Oct. 22, 1935. E. HEITMAN 2,018,521

REFRIGERATING APPARATUS

Filed Feb. 13, 1933 3 Sheets-Sheet 1

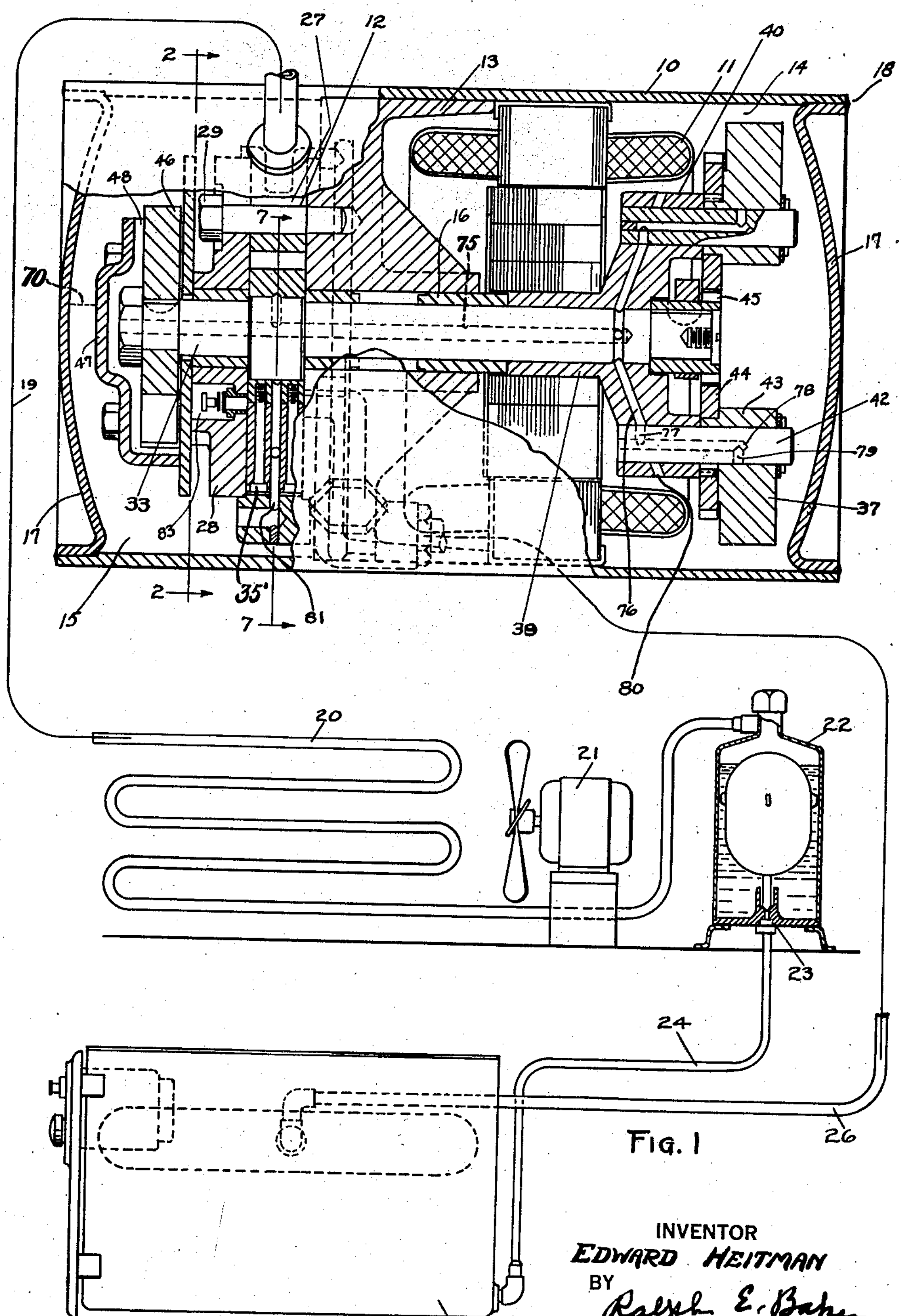

FIG. 1

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REFRIGERATING APPARATUS

Filed Feb. 13, 1933 3 Sheets-Sheet 2

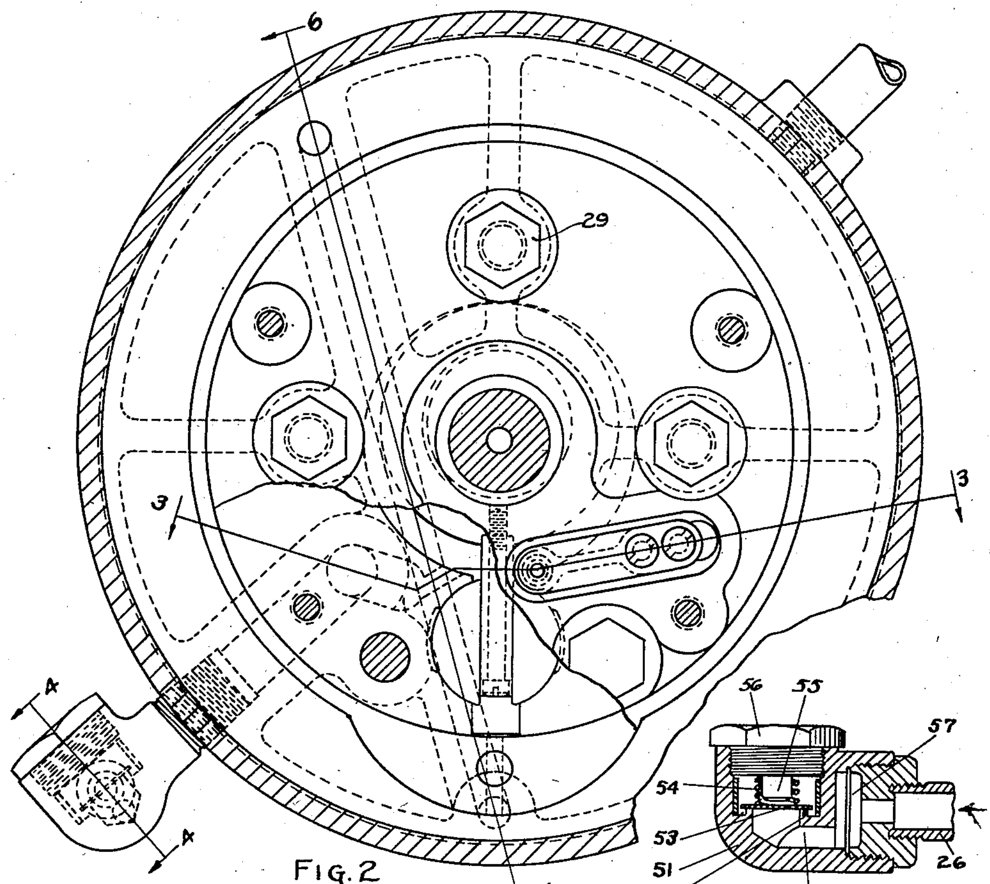

FIG. 2

FIG. 4

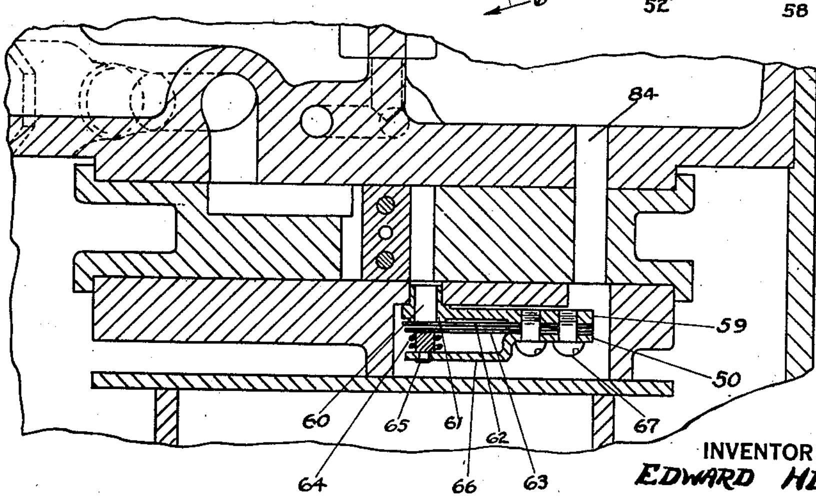

FIG 3

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Oct. 22, 1935. E. HEITMAN 2,018,521

REFRIGERATING APPARATUS

Filed Feb. 13, 1933 3 Sheets-Sheet 3

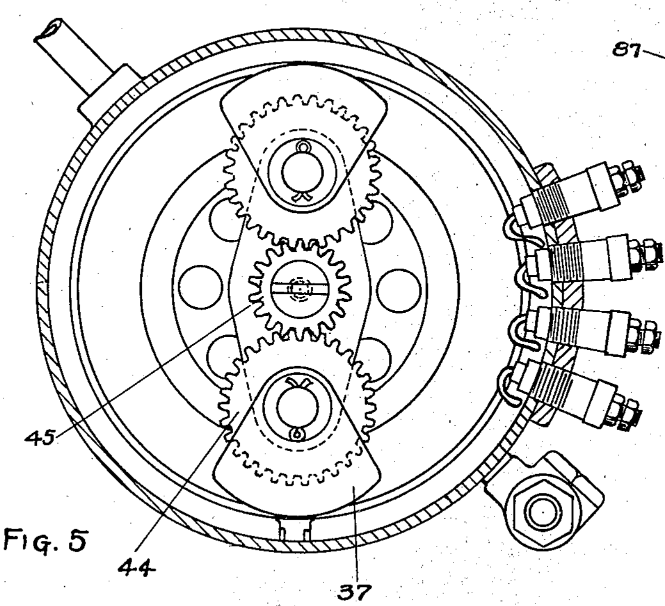

FIG. 5

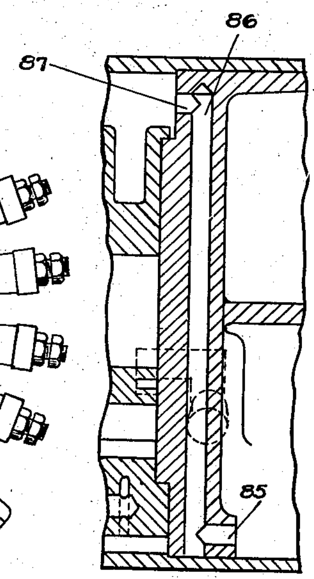

FIG. 6

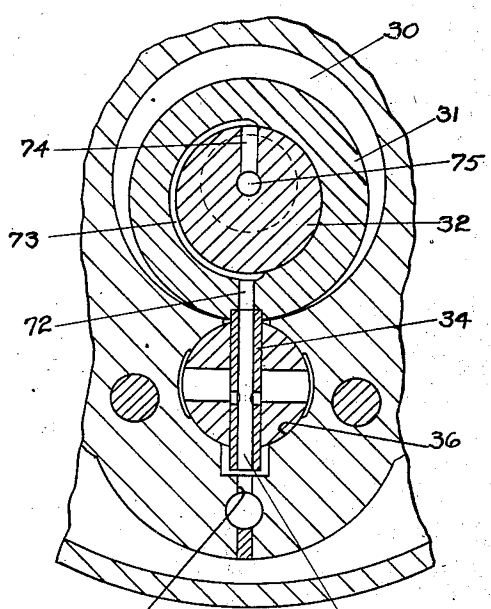

FIG. 7

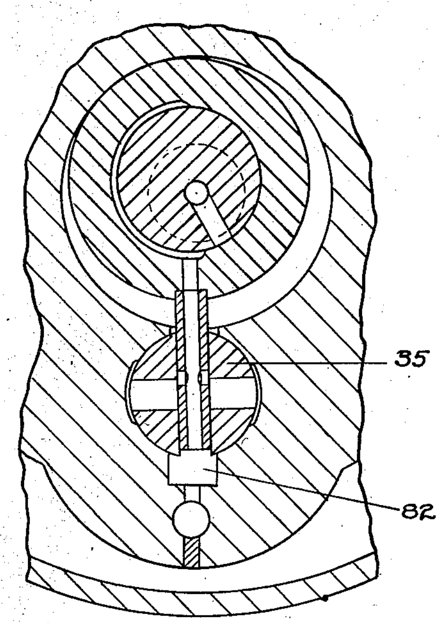

FIG. 8

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Patented Oct. 22, 1935

2,018,521

UNITED STATES PATENT OFFICE

2,018,521

REFRIGERATING APPARATUS

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Application February 13, 1933, Serial No. 656,415

5 Claims. (Cl. 230—139)

This invention relates to refrigerating apparatus, particularly to a refrigerating apparatus of the compression type, in which the motor and compressor for the system are enclosed within a common fluid tight casing.

An object of the invention is to provide a compact and efficient compression mechanism which may be readily assembled in a relatively small space.

Another object of the invention is to provide an improved lubricating system for the moving parts of the compressor and motor.

A further object of the invention is to provide an efficient means for returning lubricant from the motor compartment of the fluid tight casing to the compressor compartment.

Other objects and advantages of the invention will be apparent from the following description and accompanying drawings wherein:

Fig. 1 is an elevational view partly in section showing a refrigerating system embodying the invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 and showing an end view of the compression mechanism;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2 showing details of the discharge valve;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 2 and showing details of the intake valve;

Fig. 5 is an end view looking toward the left in Fig. 1 with the end plate removed and showing the construction of clutch mechanism used for connecting the motor to the compressor;

Fig. 6 is a sectional view taken on line 6—6 of Fig. 2 showing details of the oil return passages from the motor compartment to the compressor compartment;

Fig. 7 is a section view taken on line 7—7 of Fig. 1 showing details of the oil pumping mechanism with the compressor piston in its lowermost position;

Fig. 8 is a view similar to Fig. 7 but showing the compressor piston in its upper-most position.

Referring to the drawings wherein is shown one embodiment of the invention, 10 designates a substantially cylindrical steel casing within which is mounted a motor 11 and a compression mechanism 12. The casing 10 is provided with a partition wall 13 dividing the casing into a motor compartment 14 and a compressor compartment 15. The wall 13 is provided axially thereof with a bearing surface 16 which serves as the sole bearing for both the motor and the compressor. The casing 10 is closed in a fluid tight manner at each end by means of end plates 17 which are welded to the periphery of the casing as indicated at 18. The compressor is so arranged that compressed gas passes directly from the casing through a conduit 19 to a condenser 20 where is is liquefied, the condenser being cooled by a blast of air created by the motor driven fan 21. The liquefied refrigerant under pressure then passes to the upper part of a float valve casing 22 from which casing it passes, when a sufficient quantity has been collected, through the pressure reducing valve 23 and then through the conduit 24 to the cooling unit or evaporator 25 which may be of any suitable type. Here the liquefied refrigerant expands as it absorbs heat from the medium to be cooled and in its gaseous state passes through a conduit 26 to the intake side of the compression mechanism where it is re-compressed and the cycle repeated.

The compression mechanism here shown comprises a rotary pendulum type pump of the type described in the co-pending application of Frederick R. Erbach, Serial No. 634,129, filed September 21, 1932, and assigned to Kelvinator Corporation. In general this mechanism comprises a cylinder casting 27 securely fastened to the partition member 13, between an end plate 28 and one side of the partition, by means of bolts 29. The cylinder casting 27 is provided with a cylindrical bore 30, and a rotary piston 31 is mounted within the bore 30 upon an eccentric 32 formed on the crank shaft 33. A blade 34 is rigidly secured to one side of the piston by means of bolts 35′. This blade reciprocates between two substantially semi-circular rocker members 35 which are mounted to oscillate in a cylindrical bore 36 provided in the cylinder casting.

The motor 11 drives the compression mechanism 12 through a clutch mechanism 37, which clutch mechanism is similar to that described in Patent No. 1,826,172 granted October 6, 1931 to Harold A. Greenwald, and to which patent reference is made for complete details as to the operation of this mechanism. It comprises in general the crank shaft 33 upon which the piston

31 is mounted. This shaft is supported in the bearing 16 formed in the web 13 and projects beyond this bearing in each direction. The rotor for the motor is supported on and rigidly secured to a relatively short shaft or hub 39 which is in turn supported by and rotatably mounted on a projecting end of the shaft 33. The hub 39 has two outwardly extending portions 40, each of which is provided with a bore 41 serving as a bearing surface for a short shaft 42 freely rotatable therein. At one end of each of the shafts 42 is secured a counterweight 43 to which a spur gear 44 is rigidly attached. Each of the gears 44 is constructed and arranged to mesh with a spur gear 45 rigidly secured to one end of the shaft 33. The opposite end of the shaft 33 may be provided with a counterweight or fly wheel 46 which operates within a hollow member 47 rigidly secured to the end plate 28 and is open at its top as indicated at 48.

When the motor 11 is energized the initial load on the compression mechanism is such that the shaft 33 tends to remain stationary while the rotor and its associated hub 39 together with the gears 44 rotate about the shaft 33 and likewise the gears 44 which are in mesh with the gear 45 will rotate about that gear. As the speed of the hub 39 increases the angular velocity of the weights 37 about the axis of the gear 45 correspondingly increases, and since the centers of gravity of the weights 37 are spaced a considerable distance radially outwardly from the fixed axis of rotation of the gear 45, a centrifugal force will be set up tending to maintain the weights in the position shown in Fig. 5. When these weights have assumed the position indicated, the rotation of the gears 44 around the gear 45 will cease and as a result the gear 45 will be driven by the gears 44 and consequently the shaft 33 will also be driven and the compressor operated.

It will be apparent that any excessive load which may be imposed on the compressor will tend to reduce the speed of rotation of the gear 45 and cause the gears 44 to again begin to rotate around this gear, thereby relieving the motor of any excessive load which may be placed upon the compressor.

The valve structure for the compressor comprises a discharge valve mechanism 50 shown in detail in Fig. 3 and an inlet or check valve 51 in the suction line, which valve is shown in detail in Fig. 4. The check valve mechanism 51 comprises generally a seat 52 with which cooperates a flat spring disc 53 normally maintained seated by coil spring 54 which surrounds a stud 55 mounted on the under side of a screw threaded plug 56. Vaporized refrigerant from the evaporator passes through the conduit 26, through a screen 57 which is used to filter out particles of foreign matter, through a passage 58 to the under side of the valve 53, and then through the inlet valve to the intake side of the compressor.

The discharge valve mechanism, which is similar to that shown in the aforementioned application of Frederick R. Erbach, comprises a rigid member 59 having a passage 60 extending through one end thereof in communication with the discharge side of the compressor. A valve seat 61 is formed at one end of the passage 60 and an elongated leaf spring 62 rigidly fastened at one end to the member 59 cooperates with the seat 61 to form a valve. A second elongated spring member 63 extends parallel to but spaced a short distance from the valve member 62. This member 63 serves to limit the movement of valve member 62 but is so constructed that in the event excess pressure is produced in the discharge side of the compressor, as by the passage of a slug of oil, this member 63 will also yield and assist in relieving the pressure so created. The valve member 62 is normally maintained seated by a coil spring 63 which is in turn supported about a stud 65 rigidly secured to one end of an elongated rigid member 66 which projects above the leaf springs 62 and 63. The members 66 and springs 62 and 63 are rigidly secured to one end of the member 59 by means of bolts 67.

The invention also contemplates a forced lubricating system for the moving parts of the compressor and the motor.

The details of the oil pump are shown in Figs. 7 and 8. From these figures it will be noted that the blade member 34 is provided with a longitudinal passage 71 which cooperates with a passage 72 extending radially through the piston 31. The inner surface of the piston 31 is provided with a substantially semi-circular groove 73 which extends from the passage 72 to a point substantially diametrically opposite this passage. The eccentric member 32 on which the piston is mounted is provided with a passage 74 extending from its periphery inwardly to an axial passage 75 which extends axially of the shaft 33 for the greater part of its length. The end of the passage 75 adjacent the motor 11 is in open communication with passages 76 formed in the hub member 39 and which extend substantially radially outwardly to communicate with ports 77. The ports 77 are formed radially through each of the shafts 42 and communicate with longitudinal passages 78 formed axially of the shafts 42 on which the weights 37 and gears 44 are mounted. In order to lubricate the bearing surfaces of the weights 37 on the shafts 42, a port 79 is provided extending radially from the outer end of each passage 78 to the periphery of each shaft 42. Oil from this bearing surface is returned to the lower part of the motor compartment through a passage 80.

In the operation of the lubricating system the compressor compartment is filled with a body of lubricating medium to approximately the level indicated by the dotted line 70 in Fig. 1. A restricted port 81 connects the body of lubricating medium with the passage way 72 formed in the blade member 34. On the up stroke of the piston, which is the position indicated in Fig. 8, a portion of the lubricating medium is drawn in through the passage 81 and into the recess 82 provided in the cylinder casting below the recess 36. When the blade member 34 makes its down stroke the lubricant contained in the recess 82 is forced upwardly through the passage 71 rather than out the passage 81 because of the relatively restricted diameter of the passage 81. The lubricating medium flows through the passages 71 and 72 into the passage or recess 73 formed in the piston 31 and then flows into the passage 74 provided in the eccentric member 32, inasmuch as the passage way 74 communicates with the recess 73 during the down stroke of the blade member 34 as shown in Fig. 7. Continued rotation of the eccentric 32 to rotate the piston 31 and raise the blade member 34, results in the breaking of communication between the passage 74 and the groove 73 as shown in Fig. 8 and therefore the lubricating medium trapped in the passage 74 flows through the axial passage 75 and out through the passages 76 and the ports 77 to the axial passages 78 and thence through the ports 79 to the bearings for the respective shafts 42, from there the lubricant passes between the bearing surfaces of the weights and the shafts 42 to the motor compartment. Lubricating medium also passes up on the outer surface of the blade member 34, bearing surfaces of the rocker members 35 and into the cylinder 30 so as to effectively lubricate the piston 31 and the bearing surfaces of the rocker members 35. Lubricating medium also will flow from the cylinder 30 to the bearings for the shaft 33 and outwardly to each end of the shaft, that portion of lubricating medium which flows toward the motor and eventually falling to the bottom of the motor compartment.

In order to provide for the return of the lubricant which collects in the motor compartment the compressor is so arranged that the gas compressed thereby is discharged directly into the motor compartment, the gas passing through the discharge valve 51 into a recess 83 which communicates through a passage 84 directly with the motor compartment. The compressed gas then passes through a passage 85 formed in the lower part of the partition wall 13 and through a passage 86 extending through this wall from the bottom to the top thereof from which passage gas flows through a port 87 into the interior of the compressor compartment. Inasmuch as the gas must pass from the motor compartment to the discharge conduit 19, which is connected to the casing wall at the compressor compartment, and in doing so flows through the passages 85, 86 and 87, it will force ahead of or entrain such lubricant as has collected in the lower part of the motor compartment and return the lubricant to the compressor compartment where the lubricant separates by gravity, returning to the main body of lubricating medium in the compressor compartment.

It will be apparent from the foregoing description that this invention provides a compression mechanism for a refrigerating system in which the compressor and its driving motor, both of which are enclosed in a common fluid tight casing, may be thoroughly and effectively lubricated in a positive manner, utilizing as a lubricating pump only the parts necessary for the compression of the gas and without the addition of a separate oil pump. It will also be apparent that this invention provides a simple and effective system for returning lubricant from the moving parts of the apparatus to the main lubricant reservoir.

While I have shown and described a specific embodiment of the invention it will be apparent that other forms may be adopted all coming within the scope of the appended claims.

I claim:

1. In a compression mechanism, a fluid tight enclosure divided into a motor compartment and a compressor compartment, a motor and a compressor disposed in said compartments, respectively, said compressor compartment providing a reservoir for lubricant, means for supplying lubricant to the compressor, communicating means between the outlet of the compressor and the motor compartment to conduct the compressed medium discharged by the compressor and lubricant to the motor compartment before said compressed medium and lubricant enters said compressor compartment, and additional communicating means arranged for conducting lubricant and compressed medium from a point adjacent the lower part of the motor compartment to said compressor compartment at a point above the level of lubricant in said reservoir, said lubricant being forced through said additional communicating means by the pressure of the compressed medium in said motor compartment.

2. In a compression mechanism, a fluid tight enclosure divided into a motor compartment and a compressor compartment, a motor and a compressor disposed in said compartments, respectively, communicating means between the outlet of the compressor and the motor compartment to conduct the compressed medium discharged by the compressor to the motor compartment before it enters said compressor compartment, and additional communicating means arranged to conduct the compressed medium from adjacent the lower part of the motor compartment to a point adjacent the upper part of said compressor compartment.

3. In a compression mechanism, a fluid tight casing divided into a motor compartment and a compressor compartment, a motor and a compressor disposed in said compartments, respectively, driving means connecting the motor and the compressor, said compressor compartment providing a reservoir for lubricant, means for supplying lubricant to the compressor and said driving means, communicating means between the outlet of the compressor and the motor compartment to conduct the discharged compressed medium and lubricant to the motor compartment before the same enters said compressor compartment, and additional communicating means arranged for conducting lubricant and compressed medium from a point adjacent the lower part of the motor compartment to said compressor compartment at a point above the level of lubricant in said reservoir, said lubricant being forced through said additional communicating means by the pressure of the compressed medium in said motor compartment.

4. In a compression mechanism, a fluid tight casing, vertical partition means dividing the casing into a motor compartment and a compressor compartment, a motor and a compressor disposed in said compartments, respectively, said compressor compartment providing a reservoir for lubricant, means for supplying lubricant to the compressor, communicating means between the outlet of the compressor and the motor compartment for conducting the discharged compressed medium and lubricant to the motor compartment before it enters said compressor compartment, and additional communicating means arranged with its inlet adjacent the lower part of said motor compartment for conducting the compressed medium and lubricant upwardly into said compressor compartment at a point above the level of lubricant in said reservoir, said lubricant being forced through said additional communicating means by the pressure of the compressed medium in said motor compartment.

5. In a compression mechanism, a fluid tight casing, vertical partition means dividing the casing into a motor compartment and a compressor compartment, a motor and a compressor disposed in said compartments, respectively, said compressor compartment providing a reservoir for lubricant, means for supplying lubricant to the compressor, said partition means having a passage associated with the outlet of said compressor for conducting the discharged compressed medium and lubricant into said motor

compartment before same enters said compressor compartment, and said partition means having a second passage leading from the lower part of said motor compartment upwardly to said compressor compartment at a point above the level of lubricant in said reservoir for conducting the compressed medium and lubricant in said motor compartment to said compressor compartment, said lubricant being forced through said second passage by the pressure of the compressed medium in said motor compartment.

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