

Jan. 29, 1924.

1,482,028

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ARTIFICIAL REFRIGERATING APPARATUS

Filed Oct. 9, 1919

4 Sheets-Sheet 1

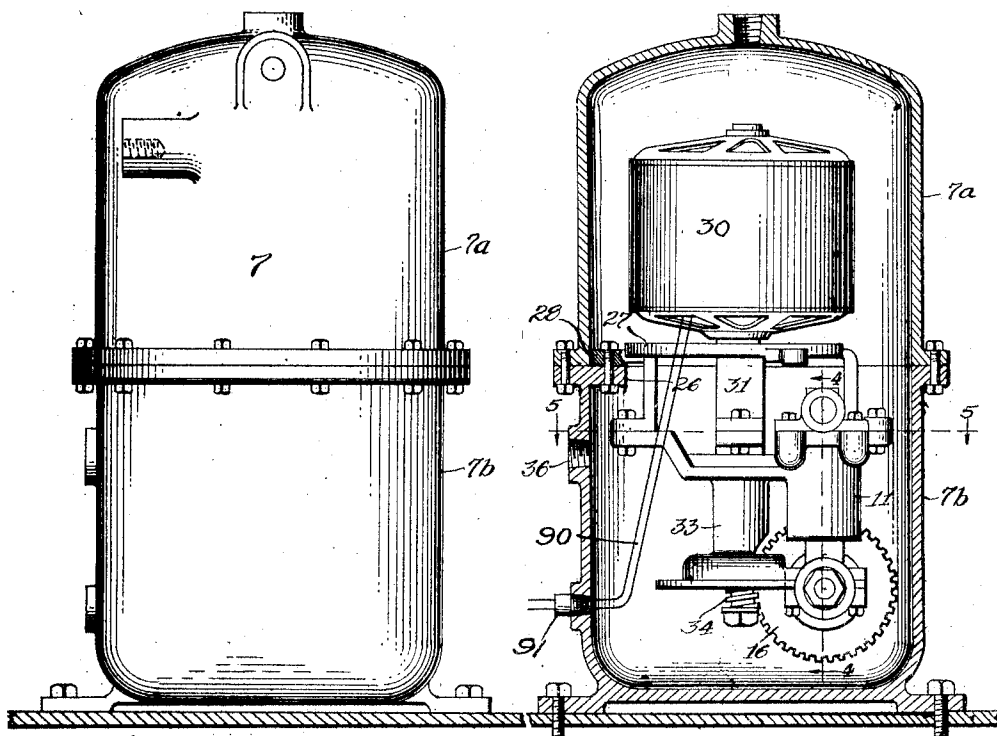


Fig. 1

Fig. 2

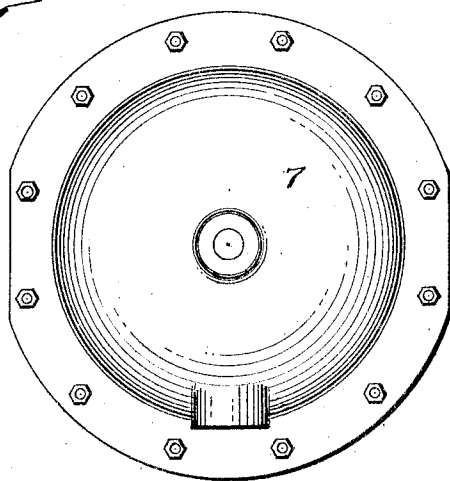


Fig. 3

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4 Sheets-Sheet 2

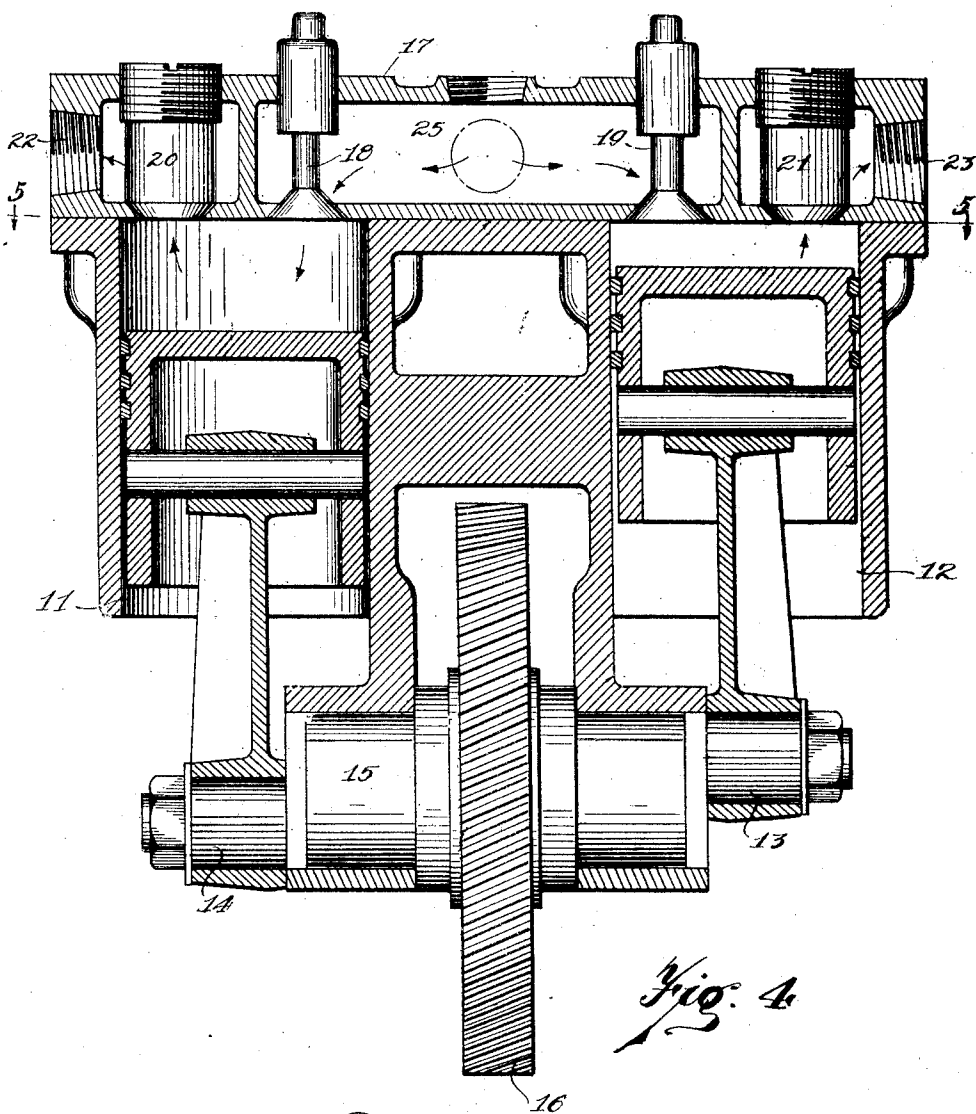


Fig. 4

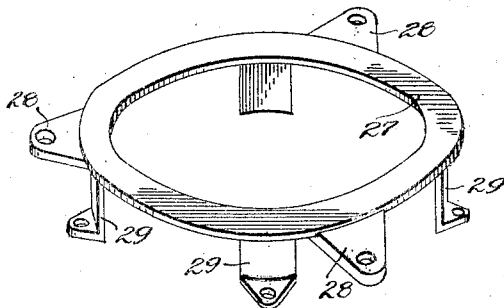


Fig. 8

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4 Sheets-Sheet 3

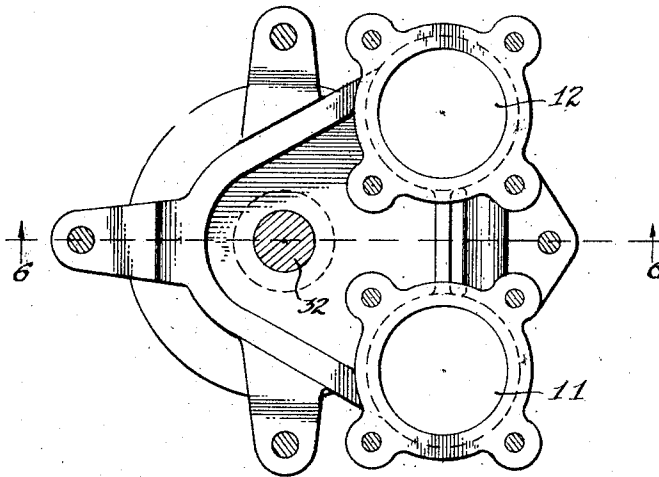


Fig. 5.

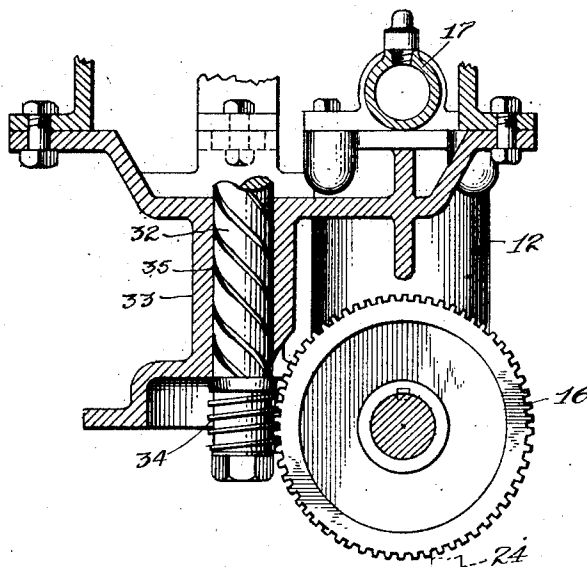


Fig. 6.

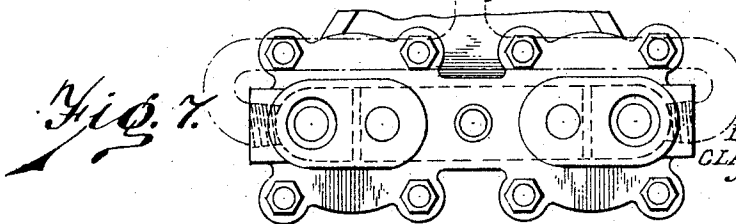


Fig. 7.

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4 Sheets-Sheet 4

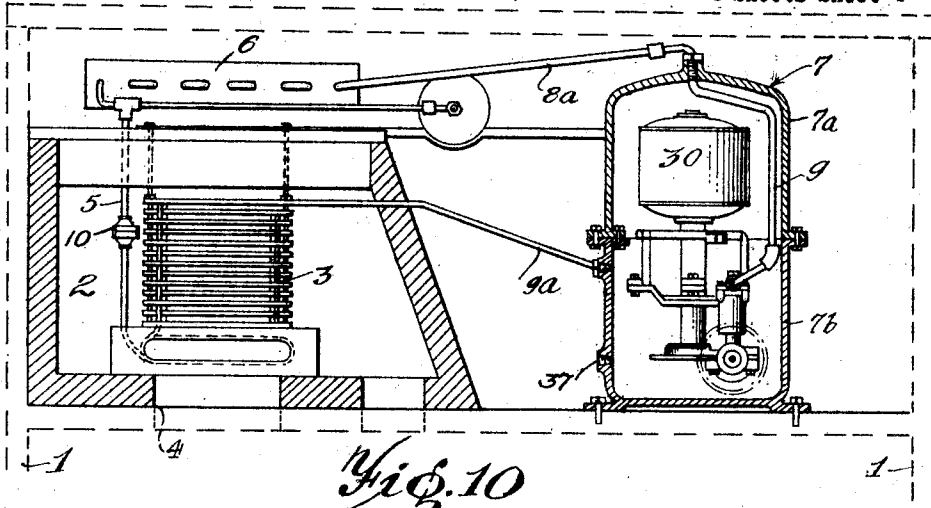


Fig. 10

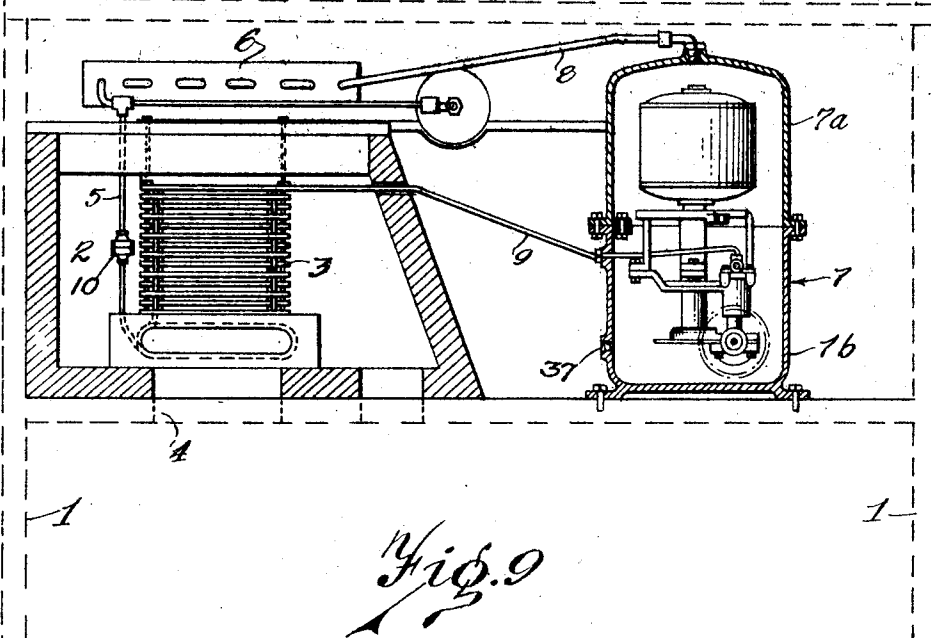


Fig. 9

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UNITED STATES PATENT OFFICE.

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MICHIGAN.

ARTIFICIAL-REFRIGERATING APPARATUS.

Application filed October 9, 1919. Serial No. 329,469.

To all whom it may concern:

Be it known that we, EARL P. OSWALD and CLARENCE M. HOLLEY, citizens of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Artificial-Refrigerating Apparatus, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to artificial refrigerating apparatus, and a particular object of the invention is to provide a leak proof system preventing an escape of the refrigerant to atmosphere or to the storage compartment of the refrigerator. More specifically the object is to provide a construction permitting the incorporation within the circulating system of an artificial refrigerating apparatus in which a fluid is compressed and expanded to produce a cooling effect in the storage chamber of all the apparatus for producing the transfer of fluid.

In the usual apparatus heretofore used, a motor and pump are employed to transfer gas from the low pressure lines to the high pressure lines and in such previous construction a particular difficulty arises in packing the pump. As is well known packings sooner or later become inefficient permitting the escape of the gas to atmosphere or to the storage compartment and decreases the efficiency of operation of the apparatus. A primary object of this invention therefore is to provide a construction eliminating the possibility of leakage and to provide a tank or enlargement of the circulating system either on the high or low pressure side enclosing the entire operating apparatus. A secondary object of the invention is to house the apparatus in such manner that the perceptible noise is reduced to a minimum. These and other objects and the several novel features of construction are hereinafter more fully described and claimed, and the preferred form of construction embodying our invention is shown in the accompanying drawings in which—

Fig. 1 is an elevation showing the tank

forming an enlargement of a portion of the circulating system.

Fig. 2 is a vertical section of the tank showing the pump and motor for transfer of the fluid housed therewithin.

Fig. 3 is a plan view of the tank.

Fig. 4 is a vertical section on an enlarged scale of the preferred form of pump utilized in the transfer of the fluid taken on line 4—4 of Fig. 2.

Fig. 5 is a view of the pump on a smaller scale with the head thereof removed on line 5—5 of Fig. 4.

Fig. 6 is a vertical section of the pump taken on line 6—6 of Fig. 5.

Fig. 7 is a plan view of the valve chamber of the pump.

Fig. 8 is a perspective view of the frame supporting the motor and pump.

Fig. 9 is an elevation partly in section showing the relationship of the tank to the circulating system of the refrigerating apparatus in which the housing for the motor forms a part of the high pressure side of the system.

Fig. 10 is a similar view partly in section showing the tank or housing as forming a part of the low pressure side of the circulating system.

In the illustrations of the use of the invention shown in Figs. 9 and 10, it is to be understood that the usual food storage chamber is indicated merely by the dotted lines, 1, above which is a chamber 2 for the expansion coils 3 of the circulating system and this chamber is open to the food chamber in any approved manner as indicated by dotted lines 4 in Fig. 9. So far as this application is concerned the chamber 2 may be considered a part of the cooling chamber and may be hereinafter referred to as the cooling chamber.

The expansion coils 3 are connected by means of the pipe 5 with the high pressure coils which are to be understood as being positioned within a tank 6 preferably above the coils 3 and in the case shown in Fig. 9 the compressor and motor are enclosed in the tank 7 connected by means of a pipe 8 to the high pressure line and the pump taking from the low pressure side by means of pipe or conduit 9 connected with the intake part of the pump. Interposed between the high

pressure and low pressure lines is an expansion valve enclosed within the case 10.

In the construction shown in Fig. 10 the low pressure side of the circulating system, by means of the pipe 9^a, discharges directly into the chamber formed within the tank 7 and the pump discharges directly into the line 8^a of the high pressure side. In either case, however, the invention is the same in that a tank is provided as a part of the circulating system through which the refrigerant fluid flows. The preferred construction however is shown in Fig. 10 in which the compressed fluid is discharged directly to the high pressure line through a conduit connected with the discharge orifice of the pump, the tank being open to and forming part of the low pressure side of the system and from which the pump takes its supply. The pump to be employed so far as this invention is concerned is not material, any type of pump adapted for the purpose being considered within the spirit of this invention and within the limitation of the appended claims. Preferably, however, a reciprocating type of pump is employed having two cylinders 11 and 12 in which are pistons connected in the usual manner to cranks 13 and 14 of the drive shaft 15 on which is centrally secured a spiral gear 16. The cylinders are cast together in the construction here shown and are open at the upper end. On this upper end is secured the valve chambers 17 supporting the intake valves 18 and 19 for the respective pumps and exhaust valves 20 and 21 each positioned in a chamber individual thereto and of a type to lift under the compression stroke of the pistons thereby passing the compressed fluid through the respective discharge orifices 22 and 23 connected to a common discharge line 24. As indicated by dotted lines in Fig. 7, the intake valves open into a common chamber 25 which, in the case shown in Fig. 10, is open to the tank and in the case shown in Fig. 9 is directly connected to the conduit 9 of the low pressure side. Also in the case shown in Fig. 9 the discharge chambers open directly into the tank.

For convenience in construction the tank is made of two parts 7^a and 7^b shown particularly in Fig. 2 being secured together at the center and provided with an ordinary gasket to prevent leakage. The lower part 7^b of the tank is provided with several inwardly projecting lugs 26 and supported on these lugs is mounted a frame 27 having similar lugs 28 by means of which the frame is attached to the lugs 26 of the tank. This frame is thus rigidly secured in position. The frame is also provided with depending legs 29 and the pump casing is provided with somewhat similar portions adapted to be bolted directly to these legs 29 of the

frame and thus supporting the pump from the frame member 27. The motor 30 is supported by means of a bracket 31 directly on the pump casting.

The motor here shown is an electric motor and it is to be understood as having a circuit 90 passing into the tank 7 through a plug 91 from which it receives the current supply. The motor shaft extends vertically of the casing or tank 7 as will be understood from Fig. 6, the shaft 32 extending downward through the bearing 33 provided therefor in the pump casting at one side of the cylinders and provided with a worm or spiral gear 34 at the lower end thereof meshing with the gear 16 of the pump drive shaft, rotation of the motor thus actuates the pump pistons. The shaft is preferably spirally grooved as shown in Fig. 5 to carry oil through the bearing and preferably the tank is partly filled with oil immersing the pump gears. The necessary quantity of oil for the system is placed in this tank and the aperture 36 to which the expansion line is connected is above the normal level of oil. The lower end of the pump or compressor and its shaft and the lower end of the motor shaft and the gearing between the shafts are therefore immersed in oil. The aperture 36 permits connection of the pipe line 9 and the aperture 37 is for the plug 91. As heretofore stated, however, this peculiar construction of the pump is not necessary in the carrying out of our invention as any pump adapted for the purpose may be utilized. The principal result desired is the enclosure of the pump and the motor avoiding the necessity of providing a packing about any moving part as a shaft and which, by reason of the movement of the part soon becomes worn and allows a leakage of the refrigerant fluid. The packing in the case here shown is between the two parts of the tank or chamber 7 and as these are stationary, no wear of the packing may take place. By housing the pump and motor within a chamber forming part of the circulating system the necessity of packing of the moving part is entirely avoided and as the system is positively closed to atmosphere throughout and a pump having an open ended cylinder may be utilized. Also by housing the motor and pump within the tank as shown perceptible noise in operation thereof is avoided.

Preferably the apparatus is set up as shown in Fig. 10 in which the tank 7 forms a part of the low pressure side of the circulating system and in which case the pump discharge orifices are connected by a conduit 9 directly with the high pressure side. This method of arranging the parts is also preferable for the reason that the refrigerant fluid in the vacuum side of the chamber is cool while in the case shown in Fig. 9 the

fluid under pressure discharged directly into the pump chamber is warm and does not lose its heat until it is passed to the tank 6 where it is cooled previous to passing through the expansion valve. By opening the chamber to the low pressure side of the system the motor is cooled preventing overheating thereof in operation inasmuch as the low pressure fluid has not absorbed all the heat of which it is capable. Thus, an overheating of the motor due to a rise in temperature in the chamber 7 is obviated and a tendency to become heated during operation is counteracted.

By the arrangement described, particularly that illustrated in Fig. 10 in which the motor and pump are subjected to the cooling influence of the low pressure fluid, a highly efficient apparatus is secured and possibility of leakage entirely avoided and excessive perceptible noise eliminated. It is further evident that the several objects of the invention herein set forth are secured by a construction that is simple and inexpensive and highly efficient in operation.

Having thus described our invention, what we claim and desire to secure by Letters Patent of the United States is—

1. In artificial refrigerating apparatus, the combination with the compression and expansion coils for the refrigerant, of a chamber sealed to atmosphere into which the expansion coils discharge, a pump and a motor entirely housed within the chamber and subject to the cooling influence of an expanded refrigerant, said pump taking its supply of refrigerant from the chamber and discharging the same to the compression coils exteriorly of the chamber, the said chamber providing an oil receptacle, a driving connection between the pump and motor immersed in the said oil, a conduit connecting the compression and expansion coils, and an expansion valve in the last named conduit.

2. In artificial refrigerating apparatus, the combination with the compression and expansion coils for the refrigerant, a conduit connecting the same and an expansion valve in the conduit, of a chamber sealed to atmosphere into which the expansion coils discharge, said chamber providing an oil receptacle for the system, a compressor and a motor therefor entirely housed within the chamber, said motor having an intake port opening to the chamber, and a conduit connected with the discharge port and leading to the compression coils.

3. In artificial refrigerating apparatus the combination with the circulating system including compression and expansion coils for the refrigerant, a conduit connecting the same and an expansion valve in the conduit, of a tank forming part of the expansion

side of the circulating system, the expansion coils being connected with the tank at a distance from the bottom thereof, the said tank providing an oil receptacle for the system, a compressor and a motor for operating the compressor entirely housed within the tank, gearing connecting the motor and compressor, said gearing being below the point of connection of the expansion line with the tank and immersed in the oil carried in the tank, and a discharge conduit connected with the discharge port of the pump extending through the wall of the chamber to the compression coil.

4. In artificial refrigerating apparatus, the combination with the circulating system for the refrigerant including compression and expansion coils and a valve for regulating the flow from the compression to the expansion coils, of a tank sealed to atmosphere into which the expansion coils discharge, said tank providing a retainer for oil, a compressor suspended in the tank, a motor and gearing for operating the compressor, the said gearing being immersed in oil in the tank, the compression and expansion coils being exteriorly of the tank, and a conduit leading from the compressor through the wall of the tank to the compression coils.

5. In artificial refrigerating apparatus the combination with the circulating system for the refrigerant including compression and expansion coils, of a chamber sealed to atmosphere and forming part of the expansion side of the system, said chamber being of a character to contain an oil supply, a motor supported in the chamber above the level of the oil, a compressor in the chamber operable by the motor and taking refrigerant from the chamber, and a discharge conduit for the compressor leading through the wall of the chamber to the compression coils.

6. In artificial refrigerating apparatus, the combination with the circulating system for the refrigerant including compression and expansion coils, of a chamber sealed to atmosphere forming part of the expansion side of the system and being of a character to contain an oil supply, said chamber being formed of two parts secured together, a casting secured within the chamber to one of the parts, a motor in the upper end of the chamber with its shaft in vertical position, a compressor supported by the casting, gearing interposed between the motor shaft and the compressor for operation thereof, said gearing and shaft extending into the oil supply, and a discharge conduit for the compressor leading directly to the compression coils of the circulating system.

In testimony whereof, we sign this specification.

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