Nov. 4, 1930. A. A. CANTON 1,780,335

ELECTRICAL PUMP

Filed April 22, 1927 2 Sheets-Sheet 1

Fig. 1,

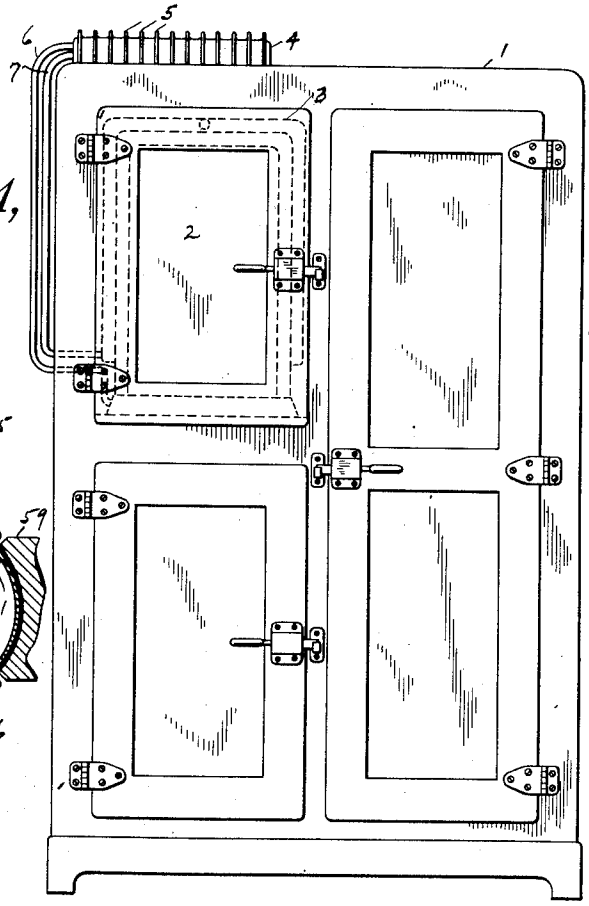
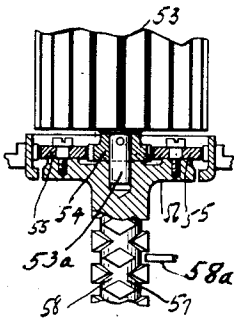


Fig. 5,



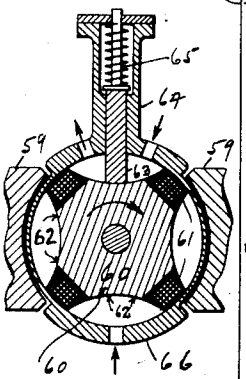


Fig. 7.

Fig. 6

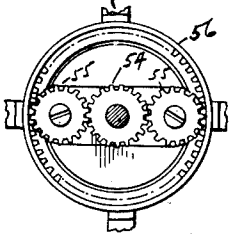


Fig. 3,

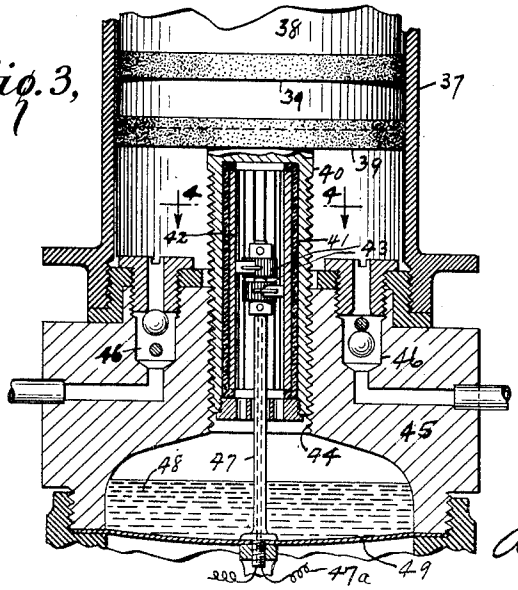
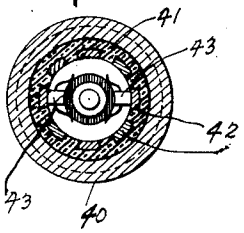


Fig. 4,



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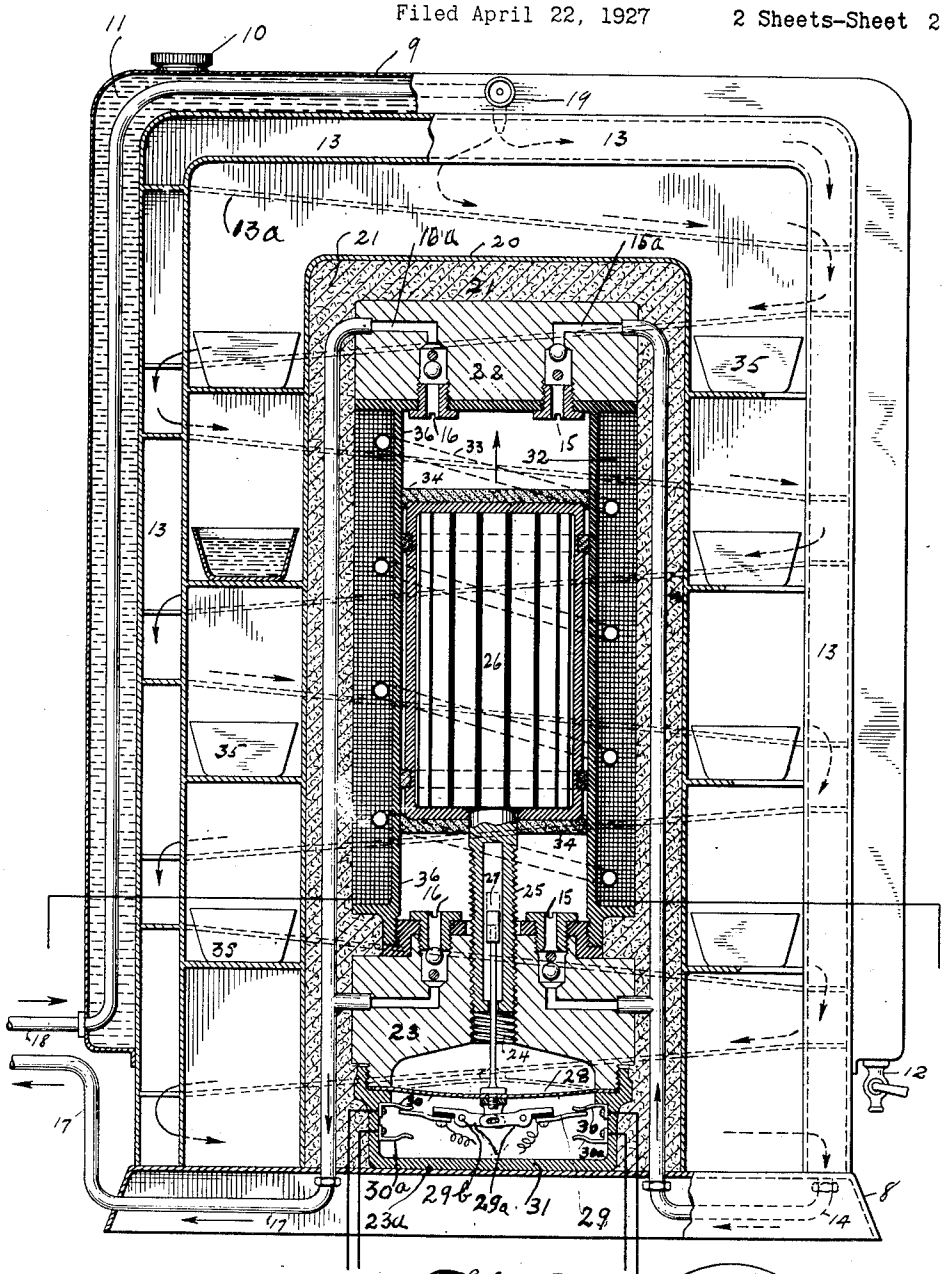


Fig. 8.

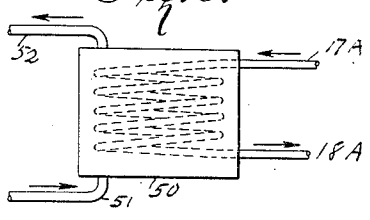


Fig. 2.

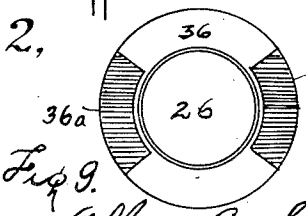


Fig. 9.

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UNITED STATES PATENT OFFICE

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ELECTRICAL PUMP

Application filed April 22, 1927. Serial No. 185,673.

This invention relates particularly to the apparatus for compressing the refrigerant gases. The primary object of the invention is to combine the electric motor and compressor mechanism into a small, inexpensive, and compact unit, and at the same time eliminate packing glands through which the gases might escape.

Another object is to make the armature of the motor act as the piston of a reciprocating compressor. And yet another object of the invention is to utilize the armature of the motor as the rotating element of a rotary compressor.

The invention also includes the apparatus designed for carrying out the foregoing objects.

With the foregoing objects outlined and with other objects in view, which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail in connection with the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings, Fig. 1 shows a front view of a refrigerator embodying my invention.

Fig. 2 is a cross section through my reciprocating motor compressor.

Fig. 3 is a cross section of a modified piston and using a commutator.

Fig. 4 is a cross section on line 4—4 of Fig. 3.

Fig. 5 is a view, partly in section, of a modified armature showing a double threaded drive.

Fig. 6 is a plan view of the planetary drive used in the armature of Fig. 5.

Fig. 7 is a cross-section of an armature acting as a rotary element of a rotary compressor.

Fig. 8 is a side view of the condensing coil used in conjunction with any of the several species of my refrigerating units; and

Fig. 9 is a cross-section of the motor and the cylinder casing.

In Figure 1 of the drawings, number 1 represents a refrigerator in which the ice chest 2 contains part or all of the electrical refrigerating unit 3. If the said unit is water-cooled, the entire unit can be placed in the ice chest 2. If it is air-cooled, the condensing coil and the compressor unit can be placed outside of the refrigerator as indicated by number 4, which comprises the heat radiating fins 5, and the intake and outlet tubes 6 and 7 connecting the compressor and the condensing coil with the expansion chamber inside the ice chest 2.

Figure 2 illustrates a cross-section of the entire electrical refrigerating unit, water-cooled, with the motor compressor unit placed inside the expansion chamber. The base 8 is made of some suitable stamped or cast metal to which all the parts making up the unit are fixed. The brine tank 9 is filled with brine 11, through the cap opening 10, and may be emptied through the valve 12. An expansion chamber 13 is provided in which the compressed gas is expanded, and made to flow evenly by baffle plates 13ª until it has gone through every part of the tank, and finally passes into tube 15, which conducts it to two intake valves 15, 15. The gas is forced under pressure through the outlet compression valves 16, 16, then through the tube 17 to the condensing coil or radiator 17ª. The compressed gas, after condensing or cooling, returns through tube 18, through the needle valve 19, into the expansion chamber 13.

A casing 20 is provided for the compressor unit, which preferably has a lining 21 of some heat insulating and water-proofing material.

At the top of the cylinder a block 22 is provided in which an intake valve 15 and an outlet valve 16 are fixed. At the bottom of the cylinder a block 23 is provided in which an intake valve 15 and an outlet valve 16 are fixed. The blocks 22 and 23 are provided with passages 15ª and 16ª which communicate respectively with the inlet and outlet pipes 14 and 17, which pipes are hermetically sealed to the passages. Block 23 is provided with a central threaded opening 24. This block carries at its lower portion a diaphragm switch mechanism. In the threaded opening 24, the threaded connecting rod 25 rides, compelling the armature piston 26

to travel up or down, depending upon the direction of motion of the armature 26.

An induction type motor is represented by the field winding 32 and an armature 26. A thin shell 36, partly of hard insulating material and partly of magnetic material, separates the armature from the field, and acts as a compressor cylinder. To each end of the armature 26 is connected a disc 34, which acts as a piston ring, preventing the gases from going past the armature to the other end of the cylinder. These discs are loosely connected to the armature so as not to rotate with it, but to reciprocate with it.

The switch mechanism comprises four contacts 30 and 30[a], two on each side of and below the block 23, and two contacts 29, 29, fastened to pivot links 29[a] which links are in turn connected to the switch rod 27. The contacts 29 reciprocate between the contacts 30 and 30[a], controlling the direction of current in the field. Links 29[a] are pivoted at 29[b] to the lower valve block cap 23[a].

It is apparent that as the armature 26 rotates in one direction, it moves downwardly, due to the threaded connecting rod 25, riding in the threaded opening 24, thereby compressing the gases in the lower chamber and forcing them through the outlet valve 16 in the lower chamber; at the same time the gas is being drawn in through the inlet valve 15 into the upper chamber. The armature, on reaching the limit of its downward stroke, forces the switch rod 27 downwardly and presses the center of the diaphragm 28 outwardly. The link 29[a], being connected to the diaphragm 28 and pivotally connected to the cap 23[a], throws the switch contacts 29 upwardly, from contacts 30[a] to contacts 30. The armature will now rotate in the opposite direction and move upwardly, compressing the gas in the upper chamber, and drawing gas into the lower chamber.

Figure 3 illustrates a commutator type motor, with the commutator inside the threaded drive. An armature 38, having packing discs 39, is connected to a threaded section 40 containing the insulating material 41, the commutator segments 42, 42, and the brush mountings 43, 43. A block 45 closes the lower end of cylinder case 37 and contains inlet and outlet valves 46, 46. Said block is provided with a central threaded opening 44, in which opening the threaded section 40 travels. A switch rod 47 carrying wires 47[a] to the brushes 43, acts as the switch operator similar to that shown in Fig. 2.

The lower portion of block 45 is provided with a recess and is closed by diaphragm 49. Oil 48 is placed in the chamber, to prevent the escape of gas as well as lubricating the driving mechanism 40 and 44. The driving mechanism 40 and the commutator device is shown in section in Figure 4.

Figure 5 shows a modified armature piston with a double threaded drive for changing the rotary motion into reciprocating motion. By this arrangement it is unnecessary to use any switching mechanism to reverse the motor. The armature 53 is provided with a shaft 53[a] which carries a small pinion 54, which meshes with idling pinions 55, 55. These pinions 55 are in mesh with the large internal gear 56 forming a planetary gear assembly. Gear 56 is provided with a hub having two opposite threads 57 and 58. These threads are connected at their respective ends so that any riding member 58[a] engaging the threads would, upon the termination of its travel in one direction enter the second thread and compel the armature to move in the opposite direction without reversing the armature.

The armature 60 shown in Fig. 7 involves a departure from the reciprocating type of pumps in that the armature itself is so constructed as to act as the rotating element of a rotary pump. Between the armature windings 61 air chambers 62 are provided. The pump casing 66 surrounding the armature 60 is provided with inlet and outlet ports indicated by arrows. The casing 66 is provided with a valve guide 64 in which the valve stem 63 reciprocates. The stem rides on the periphery of the armature due to the pressure of the spring 65.

As the armature rotates the valve stem 63 will follow the contour of the armature, thereby forcing the gases which enter the inlet openings into the outlet openings, the direction of travel of the gases being indicated by the arrows.

Figure 8 represents the condenser unit in which the water flows though the tube 51, through the tank 50, and out through pipe 52; the gases flowing through 17, through the coil immersed in the water, are condensed and flow back through 18[a] to the needle valve 19, shown in Fig. 2. Part of the cooling water, flowing through 51, is bypassed through the coils 33. These coils are imbedded in the fields of the motor so as to conduct the heat away from the motor as well as any of the heat produced by compression.

Fig. 9 shows the novel construction of the casing surrounding the armature. If the casing were made entirely of insulating material a magnetic gap would be produced great enough to materially reduce the efficiency of the motor. In order to reduce the magnetic gap between the armature and field poles and still retain a substantially heavy wall for the casing, portions of the insulating casing are removed and replaced with magnetic material 36[a]. These portions are located adjacent the pole pieces of the motor field. The result produced is a casing of equal strength with a casing made entirely of insulating material and having the magnetic gap no greater than in prevailing practice.

In practice the magnetic portions 36ª would be moulded in the insulating material of the casing 36. The same construction of the casing may be adapted for the rotary type of compressor shown in Fig. 7.

As the arts of refrigeration and electric motor operation are well established, I have omitted a number of minor details, such as motor circuits and connecting tubes for some of the coils, as any one versed in the art can make any number of connections.

The constructions shown are for illustrative purposes only and various modifications may be made by those skilled in the art without departing from the spirit of the invention.

What I claim is:

1. In an electrically operated pump device, a magnetic field, an armature rotating and sliding in said field, a pump casing surrounding said armature and separating it from the field and means at one end of the armature and casing compelling a reciprocation of the armature while it rotates.

2. In an electrical refrigerating system, a compressor unit comprising an armature and a field, a pump cylinder casing separating said armature and field, valve mechanism in said casing, a threaded shaft connected to said armature, said casing being provided with a threaded opening, and a reversing switch mechanism operated by said shaft.

3. A motor compressor consisting of a motor field, an armature, a pump cylinder separating said armature and field and surrounding said armature, a shaft on said armature and provided with two opposite threads connected at their ends, piston rings on said armature, a fixed element engaging said threads so as to cause a reciprocating motion of the said armature while revolving in one direction, and means to prevent the escape of gas outside the threaded shaft.

4. A motor compressor consisting of a motor field, an armature, a pump cylinder, separating said armature and field and surrounding said armature, a planetary gear device, a double threaded shaft connected to said armature through the planetary gear, piston rings on said armature, a fixed element engaging said double threads so as to cause a reciprocating motion of the armature while revolving in one direction, valves in said cylinder and means for sealing said cylinder to prevent the escape of gas.

5. In a pump device, a cylinder casing provided with inlets and outlets, a piston reciprocating in said casing, said piston comprising an armature rotating and reciprocating in said cylinder, a magnetic field outside said casing to cause the rotation of the armature, and means to cause the reciprocation of the armature to operate it as a piston within the casing.

6. In a pump device, a cylinder casing provided with inlets and outlets, a rotating element in said casing, said rotating element comprising an armature provided with means to draw in and force out a fluid through the cylinder casing, and a magnetic field surrounding the casing to rotate the armature.

7. A pumping device comprising an armature revolving in a magnetic field, said armature being enclosed in said field, inlet and outlet ports in said enclosure, and means to cause the reciprocation of the armature to operate it as a piston within the enclosing field.

8. In a pump device comprising an armature revolving in a magnetic field, said armature being enclosed in said field, inlet and outlet ports in said enclosure, said armature being provided with means to draw in and force out a fluid through the said inlet and outlet ports.

9. In an electrically operated pump device, a magnetic field, an armature rotating and sliding in said field, a pump casing surrounding said armature and separating it from the field, and means for compelling the reciprocation of the armature while it rotates.

ALLEN A. CANTON.