

April 16, 1957

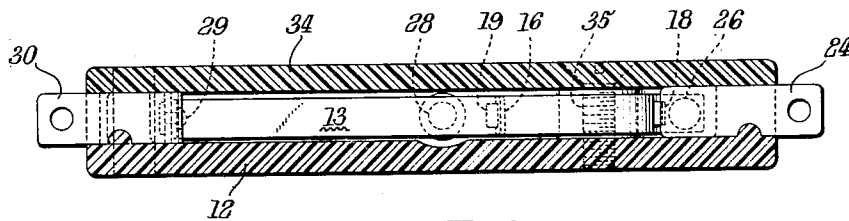
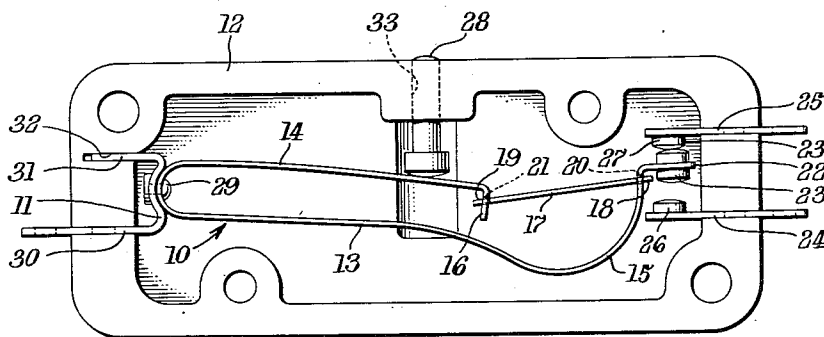
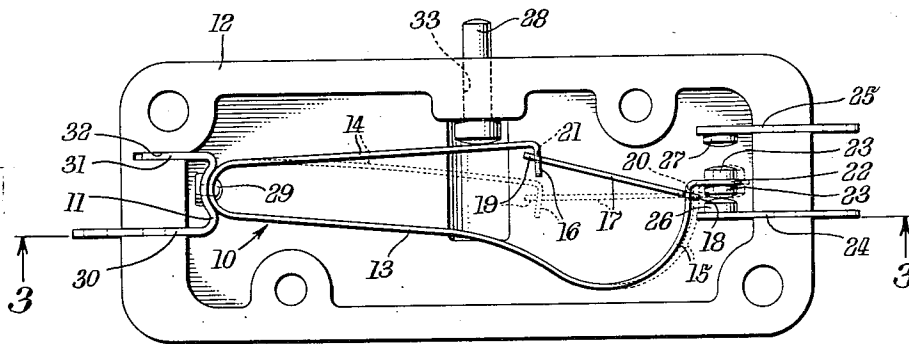
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2,789,172

SNAP-ACTING SWITCH MECHANISMS

Filed May 26, 1953

2 Sheets-Sheet 1



WITNESS

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2 Sheets-Sheet 2

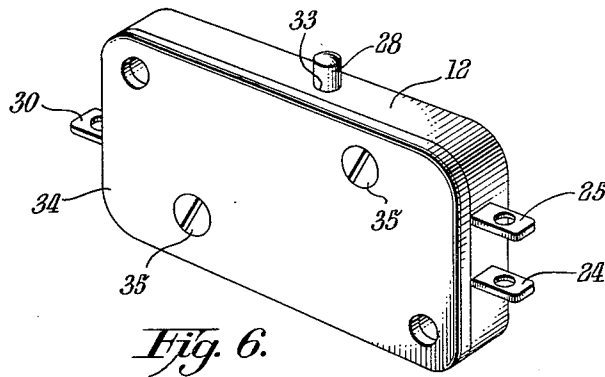


Fig. 6.

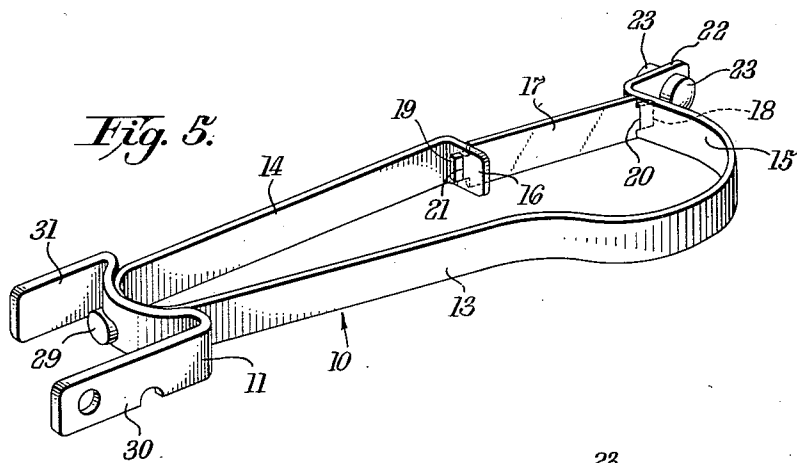


Fig. 5.

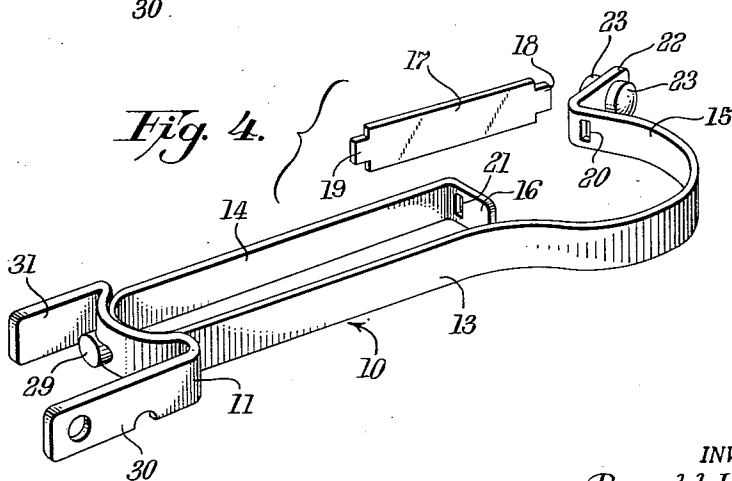


Fig. 4.

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1

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SNAP-ACTING SWITCH MECHANISMS

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5 Claims. (Cl. 200—67)

This invention relates to an electric switch mechanism and more particularly to one which provides a positive snap action responsive to small actuating pressure.

An important object of this invention is to provide a switch having minimum dimensions relative to its current-carrying capacity.

Another object of this invention is to provide a switch which has substantial contact movement responsive to minimum actuator movement.

A further object of this invention is to provide a sensitive snap-action mechanism for a switch which effects, during normal operation, a substantial contact wipe.

A still further object of this invention is to provide a pressure-sensitive switch which is characterized by having one of its dimensions relatively very small, which creates a generally thin wafer shape for the entire unit.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations, and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the drawings:

Fig. 1 is an open plan view of a snap acting electric switch embodying my invention and showing one extreme position of the parts.

Fig. 2 is an open plan view similar to Fig. 1 but showing the other extreme position of the parts.

Fig. 3 is a longitudinal section partly in elevation taken on line 3—3 of Fig. 1 and includes the cover.

Fig. 4 is a partially disassembled view of the primary components of the switch of Fig. 1.

Fig. 5 is a detailed view showing a pivotal connection used in the switch of Fig. 1.

Fig. 6 is a perspective view showing the general external appearance of the switch of Fig. 1.

Referring now to Fig. 1, a narrow, flexible band 10 made of flat spring stock, preferably of beryllium copper alloy, is secured to a single support 11 which, in turn, is secured to an insulation base 12. The band 10 is bent to form two spaced-apart limbs 13 and 14 which extend generally in the same direction from the stationary support 11. The limb 14 is relatively short and straight, while the other limb 13 is longer, bowed and positioned so that its free end 15 extends beyond and overhangs the free end 16 of the shorter limb 14. A straight link 17 is substantially stiffer than the resilient limbs 13 and 14 and, as seen best in Fig. 4, is formed at each end with reduced shouldered portions 18 and 19, which are adapted to fit within cooperating apertures 20 and 21 in the limbs 13 and 14 respectively. These elements are shown assembled in Fig. 5. In this manner, the link 17 is suspended between and pivotally connected to each of the free ends of the limbs 13 and 14, and the length and configuration of the limbs is

2

such that the link 17 is always under compression between said free ends.

In the preferred embodiment shown in Fig. 1, the support 11 to which the band 10 is secured as by rivet 29, is bent to form a U-shaped element having one limb 30 extending through the wall of the base 12 to provide a soldering lug; and the other limb 31 is received in an internal recess 32.

The bowed limb 13 terminates in a sharply-bent contact arm portion 22 to which may be secured a double contact button 23. This constitutes the movable contact which is confined to operate between two spaced-apart conducting fingers 24 and 25 which are each secured to the insulation base 12 and extend through the wall thereof to form external soldering lugs. These fingers are provided with contact buttons 26 and 27 respectively, and constitute the stationary contacts which may be connected into external circuits, as desired.

It will be seen in Fig. 4, which shows the limbs 13 and 14 in their normal unstressed condition, that the span distance between the free ends 15 and 16 thereof is less than the seated length of the link 17, so that the link, when it is inserted to complete the loop, as in Fig. 5, must be under compression. The amount of compression in the link 17 depends upon its position relative to the limbs 13 and 14, and there is a position of maximum compression indicated by the dotted lines in Fig. 1. This is an unstable condition and slight further counterclockwise angular movement of the link 17 reverses the force acting on the bowed limb causing it and the movable contact 23 to move with a snap action to its other engaging position, with the stationary contact 27 as shown in Fig. 2. The limb 14 is formed so that, normally, it biases the link 17 to one side of its unstable position, as shown by the full lines in Fig. 1. This corresponds to stable closure of the contacts 23 and 26. A headed pin 28 of insulation material is mounted for endwise movement in an apertured portion 33 of a wall of the base 12 and imparts movement to the limb 14 to swing the link 17 to and through its intermediate unstable position shown dotted, whence it snaps to the second stable position shown in Fig. 2, in which case the contacts 23 and 27 are closed. Upon release of the pin 28, the biasing force supplied by the limb 14 returns the switch to its normal position.

An insulated cover-plate 34, removably secured to the base 12 by screws 35—35, completes the assembly enclosing the operative switch parts and serves to retain the elements 24, 25 and 30 in their proper predetermined positions in the wall slots to insure precise operation of the switch. It will be noted that these elements are formed with notched portions which engage with cooperating lugs in the slot portions to prevent lateral displacement.

It will also be noted that neither end of the link 17 is tied to a stationary pivot and, indeed, the link is allowed considerable freedom of endwise movement due to the resiliency in that direction provided by the bowed portion of the limb 13. This structural relation results in substantial wiping action between the contacts during normal operation of the switch which provides a continual cleaning of the contact surfaces and the automatic maintenance of minimum contact resistance and maximum useful life.

As a matter of fact, the exceptional wiping action of this switch makes it ordinarily unnecessary to use special precious metal contact material such as would normally be used in the contact buttons 23, 26 and 27, thus decreasing substantially the manufacturing cost of the switch without sacrifice of its good operating characteristics. It will also be noted that, except for the face-to-face contacts themselves, the current path through

the switch is entirely solid and continuous, and is not broken up by any of the joints of the usual pivoted elements which would contribute their resistance to the path and thus unduly limit the current-carrying capacity of the switch.

It is also evident that the basic mechanism of this switch need be substantially no wider than the narrow band 10 from which the limbs 13 and 14 are made. This is due to the overhanging, in-line construction which eliminates the paralleled side-by-side spring elements which characterize many of the prior-art snap switches. As a result, the general overall shape of the switch takes on the form of a thin wafer as seen best in Fig. 6, and which is a very adaptable form and one which may readily be sandwiched in-between existing equipment.

A further characteristic feature of this construction permits the movable contact 23 to be moved in a direction precisely the opposite from that of the actuator pin 28 which imparts the movement.

Viewed in its broadest sense, the switch mechanism of the present invention comprises a closed, articulated loop supported at but one point and comprising a U-shaped resilient leaf spring having limbs of unequal length with a substantially stiff link pivotally secured between the free ends of said limbs and held in compression therebetween.

Having thus set forth the nature of the invention, what I claim herein is:

1. In a snap-acting switch, a single support, a spring supported thereby intermediate its ends and bent to form two spaced-apart limbs of equal width and unequal length extending generally in the same direction from the support, a link pivotally supported in compression between the free ends of said limbs, the longer one of said limbs being bowed and formed at the end with a bent portion forming a movable electrical contact arm, two spaced fixed contacts, the shorter one of said limbs being selectively movable to impart a snap-action movement in said movable contact arm between the positions thereof limited by said fixed contacts.

2. In a snap-acting switch, a single support, a single constant width leaf spring supported thereby intermediate its ends and bent to form two spaced apart limbs extending generally in the same direction from the support, a link pivotally connected to and held in compression between the free ends of said limbs, an actuator in operative connection with one of said limbs, said other limb being formed with a bent terminal portion forming a movable electrical contact, and two, spaced, stationary contacts defining stable positions between which said movable contact operates responsive to movement of said actuator.

3. In an electric switch, an insulated base, a conducting support secured to said base, a single piece of spring conducting material of constant width secured to said support and formed into two limbs which extend in the same general direction from said support and terminate in free ends, a relatively stiff link element held suspended between said free ends in a pivotal connection therewith, a contact arm formed as an extension of one of said limbs, spaced contacts secured to said base and engageable by said contact arm, and manual means for moving said other limb to impart snap-action to said first limb and to said contact arm.

4. In a snap switch, an insulated base, a support secured to said base, a single, flat, resilient leaf spring of constant width bent to form a generally U-shaped member secured to said support adjacent the bend and positioned with its longitudinal axis parallel to said base, one limb being generally straight and short, the other limb being bowed, longer and extending more remotely from said support than the free end of said first limb, a substantially stiff link pivotally secured to and held in compression between the free ends of said limbs to form a closed loop with a single support, said bowed limb being formed with a terminal bend providing a contact arm, and two spaced conducting fingers secured to said base between which fingers said contact arm moves to make and break contact therewith in response to flexure of said first limb.

5. In a snap-switch mechanism, a closed loop supported at one point and comprising a generally U-shaped resilient leaf spring of constant width having one limb longer than the other, the longer limb being bowed and bent at its free end to form a contact arm, a substantially stiff link pivotally secured between the free end of said shorter limb and the bend of said longer limb and held in compression therebetween by the normal spring of the parts, two, spaced conducting elements forming stationary contacts between which said contact arm moves, and an actuator for flexing said shorter limb to impart snap-action to said longer limb and to said contact arm.

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