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2,482,222

TWO-TEMPERATURE REFRIGERATING MEANS

Filed Feb. 16, 1948

2 Sheets-Sheet 1

FIG. 1.

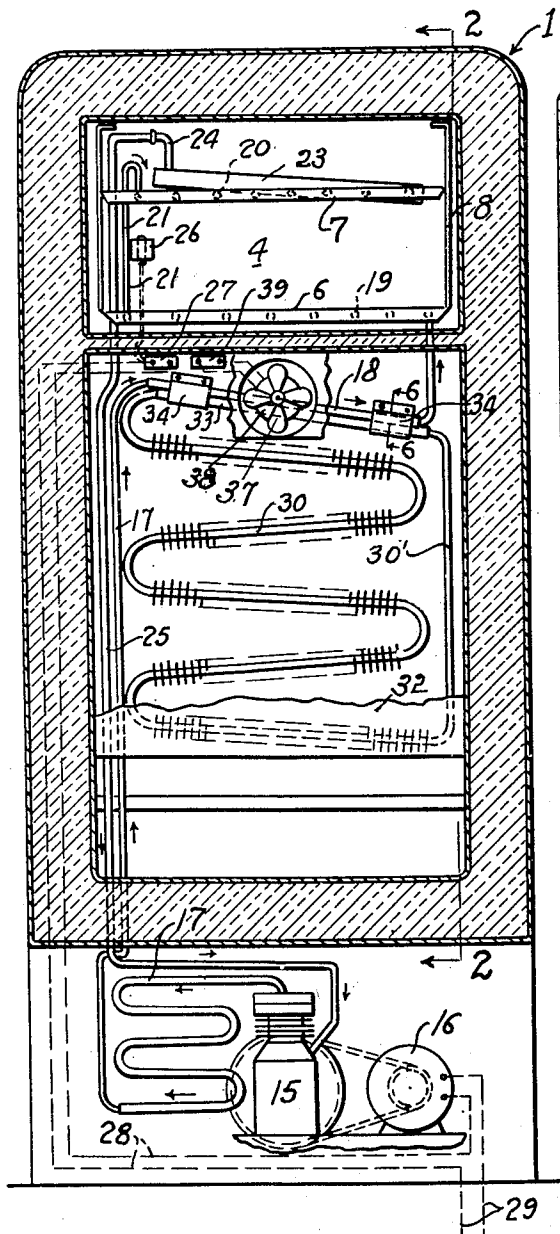
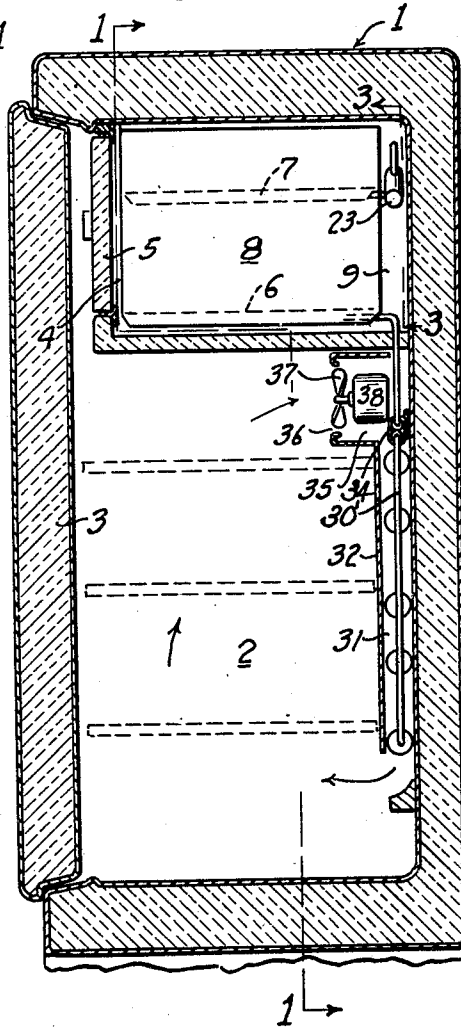


FIG. 2.



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FIG. 7.

FIG. 3.

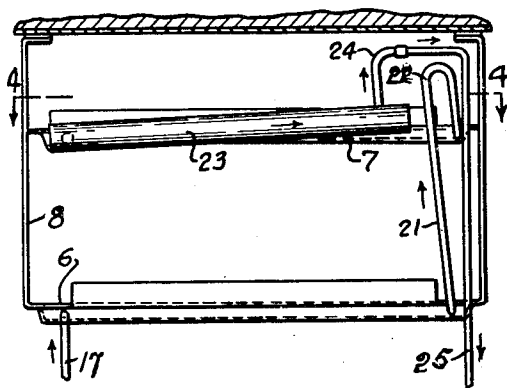


FIG. 4.

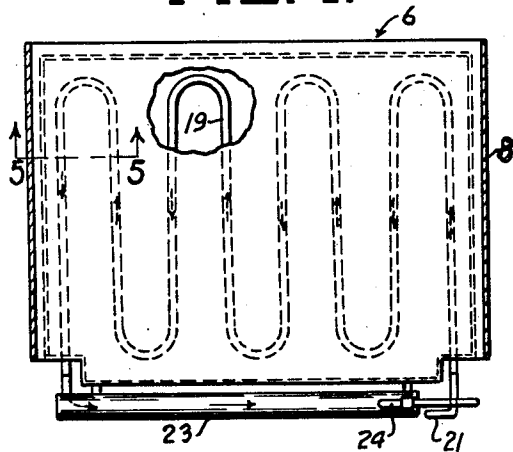


FIG. 5.

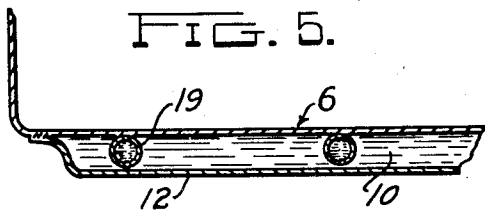
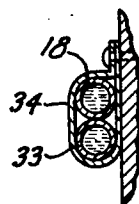


FIG. 6.



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TWO-TEMPERATURE REFRIGERATING
MEANS

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6 Claims. (Cl. 62—102)

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This invention relates to refrigerating means, and particularly to such a means of the type in which different temperatures, one for freezing and one for non-freezing, are maintained in different compartments preferably but not necessarily in a unit type refrigerator.

The primary object of the invention is the provision of a new and useful refrigerating means of this character wherein primary and secondary refrigerating circuits are provided in different compartments to maintain them at different predetermined temperatures in a simple, efficient, accurately controlled and economical manner.

Another object of the invention is the provision in a refrigerating system of the character described of primary and secondary refrigerating circuits associated with different compartments, with the cold imparting temperature of the refrigerant in one circuit produced by conduction from the other, and control means for each compartment.

Another object of the invention is the provision in a refrigerating system of separate primary and secondary refrigerating compartments with gravity circulation of the air in the colder compartment and forced circulation of air, when needed, in the compartment of higher temperature, and the primary refrigerant circulating through the cooler compartment and cooling a secondary refrigerant for the other compartment.

Other objects and advantages of the invention will be apparent from the following detailed description, and from the accompanying drawings showing two embodiments thereof in which—

Fig. 1 is a vertical cross-section of a refrigerating unit embodying the invention taken on the line 1—1 in Fig. 2 and looking toward the rear of the case; Fig. 2 is a vertical section from front to rear taken on the line 2—2 in Fig. 1; Fig. 3 is a fragmentary section on the line 3—3 in Fig. 2; Fig. 4 is a cross-section on the line 4—4 in Fig. 3; Fig. 5 is an enlarged fragmentary section on the line 5—5 in Fig. 4; Fig. 6 is an enlarged fragmentary section on the line 6—6 in Fig. 1, and Fig. 7 is a section similar to Fig. 2 with a different form of air circulating flue in the cold chamber.

Referring to the drawings, 1 designates a refrigerator case or cabinet having what may be termed a "cold" chamber 2 to which access is had through a door 3, and also having interiorly thereof, in the present instance, and in its upper portion, a "freezing" chamber 4 controlled by a door 5. The chambers 2 and 4 are heat insulated one from the other and the doors for both cham-

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bers fit closely to seal the chambers when the respective doors are closed.

The "freezing" chamber 4, in the present instance, is smaller than the "cold" chamber 2, and is provided with two vertically spaced superimposed shelves 6 and 7 supported within a liner member 8 that is spaced from the side and bottom walls of the chamber. This liner, in its present embodiment, is of U-form with its legs attached at their free ends to and suspended from the top wall of the chamber in parallel spaced relation to the side walls and with its cross or loop portion in spaced relation to the chamber bottom for air circulation purposes. The liner is slightly spaced at the back from the rear end wall of the chamber to provide a space 9 therebetween, and its front end is preferably spaced from the front wall of the chamber.

The shelves 6 and 7 are built up to form freezer plates of the eutectic type and are of hollow watertight construction to form a shallow chamber 10 (Fig. 5) substantially throughout the area of the plates in which an eutectic solution is disposed in surrounding relation to portions of the refrigerant circulating coils, as hereinafter described. The bottom or loop portion of the lining 8 may form the top wall of the lower plate chamber 10, while a sheet 12 attached thereto may form its bottom wall.

The refrigerating means includes a primary system or unit for supplying freezing temperature to the "freezing" chamber 4, and a secondary system or unit for supplying the desired temperature, less than freezing, to the "cold" chamber 2, the latter action being the result of direct conduction from the refrigerant circulating tubes of the primary unit to those of the secondary unit.

The primary unit comprises a gas compressor 15 driven by an electric motor 16, an outlet or dispensing tube 17 from the compressor to a length of tubing 18 of rapid thermal conductive material, in the present instance, in the upper portion of the "cold" chamber 2. From the part 18 this tubing extends up into the "freezing" chamber where it passes backward and forward through the eutectic solution in the lower plate 6, as shown at 19, and thence up and through the eutectic solution in the top plate 7 in the same manner, as shown at 20. The connection 21 between the lower and upper plate coils includes an inverted U loop 22 (Fig. 3) above the level of the top plate to prevent the liquid refrigerant from draining back from the upper plate to the lower plate. The tubing, after traversing the upper

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plate, connects with a larger accumulator tube section 23 extending crosswise of the chamber 4 through the rear space 9, such section being inclined slightly upward from a horizontal and connected at its opposite end through an upward loop 24 and down tube section 25 to the inlet side of the compressor 15, thus completing the primary refrigerating circuit.

The sensitive element of a thermostatic control for the refrigerating machine is disposed at 26 within the "freezing" chamber 4, being clamped to the connection 21 between the upper and lower plate coils 19 and 20, and the responsive control, in the present instance, is located at 27 within the upper part of the "cold" chamber 2. This control is in series through wires 28 with the motor circuit wires 29, so that an opening of the control circuit will stop the motor, as well understood in the art. Because the machine control is clamped to the connecting tube 21 between the freezer plates 6 and 7, it is very responsive to the changing load conditions in both compartments of the refrigerator as reflected by the primary refrigerant.

The secondary refrigerating means for the "cold" chamber 2 comprises a coil 30 located in a passage 31 formed between the rear wall of said chamber and a partition 32, and open at top and bottom to the chamber. The coil 30 is preferably of the finned type and has an upper length 33 paralleling and closely clamped to the length 18 of the primary refrigerating line by members 34. This tube part 33 is of suitable rapid thermal conductive material so that refrigerant liquid in the coil 30 will be chilled by conduction from the refrigerant in the primary freezing line. The upper end of the passage 31 is enlarged, as shown at 35, and provided with an opening 36 to the chamber 2. A fan 37, driven by a motor 38, is disposed adjacent to this opening to create a down draft through said passage, and thus set up a circulation through the chamber. A thermostatic control for the fan motor is located at 39 and is responsive to temperature changes in the chamber 2, as well understood in the art. It will be noted that the entire secondary coil is located in convenient accessible position within the main compartment of the "cold" chamber of the refrigerator, and is thus easily accessible for servicing.

A refrigerant gas is used in the secondary coil 30 and this rises from the lower loops of the coil and liquefies when it comes in contact with the cold portion 33 thereof. The liquid refrigerant then runs down through the pipe portion 30' by gravity and volatilizes on its way up through the loops as it picks up heat from the chamber 2, thus causing a continuous circulation through the secondary coil. The circulation of the air over the loops 30 between plate 32 and the wall of the chamber is restricted as desired to prevent over cooling of the "cold" chamber under normal operating conditions.

The provision of the eutectic plates in the "freezing" chamber is important in stabilizing the temperatures therein, first, when ice trays filled with water are placed in the freezer, as the eutectic solution prevents too rapid gasification of the primary refrigerant in the primary tubes which might blow all liquid refrigerant out of the tubes, and second, when a heavy load is placed on the secondary coil, the action of the eutectic plates serves to hold the refrigerator temperatures more nearly uniform while the bulk of refrigerating work is being done on the incoming line in the transference of cold to the secondary

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refrigerant. Thus the thermostatic control in compartment 4 provides for circulating the primary refrigerant to the degree necessary to maintain a nearly constant temperature in compartment 4, whether the load is in that compartment or in compartment 2, while the thermostatic control in compartment 2 provides for circulation of air over the coils of the secondary refrigerant to the degree necessary for proper cooling of compartment 2.

In Fig. 7 the enlarged space for the fan and its motor is shown as extended forward in gradually diminishing depth under the bottom wall of the freezing compartment, and with the partition 40 which forms the same provided with a plurality of cross wise extending louvered slots 41.

While the preferred construction provides the two compartments in one insulated cabinet, with a partition with relatively little insulation between the compartments, in its broader aspects the invention would apply where the two compartments had separate insulated walls with a properly insulated conduit for the primary refrigerant from compartment 2 to compartment 4.

The present invention admirably adapts itself for use in connection with either domestic or commercial sized refrigerators and to the use of a small or large "freezing" chamber therein. Also the "freezing" chamber may be the same width as the main chamber with the side and top insulated walls formed by the respective walls of the cabinet 1 or the insulated top and side walls of the "freezing" chamber may be formed entirely separate and spaced from the respective walls of the cabinet, depending on the sizes and location of the respective chambers.

We wish it understood that our invention is not limited to any specific construction, arrangement or form of the parts, as it is capable of numerous modifications and changes without departing from the spirit of the claims.

Having thus described our invention, what we claim as new and desire to secure by United States Letters Patent is:

1. In a two-temperature refrigerator, two compartments, refrigerating means having a primary refrigerant line with a coil in one of the compartments, a separate closed line for a refrigerant having a coil in the other compartment, the two lines being in heat-exchanging relation for a portion of their lengths, thermostatic means controlling circulation through said primary coil in accordance with the temperature in the first said chamber, a fan for circulating air in the said other compartment over the refrigerant coil therein, and thermostatic means governing the fan in accordance with the temperature in the said other compartment.

2. In a refrigerator, an insulated compartment, a closed refrigerant line in the compartment comprising a down line, a rising coil and a connecting pipe between the tops of the coil and the down line, a pipe for a refrigerant of approximately constant temperature in heat-exchange relation to the connecting pipe, a fan for forcing air down past the coil, and thermostatic means controlling the fan in accordance with the temperature in the upper portion of the compartment.

3. In a refrigerator, a freezing chamber and a cold chamber, one or more hollow plates in the freezing chamber serving as shelves and containing an eutectic solution, a primary refrigerating means with its refrigerant circulating line extending through each of said plates to chill the eutectic solution therein, a secondary refrigerat-

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ing means comprising a closed coil in said cold chamber with a portion in thermal conductive contact with said primary line in advance of said plates to chill and set up circulation of the secondary refrigerant in its line, and a thermostatic control for said primary line with its temperature-sensitive element in heat-conductive relation to the primary line between two of said plates.

4. In a refrigerator, a freezing chamber, a plurality of hollow vertically spaced plates in said chamber containing an eutectic solution, a refrigerating means including a refrigerant circulating line with successive portions in the solution in successive plates, connection between said portions with an inverted U bend entering the uppermost portion, an accumulator adjacent to and at the outlet side of said uppermost plate, and a thermostatic control for refrigerating means with its heat-sensitive element in thermal relation to the refrigerant line between two of said plates.

5. In a two-temperature refrigerator, a freezing compartment, a cool compartment, a partition in the cool compartment forming a restricted vertical channel, a refrigerating means comprising a line for a primary refrigerant having a coil

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in the freezing compartment, a closed line for a secondary refrigerant having a coil in said channel, a portion at the top of the second said line being in heat-exchange relation to the first said line, a fan for blowing air down through said channel, and thermostatic means controlling the fan in accordance with the temperature in the cooling compartment.

6. Apparatus in accordance with claim 5 and comprising thermostatic means for controlling circulation in said primary line in accordance with the temperature of said line at an intermediate point in the coil in the freezing chamber.

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