

Oct. 25, 1932.

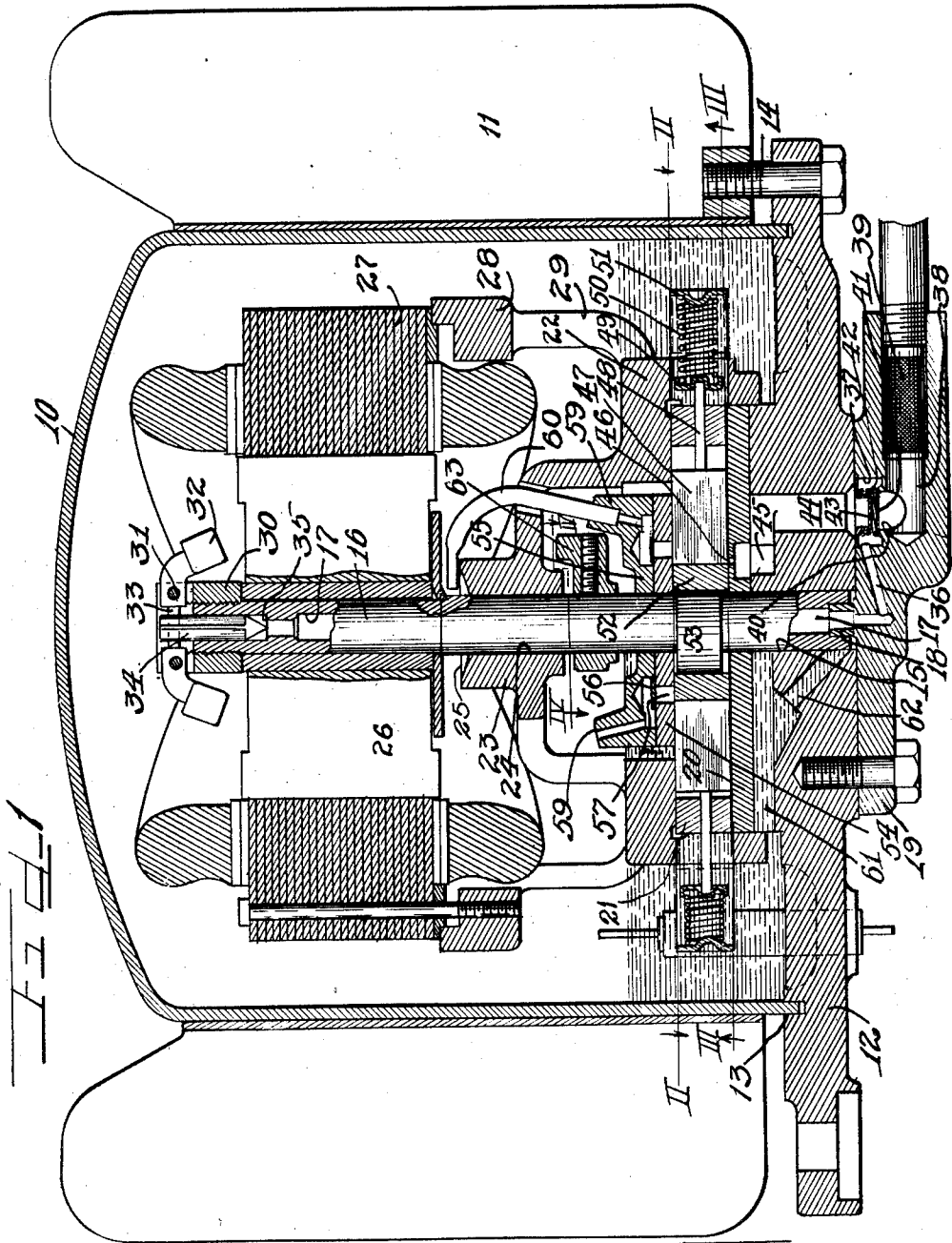
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1,884,702

ROTARY COMPRESSOR UNIT

Filed Nov. 29, 1929

3 Sheets-Sheet 1



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Fig. 2

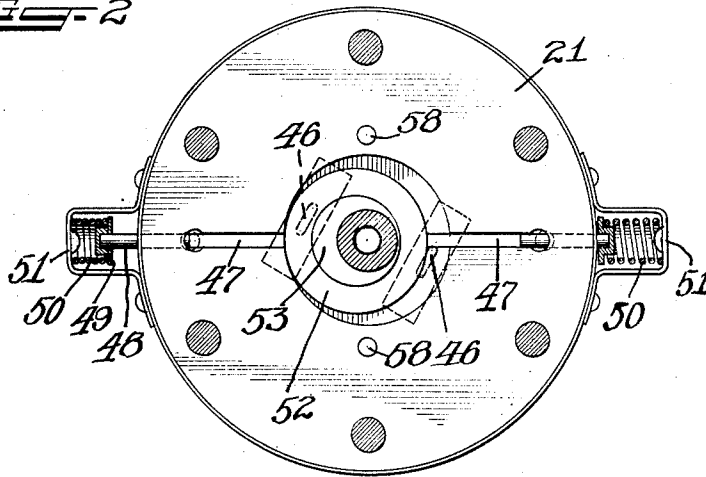
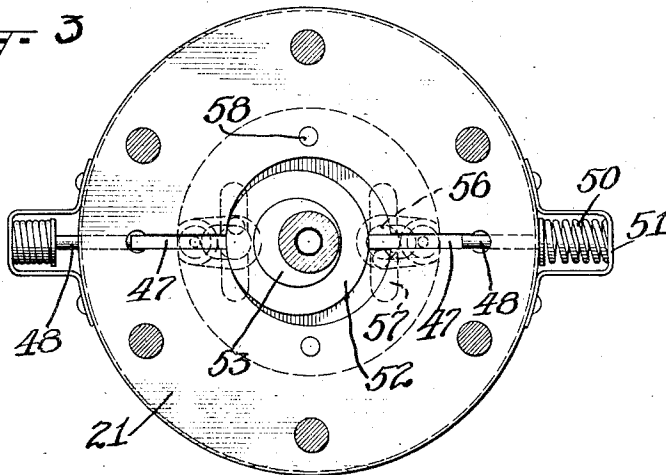


Fig. 3



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Fig. 4

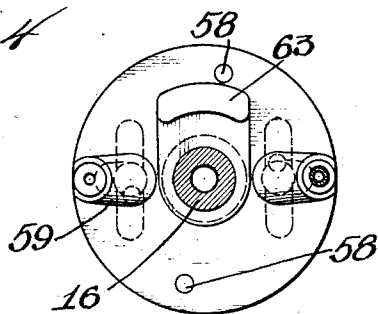
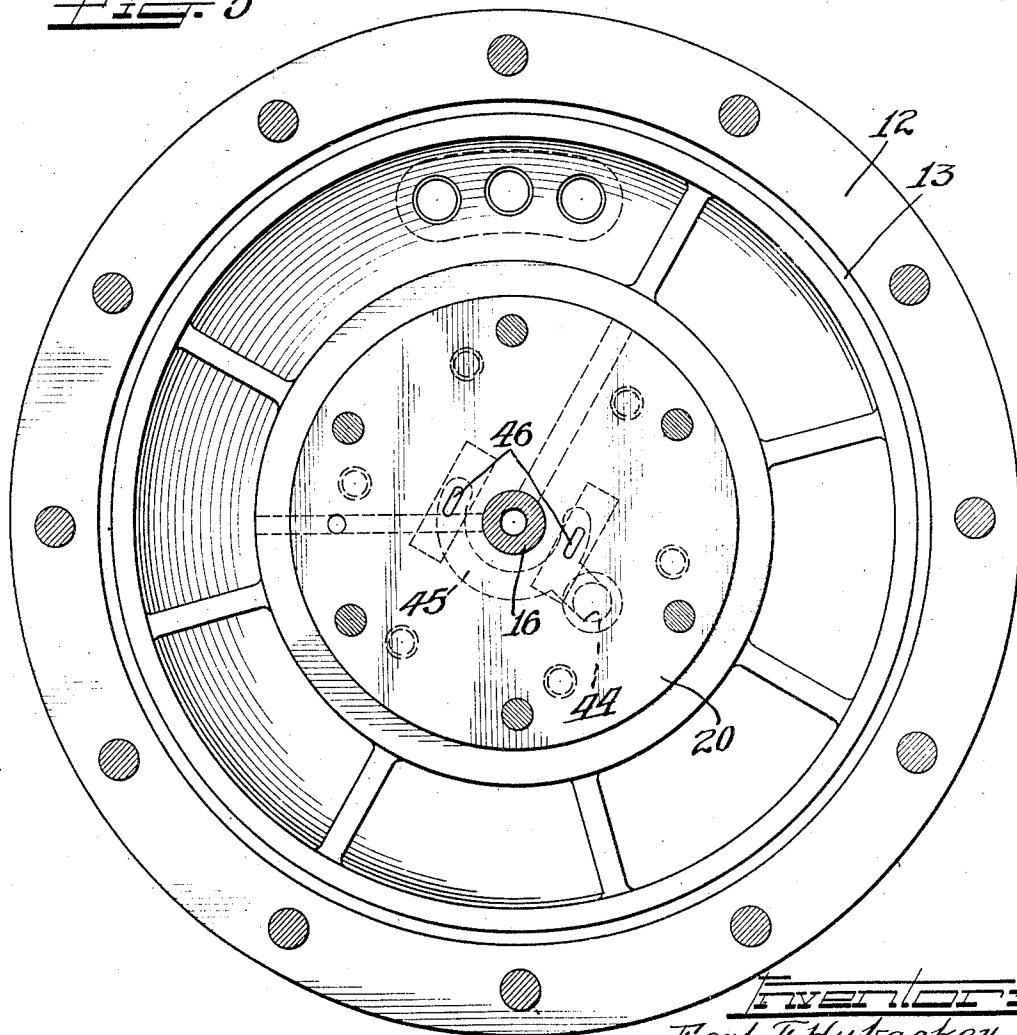


Fig. 5



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UNITED STATES PATENT OFFICE

EARL F. HUBACKER, OF DETROIT, MICHIGAN, ASSIGNOR TO NORGE CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN

ROTARY COMPRESSOR UNIT

Application filed November 29, 1929. Serial No. 410,287.

This invention relates to an improved compressor unit adapted for use in domestic refrigeration apparatus.

It is an object of this invention to provide an improved and simplified compressor of the rotary type direct connected to a driving motor, wherein unloading means are provided to facilitate starting up without a heavy current demand by the driving motor. To this end I provide a bypass from the delivery or high pressure side of the compressor to the suction or intake passages thereof, and suitably control this passage as by providing a centrifugal unloader valve adapted to close the passage after the motor picks up sufficient speed. When the valve is open the high pressure gas is thus bypassed to the suction side of the compressor, so that no pumping load is imposed thereon since the high pressure gas simply circulates through the pump.

It is another object of this invention to provide an improved unit of the class described comprising a direct connected motor and compressor unit mounted in a closed casing with the driving shaft mounted vertically and having an aperture therethrough, the lower shaft end being mounted on a combined seal ring and bearing which carries the weight of the shaft while affording sealed communication with the aperture therein.

It is a further object of this invention to provide an improved rotary compressor structure of the double blade type wherein a cylinder is mounted concentrically relative to a driving shaft carrying an eccentric rotor therein. The rotor or eccentric is provided with a floating sleeve adapted to make rolling contact with the cylinder and blade, one end seal being pinned in position to overlap both the cylinder and sleeve ends, so that the seal is held against rotation while being yielding in an axial direction to relieve excessive pressures within the compressor.

It is a further object of this invention to provide an improved rotary compressor of the multiple blade type wherein the movement of the rotor serves as a valve controlling suction ports, thus eliminating the need of individual suction valves; a single check or non-return valve being provided in the suc-

tion line to prevent back flow of high pressure gas when the compressor is shut down.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a vertical section through a compressor unit embodying the preferred form of this invention.

Figure 2 is a section on the line II—II of Figure 1 showing the cylinder with the suction port locations in the base.

Figure 3 is a section on the line III—III of Figure 1 showing the cylinder with the discharge valve locations in the cover.

Figure 4 is a section on the line IV—IV of Figure 1 showing a plan view of the cylinder cover.

Figure 5 is a section on the same line as Figure 3 but taken in the opposite direction.

As shown on the drawings:

The compressor and motor unit is intended to be mounted in a sealed casing comprising an inverted cup-like member 10, having cooling fins 11 applied thereto, which is closed by a removable bottom closure 12 provided with a groove 13 to receive the edge of the member 10 the parts being drawn against a gasket in the groove by bolts 14. The bottom closure 12 is provided with a central bearing aperture 15 for a vertical shaft 16 passed throughout its length as indicated by the numeral 17. The lower end of the shaft carries an inserted seal ring 18 of anti-friction metal which projects slightly beyond the shaft and serves to carry the weight of the rotating parts associated with the shaft, this seal ring bearing against a cover 19 bolted to the bottom face of the closure 12. The seal ring also serves to prevent leakage between the shaft passage 17 and the spaces on the suction side of the compressor hereinafter to be described.

A compressor base plate 20 is mounted on the inside surface of the casing closure 12 and a compressor cylinder 21 is in turn

mounted thereon, the cylinder and base plate being aligned and clamped down by a saddle-like enveloping member 22 having a central upstanding boss 23 forming an upper guide bearing 24 for the shaft 16. The upper end of the boss 23 is dished as at 25 about the bearing 24 to form an oil collecting pocket.

The projecting upper end of the shaft carries a motor armature 26 the field and winding 27 therefor being mounted on a ring 28 supported by upwardly extending arms 29 from the saddle-like member 22. The armature 26 is clamped against a shoulder on the shaft 16 by a nut 30 which is provided with oppositely disposed pivots 31 supporting weighted arms 32 which engage a collar 33 in turn engaging a valve stem 34 mounted in the shaft aperture 17 and cooperating with a valve seat 35 therein. This assembly forms a centrifugal unloading valve which is opened by the weighted arms 32 below a predetermined rotative speed but is closed by the outward swing of the weighted ends of the arms 32 under the influence of centrifugal force; the action of the arms being similar to that of a flyball governor.

When this unloader valve is open it admits high pressure gas, from the upper part of the casing, into the shaft passage 17 and through the bottom seal ring 18 from where a passage 36 leads to a check valve chamber 37 in the cover 19. This check valve chamber has an anteriorly disposed inlet passage 38 containing a screen 39 which passage forms the suction connection to the freezer or evaporator unit of a refrigerating system. A valve seat 40 is interposed between the inlet passage 38 and the chamber 37, a disc valve 41 seating thereagainst to prevent back flow of high pressure gas into the suction line. This disc valve is held on its seat by a light spring 42 on a spring guide 43 clamped between the closure 12 and the cover 19. From the check valve chamber 37 a passage 44 leads to a crescent shaped groove 45 in the closure 12 immediately below the compressor base plate 20, which base plate contains diametrically disposed suction ports 46 opening into the compressor cylinder on the suction sides of partition blades 47 which reciprocate in slots in the cylinder walls. These blades carry outwardly projecting stems 48 on which spring seats 49 are mounted, springs 50 held by brackets 51 acting thereagainst to urge the blades inwardly.

The inner ends of the blades 47 ride on an eccentric floating sleeve 52 which is oscillated around within the cylinder by an eccentric 53 formed on the shaft 16. The oscillating movement of the floating sleeve 52 uncovers the suction ports 46 at the proper time in the cycle of operation so that suction valves are unnecessary.

The top cover or seal for the compressor cylinder comprises two plates 54 and 55 be-

tween which thin steel flapper valves 56 are caught, these valves controlling discharge ports 57 through the plates to prevent back-flow of high pressure gas into the compressor. The plates 54 and 55 are pinned at 58 against rotation but are free to lift upon the generation of excessive pressures within the compressor.

Lubrication of the working parts is provided by an oil bath submerging the compressor and subjected to the discharge pressure thereof which causes sufficient quantities of oil to work in past the moving surfaces into the suction regions of the compressor to efficiently lubricate the same. In order that the compressor may discharge above the oil level, bosses 59 are formed on the top plate 55 about the discharge ports 57, and one of these bosses is provided with a tube 60 leading the discharge into the oil trap 25 formed above the shaft bearing 24, so that oil entrained in the compressor discharge is deposited in the trap and serves to maintain lubrication at this point. The lower shaft bearing is lubricated by a groove 61 and a direct passage 62 in the bottom closure 12, below the oil level in the casing.

For high speed operation it is desirable to balance the rotating parts, to which end a counterweight 63 is applied to the shaft to balance the weight of the eccentric thereon.

The operation is as follows:

The compressor eccentric 53 rotates clockwise in Figure 2 so that the lower portion of the crescent shaped space between the floating sleeve 52 and the cylinder wall is increasing in volume, drawing in low pressure gas through the right hand suction port 46. At the same time the part of the crescent shaped space above the partition blades is decreasing in volume thus compressing the gas therein which is discharged through the right hand discharge port 57 and valve 56 in Figure 3. As Figure 3 is an upside down view, the direction of rotation and the upper and lower compression spaces are reversed relative to Figure 2. This simultaneous compression and suction on opposite sides of the partition blades gives two delivery strokes per revolution of the eccentric. Since the sleeve is free on the eccentric its motion is largely a rolling one within the cylinder because the continuous bearing surface between the sleeve and the eccentric offers much less friction than the line contact between the sleeve and the cylinder and partition blades.

The cover plates 54 and 55 are held down onto the cylinder and sleeve by the high pressure gas in the upper part of the casing, thus forming a releasable end seal which can yield under excessive pressures as when a slug of liquid works into the compressor.

In order to facilitate starting of the compressor and motor unit the compressor is re-

lieved of its load and thus the heavy starting current demand by the motor is materially reduced. This result is accomplished by the centrifugal unloading valve, which bypasses high pressure gas to the suction ports of the compressor below a predetermined rotative speed, thus removing the pumping load on the compressor. This unloading valve is automatically closed as soon as the motor picks up sufficient speed.

It will thus be seen that I have invented an improved and simplified compressor unit wherein suction ports replace the usual valves; wherein excessive pressures can be met without damage to the compressor; and wherein the starting load is materially reduced.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. A device of the class described comprising a closed casing, a rotary compressor, a driving shaft therefor and a driving motor mounted on said shaft, the compressor, shaft and motor being enclosed in said casing, a relief passage extending axially through said shaft, a centrifugal unloading valve controlling said relief passage, a suction supply passage to said compressor having a branch in communication with the relief passage in said shaft, and a check valve in said suction supply passage and anteriorly located relative to said branch.

2. A device of the class described comprising a closed casing, a rotary compressor, a driving shaft therefor and a driving motor mounted on said shaft, the compressor, shaft and motor being enclosed in said casing, a relief passage extending axially through said shaft, a centrifugal unloading valve controlling said relief passage, a suction supply passage to said compressor having a branch in communication with the relief passage in said shaft, a combined seal ring and bearing support at the end of said shaft to prevent leakage from said relief passage adjacent the suction branch, and a check valve in said suction supply passage and anteriorly located relative to said branch.

3. A device of the class described comprising a closed casing containing a bath of lubricant, a rotary compressor submerged in said bath of lubricant, a driving shaft therefor and a driving motor mounted on said shaft, the compressor, shaft and motor being enclosed in said casing, a relief passage extending axially through said shaft, a centrifugal unloading valve controlling said relief passage, a suction supply passage to said compressor having a branch in communication

with the relief passage in said shaft, and a check valve in said suction supply passage and anteriorly located relative to said branch.

4. A device of the class described comprising a closed casing containing a bath of lubricant, a rotary compressor submerged in said bath of lubricant, a driving shaft therefor and a driving motor mounted on said shaft, the compressor, shaft and motor being enclosed in said casing, a relief passage extending axially through said shaft, a centrifugal unloading valve controlling said relief passage, a suction supply passage to said compressor having a branch in communication with the relief passage in said shaft, a combined seal ring and bearing support at the end of said shaft to prevent leakage from said relief passage adjacent the suction branch, and a check valve in said suction supply passage and anteriorly located relative to said branch.

5. A device of the class described comprising a closed casing having a removable bottom closure, a hollow shaft vertically journaled in said bottom closure, a seal ring and thrust bearing supporting said shaft, an eccentric carried by said shaft, a rotary compressor operated by said eccentric, discharge outlets from said compressor opening into the casing, a suction inlet passage in said bottom closure leading to said compressor, a branch passage therefrom communicating with the interior of said hollow shaft through the seal ring, and a centrifugal unloading valve controlling the admission of fluid to the interior of the hollow shaft at the upper end thereof.

6. A device of the class described comprising a closed casing having a removable bottom closure, a hollow shaft vertically journaled in said bottom closure, a seal ring and thrust bearing supporting said shaft, an eccentric carried by said shaft, a rotary compressor operated by said eccentric, discharge outlets from said compressor opening into the casing, a suction inlet passage in said bottom closure leading to said compressor, a branch passage therefrom communicating with the interior of said hollow shaft through the seal ring, a check valve in said suction passage anterior to the branch passage, and a centrifugal unloading valve controlling the admission of fluid to the interior of the hollow shaft at the upper end thereof.

7. A device of the class described comprising a closed casing having a removable bottom closure, a hollow shaft vertically journaled in said bottom closure, driving means engaging the upper portion of said shaft, an eccentric carried by said shaft, a rotary compressor operated by said eccentric, discharge outlets from said compressor opening into the casing, a suction inlet passage in said bottom closure leading to said compressor, a branch passage therefrom communicating with the interior of said hollow shaft, and a centrifu-

gal unloading valve controlling the admission of fluid to the interior of the hollow shaft at the upper end thereof.

8. A device of the class described comprising a closed casing having a removable bottom closure, a hollow shaft vertically journaled in said bottom closure, driving means engaging the upper portion of said shaft, an eccentric carried by said shaft, a rotary compressor operated by said eccentric, discharge outlets from said compressor opening into the casing, a suction inlet passage in said bottom closure leading to said compressor, a branch passage therefrom communicating with the interior of said hollow shaft, a check valve in said suction passage anterior to the branch passage, and a centrifugal unloading valve controlling the admission of fluid to the interior of the hollow shaft at the upper end thereof.

9. A compressor of the class described comprising a casing having a removable closure, a compressor base plate thereon, a shaft journaled in said closure, an eccentric on said shaft, a sleeve floating on said eccentric, a cylinder on said base plate inclosing said sleeve and eccentric, suction ports through said casing closure and base plate, a closure for the other end of said cylinder, mounting means therefor adapted to prevent rotation thereof while permitting movement in alignment with the shaft, and compressor discharge means in said cylinder closure.

10. A compressor of the class described comprising a casing having a removable closure, a compressor base plate thereon, a shaft journaled in said closure, an eccentric on said shaft, a sleeve floating on said eccentric, a cylinder on said base plate inclosing said sleeve and eccentric, suction ports through said casing closure and base plate, a closure for the other end of said cylinder, mounting means therefor adapted to prevent rotation thereof while permitting movement in alignment with the shaft, compressor discharge means in said cylinder closure, and a conduit connected to said discharge means to conduct said discharge to a position adjacent said shaft for lubricating the same.

11. A compressor of the class described comprising a casing having a removable closure, a compressor base plate thereon, a shaft journaled in said closure, an eccentric on said shaft, a sleeve floating on said eccentric, a cylinder on said base plate enclosing said sleeve and eccentric, suction ports through said casing closure and base plate, a closure for the other end of said cylinder, mounting means therefor adapted to prevent rotation thereof while permitting movement in alignment with the shaft, compressor discharge means in said cylinder closure, a relief passage formed in said shaft and communicating with the compressor suction ports, and an

automatic unloading valve controlling said relief passage.

12. A compressor of the class described comprising a casing having a removable closure, a compressor base plate thereon, a shaft journaled in said closure, an eccentric on said shaft, a sleeve floating on said eccentric, a cylinder on said base plate enclosing said sleeve and eccentric, suction ports through said casing closure and base plate, a closure for the other end of said cylinder, mounting means therefor adapted to prevent rotation thereof while permitting movement in alignment with the shaft, compressor discharge means in said cylinder closure, a conduit connected to said discharge means to conduct said discharge to a position adjacent said shaft for lubricating the same, a relief passage formed in said shaft and communicating with the compressor suction ports, and an automatic unloading valve controlling said relief passage.

13. A compressor of the class described comprising a base plate having suction ports therein, a cylinder mounted on said base plate, a shaft centrally mounted relative to said cylinder, an eccentric on said shaft, a sleeve mounted on said eccentric and cooperating with said cylinder, an end cover for said cylinder, means restraining the cover from rotation while permitting longitudinal movement under excessive pressures in the cylinder, and discharge ports and valves in said cover.

14. A compressor of the class described comprising a base plate having suction ports therein, a cylinder mounted on said base plate, a shaft centrally mounted relative to said cylinder, an eccentric on said shaft, a sleeve mounted on said eccentric and cooperating with said cylinder, an end cover for said cylinder, means restraining the cover from rotation while permitting longitudinal movement under excessive pressures in the cylinder, discharge ports and valves in said cover, and a conduit connected to said discharge means to conduct said discharge to a position adjacent said shaft for lubricating the same.

15. A compressor of the class described comprising a base plate having suction ports therein, a cylinder mounted on said base plate, a shaft centrally mounted relative to said cylinder, an eccentric on said shaft, a sleeve mounted on said eccentric and cooperating with said cylinder, an end cover for said cylinder, means restraining the cover from rotation while permitting longitudinal movement under excessive pressures in the cylinder, discharge ports and valves in said cover, a relief passage formed in said shaft and communicating with the compressor suction ports, and an automatic unloading valve controlling said relief passage.

16. A compressor of the class described

comprising a base plate having suction ports therein, a cylinder mounted on said base plate, a shaft centrally mounted relative to said cylinder, an eccentric on said shaft, a sleeve mounted on said eccentric and cooperating with said cylinder, partition members slidably mounted in said cylinder walls, means adapted to maintain said partition members in contact with said sleeve, an end cover for said cylinder, means restraining the cover from rotation while permitting longitudinal movement under excessive pressures in the cylinder, discharge ports and valves in said cover, and a conduit connected to said discharge means to conduct said discharge to a position adjacent said shaft for lubricating the same.

17. A compressor of the class described comprising a base plate having suction ports therein, a cylinder mounted on said base plate, a shaft centrally mounted relative to said cylinder, an eccentric on said shaft, a sleeve mounted on said eccentric and cooperating with said cylinder, partition members slidably mounted in said cylinder walls, means adapted to maintain said partition members in contact with said sleeve, an end cover for said cylinder, means restraining the cover from rotation while permitting longitudinal movement under excessive pressures in the cylinder, discharge ports and valves in said cover, a relief passage formed in said shaft and communicating with the compressor suction ports, and an automatic unloading valve controlling said relief passages.

In testimony whereof I have hereunto subscribed my name at Detroit, Wayne County, Michigan.

EARL F. HUBACKER.