Jan. 24, 1950 R. D. ROHR 2,495,349

SNAP ACTING DEVICE

Filed March 4, 1946

Fig. 1

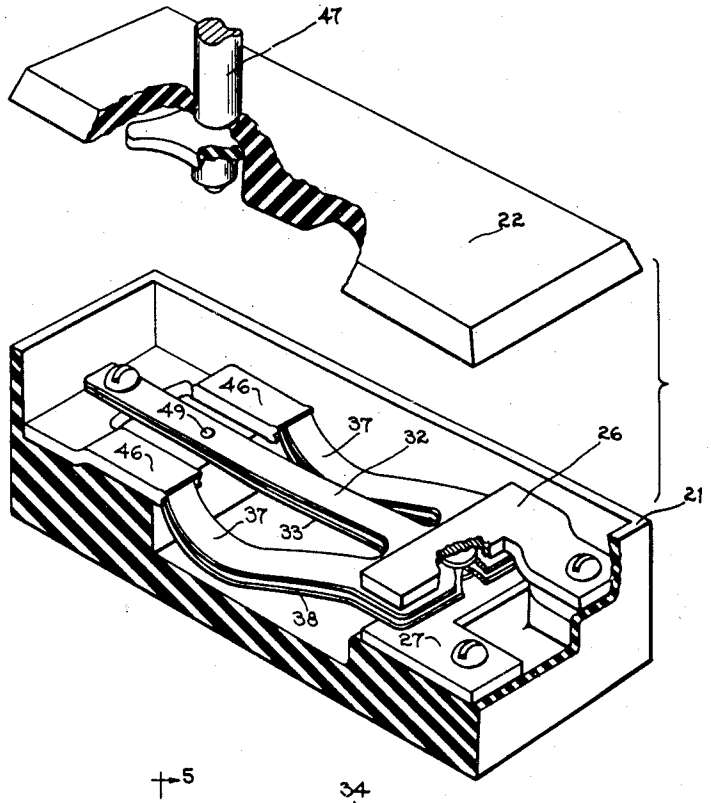


Fig. 2

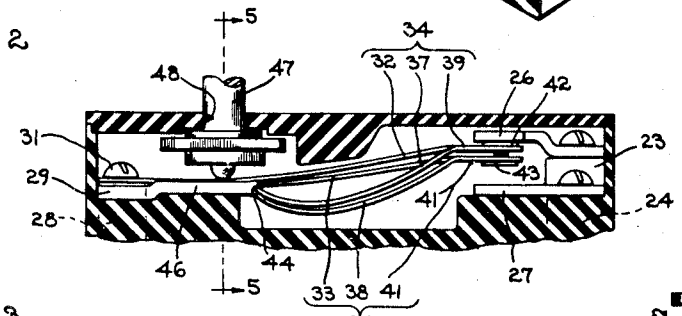


Fig. 3

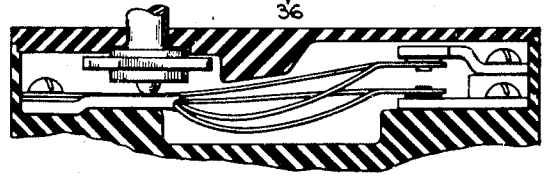


Fig. 4

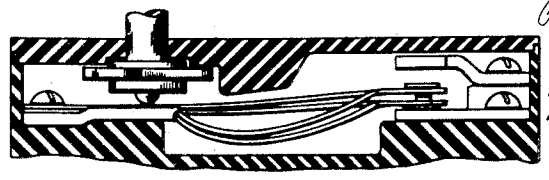
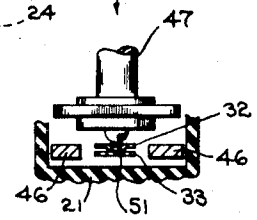


Fig. 5



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SNAP ACTING DEVICE

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9 Claims. (Cl. 200—67)

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My present invention relates to snap acting mechanisms which may be used in precision type snap acting switches and constitutes an improvement upon the snap switch mechanism disclosed in U. S. Patent No. 1,960,020 to P. K. McGall, dated May 22, 1934.

The McGall snap switch employs a single movable contact carried by a single snap spring which has two stable positions between which it snaps. Thus, when the McGall mechanism is applied to a double throw switch to direct current from one circuit to another, there is a momentary, but definite, interval while the spring is snapping between circuits in which neither circuit is energized. While the McGall switch possesses a desirable combination of operating precision, large control capacity, and small operating effort which has won its adoption in a large number of electrical control applications, in many of these applications it has been desirable that one or the other of the circuits be energized at all times and therefore that there be no interval, however momentary between switching positions, in which neither circuit is energized. Furthermore, it is desirable that the switch, although maintaining contact with one or the other of the circuits at all times, should nevertheless retain its original precision, sensitivity and high control capacity.

It is an object of my invention to provide a snap acting mechanism of the McGall type which, when applied to a double throw switch, will maintain one or the other of the circuits energized at all times but possess the full precision, sensitivity and control capacity of the McGall switch.

Another object of my invention is the provision of a highly compact and efficient snap acting switch mechanism which moves a pair of independently movable contacts between stationary contacts through an intermediate momentary position at which both stationary contacts are engaged by the movable contacts.

An important feature of my invention resides in a construction employing toggle spring members associated with an actuating plunger in such a manner that in moving the spring members between preselected positions each spring member will be moved through an axis of maximum stress at a separate position of the actuating plunger, thus causing each spring to move separately by snap action at a separate position of the actuating plunger.

These and other objects and advantages will become apparent in the following description of a specific embodiment of my invention which serves by way of example to illustrate the manner in

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which the invention may be carried into practice. However, the invention is not to be limited to the particular details of any embodiment or example.

In the drawings:

Figure 1 is a partially exploded cut-away pictorial view of a self-returning type of single pole double throw switch embodying one modification of my invention;

Fig. 2 is a side view of the switch shown in Figure 1 with a side removed to show the interior parts;

Fig. 3 is a view similar to Fig. 2 showing the plunger partially depressed and the snap springs and movable contacts in intermediate positions;

Fig. 4 is a view similar to Fig. 2 showing the plunger completely depressed and the snap springs and movable contacts in opposed positions with respect to the positions shown in Fig. 2; and

Fig. 5 is a section taken on the line 5—5 of Fig. 2.

Like reference characters refer to like parts throughout the figures.

Referring now more specifically to the drawing, the switch includes an insulating housing 21 and an insulating cover 22 for the housing. Two separate, threaded metal terminal bushings 23 and 24 of different lengths located alongside each other are embedded in the insulating housing 21 and support stationary contacts 26 and 27, respectively. The details of this particular part of the switch construction are shown in U. S. Patent No. 2,172,673, issued to M. W. Eaton, September 12, 1939.

At the other end of the housing a threaded metal terminal bushing 28 embedded in the bottom of the housing 21 supports a spring anchor member 29. A single screw 31 mounts the anchor 29 and clamps also the ends of tension members or elements 32 and 33 of toggle snap spring members, generally designated 34 and 36, respectively. These toggle springs are of the type described in detail in the McGall Patent No. 1,960,020, and include respectively central tension strips or elements 32 and 33 and two compression side member strips or elements 37 and 38 connected together at the movable ends 39 and 41 of the toggle springs, which ends support separately movable contacts 42 and 43. As shown in the figures, the side members or compression elements 37 and 38 are bowed in compression in the assembled switch, thereby placing central tension members 32 and 33 under tension. The ends of these side legs or thin leaf compression springs 37 and 38 are pivotally supported in notches 44 of the U-shaped spring anchor 29.

The tension members 32 and 33 of the toggle

spring, being fastened under the screw 31 at the center of the base of the U-shaped anchor, extend out over the space between the legs 46 of that anchor where they may be deflected up and down by the plunger 47 for causing the toggle springs to snap back and forth between the two stationary contacts or stops 26 and 27. Each of the portions of tension elements 32 and 33 that lies over this space between the two legs 46 of the spring anchor constitutes a sensitive area of the springs which may be moved a slight distance through an axis of maximum stress to cause a much larger snap motion of the movable ends 39 and 41 carrying the contacts 42 and 43. Operative or actuating means constituting a reciprocable plunger 47 arranged to slide up and down within the opening 48 formed in the cover plate, is aligned with the sensitive areas of the tension elements 32 and 33. Accordingly, an actuating force may be applied to the plunger 47 to move the sensitive areas of the tension elements down a slight distance for causing the movable ends 39 and 41 of the toggles 34 and 36 to snap down, first, to the positions shown in Fig. 3 where both terminal bushings 23 and 24 are connected to the terminal bushing 28 through the toggle springs 34 and 36, and second, to the positions shown in Fig. 4 where only terminal bushing 24 is connected to the terminal bushing 28.

An important part of my invention lies in the way I provide for movable contact 43 to be snapped down upon stationary contact 27 before movable contact 42 is snapped away from stationary contact 26, when plunger 47 is depressed; and, likewise, in the way I provide for movable contact 42 to be snapped upward into engagement with stationary contact 26 before the movable contact 43 is snapped out of engagement with stationary contact 27, when the depressive force is released from the plunger. I have discovered that this may be accomplished in a highly satisfactory manner by positively spacing toggle spring members 34 and 36, particularly by interposing spacing means between the tension elements 32 and 33; to be effective this spacing need not be more than a few thousandths of an inch in precision type switches of high sensitivity. By spacing the toggle springs in this way it will be possible to arrange them as shown in Fig. 2 where spring 36 is a few thousandths of an inch closer than spring 34 to the axis of maximum stress through which it must be moved by the plunger 47 in order to move downwardly by snap action. That is, by spacing the tension elements a short distance apart there will be two operative positions of the plunger 47 in each reciprocal direction, each of these positions corresponding with a position for one of the spring members 34 and 36 where it will have been moved through an axis of maximum stress through which it must be moved in order to continue the movement, of its own accord, by snap action.

One spacing means which I have found to be simple, yet highly effective for maintaining the spring members positively separated is by indenting one of the spring members; for instance, by indenting the top tension element 32 as indicated by the numeral 49 in Figure 1, thereby producing a projection 51 on the other side which serves to maintain the tension elements 32 and 33 properly spaced. In one commercial construction, for example, a projection approximately $\frac{1}{16}$'' in diameter at its base and having a height of less than .004'' was sufficient to enable the

switch to operate as disclosed herein. Obviously, such a spacing projection may be formed on the top side of the lower tension element 33 with equally good results; or even a separate spacing insert would be effective. The best results will be obtained if the particular spacing means employed is positioned directly under the plunger 47; that is, in such a manner as to be intersected by the axis of movement of the actuating or operative means, whereby movement of the plunger, or other actuating means, may be transmitted directly to both of the spring members 34 and 36.

Considering now the operation in detail, assume the parts are as shown in Fig. 2, with the terminal bushings 23, 24 and 28 suitably connected to outside circuits (not shown) and with current flowing between terminal bushings 23 and 28 through the toggle spring members 34 and 36. Depression of the plunger 47 moves the tension elements 32 and 33 slightly downward until tension element 33 passes through the axis or position of maximum stress for the spring member 36, whereby the latter snaps downwardly carrying movable contact 43 into engagement with the stationary contact 27, as shown in Fig. 3; at this intermediate position, terminal bushing 28 is connected to both terminal bushing 23 and terminal bushing 24 through the spring members 34 and 36. Further depression of the plunger causes the tension element 32 to pass through the axis of maximum stress for the spring member 34, whereby the latter snaps downwardly carrying the movable contact 42 out of engagement with stationary contact 26, as shown in Fig. 4; at this position, terminal bushing 28 is connected only to terminal bushing 24.

Spring members 34 and 36 are suitably biased to make them self-returning, and they will stay in the positions shown in Fig. 4 only as long as the plunger remains depressed by an outside force. When this outside force is released and the plunger is thereby permitted to move upwardly under the influence of the energy stored in the spring members, the tension element 32 will first pass through the maximum stress position of spring member 34, causing it to snap upwardly to the position shown in Fig. 3; and, permitting the plunger to move slightly more will allow the tension element 36 to pass through the maximum stress position of the spring 36 causing it to follow the spring member 34 upwardly by snap movement to the normal position shown in Fig. 2.

The present invention provides a new and improved construction for adapting the McGall type of switch with its inherent precision, sensitivity and high control capacity, to a number of new uses.

It will be apparent to those skilled in the art that the invention is capable of numerous modifications and variations within the scope of the amended claims. For instance, instead of biasing the springs to return to the Figure 2 position as shown, the principles of my improved snap acting device may be applied to a reset type of switch, that is one in which the snap acting springs are not biased to assume a definite position but will remain in either the Fig. 2 or Fig. 4 positions until moved therefrom by an outside force applied to an operating plunger. A reset plunger mechanism of the kind disclosed in Patent No. 2,304,400, issued to Malcolm W. Eaton, December 8, 1942, may be employed to move the springs from the Fig. 4 to the Fig. 2 position.

Another modification of my snap acting device would take the form of a switch, such as illustrated, in which only one of the springs would be biased to be self-returning to the Fig. 2 position and the other spring would be non-biased and have a reset plunger, such as that shown by Eaton, to move it to the Fig. 2 position.

I claim:

1. In a snap acting device, a plurality of like formed spring members fabricated from a strip of thin metallic material, each of said spring members having side portions comprising compression elements and a central portion comprising a tension element, said elements being connected at one end in each of said spring members, said spring members being stacked flatwise in substantially parallel alignment and mounted on common mounting means for tensile stress in said tension elements and compressive stress in said compression elements, spacing means for maintaining portions of said tension elements in spaced relation, a movable actuating member having an axis of movement intersecting said tension members to move each of said spring members through a separate position of maximum stress coinciding with a separate position of said actuating member whereby said spring members are moved in stepwise succession between preselected positions by snap action, said spacing means being positioned between said tension elements in alignment with the axis of movement of said actuating member.

2. In a snap action switch, the combination of, a support, an anchor plate having spaced legs mounted on said support, each of said legs having a groove formed thereon, a first movable contact and a second movable contact shiftable between preselected positions, a first spring member supporting said first movable contact and having a first tension member and first spaced compression members, said first tension member shaped to be secured to said anchor plate and said first compression members shaped to be pivotally supported in said grooves, said first tension and compression members forming a first snap spring system shaped and positioned to move said first movable contact between its preselected positions with a snap action, a second spring system in a juxtaposed relation with said first spring member and supporting said second movable contact, said second spring member having a second tension member and second spaced compression members, said second tension member shaped to be secured to said anchor plate in a contiguous relation with first tension member and said second compression members shaped to be pivotally supported in a contiguous relation with said first compression members in said grooves, said second tension and compression members forming a second snap spring system shaped and positioned to move said second contact between the fixed contacts with a snap action, means for maintaining said spring members in spaced relation, and means engageable with one of said spring members for seriately actuating said spring systems whereby said movable contacts move successively between said preselected positions by a snap action.

3. In a snap action switch, the combination of, an anchor plate, a first spring member having a first free end movable between preselected positions and having a first tension member and a first compression member, said first tension member shaped to be secured to said anchor

plate and said first compression member shaped to be pivotally supported on said anchor plate, said first tension and compression member forming a snap spring system to move said first free end between its preselected positions with a snap action, a second spring member in a juxtaposed relation with said first spring member and having a second free end movable between preselected positions, said second spring member having a second tension member shaped to be secured to said anchor plate and a second compression member shaped to be pivotally supported on said anchor plate, said second tension and compression members forming a second snap spring system shaped and positioned to move said second free end between its preselected position with a snap action, means integral with one of said spring members for maintaining said spring members in spaced relation, and means independent of said anchor plate engaging one of said tension members for depressing said tension members to actuate said spring systems whereby said free ends move seriately between said preselected positions with a snap action.

4. In a snap action switch, the combination of, a pair of spaced fixed contacts, a first movable contact and a second movable contact shiftable between preselected positions determined by said fixed contacts, a first spring member carrying said first contact and having a tension portion and a compression portion shaped and positioned to form a first overcenter snap spring system, a second spring member in side by side relation with said first spring member supporting said second movable contact and having a tension portion and a compression portion shaped and positioned to form a second overcenter snap spring system, one of said tension portions having a projection formed thereon shaped to position said spring members in a spaced relation, and means engageable with the tension portion of one of said snap springs on the side of the tension portion away from the projection and substantially overlying the latter for actuating said snap spring systems whereby the movable contact on the other snap spring moves from its first position to its second position with a snap action before the movable contact on the spring member which the actuating means engages moves from its first position to its second position with a snap action.

5. In a snap acting device, the combination of, a first overcenter snap spring having a first free end movable between opposed positions, a second overcenter snap spring having a second free end movable between preselected positions, said first and said second springs shaped and positioned in side by side relation so that said first and second free ends are in touching side by side relation in each of their respective preselected positions, means engaging one of the springs for actuating the respective springs, and means integral with one of the springs for actuating the other overcenter snap spring in advance of said last-mentioned one snap spring, whereby the free end of said other spring member moves between said preselected positions with a snap action ahead of the free end of the spring member engaged by the actuating means.

6. In a snap switch, the combination of, spaced fixed stops, a plurality of movable contacts, a plurality of spring members mounted in side by side relation, and each having one end contiguous with the adjacent spring member and each having a free end movable between said stops

carrying one of said movable contacts, each of said spring members having stressed members shaped and positioned to form snap spring systems, each having an axis of maximum stress, means for spacing each spring member so that the respective axes of maximum stress are in spaced relation, and means for actuating said spring systems whereby said contacts are moved seriately between said stops with a snap action after each respective snap spring system passes through its axis of maximum stress.

7. In a snap action switch, the combination of spaced contacts, a first movable contact and a second movable contact movable between preselected positions determined by said spaced contacts, a first spring member carrying said first movable contact and having a first tension portion and a first compression portion, a second spring member in side by side relation with said first spring member and supporting said second movable contact, said second spring member having a second tension portion and a second compression portion, means for mounting said first and second tension portions, means in spaced relation with said latter means for mounting said first and second compression portions to form first and second overcenter snap spring systems, one of said tension portions having a projection formed thereon intermediate said mounting means for the compression portions and the mounting means for the tension portions to maintain said tension portions in spaced relation, and means engageable with the tension portion of one of the spring members intermediate the mounting means of the tension portions and the compression portions for actuating said snap spring systems whereby the movable contact on the other spring member moves from its first position to its second position with a snap action before the movable contact on the spring member which the actuating means engages moves from its first position to its second position with a snap action.

8. In a snap acting device, the combination of spaced fixedly mounted stops, a plurality of springs in side by side relation each defined by tension and compression members, the tension and compression members of each spring being interconnected at one end to form an end free to move between said stops with a snap action, one of said members of each spring having a portion movable between positions on opposite sides of a portion of the other member, means for mounting the opposite end of one of said tension and compression members of each spring, rigid means between said movable portions of the first named members of the springs to uniformly space the latter, actuating means operable against the movable portion of one of said first named members to simultaneously effect movement of all of said movable portions of said first named members respectively between said opposed positions in either direction of movement between said positions, and means for mounting the opposite end of said other member of each spring to define a plurality of snap spring systems and positioning said opposite ends to be passed, respectively, successively, by the movable portion of the spring system of which it forms a part beginning with the spring system remote from the actuating means in one direction of movement of the actuating means and beginning with the spring system engaged by the actuating means in the opposite direction of movement of the actuating means.

9. In a snap acting device, a plurality of spring members each having an end shiftable between preselected positions with a snap action, a tension portion and a compression portion, one of said portions being movable between opposed positions on opposite sides of the other, stationary means for mounting one of said portions of said spring members, means for mounting the other of said portions of said spring members to define a plurality of snap spring systems each having an axis of maximum stress between said opposed positions of the movable portion, rigid means adjacent said mounting means acting between adjacent spring systems for spacing the axis of maximum stress of each system from that of the adjacent system and actuating means engageable with the movable portion on one of said spring systems for effecting movement of each movable portion, respectively, seriately through the axis of maximum stress of the spring system of which it forms a part to move said ends of the spring systems successively between the preselected positions, said actuating means, in one direction of movement, moving the end on the spring system remote from said actuating means between said preselected positions first, and in the opposite direction of movement, moving the end of the spring system engaged by said actuating means between said preselected positions first.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,960,020	McGall	May 22, 1934
2,113,227	Bokeeno	Apr. 5, 1938
2,204,949	Riche	June 18, 1940
2,242,769	Werner	May 20, 1941
2,424,668	Riche	July 29, 1947