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LOW VOLTAGE DEFROSTING DEVICE

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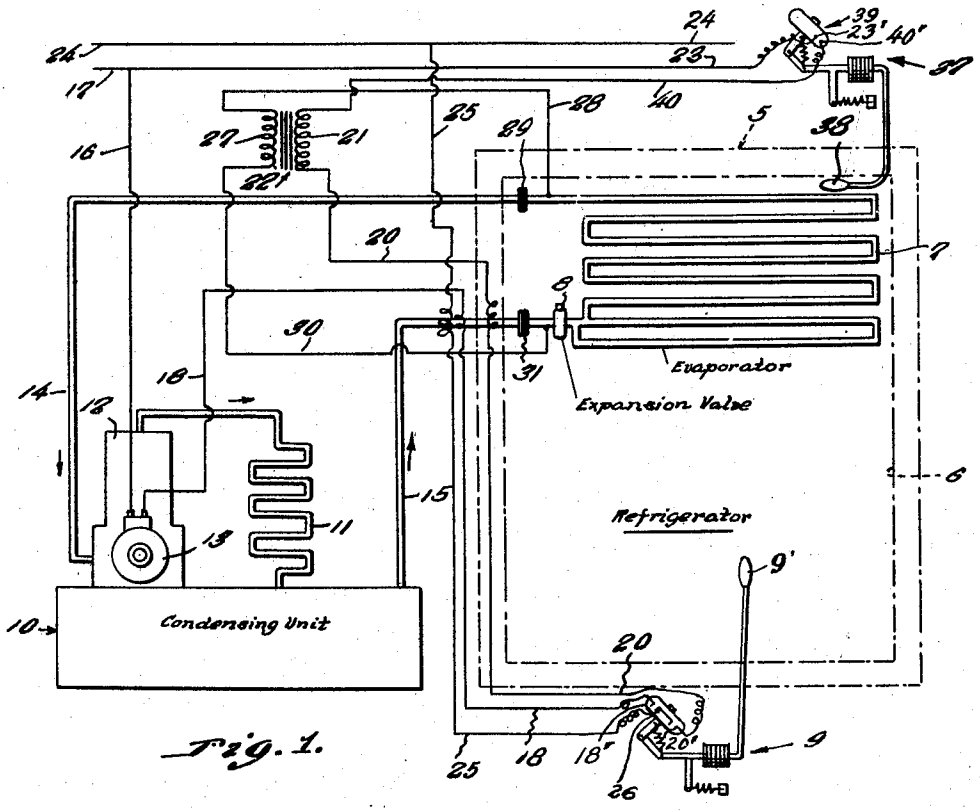


Fig. 1.

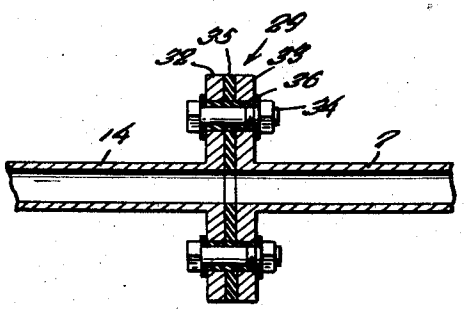


Fig. 2.

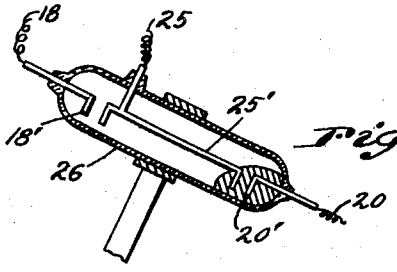


Fig. 3.

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LOW-VOLTAGE DEFROSTING DEVICE

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1 Claim. (Cl. 62—4)

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My invention relates to improvements in low voltage defrosting devices for electrical refrigerator systems of the evaporation type, and is not intended for domestic refrigeration. The primary object of my invention is to provide a substantially automatically operating arrangement of this character which is adapted to establish a low voltage defrosting circuit upon completion of the refrigeration cycle, and which will automatically eliminate frost from the evaporator even though a below freezing temperature prevails therein at the start of the defrosting cycle.

Other important objects and advantages of my invention will be apparent from a reading of the following description taken in connection with the appended drawing, wherein for purposes of illustration there is shown a preferred embodiment of my invention.

In the drawing:

Figure 1 is a general schematic diagram of the device showing the components of the present invention and the electrical and mechanical connections involved at the beginning of a defrosting period.

Figure 2 is a fragmentary enlarged vertical longitudinal sectional view taken through one of the insulated joints.

Figure 3 is an elevation of a dual contactor mercury tube.

Referring in detail to the drawings, the numeral 5 generally designates a refrigerator having a freezing compartment 6 in which are located the coils 7 of the evaporator, and the expansion valve 8 as well as part of the capillary tube with the bulb 9' of the temperature controlled mercury switch 9. The switch 9 is of a conventional type in which the effective element consists of a sealed tube of insulating material such as glass, containing a small quantity of mercury, into which contacts project. The tube is mounted in such a way on a pivot or pivots that it may be tilted and may remain in a tilted position in either direction, in accordance with the portion of the cycle of operation of the refrigerator.

The numeral 10 generally designates the receiver of the condensing unit from which rises the condenser coil 11 which is connected to the discharge of the compresser 12 which is driven by the electric motor 13, with the intake of the compressor 12 connected by the suction line 14 to the evaporator coils 7.

The liquid pipe line 15 is connected to the receiver 10 and through the expansion valve 8 to the inlet of the evaporator coil 7. One side of

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the electric motor 13 is connected by the wire 16 to one wire 17 of the A. C. supply line, while the remaining side of the motor is connected by a wire 18 to the contact point 18' at one end of the tiltable mercury tube 26 of switch 9, the tilting being controlled by the bulb 9'. The contact point 20' at the opposite end of the tiltable mercury tube 26 of the switch 9 is connected by the wire 20 to one end of the primary 21 of the low voltage transformer which is generally designated by 22. The other end of the primary 21 is connected by wire 40 through the points 40' and 23' and wire 23 of the thermoswitch 37 to the said wire 17 of the A. C. power supply line. The opposite wire 24 of the power supply is connected by a wire 25 with the contact 25' of mercury tube 26 of the switch 9.

The secondary 27 of the low voltage transformer 22 has one end thereof connected by the wire 28 to the suction end of the evaporator coil 7 here shown on the right side of the insulated joint 29, while the other end of the secondary winding 27 of the transformer 22 is connected by the wire 30 with the opposite end of the evaporator coil 7 adjacent the insulated joint 31, whereby the passage of current through the evaporator coil 7 located between the two insulation joints 29 and 31 on the piping will be able to heat the coil 7.

The second mercury switch, which is automatic, may be substantially similar to the switch 9 and is generally designated by reference numeral 37 has its thermal bulb 38 adjacent to the evaporator coil 7. The tiltable tube 39 of the mercury switch 37 has its two contacts 23' and 40' located at its right-hand end, as seen in Fig. 1, instead of at opposite ends, as is the case in tube 26 of the switch 9. The portion 23 of the wire 17 of the power source is connected to one of these tube contacts 23', while the remaining contact 40' is connected by the wire 40 with one end of the primary winding 21 of the transformer 22.

The insulated joints 29 and 31 are both alike and are shown in detail in Figure 2 of the drawings. The pipes are provided with the usual flanges 32 and 33 and with the usual bolts 34 passing through these flanges and clamping the same against opposite sides of a dielectric annulus 35. In addition to these provisions, insulating sleeves 36 are provided to surround the bolts 34 and to prevent their electrical engagement with either of the flanges or with the annulus 35, so that the pipes 14 and 15, in the arrangement shown in Figure 1 of the drawings, are insulated

from the coil section 7. The coil 7 is insulated from the body of the refrigerator to prevent grounding of the electric circuit.

The above described, is a complete defrosting arrangement for refrigeration evaporators, using low voltage for commercial but not for domestic refrigerators, wherein the control is of the double-acting type so that after the refrigeration cycle has taken place, the control mercury tube 26 of switch 9 has to be tilted back to its original position and complete the low voltage transformer circuit, thereby providing the necessary potentials across the evaporator coil 7 to raise the temperature thereof to about 32° F. A complete defrosting cycle is thus provided. By using this method of defrosting, much greater efficiency is obtained from the evaporator because of its consequent freedom from frost. By using the foregoing device with forced convectional air units on low temperature application, it has been found possible to operate the condensing unit at a much higher back pressure whereby the efficiency of the unit is greatly increased. In the cycle of this unit no definite temperatures can be given as this must be gauged by particular application. Assuming a sharp freezer, its temperature should be maintained at about 20° below zero; in ice cream hardening cabinets, about 10° below and in ice-cream dispensing cabinets 5° below zero.

The foregoing arrangements are applicable for automatically defrosting ice cream cabinets, soda fountains, and sharp freezers. It is to be noted that this device is not intended for domestic use, but for low temperature work and that, in the case of forced convection units, the present invention can be applied for completely defrosting the evaporator during the off-cycle when it is below freezing temperatures.

Referring to Figure 1 of the drawings and assuming that a refrigerator on-cycle has just been completed, then the thermoswitch 37 with mercury tube 39 will be in the position as seen in Fig. 1, due to the fact that the thermo-bulb 38, which is adjacent to the evaporator 7, is cold and also to the fact that the temperature control mercury tube 26 of switch 9 is then held in the position as seen in Fig. 1, that is the wires 25 and 18 make a complete circuit to the compressor motor 13. With the switches so set the device is now put in operation by closing the power line switch (not shown) to the motor, when the mercury tube 26 of switch 9 will keep the power line circuit closed until the predetermined temperature of the cooling compartment 6 has been reached. Upon reaching this temperature the mercury tube 26 tilts in the opposite direction and thereby completes a circuit including the wires 24 and 25, 25', 20' and through wires 20, 40 to the tube 39 of switch 37. Owing to the fact that the evaporator coil 7 has been cooled to a point below freezing temperature, the thermostatic switch 37 then turns the mercury tube 39 into closed position and said tube 39 remains in that position until the temperature of the evaporator coil 7 has been raised to about 34° F. In the said closed position the thermostatic bulb 38 with the mercury tube 39 of switch 37 brings the power supply in energizing relation to the primary 21 of the lower voltage transformer 22, through the wire 40 of the other side of the power supply.

The present defrosting device is fully automatic in every respect. There will be no accumulation of frost remaining over from the end of one compressor operating cycle to the beginning of the next one and it is not necessary to manipulate one or more switches to defrost the evaporator. The device is applicable to all low temperature evaporators, and more especially to the type using forced air units.

The mercury tube 39 actuated automatically by the thermostat-bulb 38 works in opposition to the tube 26 of switch 9, accordingly, tube 39 of automatic switch 37 opens the circuit when the temperature is rising, that is after the predetermined defrosting temperature has been reached.

Although I have shown and described herein a preferred embodiment of my invention, it is to be definitely understood that I do not desire to limit the application of my invention thereto, except as may be required by the scope of the subjoined claim.

Having described the invention, what is claimed as new is:

In combination, a refrigerating device for a temperature between 0° and minus 20° C., consisting of a vaporizing device having its terminals electrically insulated and including an evaporator coil and an expansion valve connected to said coil, a compartment in which said evaporator coil and expansion valve are located, and exteriorly to said compartment an electric power supply, a compressor, an electric motor having one side connected to one wire in the circuit of said power supply, a condenser having a condenser coil connected at one end with the discharge side of said compressor, a receiver connected with the other end of said condenser coil, a suction pipe connecting one of said insulated terminals with the intake side of said compressor, and an outlet pipe from said receiver connecting with the vaporizing device at the other insulating terminal of said vaporizing device, a step down low voltage transformer having the terminals of its secondary connected one to each of said insulated terminals thereby to heat said vaporizing device between its terminals, a thermo-control switch including a tiltable mercury tube having a thermo-bulb located within said compartment and governing the tilting of said tube, said tube having two end contacts and a central contact alternately connected with one of the end contacts or the other according to the tilted position of said tube, one of said end contacts having wire connection with the other side of said motor and the other end contact having wire connection with the primary of said transformer and the central contact having wire connection with said electric power supply, a second thermo-control automatic switch having a thermo bulb located within said compartment and a tiltable mercury tube having two contacts at one end, one of said contacts being connected with the primary winding of said transformer and the other end contact having wire connection with said electric power supply.

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