Feb. 21, 1939. A. S. VOLPIN 2,147,867

AUTOMATIC DEFROSTING REFRIGERATOR APPARATUS

Filed July 23, 1934

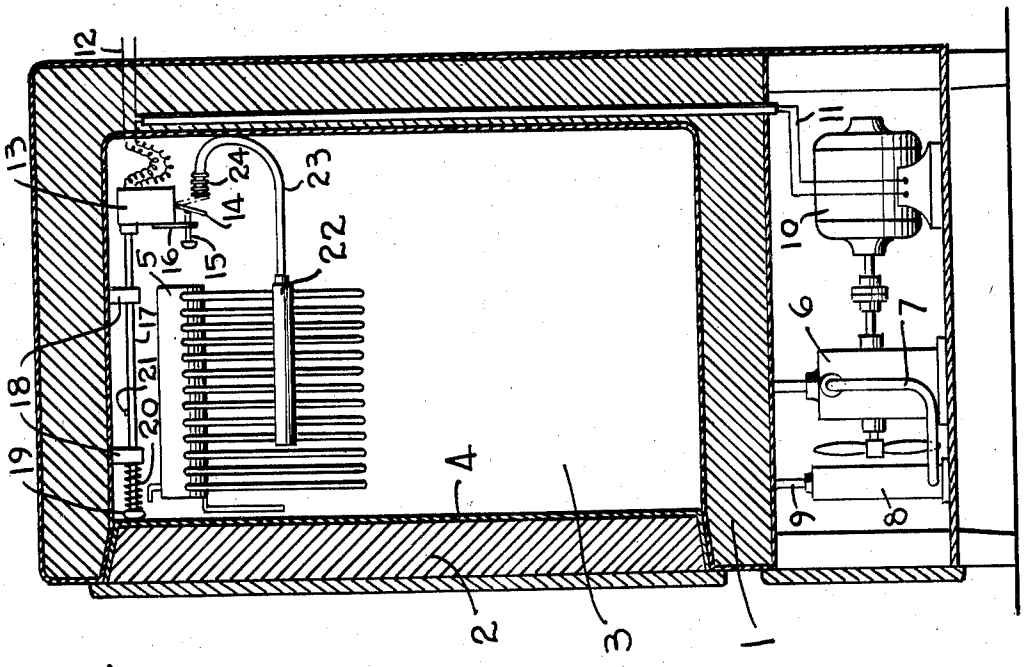


Fig. 1.

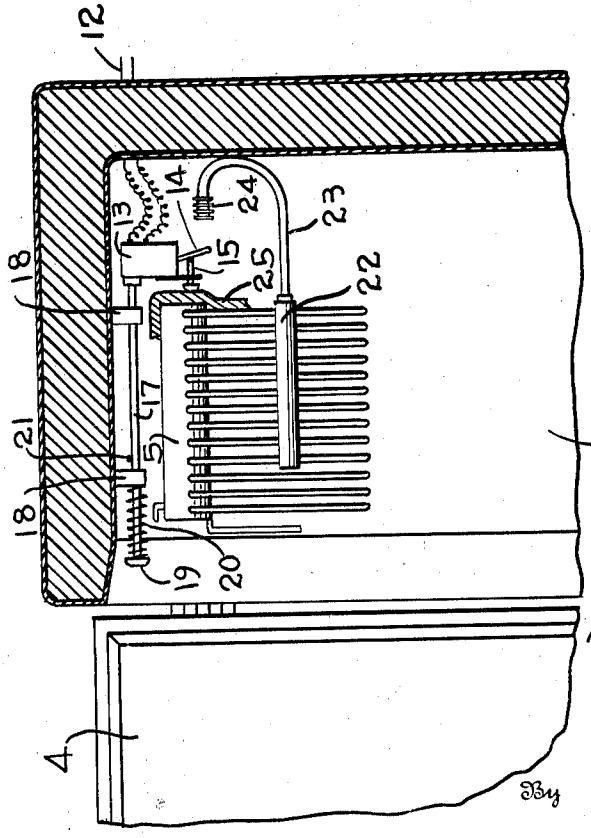


Fig. 2.

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Patented Feb. 21, 1939

2,147,867

UNITED STATES PATENT OFFICE

2,147,867

AUTOMATIC DEFROSTING REFRIGERATOR APPARATUS

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Application July 23, 1934, Serial No. 736,535

18 Claims. (Cl. 62—4)

My invention relates to apparatus for defrosting mechanically operated refrigerators.

A difficulty commonly encountered with the modern mechanically operated refrigerator arises from the accumulation of ice over the cooling element in the refrigerator, said coating acting to insulate the cooling element from the interior of the box, thus interfering with its effective cooling action. As a result of the foregoing this coating of ice or frost has to be removed from the cooling element at intervals and this ordinarily is done by turning off the connection between the cooling element and the mechanical device which supplies the cooling fluid thereto and allowing the ice upon the cooling element to melt and drop away from the said element. The operator of the refrigerator therefore has to keep close watch upon the ice accumulation upon the cooling element to decide when defrosting should be started and in addition must note when the ice has melted and then again put the refrigerator into operation. This necessitates a marked amount of personal attention which makes the operation of the device a task which requires a material amount of time.

It is an object of the invention to provide means automatically operated in the use of the refrigerator which will modify normal operation of the cooling element to allow the ice to melt and drop from the device and to automatically again put the cooling element in normal operation.

It is another object of the invention to provide a switch for turning off the electrical current to the motor operating in response to the thickness of the coating of ice and frost upon the cooling element.

It is another object of the invention to provide means responsive to the temperature of the cooling coil to again close the switch and start the operation of the motor.

It is another object of the invention to move the switch relative to the cooling element to accomplish the results stated through the opening and closing of the door to the refrigerator chamber.

In the drawing herewith, Fig. 1 is a central vertical section through the refrigerator equipped with my invention.

Fig. 2 is a broken upper section similar to that shown in Fig. 1 with the refrigerator door open and the switch in a differently operated position from that shown in Fig. 1.

The refrigerator here shown has an insulated wall 1 with a door 2 on the forward side thereof. The walls enclose a central chamber 3 which may, as in the ordinary construction, be lined with porcelain or similar material, as indicated at 4.

Within this chamber and ordinarily at one side thereof is a cooling element 5 which is shown as of ordinary construction including an upper chamber and coils connected therewith through which the cooling liquid is circulated. There is a connection between the said cooling element 5 and the compressor 6, which is shown as being mounted below the refrigerating chamber. Said compressor is connected through the pipe 7 with the condenser 8, said condenser in turn being connected through the pipe 9 with the cooling element. The compressor is operated through an electric motor 10 connected in an electric circuit 11, which obtains its current through lines 12, which may be connected with the circuit. It is to be understood that the operation of the compressor 6 by the motor 10 will circulate the cooling liquid through a circuit including the cooling element 5 back to the condenser 8. This particular cooling apparatus is not a novel portion of my invention.

The circuit 12 is extended through the walls of the refrigerator to a switch 13 within the chamber 3 of the refrigerator. This switch has an operating arm 14 thereon which may be moved to cut off or turn on the current to the motor, said arm being adapted for operation by push button 15 slidably mounted within the bracket 16 upon the housing for the switch.

The housing 13 for the switch is supported upon the end of a slidable rod 17 supported in the brackets 18 mounted on the inner wall of the refrigerator. Said rod extends forwardly beyond the supports and has a rounded head 19 thereon which is ordinarily held resiliently toward the door 2 of the chamber by means of a compression spring 20. There is a small stop pin 21 on the rod 17 which limits the forward movement of the rod within its bearing 18. It is to be noted, therefore, that when the door of the refrigerator is open, as shown in Fig. 2, the spring 20 will move the rod 17 slidably forward toward the said door, advancing the switch housing 13 and the push button 15 into a position closely adjacent the end of the cooling element 5.

In order to close the switch 14 after it has been opened sufficiently to allow the defrosting of the coil, I provide a thermostat usually containing temperature responsive fluid, such as mercury, and connected by a curved neck 23 to a bellows-shaped chamber 24 ordinarily termed a Sylphon element, said bellows being expanded and contracted by temperature changes in the evaporator.

This Sylphon is positioned as shown in the drawing so that the forward end thereof will be closely adjacent the switch lever 14 and will act, when the element 24 has been sufficiently expanded by heating during defrosting of the cooling element 5, to move the switch arm from the dotted line position in Fig. 1 to the full line position, thus turning on the current to the motor and starting the operation of the cooling apparatus.

The operation of this device will now be clear. The device may be set to operate when a coating of the desired thickness has been formed upon the cooling element. In Fig. 2 a portion of such coating of ice or frost is shown at 25. This is understood to be a reasonably uniform coating of ice entirely about the cooling element 5. When the door of the refrigerator is open the switch housing 13 will be moved from its position shown in Fig. 1 forwardly against the ice coating 25 by the action of the spring 20 upon the rod 17. If this coating of ice 25 has reached the thickness where the element should be defrosted it will contact with the push button 15 and move the same so as to open the switch 14 and shut off the motor 10. This will allow the cooling element 5 to absorb heat from the interior of the refrigerator to such an extent as to allow the ice to melt and drop away from the cooling element. When the cooling element has been warmed and sufficient time has elapsed, permitting the ice to melt, the temperature responsive device 24 will expand to move the end of the Sylphon element 24 against the switch arm 14 and move it again to closed position, again turning on the current and placing the cooling apparatus into operation.

It will be obvious that this device is of very simple construction, easily and cheaply manufactured, and one not liable to get out of order or fail in use. It is to be understood that each time the door of the refrigerator is opened, the switch box 13 will be moved forward toward the cooling element, but not until the ice coating thereon has been accumulated to a sufficient thickness will the contact of the push button 15 therewith open the switch and turn off the current. The current will be again turned on automatically when the ice has been melted so as to allow the coil to warm up and actuate the temperature-operated member 22. The advantages of this construction will be obvious to those skilled in the art.

What is claimed as new is:

1. In a mechanical refrigerator having a cooling chamber therein and a cooling element in said chamber, the combination of an electrically operated cooling apparatus, a motor therefor, an electric circuit including said motor, a switch in said chamber connected in said circuit, means to move said switch toward said cooling element, and means responsive to the accumulation of ice on said cooling element to actuate said switch to open the same when said switch is moved toward said cooling element.

2. A mechanical refrigerator including a cooling chamber, a cooling element therein, and electrically operated means to actuate said cooling element; in combination with an electrical circuit including said means, a switch in said circuit within said chamber, a lever on said switch, means to move said switch toward said element, means to hold said switch away from said element, and means to engage said lever and open said switch when said switch is moved toward said element, operating in response to the accumulation of ice on said element.

3. A mechanical refrigerator including a cooling chamber, a cooling element therein, and electrically operated means to actuate said cooling element, in combination with an electrical circuit including said means, a switch in said circuit within said chamber, a slidable support for said switch, resilient means to move said support and switch toward said cooling element, and means responsive to the accumulation of ice on said element to open said switch when said switch is moved toward said element.

4. A mechanical refrigerator including a cooling chamber, a cooling element therein, an electrical motor, an electrical circuit including said motor, a slidable support in said chamber, a switch in said circuit and mounted on said support, a door for said chamber, means to move said switch toward said cooling element and normally holding said support in position contacting said door to space said switch from said element, and means operating in response to a coating of ice on said element to open said switch when said door is opened.

5. A mechanical refrigerator including a cooling chamber, a cooling element therein, an electrical motor, an electrical circuit including said motor, a slidable support in said chamber, a switch in said circuit and mounted on said support, a door for said chamber, means to move said switch toward said cooling element and normally holding said support in position contacting said door to space said switch from said element, means operating in response to a coating of ice on said element to open said switch when said door is opened, and a temperature responsive device to again close said switch.

6. In a mechanical refrigerator including a cooling chamber, a cooling element therein, means to cause the circulation of cooling fluid therethrough including an electric motor, an electric circuit in which said motor is connected, a switch in said chamber and connected in said circuit, means tending to move said switch toward said element, means to hold said switch spaced therefrom, and means operative through a predetermined coating of ice on said element to open said switch when said switch is moved toward said element.

7. A refrigerating chamber, a door therefor, a cooling element in said chamber, means to circulate cooling fluid through said element, and means actuated by the opening of said door to control said circulating means to render the same inoperative when a predetermined thickness of ice has formed on said element.

8. A refrigerating chamber, a door therefor, a cooling element in said chamber, means to circulate cooling fluid through said element, means actuated by the opening of said door to control said circulating means to render the same inoperative when a predetermined thickness of ice has formed on said element, and additional means cooperating with the second mentioned means to render said circulating means again operative when said cooling element has attained a certain temperature.

9. A chamber, a door therein, a cooling element in said chamber, means to circulate a cooling fluid in said cooling element, a support in said chamber, means to hold said support resiliently against said door when said door is closed, means on said support to control said fluid circulating means, said control means operating in response to contact with a coating of ice on said cooling

element when said door is opened to stop said circulation.

10. A mechanical refrigerator including a chamber to be cooled, a cooling element therein, electrically operated means to actuate said cooling element including an electrical circuit, a switch in said circuit and means for moving said switch toward said cooling element to open said switch by contact with the accumulation of ice on said cooling element.

11. A refrigerator including a cooling chamber, a door thereon, a cooling element in said chamber, means to circulate a cooling fluid through said element, and means to discontinue said circulation after a predetermined coating of ice has accumulated on said element, operating in response to the opening of said door.

12. A mechanical refrigerator including a chamber to be cooled, a door thereon, a cooling element in said chamber, an electric circuit, electrically operated cooling means in said circuit and connected with said element, a switch in said circuit, a support for said switch, means operating in response to the opening and closing of said door to cause said support to move relative to said cooling element, and to open said switch by contact thereof with ice on said cooling element.

13. A refrigerator including a cooling chamber, a door thereon, a cooling element in said chamber, means to circulate a cooling fluid through said element, and means actuated in response to the movement of said door to discontinue said circulation after a predetermined coating of ice has accumulated on said element.

14. A refrigerator including a cooling chamber, a door thereon, a cooling element in said chamber, means to circulate a cooling fluid through said element, a device to automatically defrost said cooling element consisting of means to discontinue said circulation, operating in response to the movement of said door, and means independent of said door to re-establish operation of said circulation means when defrosting has been accomplished.

15. A refrigerator comprising a cabinet having an insulated storage compartment, a door for said compartment, refrigeration apparatus including a cooling element for cooling air in said compartment, means for normally controlling operation of said apparatus so that said cooling element is at a temperature below freezing and subject to formation of frost thereon, a device operative to modify operation of said refrigeration apparatus to permit increase in temperature of said cooling element and melting of the frost, a member actuated by the door for operating said device movable toward and away from said cooling element and constructed and arranged to instigate operation of said device upon impact against frost when it is moved toward said cooling element.

16. In a refrigerator comprising a cabinet having an insulated chamber, a door providing access to said chamber, refrigeration apparatus including a cooling element for cooling air in said chamber, means normally controlling operation of said refrigeration apparatus so that said cooling element is operated at a temperature below freezing and is therefore subject to formation of frost thereon, the combination of a device operative upon changes in temperature of said cooling element, and mechanism arranged to be operated by both said door and said temperature responsive device and constructed and connected to impose control on said refrigeration apparatus to cause increase in temperature of said cooling element for defrosting the latter responsive to said door operation and relinquish control responsive to operation by said temperature responsive device upon rise in temperature of said cooling element.

17. A refrigerator comprising a cabinet having an insulated chamber and a door affording access to said chamber, apparatus for producing refrigeration including a cooling element for cooling air in said chamber, control means for modifying the normal operation of the refrigeration apparatus for discontinuing the normal reduction of temperature of the cooling element and thereby permitting the cooling element to rise in temperature to melt off the frost until the said cooling element reaches a predetermined temperature, means for rendering inoperative said modifying means to permit normal operation of the refrigeration apparatus when said predetermined temperature is reached, and means whereby said modifying means is set into action by said door.

18. A refrigerator comprising a cabinet having an insulated chamber and a door affording access to said chamber, apparatus for producing refrigeration including a cooling element for cooling air in said chamber, control means for modifying the normal operation of the refrigeration apparatus for discontinuing the normal reduction of temperature of the cooling element and thereby permitting the cooling element to rise in temperature to melt off the frost, and means whereby said control means for modifying the normal operation of the refrigerating apparatus is set into action by said door, the construction and arrangement being such that the door and the control means are disassociated after initiation of the defrosting cycle until said cycle has been completed.

ALEXANDER S. VOLPIN.