Nov. 11, 1941. R. B. IMMEL ET AL 2,262,397

CIRCUIT INTERRUPTER

Filed Jan. 24, 1940

Fig. 1.

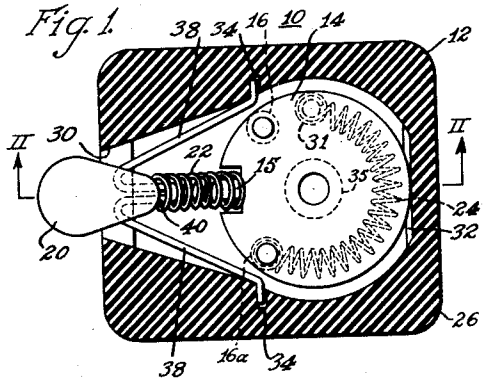


Fig. 5.

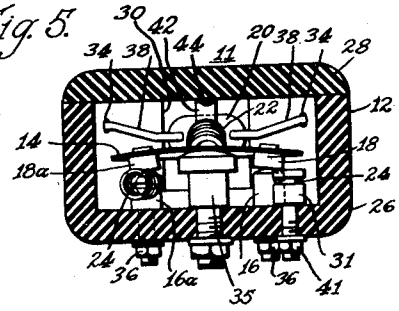


Fig. 2.

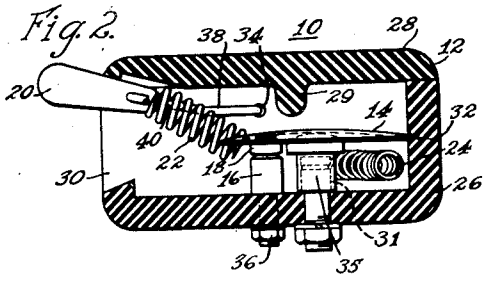


Fig. 6.

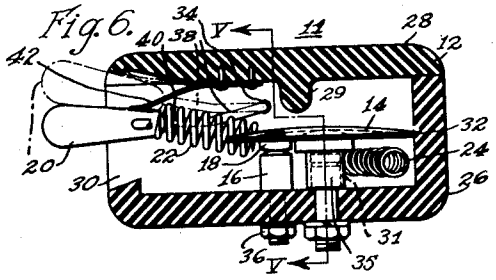


Fig. 3.

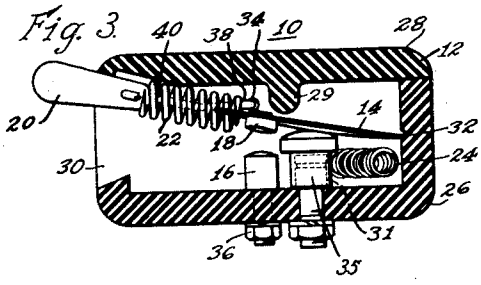


Fig. 7.

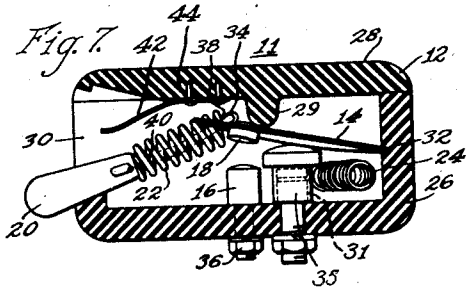


Fig. 4.

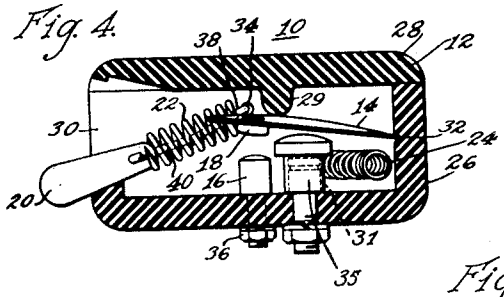


Fig. 8.

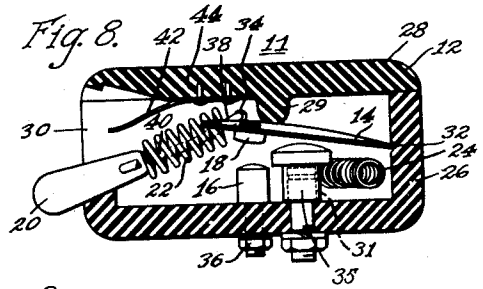
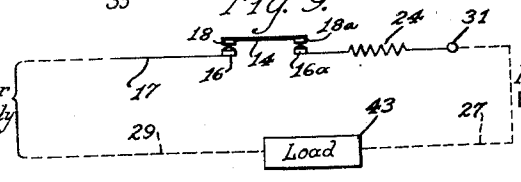


Fig. 9.



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CIRCUIT INTERRUPTER

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Application January 24, 1940, Serial No. 315,370

13 Claims. (Cl. 200—122)

Our invention relates to circuit interrupters and more particularly to thermally-controlled, manually-operable snap-acting switches.

An object of our invention is to provide an inexpensive, ruggedly-constructed snap-acting switch which may function both as a thermostat and a manually-operable switch.

A further object of our invention is to provide a manually or thermally-actuable switch which has a manual reset associated therewith for preventing the thermal reengagement of the contacts after disengagement thereof.

Another object of our invention is to provide an improved thermally and manually-operable snap-acting switch which has a bimetallic member as the movable member thereof.

Still another object of our invention is to provide a thermally-actuable manually-operable snap-acting switch in which the cooperating contacts thereof cannot be manually reengaged while the thermally-actuable member remains in an open or hot position.

Other objects of our invention will either be pointed out specifically in the course of the following description of a device embodying our invention, or will be apparent from such description.

Referring to the accompanying drawing:

Figure 1 is a top plan view of a structure, embodying our present invention, with a portion of the casing removed;

Figs. 2, 3 and 4 are sectional views taken along the line II—II of Fig. 1, illustrating the structure in its various operating positions;

Fig. 5 is a view taken along the line V—V of Fig. 6 illustrating a modified structure;

Figs. 6, 7 and 8 are views similar to Figs. 2, 3 and 4, respectively, of the modified structure illustrated in Fig. 5; and

Fig. 9 is a schematic wiring diagram illustrating the switch embodying our invention associated with a load.

Referring to the accompanying drawing, in which like reference characters illustrate like parts in the several figures, we show a thermally-actuable manually-operable snap-acting switch 10 comprising a supporting structure or casing 12, a thermally-responsive switch member 14, cooperating contacts including stationary contacts 16 and 16a and movable contacts 18 and 18a attached to the member 14, an operating handle 20, a toggle connection 22 between the handle 20 and switch member 14 for manually operating such member from one position to another with a snap-action, and a heating element 24 which is electrically associated with the cooperating contacts and thermally associated with the bimetallic member 14.

The supporting structure or casing 12 is, in this instance, formed of a suitable insulating phenolic resin into substantially a hollow box-like shape. The casing 12 includes an upper removable member 28 and a lower cup-shaped member 26 to receive the operating parts of the switch structure 10. A centrally located protuberance 29 extends down from the upper member 28 to limit the upper movements of switch member 14. A vertically extending slot 30 is located or positioned within one side of the lower member 26 of the casing 12 to receive the operating handle 20. A horizontally extending shallow slot 32 is positioned within the rear upwardly extending wall portion of the lower member 26 of casing 12 to receive the bimetallic switch element 14 and to function as a fulcruming point therefor. A plurality of outwardly extending cylindrical apertures 34 are located within the side portions of the lower section 26 of casing 12 to receive suitable supporting members 38 of the handle 20. While the preferred form of the casing 12 is herein described, it is to be understood that any other suitable casing may be used in lieu thereof.

The thermally-responsive switch member 14 is, in this instance, a bimetallic disc-type thermally-responsive element. However, it is to be understood that the switch member 14 need not be in the shape of a disc, but may, if desired, be, say, an elongated rectangularly-shaped bimetallic member. A plurality of movable contacts 18 and 18a are rigidly attached to the member 14 and, in this instance, are electrically associated therewith. These contacts are adapted to cooperatively engage suitable stationary contacts 16 and 16a as hereinafter described. The switch member 14 fits into and is fulcrummed about the slot 32 within the rear wall of member 26 of casing 12, and when in an operative position is close to or may rest against a centrally located upwardly extending fulcruming post 35 which is located centrally with respect to the bimetal. The bimetal is also attached to the toggle connection 22 by means of an integral tongue 15 (see Fig. 1), which is located at a point substantially diametrically opposite the engagement of switch member 14 with the casing 12. The toggle connection 22 is adapted to bodily move the disc-like switch member 14 either upwardly or downwardly depending upon the position of the operating handle 20, as hereinafter described.

The switch member 14 is adapted to be retained in either of two positions by means of the handle 20 and toggle connections 22, namely, a lower or operative position as illustrated in Fig. 2, or an upper or inoperative position as illustrated in Fig. 4. When the switch member 14 is in a lower or operative position (see Fig. 2), the movable contacts 18 and 18a rigidly attached thereto are adapted to engage the stationary contacts 16 and 16a, the switch member being in its convex upward position. Conversely, when the bimetal switch member 14 is in a raised or inoperative position (see Fig. 4), the contacts 18 and 18a cannot become engaged with the stationary contact 16 regardless of the curvature of such member.

However, the bimetallic switch member 14 may move from the operative position, as illustrated in Fig. 2, to an intermediate inoperative position (see Fig. 3). Such intermediate movement of the member 14 is not controlled by the operating handle 20 and toggle connection 22, as hereinabove described, but is controlled by the inherent thermal action thereof, in a well-known manner. In other words, when the operating handle 20 is in an upper position, the bimetallic switch member 14 operates as a thermostat, from a lower operative position to an intermediate inoperative position, in response to the temperature variations thereof.

The stationary contacts 16 and 16a include, in this instance, upwardly extending post-like members which pass through the lower member 26 of supporting structure 12 and are rigidly attached thereto by suitable nuts 36. The contacts 16 and 16a are positioned below the movable contacts 18 and 18a, respectively, and are of such height as to make good contact therewith as the switch moves to a closed or contact-engaging position. The stationary contact 16 is also used as a terminal for the switch structure 10 as hereinafter described.

The operating handle 20 is, in this instance, a tapered member which is adapted to extend into the casing 12 through the vertically slotted aperture 30. The handle 20 is hingedly attached to the lower member 26 of casing 12 by means of a suitable substantially V-shaped elongated hinging member 38. The hinging member 38 is rigidly attached to the handle 20 and passes through the inner end of such handle so as to form an inwardly extending loop-portion 40 at the innermost end thereof. The loop-portion 40 is adapted to cooperate with the toggle connection 22 as a supporting means, therefore, as hereinafter described. The other or free ends of the V-shaped hinge members 38 are bent substantially outwardly and are positioned within the apertures 34 in member 26 to afford hinging means for the switch handle 20. It is, therefore, obvious that the handle 20 may move vertically within the slot 30, being limited by the confines thereof, and rotate about the apertures 34, as fulcrums.

The toggle connection 22 between handle 20 and switch member 14 comprises, in this instance, a substantially helically wound resilient member. However, it is to be understood that any other suitable toggle connection between the operating handle 20 and the bimetallic disc 14 may be used in lieu thereof. The helically wound resilient toggle connection 22 cooperates with the inner end of handle 20 by being positioned about the inwardly extending portion 40 of the hinge member 38 at one end thereof so as to rest against the inner end of the handle 20 and cooperates with member 14 by fitting over the tongue portion 15 of the bimetallic member 14 at the other end thereof. The toggle connection 22 is thus adapted to convey the vertical movements of handle 20 to the switch member 14 so as to produce a snap-action thereof, in a well-known manner, namely, by being compressed as the handle 20 is moved toward the member 14 until it reaches its natural plane or a plane parallel to the member 14, at which time, with a continued movement of the handle 20, the toggle connection expands, causing the member 14 to move upwardly with a snap-action. This action of the handle 20 and toggle connection 22 moves the switch member 14 from one position to another with a snap-action, regardless of the position of such handle. Further, the connection 22 is adapted to force the switch member 14 downwardly when the handle is in an upper position and to force the member 14 upwardly when the handle is in a lower position, see Figs. 2 and 4, respectively. It, therefore, follows that the handle 20 is adapted to bodily move the thermally-responsive switch member 14 from one position to another with a snap-action through the cooperation of the toggle connection 22.

The heating element 24 is, in this instance, rigidly attached at one end to the stationary contact 16a and to a suitable terminal post 31 at its other end. The heater 24 is located substantially intermediate the member 26 of casing 12 and the under-surface of the thermally-responsive switch member 14. Such heater is thus in direct thermal communication with the bimetal switch member 14 and is in series with the cooperating contacts 16 and 18. The terminal post 31 is, in this instance, rigidly attached to the casing 12 by means of a suitable nut 41. The post 31, by means of nut 41, functions not only as a support for the heater 24 but as one of the terminals of the structure 10.

The switch structure 10 may be connected in any desired circuit and is illustrated in Fig. 9 as being in series with a predetermined load 43. With such an arrangement the stationary contact 16 is used as one terminal and is connected to the power supply by the lead line 17. The circuit then goes to movable contact 18, through member 14, and movable contact 18a to stationary contact 16a, then to heater 24 to terminal 31, line 27 to load 43 and lead line 29 to the power supply.

When operating the switch structure embodying our invention, in series with the suitable circuit, as illustrated in Fig. 9, and with the switch in a closed or operated position (see Fig. 2), the cooperating contacts 16 and 18 are engaged, the operating handle 20 is in its upper position, and the heating element 24 is adapted to increase the temperature of switch member 14. The resilient toggle connection 22 also biases the switch member 14 downwardly. With a continued passage of current through the switch structure 10, the heating element 24 will cause the thermally-responsive switch member 14, in thermal communication therewith, to increase in temperature. Assuming the current passing through the circuit is above a predetermined value, the switch member 14 will increase in temperature to a predetermined value, at which time such member will flex upwardly with an inherent snap-action in a well-known manner. The cooperating contacts 18 and 16 will then be disengaged, disconnecting the load from the power supply. However, the handle 20 will remain in an upper position (see Fig. 3). The heater 24 and switch member 14

thus tend to cool. After cooling to a predetermined closing temperature value, the bimetallic member 14 will, with the handle in an operative position, then flex from the upwardly dished position (see Fig. 3) to a lower contact cooperating or engaged position reconnecting the load to the power supply (see Fig. 2). In other words, the switch member 14 thus functions as a snap-acting thermostat in response to the heat produced by the heater 24 and the ambient temperature associated therewith. During this time the operating handle 20 has remained in its upper or operative position.

However, assuming that it is desired to manually disengage the cooperating contacts 18 and 16, the handle 20 is moved to a lower position. Toggle connection 22, after passing the neutral position, biases the thermally-responsive switch member 14 upwardly with a snap-action irrespective of its curvature. The cooperating contacts 18 and 16 are then disengaged regardless of the temperature of the switch member. The switch member 14 will then be in an upper or inoperative position regardless of its curvature (see Fig. 4), it being understood that such member may flex from one curvature to another without causing the cooperating contacts 18 and 16 to become engaged.

If it be desired to return the switch to its operative position, the handle 20 is moved to its upper position, whereupon, assuming the switch member 14 is curved into a cooperative position, the contacts 18 and 16 will become reengaged with a snap-action. Thereafter, such switch again functions as a thermal switch.

It is, therefore, obvious that the switch structure shown as embodying our invention comprises a thermally-responsive member or means adapted to carry one of the cooperating contacts, and is capable of moving from one position to another with a snap-acting movement in response to the temperature variations thereof. Further, that the operating handle operatively associated therewith, through a suitable toggle connection, is adapted to operate such member in response to the manually-actuated movements thereof.

If it be desired, a manual resetting feature may be incorporated with the switch structure embodying our invention, as hereinafter described. Such switch structure 11, as shown in Figs. 5, 6, 7 and 8, would comprise the casing 12, operating handle 20, switch member 14, cooperating contacts 16 and 18, and toggle connection 22. However, a resilient finger 42, which is rigidly attached at one end to the casing 12 and flexibly associated with the operating handle 20 at the other end, would be associated therewith, it being understood that any other suitable resilient member may be used in lieu thereof. The switch structure 11 is identical with the switch structure 10 hereinabove described, except that the elongated resilient finger 42 is operatively associated therewith.

The finger 42 is, in this instance, rigidly attached to the upper portion of casing 12 by means of suitable rivets 44. The resilient finger 42 is shaped or bent downwardly so as to engage the operating handle 20 and hold such handle in substantially its neutral plane, when the structure is in its normal operative position. With the handle maintained in such a mid-position, it will be forced downwardly, through the cooperative action of toggle connection 22, into an inoperative position as the thermally-responsive switch member 14 flexes from an engaging curvature (see Fig. 6) to a disengaged curvature (see Fig. 7). The member 14 thus moves into its upper or inoperative position as the handle 20 moves downwardly. It, therefore, follows that with the member 14 in such an upward position, the cooperating contacts 18 and 16 will not become engaged, even though the member 14 returned to its normal operating curvature (see Fig. 7). The bimetallic member 14 is then free to flex to its original contact-engaging curvature, but cannot cause the cooperating contacts to be reengaged (see Fig. 8), as hereinabove described.

If it be desired to reengage the cooperating contacts 18 and 16 with the member 14 flexed into an operative position (see Fig. 8), the operating handle 20 must be moved upwardly to its uppermost position (see the dotted lines in Fig. 6). This action is similar to that hereinabove described and as illustrated in Fig. 2. However, the handle 20 is moved into such a position against the biasing action of resilient finger 42. The cooperating toggle connection 22 between handle 20 and member 14 then forces the member 14 into a contact-engaging position with a snap-action, as previously described. However, upon releasing the handle 20, the resilient member 42 moves such handle back to substantially its neutral or horizontal position.

If the bimetallic switch member 14 were not flexed into an operative position, but had an inoperative curvature (see Fig. 7), the switch could not be reset. The operating handle 20 would, as the operator released it from the upper or resetting position, illustrated by the dotted lines in Fig. 6, be first returned to the neutral or central position by resilient member 42, and then would be forced into its lower or inoperative position by toggle connection 22. The cooperating contacts 16 and 18 of our modified structure thus cannot be reengaged unless the bimetallic switch member 14 is first flexed into an operative position.

It is, therefore, obvious that, when the resilient member 42 is operatively associated with the switch structure, such switch functions as a manually or thermally-actuable switch which may be thermally or manually disconnected, but which has a reset feature in that only the operating handle can return the bimetallic switch member to its operative or engaging position.

It is further obvious that we have provided a circuit interrupter having a movable thermally-responsive switching member carrying the movable contact and adapted to move with a snap-acting movement in response to temperature variations, and having manually-operable means operatively associated therewith for manually actuating the movements thereof.

Various other modifications may be made in the structure embodying our invention without departing from the spirit and scope thereof, and we desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art and the appended claims.

We claim as our invention:

1. A snap-acting switch comprising a supporting structure, a plurality of cooperating contacts, movable thermally-responsive means for carrying one of said contacts, said means having a snap-acting movement in response to temperature variations, an operating handle, and resilient means permanently interconnecting the handle and thermal contact carrying means for actuating the contact carrying means with a snap-action in response to the movements of the handle.

2. A snap-acting switch comprising a support-

ing structure, a plurality of cooperating contacts, movable thermally-responsive means for carrying one of said contacts, said means having a snap-acting movement in response to temperature variations, an operating handle, and resilient means constituting the sole connection between the handle and thermal contact carrying means for actuating the contact carrying means with a snap-action in response to the movements of the handle.

3. A snap-acting switch comprising a supporting structure, a plurality of cooperating contacts, movable thermally-responsive means for carrying one of said contacts, said means having a snap-acting movement in response to temperature variations, an operating handle, and resilient means directly connecting the handle and thermal contact carrying means for actuating the contact carrying means with a snap-action in response to the movements of the handle, said movable thermal means being supported by the structure and the resilient means.

4. In a circuit maker and breaker, a supporting structure, a plurality of contacts, a thermally-responsive bimetallic movable switch member for carrying one of said contacts adapted to snap from one position to another in response to changes in the temperature thereof, an operating handle, and resilient means constituting the sole connection between the handle and member for actuating the member with a snap-action in response to the movements of the handle, said handle and resilient means adapted to maintain the member in contact engaging location when in an operating position and to maintain the member in a contact disengaging location when in an inoperative position.

5. A snap-acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic disc for carrying one of said contacts, a helical spring, and manually-operable means connected through said spring to the disc for manually controlling the movements thereof in both directions.

6. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, and a handle resiliently connected to said bimetallic member at the opposite side for controlling the operation thereof.

7. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, an operating handle, and a helical spring having one end connected to the opposite side of said bimetallic member and the other end connected to said handle.

8. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, and a handle resiliently connected to said bimetallic member at the opposite side for controlling the operation thereof, said handle extending in a plane approximately parallel to that of said bimetallic member.

9. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, an operating handle, means for mounting said handle in said structure for movement in a plane substantially perpendicular to the plane of said bimetallic member, and resilient means for interconnecting said handle and said bimetallic member.

10. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, an operating handle, wire means attached to said handle and having outer ends pivotally mounted in said structure along an axis transverse to the direction of movement of said bimetallic member when heated, and spring means for directly connecting said handle and said bimetallic member.

11. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, a handle resiliently connected to said bimetallic member at the opposite side for controlling the operation thereof, and an abutment for assisting in the operation of said bimetallic member mounted in said structure intermediate said handle and said one side of said bimetallic member.

12. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, a handle resiliently connected to said bimetallic member at the opposite side for controlling the operation thereof in both directions, and a spring member secured to said structure for preventing movement of said handle to one of its extreme positions by operation of said bimetallic member in response to temperature.

13. A snap acting switch comprising a supporting structure, a plurality of cooperating contacts, a snap-acting bimetallic member carrying one of said contacts and operably mounted at one side in said structure, a handle resiliently connected to said bimetallic member at the opposite side for controlling the operation thereof in both directions, and a flat spring member secured to said structure for preventing movement of said handle to its extreme position corresponding to closure of said contacts by operation of said bimetallic member in response to temperature.

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