Nov. 6, 1951 C. W. WOOD 2,574,429

SNAP ACTION SWITCH

Filed June 4, 1943

Fig. 1.

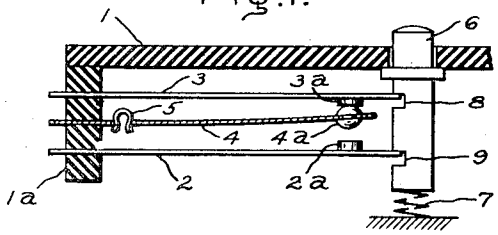



Fig. 2.

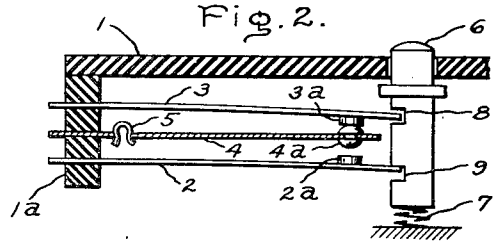



Fig. 3.

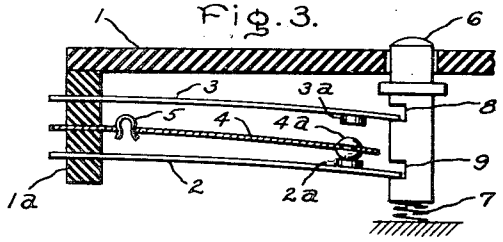



Fig. 4.

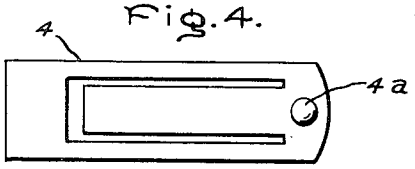



Fig. 5.

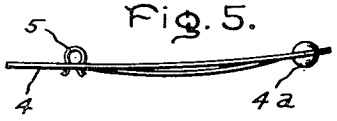



Fig. 6.

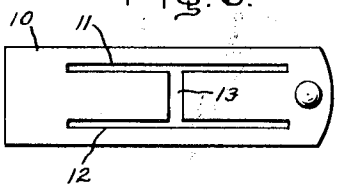



Fig. 7.




Fig. 8.

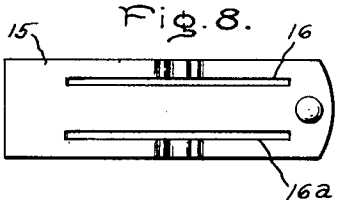
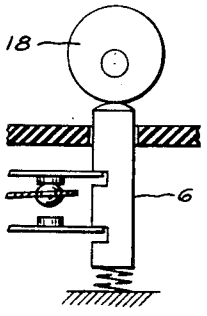



Fig. 9.




Fig. 10.




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# UNITED STATES PATENT OFFICE

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## SNAP ACTION SWITCH

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5 Claims. (Cl. 200—67)

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My invention relates to snap action electric switches, and more particularly to snap action switches especially adapted for slow actuation, as by camming means or the like.

The invention has for its general object the provision of a new and novel switch of this character, which is composed of a minimum number of parts and which is simple and inexpensive in construction without sacrifice of capacity, reliability and durability.

It is a further object of my invention to provide new and novel actuating means for an over-center snap action switch arranged to ensure positive actuation of the switch arm through its position of zero pressure with respect to the fixed contact. Such a switch may be referred to as a "no zero" switch. By this term, it is meant that the switch is arranged to maintain upon the fixed contact a positive pressure until over-center movement of the movable switch arm is about to begin. Once the over-center movement is started, it is self-completing without further movement of the actuating member, so that the movable contact passes through its position of zero pressure substantially instantaneously and can, under no circumstances, be stopped in a dead center position of zero contact pressure.

For a more complete understanding of my invention, and for further appreciation of its various objects and advantages, reference should now be had to the following detailed specification taken in conjunction with the accompanying drawing, in which Fig. 1 is a side elevation of a push button actuated snap action switch embodying my invention; Figs. 2 and 3 are side elevations of the same switch showing it in intermediate and final actuated positions, respectively; Figs. 4 and 5 are plan and elevational views, respectively, of the over-center switch arm in the switch of Figs. 1, 2, and 3; Figs. 6 and 7 are plan and elevational views, respectively, of a modified form of over-center switch arm suitable for use in connection with my invention; Figs. 8 and 9 are plan and elevational views, respectively, of still another form of over-center switch arms suitable for use in connection with my invention; and Fig. 10 is a fragmentary side elevational view of a switch similar to that of Figs. 1, 2, and 3 but including a cam operated actuating member.

Briefly, my invention comprises an over-center snap action switch member arranged for actuation by deflection of a relatively weak cantilever spring strip carrying at its free end a relatively fixed contact, the spring strip being moved by an actuating member loosely connected to the free end of the spring strip.

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Referring now to the drawing, I have shown my invention in one form as applied to a push button actuated snap action electric switch comprising a base 1, shown in fragmentary form and including a mounting block 1*a*. The base 1 is preferably formed of a moulded plastic insulating material and provided with a removable cover (not shown) permitting access to the operating parts of the switch in a manner well-known to those skilled in the art. Mounted in parallel spaced-apart relation in the block 1*a*, are a pair of cantilever spring strips 2 and 3, which carry at their free ends a pair of relatively fixed contacts 2*a* and 3*a*, respectively. The spring strips 2 and 3 are biased toward each other and the contacts 2*a* and 3*a* are mounted on the inner or proximate sides of the spring strips.

An over-center switch arm 4 is mounted in the block 1*a* between the spring strips 2 and 3 and in substantially parallel spaced relation therewith. The switch arm 4 carries at its free end a movable contact 4*a* which is alternatively engageable with the relatively fixed contacts 2*a* and 3*a*. In the form of the invention shown by way of illustration, this over-center switch arm (Figs. 4 and 5) is formed of an integral strip or plate of spring material slotted longitudinally to provide a plurality of parallel resilient arms which are oppositely internally stressed. As shown at Figs. 4 and 5, the center arm is shorter than the outside arms, and a spreader, shown as a loop spring 5, is inserted between the center arm and one end of the plate, thereby to place the center arm under compression and the outer arms under tension. This opposite internal stressing of adjacent parallel spring arms buckles the plate 4 to one or the other side of a median plane, and provides for snap acting over-center movement of the plate between two alternative buckled positions.

For operating the switch, I provide a movable actuating member, illustrated as a rectilinearly movable push button 6 which is slidably mounted in the base 1 and provided with a return, or biasing, spring 7. The push button 6 is provided at one side with a pair of spaced apart notches 8 and 9 into which project the free ends of the spring strips 2 and 3, respectively. The notches 8 and 9 are sufficiently large to provide an appreciable degree of lost motion between the actuating push button 6 and the spring strips 2 and 3, and are so spaced on the push button 6 that the spring strips 2 and 3, by reason of their bias, tend to rest against the inner or proximate sides of the two notches.

The relatively fixed contacts 2*a* and 3*a* on the

spring strips 2 and 3 are so positioned in relation to the switch arm 4 that they serve alternatively as stops to limit over-center movement of the arm 4. In either of its contact engaging positions, the internal stress, or maximum over-center bias, of the switch arm 4 is sufficient to overcome the force of the associated spring strip 2 or 3, as the case may be, so that the engaged spring strip is bent outwardly and pressed against the outer side of its push button notch 8 or 9. As shown at Fig. 1 then, with the push button 6 in its normal position and the movable contact 4*a* in engagement with the upper relatively fixed spring contact 3*a*, the spring strip 2 rests against the inner side of the notch 9 and the spring strip 3 is forced against the outer side of the notch 8.

In view of the foregoing description of the component parts of my invention, its mode of operation will be understood from the following brief description. It should be borne in mind that, fundamentally, the switch described operates to move the movable contact 4*a* substantially instantaneously from a position of positive pressure on one fixed contact to a position of positive pressure on the other fixed contact, the positions of zero pressure on the fixed contacts being transient positions.

As the push button 6 is depressed, the free end of both spring strips 2 and 3 are forced downward, the strip 3 carrying with it the over-center switch arm 4. As the switch arm or plate 4 approaches its dead center position, the contact pressure gradually diminishes. However, at an intermediate point between the two extreme positions of strip 3, and before the contact pressure reaches zero, the biasing force of the spring strip 3 overcomes the diminished over-center bias of the switch arm 4, so that the spring strip 3 moves the switch arm 4 independently of the actuating button 6 to take up the lost motion provided by the slot 8. In this independent movement, the spring strip 3 moves from the outer to the inner side of the slot 8 and carries the switch arm 4 through its dead center position, so that over-center movement of the switch arm to bring the contacts 2*a* and 4*a* into engagement is self-completing, the button 6 losing control before dead center at the intermediate point where spring strip 3 overpowers the arm 4. This operation is illustrated at Figs. 2 and 3, wherein Fig. 2 shows a transient position of the switch element in which the spring strip 3 is in the center of its independent lost motion movement after the intermediate equal pressure point has been passed, and Fig. 3 shows the switch in its actuated position without further movement of the push button 6.

It will, of course, be understood by those skilled in the art that my invention may be utilized in conjunction with over-center switch arms, or snap action switch members of various types well-known to those skilled in the art. For example, I have shown at Figs. 6 and 7, another form of switch member comprising an integral plate of spring material 10 having a pair of parallel longitudinal slots 11 and 12 and a transverse slot 13 dividing the center arm into two opposed halves. Between the opposed ends of the center arms, there is inserted a spreader, shown as a loop spring 14, which acts to place the center arms in compression and the outer arms in tension, thereby to effect over-center snapping action of the spring plate due to internal buckling stresses. Similarly, at Figs. 8 and 9, I have shown still another form of buckled



spring plate, comprising a plate 15 having a pair of spaced-apart longitudinal slots 16 and 16*a* which divide the plate into three parallel resilient arms, the outer or tension arms being crimped, as at 17, to place the center arm in compression and buckle the plate.

As previously mentioned, my invention is particularly suitable for application to snap acting switches arranged for very slow actuation. In such applications, the action of my switch in positively preventing dead center sticking of the switch member is highly desirable. By way of illustration, I have shown at Fig. 10, a fragmentary view of an electric switch similar to the switch shown at Figs. 1, 2, and 3, but in which the rectilinearly movable actuating member 6 is moved by an eccentric 18. The eccentric 18 may, of course, be rotated manually, or it may be part of any power driven machinery to which it is desired to connect the switch for actuation.

It may now be observed that, in a switch embodying my invention, a positive pressure is applied by the movable switch member against the fixed contact until over-center movement of the switch member is started. As soon as such over-center movement begins, it is self-completing without further movement of the actuating member, so that the movable contact passes substantially instantaneously from a position of positive pressure against one fixed contact to a position of positive pressure against the other fixed contact or stop. It will be understood that a similar action occurs upon reverse movement of the actuating member.

While I have used the term "fixed contact" in the foregoing specification and in the appended claims to identify the contacts 2*a* and 3*a* on the spring strips 2 and 3, respectively, it will, of course, be understood by those skilled in the art that I do not intend to imply that these contacts are rigidly fixed in space, but only that they are subject to a controlled movement by reason of their loose connection with the actuating member 6, and are thereby to be regarded as relatively fixed contacts in their relation to the movable contact 4*a* on the over-center switch arm 4.

Moreover, while I have shown and described only certain preferred embodiments of my invention by way of illustration, many modifications will occur to those skilled in the art, and I, therefore, wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A snap action electric switch comprising a pair of cantilever spring strips mounted in substantially parallel spaced relation and having their free ends biased toward each other, a relatively fixed contact mounted upon the free end of at least one of said strips on the side adjacent the other strip, a movable over-center switch arm mounted between said strips in substantially parallel spaced relation therewith and carrying at its free end a contact movable between said spring strips, the maximum over-center biasing force of said switch arm being sufficient to deflect the associated spring strip against its bias when said switch arm is in engagement with said fixed contact, and a movable actuating member having a connection with the free end of at least said one spring strip and

arranged to deflect said one strip laterally in the direction of said switch arm until the biasing force of said spring strip exceeds the biasing force of said switch arm, thereby to actuate said over-center switch arm.

2. A snap action electric switch comprising a pair of cantilever spring strips mounted in substantially parallel spaced relation and having their free ends biased toward each other, a pair of relatively fixed contacts mounted upon the free ends of said spring strips at the proximate sides of said strips, a movable over-center switch arm mounted between said strips in substantially parallel spaced relation therewith and carrying at its free end a contact movable between alternative positions of engagement with said fixed contacts, the maximum over-center biasing force of said switch arm being sufficient to deflect the associated spring strip against its bias when said movable contact is in engagement with either of said fixed contacts, and a movable actuating member having a lost motion connection with both of said spring strips and arranged to deflect said strips laterally, thereby to actuate said over-center switch arm for snap acting movement between said positions.

3. In a snap action electric switch comprising an integral plate of spring material mounted in cantilever fashion and slotted longitudinally to form a plurality of parallel resilient arms, means for oppositely internally stressing at least two of said arms thereby to buckle said plate and to provide for snap acting over-center movement thereof, a movable contact mounted upon the free end of said plate, a pair of cantilever spring strips mounted in substantially parallel spaced relation on opposite sides of said slotted plate and carrying at their free ends relatively fixed contacts biased toward said movable contact and positioned for alternative engagement therewith, the maximum over-center biasing force of said slotted plate being sufficient to deflect either of said spring strips when said movable contact is in engagement with the associated fixed contact, and a movable actuating member having a lost motion connection with both said cantilever spring strips and arranged to deflect said spring strips laterally, thereby to move said slotted plate over-center with a snap action.

4. A snap action electric switch comprising a cantilever spring strip having at its free end a relatively fixed contact, movable stop means cooperating with the free end of said spring strip for limiting the movement thereof between two extreme positions, an over-center switch arm mounted in spaced relation with said spring strip, said switch arm having at its free end a contact movable into and out of engagement with said fixed contact, the maximum over-center biasing force of said switch arm being sufficient to deflect said spring strip to a first extreme position when said contacts are in engagement, said spring strip being biased toward said switch arm with a force sufficient to overpower said switch arm at a point intermediate said extreme positions and before said switch arm reaches its dead center position when it is moved in the switch opening direction, said stop means being arranged for movement to deflect said spring strip from said first extreme position to and beyond said intermediate position whereupon said spring strip moves said switch arm through its dead center position with a snap action, said spring strip thereafter moving to its second extreme position while the said over-center switch arm snaps to a position which separates said movable contact from said fixed contact.



5. A snap action switch comprising a buckled plate of spring material mounted in cantilever fashion and having a free end movable over-center with a snap-action between two buckled positions, a movable contact mounted upon the free end of said plate, a cantilever spring strip mounted in substantially parallel relation adjacent one side of said plate, said spring strip being biased toward said plate, movable stop means cooperating with the free end of said strip for limiting the movement thereof away from and toward said plate between first and second extreme positions, a relatively fixed contact mounted upon the free end of said spring strip for engagement with said movable contact, said spring strip and said buckled plate being so positioned and arranged that when the latter is in a first buckled position said contacts are in engagement, the internal buckling force of said plate in said first buckled position being sufficient to deflect said spring strip to said first extreme position, said switch having a point intermediate the two extreme positions of said spring strip at which the forces exerted by this strip and said plate are equal and opposite and beyond which in the direction of said second extreme position the spring strip overpowers the buckled plate, such overpowering action occurring before said plate reaches its dead center position, whereby a movement of said movable stop means which moves said spring strip from said first extreme position to and beyond said intermediate point permits said spring strip to move said plate through its dead center position with a snap action, said spring strip thereafter moving to said second extreme position while said plate snaps to its second buckled position whereby said contacts are parted.

CHARLES W. WOOD.


## REFERENCES CITED

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

### UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,868,500 | Hanel | July 26, 1932 |
| 2,197,229 | Waddell | Apr. 16, 1940 |
| 2,236,699 | Riche | Apr. 1, 1941 |
| 2,326,760 | Clare | Aug. 17, 1943 |
| 2,487,037 | Smith | Nov. 1, 1949 |