

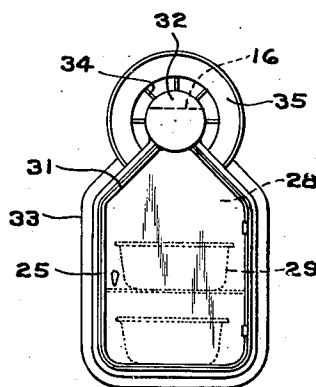
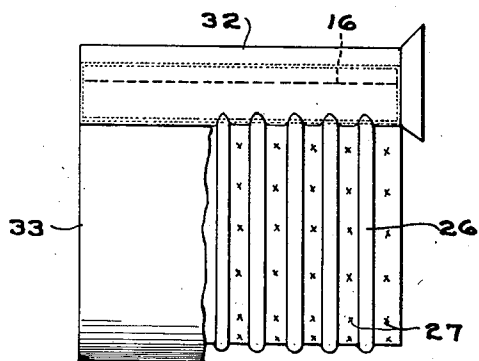
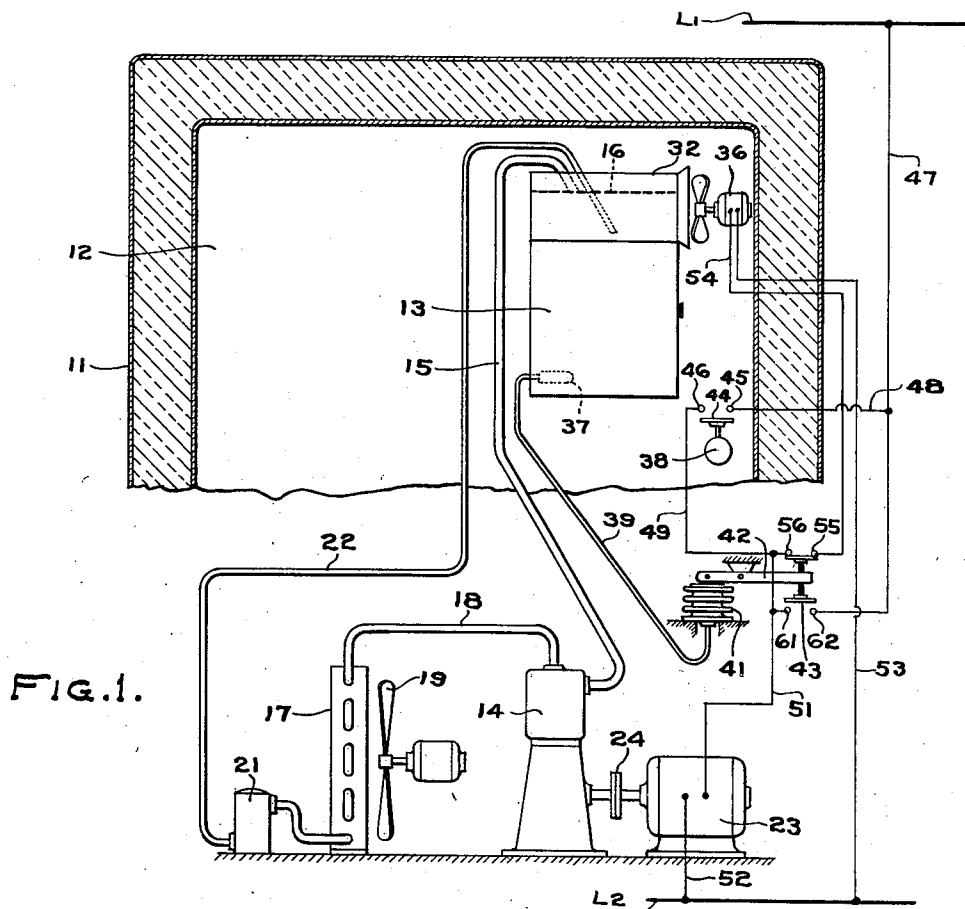
Oct. 25, 1938.

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2,133,965

REFRIGERATION APPARATUS

Filed Jan. 26, 1937



WITNESSES:

FIG. 2.

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E. Lutz

FIG. 3.

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2,133,965

REFRIGERATION APPARATUS

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5 Claims. (Cl. 62—116)

My invention relates to refrigeration apparatus and particularly to refrigeration apparatus of the type wherein two or more zones of a refrigerator are refrigerated at different temperatures.

It is an object of my invention to provide a two temperature refrigerator of improved design and of simple and inexpensive construction.

It is another object of my invention to provide a two temperature refrigerator for domestic use in which a unitary welded evaporator is adapted for use in a two temperature construction.

It is still another object of my invention to utilize portions of a welded evaporator to provide a sharp freezing chamber and to utilize other portions of the welded evaporator, preferably the header, to cool the food compartment of the refrigerator.

It is still another object of my invention to provide a novel temperature control for a two temperature refrigerator, and to provide a fan for circulating the air in the food compartment.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a diagrammatic view of a portion of a refrigerator cabinet containing an evaporator constructed in accordance with my invention and showing a motor, compressor, and condenser for circulating refrigerant through the evaporator as well as a control scheme for regulating the temperature of the evaporator and the food storage compartment.

Fig. 2 is a side elevational view of my improved evaporator with portions of the heat insulation broken away for the sake of clarity; and

Fig. 3 is a front elevational view of my evaporator showing the construction of the finned header at the top thereof.

Referring specifically to the drawing for a detailed description of my invention, numeral 11 designates a heat insulated refrigerator cabinet embodying a food storage compartment 12, in which is disposed an evaporator, generally indicated at 13, for abstracting heat from the food storage compartment 12. Refrigerant vapor is withdrawn from the evaporator 13 by a compressor 14 through a conduit 15, the evaporator being substantially filled with refrigerant to the level shown at 16. Refrigerant vapor withdrawn from the evaporator is compressed by the compressor 14 and is conveyed to a condenser 17

through a conduit 18 wherein the refrigerant is cooled and liquefied by cooling action of a fan 19. Refrigerant liquid is supplied to the evaporator 13 through a flow control device 21, shown as a float valve, and refrigerant from the float valve enters the evaporator 13 by means of a conduit 22. As refrigerant evaporates in the evaporator 13, heat is abstracted from the storage compartment 12 and the refrigerant cycle is again repeated. A motor 23 drives the compressor 14 through a suitable coupling 24.

The evaporator 13 is preferably formed of sheets of metal 25, one of which is provided with corrugations 26 therein to provide refrigerant passages. The sheets of metal are welded together at the edges and between corrugations as shown at 27 and the sheets are then bent to provide a sharp freezing chamber 28 in which ice trays 29 are disposed for freezing water. A door 31 is preferably provided for the front of the sharp freezing chamber 28 and a closure (not shown) is provided at the rear of the sharp freezing chamber 28. A metal header 32 is provided at the top of the evaporator with the refrigerant passages opening into the header so that it is filled with liquid to the level shown at 16. The header is substantially cylindrical in form and extends the entire length of the evaporator 13. An example of the type of evaporator which may be used is shown in the patent to F. L. Tarleton, #1,928,467.

In practicing my invention, the sharp freezing chamber 28 of the evaporator 13 is surrounded with heat insulation 33 to such an extent that the lower portions of the evaporator below the header are not effective to appreciably cool the food storage compartment 12, but only cool the sharp freezing chamber 28.

The header 32 of the evaporator, however, is provided with fins 34 and a shroud 35. The metal of the header 32 is directly exposed to the air in the food storage compartment 12 for abstracting heat from the latter, the fins assisting in the heat transfer between the air in food storage compartment and the header of the evaporator. A fan 36 is provided for effecting a forced circulation of air from the food storage compartment 12 through the shroud 35, over the header 32 and fins 34. Since the header 32 is substantially filled with liquid, it will cool the air passing thereover by the vaporization of the refrigerant in the header.

There is shown in Fig. 1 a control scheme for effecting refrigeration of one or the other portions of the evaporator 13. A thermostatic bulb

37 is disposed near the bottom of the evaporator 13 between the heat insulation 33 and the sheets of metal 25 and is responsive, therefore, to the temperature of the fast freezing portion of the evaporator. A box thermostat, diagrammatically shown at 38 is responsive to the air temperature of the food storage compartment 12. The bulb 37 is filled with volatile liquid and is connected through a tube 39 to a bellows 41, which bellows expands and contracts in response to temperature changes of the volatile liquid within the bulb 37 and tube 39. The bellows 41 is connected to a leverage device 42 which operates a switch generally indicated at 43 in a manner hereinafter described. The box thermostat 38 also has associated therewith a switch mechanism generally indicated at 44, more fully described hereinafter.

Operation

In the position of the apparatus shown in Fig. 1 of the drawing, both the food storage compartment 12 and the sharp freezing chamber 28 have been cooled to the desired degree and the motor 23 and the fan 26 are, therefore, idle. Assume that the temperature of the storage compartment 12 rises. In such a case, the thermostat 38 will close and will bridge contacts 45 and 46, thus starting the fan and the motor compressor unit in operation by completing the following circuits. The motor 23 is energized through a circuit beginning with the line L₁, through conductor 47, conductor 48, across the contacts 45 and 46 to conductor 49, the conductor 51 and through the motor 23 to the other side of the line L₂ through conductor 52. The fan is energized through conductor 53 connected to the line L₂, through conductor 54, through contacts 55 and 56 of switch 43, which are normally closed at this time, through conductor 49, contacts 46 and 45, conductor 48 and conductor 47 back to the line L₁. The motor compressor unit and the fan are, therefore, both energized and the food storage compartment 12 will be refrigerated by the passage of the air over the header 32, fins 34, through the shroud 35. The size of the header and the fin area are so proportioned that the amount of heat removed is sufficient to raise the suction pressure and the temperature of the header so that a relatively high humidity will result in the food storage compartment. As heretofore stated, the header is always filled to the level 16 with refrigerant and, when the fan is operating to refrigerate the food storage compartment 12, only the header will be effective for refrigeration and the remainder of the evaporator will be undisturbed in its operation and will not warm up in normal operation due to the operation of the boiler alone. In normal operation, the portion of the evaporator forming the sharp freezing chamber 28 will have been reduced to a relatively low temperature and refrigerant in the boiler at high suction pressure will, therefore, not vaporize the refrigerant in the corrugations 26.

Assume now that the food storage compartment 12 has been reduced in temperature to the desired degree, box thermostat 38 opens the contacts 45 and 46 and deenergizes the motor 23 and the fan 36. If the sharp freezing chamber 28 then calls for cooling, the volatile liquid in the bulb 37 will expand, thus expanding the bellows 41 and opening the contacts 55 and 56 and closing contacts 61 and 62. The compressor motor 23 will therefore be energized from line

L₁, through conductor 47, across contacts 62 and 61, through conductor 51, through the motor to conductor 52 and to the line L₂. The fan 36, however, will not be energized because the contacts 55 and 56 of switch 43 will be open. Since the fan is stopped, the evaporator will pull down to a low temperature, the insulation on the sides of the evaporator preventing substantial cooling of the food storage compartment 12, thereby preventing dehydration of this compartment. During this period, the header will also be at the same low temperature as the remainder of the evaporator, but, with the fan stopped, there will be substantially no air circulation past the header and therefore no cooling or dehydration will occur.

From the foregoing, it will be apparent that I have provided a two temperature refrigerating apparatus which may be formed from a unit evaporator construction and which will maintain the desired temperature in the food storage compartment without dehydration of the foodstuffs and will also provide for a sharp freezing chamber in which the liquids may be quickly congealed. In the embodiment shown herein, it is apparent that the quick freezing chamber 28 will have preference over the food storage compartment 12 since, if the low temperature portion of the evaporator is calling for cooling, the contacts 55 and 56 will be open and even though the contacts 45 and 46 controlled by the box thermostat 38 are closed, the fan 36 will not operate. It is also apparent that the switches and thermostats shown herein are shown diagrammatically and that suitable snap-acting devices will be utilized in the actual construction of such a machine.

If desired, the fan 36 may be operated at all times except when the ice freezing portion of the evaporator is calling for cooling, thus improving the temperature distribution throughout the box.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various 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 refrigeration apparatus, the combination of a refrigerator cabinet embodying a food storage compartment, an evaporator formed of sheets of metal welded together to provide refrigerant passages therein for abstracting heat from the food storage compartment, said welded evaporator having a portion bent to provide a substantially closed sharp freezing zone, heat insulation arranged to form a compartment and closing said sharp freezing zone, said evaporator having a second welded sheet metal portion extending through the heat insulation into the food storage compartment, and a fan for circulating air from the food storage compartment over the portion of the welded evaporator extending into the food storage compartment for cooling the latter.

2. In refrigeration apparatus, the combination of a refrigerator cabinet embodying a food storage compartment, a metal evaporator for abstracting heat from the food storage compartment, said evaporator having a portion formed to provide a sharp freezing zone and embodying

a plurality of refrigerant passages, header means for connecting said refrigerant passages, heat insulation arranged to form a compartment and closing said sharp freezing portion of the evaporator, said header extending through the heat insulation into the air in the food storage compartment, and a fan for circulating air from the food storage compartment over said header to cool the food storage compartment.

10 3. In refrigeration apparatus, the combination of a refrigerator cabinet embodying a food storage compartment, an evaporator for abstracting heat from the food storage compartment, said evaporator being formed of sheets of metal welded together to provide refrigerant passages and
15 a header connecting said refrigerant passages at the upper ends thereof, said passages being formed to provide a sharp freezing chamber, heat insulation arranged to form a compartment
20 enclosing said sharp freezing chamber, said header extending through the heat insulation into the food storage compartment, and a fan for circulating air from the food storage compartment over the header to cool the food storage compartment.

25 4. In refrigeration apparatus, the combination of a refrigerator cabinet embodying a food storage compartment, an evaporator for abstracting heat from the food storage compartment, said
30 evaporator being formed of sheets of metal welded together to provide refrigerant passages and a header connecting said refrigerant passages at the upper ends thereof, said passages being

formed to provide a sharp freezing chamber, heat insulation arranged to form a compartment and closing said sharp freezing chamber, said header extending through the insulation into the food storage compartment, a fan for circulating air
5 from the food storage compartment over the header to cool the food storage compartment, and fins provided on said header in the path of the air circulated by said fan to increase the heat transfer rate between the air and the
10 header.

5. In refrigeration apparatus, the combination of a refrigerator cabinet embodying a food storage compartment, an evaporator for abstracting heat from the food storage compartment, said
15 evaporator being formed of sheets of metal welded together to provide refrigerant passages and a header connecting said refrigerant passages at the upper ends thereof, said passages being formed to provide a sharp freezing chamber,
20 heat insulation arranged to form a compartment and closing said sharp freezing chamber, said header extending through the heat insulation into the food compartment and being substantially filled with refrigerant at all times, a
25 fan for circulating air from the food storage compartment over the header to cool the food storage compartment, and fins provided on said header in the path of the air circulated by said fan to increase the heat transfer rate between
30 the air and the header.

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