

July 12, 1949.

W. A. MARTIN

2,476,056

SNAP ACTION DEVICE

Filed July 3, 1946

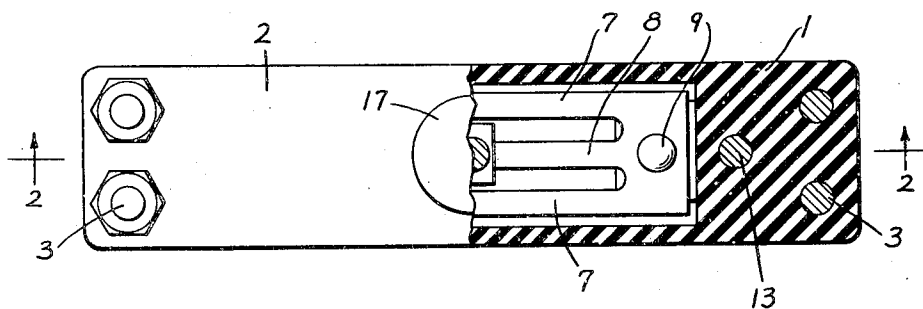


FIG. 1

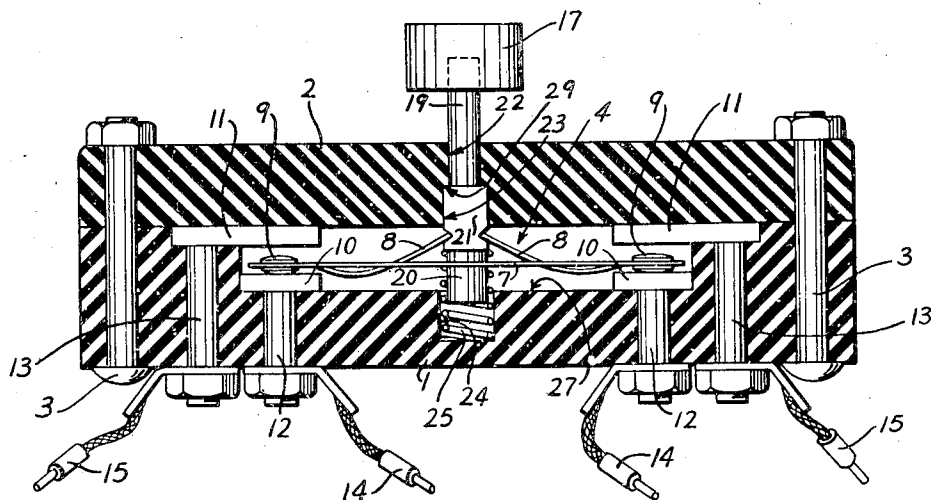


FIG. 2

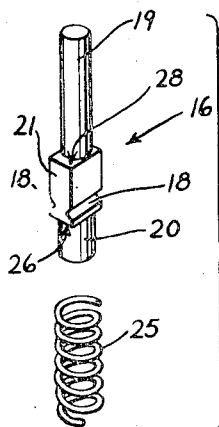


FIG. 3

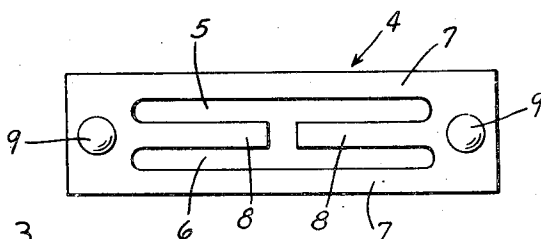


FIG. 4

INVENTOR

Wilbert A. Martin

BY

McCanna and Morabach

ATT'YS.

UNITED STATES PATENT OFFICE

2,476,056

SNAP ACTION DEVICE

Wilbert A. Martin, Freeport, Ill., assignor to First Industrial Corporation, Wilmington, Del., a corporation of Delaware

Application July 3, 1946, Serial No. 681,247

3 Claims. (Cl. 200—76)

1

2

The present invention relates to snap action devices and particularly to snap acting switches, and has for its primary object the provision of a compact precision type switch having a minimum number of parts and which is inexpensive to manufacture.

An important object of the invention is the provision of a novel one piece switch spring structure and a one piece actuating means arranged for improved operation and reduced cost of manufacture.

For a more complete understanding of the present invention and a further appreciation of its objects and advantages, reference should now be had to the following description taken in connection with the drawings, in which—

Figure 1 is a partially sectioned top view of a compact precision type electric snap switch embodying the principles of the invention;

Fig. 2 is an elevational sectional view of the switch taken on line 2—2 of Figure 1;

Fig. 3 is an enlarged perspective view of the actuating member and return spring, and

Fig. 4 is a top view of the resilient switch blade.

Referring now more particularly to the figures, the present invention is shown as applied to a plunger actuated snap action switch. The switch comprises a casing 1 having a cover plate 2 of insulating material mounted thereon as by means of rivets or screws 3. The switch blade, generally designated 4, is formed from a single piece of flat spring strip material such as beryllium copper and is slotted longitudinally at 5 and 6 to provide a pair of outer tension elements 7 and a central inwardly extending pair of opposed compression elements 8 in spaced relation. The thickness and resilience of the spring strip from which the switch blade is formed is so chosen that the compression elements 8 may be readily and substantially bowed when assembled, as shown in Fig. 2, so the compression elements will possess a considerable amount of longitudinal softness for relatively easy over-center movement. The compression elements 8 are formed by dividing the central arm transversely, preferably at its center, so that the inner ends of the compression elements or tongues 8 are juxtaposed. At opposed outer ends of the switch blade 4 are mounted movable contact members 9.

At each end of the switch casing are positioned a pair of stationary contact members 10 and 11. As shown in Fig. 2, the stationary contacts are provided with terminal bolts 12 and 13 which

are welded or soldered or otherwise mounted thereon. These terminal bolts serve the dual purpose of mounting the stationary contacts in place and of providing electrical communication between the stationary contacts and the wires 14 and 15 which are connected into suitable electric circuits controlled by the switch.

A one-piece plunger or actuating member generally designated 16, having an exterior operating button 17 of insulating material, is slidably supported within the casing 1 and cover 2 for reciprocable movement along a line normal to the plane of the switch blade 4. This part of the construction represents an important feature of the present invention in that the plunger is a single, rigid, non-resilient member having pivot grooves 18 in which the ends of the compression elements 8 are directly mounted. By constructing the compression elements so that, when assembled, they are substantially bowed, it has been found that sufficient resilience for satisfactory switch operation is present in the compression elements themselves. Thus, the spring members associated with the operating plunger in conventional switches of this type and formerly considered essential for proper switch operation have been entirely dispensed with, resulting in a cheaper and simpler structure yet operated with a high degree of accuracy. In this instance, the actuating member 16 may be formed from a single bar of metallic material, such as brass, or, if preferred, may be formed of a suitable insulating material. It comprises upper and lower cylindrical end extensions 19 and 20 with an intermediate enlarged portion 21 having the above-mentioned pivot grooves 18 formed in it. The extension 19 and intermediate portion 21 are respectively journaled for reciprocation within similarly formed openings 22 and 23 in the cover 2. The bottom extension 20 fits within a bore 24 formed in the casing 1 and is surrounded by a coil spring 25 which bears, respectively, on the plunger shoulder 26 and the bottom of the bore 24. In this case, the spring 25 is employed to bias the switch blade 4 to connect stationary contacts 10 so that when the depressing force on the button 17 is released the spring 25 will urge the switch blade to the Figure 1 position. Obviously, the principles of this invention are equally applicable to a non-return or reset type of switch in which case the spring 25 would be omitted and a reset button similar to 17 would be provided on the bottom of the switch. The shoulder 26 serves the additional purpose of coacting with the cas-

ing surface 27 to limit downward movement of the plunger 16 after the compression elements 8 have been moved through the overcenter position and the switch blade has snapped upwardly to connect contacts 11. Similarly, the upper plunger shoulder 28 coacts with the shoulder 29 formed in the cover 2 to limit upward movement of the plunger after the switch blade has snapped downwardly to connect stationary contacts 10.

Considering now the operation of the device, Fig. 2 shows the switch in its normal position where wires 14 are connected through the switch blade 4 and the actuating member 16 is biased upwardly by the spring 25. If now the actuating member is depressed by pushing downwardly on the button 17 the bowed compression arms 8 of the resilient switch member 4 will be forced over-center with respect to the plane of the tension elements 7. Such over-center movement will be accomplished entirely by increased deformation or bowing of the resilient compression arms 8 inasmuch as the plunger 16 is a rigid, non-resilient member. As soon as the compression elements are moved over-center with respect to the plane of the spring strip 4 the outer ends of the spring strip carrying the contacts 9 will move upwardly by snap action under the influence of the stresses stored in the bowed compression elements 8. Some further downward movement of the actuating member 16 will now be permitted to insure positive engagement of the contacts 9 with contacts 11. However, such additional downward movement of the actuating member 16 must be limited, as by engagement of the shoulder 26 upon the casing surface 27 in order to prevent the actuating member 16 from carrying the entire switch member 4 downwardly with it to the extent that it will reverse the movement of the contacts 9 and thereby re-engage the lower stationary contacts 10.

Operation of the switch in the reverse direction will be evident from the foregoing description. When the push button 17 is released and the plunger 16 is permitted to move upwardly under the urgency of the spring 25 the over-center action of the bowed compression arms 8 will be similar to that previously described. It will be noted, however, that the plane of the switch member 4 is now displaced upward somewhat from its former position because the contacts 9 have been moved upwardly into engagement with the contacts 11. Therefore, the dead center, or position of maximum stress, for the plunger 16 will be slightly different upon the upward movement than it was upon the downward movement.

While a particular form of the present invention has been shown, it will be apparent that minor changes therein will readily suggest themselves to others skilled in the art without departing from the spirit and scope of the invention. Having thus described the invention, what is claimed as new is:

1. A snap action device comprising an integral strip of spring material slotted longitudinally to form a plurality of substantially parallel resilient arms connected together at opposite outer ends of said strip, at least one of said arms being divided transversely in the region of its center to provide a pair of spaced apart opposing compression members having their ends in juxtaposition, actuating means movable between opposed positions comprising a rigid member disposed between and pivotally engaging the juxtaposed ends of said compression members, said compres-

sion members being normally deformed out of the plane of the arms so that in one position of the actuating means the juxtaposed ends are on one side of a plane of the arms and the remainder of at least one compression member is bowed on the opposite side of the plane of the arms and in the other position of the actuating means the juxtaposed ends and the bowed portion of the compression member are both on said opposite side of the plane of the arms, means for supporting said actuating means for movement normal to the plane of said strip to move said juxtaposed ends of the compression members over-center with respect to the other arms of said strip thereby to move the outer ends of said strip with a snap action, and stop means for limiting the movement of both outer ends of said strip in both directions normal to the plane of said strip.

2. A snap action device comprising an integral strip of spring material slotted longitudinally to form three substantially parallel resilient arms connected together at opposite outer ends of said strip, the central arm being divided transversely at substantially the center thereof to provide a pair of spaced apart opposing compression members having their ends in juxtaposition, actuating and supporting means movable between opposed positions supporting said strip including non-resilient spreading means disposed between and pivotally engaging the juxtaposed ends of said compression members, said compression members being shaped and positioned so that the juxtaposed ends are on one side of a plane of the arms and the portion of the compression members disposed between the juxtaposed ends and the ends connected to the arms are bowed on the opposite side of the plane of the arms and in the other position of the actuating means the juxtaposed ends and the bowed portion of the compression members are on the same side of the plane of the arms, means for mounting said actuating means for substantially rectilinear movement substantially normal to the plane of said strip to move said compression members over-center with respect to the other arms of said strip and thereby to cause the outer ends of said strip to move in a reverse direction with a snap action, spaced stop means for limiting the movement of both outer ends of said strip in both directions normal to the plane of said strip, and second spaced stop means for limiting movement of said actuating member in both directions after overcenter movement of said compression members.

3. A snap action switch comprising a base, a switch member formed of an integral strip of spring material slotted longitudinally to form three substantially parallel resilient arms connected together at opposite outer ends of said strip, the central arm being divided transversely at substantially the center thereof to provide a pair of spaced apart opposing compression members having their ends in juxtaposition, a movable contact member mounted at each outer end of said switch member, actuating and supporting means for said switch member movable between preselected positions comprising substantially rigid movable spreading means disposed between and pivotally engaging the juxtaposed ends of said compression members, said compression members being shaped and positioned so that in one of the preselected positions of the actuating means the juxtaposed ends are on one side of the strip and the remaining portion of at least one compression member is bowed on the oppo-

5

site side of the strip and in the other preselected position of the actuating means the juxtaposed ends and the bowed portion of the compression member are on the same side of the strip, said bowed compression member being bowed in the same direction in either position of the actuating member, means for mounting said actuating means upon said base for substantially rectilinear movement substantially normal to the plane of said switch member to move said compression members overcenter with respect to the other arms of said switch member thereby to cause said movable contact members to move in a reverse direction with a snap action, a pair of fixed contacts positioned adjacent said movable contacts on one side of said switch member, said fixed contacts serving as stops to limit the movement of the outer ends of said switch member in one direction, a pair of fixed stops positioned in spaced relation to said fixed contacts on the other

6

side of said switch member to limit the movement of the outer end of said switch member in the other direction, and spaced stop means for limiting movement of said actuating member in both directions after overcenter movement of said compression members.

WILBERT A. MARTIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,182,856	Riche -----	Dec. 12, 1939
2,332,911	Hausler -----	Oct. 26, 1943
2,349,008	Sauter -----	May 16, 1944
2,412,119	Bentley -----	Dec. 3, 1946
2,417,169	Kaminky -----	Mar. 11, 1947