and an outlet orifice at its end, a valve located exteriorly of said cylinder block, a dome over said valve and outlet means from said dome for delivering material pumped in said supplementary cylinder to said Scotch yoke, trap means connected to the inlet orifice of said pump, and means for admitting to said trap a limited quantity of gas.
11. In a compressor structure, a cylinder block, a main cylinder in said block and a supplementary cylinder in said block, main and supplementary pistons respectively in said cylinders, driving means and Scotch yoke means constituting a power transmitting connection between said driving means and said main piston, and a power transmitting connection between said supplementary piston and said Scotch yoke, said supplementary cylinder having an inlet orifice intermediate the stroke of said supplementary piston and an outlet orifice at its end, a valve located exteriorly of said cylinder block, a dome over said valve and outlet means from said dome for delivering material pumped in said supplementary cylinder to said Scotch yoke, and trap means connected to the inlet orifice of said pump, said trap means comprising an elongated casing located substantially at the level of said pump and an inlet orifice for oil effective at the upper end of said casing and an outlet orifice for oil effective at the lower end of said casing, and means

for admitting to said trap a limited quantity of gas.

12. In a compressor structure, a main compressor, and an oil pump, said main compressor 5 having a piston and a crank arm for actuating said piston, said crank arm having an oil feeding perforation therein with an inlet located on its axis of revolution in said crank arm, said pump having outlet means stationarily located on said 10 axis and directly above and opposite the inlet to said oil feeding perforation.

13. In a compressor mechanism, a cylinder block containing a main compressor cylinder and a supplementary oil pump cylinder, pistons in 15 said cylinders, and means for operating said pistons, an oil dome located above said cylinder block and adapted to receive oil from said oil pumping cylinder, said oil dome having outlet means for delivering oil to moving parts of said 20 compressor and additional outlet means for delivering oil externally to said cylinder block and oil deflecting means attached to said cylinder block for directing the movement of oil thereover.

14. In a compressor mechanism, a cylinder 25 block containing a main compressor cylinder and a supplementary oil pump cylinder, pistons in said cylinders, and means for operating said pistons, an oil dome located above said cylinder block and adapted to receive oil from said oil 30 pumping cylinder, said oil dome having outlet means for delivering oil to moving parts of said

compressor and additional outlet means for delivering oil externally to said cylinder block and oil deflecting means attached to said cylinder block for directing the movement of oil thereover, said compressor cylinder having oppositely 5 located inlet and outlet means comprising tubing, and said oil deflecting means having portions lying along and in intimate contact with said tubing whereby to deflect a portion of said oil over said tubing. 10

15. In a compressor structure, a cylinder block containing a compressor cylinder and an oil pump, oil inlet means for said oil pump including a trap, and means for admitting with the oil 15 into said trap a limited quantity of gas to act as a buffer, said means comprising a capillary tube having an open end located within said trap and an open end external to said trap.

16. In a compressor structure, a unitary cylinder block, a main cylinder and a supplementary cylinder in said block, main and supplementary pistons respectively in said cylinders, 20 driving means, and Scotch yoke means constituting a power transmitting connection between said driving means and said main piston, and a power transmitting connection between said 25 supplementary piston and said Scotch yoke and comprising a band of springy material embracing said yoke and attached to said supplementary piston. 30

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