July 19, 1932. E. C. RANEY 1,867,711

DEFROSTER

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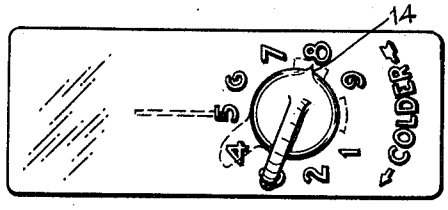


Fig 2

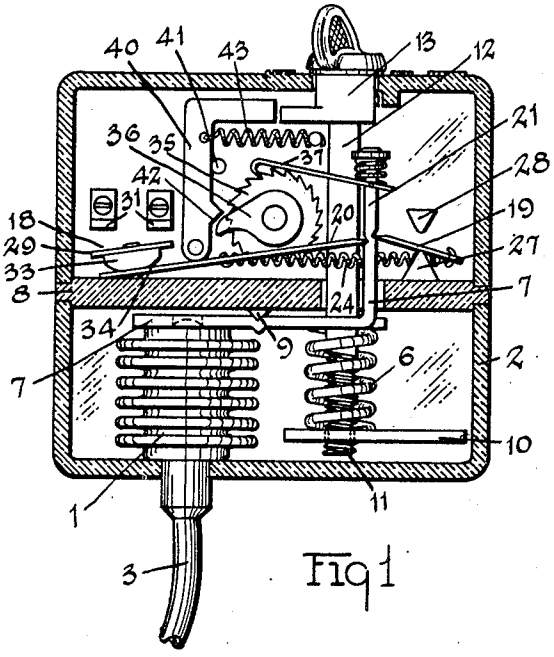


Fig 1

Inventor

Estel C. Raney

By Faust F. Crampton.

Attorney

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UNITED STATES PATENT OFFICE

ESTEL C. RANEY, OF COLUMBUS, OHIO

DEFROSTER

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My invention has for its object to provide a means for the prevention of the accumulation of frost on the surface of the refrigerating heat absorbing element, such as the expansion chamber, of a refrigerating apparatus. As is well known in connection with refrigerators, the accumulation of frost increases resistance to heat transmission and consequently decreases the efficiency of the refrigerator. Also, as is well known, defrosting that is dependent upon manual operation results in irregular defrosting periods which repeatedly allows accumulations of large amounts of frost with the result that upon defrosting there frequently occurs the discharge of a large amount of water, with the attendant inconvenience of disposing of the water, often resulting in the overflow of receptacles used for the purpose of receiving the water. Furthermore, where defrosting of the refrigerating apparatus depends upon manual operation, restoration, particularly in connection with domestic refrigeration, is frequently delayed to such an extent as to cause the temperature to rise above the proper food preservative point and for a period of time that causes deterioration and injury to the food. Also, repeated change from the low temperature of refrigerators to the non-preservative temperature, causes marked deleterious effects on certain kinds of food. By my invention I have provided a means for automatically preventing the accumulation of a material amount of frost, thereby keeping the surface of the heat absorbing element free from more than a thin layer of frost by producing defrosting at periods properly timed and spaced apart according to the refrigerating operations of the refrigerating apparatus. Defrosting may thus be automatically produced at regular intervals to prevent more than the formation of a very thin frost coating during the refrigerating operations and for a period of time that will produce complete removal of the slight deposit of frost without undue rise in temperature of the food storage chamber of the refrigerator.

The invention particularly provides a means for producing periods of defrosting operation that are separated by a predetermined number of refrigerating operations of the refrigerating apparatus, the length of the periods of defrosting depending entirely upon the rise in temperature occurring during the defrosting period and consequently insuring complete frost removal in advance of beginning of subsequent cycles of refrigerating operations, the defrosting recurring with sufficient frequency as to prevent more than a thin layer of frost accumulation during the refrigerating operations. The device produces restoration of the apparatus to the refrigerating operations immediately upon completion of the defrosting operation which prevents undue temperature rise within the food storage space of the refrigerator. Thus the device maintains the apparatus at its maximum efficiency and eliminates the inconvenience of personal inspection and regulation of the frost conditions of the refrigerator.

The invention consists in other features which will appear from the following description and upon examination of the drawing. Structures containing the invention may partake of different forms and may be varied in their details and still embody the invention. To illustrate a practical application of the invention, I have selected a defroster embodying the invention as an example of the various structures and details of such structures that contain the invention and shall describe the selected structure hereinafter, it being understood that variations may be made and that certain features of my invention may be used to advantage without a corresponding use of other features of the invention and without departing from the spirit of the invention. The particular structure selected is shown in the accompanying drawing.

Fig. 1 illustrates a view of a section of the defrosting device. Fig. 2 is a top or face view of the shell of the defrosting device.

In the particular form of construction shown in the drawings, a bellows 1 is suitably mounted in the shell 2. The bellows communicates with a suitable pipe 3 that may be connected to a pressure device that is responsive to the operations of the refrigerator.

The pipe 3 may be connected to the low pressure side of the refrigerating apparatus and the bellows operated by the pressure in that part of the apparatus, or it may be connected to a bulb and contain a thermic expansible gas and the bulb located at a point contiguous to elements of the refrigerating apparatus where the temperature, and consequently the pressure within the pipe and the bellows, changes according to the operations of the refrigerating apparatus.

In order to load the bellows, and particularly to provide means for varying the pressures within the bellows required to produce a predetermined expansive movement of the bellows, a spring 6 is suitably connected to the bellows to counteract the expansive movements of the bellows, and means is provided for adjusting the resistance of the spring to the movements of the bellows to vary the internal pressure required to produce a predetermined expansion of the bellows. A lever 7 is fulcrumed on the wall 8, as at 9. The bellows 1 engages one end of the lever and one end of the compression spring 6 engages the other end of the lever to counterbalance the pressure of the bellows on the lever 7. The other end of the spring 6 is connected to an adjustably supported plate 10. The plate 10 is adjustably located by means of a screw 11 located on the rod 12 which may be rotated to vary the pressure of the spring on the lever. Rotation of the plate 10 with the screw is prevented by any suitable means, such as the side wall of the shell 2. The rod 12 may be connected to a head 13 having a suitable indicator 14 that moves contiguous to a dial or circularly arranged indicating numbers that indicate relative location of the plate 10 and, consequently, the pointer and dial indicates relative pressures of the spring 6 that are exerted against the expansive pressure of the bellows 1. This consequently indicates the rise of pressure required in the bellows to produce a predetermined extent of movement of the end of the bellows that engages one end of the lever 7. Since the pressures within the bellows, as determined by the adjustment of the spring are utilized for the control of the operation of the compression of the refrigerating apparatus, the temperature of the refrigerator may be controlled by adjustment of the pointer with respect to the dial.

The lever 7 operates a snap switch 18 located in the circuit of the motor that operates the refrigerating compression. Preferably, the lever 7 has a part 21 that extends through the wall 8. The wall 8 divides the shell 2 into two chambers. The switch 18 is located in one chamber and the bellows and counterbalancing spring is located in the other.

The switch 18 is a snap switch, preferably of toggle form in that it has two links 19 and 20, having ends that are supported in recesses formed in the extension 21 of the lever 7. A spring 24 is connected to the links 19 and 20 at points remote from the lever abutting ends. The spring 24 produces endwise thrusts in the links 19 and 20 and lateral components, that snap the ends of the links 19 and 20 to one side or the other, dependent upon limiting stops that are disposed on opposite sides of the links 19 and 20 and the movement of the lever to draw the abutting ends of the links through planes located between the limiting stops. The link 19 operates between the stops 27 and 28. The link 20 carries the movable contact 29 of the switch 18 and is limited in its movement by the fixed contacts 31 on one side and the wall 8 on the other side.

To insure contact of the movable contact 29 with the fixed contacts 31, notwithstanding the angular movement of the link 20, the movable contact 29 may be located on a suitable block 33 which is loosely connected to the end of the link 20. The block has a curved surface 34 that enables the block 33 to rock relative to the link 20 and insure a large contact area between the movable and the fixed contacts. The lever 7 rocks on its fulcrum and the extension 21 swings to and from the fixed contacts which produces a dragging or wiping movement of the movable contact over the surfaces of the fixed contacts, which insures good electrical connection between the contacts.

The switch 18 controls a circuit of a motor that operates the refrigerating apparatus to lower the temperature and reduces the pressure in the bellows and consequently, the volume of the bellows until the switch 18 is opened. It will again be closed when the pressure within the bellows expands to a predetermined volume against the load produced by the spring. This will occur when the temperature within the refrigerator rises to a substantially predetermined point, as determined by the adjustment of the spring 6. Thus, there is produced succeeding cycles of operations of the refrigerating apparatus to maintain a low temperature range within the refrigerator.

During sequential operations of the refrigerating apparatus there is an accumulation of the frost on the surface of parts of the apparatus, such as the wall of the expansion chamber, which increases the resistance to heat transmission and consequently, decreases the efficiency of the machine. In order to eliminate excess accumulation and prevent the formation of more than a film or thin coating of frost over the surface of the heat absorbing elements of the refrigerating apparatus and thus maintain the refrigerator at its maximum efficiency, I have provided a means for raising the temperature of the refrigerator for a short period and sufficient to

permit removal of the slight frost formation.

In the particular form of construction shown, defrosting is brought about by increasing the load on the bellows to increase the pressure of the gas within the bellows that will be required to cause the switch to close. Thus, by my invention, the temperature within the storage chamber of the refrigerator will be raised for a period of time to enable melting of the frost from the surfaces of the heat absorbing parts of the apparatus. Defrosting is, preferably, brought about upon the expiration of a predetermined number of periods of refrigerating operations as, for example, about once in twenty-four hours.

In the form of construction shown, a member is moved step by step and progressively upon each refrigerating operation initiated by the bellows, and consequently may be made dependent, in its movements, upon the expansion movements of the bellows. The member eventually engages a member that yieldingly resists a subsequent expansive movement of the bellows to cause a greatly increased temperature and pressure to produce a succeeding switch closing movement and causes defrosting of the refrigerator.

In the form shown, a ratchet wheel 35 is suitably supported for rotative movements. It carries a cam 36 and is operated to progressively move the cam 36 by a dog 37 that is reciprocated by the lever 7. The fulcrum 9 is located at a point substantially in line with the center of rotation of the ratchet wheel 35 and the ratchet engaging end of the dog 37, consequently angular movements of the lever 7, produced by the expansion and contractive movements of the bellows 1, as counterbalanced by the spring 6, will cause the cam 36 to move step by step and progressively in a clockwise direction.

A lever 40 is pivotally supported on the wall of the shell 2 and has a projecting lug 41 having an inclined surface 42 that is adapted to frictionally engage the cam 36 and yieldingly resist further movement of the cam 36 and, consequently, the rotation of the ratchet wheel 35, which in turn resists the angular movement of the lever 7, and co-operates with the spring 6, to increase the load that is placed upon the bellows and increase the pressure required to expand the bellows against the combined resistance of the spring 6 and the friction of the lug 41. A spring 43 may be connected to the lever and a fixed part of the frame. The spring 43 will operate to draw the lever against a stop 44 and thus operate to yieldingly resist the movement of the cam 36 until the pressure within the bellows reaches such a point that it may overcome the combined resistance of the load that is thus placed upon the bellows. When the cam passes the lug the bellows is released from the yielding resistance of the lever 40 and thereafter continues to respond to pressures determined only by the pressure of the spring 6 and produce switch responsive movements at lower pressures which immediately chills the refrigerator to the desired low temperature, as determined by the setting of the pointer 14 relative to the dial.

I claim:

1. In a refrigerating defrosting device, a bellows responsive to pressure, means for resisting the expansive movement of the bellows, a switch for closing and opening a circuit upon expansion and contraction of the bellows and at predetermined pressure points, a member progressively moved upon each expansive movement of the bellows, and means for yieldingly resisting the expansion of the bellows when the last named member has been moved a predetermined number of times to increase the required switch closing pressure of the bellows.

2. In a refrigerating defrosting device, a bellows responsive to pressure, means for elastically resisting the expansive movement of the bellows, an adjustable member for adjusting the pressure of the said elastic member, a snap switch for closing and opening a circuit upon expansion and contraction of the bellows at predetermined pressure points of the bellows, a member progressively moved upon each expansive movement of the bellows, and means for yieldingly resisting the expansion of the bellows when the last named member has been moved a predetermined distance to increase the required switch closing pressure of the bellows.

3. In a refrigerating defrosting device, a pressure operated bellows, a member for loading the bellows to resist expansion of the bellows, and means for varying the load, an electric snap switch operated by movement of the bellows to close and open the switch at predetermined pressure points as determined by the load varying means, a member progressively operated upon each alternate movement of the bellows, and a second bellows loading member for increasing the pressure required to produce a predetermined switch closing movement of the bellows when the said member has moved a predetermined distance.

4. In a refrigerating defrosting device, a pressure operated bellows, a lever engaged by the bellows, an elastic means for resisting the movement of the lever, an electric snap switch operated by the lever, a member progressively operated by the lever during alternate movement of the bellows, a member for yieldingly resisting the expansive movement of the bellows to increase the pressure required to produce switch closing movement of the bellows when the progressively movable member has moved a predetermined distance.

5. In a refrigerating defrosting device, a pressure operated bellows, a lever engaged by the bellows, a spring for counterbalancing the pressure of the bellows on the lever, a member for adjusting the pressure of the spring, a member progressively operated by the lever upon alternate movements of the lever by the bellows, a member for yieldingly resisting expansive movements of the bellows to increase the pressure required to produce switch closing movements of the bellows subsequent to a predetermined number of operations of the bellows of the progressively moved member and subsequently releasing the resistance of the said yieldingly resisting member to produce switch closing operations of the bellows at pressure points determined by the said spring.

6. In a refrigerating defrosting device, a pressure operated bellows, a lever engaged by the bellows, a spring for counterbalancing the pressure of the bellows on the lever, a member for adjusting the pressure of the spring, a ratchet wheel, a dog connected to the lever for moving the ratchet wheel step by step as the lever is actuated by the bellows, a member for frictionally engaging a part of the ratchet wheel when the said ratchet wheel has moved a predetermined angular distance by the operation of the lever to increase the resistance to the movement of the lever by the bellows upon predetermined angular movements of the ratchet wheel, a snap switch operated by the lever for opening and closing the circuit upon expansive and contractural movements of the bellows.

In witness whereof I have hereunto signed my name to this specification.

ESTEL C. RANEY.