Feb. 13, 1934. E. B. MALLORY 1,947,016

COMPRESSION UNIT

Filed June 27, 1929 2 Sheets-Sheet 1

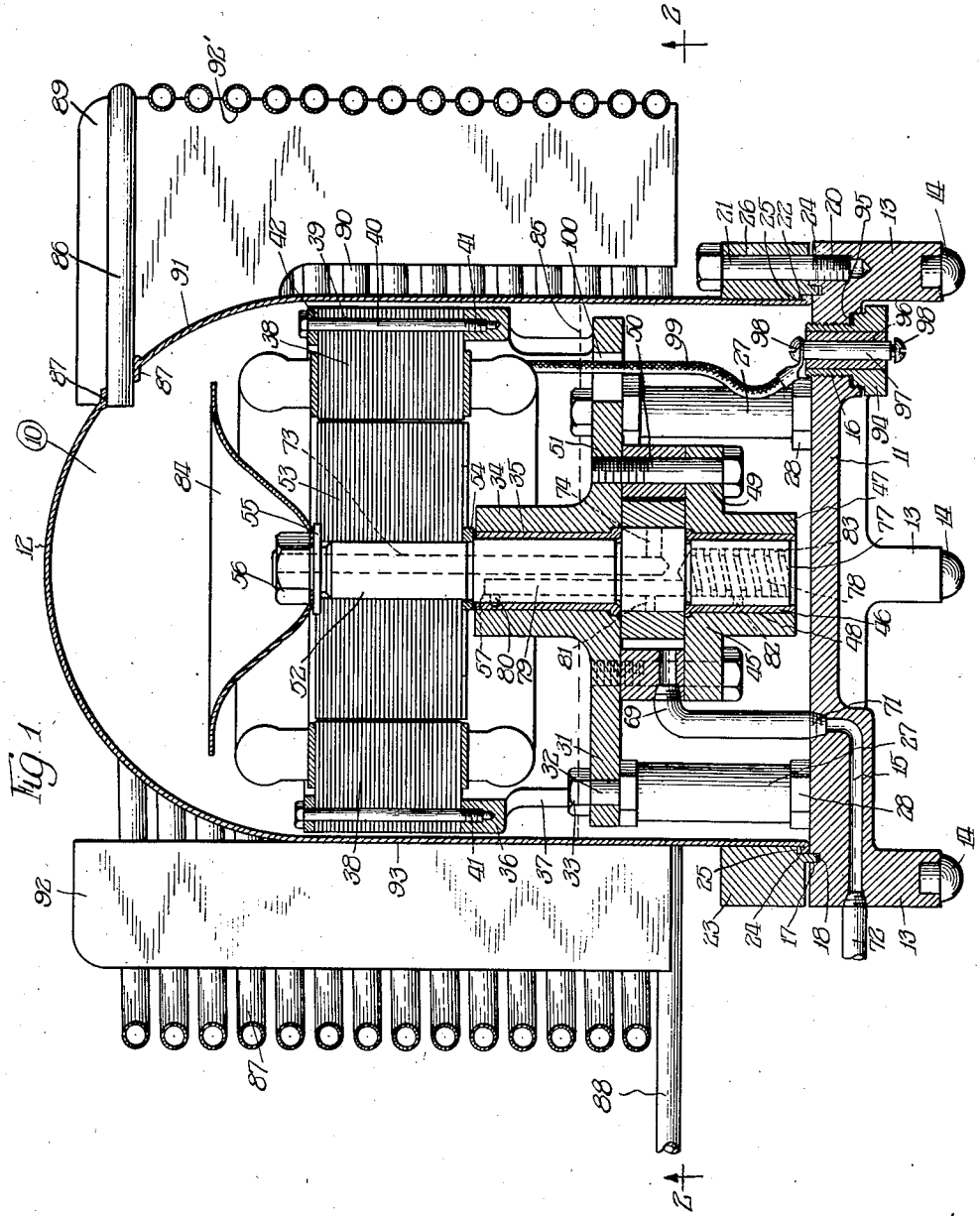


Fig. 1.

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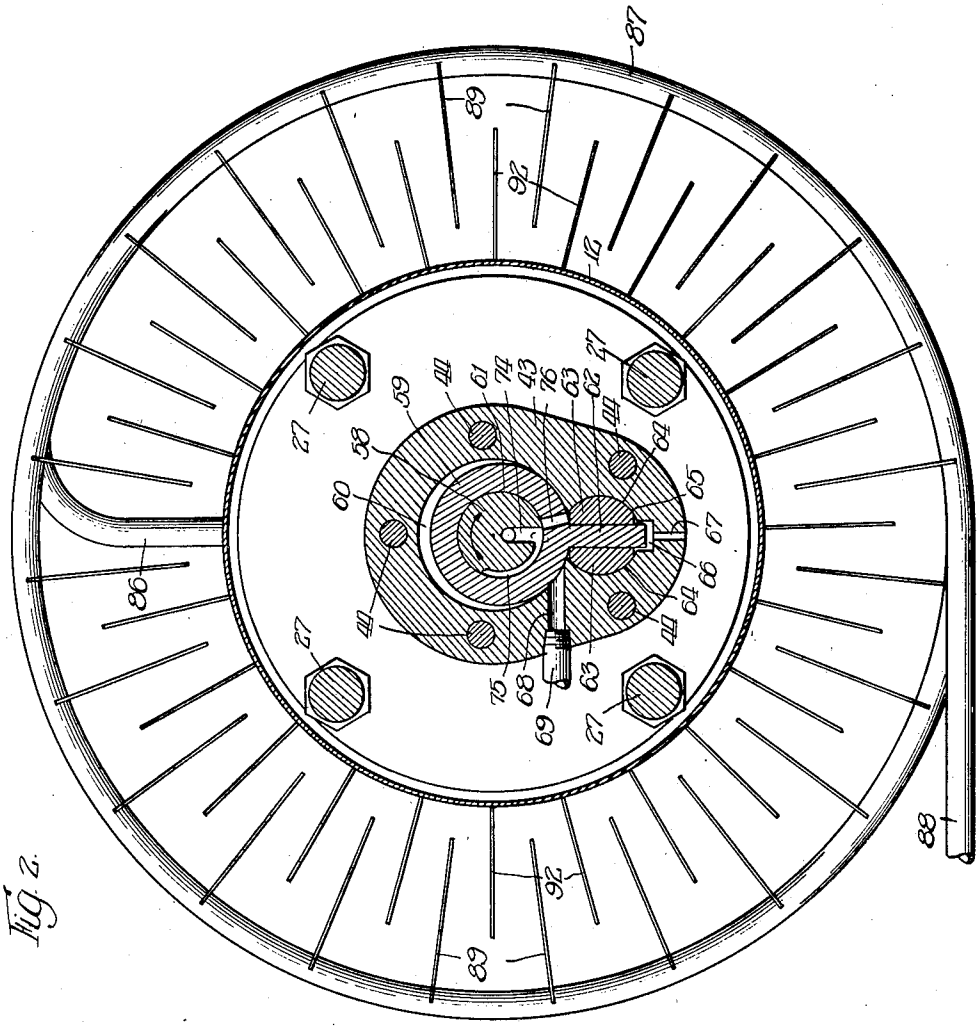


Fig. 2.

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UNITED STATES PATENT OFFICE

1,947,016

COMPRESSION UNIT

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4 Claims. (Cl. 230—207)

This invention relates to improvements in mechanical refrigerating mechanism and is herein illustrated as embodied in mechanism having a compressor and motor therefor mounted in a sealed container and equipped with a condenser which is supported in position surrounding said sealed container.

An object of the present invention is to provide a refrigerating mechanism which comprises in combination a rotary compressor and a prime mover or motor in direct driving relationship therewith and all of a construction which is greatly simplified having a fewer number of parts than devices heretofore constructed, is simple in design and construction and yet is highly efficient in operation and embodies certain novel and improved features and principles as will hereinafter more readily appear.

Another object of this invention is to provide a refrigerating mechanism comprising a motor and compressor which have common bearings and supporting means.

Another object is to provide a refrigerating mechanism which is extremely durable and is capable of continuous operation without liability of becoming out of order or becoming excessively worn in use.

A further object of this invention is to provide a refrigerating mechanism, the compressor of which is disposed submerged in an oil bath, having an improved means for maintaining lubrication of the bearings and compressor parts and for separating any oil that may find its way into the compressor and become commingled with the compressed refrigerant medium.

A further object of this invention is to provide an improved refrigerating mechanism, the motor and compressor of which are mounted wholly out of contact with the walls of the enclosing dome and one in which the motor and compressor are carried on a base plate, all of such construction and arrangement that a limited amount of vibration is set up, which limited vibration is substantially completely absorbed in the base plate due to the natural period of vibration of the base plate, whereby substantially no audible sound is detectable when the motor and compressor are in operation.

A further object is to provide means for supporting condenser coils surrounding the outside of the container which supporting means are of a novel and improved construction and arrangement whereby an improved cooling effect is provided both for the container and for the condenser coils.

A further object is to provide a refrigerating mechanism which has a relatively high capacity for its size, whereby devices of a given capacity may be smaller in construction and lighter in weight than devices of corresponding capacity heretofore devised.

Various other objects not specifically enumerated are contemplated in this invention and will readily appear to one skilled in the art as the description hereinafter given proceeds.

The following detailed description is of one embodiment of the present invention which is given by way of illustration but the present invention is not to be limited thereby in any particular, as the scope of the invention may be determined from an understanding of the illustrated embodiment and an appreciation of the advantages which the invention produces in the illustrated form.

The following description will be more readily understood by referring to the accompanying drawings, in which:—

Figure 1 is a cross sectional view in elevation of a refrigerating mechanism constructed in accordance with the present invention and

Figure 2 is a horizontal cross sectional view taken on the line 2—2 of Figure 1 and looking in the direction of the arrows.

By referring to the drawings, it will be noted that the present invention is illustrated as embodied in a refrigerating mechanism comprising a sealed casing, designated generally, 10, having a base 11, and a dome-like portion 12. The base 11 may be of any suitable construction but is herein disclosed as a casting having legs 13, provided with rubber or other sound deadening tips 14, which are mounted in cavities provided in the ends of the legs.

The base 11 is shown as being round and is provided with a duct or passage 15, and an opening 16, for purposes hereinafter more fully described. On the upper face of the base plate, inwardly of the edge thereof, is an annular groove 17, provided with packing 18 in the bottom thereof. Disposed at spaced points around the periphery of the base plate between the groove 17 and the edge of the base plate, are a plurality of threaded openings 20 which are adapted to receive the bolts 21.

The dome portion 12 of the sealed container is of general cylindrical shape having a rounded dome top, all preferably formed in one piece, but capable of being formed in any suitable manner and is provided at its lower end with the reversed

turned edge 22 which constitutes a flange projecting outwardly from the lower edge thereof.

A clamping ring 23 is provided having a downwardly depending flange 24 adapted to fit in the groove 17 and in addition, has a recess 25, adapted to receive and cooperate with the flange 22 on the dome portion of the casing. The flange 24 of the ring is slightly longer than the depth of the groove 17, whereby when the ring is mounted in position, sufficient clearance is provided for the ring to be clamped tightly against the packing 18 in the bottom of the groove in a manner to permit the ring to firmly grip the flange 22 on the bottom of the dome portion so as to constitute a clamping and sealing means therefor. The clamping of the ring is accomplished by means of the bolts 21 previously mentioned which may be provided in any suitable manner disposed through openings 26, provided in the ring and at locations to register with the openings 20 in the base plate. By tightening the bolts, the parts are securely held together in a sealed manner. Mounted within the casing and projecting upwardly from the base plate, are a plurality of posts 27, in the present instance, four, which may be formed integrally with the base plate, or otherwise rigidly secured thereto, which posts have the nuts or flanges 28 provided thereon at their lower portions. These posts constitute positioning and supporting means for the motor and compressor supporting plate 31. In the present instance, the posts 27, are shown with reduced upper ends 32, which extend through the base plate and are secured by nuts 33.

The motor and compressor are of such construction, particularly in that the compressor is of the rotary wabbler type that a minimum amount of vibration is set up by these parts in operation. Due to the fact that the motor and the compressor are wholly out of contact with the side walls of the dome and also due to the fact that they are supported on the columns 27 which secures them rigidly on the base casting 11, substantially no sound creating vibrations are transmitted to the dome walls, which walls, in prior art construction, would otherwise serve as sounding boards, setting up disagreeable and annoying sounds of vibration. In the present construction, the supporting columns 27 and the base plate are, as it will be noted, relatively heavy and are constructed as having the natural period of vibration relative to the vibration of the motor such as will serve to substantially absorb the sound producing vibrations and prevent any transmission thereof to the walls of the enclosing dome.

The supporting plate 31 is provided with a flat under face and with a central opening surrounded by a bearing boss 34. This boss is lined with bearing metal 35 so as to constitute a relatively long and large journal bearing for supporting the shaft of the motor and compressor.

The supporting plate 31 is also provided with a circumferential flange 36, which extends entirely around the plate so as to constitute means for supporting the motor. This flange is preferably provided with cut-out portions, as shown at 37, at locations where the metal is not needed, so as to reduce the weight of the device and to accommodate the nuts 33 as shown in Figure 1.

The stator 38 of the motor, is provided with openings 39 at spaced points around its periphery adapted to receive the bolts 40. The bolts 40 are provided with screw threaded ends adapted to be received by the screw threaded openings 41, provided in the upper surface of the upstanding flange 36 so that by means of the bolts 40 and the ring 42, the stator of the motor may be tightly clamped on and supported by the upstanding flange 36.

Mounted on the under side of the supporting plate 31, is the central part 43 of the cylinder of the compressor, which part is provided with openings 44 in the present instance, five, in number, by which it is secured with the bolts, hereinafter more fully described.

On the opposite face of the cylinder part 43 is a closing plate and bearing part 45, having the central opening 46, and surrounding flange 47. This flanged opening is lined with bearing metal as at 48 and constitutes the other bearing for the compressor and motor shaft. Bearings 48 and 35 are of course, made in alignment.

The part 45 of the compressor cylinder is likewise provided with openings 49 in alignment with openings 44 so as to receive the bolts 50. The bolts pass through the openings and screw threaded ends which fit into threaded openings 51 in the supporting plate 31. These parts are clamped together so as to provide a cylinder, one face of which is provided by the under side of the supporting plate 31. It is obvious that this materially reduces the number of parts.

The rotor 53, of the motor is mounted on the upper end of the shaft 52 and is held in place by means of the washers 54 and 55 and nut 56. The nut is provided on the upper screw threaded end of the shaft.

The portion of the shaft next below is formed with the bearing surface 57 which is in bearing relationship in the journal provided as at 34 and 35. That portion of the shaft which is disposed within the cylinder of the compressor, is provided with a cylindrical portion 58, disposed eccentrically to the center shaft and with an outer surface constructed as a bearing surface. The portion of the shaft next below, is provided with a bearing portion for receiving and cooperating with the journal bearing provided by means of the liner 46, and bearing boss 47.

Mounted on the eccentrically arranged cylindrical portion 58 is a piston 59 of cylindrical form and of less circumference than the cylindrical opening 60. The inner surface of the piston 59 is provided with a bearing surface cooperating with the bearing surface of the piston member 58 so that rotation may be readily provided between these parts. The piston 59 is provided with a tail portion 62 which is of rectangular cross section and of the same height as the depth of the piston. The tail portion is mounted between two oscillating blocks 63 disposed on opposite sides thereof and having their outer surfaces 64 constructed as bearing surfaces and disposed on the circumference of a circle. These blocks together with the tail portion, are mounted in the cylindrical recess 65 which has an additional recess 66 at the bottom thereof to accommodate the end of the tail. A lubricant opening 67 extends from the outer surface of the cylinder casing into the opening 66 as shown in Figure 2.

It will be obvious from the above description that by rotation of the shaft, the piston will be caused to wabble in the cylinder and the piston will present a portion in tangent relationship and approximately contacting with the interior of the cylinder and this point of approximate contact will move around the periphery of the cylinder as the piston moves. In actual practice, the piston does not touch the cylinder, but

a seal is maintained by oil held between the closely arranged surfaces which operates to effectively separate the compression from the intake sides of the compressor.

Adjacent the tail portion on one side thereof, an opening 68 is provided through the cylinder member 43, which opening communicates with the pipe 69, and having its other end connected to one end of the duct 15, provided in the base plate. The opposite end of the duct 15 connects with a pipe 72 which in turn, connects with the suction side of the refrigerating system.

Although the outlet of the compressor may be of any suitable construction, that is, it may be on the opposite side of the compressor, but arranged similarly to the inlet opening 68, in the present illustration, it is shown as provided through the shaft 52, so that the compressed refrigerant medium is forced upwardly through the shaft and discharged adjacent the top of the dome of the container.

The special features of this type of compressor are covered broadly in the applicant's copending application, filed under even date, herewith and therefore the compressor construction will only be briefly described here and claimed only as an element of the combination.

In the present illustration, the outlet for the compressor comprises the duct 73 which extends longitudinally of the shaft and eccentrically of the center and extends out of the upper end of the shaft in the same manner. This duct communicates with a radially disposed duct 74 which extends to the outer edge of the cylindrical member 58.

Disposed circumferentially around the periphery for a predetermined arc of the cylindrical member 58, is the groove 75 which is in communication with the radial duct 74. A duct 76 is provided through the piston member 59 at the location immediately adjacent the tail portion 62 on the side opposite the intake opening 68.

The radial ducts 74, 76 and a circumferential groove 75 are disposed in the same plane such as will cause them to come in registration at predetermined times during the operation of the compressor. The purpose of the groove 75 is to provide an outlet opening for the compressed medium prior to the time that the compressing cycle is completed or at such time for instance, when the medium has been compressed to substantially the pressure of the pressure side of the refrigerating system.

It is obvious that the degree of compression may be varied according to needs and that under the particular set of circumstances, the length of the groove 75 may be selected as desired. However, it will be obvious that upon a predetermined degree of compression, that the medium will be discharged outwardly through the shaft until the compression cycle is completed at which time an instantaneous positive shut-off will be provided by means of the radial duct 74 passing out of registration with the duct 76.

The lower end of the shaft 52 is exposed as at 77 to the interior of the container and the shaft is provided with a duct 78, which is in communication with a second duct 79 at the upper portion thereof. The duct 79 is provided with a radial duct 80, extending to the bearing surface of the upper bearing and with a radial duct 81 extending to the bearing surface between the cylindrical member 58 and the piston 59.

The lower duct 78 is provided with a radical duct 82 communicating with the bearing surface of the lower bearing.

In the present illustration, the lower duct 78 is illustrated as being enlarged and having a spiral spring or washer element 83 mounted therein, spiralled in a direction depending upon the direction of rotation of the shaft to serve as an oil lifting pump to assist in directing the oil upwardly in a manner to lubricate the bearings and the piston of the compressor. This form is merely shown as one suitable method of assisting the oil upwardly, but it is to be understood that no such means need be provided, as a plain duct will serve, inasmuch as the oil in the sealed container is under the pressure of the pressure side of the system.

It is to be noted that the discharge duct 73 continues upwardly and out through the end of the shaft and by virtue of the fact that it is eccentric it constitutes a centrifugal oil separator adjacent the top of the container. Any oil which becomes commingled with the compressed refrigerant is caused to be thrown outwardly and becomes separated from the compressed gaseous medium. As the oil flies outwardly it comes in contact with the deflector 84 which is mounted on top of the shaft by means of the nut 56 and serves to direct the oil outwardly over the edge thereof so that it may return adjacent the side portions of the container to the main body of oil below. The oil is maintained in the container to a height of substantially that indicated by the line 85 in Figure 1, or in other words, so that the compressor is completely submerged.

Adjacent the top of the dome of the container an opening is provided, through which extends the outlet pipe 86 which is preferably secured by welding, as shown at 87 or any other suitable means so as to maintain the entire system sealed. The pipe 86 extends radially outwardly for a short distance and is then formed into a coil 87 disposed around the container so as to constitute a condenser for the refrigerant medium. The end of the coil finally extends outwardly as at 88 and leads to the compression side of the refrigerating system.

The coils of the condenser are mounted on and are supported by radially disposed fins, 89 which are preferably constructed as shown on the right hand side of Figure 1 or in other words, with cut-away portions as at 90 throughout the main portion of their length and adjacent the wall of the container. They have an arcuate portion 91 contacting the dome of the container and secured by means such as welding thereto. The outer edge of the fins are provided with a series of semicircular notches 92' for receiving and positioning the coils of the condenser. Disposed intermediate the fins 89 are other fins 92 which are secured by means such as welding at 93 to the cylindrical portion of the walls of the container.

These fins, it will be noted, are of less depth than the fins 89 and do not extend all the way to the coils. This is shown best in Figure 2. The fins 92 may extend straight upwardly at their inner edges as shown in Figure 1 or may curve inwardly in contact with the surfaces of the dome, as do the fins 89.

By this fin construction, it will be noted that the transfer of heat by convection from the wall of the container to the coils cannot take place to any appreciable extent as there is no substantial contact with these parts by metal parts extending therebetween. A very efficient cooling action is accomplished by this general arrange-

ment as the air spaces between the fins 92 constitute chimney or draft creating air columns causing the air to pass inwardly between the coils and thence upwardly in a manner to cool the surface of the container. The fins in addition, offer large areas for increasing the cooling effect both from the coils and the container and without transmitting the heat of the container to the coils where it is desirable to have the maximum cooling effect.

The opening 16 above mentioned, is provided for accommodating a current line for the electric motor. Screw threaded in the opening is a plug 94 which has a shoulder bearing against the shoulder of the opening and for compressing the packing 95 which is provided to prevent leakage. Through the plug 94 is an insulating sleeve 96 and the metallic conductors 97. Each end of the conductors is provided with a means 98, adapted for attachment of the proper current lines.

The inner means 98 connects with the conducting wire 99 which extends upwardly through the opening 100 in a supporting plate 31 and connects with the motor. It will be obvious that the current line may be connected to the outside means 98 for supplying the motor with current and without permitting any leakage from the container.

From the above description it will appear that the present invention provides a construction which has relatively few parts, is simple in construction and design and is highly efficient in operation. The bearings, mounting the single shaft constitute bearings for both the motor and the compressor.

The device will be efficiently lubricated and quietly operated inasmuch as the compressor is submerged in a bath of oil which through the ducts provided, passes upwardly of the shaft and to the locations of the bearings.

In operation, the refrigerant medium is drawn in through the inlet pipe 69 from the suction side of the system and is compressed by the compressor and discharged upwardly through the duct 73. Due to the eccentric position of the opening, a greater centrifugal force is developed which acts to discharge laterally the heavier oil particles so as to effect a separation of the oil from the gaseous medium. The oil is effectively thrown against the inner walls of the container where it runs down returning to the main bath of oil. The entire assembly including the motor, the shaft and the compressor are supported by the supporting plate 31 which is in turn mounted on the base plate 11 and posts 27 so as to be supported out of contact with the side walls and only by such means as will be effective to deaden the sound of vibration in operation. As the medium is compressed and discharged into the container, it finds its way out through the pipe 86 into the condenser where it is condensed by means of the cooling effect at this point.

The cooling effect is promoted and maintained by the air current which passes between the coils, radially inwardly and thence upwardly adjacent the side walls of the container.

The entire system is sealed and thus is free from leakage. Due to the unusually large bearings and the arrangement of the bearings and shaft, the device herein illustrated is capable of prolonged use without danger of disorder due to wear or breakage and is one in which a relatively large capacity can be had for a relatively small machine.

It is to be understood that this invention is not to be limited to the illustrated method mounting the fins 89 and 92 namely, by supporting them on the enclosing dome, as it is perfectly obvious that they may be supported in any other suitable manner such as for instance, from the base plate 11 or ring 23.

I claim:

1. A refrigerating machine comprising, a container, oil in said container and a compressor disposed below the level of said oil and a shaft for said compressor extending from a point below to a point above the level of said oil, said compressor having a discharge port extending axially through said shaft from a point below the oil level and discharging above the oil level in said casing, said discharge port extending eccentrically to the center of said shaft.

2. A refrigerating machine comprising, a closed container, a compressor in said container having a shaft and having a discharge port extending axially through said shaft, said discharge port discharging into said closed container from the end of said shaft at a point eccentric to the center of said shaft and serving as an oil separator.

3. A refrigerating machine comprising, a closed container, a compressor in said container having a rotary shaft and a discharge port extending axially through said shaft, said discharge port discharging into said closed container from the end of said shaft at a point eccentric to the center of said shaft and serving as an oil separator, and a rotary oil deflector fixed to the discharge end of said shaft and surrounding said discharge port.

4. A refrigerating machine comprising, a closed container, a compressor in said container having a rotary shaft and a discharge duct extending longitudinally through said shaft laterally of the center thereof, said duct discharging into said closed container from the end of said shaft at a point eccentric to the center of said shaft and serving as an oil separator, and a rotary oil deflector fixed to the discharge end of said shaft and surrounding said discharge port.

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