

March 25, 1930.

R. L. KING

1,752,093

COMPRESSOR

Filed May 28, 1926

4 Sheets-Sheet 1

Fig. 1.

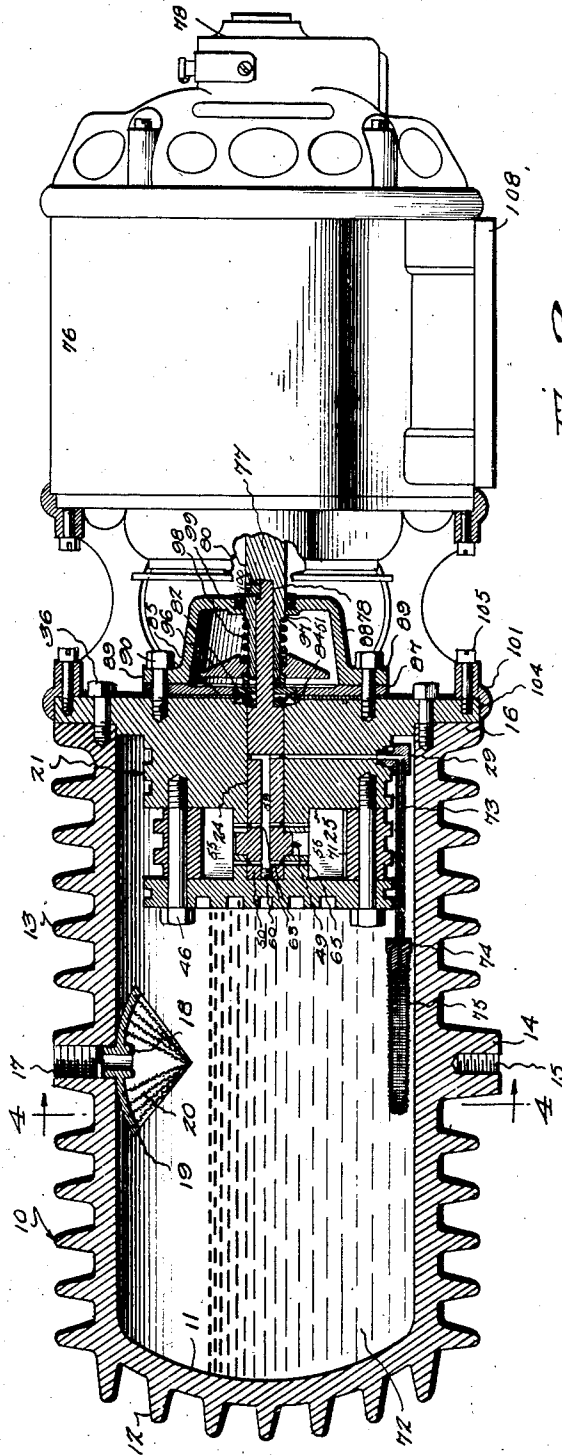


Fig. 3.

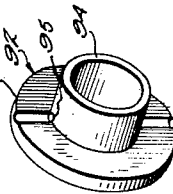
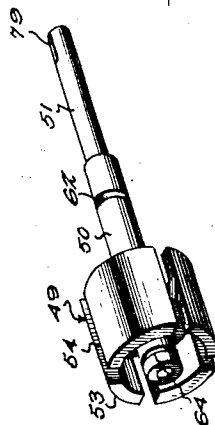


Fig. 2.



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Fig. 4.

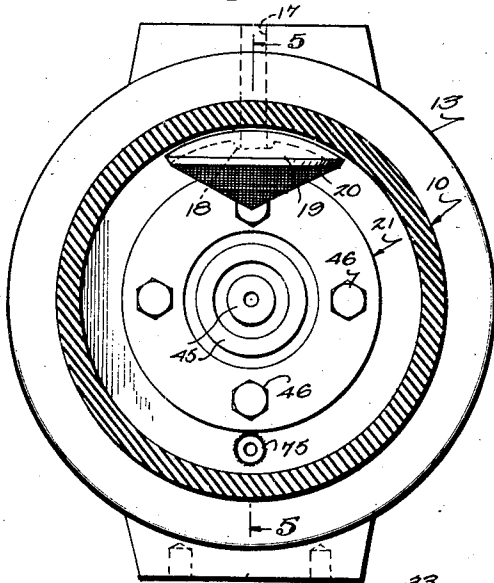


Fig. 6.

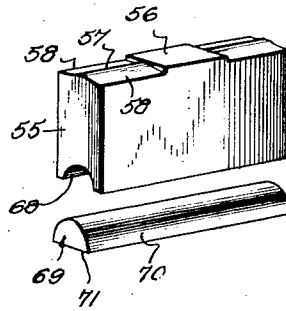
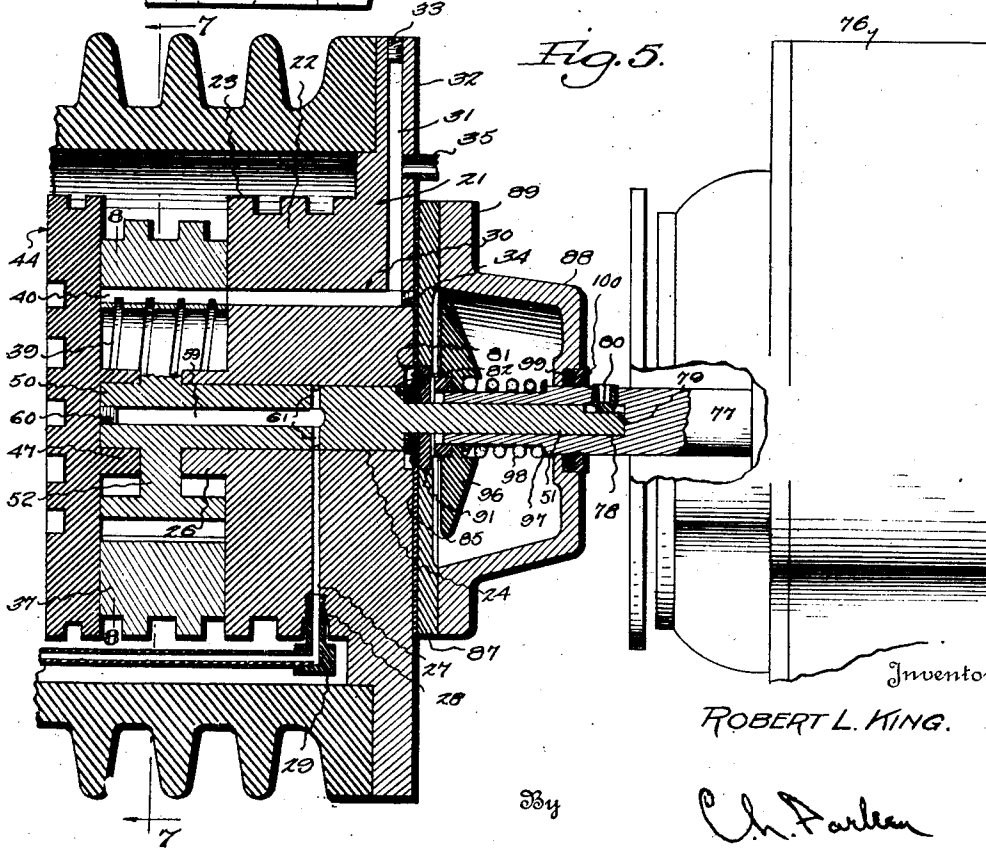


Fig. 5.



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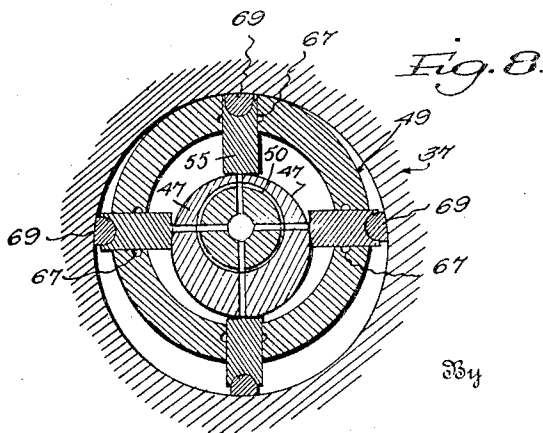
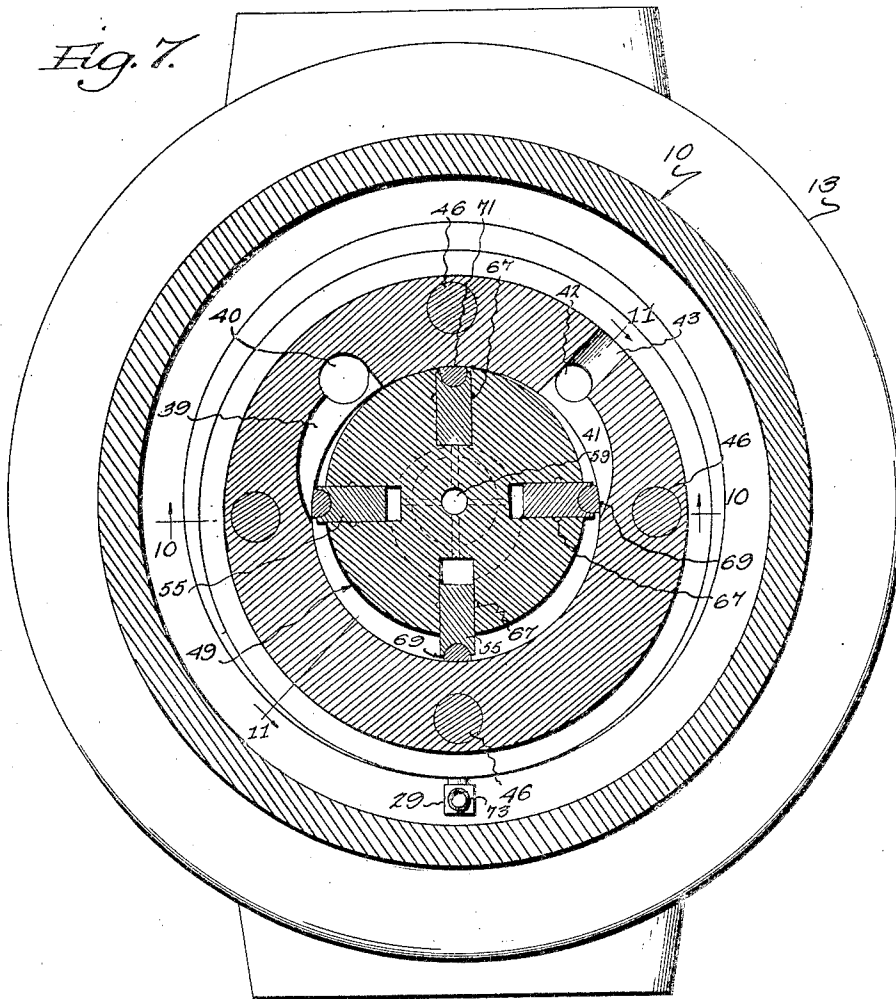
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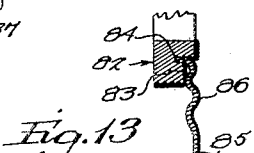
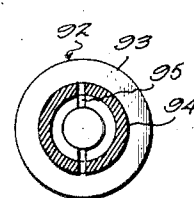
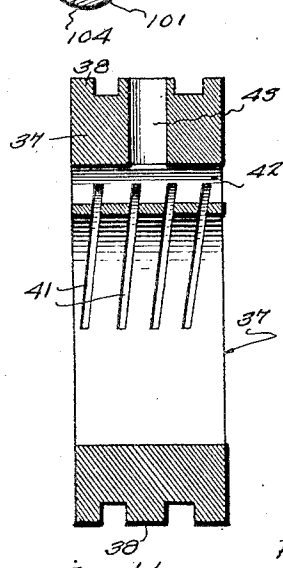
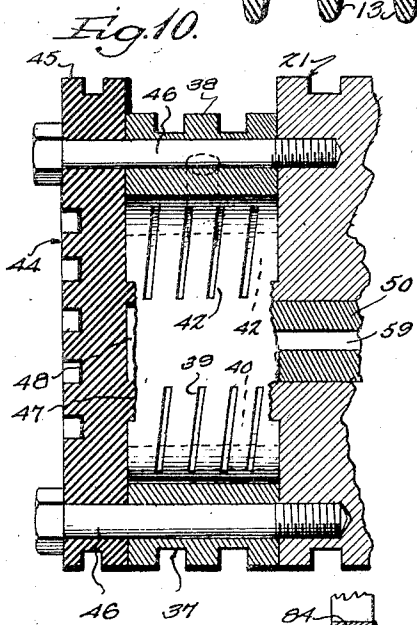
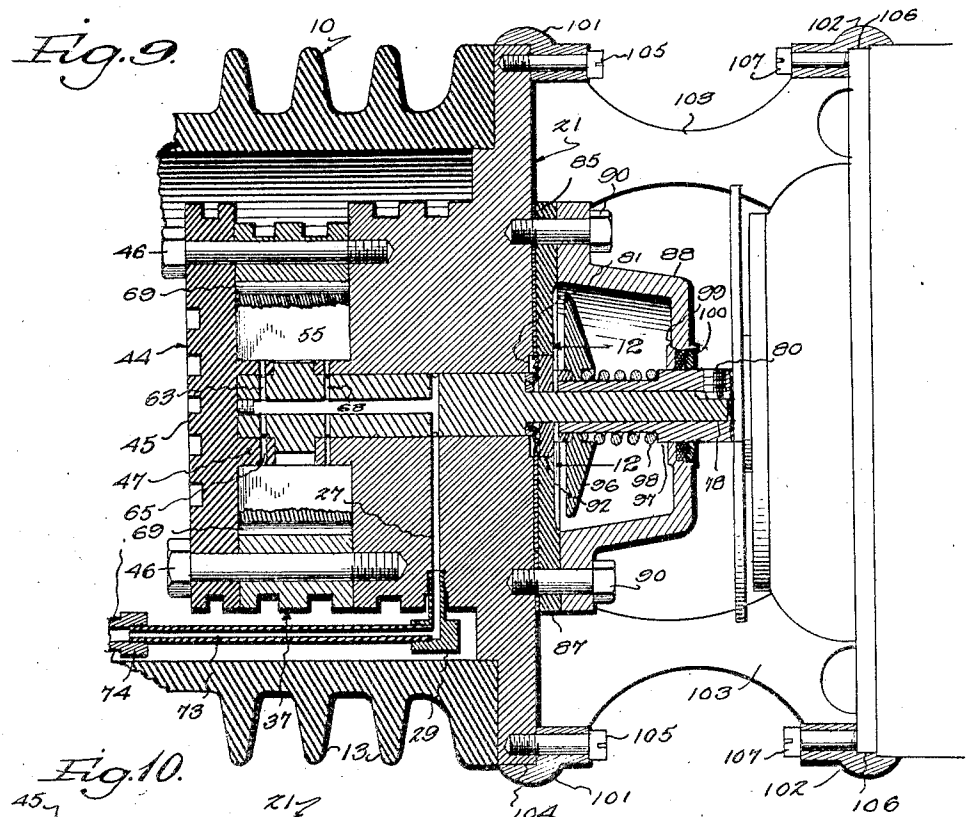
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1,752,093

COMPRESSOR

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4 Sheets-Sheet. 4



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UNITED STATES PATENT OFFICE

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COMPRESSOR

Application filed May 28, 1926. Serial No. 112,342.

This invention relates to compressors and more particularly to a compressor adapted for use in connection with domestic refrigerating systems.

5 An important object of the invention is to provide a novel form of motor-compressor unit of simple compact construction particularly adapted for use in connection with domestic refrigerating systems.

10 A further object is to provide a novel form of compressor mounted directly in a pressure receiving chamber and forming substantially a part thereof, thus economizing on the space required for the unit and eliminating piping connections from the compressor to a
15 separate pressure tank or chamber.

A further object is to provide a novel compressor of the sliding piston type which is economical and highly efficient in operation.

20 A further object is to provide a compressor of the type referred to provided with means for forming oil seals around the moving parts to prevent leakage of the fluid being compressed, thus materially increasing the efficiency of the unit.

A further object is to provide a compressor of the sliding piston type having novel forms of inlet and outlet connections.

25 A further object is to provide a compressor of the type just mentioned wherein the inlet and outlet connections include novel angularly arranged ports communicating with the compressor cylinder through the inner surface thereof, the ports being angularly arranged with respect to the plane of rotation
30 of the rotating element to minimize wear at the ends of the sliding piston.

A further object is to provide a compressor mounted directly in the pressure tank or chamber, the latter being provided with a
35 body of a lubricant, and to provide a novel form of means for supplying lubricant to the compressor to form seals around the sliding pistons to prevent leakage of fluid there-
40 by.

A further object is to provide a novel form of sliding piston which is adapted to cooperate with other elements of the compressor in such a manner that the outer edges of the sliding
45 pistons are maintained in close contact

with the walls of the cylinder in which they rotate.

A further object is to provide a motor-compressor unit having the shafts of the motor and compressor directly connected to each
55 other, and to provide novel means for preventing leakage of oil and fluid past the shaft of the compressor.

Other objects and advantages of the invention will become apparent during the
60 course of the following description.

In the drawings I have shown one embodiment of the invention. In this showing:

Figure 1 is a central vertical sectional view through the motor-compressor, the motor be-
65 ing shown in elevation,

Figure 2 is a detail perspective of the rotor,

Figure 3 is a detail perspective view of a portion of the compressor shaft sealing
70 means,

Figure 4 is a section on line 4—4 of Figure 1,

Figure 5 is an enlarged view similar to Figure 1, taken at a different angle,

Figure 6 is a detail perspective view of one
75 of the sliding pistons and its packing key,

Figure 7 is a section on line 7—7 of Figure 5,

Figure 8 is a section taken substantially
80 on line 8—8 of Figure 5,

Figure 9 is an enlarged view similar to Figure 5, taken substantially in the same plane as Figure 1,

Figure 10 is a detail section on line 10—10
85 of Figure 7,

Figure 11 is a similar view of the compressor cylinder taken substantially on line
11—11 of Figure 7,

Figure 12 is a detail section on line 12—12
90 of Figure 9, and,

Figure 13 is a detail fragmentary section of the sealing ring and diaphragm.

Referring to the drawings the numeral 10 designates a pressure tank or casing as a whole preferably cast integral and provided
95 with a closed end 11 having heat radiating fins or flanges 12 on its outer face. The casing 10 is substantially cylindrical and is provided on its outer face with similar heat radiating fins 13. The casing is provided
100

with a boss 14 having internally threaded openings 15 to receive suitable bolts whereby the casing may be mounted upon any desired form of supporting base. The end of the casing 10 opposite the head 11 is open and is provided with a flange 16 having a machined outer face for a purpose to be described. The casing 10 is further provided centrally of its top portion with an internally threaded opening 17 communicating with the interior of the casing. The opening 17 is adapted for connection through suitable piping with the other elements of a domestic or other refrigerating system. A plug 18 is threaded in the inner end of the opening 17 and is formed integral with a plate 19. A plurality of conical sections of wire 20 are carried by the plate 19 to act as oil collectors in a manner to be described.

Referring to Figures 1, 5 and 9, the numeral 21 designates a compressor head as a whole. This head is preferably formed of cast iron and has a relatively heavy substantially cylindrical body portion 22 having radiating fins 23 formed on its outer surface. The head 21 is provided with an axial opening 24 forming a bearing for a compressor shaft to be described. The inner face 25 of the head 21 is machined and is arranged at right angles to the axis of the opening 24. Inwardly of the face 25 the head 21 is provided with a hub 26 the outer surface of which is turned to a true circle eccentric to the axis of the opening 24. The body 22 is provided with a radial opening 27 communicating at its inner end with the axial opening 24, the outer end of the opening 27 being enlarged and internally threaded as at 28 to receive the threaded end of a connecting plug 29. The head 21 is further provided with a relatively large inlet passage 30 communicating with a radial passage 31 formed in the upper portion of the head 21. The head 21 is provided at its outer portion with a radial flange 32 through which the passage 31 extends, the outer end of this port being closed by a suitable plug 33. The passage 30 is drilled through the outer face of the head 21, and the outer end of this port may be closed by a plug 34. A pipe 35 is tapped into the head 21 to communicate with the passage 31. The opposite end of the pipe 35 is connected with a suitable source of fluid supply forming a part of the refrigerating system. The body 22 of the head 21 projects into the casing 10 as clearly shown in Figure 1, and the head is maintained in position by bolts 36 passing through the radial flange 32.

A compressor cylinder 37 is arranged against the inner face 25 of the head 21. This cylinder is arranged concentric with the outer face of the hub 26, and is provided on its outer surface with heat radiating fins 38. The opposite end faces of the cylinder 37 are machined, and accordingly it will be apparent

that the adjacent faces of the cylinder and the head 21 seat tightly against each other. The cylinder 37 is provided at one side with a series of arcuate inlet ports 39, as clearly shown in Figures 5 and 7. These ports are arranged parallel to each other, but are angularly arranged with respect to the planes of the contacting faces of the head 21 and cylinder 37. An inlet passage 40 is drilled through the cylinder 37 parallel to the axis thereof, and this passage intersects the ports 39 and thereby communicates with these ports. As clearly shown in Figure 5, the passage 40 extends entirely through the wall of the cylinder and communicates with the passage 30 in the head 21. The cylinder 37 is similarly provided with a series of outlet ports 41, as shown in Figures 7, 10 and 11. These ports also are angularly arranged with respect to the end faces of the cylinder and communicate with a longitudinal passage 42 drilled through or otherwise formed in the cylinder 37. The cylinder 37 is provided preferably centrally of the length thereof with a radial passage 43 communicating at its inner end with the passage 42 and at its outer end with the interior of the casing 10, as shown in Figure 7.

The cylinder is closed at its inner end by a suitable head 44. This head is provided on its outer face and at its periphery with heat radiating fins 45. The inner face of the head 44 is machined to form a perfect fit against the inner end of the cylinder, and bolts 46 pass through the head 44 and cylinder 37 and are threaded into the head 21. It will be obvious that the cylinder and the two cylinder heads are securely fastened together to form a closed cylinder in which the compression of the fluid takes place in a manner to be described. The head 44 is provided on its inner face with a hub 47 having an opening 48 therein concentric with the opening 24 and forming therewith a coacting bearing to receive the compressor shaft to be described. The outer face of the hub 47 is arranged eccentric to the opening 48, but concentric and in alinement with the outer face of the hub 26 previously described.

A rotor 49, shown in detail in Figure 2 of the drawings, is mounted to rotate within the cylinder 37. The rotor includes a shaft portion 50, the outer end of which is journaled in the bearing 48 of the compressor head 44. The inner end of the shaft 50 is journaled in the axial opening 24, as clearly shown in Figure 5. The shaft 50 is provided with an elongated reduced end 51 for a purpose to be described. The rotor further includes a radial angular portion 52 preferably formed integral with the shaft 50 and provided with an outer substantially cylindrical member 53. The rotor is divided by a series of radial slots 54 in which are arranged a plurality of slidable pistons 55 shown in detail in Figure 6. As clearly shown in Figure 5, the hubs 26 and

47 project into the rotor and slidably engage the inner faces of the sliding pistons. Each of the pistons 55 is formed as shown in Figure 6. The central flattened portion 56 of the piston corresponds in width to the radial portion 52 of the rotor, and outwardly of the central portion 56 each end of the inner edge face of each piston is formed with a central curved raised portion 57 which connects with curved depressions 58 on each side thereof. The end portions of the inner edge faces of the pistons contact with the outer eccentric faces of the hubs 26 and 47 whereby the sliding action of the pistons is accomplished in a manner to be described. The shaft 50 is provided with an axial oil passage 59 which may be closed at its outer end by a plug 60. The inner end of the passage 59 communicates with radial passages 61. At the ends of the passages 61, the shaft is provided with an annular groove 62 which communicates with the passage 27, to receive lubricant therefrom. Within the rotor proper, the shaft 50 is provided with pairs of aligned passages 63, and outwardly of these passages, the shaft is provided with annular grooves 64. The hubs 26 and 47 also are provided with radial passages 65, the inner ends of which communicate with the grooves 64 to receive lubricant therefrom in a manner to be described. The outer ends of the passages 65 feed the lubricant to the inner edge faces of the sliding pistons, from whence the lubricant is adapted to flow around the pistons. Referring to Figure 7, it will be noted that the rotor is provided with oil receiving grooves 67 on opposite sides of each of the sliding pistons. These grooves are adapted to be filled with oil fed outwardly through the passages 65 previously referred to.

As previously stated, the axis of the bearing opening 24, and consequently the axis of the shaft 50, is arranged eccentrically with respect to the cylinder 37 and the outer faces of the hubs 26 and 47. Obviously the rotor and the sliding pistons rotate about the axis of the shaft 50 and consequently the outer ends of the pistons alter their positions angularly with respect to the inner wall of the cylinder. I provide means therefore, for effectively seating the sliding pistons against the cylinder wall. As shown in Figure 6, each of the pistons is provided in its outer edge with an elongated groove 68 which is substantially semi-circular in cross section. A sealing key 69, acting as a packing member, is provided with a semi-circular inner surface 70 which is arranged in the groove 68 and is adapted to alter its position therein according to the position of the rotor. The outer face 71 of each of the keys 69 is curved to correspond with the curvature of the interior of the cylinder whereby it will seat thereagainst.

The casing 10 is adapted to contain a body of oil 72 as shown in Figure 1. A pipe 73 is

threaded at one end into the plug 29 and is provided at its opposite end with a connecting member 74 having an axial opening there-through. A screen 75 is secured to and surrounds the connecting member 74. The screen 75 is preferably elongated to present a substantial outer area to the oil to permit a free flow of oil through the screen.

Referring to Figures 1, 5 and 9, the numeral 76 designates a suitable electric motor adapted to drive the generator and provided with the usual armature shaft 77. One end of the shaft 77 is rotatably mounted in a bearing 78' but the opposite end of the shaft projects from the motor without being supported by a motor carried bearing. As shown, the inner end of the motor shaft is provided with an axial opening 78 which receives the reduced end 51 of the compressor shaft. The end of the portion 51 of the compressor shaft is flattened or recessed as at 79, and a set screw 80 passes through the shaft 77 and seats against the flattened portion 79, whereby the motor and compressor shafts will be driven as a unit. It will be noted that the recess 78 and the shaft section 51 are both relatively long, and the latter preferably fits snugly into the opening 78 to prevent any play from developing between these parts.

Means are provided for preventing leakage of oil outwardly and beyond the outer ends of the shaft 50 and bearing opening 24. As shown in Figures 5 and 13, a small recess 81 is formed in the outer face of the head 21, this recess being arranged adjacent the shoulder formed between the shaft sections 50 and 51. This recess receives a ring 82 having an annular recess 83 in its outer face. The ring is further provided with an annular groove 84 in which is arranged the inner end of a diaphragm 85. Within the recess 81, the diaphragm is provided with a series of circular corrugations 86 to permit a slight sliding movement of the ring 82 along the shaft section 51. Outwardly of the corrugations 86, the diaphragm 85 is disc shaped and lies flat against the outer face of the head 21. A stationary plate 87 is arranged against the face of the diaphragm as shown in Figure 5. A cup 88 surrounds the telescoped portions of the shaft 51 and 77, and this cup is provided at its edge with an annular flange 89 which seats against the plate 87. Bolts 90 extend through the diaphragm 85, plate 87, and flange 89, and these bolts are threaded into the head 21 to secure these elements together. The plate 87 is provided with an enlarged central opening 91 in which is arranged a ring 92, shown in detail in Figures 3 and 12 of the drawings. This ring is provided with a flanged portion 93 which seats against the outer face of the ring 82, and is further provided with a central hub portion 94 surrounding the adjacent end of the shaft 77. The ring 92 is provided with a diametrical oil pas-

sage 95 extending into the interior of the hub portion 94. Means is provided for pressing the rings 82 and 92 inwardly to form a seal against the shoulder which joins the shaft sections 50 and 51. As shown, a flattened pyramidal member or disc 96 surrounds the inner end of the shaft 77 and contacts with the hub of the ring 92. As shown in Figure 5, the inner end of the shaft 77 is provided with a shoulder 97, and a spring 98 of the compression type is arranged between the shoulder 97 and the disc 96 to exert an inward pressure against the latter. The cup 88 is adapted to contain oil, and leakage thereof from the cup may be prevented by a packing member 99 retained in position by a threaded ring 100.

It is desirable to rigidly connect the motor 76 to the casing 10 in order that the bearings 78 and 24 may be maintained in proper alignment with each other. In the drawings I have shown in a general way one type of connection which may be employed. As shown, a pair of annular rings 101 and 102 are provided, and these rings preferably are connected by integral webs 103. The ring 101 is provided with an annular recess 104 receiving the flange 32, and the ring may be secured thereto by bolts 105. Similarly the ring 102 may be provided with an annular recess 106 to receive the end of the motor casing, and screws 107 are adapted to secure the ring 102 to the motor. The motor is preferably provided with a base 108 which is arranged in alignment with the lower end of the boss 14 and is adapted to be arranged on the same supporting member.

The operation of the apparatus is as follows:

Rotation of the armature shaft 77 of the motor obviously will rotate the shafts 50 and 51, and consequently the rotor as a whole. This causes rotation of the sliding pistons 55 with the inner ends of the pistons contacting with the outer faces of the hubs 26 and 47. These hubs are stationary, and since they are eccentrically arranged with respect to the shaft 50, it will be apparent that the pistons 55 are caused to move inwardly and outwardly. The rotor rotates in a counterclockwise direction as viewed in Figure 7 of the drawings, and it will be obvious that as each piston passes the intake ports 39, the volume of the space between the piston, the rotor and the inner wall of the cylinder will increase, thus causing gas to be drawn inwardly into the space. This action increases until the piston reaches the bottom of the cylinder, at which time the following piston leaves the intake ports and the space previously referred to starts to decrease at the outlet side of the compressor. Thus the gas previously taken in is compressed and when the space referred to comes into communication with the outlet ports 41, the compressed

gas will be discharged through the ports 41, passage 42, and outlet opening 43 whereby the gas will be discharged directly into the interior of the casing 10. This action is continued for successive pistons as long as the rotor is operating. Thus a constant pressure of gas will be maintained in the casing 10, and the gas is carried off through the piping connected to the opening 17. The pressure created within the casing 10 forces oil through the screen 75, connection 74, pipe 73, and plug 29, from whence it passes into the radial passage 27. Thus the oil will pass into the space provided by the annular groove 62 surrounding the shaft 50 and from this groove the oil will flow through the radial passages 61 into the axial passage 59. From the latter passage, the oil will flow through the passages 65 to the annular grooves 64 and from these grooves the oil will find its way into the radial slots 54 through the passages 63. The constant pressure maintained within the casing 10 forces a constant supply of oil to the moving parts in the manner described. The lubricant thus supplied is fed by pressure along the bearings of the shaft 50 and also into the radial slots 54, the oil being supplied in a film completely covering each piston 55. The supply of oil will be maintained in the grooves 67, shown in Figure 7, and this supply of oil has been found to form an effectual seal against the leakage of the gas being compressed. A sufficient quantity of the oil will flow past the pistons to lubricate the keys 69 and the interior of the cylinder. A certain amount of the oil thus fed to the moving parts, will be returned to the casing 10 by the gas pumped through the outlet opening 43. The oil thus returned is in a more or less vaporized form and tends to flow upwardly through the opening 17 with the discharged gas. The screens 20 act as collectors and condensers for the vaporized oil, and this oil flows by gravity to the apices of the conical screens from whence it is drained back into the body of oil 72, thus permitting the pure gas to be discharged through the opening 17. Thus it will be apparent that I have provided an efficient pump wherein the gas to be compressed may be fed from an external source and may be directly discharged into the compressor tank, thus permitting the compressor and tank to be mounted as a unit to materially simplify the construction, and to economize in space. At the same time, an efficient lubricating system is provided whereby the wearing of the parts is greatly minimized and the moving parts are sealed against leakage of the gas, thus greatly increasing the efficiency of the unit. The thrust of the spring 98 is taken up at one end by the shoulder 97. The opposite end of the spring presses against the disc 96 and the disc exerts a pressure against the ring 92, this pressure being transmitted to the ring 82

which seats against the shoulder connecting the shaft sections 50 and 51. Thus it will be apparent that the thrust of the spring is taken up at its ends by the shafts 51 and 77, and since these elements are in effect a unit, it will be apparent that the spring exerts no end thrusts which cause excessive wear upon moving parts. Obviously there can be no leakage of oil from the bearing 24 past the diaphragm 85. The ring 82 is stationary and seats against the adjacent shoulder of the shaft 51, thus preventing leakage of oil at this point. Lubrication of the parts outwardly of the ring 80 is provided by the oil within the cup 88. The disc 96 rotates with the shaft 77 and tends to throw the oil outwardly by centrifugal force to the outer portion of the cup, from whence the oil finds its way in the inner face of the plate 87, and through the openings 95 (see Figure 3) to provide proper lubrication for the contacting elements which rotate with respect to each other. Elimination of the bearing at the inner end of the motor saves wear and power, the bearing 24 acting as a journal for both the shafts 50 and 77.

The inlet and outlet ports 39 and 41 are angularly arranged with respect to the plane of rotation of the rotor in order that wear upon the keys 69 may be equally distributed and thus minimized. Obviously, if these ports were arranged parallel to the plane of rotation, the keys 69 would wear unevenly, thus decreasing the efficiency of the compressor.

Referring to Figures 5 and 8 of the drawings, it will be noted that the hubs 26 and 47 are circular, but are eccentric to the axis of the rotor. When opposite pistons are arranged in alinement with the centers of the shaft 59 and the hubs 26 and 47, the raised curved portions 57 of the pistons contact with the hubs, but when the device is rotated, the hubs contact with either of the depressions 58 of each of the keys. The curvatures 57 and 58 are so designed that the outer faces of the keys 69 will be maintained in snug contact with the inner wall of the cylinder. The firmness of the contact is increased, however, by the feeding of the oil under pressure against the inner faces of the piston. The oil passages 65 are arranged in alinement with the radial slots 54 of the rotor and thus it will be apparent that the oil exerts a constant pressure against the inner faces of the pistons, thus maintaining the faces 71 of the keys 69 in firm contact with the inner wall of the cylinder, thus increasing the efficiency of the pumping action. As previously stated its efficiency of action is increased by the oil seal provided around the pistons.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape,

size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. A compressor comprising a pressure chamber having an opening therein, a compressor mounted in said chamber and having a portion forming a closure for the opening therein, said compressor including a cylinder having an inlet port, and an outlet port directly communicating with the interior of said chamber, a shaft rotatable in said cylinder eccentric thereto, a rotor carried by said shaft concentric therewith, a plurality of radial sliding pistons carried by said rotor, heads closing the ends of said cylinder, said rotor being provided in each end with recesses surrounding said shaft, circular cams carried by said heads concentric with said cylinder and projecting into said recesses, said cams contacting with the inner edges of said pistons, and lubricant feeding means controlled by pressure in said chamber for feeding lubricant therefrom under pressure to the inner edges of said pistons.

2. A device constructed in accordance with claim 1 wherein said lubricant feeding means includes a screened pipe communicating with the interior of said casing below the level of the lubricant therein, one of said heads being provided with a passage communicating with said pipe, said shaft and said cams being provided with passages communicating with each other and with the passage in said head to feed the lubricant from the latter to the inner edges of said piston.

3. A compressor comprising a pressure chamber having an opening therein, a compressor unit mounted in said chamber and forming a closure for said opening, said unit including a cylinder, heads closing the ends of said cylinder, said cylinder being provided with an inlet port, and an outlet port directly communicating with the interior of said chamber, a rotor mounted eccentrically in said cylinder, means for driving said rotor, a plurality of radial sliding pistons contacting at their outer edges with said cylinder, and cam means for maintaining the outer edges of said pistons in contact with said cylinder, each of said ports being elongated and arranged at an angle to the plane of rotation of said rotor.

4. A compressor comprising a cylinder, heads closing the ends of said cylinder, said cylinder being provided with inlet and outlet ports, a shaft rotatable in said cylinder eccentric thereto, a rotor carried by said shaft concentric therewith, each of said ports being elongated and arranged at an angle to the plane of rotation of said rotor, said rotor being provided with a plurality of radial longitudinally extending slots, a sliding piston arranged in each of said slots and contacting at its outer edge with the inner wall of said

cylinder, said rotor being provided in each end with recesses surrounding said shaft, and circular cams carried by said heads concentric with the inner wall of said cylinder and projecting into said recesses, said cams contacting with the outer portions of the inner edges of said pistons, the centers of the portions of said pistons engaged by said cams being provided with raised curved portions, said pistons being provided with curved depressions on opposite sides of said raised curved portions.

In testimony whereof I affix my signature.
ROBERT L. KING.

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