



## UNITED STATES PATENT OFFICE

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## REFRIGERATOR PROVIDED WITH A DEFROSTING CONTROL FOR THE REFRIGERATION SYSTEM THEREOF

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10 Claims. (Cl. 62-4)

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This invention relates to refrigeration apparatus and more especially to a temperature and defrosting control for the cooling unit for such apparatus.

Automatic defrosting controls actuated by a predetermined number of door openings frequently embody a ratchet wheel or an equivalent cyclic element which is advanced slowly by the refrigerator door as it is opened and closed. When this wheel completes one revolution, it engages and moves a control member into a position to effect defrosting. This member must be released prior to, or simultaneously with, its movement to said position so that it can be returned to its original position when the cooling unit is defrosted, even though no further movement of the wheel has taken place.

It is an object of the invention to provide a novel means for releasing the defrost control member when the defrosting cycle has been initiated.

It is a further object of this invention to provide a novel defrosting control responsive to a predetermined number of door openings.

It is another object of the invention to provide a novel defrosting control in which the defrosting period may be terminated without further movements of the actuating member after the defrosting cycle has been initiated.

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

Fig. 1 is a vertical sectional view of a domestic refrigerator cabinet embodying the control of this invention;

Fig. 2 is a schematic view of some of the elements of the control mechanism of this invention and shows in full lines the position of the defrost elements during the normal freezing cycle of the apparatus, but with the temperature-controlling switch open. The dotted lines show the defrosting elements at the point at which the next door opening movement will initiate the defrosting cycle; and

Fig. 3 is a view of the same elements, the full lines showing the position of the defrost elements during the defrosting cycle and the temperature-controlling switch in the closed position. The dotted lines show the position of the temperature-controlling elements as they close the defrost switch and the defrost switch as it is being moved toward its closed position.

In the drawings, the reference numeral 10 des-

ignates a refrigerator cabinet having an upper heat insulated food storage compartment 12 and a lower compartment 14 for housing the refrigerant supplying apparatus 16. The food storage compartment is maintained at a temperature of about forty degrees Fahrenheit. The apparatus 16 comprises a sealed casing 18 enclosing a refrigerant compressor and an electric motor for driving the same. The refrigerant compressor withdraws refrigerant vapor through a suction tube 20 from an evaporator 22. The compressed refrigerant is conducted through a tube 24 to a condenser 26 wherein it is liquefied and returned through a capillary tube 28 to the evaporator 22. The electric motor is supplied with electrical energy through electric supply lines 30. The control 32 of this invention is connected in one of the supply lines by binding posts 34.

The control 32 includes a push rod 36 which contacts the door 38 of the food storage compartment 12. The operating mechanism of the control is shown in Figs. 2 and 3 and comprises the push rod 36 mounted for sliding motion in the stationary supports 42. A spring 40 is compressed by the push rod 36 whenever the door 38 is closed and returns the push rod 36 to the position shown in Figs. 2 and 3 when the door is opened. A ratchet wheel 44 is located below the push rod 36 and a dog 46, comprising a flexible spring, is secured to the push rod 36 and engages the teeth of the ratchet wheel 44 to advance the same in the counterclockwise direction by one notch whenever the door 38 is closed. A second dog 48 is pivoted on a fixed support 50 and prevents rotation of the ratchet wheel 44 in the clockwise direction whenever the door 38 is opened.

A switch arm 52, reduced to a knife edge 54 at one end, is pivoted on said edge 54 in a stationary notch 56. The other end of the switch arm 52 carries a metal bridging member 58 which is electrically insulated from the switch arm 52 by the electrical insulating material 60. The bridging member 58 bridges two electrical contacts 62 when the switch arm 52 is in its uppermost position. In its lowermost position, the switch arm 52 rests against the fixed support 64.

C-shaped spring 66 is pivoted to a path 70 on the switch arm 52 at one end and to a fixed pivot 68 at the other end. The spring 66 is stressed to bias the pin 70 towards the fixed pivot 68 to provide a snap-acting movement to the switch arm 52, as is well known in the art. A flat spring 72 is secured to the switch arm 52 and extends over the knife edge 54 to lie opposite the ratchet

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wheel 44. A small weight 73 may be attached to the end of the spring 72 to increase its weight. A pin 74 is secured to the side of the ratchet wheel 44 and engages the spring 72 to flex it downwardly as the ratchet wheel 44 revolves.

As the ratchet wheel 44 continues in its counterclockwise rotation due to repeated door openings and closings, the pin 74 is carried beyond the end of the spring 72 and suddenly releases it. The spring 72 and weight 73 thereupon snap back to their normal position with respect to the switch arm 52, swing beyond their normal position, and by their momentum move the switch arm 52 downwardly against the fixed stop 64. This initiates the defrost cycle, as will be more fully explained.

The control 32 controls the temperature of the evaporator 22 to below freezing through a well-known temperature-regulating device comprising a metal bellows 76 secured on a fixed support 78. A pin 80, provided with a knife edge at its upper end, is secured to the upper side of the bellows 76 and engages an operating lever 82 with its knife edge. The operating lever 82 is pivoted to a fixed support 84 at one end and is engaged by a tension spring 86 at the other end.

A second switch arm 88 is pivoted to a fixed support 90 at one end and carries a metal bridging member 92 at the other end, electrically insulated from the switch arm 88 by the electrical insulating material 94. The switch arm 88, when in its uppermost position, bridges two electrical contact points 96 and, when in its lower position, rests against the stop 98. The other end of the tension spring 86 is secured to the switch arm 88 at a point remote from the fixed support 90 to provide a snap action to the movements of the switch arm 88 as is well understood in the art.

The bellows 76 is subjected to the vapor pressure of a volatile liquid (not shown) in a bulb 100 which is located in heat transfer relationship with the evaporator 22. The vapor pressure of the volatile liquid is transmitted to the bellows 76 by a tube 102. The vapor pressure in the bellows 76 urges the pin 80 upwardly, and this upward movement is opposed by a spring 104 interposed between a fixed support 106 and the operating lever 82. The binding posts 34, the two electrical contact points 62, and the two electrical contact points 96 are connected in series by the electrical conductors 108.

It will be apparent from the description of the apparatus that the switch arm 88 is closed when the temperature of the evaporator 22 rises above a predetermined limit and is opened when this temperature drops below a second predetermined limit, thereby controlling the refrigerant supplying apparatus 16 to keep the temperature of the evaporator 22 between these two predetermined temperature limits. It will further be apparent that the switch arm 52, when bridging the contacts 62, allows the switch arm 88 to function as a temperature control, and that when the switch arm 52 is in its lowermost position, as shown in Fig. 3, the refrigerant supplying apparatus 16 will be rendered inactive, so that the cooling unit 22 defrosts.

A contacting finger 110 is provided on the operating lever 32 to return the defrosting switch 52 to the uppermost position shown in Fig. 2. When the evaporator is fully defrosted, it will be considerably warmer than during its normal operating temperature, and the vapor pressure of the volatile liquid in the bulb 100 will also be

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very much higher. This higher vapor pressure forces the arm 82 upwardly to the position shown by the dotted lines in Fig. 3. During its upward movement, the contacting finger 110 engages the switch arm 52 and moves it beyond its dead center position, so that the C-shaped spring 66 causes it to snap upwardly against the electric contact points 62 and thereby restore the control of the refrigerant supplying apparatus 16 to the switch arm 88.

This invention is not to be limited to defrosting of the evaporator 22 by rendering the refrigerant supplying apparatus 16 inactive, for the defrosting may be carried on by other means, such as having the apparatus 16 supply a warm refrigerant to the evaporator 22. The broad scope of the switch arm 52 is to afford normal operation of the refrigerant supplying apparatus 16 when the switch arm 52 is in one of its positions and to provide for defrosting of the evaporator 22 when it is in the other of its positions.

It will be apparent from the above that this invention provides for actuating a defrost mechanism by a member which moves slowly and which member immediately releases the defrosting mechanism when the defrosting cycle is initiated. It will further be apparent that the defrosting cycle is terminated without regard to the position of the slowly-moving member.

While the invention has been shown 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.

What is claimed is:

1. In a refrigerator including an insulated cabinet, a door thereon, a cooling unit for said cabinet, and apparatus for supplying said cooling unit with refrigerant, the combination with said refrigerator of a control mechanism comprising a control member adapted for movements between a first and a second position, said member, when in said first position, controlling said apparatus to supply refrigerant to said cooling unit and, when in said second position, controlling said apparatus to produce defrosting of said cooling unit, said control member having a resilient portion, an actuating member adapted for cyclic movement in response to a series of opening and closing movements of said door, said actuating member, during its cyclic movement, stressing said resilient portion by bending it from its normal position in a direction away from its second position and thereafter suddenly releasing said portion for return to and beyond its normal position with respect to the remainder of said control member, said flexible member moving said control member to its second position by virtue of the momentum developed by said portion on its return movement.

2. The refrigerator and control mechanism defined in claim 1 including means responsive to the temperature of said cooling unit for returning said control member to its first position when said temperature rises to above freezing.

3. The refrigerator and control mechanism defined in claim 1 including means responsive to the temperature of the cooling unit for controlling said apparatus to maintain said temperature substantially constant when said control member is in said first position and to move said control member from the second to the first position when said temperature rises to above freezing.

4. In a refrigerator including an insulated cabinet, a door therefor, a cooling unit for said

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cabinet, electrically-driven refrigerant supplying apparatus for said cooling unit, and electric supply lines for said apparatus, the combination with said refrigerator of control mechanism comprising a ratchet wheel adapted to be rotated by the opening and closing of said door, a switch in one of said electric supply lines, said switch having a resilient member thereon and adapted to be engaged by said ratchet wheel when said switch is in the closed position to flex said member to bias said switch against opening thereof, said wheel releasing said member upon further movement of said wheel, said member, thereupon, returning to and swinging beyond its normal position with respect to said switch with sufficient momentum to open the same, a second switch in series with said first-named switch, and means responsive to the temperature of said cooling unit to actuate said second switch to maintain the temperature of said cooling unit substantially constant when said first-named switch is closed, said means being arranged to close said first-named switch when said temperature rises to above freezing.

5. Control mechanism for refrigeration apparatus including a cooling unit, said mechanism comprising a first control member adapted for movements between a first and a second position, a connection between said control member and said mechanism to cause said refrigeration apparatus to refrigerate said cooling unit when said control member is in said first position and to cause said refrigeration apparatus to discontinue to refrigerate said cooling unit when said control member moves from said first to said second position, an actuating member adapted to move in response to temperature changes of said cooling unit to positions which vary with the temperature of the cooling unit, a second control member actuated by said actuating member through resilient means, said second control member being adapted for movement to a first and to a second position, and adapted to render said refrigerating apparatus active when in said first position provided said first control member is in its first position and to render said apparatus inactive when said second control member is in said second position thereby maintaining the temperature of said cooling unit substantially constant when said first control member is in its first position, said actuating member being adapted to move said first controlling member from its second to its first position when the temperature of said cooling unit rises to above freezing temperatures.

6. Control mechanism for refrigerating apparatus including a cooling unit, an electrically-driven refrigerant apparatus for supplying re-

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frigerant to said cooling unit, and electric supply lines for operating said apparatus, said mechanism comprising a first and a second electric switch adapted to be located in said lines in series with said apparatus, said first switch being actuated through resilient means by an actuating member adapted for response to the temperature of said cooling unit to assume a plurality of positions, said first switch and actuating member controlling said apparatus to maintain said cooling unit at a substantially constant temperature, said actuating member closing said second switch when the temperature of the cooling unit rises to above freezing temperatures.

7. A control mechanism for mechanical refrigeration apparatus including a cooling unit, said refrigeration apparatus comprising a control member adapted to move between a first and a second position, a connection between said control member and said mechanism to cause said refrigeration apparatus to refrigerate said cooling unit when said control member is in said first position and to cause said refrigeration apparatus to discontinue to refrigerate said cooling unit when said control member moves from said first to said second position, said control member having a weighted resilient portion, said mechanism also including an actuating member adapted for cyclic movement, said actuating member being positioned to engage said resilient portion during the course of said cycle if said member is in said first position, flex said resilient portion from said first position in a direction away from the second position thereof, and thereupon release said resilient portion, whereupon said resilient portion snaps back to and beyond its first position, the weight and speed of said resilient portion, on snapping back, being such that its momentum moves said control member to its second position.

8. Control mechanism as defined in claim 7 including means adapted for response to the temperature of said cooling unit for moving said control member from said second to said first position when said temperature rises to above freezing.

9. Control mechanism as defined in claim 7 in which said actuating member is a ratchet wheel adapted to be rotated by the opening and closing of a door associated with said apparatus.

10. Control mechanism as defined in claim 7 including a snap-acting device for controlling said movements of the control member.

GRAHAM S. McCLOY.

No references cited.

**Certificate of Correction****Patent No. 2,459,083.****January 11, 1949.****GRAHAM S. McCLOY**

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 2, line 48, before "C-shaped" insert *A*; same line, for the word "path" read *pin*; column 6, line 17, for the words "refrigeration apparatus" read *mechanism*; line 20, for "mechanism" read *refrigeration apparatus*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of May, A. D. 1949.

[SEAL]

**THOMAS F. MURPHY,**  
*Assistant Commissioner of Patents.*