Oct. 28, 1947. G. M. HAUSLER 2,429,812

SNAP ACTION DEVICE

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Fig. 1.

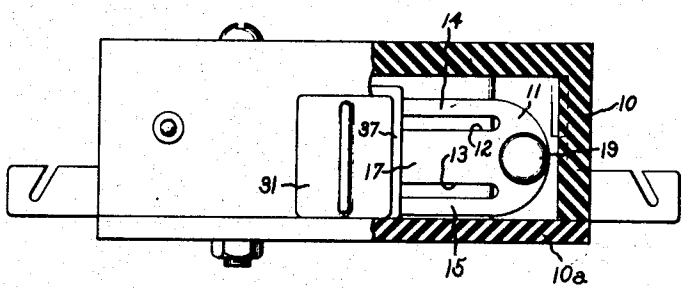


Fig. 2.

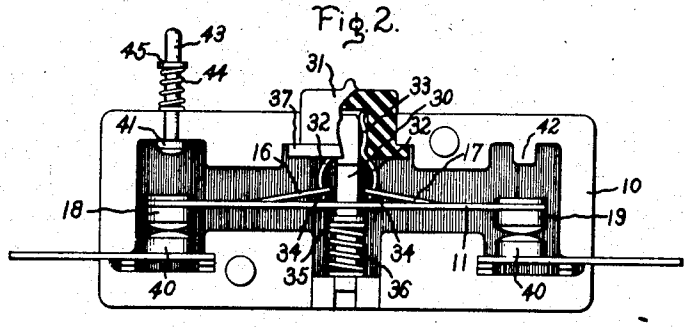
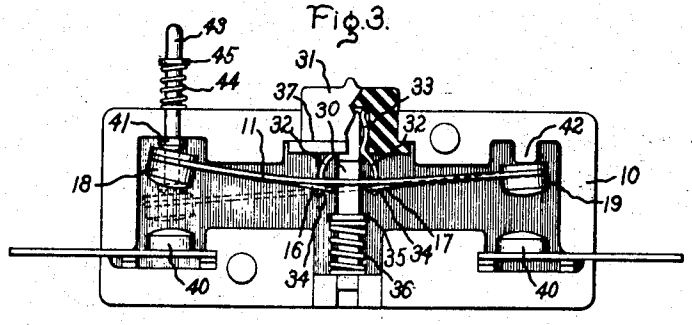


Fig. 3.



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SNAP ACTION DEVICE

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6 Claims. (Cl. 200—67)

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My invention relates to snap action devices, more particularly to snap acting switches and the like, and has for its object the provision of a new and novel device 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.

In carrying out my invention in one form I utilize a switch member comprising a single unitary strip of spring material slotted to provide a pair of outer tension members and a central pair of spaced apart compression members in opposing relation, such as described and claimed in my copending application Serial No. 435,220, filed March 18, 1942, now Patent No. 2,332,911. The juxtaposed ends of the compression members each pivotally engages a supporting and actuating member which is preferably mounted for reciprocal movement in a direction normal to the plane of the spring strip thereby to move the pivoted ends of the compression members overcenter with respect to the center line of the tension members. The actuating member and the outer ends of the spring strip are each provided with suitable stops to limit the movement of the various parts of the device.

It is a particular object of my invention to provide a snap action switch of the above character which after actuation from a normal position shall remain in its actuated position until manually reset by means other than the actuating means. For this purpose I bias the actuating member to a normal position which is so disposed in relation to the location of the stop members that the spring strip will remain in either of two alternative equilibrium positions on opposite sides of the pivot points of the compression members with the actuating member in its normal position. Thus if the spring strip is in that position of equilibrium in which movement of the actuating member brings the pivoted ends of the compression members toward the plane of the strip, snap action is effected by thus moving the actuating member to move the pivoted ends of the compression members overcenter with respect to the plane of the strip. When the spring strip is in its other posiiton of equilibrium movement of the actuating member can have no effect, since it moves the pivoted ends of the compression members away from the plane of the spring strip. In this position a reset button is provided for moving the plane of the spring strip itself overcenter with respect to the pivoted ends of the compression members. Thus after the snap action device

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has been once actuated by movement of the actuating member further movement of the actuating member will have no effect upon the device until it is first reset by the reset button.

A snap action device of the above type may be built in very small sizes and, when used to actuate the contacts of an electric switch, the switch possesses remarkably high interrupting capacity for both alternating and direct current in comparison to its physical dimensions. The switch is also suitable for precision work, since movement of the actuating member required to effect circuit making or circuit breaking movement of the contacts is quite small and remains substantially constant. For example, in a typical switching device in which the switch member of spring material was approximately one inch in length the actuating movement was approximately one thirty-second of an inch and was found to be substantially invariable after many thousands of operations. In this device the contact movement was of the order of only one hundredth of an inch, yet the switch successfully made the circuit of a one-half horsepower stalled-rotor capacitor motor and interrupted the full load running current of the motor thousands of times.

For a more complete understanding of my invention and for a further appreciation of its objects and advantages reference should now be had to the following detailed specification taken in conjunction with the accompanying drawings in which Fig. 1 is a plan view, partly in section, of a snap action electric switch emboding my invention; Fig. 2 is a side elevation, partly in section, of the device shown in Fig. 1 with the cover removed; and Fig. 3 is a view similar to Fig. 1 showing the snap acting element in its tripped position.

Referring now to the drawings, I have shown my invention in one form as applied to a push button operated snap action electric switch. The switch is mounted in a casing 10 which is preferably made of insulating material molded to a suitable configuration and provided with an insulating cover 10a. The switch member itself is a unitary flat strip of spring material 11 slotted at 12 and 13 to provide a pair of outer tension arms 14 and 15 and a central pair of opposing compression arms 16 and 17 in spaced relation. The compression arms 16 and 17 are slightly deformable in compression and are formed by dividing a single central arm transversely in the region of its center so that the inner ends of the arms 16 and 17 are in juxtaposed relation. At opposite

outer ends of the strip 11 are mounted movable contact members 18 and 19.

Slidably supported in the casing 10 for rectilinear movement along a line substantially normal to the plane of the switch member 11 I provide an actuating and supporting member in the form of a push button comprising a shank portion or rod 30, a molded head portion 31 and a pair of bowed spring strips 32. The spring strips 32 are provided with slightly curved base sections 33 arranged for insertion in suitable slots in the head portion 31 of the push button along with one end of the rod 30. The portions 33 of the springs 32 serve frictionally to attach the head portion 31 and the springs 32 themselves to the shank portion 30 of the slidable actuating member. The spring strips 32 are notched at their lower ends, as at 34, pivotally to support the juxtaposed inner ends of the deformable compression members 16 and 17. The springs 32 are also biased outwardly to apply endwise forces to the members 16 and 17, thereby to bend and spread the compression members and force them out of the plane of the spring strip 11 on one side or the other. The portion of the actuating member between the pivoted inner ends of the compression members 16 and 17 is wider than the space between these ends in the plane of the spring strip. Thus the notched ends of the spring strip 11 provide a pivotal supporting and actuating connection between the actuating members 30, 31, 32 and the resilient switch member 11. It will, of course, be understood that, if desired, the springs 32 may be made integral, as in the form of a resilient yoke bridging the gap between the abutting ends of the compression members 16 and 17.

The slidable rod 30 is provided at 35 with a suitable shoulder forming a seat for a compression spring 36 disposed between the shoulder 35 and a portion of the casing 10 to bias the entire pushbutton assembly outwardly, or as shown in the drawing in the upward direction. To limit outward movement of the actuating member the pushbutton head portion 31 is provided with a peripheral flange 37 arranged to engage a portion of the casing 10. Thus under the influence of the spring 36 the pushbutton actuating member normally assumes its uppermost position as shown at Figs. 2 and 3. Downward movement of the pushbutton is limited by the limit of compression of the spring 36 between the shoulder 35 and the lower portion of the casing 10.

To provide alternative positions of equilibrium for the spring strip 11 on opposite sides of the pivoted ends of the compression arms 16 and 17 the casing 10 is provided with a pair of fixed contacts 40 on one side of the spring strip 11 and adjacent the movable contacts 18 and 19 and a pair of stop members 41 and 42 on the other side of the spring strip 11 and in spaced relation with respect to the fixed contacts 40. The stop member 41 is movable and is mounted upon the end of a reciprocable reset rod 43 extending outside of the casing 10. The reset rod 43 is biased to a retracted position by means of a small compression spring 44 disposed between the casing 10 and a shoulder 45 upon the reset rod. As indicated at Figs. 2 and 3 the fixed contacts 40 and the stop members 41 and 42 are so disposed that they determine two alternative positions of equilibrium of the spring strip 11 on opposite sides of the pivoted ends of the compression arms 16 and 17 when the actuating member 30, 31, 32 is in its

normal position. That is, referring to Fig. 1, if the plane of the spring strip 11 is below the pivot points of the compression members 16 and 17 with the actuating member 30 in its normal position, the spring strip will remain in this position of contact engagement. Similarly, as shown at Fig. 3, if the outer ends of the spring strip 11 are against the upper stops 41 and 42 the plane of the spring strip will be above the pivot points of the compression members 16 and 17 so that the strip will remain in this tripped position until moved or reset by some external force.

With the foregoing understanding of the various elements of my invention and their interrelation in an actual operative device, the mode of operation of the device itself will be clear from the following brief description. Referring first to Fig. 2 the switch is shown in its normal contact engaging position with the actuating member 30 in its normal biased position, the plane of the spring strip below the pivot points of the compression members 16 and 17 thereby to engage the contacts, and the reset rod 43 retracted. If now the pushbutton actuating member 30, 31, 32 is depressed by any suitable means, for example, manually, thermostatically, or by fluid pressure, the pivoted inner ends of the compression arms 16 and 17 will be moved toward the plane of the spring strip 11 and finally overcenter with respect to this plane. As soon as such overcenter movement occurs the outer ends of the spring strip will move upwardly with a snap action under the influence of the compression members 16 and 17 and the bowed spring 32 tending to spread the compression members and force them apart. If the actuating member 30 is now released it will be forced back to its normal position by the compression spring 36 and the device will be in the position shown at Fig. 3.

It will be noted from Fig. 3 that in moving back to its normal position the actuating member 30 does not again move the pivoted ends of the compression members 16 and 17 overcenter with respect to the plane of the tension members 14 or 15 in the upper or tripped position. Thus release of the actuating member will not effect automatic return of the movable contacts to their lower position. The device may now be reset to contact engaging position by depressing the reset rod 43. By this movement one end of the spring strip 11 is moved downwardly toward contact engaging position as indicated in the phantom view of Fig. 3. By this resetting movement the plane of the spring strip, and more particularly the plane of the tension members 14 and 15, is rotated about the fixed stop member 42 until the tension members 14 and 15 move overcenter with respect to the pivoted ends of the compression members 16 and 17. As soon as this overcenter movement takes place both outer ends of the spring strip and the movable contacts 18 and 19 are moved into engagement with the fixed contacts 40 with a snap action independently of further movement of the reset rod 43 and under the influence of the compression members 16 and 17 and the spreading spring 32. Upon release of the reset rod 43 it will be automatically retracted by the compression spring 44 and the entire device will again be in the position shown at Fig. 2.

While I have shown a particular embodiment of my invention by way of illustration many further 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 device comprising a base, an actuating member movably mounted upon said base, a pair of compression members pivotally mounted upon said actuating member and extending in opposite directions therefrom, a tension member connected between the free ends of said compression members, stop means positioned in spaced relation adjacent the free ends of said compression members to determine two alternative positions of equilibrium of said tension member with respect to a predetermined normal position of said actuating member, means for biasing said actuating member to said normal position, said actuating member being movable against its bias to move the pivoted ends of said compression members overcenter with respect to the center line of said tension member when said tension member is in one of said positions of equilibrium, and means for moving said tension member overcenter with respect to the pivoted ends of said compression members when said tension member is in the other of said positions of equilibrium.

2. A snap action device comprising a base, an actuating member movably mounted upon said base, a pair of compression members pivotally mounted upon said actuating member and extending in opposite directions therefrom, a tension member connected between the free ends of said compression members, two pairs of stop members for limiting movement of the free ends of said compression members in each direction longitudinally of the direction of movement of said actuating member, the stop members of said pairs being in spaced relation adjacent each free end of said compression members thereby to determine two alternative positions of equilibrium of said tension member on opposite sides of the pivot points of said compression members, means for biasing said actuating member to a normal position arranged selectably to maintain said tension member in either of said equilibrium positions, said actuating member being movable against its bias to move the pivoted ends of said compression members overcenter with respect to said tension member when said tension member is in one of said equilibrium positions, and means for moving at least one of said stop members to move said tension member overcenter with respect to the pivoted ends of said compression members when said tension member is in the other of said positions of equilibrium.

3. 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, one of said arms being divided transversely intermediate its ends to provide a pair of spaced apart opposing compression members having their ends in juxtaposition, an actuating and supporting member disposed between the juxtaposed ends of said compression members, said actuating member being wider between said juxtaposed ends of said compression members than the space between said ends in the plane of said strip, means for supporting said actuating member for movement substantially normal to the plane of said strip, pivotal means for connecting the juxtaposed ends of said compression members to said actuating member thereby to support said spring strip, means for biasing said actuating member to a predetermined normal position, two pairs of stop members arranged in spaced relation to determine two alternative positions of equilibrium of said strip on opposite sides of the pivot points of said compression members, said actuating member being movable against its bias to move the pivoted ends of said compression members overcenter with respect to the plane of said strip when said strip is in one of said positions of equilibrium, and means for moving said spring strip overcenter with respect to the pivoted ends of said compression members when said spring strip is in the other of said positions of equilibrium.

4. A snap action electric switch comprising a base, a reciprocable actuating and supporting rod slidably mounted upon said base, a pair of compression members pivotally mounted upon said actuating rod and extending in opposite direction therefrom, a tension member connected between the free ends of said compression members, a movable contact mounted upon the free end of at least one of said compression members, stop means including a fixed contact positioned in spaced relation adjacent the free ends of said compression members to determine two alternative positions of equilibrium of said tension member with respect to a predetermined normal position of said actuating rod, means for biasing said actuating rod to said normal position, said actuating rod being movable against its bias to move the pivoted ends of said compression members overcenter with respect to the center line of said tension member when said tension member is in one position of equilibrium with said contacts engaged, and means for moving said tension member overcenter with respect to the pivoted ends of said compression members to reset said contacts when said tension member is in the other of said positions of equilibrium with said contacts disengaged.

5. A snap action electric switch comprising a base, 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, one of said arms being divided transversely intermediate its ends to provide a pair of spaced apart opposing compression members having their ends in juxtaposition, a movable contact mounted on at least one outer end of said strip, an actuating and supporting rod disposed between the juxtaposed ends of said compression members, said actuating rod being wider between said juxtaposed ends of said compression members than the space between said ends in the plane of said strip, pivotal means for slidably supporting said actuating rod for movement substantially normal to the plane of said strip, pivotal means for connecting the juxtaposed ends of said compression members to said actuating rod thereby to support said strip, upon said rod, two pairs of stop members arranged to determine two alternative positions of equilibrium of said strip on opposite sides of the pivot points of said compression members, one of said pairs of stop members including a fixed contact mounted upon said base for cooperation with said movable contact and the other of said pairs of stop members including a movable reset member, said actuating member being movable against its bias to move the pivoted ends of said compression members overcenter with respect to the plane of said strip when said strip is in its contact engaging position of equilibrium and said reset member being movable to move the plane

of said spring strip overcenter with respect to the pivoted ends of said compression members when said spring strip is in its contact disengaging position of equilibrium and said actuating rod is in said normal position.

6. A snap action device comprising an integral strip of spring material formed to provide a pair of parallel outer tension arms and a pair of opposing inner compression arms, a movable actuating member slidably mounted for reciprocal movement substantially normal to the plane of said spring strip, means for pivotally mounting the juxtaposed ends of said compression arms upon said actuating member for overcenter movement with respect to the plane of said strip, said actuating member being wider between said juxtaposed ends than the space between said ends in the plane of said strip, two pairs of stop members for limiting movement of the outer ends of said strip in both directions normal to the plane of said strip, means for biasing said actuating member to a predetermined normal position such that said pairs of stop members determine alternative positions of equilibrium of said strip on opposite sides of the pivot points

of said compression members, said actuating member being movable against its bias to move the pivoted ends of said compression members overcenter with respect to the plane of said spring strip in one of said equilibrium positions, and means associated with said stop means for moving the plane of said spring strip overcenter with respect to said pivot points when said strip is in its other equilibrium position and said actuating member is in its normal position.

GEORGE M. HAUSLER.

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