March 10, 1942. E. A. NORDBERG 2,275,642

SWITCH

Filed Jan. 18, 1940

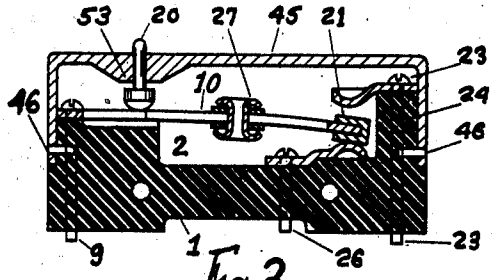

Fig 3

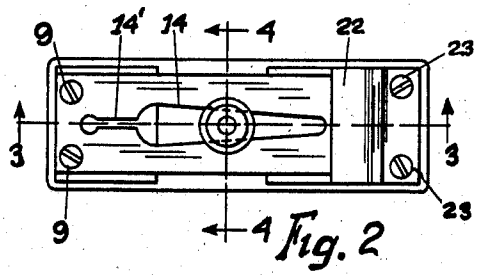

Fig. 2

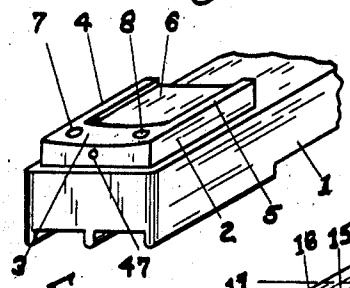

Fig 6

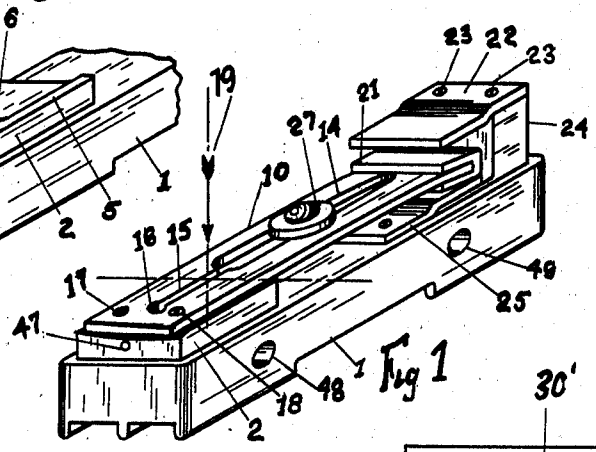

Fig 1

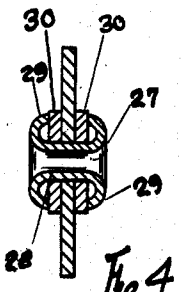

Fig 4

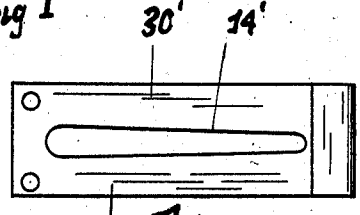

Fig 8

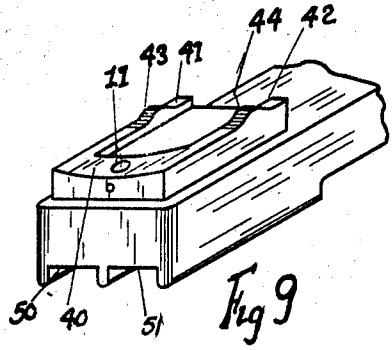

Fig 9

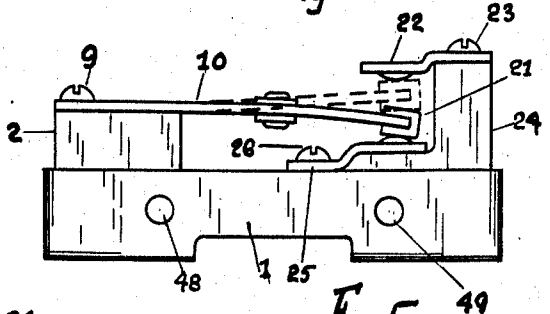

Fig 5

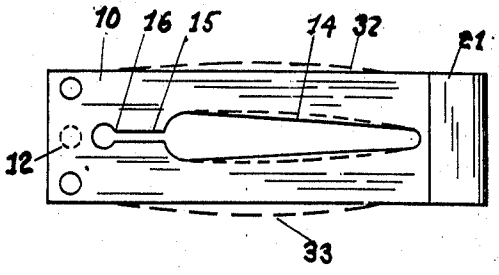

Fig 7

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UNITED STATES PATENT OFFICE

2,275,642

SWITCH

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Application January 18, 1940, Serial No. 314,499

7 Claims. (Cl. 200—67)

The present invention relates to electrical switch mechanism, and more particularly to such mechanism where electrical contacts are made or broken with a snap action by a comparatively light pressure and very small motion of the operating plunger, button or lever.

In the present invention the operating key, lever, pin or button may move only a few thousandths of an inch in rapidly effecting a quick making or opening of an electrical contact with a motion of a much greater distance than the movement of the pin or button. In one form of such switch, a slotted leaf spring is used, which is bowed in at its unsupported end, usually by the electric contact plate to produce a sensitive area around the end of the slot near the supported end of the leaf spring. In this form care must be exercised to assure that the plate maintain fixed, the bowed in ends, as otherwise the spring action will change. The present invention is an improvement over this type of switch, and permits a simpler construction as well as one which is apt to be much more reliable and easier to adjust.

The invention will be better understood from the explanation and description given in the specification below, when taken in connection with the drawing showing an embodiment of the switch, in which:

Figure 1 shows a perspective view of the switch with the cover removed, the arrow showing the point at which pressure is applied to snap the contact end up.

Figure 2 shows a top view of Figure 1.

Figure 3 shows a cross section taken on the line 3—3 of Figure 2.

Figure 4 shows a cross section of the adjustment detail taken on line 4—4 of Figure 2.

Figure 5 shows a side view of the switch with the cover removed wherein the dotted line shows the spring in the up position.

Figure 6 shows the detail of the shape of the base support for holding the spring.

Figure 7 shows the detail of the original shape of the spring without the adjustment element applied thereto.

Figure 8 shows a modification of the spring in the same corresponding view as Figure 7, and,

Figure 9 shows a modification of the supporting base for the leaf spring in the same relationship as Figure 6.

Referring to the drawing in which the same parts bear the same numbers, 1 is the switch base which may be made out of any suitable insulating material such as hard rubber, pressed Bakelite, mica compounds, or other prepared insulating material. At one end the base has a built up support 2 which may be an integral part of the base or a separately attached piece. The support 2 has peripheral flanges at the back 3 and the sides 4 and 5 forming a recessed portion 6 at the center portion of the support. Two holes 7 and 8 extend through the back flange 3 and the base 1 and receive the bolts or screws 9 which hold the leaf spring 10 which will presently be described, although the leaf spring may be held by a single screw passing through a centrally located hole 11 as indicated in Figure 9, and for this purpose the spring leaf may have a centrally located hole 12 shown dotted in Figure 7. The spring leaf 10 which may be made out of Phosphor bronze or any other suitable metal is initially a flat piece or sheet having a slot 14, either tapered all the way as shown at 14' or only part way as shown at 14, with a narrow parallel edged slot 15 extending from the tapered slot and terminating in a circular hole 16. The leaf spring may also be made of thermal bi-metal in which case it will actuate a small temperature change independent of the operation of the pin 20. One end of the spring has holes 17 and 18, spaced apart and located to position the spring symmetrically on the support 2 when the screws 9 are put through the spring for fastening the spring to the base. In its proper position the edges of the spring about the mounting end rest on the flanges 3, 4 and 5, and since the surface of the portion 3 is concaved slightly as indicated in Figures 6 and 9, the spring when mounted against this surface is also strained slightly in making it conform to the shape of this surface. Within the area 6 which is recessed, the spring is unsupported on its bottom side and it is in this area, as indicated by the area 19 that the pin 20 acts. The other end of the leaf spring 10 may carry a contact element 21 cooperating with the contact element 22 mounted by the screws or bolts 23 passing through the back posts 24 mounted on the base 1.

In its lower position, the spring leaf (Figures 3 and 5) is limited in motion by a lower support 25 mounted on the base 1 by means of the screws 26. This support may also be an electrical contact in which case the switch may be used as a single pole double throw switch.

In the present invention the portion of the spring in the vicinity of the arrow is made sensitive by the adjustment of the sliding tube 27 which may be a tubular rivet 28 with spread ends 29 spread over washers 30. The slide 27 is mount-

ed on the slot 14 or 14' somewhat near the larger end of the taper and is then pushed towards the narrow end of the taper. As it is pushed towards the narrower end of the taper in the slot and spreads the side walls or legs 30' and 31 to the dotted line position 32, 33, indicated in Figure 7, the legs are slightly bowed so that when the end of the spring is clamped in position by screws 9, the free end of the spring is bowed downward as shown in Figure 3 and the area under the pin 20 is convexed slightly or level, but strained, making this area unstable, so that even a slight motion downward of one-thousandth of an inch or thereabouts will immediately snap the contact end 21 (Figure 3) upwards. The slider 27 is adjustable in the tapered slot to obtain the throw of the contact end of the spring with the desired movement and pressure of the pin 20. The concaved surface 3 concaves the fixed end of the spring thus confining and making more sensitive the sensitive area under the pin 20. Actually in the operation of the spring, a very sensitive balance exists between the fixed concaved end of the spring and the bowed out convexed section around the point of action of the pin, and the more nearly the area under the pin is flat or level, the less the motion will be to throw the contact end of the spring upwards. The action of the pin 20 in this area will be to change the surface contour of the spring at this point from convex to concave upwards, thus bowing the free end of the spring upwards. As little motion as one-thousandth of an inch will snap the free end upwards.

In the modification shown in Figure 9, besides the concaved flange 40 and a single hole 11 for fixing the spring end, the side flanges 41 and 42 have projecting sections 43 and 44, thus assuring that the surface of the fixed end of the spring is concaved upwards. Since the slider convexes the free end of the spring upwards, the sensitive area embodies the transitional section wherein a portion may practically be level. Operation of the pin at this point will take little pressure and little motion.

A cover 45 may fit on the base 1 around the supports 2 and 24 and be held by pins 46 passing into holes 47 in the supports 2 and 24. The base 1 may be mounted in any convenient way as for instance by means of the holes 48 and 49 and the switch terminals may be brought out on the base grooves 50 and 51 attaching to the switch contacts through the screws 9 and 23. The pin 20 may be operated manually or by any usual lever, relay or mechanical arrangement, the pin 20 being freely supported in the boss 53 in the cover 45.

When the pressure on the pin 20 is released, the leaf spring 10 will return to its normal inoperative position returning the pin also to the position it had before pressure was exerted against it so that the switch will again be ready for any succeeding operation. From consideration of Figures 1, 3, and 5, it will be noted that the contact end of the spring 10 is limited in its free motion in a vertical direction by the lower or the upper contact member. These contact members are so positioned that the spring 10 never assumes a balanced second position of equilibrium in its operated condition so that the spring will retain sufficient restoring force, when pressure on the pin is released, to return back to its normal position. While this condition may be obtained by limiting the end throw of the spring 10, which, as will be noted, is sometimes no more than a few thousandths of an inch, it may also be limited by the support beneath the spring opposite to the position of the pin.

Having now described my invention, I claim:

1. In an electric switch mechanism, a leaf spring carrying a switch contact element at one end, means fixing said spring at the other end, a slot positioned longitudinally wholly within said leaf spring and wedge means cooperating with said slot for bowing outward the metal at the sides of said slot and producing a longitudinal bowing of said spring including a sensitive area in the vicinity of the fixed end of said spring wherein a slight pressure thereon will cause the free end of the spring to move with a snap action from its bowed position in one direction to the opposite direction, and means for applying said pressure within such area.

2. In an electric switch mechanism, a leaf spring carrying a switch contact element at one end, means fixing said spring at the other end, a tapered shaped slot positioned longitudinally wholly within said leaf spring and wedging means positioned in said slot and adapted to be adjusted to the desired position for bowing outward the metal at the sides of said slot and producing a longitudinal bowing of said spring including a sensitive area in the vicinity of the fixed end of said spring wherein a slight pressure thereon will cause the free end of the spring to move with a snap action from its bowed position in one direction to the opposite direction, and means for applying said pressure within such area.

3. In an electric switch mechanism, a leaf spring carrying a switch contact element at one end, means fixing said spring at the other end including a concave support on which the fixed end of the spring rests giving said fixed end a concave shape, a tapered shaped slot positioned longitudinally wholly within said leaf spring and wedging means positioned in said slot and adapted to be adjusted to the desired position for bowing outward the metal at the sides of said slot and producing a longitudinal bowing of said spring including a sensitive area in the vicinity of the fixed end of said spring wherein a slight pressure thereon will cause the free end of the spring to move with a snap action from its bowed position in one direction to the opposite direction, and means for applying said pressure within such area.

4. In an electric switch mechanism, a leaf spring carrying a switch contact element at one end, means fixing said spring at the other end including a concave support on which the fixed end of the spring rests and a single element centrally located on said concave support for holding said spring in place. a tapered shaped slot positioned longitudinally wholly within said leaf spring and wedging means positioned in said slot and adapted to be adjusted to the desired position for bowing outward the metal at the sides of said slot and producing a longitudinal bowing of said spring including a sensitive area in the vicinity of the fixed end of said spring wherein a slight pressure thereon will cause the free end of the spring to move with a snap action from its bowed position in one direction to the opposite direction, and means for applying said pressure within such area.

5. In an electric switch mechanism, a leaf spring carrying a switch contact element at one end, means fixing said spring at the other end including a support having a recessed central

area surrounded by a peripheral flange on the sides and back end with respect to the position of the spring, said spring being mounted in contact with said flanges and resting thereon, a tapered shaped slot positioned longitudinally wholly within said leaf spring and wedging means positioned in said slot and adapted to be adjusted to the desired position for bowing outward the metal at the sides of said slot, and producing a longitudinal bowing of said spring including a sensitive area in the vicinity of the fixed end of the spring within said recessed central area of said support wherein a slight pressure thereon will cause the free end of the spring to move with a snap action from its bowed position in one direction to the opposite direction, and means for applying said pressure within such area.

6. In an electrical switch mechanism, a leaf spring carrying a switch contact element at one end, means fixing said spring at the other end including a support having a recessed central area surrounded by a peripheral flange having a concaved back section and sides with respect to the position of said spring, said spring being mounted in contact with said flanges and resting thereon, a tapered shaped slot positioned longitudinally wholly within said leaf spring and wedging means positioned in said slot and adapted to be adjusted to the desired position for bowing outward the metal at the sides of said slot and producing a longitudinal bowing of said spring including a sensitive area in the vicinity of the fixed end of the spring within said recessed central area of said support wherein a slight pressure thereon will cause the free end of the spring to move with a snap action from its bowed position in one direction to the opposite direction, and means for applying said presure within such area.

7. In an electrical switch mechanism, a leaf spring carrying a switch contact element at one end, means fixing said spring at the other end including a support having a recessed central area surrounded by a peripheral flange having a concaved back section and sides with upwardly projecting portions, said spring being mounted with its end portion in contact with said flanges and resting thereon, a tapered shaped slot positioned longitudinally wholly within said leaf spring and wedging means positioned in said slot and adapted to be adjusted to the desired position for bowing outward the metal at the sides of said slot, and producing a longitudinal bowing of said spring including a sensitive area in the vicinity of the fixed end of the spring within said recessed central area of said support wherein a slight pressure thereon will cause the free end of the spring to move with a snap action from its bowed position in one direction to the opposite direction, and means for applying said pressure within such area.

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