May 28, 1940. S. B. ALLEN 2,202,681

SWITCH

Filed April 19, 1938

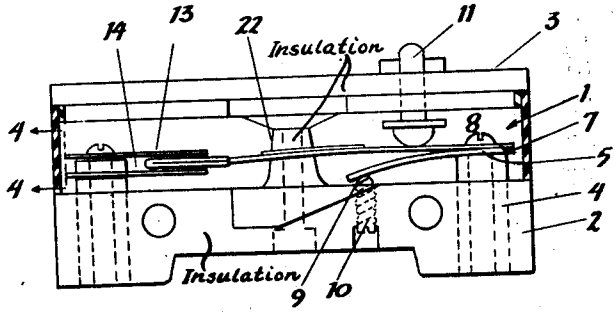


Fig. 1

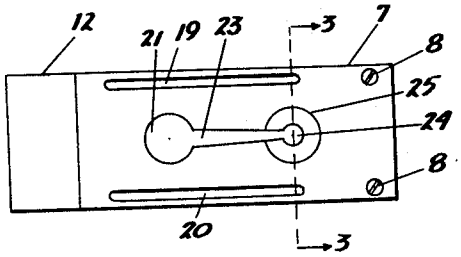


Fig. 2

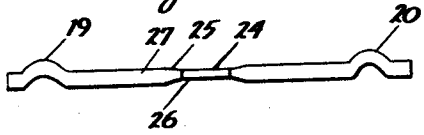


Fig. 3

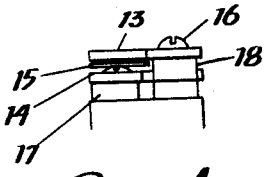


Fig. 4

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2,202,681

SWITCH

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Application April 19, 1938, Serial No. 202,856

3 Claims. (Cl. 200—67)

The present invention relates to electrical switches and in particular to switches adapted to operate on the small motion of the operating element and with great rapidity. One form of this switch is shown in the patent to H. G. Leupold, No. 1,780,758 issued November 4, 1930, of which the present type of switch is an improvement in construction and in means of operation.

In the patent mentioned, the switch leaf element is constructed of some spring material such as phosphor bronze or the like and is slotted at the end to form two forks or branches which are bowed inwardly in the plane of the leaf and held in this position by means of a plate riveted over the top faces of the two forked elements. This exerts a strain in the branches which, when a slight bend is given to the leaf, tends to make the spring seek one of two natural positions.

The present invention employs this principle as set forth above, and more specifically in the patent referred to, but accomplishes the result in a different and superior fashion. Instead of slotting the spring leaf at the end, the leaf is punched out in a uniform flat shape with a slot running down the center. A strain is then impressed upon the leaf tending to exert a transverse tension by punching the flat strip with a press punch in such a manner as to force some of the material outward from the point at which the force of the press is exerted. In this way natural stresses are set up in the spring leaf tending to bow the leaf inward in only two stable positions. A slight pressure then at the point where the strain in the metal was created will throw the spring from one position of equilibrium to the other, where it will remain until the pressure applied is released. When this applied pressure is released the equilibrium of the forces in the spring no longer exists for the spring in its snapped position and the strain in the metal forces the spring back into its original position that it had before the pressure was applied. It will be noted therefore that while there are two stable positions of equilibrium, one of these positions is only stable as long as pressure is exerted on the sensitive portion of the spring. This method of accomplishing the result allows a simple and definite means of effecting the exact tension desired and the spring leaves may be manufactured in quantity production with just the exact amount of tension desired for operating the spring from one position to the other.

Further advantages of this construction will appear from the specification below.

In addition to this feature there is provided in the switch a plate element which in a portion of its surface contacts the leaf spring and positions the spring at the desired inclination and elevation so that even though a greater pressure than that for which the switch is designed is exerted upon the operating point, the spring leaf will not revert back to its initial normal position. Before the spring is sent out for use this plate is adjusted in its proper position, and there is thereby avoided considerable cut and try methods which usually are necessary to obtain exact spring adjustment.

The present invention belongs to a class of switches commonly called micro switches since they operate on exactingly low pressures and produce rapid action with a very short distance of travel between their two contact positions. The leaf spring in the present case may be made not only out of phosphor bronze or other metallic material, but may be constituted of bi-metallic metals and operate directly under desired thermostatic conditions.

Without further describing the merits and advantages of the present invention, the invention will be described fully in connection with the specification and the drawing annexed hereto, in which:

Figure 1 shows the switch in elevation approximately double size with a portion of the cover removed to show the internal mechanism thereof.

Figure 2 shows a plan view of the leaf spring.

Figure 3 shows a section taken on the line 3—3 of Figure 2, this section being three times the size of the element in Figure 2, and,

Figure 4 shows a view taken on the line of 4—4 of Figure 1.

In Figure 1 the switch may be housed in a switch box 1, comprising some insulating material as Bakelite or some other product, as for instance hard rubber, mica compounds or other suitable material depending upon the use and current or voltage capacities which the switch is designed to stand. In Figure 1, the housing 1 has a base 2 and a cover 3 in which the parts of the switch are fastened and operate. In the base 2 in perforations therein are positioned two sleeves 4, threaded at the top to receive the plate 5 underneath and the switch spring leaf 7 positioned over it, both of which are secured by means of the machine screws 8 threaded into the sleeve 4. The plate 5 is substantially the same width as the spring leaf 7 and is bowed as indicated in Figure 1, the free end of the plate 5 being in-

clined downward and resting upon the end 9 of the adjustment screw 10 which is threaded through the insulating base 2 of the switch box. This adjustment screw 10 may be raised or lowered allowing more or less amplitude of the switch leaf 7 before the lower surface of the leaf comes in contact with the upper surface of the plate. This adjustment controls the amplitude and motion of the operating pin 11. If the motion of this pin 11 was not limited a motion greater than a given amount would further make the contact between the end contact plate 12 of the spring with a motion upward, reverse the motion of the plate 12 and thereby break the contact which was made. That is, too great an amplitude of the pin 11 will reverse the motion and position of the contact plate 12 at the end of the spring leaf 7. The spring leaf 7 which has a contact plate 12 at its end is positioned to suspend this plate between the two contact elements 13 and 14. These contact elements are mounted upon the base of the switch box 2 by means of the screws 15 and 16 and spaced apart from one another by means of the spacer rings 17 and 18 to obtain the desired spacing between the contact plates 13 and 14. The spring switch plate or leaf is shown in Figure 2. This comprises a flat piece of material in which two ribs 19 and 20 are pressed to furnish stiffness and resistance and obtain the proper action in the throw of the spring from one position to the other in the operation when the pin 11 is pressed. The center of the spring plate is provided with a perforation 21 through which the cone 22 extending from the base 2 passes and in which is positioned the threaded stud holding the bottom and cover of the switch box together. Extending from the perforation 21, which is circular in shape, is a slot 23 which is slightly V shaped in section and at the end of which is a small circular perforation 24 which is the center of the strained section as more clearly indicated in the enlarged view in Figure 3. This section as shown in Figure 3 is made up by means of a press punch which spreads the metal around the perforation 24 making a thinner section at the inner edge 26, than at the outer edge 27. By forcing the metal outward in this fashion, tensions inward towards the center are exerted and when the spring is bent as indicated in Figure 1, the tendency of this pressure is to make the spring stable in either of two positions, one in which the spring is bent concave downward and the other in which the spring is bent, concave upwards. To effect the change from the position indicated in Figure 1 to a position where the spring is bent upwards, a slight pressure of a few ounces is exerted at the pin 11. The amount of pressure necessary may be obtained by the amount of strain that is given to the spring leaf.

Usually in forming the section around the perforation 24, the spring leaf is put into a punch press which has upper and lower punch elements having convex caps. The punch is set so that the desired shaping of the metallic section around the perforation may be obtained after a number of operations of the press and not with one blow so that the metal is not strained beyond its elastic limit and so that the strain will be uniform and in a direction towards the center of the perforation. When the spring is pressed at the point of contact of the pin 11 beyond its dead center position, the free end of the spring leaf which is the electrical contact end, springs at that instant and flies upwards to make contact with the top contact plate 13. A further pressure may cause the spring to drop downwards but this is prevented by the plate 5.

The pressure of the plunger 11 upon the spring causes a tension in the spring acting upwards against the plunger if the spring has not been pressed too far, which action is controlled by the plate 5 positioned beneath the spring. When the plunger 11 is released this tension on the spring is free to cause the spring to fly upwards at this point thus bowing the contact end 12 downward into its normal initial position.

Having now described my invention, I claim:

1. An electrical switch comprising a spring leaf element formed of a flat spring leaf material having a slot formed longitudinally of the spring leaf but entirely enclosed by the material of the spring, a circular perforation formed at the end of the slot and slightly larger than the slot, said perforation being the center of an area deformed by pressing the material of the spring outward from the edge of the perforation, means holding said spring leaf fast at one end, means positioned adjacent the other end to make electrical contact therewith, and an operating pin positioned to press against the surface of said leaf in the vicinity of the deformed area for moving the free end of the spring in a direction opposite to the pressure on said spring.

2. An electrical switch comprising a spring leaf element formed of a flat spring leaf material having a slot formed longitudinally of the spring leaf but entirely enclosed by the material of the spring, one end of said slot being the center of a concaved area on both surfaces of said spring leaf, means fastening said spring near said area transversely across its surface, an electrical contact element adapted to engage the free end of the spring when the spring flexes, and a pin positioned to press against the surface of said spring in the vicinity of said concaved area to operate the same.

3. An electrical switch comprising a spring leaf element formed of a flat spring leaf material having a slot formed longitudinally of the spring leaf but entirely enclosed by the material of the spring, one end of said slot being the center of a concaved area on both surfaces of said spring leaf, means fastening said spring at one end, a plate positioned beneath the fastened portion of said spring, said plate being inclined away from said spring near the concaved area of said spring, means contacting the bottom end of said plate for raising or lowering its position, an electrical contact element adapted to engage the free end of the spring when the spring flexes, and a pin positioned to press against the surface of said spring in the vicinity of said concaved area on the side of the spring opposite to the one on which the plate is positioned.

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