United States Patent

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[54] **DEFROST CONTROL SYSTEM DEVICE WITH IMPROVED LEVER OPERATING MEANS**
20 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **200/38,** 74/354
[51] **Int. Cl.** **H01h 7/08,** H01h 43/10
[50] **Field of Search** ..... 200/38 (D), 38 (D1), 38 (D2), 38 (D3), 38, 38 (A), 38 (A1); 74/3.5, 3.52, 3.54; 62/153

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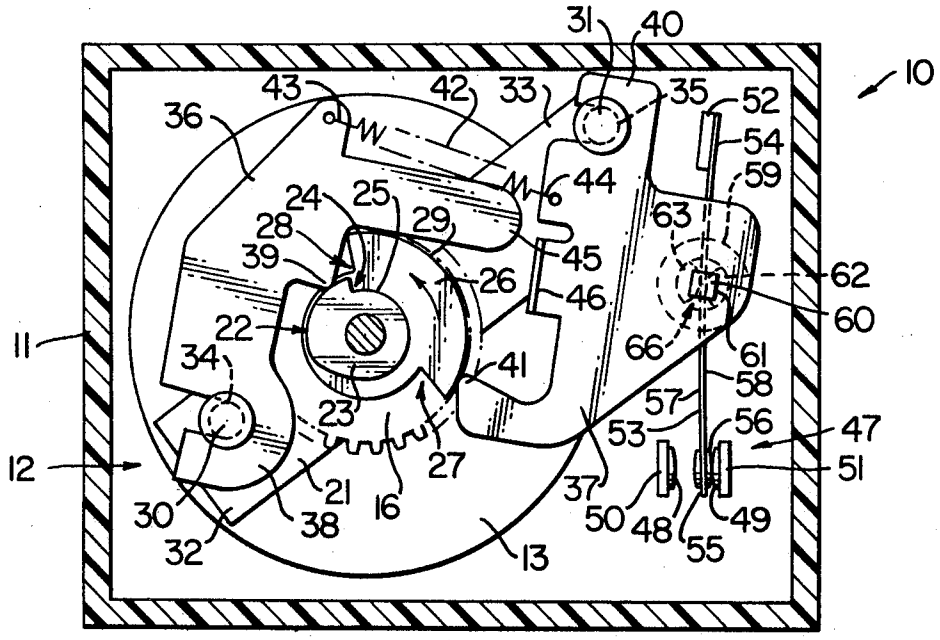
ABSTRACT: A control device for moving an electrical switch blade to one position thereof to initiate a defrost cycle or the like and, after a predetermined time period, moving the switch blade to another operating position thereof to terminate the defrost cycle, the control device having a pair of movable levers of which one is interconnected to the switch blade with the levers being continuously urged toward operative engagement with a cam means disposed therebetween. The cam means maintains the one lever in one position thereof until the defrost cycle is to be initiated whereby the one lever moves to another position thereof and remains in that position until the cam means causes the other lever means to engage against the one lever and move the same back to its one operating position, the cam means thereafter causing the other lever to move out of engagement with the one lever while maintaining the one lever in its one position thereof.



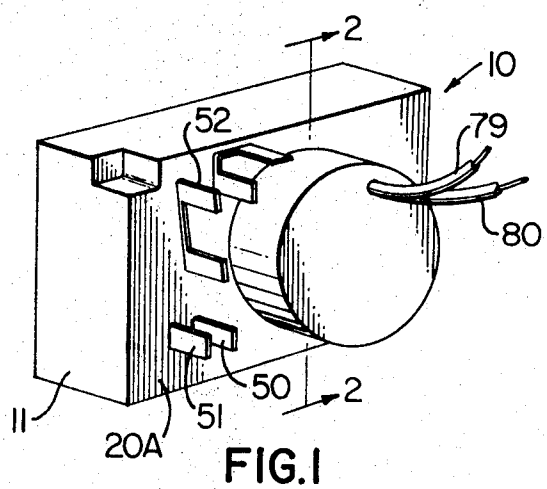


FIG.1

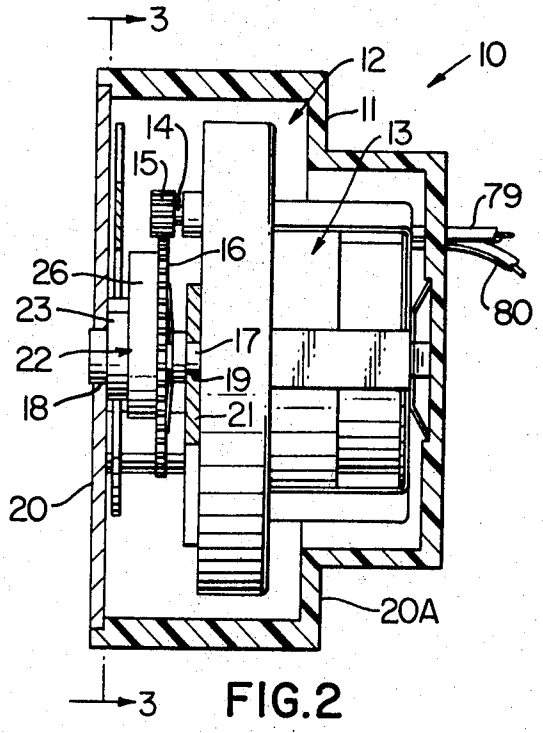


FIG.2

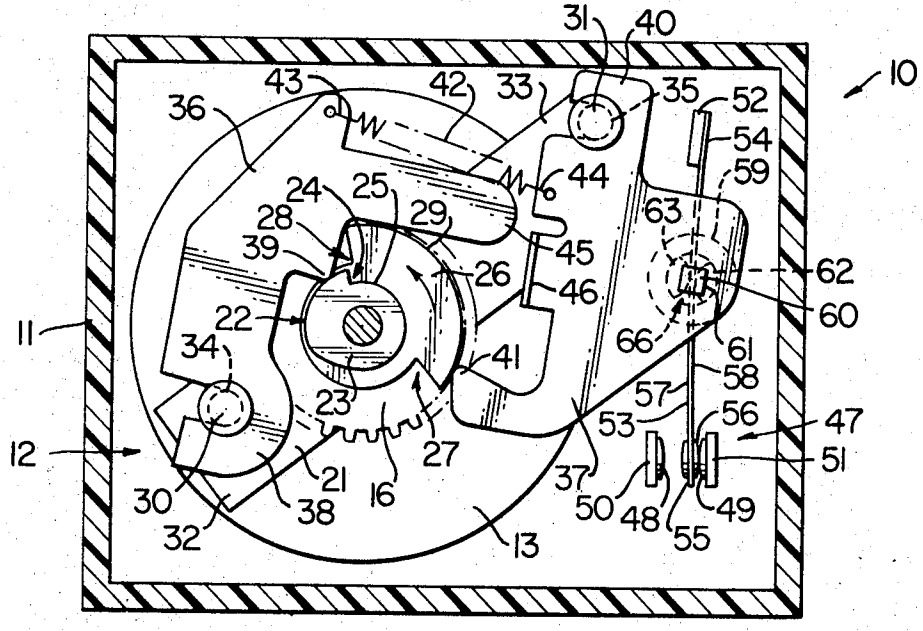


FIG.3

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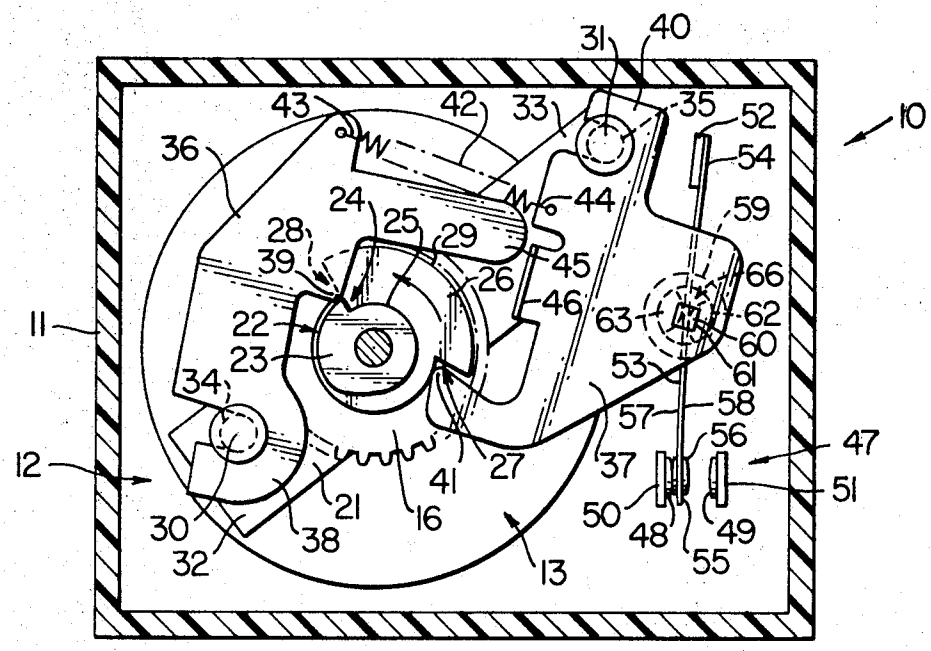

FIG. 4

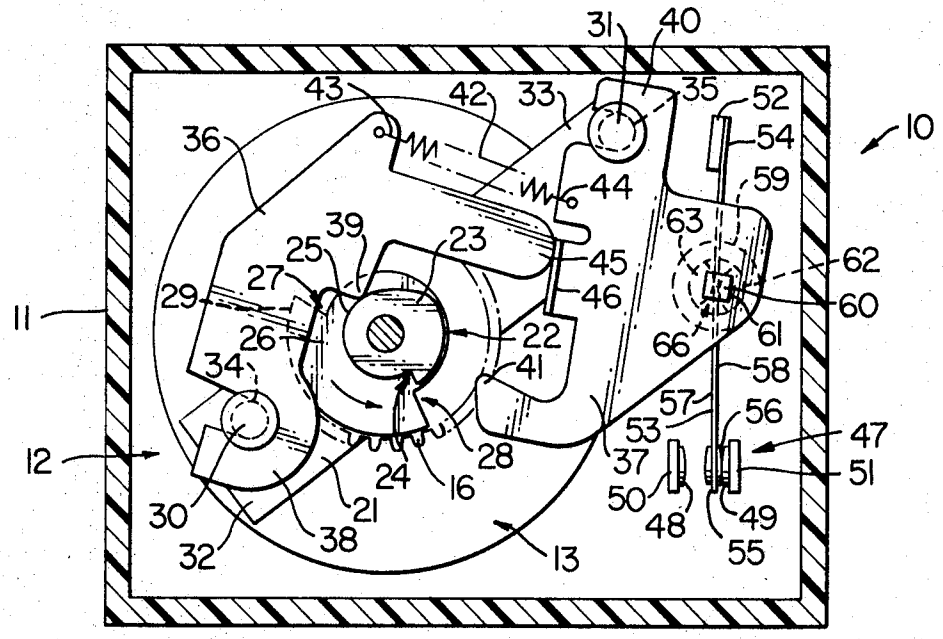

FIG. 5

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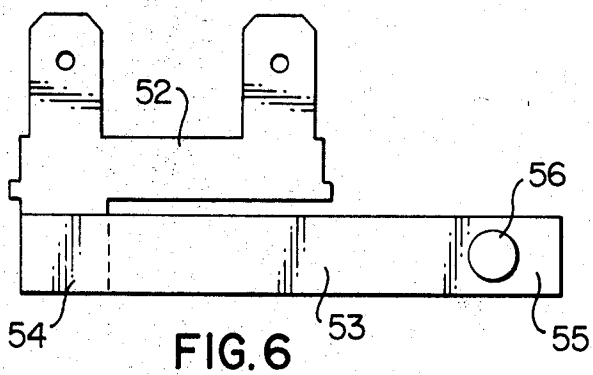

FIG. 6

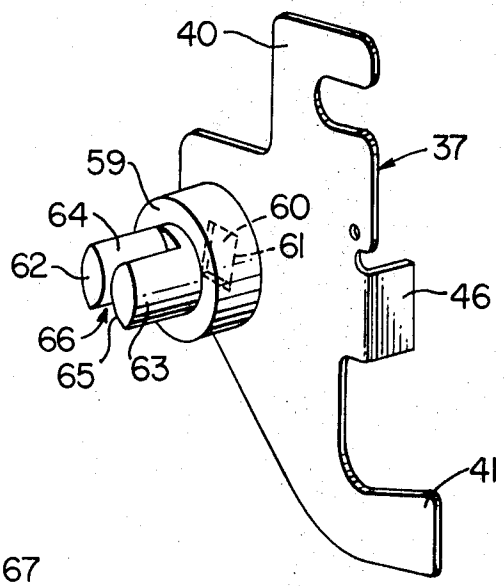

FIG. 7

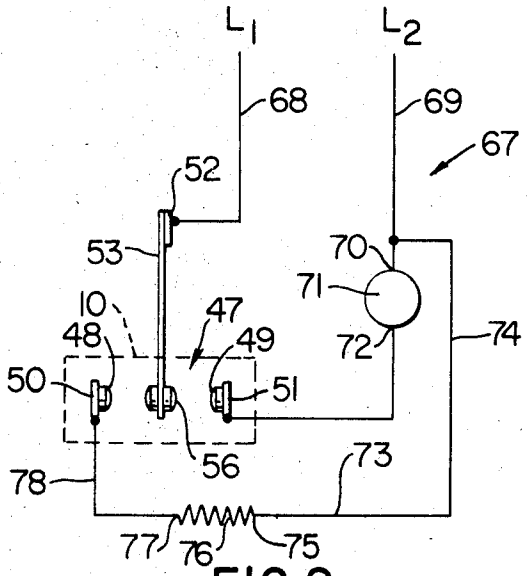

FIG. 8

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DEFROST CONTROL SYSTEM DEVICE WITH IMPROVED LEVER OPERATING MEANS

This invention relates to an improved defrost control system as well as to an improved control device for such a system or the like.

It is well known that various refrigeration systems periodically require a defrosting of the evaporator thereof in order to maintain an efficient heat exchange system. Such defrosting is normally timer operated whereby after a predetermined lapse of time, the timer causes a defrost cycle for another predetermined period of time, such as by causing the operation of a heater means to defrost the evaporator coil or the like. Thereafter, the timer means terminates the defrost cycle and the control system remains operative for another predetermined length of time before the timer means again initiates a defrost cycle.

It is one of the features of this invention to provide an improved control device for such a defrost system or the like wherein an electrical switch is timer controlled in a unique and novel manner.

In particular, one embodiment of this invention provides a control device having a pair of movable levers controlled by a timer operated cam means wherein one of the levers is operatively associated with the electrical switch means of the control device. A tension spring means is respectively interconnected to the two levers to tend to maintain the same in operative engagement with the cam means, the cam means being disposed between the levers and being so constructed and arranged that the same maintains the one lever in one operating position thereof for a predetermined period of time and, thereafter, causes the one lever to move to another operating position thereof for another predetermined period of time after the lapse of which the cam means causes the other lever to engage against the first lever and move the first lever back to its first operating position. Subsequently, the cam means moves the other lever away from the first lever while maintaining the first lever in its one operating position until it is time to again initiate a defrost cycle wherein the cam means again causes movement of the first lever to its other operating position.

Therefore, it is an object of this invention to provide an improved defrost control system having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved control device having one or more of the novel features set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a perspective view of the improved control device of this invention.

FIG. 2 is an enlarged cross-sectional view taken on line 2–2 of FIG. 1

FIG. 3 is a cross-sectional view taken on line 3–3 of FIG. 2 and illustrates the control device in one of its operating positions.

FIG. 4 is a view similar to FIG. 3 and illustrates the control device in another operating position thereof.

FIG. 5 is a view similar to FIG. 3 and illustrates the control device being moved back to the operating position of FIG. 3.

FIG. 6 is a side view of part of the electrical switch means of the control device of FIG. 1.

FIG. 7 is a perspective view of one of the operating levers of the control device of FIG. 1.

FIG. 8 illustrates schematically one control system of this invention.

While the various features of this invention are hereinafter described and illustrated as being particularly adaptable to provide a defrost control system for a refrigerating apparatus, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide a control device for other types of systems as desired.

Therefore, this invention is not to be limited to only the embodiments illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGS. 1, 2 and 3, the improved control device of this invention is generally indicated by the reference numeral 10 and comprises a housing means 11 having a chamber 12 therein receiving and supporting a conventional timer motor means 13 therein, the timer motor 13 having an output shaft 14 carrying a pinion gear 15 disposed in meshing relation with a larger gear 16 interconnected by suitable friction clutch means to a shaft means 17 rotatably mounted to the housing means 11 by having its opposed ends respectively received in opening means 18 and 19 of a removable end wall means 20 of the housing means 11 and a support means 21 that is secured in spaced relation to the end wall means 20. The friction clutch means (not shown) that interconnects the gear 16 to the shaft 17 is so constructed and arranged that movement of the pinion gear 15 by the timer motor 13 causes simultaneous movement of the shaft means 17 through the gear 16 and friction clutch means so that there is no slippage between the gear means 16 and the shaft means 17 except when the shaft means 17 is turned manually to position the shaft means 17 in a new rotational position relative to the gear 16 as will be apparent hereinafter whereby such manual setting of the shaft 17 relative to the gear 16 will not adversely affect the timer motor 13.

A cam means 22 is secured to the shaft means 17 to rotate in unison with the shaft means 17, the cam means 22 comprising a first cam member 23 having a drop off 24, FIG. 3, in its outer peripheral cam surface 25 and a second cam member 26 having two drop off points 27 and 28 in its outer peripheral cam surface 29. While the cam members 23 and 26 are illustrated and hereinafter described as being fixed to the shaft 17 in the relationship illustrated in FIG. 3, it is to be understood that the cam means 23 and 26 can be made adjustable on the shaft means 17 so that an operator or the like can adjust the relative positions of the cam means 23 and 26 to a desired timing sequence condition as will be apparent hereinafter.

The frame or support member 21 carries a pair of outwardly directed pairs or posts 30 and 31 at the opposed ends 32 and 33 thereof that secure the support member 21 in spaced relation to the end wall means 20, the post means 30 and 31 respectively having annular recesses 34 and 35 therein to respectively pivotally mount a pair of levers 36 and 37 in the housing means 11.

In particular, the lever 36 has a U-shaped yoke 38 surrounding the post 30 and being received in the recess 34 thereof, the lever 36 being provided with a cam follower portion or tongue 39 adapted to operatively engage and follow the cam contour surface 25 of the cam member 23. Similarly, the lever 37 has a U-shaped yoke portion 40 surrounding the post 31 and being received in the annular groove 35 thereof, the lever 37 having a cam follower or tongue portion 41 adapted to operatively engage and follow the cam contour or surface 29 of the cam 26.

A tension spring 42 has its opposed ends 43 and 44 respectively interconnected to the levers 36 and 37 to continuously tend to pull the levers 36 and 37 toward each other so that the cam follower portions 39 and 41 thereof are respectively drawn toward their respective cams 23 and 26 for a purpose hereinafter described. However, it can readily be seen that the arrangement of the spring 42 relative to the levers 36 and 37 as well as relative to the posts 30 and 31 causes the spring 42 to hold the levers 36 and 37 against the posts 30 and 31 so that the levers 36 and 37 will respectively pivot about the posts 30 and 31 as will be apparent hereinafter.

The lever 36 has an outwardly directed arcuate tongue 45 adapted to engage against an upwardly directed flat tang 46 formed on the lever 37 when the cam means 22 is disposed in the position illustrated in FIG. 5 for a purpose hereinafter described.

An electrical switch means 47 is carried by the housing means 11 and comprises a pair of spaced stationary electrical contacts 48 and 49 respectively carried by terminals 50 and 51 which are supported by an end wall 20A of the housing 11 and project outwardly therefrom as illustrated in FIG. 1 to be interconnected to suitable lead means. Another terminal 52 is also carried by the housing means 11 to project out of the end wall 20A as illustrated in FIG. 1, the terminal 52 as illustrated in FIG. 2 and 6 additionally carrying a flexible conductive switch blade 53 having one end 54 secured to the terminal 52 and an opposed free end 55 carrying contact means 56 on the opposed sides 57 and 58 thereof.

The lever 37 has a retainer 59 secured thereto by having a rectangular portion 60 thereof passed through a like opening 61 in the lever 37 and being suitably staked thereto, the retainer 59 having a pair of spaced abutments 62 and 63 projecting rearwardly therefrom with the abutments 62 and 63 respectively having facing surfaces 64 and 65 that are convex in cross-sectional configuration and defining a spacing 66 therebetween. The retainer is formed of suitable electrically insulating material, such as plastic or the like molded or otherwise formed in the configuration illustrated in the drawings.

When the various parts of the control device 10 of this invention are assembled together in the manner illustrated in FIGS. 2 and 3, it can be seen that the switch blade 53 is recieved in the spacing 66 between the abutments 62 and 63 of the retainer 59 so that the same engage the opposed sides 57 and 58 of the switch blade 53 to cause movement of the switch blade 53 between the fixed contacts 48 and 49 as the lever 37 moves in a manner hereinafter described whereby the lever 37 is operatively associated with the switch means 47 for controlling the same.

Therefore, it can be seen that the switch 47, timer motor 13 and housing means 11 can be assembled together as one subassembly and the levers 36 and 37, shaft 17, cam means 22, gear 16 and spring 42 can be assembled together with the end wall 20 and frame member 21 to form another subassembly that can be inserted as a unit into the chamber 12 of the housing means 11 in such a manner that the gear 16 will mesh with the gear 15 and the retainer 59 will receive the switch blade 53 in the spacing 66 between the abutments 62 and 63 thereof, the end wall 20 being subsequently secured in place to the housing means 11 by suitable fastening means to complete the control device 10.

While the control device 10 of this invention can be utilized to control any desired system, one system of this invention is generally indicated by the reference numeral 67 in FIG. 8 wherein a power source lead L_1 is interconnected by a lead 68 to the terminal 52. The other power source lead L_2 is interconnected by a lead 69 to one side 70 of a refrigerator compressor means 71 while the other side 72 thereof is interconnected by a lead 73 to the terminal 51 that carries the contact 49 of the electrical switch 47. The lead 69 is also interconnected by a lead 74 to one side 75 of an electrical heater means 76 that can be utilized for defrosting the evaporator (not shown) of the refrigerator system 67 when the heater means 76 is energized, the other side 77 of the heater means 76 being interconnected by a lead 78 to the terminal 50 of the control device 10 that carries the contact 48 of the electrical switch means 47.

The operation of the control device 10 of this invention as utilized in control system 67 of FIG. 8 will now be described.

With the timer motor 13 of the control device 10 interconnected to the power source leads L_1 and L_2 by leads 79 and 80 as illustrated in FIG. 1, the timer motor 13 will be continuously running to rotate the shaft 17 and, thus, the cam means 22 in a counterclockwise direction as illustrated by the arrows in FIGS. 3—5 whereby in the typical system 67 of this invention, the gear ratio 15,16 can be so constructed and arranged that the shaft 17 and, thus, the cam means 22 will make one complete revolution every 6 hours so that a defrosting cycle will occur once in every 6 hour period.

Thus, with the control device 10 disposed in the position illustrated in FIG. 3, it can be seen that the cam follower 41 of the lever 37 is riding on the cam surface 29 of the cam 26 in such a manner that the cam surface 29 maintains the lever 37 to the right so that the switch blade 53 and contact means 56 thereof are held in electrical contact with the fixed contact 49 whereby the compressor means 71 is continuously operating for the system 67 to provide the normal operation of the refrigerating system. However, as the cam means 22 continues to rotate in a counterclockwise direction, the drop off point 27 of the cam 26 reaches the cam follower 41 in the manner illustrated in FIG. 4 whereby the stored energy in the tension spring 42 pulls the lever 37 toward the lever 36 so that the lever 37 pivots in a clockwise direction about the pivot post 31 and moves the switch blade 53 and its contact means 56 out of electrical contact with the fixed contact 49 with a snap movement and into electrical contact with the fixed contact 48 as illustrated in FIG. 4.

At this time, it can be seen that the compressor 71 of the system 67 is disconnected from across the power source leads L_1 and L_2 and that the heater means 76 is now placed across the power source leads L_1 and L_2 to begin to heat to defrost the evaporator of the system 67.

As illustrated in FIG. 4, the other lever 36 is still spaced from the lever 37 because the cam follower 39 of the lever 36 is riding on the high part of the cam surface 25 of the cam 23 though closely adjacent the drop off point 24 thereof. Thus, the defrost cycle continues for a predetermined period of time as illustrated in FIG. 4 until the cam means 22 further rotates in a counterclockwise direction so that the cam follower 39 of the lever 36 falls off the drop off point 24 of the cam member 23 in the manner illustrated in FIG. 5 whereby the stored energy in the tension spring 42 pulls the lever 36 toward the lever 37 and the tongue 45 of the lever 36 engages the tang 46 of the lever 37 as illustrated in FIG. 5. The force of the spring 42 is such that when the tongue 45 of the lever 36 engages the tang 46 of the lever 37, the spring 42 causes the lever 36 to pivot the lever 36 in a counterclockwise direction about the pivot post 31 to move the switch blade 53 to the right and cause the contact means 56 to break electrical contact with the fixed contact 48 and be placed back into electrical contact with the fixed contact 49 as illustrated in FIG. 5 whereby the operation of the defrost cycle is terminated and the compressor 71 is again energized to perform its normal function for another cycle of rotation of the cam means 22.

As the cam means 22 continues to rotate in a counterclockwise direction from the position illustrated in FIG. 5, it can be seen that the cam follower 41 of the lever 37 is now in a position to clear the other drop off point 28 of the cam member 26 when the same aligns with the cam follower 41 so that the cam follower 41 will follow the high part of the cam member 26 as the high part of the cam means 23 begins to cam the lever 36 away from the lever 37 in the manner illustrated in FIG. 3. In this manner, the spring 42 draws the cam follower 41 of the lever 37 against the cam surface 29 of the cam 26 to permit the lever 37 to initiate another defrost cycle when the cam means 22 reaches the position illustrated in FIG. 4 in the manner previously described.

Thus, it can be seen that during a defrost cycle of the system 67, the drop off points 27 and 24 of the cam means 26 and 23 can be so arranged relative to each other that the length of the defrost cycle can be any desired period, such as 14 minutes during any 6 hour period of operation of the control device 10.

Accordingly, it can be seen that when it is desired to first install the control device 10 of this invention in the control system 67 of FIG. 8, the shaft means 17 of the control device 10 can be initially turned to a position wherein the cam follower 39 of the lever 37 has just fallen off the drop off point 24 of the cam 23 to permit the contact 56 to be engaged against the contact 49 so that the first defrost cycle caused by the control device 10 in the system 67 will occur toward the end of one complete revolution of the shaft 17 and will occur

thereafter toward the end of each succeeding complete revolution of the shaft 17 by the timer motor 13. Thus, it can be seen that the friction clutch means interconnecting the gear 16 to the shaft 17 permits such initial lmanual adjusting of the shaft 17 relative to the timer motor 13 without adversely affecting the motor 13 during such manual setting of the shaft 17.

Accordingly, it can be seen that this invention provides not only an improved defrost control system, but also this invention provides an improved control device for such a system or the like.

I claim:

1. In a defrost control system having a timer operated electrical switch means for providing a defrost cycle of said system, the improvement comprising cam means driven by said timer, a pair of movable levers, one of said levers being operatively interconnected with said switch means for controlling the same in relation to the position of said one lever, and means operatively interconnected to said levers tending to maintain said levers in engagement with said cam means, said cam means being so constructed and arranged that said cam means by its engagement with said one lever being adapted to maintain said one lever in one position thereof for a first predetermined period of time and then cause movement of said one lever to another position thereof for a second predetermined period of time for said switch means to provide said defrost cycle, said cam means thereafter being adapted to cause movement of the other of said levers into engagement with said one lever to move said one lever back to said one position thereof after the lapse of said second predetermined period of time by its engagement with said other lever.

2. In a defrost control system as set forth in claim 1, the further improvement wherein said cam means is adapted to thereafter move said other lever out of engagement with said one lever while maintaining said one lever in said one position thereof for said first predetermined period of time.

3. In a defrost control system as set forth in claim 1, the further improvement wherein said means for tending to maintain said levers in operative engagement with said cam means is a single tension spring.

4. In a defrost control system as set forth in claim 3, the further improvement wherein said tension spring has its opposed ends respectively interconnected to said levers to tend to pull said levers toward each other.

5. In a defrost control system as set forth in claim 4, the further improvement wherein said cam means is disposed between said levers.

6. In a defrost control system as set forth in claim 5, the further improvement wherein said levers are respectively pivotally mounted.

7. In a defrost control system as set forth in claim 6, the further improvement wherein said levers are pivotally mounted at diametrically opposed ends thereof.

8. In a defrost control system as set forth in claim 1, the further improvement wherein said cam means is rotated by said timer about an axis thereof, said cam means having two axially spaced cam surface means respectively being adapted to control the positions of said levers.

9. In a defrost control system as set forth in claim 1, the further improvement wherein said switch means comprises a switch blade, said one lever having a pair of spaced abutments receiving said switch blade therebetween to interconnect said switch blade to said one lever.

10. In a defrost control system as set forth in claim 9, the further improvement wherein said abutments of said one lever having facing surfaces that are convex in cross-sectional configuration and respectively engage said switch blade on opposed sides thereof.

11. A control device comprising a housing means, an electrical switch means carried by said housing means, a pair of movable levers carried by said housing means, one of said levers being operatively interconnected with said switch means for controlling the same in relation to the position of said one lever relative to said housing means, movable cam means carried by said housing means, and means carried by said housing means and being operatively interconnected with said levers for tending to maintain said levers in engagement with said cam means during movement of said cam means, said cam means being so constructed and arranged that said cam means be its engagement with said one lever being adapted to maintain said one lever in one position thereof during a first segment of movement of said cam means in one direction thereof and to then cause movement of said one lever to another position thereof during a second segment of movement of said cam means in said one direction, said cam means thereafter being adapted to cause movement of the other of said levers into engagement with said one lever to move said one lever back to said one position thereof during a third segment of movement of said cam means in said one direction thereof by its engagement with said other lever.

12. A control device as set forth in claim 11 wherein said cam means is adapted to move said other lever out of engagement with said one lever while maintaining said one lever in said one position thereof as said cam means moves in said one direction from said third segment of movement thereof back to said first segment of movement thereof.

13. A control device as set forth in claim 11 wherein said means for tending to maintain said levers in operative engagement with said cam means comprises a single tension spring.

14. A control device as set forth in claim 13 wherein said tension spring has opposed ends respectively interconnected to said levers to tend to pull said levers toward each other.

15. A control device as set forth in claim 14 wherein said cam means is disposed between said levers.

16. A control device as set forth in claim 15 wherein said levers are respectively pivotally mounted to said housing means.

17. A control device as set forth in claim 16 wherein said levers are pivotally mounted at diametrically opposed ends thereof.

18. A control device as set forth in claim 11 wherein said cam means is rotatably mounted to said housing means to rotate about an axis thereof, said cam means having two axially spaced surface means respectively being adapted to control the positions of said levers relative to said housing means.

19. A control device as set forth in claim 11 wherein said switch means comprises a switch blade, said one lever having a pair of spaced abutments receiving said switch blade therebetween to interconnect said switch blade to said one lever.

20. A control device as set forth in claim 19 wherein said abutments of said one lever have facing surfaces that are convex in cross-sectional configuration and respectively engage said switch blade on opposed sides thereof.