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2,199,779

REFRIGERATION APPARATUS

Filed March 21, 1938

2 Sheets-Sheet 2

FIG. 2

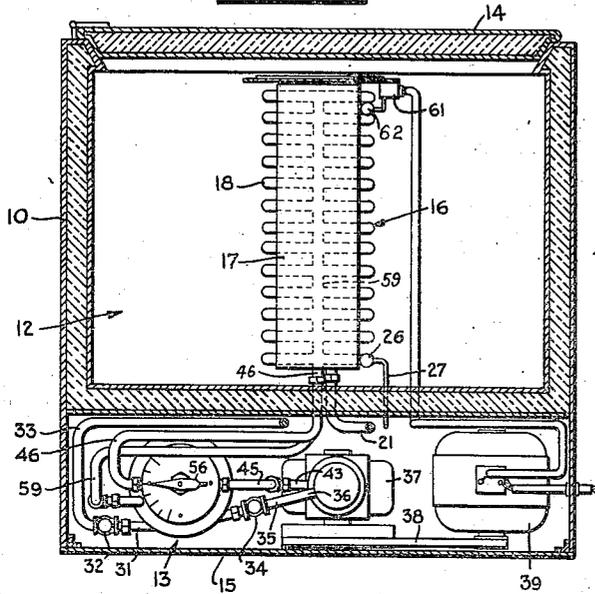


FIG. 3

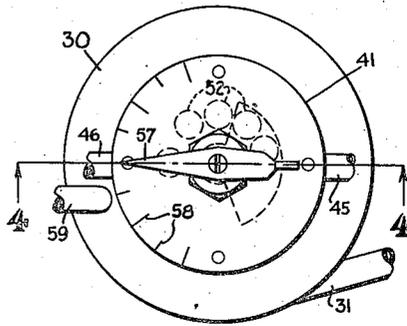


FIG. 4

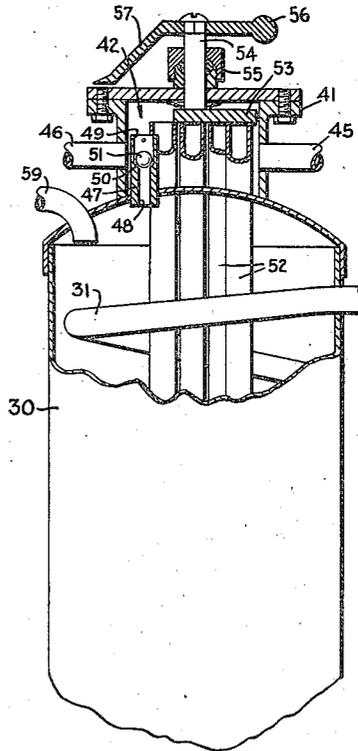
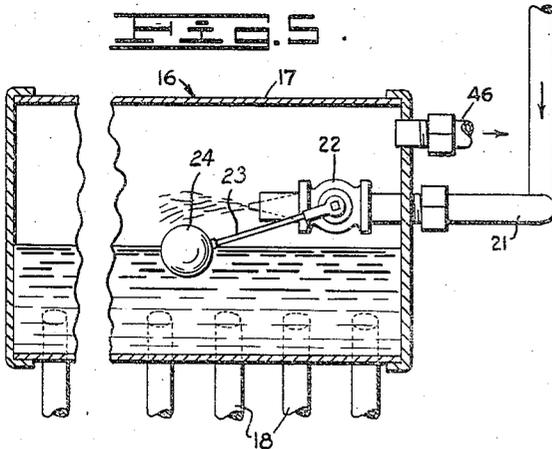


FIG. 5



BY

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UNITED STATES PATENT OFFICE

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REFRIGERATION APPARATUS

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10 Claims. (Cl. 62—115)

This invention relates to improvements in mechanical refrigerators.

The general object of the invention is to provide an improved mechanical refrigerator which employs a simple and effective cooling system.

Another object of the invention is to provide a novel refrigerant circuit for a mechanical refrigerator.

Other objects and the advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a vertical section through the machinery compartment of my improved refrigerator device;

Fig. 2 is a section taken on line 2—2 of Fig. 1 on a reduced scale;

Fig. 3 is an enlarged top plan view of the receiver tank;

Fig. 4 is a fragmentary section taken on line 4—4 of Fig. 3; and

Fig. 5 is a fragmentary enlarged section taken on line 5—5 of Fig. 1.

Referring to the drawings by reference characters I have shown my invention embodied in a refrigerator which I have indicated generally at 10. As shown the refrigerator 10 comprises a box like structure having a storage compartment 12 and a machinery compartment 13. Access to the storage compartment 12 is had through a suitable door 14 and access to the machinery compartment 13 is had by removing the rear wall 15.

Within the storage compartment I provide an evaporator unit 16 of the standard type which includes a horizontal tank member 17 having the usual heat exchange tubes 18 looped downward around a freezing compartment 19. Mounted on the top of the refrigerator I provide a vertical receiver tank 20.

One end of a conduit 21 enters the evaporator tank 17 wherein it communicates with a shut off valve 22. The valve 22 includes an operating lever 23 which has a buoyant member 24 on the end thereof. The member 24 is adapted to open and close the valve 22 to maintain the fluid in the tank 17 at a predetermined level. The opposite end of the conduit 21 communicates with a standard type thermo and pressure operated expansion valve member 25 which includes the usual thermo responsive bulb member 26 located adjacent the tank 17 and its associated connector tube 27. A conduit 28 communicates at one end with the valve 25 and the opposite

end opens into the lower portion of the receiver tank 20.

In the machinery compartment 13 I provide a vertical heat exchange or absorption tank 30. Within the tank 30 I provide a coiled conduit 31 the lower end of which communicates through a shut off valve 32 with a conduit 33. The opposite end of the conduit 33 opens into the receiver tank 20 through the top thereof. The upper end of the coiled conduit 31 communicates through a shut off valve 34 with a conduit 35 which communicates with the outlet member 36 of a compressor device 37. The compressor device 37 is shown as driven by a belt 38 from an electric motor 39.

On the top of the tank 30 I provide a member 41 which forms a closed chamber 42 (Fig. 4). An inlet member 43 of the compressor 37 communicates through a shut off valve 44 with a conduit 45 which opens into the chamber 42. One end of a conduit 46 opens into the chamber 42 opposite the conduit 45. The opposite end of the conduit 46 opens into the tank 17.

Positioned in the chamber 42 I provide a check valve member 47 the lower end of which extends into the tank 30. Opening through the lower end the member 47 has an aperture 48 therein and opening through the upper end it has an enlarged recess 49 therein. The shoulder at the juncture of the aperture 48 and the recess 49 is bevelled to form a valve seat 50 which is adapted to be engaged by a ball valve member 51.

Positioned in the tank 30 and encircled by the coil 31 I provide a plurality of circumferentially spaced vertical tubes 52, the upper portions of which extend into the chamber 42 and terminate adjacent the top thereof. Engaging the upper ends of the tubes 52 I provide a flat segmental valve member 53 which includes a vertical valve stem 54 extending out of the top of the member 41 through a suitable packing gland 55.

An operating handle 56 is provided on the valve stem 54 and includes a pointer portion 57 which coacts with indicia matter 58 on the top of the member 41 to indicate the position of the valve member 53.

One end of a conduit 59 opens into the tank 30 and the opposite end communicates with the depending heat exchange loops 18. Interposed in the conduit 59 adjacent the tank 30 I provide a shut off valve 60.

The action of the motor 39 is preferably controlled by any suitable type of thermo switch mechanism 61 having a thermo responsive bulb 62 positioned adjacent the tank 17.

In operation the system is filled with the required amount of refrigerant fluid which in this instance may be aqua-ammonia. When the compressor 37 is operating it draws ammonia gas out of the chamber 42 through the conduit 45 and the valve 44 into the inlet 43 and discharges it under pressure and at increased temperature through the outlet 36, through the conduit 35, the valve 34 and into the coiled conduit 31.

Passing down the conduit 31 the high pressure, heated, gas is cooled and becomes a liquid. Thus, the conduit 31 constitutes a refrigerant condenser which is in heat exchange relation with the absorbent liquid contained in the tank 30. A particular advantage of this construction is that the heat of condensation, that is, the heat given up when the refrigerant changes from a gas to a liquid, is taken up by the absorbent liquid and is effective toward vaporizing from the absorbent liquid the refrigerant which is being withdrawn by the compressor 37. The heat of the compressed gas is absorbed by the liquid in the tank 30, thus raising the temperature of the liquid in the tank. The heat from the tank 30 is dissipated into the atmosphere. The raising of the temperature of the fluid in the tank 30 drives off ammonia which is drawn through the conduit 46 to the chamber 42 whence it flows to the compressor inlet. From the bottom of the coiled conduit 31 the refrigerant liquid is forced through the conduit 33 and falls into the receiver tank 20. The high pressure liquid accumulates in the bottom of the receiver 20 whence it flows through the conduit 28, the control valve 25, the conduit 21 and float valve 22 and is sprayed into the tank 17.

The fluids in the tank 17 are under relatively low pressure and a portion of the liquid evaporates producing a cooling effect. The liquid ammonia accumulating in the bottom of the tank 17 circulates through the heat exchange tubes 18 cooling the compartment 19. The float valve 24 maintains the liquid in the tank 17 at the proper level.

When the cooling operation in the tank 17 has gone sufficiently far to produce the desired degree of cold the bulb 62 and its associated switch mechanism 61 will cause the motor 39 to be shut off stopping the compressor 37. The accumulated pressure in the receiver continues to force liquid through the float valve 22 subject to the regulation of the valve 25 as determined by the thermo responsive member 26.

The gas continues to flow through the conduit 46 and into the chamber 42 as previously described. From the chamber 42 the gas is allowed to pass down one or more of the tubes 52 as predetermined by the position of the valve member 53.

The lower portion of the tank 30 contains water in which the gas passing down the tubes 52 is absorbed. The rate at which the gas is absorbed in the water in the heat exchanger 30 determines the degree of cold produced by the system and the absorption rate is controlled by the valve member 53 operated by the associated handle 56. As previously inserted gas driven from the liquid in the tank 30 passes into the chamber 42 through the valve member 47, whence it passes to the compressor inlet during the operation of the compressor and in this manner the absorber is prepared to receive a fresh charge of gas during the continuation of the cycle.

When the pressure in the receiver 20 has

dropped so low that the system does not maintain sufficient cold, the motor 39, controlled by the switch 61 and the associated thermo responsive device 62, is started and the pressure is again raised and the cooling action accelerated until the motor is again stopped as previously described.

After a considerable period of time water or other undesirable substances may accumulate in the bottom of the tubes 18. This may be drawn off through the conduit 59 by opening the valve 60 and allowing them to pass through the conduit 59 into the heat exchanger 30.

From the foregoing description it will be apparent that I have provided a novel mechanical refrigerator device which is simple in construction, economical to operate and highly efficient.

Having thus described my invention I claim:

1. In a refrigerator system, a heat exchange device including a tank portion and a closed chamber portion, a coil in said tank, means to draw fluid from said chamber and to discharge it under pressure into said coil, an evaporator unit including a tank, conduit means between said evaporator tank and said coil, conduit means affording communication between said evaporator tank and said chamber and valved means affording communication between said chamber and said first mentioned tank.

2. In a refrigerator system, a heat exchange device including a tank portion and a closed chamber portion, a conduit including a coil in said tank, means to withdraw fluid from said chamber to direct it to said coil, a plurality of vertical tubes in said tank, the upper portion of said tubes opening into said chamber and the lower portion of the tubes opening into the tank, valve means to control flow through said tubes, a receiver, means connecting the other end of said conduit and said receiver, an evaporator, valved means connecting said receiver and said evaporator and conduit means communicating at one end with said evaporator unit and the other end opening into said chamber.

3. In a refrigerator system, a receiver tank, an evaporator unit, a compressor including an inlet and an outlet, said evaporator unit including a tank, a coil, means including said coil connecting said receiver tank and said compressor outlet, a conduit connecting said receiver tank and said evaporator tank, said conduit having a valve member interposed therein between said receiver tank and said evaporator tank to control passage therethrough, a flow control valve member interposed in said conduit and disposed within said evaporator tank, an absorption tank in which said coil is disposed, means to conduct fluid from said evaporator to said absorption tank, said last mentioned means including a valve controlled portion and means to draw fluid from said absorption tank and to return it to said coil.

4. In a refrigerator system, a receiver tank, an evaporator unit including a tank, a compressor member including an inlet and an outlet, means including a coil connecting said receiver tank and said compressor outlet, a conduit connecting said receiver tank and said evaporator tank, said conduit having a combination pressure and thermo actuated expansion valve member interposed therein between said receiver tank and said evaporator tank to control passage therethrough, a flow control valve member interposed in said conduit and disposed within said evaporator tank, an absorption tank in which said coil is disposed, means affording communication between

said evaporator tank and said absorption tank, said last mentioned means including a valve controlled portion and means to afford communication between said absorption tank and said compressor inlet.

5 In a refrigerator system, a compressor including an inlet and an outlet, a heat exchange device including a tank portion and a closed chamber portion, a conduit in said tank, a coil
10 in heat exchange relation with said tank portion, means connecting one end of said coil and said compressor outlet, means communicating with said compressor inlet and said chamber, a plurality of tubes in said tank, one portion of said
15 tubes opening into said chamber and another portion of the tubes opening into the tank, valve means operable from the exterior of said chamber to control flow through each tube, a receiver, means connecting the other end of said conduit
20 and said receiver, an evaporator, means connecting said receiver and said evaporator and conduit means communicating with said evaporator unit and said chamber.

6. In a refrigerator system, a compressor including an inlet and an outlet, a heat exchange device including a tank portion and a closed chamber portion, a conduit including a coil in
25 said tank, means connecting one end of said conduit and said compressor outlet, means communicating with said compressor inlet and said chamber, a plurality of tubes in said tank, one portion of said tubes opening into said chamber
30 and another portion of the tubes opening into the tank, valve means to control flow through said tubes, a receiver, means connecting the other end of said conduit and said receiver, an evaporator, valved means connecting said receiver
35 and said evaporator and conduit means communicating at one end with said evaporator unit and the other end opening into said chamber.

7. In a refrigerator system, a compressor including an inlet and an outlet, a heat exchange device including a tank portion and a closed chamber portion, a check valve adapted to control
45 passage from said tank to said chamber, a coil in said tank, conduit means connecting one end of said coil and said compressor outlet, conduit means communicating at one end with said compressor inlet and at the opposite end opening
50 into said chamber, valved means to afford communication between said tank and said chamber, a receiver tank, conduit means communicating with the other end of said coil and the upper portion of said receiver tank, an evaporator unit including a tank and a plurality
55 of looped evaporator tubes depending therefrom and opening thereinto, conduit means between said evaporator tank and said receiver tank, conduit means affording communication between the upper portion of said evaporator tank and said
60 chamber and a drain member communicating with said evaporator tubes and opening into said heat exchange member.

8. In a refrigerator system, a compressor member, said compressor including an inlet and an outlet, a heat exchange device, said device including a vertical tank portion and a closed chamber portion thereabove, a check valve member
65 opening into said tank and into said chamber adapted to allow passageway from said tank into said chamber when the pressure in said tank reaches a predetermined amount and to restrict flow from said chamber to said tank at all times, a vertically coiled conduit in said tank, conduit
70 means connecting the upper end of said coil and

said compressor outlet, conduit means at one end communicating with said compressor inlet and at the opposite end opening into said chamber, a plurality of vertical tubes in said tank, the upper portions of said tubes extending into said
5 chamber and opening thereinto, valve means operable from the exterior of said chamber to control the openings of said tubes, an evaporator unit, means connecting the lower end of said coiled conduit and said evaporator unit and
10 conduit means communicating at one end with said evaporator unit and at the opposite end opening into said chamber.

9. In a refrigerator system, a compressor including an inlet and an outlet, a heat exchange device including a tank portion and a closed chamber portion, a coil in said tank, a conduit
15 connecting the upper end of said coil and said compressor outlet, conduit means communicating at one end with said compressor inlet and at the opposite end opening into said chamber, a plurality of tubes in said tank opening into said tank and into said chamber, means to control
20 passage through said tubes, a receiver tank, means communicating with the coil and opening into the upper portion of said receiver tank, an evaporator unit including a tank having a plurality of looped evaporator tubes depending therefrom and opening thereinto, conduit means
25 opening into said evaporator tank and into the lower portion of said receiver tank, said last mentioned conduit means having a thermo actuated expansion valve member to control passage of refrigerant therethrough and having a float controlled valve member interposed therein within
30 said evaporator tank and conduit means affording communication between the upper portion of said evaporator tank and said chamber.

10. In a refrigerator system, a compressor including an inlet and an outlet, a heat exchange device including a tank portion and a closed chamber portion, means to allow passage of refrigerant from said tank into said chamber
40 when the pressure in said tank reaches a predetermined amount and to restrict flow from said chamber to said tank at all times, a coil in said tank, a conduit connecting the upper end of said coil and said compressor outlet, conduit means communicating at one end with said compressor inlet and at the opposite end opening into said
50 chamber, a plurality of tubes in said tank opening into said tank and into said chamber to control passage through said tubes, a receiver tank, conduit means communicating at one end with the lower end of said coil and at the opposite end opening into the upper portion of said receiver tank, said last mentioned conduit having
55 valve means interposed therein to control passage therethrough, an evaporator unit including a tank having a plurality of looped evaporator tubes depending therefrom and opening thereinto, conduit means opening into said evaporator tank and into the lower portion of said receiver tank, said last mentioned conduit means having a combination pressure and thermo actuated valve member interposed therein between
60 said receiver tank and said evaporator tank to control passage therethrough and said conduit means having a float controlled valve member interposed therein within said evaporator tank and conduit means affording communication between the upper portion of said evaporator tank and said chamber.