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T. W. DUNCAN

2,697,332

AUTOMATIC DEFROSTER CONTROL

Filed June 12, 1951

Fig. 1

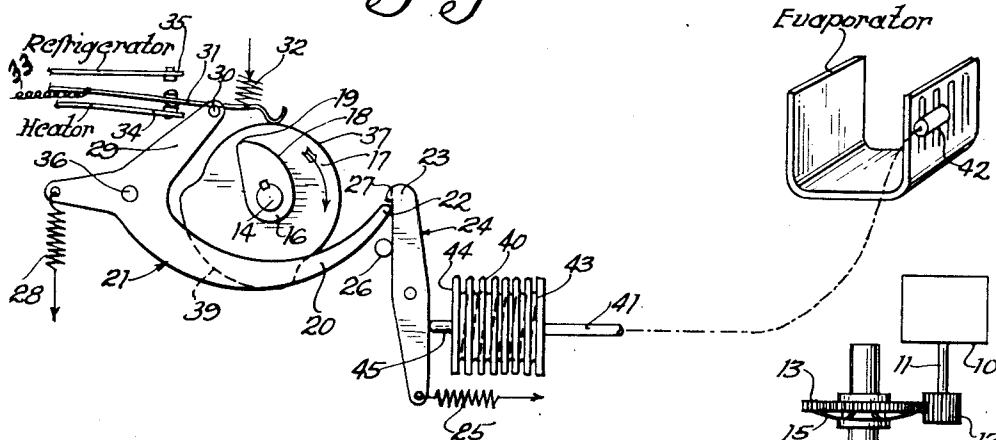


Fig. 3

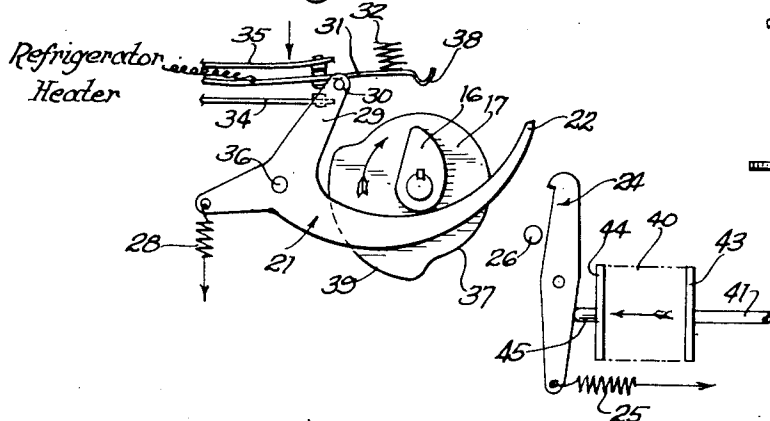


Fig. 2.

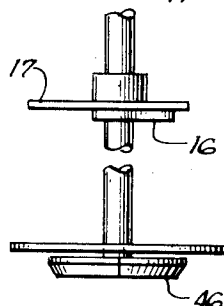


Fig. 5

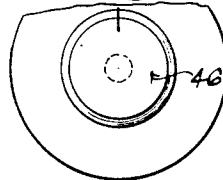
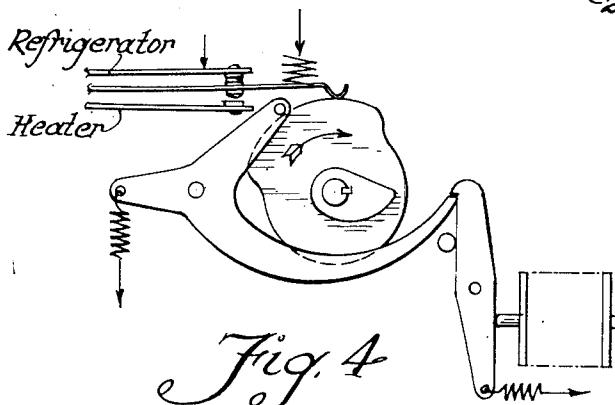


Fig. 4



INVENTOR.
 Thomas W. Duncan
 BY
 Robert H. Wendt
 Attorney

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2,697,332

AUTOMATIC DEFROSTER CONTROL

Thomas W. Duncan, Evansville, Ind., assignor to Seeger Refrigerator Company, St. Paul, Minn., a corporation of Minnesota

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3 Claims. (Cl. 62—4)

The present invention relates to automatic defroster controls, and is particularly concerned with improvements in the automatic defroster disclosed in my prior application, Ser. No. 144,641, filed February 17, 1950, entitled Automatic Defrosting Mechanism.

One of the objects of the invention is the provision of an automatic defroster control which is adapted to prevent overheating of the evaporator by the electrical heaters which are provided for the purpose of defrosting.

Another object of the invention is the provision of an improved automatic defroster mechanism which is so constructed that in the event the timer motor fails, during the defrost cycle, this control will prevent overheating and it will prevent the heaters from becoming energized until the control has been manually turned to the refrigeration position whenever the timer motor fails.

Another object of the invention is the provision of an improved safety mechanism for automatic defrosters which is so constructed that there will be no heating of the evaporator by the electrical elements if the thermostat leaks and there will be no heating of the evaporator if the timer motor fails.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings,

Fig. 1 is a diagrammatic elevational view of an improved defrosting mechanism embodying the invention;

Fig. 2 is a diagrammatic view showing the arrangement of the driving mechanism and the resetting and indicating dial;

Fig. 3 is a view similar to Fig. 1, with the parts of the mechanism in another position;

Fig. 4 is another similar view with the parts in a third position;

Fig. 5 is an elevational view of the controlling knob.

The present automatic defrost control may embody all of the features of my prior application, the subject-matter of which is hereby incorporated by reference thereto.

The present control preferably includes a synchronous motor or timer motor 10, the drive shaft 11 of which has a pinion 12 meshing with a gear 13 on the drive shaft 14 of the present mechanism. The timer motor is of the self-starting type adapted to be driven in synchronism with the ordinary 110 volt 60 cycle lighting circuit used in homes.

The shaft 14 is mounted for free rotation in the gear 13 and is driven through the intermediary of a spring clutch 15, which may take the form of a spider, having a plurality of legs rotating with the shaft 14 and frictionally engaging the gear 13. The shaft 14 carries a resetting cam 16 and a defrosting cam 17.

The resetting cam 16 has a relatively small radius over the major portion of its circumference, but is provided with a rise at 18 leading to a portion of maximum radius at 19 for engaging the arm 20 of a switch operating arm 21 and driving it down until its latching end 22 is located below the hooked end 23 of a thermostatically controlled latch or trigger 24.

A spring 25 urges the lever 24 toward the latching position, and a stop 26 prevents it from going beyond this position. The stop 26 holds the camming end 27 in position so that the point 22 may force it back against the spring 25 to get below the latch.

The switch operating arm 21 is urged counterclockwise by spring 28 and has an upwardly extending arm 29

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with a pin 30 engaging under the switch blade 31. The switch blade 31 is biased downward by spring 32, but has a snap action past dead center, due to the snap spring 33.

Two fixed contacts are provided for engagement with the movable switch blade 31, these being the heater contact 34 below and the compressor controlling contact 35 above.

It should be understood that the disclosure of the switch is diagrammatic; and any suitable single contact or double contact controlling switches may be employed.

The switch operating arm is pivoted at 36; and when it is latched as shown in Fig. 1, the heater contact is closed. When it is unlatched as shown in Fig. 3, the spring 28 is strong enough to urge the operating arm 21 counterclockwise to open the heater contact and close the refrigerator contact.

The shaft 14 also carries the defroster cam 17, which has a portion 37 of relatively small radius for engaging the curved end 38 of the switch blade 31 and another portion of relatively larger radius 39 for engaging the same end 38 of the switch blade 31.

The portion 37 of the defroster cam corresponds to the heating portion of the cycle, which may amount to from fifteen to thirty minutes, preferably about twenty-eight minutes in one embodiment of my invention.

The portion 39 of the defroster cam 17 corresponds to the refrigeration part of the cycle and is of a proportionate length, amounting to about twelve minutes in the preferred embodiment of the invention.

As described in my prior application, the timer motor is placed in parallel with the cabinet light and in series with the door switch so that every time the door opens the timer motor 10 operates during the period of the door opening. This represents a time when the space in the cabinet is accessible to moisture from the outside.

Thus the timer motor operates only when the door is open, and integrates the time intervals of door opening until they have amounted to about twelve minutes. This time may be changed as required, but represents the amount of time when enough frost will accumulate to require an automatic defrosting.

The latching lever or trigger 24 is also under the control of a thermostatic bellows 40, which is connected by a capillary tube 41 to a bulb 42 in heat conducting relation with the heated surfaces of the evaporator. In Fig. 1 the bulb is shown attached to the side of the evaporator; but it may be attached to the depending heated portion of the evaporator, shown in a co-pending application, in order to be more quickly responsive to the heating conditions.

The end 43 of the bellows 40 is the fixed end; and the movable end 44 may have a pin 45 acting on the trigger 24 and urging it in a clockwise direction, or unlatching condition.

The operation of the defrosting control is as follows: Assuming that there is no accumulation of frost on the evaporator and the motor compressor is operating, the cam 17 may have its dwell 39 with the longest radius engaging the movable contact blade 31 to hold the refrigeration contacts in closed position.

The motor compressor under the control of the usual thermostatic switch will then operate as required to provide refrigeration whenever necessary to maintain a predetermined refrigerating temperature. The timer motor 10 will only operate while the door is open; and after the total amount of door opening amounts to about twelve minutes, the cam 17 will have progressed until the portion 38 of contact blade 31 is engaged by the dwell 37 of relatively small radius.

This will permit the contact 31 to snap downward under the influence of its springs 32 and 33, closing the heater circuit; but at about the same time the resetting cam 16 will engage the switch actuating arm 20 and move it downward to bring its end 22 into latching engagement with the trigger 24.

At this time the bellows 40 is contracted because it is subjected to the refrigeration temperatures of the evaporator. The parts are then in the position of Fig. 1. The cam 17 continues to operate at the same time the heaters are energized because the heater contacts also control

the timer motor according to the circuit of my prior application.

When the cam 17 has turned over a range of about twenty-eight minutes, it will arrive at the longer radius, which will again open the heater circuit, as shown in Fig. 4, and place the timer motor under the control of the door switch again.

If at any time the evaporator becomes too hot or exceeds a predetermined temperature at the bulb 42, the bellows 40, which has a sub-atmospheric charge, will expand and release the trigger 24, releasing the switch arm 21, which rises until its pin 30 lifts the switch blade 31, opening the heater circuit.

Thus the heater circuit may be disconnected either by the automatic defrosting cam or by the thermostatic latching arrangement controlled by heating conditions in the evaporator. If the timer motor fails and the heater continues to heat, due to lack of movement of the defrosting cam, which can no longer cut off the circuit, a predetermined rise in temperature will cause the bellows 40 to actuate the latch 24 and release the switch arm 21 to open the heater circuit.

Thus, since the timer motor is not operating, the circuit of the heater will remain open until it is reset by means of knob 46 on shaft 14. Due to the clutch 15, the knob 46 may be used to set the two cams as desired.

Another example of its operation is as follows: Suppose that the frost load on the evaporator is extremely light and the full defrost cycle is not required to remove the frost accumulation. Under these conditions the full defrost cycle would cause the evaporator to become overheated.

Assuming, for example, that the evaporator has been completely freed of frost during the first ten minutes of the cycle and that it has reached such a temperature that the bellows 40 is actuated, this will release the trigger and release the switch arm 21 and open the heater circuit.

Refrigeration then takes place by operation of the motor compressor; and as the temperature of the evaporator becomes lower the thermally sensitive element 40 will again assume a position in which it would permit energization of the heater. This, however, is prevented by the parts being in the position of Fig. 3 until the timer has completed its usual cycle and again goes under the control of the door switch.

The present mechanism is thus adapted to prevent the application of heat if the thermostat 40 fails and also to prevent the application of heat if the timer motor fails. It also prevents the overheating of the evaporator beyond a predetermined temperature under any conditions.

It will thus be observed that I have invented an improved automatic defrosting system in which overheating of the evaporator is positively prevented, whether it be due to an unusually light accumulation of frost or to some failure of a part of the mechanism.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an automatic defroster control mechanism for household refrigerators, the combination which comprises an electric timer motor for controlling defrosting, a shaft driven by said timer, a switch actuating lever biased strongly toward a cooling position, an electric switch including a cooling contact for controlling a motor compressor, and a heating contact for controlling an evaporator heater, and a common contact located in between the cooling and heating contacts to engage one or the other of them and biased toward the heating position less strongly than said switch actuating lever, a cam carried by said shaft, said cam having a rise adapted to engage and move said common contact to cooling position for a predetermined time period, and having a dwell of lesser radius, permitting said common contact to move under its bias to a heating position, a latching member biased to latching position for engaging a shoulder on said switch actuating lever, said switch actuating

lever having a part engaging said common contact, a thermostat responsive to evaporator temperature and acting on said latch to move the latch to unlatching position upon attainment of a predetermined temperature of said evaporator, the said heater contact being closed while said switch actuating lever is latched to heat said evaporator until said temperature is attained, when the thermostat unlatches the switch actuating lever, which moves the common contact from the heating position into the cooling position by virtue of the stronger bias of the switch actuating lever against the lesser opposing bias of the common contact, said cam rise assuring a cooling period of predetermined length while said thermostat terminates the heating period when the evaporator has been defrosted, as shown by its rise in temperature to a predetermined value.

2. In an automatic defroster control mechanism for household refrigerators, the combination which comprises an electric timer motor for controlling defrosting, a shaft driven by said timer, a switch actuating lever biased strongly toward a cooling position, an electric switch including a cooling contact for controlling a motor compressor, and a heating contact for controlling an evaporator heater, and a common contact located in between the cooling and heating contacts to engage one or the other of them and biased toward the heating position less strongly than said switch actuating lever, a cam carried by said shaft, said cam having a rise adapted to engage and move said common contact to cooling position for a predetermined time period, and having a dwell of lesser radius, permitting said common contact to move under its bias to a heating position, a latching member biased to latching position for engaging a shoulder on said switch actuating lever, said switch actuating lever having a part engaging said common contact, a thermostat responsive to evaporator temperature and acting on said latch to move the latch to unlatching position upon attainment of a predetermined temperature of said evaporator, the said heater contact being closed while said switch actuating lever is latched to heat said evaporator until said temperature is attained, when the thermostat unlatches the switch actuating lever, which moves the common contact from the heating position into the cooling position by virtue of the stronger bias of the switch actuating lever against the lesser opposing bias of the common contact, said cam rise assuring a cooling period of predetermined length while said thermostat terminates the heating period when the evaporator has been defrosted, as shown by its rise in temperature to a predetermined value, the said shaft also supporting a resetting cam having an abrupt rise and drop adapted to engage said switch actuating lever and to move it against its bias, away from the common contact into position to be latched in the heating position.

3. In an automatic defroster control mechanism for household refrigerators, the combination which comprises an electric timer motor for controlling defrosting, a shaft driven by said timer, a switch actuating lever biased strongly toward a cooling position, an electric switch including a cooling contact for controlling a motor compressor, and a heating contact for controlling an evaporator heater, and a common contact located in between the cooling and heating contacts to engage one or the other of them and biased toward the heating position less strongly than said switch actuating lever, a cam carried by said shaft, said cam having a rise adapted to engage and move said common contact to cooling position for a predetermined time period, and having a dwell of lesser radius, permitting said common contact to move under its bias to a heating position, a latching member biased to latching position for engaging a shoulder on said switch actuating lever, said switch actuating lever having a part engaging said common contact, a thermostat responsive to evaporator temperature and acting on said latch to move the latch to unlatching position upon attainment of a predetermined temperature of said evaporator, the said heater contact being closed while said switch actuating lever is latched to heat said evaporator until said temperature is attained, when the thermostat unlatches the switch actuating lever, which moves the common contact from the heating position into the cooling position by virtue of the stronger bias of the switch actuating lever against the lesser opposing bias of the common contact, said cam rise assuring a cooling period of predetermined length while said thermostat terminates

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the heating period when the evaporator has been defrosted, as shown by its rise in temperature to a predetermined value, the said shaft also supporting a resetting cam having an abrupt rise and drop adapted to engage said switch actuating lever and to move it against its bias, away from the common contact into position to be latched in the heating position, the said shaft having a driven gear, and said timer having a pinion, and clutch means connecting said driven gear and said shaft, said shaft having an actuating knob, the knob being rotatable with the cam to advance the cam to defrosting position or to advance it past defrosting position for selective timing of the cooling and defrosting periods.

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