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S. G. RANSOME
SNAP ACTING MECHANISM

2,508,040

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2 Sheets-Sheet 1

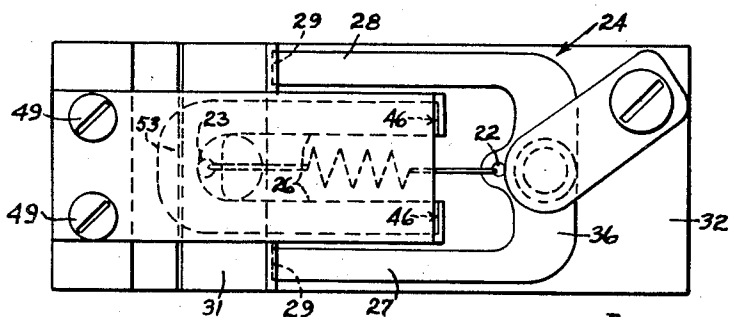


Fig. 1

Fig. 2

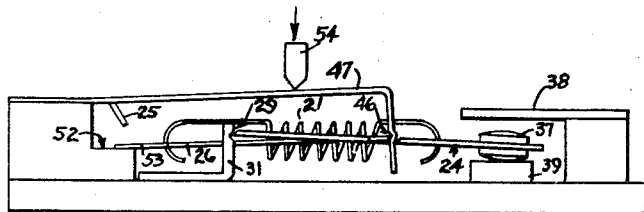
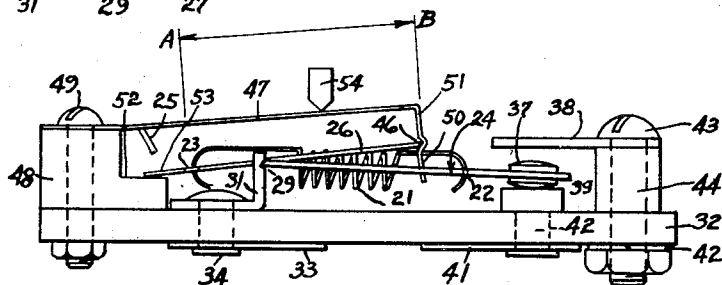


Fig. 3

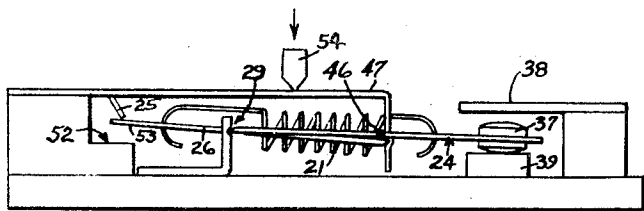


Fig. 4

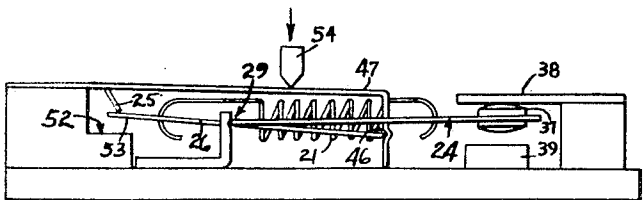


Fig. 5

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Fig. 6

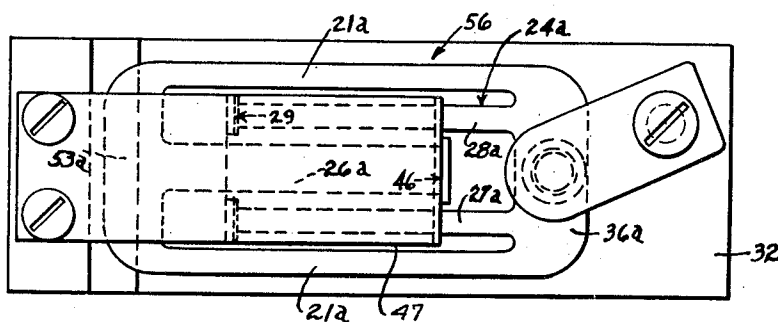
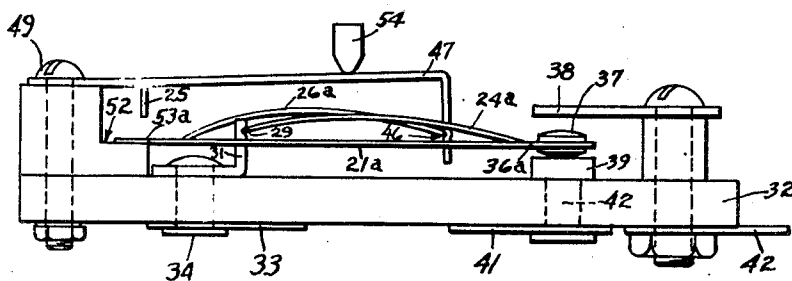


Fig. 7



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SNAP ACTING MECHANISM

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5 Claims. (Cl. 74-100)

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The present invention relates to a snap acting mechanism particularly as applied to a snap acting precision type electric switch.

One object of the present invention is to provide a snap acting precision type switch which will maintain a high contact pressure, up to the point of opening the contacts, eliminating what is referred to as "sizzle," or "arcing" between lightly loaded contact surfaces such as occurs under certain conditions of operation in the conventional snap acting switch. Sizzle is objectionable because it reduces the contact life and because it may bring about failure or improper actuation of associated apparatus.

Sizzle can be eliminated by imparting rapid actuation of the snap acting mechanism carrying the contact. This is accomplished in the present invention by providing an intermediate snap acting mechanism between the operating plunger and the snap acting mechanism carrying the contact; thus the contact is always opened or closed at high speed regardless of the speed at which the operating plunger is moved.

Other objects and advantages will be apparent from the following description in connection with the accompanying drawings wherein two preferred forms of the present invention are clearly described and shown.

In the drawings:

Figure 1 is a top view of one form of the present invention showing it applied to a self-returning type of single pole double throw switch;

Fig. 2 is a side view of Figure 1 showing the parts in their normal positions;

Figs. 3, 4 and 5 are views similar to Fig. 2 but showing the parts in various operative positions, Fig. 5 being the abnormal position as opposed to the Fig. 2 or normal position;

Fig. 6 is a view, similar to Figure 1, of another modification, and

Fig. 7 is a side view, similar to Fig. 2, of the Fig. 6 modification.

Like parts are designated by like reference characters throughout the figures.

The modification in Figures 1 to 5 shows a tension spring 21 pivoted at points 22 and 23 in the U-shaped compression members 24 and 26, respectively. A first compression member 24 has the longitudinally extending arms 27 and 28 pivoted in the fixed points or grooves 29 which are formed in the bracket 31 mounted on the insulating base 32 and connected to the terminal 33 by the rivet 34. The arms 27 and 28 are connected by the end or base portion 36 of the U-shaped member 24 which carries the double faced contact 37 between the upper and lower stationary contacts 38 and 39. Contact 39 is mounted to the base 32 and connected to the terminal 41 by the riveted end portion 42 of the contact 39; and contact 38 is connected to the terminal 42 by

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the bolt 43, a bushing 44 being provided to determine the spacing of the two stationary contacts. The second or intermediate compression member 26 has a pair of arms joined by the base portion 53 and pressed by the tension spring 21 into pivotal abutment with the pivot points or grooves 46 formed in the movable right-angled end portion 51 of the L-shaped actuating arm 47. This arm will preferably be made of resilient spring material and mounted in an elevated position by means of an insulating shim or spacer block 48 which is attached to the base plate 42 by means of the bolts 49. The right angled end portion 51 of the actuating arm has an extension 50 beyond the groove 46 of sufficient length to limit the downward movement of the arm by abutment with the base plate. The free end 53 of the intermediate compression member is limited in its upward movement by the stop 25 struck from the arm 47 and in its downward movement by the shim shoulder 52. Where, as in the modification illustrated, the switch is to be self-returning to the Fig. 2 position, this will be effected by biasing the arm upwards to seek that position. Obviously, it may be biased to seek the opposite position if desired. Or, as in the case where the switch is of the non-returning type which would be stable in both the Fig. 2 and Fig. 5 positions, the actuator arm will preferably not be biased in either direction. The actuator arm 47 is adapted to be depressed by means of an operating plunger, indicated diagrammatically by the numeral 54, and it may be positioned to engage the arm at any position within the range indicated roughly by A-B in Fig. 2. The particular position of the plunger within this range will depend on the force-deflection characteristics required of the particular switch. The operating force will be least at B and the deflection will be greatest, while at A the reverse is true.

The modification shown in Figs. 6 and 7 is the same in principle as that shown in Figures 1 and 2 except that the tension and compression members are integral, being formed from a single piece of spring strip material. The spring, generally designated 56, has a tension member comprising the longitudinally extending struts or arms 21a which are connected by the end portions 36a and 53a, the former carrying the contact 37. It will be seen that the pair of struts 21a, and the end portions 36a and 53a are equivalents of the tension spring 21, and the base portions 36 and 53, respectively, in the first modification. The end portion 36a has the longitudinally extending compression member 24a comprising the arms 27a and 28a (corresponding to arms 27 and 28 in Fig. 1) bowed upwardly in longitudinal compression on the fixed pivot points or grooves 29 formed on the bracket 31. The end portion 53a has the compression mem-

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ber 26a (corresponding to the pair of arms of member 26 in Fig. 1) extending longitudinally between the arms 24a, likewise bowed upwardly in longitudinal compression, and engaged by the pivot point or groove 46 formed on the L-shaped actuator arm. All other parts of the switch are identical to those already described in connection with Figures 1 and 2. While compression member 24a has been shown as comprising two arms 21a and 28a and the compression member 26a has been shown as a single arm, the reverse would obviously function similarly. It is desirable that one of the compression members have arms on both sides of the other so there will be no tendency for the spring to twist or cock on its mounting.

As already stated, the normal position of the switch is shown in Fig. 2 where terminal 33 is connected to the lower contact 39 through the compression member 24. The upward bias of the resilient arm 47 moves it to this position when the operating plunger 54 is not depressed. To operate the switch, the plunger 54 is depressed, moving the arm 47 through the position shown in Fig. 3 at which position the pivot 46 is substantially in alignment with a plane through the tension center line of spring 21, this being just short of the position of maximum stress for the switch. As the arm moves through the position of Fig. 3 the plunger 54 moves the pivot 46 beyond the tension center line of spring 21 and through the axis of maximum stress whereupon the tension spring 21 snaps the free end 53 of the compression member 26 upward against the stop 25, as shown in Fig. 4. This action moves the tension center line of spring 21 quickly past the pivot 29 through a second axis of maximum stress so that, without further downward movement of the arm 47, the spring 21 snaps the free end of the compression member 24 upward carrying the movable contact 37 away from contact 39 and against the stationary contact 38. By this construction it will be obvious that the speed of the contact opening and closing will be absolutely independent of the speed of the plunger 54 for, regardless of how slowly the plunger is depressed, the engagement of the contacts will be undisturbed and contact pressure maintained until the intermediate member 26 snaps over to its opposite position at which time the contact-carrying member 24 will be snapped with great rapidity.

The reverse operation of the switch is substantially the same as that already described in the respect that the intermediate compression member 26 first snaps downward into abutment with the shim surface 52 followed by the contact 37 snapping downward away from contact 38 and against the contact 39. That is, as the pivot 46 is moved upward by the resilience in the arm 47 through and above the tension line of spring 21, the spring 21 snaps the free end of the compression member 26 downward into engagement with the surface 52 and this in turn moves the tension line of the spring 21 across the pivot 29 to snap the compression member 24 downwardly to engage the contact 37 against the stationary contact 39.

Likewise in the form shown in Figs. 6 and 7, when the arm 47 is depressed by operation of the plunger 54, the pivot point 46 is depressed to a position at which the compression member 26a snaps the end 53a against the stop 25. During this movement the tension arms 21a pass above the pivots 29, whereupon the compression

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arms 24a snap the contact 37 from engagement with the contact 39 into engagement with the contact 38. Upon upward movement, the arm 47 returns to the position of Fig. 7 during the course of which the compression member 26a snaps the end 53a down against the surface 52 causing the tension arms 21a to move down across the plane of the pivot points 29, whereupon the compression arms 24a return the contact 37 to the position of Fig. 7.

While the present invention has been shown and described in connection with two specific embodiments it will be apparent to those skilled in the art that those specific embodiments are capable of many modifications and variations without a departure from the spirit and teachings of the invention.

I claim:

1. In a snap acting device, the combination of a tension member having opposed end portions movable between preselected positions, opposed stationary stops defining said positions mounted independently of the tension member, a first compression member disposed on one side of said tension member and connected at one end with one of said end portions, means for pivotally supporting the opposite end of said first compression member to form with the tension member a first snap spring system, said means positioned so that movement of the opposite end portion of the tension member between the preselected positions moves the tension member past the pivotal support to move said one end between the preselected positions with a snap action, a second compression member disposed on the same side of said tension member as the first compression member and connected at one end with the opposite end portion of said tension member, said tension and compression members being integral and formed from a single piece of spring strip material, a cantilever mounted resilient actuating member arranged to pivotally support the opposite end of the second compression member, said latter compression member and said tension member forming a second snap spring system, and means for moving the actuating member to move said pivotally supported end of the second compression member past the tension member to move said opposite end of the tension member from one to the other of said preselected positions with a snap action.

2. In a snap acting device, a tension member, a first resilient compression member having one end connected with one end of said tension member and movable between preselected positions, said compression member being bowed outwardly from the same side of the tension member in both positions of said one end of the compression member, spaced fixed stops defining said positions mounted independently of the tension and compression members, a movable cantilever mounted resilient actuating member for pivotally supporting the opposite end of said first compression member between the ends of the tension member to form with said tension member a first snap spring system having a first axis of maximum stress, movement of said actuating member moving said pivotally supported end of the first compression member through the first axis of maximum stress to move said one end of the first compression member between the preselected positions with a snap action, a second resilient compression member having one end connected with the opposite end of said tension member and movable between

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preselected positions, said second resilient compression member being bowed outwardly from the same side of the tension member as the first compression member in both positions of said one end of the second compression member and stationary means for pivotally supporting the opposite end of said second compression member between said support for the first compression member and said one end of the tension member in a position to be passed by the tension centerline of the tension member upon movement of said one end of the first compression member between the preselected positions, said second compression member and said tension member forming a second snap spring system having a second axis of maximum stress whereby movement of the tension centerline of the tension member past the pivotal support of the second compression member moves said one end of the second compression member from one to the other of the preselected positions with a snap action.

3. In a snap acting device, the combination of a tension member having opposed end portions movable between preselected positions, fixed stops independent of the tension member defining said preselected positions, a first compression member interconnected at one end with one of said end portions, stationary means between the end portions of said tension member for pivotally mounting the opposite end of said first compression member, said tension member and said first compression member forming a first snap spring system having an axis of maximum stress defined by alignment of the point of interconnection between the tension member and the first compression member with the pivotal mounting of the first compression member and the opposite end of said tension member whereby movement of said opposite end of the tension member through the axis of maximum stress moves said one end portion of the tension member between its preselected positions with a snap action, a second compression member interconnected at one end with said opposite end of said tension member, a cantilever mounted resilient actuating member movable between preselected positions, and mounting means on said actuating member disposed between said stationary mounting means and said one end portion of the tension member pivotally supporting the opposite end of the second compression member, said tension member and said second compression member forming a second snap spring system having a second axis of maximum stress defined by alignment of the point of interconnection between the second compression member and said opposite end of said tension member with the pivotal support of the second compression member and said one end of the tension member, movement of said actuating member between said preselected positions moving said pivotal support of the second compression member through the second axis of maximum stress whereby said opposite end of the tension member moves between the preselected positions with a snap action to thereby actuate said first snap spring system.

4. In a snap acting mechanism, the combination of a tension member having opposed end portions movable between preselected positions, a first resilient compression member being generally disposed on the same side of said tension member in both positions of said end portions

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and connected at one end with one of said end portions, stationary means for pivotally supporting the opposite end of said first compression member in a position to be passed by the tension member upon movement of the opposite end of said tension member between two opposed positions, said first compression member and said tension member forming a first snap spring system having a first axis of maximum stress, said movement of the tension member past the pivotal support moving said one end of the tension member between the preselected positions with a snap action, a second resilient compression member being generally disposed on the same side of said tension member in both positions of said end portions as the first compression member in both positions of said end portions and connected at one end with the opposite end portion of said tension member, a cantilever mounted actuating member movable between preselected positions arranged to pivotally support the opposite end of the second compression member to form with said tension member a second snap spring system having a second axis of maximum stress, and means engaging said actuating member for moving said pivotally supported end of the second compression member through the second axis of maximum stress to move said opposite end of the tension member from one to the other of said preselected positions with a snap action.

5. In a snap acting mechanism, a cantilever mounted resilient actuating member movable between preselected positions, a first resilient compression member pivoted on said actuating member and having a first free end movable between preselected positions with a snap action, a second resilient compression member pivoted at a stationary point and having a second free end movable between preselected positions with a snap action, a tension member interconnecting said free ends to form first and second interdependent snap spring systems having first and second axes of maximum stress, respectively, said compression members and said tension member being integral and formed from a single piece of spring strip material, said actuating member being arranged to move the pivotal connection of the first compression member through the first axis of maximum stress to move the first free end between preselected positions with a snap action, said latter movement of the first free end moving the second spring system through the second axis of maximum stress whereby the second free end moves between its preselected positions with a snap action.

STAFFORD G. RANSOME.

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