

Aug. 2, 1955

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2,714,293

DEFROSTING SYSTEMS FOR HOUSEHOLD REFRIGERATORS AND THE LIKE

Filed Feb. 21, 1952

Fig. 1

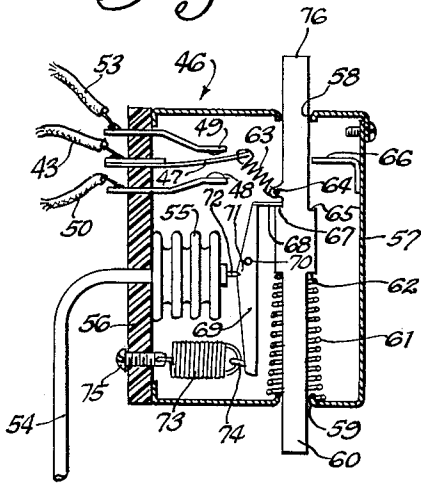


Fig. 2

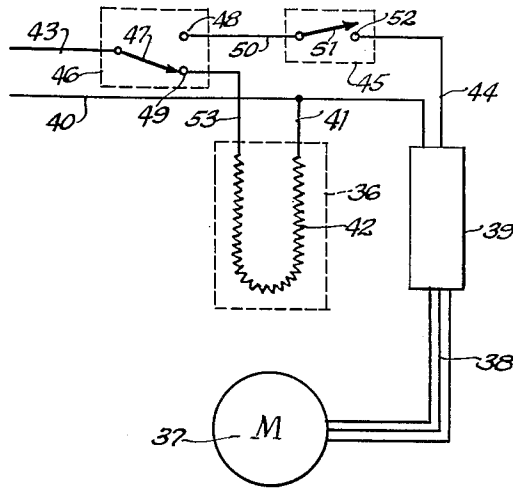


Fig. 3

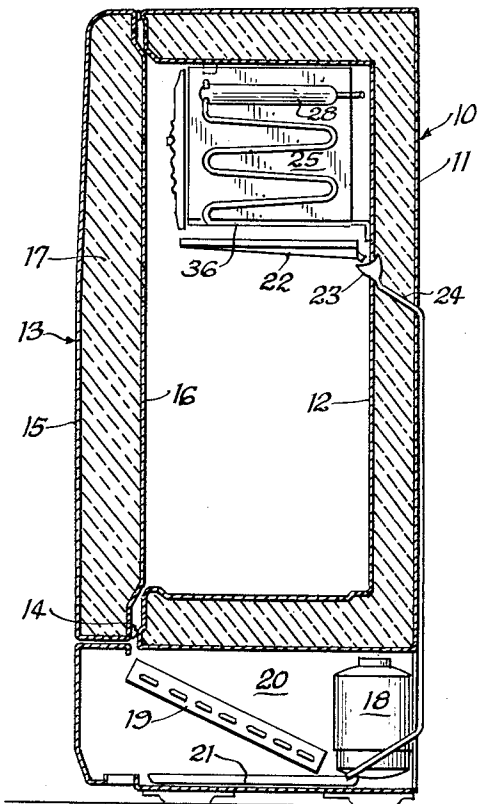
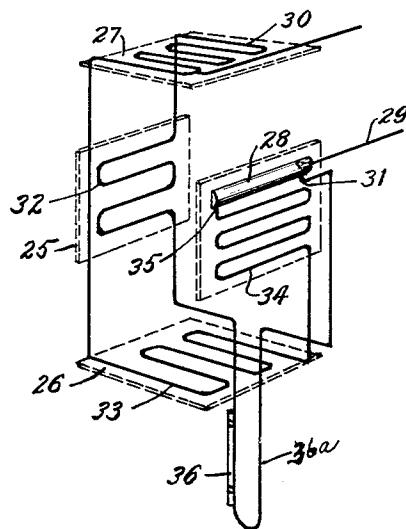


Fig. 4



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Application February 21, 1952, Serial No. 272,811

7 Claims. (Cl. 62—4)

The present invention relates to defrosting systems for household refrigerators and the like, and is particularly concerned with defrosting systems which may be initiated manually, but which are terminated automatically.

One of the objects of the invention is the provision of a semi-automatic control for defrosting refrigerators, in which a source of heat is arranged to defrost the evaporator quickly when initiated manually, and in which the defrosting is terminated by the action of a thermostatic element which is controlled responsive to evaporator temperature.

Another object of the invention is the provision of an improved defrosting system having an electric heater in which the user may start the defrosting operation at any time.

Another object of the invention is the provision of an improved defrosting arrangement utilizing a heater, in which the heater is applied to the lower parts of refrigerator tubes, and in which the heat is initiated manually and terminated automatically when the evaporator reaches a predetermined temperature, the refrigerator boiling up through the tubes to a common receiver so that all parts of the evaporator are defrosted by the application of heat to one part.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings accompanying the specification,

Fig. 1 is a sectional view taken through the housing of a defrost control switch, showing the parts of the switch in elevation;

Fig. 2 is a wiring diagram for the system;

Fig. 3 is a vertical sectional view, taken through the cabinet embodying the system, and showing the evaporator, compressor, and condenser in elevation;

Fig. 4 is a view in perspective of one form of evaporator which may be employed.

Referring to Fig. 3, the present defrosting system is shown in connection with a cabinet 10 having an outer shell 11 and a liner 12 provided with a door opening closed by a door 13. The door is provided with a suitable seal 14 and is also formed of an outer shell 15 and an inner panel 16. The door and the cabinet walls are filled with a suitable insulation 17; and the motor compressor 12 and condenser 19 may be disposed in a lower machine compartment 20.

The machine compartment 20 has an evaporation pan 21 for condensate, which is drained to the pan 21 from the drip pan 22 by means of a funnel 23 and conduit 24. The system includes a suitable evaporator 25, which may consist of a U-shaped sheet aluminum member 26 having a transverse shelf 27.

One of the walls of the U-shaped member 26 has an aperture in which a cylindrical receiver 28 is located and connected with a suction tube 29. The shelf 27 has sinuous refrigerant tubes 30 welded to its lower side.

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The sinuous tubes 30 extend across the shelf and continue sinuously at 32 down the left side of the evaporator and are connected to the U-shaped depending leg 36a, which has its other end connected to the receiver at 31. Sinuous tubes 30 have their other end connected to tubes 33 on bottom plate 26, which are connected to tubes 34.

The sinuous tubes continue at 34 up the right side of the evaporator, communicating with the receiver at 35 so that both ends of the tubes are connected to the receiver. In the sinuous tubes 32 and 34 on the sides of the evaporator the tubes are preferably downwardly sloping instead of being parallel so that refrigerant tends to boil up through the tubes to the receiver on both sides when the lowermost refrigerant tubes 33 are heated.

A heater 36 is attached to the U-shaped leg 37 by means of a clamp.

All of the details of the evaporator may be substantially as disclosed in the copending application of myself and Albert C. Rosencranz, Ser. No. 242,462, filed August 18, 1951, now Patent No. 2,654,226.

Referring to Fig. 2, this is a wiring diagram in which 37 indicates the motor for the motor compressor, preferably of the induction type, energized through the three conductors 38 by means of a motor start relay 39. The common line conductor 40 is connected by conductor 41 to the resistance wire heater 42 in heater plate 36 and is also connected to the motor starting relay.

The other line conductor 43 is connected to the motor starting relay conductor 44 through the customary controlling thermostat 45 and the defroster control 46. The defrosting control includes a movable switch arm 47 and two fixed contacts 48 and 49. Contact 48 is connected by conductor 50 to the movable contact arm 51 of the control thermostat, which has a fixed contact 52 connected to conductor 44.

The fixed contact 49 of the defrost control is connected by conductor 53 to the other terminal of the heater. The thermostatic switch 45 is controlled by the usual bulb, which may be located on the evaporator 25 adjacent the shelf 27. The defrost control 46 is controlled by another bulb, which may be located adjacent the heater 36, and which is connected by a tube 54 to a thermostatic bellows 55.

Referring to Fig. 1, this view shows the defrost control 46 with the contacts already described. The defrost control includes an insulating base 56, which supports a housing 57 having aligned bores 58, 59 for slidably supporting an insulating plunger rod 60.

The plunger rod 60 is urged upward in Fig. 1 by a helical compression spring 61, which engages an annular shoulder 62 on the plunger rod and is seated about a tubular formation at the bore 59 around the rod 60. The plunger 60 is connected by means of compression coil spring 63 to the movable contact 47. The compression coil spring may be seated about a lug 64 on the plunger 60 and about a similar projecting lug on the end of spring 47.

The spring 63 provides the contact 47 with a snap action. Plunger 60 has a stop shoulder 65 engaging an angular stop member 66 in the housing. A similar shoulder 67 is engaged by a keeper 68 on a lever 69, which is pivotally mounted at 70, but engaged by the bellows by means of a groove 71 and knife edge 72. Lever 69 is tensioned by coil springs 73, which has one end hooked to the lever at 74 and the other end secured to an adjustable screw bolt 75.

The operation of the control of Fig. 1 is as follows: The plunger 60 is ordinarily in the position in which shoulder 65 engages stop 66. In this position the lug 64 supporting spring 63 is above the contact 47, urging contact 47 into engagement with contact 48 for refrigeration, as required by the thermostatic control 45.

The spring 73 urges the keeper 68 constantly toward the latching position of Fig. 1; but the lever 69 may be moved to unlatching position by expansion of the bellows 55 when the defrosting bulb arrives at a suitable temperature.

When the user wishes to initiate defrosting, he has merely to press upon the end 76 of the plunger 60, moving the plunger against the spring 61 to the position shown in Fig. 1.

As the plunger 60 moves downward, the lug 64 passes the line of dead centers between the base of the spring 47, the end of the spring 47, and the lug 64; and the spring 63 causes the contact 47 to snap upward, engaging the heater contact 49. As the plunger 69 is pushed downward, it reaches the position of Fig. 1, where the keeper 68 engages behind shoulders 67, holding the plunger in the heating position.

This disconnects the motor compressor circuit at 48 preventing any operation of the compressor, but energizes the heater 42. The electric wire 42 in the heater 36 heats the depending leg 36a, heating the refrigerant and causing it to boil upward through the tubes 32 and 34 on both sides and across the shelf until the hot refrigerant reaches the receiver 28.

At this time all of the evaporator is heated by the refrigerant; and when the refrigerant has passed out of the tubes 33, the bottom of the evaporator arrives at a suitable temperature to actuate the bellows 55. The bellows 55 moves to the right in Fig. 1, moving the lever 69 counterclockwise on its pivot 70, and moving the keeper 68 out of engagement with the shoulder 67.

The spring 61 is stronger than the spring 63; and the plunger then moves upward against the compression of spring 63, and the spring 63 causes the contact 47 to snap downward into the refrigeration position.

Thus the evaporator is prevented from overheating by the bellows 55 and its bulb, even though for some reason it has not completely defrosted. The melting condensate drips into the drip pan 22, runs into the funnel 23 and conduit 24, and passes down to the evaporation pan 21.

The air passing over the condenser coils 19 and backwardly over the motor compressor 18 carries away the evaporating condensate, which is evaporated from the pan 21 by heat from the condenser and motor compressor.

It will thus be observed that I have invented an improved defrosting system which may be initiated manually, but which is terminated automatically, and which will quickly defrost the entire evaporator and return the system to normal refrigeration conditions after the defrosting has been completed.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. A refrigerating system, comprising an insulated cabinet, an evaporator located in said cabinet, a motor compressor and a condenser outside said cabinet and connected to supply refrigerant to said evaporator, said evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, the said sinuous tubing communicating with said header at both of its ends, and an electric heater in heat exchange with said tubing at the lowermost part of said tubing for heating the refrigerant

contained in said tubing and causing it to boil upward through one section of said tubing to said header and to circulate downward from said header toward said heater through the other section of said tubing, the circulation of heated refrigerant heating all parts of the tubing and evaporator to melt the frost from said evaporator.

2. A refrigerating system, comprising an insulated cabinet, an evaporator located in said cabinet, a motor compressor and a condenser outside said cabinet and connected to supply refrigerant to said evaporator, said evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, the said sinuous tubing communicating with said header at both of its ends, and an electric heater in heat exchange with said tubing at the lowermost part of said tubing for heating the refrigerant contained in said tubing and causing it to boil upward through one section of said tubing to said header and to circulate downward from said header toward said heater through the other section of said tubing, the circulation of heated refrigerant heating all parts of the tubing and evaporator to melt the frost from said evaporator, and switching means for disconnecting said motor compressor and for energizing said heater during the defrosting operation.

3. A refrigerating system, comprising an insulated cabinet, an evaporator located in said cabinet, a motor compressor and a condenser outside said cabinet and connected to supply refrigerant to said evaporator, said evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, the said sinuous tubing communicating with said header at both of its ends, and an electric heater in heat exchange with said tubing at the lowermost part of said tubing for heating the refrigerant contained in said tubing and causing it to boil upward through one section of said tubing to said header and to circulate downward from said header toward said heater through the other section of said tubing, the circulation of heated refrigerant heating all parts of the tubing and evaporator to melt the frost from said evaporator, and switching means for disconnecting said motor compressor and for energizing said heater during the defrosting operation, latching means for holding said switching means in the defrosting position, said switching means being spring biased away from the defrosting position and a thermostat adapted to unlatch said latching means, and having a bulb located to be responsive to the temperature of the coils adjacent said heater to cut off the defrosting operation when the coils have reached a predetermined temperature at which all frost is melted from the evaporator.

4. A refrigerating system including an evaporator provided with a supply of refrigerant, said evaporator comprising a header and a single continuous length of tubing connected at both ends to said header and providing a series circuit for refrigerant, said tubing including a first portion and a second portion in series with said first portion, one end of said tubing being connected to said header below the level of liquid refrigerant therein for supplying liquid refrigerant to said first portion, the other end of said tubing being connected to said header for conducting vaporized refrigerant from said second portion

tion to said header, and means for supplying heat to said evaporator at the lowermost part of said tubing for defrosting said evaporator, the heat supplied to said tubing being also effective for inducing the circulation of refrigerant upward through said second portion of said continuous tubing to the header and downward through said first portion from said header toward the heating means.

5. A refrigerating system including an evaporator provided with a supply of refrigerant, said evaporator comprising a header and a single continuous length of tubing connected at both ends to said header and providing a series circuit for refrigerant, said tubing including a first portion and a second portion in series with said first portion, one end of said tubing being connected to said header below the level of liquid refrigerant therein for supplying liquid refrigerant to said first portion, the other end of said tubing being connected to said header for conducting vaporized refrigerant from said second portion to said header, and means for supplying heat to said evaporator at the lowermost part of said tubing for defrosting said evaporator, the heat supplied to said tubing being also effective for inducing the circulation of refrigerant upward through said second portion of said continuous tubing to the header and downward through said first portion from said header toward the heating means, said heating means comprising an electric heater clamped in heat exchange relation with the lowermost part of said tubing for causing refrigerant to boil upward away from said heater and to draw further refrigerant downward toward said heater to be circulated throughout said continuous tubing.

6. A refrigerating system including an evaporator provided with a supply of refrigerant, said evaporator comprising a header and a single continuous length of tubing connected at both ends to said header and providing a series circuit for refrigerant, said tubing including a first portion and a second portion in series with said first portion, one end of said tubing being connected to said header below the level of liquid refrigerant therein for supplying liquid refrigerant to said first portion, the other end of said tubing being connected to said header for conducting vaporized refrigerant from said second portion to said header, and means for supplying heat to said evaporator at the lowermost part of said tubing for defrosting said evaporator, the heat supplied to said tubing being also effective for inducing the circulation of refrigerant upward through said second portion of said continuous tubing to the header and downward through

said first portion from said header toward the heating means, said evaporator comprising a sheet metal member having a wall arranged in a horizontal plane carrying said first portion of tubing, and having another wall arranged in a vertical plane carrying said second portion of tubing.

7. A refrigerating system including an evaporator provided with a supply of refrigerant, said evaporator comprising a header and a single continuous length of tubing connected at both ends to said header and providing a series circuit for refrigerant, said tubing including a first portion and a second portion in series with said first portion, one end of said tubing being connected to said header below the level of liquid refrigerant therein for supplying liquid refrigerant to said first portion, the other end of said tubing being connected to said header for conducting vaporized refrigerant from said second portion to said header, and means for supplying heat to said evaporator at the lowermost part of said tubing for defrosting said evaporator, the heat supplied to said tubing being also effective for inducing the circulation of refrigerant upward through said second portion of said continuous tubing to the header and downward through said first portion from said header toward the heating means, switching means for energizing said heater to initiate the defrosting operation, latching means for holding said switching means in the defrosting position, and thermostatic means responsive to the temperature of said tubing adjacent said heater for unlatching said latching means and moving said switching means away from the defrosting position.

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