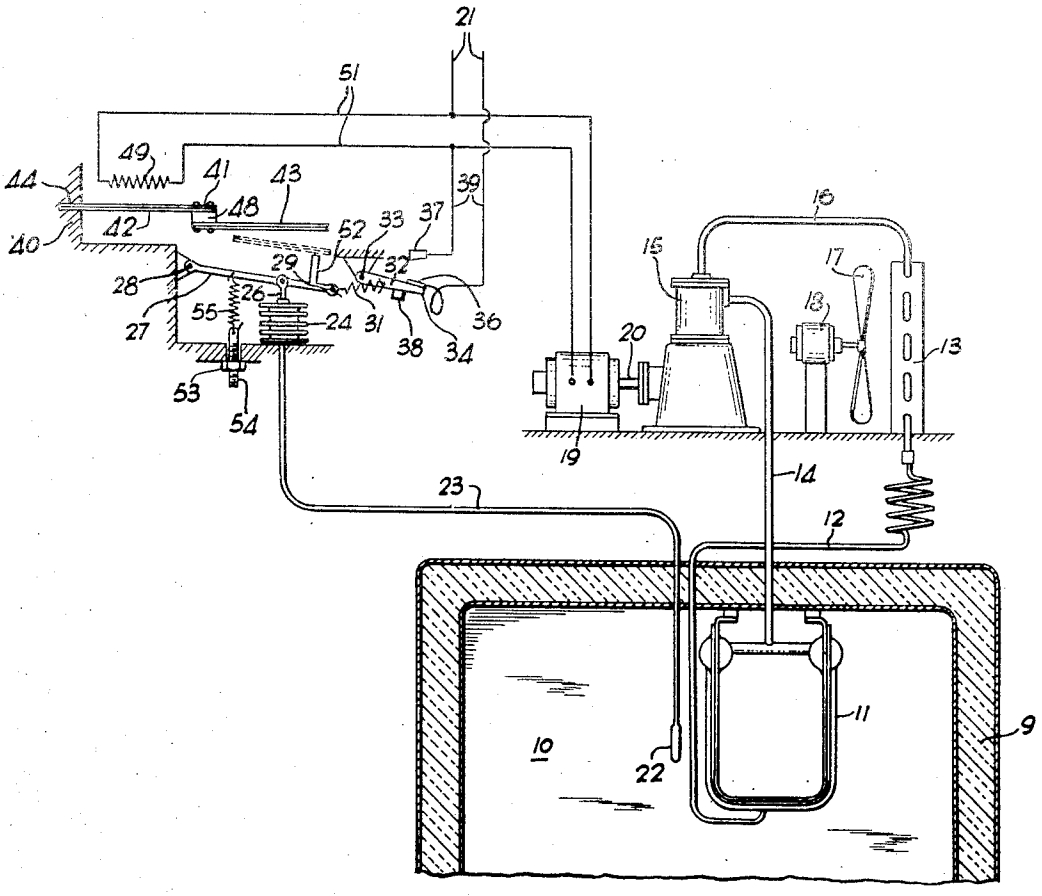
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REFRIGERATION APPARATUS

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REFRIGERATION APPARATUS

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3 Claims. (Cl. 62—4)

This invention relates to control apparatus and more especially to thermostats for refrigerators.

One object of this invention is to provide a sensitive thermostat capable of directly controlling apparatus requiring substantial amounts of power for their actuation.

Another object of this invention is to provide a regulating device responsive to small changes in the physical characteristic of a medium and capable of operating snap-acting contacts.

A further object of the invention is to provide a regulating device which exerts a substantial force which is derived largely from a source external of the material being regulated.

A still further object is to provide a control for a mechanical refrigerator capable of maintaining the temperature thereof within close limits regardless of the room temperature in which the refrigerator is operating.

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, the single figure of which shows a schematic view of the control apparatus as applied to a mechanical refrigerator.

Referring to the drawing, the reference numeral 9 represents the insulated walls of a refrigerator cabinet 10. The refrigerating apparatus for the cabinet 10 is of conventional design and comprises a cooling unit 11 of the evaporative type which is secured in the upper portion of the cabinet 10 and which is supplied with liquid refrigerant through a capillary flow impeding tube 12 from a condenser 13. The evaporated refrigerant in the cooling unit 11 is withdrawn therefrom through a suction conduit 14 by a compressor 15 which forces the refrigerant vapor into the condenser 13 through a tube 16. A fan 17 driven by a motor 18 draws a current of air through the condenser 13 to cool the same. The compressor 15 is driven through a shaft 20 by a motor 19 which receives power from leads 21.

The regulating device for the refrigerating apparatus, which comprises the subject-matter of this invention, includes a bulb 22 in heat exchange relationship with the air in the cabinet 10. The bulb 22 contains a volatile liquid and connects through a tube 23 with a Sylphon bellows 24. The Sylphon bellows 24 engages through a pin 26 with a lever 27 pivoted at one end 28 to a fixed support and connects at the other end 29 with one end of a spring 31. The other end of the spring 31 engages a lever 32, one end of which is pivoted on a pin 33 secured to a substantially fixed support. The other end 34 of the lever 32 carries an electrical contact 36 adapted to engage with a fixed contact 37 to close an electrical circuit 39 from the supply lines 21 through the motor 19. The lever rests against a stop 38.

The levers 27 and 32 and the spring 31 comprise an overcenter mechanism of well known design which quickly opens and closes the contacts 36, 37 when a sufficient force is applied to the lever 27. It will be apparent that both for the opening and for the closing of the contacts 36, 37, the force exerted upon the lever 27 must be sufficient to move the spring 31 beyond the pin 33 of the lever 32. The temperature at which the refrigerator is maintained may be varied by turning a nut 53 on a bolt 54 to vary the tension of a spring 55 on the lever 27.

A bi-metallic temperature responsive element 41, comprising portions 42 and 43, is secured at one end 44 to a fixed support 40. The portions 42 and 43 are joined end to end by a heat insulating spacer 48. The portion 42 is adapted to flex downwardly and the portion 43 to flex upwardly at increased temperatures. A heating element 49 for the portion 42 is connected in parallel with the motor 19 through leads 51.

The operation of the device is as follows: Assume that the cabinet 10 has been cooled to the desired temperature and the contacts 36, 37 are open, as shown. Heat leakage through the walls 9 of the cabinet will raise the temperature of the air therein and of the bulb 22 causing the vapor pressure of the volatile liquid in the bulb to expand the Sylphon bellows 24 thereby closing the contacts 36, 37. The closing of the contacts 36, 37 will energize the motor 19 through leads 39 and set the refrigerant-supplying apparatus 15, 13, and 17 in operation to abstract heat from the cooling unit 11. This will gradually cool the interior of the cabinet 10.

The closing of the contacts 36, 37 also energizes the heater 49 which will heat the portion 42 of the bimetallic element 41 and cause the element 41 to flex downwardly as its temperature increases. After a period of time, the downward flexing of the bi-metallic element 41 forces the lever 27 downwardly by engaging an upright projection 52 thereon, moves the spring 31 beyond the pin 33, and causes the contacts 36, 37 to snap into the open position. At this moment the bimetallic element is in the position shown by the dotted lines in the drawing, the lever 32 resting against a stop 38.

The opening of the contacts 36, 37 stops the motor 19 and also deenergizes the heater 49. On

cooling, the bi-metallic element 41 moves upwardly, and the lever 27 follows to a position at which the various forces exerted by the springs 31 and 55 and the Sylphon bellows 24 are in equilibrium.

The time interval during which the motor 19 operates is preferably of such duration as to cool the air and the control bulb 22 in the cabinet 10 through only a few degrees of temperature, sufficient merely for the lever 32 to be retained in the open position. A slight increase in the temperature of bulb 22, therefore, suffices to again close the contacts 36, 37, thus controlling the temperature of the air in the cabinet 10 within close limits. The contacts 36, 37 and the snap-acting device 31, 32 may be built sufficiently heavy to handle large quantities of electrical energy, because the operation of the snap-acting device is obtained mainly from a source such as the heater 49 in the embodiment illustrated, and only secondarily from changes in the temperature of the air in the cabinet 10.

The placing of the control bulb 22 in heat exchange relationship with the air of the cabinet 10 maintains the air of the cabinet, and consequently, also the material stored in the cabinet, at an average temperature which does not vary appreciably in spite of variations in the temperature of the room in which the refrigerator operates.

The function of the bi-metallic portion 43 is to compensate for the effect of room temperatures on the bi-metallic portion 42. Without such compensation, the running period of the refrigerator would be shorter in a warm room than in a cool room as the room temperature also affects the flexing of the portion 42. Such a shortened running period is generally not desired. An over-compensation may also be secured by lengthening the portion 43 and shortening the portion 42, thereby providing an increased running period in a warm room.

When the refrigerator is first set in operation, the control bulb 22 will not be sufficiently cooled to allow the contacts 36, 37 to remain in the open position when opened by the heater 49. The contacts 36, 37 will, therefore, close again when the heater 49 cools and the refrigerating cycles will be continued until the temperature of the bulb 22 is sufficiently low to allow the contacts 36, 37 to remain in the open position.

It will be apparent from the above that this invention provides a sensitive control apparatus capable of directly actuating elements requiring a substantial force and that the power used in actuating the contacts is derived largely from a source external to the material being regulated. It will be further apparent that this invention provides a control for a refrigerator which maintains the temperature thereof substantially constant regardless of the ambient temperature.

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 refrigerating apparatus, the combination of a chamber, a cooling unit for abstracting heat from said chamber, apparatus for supplying refrigerant to said cooling unit, and a thermostat for controlling said apparatus to maintain the temperature of said chamber substantially constant, said thermostat comprising a switch, means responsive to the temperature of said chamber for moving said switch to energize said apparatus when the temperature of said chamber rises to a predetermined value, and means substantially independent of the cooling effect of said refrigerant for moving said switch to deenergize said apparatus a relatively constant time interval after said apparatus has been energized.

2. In refrigerating apparatus, the combination of a chamber, a cooling unit for abstracting heat from said chamber, apparatus for supplying refrigerant to said cooling unit, and a thermostat for maintaining the temperature within said chamber substantially constant, said thermostat comprising a switch for controlling said apparatus, said switch incorporating snap-acting means for accelerating the opening movement of said switch to minimize electric arcing, means responsive to the temperature of said chamber for moving said switch to actuate said apparatus when the temperature of said chamber rises to a predetermined degree, and means substantially independent of the cooling effect of said refrigerant for moving said switch to render said apparatus inactive a short but substantial time interval after the switch has been moved to actuate said apparatus.

3. In refrigerating apparatus, the combination of a chamber, a cooling unit for abstracting heat from said chamber, apparatus for supplying refrigerant to said cooling unit, and a thermostat for maintaining the temperature within said chamber substantially constant, said thermostat comprising a switch for controlling said apparatus, said switch incorporating snap-acting means for accelerating the opening movement of said switch to minimize electric arcing, means responsive to the temperature of said chamber to close said switch when said temperature rises to a predetermined value, an element responsive to heat to open said switch, a heating element for heating said heat-responsive element, said heating element being energized only when said switch is closed, whereby said switch is opened by said heat-responsive element a time interval after it is closed by said temperature-responsive means.

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