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REFRIGERATION APPARATUS

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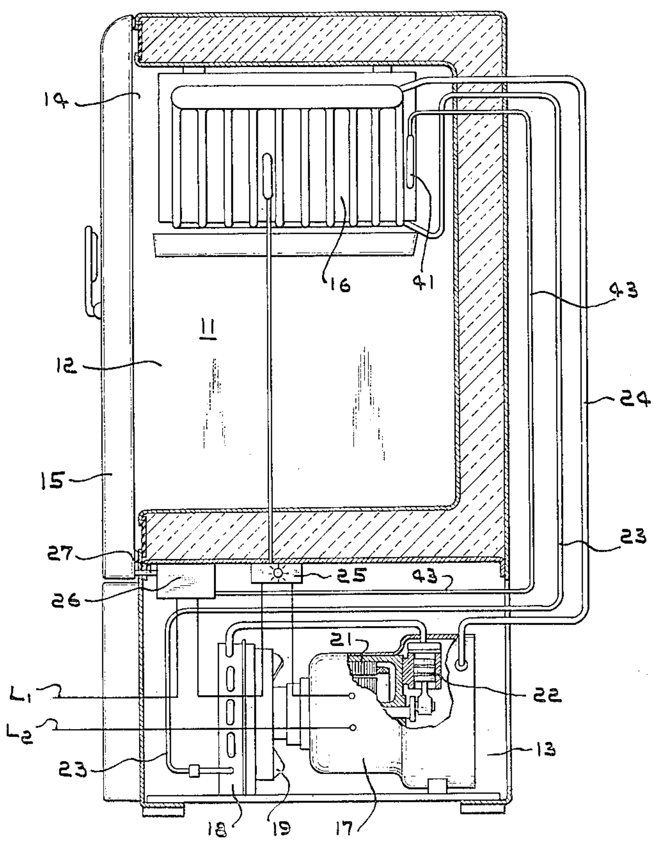

FIG. 1.

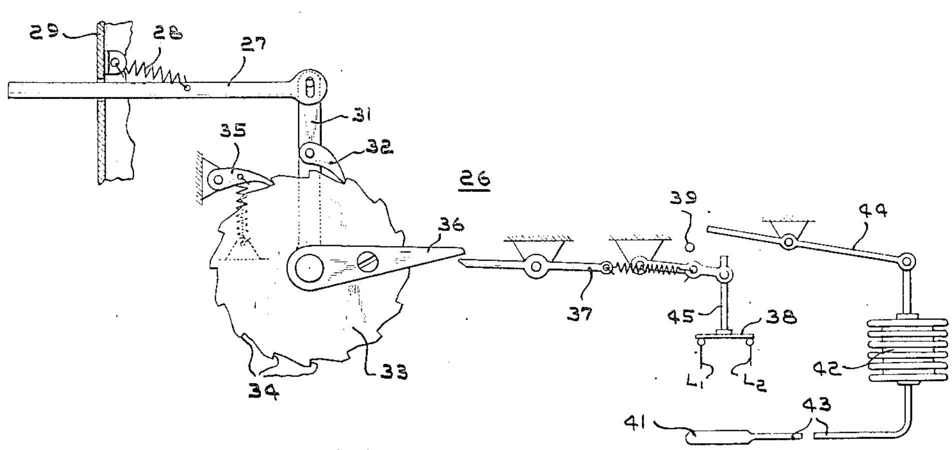

FIG. 2.

WITNESSES:

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REFRIGERATION APPARATUS

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5 Claims. (Cl. 62—4)

My invention relates to refrigeration apparatus and particularly to automatic defrosting of the cooling element of such apparatus.

It is desirable to defrost the cooling element of a refrigerator very frequently, for example every day, to obtain maximum heat transfer between the cooling element and the media to be refrigerated. It has, therefore, been the practice in some cases to provide a defrosting clock which renders the refrigerating system inactive every twenty-four hours for a sufficient time to effect defrosting.

However, the major portion of the moisture which is condensed and forms frost on the cooling element is obtained from the air in the refrigerator. Each time the refrigerator door is opened, a charge of moisture laden air enters the refrigerator, it being obvious, therefore, that the amount of frost on the cooling element is in nearly direct ratio for given average cooling element temperatures to the number of door openings. A clock defrosting device has no relation to the amount of frost on the cooling element, with the result that if the refrigerator door is not opened for twenty-four hours, the refrigerator cooling element is defrosted when it is unnecessary, thereby raising the temperature of the refrigerator and its contents and requiring additional unnecessary power consumption after defrosting to reduce the temperatures to normal. On the other hand, if the refrigerator is being used constantly and the door is being opened many times in a day, defrosting may be necessary in less than twenty-four hours. Defrosting devices directly responsive to the thickness of frost on the cooling element are either quite complicated or lack dependability.

It is, therefore, an object of my invention to provide intermittent defrosting of the cooling element of a refrigerator in response to an operation or use of the refrigerator which has substantially a direct relationship with the quantity of frost collected on the cooling element.

It is another object of my invention to provide intermittent automatic defrosting of the cooling element of a refrigerator in response to the number of times the access door of the refrigerator is opened.

It is still another object of my invention to provide a defrosting device responsive to refrigerator door openings which is readily adaptable to different climatic conditions, particularly humidity conditions in different localities.

It is a further object of my invention to provide a defrosting device responsive to refrigerator door openings for initiating a defrosting period and responsive to the cooling element temperature for ending a defrosting period and restoring normal operation of the refrigerating system.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a sectional view of a refrigerator cabinet and mechanism embodying my invention; and,

Fig. 2 is a schematic view of a mechanism to initiate and terminate a defrosting period in accordance with my invention.

Referring specifically to the drawing for a detailed description of my invention, numeral 11 designates generally a refrigerator cabinet having a food-storage compartment 12 and a machinery compartment 13. The food-storage compartment is provided with an access opening 14 closed by a hinged door 15. An evaporator or cooling element 16 refrigerates the air in the food-storage compartment 12 to preserve food stored therein.

A hermetically sealed motor compressor unit 17, a condenser 18 and a motor driven fan 19 for cooling the condenser are disposed in the machinery compartment 13. The refrigerating system is of the compression type having a motor 21 driving a compressor 22. Compressed refrigerant vapor is delivered to the condenser 18 wherein it is condensed by the cool air from the fan 19. Condensed refrigerant is delivered through a capillary tube flow restricting device 23 to the evaporator 16 wherein the condensed refrigerant vaporizes and absorbs heat. Refrigerant vapor is withdrawn from the evaporator 16 through a conduit 24 by the compressor 22, whereupon the refrigeration cycle is repeated.

A standard adjustable temperature control, shown diagrammatically at 25, is provided for normally controlling cyclic operation of the motor 21 and compressor 22 to maintain an average evaporator temperature below the freezing point of water, at which temperature moisture is condensed from the air in the food-storage compartment 12 and is deposited on the evaporator 16 in the form of frost.

As stated hereinbefore, intermittent automatic defrosting of the evaporator 16 is effected in response to the number of times the door 15 is opened. A mechanism for initiating a defrosting period in response to door openings and terminating said defrosting period in response to

evaporator temperature is indicated generally at 26. The mechanism 26 comprises an operating plunger 27 which is forced inwardly each time the door 15 is closed. A tension spring 28 is attached to the plunger 27 and to a portion 29 of the refrigerator cabinet 11 to pull the plunger 27 outwardly when the door 15 is opened. The plunger 27 is attached to a freely rocking lever 31 having a pawl 32 attached thereto. A ratchet wheel 33 having teeth 34 is rotated by movement of the plunger 27, lever 31 and pawl 32, the pawl 32 engaging the teeth 34 of the ratchet wheel 33. A retaining pawl 35 also engages the teeth 34 and allows rotation of the ratchet wheel 33 in a clockwise direction, but prevents it in a counter-clockwise direction while the pawl 32 is being moved from one tooth to another. The ratchet wheel 33 is provided with a fixed arm 36 which engages a snap-acting device 37 to open a set of contacts 38. A stop 39 limits the movement of the snap-acting device 37. The contacts 38, when closed, establish a flow of current to the temperature control device 25 and motor 21 through a source of power L_1, L_2 and when open, interrupt said flow of current. After the arm 36 has operated the snap-acting device 37 to open the contacts 38, the evaporator 16 rises in temperature due to heat leakage into the refrigerator cabinet 11, and the evaporator is defrosted after a short period of time.

When the evaporator temperature reaches a predetermined temperature above the freezing point of water to insure that all the frost has melted off, expansible fluid contained in a bulb 41 expands, causing expansion of a bellows 42 which is connected to the bulb 41 by a conduit 43. As the bellows 42 expands, it moves a lever 44 which engages a member 45 which carries the movable portion of the contact 38. Lever 44 also engages one end of the snap-acting device 37, causing it to snap into the position shown in Fig. 2 and close the contacts 38. It is apparent that the defrosting period is terminated in response to evaporator temperature and the refrigerating mechanism again cycles to maintain an average evaporator temperature below freezing, as determined by the setting of the temperature control 25.

The ratchet wheel 33 shown in Fig. 2 by way of example has sixteen teeth 34 therein. However, in actual practice the wheel would have perhaps fifty teeth, so that a defrosting period would be initiated every fiftieth time the door 15 is opened and re-closed. For given climatic conditions, it is possible to determine how many door openings will result in the necessity for defrosting under average normal conditions. If the humidity in a particular climate is, for example, very low, it is not necessary to defrost quite as frequently and a ratchet wheel having, for example, one hundred teeth may be provided on refrigerators shipped to such a locality.

From the foregoing it will be apparent that I have provided a new defrosting device which intermittently automatically effects defrosting of the cooling element of a refrigerator in response to the number of times the access door is opened.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In refrigeration apparatus, the combination of a refrigerator cabinet having a food-storage compartment provided with an access opening therein, a door movable for opening and closing the access opening, a cooling element for refrigerating the air in said food-storage compartment, refrigerating apparatus for normally maintaining said cooling element at an average temperature below the freezing point of water, at which temperature it collects frost from the moisture in said air and means responsive to the opening and closing of said door a predetermined plurality of times to modify the operation of said refrigerating apparatus to permit the temperature of said cooling element to rise above the freezing point of water.

2. In refrigeration apparatus, the combination of a refrigerator cabinet having a food-storage compartment provided with an access opening therein, a movable door for opening and closing the access opening, a cooling element for refrigerating the air in said food-storage compartment, refrigerating apparatus for normally maintaining said cooling element at an average temperature below the freezing point of water, at which temperature it collects frost from the moisture in said air and means for modifying the operation of said refrigerating apparatus to permit the temperature of said cooling element to rise above the freezing point of water, in response to the opening and closing of said door a predetermined plurality of times, and for re-establishing normal operation of said refrigerating apparatus in response to an above freezing temperature of said cooling element.

3. In refrigeration apparatus, the combination of a refrigerator cabinet having a food-storage compartment provided with an access opening therein, a door movable for opening and closing the access opening, a cooling element for refrigerating the air in said food-storage compartment, refrigerating means for normally maintaining the temperature of said cooling element below the freezing point of water, at which temperature it collects frost from the moisture in said air, and means operative by the opening and closing of said door a predetermined plurality of times to modify the operation of said refrigerating means and thus permit a rise in the temperature of said element above the freezing point of water.

4. In refrigeration apparatus, the combination of a refrigerator cabinet having a food-storage compartment provided with an access opening therein, a door movable for opening and closing the access opening, a cooling element for refrigerating the air in the food-storage compartment, means for circulating a refrigerant through said cooling element, control means for normally operating said refrigerant circulating means to maintain an average temperature of said cooling element below the freezing point of water, at which temperature the cooling element collects frost from the moisture in said air and means for intermittently modifying the operation of said refrigerant circulating means when said door has been opened and closed a predetermined plurality of times to raise the temperature of said cooling element and effect defrosting of said cooling element.

5. In refrigeration apparatus, the combination of a refrigerator cabinet having a food-storage compartment provided with an access opening therein, a door movable for opening and closing the access opening, a cooling element for refriger-

ating the air in the food-storage compartment, means for circulating a refrigerant through said cooling element, control means for normally operating said refrigerant circulating means to maintain an average temperature of said cooling element below the freezing point of water, at which temperature the cooling element collects frost from the moisture in said air, means for intermittently superseding said control means and for modifying the operation of said refrigerant circulating means when said door is opened and closed a predetermined plurality of times to raise the temperature of said cooling element and permit defrosting of said cooling element and means responsive to an above freezing temperature of said cooling element for restoring control of said circulating means to said control means.

GRAHAM S. McCLOY.