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G. M. RUSSELL
SNAP ACTION SWITCH

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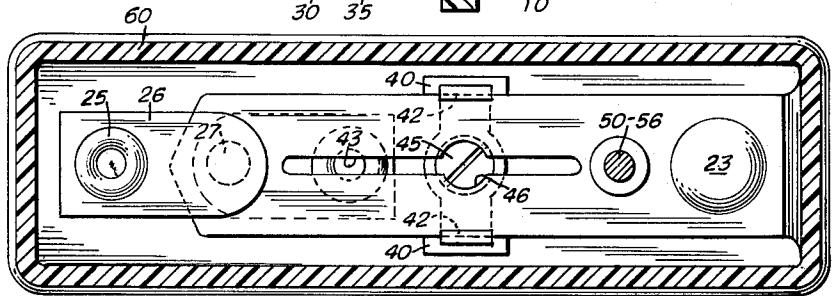
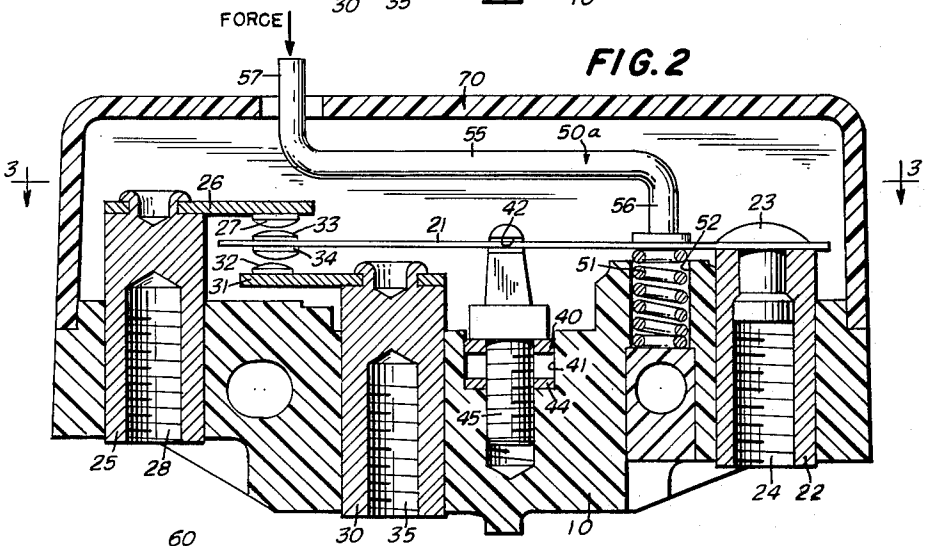
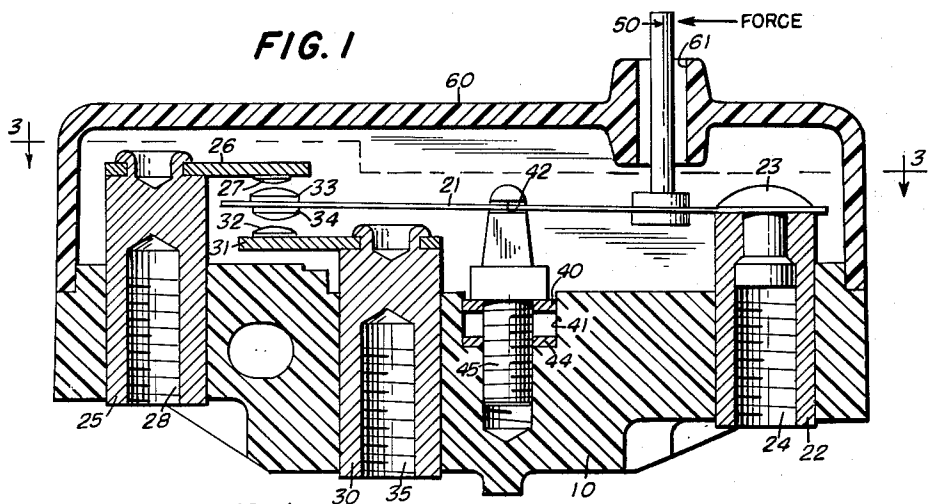


FIG. 3

INVENTOR
GROVER M. RUSSELL

BY *K. M. Lefever*

ATTORNEY

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SNAP ACTION SWITCH

Grover M. Russell, Goshen, Ind., assignor to Penn Controls, Inc., Goshen, Ind., a corporation of Indiana

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This invention relates to a new and improved snap action switch. Particularly the invention relates to a new principle of actuating a snap action switch of a particular design. Still more particularly the invention relates to a snap action switch wherein a leaf spring is actuated by means of the application of a torsional force thereto.

The prior art is familiar with snap action—or positive action—switches wherein compressive forces are applied to side edges of a leaf spring so that a force applied at a point perpendicular to the leaf will result in a snap—or positive—action of the blade of the spring to cause it to move to its alternate position. For example, in U.S. Patent 2,789,173 issued to Oscar H. Kaminky on April 16, 1957, there is described a unique positive action mechanism comprising a switch blade secured to a base at one end, having contacts adapted to cooperate with fixed contacts mounted on said base at its other end and a longitudinal slot in a portion of its center, a U-shaped clamp whose arms engage the outer edges of the switch blade and compress the two halves of the blade on either side of the slots toward each other, an actuating element adapted to apply compressive force perpendicular to the blade at a point on the blade between the slot and the secured end, and a spring bearing on the opposite side of said blade to supply a constant force resisting the compressive force applied by the actuator.

It is often desirable to vary the force-movement relationship constituting the work required to actuate a switch by increasing the movement and decreasing the force required. In the past, this has been done by adding a lever arm which acted against the normal plunger-type actuator of a positive action switch. The addition of a lever arm introduces additional frictional and other force losses so that the work required to actuate a switch increases with the addition of an arm to change the force-movement relationship. The present invention overcomes this difficulty by providing a structure wherein the work required to actuate the switch remains constant regardless of the force-movement relationship utilized.

In the utilization of a standard high production snap switch, it has often been desirable to apply a force to the switch in a direction other than that required by the actuating plunger. Therefore, additional lever arms had to be arranged between the actuating plunger and an element which is to apply the force to the switch. Again, the friction and other forces involved in such lever arms increased the work required to actuate each particular type of switch. The present invention provides for the application of force from any direction throughout a 180° arc while maintaining the work required to actuate the switch constant at the minimum value required for actuating the switch. Thus, the present invention makes it possible not only to actuate a switch of a given electrical rating from any direction throughout a 180° arc, but it allows such a switch to be so actuated without any increase or variation in the amount of work required. As aforementioned, that amount of work is less than that required by switches presently known in the art.

It is thus an object of the present invention to provide a new and improved snap action mechanism.

Another object of this invention is to provide a new and improved snap action device which is actuated by the application of a torsional force.

Another object of the present invention is to provide a snap action mechanism which requires a lower amount

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of work for actuation of the mechanism than is required to actuate positive action mechanism presently known in the art.

An additional object is to provide a snap action mechanism wherein the work required to actuate the mechanism can be divided into any desired force movement relationship with the work required for actuation remaining constant.

A further object is to provide a snap action mechanism wherein the actuating force may be applied from any direction throughout a 180° arc without varying the work required to actuate the mechanism.

Yet another object of the present invention is to provide a snap action mechanism which is comprised of a thin metallic blade having one end secured while the other end is free to move, a pair of elements forcing each portion of the blade inwardly toward the other to buckle the blade, and means secured to said blade at a point between said elements and the secured end of the blade to apply torsional force thereto.

Further objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a side sectional view of an embodiment of the present invention;

FIG. 2 is a side sectional view of a modification of the embodiment of the invention shown in FIG. 1; and

FIG. 3 is a top sectional view taken along the line 3—3 in both FIGS. 1 and 2.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail, embodiments of the invention with the understanding that the present disclosures are to be considered as exemplifications of the principle of the invention and are not intended to limit the invention to the embodiments illustrated. The scope of the invention will be pointed out in the appended claims.

Referring now to the figures, a base 10 which is composed of molded insulating material has a positive acting blade in the form of a spring leaf element 21 secured at one end to a metallic sleeve 22 by a rivet 23. The sleeve 22 is securely molded into the base 10 and thereby forms a rigid part of the base 10. The inner surface 24 of the sleeve 22 is threaded to receive a terminal screw.

A second metallic sleeve 25 is rigidly embedded in the base 10 to form a part thereof at the other end of the base 10. A contact arm 26 is mounted on the sleeve 25 at one of its ends and has a contact 27 mounted near its other end. The inner surface 28 of sleeve 25 is threaded to receive a terminal screw. A third metallic sleeve 30 is rigidly embedded in the base 10 and carries an arm 31 rigidly mounted thereon, which has a contact 32 mounted near one end. A pair of contacts 33 and 34 are mounted on the free end of the blade 21 so that they coact with the contacts 27 and 32. The sleeve 30 is similar to the sleeves 22 and 25 in that it also has a threaded internal surface 35.

A U-shaped strip of spring metal forms a clamp 40 when it is mounted in a socket 41. It has arms which are provided with notches 42. The blade 21 may be provided with a centrally located slot 43 although this slot is not always necessary. As is more fully shown in U.S. Patent 2,789,173, a clamp seat 44 underlies the cross member of the clamp 40 in the socket 41 and is provided with seating corners engaging this cross member. A clamp adjusting screw 45 secures the clamp 40 and the clamp seat 44 onto the base 10 by being threaded in the base 10. As the adjusting screw 45 is screwed into the base 10, the cross member of the blade clamp 40 is forced downward onto the seating corners of seat 44 forcing the arms of the clamp toward each other. This ap-

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plies a stress onto the blade 21 until a sufficient amount of buckling has occurred which forces the center portion of the blade out of the plane of the blade. The turning of the adjustment screw 44 is accomplished by passing a screwdriver through an opening 46 in the blade 21. The degree of buckling can be regulated by tightening or loosening screw 45. When the blade is stressed, as described, it will stay in a depressed position with the contact 34 engaging the contact 32. The blade 21 may be made of any resilient material such as spring steel or bronze that has some inherent resiliency.

Referring now specifically to FIGS. 1 and 3, a lever arm 50 is secured to the blade 21 between the end of the slot 43 and the rivet 23 which secures the blade 21 to the base 10. A spring 51 may be mounted in a recess 52 in the base 10 to cause the blade 21 to buckle upwardly, as shown in FIG. 2 if desired. In the absence of spring 51 it will be apparent that the blade 21 will remain in the snapped position.

If a force is applied to the lever 50 in a direction perpendicular to the center line, as illustrated in FIG. 1, the blade 21 will be subject to a torsional force at the point the lever 50 is secured to the blade 21. The portion of the blade between lever 50 and the rivet 23 securing the end of the blade will remain relatively fixed and act as a flexible hinge about which the portion of the blade at the lever 50 pivots. Therefore, the lever arm 50 may be secured in any manner which will create a torsional force at the point the lever arm 50 is secured to the blade 21 such as rigidly brazing, riveting, bolting, or soldering the lever to the blade. The securing method is not limited to rigid securing methods, since a lever may be pivotally or loosely secured to the blade as long as it can at some point produce the required torsional force. For example, the lever 50 could pass loosely through a hole in the blade and have collars on either side of the blade which contact the blade to apply a torsional force on it when the lever is tilted sufficiently, or the lever could be hinged to the blade with the hinge parallel to the long axis of the blade. As this force, illustrated in FIG. 1, pivots the lever 50, the portion of the blade between the lever arm 50 and the blade clamp 40 is forced downwardly until the blade buckles in the opposite direction with a positive action to break the contact between contacts 27 and 33 and to make a closed circuit between contacts 32 and 34. As shown in FIG. 1, the blade 21 will remain in its downward buckled position. In the embodiment shown in FIG. 2, when the force is removed from the lever 50, the spring 51, has sufficient force to urge the portion of the blade 21 at the connection of the arm 50 to pivot upwardly until the blade 21 again buckles to its upward position. The circuit between contacts 32 and 34 is opened while a circuit between contacts 27 and 33 is closed. The product of the force applied to the lever 50 multiplied by the distance of movement through which the lever arm must traverse, at the point the force is applied, is significantly less than the product of the force that must be applied vertically downward on the lever 50 multiplied by the movement of the lever 50 to buckle the blade 21 downwardly. Therefore, by applying a torsional force to the blade 21 through the lever 50, a smaller quantity of work is required than when a direct compressive force is used. Thus, the switch structure shown in FIG. 1 and FIG. 3 requires a smaller quantity of work to actuate it than is presently required in the positive action switch described in U.S. Patent 2,789,173 or in other positive action switches presently known in the art.

A cover 60, which may also be molded, of insulating material is fitted onto the top of the base 10 to enclose the switch mechanism. A channel 61 is formed in the cover 60 which is so much larger than the shaft 50 that the shaft has sufficient space to be rotated about the hinge provided by the portion of the blade 21 between the shaft 50 and the rivet 23.

If the point of applying force, shown in FIG. 1, is

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moved downwardly on the shaft 50, the amount of force necessary to actuate the switch will increase, but the movement of the force will decrease so that the work required to actuate the switch remains constant. Although switches in the past have utilized multiplying lever arms to adjust the force-movement relationship required to actuate various switches, these devices could not do so while maintaining the total work required constant because the additional levers, introduced additional frictional and other forces. These have been eliminated by the present invention.

Referring now specifically to FIG. 2, a modification of the embodiment of the invention shown in FIG. 1 is disclosed. It differs from the structure shown in FIG. 1 in that the straight lever 50 has been replaced with a lever 50a which has a portion 55 which is perpendicular to a portion 56 in order that it may be perpendicular to a downwardly applied force as indicated in FIG. 2. The portion 56 of the arm 50a is rigidly connected to the blade 21 in the same manner as lever 50 in FIG. 1. The remaining components of the embodiment illustrated in FIG. 2, except for the replacement of the cover 60 with a cover 70, are identical to those in FIG. 1 and bear the same reference numerals. A portion 57 of the lever 50a is substantially perpendicular to the portion 55 so that a portion of the lever extends beyond the cover 70 which is mounted in the same manner as is cover 60 on the base 10. An aperture 71 allows for the movement of the portion 57 of the lever 50a as the lever pivots about the hinge provided by the portion of the blade 21 between the attaching point of the lever to the blade 21 and the rivet 23.

Thus, as illustrated in FIG. 2, the force may now be applied to the switch in a vertically downward direction. The length of the portion 55 of the arm 50a determines the force-movement relationship required to actuate the switch. As the arm is shortened, the force required is increased and vice versa. As will be recognized by those skilled in the art, the lever may be made of such shapes that a force may be applied in an upward direction, a side-ward direction as illustrated in FIG. 1, or in a downward direction as illustrated in FIG. 2. In whatever direction the force is applied, it is applied at substantially a right angle to a lever arm which extends from the point of application of force on the lever to the point of connection of the lever arm to the blade 21. Thus, the present invention allows for the application of an actuating force in any direction throughout at least a 180° arc while maintaining a constant work requirement for actuation which is lower than that required by switches presently in the art. It further maintains this work requirement constant while the force-movement relationship constituting the quantity of work required is varied.

It is also apparent that many modifications of the principle hereinbefore described may be designed to accomplish a desired result. For example a spring tension device may be arranged opposite the point of application for force to lever arm 50 which must be overcome prior to actuation—or which will cause return to the original position such as may be accomplished by spring 51 of FIG. 2. Other applications will suggest themselves to those familiar with the art.

To reiterate briefly the instant invention relates to a snap—or—positive action mechanism which comprises a resilient blade having one end rigidly mounted on a base with the other end free to move. The blade is subjected to lateral stress and is equipped with means for applying torsional force at a point between the fixed end and the point of application of lateral stress thereto. If desired the blade may be weakened in resistance to lateral stress, and the base may be equipped with a spring to resist any torsional force applied to the blade. By proper design of the torsional force application means the improved snap action mechanism of the invention may be actuated by the application of a force in any direction within a 180°

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arc and without change in work required to accomplish the actuation. Also with the new mechanism of this invention the force-movement relation for actuation may be varied at will without change of the necessary actuating work.

What is claimed is:

1. A positive action mechanism comprising: a base, a resilient blade having one end rigidly mounted hereon with its other end free to move with a positive action and having an intermediate portion subjected to lateral compressive stress, and means secured to said resilient blade for applying a torsional movement to said blade.

2. In combination with the positive action mechanism specified in claim 1, a spring urging said blade to resist said torsional movement.

3. A positive action mechanism comprising: a base, a resilient blade having one end rigidly mounted thereon with its other end free to move with a positive action and having an intermediate portion which is subjected to lateral compressive stress, and a lever secured to said resilient blade between said intermediate portion and said rigidly mounted end.

4. A positive action mechanism in accordance with claim 3, wherein said lever consists of a generally straight shaft secured substantially perpendicular to said blade.

5. A positive action mechanism in accordance with claim 3, wherein said lever includes a generally straight portion which is substantially perpendicular to the direction that force is to be applied to said lever to operate said mechanism.

6. A positive action mechanism in accordance with claim 3, wherein said lever includes a first generally straight shaft portion secured substantially perpendicular to said blade and a second generally straight shaft portion secured to said first portion and substantially perpendicular to the direction that force is to be applied to said lever to operate said mechanism.

7. A positive action mechanism comprising: a resilient blade having ends of which one is secured and having a longitudinal slot terminating short of said blade ends, said slot dividing a portion of the blade into two separate halves, a pair of abutments for stressing said halves to-

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ward each other to cause them to assume a buckled position, and means for applying torsional force to said blade between said abutments and said secured end.

8. In combination with the positive action mechanism specified in claim 7, a spring bearing against said blade to resist a movement of said blade by a torsional force exerted by said means.

9. A positive action mechanism comprising: a spring leaf element having ends and being slotted lengthwise intermediate its ends, mounting means clamping said leaf element at one end and leaving the other end free, clamping means engaging side edges of said spring leaf element to exert a pressure on said leaf element which tends to reduce the width of said slot whereby said free end moves in one direction or the other out of the normal plane of the spring leaf element, and a lever secured to said spring leaf element for moving said spring leaf element intermediate said clamping means and said fixed end in opposite directions to cause positive motion of said free end in corresponding directions out of the plane of the element.

10. A positive action mechanism comprising: an elongated resilient blade having ends and a single generally longitudinally extending slot therein terminating short of said ends, an adjustable means for biasing opposite side edges of said blade in the vicinity of said slot toward each other to produce a positive action of the blade as a portion thereof is moved to one side or the other of the plane of the blade, and a lever secured to said blade for twisting said portion of the blade to one or the other side of the plane of the blade.

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40 BROUGHTON G. DURHAM, *Primary Examiner*.

MILTON KAUFMAN, *Examiner*.

F. E. BAKER, *Assistant Examiner*.