

March 18, 1930.

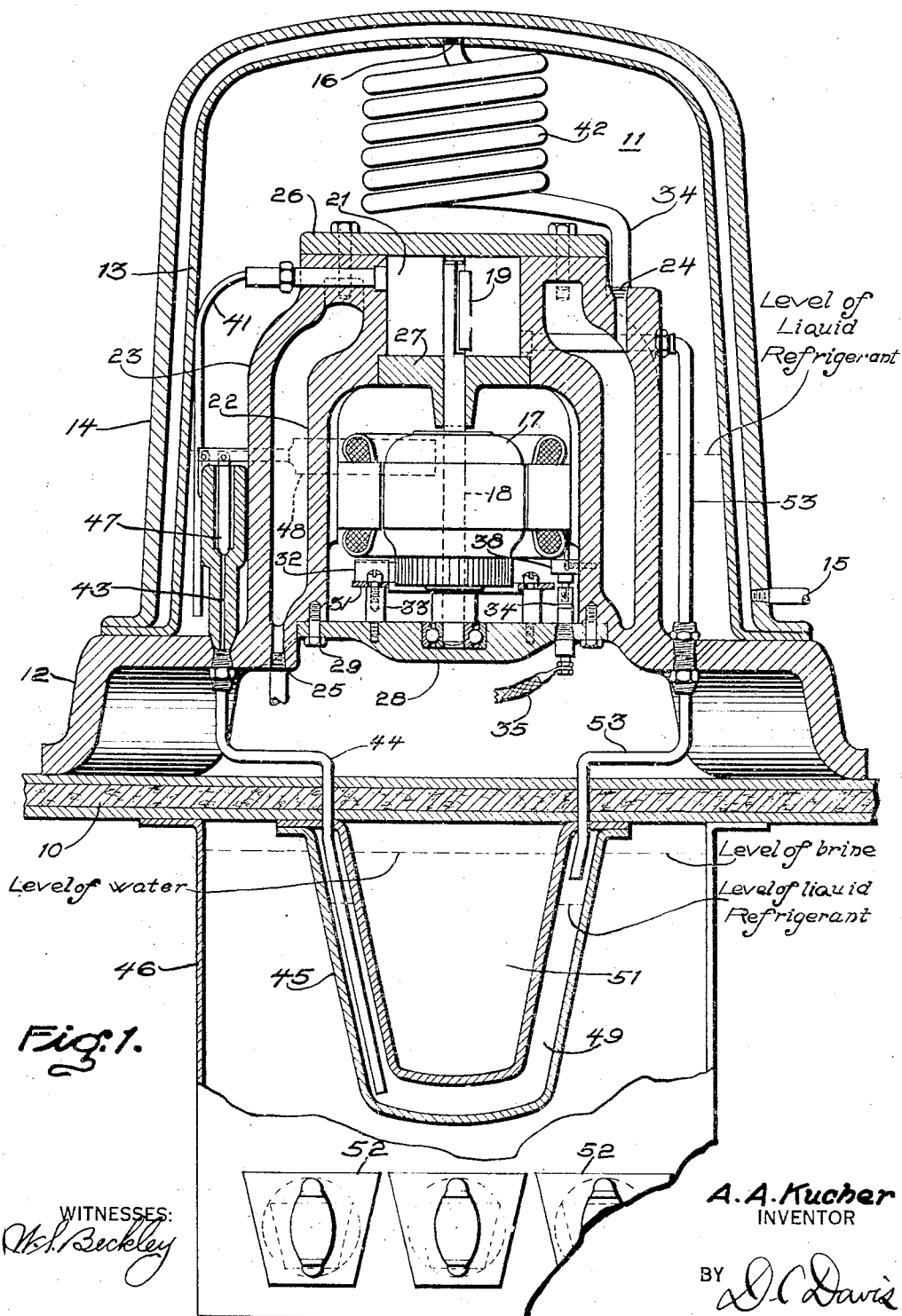
A. A. KUCHER

1,751,209

REFRIGERATOR

Filed July 10, 1923

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

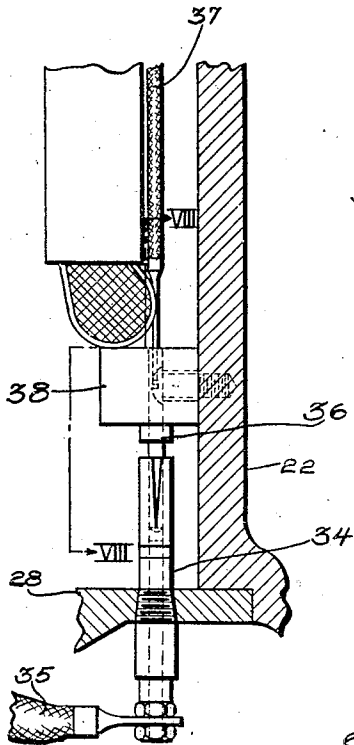


Fig. 7.

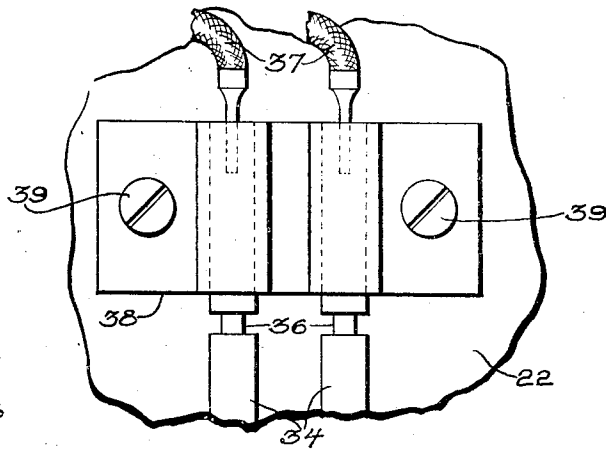


Fig. 8.

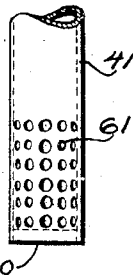


Fig. 6.

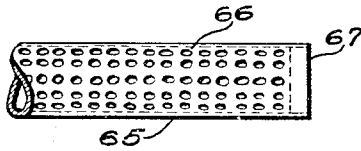


Fig. 5.

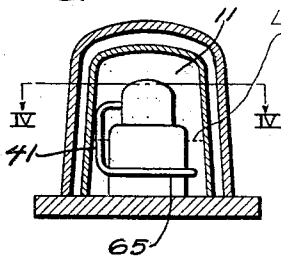


Fig. 3.

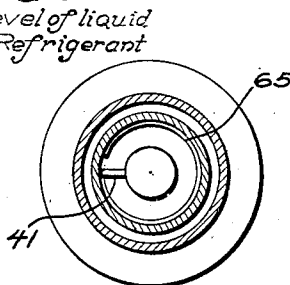


Fig. 4.

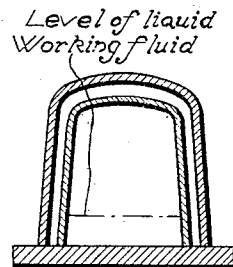


Fig. 2.

WITNESSES:
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UNITED STATES PATENT OFFICE

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REFRIGERATOR

Application filed July 10, 1923. Serial No. 650,668.

My invention relates to refrigerating machines, particularly to small capacity machines of the compression type which are suitable for household use, and it has for an object to provide apparatus of the character designated which shall include a novel method and means for condensing the refrigerant vapors and for dissipating the heat generated by the working parts. In addition thereto, it has for an object to provide a structure which shall permit ready inspection of the enclosed motor and to associate with the inspection facilities an improved means for connecting the motor to a source of electrical energy.

These and other objects, which will be made apparent throughout the further description of the invention, may be attained by the employment of the apparatus hereinafter described and illustrated in the accompanying drawings, in which Fig. 1 is a view partly in section and partly in elevation of a compression refrigerator in which my invention may be practiced; Fig. 2 is a sectional elevation of a modified form of condensing chamber; Fig. 3 is a sectional elevation of the condensing chamber showing a modified form of vapor discharge conduit; Fig. 4 is a plan in section taken on the line IV—IV of Fig. 3; Fig. 5 is an enlarged detail view of a portion of the conduit shown in Figs. 3 and 4; Fig. 6 is a partial elevation of still another form of vapor discharge conduit; Fig. 7 is an enlarged sectional elevation of the device shown in Fig. 1 for connecting the motor to a source of electrical energy and Fig. 8 is a sectional elevation taken on the line VIII—VIII of Fig. 7.

Compression refrigerators of the household type very frequently have their compression mechanism, consisting principally of a motor and a compressor, tightly encased in the condensing chamber to prevent escape of the working fluid. For this reason, some means for dissipating the heat generated by the motor and the compressor must be provided which will effectively maintain a desired operating temperature, without care and attention, for long periods of time. In addition, adequate means for the condensation of

the refrigerant vapor discharged by the compressor must be provided.

In my apparatus, I provide very complete facilities for cooling the working parts of the apparatus and for condensing the refrigerant vapor by circulating water in series through a jacket surrounding the condensing chamber, thence through a coil, and finally through a jacket surrounding both the motor and the compressor. In its passage through the apparatus, additional heat is successively absorbed, and incidentally very effective condensation and adequate cooling effect is produced. Furthermore, conduction of heat from the motor and compressor to the condensed refrigerant is substantially prevented. This is accomplished without any material increase in the rate of water consumption.

In my apparatus, I also provide a portable plate in the lower portion of the condensing chamber, by the removal of which access may be had into a chamber in which the motor is disposed, and which contains substantially no liquid refrigerant. Associated therewith is an improved means for connecting the motor to a source of electrical energy which comprises a contact and a receptacle which dis-engage when the portable plate is removed and which re-engage upon the plate being replaced.

Referring to the drawings for a detailed description of my invention, I show a compression refrigerator of the type similar to that disclosed in a copending application serially numbered 509,672, filed October 22, 1921, entitled "Refrigeration machine", and in which my novel method of operation is carried out. It is to be understood that this invention may be practiced in other types of refrigeration machines, and that the apparatus illustrated and herein described is employed by way of example and as an aid in presenting a clear exposition of my invention. As illustrated, 10 designates a refrigerator box. Mounted thereon is a condensing chamber 11 comprising a base 12 and a dome 13. Surrounding the dome 13 is a jacket 14 having an inlet connection 15 and an outlet connection 16 for the circulation of a cooling medium. Disposed within the dome 13 is a

motor 17 having a shaft 18 which is connected by means of keys 19 to a rotor 21. The keys 19 are fixedly secured to the rotor 21 and rotatably engage the shaft 18 but are in slidable engagement therewith axially. A casting 22 forms a common casing for both the motor 17 and the rotor 21. Surrounding the casting 22 is a jacket 23 having an inlet connection 24 and an outlet connection 25 for the circulation of a cooling medium. An end plate 26 and an intermediate plate 27 are secured to the casting 22 and form therewith and the rotor 21 a compression mechanism. Secured to the lower portion of the casting 22 is a portable plate 28 held in place by bolts 29. A commutator brush ring 31 together with the brushes 32 are supported upon the portable plate 28 by means of a plurality of supporting studs 33.

Fixed in the portable plate 28 is a receptacle 34 which, as shown to a large scale in Figs. 7 and 8, includes provision for connecting through a cable 35 to a source of electrical energy. Upon the portable plate 28 being placed in position, the receptacle 34 engages the contacts 36 which are in turn connected to the windings of the motor by means of the cables 37. The contacts 36 are fixed in a bracket 38 which is composed of a suitable insulating material and which is rigidly secured to the casting 22 by means of the screws 39. The receptacle 34 is so disposed in the portable plate 28 that, upon the same being placed in position, the receptacle and the contacts register and a rigid and positive means for the transmission of electrical energy to the motor is provided.

Connected to the compression mechanism is a conduit 41 which is open at its lower end for the discharge of refrigerant vapor. Disposed in the upper portion of the condensing chamber is a coil 42 which communicates at its respective ends with the outlet connection 16 from the jacket surrounding the condensing chamber and with the inlet connection 24 to the jacket surrounding the compression mechanism and the motor. I have found that it is possible, under mild operating conditions, to eliminate the coil 42, and by lowering the level of the liquid refrigerant within the condensing chamber, as shown in Fig. 2, to utilize only the cooling surface of the jacket surrounding the condensing chamber to effect condensation of the refrigerant vapor. The coil 42 is so disposed as to cause the relatively cool condensate dripping therefrom to fall upon the end plate 26 and absorb a portion of the heat generated by the compression mechanism.

The condensed refrigerant is conveyed by means of conduits 43 and 44 to an evaporator 45, which is disposed within a brine tank 46 located within the refrigerator box 10. The flow of the liquid through the conduit 43 is controlled by means of a reducing valve

47 which is actuated by a float 48, thereby maintaining a constant body of liquid refrigerant within the condensing chamber. The evaporator 45 comprises a circulating compartment 49, into which the conduit 44 discharges liquid refrigerant, and a cold storage compartment 51. Some congealable liquid, such as water, may be provided in the compartment 51 and by alternate freezing and melting during operation and non-operation of the apparatus, may serve as a means of cold storage and thereby increase the capacity of the refrigeration cycle. A plurality of drawers or molds 52 are disposed in the brine tank 46 for the manufacture of ice for table or similar uses. Refrigerant vapor is conveyed from the circulating compartment 49 of the evaporator to the inlet of the compression mechanism by a conduit 53.

The operation of the apparatus thus described is as follows: The condensing chamber 11 and the circulating compartment 49 of the evaporator are filled to a level, such as indicated on the drawing, with a suitable refrigerant fluid. The brine tank 46 is filled with brine and the cold storage compartment 51 is filled with water to the levels indicated. Water from some extraneous source is then conveyed through the inlet connection 15 to the jacket surrounding the condensing chamber. It passes through the outlet 16 to the condensing coil 42 and thence through the inlet 24 to the jacket surrounding the compressor and the motor. It circulates there-through and is finally discharged through the outlet 25. In its passage through the jacket surrounding the condensing chamber and through the condensing coil, sufficient heat is absorbed for the complete condensation of refrigerant vapor discharged by the compression mechanism. Furthermore, the outer surfaces of the condensing chamber are not subject to the temperature of the surrounding atmosphere. In its passage through the jacket surrounding the compression mechanism and the motor, a considerable portion of the heat generated thereby is absorbed, and overheating of the working parts is avoided. In addition thereto, as the operating temperature of the compressor and the motor is in excess of the temperature of condensation of the refrigerant vapor, no increase in the amount of cooling water is required, as the water is successively heated in its passage through the apparatus.

Upon starting the motor 17, the compression mechanism connected thereto by the shaft 18 will discharge a refrigerant vapor or gas through the conduit 41 into the lower portion of the condensing chamber, or below the level of the liquid refrigerant contained therein. The gas rises upwardly through the relatively cool liquid and along the cold walls of the dome 13, and is partially condensed,

while final condensation is effected by the coil 42. The relatively cool condensate, dripping from the coil 42, falls downwardly upon the end plate 26 and, in flowing over the same, absorbs a portion of the heat generated by the compression mechanism.

Upon sufficient accumulation of liquid refrigerant in the lower portion of the condensing chamber, the float 48 will act to move the valve 47 to permit the liquid to flow through the conduits 43 and 44 to the circulating compartment 49 of the evaporator. Cooling effect is then produced in normal manner by the vaporization of the liquid refrigerant caused by the vacuum maintained by the compression mechanism. Heat is absorbed from the cold storage compartment 51 and from the brine in the tank 46. The brine in turn absorbs heat from the interior of the relatively warm refrigerator box until the temperature therein is reduced an amount sufficient to cause an automatic device (not shown) to stop the motor. The brine tank 46, being of ample proportions, a substantial amount of heat absorbing liquid is provided therein, and the length of the inactive period of the apparatus is considerably prolonged. During the active period of the machine, the water in the cold storage compartment 51 forms into ice and thereafter, during the inactive period, absorbs the heat of melting. Ice may be formed in the drawers 52 and removed for table or similar uses. Refrigerant vapor generated in the evaporator 45 is removed to the compression mechanism through the conduit 53 and the cycle of operation may then be repeated.

Should continued operation of the apparatus necessitate the renewal of the commutator brushes 32, the bolts 29 may be removed and the plate 28 lowered. The construction is such that the brushes are removed with the plate and may be withdrawn through openings provided in the base 12. The means for conveying electrical current to the motor pass through the plate 28 as it is desirable to avoid the fluid containing portions of the apparatus. Simultaneously, with the lowering of the plate 28, the electrical connection to the motor is broken, and upon replacement of the same, the receptacle 34 registers with the contact 36 and the connection is remade. As the shaft 18 freely engages, in an axial direction, the rotor 21 of the compression mechanism, should it be desired to provide means for removing the armature of the motor, this may be accomplished in my apparatus by increasing the height of the base 12. However, I do not consider this feature necessary, and I prefer to provide only such access means as may be required for the renewal of the commutator brushes. I have further found from experiment that in order to insure a proper functioning of the float 48, which controls the movement of the reducing valve

47, it is advisable to maintain the liquid refrigerant within the condensing chamber in a tranquil condition. This may be accomplished to some extent, as shown in Fig. 6, by closing the outlet end 60 of the vapor discharge conduit 41 and by providing a plurality of very small openings 61 in the lower portion thereof. In this way, the stream of gas discharged by the compression mechanism is broken up into a plurality of relatively smaller streams, and the agitation of the liquid refrigerant considerably reduced. Increased condensation and cooling of the vapor in passing upwardly through the relatively colder liquid is also effected.

Agitation of the liquid refrigerant contained in the condensing chamber may be still more reduced by the construction shown in Figs. 3, 4 and 5. As shown, the vapor discharge conduit 41 has an extended portion 65 which is arranged in the lower portion of the condensing chamber and which is formed into almost a complete circle, as shown in Fig. 4. This extended portion, as shown in Fig. 5, is provided with a very large number of extremely small holes 66, and has its discharge end 67 blanked off. In this manner, a very fine and even distribution of the refrigerant vapor throughout the entire condensing chamber is effected.

While I have shown my invention in but several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In a refrigerating apparatus, the combination of an evaporator, a compressor, cooling means for condensing the refrigerant vapor discharged by the compressor, a motor for driving the compressor, a chamber enclosing the compressor and the motor, a single jacket both surrounding the motor and the compressor and disposed in direct heat-exchanging relation therewith, and means for conveying a cooling medium through said jacket.

2. In a refrigerating apparatus, the combination of a compressor, a motor for driving the compressor, a condensing chamber surrounding the compressor and the motor and arranged to receive refrigerant fluid discharged by the compressor, a jacket surrounding the motor, and means for conveying a cooling medium through the condensing chamber and through the jacket.

3. In a refrigerating apparatus, the combination of a compressor, a motor for driving the compressor, a casing for the motor, a jacket surrounding the compressor and the

motor casing, a condensing chamber surrounding the compressor and the motor and arranged to receive refrigerant fluid discharged by the compressor, a jacket surrounding the condensing chamber, a heat exchanging device disposed within the condensing chamber, and means for conveying a cooling medium through the jacket surrounding the compressor and the motor, the jacket surrounding the condensing chamber and the heat exchanging device.

4. In a refrigerating apparatus, the combination of an evaporator, a condenser, a compressor having a rotor and a casing, a motor, and a shaft for transmitting torque from the motor to the rotor of the compressor, said shaft being so arranged within the rotor as to permit relative longitudinal movement between the shaft and the rotor.

5. In a refrigerating apparatus, the combination of an evaporator, a base plate, a condensing chamber mounted on said plate, a compressor and a motor disposed within the condensing chamber, a housing for the motor, and access means associated with the motor housing and located in said base plate.

6. In a refrigerating apparatus, the combination of an evaporator, a base plate, a dome mounted on the base plate and defining therewith a condensing chamber, a compressor and a motor for driving the compressor disposed within the condensing chamber, a casing for the motor supported upon the base plate, and a removable plate provided in the base plate for permitting access to the motor casing.

7. In a refrigerating apparatus, the combination of a refrigerator box, an evaporator disposed within the refrigerator box, a compressor, a motor for driving the compressor, a fluid-tight casing enclosing both the motor and the compressor, said casing being supported from the refrigerator box and in spaced relation thereto, and a removable cover for permitting access to the interior of the casing provided in that portion of the casing which is disposed adjacent to the refrigerator box.

8. In a refrigerating apparatus, the combination of an evaporator, a condenser, a compressor, a motor for driving the compressor, a fluid tight casing enclosing the motor and the compressor, a removable cover plate provided in the casing, a contact fixedly secured within the casing and connected through wiring to the motor, and a second contact secured to the removable cover and adapted to engage the first contact when the cover is in position, said second contact being adapted to be connected to a source of electrical energy.

9. In a refrigerating apparatus, the combination of an evaporator, a compressor, cooling means for condensing the refrigerant vapor discharged by the compressor, a motor

for driving the compressor, a casing enclosing the compressor and the motor, a housing for the motor carried by a wall of the casing, a removable access plate located in a wall of the casing for permitting access to the motor housing, a contact fixedly secured in the motor housing and connected by wiring to the motor, and a second contact located in the removable cover and adapted to engage the first contact when the cover is in position, said second contact being adapted to be connected to a source of electrical energy.

10. In a refrigerating apparatus, the combination of an evaporator, means for condensing refrigerant vapor, a compressor, a motor for driving the compressor, a casing enclosing the motor and the compressor, and a removable cover provided in a wall of the casing and arranged to support a portion of the motor.

11. In a refrigerating apparatus, the combination of an evaporator, means for condensing refrigerant vapor, a compressor, a motor for driving the compressor, a casing enclosing the motor and the compressor, a housing for the motor carried by a wall of the casing, and a removable cover plate provided in a wall of the casing adjacent the motor housing for permitting removal and replacement of the motor.

12. In a refrigerating apparatus, the combination of an evaporator, means for condensing refrigerant vapor, a compressor, a motor for driving the compressor, a fluid-tight casing enclosing the motor and the compressor, partition means dividing the casing into a compartment for the compressor and a compartment for the motor, and a removable, fluid-tight cover plate provided in a wall of the casing for permitting access to the motor compartment.

13. In a refrigerating apparatus, the combination of evaporating means, condensing means, a compressor having a movable element, a motor having a movable element, a fluid-tight casing enclosing both the compressor and the motor, and shaft means disposed within the casing for transmitting torque from the motor to the compressor, said shaft means being so arranged as to permit relative axial movement between the movable element of the motor and the movable element of the compressor.

In testimony whereof, I have hereunto subscribed my name this 2nd day of July, 1923.

ANDREW A. KUCHER.