Jan. 16, 1951 E. H. AYERS 2,538,639

REFRIGERATOR DEFROSTING DEVICE

Filed May 28, 1948

Fig. 1.

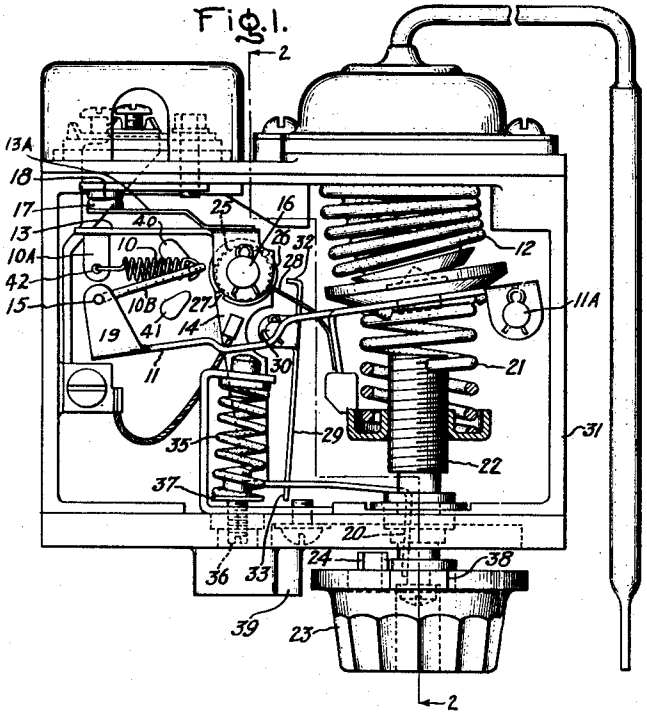


Fig. 2.

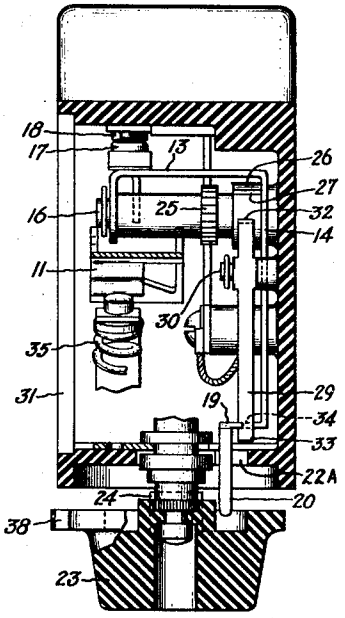


Fig. 3.

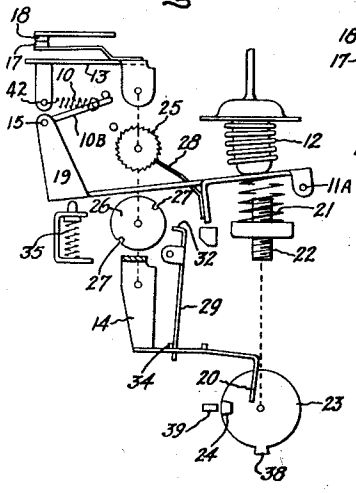


Fig. 4.

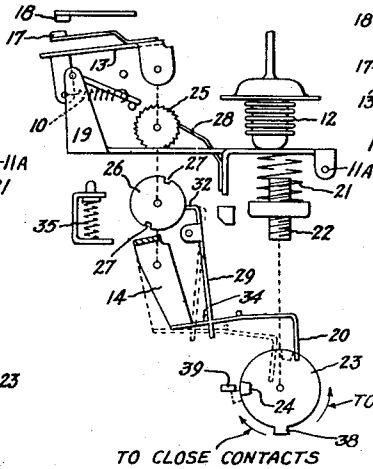
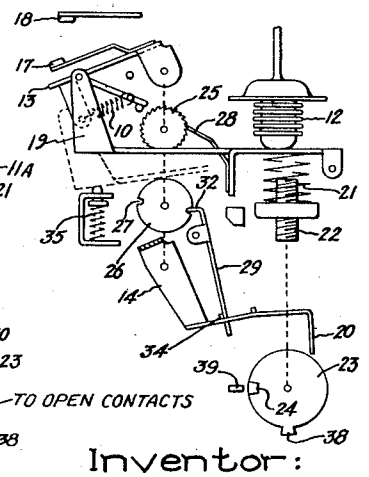


Fig. 5.



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REFRIGERATOR DEFROSTING DEVICE

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7 Claims. (Cl. 200—83)

1

My invention relates to control devices, more particularly to electric refrigerating motor control devices, and has for its object a simple and reliable arrangement providing an automatically operable defrosting cycle.

This invention is an improvement over the invention described and claimed in Patent 2,314,240, issued to Joseph W. Owens on March 16, 1943, and assigned to the same assignee as this invention.

In carrying out my invention in one form, I provide a ratchet arrangement progressively movable in response to recurrent movements of a pressure-actuated device responsive to temperature changes. This device in turn is associated with an operating member responsive to the movement thereof to operate a switch member between open and closed circuit positions in response to upper and lower temperature limits. Associated with the ratchet is a stop member comprising a disk having a plurality of depressions in the periphery thereof. The stop member is adapted to move in step with the ratchet and arranged to engage a member coupled to said switch member. In the unengaged relation of the coupling member and one of the depressions in the stop member, this member serves to limit the distance the switch can open. When the coupling member engages one of the depressions this limiting action is removed and the switch is opened an abnormally greater distance. As a result of this arrangement, the operating member requires an appreciably greater movement to close said switch member. This greater movement requires a higher pressure in the actuating device, and so provides a correspondingly higher temperature for defrosting.

For a more complete understanding of my invention reference should be had to the accompanying drawing in which Fig. 1 is a plan view of a control device embodying my invention; Fig. 2 is a sectional view along the line 2—2 of Fig. 1 looking in the direction of the arrows; Figs. 3, 4 and 5 are diagrammatic presentations of sequential operating movements of the device.

Referring to the drawing, in one form of my invention I provide over-center spring snap operating means for the switching means comprising a pivoted switch arm or lever 13 mounted on a pivot 16 and provided with a flexible arm 13A carrying on its end a movable contact 17 which cooperates with a stationary electric contact 18. This switch arm 13 is actuated by a pivoted operating arm or lever 11 having a pivot 11A and operated by a temperature responsive device or bellows 12. The over-center spring connection between these two arms 11 and 13 comprises a U-shaped link 10B having its ends pivotally secured on a pivot 15 on the ends of two laterally-

2

extending projections 19 (only one of which is shown) which are spaced apart and secured to the end of the operating arm 11. The cross or base portion of the link is connected by an over-center helical tension spring 10 with a projection 10A on the end of the switch arm 13 and extending laterally therefrom. This projection 10A is positioned to move between the projections 19 upon relative movement between the two arms 11 and 13. Stops 40 and 41, made of electrically-insulating material, are provided on opposite sides of the link 10B adjacent its closed movable end for the purpose of limiting the movement of this end.

In the operation of this over-center snap mechanism, the determining factor is the relative positions of the pivot 15 and the pivot 42 forming the connection between the spring 10 and the projection 10A. When the pivot 15 is below the pivot 42, as viewed in Fig. 1, the spring applies a force holding the link 10B against the upper stop 40 and a force to the arm 13 biasing it in a counterclockwise direction so as to hold the contact 17 in engagement with the contact 18. If now the arm 11 is raised, as viewed in Fig. 4, until the pivot 15 is slightly above the pivot 42, then the spring applies a component of force tending to move the link 10B clockwise about its pivot 15 into engagement with the lower stop 41. This, of course, changes the position of the end of the spring and thereby reverses its component applied to the arm 13. As seen in Fig. 4, the spring applies a force along a line passing through the pivot 42 and extending above the pivot 15. Soon after the link 10B begins to move downward, the line of force of the spring moves below the pivot 16 whereby a counterclockwise torque is applied to the arm 13 and the arm is therefore snapped in a counterclockwise direction to cause the contacts to assume an open circuit position.

In accordance with my invention, I provide for an abnormally great movement of the arm 13 in the circuit opening direction whereby the pivot 42 is allowed to move to a lower position, as seen in Fig. 5, and as a result, in order to move the contact arm 13 to its closed circuit position the arm 11 must be moved correspondingly lower. To effect this, a higher bellows pressure and higher temperature are required with the result that the evaporator of the refrigerator, to the temperature of which the bellows is responsive, is allowed to reach a high defrosting temperature before the refrigerator motor is restarted.

In the form of my invention shown, I also provide an extension 14 extending downwardly and laterally from the switch arm 13, as viewed in Fig. 2. On its end this extension 14 is provided with a portion 20 behind a bellows spring adjusting screw 22, parallel therewith, and projecting

through an aperture 22A provided for it in the enclosing casing 31 for bringing the mechanism into cooperative relation with a knob 23 secured on the end of the adjustment screw 22.

Control of the desired refrigerating temperature is accomplished by adjusting a loading spring 21 by means of the adjusting screw 22. Rotation of the knob 23 causes engagement of a projection 24 on the inner end of the knob with the downwardly-extending portion 20.

When the knob 23 is rotated in a counterclockwise direction it will cause the projection 24 to actuate the portion 20 thereby to open the contacts 17—18 and disable the refrigerator. Increasingly colder temperatures are provided by rotating the knob in a clockwise direction. Normal defrosting of a refrigerator, utilizing the type of control just described, is accomplished by disabling the refrigerating unit until the frost has melted from the evaporator. This is, of course, a manual operation and requires the personal attention of the operator.

The abnormally greater movement of the contact 17 above referred to is accomplished in the following manner. I provide a ratchet wheel 25, having integral therewith an annular stop member 26 which has on the periphery thereof a plurality of depressions 27. The ratchet wheel and stop member are rotatably supported on the pivot 16 of the switch arm 14. Means for progressively moving the ratchet wheel and stop member in response to contractive movements of the bellows 12 is provided by engagement of the ratchet wheel with a dog or ratchet arm 28 secured to the bellows lever or operating arm 11. The dog is attached by soldering, welding or other suitable means.

Means for controlling the movement of the contact 17 during normal operation of the refrigerator is provided by a coupling member 29 pivotally mounted on a pin 30 which is secured to the case 31. The coupling member 29 is pivotally mounted so as to be balanced about a fulcrum which is disposed intermediate the middle portion of this member and one end thereof. The last-mentioned end is provided with a lateral member 32 for engagement with the depressions 27 in the stop member 26. Since the fulcrum of the coupling member 29 is disposed as just described, a small movement of the lateral portion 32 will cause an appreciably greater movement of the lower portion 33 of said member.

The portion 33 is so arranged that it comes to rest against a transverse portion 34 provided for in the member 14. This arrangement serves to limit the movement of the switch arm 13 and its associated parts during the normal operation of the bellows 12 as will be presently explained.

Referring now to Fig. 3 there is illustrated, diagrammatically, the operating position of the control device when the unit is in its refrigerating phase, the contacts 17—18 being in a closed position. It will be observed that the coupling member 29 is so disposed that the lateral portion 32 thereof is now an appreciable distance from the stop member 26.

Assuming now that the temperature in the refrigerator has reached a suitable refrigerating value, the bellows 12 will contract due to the lowered temperature and the lever 11 will move upwardly to cause the contact 17 to move away from its associated contact 18 through the medium of over-center spring arrangement. The resulting movement of the operating arm 11, as shown in Fig. 4, in addition to moving the contact 17, simultaneously causes the ratchet wheel 25 to move progressively in a counterclockwise direction and the lateral portion 32 of the coupling member to bear against the stop member 26. The last-mentioned action has a braking effect on the stop member and limits the movement of contact carrying lever 13. The braking effect also prevents the movement of the ratchet wheel 26 in a clockwise direction when the bellows 12 starts its expansive movement.

In Fig. 5, the stop member 26 has been progressively rotated in the manner above-described until one of the depressions 27 engages the lateral portion 32 of the coupling member 29. In this position of the coupling member, the contact 17 has moved an abnormal distance away from the contact 18 and as a result the bellows 12 will now have to expand over a greater distance in order to trip the over-center spring arrangement which controls the movement of the contact arm 13. This requirement of added expansion of the bellows 12 creates a demand for an increase of temperature in the refrigerator. In the process of expanding, the bellows 12 gradually forces the lever or operating arm 11 against an auxiliary load spring 35 which further augments the increase in temperature and the load which the bellows must overcome before the tripping action of the over-center spring arrangement can take place. The load member 35 is made adjustable by the provision of threaded member 36 in threaded engagement with the case 31, the unthreaded end of the member being terminated in a flange 37, the size of which is adapted to accommodate the load member 35.

When it is desirable at any time during the aforementioned automatic defrosting cycle, illustrated in Fig. 5, to place the unit in operation for refrigerating, I provide by means of the projection 24 on the inner side of the knob 23, independent means for closing the contacts 17—18. This I do by rotating the knob 23 in a clockwise direction until a projection 38 on the periphery of the knob abuts a stop 39 on the case 31. In this position the projection 24 now urges the lateral portion 20 to the left, with respect to the drawing, thereby to move the contact 17 into closed circuit relation with the contact 18 through the medium of the lever 13.

The embodiment of my invention which I have described and illustrated was selected for the purpose of setting forth the principles involved. It will be obvious that the invention may be modified to meet various conditions and it is, therefore, intended to cover by the appended claims all such modifications which fall within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a refrigerator control device, a pivoted overcenter switch lever, a pivoted temperature responsive operating lever coupled to actuate said switch lever overcenter and movable recurrently between spaced-apart switch opening and switch closing positions at which such actuation takes place, said switch opening and switch closing positions defining lower and upper temperature limits respectively, a freely movable stop member associated with said switch lever to determine said switch closing position of said operating lever, said stop member normally being positioned to determine a first switch closing position defining a normal upper temperature limit, and means progressively movable by recurrent move-

ment of said operating lever for recurrently positioning said stop member to determine a second switch closing position beyond said first switch closing position, thereby to define an abnormally high upper temperature limit.

2. In a refrigerator control device, a pivoted overcenter switch lever, a pivoted temperature responsive operating lever, a spring member connected to couple said levers and bias said switch lever to either of a pair of spaced-apart open and closed positions, said open and closed positions defining lower and upper temperature limits respectively, a freely movable stop member associated with said switch lever for determining said open position, said stop member normally being positioned to determine a first open position defining a normal upper temperature limit, and means progressively movable by recurrent movement of said operating lever while said switch lever is in said closed position and said stop disengaged for recurrently positioning said stop member to determine a second open position defining an abnormally high upper temperature limit.

3. In a refrigerator control device, a temperature responsive member, a lever directly actuated by said temperature responsive member, a pivoted snap action overcenter switch arm coupled to said lever and actuable thereby between spaced-apart open and closed positions, said open and closed positions defining upper and lower temperature limits respectively, a freely movable stop member associated with said snap action switch arm for determining said open position, said stop member normally being positioned to determine a first open position defining a normal upper temperature limit, and means progressively movable by recurrent movement of said lever while said switch arm is in said closed position and said stop disengaged for recurrently positioning said stop member to determine a second open position of said switch arm defining an abnormal upper temperature limit.

4. In a refrigerator control device, a pivoted overcenter switch arm, a pivoted temperature responsive operating arm coupled to actuate said switch arm overcenter and movable recurrently between spaced-apart switch opening and switch closing positions, said switch opening and switch closing position defining lower and upper temperature limits respectively, a freely rotatable annular stop member associated with said switch arm to determine a first switch closing position defining a normal upper temperature limit, said stop member being provided with at least one depression in the periphery thereof to determine a second switch closing position defining an abnormally high upper temperature limit, and means progressively movable by recurrent movement of said operating arm for rotating said stop member while it is disengaged, retractive reverse movement of said operating arm occurring while said switch arm is in said open position and said stop member engaged and held.

5. In a refrigerator control device, a movable temperature responsive member, a lever directly actuated by said temperature responsive member, a snap action overcenter switch arm coupled to said lever and actuable thereby recurrently between spaced-apart open and closed positions, said open and closed positions defining switch opening and switch closing positions of said lever and corresponding lower and upper temperature limits respectively of said temperature responsive member, a freely rotatable annular stop member disposed to limit movement of said switch arm and thereby to determine a first switch closing lever position and a corresponding normal upper temperature limit, said stop member being provided with at least one depression in the periphery thereof to determine a second switch closing lever position and a corresponding abnormal upper temperature limit, and means progressively movable by recurrent switch opening movement of said lever to rotate said stop member and position said depression to define said second switch closing position.

6. In a refrigerator control device, the combination of a pivoted overcenter switch arm, a temperature responsive pivoted operating arm, a spring operatively connected between said arms and arranged to bias said switch arm overcenter to spaced-apart open and closed circuit position, a freely rotatable stop member arranged to determine the open circuit position of said switch arm, a progressively movable member actuated by switch opening movement of said operating arm for recurrently moving said stop member to an abnormal position upon completion of a predetermined number of movements of said operating arm thereby to provide for an abnormal open circuit position of said switch arm whereby an increased movement of said operating arm is required to move said switch arm to its closed circuit position, and resilient means in the path of movement of said operating arm for resisting the increased movement thereof thereby to require an increased temperature to actuate said operating arm to move said switch arm to its closed circuit position.

7. In a refrigerator defrosting device, a movable temperature responsive operating member, a first lever pivotally mounted and coupled to be moved directly by said operating member, a pair of contacts, a second pivotally mounted lever coupled to said first lever for overcenter actuation by said first lever and arranged to support one of said contacts for movement relative to the other contact, a ratchet member freely rotatably supported on the pivot of said second lever, means mounted upon said first lever for progressively moving said ratchet member in response to recurrent switch opening movements of said operating member, an annular stop member connected to said ratchet member and arranged normally to determine the open circuit position of said second lever, said stop member having a depression in the periphery thereof providing for abnormal switch opening movement of said second lever, and a member pivotally mounted to engage said stop member and said second lever, thereby to couple said stop to determine the open circuit position of said second lever and to release said stop member for free advancing movement upon recurrent switch opening actuating movement of said operating member.

EDGAR H. AYERS.

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