July 13, 1943. W. E. SHORE 2,324,434

REFRIGERANT COMPRESSOR

Filed March 29, 1940 4 Sheets-Sheet 1

Fig. 1.

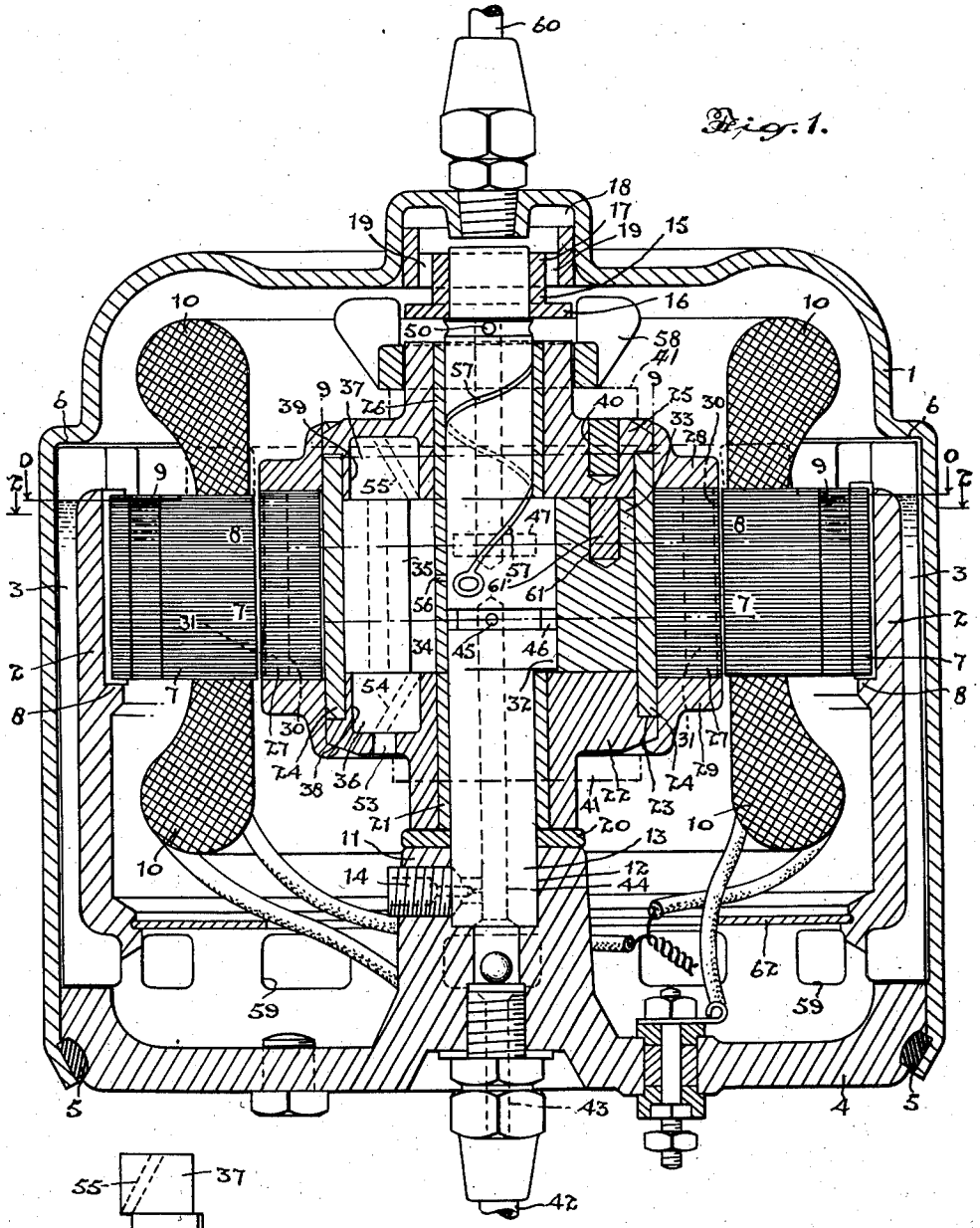


Fig. 11.

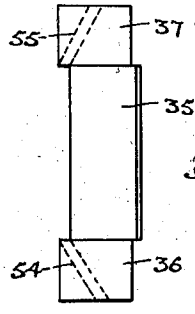
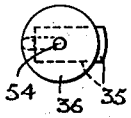


Fig. 12.



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REFRIGERANT COMPRESSOR

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Fig. 2.

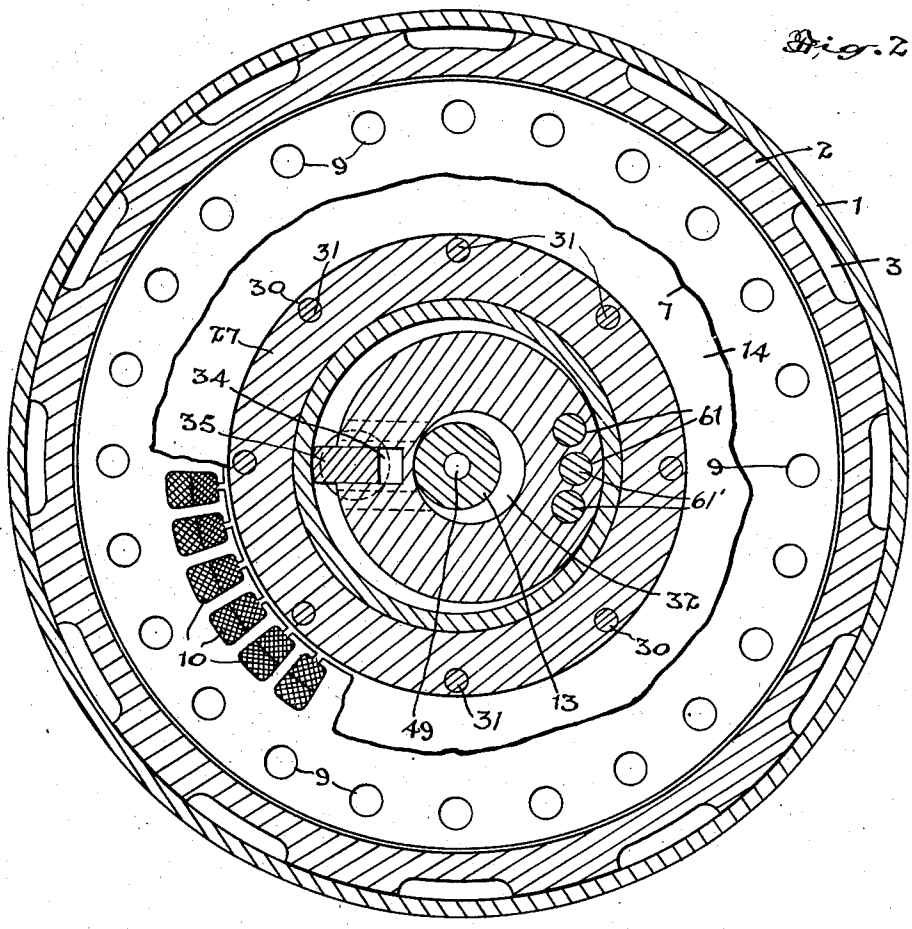
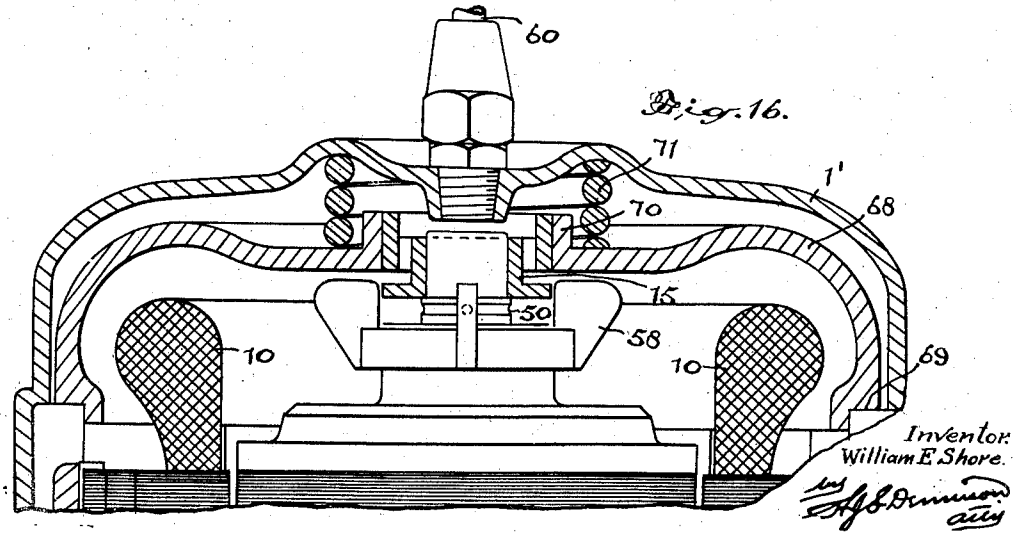


Fig. 16.



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REFRIGERANT COMPRESSOR

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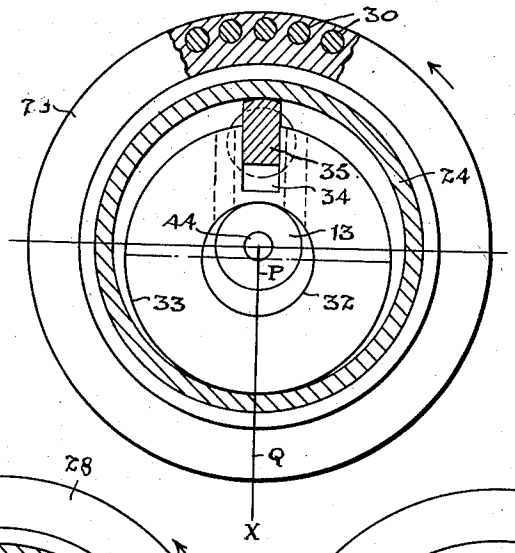


Fig. 5.

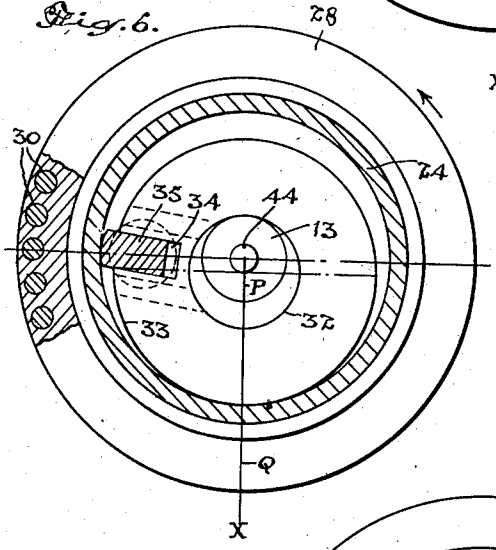


Fig. 6.

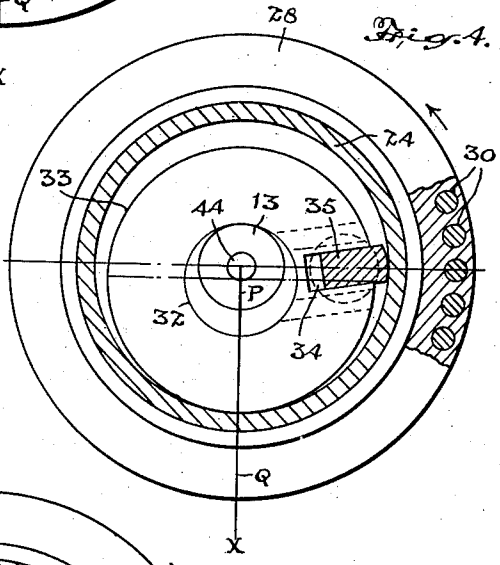


Fig. 4.

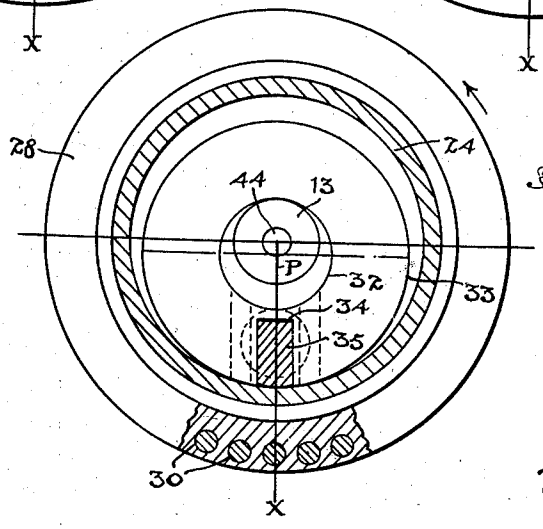


Fig. 3.

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REFRIGERANT COMPRESSOR

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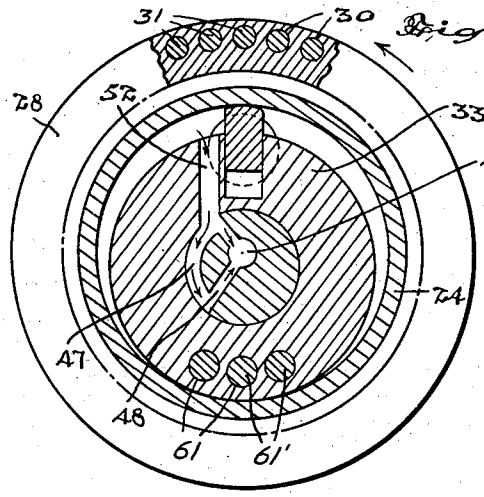


Fig. 8.

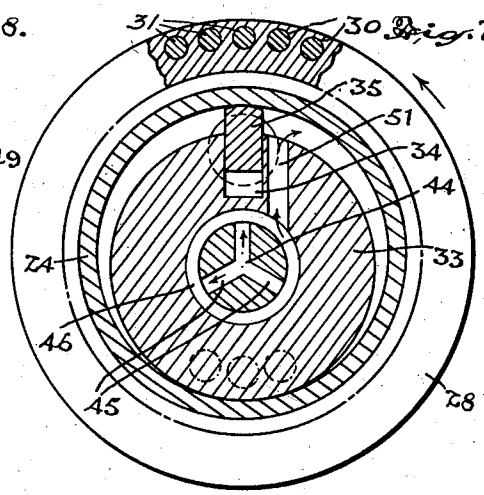


Fig. 7.

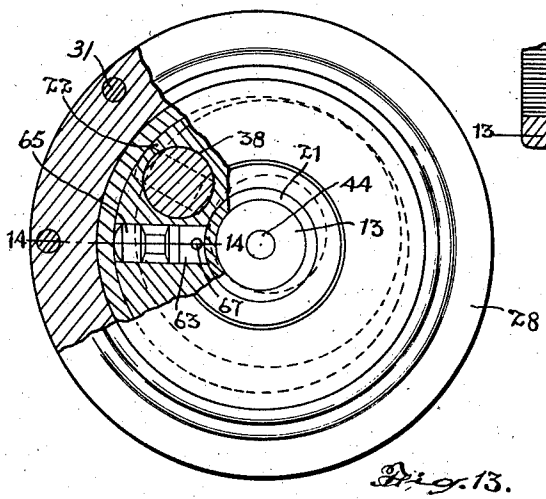


Fig. 13.

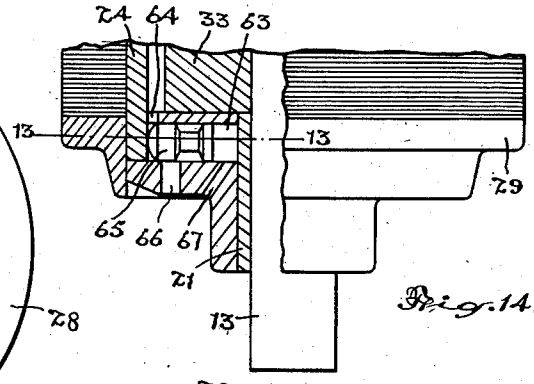


Fig. 14.

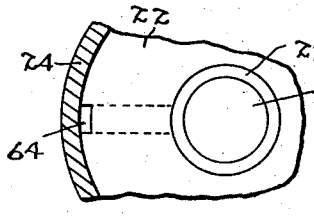
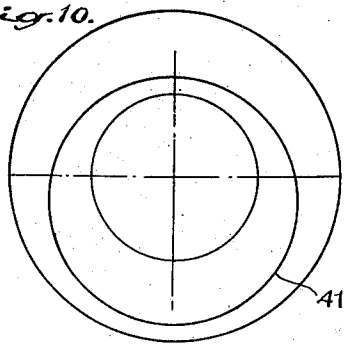


Fig. 15.

Fig. 10.



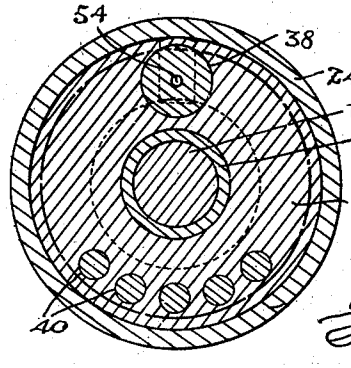


Fig. 9.

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Patented July 13, 1943 2,324,434

UNITED STATES PATENT OFFICE

2,324,434

REFRIGERANT COMPRESSOR

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Application March 29, 1940, Serial No. 326,704

15 Claims. (Cl. 230—139)

The present invention relates to the type of electrically operated refrigerant compressors in which the operating mechanism is hermetically sealed within an enclosing casing, and the principal objects of the invention are to provide a mechanism of extremely high efficiency in which the parts are so constructed and balanced that vibratory inertia and the resultant noise and wear are reduced to a negligible quantity.

A further and very important object of this invention is to effect a substantial transfer of the mechanical heat generated in the compressor as well as the heat of compression of the refrigerant so that such heat will be readily dissipated from the externally exposed surfaces of the enclosing casing.

A still further object is to provide a mechanism in which all the operating parts are effectively lubricated so as to reduce friction to the minimum and to enable the operation of the device continuously at high speed, and in which the lubricant is effectively retained against discharge from the compressor with the compressed refrigerant.

Another and important object is to devise a structure which will be highly efficient but can be manufactured at low cost without the necessity of expensive precision operation.

The principal features of the invention consist in the novel construction and arrangement within an enclosed electrical stator of a rotor including a compressor cylinder mounted upon a fixed axis and a rotative compressor element mounted upon a fixed axis eccentric to the axis of said cylinder, said cylinder carrying an abutment axially slidable in said compressor element and directing the inflow of the refrigerant to the cylinder and dividing the intake and compression areas and also directing the discharge of the compressed refrigerant.

A further and important feature of the invention resides in the novel manner of individually balancing the separate rotative members of the composite rotor.

A still further important feature resides in the novel manner of circulating the lubricant to the bearing surfaces and through a plurality of ducts adjacent to the outer casing to effect the transfer and dissipation of heat generated or accumulated within the rotor.

In the accompanying drawings Figure 1 is a longitudinal mid-sectional view of an electrically operated sealed refrigerant compressor unit constructed in accordance with this invention.

Figure 2 is a partial fragmentary cross sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a diagrammatic plan and fragmentary sectional view of the rotor showing the abutment for dividing the intake and compression areas of the cylinder arranged in the neutral position at the end of discharge and the commencement of intake.

Figure 4 is a view similar to Figure 3 showing the relative position of the abutment at approximately one quarter of a revolution from the position illustrated in Figure 3.

Figure 5 is a view similar to Figure 4 showing the relative position of the parts when the abutment is in a position diametrically opposite to that shown in Figure 3.

Figure 6 is a view similar to Figures 3, 4 and 5 illustrating the abutment in a position diametrically opposite to the position illustrated in Figure 4.

Figure 7 is a horizontal sectional view of the rotor taken on the line 7—7 of Figure 1 and showing the arrangement of the refrigerant intake passages to the cylinder.

Figure 8 is a horizontal section of the rotor taken on the line 8—8 of Figure 1 illustrating the arrangement of the discharge passages from the compressor cylinder.

Figure 9 is a horizontal sectional view through the rotor taken on the line 9—9 of Figure 1.

Figure 10 is an end view of the rotor showing a modified arrangement of balancing means.

Figure 11 is a side elevational view of the abutment member of the rotor removed from the cylinder.

Figure 12 is an end elevational view of the abutment shown in Figure 11.

Figure 13 is a top plan view of the bottom end member of the compressor cylinder shown in part horizontal section on the line 13—13 of Figure 14.

Figure 14 is an elevational view of the bottom end of the compressor cylinder member taken in part section on the line 14—14 of Figure 13 also showing in part section a portion of the rotary compressor member within the compressor cylinder.

Figure 15 is a fragmentary plan view and part section of the compressor cylinder showing the arrangement of the emergency or overload discharge passage from the cylinder to the mechanism illustrated in Figures 13 and 14.

Figure 16 is an elevational and part mid-sectional view illustrating a modification of the casing structure illustrated in Figure 1.

It is known to those skilled in the art that a

great variety of hermetically sealed pumps and compressors for the handling of liquids, gases and refrigerants, have been proposed in which numerous forms of eccentric and reciprocating piston devices are used, and it is recognized that different means for counter-balancing the operating members have been proposed.

It is the purpose of this invention to provide a structure of remarkably simple form which will accomplish the object which it is desired to attain in devices of this class, and, with the consideration pertaining to mechanical balanced unity, the present invention provides improved balance methods and means in a rotary compressor wherein each rotatable member is individually balanced, each concentric to its specific operative axis with each specific axis considered individual to each other and all collectively rotating in such a manner as to practically eliminate compression vibratory impulses and mechanical unbalance.

Referring to the accompanying drawings, the outer casing 1 is of substantially dome shape and encloses a motor frame housing 2 which is provided with a plurality of longitudinal channels 3 extending from end-to-end thereof and spaced apart around the periphery.

A base member 4 closing the bottom end of the casing 1 is preferably hermetically sealed within the casing by flanging the rim of the casing inwardly against a suitable packing 5. The base member abuts the frame housing 2 securing same snugly against a shoulder 6 formed in the upper part of the side wall of said casing.

A motor stator structure 7 is rigidly mounted within the frame housing 2 at its upper end, being supported by an inwardly extending flange 8. The stator is provided with a plurality of spaced openings 9 extending vertically therethrough and the electrical windings 10 are arranged inwardly of said openings.

The base 4 is provided with a centrally arranged hub 11 which is provided with a cylindrical recess 12 in the top thereof in which is rigidly mounted a stationary shaft 13, said shaft being preferably a press fit into said recess and being suitably anchored by a set screw 14 threaded through the hub.

The upper end of the shaft 13 has mounted thereon a collar 15 which is provided with a flange 16 at its lower end and has an enlarged upper flange portion 17 which fits snugly within a cupped recess 18 formed in the top of the casing 1. The flange 17 is provided with a plurality of holes 19 extending downwardly therethrough and opening at the bottom end into the interior of the casing 1.

A washer 20 encircles the shaft at the inner end of the hub 11 and a bearing bushing 21 surrounds said shaft above said end-bearing washer.

A flange member 22, which forms the lower end of the compressor cylinder, encircles the bushing 21 and is formed with a peripheral concentric recess 23 in which a tubular shaped cylinder 24 is mounted. A flange member 25, similar in construction to the flange 22, closes the upper end of the cylinder 24 and has a bushing 26 encircling a portion of the shaft 13, the upper end of said flange and bushing being a short distance from the flange 16 of the collar 15. The entire cylinder structure is thus rotatably mounted concentrically of the shaft 13.

The electrical element of the rotor is here shown in the form of laminations 27 which surround the periphery of the cylinder 24 and are secured between the flanges 28 and 29. The preferable method of constructing the electrical element of the rotor is to form the lamination stack with a plurality of holes 30 extending from top to bottom of the stack, and the resistance flanges 28 and 29 and the connecting inductors 31 extending through the holes 30 are die-cast from suitable metal and the structure thus forms a squirrel-cage type of rotor, which, after being properly machined and balanced, may be pressed on to the periphery of the cylinder and the edges of the flanges 28 and 29 may be pressed or rolled over the flanged cylinder end members, thereby tightly clamping the latter against the ends of the cylinder and retaining the unit in assembled form. It is important to note that this construction provides a continuously smooth outer surface free from clamping bolt projections, thereby greatly minimizing the resistance to rotation of the cylinder-rotor unit which is of vital importance where the unit is to be operated in submerged relation to a body of lubricating oil.

The rotor when thus assembled is rotatably mounted within the stator 8.

The shaft 13 is formed with an eccentric portion 32 intermediate of its length, which is arranged between the inner faces of the cylinder end flanges 22 and 25, and a cylindrical rotor piston 33 encircles and is journalled upon the eccentric 32 in such a manner that the perimeter of the piston engages the inner wall of the cylinder 24 in line with the greatest distance of eccentricity of the eccentric 32 from the main portion of the shaft 13, the remainder of the perimeter of the piston being separated from the cylinder wall.

The piston 33 is formed with a vertical slot 34 extending radially inward from the perimeter and extending from end-to-end thereof and the opposing faces of said slot are parallel.

An abutment in the form of a substantially rectangular shaped block 35 is slidably mounted within the slot 34 and has mounted upon its ends, forming a part thereof, cylindrical journal members 36 and 37. These journal members are rotatably mounted within cylindrical recesses 38 and 39 formed respectively in the cylinder end flanges 22 and 25 which are in axial alignment, the axis being parallel to the axis of the shaft 13.

It is important to note that the trunnion portions 36 and 37 are so proportioned in relation to the intervening blade or abutment 35 so that they present the maximum bearing surface area both peripherally as well as endwise in relation to the size of the blade or abutment.

I have determined through extensive experimentation that not only is it important in a compressor of the type set forth, to maintain the axis of oscillation of the abutment within the periphery of the eccentrically mounted piston, but also to permit little or no sliding contact of the ends of the abutment with the inner surfaces of the cylinder ends due to the detrimental binding or wearing action against such surfaces.

I therefore purposely form the trunnion portions 36 and 37 of such size that they overlap all or substantially all of what would otherwise be exposed end faces of the abutment and in the form shown it will be seen that the trunnions extend well beyond at least three sides of the abutment in planes transversely of the axis of oscillation, so that they provide extensive sealing and positioning contact with the ends of the rotary piston.

Moreover the outer faces of the trunnions contact the bottoms of the journal recesses 38 and 39, providing extensive end thrust surface contact. There will thus be little or no wearing contact between the abutment proper and the ends of the cylinder.

I prefer in any case to so relatively proportion the abutment portion and the trunnions that the cross sectional area of each trunnion will be greater than the cross sectional area of the abutment or so that the end thrust surface presented by each trunnion will be greater than or will replace the otherwise exposed end surfaces of the abutment proper even to the exclusion thereof.

The outward longitudinal face of the rectangular abutment member 35 is held by the journal ends 36 and 37 in engaging or sealing contact with the inner peripheral surface of the cylinder 24, and said contact being lengthwise of the abutment, is concentric to the axis of the journal ends thereof, so that the abutment may roll and maintain its operating contact with the cylinder surface.

It will be understood that as the rotor is caused to rotate through the influence of the electrical forces acting between the stator and rotor, the cylinder will rotate upon its bearings formed by the bushings 21 and 26, and it will be seen that there will be an unbalanced condition due to the location of the abutment member 35 between its journals.

This condition may be corrected by forming recesses 40 in one or both of the cylinder end flanges 22 or 25 and placing in these any suitable substance which will effect a balance, or, it may be found desirable to apply to one or both of the hubs of the flanges 22 or 25, if the rotor is not submerged in a fluid lubricant, an eccentric balance member 41 illustrated particularly in Figure 10.

An intake conduit 42 leading from the refrigerating system is connected to a central orifice 43 leading through the hub 11 of the base 4, and the shaft 13 is provided with a central orifice 44 in the shaft 13 which leads to a plurality of radial channels 45 which extend outwardly to a peripheral channel 46 which extends completely around the eccentric portion of the shaft, as shown particularly in Figure 7 and in elevation in Figure 1.

A peripheral channel 47, which extends only part way around the circumference of the eccentric portion of the shaft, is spaced from the channel 46 and is connected by radial channels 48 with a central orifice 49 extending upwardly through the shaft and connecting with radial channels 50 which open outwardly from the shaft between the top of the hub of the upper cylinder end 26 and the flange 16 of the collar 15 mounted in the casing 1.

On reference particularly to Figure 7, it will be seen that the peripheral intake channel 46 in the eccentric portion of the shaft 13 is in constant communication with a channel 51 leading through the piston member 33 at one side of the slot 34 therein, which thus forms a communicating connection with the interior of the cylinder on the intake side of the abutment member 35.

A channel 52, arranged in the rotor piston 33 at the opposite side of the abutment slot 34 to that on which the channel 51 is arranged, communicates with the peripheral discharge channel 47 periodically in the operation of the machine and permits the refrigerant compressed within the cylinder to flow inwardly and upwardly through the central channel in the upper portion of the shaft 13 to discharge through the radial channels 50 into the interior of the chamber enclosed by the casing 1.

Upon the application of electric energy to the stator 7 the rotor will be caused to rotate, the direction of rotation being indicated by the arrow in Figures 3, 4 etc., and the cylinder 24 with its flange ends 22 and 25 rotates about the main axis of the shaft 13.

It will be understood that, as the abutment 35 has its journal ends 36 and 37 mounted in the bearings 38 and 39 in the said flange ends, the outward rounded edge of the abutment is held in contact with the inner wall of the cylinder and is carried with the cylinder in its rotating movement.

The engagement of the flat side faces of the abutment 35 with the side walls of the slot 34 in the rotor piston 33 causes the piston to rotate about the axis of the eccentric portion 32 of the shaft 13 in harmony with the rotation of the cylinder, and the cylinder chamber is in constant communication with the intake to the passages in the shaft and the channel 51 extending through the rotor piston.

The movement of the cylinder and the abutment from the position indicated in Figure 3 to the position indicated in Figures 4 and 5, creates a suction to draw refrigerant gases into the cylinder chamber from the refrigerating system. This intake action continues throughout the completion of each revolution of the cylinder and, as the abutment passes the line of contact between the rotor piston and the cylinder wall the gases that have been previously drawn into the cylinder are compressed until the piston reaches approximately the position shown in Figs. 5 and 8 when the channel 52 moves into communication with the peripheral channel 47 in the shaft and the gases which have been compressed are discharged to the channel 47 and radial channel 48 into the central discharge orifice 49 in the shaft which discharges, as previously described, through the radial channels 50.

It will be appreciated that in the operation of the rotor the piston rotates in unison with the cylinder about its eccentric axis and it operates with a relative harmonic movement and the abutment in the course of rotation of the cylinder slides radially in the slot 34.

The mechanism as herein described is immersed in a bath of oil which, when the machine is at rest, has its upper level slightly below the top of the stator indicated by the line O—O of Figure 1, and, as the compressed refrigerant is discharged into the interior of the casing 1 above this oil level, there is a pressure applied to the oil.

An opening 53 is arranged in the flange member 22 at the bottom of the recess 38 in which the lower abutment journal is mounted and oil is forced through the opening 53 to lubricate the journal.

A diagonally arranged oil duct 54 extends upwardly through the journal end 36 and it directs oil into the inner end of the slot 34 in the piston back of the abutment. A corresponding diagonal oil duct 55 extends through the upper journal and conducts oil from the slot 34 to lubricate the journal recess 39.

A small oil duct 56 extends through the wall of the rotor piston and conducts oil from the slot 34 to lubricate the shaft, the surface of said shaft having a spiral oil groove 57 cut therein to distribute oil to the upper bearings.

The oil pressure within the interior of the slot 34 forces a film of oil outwardly either side of the abutment to both lubricate the abutment and also to lubricate the inner wall of the cylinder.

It will of course be appreciated that a certain amount of lubricating oil will be discharged from the cylinder with each cycle of operation but this will flow laterally from the discharge openings 50 at the top of the shaft 13, and in order to precipitate any oil discharged in this manner and prevent an excess of oil vapour being carried out through the ultimate discharge of the compressed regfrigerant, a fan member 58 is provided in the form of a collar having a plurality of radial vanes which is secured on the hub of the upper cylinder flange end 25, the said vanes extending into the path of discharge from the radial discharge channels 50.

It will be understood that heat accumulated within the cylinder or developed through mechanical operation will be absorbed by the body of oil surrounding the rotor, and in order to effect the dissipation of such heat the stator is provided with the openings 9 through which the oil may flow, and when the machine is in operation there will be a considerable displacement effected and the oil level will rise until it flows from the top of the openings 9 over the frame 2 and down through the peripheral longitudinal channels 3.

Openings 59 are arranged between the base 4 and the housing 2 at the bottom end of the channels 3 to permit a free circulation of the oil. Heat absorbed by the oil surrounding the inner portions of the mechanism will be carried outwardly with the circulating oil and will be dissipated by conduction and radiation from the outer surface of the casing 1.

A discharge conduit 60 extends outwardly from the recess 18 in the top of the casing 2.

It has been previously described that the composite member forming the cylinder will be balanced by the arrangement of extra weight in the openings 40 or by the adjustment of the eccentric members 41, and as the rotor piston is unbalanced by the cutting of the slot 34 therein, it is found necessary to balance this element to remove unbalance inertia. This is accomplished in a very simple manner by boring holes 61 therein to remove the required amount of metal from the side of the piston opposite to the abutment slot and plugs 61' of a lighter material are preferably placed in the holes 60 so that oil will not lodge therein to disturb the balance.

In order to ensure the most active circulation of the oil in its function of dissipating heat accumulated or generated within the machine a baffle disc 62 is secured to the housing 2 and extends inwardly therefrom above the circulation openings 59.

In order to prevent overloading of the compressor a special release valve mechanism is provided. This is illustrated particularly in Figures 13, 14 and 15. A small cylinder 63 is provided in the form of a radial passage formed in the lower cylinder flange 22 and arranged adjacent to and slightly to one side of the journal recess 38 of the abutment. The outer end of the cylinder 63 communicates with the main cylinder chamber through a port 64 immediately adjacent to and on the compression side of the abutment 35 and within the the cylinder 63 is arranged a small piston valve 65. A duct 66 extending upwardly through the bottom end of the flange 22 enters the relief cylinder 63 intermediate of its length and a smaller duct 67 extends through said flange 22 and communicates with the inner end of the cylinder 63.

In the event of oil or other liquids filling the compression side of the cylinder chamber at the beginning of a compression movement the discharge port 52 would of course be closed. Consequently any force exerted to turn the compressor body to compress or discharge the non-compressible liquid therein, would form an extreme overload and strain. In such an event the liquid under pressure would flow through the port 64 into the relief cylinder, forcing the piston valve 65 inwardly until communication would be established between the said port 64 and the main duct 66 in the bottom of the flange and the pressure in the cylinder would therefore be immediately released, the oil or liquid being forced from the main cylinder, and immediately this pressure is relieved the oil under pressure within the casing will flow in through the small duct 67 to the inner end of the piston valve 65, forcing it outwardly in addition to a natural operation under centrifugal force. Such a relief mechanism is extremely simple and obviates many difficulties that are found in spring-loaded types of relief valves.

An important feature in the construction of device herein shown is, that in providing for the lubrication of the contacting moving parts, the pressure within the casing 1 being exerted against the bath of oil surrounding the mechanism, forces oil through the passages described into the slot 34 in the piston back of the abutment 35, and as the compressor operates from the position illustrated from Figures 3 to 4 and from 4 to 5, the oil being fed to the slot 34 is at a higher pressure than the refrigerant in the compression chamber and suction chamber. Consequently there will be no leakage of compressing fluid from the high side of the abutment member 35 to the low side through the oil entrapped behind said abutment, but as the compressor moves from the position illustrated in Figures 5 and 6 to that shown in Figure 3, the passage 52 is opened to the cut-off passage 47 in the shaft. The compression chamber is then opened and balances the pressure within the main casing, and the lubricant pressure in the slot 34 is equalized.

The maintenance of pressure upon the oil bath in which the parts operate causes a continuous feed of oil to be effected to all the working parts, the pressure within the slot 34 feeding oil to the flat contacting surfaces of the abutment and the rotor and also feeding oil through the oil duct 56 in the piston to the oil groove 57 in the shaft. It will of course be understood that oil will seep downwardly along the shaft surfaces to lubricate the lower journal of the bushing 21.

The circulation of the oil upwardly through the ducts 9 in the stator to flow downwardly through the ducts 3 adjacent to the inner peripheral surface of the casing 1, is effected jointly by the operation of the rotative elements and the expansion of the oil due to heat as well as the applied pressure, but the moment the unit comes to rest the displaced oil will settle, lowering the oil level below the top of the stator and arresting the circulation and the heat exchange cycle. When this occurs it will of course be understood that the heat contained in the various elements, including the body of oil, holds the temperature for a considerable period of time, so that a normal working temperature is maintained in the entire motor compressor mechanism.

It will of course be understood that, if under certain circumstances it is found that the dissipation of heat through radiation from the outer surface of the casing 1 is insufficient, radiating vanes may be introduced or cooling coils may be used to amplify the ordinary atmospheric heat exchange surface.

It may in some instances be found desirable to modify the external casing structure and a modification is illustrated in Figure 16. In this construction a cup or bell-shaped cap 68 is arranged within the casing 1' and is provided with a flanged edge 69 which rests upon the motor housing 2. The ported collar 15 is fitted within the flange 70 of the cap 68 and a coil compression spring 71 is interposed between the cap 68 and the outer casing 1'.

The upper support of the shaft 13 is thus mounted in the bell cap 68 instead of directly in the outer shell casing and such construction may obviate any distortion of the motor frame and compressor shaft which might possibly occur in the sealing of the outer casing and motor frame, as illustrated in Figure 1.

It is important to note the peculiar co-operative movement between the cylinder and the rotary piston. The cylinder rotates concentrically of the main axis of the shaft 13 and, as the abutment member 35 is mounted between fixed pivots in the cylinder ends, the abutment is carried with the cylinder.

The abutment extends radially into the slot 34 in the piston which is of smaller diameter than the interior of the cylinder and rotates concentrically with the axis of the eccentric portion 32 of the shaft.

It will be noted on reference to Figure 3 that the abutment is shown in central alignment with the line P—X and the abutment is then in its fully recessed position in the slot 34 with the piston practically touching the inner wall of the cylinder.

As the cylinder continues its rotation the piston member maintains its line of contact with the cylinder wall on the line P—Q, Figures 4, 5 and 6, while the remaining portion of the perimeter recedes away from and again approaches the cylinder wall, and, because of the fact that the piston is carried around a complete revolution with each revolution of the cylinder due to the contact of the abutment with the sides of the slot in the piston, there is a change of speed due to the difference in diameter of the piston and cylinder in their peripheral relation.

It will be observed that the rotor surface, as the slot 34 passes the line P—X, will be moving in unison with the cylinder, but as the slot 34 passes the position shown in Figure 5, that is, diametrically opposite the line P—X, the rotor surface will be moving slower than the cylinder wall. There is therefore a relative increasing and decreasing relationship of the speed between the rotor and the cylinder. If the cylinder were stationary it would be noticeable by vibration even though the rotor was perfectly balanced. A similar action appears in the sliding vane pump, which is very noticeable, but because of the cylinder in the present construction being propelled by a flexible magnetic rotation, some of the harmonic movements defined is taken up by the compressor body and the motor rotor and is distributed among the rotating members. The slight difference in movement is therefore dissipated among the several members without creating any distinct unharmonic condition.

From the foregoing description it will be readily appreciated that extremely fine machining of the parts will not be necessary in order to accomplish the desired effect and a very efficient apparatus is produced which will be extremely economic in its operation and will occupy the very minimum of space. Further, it operates without vibration and without noise.

An important feature in the operation of this device is that the lubricant entrapped in the slot 34 back of the abutment 35 is subjected to a high centrifugal force due to the speed of rotation, and such lubricant is raised above compressor pressure during the last period of compression discharge cycle, thus boosting the sealing pressure under the abutment 35 at the extreme critical period for volumetric efficiency.

What I claim as my invention is:

1. A refrigerant compressor comprising, a sealed casing enclosing an electrical stator and a shaft fixed from rotation in said casing, an electric motor rotor including a compressor cylinder rotatably mounted on said shaft and surrounded by said stator, a cylindrical rotary piston eccentrically mounted within said cylinder and having sealing contact therewith at one side thereof, a member having journal portions at each end thereof journalled in said cylinder at both ends thereof for oscillation about an axis permanently disposed within the periphery of said rotary piston and having blade portion intermediate said journal portions extending inwardly from the inner periphery of the cylinder and operatively engaging said eccentric piston to rotate same in unison with said cylinder, and said journal portions projecting beyond the piston to form a seal the cross sectional area of each of the journal portions of said member being substantially greater than the cross sectional area of said blade portion, means for directing the inflow of refrigerant to the cylinder at one side of said member, and means for controlling the outflow of the compressed refrigerant from said cylinder on the opposite side of said member.

2. A device as claimed in claim 1 in which the means carried by the cylinder and operatively engaging the eccentrically mounted piston comprises an abutment journalled at its ends in the ends of the cylinder and having its outward edge engaging in sealing contact with the inner periphery of the cylinder and having parallel walls engaging in sliding contact with said eccentric piston, said piston having a radial slot for sealing and engaging the parallel walls of said abutment, the journal portions of said abutment each presenting inwardly and outwardly facing surfaces respectively engaging the ends of the piston and the ends of the cylinder in end thrust and positioning contact and representing substantially the only end contact area between said abutment and said piston and cylinder ends.

3. A refrigerant compressor comprising a sealed casing for containing a body of lubricant, an electric motor stator mounted in said casing, a shaft rigidly mounted axially of said casing having an eccentric portion intermediate of its length, a journal encircling said shaft at each end of said eccentric portion, flange members mounted on said journals, a cylinder arranged between said flange members and sealed thereto, an electrical rotor embracing said cylinder and operatively connected to and surrounded by said stator, an annular piston encircling the eccentric portion of said shaft and arranged between

said flange members and having sealing engagement therewith, an abutment secured in said flange members and engaging the interior wall of the cylinder in sealing contact and having sliding engagement with said piston to operate same in unison with said cylinder, the outer ends of said electrical rotor having reduced end portions turned inwardly over the ends of said flange members in a smooth continuous circumferential clamping relation to retain said cylinder, flanges and electrical rotor together in a firmly assembled unit free of rotation-obstructing protuberances, said unit being submerged in part at least in the body of lubricant in said casing, means for directing a refrigerant medium into the intake side of the cylinder at one side of said abutment, and means for directing compressed refrigerant from the discharge side of said cylinder on the other side of said abutment.

4. A refrigerant compressor comprising a sealed casing enclosing an electric motor stator and containing a body of lubricant, a shaft rigidly mounted in said casing concentrically of said stator and having an eccentric portion, a pair of cylinder ends rotatably mounted on said shaft and having balancing weight members recessed thereinto to balance said ends and parts connected therewith and being free of projection to minimize frictional resistance with the body of lubricant, a cylinder connecting said ends, an electric motor rotor surrounded by said stator and operatively connected to said cylinder an abutment supported between said ends and engaging the inner wall of the cylinder, an annular piston encircling the eccentric portion of the shaft and having a radial slot housing said abutment, said annular piston having the side opposite the abutment slot opposed to said slot reduced in volumetric capacity to effect the balancing of said piston independently, means for directing a refrigerant medium to the cylinder at one side of said abutment, and means for directing the compressed refrigerant medium from the cylinder on the opposite side of said abutment.

5. In a refrigerant compressor, a sealed casing enclosing an electric motor stator, a shaft fixed from rotation in said casing concentric with said stator and having an eccentric portion, a cylinder rotatably mounted on said shaft within said stator, an electric motor rotor surrounded by said stator and operatively connected to said cylinder, an annular piston encircling the eccentric portion of said shaft, an abutment carried by said cylinder and extending in operative engagement with said piston to rotate same in unison with the cylinder, means for directing the inflow of refrigerant to the interior of the cylinder at one side of said abutment, means for controlling the outflow of compressed refrigerant from the cylinder on the opposite side of said abutment, and means for releasing an overload in the compression side of the cylinder, including a relief discharge port, a piston valve normally sealing said port and arranged to be acted upon by an abnormal force of compression in opposition to centrifugal force to release the overload through said port, and means for applying the force of the compressed medium to said piston valve to supplement the centrifugal closing force thereof.

6. In a refrigerant compressor comprising a sealed casing forming a motor housing enclosing an electric motor stator rigid therewith, a fixed shaft mounted within and fixed to said casing, an electric motor rotor mounted on said shaft surrounded by said stator and including a compressor cylinder, an annular piston operating in said cylinder, means for directing refrigerant into the intake side of said cylinder, and means for directing compressed refrigerant from the discharge side of said cylinder into the interior of said sealed casing, the combination therewith of a bell cap arranged within the casing supported on the motor housing and having discharge ports, a compression spring arranged between said bell cap and said sealed casing and serving solely to retain said bell cap in place, a collar mounted in said bell cap supporting the upper end of said shaft and having passages therethrough leading from the interior of the bell cap, and a discharge conduit connected with the sealed casing communicating with the discharge ports through the bell cap.

7. A refrigerant compressor comprising, a sealed casing enclosing an electrical motor stator and a shaft fixed in said casing, an electric motor rotor surrounded by said stator and, including a compressor cylinder having closed ends and rotatably mounted on said shaft, a cylindrical rotary piston eccentrically mounted within said cylinder and having sealing contact therewith at one side thereof, a member having journal portions journalled in said cylinder for oscillation about an axis permanently disposed within the periphery of said rotary piston and having an intermediate blade portion extending inwardly from the inner periphery of the cylinder and operatively engaging said eccentric piston to rotate same in unison with said cylinder, said journal portions of said member being arranged in bottomed journal recesses in the ends of the cylinder wall and presenting therewith end thrust and positioning contact areas at each end of said blade portion greater than the cross-sectional area of the said blade portion, means for directing the inflow of refrigerant to the cylinder at one side of said blade member, and means for controlling the outflow of the compressed refrigerant from said cylinder at the opposite side of said blade member.

8. A compressor as claimed in claim 7 in which the journal portions of said member comprise trunnions so constructed and arranged in relation to the blade portion that they extend in planes transversely of the axis of oscillation well beyond at least three sides of the blade portion in extensive sealing relation to the ends of the rotary piston.

9. A compressor as claimed in claim 7 in which the journal portions of said member comprise trunnions so constructed and arranged in relation to the blade portion that they extend in planes transversely of the axis of oscillation well beyond at least three sides of the blade portion in extensive sealing relation to the ends of the rotary piston, said trunnions overlying substantially the entire end areas of said blade portion except for local areas immediately adjacent the inner peripheral surface of said cylinder.

10. In a compressor of the class described, in combination, a cylinder unit rotatable about a fixed axis and having fluid inlet and discharge means, a rotary piston rotatable with said cylinder about an axis eccentric to said cylinder and having a slot in one side, an abutment member slidably fitting in said slot and having piston-like trunnion portions at the ends, said cylinder having bottomed cylindrical journal bores receiving said piston-like trunnions, means for directing fluid under substantially uniform pres-

sure to the ends of said respective cylindrical journal bores to provide a substantially balanced end pressure between said piston-like trunnions and the respective bottoms of said cylinders.

11. A compressor as claimed in claim 10 in which said compressor is sealed within a casing having a body of lubricant and has the discharge means connected with the casing interior, one of said cylindrical journal bores being directly connected axially with the body of lubricant in said casing and the other of said bores being connected with the first-mentioned bore through said slot.

12. A compressor as claimed in claim 10 in which said compressor is sealed within a casing having a body of lubricant and has the discharge means connected with the casing interior, one of said cylindrical journal bores having an axial opening to expose the outer end of the respective piston-like trunnion to the working pressure of the lubricant body, the latter trunnion having a passage leading obliquely from the outer axial region and opening into said piston slot at one end inwardly of the abutment therein, and the other trunnion being formed with a passage leading from the other end of said piston slot obliquely through the said other trunnion to the axial region of the respective journal bore.

13. In a refrigerant compressor, a sealed casing enclosing an electric motor stator, a shaft fixed from rotation in said casing concentric with said stator and having an eccentric portion, a cylinder rotatably mounted on said shaft within said stator, an electric motor rotor surrounded by said stator and operatively connected to said cylinder, an annular piston encircling the eccentric portion of said shaft, an abutment carried by said cylinder and extending in operative engagement with said piston to rotate same in unison with the cylinder, means for directing the inflow of refrigerant to the interior of the cylinder at one side of said abutment, means for directing the outflow of compressed refrigerant from the cylinder into the interior of said casing at the opposite side of said abutment, the cylinder structure being provided with a cylindrical valve chamber having communication with the compression side of the cylinder chamber, a piston valve operable in said valve chamber, a port intermediate of the length of said valve chamber and adapted to be uncovered by the movement of the valve to open communication between the compression side of the cylinder and the interior of the sealed casing, and a port connecting the inner end of said valve chamber with the interior of the sealed casing and forming a passage to conduct the pressure of compression in the casing to the valve chamber to operate the valve to close the cylinder port.

14. In a refrigerant compressor, a sealed casing enclosing an electric motor stator, a vertically disposed shaft fixed from rotation in said casing concentric with said stator and having an eccentric portion, a cylinder having upper and lower ends rotatably mounted on said shaft within said stator, an electric motor rotor surrounded by said stator and operatively connected to said cylinder, an annular piston encircling the eccentric portion of said shaft, an abutment carried by said cylinder and extending in operative engagement with said piston to rotate same in unison with the cylinder, means for directing the inflow of refrigerant to the interior of the cylinder at one side of said abutment, means for controlling the outflow of compressed refrigerant to the interior of the sealed casing from the cylinder at the opposite side of said abutment, a cylindrical valve chamber being radially arranged in the lower cylinder end, said valve chamber having a port at its outer end communicating with the compression side of the cylinder and having a port at its inner end communicating with the interior of the sealed casing and also having a port arranged intermediate of its length communicating with the interior of the cylinder casing, and a piston valve slidably arranged within said radial valve chamber and adapted to be maintained in its outward sealing position through the centrifugal action of the cylinder in addition to pressure from the interior of the casing flowing through the port communicating with the inner end of the valve chamber.

15. In a compressor of the class described, a cylinder structure rotatable about a fixed axis, a piston eccentrically co-operating interiorily with said cylinder, and an electrical induction rotor embracing said cylinder and formed with integral flanges turned inwardly into clamping engagement with the cylinder structure.

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