

Sept. 4, 1934.

J. A. SPENCER

1,972,364

THERMOSTATIC ELECTRIC SWITCH

Original Filed Sept. 19, 1932

FIG. 1.

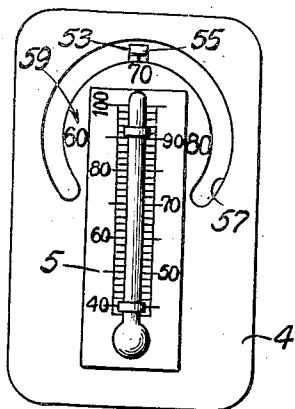


FIG. 2.

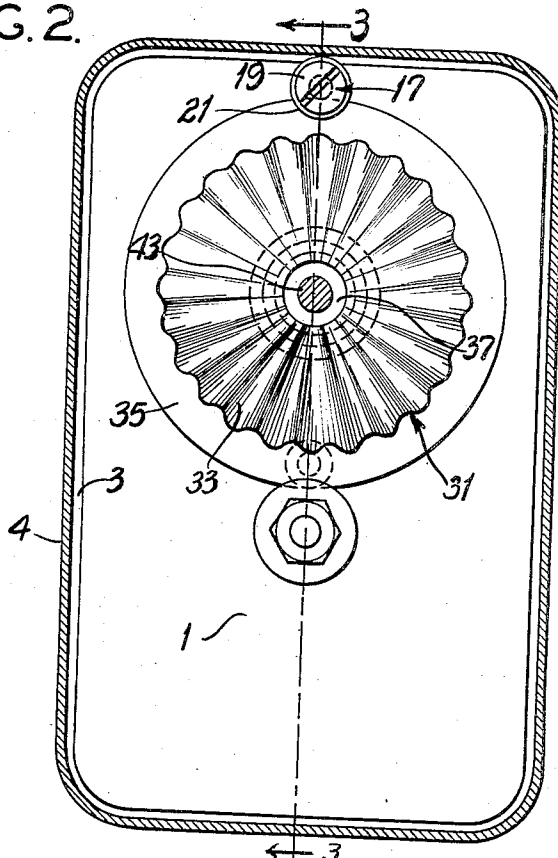


FIG. 3.

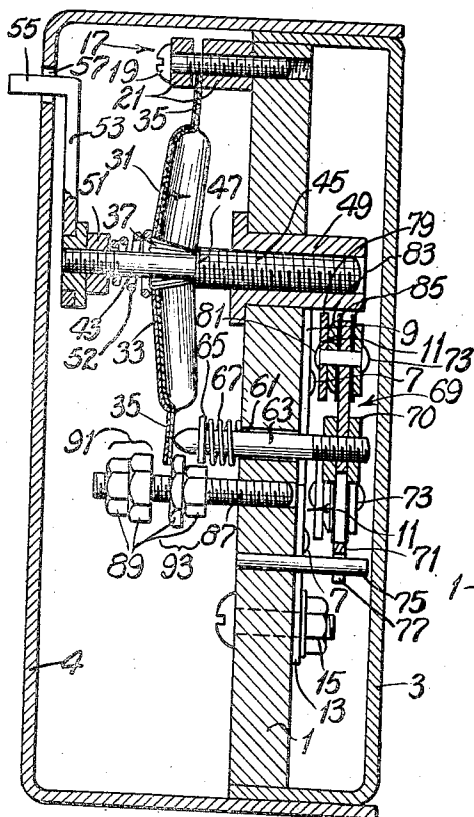
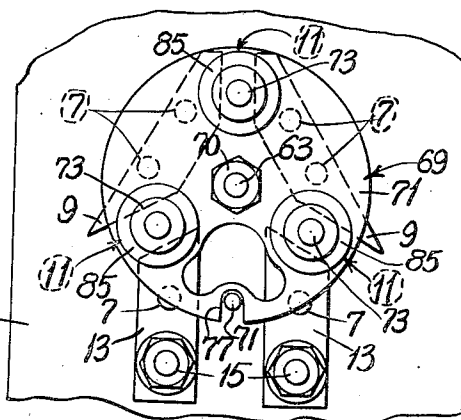


FIG. 4.



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UNITED STATES PATENT OFFICE

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THERMOSTATIC ELECTRIC SWITCH

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Application September 19, 1932, Serial No. 633,772
Renewed January 25, 1934

17 Claims. (Cl. 200—138)

This invention relates to electric switches, and with regard to certain more specific features, to temperature-controlled or thermostatic electric switches.

Among the several objects of the invention may be noted the provision of a thermostatic switch having improved control features, whereby the temperature operating differential may be closely adjusted, and having further control features whereby the range of temperature operation may be varied; the provision of a switch of the class described having improved contact-making and contact-breaking means; the provision of a switch of the class described which is capable of carrying relatively high currents at relatively high voltages without affecting the delicacy of its operation, and the provision of a switch of the class described which is compact and relatively simple in construction and operation. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which are illustrated several of various possible embodiments of the invention,

Fig. 1 is a front elevation of one embodiment of the present invention;

Fig. 2 is an enlarged front elevation of a portion of Fig. 1, a cover member being removed;

Fig. 3 is a vertical cross section taken on line 3—3 of Fig. 2; and

Fig. 4 is a fragmentary back elevation showing certain contacting members.

Similar reference characters indicate corresponding parts throughout the several views of the drawing.

In my copending patent application Serial No. 516,042, filed February 16, 1931, I have shown an improved form of thermostat, which, for its size, has a greatly increased throw or travel between its "cold" and "hot" positions, and has improved thermal-response characteristics. It is a principal object of the present invention to embody, or provide for the embodiment of, such improved thermostat in a thermostatic electric switch, particularly such a switch as adapted for household or room temperature control. To this end, it is desirable, first, that the operating differential of the thermostatic switch be reduced to a minimum, second, that there be no considerable

lag between the room temperature and the temperature of the thermostat, and, third, that the thermostat be capable of adjustment whereby it operates at any desired temperature. The invention as hereinafter described meets all of these requirements, and in addition presents numerous other advantages.

Referring now more particularly to the drawing, numeral 1 indicates a base board, mounting panel, or the like, which is preferably formed of suitable insulating material. Frictionally held, on the base 1 are a back cover portion 3 and a front cover portion 4. On the front of front cover portion 4 a thermometer 5 is mounted. The thermometer 5 is not a part of the invention, but is provided, as is customary in switches of this art, merely as a convenience for the user.

Mounted directly upon the back of base 1 as by rivets 7 are a series of contact plates 9 (Fig. 4), with gaps 11 therebetween. The two end plates 9, as indicated at numeral 13, constitute the terminals of the switch and are accordingly provided with suitable binding posts 15 (Figs. 3 and 4). The arrangement is such that three gaps 11 are provided between the two terminal plates 13. This number (three) is not arbitrary, but by way of example only.

On the front side of base 1 is provided a mounting post 17, which comprises a screw threaded into base 1 having two collars 21 thereon.

Numeral 31 indicates a thermostatic element of the type disclosed and claimed in my said copending application. It comprises a disc of thermostatic metal (usually bimetal), the central portion of which is radially corrugated, as indicated at numeral 33, but the edge portion 35 whereof is flat or flattened. A central opening 37 is provided in the corrugated region 33 (Figs. 2 and 3). The disc as a whole is normally dished, or made slightly conical, in one direction. Normally, when the thermostat is to be used to turn on a circuit when the temperature drops to a predetermined value, the dishing is such that, at temperatures below said predetermined value, the metal layer of the thermostatic metal having the higher coefficient of thermal expansion is on the concave side of the disc.

The action of the thermostat 31 is such, that as temperature change occurs, past a predetermined value, the direction of curvature of the disc reverses itself with a snap. The fact is that when the temperature is rising, the snapping temperature is higher, for the same thermostat,

than the snapping temperature when the temperature is falling, the difference being termed the operating differential. For example, in the heating phase, a thermostat snaps from cold to hot position at 85° F., while the same thermostat, in the cooling phase, snaps from hot to cold position at 80° F., the difference (85°—80°=5°) being known as the operating differential of the particular thermostat.

Returning to the switch, the thermostatic disc 31 is mounted at post 17, by having its flat edge portion 35 clamped tightly between the collars 21 (Fig. 3). This single-spot mounting leaves the remainder of the disc free to snap into its two opposite positions of curvature with temperature changes, as will be more fully described herein-after.

Extending through the central opening 37 in disc 31 is a shaft 43 extending transversely to the general plane of the thermostat. The shaft 43 is unthreaded at the place it passes through opening 37, but immediately therebehind it has an enlarged, threaded portion 45, providing a shoulder 47. The portion 45 is threadedly received in a bushing 49 passing through and secured to base 1. At its front end, the shaft 43 is threaded to receive a nut 51, and the threaded end of an adjusting lever 53 (the nut 51 locking the lever 53 against rotation relative to the shaft). The nut 51 also forms one abutment of a compression spring or the like 52, the other end of which abuts the inner periphery of disc 31. The lever 53 has a projecting arm 55, which extends through a circular slot 57 provided in front cover portion 4. A scale 59 (numbers "60—70—80", Fig. 1) is desirably provided on the face of cover 4 to indicate the adjustment of lever 53.

Freely sliding in a hole 61 in base 1 is a pin or shaft 63. Near its forward end, pin 63 carries a collar 65. A compression spring 67 reacts at one end against the collar 65, and at the other end against the base 1, and at all times urges the pin 63 to move forwardly. The forward end of pin 63 is positioned to abut a point on the flat periphery 35 of thermostatic disc 31, said point of abutment preferably being diametrically across the disc 31 from its point of mounting, at numeral 17.

On the rearward end of pin 63 is secured, by nuts 70, a movable contact-bridging assembly 69.

The contact-bridging assembly 69 comprises a plate 71, which is usually circular, upon which are insulatedly mounted three contact buttons 73. The buttons 73 are preferably allowed a slight degree of motion on plate 71. The buttons 73 are so arranged that they bridge each gap 11 (Fig. 4) of the contact plates 9, so that, when one of them completes a circuit across its particular plates 9, the others do likewise and instantly establish an electrical connection between terminals 13. To keep the plate 71 from rotating, a pin 75 is rigidly mounted in base 1, and engages a slot or notch 77 in the edge of plate 71.

The buttons 73 each comprise (Fig. 3) a disc 79 of good conducting metal, held by a rivet 81 to disc 71. Also on the rivet 81 is a rounded plate 83 upon which the disc 79 rocks through a few degrees. Insulating material 85 electrically isolates disc 79 from disc 71.

The buttons 73 may well be made in accordance with the teachings of Spencer Patent 1,697,886. The contact plates 9, in turn, may well be made in accordance with the teachings of Marshall Patent 1,700,172.

A threaded pin 87 is mounted in base 1 at a point just exterior to the lower edge of thermostatic disc 31. On the pin 87 are threaded nuts 89, arranged in a forward group of two 91 (the two locking each other) and a rearward group of two 93. The groups 91 and 93 extend far enough from the pin 87 to form forward and rearward abutments for the edge 35 of thermostatic disc 31.

The operation of the switch is as follows:

Assume that Fig. 3 represents the hot, stable position of the thermostatic disc 31, dished towards the left, and abutting the pin 63 to hold it backwards against spring 67 to hold the movable contact assembly 69 off the stationary contacts 9, the circuit being thus broken. The center of disc 31, at hole 37, abuts the shoulder 47 of shaft 43, as held by spring 52. When the ambient temperature now drops to a predetermined value, the disc 31 snaps to a position of reversed curvature (dished towards the right). Since the upper edge of disc 31 is rigidly held by the mounting 17, and since the center of the disc abuts relatively immovable shoulder 47, the motion of the disc 31 in reversal takes place primarily at the lower, free edge thereof, said edge moving forwardly through a considerable amplitude, until it abuts the nuts 91 on pin 87. This forward motion frees the pin 63 to move forwardly under the influence of spring 67 and thus bring movable contact assembly 69 into contact with stationary contacts 9 and thus complete the circuit between terminals 13.

Suppose that the completed circuit sets in operation an oil burner, which proceeds to increase the ambient temperature. Soon the snapping temperature of the disc 31 is again reached. The condition of the disc is now such that, aside from its rigid mounting at its upper edge, it still abuts the shoulder 47 at its central portion and in addition abuts nuts 91 at its lower edge. Against these several abutments it reacts and proceeds to reverse its curvature, and take the position shown in Fig. 3, thus again breaking the circuit.

As has been indicated, the thermostat 31 is subject to two adjustments: first, the adjustment of the operating differential, and, second, the adjustment of the temperature of operation, independently of the differential.

The operating differential adjustment, which is usually done once and for all at the factory, is effected by the placement of nuts 91 and 93 on pin 89. Nuts 91 and 93, it will be seen, limit the amplitude of movement of the disc 31 in snapping. When the amplitude of movement is small, the differential is small, and when the amplitude of movement is large, the differential is large.

The operating temperature adjustment is effected by the user, by moving the lever 53 to advance or back up the shoulder 47, against which the center of disc 31 always abuts. The effect of moving the shoulder 47 is to increase the extent of dishing or concavity to which the disc 31 is subjected in one position of the disc and to decrease the extent of dishing in the other position, as will be apparent. In other words, considering the disc 31 to be in the position shown in Fig. 3, motion of the lever 53 so as to move the shoulder 47 to the left, increases the concavity of disc 31. On the other hand, if disc 31 is in its position of opposite curvature, the identical motion of shoulder 47 decreases the concavity of disc 31.

Assuming for the moment that the metal having the higher coefficient of thermal expansion

is on the left side of disc 31 in Fig. 3 (front of Fig. 2), such movement of the shoulder 47 as described in the next paragraph above causes the disc to snap from its illustrated position to its alternate position at a lower temperature. Similarly, a lower temperature causes the disc to snap back from alternate to illustrated position. Thus is the operating temperature of the thermostat lowered. When the dishing is but slight, only slight thermostatic forces are required to initiate the snap, and hence it snaps at a lower or higher temperature, as the case may be.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A control comprising a snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, means for controlling the operating differential of said disc, and separate means controlling the operating temperature of said disc.

2. A control comprising a snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, means controlling the operating differential of said disc, and separate means controlling the operating temperature of said disc, said differential control means comprising means limiting the amplitude of movement of the said free portion of the periphery of said disc.

3. A control comprising a dished, snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, means controlling the operating differential of said disc, and separate means controlling the operating temperature of said disc, said temperature control means comprising means controlling the extent of dishing of said disc.

4. A control comprising a radially corrugated, snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, means controlling the operating differential of said disc, and separate means controlling the operating temperature of said disc, said differential control means comprising means limiting the amplitude of movement of the said free portion of the periphery of said disc, and said temperature control means comprising means controlling the extent of dishing of said disc.

5. An electric switch comprising a radially corrugated, snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, stationary contact means, and movable contact means operated by the said free portion of the periphery of said disc, means controlling the operating differential of said disc, and means controlling the operating temperature of said disc.

6. An electric switch comprising a radially corrugated, snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but

leaving a portion of the periphery free for movement, stationary contact means, and movable contact means operated by the said free portion of the periphery of said disc, means controlling the operating differential of said disc, and means controlling the operating temperature of said disc, said differential control means comprising means limiting the amplitude of movement of the said free portion of the periphery of said disc.

7. An electric switch comprising a dished, snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, stationary contact means, and movable contact means operated by the said free portion of the periphery of said disc, means controlling the operating differential of said disc, and means controlling the operating temperature of said disc, said temperature control means comprising means controlling the extent of dishing of said disc.

8. An electric switch comprising a radially corrugated, snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, stationary contact means, and movable contact means operated by the said free portion of the periphery of said disc, means controlling the operating differential of said disc, and means controlling the operating temperature of said disc, said differential control means comprising means limiting the amplitude of movement of the said free portion of the periphery of said disc, and said temperature control means comprising means controlling the extent of dishing of said disc.

9. An electric switch comprising a radially corrugated snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, stationary contact means, and movable contact means operated by the said free portion of the periphery of said disc, means controlling the operating differential of said disc, and means controlling the operating temperature of said disc, said differential control means comprising adjustable abutments on both sides of the said free portion of the periphery of said disc.

10. An electric switch comprising a radially corrugated, snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, stationary contact means, and movable contact means operated by the said free portion of the periphery of said disc, means controlling the operating differential of said disc, and means controlling the operating temperature of said disc, said temperature control means comprising an adjustable abutment engaging the central portion of said disc.

11. An electric switch comprising a radially corrugated, snap-acting thermostatic disc, means mounting said disc at a single point on the periphery thereof, an adjustable abutment engaging said disc at the central portion thereof, stationary contact means, movable contact means arranged to cooperate with said stationary contact means, and means for operating said movable contact means comprising a pin positioned to engage a second point on the periphery of said disc diametrically opposite the said first point.

12. An electric switch comprising a radially corrugated, snap-acting thermostatic disc, means mounting said disc at a single point on the periphery thereof, an adjustable abutment engaging

said disc at the central portion thereof, stationary contact means, movable contact means arranged to cooperate with said stationary contact means, and means for operating said movable contact means comprising a pin positioned to engage a second point on the periphery of said disc diametrically opposite the said first point, and adjustable abutments limiting the amplitude of motion of said second point on the periphery of said disc.

13. A control comprising a snap-acting thermostatic disc, means supporting said disc at the periphery thereof, but leaving a portion of the periphery free for movement, and means for controlling the operating differential and the operating temperature of said disc.

14. A control comprising a snap-acting thermostatic disc, means supporting said disc at a single region on the periphery thereof and at the center thereof, leaving the remainder of the periphery of said disc free for movement, and means actuated by the free portion of the periphery of said disc.

15. A control comprising a snap-acting ther-

mostatic disc, means supporting said disc at a single region on the periphery thereof and at the center thereof, leaving the remainder of the periphery of said disc free for movement, means actuated by the free portion of the periphery of said disc, and means controlling the operating differential of said disc.

16. A control comprising a snap-acting thermostatic disc, means supporting said disc at a single region on the periphery thereof and at the center thereof, leaving the remainder of the periphery of said disc free for movement, means actuated by the free portion of the periphery of said disc, and means controlling the operating temperature of said disc.

17. A control comprising a snap-acting thermostatic disc, means supporting said disc at a single region on the periphery thereof and at the center thereof, leaving the remainder of the periphery of said disc free for movement, and means actuated by the free portion of the periphery of said disc and controlling the operating differential and the operating temperature of said disc.

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