Nov. 11, 1941. R. W. HASTINGS 2,262,026

CONTROL APPARATUS

Filed March 8, 1939

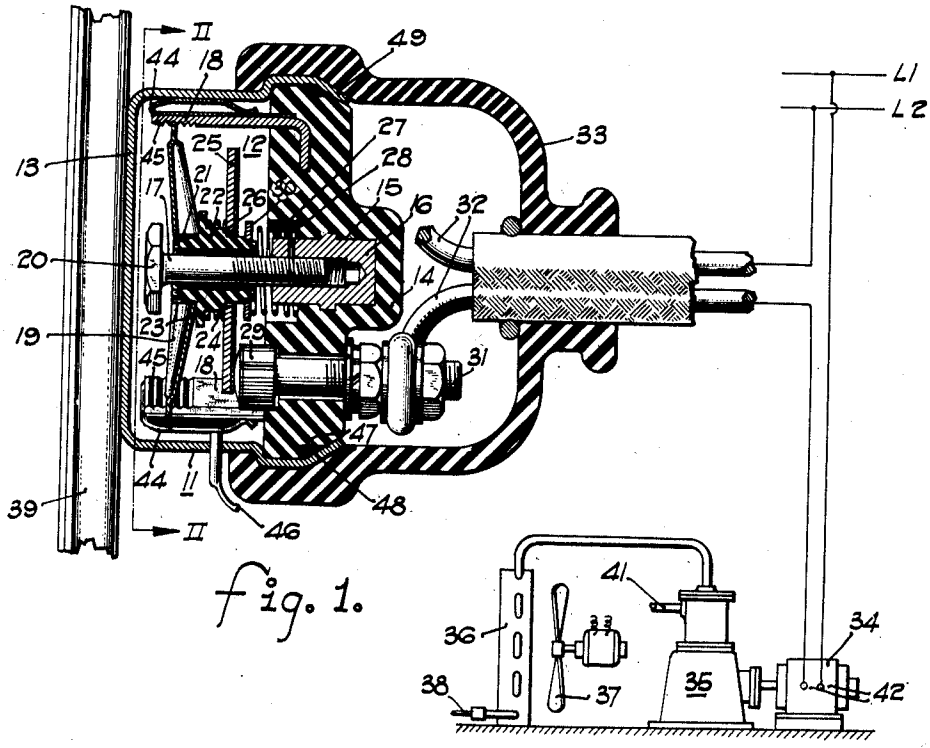


fig. 1.

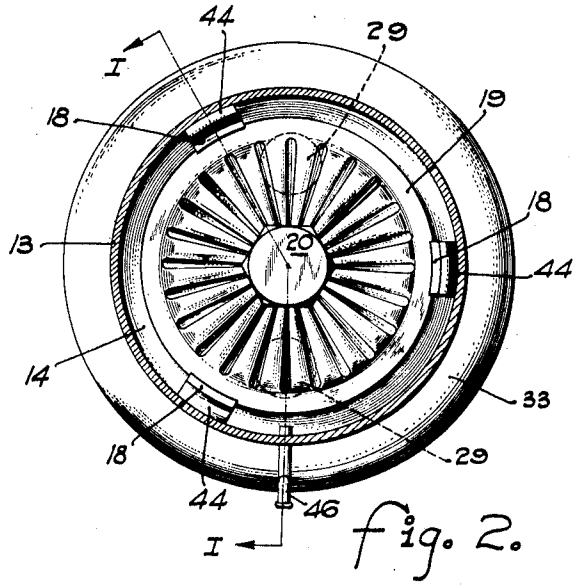


fig. 2.

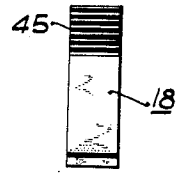


fig. 3.

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CONTROL APPARATUS

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Application March 8, 1939, Serial No. 260,517

7 Claims. (Cl. 200—138)

My invention relates to control apparatus and it has for an object to provide improved apparatus of this kind.

A further object of my invention is to provide improved control apparatus for refrigerating machines which is inexpensive to construct and which may be readily applied to various forms of refrigerators.

It is a further object of the invention to provide an improved control apparatus employing a snap-acting thermal device that may be adjusted to maintain different temperatures.

A still further object of the invention is to provide an improved control mechanism including a hermetically sealed switch structure and to provide for adjustment of the switch structure so that the temperatures at which the contacts are opened and closed may be varied at will and substantially independently of each other.

It is another object of the invention to provide an improved mounting for a control mechanism employing a snap-acting thermal device.

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

Fig. 1 is a sectional view of my improved control mechanism taken on the line I—I of Fig. 2 and includes a diagrammatic view of a domestic refrigerator having my improved control mechanism applied thereto;

Fig. 2 is a sectional view of my improved control mechanism taken on line II—II of Fig. 1; and,

Fig. 3 is a detail view of one of the supports for the snap-acting thermal element shown in Figs. 1 and 2.

Referring specifically to the drawing for a detailed description of my invention, numeral 11 designates a hermetically sealed casing containing a control mechanism generally designated at 12. The hermetically sealed casing 11 embodies a heat conducting cover member 13, preferably formed of a metal such as copper or brass and an electrical and heat insulating base member 14, preferably formed of a material such as hard rubber or a molded plastic composition.

The base member 14 is provided with an opening 15 in which a tapped metal bushing 16 is disposed. A threaded shaft 17 is screwed into the metal bushing 16 and extends outwardly therefrom a considerable distance. A stop 20 in the form of a bolt head is provided at the end of the shaft 17 for a purpose hereinafter described. The supporting fingers 18, a detail of which is shown in Fig. 3, are molded into the base member 14. As shown in Fig. 2, three equally spaced supporting fingers 18 are provided adjacent the periphery of the base member 14. A bi-metal snap-acting disk 19 is supported by the fingers 18 and is provided with an aperture 21 in the center thereof through which the threaded shaft 17 extends.

An insulating bushing 22 is slidably mounted on the shaft 17 and a shoulder 23 thereof is held in engagement with the bi-metal disk 19 by a coiled spring 27. One end of the spring 27 engages a washer 30 on the bushing 22 and the other end engages a shoulder 28 in the base member 14. A movable contact member 25 is loosely mounted on the bushing 22 and is in engagement with one end of a coiled spring 24. A second shoulder 26 is provided on the bushing 22 and engages the movable contact member 25 when the switch mechanism is in the closed circuit position. Two stationary contacts 29, shown in Figs. 1 and 2, are mounted on the base member 14. Terminals 31 extend through the base member 14 and are connected to conductors 32. A rubber cap 33 may be clamped over the hermetically sealed casing 11 to protect the terminals 31 and provide an opening for the conduits 32.

I have shown my invention as applied to domestic refrigerating machines in which a motor 34 drives a compressor 35 to compress refrigerant and condense the same in a condenser 36 cooled by a fan 37. The condensed refrigerant is delivered through a conduit 38 to an evaporator 39, a portion of which is shown in Fig. 1, any suitable expansion device (not shown) being disposed between the condenser 36 and the evaporator 39. Vaporized refrigerant is returned to the compressor through a conduit 41. The conductors 32 connect a line L_1, L_2 to the switch terminals 31 and to terminals 42 on the motor 34. The thermostatic element 19, therefore, opens and closes the circuit to the motor 34 in response to the temperature of the evaporator 39, the heat conducting cover 13 of the casing 11 providing for the passage of heat between the evaporator 39 and the bi-metal disk 19.

Preferably, each finger 18 is provided with a spring member 44 formed of a good heat conducting material such as phosphor-bronze and so positioned that it will contact with the metal heat conducting cover 13 when the cover 13 is in its assembled position on the base 14. The phosphor-bronze springs 44 provide increased

heat transfer from the evaporator 39 to the interior of the sealed control mechanism 12 and to the bi-metal disk 19. This feature, however, does not form a part of the present invention and is fully disclosed and claimed in the copending application of Gerald P. Marcy, Serial No. 260,500, filed March 8, 1939, for Refrigeration apparatus.

In accordance with my invention, the temperatures of the evaporator 39 at which the bi-metal disk 19 respectively opens and closes the contacts 25, 29 may be varied substantially independently of each other.

If it is desired to change the temperature of the evaporator 39 at which the bi-metal disk 19 closes the contacts, the shaft 17 is screwed into or out of the tapped metal bushing 16 so that the stop 20 is moved either towards or away from the disk 19. When the disk 19 snaps to the open contact position (not shown) the center of the disk engages the stop 20. Therefore, if it is desired to raise the temperature of the evaporator 39 at which the disk 19 will snap to close the contacts 25, 29 the stop 20 is positioned closer to the disk 19 so that when the disk is in the open contact position its internal stress will be increased mechanically and less of a temperature change will be required to snap the disk. On the other hand, if it is desired to lower the temperature at which the evaporator 39 will snap the disk 19 to the closed contact position, the stop 20 is positioned further away from the disk 19 so that the stress in the disk 19 due to mechanical force, when in the open contact position, is lessened and a greater temperature change will be required to snap the disk to the closed contact position.

When it is desired to vary the temperature at which the contacts 25, 29 are opened, the position of the bi-metal disk 19 relative to the bushing 22 is changed by moving the disk 19 bodily in notches 45 provided in the fingers 18. For example, if it is desired to decrease the temperature at which the disk 19 opens the contacts 25, 29 from that shown in Fig. 1, the disk 19 is bodily moved to notches nearer the bushing 22 in fingers 18. The internal stresses in the bi-metal disk 19 are, therefore, increased mechanically and thus a reduction in the temperature of the disk 19 and the evaporator 39 is required to open the contacts 25, 29. On the other hand, if the bi-metal disk 19 is moved to notches 45 more remote from the bushing 22, the internal stresses in the bi-metal disk 19 are decreased and the temperature necessary to open the contacts 25, 29 will be lower. Since the bushing 22 is always in contact with the center of the disk 19, as the disk 19 is moved in the notches 45, the shoulder 23 of bushing 22 remains stationary so that only the edges of the disk 19 are moved, with the result that the disk assumes either a flatter position or a more concave position. It may then be necessary to change the position of the stop 20 to compensate for the change in position of the disk 19 in the notches 45, if it is desired to maintain the contact closing temperature the same. When the disk 19 is adjusted in the manner aforesaid, only the temperature at which the evaporator 39 effects opening of the contacts 25, 29 is changed.

If desired, the hermetically sealed casing 11 may be evacuated through a conduit 46 after which the casing 11 is preferably filled with inert gas such as nitrogen and the conduit 46 pinched off, so that oxidation of contacts 25, 29 is prevented.

Another feature of my invention is the manner of sealing the hermetically sealed casing 11. In order to effect a complete hermetic seal, the base member 14 is provided with an annular notch 47 in which a gasket 48 of a resilient material such as rubber is disposed. The metal cover 13 is then disposed in its position on the base 14 and the edge thereof is rolled inwardly and downwardly, as shown at 49, by any suitable tool. This provides a very inexpensive method of hermetically sealing the casing 11 and also facilitates reopening the casing for repairs, after which the cover 13 may be re-rolled to again provide a hermetic seal.

From the foregoing it will be apparent that I have provided an improved switch structure of the hermetically sealed bi-metal thermostat type in which both the upper and lower temperature at which the thermostat operation may be varied independently of each other. It is also apparent that I have provided improved means for effecting such adjustments. I have also provided a very economical structure for hermetically sealing the switch structure which may be resealed after it is opened, if desired.

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 imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. A switch structure embodying electrical contacts and a bi-metal disk type thermostat for opening and closing said contacts in response to changes in temperature, a plurality of fingers retaining said bi-metal disk thermostat in snap-acting position, a stop for engaging said thermostat when in its closed contact position, and means associated with at least one of said supporting fingers affording movement of at least a portion of said bi-metal disk as an entirety as distinguished from snap-acting movement to change the travel of said disk when it snaps to the closed contact position.

2. A switch structure embodying electrical contacts and a bi-metal disk type thermostat for opening and closing said contacts in response to changes in temperature, a plurality of fingers retaining said bi-metal disk thermostat in snap-acting position, a stop for engaging said thermostat when in its closed contact position, and means associated with at least one of said supporting fingers affording movement of at least a portion of said bi-metal disk as an entirety as distinguished from snap-acting movement to change the travel of said disk when it snaps to the closed contact position, said last-mentioned means including a plurality of notches on at least one of said fingers engaging said disk and extending at an angle to the snap-acting force exerted by said disk.

3. A switch structure embodying electrical contacts and a bi-metal thermostat for opening and closing said contacts in response to changes in temperature, a supporting means for retaining said thermostat in position and a stop for engaging said thermostat when in its closed contact position, said supporting means

affording movement of said bi-metal thermostat as an entirety as distinguished from snap-acting movement to change the travel of the thermostat when it snaps to its closed contact position to change the temperature at which the thermostat operates to open the contacts.

4. A switch structure claimed in claim 3 wherein a second stop is adjustable to change the travel of said thermostat in its open contact position to change the temperature at which the thermostat operates to close the contacts.

5. In a control mechanism, the combination of a base member, movable and fixed electrical contacts supported on said base member, a bi-metal thermostat for opening and closing said contacts disposed above said electrical contacts, means for supporting said bi-metal thermostat from said base member, said base member being provided with an opening therein, a shaft extending into said opening and freely through said thermostat, an insulating bushing slidably supported on said shaft in a position to be engaged by said thermostat and resilient means for maintaining said bushing in engagement with said thermostat, said movable electrical contact being mounted on said bushing in a position to engage said fixed contact when the thermostat moves to the closed contact position.

6. A switch structure embodying electrical contacts and a bi-metal disc type thermostat for opening and closing said contacts in response to changes in temperature, a plurality of fingers retaining said bi-metal disc thermostat in snap-acting position, a stop for engaging said thermostat when in its closed contact position, and means associated with at least one of said supporting fingers affording movement of at least a portion of said bi-metal disc as an entirety as distinguished from snap-acting movement to change the travel of said disc when it snaps to the closed contact position.

7. A switch structure embodying electrical contacts and a bi-metal disc type thermostat for opening and closing said contacts in response to changes in temperature, a plurality of supporting members retaining said bi-metal disc thermostat in a position affording snap-acting movement, a stop for engaging said bi-metal thermostat when in its closed contact position, and means associated with at least one of said supporting members for changing the internal stress of the bi-metal disc independently of the stresses therein due to prevailing temperatures.

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