April 24, 1934. A. HERZ 1,956,067

THERMOSTATIC DEVICE

Filed March 28, 1932

Fig. 1.

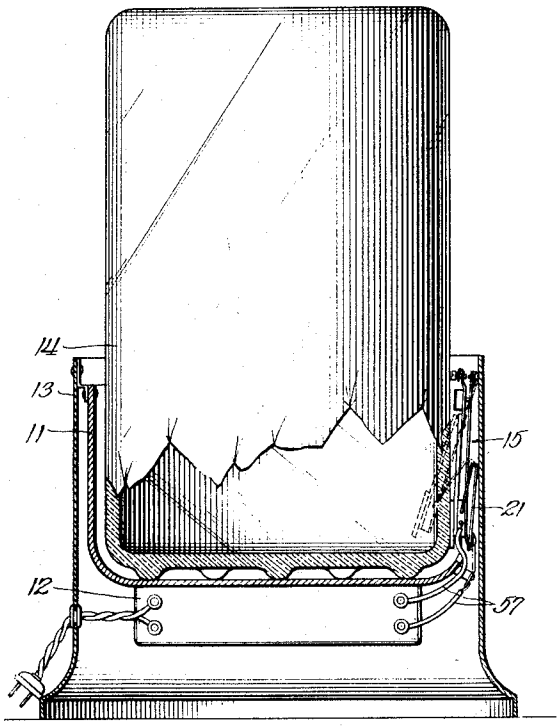


Fig. 3.

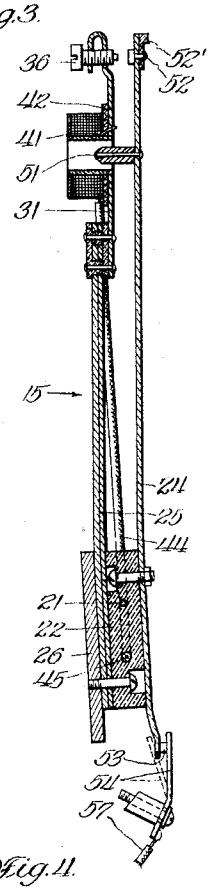


Fig. 2.

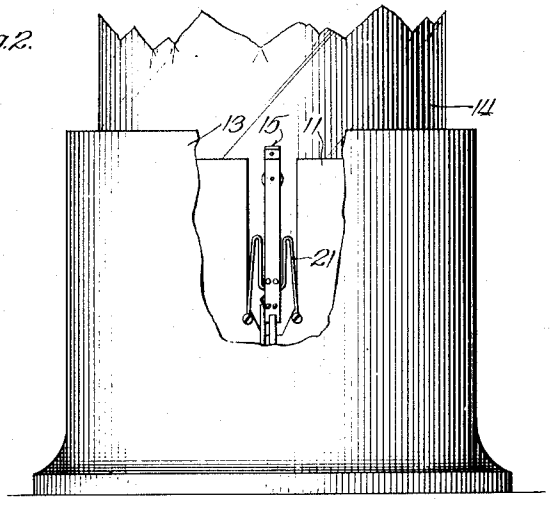
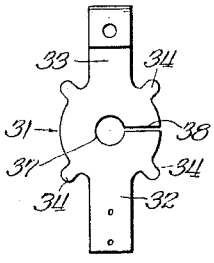


Fig. 4.



Inventor:
Alfred Herz
By Brown Jackson Boettcher Dunner
Attys.

Patented Apr. 24, 1934

1,956,067

UNITED STATES PATENT OFFICE

1,956,067

THERMOSTATIC DEVICE

Alfred Herz, Chicago, Ill.

Application March 28, 1932, Serial No. 601,499

10 Claims. (Cl. 200—138)

The present invention relates generally to electric control devices, and particularly to contact-making thermostats for controlling electric circuits.

Contact-making thermostats are widely used in which a thermally responsive element such as a bi-metallic strip carries a contact member into and out of engagement with another contact member to close and open electric circuits. The contacts of such thermostats are moved into and out of engagement gradually in response to temperature changes so that under certain conditions the contacts may be held together with only a very slight force or they may be barely separated. Under such conditions any shock or vibration to which the thermostat may be subjected will cause the contact making members to vibrate into and out of contact so that they repeatedly open and close the circuit. This produces severe sparking of the contacts, which tends to burn them away rapidly and also produces an electrical disturbance which interferes with radio reception.

Various means have been devised in an attempt to overcome this chattering and sparking of the contacts, but all devices heretofore employed have possessed certain inherent disadvantages. Condensers have in some cases been shunted across the contacts to prevent sparking, but condensers of ample capacity and capable of withstanding the heat to which thermostats are subjected are rather expensive. Mechanical snap mechanisms have been used to produce a quick movement of the contacts into and out of engagement, but such mechanisms have usually entailed a bulky and expensive construction. Magnetic seizing devices have also been employed to prevent chattering and sparking, but such magnetic devices as have been heretofore known to the art have not been completely satisfactory in operation. The contacts have been subject to bouncing, so that in coming into engagement they have rebounded to momentarily reopen the circuit a number of times. Also, when prior magnetic seizing devices have been used on alternating current circuits they have induced a vibration of the contacts which in or of itself has often produced a "chattering" of the contacts. In addition, their mechanical adjustments have been critical so that they have permitted only a very slight adjustment of their operating temperatures.

It is one of the objects of my present invention to provide a contact-making thermostat having a magnetic seizing device which will overcome the above described difficulties which may be cheaply manufactured and which will be reliable in operation.

Prior magnetic seizing devices for thermostats have employed electromagnets of the horse-shoe or magnetic pole construction. As the armature and core of such a magnet are brought together the force exerted between them increases rapidly, approximately inversely as the square of their spacing. This causes the magnet and its armature to be brought sharply into engagement so that they are likely to rebound to cause a chattering of the contacts.

In the thermostat herein claimed and described I employ a seizing device in the form of a solenoid magnet. Unlike the pole type magnet, the solenoid permits a considerable movement of its armature or core with a relatively small change in the force exerted thereon. Consequently the forces exerted do not attain such large magnitude as will hinder the proper operation of the thermostat. My improved thermostat is entirely free of all bouncing, exhibits no tendency to chatter when used with alternating current and is capable of a wide range of temperature adjustment.

A further object of my present invention is the provision of a thermostat that may be employed to "feel" the temperature of objects to be heated.

To this end I provide my improved thermostat with a thermal contact shoe for engaging the bodies to be heated, so that the thermostat may be applied to the surface of such bodies to test their temperatures in the same manner as one might employ his finger for the same purpose.

Such a thermostat may be employed in connection with food warmers and similar devices which are adapted to receive a food container. The thermostat may be conveniently mounted within the device to hold its contact shoe or "feeler" into thermal engagement with the food container when the latter is in place in the heater.

In order to acquaint those skilled in the art with the teachings and practice of my invention, I shall now describe a specific embodiment of the same, reference being had to the accompanying drawing forming a part of this specification, and in which,

Figures 1 and 2 illustrate a food warming device employing my improved thermostat; and

Figures 3 and 4 illustrate the thermostat itself.

Figures 1 and 2 illustrate my improved thermostat employed in a heating device such as may be used by soda fountains to maintain fudge and similar commodities warm. The fudge-warmer

consists of a cup-shaped receptacle 11 constructed of copper or other heat-conducting material and having an electric heater 12 in the thermal association therewith. The cup 11 is supported in any convenient manner within an outer casing 13, and is adapted to receive a glass jar or container 14. A notch is cut out of one side of the cup 11 to permit a thermostat 15 to be mounted therein. A spring member 21, which is secured to the cup 11 in any convenient manner, supports the thermostat 15 and holds it firmly against the jar 14. Referring to Figures 1, 2 and 3, the spring 21 pivotally engages an insulating block 22 which carries a resilient metal strip 24 and a thermally responsive bimetallic strip 25, which latter is provided with a copper contact shoe 26. The spring 21 urges the contact snoe 26 into thermal engagement with jar 14 so that the bimetallic strip will assume the temperature of the jar.

The bimetallic strip 25 carries at its outer end a supporting plate 31, which is insulated therefrom in any convenient manner. As is shown more clearly in Figure 4, the supporting plate 31 comprises a central disc portion from which extends two strap portions 32 and 33 and a number of tabs 34. The strap portion 32 is secured to the bimetallic element 25, and the strap portion 33 carries an adjustable contact screw 36. The disc portion is provided with a central perforation 37 from which a slot 38 extends to the edge of the plate. This slit prevents the flow of electric current about the perforation 37 when the thermostat is used with alternating current.

Referring again to Figure 3, a bobbin wound coil 41 is mounted on the supporting plate 31 with its hole registering with the perforation 37 of the supporting plate. The tabs 34 are bent over the edge of a wall 42 of the bobbin to hold it in place. One terminal of the coil 41 is electrically bonded to the supporting plate 31 to provide an electrical connection to the contact screw 36, and the other terminal is carried by means of a conductor 44 to a terminal 45 located on the insulating block 22.

The resilient strip 24 carries a magnetic core 51 in such position that it enters the coil 41 when the strips 24 and 25 are flexed towards each other. This core is provided with a longitudinal, radial slit (not shown) to diminish the flow of current in a manner similar to that of the slit 38 in the plate 31. The strip 24 also carries a contact member 52 electrically bonded thereto and adapted to engage the contacting screw 36 carried by the supporting plate 31. A bumper 52′ of insulating material is provided at the extreme upper end of the strip 24. A contact portion 53 at the lower end of the strip 24 engages a resilient contact 54 which is carried by an insulating block 55 mounted on the cup 11.

The circuit of the thermostat passes from the resilient contact 54, through the contact 53, the strip 24, the contacts 52 and 36, the plate 31, the coil 41, the conductor 44 and the terminal 45. The thermostat is connected in series with the heater 12 by means of the conductors 57.

Referring again to Figures 1 and 2 the thermostat 15 is supported and pivoted on the spring member 21 which holds the contact shoe 26 firmly against the wall of the jar 14 as shown by the full lines of Figure 1. When the jar is removed from the warming device the spring 21 relaxes and carries the thermostat to the position shown by the dotted lines of Figure 1, with the upper end thereof leanning against the wall of the casing 13. The contact 53 is thereby carried out of engagement with the contact 54 so that the circuit remains open until the jar is replaced, thereby preventing useless operation of the heater 12.

The operation of the thermostat is as follows:

Assuming that the contacts 36 and 52 are open, no current will be flowing to the heater 12 and consequently the temperature of the jar 14 will be falling. Because of the good thermal connection provided by the contact shoe 26, the temperature of the bimetallic strip 25 is maintained substantially the same as that of the jar 14, so that as the temperature falls the bimetallic strip 25 bends to move the contact 36 towards the contact 52. As soon as the contacts come into engagement, the circuit is closed and current passes through the heater 12 and through the coil 41 of the thermostat. The coil 41, being thereby energized, exerts a magnetic attraction upon the core 51 to seize the contacts and hold them tightly in their closed position.

As the temperature of the jar 14 rises the bimetallic strip 25 tends to move towards the left away from the resilient strip 24 to disengage the contacts. However, the magnet holds the contacts in engagement until the temperature drops to such an extent that sufficient force is exerted between the strips 24 and 25 to overcome the attracting force exerted by the magnet. As soon as the contacts separate the circuit is open and the force of the magnet is removed so that the contacts spring apart to a considerable spacing.

Thus, chattering and its attendant undesirable sparking of the contacts is entirely prevented. Should the contacts be accidently brought into engagement due to shock or vibration they will be seized immediately by the magnet and held in the closed position until the temperature rises to such value that the tension in the resilient parts overcomes the force of the magnet. Upon opening the contacts assume a spacing too wide to permit them to be brought again into engagement, even when subject to shock or vibration, until the temperature returns to a lower value.

The temperature at which the thermostat operates is controlled by means of the adjusting screw 36. Advancing the screw towards the contact 52 causes the thermostat to close and also to open at a lower temperature.

While I have shown and described one specific embodiment of my invention, it will be apparent to those skilled in the art that the same is capable of a much broader application. I therefore do not wish to be limited to the specific disclosure but desire to avail myself of all modifications and variations thereof as fall within the scope of the appended claims.

I claim:

1. In combination, an article holder including means for removably supporting an article, two separately operable series connected switches, means for controlling one of the switches in accordance with the positioning of an article in the holder, thermal means for controlling the other switch, and means responsive to the closing of both switches for changing the effectiveness of the thermal means.

2. In combination, an article holder including means for removably supporting an article, two separately operable series connected switches, means for controlling one of the switches in accordance with the positioning of an article in the holder, thermal means for controlling the other switch, electromagnetic means for altering the

temperature of operation of the thermal means, and circuit connections controlled by the joint action of both switches for controlling the energization of the electromagnetic means.

3. In combination, an article holder including means for removably supporting an article, switching means, means controlled in accordance with the positioning of an article in the holder for placing the switching means in condition to establish a control circuit, thermal means actuating the switching means to complete the control circuit, electromagnetic means for altering the temperature of operation of the thermal means, and circuit connections effective upon completion of a circuit by the switching means for energizing the electromagnetic means.

4. In combination, an article holder including means for removably supporting an article, switching means, means controlled in accordance with the positioning of an article in the holder for placing the switching means in condition to establish a control circuit, thermal means actuating the switching means to complete the circuit, a heat conducting member in heat conducting relation to the thermal element and adapted to be engaged by an article in the holder for transferring heat from the article to the thermal means, electromagnetic means for altering the temperature of operation of the thermal means, and circuit connections effective upon completion of a circuit by the switching means for energizing the electromagnetic means.

5. In combination, an article holder including means for removably supporting an article, switching means, means controlled in accordance with the positioning of an article in the holder for placing the switching means in condition to establish a control circuit, thermal means actuating the switching means to complete the circuit, and a heat conducting member in heat conducting relation to the thermal element and adapted to be engaged by an article in the holder for transferring heat from the article to the thermal means.

6. A switch including a pair of relatively movable cooperating contacts biased to the switch open position, a thermal element mounted on one of the contacts and movable from a switch closing to a switch opening position, a pair of switching contacts actuated by the thermal element and connected in series with the first mentioned contacts, electromagnetic means for biasing the thermal element to maintain it in one of its positions, and circuit connections for the electromagnet including both sets of contacts in series.

7. A switch including a pair of relatively movable cooperating contacts, a spring biased support for the movable contact, a second pair of cooperating movable contacts including a thermal element mounted on said spring biased support, and electromagnetic means connected in series with both sets of contacts for biasing the thermostat.

8. A switch including a supporting block of rectangular cross section, spring means supporting the same, a pair of side by side parallel extending cantilever spring elements mounted on said block, cooperating contacts on the free ends of the spring elements, one of said elements comprising a thermostat, and a heat conducting plate mounted on the block in physical contact with the thermostat for conveying heat thereto, the heat absorbing surface of the plate facing in the direction that the block is urged by the spring means.

9. A switch including a supporting block of rectangular cross section, spring means supporting the same, a pair of side by side parallel extending cantilever spring elements mounted on said block, cooperating contacts on the free ends of the spring elements, one of said elements comprising a thermostat, a heat conducting plate mounted on the block in physical contact with the thermostat for conveying heat thereto, the heat absorbing surface of the plate facing in the direction that the block is urged by the spring means, and electromagnetic means carried by one of the cantilever spring elements for biasing the thermostat, said electromagnetic means being connected in series with the contacts.

10. A switch including a supporting block of rectangular cross section, spring means supporting the same, a pair of side by side parallel extending cantilever spring elements mounted on said block, cooperating contacts on the free ends of the spring elements, one of said elements comprising a thermostat, and electromagnetic means carried by one of the cantilever spring elements for biasing the thermostat, said electromagnetic means being connected in series with the contacts.

ALFRED HERZ.