June 21, 1955 C. J. GOODHOUSE ET AL 2,711,456

DEFROSTER TIMER

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Fig. 1

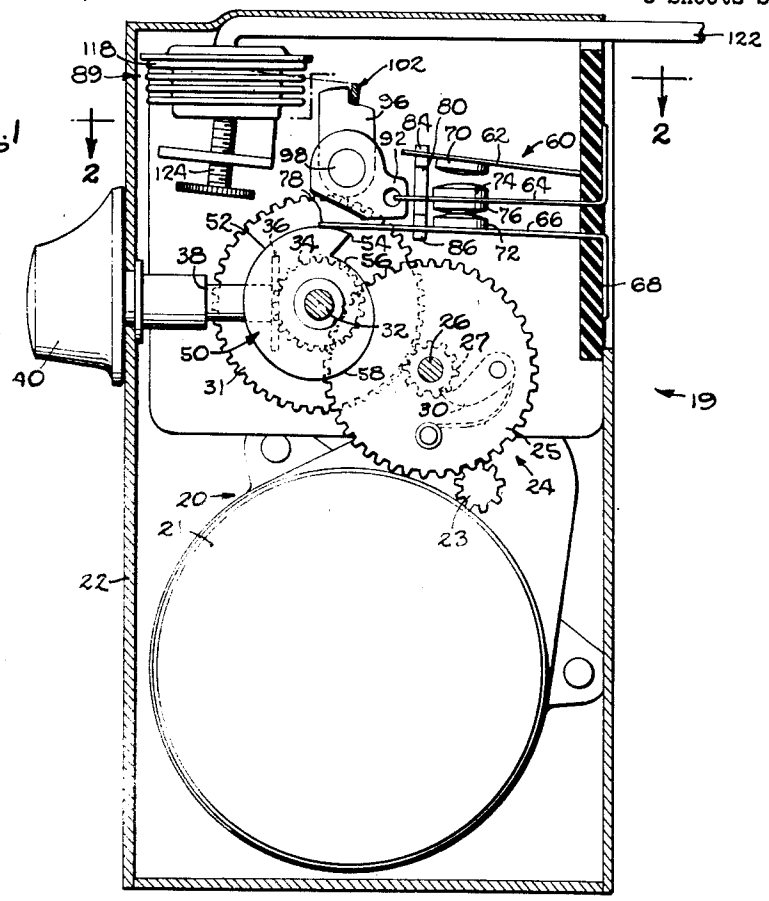

Fig. 2

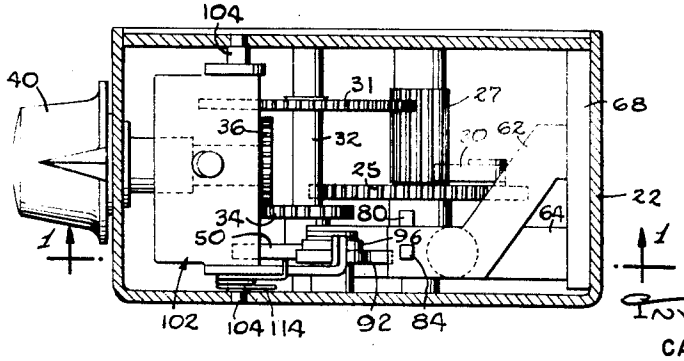

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Fig. 3

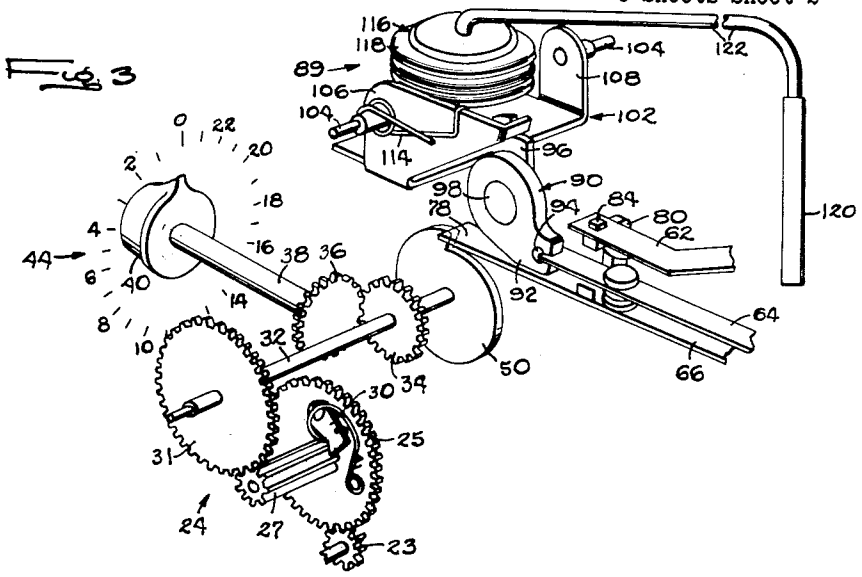

Fig. 4

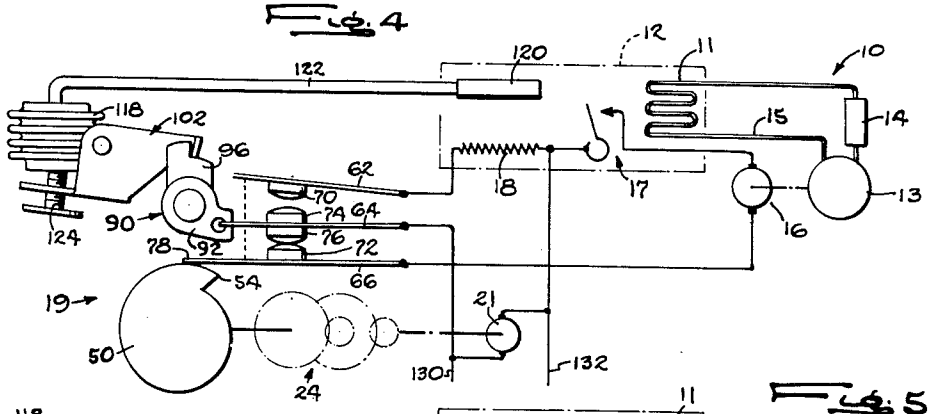

Fig. 5

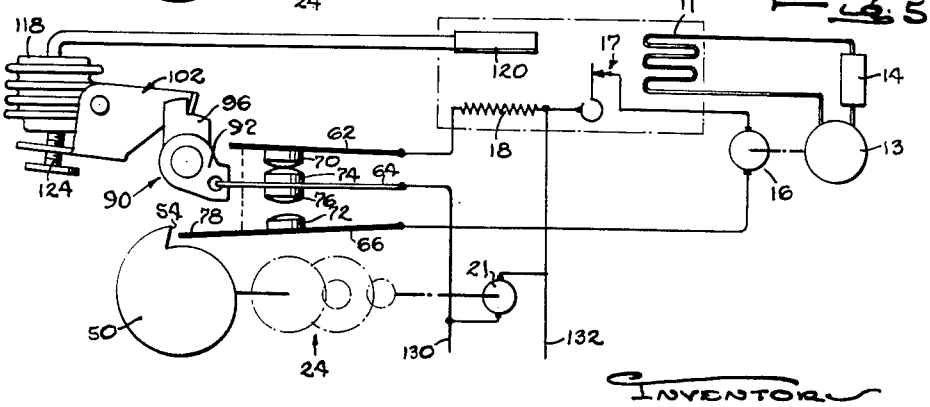

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Fig. 6

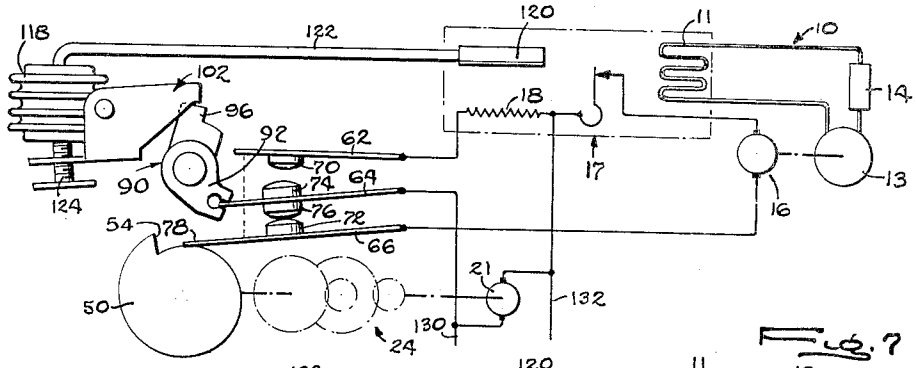


Fig. 7

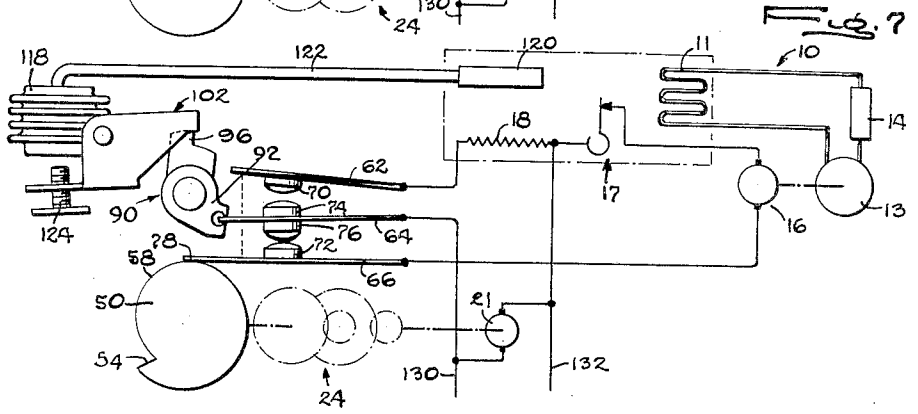
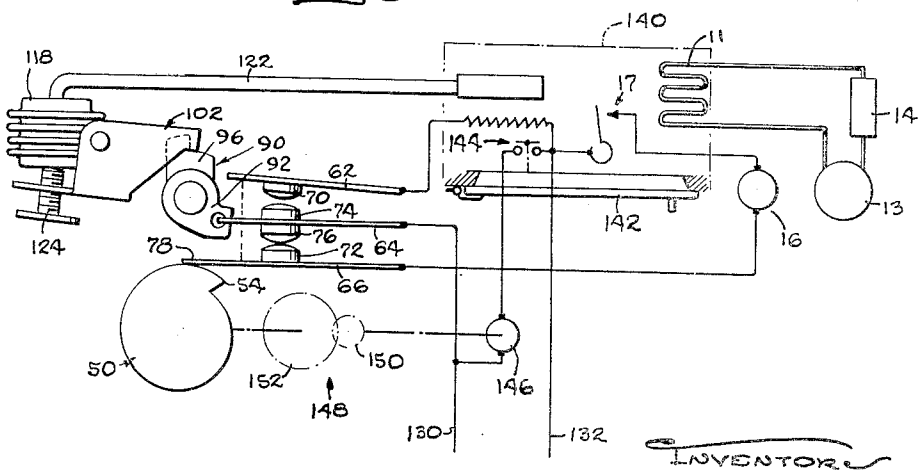


Fig. 8



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2,711,456

DEFROSTER TIMER

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Application January 18, 1952, Serial No. 267,164

12 Claims. (Cl. 200—136.3)

This invention relates to control mechanisms and more particularly to control mechanisms for refrigerating systems for effecting automatic defrosting.

Such mechanisms are used for automatically removing frost and ice which form on refrigerator evaporators or other heat-absorbing elements by condensation of moisture from the atmosphere. An undue accumulation of ice on the evaporator will seriously impair the efficiency of a refrigerator, and while refrigerators can be defrosted manually, this is a troublesome operation which is apt to be overlooked or carried out very infrequently. Whenever the refrigerator door is opened, warm moisture-laden air from the room comes in contact with the evaporator and is cooled to such an extent that the condensed moisture freezes on the evaporator, the amount of frost which accumulates on the evaporator depending to a considerable extent upon the total time that the refrigerator door is kept open.

An object of the invention is to provide a particularly reliable, convenient and inexpensive defrosting control device for a refrigerating system.

It is another object of the invention to provide a defrosting control device and system which may be easily and quickly adjusted and which is accurate and positive in operation and which retains its calibration over long periods of repeated cycling. It is a related object to provide a defrosting control device and system in which the cycle is initiated automatically in response to predetermined frost-producing conditions and in which the cycle is terminated only upon reaching a predetermined temperature rise occurring upon substantially complete frost removal and regardless of the amount of frost which has actually collected. It is another related object to provide a control device and system which employs a source of heat for frost removal but in which the heat is applied in minimum amount to insure complete defrosting and without danger of thawing out the frozen foods which may be stored in the cooling unit.

It is another object of the invention to provide an improved refrigerating system including a defrosting control device which is fail-safe so that the normal refrigerating operation is not permanently interrupted in case of a failure of the control device. A more specific object is to provide a refrigerating system in which defrosting is initiated by time responsive means and terminated by temperature responsive means, the system being so arranged that the normal refrigerating operation will not be permanently interrupted by failure of the time responsive means or the temperature responsive means or both. In this regard it is an object to provide a refrigerating system of this character in which the temperature responsive means includes a vapor-operated thermostatic bellows in which the vapor pressure is subatmospheric.

A further object is to provide a novel defrosting control including a novel switching arrangement providing positive snap action. A related object is to provide an unusually efficient automatic switching device in which

a first switching element is moved to initiate a defrosting operation and a second distinct switching element is moved to terminate the defrosting operation.

It is a further object of the invention to provide a defrosting control device whereby a defrosting operation is accurately and abruptly terminated by means of a thermostatic element, the control device being so constructed that the thermostatic element is required to do only the small amount of work necessary to release a latch.

Further objects and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is an elevational sectional view of an illustrative refrigerator defrosting control device constructed in acordance with this invention, the view being taken along the line 1—1 of Fig. 2.

Fig. 2 is a plan sectional view of the illustrative device taken along the line 2—2 of Fig. 1.

Fig. 3 is a perspective view of the principal working parts of the illustrative device, the stationary supporting parts and certain other parts being omitted for the sake of clarity.

Fig. 4 is a diagrammatic illustration of an automatically defrosted refrigerating system which is constructed in accordance with this invention and which includes the control device of Fig. 1, the system being shown in its normal refrigerating condition prior to the initiation of a defrosting operation.

Fig. 5 is a view similar to Fig. 4 showing the system in the condition existing immediately after the initiation of a defrosting operation.

Fig. 6 is a view similar to Fig. 4 showing the system in the condition existing immediately after the termination of the defrosting operation.

Fig. 7 is a view similar to Fig. 4 showing the condition of the system as it is about to reset itself in preparation for another defrosting operation, and

Fig. 8 is a diagrammatic illustration of a modified automatically defrosted refrigerating system including a modified defrosting device, the modified system being adapted to be automatically defrosted after the door of the refrigerator has been opened a predetermined total time.

While the invention is susceptible of various modifications and alternative constructions, there is shown in the drawings and will herein be described in detail the preferred embodiments, but it is to be understood that it is not thereby intended to limit the invention to the forms disclosed, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

The illustrative automatically defrosted refrigerating system of Fig. 4 includes a conventional cooling or refrigerating unit **10** comprising an evaporator **11** enclosed in a refrigerator box **12**. Refrigerant is supplied to the evaporator by means of a compressor **13** which is connected to the evaporator through a condenser **14**, vaporized refrigerant returning to the compressor **13** from the evaporator through a return conduit **15**. The compressor **13** is driven by an electric motor **16** which is controlled by a conventional thermostatic cold control switch **17**, the contacts of which are connected in series with the motor **16** in order to regulate the temperature in the refrigerator box **12**.

In practicing the invention, the refrigerating system is provided with a defrosting heater which in this case comprises an electrical heating element **18** situated in the refrigerator box **12** adjacent the evaporator **11** and capable of raising the temperature of the latter above the melting point. A defrosting control mechanism **19** is provided for selectively energizing the cooling unit **10**

and the heater 18 in a novel manner in order to provide alternate periods of normal refrigerating operation and defrosting operation.

The illustrated defrosting control device 19 shown diagrammatically in Fig. 4 and more completely in Figs. 1–3 includes time-responsive means 20 for initiating the defrosting cycle driven by a synchronous electrical clock-type motor 21. The motor 21 is suitably mounted on a sheet metal box-like frame 22 which also supports the other components of the defrosting device. The motor 21 includes a driving pinion 23 which in this instance rotates in a counterclockwise direction at a speed of one revolution per hour for driving a reduction gear train 24. The gear train 24 includes a large gear 25 having a shaft 26 and pinion 27. Overrunning of the pinion relative to the gear for setting purposes is permitted by mounting the pinion freely on the shaft and coupling it to the gear 25 by a spring-pressed pawl 30 mounted on the latter. The pinion 27 meshes in turn with a gear 31 secured to a rotatable cam shaft 32. The latter rotates in a counterclockwise direction at a speed of one revolution in each 24 hours.

For manual setting of the device means are provided for varying the phase relationship between the cam shaft 32 and the driving motor. Such manual setting means includes a gear 34 secured to the shaft 32 and meshing at right angles with a similar gear 36 which is secured to a settable shaft 38. An adjusting knob 40 having a pointer is mounted on the outer end of the shaft 38. Suitable dial graduations 44 are positioned on the frame 22 around the knob 40 for indicating its position. As shown in Fig. 3, the graduations 44 are numbered from zero to 24. It will be understood that the dial graduations are viewed from the rear and for the sake of convenience the numerals are reversed so as to be readable in the normal manner.

A switch operating element in the form of a spiral disc cam 50 is secured to the shaft 32 in order to initiate a defrosting operation once for each revolution of the shaft. The particular cam illustrated has a portion 52 with a circular periphery, an overhanging drop-off edge 54 forming the terminus of the circular portion 52, a low portion 56 located immediately below the drop-off edge 54, and a sloping or rising portion 58 which slopes outwardly from the low portion 56 for approximately one-half revolution, and then merges with the circular portion 52. The cam is made of an electrically insulating material for a purpose which will be apparent shortly.

The defrosting control device includes switching means 60 to control the refrigerating system and thereby to determine whether defrosting or refrigerating is to take place. In this instance the switching means 60 includes three spring contact blades 62, 64 and 66, each of which is mounted at one end on an insulating plate 68 secured to the frame 22. The three contact blades 62, 64 and 66 are generally parallel to one another with their outer ends in alinement. Blades 62, 64 carry cooperating contacts 70, 74 which serve to energize the heater 18, while blades 64, 66 carry cooperating contacts 76, 72 which are in the circuit of the compressor motor. The three contact blades 62, 64 and 66 may be referred to for convenience as a defrosting switch blade, a power line switch blade, and a refrigerating switch blade.

The lowermost contact blade 66 is provided with a cam following portion 78 which projects outwardly beyond the contact point to engage the spiral disc cam 50.

The upper switch blade 62 is caused to move in unison with the lower blade 66 by means of a C-shaped electrically insulating bridge or connecting member 80 interposed between the outer portions of the contact blades. In the present instance the bridge is anchored to the blades by prong extensions 84 and 86, respectively. The spring blades 62 and 66 not only move together but act together to provide a resilient bias tending to move the contact points 70 and 72 downwardly, and to hold the cam following portion 78 against the cam 50. The intermediate spring blade 64 provides a bias tending to move the power contact 76 into engagement with the refrigerating contact 72.

The defrosting control device 19 includes temperature responsive means 89 for terminating the defrosting operation after the temperature of the heat-absorbing element 11 has increased sufficiently to melt any accumulation of frost. In this case, the temperature responsive means includes a latching member 102 and a latch engaging member 90 for holding the switch blade 64 in its upraised position and for triggering the same downwardly upon reaching of a predetermined temperature. The latch-engaging member 90 is of bell-crank formation, having an insulated switch arm 92 and latch-engaging arm 96 mounted on a common shaft 98. The switch arm is coupled to the end of the switch blade 64 for toggle-like movement of the two members, the blade being received in a slot 94 in the arm. The arm 96 is maintained in latched position by the latching member 102. The latter is pivoted more or less centrally on a pair of trunnions or stub shafts 104 mounted on upturned ears 106, 108, respectively. The latching member is biased in the arm-engaging direction by a spring 114.

For the purpose of rotating the latching member against the force of the spring 114 for triggering at a predetermined temperature a thermostatic element 116 is provided which in this case comprises a resilient metallic bellows 118 of the sylphon type connected with a metallic bulb 120 by means of a metallic tube 122. The bulb 120 is positioned in the refrigerator box 12 (Fig. 4) adjacent the heat-absorbing unit 11. The bellows, the bulb, and the tube form a closed system which is filled with a suitable volatile liquid having a vapor pressure which is sub-atmospheric at the melting point of ice. Increasing and decreasing the temperature of the bulb 120 produces a corresponding expansion and contraction of the bellows 118. The movement of the bellows is transmitted to the latching member 102 by means of an adjusting screw 124 which is threaded through the outboard end thereof into engagement with the "free" end of the bellows. Thus expansion of the bellows 118 produces counterclockwise rotation of the latching member 102 and tends to move the latching member out of engagement with the latch-engaging arm 96. The screw 124 may be adjusted so that the latching member 102 releases the arm 96 when the temperature of the bulb 120 rises slightly above the melting point of ice.

As shown in Fig. 4, the illustrative refrigerating system is energized from a pair of power lines 130 and 132. The cooling unit motor 16 is connected in series with the thermostatic switch 17 between the power line 132 and the lower switch blade 66 in the control mechanism 19. The defrosting heater 18 is connected between the power line 132 and the upper switch blade 62. The central switch blade 64 is connected to the power line 130. The timer motor 21 is connected directly across the lines 130 and 132 so that this motor runs continuously.

When the illustrative refrigerating system of Fig. 4 is in operation, the power lines 130 and 132 are connected to a conventional source of alternating current. Normal refrigerating operation takes place for the greater part of the day. Fig. 4 shows the system in the normal refrigerating condition and with the system approaching the defrosting point. The switch blade 64 is latched in its normal or upraised position. Consequently, switch blades 64, 66 are maintained in contact to complete a circuit from the line 130 to the compressor motor 16 of the cooling unit and putting the motor under the control of the refrigerator thermostat 17. The cooling unit 10 is therefore turned off and on in the conventional fashion to regulate the temperature in the box 12.

Since the synchronous timer motor 21 runs continuously and is independent of the above cycling, a point of time, preselected by the knob 40, is reached at which the

cam follower 78 drops off the overhanging edge 54 of the cam as shown in Fig. 5. The inherent bias of the upper and lower blades 62 and 66 then moves these blades downwardly so that the engagement between the contacts 72 and 76 is broken and the contacts 70 and 74 are engaged. The blades 62 and 66 move in unison because of the insulating bridge 80 connected between them. During such movement the intermediate blade 64 is maintained stationary by latching engagement between the latching member 102 and the latch-engaging arm 96.

The above switching initiates a defrosing operation by stopping the compressor motor 16 and energizing the defrosting heater 18, the heater being connected to the power line 130 through the contact blades 62 and 64. Much more rapid melting of frost and ice accumulated on the heat absorbing element 11 is provided by the heater than would be provided by natural warming of the heat-absorbing element from its surroundings. By virtue of the heater 18, the temperature of the heat-absorbing element 11 quickly rises to the melting point of ice, and the temperature remains at or near the melting point as the accumulated ice is being melted from the heat-absorbing element. Melting occurs so quickly that the frozen food in the unit remains unaffected.

When substantially all of the ice has been melted, the temperature quickly begins to rise above the melting point. The consequent warming of the thermostat bulb 120 increases the vapor pressure within the thermostatic system 116 and thereby produces expansion of the bellows 118. The expanding bellows produces counterclockwise or latch-disengaging rotation of the latching member 102. After the temperature of the heat-absorbing element 11 has increased to a point just above the melting point, the latching member 102 moves out of engagement with the latch-engaging arm 96. The central spring blade 64, thus released, moves downwardly under the impetus of its own inherent bias, as shown in Fig. 6. During this movement the latch-engaging member rotates clockwise. The engagement of the contacts 70 and 74 is thus broken and the contacts 72 and 76 are re-engaged with the result that the heater 18 is disconnected and the cooling unit 10 is re-energized.

The resumption of normal refrigerating operation reduces the temperature of the evaporator 11 below the freezing point, and as a result the thermostatic bellows 118 contracts away from the adjusting screw 124 on the latching member 102. The latching member is thereby automatically reset for the latching engagement which follows.

The continuing rotation of the cam 50 gradually moves the contact blades 62, 64 and 66 upwardly as the cam follower 78 rides along the rising portion 58 of the cam. The central switch blade 64 is moved in unison with the blades 62 and 66 because of the engagement between the contacts 72 and 76. In Fig. 7 the upward movement of the switch blades has progressed to a point at which the central blade 64 is about to be latched in its initial position. Upon continued movement of the latch-engaging member the latching member 102 is free to move under the influence of the biasing spring 114, into its latching position and completing the defrosting cycle.

For setting purposes the cam 50 may be advanced manually by rotating the setting knob 40 in the direction of the arrow in Fig. 3. When the cam is being manually rotated, the ratchet pawl 30 ratchets along the elongated pinion 27. This changes the phasing between the cam and the motor, enabling the time of day at which drop-off (switching) occurs to be pre-set.

The zero point on the dial 44 corresponds to the point at which the defrosting operation is initiated by the cam 50. Thus the graduations 44 on the dial indicate the time that will elapse before another defrosting operation begins. The control device may be set to begin defrosting at a desired time by turning the knob 40 until the pointer is alined with the particular dial graduation 44

corresponding to the number of hours yet to elapse between the present time and the desired time. By way of example, it will be assumed that it is desired for defrosting to begin at 2 a. m. daily and that the control device is being adjusted at 8 p. m. The pointer 42 would be set to the 6-hour graduation on the dial since 6 hours is the amount of time yet to elapse between 8 p. m. and 2 a. m.

In accordance with one of the features of this invention, the defrosting control device 19 is so arranged as to be "fail-safe" so that the normal refrigerating operation of the refrigerator will not be permanently interrupted to cause food spoilage if the control device should fail. In this regard, the sub-atmospheric thermostatic system 116 is particularly advantageous. When the thermostatic system 116 is operating properly, the vapor pressure within the system is less than atmospheric pressure, and as a result the bellows 118 is compressed to a considerable extent by atmospheric pressure. If the bellows 118 springs a leak, the bellows will be expanded immediately by its inherent resiliency, and the latch 102 will thereby be moved out of engagement with the switch operating arm 96. The central switch blade 64, thus released, will then be free to ride upwardly and downwardly on the blade 66, maintaining the contacts 72, 76 closed despite the cyclical rotation of the cam and the movement of the cam follower 78. Ultimately the collection of frost will warn the householder that service is required; the important thing is that refrigeration is not interrupted.

It will also be noted that failure of the timing drive motor 21 at any point in the rotation of the cam 50 does not permanently interrupt the normal refrigerating operation. Failure of the motor 21 when refrigerating is taking place will prevent the automatic initiation of subsequent defrosting operations. If, on the other hand, the timing motor 21 fails while the defrosting operation is in progress, the defrosting operation will be terminated as soon as complete and in the normal manner by the thermostatic bellows 118. Specifically, the bellows releases the latch 102 and the central switch blade 64 shifts into engagement with the lower switch blade 66, thus energizing the cooling unit 10. No further defrosting operations will be initiated and conventional refrigeration will continue until the defect in the timing motor is remedied.

It is noteworthy that the present invention accomplishes snap action of the switching means 60 both when the defrosting operation is initiated and when it is terminated. At the initiation of defrosting the snap action is accomplished when the cam follower 78 abruptly drops off the drop-off edge 54 of the cam 50. The releasing of the latch 102 brings about abrupt snap action of the central switch blade 64 at the termination of the defrosting operation.

In accordance with the invention the operation of the illustrative control device is inherently accurate and dependable because the thermostatic bellows 118 is called upon to do a minimum of work in accomplishing its function of terminating the defrosting operation. The bellows 118 merely releases the latch 102, and this operation does not involve overcoming any great frictional resistance.

Fig. 8 illustrates a modified refrigerator control system in which defrosting it automatically initiated after the refrigerator door has been opened for a predetermined aggregate time. The modified system includes a refrigerator box 140 which corresponds to the refrigerator box 12 of Fig. 4. The refrigerator box 140 has a conventional access door 142 together with a door switch 144 which is closed by opening the door 142. Conventional refrigerators usually have such a switch for turning on a lamp bulb in the box.

The system of Fig. 8 includes a timing motor 146 which may be similar to the motor 21 of Fig. 4 except that the motor 146 may run at a higher speed than the motor 21

or have a lower gear reduction to produce more rapid cam rotation. The motor **146** is connected to the cam **50** by gearing **148** which in this instance comprises merely a motor drive pinion **150** meshing with a gear **152** which is rotatably connected to the cam. The motor thereby drives the cam at a suitable speed such as 1 revolution in 15 minutes. The motor **146** and the door switch **144** are connected in series between the power lines **130** and **132**. In other respects, the refrigerating system of Fig. 8 may be the same as the system of Figs. 1–4, and corresponding components of the two systems have been given the same reference characters.

In operation, the system of Fig. 8 integrates the time that the door **142** is open and initiates a defrosting operation after a predetermined total integrated time has elapsed. The timing motor **146** starts when the door is opened and stops when it is closed. Eventually the cam **50** advances until the cam follower **78** drops off the drop-off edge **54**, and a defrosting operation is thereby initiated. The manner in which defrosting operation proceeds and is terminated and the manner in which the control device is conditioned for a subsequent defrosting operation may be similar to that described in connection with Figs. 1–7. A manual setting arrangement is not particularly necessary or desirable in the system of Fig. 8, but if such an arrangement is provided, the dial is graduated in units corresponding to the time required for the cam **50** to complete 1 revolution. For example, the dial may be graduated to represent an elapsed time of 0–15 minutes and moving the dial to the zero point will cause immediate defrosting.

In both of the above embodiments the atmosphere is utilized as a resisting force on the bellows **118**. Since the atmospheric pressure varies depending upon the elevation, it is one of the features of the present invention that the adjusting screw **134** is readily accessible for adjustment by the service man when installing the refrigerator in a particular location, and once set, such adjustment need not be changed.

We claim as our invention:

1. In a refrigerator having an electrically operable refrigerating unit including a heat absorbing element, control means comprising switching means to control the refrigerating unit including a first movable contact and a second movable contact, initially positioned in engagement with the first contact, time responsive means for abruptly moving the first contact away from the second to initiate a defrosting operation, latching means to prevent the second contact from following the first, means to release the latching means after a predetermined amount of defrosting, biasing means for abruptly re-engaging the second contact with the first to terminate the defrosting operation upon the release of the latching means, and means in the time responsive means for resetting the latching means by moving the first and second contacts reversely in unison to their initial positions.

2. In a refrigerator having an electrically operable refrigerating unit including a heat absorbing element, control means comprising switching means to control the refrigerating unit including a first movable contact and a second movable contact initially positioned in engagement with the first contact, a cam, time responsive means to advance the cam, a cam follower operable by the cam to move the first contact, a drop off portion on the cam for abruptly separating the first contact from the second to initiate a defrosting operation, biasing means urging the second contact to follow the first contact, latching means to prevent the second contact from following the first, temperature responsive means adapted to respond to the temperature of the heat absorbing element to release the latching means after a temperature rise above the melting point of ice, the biasing means thereupon being effective to re-engage the second contact with the first and thereby terminate the defrosting operation, and a rising portion on the cam for resetting the latching means by moving the first and second contacts reversely in unison into their initial positions.

3. In a refrigerator having a refrigerating unit including a heat absorbing element, control means comprising switching means to control the refrigerating unit including a first movable contact and a second movable contact initially engaging the first contact, a cam, time responsive means to advance the cam, a cam follower operable by the cam to move the first contact, a drop off portion on the cam for abruptly separating the first contact from the second to initiate a defrosting operation, biasing means urging the second contact to follow the first contact, latching means to prevent the second contact from following the first, a thermostatic device including an expansible bellows adapted to respond to the temperature of the heat absorbing element for releasing the latching means after a temperature rise above the melting point of ice, the biasing means thereupon being effective to re-engage the second contact with the first to terminate the defrosting operation, and a rising portion on the cam for resetting the latching means by moving the first and second contacts reversely in unison into their initial positions.

4. In a refrigerator having a refrigerating unit including a heat absorbing element, control means comprising switching means to control the refrigerating unit including first and second movable contacts initially in engagement, a cam, time responsive means to advance the cam, a cam follower operable by the cam to move the first contact, a drop off portion on the cam for abruptly separating the first contact from the second to initiate a defrosting operation, biasing means urging the second contact to follow the first contact, latching means to prevent the second contact from following the first, temperature responsive means adapted to respond to the temperature of the heat absorbing element for releasing the latching means after a temperature rise above the melting point of ice, the temperature responsive means being provided with a resilient thermostatic bellows containing a liquid having a sub-atmospheric vapor pressure at temperatures below the melting point of ice, the biasing means being effective abruptly to re-engage the second contact with the first to terminate the defrosting operation upon the release of the latching means, and a rising portion on the cam for resetting the latching means by moving the first and second contacts reversely in unison into their initial positions.

5. In a control device, the combination comprising switching means including first and second movable contacts initially in engagement, a cam, a cam follower operable by the cam to move the first contact, a drop off portion on the cam for abruptly separating the first contact from the second, biasing means urging the second contact to follow the first, latching means for preventing the second contact from following the first, temperature responsive means to release the latching means, the biasing means thereupon being effective abruptly to re-engage the second contact with the first contact, and a rising portion on the cam for resetting the latching means by moving the first and second contacts reversely in unison into their initial positions.

6. In a refrigerator having a defrosting heater and an electrically operable refrigerating unit including a heat absorbing element, the heater being adjacent the element, control means comprising switching means for selectively energizing the refrigerating unit and the heater including first, second, and third movable contacts, the second contact being positioned between the first and the third contacts and being initially engaged with the first contact, a spacer connecting the first and the third contacts for moving the third contact in unison with the first, a cam, a timer to advance the cam, a cam follower operable by the cam to move the first and third contacts, a drop off portion on the cam for abruptly disengaging the first contact from the second contact and engaging the third contact with the second to initiate

a defrosting operation, the first contact being adapted to energize the refrigerating unit and the third contact being adapted to energize the defrosting heater, biasing means urging the second contact to follow the first, latching means for preventing the second contact from following the first, temperature responsive means adapted to respond to the temperature of the heat absorbing element for releasing the latching means after a temperature rise above the melting point of ice, the biasing means thereupon being effective abruptly to re-engage the second contact with the first contact to terminate the defrosting operation, and a rising portion on the cam for resetting the latching means by moving the first, second, and third contacts reversely in unison into their initial positions.

7. In a refrigerator having an electrically operable defrosting heater and an electrically operable cooling unit including a heat absorbing element, the heater being adjacent the element, control means comprising a first switching element including opposed insulated contacts supported for joint movement, one of the contacts being a heater energizing contact and the other being a cooling unit energizing contact, a second switching element having a double faced power line contact movable between the contacts of the first switching element and initially engaged with the cooling unit contact, an electrically operable timer for cyclically initiating a defrosting operation by moving one of the switching elements in a direction to disengage the power line contact from the cooling unit contact and engage the power line contact with the heater contact, means biasing the other switching element in a direction to engage the power line contact with the cooling unit contact, latching means to maintain the position of said other switching element in opposition to the biasing means, and temperature responsive means adapted to respond to the temperature of the heat absorbing element to terminate the defrosting operation by releasing the latching means after a temperature rise above the melting point of ice.

8. In a refrigerator having a heat absorbing element, a cooling unit for cooling the element, and a defrosting heater for removing accumulated ice from the element, control means comprising first and second switching elements, one of the switching elements including a pair of opposed insulated contacts supported for joint movement, one of the contacts being a heater energizing contact and the other being a cooling unit energizing contact, the other switching element having a power line contact movable between the heater energizing contact and the cooling unit energizing contact and initially engaged with the latter contact, a cam, a timer to advance the cam, a cam follower operable by the cam to move the first switching element, a drop off portion on the cam for abruptly moving the first switching element to bring the power line contact into engagement with the heater contact to initiate a defrosting operation, biasing means urging the second switching element to move in a direction to re-engage the power line contact and the cooling unit contact, latching means to maintain the position of the second switching element, temperature responsive means adapted to respond to the temperature of the heat absorbing element to terminate the defrosting operation by releasing the latching means after a temperature rise above the melting point of ice, and a rising portion on the cam for resetting the latching means by moving the three contacts reversely in unison into their initial positions.

9. In a control device, the combination comprising first and second switching elements, one of the switching elements being provided with first and second spaced opposed contacts mounted for joint movement, the other switching element being provided with a movable intermediate contact movable between the first and second

contacts and initially engaged with the first contact, a cam, an electrically operable timer to advance the cam, a cam follower operable by the cam to move the first switching element, a drop off portion on the cam for moving the first switching element in a direction to separate the intermediate and the first contacts and to engage the intermediate and the second contacts, biasing means tending to re-engage the intermediate contact with the first contact, latching means for preventing re-engagement of the intermediate contact with the first contact, temperature responsive means to release the latching means, the biasing means thereupon being effective abruptly to re-engage the intermediate and the first contacts, and a rising portion on the cam for resetting the latching means by moving the first and second switching elements reversely in unison into their initial positions.

10. In a control means, first, second and third contacts, said first and second contacts being normally in engagement, a spacer connecting said first and third contacts for moving them in unison, time responsive means for breaking the engagement between said first and second contacts and engaging said second and third contacts, a latch for holding said second and third contacts in engagement independently of said time responsive means, temperature responsive means for releasing said latch to break the engagement between said second and third contacts and reengaging said first and second contacts, and means in said time responsive means for moving said three contacts in unison to reset said latch.

11. In a control means, a first circuit and a second circuit, switching means in said circuits normally maintaining said first circuit closed and said second circut open, time responsive means for controlling said switching means to open said first circuit and close said second circuit, latching means for said switching means to hold said first circuit open and said second circuit closed independently of said time responsive means, temperature responsive means for releasing said latch to cause said switching means to open said second circuit and close said first circuit, and means in said time responsive means for moving said switching means to reset said latch while maintaining said first circuit closed and said second circuit open.

12. In an electrical switching mechanism, three spring contact blades at least two adjacent blades of which are normally urged in one direction, and the outer blades being engageable with the intermediate blade, means interengaging the two outermost blades for causing said outermost blades to move substantially in unison, a cam engaged by one of said outermost blades and arranged to move said blade in the direction opposite to said one direction and to release said blade for snap movement in said one direction, a latch to releasably hold the intermediate blade in one position, said intermediate blade being moved by said one outermost blade to engage said latch during movement of said one outermost blade in said opposite direction and to be engaged by the other of said outermost blades when said one outer blade is released by said cam, a thermal responsive device for moving said latch to release said intermediate blade, and time means to drive said cam.

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