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AUTOMATIC DEFROSTER

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Fig. 1

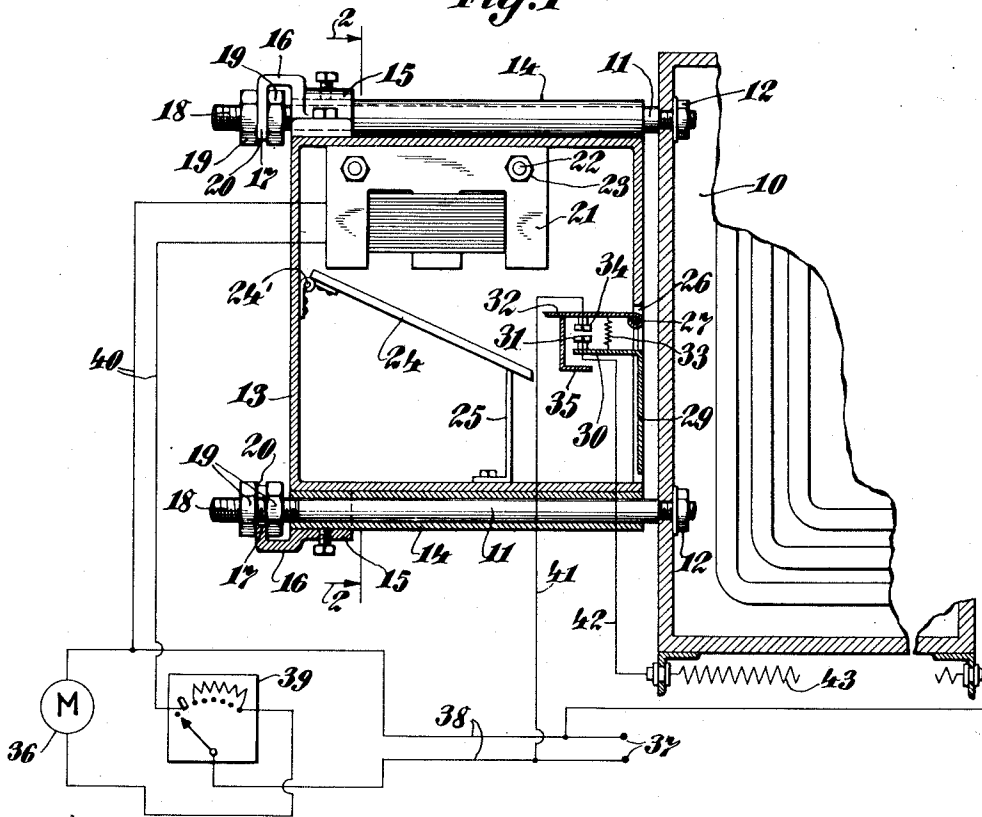


Fig. 2

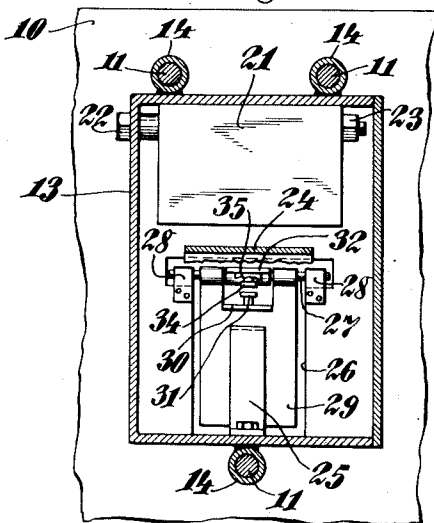
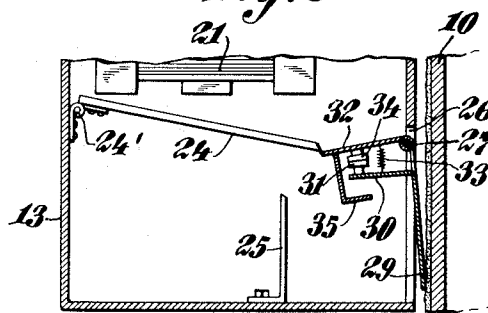


Fig. 3



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AUTOMATIC DEFROSTER

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14 Claims. (Cl. 62—1)

This invention relates to a mechanism for defrosting refrigerators of the type which are operated either by electricity or gas, although it is not limited to such use. More specifically, the invention relates to a defrosting mechanism which is adapted to cause the rapid and effective removal of the frost and ice which forms on the surfaces of refrigerator freezing compartments, when the ice formed thereon has reached a predetermined limiting thickness.

It is a well known fact that the water vapor present in the air which circulates throughout refrigerators is usually a detriment to their proper operation since it tends to condense upon the outer surface of the freezing compartment where it freezes and forms a solid layer of ice. Since this layer of ice is a good heat insulator, the efficiency of the cooling operation is greatly diminished and, as the thickness of the ice increases, the cooling effect of the refrigerator decreases, up to a point where eventually the operation becomes uneconomical. The layer of ice must then be removed if proper refrigeration is to be obtained.

The insulating layer of ice is ordinarily removed by shutting off the power to the refrigerator and allowing the temperature of the air contained therein to increase until it is high enough to melt the ice. This operation frequently takes as long as 24 hours, during which period the refrigerator cannot be used to store perishable foods since the temperature therein is usually not low enough to keep them in good condition. Moreover, there is a tendency on the part of some persons to defrost the refrigerator without first looking to see if there are perishable goods stored in it, so that these goods will be without refrigeration during the defrosting period and will frequently spoil.

An object of the invention, accordingly is to provide a defrosting mechanism which will operate automatically to melt the ice when the depth of the ice layer formed on the freezing compartment has reached a predetermined limiting value.

Another object of this invention is to provide a defrosting mechanism of the above character by means of which a refrigerator may be effectively defrosted within a very short period of time and without increasing the temperature of the air within the refrigerator to any appreciable extent.

A further object of the invention is to provide a defrosting mechanism of the above character

in which the ice is rapidly and effectively removed by the application of heat.

Another object of the invention is to provide a mechanism of the above character in which the thickness of the ice is periodically tested and in which a circuit is closed to energize means for the removal of the ice when the latter has reached a predetermined thickness.

In a preferred embodiment of the invention a mechanism for testing the thickness of the ice is provided, which comprises two members, maintained substantially at right angles to each other by suitable resilient means, and which are so mounted that one member hangs perpendicular to, and out of contact with one side of the freezing chamber of the refrigerator. Each member has a contact mounted on it, and the mechanism is so assembled that the contacts are normally open. An electromagnet is provided which is periodically energized to raise an armature past the horizontal member of the testing mechanism. The electromagnet remains energized for only an instant so that its armature immediately falls back into position. To return to the normal inoperative position, however, it must move past the horizontal member of the testing mechanism, causing the latter to rotate about a fixed point. The testing mechanism is so adjusted that if a layer of ice of predetermined thickness has formed on the side of the freezing chamber, the armature of the electromagnet will rest on the horizontal member of the testing mechanism and since the vertical member is prevented from moving by the layer of ice on the side of the freezing chamber, the weight of the armature will act to depress the spring between the two members to close the contacts mounted thereon. These contacts complete a circuit through a number of series-connected heating coils which are secured to the outer surfaces of the freezing chamber. The heat generated in these coils acts to melt the ice formed on the sides of the freezing chamber reducing its thickness until the testing mechanism has moved far enough to allow the armature of the electromagnet to drop into the original inoperative position, when the contacts are again broken. It is evident that with this device the thickness of the ice formed on the side of the freezing chamber may be controlled within very close limits, and the refrigerator may be automatically defrosted within a very short period of time without raising the temperature of the air therein by any substantial amount.

Additional objects will be evident from the following detailed description of a preferred em-

bodiment of the invention when taken in connection with the single drawing, in which:

Figure 1 is a front view in elevation and partly in section, of an automatic defrosting mechanism constructed in accordance with this invention, which is shown secured to one side of the freezing chamber of a refrigerator;

Figure 2 is a side view, partly in section, taken through the line 2—2 of Fig. 1, looking in the direction of the arrows, illustrating the construction of the ice thickness testing mechanism; and

Figure 3 is a front view, partly in section, showing the operative position of the device when the thickness of the ice formed on the freezing chamber has reached the limiting value.

Referring to Figure 1, the freezing chamber of a refrigerator is shown at 10, to one side of which the three elongated bolts 11 are secured by means of the nuts 12. The defrosting mechanism comprises a housing 13 to which are soldered or otherwise secured three elongated tubes 14 which are adapted to receive three bolts 11 on the side of the freezing chamber 10. At the outer extremity of each of the tubular members 14 a short sleeve 15 is secured which is formed with an outward extension 16 which is bent downwardly to form the split lug 17. In assembling, the tubes 14 slide over the bolts 11 until the housing 13 is in the desired position next the outer wall of the freezing chamber 10. The extreme ends of the bolts 11 are threaded at 18 to receive the nuts 19 in which the axial grooves 20 are formed to receive the split lugs 17 on the extensions 16. By adjusting the nuts 19, the housing 13 may be moved within a reasonable range so as to control the distance between the side of the freezing chamber 10 and the defrosting mechanism.

At the upper end of one of the side walls of the housing 13 an electromagnet 21 is secured by means of the through bolts 22 and the nuts 23. Directly below the electromagnet an armature 24 is pivoted at 24' and is adapted to rest on a vertical stop member 25 which is secured to the base of the housing 13. The position of the armature 24 is so chosen that the air gap will be small enough to permit it to be rapidly brought into contact with the lower surface of the electromagnet 21 when the latter becomes energized.

A rectangular aperture 26 is formed in the side of the housing 13 which is nearest the freezing chamber 10, at the upper end of which a pin 27 is journaled at 28 to form a hinge about which a vertically depending member 29 may freely swing. The upper central portion of the vertical member 29 is bent inwardly at right angles to form an arm 30 on which an insulated contact 31 is mounted. A member 32 is hinged on the central portion of the pin 27 and is maintained parallel to the arm 30 by means of a coil spring 33 which is mounted therebetween. On the member 32 an insulated contact 34 is mounted which is adapted to engage the contact 31 on the member 30 to close a circuit for defrosting the refrigerator. The member 32 also carries a downwardly depending L-shaped guard 35 which acts to prevent the contacts 31 and 34 from separating more than a fixed amount when the member 32 is raised by the armature 24.

The refrigerator compressor motor 36 is supplied with power from a source 37 through the wires 38 and a starting box 39 which is connected in series with the motor 36. A connection is also made from the source 37 through the wires 38, the starting box 39 and the wires 40 to

to the electromagnet 21 by means of which it may be energized. These last connections are so made that when the handle of the starting box 39 is on the first point the electromagnet 21 is instantaneously energized. But when the handle has moved to the second resistance point the magnet is then deenergized and it remains in this condition until the motor has stopped and has started again.

In operation, let it be assumed that the temperature within the refrigerator has been raised to such a point that the motor starting box 39 is operated in conjunction with the usual thermostat and electromagnet, not shown. The handle of the starting box begins to move from the highest resistance point to the lowest and as it passes over the first point it energizes the electromagnet 21 through the wires 40. The armature 24 thereupon instantaneously swings upwardly until it is in contact with the face of the electromagnet 21 and in so doing it strikes the edge of the horizontal member 32 of the ice testing mechanism. Since the member 30 and the member 32 are connected by means of the spring 33, the entire testing mechanism rotates in a clockwise direction about the pin 27. When the handle of the starting box 39 reaches the second point the electromagnet 21 is instantaneously deenergized, allowing the armature 24 to fall downwardly when it again engages the upper surface of the horizontal member 32, forcing it downwardly and causing the entire testing mechanism to rotate in a counter-clockwise direction about the pin 27 until the armature 24 rests on the stop 25 in the normal inoperative position. The tension in the coil spring 33 is so adjusted that the contacts 34 and 31 will not be closed when the horizontal member 32 is moved downwardly unless the vertical member 29 is held in a fixed position. Thus, if no ice has formed on the side wall of the freezing chamber 10, the testing mechanism will freely rotate and allow the armature 24 to return to its normal position without closing the circuit through the heating coils.

When the ice formed on the side of the freezing chamber 10 has reached the predetermined limiting thickness, the initial energizing of the compressor motor 36 will energize the electromagnet 21 causing its armature 24 to swing upwardly past the horizontal member 32 until the electromagnet 21 is again deenergized. The armature 24 then drops downwardly, striking the horizontal member 32 which is thus also forced downwardly, causing the testing mechanism to rotate about the pin 27. As shown in Figure 3, however, the presence of a layer of ice of limiting depth on the side of the freezing chamber 10 almost immediately stops the movement of the vertical member 29, so that the weight of the armature 24 compresses the spring 33, closing the contacts 31 and 34. This completes a circuit from the source 37 through a wire 41, contacts 34 and 31, a wire 42 and the heating coils 43 which are thus energized. The heating coils 43 have been shown only on the lower wall of the freezing compartment for the sake of clarity, but in a regular installation it is assumed that heating coils will be used on both the sides and bottom of the freezing chamber 10 so that the heat generated thereby will rapidly and effectively melt the ice formed.

As the heating progresses, the thickness of the layer of ice on the side wall of the freezing chamber 10 is reduced, permitting the vertical member 29 to move outwardly from the defrost-

ing mechanism and simultaneously allowing the horizontal member 32 to move downwardly until eventually the armature 24 will fall past the member 32 to rest on the stop 25. The relative weights of the horizontal member 32 and the vertical member 29 should be so chosen that the testing mechanism will remain in the inoperative position substantially as shown in Figure 1, in which the member parallel to the side of the freezing chamber 10 is in a substantially vertical position. Furthermore, the armature 24 should be so designed that it will be heavy enough to overcome the tension in the spring 33 when it rests on the horizontal member 32 in the circuit closing position.

This invention provides a mechanism by means of which ice formed on the outer walls of a freezing chamber may be rapidly and effectively removed. Furthermore, defrosting may be accomplished without raising the temperature of the air within the refrigerator to any appreciable extent so that there is no possibility of perishable food being inadvertently spoiled, as frequently happens with other defrosting processes. The mechanism, moreover, is very simple in character and occupies a minimum amount of space within the refrigerator. This last is an important feature since the available space in modern electric and gas refrigerators is very limited.

It is obvious that the automatic defrosting mechanism described above can be applied to a wide range of refrigerating equipment and is not necessarily limited to refrigerators of the electric or gas type. For example, it might be used to determine the thickness of ice on the large freezing coils which are customarily used in cooling large show cases and the like. It is to be understood, therefore, that this invention comprehends all such uses.

While a specific embodiment has been presented above, the invention is not intended to be limited in any way thereby, but it is susceptible of various changes in form and detail within the scope of the appended claims.

I claim:

1. An automatic defrosting mechanism comprising means to test the thickness of a layer of ice intermittently, and means responsive to a predetermined thickness of ice for applying heat to the said ice layer.

2. An automatic defrosting mechanism comprising means to test the thickness of a layer of ice intermittently, electrical means to remove the said layer of ice, and means responsive to a predetermined thickness of the said ice layer for closing a circuit to energize the said ice removing means.

3. An automatic defrosting mechanism comprising means to test the thickness of a layer of ice intermittently, means to apply heat to the said ice layer, and means responsive to a predetermined thickness of the said ice layer for closing a circuit to energize the said heat applying means.

4. An automatic defrosting mechanism comprising means to test the thickness of a layer of ice, means to actuate the said testing means intermittently, means for removing the said layer of ice, and means responsive to the thickness of the said ice layer for closing a circuit to energize the said ice removing means.

5. An automatic defrosting mechanism comprising means to test the thickness of a layer of ice, means to actuate the said testing means intermittently, means for applying heat to said ice

layer and means responsive to the thickness of the said ice layer for closing a circuit to energize the said heat applying means.

6. In refrigerating apparatus having a freezing element on which ice normally forms, an automatic defrosting mechanism comprising means to remove ice formed on the said element a rotatable member disposed adjacent one side of the said freezing element, the said member having a portion formed as an arm extending substantially at right angles to the said member, a contact on the said arm, a second rotatable member disposed adjacent the said arm having a contact mounted thereon, resilient means between the said second member and the said arm to maintain the said contacts normally open, and means to swing the said second arm upwardly and then downwardly intermittently, the said last means being adapted to close the said contacts when the ice formed is of a predetermined thickness to energize said ice removing means.

7. In refrigerating apparatus having a freezing element on which ice normally forms, an automatic defrosting mechanism comprising a housing, a member pivotally mounted on the said housing adjacent one side of the said freezing element, the said member having a portion formed as an arm extending substantially at right angles to the said member, a contact on the said arm, a second member pivotally mounted on the said housing adjacent the said arm and having a contact mounted thereon, resilient means between the said second member and the said arm to maintain the said contacts normally disengaged, an electromagnet having an armature adapted to intermittently swing past and engage the said second arm, and heating coils mounted on the said freezing element, whereby when the ice formed on the freezing element has reached a predetermined thickness, the said armature will rest on the said second member thereby closing the said contacts and energizing the heating coils to melt the ice.

8. An automatic defrosting mechanism comprising means to test the thickness of a layer of ice intermittently, means to remove the said layer of ice, means responsive to a predetermined thickness of the said ice layer for closing a circuit to energize the said ice removing means, and means to adjust the said testing means to control the limiting ice thickness.

9. In refrigerating apparatus having a freezing element on which ice normally forms, an automatic defrosting mechanism comprising means to remove ice formed on said element, a rotatable member disposed adjacent one side of the said freezing element, an arm on the said member extending substantially at right angles to the said member and having a contact thereon, a second rotatable member disposed adjacent the said arm and having a contact mounted thereon, a guard member on the arm to limit the extent of separation of the said contacts, resilient means between the said member and the said arm to maintain the contacts normally disengaged, means to swing the said second member upwardly and then downwardly intermittently, the said last means being adapted to close the said contacts when the ice formed is of a predetermined thickness, to energize said ice removing means.

10. In refrigerating apparatus having a freezing element on which ice normally forms, an automatic defrosting mechanism comprising means to remove ice formed on said element a ro-

tatable testing device having one member disposed adjacent the said freezing element, a second member angularly disposed with respect to the said first member; contacts on the said members, and means to rotate the said testing device to move the said first member in the direction of the ice formed on the freezing element, whereby when the ice has reached a predetermined limiting thickness the testing device will be brought to rest and the rotating means will rest on the said second member to close the contacts for energizing said ice removing means.

11. In an automatic defrosting mechanism for removing ice formed on a cooling surface a testing device comprising a rotatable member disposed adjacent the cooling surface, the said member having a portion formed as an arm extending substantially at right angles to the said member, a contact on the said arm, a second rotatable member disposed adjacent the said arm and having a contact mounted thereon, resilient means between the said member and the said arm to maintain the contacts normally open, and means to move the second arm intermittently, the said last means being adapted to close the said contacts when the ice formed is of a predetermined thickness.

12. In an automatic defrosting mechanism for removing ice formed on a cooling surface a testing device comprising a rotatable member disposed adjacent the cooling surface, a second member angularly disposed with respect to the said first member, contacts on the said members, and means to rotate the said testing device to move the said first member in the direction of the ice formed on the cooling surface, whereby

when the ice has reached a predetermined limiting thickness the testing device will be brought to rest and the rotating means will rest on the second member to close the contacts.

13. In refrigerating apparatus having a freezing element on which ice normally forms, an automatic defrosting mechanism comprising means for removing ice formed on said freezing element, a movable member disposed adjacent said freezing element and having a contact thereon, a second movable member operatively associated with said first movable member and having a contact thereon, resilient means for maintaining said contacts normally open and means for moving said second movable member to cause the first movable member to move in the direction of the freezing element, the said last means being adapted to close the said contacts when the ice formed is of a predetermined thickness, for operating said ice removing means.

14. In an automatic defrosting mechanism for removing ice formed on a cooling surface, a testing device comprising a movable member disposed adjacent the cooling surface and having a contact thereon, a second movable member operatively associated with said first movable member and having a contact thereon, resilient means between the said first and second movable members for maintaining the contacts normally open, and means for moving the second movable member to cause the first movable member to move in the direction of the cooling surface, the said last means being adapted to close the said contacts when the ice formed is of a predetermined thickness.

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