

Feb. 7, 1961

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2,971,069

SWITCH

Filed Aug. 4, 1958

2 Sheets-Sheet 1

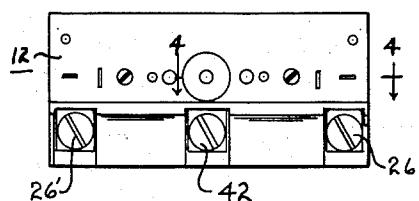


FIG. 2

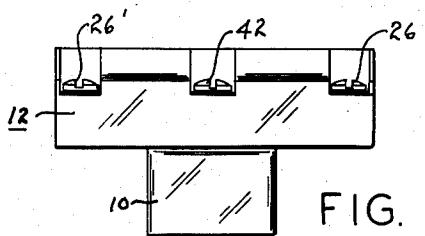


FIG. 1

FIG. 3

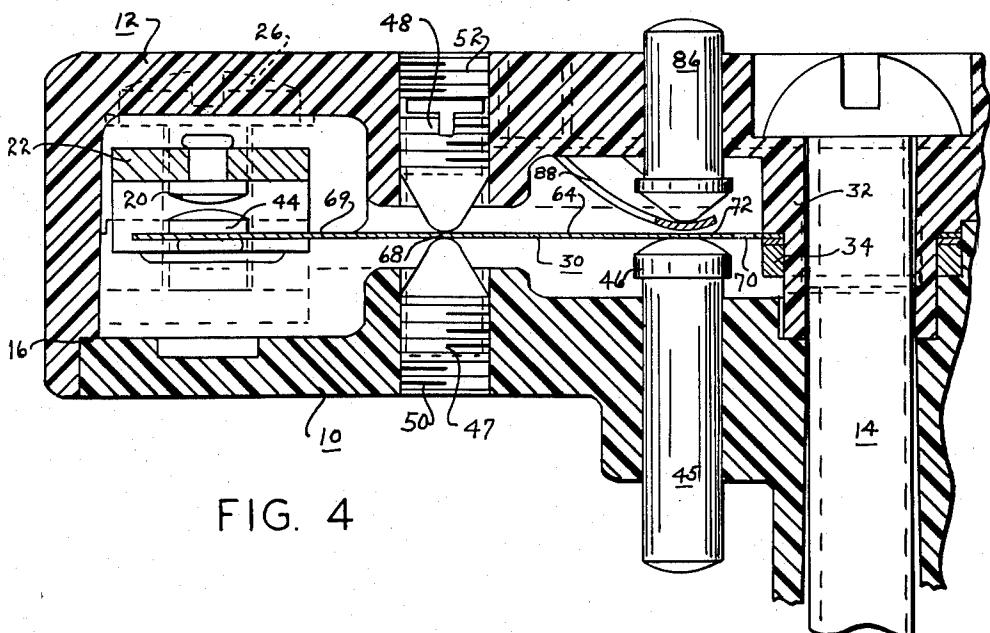


FIG. 4

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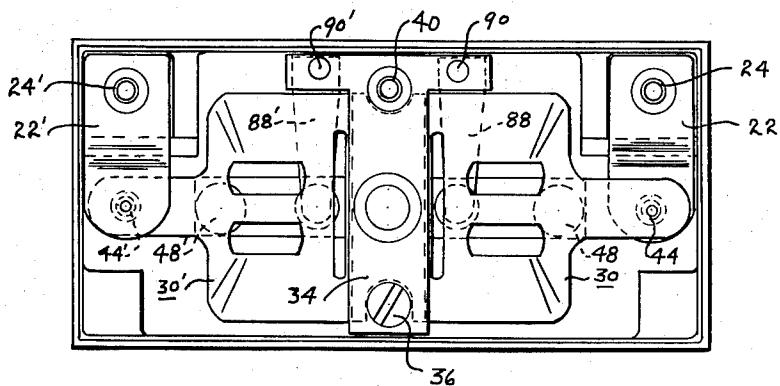


FIG. 5

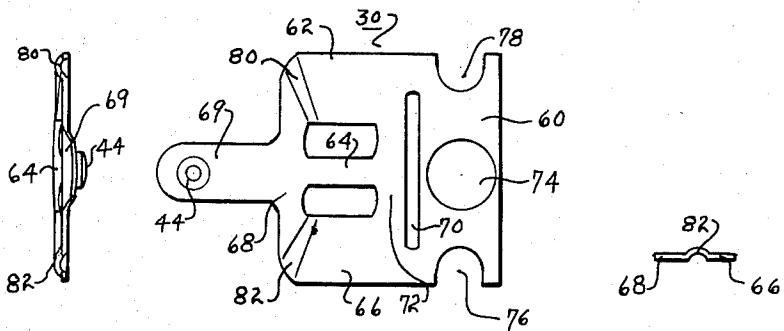


FIG. 7

FIG. 6

FIG. 8

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2,971,069

## SWITCH

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6 Claims. (Cl. 200—72)

The present invention relates to a snap acting mechanism and more particularly to a mechanism of this type for use primarily in electrical switches, valves and the like.

One of the principal objects of the present invention is to provide a switch having a snap acting element therein, in which a substantially constant effective pressure is maintained between cooperating contacts while the contacts are closed and during the initial stage of the opening operation and which opens instantaneously when a predetermined opening force is applied to the switch element.

Another object of the invention is to provide a snap acting switch which is compact and relatively simple in construction and operation and which is readily adaptable to various installations and operating conditions.

Still another object is to provide a snap acting switch having a pre-stressed resilient contact element actuatable with only slight movement by the little force on the element operating means.

Another object of the invention is to provide a snap acting mechanism having the foregoing characteristics, adapted for use in switches, valves and similar mechanisms.

Further objects and advantages will become apparent from the following description and accompanying drawings, wherein:

Figure 1 is a side elevational view of my switch housing showing it disassociated from an actuating or control mechanism;

Figure 2 is a top plan view of the switch shown in Figure 1;

Figure 3 is an end elevational view of the switch shown in the two preceding views;

Figure 4 is an enlarged cross sectional view of the switch, taken on line 4—4 of Figure 1;

Figure 5 is a plan view of the switch mechanism with the base portion thereof removed and with some of the elements being shown in broken lines to show the relationship of the switch parts;

Figure 6 is a plan view of one of the switch contact elements removed from the switch assembly shown in Figures 4 and 5;

Figure 7 is an elevational end view of the switch contact element shown in Figure 6; and

Figure 8 is an elevational view of the element shown in Figure 6 viewing it from the lower left hand position.

Referring more specifically to the drawing, numeral 10 designates a base, 12 a block in which the switch elements are secured and 14 a screw extending through the block and base for mounting the switch on or in an operating mechanism, said base and block being constructed of Bakelite or other suitable rigid electrical insulating material. Base 10 seats in a groove or recess 16 in the wall of block 12 and is held therein by screw 14 when the latter is tightened into place in the operating mechanism. When screw 14 is removed the base and block may be easily separated and the elements of the switch

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readily inspected. Only one half of the switch will be described in detail, i.e. the half shown in Figure 4, since the parts and the operation of those parts are the same for both halves of the switch. Like numerals with a prime will be used herein to designate like parts in the other half of the switch.

A stationary contact 20 is mounted in the end of the block on a blade 22 which is rigidly secured to and supported by a sleeve 24 embedded in the body of block 10. 12. A terminal screw 26 is adapted to be screwed into the sleeve 24 for connection of an electrical circuit to blade 22. The main element of my snap acting switch is leaf contact element 30 shown in Figures 4 and 5 mounted on and rigidly supported at one end by boss 32 and clamped thereon by a blade 34 which is secured to the boss at one end by screw 36 extending through the blade and threaded into the boss and at the other end by a sleeve 40 embedded in and extending through the block and being flanged at its inner end to hold the blade 20 and element firmly against the boss. A terminal screw 42 is threaded into sleeve 40 and forms a connection for an electrical circuit to element 30. A contact 44 is secured to the free end of element 30 and is adapted to move to and from stationary contact 20 to make and break the circuit in which the present switch is mounted. A pin 45 for operating element 30 is mounted in base 10 and movable longitudinally in a hole therethrough and is provided with a head 46 for contacting the element near the boss and for preventing the pin from becoming dislodged from the hole in the base. Two set screws 47 and 48 disposed on opposite sides of element 30 and threaded into holes 50 and 52 in the base and block, respectively, form pivot or rocker points for element 30 when it is being flexed by operating pin 45. Contact 35 20 may be placed below the end of element 30 and contact 44 placed on the lower side of the element instead of the arrangement shown so that actuation by the switch operating mechanism is reversed.

Element 30, the construction of which is best shown in Figures 6, 7 and 8, consists of a substantially flat piece of metal, preferably, for example, Phosphor bronze or beryllium copper alloys, having a base portion 60, three parallel members 62, 64 and 66 extending outwardly from the base portion and being connected at their outer ends 45 by a cross member 68 and a tongue portion 69 joined to the cross member and supporting contact 44, said contact extending through a hole in the free end of the tongue portion and being riveted thereto. Member 64 is separated from base 60 by a slot 70 and is connected 50 to side members 62 and 66 by cross member 72. A hole 74 is provided in the center of base portion 60, and slots 76 and 78 are provided in the sides to permit screw 14, screw 36 and sleeve 40, respectively, to pass through the base portion. Blade 34 is held firmly against element 55 30 by screw 36 and is joined rigidly to sleeve 40 to form a good electrical contact therewith, the sleeve and blade preferably being formed of brass, but copper may be used if desired.

When element 30 is initially blanked from a piece of sheet metal, it is flat and members 62, 64 and 66 are on the same plane, and in this form it does not possess the snap action characteristics. The snap action feature is imparted to the element by forming into the two side members 62 and 66, preferably near the point of junction with cross member 68, transverse crimps 80 and 82, thus making members 62 and 66 slightly shorter in length than member 64, and, preferably, member 68 slightly narrower or shorter than member 72. To adjust itself to the shorter side members, member 64 bears 70 firmly against cross members 68 and 72 causing a slight arching of member 72 and a slight flexing of member 68. The buckling of member 72 tilts member 64 either down-

wardly or upwardly causing cross member 68 to twist slightly and tongue portion 69 to tilt upwardly or downwardly in the direction opposite to member 64 and thus to make or break contact with stationary contact 20. Pressure on the top side of cross member 72 adjacent the point of juncture with member 64, when member 72 is arched upwardly, causes member 72 to buckle downwardly and member 64 and portion 69 to tilt with a snap action in the opposite direction. Set screws 47 and 48 form a pivot point for the line of force between member 64 and portion 69 and prevent cross member 68 from moving laterally when the action is taking place. By having screws 47 and 48 threaded into the holes in the base and block, the position of contact 44 may be adjusted to or from contact 20 and thus the pressure holding contacts 20 and 44 together as well as the pressure required to break the contact between them may be varied to suit requirements. As seen in Figure 4, pressure on pin 45 buckles cross member 72 upwardly, forcing contact 44 away from contact 20, thus opening the switch.

In the embodiment shown in Figure 4 a return pin 86 mounted in a hole in block 12 may be used to shift cross member 72 downwardly and thus close contacts 20 and 44; however, a return spring either operating on pin 86 or independently of this pin may be used to close the contacts as soon as the operating pressure has been removed from pin 45. A leaf type spring 88 is employed in the present embodiment, one end of which is secured to block 12 by rivets 90 extending through blade 34 into a lateral extension of boss 32, as shown in broken lines in Figure 5, and the other end of which extends between the end of pin 86 and element 30 and bears against the upper side of cross member 72 to constantly urge the member downwardly. In Figure 4 spring 88 is shown mounted to the side of blade 34. Without spring 88, the element must be snapped in both directions to open and close contacts 20 and 44. However, element 30 may be so stressed that it will return to its original position without the use of either pin 86 or spring 88.

The switch shown in the drawings is a dual type which in effect is two independent switches containing snap acting elements 30 and 30' connected to a common terminal 42 and stationary contacts 20 and 20' cooperating with contacts 44 and 44' respectively. For the purpose of illustration, contacts 20 and 20' are placed on opposite sides of their respective elements 30 and 30', hence pin 45 operates to open contacts 20 and 44'. Pin 86' and spring 88' conversely operate to open contacts 20' and 44'.

While members 62, 64 and 66 are shown as separate parallel members, they may in some forms be integrally joined together through their length, and in the integral form they operate in substantially the same manner as in the separate form. These members referred to in the claims may be either the separate or integral form, thus representing lines of forces rather than an exact physical shape.

A number of variations in the structure forming the present invention have been described herein; however, other changes and modifications may be made without departing from the scope of the invention. The snap-acting element 30 may be used in other devices such as valves, latches and the like, with only minor modification.

I claim:

1. A snap acting switch, comprising a block and base of electrical insulating material forming a compartment, a boss in said compartment, a stationary contact spaced from said boss, a blade for supporting said contact, a sleeve extending through said block and engaging said blade, a screw threadedly received in said sleeve for connection into a circuit, a relatively flat flexible sheet metal element rigidly mounted at its base on said boss and extending into the proximity of said contact, said element having three longitudinal members in parallel relation, a cross member connecting the ends of said members near

the element base and being spaced throughout a substantial portion of its length from said base, a cross member connecting the other ends of said members, a tongue portion extending beyond said members in alignment with the middle longitudinal member, a contact secured to said portion and adapted to engage said first mentioned contact, said middle member being slightly longer than said other longitudinal members causing an outward buckling thereof and a corresponding movement of said tongue, opposed pins seated in said block and base and projecting inwardly to a point adjacent said element near the point of juncture between said middle longitudinal member and said second cross member, an operating pin in said base for engaging said first mentioned cross member on the opposite side from said first mentioned operating pin, a spring means attached to said block extending to a point on said element opposite from said first mentioned operating pin for opposing the operation of said element by said first mentioned operating pin, a sleeve extending through said block and being joined to said element, and a screw threadedly received in said last mentioned sleeve for connection into a circuit.

2. A snap acting switch, comprising a block and base of electrical insulating material forming a compartment, a boss in said compartment, a stationary contact spaced from said boss, a relatively flat flexible sheet metal element rigidly mounted at its base on said boss and extending into the proximity of said contact, said element having three longitudinal members in parallel relation, a cross member connecting the ends of said members near the element base and being spaced throughout a substantial portion of its length from said base, a cross member connecting the other ends of said members, a tongue portion extending beyond said members in alignment with the middle longitudinal member, a contact secured to said portion and adapted to engage said first mentioned contact, said middle member being slightly longer than said other longitudinal members causing an outward buckling and a corresponding movement of said tongue, opposed pins seated in said block and base and projecting inwardly to a point adjacent said element near the point of juncture between said middle longitudinal member and said second cross member, an operating pin in said base for engaging said first mentioned cross member on the opposite side from said first mentioned operating pin, and a spring means attached to said block extending to a point on said element opposite from said first mentioned operating pin for opposing the operation of said element by said first mentioned operating pin.

3. A snap acting switch, comprising a block and base of electrical insulating material forming a compartment, a boss in said compartment, a stationary contact spaced from said boss, a leaf element rigidly mounted at its base on said boss and extending into the proximity of said contact, said element having three longitudinal members in parallel relation, a cross member connecting the ends of said members near the element base and being spaced throughout a substantial portion of its length from said base, a cross member connecting the other ends of said members, a tongue portion extending beyond said members in alignment with the middle longitudinal member, a contact secured to said portion and adapted to engage said first mentioned contact, said middle member being slightly longer than said other longitudinal members causing an outward buckling thereof and a corresponding movement of said tongue portion, opposed pins seated in said block and base and projecting inwardly to a point adjacent said element near the point of juncture between said middle longitudinal member and said second cross member, an operating pin in said base for engaging said first mentioned cross member, and a means for opposing the operation of said element by said operating pin.

4. In a switch structure, a block of electrical insu-

lating material, a boss in said block, a stationary contact spaced from said boss, a leaf element rigidly mounted at its base on said boss and extending into the proximity of said contact, said element having three longitudinal members in parallel relation, the middle longitudinal member being spaced from said base by a transversely extending slot, a tongue portion extending beyond said members in alignment with the middle longitudinal member, a contact secured to said portion and adapted to engage said first mentioned contact, said middle member being slightly longer than said other longitudinal members, opposed pins seated in said block and base and projecting inwardly to a point adjacent said element near the point of juncture between said middle longitudinal member and said tongue portion, and an operating pin engaging said middle longitudinal member near said transversely extending slot.

5. In a switch structure, a stationary contact, a relatively flat flexible sheet metal element, said element having a base and three longitudinal members in parallel relation, a cross member connecting the ends of said members near the element base and being spaced throughout a substantial portion of its length from said base, a cross member connecting the other ends of said members, a tongue portion extending beyond said members in alignment with the middle longitudinal members, a contact secured to said last mentioned member and adapted to engage said first mentioned contact, said middle member being slightly longer than said other longitudinal members causing an outward buckling thereof and a corresponding movement of said tongue, opposed pins

positioned at a point adjacent said element near the point of juncture between said middle longitudinal member and tongue portion, an operating pin engaging said first mentioned cross member, and a means for opposing the operation of said element by said operating pin.

6. In a switch structure, a stationary contact, a relatively flat flexible sheet metal element, said element having a base and three longitudinal members in parallel relation, a cross member connecting the ends of said members near the element base and being spaced throughout a substantial portion of its length from said base, a cross member connecting the other ends of said members, a tongue portion extending beyond said members in alignment with the middle longitudinal member, a contact secured to said portion and adapted to engage said first mentioned contact, said middle member being slightly longer than said other longitudinal members, opposed pins projecting to a point adjacent said element near the point of juncture between said middle longitudinal member and said second cross member, and an operating pin engaging said first mentioned cross member.

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