Feb. 11, 1941. A. O. GROOMS 2,231,532

REFRIGERATING APPARATUS

Filed April 16, 1938 4 Sheets-Sheet 1

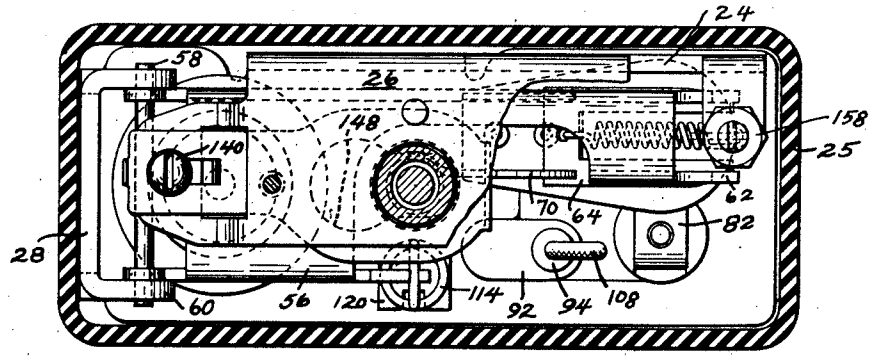


Fig. 2

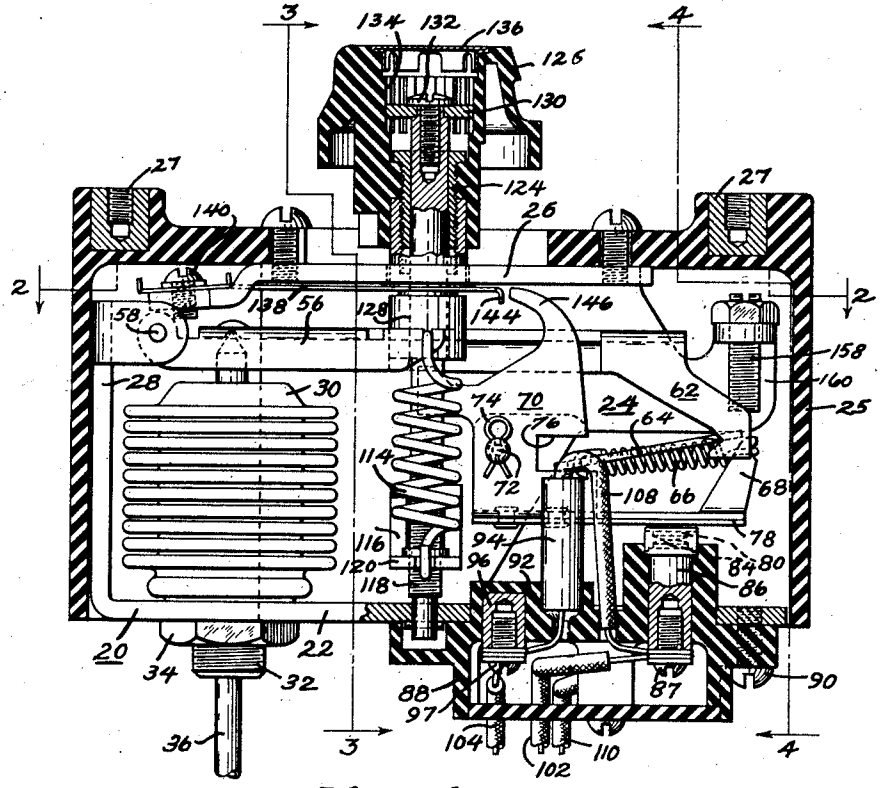


Fig. 1

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REFRIGERATING APPARATUS

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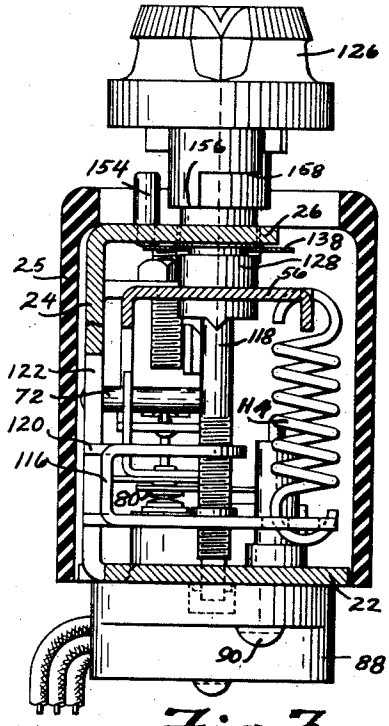


Fig. 3

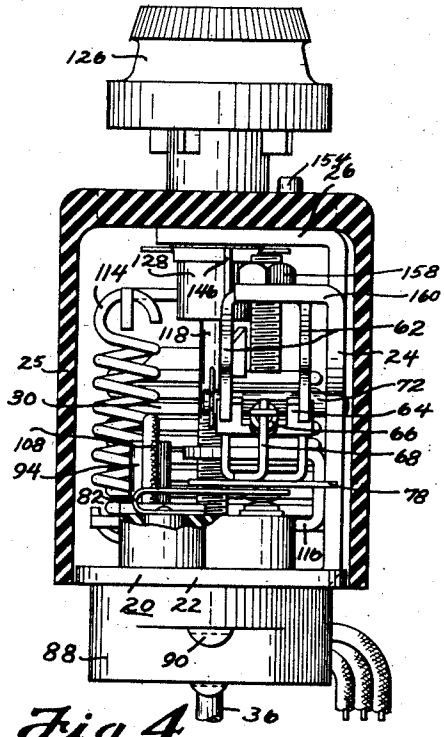


Fig. 4

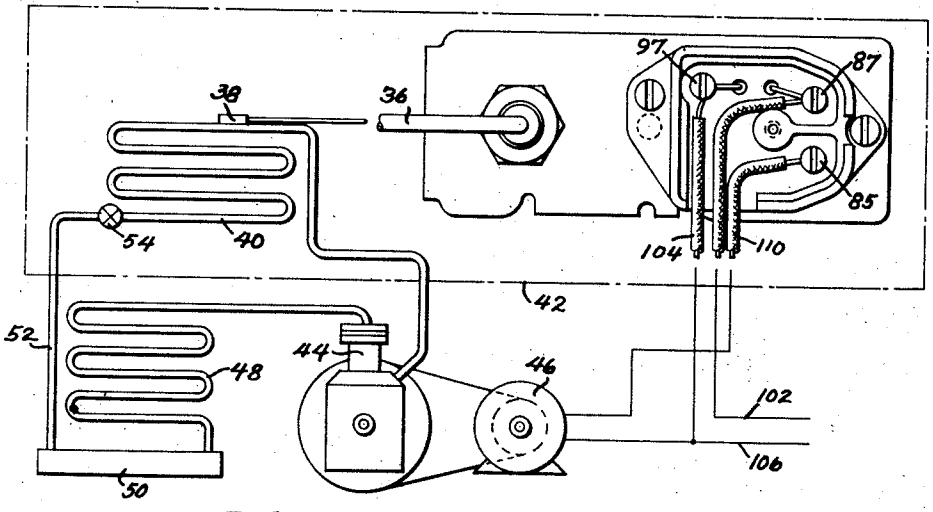


Fig. 5

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REFRIGERATING APPARATUS

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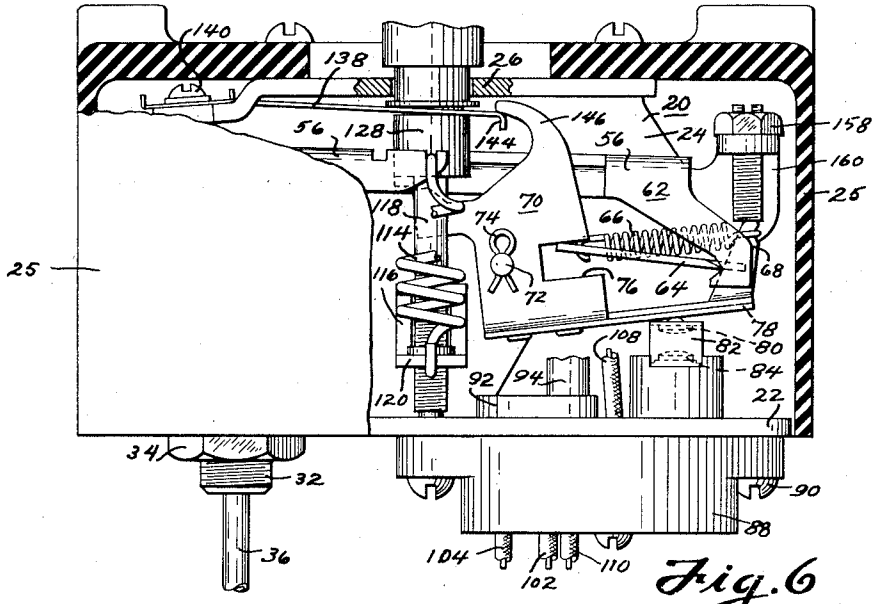


Fig. 6

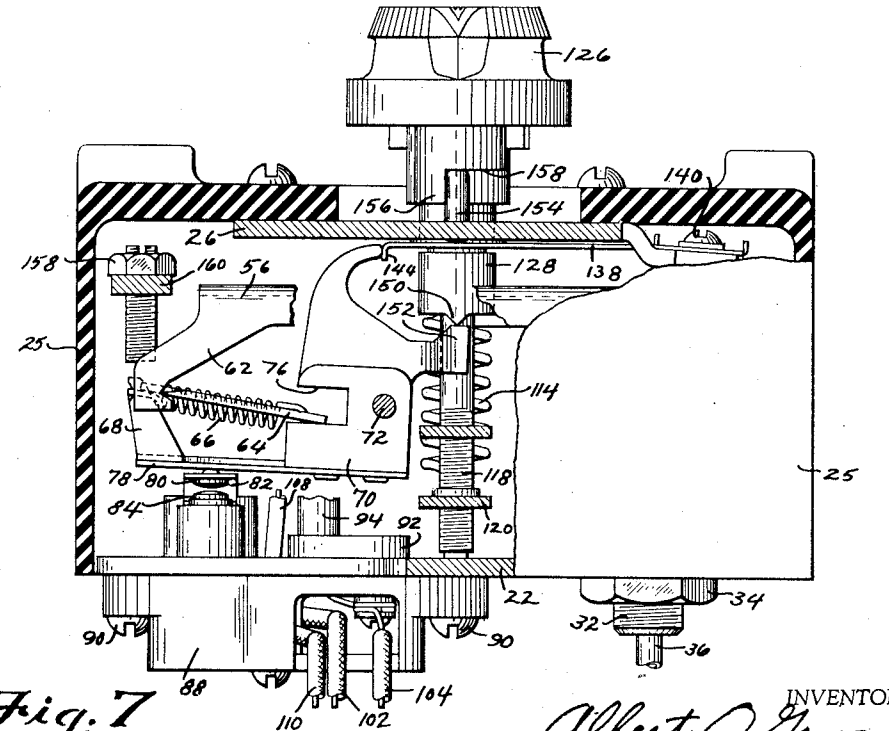


Fig. 7

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REFRIGERATING APPARATUS

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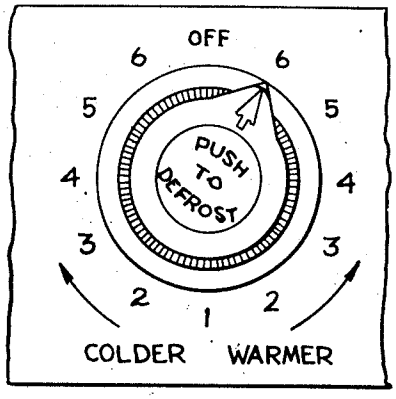


Fig. 9

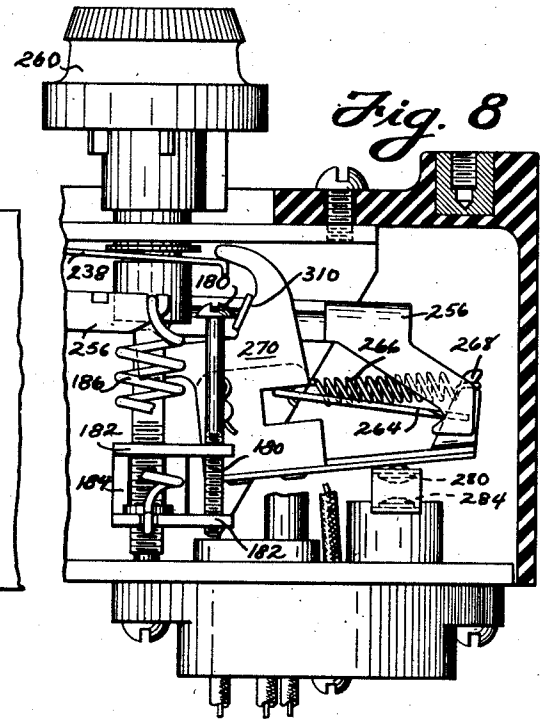


Fig. 8

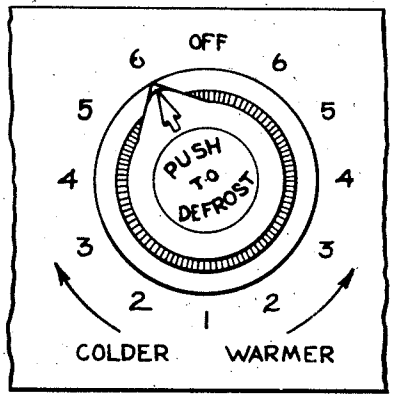


Fig. 11

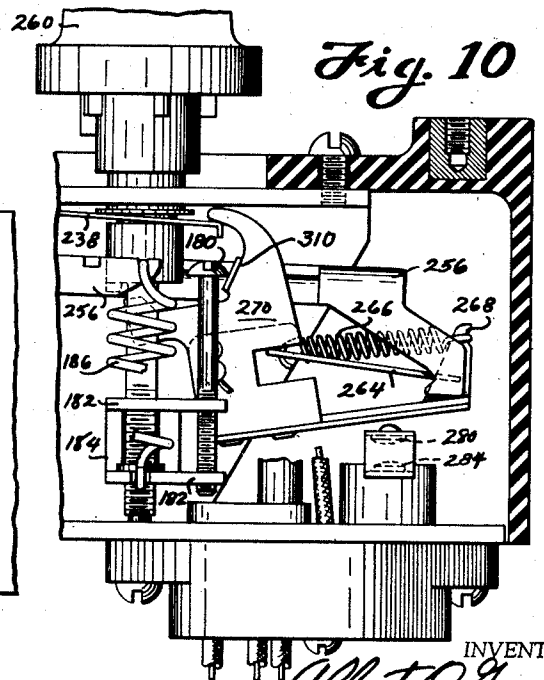


Fig. 10

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Patented Feb. 11, 1941 2,231,532

UNITED STATES PATENT OFFICE

2,231,532

REFRIGERATING APPARATUS

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Application April 16, 1938, Serial No. 202,515

10 Claims. (Cl. 200—83)

This invention relates to refrigerating apparatus and more particularly to refrigerator control.

In refrigerator controls it has been deemed necessary to satisfy the demands of the public to provide a control in which a considerable range of temperature adjustment is provided together with a single cycle automatically reset defrosting device, as well as a convenient device for shutting off the refrigerator. To provide a control which incorporates all these features has required a rather complicated and expensive structure.

It is an object of my invention to so improve the structure of refrigerator controls that all these functions may be accomplished in a very simple control.

It is a further object of my invention to make it possible to provide satisfactory defrosting by a single cycle defrosting means in any position of the temperature regulator.

Recently it has been customary to place refrigerator controls directly within the food storage compartment of refrigerators. I find that under such conditions the parts of the control tend to corrode, especially where high humidity prevails.

It is a further object of my invention to prevent this corrosion, and particularly to provide a carbon resistance heater in parallel electric circuit relationship with the switch contacts so that a small supply of heat is always available for preventing this corrosion.

Heretofore single cycle automatic reset defrosting devices have been in the form of a single cycle loading device which loads the temperature responsive means or bellows for a single cycle. This necessitates considerable additional mechanism and it is an object of my invention to simplify the refrigerator control by eliminating this single cycle loading mechanism in a control providing automatic reset defrosting.

It is another object of my invention to provide a single cycle automatic reset defrosting device for a refrigerator control in which the stop means for the snap acting toggle switch device is changed so as to provide a higher switch closing temperature for defrosting purposes.

It is another object of my invention to provide a refrigerator control in which a single knob controls the temperature regulation, the automatic reset defrosting device, and the manual shut-off.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical sectional view through the refrigerator control embodying my invention;

Fig. 2 is a sectional view taken along the lines 2—2 of Fig. 1;

Fig. 3 is a sectional view taken along the lines 3—3 of Fig. 1;

Fig. 4 is a sectional view taken along the lines 4—4 of Fig. 1;

Fig. 5 is a diagrammatic view showing the bottom of the refrigerator control connected to a refrigerating system;

Fig. 6 is a front view partly in section showing the control in single cycle defrosting position;

Fig. 7 is a rear view of the refrigerator control showing the switch in "off" position;

Fig. 8 is a fragmentary front view of a modified form of control shown in defrosting position with the temperature regulating knob in the warmest position;

Fig. 9 is a view of the temperature regulating knob and its dial plate with the knob shown in warmest position;

Fig. 10 is a view similar to Fig. 8 in which the temperature regulating knob is in its coldest position; and

Fig. 11 is a view of the temperature regulating knob in its coldest position together with its dial plate.

Briefly, I have shown a refrigerator control having a bellows and a cycling snap acting switch mechanism in which the switch lever is provided with a normal stop in the form of a leaf spring which determines the normal differential of the switch and a second stop in the form of a screw which controls the cut-in point for the single cycle when the normal stop is rendered ineffective to produce a single defrosting cycle. In one form the defrosting cycle is kept at a constant upper temperature limit by a compensating device operated by the temperature regulating mechanism. A carbon type heater of a fraction of a watt rating is connected in parallel electric circuit relation with the switch contacts for heating the interior of the switch casing to prevent corrosion of the switch parts.

Referring now more particularly to the drawings there is shown a frame member 20 formed of a single piece of heavy metal which is bent so as to form a frame extending over substantially all of the bottom 22 of the switch as well as the major portion of the side 24, the top 26 and one end 28 of the switch. The operating bellows 30 rests upon the bottom portion 22 of the frame member 20 and has a threaded neck 32 extending through the aperture in the base portion 22 and fastened by a thin nut 34. A small tube 36 extends from the neck and is connected to a thermostat bulb 38 which is mounted in heat exchange relationship with the evaporating means 40 as is shown in Fig. 5.

The evaporating means 40 as well as the refrigerator control is mounted within the food compartment 42 of a domestic refrigerator as indicated diagrammatically in Fig. 5. The evaporat-

ing means is a part of the refrigerating system which includes a compressor 44 driven by an electric motor 46 for withdrawing evaporated refrigerant from the evaporating means 40, and forwarding the compressed refrigerant to a condenser 48 where the compressed refrigerant is liquefied and collected in a receiver 50. From the receiver 50 the liquid refrigerant is forwarded through a supply conduit 52 under the control of an expansion device 54 to the evaporating means 40.

The bellows 30 is provided with a conical pointed tip which engages a pressed metal bellows follower lever 56 pivoted upon the pivot pin 58 which extends through the ears 60 formed from the end portion 28 of the frame member 20. The bellows follower lever 56, at the end opposite the pivot pin 58, has a pair of bent down portions 62 provided with notches which receive a flat secondary toggle lever 64, which has a general U-shape and has knife edges upon the legs of the U-shaped portion which engage the notches provided in the portion 62 of the bellows follower lever 56. The portion of the U-shaped lever 64 which connects the legs of the U-shape is hooked by a tension type coil toggle spring 66 which has its other end hooked around an upwardly extending post 68 of the contact lever 70. This contact lever 70 is pivoted upon a pivot pin 72 and held in place by a spring clip 74 which engages grooves in the pivot pin 72. The contact lever 70 is also provided with a notch 76 which serves as a stop for the secondary lever 64, and aids in providing satisfactory contact pressure for holding the contacts in closed position until tripping time.

The bottom of the contact lever 70 has riveted to it a thin sheet of insulating material 78 which bears upon the rivet head of the movable contact 80. This movable contact 80 is fastened to the free end of a very thin U-shaped strip 82 of spring bronze, beryllium copper or similar material. The other end of this U-shaped strip is fastened in place by a rivet mounted upon the top of a metal post 86. This metal post 86 is lodged within an insulating member 88 which is fastened to the bottom portion 22 of the frame member 20 by screws 90. This insulating member 88 has portions which extend upwardly through the aperture in the bottom portion 22 which include a portion surrounding the post 86 and a second portion 92 which receives a carbon heater 94 as well as a binding post 96.

The post 86 is connected by a screw 87 to the conductor 102 which connects to the power line while the binding post 96 is connected by a screw 97 to the connector 104 connecting it to the other power line 106. The carbon heater 94 is connected by the conductor 108 to the fastening screw 87 on the post 86 and connected by a shorter conductor to the fastening screw 97 on the binding post 96. A conductor 110 connects to the post which supports the stationary switch contact 84 with the electric motor 46. The conductor 110 is fastened to the stationary contact post by a fastening screw 85. By this arrangement the opening and closing of the switch contacts 80 and 84 stops and starts the electric motor 46 while at all times a small amount of electric current flows through the carbon heater 94 and thereby protects the switch mechanism from corrosion.

The bellows 30, which is filled with a volatile fluid, is opposed by a tension type coil spring 114 hooked at its upper end to a projecting portion of the bellows follower lever 56 and hooked at its lower end to a U-shaped member 116, which is threaded upon the adjusting screw 118. The U-shaped member 116 is provided with a pair of tongues 120 which engage a vertical slot 122 formed in the rear portion 24 of the frame member 20. This tongue and slot construction securely guides the U-shaped member 116 and prevents its rotation when the adjusting screw 118 is turned. The upper end of the adjusting screw 118 extends through a sleeve 124 which is threaded into a molded control knob 126 and into a bushing 128 for fastening the knob to the bushing. The bushing 128 is rotatably mounted upon the shank of the adjusting screw 118.

The upper end of the adjusting screw 118 is provided with flats upon two sides and receives a serrated washer 130 held in engagement with the upper end of the adjusting screw 118 by a fastening screw 132. This serrated washer 130 slides within the splined recess 134 which is provided within the molded knob 126 and which is concealed by a metal cover 136. Thus the knob 126 is slidable axially upon the screw 118 but rotates with it by reason of the spline construction. The bushing 128 is grooved to receive a leaf spring member 138 which at one end is fastened, by the screw 140, to the top portion 26 of the frame member 20. At the other end this spring member is provided with a turned down lip 144 which is adapted to engage or stop a projection 146 of the contact lever 70. The spring member 138 is provided with a keyhole shaped aperture 148 so that the bushing 128 may be slipped through the larger portion of the opening and then moved laterally so that the narrower portion may engage the groove in the bushing 128 when the bushing and the spring member 138 are placed in its proper position. The switch mechanism is enclosed by a housing 25 of electrical insulating material which extends down to the bottom portion 22. Bushings 27 are provided for mounting the control upon the evaporating means 40.

As shown in Fig. 1 the switch is in the closed position. This causes current to flow to the compressor motor 46 causing operation of the refrigerating system and the cooling of the evaporating means and the thermostat bulb 38. This reduces the pressure within the bellows 30 so that the adjusting spring 114 can gradually pull the bellows follower lever 56 downwardly. The contact lever 70 remains in its downward or closed position until the secondary lever 64 crosses the axis of the toggle spring 66. As soon as this takes place the secondary lever 64 moves from the bottom of the slot 76 to the top of the slot 76 and the toggle spring 66 then pulls the contact lever 70 in a counter-clockwise direction until the projection 146 engages the lip 144 which serves as the normal stop for normally limiting the open movement of the lever 70. The position of the lever 70 when against the stop 144, in the open position, determines the position to which the bellows follower lever 56 must rise before it again causes the secondary lever 64 to again cross the center line of the toggle spring 66 to cause the lever 70 to again move to closed position. The amount of movement permitted the contact lever 70 determines the normal differential of the switch.

The range of the switch is controlled by the adjustment of the adjusting screw 118 which, as illustrated in Figs. 9 and 11, may be turned through the greater part of a revolution to make the switch operate at warmer or colder tempera-

tures. As indicated in Figs. 9 and 11 the control knob 126 is provided with an "off" position. A portion of the switch is shown in the "off" position in Fig. 7. In order to shut the switch off so as to prevent the operation of the refrigerating system bushing 128 is provided with a projection 150 which in the "off" position engages a projection 152 of the contact lever 70. This forces the contact lever 70 to open position and holds the contact lever 70 in open position until the knob is reset. The upper portion 26 of the frame member 20 is provided with a post 154 which coacts with a projection 156 upon the control knob to prevent the control knob from being moved beyond the "off" position, and it also cooperates with a shoulder 158 upon the control knob for preventing the control knob from being pushed inwardly when the knob is in the "off" position.

Heretofore in order to provide an automatic reset single cycle defrosting mechanism it has been customary to provide a single cycle loading device which acts upon the bellows follower lever to provide an additional load thereon to raise the temperature at which the switch will close. Such a loading device ordinarily incorporates a toggle mechanism which is moved out of the path of the bellows follower lever upon the movement of the switch to closed position upon the termination of the defrosting cycle. I find that this mechanism is somewhat complicated and difficult to make accurately and adjust properly.

I therefore have evolved a new form of single cycle defrosting device in which I remove the normal stop for the contact lever and substitute a defrosting stop for a single cycle to provide a wider differential for one cycle, after which the normal stop is automatically replaced to its normal position in which the defrosting stop does not come into use. Thus in order to provide a defrosting cycle I turn the control knob 126 to one of the warmer positions and then push it in so that, as shown in Fig. 6, the spring member 138 with its turned down lip 144 is pushed beneath the projection 146 by the downward movement of the bushing 128. The toggle springs 66 pulls the contact lever 70 in a counter-clockwise direction considerably beyond the normal movement of the lever 70 until the post 68 which supports one end of the toggle spring 66, stops against the adjusting screw 158 provided upon a projecting ear 160 of the frame member. This adjusting screw 158 is locked in position by a lock-nut 162.

The switch cannot then move to the "on" position until the bellows expands sufficiently for the bellows follower lever 56 to move the secondary lever 64 until it crosses the center line of the toggle spring 66, after which the contact lever 70 will move to closed position. This, however, does not occur until a greater movement of the bellows follower lever 56 takes place corresponding to a much higher temperature than the normal closing temperature of the switch. This higher closing temperature causes defrosting of the evaporating means before the contact lever 70 moves to closed position. When the contact lever 70 moves to closed position, the projection 146 is moved away from the spring member 138 and permits the turned down lip 144 to return to normal position, thereby restoring the normal cycle.

In Figs. 9 to 11 there is shown a modified form of control, in which it is not necessary to turn the knob to a warmer position before using the single cycle defrosting device. In this form the ear 160 with the stop screw 158 is omitted and in its place a stop screw 180 is provided which is threaded into a laterally projecting portion 182 of the U-shaped member 184 which corresponds to the member 116. This member 184 carries the lower end of the tension type coil spring 186 which corresponds to the coil spring 114. This coil spring 186 is anchored at its upper end to the bellows follower lever 256 which is identical to the bellows follower lever 56 of the first modification. The bellows follower lever 256 is connected to a secondary lever 264 which in turn is connected to a toggle spring 266 connected at its other end to a post 268 formed upon the contact lever 270. The contact lever 270 opens and closes the switch contacts 280 and 284 similar to the contacts 80 and 84 of the first modification.

In this form the contact lever 270 is formed with an inclined projection 310. When the control knob 260 is turned to the warmest position as shown in Figs. 8 and 9 the member 184 is moved downwardly carrying with it the stop screw 180. When the control knob 260 is pushed inwardly and the normal stop member 238 corresponding to the spring member 138 is pushed downwardly, the contact lever 270 will move in a clockwise direction until the inclined projection 310 engages the head of the screw 180 which serves as a stop for limiting the opening movement of the contact lever 270. Thus the engagement of the inclined projection 310 with the head of the screw 180 determines the position to which the bellows follower lever 256 must move before the secondary lever 264 crosses the center line of the toggle spring to cause the contact lever 270 to move to closed position.

If the control knob is operated in the warm position it is not necessary that the effective closing temperature of the switch be raised as much above the setting of the control knob as when the control knob is in a colder position. All that it is necessary to do is to raise the closing temperature of the switch to a temperature sufficiently above 32° F. to assure the melting of all the frost from the cooling unit. Thus a a substantially constant switch closing temperature is desired for the defrosting cycle.

The angular projection 310 is made at such an angle that the upward and downward movement of the head of the screw 180, which occurs with the adjustment of the control knob 260, will compensate for the change caused by the change in a tension of the main spring 186 which determines the temperature limits in normal operation. As shown in Figs. 10 and 11, when the control knob 260 is moved to its coldest position the screw 180 is moved upwardly along with the member 184 so that it contacts the angular projection 310 at a higher position and thus allows the contact member 270 to open wider. This compensates for the decrease in the tension of the spring 186 caused by the upward movement of the member 184 when the control knob is moved to its coldest position. In this way substantially the same force and the same temperature is required to cause the switch to move to closed position during the defrosting cycle regardless of whether the control knob is in a warm or cold position.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerator control comprising a temperature responsive switch operating means, a snap acting switch means operated by said temperature responsive means, a normal stop means providing a normal differential for said snap acting switch means, an abnormal stop means providing an abnormal differential for said snap acting switch means, means for temporarily rendering ineffective said normal stop means and rendering said abnormal stop means effective, one of said first two means being effective upon a predetermined movement for rendering said abnormal stop means ineffective and said normal stop means effective.

2. A refrigerator control comprising a temperature responsive switch operating means, a snap acting switch means operated by said temperature responsive means, a normal stop means providing a normal differential for said snap acting switch means, an abnormal stop means providing an abnormal differential for said snap acting switch means, means for temporarily rendering ineffective said normal stop means and rendering said abnormal stop means effective, one of said first two means being effective upon a predetermined movement for rendering said abnormal stop means ineffective and said normal stop means effective, means for adjusting said temperature responsive switch operating means, and means controlled by said adjusting means for providing a compensating adjustment of said abnormal stop means.

3. A refrigerator control comprising a temperature responsive switch operating means, a toggle snap acting switch means operated by said temperature responsive means, stop means for said toggle means for determining the position of the temperature responsive means required to trip the switch means, and means for temporarily changing the stop means to temporarily change the position of the temperature responsive means at which the toggle means trips and thereafter restoring the stop means to the former action.

4. A refrigerator control comprising a temperature responsive switch operating means, a toggle snap acting switch means operated by said temperature responsive means, stop means for said toggle means for determining the position of the temperature responsive means required to trip the switch means, and means for temporarily changing the stop means to temporarily change the position of the temperature responsive means at which the toggle means trips, said toggle means being constructed to restore the stop means to normal relationship upon tripping.

5. A refrigerator control comprising a temperature responsive switch operating means, a toggle snap acting switch means operated by said temperature responsive means, stop means for said toggle means for determining the position of the temperature responsive means required to trip the switch means, and means for temporarily changing the stop means to temporarily change the position of the temperature responsive means at which the toggle means trips and thereafter restoring the stop means to the former action, means for adjusting said temperature responsive means, and means controlled by said adjusting means for compensating the changing of the stop means for the adjusting of the temperature responsive means.

6. A refrigerator control comprising a temperature responsive operating means, a toggle snap acting switch means operated by said temperature responsive means, stop means for limiting the opening movement of the snap acting switch means to control the position at which the temperature responsive means closes the switch means, and manually operable means for forcibly opening said snap acting switch means and for changing the stop means to change the position at which the temperature responsive means closes the switch means.

7. A refrigerator control comprising a temperature responsive operating means, a toggle snap acting switch means operated by said temperature responsive means, stop means for limiting the opening movement of the snap acting switch means to control the position at which the temperature responsive means closes the switch means, and manually operable means for changing thhe stop means to change the position at which the temperature responsive means closes the switch means, and means responsive to the closing of the switch means for restoring the stop means to its initial condition.

8. A refrigerator control comprising a temperature responsive operating means, a switch means operated by said temperature responsive means for opening and closing an electric circuit, a manipulating means for adjusting the temperature responsive means to change the temperatures at which the switch means is operated, means operated by said manipulating means when moved to one position for preventing the closing of the switch contacts by the temperature responsive means, and means operated by said manipulating means when moved to another position for changing the temperature at which the temperature responsive means operates the switch contacts to provide a single abnormal cycle and thereafter resetting the control to normal cycling.

9. A refrigerator control comprising a pressure operated snap acting switch means, means including a knob for adjusting the setting of the switch means to vary the relationship between the pressure and the operation of the switch means to open and closed position for continuous normal cycles of switch operation, means initiated by said knob for providing a single cycle having an abnormal temperature limit and thereafter returning the switch operation to the production of continuous normal cycles, and means operated by said knob for opening and preventing the reclosing of said switch means.

10. A refrigerator control comprising a pressure operated snap acting switch means, a knob, means operated by the rotary movement of said knob for adjusting the setting of the switch means to vary the relationship between the pressure and the operation of the switch means to open and closed position for continuous normal cycles of switch operation, means operated by an axial movement of said knob for providing a single cycle having an abnormal temperature limit and thereafter returning the switch operation to the production of continuous normal cycles, and means operated by said knob for opening and preventing the reclosing of said switch means.

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