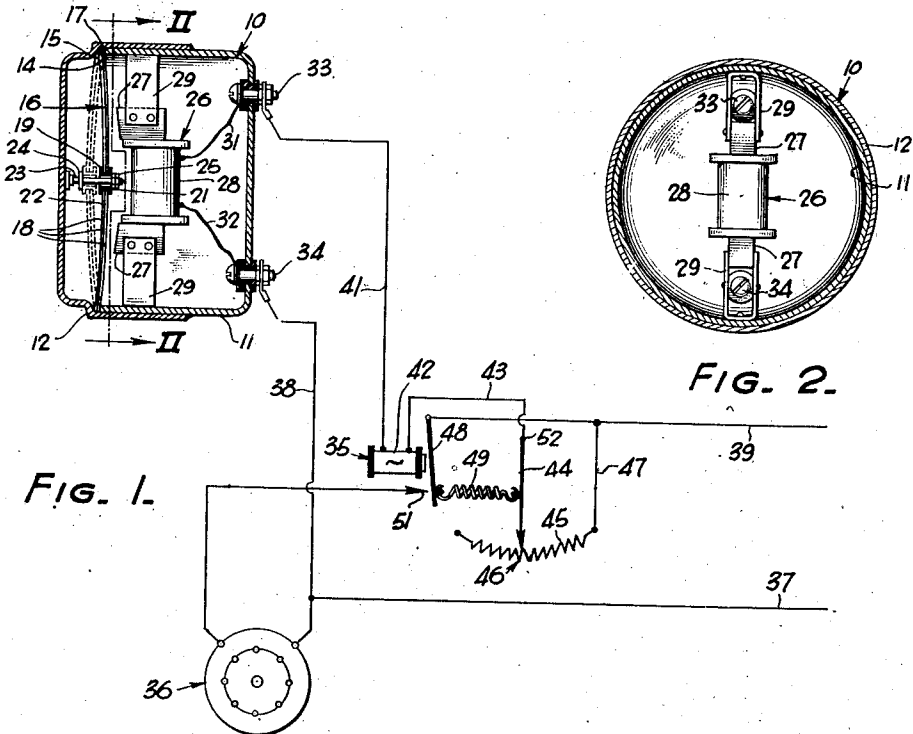
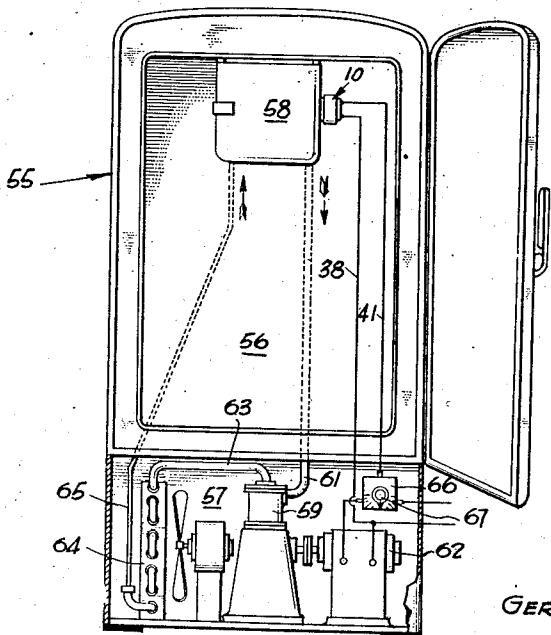


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REFRIGERATION APPARATUS

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REFRIGERATION APPARATUS

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6 Claims. (Cl. 62—4)

This invention relates to bimetallic thermostats and more especially to bimetallic thermostats adapted for installation in moist locations.

In temperature-controlling devices actuated by a bimetallic element it is necessary to have the bimetallic element at the location where the temperature is to be controlled. In refrigerating apparatus this requires that the bimetallic element be placed adjacent the moist or frost-covered evaporator. The controlling devices usually comprise moving parts such as electric contacts and temperature-adjusting devices located adjacent to the bimetallic element and, therefore, in the region of the moisture or frost on the evaporator and the usual expedient heretofore has been to enclose the entire device in a sealed casing to protect the moving parts from moisture and frost. Where the devices were adjustable, the adjusting means usually comprised the use of flexible bellows or the like to transmit the adjusting motion to the mechanism in the interior of the bellows.

One object of the invention is to provide a bimetallic control in which the electrical contacts and the temperature-adjusting devices are remote from the bimetallic element.

Another object of the invention is to provide controlling devices adapted for controlling moist or frozen zones in which devices the current-conducting contacts do not require enclosures in a sealed casing.

Another object of the invention is to provide adjustable bimetallic temperature-controlling devices adapted for controlling moist or frozen zones in which devices flexible seals or the like are eliminated.

These and other objects are effected by the 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 view of the thermostatic control of this invention partly in section and partly schematic showing its application for controlling a motor;

Fig. 2 is a sectional view on the line II—II of Fig. 1; and,

Fig. 3 is an elevation of a domestic refrigerator with the front wall of the machine compartment broken away showing the control of this invention.

Referring now more particularly to the drawing for a description of the invention, the reference numeral 10 represents a casing of non-magnetic metal and comprises two telescopically-ar-

ranged cups 11 and 12 which may be soldered together to effect a moisture-proof container.

The cup 12 has a reduced portion at its base to provide a shoulder 14 which engages one side of the edge 15 of a circular temperature-responsive element which edge 15 is secured on the other side by the lips 17 of the cup 11. The temperature-responsive element 16 preferably comprises several dished bimetallic discs 18 which are secured together at their center by an eyelet 19 passing through centrally located holes 21 in the discs 18 so that the several discs 18 act in unison. The dished contour of the discs 18 affords a snap-acting movement to the central portions 22 thereof and the discs 18 are adapted to snap to the position shown in full lines in Fig. 1 when the temperature of said discs 18 drops below a predetermined temperature and to the position shown by the dotted lines when the temperature rises a certain amount above the aforementioned predetermined temperature.

The temperature-responsive element 16 comprises iron or other magnetic material. Its travel is limited by a bolt 23 soldered to the base of cup 12 which bolt 23 is provided with a collar 24 and with lock nuts 25 forming stops.

An electro-magnet 26 comprising two pole pieces 27 and a winding 28 is secured by straps 29 of non-magnetic material to the cup 11 to lie adjacent the temperature-responsive element 16 and include the central portion 22 thereof in its magnetic field. The winding is supplied with an alternating current through two leads 31 and 32 connecting respectively with two insulated binding posts 33 and 34 in the base of the cup 11.

When the temperature-responsive element 16 is adjacent the electro-magnet 26 as shown by the full lines of Fig. 1, its central portion 22 lies directly in the magnetic field of the magnet 26, and since the element 16 comprises magnetic material, many lines of magnetic force will pass through the central portion 22 of the element 16. When the temperature-responsive element 16 is remote from the electro-magnet 26, as shown by the dotted lines, fewer of the magnetic lines of force will flow through the element 16 and the magnetic field of the magnet 26 will be generally weakened. This affects the impedance of the electro-magnet 26 and results in a smaller current flowing through the windings 28 of the same when the element 16 is in the position indicated by the full lines than when in the position shown by the dotted lines.

This change in the amount of current passing through the winding 28 is made use of to actuate

a relay 35 which in turn controls a motor 36. To this end one of the binding posts 34 on the cup 11 is connected to a supply line 37 of alternating current by a lead 38 and the other binding post 33 is connected to a second supply line 39 through lead 41, the winding 42 of the relay 35, a lead 43, the contact arm 44, the resistance wires 45 of a variable resistance 46, and lead 47.

The relay 35 has an armature 48, the magnetic pull of which is counterbalanced by a spring 49 so that when the current through the winding 42 of the relay 35 decreases, due to a movement of the temperature-responsive element 16 to the right as shown in Fig. 1, the spring 49 pulls the armature 48 to the right and opens a contact 51 associated with the armature 48. When the element 16 moves to the left, the armature 48 likewise is moved to the left by the increased magnetic pull of the relay winding 42, closes the contact 51, and energizes the motor 36.

The invention also provides for adjustment of the temperature limits at which the element 16 snaps toward and away from the pole pieces 27 of the electro-magnet 26. This is accomplished by rotating the contact arm 44 of the variable resistance on the pivot 52, a movement to the right in Fig. 1, for example, increases the voltage impressed on the winding 28 thereby increasing the current through the electro-magnet 26 so that it attracts the temperature-responsive element 16 more strongly and effects a movement thereof to the right at a higher temperature than formerly. The movement of the element 16 to the left likewise occurs at a higher temperature than formerly.

The increase or decrease in the current effected by the variable resistance also varies the pull exerted by the winding 42 of the relay 35 on the armature 48 and a compensation for this variation in pull is required. One end of the spring 49, therefore, is secured to the contact arm 44 of the variable resistance 46 so that when the arm 44 is moved to increase the current, the tension on the spring 49 is also increased and vice versa. This varied tension is such that it counteracts the varied pull of the winding 42 of the relay 35 so that the contact 51 is open when the temperature-responsive element 16 is in the position shown by the full lines of Fig. 1 and is closed when the element 16 is in the position shown by the dotted lines of Fig. 1 regardless of the position of the contact arm 44.

The apparatus of this invention is adapted for controlling mechanical refrigerating apparatus. Referring particularly to Fig. 3 of the drawing, the reference numeral 55 represents a cabinet having an insulated food storage chamber 56 in the upper portion thereof. The lower portion of the cabinet 55 comprises a machine compartment 57. An evaporator 58 is located in the upper portion of the storage chamber 56 and connects with a compressor 59 through the suction conduit 61. The compressor 61 is driven by a motor 62 and withdraws vaporized refrigerant from the evaporator 58, compresses it and passes it through a tube 63 into an air cooled condenser 64 wherein the refrigerant vapor is liquefied. The liquefied refrigerant passes upwardly through a capillary tube 65 into the evaporator 58 where it evaporates and repeats the refrigerating cycle just described.

The refrigerating apparatus is of the intermittently operated type and is regulated by the thermostatically-controlled switch of this in-

vention. This is effected by securing the casing 10 enclosing the temperature-responsive element 16 and the electro-magnet 26 adjacent to the evaporator 58. The relay 35 and the variable resistance 46 are enclosed in a box 66 provided with an external knob 67 by means of which the contact arm 44 of the variable resistance 46 may be moved back and forth along the resistance 45. The electrical connections are the same as already explained in connection with Fig. 1.

It will be apparent from the above that this invention provides a bimetallic control in which the electrical contacts are remote from the bimetallic element and do not require to be enclosed in a sealed casing to protect them from frost and moisture where these are present at the zone to be controlled. The absence of a sealed casing around the electrical contacts makes the use of flexible bellows or similar adjusting devices unnecessary.

While I have shown my invention in but one form, it will be apparent 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 a mechanical refrigerator, the combination of an insulated chamber, an evaporator for cooling the same, mechanism for supplying refrigerant to said evaporator, a control for said mechanism comprising an electro-magnet including a current-conducting winding, a temperature-responsive device, magnetic material associated therewith, said temperature-responsive device being adapted to move said magnetic material in the magnetic field of said magnet to change the impedance of said winding in response to changes in temperature of said temperature-responsive device, said temperature-responsive device being in heat exchange relationship with said evaporator and means responsive to changes in the impedance of said winding for controlling the supply of refrigerant to said evaporator.

2. In a mechanical refrigerator, the combination of an insulated chamber, an evaporator for cooling the same, mechanism for supplying refrigerant to said evaporator, a control for said mechanism comprising an electro-magnet including a current-conducting winding, a snap-acting temperature-responsive device, magnetic material associated therewith, said temperature-responsive device being adapted to move said magnetic material in the magnetic field of said magnet to change the impedance of said winding in response to the snap-acting movement of said temperature-responsive device, said temperature-responsive device being in heat exchange relationship with said evaporator, and means responsive to changes in the impedance of said winding for controlling the supply of refrigerant to said evaporator to maintain the temperature thereof within predetermined limits.

3. In a mechanical refrigerating apparatus of the type having an evaporator for absorbing heat from an enclosed chamber, the combination of mechanism for supplying refrigerant to said evaporator, a control for said mechanism comprising an electro-magnet including a current-conducting winding, a temperature-responsive device, magnetic material associated therewith,

said temperature-responsive device being adapted to move said magnetic material in the magnetic field of said magnet to vary the impedance of said winding in response to changes in temperature of said evaporator, and means responsive to changes in the impedance of said winding for controlling the supply of refrigerant to said evaporator.

4. In a mechanical refrigerating apparatus of the type having an evaporator for absorbing heat from an enclosed chamber, the combination of mechanism for supplying refrigerant to said evaporator, a control for said mechanism comprising an electro-magnet including a current-conducting winding, adjustable means for varying the current flowing through said winding, a temperature-responsive device, magnetic material associated therewith, said temperature-responsive device being adapted to move said magnetic material in the magnetic field of said magnet to vary the impedance of said winding in response to changes in temperature of said evaporator, and means responsive to changes in the impedance of said winding for controlling the supply of refrigerant to said evaporator.

5. A control system for mechanical refrigerators of the type having an evaporator for absorbing heat from an enclosed chamber and a mechanism for supplying refrigerant to said evaporator, said control system comprising a sealed casing disposed adjacent the evaporator, an electro-magnet provided with a current-conducting winding disposed in said casing, a temperature-responsive device having magnetic ma-

terial associated therewith for movement by said temperature-responsive device within the field of said electro-magnet for varying the impedance thereof in response to the temperature of the evaporator, said temperature-responsive device and magnetic material also being disposed in said sealed casing, and means disposed outside the enclosed chamber and responsive to variations in the impedance of said electro-magnet for controlling the supply of refrigerant to said evaporator.

6. A control system for mechanical refrigerators of the type having an evaporator for absorbing heat from an enclosed chamber and a mechanism for supplying refrigerant to said evaporator, said control system comprising a sealed casing disposed adjacent the evaporator, an electro-magnet provided with a current-conducting winding disposed in said casing, a temperature-responsive device having magnetic material associated therewith for movement by said temperature-responsive device within the field of said electro-magnet for varying the impedance thereof in response to the temperature of the evaporator, said temperature-responsive device and magnetic material also being disposed in said sealed casing, means disposed outside the enclosed chamber and responsive to variations in the impedance of said electro-magnet for controlling the supply of refrigerant to said evaporator, and manually-adjustable means also disposed outside said enclosed chamber to vary the current flow through said winding.

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