Aug. 2, 1955 J. W. HARRISON 2,714,644

THERMOSTAT APPARATUS

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FIG. 1.

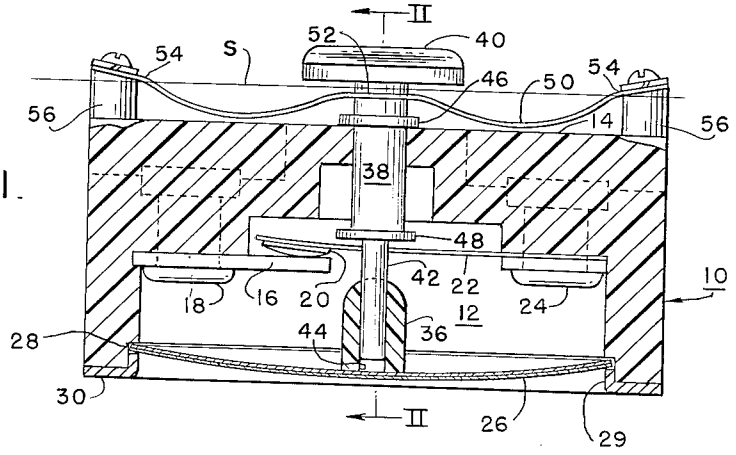


FIG. 2.

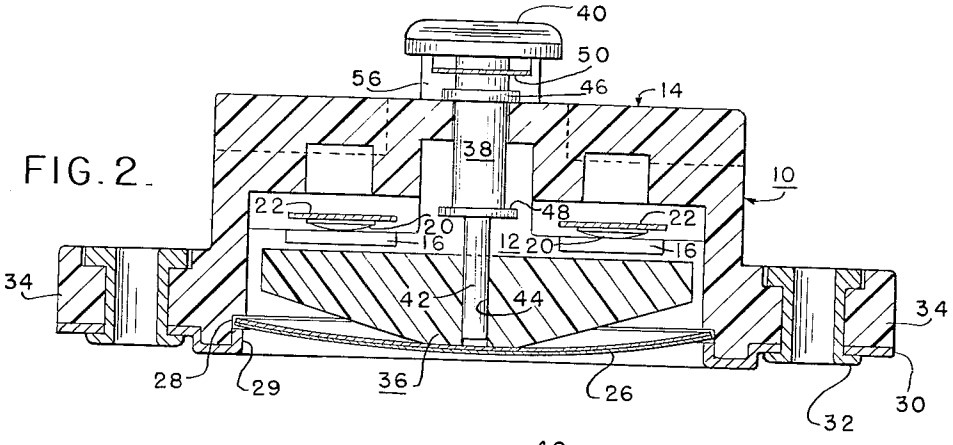
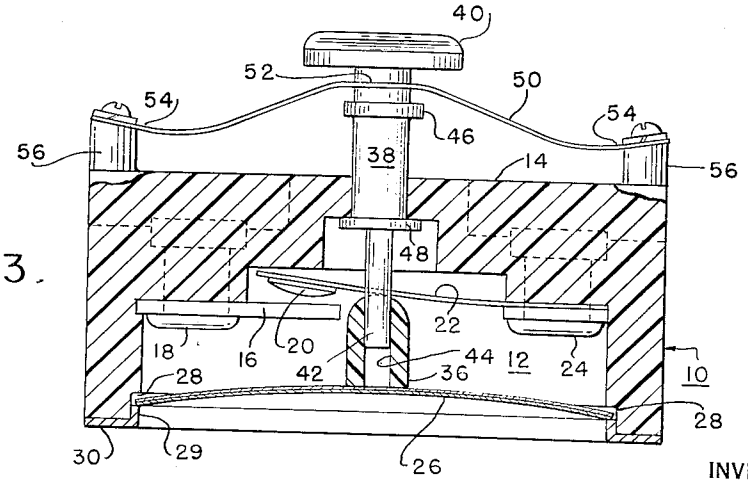


FIG. 3.



INVENTOR
JOHN W. HARRISON
BY P. J. Eisinger
ATTORNEY

United States Patent Office

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John W. Harrison, Meadville, Pa., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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This invention relates to manually resettable thermostatic switches, particularly to such switches having a snap-acting thermal element operable in response to change in temperature to interrupt an electrical circuit or the like, and operable by a push button to re-establish the circuit.

In resettable thermostatic switches, it is desirable to be able to ascertain by an external visual inspection of the switch whether it is open or closed. Various arrangements have been provided, one of which utilizes the position of the push button. With this arrangement, when the switch is open, the push button projects outwardly a greater distance from the thermostat than when the push button is pushed in to restore the circuit. However, the difference between the two positions of the push button is small and not readily apparent without close inspection.

It is an object of the invention to provide a manually resettable thermostatic switch whose position is more conspicuously indicated and may be determined at a distance from the switch.

Another object is to provide a manually resettable thermostatic switch in which the difference between the "On" position of the push button and the "Off" position is readily apparent to the observer.

A more particular object is to provide in such a switch, simple and inexpensive mechanism for amplifying the movement of the reset push button from the "On" position to the "Off" position.

In accordance with my invention, I provide an over-center spring connected to the push button that is used to manually reset the bimetal element to the "On" position. This spring has a short travel on one side of center in the direction to close the switch and a great travel in the opposite direction to open the switch. Upon movement of the bimetal element to open the switch in response to change in temperature, it moves the push button through the short travel and beyond center into the larger travel, whereupon the spring effects continued movement of the push button through the larger travel. Thus, the push button has a much greater travel than the bimetal element.

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

Fig. 1 is a vertical sectional view of a resettable thermostatic switch embodying my invention;

Fig. 2 is a vertical section taken on line II—II of Fig. 1; and

Fig. 3 is a view similar to Fig. 1, but showing the thermostat in another operating position.

Referring to Figs. 1 and 2 of the drawing in detail, a double-pole, resettable, thermostatic switch is shown, comprising preferably, a one-piece molded plastic housing 10 having a central chamber 12 accessible from the bottom of the housing and having a top wall 14. Two identical pairs of contacts are encased within the chamber 12, each pair including a stationary contact 16 rigidly

fastened to one portion of the top wall 14 by a riveted metal insert 18, and a movable contact 20 carried by a flexible arm 22 which is rigidly attached to the opposite portion of the top wall by a similar riveted metal insert 24. Contact 20 is biased downwardly into engagement with contact 16 by the inherent bias of the flexible arm 22.

A snap-acting bimetal disc 26, having its high expansion side disposed uppermost, is supported at its periphery or edge, for movement of its center portion. For example, the edge of the disc may be nested or received in an annular recess 28 provided in the lower portion of the chamber 12 and held therein by the upwardly-extending flange 29 of a bottom plate 30, which is clamped to the bottom of the housing 10 by a pair of tubular rivets 32 extending through lugs 34 of the housing. The plate 30 is formed with a central opening generally coextensive with the bimetal disc 26 to permit unrestrained snapping movement of the disc.

A vertically movable yoke 36 is interposed between the contact arms 22 and the bimetal disc, and is supported by the disc when the thermostatic switch is in the upright position shown in the drawing. The yoke spans the two contact arms 22, and the height of the yoke is such that when the contacts are in engagement a small gap exists between the upper surface of the yoke and the lower surfaces of the contact arms.

The reset mechanism for the thermostatic switch comprises a push rod 38 slidably disposed in an opening in the top wall 14, and having a reset push button 40 at its upper end and a collar 46 adapted to abut the top surface of the wall 14 to limit its downward movement. The push rod 38 has a lower end portion 42 of reduced diameter which extends into the chamber 12 and is slidably received in a vertical bore 44 in the yoke 36. At its lower limit of movement, it extends to a point just below the center plane of the bimetal disc 26, so that upon downward movement of the push rod, it is adapted to move the bimetal disc downwardly just below center, whereupon the disc snaps downwardly to its lowermost position, provided it is at a sufficiently low temperature.

Amplified movement of the reset push button is provided by a snap-acting, over-center leaf spring 50, which is rigidly fastened at its mid portion to the push rod 38 and at its end portions to bosses 56 on the top wall 14 of the casing. When the push rod is in its lowermost position, the mid portion 52 is slightly below the snap-over center of the leaf spring, which is indicated by a line S connecting the end portions 54 of the leaf spring. When the mid portion is below the snap-over center, the push rod is biased downwardly, and when it is lifted above the snap-over center, the spring bias is reversed with a snap action, thereby lifting the push rod upwardly to the position shown in Fig. 3. The upward travel of the push rod is limited by the lower collar 48, which collar is positioned to stop the push button in a position which is well above the center line S but is slightly below the unrestrained upper position of the leaf spring 50. Although the lower collar is not entirely essential, its limiting action is advantageous, since a firm "feel" is imparted to the reset button 40 in the upper position.

The mid portion 52 of the spring, the collar 46 and the lower end of the push rod are so positioned relative to each other that the extent of movement of the mid portion and the push rod when said mid portion is below the center line S is less than the movement of the disc between its upper and lower stable positions, and furthermore, such that the upper and lower limits of travel of the lower end of the push rod during such movement are located between the upper and lower limits of travel of the bimetal disc.

Although the snap-acting bimetal disc 26 may be pro-

vided with any desirable operating temperature characteristics, for purposes of explanation it will be assumed that the disc snaps upwardly when heated to 180° F. and snaps downwardly when cooled to 40° F. (below normal room temperature). Although the disc will not snap downwardly until it has cooled to 40° F., it may be manually snapped downwardly when its temperature drops below some intermediate temperature, such as 140° F., dependent upon the lowermost position of the push rod in relation to travel of the disc.

Operation

Consider first the position of the switch shown in Figs. 1 and 2, in which the reset button 40 has been pushed downwardly to the "On" position, and assume that the temperature of the bimetal disc is below 180° F. The disc is in its lower position and since a gap exists between the yoke 36 and the contact arms 22, both sets of contacts 16 and 20 are engaged.

When the temperature of the disc is raised to 180° F., the disc suddenly reverses its curvature and snaps to its upper position, as shown in Fig. 3, moving both the yoke 36 and the lower end portion 42 of the push rod upwardly. The yoke, being moved upwardly a sufficient distance by the upward travel of the disc, moves the flexible contact arms 22 upwardly, thereby disengaging the movable contacts 20 from the stationary contacts 16, to open the circuit controlled by the switch. The travel of the yoke is not greater than the maximum travel of the disc.

The upward movement imparted to the push rod 38 by the disc is sufficient to raise the mid portion 52 of the over-center leaf spring above the snap-over center S. Since the bias of the leaf spring is reversed when the mid portion 52 is above the snap-over center S, the push rod is raised to its outermost position as determined by the collar 48, in which position the lower end portion 42 is out of contact with the surface of the disc and is spaced a substantial distance above it, as shown in Fig. 3.

The over-center spring 50 is made to have a wide amplitude of movement between the snap-over center S and the uppermost position. This provides a movement of the push button which continues far beyond the movement thereof effected by the bimetal disc itself. Thus, the push button 40 is moved to a position which is sufficiently higher than the closed position, so that the higher position may be readily noticed at a distance.

To reclose or reset the switch, the reset button 40 is depressed to the lower limit of its travel as determined by the collar 46. The lower end portion 42 of the push rod is thereby moved downwardly into engagement with the upper surface of the disc 26, forcing the disc back down just below its center plane. If the disc has cooled to a sufficiently low temperature, such as 140° F. in the example stated, it continues movement with a snap action to its lower stable position shown in Figs. 1 and 2, relieving its upward pressure on the yoke and allowing the contacts 16 and 20 to be re-engaged. Immediately subsequent to engagement of the push rod with the disc 26 during its downward movement, but prior to abutment of the collar 46 on the upper wall 14, the mid portion of the leaf spring crosses the snap over center line S. The resulting reversal in the leaf spring bias holds the reset

button in its "On" position. However, if it is attempted to reset the switch before the disc has cooled to a sufficiently low temperature, 140° F. in the example mentioned, the disc does not snap to its lower position but does continue to bear against the lower end of the push rod, and returns to its upper position shown in Fig. 3 to reopen the contacts as soon as manual pressure on the reset button 40 is relieved.

The upper collar 46 limits the travel of the push rod 38 against the bimetal disc, thereby preventing possible damaging of the disc, which might be incurred by exertion of too great a manual force on the disc while the switch is being reset.

While the invention has been shown 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.

What is claimed is:

1. A manually resettable thermostat comprising a support, a snap-acting bimetal member carried by said support, a pair of mating contacts, means actuated by said bimetal to disengage said contacts in response to change in temperature, a push rod having an end portion adapted to abut said bimetal member, and an over-center snapping spring member adapted to snap to a position of rest on either one side or the other side of its snap-over center, said spring member being connected to said push rod and to said support, said bimetal member being manually movable by said push rod in one direction and movable in the opposite direction in response to change in temperature to impart to said push rod an initial movement sufficient to move said spring member beyond said snap-over center, said spring member thereby snapping to said other side and imparting additional movement to said push rod, said actuated means being so constructed and arranged as to be movable in said opposite direction independently of said push rod.

2. A thermostatic electrical switch comprising a support, a snap-acting bimetal member, a push rod disposed normal to said bimetal member and having an end adapted to be abutted by said bimetal member when the same snaps in one direction, a pair of mating contacts including a stationary contact and a movable contact, means slidable on said rod and actuated by said bimetal independently of said rod to move said movable contact out of engagement with said stationary contact when said bimetal snaps in the one direction, and an over-center snapping leaf spring, said leaf spring being connected at one portion to said push rod and at another portion to said support, said bimetal member imparting an initial movement to said push rod and said leaf spring of sufficient magnitude to move said spring beyond its snap-over center, said leaf spring thereby bowing in an opposite direction and imparting additional movement to said push rod.

References Cited in the file of this patent

UNITED STATES PATENTS

1,622,721	Hook	Mar. 29, 1927
2,205,240	Clark	June 18, 1940
2,230,770	Van Almelo	Feb. 4, 1941