June 20, 1933. A. RAMCLAU 1,915,165

REFRIGERATING UNIT

Filed Oct. 16, 1930 2 Sheets-Sheet 1

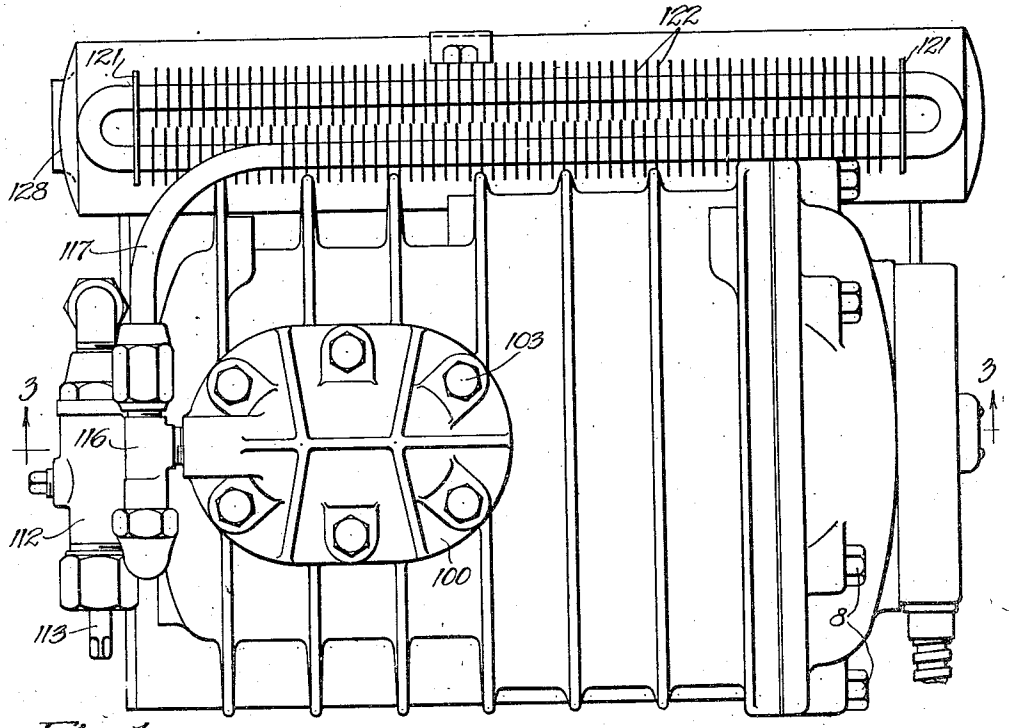


Fig. 1.

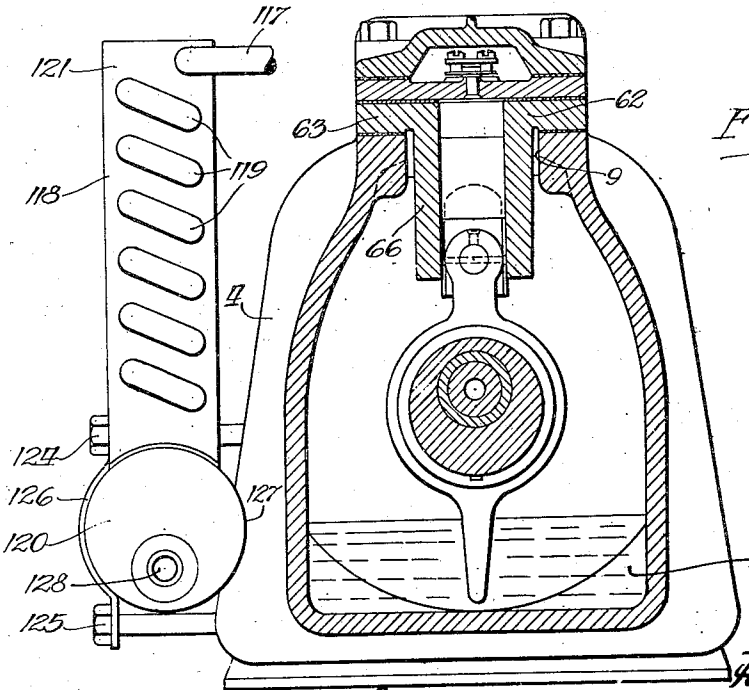


Fig. 2.

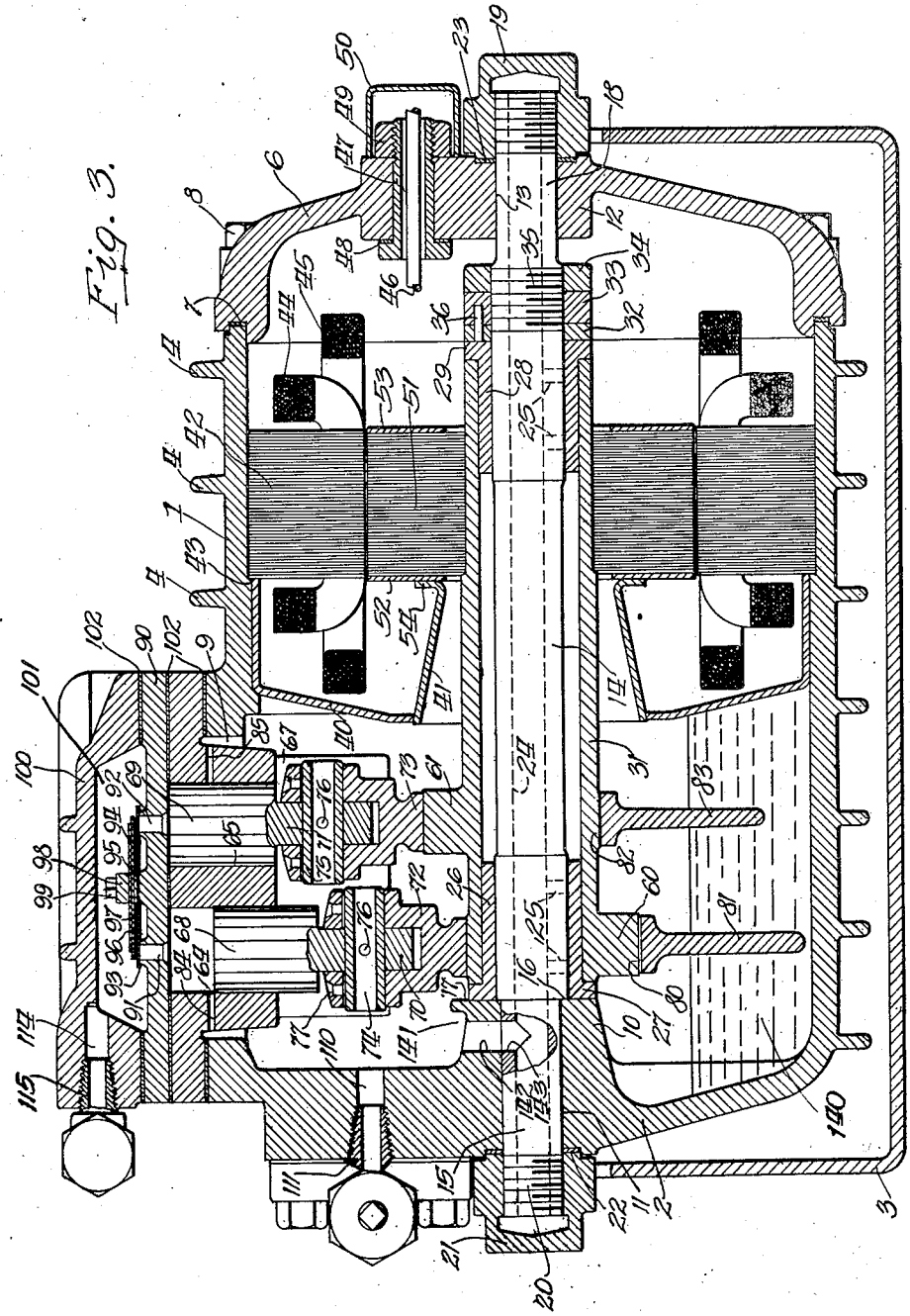
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Fig. 3.



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Patented June 20, 1933 1,915,165

UNITED STATES PATENT OFFICE

AXEL RAMCLAU, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ZEROZONE, INCORPORATED, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

REFRIGERATING UNIT

Application filed October 16, 1930. Serial No. 489,086.

This invention relates to improvements in refrigerating units.

In mechanical refrigerating units of the type used in homes, apartments, small stores and the like, it is highly desirable to have a compressor unit that is entirely free from exposed moving parts. The use of a unit of this kind eliminates the possibility of injury to children, who may gain access to the compressor unit, and also prevent injury to the unit itself by such children.

In refrigerators of this kind it is advantageous to have the motor, the pump, and the condensing coil formed as a unitary structure to which the piping leading to the expansion coil may be connected, the arrangement being advantageous for the reason that in the event of trouble in either the motor or the pump the entire unit can be quickly and conveniently removed from the refrigerator and replaced by another while the faulty unit is being repaired. Repairs on a refrigerator unit of this kind can be most advantageously made in a shop where facilities are available, and a unitary construction of this kind renders such method of repairing possible of achievement.

Refrigerators used in homes and apartments necessarily must be quiet running devices so that their operation will not prove annoying to the housewife, and for this reason the motor and pump must be of simple construction with a minimum of moving parts to enable operation of the device with a minimum noise.

Accordingly as an object of my invention I have provided a new and improved sealed compressor unit containing a motor, a pump and a condenser formed as an integral replaceable unit which is completely sealed and which has all of its moving parts completely enclosed. A quantity of lubricating oil is sealed in the unit and provisions are made for the circulation of this oil through the unit so that the parts which are subject to wear by the operation of the device will be properly lubricated and thereby capable of operating over long periods of time without attention.

My invention also provides a new and improved valve for compressor units of this type, a valve which is quiet in its operation and at the same time efficient in the performance of its duty.

Now to acquaint those skilled in the art with the teachings of my invention reference is made to the accompanying drawings in which a preferred embodiment of it is shown by way of example and in which:

Figure 1 is a plan view of a completely assembled unit;

Figure 2 is an end view of the unit partly in section;

Figure 3 is a cross-sectional view taken along the line 3—3 of Figure 1 looking in the direction of the arrow.

Referring now to the drawings in more detail, the compressor unit comprises a metallic casing 1 which is generally cylindrical in shape and provided with a closed end 2 and with projecting feet 3 upon which the unit is supported when in use. The feet 3 are provided with suitable openings through which bolts or other attaching means may be extended to securely fasten the unit upon its support.

The external surface of the cylindrical casing member 1 is provided with a plurality of upstanding ribs 4 which increase its surface area and thereby render it better able to dissipate the heat that is generated in it. Preferably though not necessarily so the unit 1 is a metallic casting of brass, bronze or iron, machined down where necessary to form proper surfaces for the devices contained in it.

The open end of the casing 1 is provided with a cover plate 6 which is seated thereon with a gasket 7 interposed therebetween to form a hermetically tight joint. The cover 6 is held on the casing 1 in any preferred manner such as by the bolts 8 extending through openings in the cover and threaded into corresponding openings in the casing itself.

The casing 1 is also provided with a flanged opening 9 located opposite to the feet 3 and in which the cylinder assembly is inserted as will presently appear.

Centrally located in the closed end 2 of the casing member 1 is an inwardly projecting

boss 10 containing a centrally drilled hole 11. In the corresponding portion of the cover member 6 is a second inwardly projecting boss 12 also containing a drilled hole 13 which is aligned with the hole 11 in the opposite end of the closed cylinder formed by the casing 1 and the cover. A hollow metallic shaft 14 is machined at 15 to fit in the opening 11 in the closed end of the casing, the shaft having a shoulder 16 which abuts against the inside edge 17 of the boss 10. The opposite end 18 of this shaft is machined to fit in the opening 13 through the cover 6 and threaded on its extreme end to receive a nut 19 by which the shaft is bolted in place. The end 15 is also threaded at 20 to receive the nut 21 which fits against the outside end of the closed portion 2 of the casing with a washer 22 interposed therebetween to form an air tight joint. Similarly the nut 19 is fitted against the outside face of the cover 6 with the washer 23 interposed therebetween to form a tight joint.

The shaft 14 is provided with a longitudinally extending hole 24 drilled through it from end to end and also with a plurality of radial holes 25 which are of smaller diameter and are located at points on the shaft that are to receive the bearings of the unit. The bearing 26 is provided with a shoulder portion 27 which abuts against the surface 17 of the boss 10. This bearing rotates over the shaft 14 and is lubricated by oil passing through the holes 25 in the shaft.

The second bearing member 28 is similarly provided with a shoulder 29 and with openings 30 which are brought into registration with the openings 25 in the shaft. This bearing 28 is rotated over the shaft 14 as will presently appear.

Obviously the shaft 14 is incapable of being rotated since it is tightly bolted to the casing and cover of the unit, and the bearings 26 and 28 are intended to rotate with respect to the shaft.

The rotating member of the unit also consists of a sleeve 31 which is pressed over the outer surface of the bearings 26 and 28 and against their shoulders 27 and 29 respectively, this sleeve and the bearings are slipped over the shaft prior to the placing of the cover 6 on the casing 1. In order to hold the rotating sleeve 31 against end play, a washer 32 is placed over the shaft adjacent the shoulder 29 and the bearing 28 and lock nuts 33 and 34 are threaded onto the threaded portion 35 of the shaft to thereby push the bearing 28 longitudinally of the shaft until the proper amount of end play between the shoulders 27 and 29 and the opposite ends of the sleeve 31 is achieved. Lock nut 34 is then tightened to hold this adjustment. Preferably, though not necessarily so, the washer 32 is equipped with a pin 36 which projects into a socket or recess in the nut 33 so that the washer cannot rotate with the bearing, to insure a free passageway for oil to the wearing parts of the mechanism as will presently appear.

The interior of the cylindrical cavity formed by the casing 1 and cover 6 is divided into two compartments by the conical wall members 40 and 41, with the rotating shaft 31 and stationary shaft 14 projecting concentrically through these conical members. As seen in Figure 3 the right-hand compartment thus formed is the motor compartment and contains an electric motor preferably of the squirrel cage induction type, this type being advantageous since it is free from mechanical switching devices and from commutators and collector rings and thereby better enabled to be operated in a completely closed space, over a long period of time, without attention.

The motor consists of stator laminæ 42 which are pressed into the casing 1 against the shoulder 43 and held therein in any preferred manner. These laminæ are slotted to provide slots in which the coils 44 and 45 of the motor are placed. These coils interact electromagnetically with each other to produce a rotating field when they are energized by single phase alternating current, which current is conducted to them through conductors 46 which are extended into the casing through the bushing 47, which bushing is gasketed at 48 and held tightly in place by a nut 49 to insure a hermetic seal at the wire entrance to the motor. A suitable cover guard 50 is interposed over the outward end of this bushing as is the practice in motors of this type.

The rotor of the motor consists of a plurality of laminæ 51 which are mounted upon the rotating sleeve 31 and held thereon and keyed thereto in any preferred manner. The opposite sides of the rotor are provided with a thicker metallic member 52 and 53 respectively the disk 52 rubbing against the overturned flanged portion 54 of the conical dividing wall member 41 to form a fairly tight joint therebetween.

These details of construction of the motor herein disclosed are given by way of example only as the objects of my invention can be served by any of the many well known types of motors, the one shown and described being shown for purposes of illustration only.

The rotating sleeve 31 as has been hereinbefore pointed out projects into both compartments within the casing 1, and is provided with cams 60 and 61 located in the second or crank case compartment of the casing. Preferably, though not necessarily so, these cams are formed integrally with the sleeve.

The pump illustrated is a two cylinder pump and consequently the cams 60 and 61 are disposed 180° from each other, this il-

lustration of a two cylinder pump obviously being made by way of example only as any number of cylinders may be employed within the teachings of my invention.

The cylinders of the pump, as will be best seen in Figures 2 and 3, are supported in the flanged opening 9 in the casing, and consist of a T-shaped casting 62 which has a flanged portion 63 registering with the upper edge of the walls of the casing around the opening 9. The cylinders 64 and 65 are located in the main or downwardly depending portion 66 of this casting, and are disposed in line and with their axes parallel.

The lower end of the portion 66 of this casting is provided with a transverse slot 67 in which the pitman heads of the piston are disposed, and the walls of this slot 67 guide the pistons during their travel, particularly when the pistons are at and near their lowermost positions.

The pistons 68 and 69 are cylindrical pistons provided with squared projecting lugs 70 and 71 respectively to which the connecting rods 72 and 73 are respectively connected by transverse pins 74 and 75. These pins are hollow and are provided with holes 76 through which a pin, not shown, is projected to prevent them from rotating with respect to their pistons. The connecting rods 72 and 73 are provided with oil holes 77 by which the bearing points of the hollow pins 74 and 75 are lubricated. The outer surfaces of the squared lugs 70 and 71 bear against the walls of the slot 67 to guide the pistons.

The connecting rod 72 is provided with a circular opening 80 which registers with and fits over the cam 60, and also provided with a downwardly depending finger or projection 81 which is employed to lubricate the pumping arrangement. Connecting rod 73 is similarly provided with a circular hole 82 in which the cam 61 fits and also with a finger 83.

The cylinder plate 62 is provided with an inlet port 84 for the cylinder 64 and an inlet port 85 for the cylinder 65, these ports leading into the crank case formed in the casing 1. The upper surface of the cylinder casting 62 is machined flat to receive the valve assembly 90, this consisting of a plate having outlet ports 91 and 92 located in it in registration with the cylinders of the pump. The upper surface of the plate is cut away adjacent these holes to form valve seats 93 and 94 and to form a boss 95 interposed midway between these two seats. The valve consists of a relatively soft flexible member 96 disposed on the boss 95 and overlying the valve seats 93 and 94, and a plurality of leaf springs 97 which are disposed above the valve member 96 and held thereon by washer 98 and the bolt 99, which is threaded into the boss 95.

The valve assembly is covered by a cover plate 100 which fits over it and which is provided with a chamber 101 into which the compressed gas escaping from the cylinder through the valve is confined.

The cylinder block 62, the valve assembly 90 and the cover plate 100 are provided with gaskets 102 which form air tight joints, and these plates are held on the casing 1 in any preferred manner such as by the bolts 103. The end wall 2 of the casing 1 is provided with an inlet port 110 into which is threaded the nipple 111 of the inlet valve 112. This valve forms no essential part of the present invention and may be any preferred type of valve provided with a stem 113 by the operation of which the valve can be closed to seal off the port 110 when it is desired to do so. The cover plate 100 is provided with an outlet port 114 which communicates with the chamber 101 and into which is threaded the nipple 115 of the outlet valve 116, this outlet valve likewise forming no essential part of the present invention and therefore capable of being modified within the teachings of it.

The outlet valve 116 leads through the pipe 117 to the condenser indicated generally at 118. This condenser comprises a series of loops 119 of the pipe 117 descending downwardly from that pipe and terminating in a drum or tank 120. These loops of pipe are supported by members 121 and are provided with a plurality of vanes 122 by which their external surfaces are increased and their ability to radiate heat thereby enlarged.

The condenser 118 is mounted upon the casing 1 by bolts 124 and 125 which extend through opposite ends of a clamp member 126 and which are threaded into the walls of the casing to thereby draw the drum 120 tightly thereagainst. Suitable recesses 127 in the ribs 4 of the casing 1 are provided to form a seating surface for the drum 120.

The pressure line from the compressor unit is led out of the drum 120 which is provided with a threaded nipple 128 to which such a line is connected.

In the operation of this pump, as the motor revolves and the sleeve 31 is revolved thereby cams 60 and 61 working in the connecting rods 72 and 73 reciprocate the pistons 68 and 69 in their respective cylinders. When the piston 68 descends to its lowermost position as shown in Figure 3, its upper surface falls below the opening of the port 84 into the cylinder, thereby establishing communication between the cylinder and the crank case of the pump. As the piston 68 descends the valve 93 is closed and consequently the cylinder is under reduced pressure so that gas in the crank case is drawn into the cylinder. The crank case is connected through the inlet port 110 and the valve 112 to the suction side of the evaporator in the refrigerating compartment, and

gas is drawn therefrom in the usual manner. When the cam 60 elevates the piston 68 this gas is compressed and forced through the valve 93 into the compression compartment 101 from which it travels into the condenser 118. Here the gas is cooled and converted into liquid which falls into the drum 120 and from there travels, under pressure, to the evaporator of the refrigerator. During the time that the piston 68 is traveling upwardly piston 69 is traveling downwardly so that vacuum is being created in the cylinder 65. When the piston 69 reaches the bottom of its stroke and the port 85 is opened permitting the suction in the cylinder to draw in gas from the crank case through the port 85, this gas to be compressed by the upward stroke of the piston during the next half revolution of the motor.

Lubrication of the moving parts of this unit is provided by a quantity of oil 140 sealed in the bottom of the crank case and into which the fingers 81 and 83 are dipped during their reciprocation by the cams 60 and 61. Since these fingers are moving rapidly because the motor is making a considerable number of revolutions per minute, preferably about 1100, the reciprocation of the fingers in the oil causes that oil to be splashed over the entire inner surface of the crank case. Oil is thereby supplied to the ports 77 in the connecting rods and to the hollow cross pins 74 and 75 to lubricate those bearings, and is also splashed against the pistons themselves when they are in their lowermost position to thereby lubricate the cylinder walls.

The boss 10 is provided with a cup-like recess 141 located in its upper surface and communicating with the opening 142 which registers with an opening 143 in the shaft, which opening in turn registers with the central longitudinal hole 24 in this shaft. The recess 141 collects oil that is splashed up against the interior wall of the end 2 of the casing and conveys it to the duct 24 where it flows longitudinally and through the holes 25 in the shaft to the wearing surfaces of the bearings and they are therefore assured of proper lubrication. Since the nuts 19 and 21 are closed, oil can not escape from them and the supply 140 is therefore capable of lubricating the unit for a long period of time.

Owing to the splashing of the oil and the drawing of vapor through the crank case some oil will be mixed with the vapor and compressed and forced out of the pump therewith, this oil subsequently collecting in the evaporator of the refrigerator and being returned to the pump with the gas drawn therefrom through the suction line.

From the foregoing it will be seen that I have provided a simple and compact compressor unit in which the motor and pump are completely encased and sealed together with a sufficient supply of oil to properly lubricate the device for a long period of time. No moving parts are exposed and because of the unitary nature of the structure it can be inserted in and removed from a refrigerator as a unit, thereby enabling repairs to be made on a refrigerator without shutting it down for a long period of time.

The specific embodiment of my invention shown in the drawings has been shown by way of example and I am not to be limited thereby since there are many modifications and adaptations which can be made by one skilled in the art within the teachings of my invention.

Having thus complied with the statutes and shown and described a preferred embodiment of my invention, what I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What is claimed is:

1. In a compressor unit of the class described, a sealed cylindrical casing, a stationary shaft concentrically located in said casing and extending through the end walls thereof, said extending ends being threaded, nuts threaded on said shaft and bearing against the casing to lock and seal the shaft therein, bearings mounted upon said shaft, a sleeve concentrically supported upon said shaft by said bearings, a pair of cams formed integrally with said sleeve, a motor having a stator carried by said casing and a rotor carried by said sleeve, a pair of pistons reciprocated by said cams as said sleeve is rotated by said motor, and a pair of cylinders attached to said casing and in which said pistons travel.

2. A compressor unit of the class described comprising a cylindrical metallic casing closed at one of its ends, cooling fins projecting from said casing, a cover plate closing the open end of said casing, a stationary hollow shaft centrally located in said casing, and extending through the closed end and cover plate thereof, means closing the ends of said shaft bearings mounted upon said shaft, a sleeve concentrically supported upon said shaft by said bearings, means for lubricating said bearings through said shaft, a pair of cams formed integrally with said sleeve, a motor having a stator carried by said casing and a rotor carried by said sleeve, a pair of pistons reciprocated by said cams as said sleeve is rotated by said motor, and a pair of cylinders attached to said casing and in which said pistons travel.

3. A compressor unit of the class described comprising a cylindrical metallic casing closed at one of its ends, cooling fins projecting from said casing, a cover plate closing the open end of said casing, a hollow shaft extending from said closed end to said cover plate centrally of said casing, said shaft having a plurality of holes extending radially

through its walls, bearings mounted on said shaft, said bearings having radial holes registering with the holes on said shaft, a rotatable sleeve held concentrically on said shaft by said bearings, means on said shaft for adjusting the distance between said bearings to thereby adjust the longitudinal play of said shaft, a compartment in said casing containing a quantity of oil, means in said casing for rotating said sleeve, and means actuated by said sleeve for maintaining oil on said shaft to lubricate said bearings.

4. A compressor unit of the class described comprising a sealed cylindrical casing having a centrally disposed hollow shaft running longitudinally of it, a wall in said casing dividing it into two compartments, a motor in one of said compartments, the shaft of said motor consisting of a sleeve surrounding said shaft and extending through said compartments, there being holes in said shaft adjacent said cams and motor cams disposed on said sleeve in the second of said compartments, cylinders opening into that compartment, pistons in said cylinders operatively connected to said cams, said second compartment containing a quantity of oil to lubricate said cylinders, pistons, and cams directly and said sleeve and motor through said shaft.

5. A compressor unit of the class described comprising a sealed cylindrical casing having a centrally disposed hollow shaft running longitudinally of it, a wall in said casing dividing it into two compartments, a motor in one of said compartments, the shaft of said motor consisting of a sleeve surrounding said shaft and extending through said compartments, said shaft having holes adjacent said pump and motor, a pump disposed in the other of said compartments, and links connected to said shaft and driven by said sleeve, said latter compartment containing a quantity of oil, said links being reciprocated through said oil to furnish splash feed lubrication directly to said pump and to said motor through said shaft.

6. A compressor unit of the class described comprising a cylindrical casing having a closed end, a perforated boss concentrically located in said end and projecting into said casing, a shaft concentrically located in said casing and extending through said boss, threads upon the ends of said shaft, a shoulder on said shaft, a nut threaded upon said shaft and bearing against the outer surface of said end to draw said shoulder against said boss and thereby locate the shaft longitudinally of the casing, cylinders carried by said casing, pistons in said cylinders, a sleeve journaled on said shaft for rotation with respect thereto, means on said sleeve for reciprocating said pistons, a motor stator fixed in said casing, a motor rotor fixed upon said sleeve and registered with said stator, a cover registered with the open end of said casing to close the same, a perforated boss concentrically located in said cover and through which said shaft projects, and a nut threaded on the projecting end of said shaft to seal the same in said casing.

7. A compressor of the class described comprising a cylindrical casing having a closed end and a flanged opening in the casing wall adjacent said end, a cylinder block removably fixed in said opening to close the same, a stationary shaft fixed in the closed end of said casing and projected therethrough and out of the closed end thereof, a sleeve journaled on said shaft, pistons fitted in said cylinder block, means on said sleeve for operating said pistons, a shoulder in the inner wall of said casing, a stator assembly registered with said shoulder and fixed thereagainst, a shoulder on said sleeve, a rotor assembly registered with said sleeve shoulder and fixed thereto, said rotor being registered with said stator to form a motor for driving said sleeve, means on said shaft for adjusting the end plug of said sleeve, said means being accessible from the open end of said casing, and a cover for the open end of said casing fixed therein to seal the casing.

In witness whereof, I hereunto subscribe my name this 8 day of October, 1930.

AXEL RAMCLAU.

CERTIFICATE OF CORRECTION.

Patent No. 1,915,165. June 20, 1933.

AXEL RAMCLAU.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, lines 38 and 39, claim 5, strike out the words and comma "said shaft having holes adjacent said pump and motor," and insert the same after "compartments," in line 40, of same claim; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of August, A. D. 1933.

M. J. Moore.
Acting Commissioner of Patents

(Seal)