

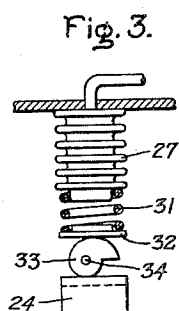
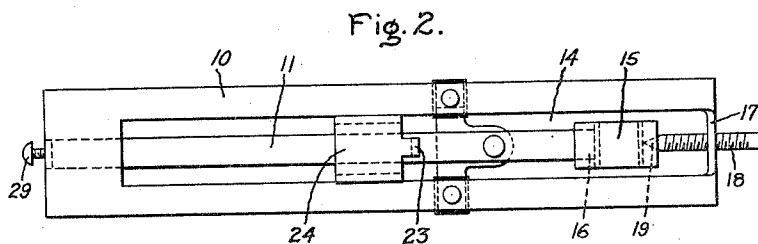
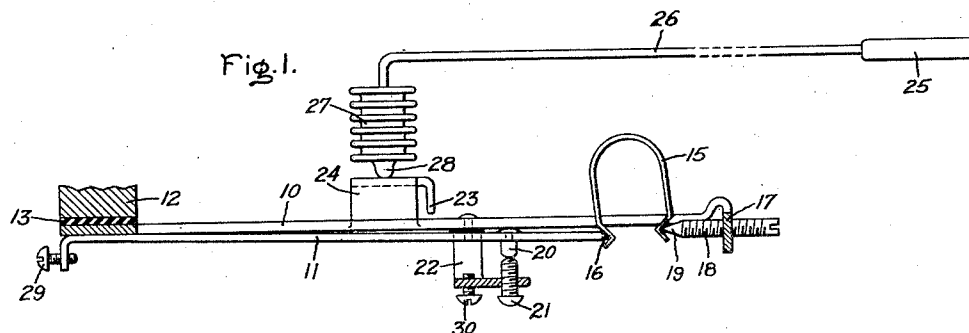
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ELECTRICAL SWITCH

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ELECTRICAL SWITCH

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4 Claims. (Cl. 200-140)

My invention relates to electrical switches more particularly to snap acting thermostatic switches, and has for its object the provision of a simple, inexpensive and reliable device of that character.

In accordance with my invention I provide in one form thereof a resilient metal strip having one end secured to a support, the other end of the strip being free to move laterally upon flexure of the strip, together with a member mounted for lateral movement adjacent the end of the strip. Between the end of the strip and the member I provide a spring for applying a force, such that when the member is moved, as by temperature responsive means, the free end of the strip is snapped quickly from one position to another to control an electric circuit.

For a more complete understanding of my invention reference should be had to the accompanying drawing, Fig. 1 of which is a side elevation view of a thermostatic switch embodying my invention; Fig. 2 is a plan view of the switching device shown in Fig. 1, the temperature responsive element being omitted, while Fig. 3 is a side elevation view of means for varying the temperature adjustment of the device.

Referring to the drawing, I have shown my invention in one form as comprising two metallic strips 10 and 11 made of a suitable flexible spring steel adapted to withstand the temperatures at which the device is to operate without losing its resiliency. These strips are suitably secured each at one end to a common support 12, as by means of bolts or rivets (not shown). As shown, the strips are arranged in substantially overlapping relation with the two adjacent ends secured to the common support 12. It will be understood, however, that the two strips may be arranged substantially in end to end relation with their remote ends secured to a common supporting member extending between them. Suitable electrically insulating material 13 is provided between the strips 10 and 11 and the support 12, whereby they are electrically insulated from the support.

As shown, the strip 10 is rectangular in form and it is provided with an elongated central opening 14. The strip 11 is secured to the support so as to lie centrally of the opening 14 as indicated in Fig. 2. The two strips as thus secured, each at one end to the support 12, have their outer ends free to move laterally in upward or downward direction as viewed in Fig. 1 upon flexure of the strips.

In order to provide for snap movement of

the free end of one strip when the free end of the other strip is moved, I mount a compression spring 15, shown as U shaped, between the free ends of the strips. As shown the strip 11 is somewhat shorter than the strip 10 to provide space for the spring 15, and its outer end is provided with a knife edge bearing 16 for supporting one end of the spring. The free end of the strip 10 is bent downward to provide a cross support 17 for an adjustable screw 18 having its inner end pointed to form a bearing 19 for the other end of the spring 15. The ends of the spring 15 are shaped to provide depressions or recesses to receive the bearings 16 and 19, whereby the spring 15 is supported on the ends of the strips.

It will be observed that the end of the strip 11 as defined by the bearing 16 is in abutting relation with the end of the strip 10 as defined by the bearing 19. Preferably, when the spring 15 is removed the two strips 10 and 11 are straight, in parallel relation, and the bearing 19 is on the longitudinal center line of the strip 11. When the spring 15 is put in place, however, it applies a longitudinally and laterally directed force to the strip 11 as well as to the strip 10, whereby they are laterally displaced somewhat. As shown in Fig. 1, the strip is deflected downward somewhat by the spring 15 so that an electrical contact 20 carried by the strip 11 is in engagement with an adjustable contact 21 carried on a bridging support 22, having its ends secured respectively to the sides of the strip 10. It will be understood that the position of the bearing 16 on a line between the bearing 19 and the point of support on the member 12 of the strip 11 is a position of instability, since any very slight deflection of the bearing 16 to one side or the other of this position causes a lateral component of pressure of the spring 15 to be exerted to move the end of the strip 11 still farther in that direction. The strip is brought to rest either by engagement of the contacts 20 and 21 as shown in Fig. 1, or in the other direction by engagement of the strip 11 with a stop member 23 secured to a bridging member 24 mounted on the strip 10. This bridging member 24 may be struck out of sheet metal stock as a unitary part of the strip 10.

As thus constructed and with the pressure of the spring 15 suitably adjusted by means of the screw 18, it will be observed that movement of one of the strips laterally by a predetermined amount in an upward or downward direction as viewed in Fig. 1, will cause the other strip to

snap suddenly from one position to another position with relation to the first strip, these positions being defined by the engagement of the strip, 11 with one or the other of the two stops 5 formed by the contact 21 and the stop 23. Preferably, however, I move the strip 10 and thereby cause the strip 11 to snap from one position to another. Thus, movement of the free end of the strip 10 downward causes the strip 11 to move downward also by reason of the fact that the strip 11 is held by the spring 15 with the contacts 20 and 21 in engagement with each other. In other words, the two strips initially move downward together, but the strip 11, as it is bent downward, exerts an increasing lateral component of force in an upward direction against the downward lateral component of force applied by the spring 15. Finally the lateral component of the strip 11 as applied to the bearing 16 in an upward direction becomes somewhat greater than the lateral component of the spring 15 applied to the bearing 16 in a downward direction, and the strip 10 then snaps upward to a position against the stop 23, thus opening the switch formed by the contacts 20 and 21. As the strip 11 starts to move it will be observed that the lateral component of the spring 15 decreases since the bearing 16 is approaching a position of alinement between the bearing 19 and the point of support of the strip 11 on the support 12. Consequently, the strip 11 accelerates quickly. As the bearing 16 passes through the position of alinement or instability, the lateral component of the spring 15 reverses and is then applied in an upward direction to assist the snap action of the strip which is completed with the strip 11 in engagement with the stop 23. By suitably adjusting the parts the strip 11 can be made to snap from one position to another upon a very small movement of the end of the strip 10, and a sensitive switch can thus be provided.

While the strip 10 may be moved in any suitable manner, I preferably move it by a suitable temperature responsive element or thermostat. I have shown a temperature responsive device of the closed chamber type containing a suitable expansible or vaporizable gas or liquid, comprising a bulb 25 which is positioned to be subjected to the temperature to which the device is responsive. This bulb 25 is connected through a tube 26 with an expansible receptacle 27, such as a metallic bellows which is mounted on a suitable support, and has its lower end adapted for movement in an upward or downward direction in response to the fluid pressure in the system. This lower end 28 of the receptacle engages with the bridging member 24 on the strip 10.

With the parts as shown in Fig. 1, an increase in temperature causes the movable end of the temperature responsive device 28 to move downward and thereby force the strip 10 downward against its resiliency. Upon the occurrence of a predetermined temperature for which the device is adjusted the strip 11 snaps to its opposite position against the stop 23, as previously described. It is contemplated that the electric switch formed by the contacts 20 and 21 will be connected in a control circuit, such as for the heating means to which the bulb 25 is responsive so that when the switch is open the source of heat is cut off. Screws 29 and 30 are provided on the strip 11 and the bridging member 22 respectively to facilitate the connection of the

switch in a suitable circuit. Suitable electrically insulating material is provided between the bridging member 22 and the strip 10 to which it is connected so that the bridging member is electrically insulated from the strip 10.

Upon a decrease in temperature the movable end 28 of the temperature responsive device moves upward and the strip 10 follows by reason of its own resiliency, the strip 10 if desired, being given a permanent set in an upward direction to assure this. When the bearing 19 has been moved upward sufficiently toward a position of alinement with the bearing 16 and the point of support of the strip 11 on the stop 23 so that the lateral component of the spring 15 is overcome, the strip 11 snaps quickly downward to the closed circuit position again as indicated in the drawing.

For purposes of temperature adjustment, a variable connection may be provided between the expansible receptacle 27 and the bridging member 24 as shown in Fig. 3. As shown here, a relatively heavy helical spring 31 is provided against which the lower end of the receptacle 27 rests. The lower end of the spring rests in turn on a disk 32 in engagement with a cam 33. This cam 33 is provided with a flexible shaft 34 and the lower face of the cam engages with the bridging member 24. The flexible shaft 34 allows the cam 33 to be moved bodily in an upward or downward direction in response to changes in temperature by an amount sufficient to operate the switch. By turning the shaft 34, the space between the lower end of the spring 31 and the bridging member 24 may be varied as desired to adjust the temperature setting. It will be observed that movement of the cam in a counterclockwise direction as seen in Fig. 3, widens this space and thereby causes the strip 10 to be forced downward to open the switch at a lower temperature, and vice versa.

The relatively heavy spring 31 is not appreciably compressed during normal operation of the switch. It is provided to permit a temperature adjustment to be made at a relatively high temperature. It will be understood that the receptacle 27 is capable of applying a relatively great force and consequently if the spring 31 were not provided a change in the temperature setting to a lower temperature under high temperature conditions would force the strip 10 downward and perhaps give it a permanent set. Furthermore, the flexible shaft 33 would probably be given a permanent set. With the spring 31, however, a temperature adjustment to a lower temperature under such conditions is taken up to a great extent by the spring.

The screw 18 provides another adjustment whereby the force applied by the spring 15 may be varied. This changes the temperature range of the switch, that is, the temperature range between the opening and closing of the switch.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A switch comprising a spring strip, and electrical contacts carried by said strip, a support to which one end of said strip is secured whereby the other end of said strip is free to

move laterally upon flexure of said strip, a member provided with an abutment bearing adjacent the free end of said strip, resilient means mounted between the end of said strip and said bearing for applying longitudinally and laterally directed forces to the free end of said strip, an electrical contact on said member arranged to cooperate with the contact on said strip when said strip is in a predetermined position, said strip being held in a position to effect the cooperation of said contacts by said resilient means, and means for moving said member in a direction to increase the flexure of said strip until the lateral component of force exerted by said strip exceeds the lateral component of force applied by said resilient means whereupon said strip snaps to another position to effect the separation of said contacts.

2. A switch comprising a pair of spring strips, a support to which one end of each of said strips is secured whereby the other ends of said strips are free to move laterally upon flexure of said strips, bearings on the ends of said strips, a spring mounted between said bearings so as to apply longitudinally and laterally directed forces to said strips, said laterally directed force changing its direction when one of said bearings moves through a position of instability, means for moving the free end of one of said strips in a lateral direction to increase the flexure of the other strip until the lateral component of the force exerted by said other strip exceeds the lateral component of the force applied to said other strip by said spring whereupon said other strip is caused to snap from one position to another with relation to the first strip and elec-

trical switch means carried by said strips and operated by the relative movement between said strips.

3. A temperature responsive switch comprising a pair of spring strips, a common support to which one end of each of said strips is rigidly secured with the other free ends of said strips in abutting relation, a spring bearing on said abutting ends so as to apply longitudinally and laterally directed forces to said strips, a temperature responsive device connected to one of said strips so as to move the free end of said strip in response to changes in temperature and thereby cause the free end of the other strip to snap from one position to another with respect to the first strip and electrical switching means carried by said strips and operated by the relative movement between said strips.

4. A temperature responsive switch comprising a spring strip supported at one end and having its other end free to move laterally upon flexure of said strip, an elongated member supported at one end and having its other end movable laterally in abutting relation with the free end of said strip, a compression spring mounted between said abutting ends, electrical contacts carried by said strip and said member arranged to cooperate with each other in predetermined relative positions of said strip and said member, and temperature responsive means connected to said member so as to move its free end in response to temperature changes and thereby cause the free end of said strip to snap quickly from one stable position to another stable position to control the cooperation of said contacts.

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