June 27, 1950 E. R. ROSWELL 2,513,053

SNAP SWITCH

Filed Dec. 22, 1945 2 Sheets-Sheet 1

Fig. 1.

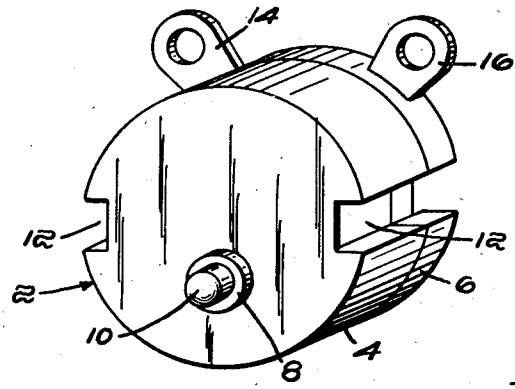


Fig. 2.

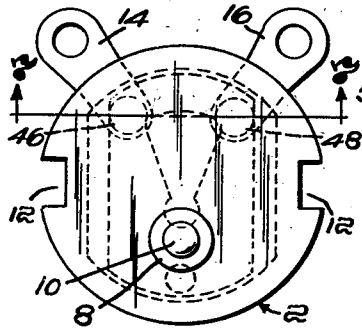


Fig. 3.

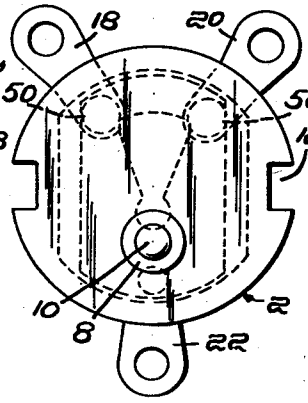


Fig. 4.

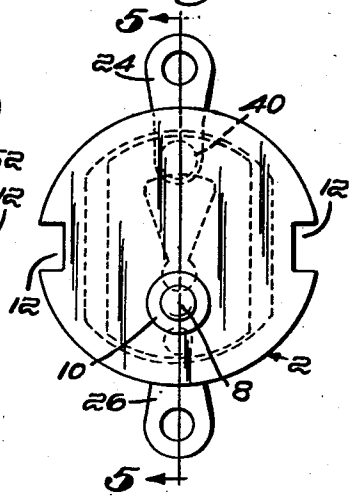


Fig. 5.

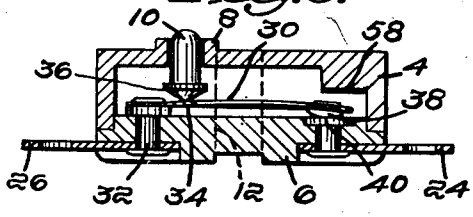
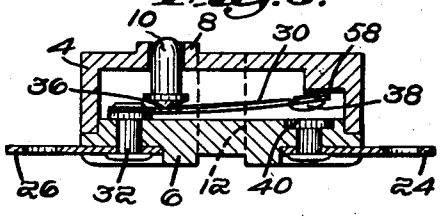


Fig. 6.



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SNAP SWITCH

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Fig. 7.

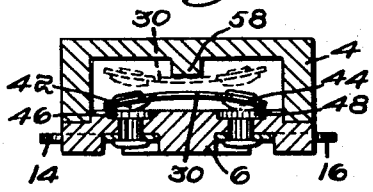


Fig. 8.

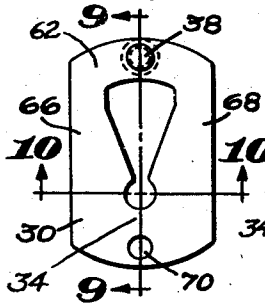


Fig. 9.



Fig. 10.

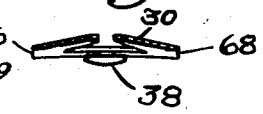


Fig. 11.

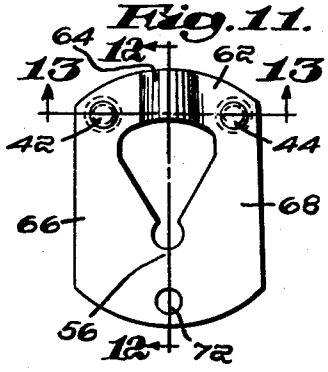


Fig. 12.

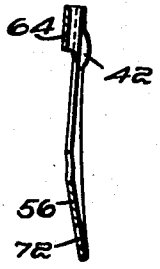


Fig. 13.



Fig. 14.

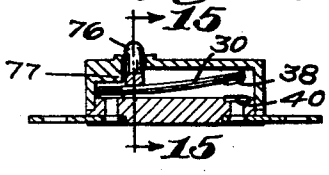


Fig. 15.

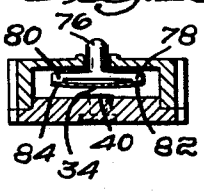
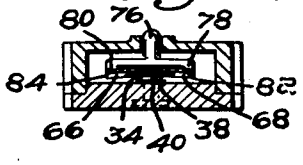


Fig. 16.



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UNITED STATES PATENT OFFICE

2,513,053

SNAP SWITCH

Earle R. Roswell, Marshfield, Mass., assignor, by mesne assignments, to The Chase Shawmut Company, Newburyport, Mass., a corporation of Massachusetts

Application December 22, 1945, Serial No. 636,647

7 Claims. (Cl. 200—67)

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The invention relates to snap action electric switches. It is particularly concerned with a snap action switch of small dimensions, positive in action, and capable of being manufactured at a price low enough to permit use in installations where switches of this type are desirable but where, heretofore, they have not been used because of the high cost, large size, or limited life.

The switch is particularly useful in installations where operating pressures do not have to be within close limits. For example, in the case of a manually operated switch, it is obviously immaterial whether the force required is somewhat greater or less. Such a situation would be found in a radio switch. The user will not be particularly concerned whether the switch operates with slightly more or less force. On the other hand, however, the functional parts of the switch of the present invention may be made with such accuracy and uniformity that switches made according to particular specifications will be substantially uniform in operating characteristics.

The construction functions with very slight movement of the operative member but at the same time the extent of separation of the contacts will be sufficient to permit use with alternating current circuits up to approximately ten amperes. The switch, of course, can be used with direct current if the voltage and amperage are such that sparking and attendant fusing of the contacts are eliminated.

It will be understood, of course, that the switches may be of the single pole single throw or single pole double throw type. If of the single pole single throw type, switches may be arranged to be either normally open or normally closed. In both cases, however, the movement of the switch blade is of the same general character, although the activating force may be applied at different areas, depending upon the normal stable position of the blade. In one case, normally open position may be obtained simply by reversing the contacts, while in the other, the contacts may remain in the same relationship with the stable position of the blade reversed.

The invention also includes the specific construction of the movable switch member with particular reference to the form thereof and the method of achieving this formation. Other advantages of the switch will be disclosed and will become more apparent as the description proceeds with the aid of the accompanying drawings, in which

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Fig. 1 is an isometric perspective of a typical form of the switch considerably enlarged.

Fig. 2 is a front elevation of the switch shown in Fig. 1, with the interior parts in dotted line.

Fig. 3 is a front elevation of a switch similar to Fig. 1, but having in addition a third contact.

Fig. 4 is a front elevation of a switch similar to Fig. 1, but with two oppositely disposed terminals.

Fig. 5 is a section on the line 5—5 of Fig. 4, showing the switch in normal closed position.

Fig. 6 is a section on the line 5—5 of Fig. 4, showing the switch in operated open position.

Fig. 7 is a section on the line 7—7 of Fig. 2 with the contacts closed.

Fig. 8 is a plan view of the formed switch blade used in Fig. 4.

Fig. 9 is a section on the line 9—9 of Fig. 8.

Fig. 10 is a section on the line 10—10 of Fig. 8.

Fig. 11 is a plan view of a modified type of switch blade.

Fig. 12 is a section on the line 12—12 of Fig. 11.

Fig. 13 is a section on the line 13—13 of Fig. 11.

Fig. 14 is a side elevation of a normally open switch.

Fig. 15 is a section on line 15—15 of Fig. 14.

Fig. 16 is a section on the line 15—15 of Fig. 14 after the switch has been closed.

A typical switch incorporating the present invention is shown in Fig. 1. In this figure the outer housing and the various members are greatly enlarged over the actual switch dimensions. In practice it is contemplated that a typical switch might have an outside diameter of three-quarters of an inch or less, with a total thickness approximately one-quarter inch. The dimensions, however, may be varied at will, and it is not intended to limit the invention in any way by the reference to specific size. The statement of particular dimensions is made merely to make it clear that a switch can be made according to the present invention small enough to be used in installations where heretofore quick action switches of this general type were precluded because of their larger size or greater cost.

The switch consists generally of a housing 2 formed in two separate parts 4 and 6 to permit easy assembling of the interior operating mechanism. The top half 4 of the housing has a cylindrical boss 8 bored to receive and operating pin 10, the inner end of which is located to press against the switch mechanism.

A shallow groove 12 extends down the two sides and across the bottom of the switch housing. This groove is adapted to receive a U-shaped band

which may be utilized in securing the switch to the structure with which the switch is to be used. Other attaching means may, of course, be used as required without affecting the switch operation in any way.

The switch may be arranged to have two terminals 14 and 16, as shown in Fig. 2, three terminals 18, 20 and 22, as shown in Fig. 3, or two terminals 24 and 26 arranged opposite each other, as in Fig. 4. All terminals are recessed in the housing to prevent rotation.

When the arrangement of Fig. 2 is used, the circuit will be broken at both terminals, thereby providing an air gap equal to twice the switch opening. In Fig. 3 the arrangement provides for dividing the circuit through the use of the common terminal 22 and the terminals 18 and 20 leading to two different circuits. In Fig. 4 the circuit is made and broken at a single point so that the air gap is equal only to the movement of the operating member.

Figs. 5 and 6 show the general nature of the switch mechanism. A leaf spring 30, two different forms of which are shown in Figs. 8 and 11, is secured to the bottom half 6 of the housing by means of a rivet 32. This rivet in addition fastens terminal 26 on the under side of the housing. In the forms of Figs. 2 and 3 the terminal 26 is omitted. In general, leaf spring 30 is in the form of a flat truncated cone with a raised portion between its support 32 and the central cut away area. The construction of leaf spring 30 will be described in detail hereinafter. In all forms, however, pressure on the raised area 34 will cause the contact end to snap upwardly to the position shown in Fig. 6, once the critical pressure has been reached, and all other parts of the leaf spring substantially reverse themselves.

Pressure is brought to bear on area 34 by operating pin 10. Pin 10 is made of insulating material, with its lower end engaging the elevated area 34 of the leaf spring 30, as shown in Figs. 5 and 6. Leaf spring 30 may have any number of contacts on its movable end. Ordinarily a single contact 38, as shown in Figs. 4, 5, 6, 8 and 10, or two contacts 42 and 44, as shown in Figs. 2, 3, 7, 11, 12 and 13, will be used.

In the single contact construction, movable contact 38 is normally in engagement with fixed contact 40, located in line with rivet 32. In the two-contact construction movable contacts 42 and 44 shown in Fig. 11 are in engagement with corresponding fixed contacts located thereunder and indicated at 46 and 48 in Fig. 2 and at 50 and 52 in Fig. 3. The two-contact arrangement is also shown in Fig. 7, which is a section on the line 7—7 of Fig. 2.

Contacts 46 and 48 in Fig. 2 are electrically associated with terminals 14 and 16, contacts 50 and 52 are similarly connected with terminals 18 and 20 in Fig. 3, and contact 40 of Fig. 4 is connected with terminal 24. When operating pin 10 is pressed downwardly against the elevated area of the leaf spring as at 34 in Fig. 8, or at 56 in Fig. 11, a point will be reached where the pressed-upon area will snap downwardly and the contact end of the leaf spring will snap upwardly substantially instantaneously. The circuit of which the switch is a part is thereby broken very quickly and sparking is held at a minimum. It will be observed that this arrangement results in the contacts being maintained at an increasing pressure until the instant that the circuit is broken. From an electrical standpoint this is very desirable and the switch has been found to operate satisfactorily on 110-volt alternating current. In addition, precision of operation is present, as the position of pin 10 at the moment contact is broken is identical on repeated operations of the switch.

When the outer end of leaf spring 30, held at its other end by the single centrally located rivet 32, has snapped upwardly, it will assume the position shown in Fig. 6 with the circuit broken. Upward movement is limited by the stop 58. In this open position, the leaf spring will not be stable, and will remain there only so long as pressure on operating pin 10 is exerted. As soon as the pressure on pin 10 is released, leaf spring 30 will snap downwardly to the position shown in Fig. 5, thereby reclosing the circuit.

The switch mechanism may also be arranged to provide a normally open switch instead of the normally closed switch heretofore described. One method of providing a normally open switch is to incorporate in the upper half 4 of the housing the fixed contacts 40, 46, 48, 50 and 52. In such cases, the contacts on the leaf spring would be placed on the upper side. As the stable position of the leaf spring is downward, as shown in Fig. 5, the switch would thus be normally open. Pressure on pin 10 would result in leaf spring 30 snapping upwardly, as shown in Fig. 6, thereby closing the contacts. So long as pin 10 is held down, the contacts remain closed, but as the leaf spring is unstable in this position, release of pin 10 will cause reopening of the circuit as the leaf spring snaps downwardly. In this arrangement, the direction of the pressure of pin 10 is opposite to the direction of movement of the free end.

Another arrangement of a normally open switch incorporating the present invention is shown in Figs. 14, 15 and 16. In this construction leaf spring 30 is anchored in the housing so that in its stable position the contact end is upward. Area 34 is in downward position while the side legs 66 and 68 are sprung upwardly.

Contact 38 is on the under side of the leaf spring, and fixed contact 40 is in the same position as shown in Figs. 5 and 6. In this construction, it is contemplated that the switch when closed will have the leaf spring in unstable position, so that reopening will take place as soon as the pressure on the operating pin is released.

The operating pin 76 has dual engaging members, 78 and 80. Thus, instead of engaging leaf spring 30 at a single point along the axis, pin 76 engages it at two laterally spaced points 82 and 84 near the bases of the legs 66 and 68. When downward pressure is exerted against the sides of leaf spring 30 by members 78 and 80, the center area 34 will snap upwardly as the side legs 66 and 68 spring downwardly. The cross-sectional upward curvature of the blade shown in Fig. 15 with the switch open reverses itself to a downward curvature with the switch closed, as shown in Fig. 16. The pressure on pin 76, causing closure of the switch, is in the direction of movement of the contact end. Thus it is evident that the greater the force applied to pin 76, the greater the pressure between contacts 38 and 40. It is unnecessary and undesirable to provide a stop above the movable end of leaf spring 30, as the greater the upward movement of the free end, the farther apart the contacts will be. Pin 76 is held against rotation by the crosswise guide 77.

The particular longitudinal location of pin 76 is not critical. The operating characteristics of the leaf spring make it possible to locate pin

76 wherever necessary to meet particular requirements of movement and pressure.

The closer pressure members 78 and 80 are to the mounting end of the blade, the faster the switch action will be, the less the vertical movement of pin 76, and the greater the operating force. As the pressure members 78 and 80 are moved toward the contact end of spring blade 30, the switch action will be slower, more travel of the operating pin will be necessary, and the operating force will be lessened.

The provision of a normally open switch by reversing the contacts shown in Figs. 5 and 6, or by reversing the leaf spring and adding means for pressing on the sides of the leaf spring as shown in Figs. 14, 15 and 16, requires no modification of the leaf spring or blade, and the character of the action is substantially identical, whether the operating force be applied at a single point on the longitudinal axis or at oppositely disposed points on the legs.

The leaf spring or blade which constitutes the operating mechanism of the switch is preferably made from a thin sheet of beryllium copper. The blade is relatively wide in comparison to its length, when viewed in the light of leaf springs on snap action switches of the prior art. As shown in Figs. 8 and 11, the center portion is cut away in what might be termed a keyhole formation. This produces short acutely tapered legs 66 and 68 and a relatively narrow end cross bar 62, both of which features are essential to proper snap action in a stubby blade of the type disclosed. For the purpose of definition, the cross-bar 62 may be considered that portion extending the width of plate which carries the contacts and which connects with the ends of the tapered legs. The spring is deformed to a generally flat truncated cone shape with the area just below the bottom of the keyhole opening raised. The raised areas are indicated at 34 in Fig. 8 and 56 in Fig. 11. Various methods of shaping the leaf spring may be used. To produce the construction of Figs. 8, 9 and 10 the spring may be placed between suitable dies which will distort the metal to the degree desired. In Figs. 11, 12 and 13 the distortion has been accomplished by arching the midsection of the end cross bar 62, as indicated at 64. This causes the legs 66 and 68 to be drawn together slightly at one end, thereby buckling the metal to raise the area at 56.

After the leaf spring or blade has been deformed in either of the two manners above described, the spring will present a raised area immediately next to the cut-away area along the longitudinal axis, as indicated at 34 in Fig. 8 and at 56 in Fig. 11. These areas are the preferred areas against which pressure may be brought to cause the switch to operate. The construction, however, presents a band extending across the entire width of the blade, which band tapers off in operating effectiveness toward either end. Appropriate pressure brought to bear against the band area of the blade will cause actuation.

The exact configuration of the side portions may be varied somewhat, but it has been found by experiment that the disclosed construction produces very satisfactory snap action. The contacts 38 of Fig. 8 and 42 and 44 of Fig. 11 are made independently of the leaf spring and then securely affixed to the spring by riveting in the usual manner.

The extent to which the leaf spring is deformed, as shown in Figs. 8, 9 and 10, or the extent to which the legs 66 and 68 are drawn together by the deformation of the cross bar 62, as shown in Figs. 11, 12 and 13, determines the amount of force that must be applied by the operating pin 18 at 34 or 56 to cause the movable end of the leaf spring to snap away from its normal position. In some switches it will be preferable to have the leaf spring operate under a light force, in which case the deformation will not be as great as in the case where more force on the operating pin is desired.

The flat cone formation produced either by pressing the spring in dies or by drawing the legs together by deformation of the cross bar at the end, both as heretofore described, results in the leaf spring being curved downwardly transversely at both ends. This curvature is plainly shown in Fig. 7. When pressure is applied to the areas 34 or 56, indicated in Fig. 8 or 11, to such an extent that the free end of the spring is caused to snap upwardly to break the circuit, the curvature of the free end then reverses itself, as shown by the dotted line position in Fig. 7. This characteristic is advantageous because it results in a greater movement of contacts 44 and 42 away from fixed contacts 46 and 48 than would otherwise be the case. Thus the switch may be used in circuits of higher voltage without sparking.

When the leaf spring 30 is deformed, as in Figs. 8 and 11, to create raised areas at 34 and 56, respectively, the legs 66 and 68 will slope laterally in a downward direction, that is, the interior edges of the legs will be higher than the outside edges. This condition is illustrated in Figs. 9, 10, 12 and 13. The tapering formation of legs 66 and 68 assists in providing excellent snap action of the contact end of leaf spring 30 when the necessary force has been applied at the raised areas immediately below the cut away area. The legs 66 and 68, in addition to sloping laterally downward, are also curved downwardly along the longitudinal edges, as indicated at 69 in Fig. 9.

The lower end of the central opening is preferably curved, as shown, as this minimizes the possibility of splitting of the leaf spring after long repeated use. The holes 70 and 72 shown in Figs. 8 and 11 are provided to permit insertion of the rivet which secures the fixed end of the leaf spring to the housing. The rivet head, while holding the end of leaf spring 30 substantially flat over a small area, nevertheless does not lower raised areas 34 and 56 appreciably, nor does it interfere with proper snap action.

The leaf spring construction heretofore described is secured to the housing at one end along its center line, as has heretofore been pointed out. It is due to this center line anchorage that the particularly desirable snap action is obtained. By this arrangement, all four corners and the sides and ends are free to spring to their new reversed positions with a minimum of restraining influence from the support. Thus, the new cone formation which the blade assumes after snapping to the new open or closed position, as the case may be, is a substantial reversal of its initial shape. The center line anchorage gives greater freedom of action and more responsiveness in this type of construction than has been known heretofore. It should be pointed out that this is true even though the toed-in character of the legs, shown in Fig. 11, is brought about by a deformation of cross bar 62. Reversal of the curva-

ture of cross bar 62 takes place even though the center area at 64 has been arched upwardly. Area 64 will bend in the opposite direction to the extent necessary as freely as if the cross bar 62 were undeformed.

The snap action characteristics created by the truncated cone formation are such that the stresses on the metal as the blade snaps from one position to the other are limited in degree. Thus, there is excellent resistance to fatigue and the switch will have adequate life in the uses to which it will be put.

In the construction of the spring blade shown in Fig. 8 it will be noted that the originally flat blade has been deformed by a suitable die to bring it into a permanently deformed shape which has heretofore been described as a very flat truncated cone. This can be seen from an observation of Figs. 9 and 10. In this form the metal of the blade surrounding the slot and particularly the metal surrounding the narrow end of the slot has been stretched beyond its elastic limit, thereby being permanently deformed so that it cannot return to flat condition. Such snap action that occurs in use, however, does not cause the elastic limit to be exceeded thereafter, and hence the blade has a very long life. The extent of the compression of the material surrounding the opening in the blade and the corresponding stretching of the material on the periphery as snap action occurs is well within the elastic limit.

The opening or slot in the blade that runs the length of the short stubby legs is entirely unobstructed, and the inner tapered edges of legs 66 and 68 are free to shift from an up to a down position as blade reversal takes places.

The blade being relatively wide with respect to its length causes the legs to be short and stubby. This feature gives to the switch its most desirable characteristics. The short, stubby construction of the legs gives very high resistance to any chattering of the contacts under the most rigorous vibration. This is because the contact force exerted by the short, stubby legs is inherently greater than that of blades of what might be considered normal proportions according to the prior art. In addition to resistance to vibration, switches using this stubby blade construction have less tendency to bounce on closure, which adds considerably to the life of the switch. For the purpose of defining what is meant by a leaf spring relatively wide in respect to its length, it is stated that any leaf spring in which the effective length is not more than twice the effective width will be such a leaf spring blade as to be within the scope of this invention.

The ease with which the deformation of the leaf spring may be varied to meet different operating conditions makes this switch adaptable for use in many different types of installations. The resulting performance in all cases, however, is substantially the same, namely, that the contacts are urged against each other with full pressure until the instant of separation, at which time the breaking of the circuit is substantially instantaneous.

When reference is made to the switch housing, it is contemplated that this includes any type or form of structure in or on which the operative parts of the switch are mounted. It is not intended to limit the housing to a closed type, such as is shown in the drawings. The housing may be such as to expose the mechanism to view, so that operating conditions may be observed. The

housing must, of course, hold the parts firmly in their proper relation.

While preferred forms of the invention have been disclosed and described, it is to be understood that the invention is not to be limited thereby, but only by the appended claims.

I claim:

1. An electrical switch comprising a housing, a leaf spring within said housing and rigidly supported thereon at one end at a position located on the longitudinal axis of said leaf spring, the other end of said leaf spring movable within said housing, said leaf spring formed of a thin sheet of metal relatively wide in respect to its length with part of its center area cut away to provide a single unobstructed slot along the sides of which are stubby side legs of non-uniform width and a relatively narrow flexible continuous cross-bar at the movable end connecting said legs, said cross-bar unsupported and free to flex on reversing movement of said leaf spring, a contact on said cross-bar, the supported end of said leaf spring being of substantially the same width as the contact carrying cross-bar and the side edges of said leaf spring extending substantially at full width in the direction of the support to present unsupported corner areas which extend laterally from said support and which are free to flex up and down in cooperative movement with other parts of the leaf spring, a contact affixed to said housing adapted to be engaged by the contact on said cross-bar, said leaf spring permanently deformed in the general shape of a very flat cone, means movable through said housing for applying pressure to said leaf spring adjacent said support whereby when sufficient pressure is applied, the movable end of said leaf spring will snap away from its normal position and the cone formation will freely and instantly partially reverse itself with the cross-bar and the supported end flexing in the reversed direction from normal, means limiting the movement of the movable end of said leaf spring so that it cannot reach a second position of stability whereby when the pressure against said leaf spring is reduced sufficiently said leaf spring will snap back to its original stable cone formation.

2. An electrical switch comprising a housing, a leaf spring within said housing and rigidly supported thereon at one end at a position located on the longitudinal axis of said leaf spring, the other end of said leaf spring movable within said housing, said leaf spring formed of a thin sheet of metal relatively wide in respect to its length with part of its center area cut away to provide a single unobstructed slot along the sides of which are stubby side legs of non-uniform width and a relatively narrow flexible continuous cross-bar at the movable end connecting said legs, said cross-bar unsupported and free to flex on reversing movement of said leaf spring, a contact on said cross-bar, the supported end of said leaf spring being of substantially the same width as the contact carrying cross-bar and the side edges of said leaf spring extending substantially at full width in the direction of the support to present unsupported corner areas which extend laterally from said support and which are free to flex up and down in cooperative movement with other parts of the leaf spring, a contact affixed to said housing adapted to be engaged by the contact on said cross-bar, said leaf spring permanently deformed to present a raised area between the fixed support and the cut away area, means for applying pressure to said leaf spring at the raised

area on the longitudinal axis whereby when sufficient pressure is applied to said area the movable end of said leaf spring will snap away from its normal position, and means attached to said housing to limit movement of the movable end of said leaf spring away from its normal position so that said leaf spring cannot reach a second position of stability whereby when pressure against said area is reduced sufficiently, said movable end of said leaf spring will snap back to normal position.

3. An electrical switch comprising a housing, a leaf spring within said housing and rigidly supported thereon at one end at a position located on the longitudinal axis of said leaf spring, the other end of said leaf spring movable within said housing, said leaf spring formed of a thin sheet of metal relatively wide in respect to its length with part of its center area cut away to provide a single unobstructed slot along the sides of which are stubby side legs of non-uniform width and a relatively narrow flexible continuous cross-bar at the movable end connecting said legs, said cross-bar unsupported and free to flex on reversing movement of said leaf spring, a contact on said cross-bar, the supported end of said leaf spring being of substantially the same width as the contact carrying cross-bar and the side edges of said leaf spring extending substantially at full width in the direction of the support to present unsupported corner areas which extend laterally from said support and which are free to flex up and down in cooperative movement with other parts of the leaf spring, a contact affixed to said housing adapted to be engaged by the contact on said cross-bar, said leaf spring permanently deformed to provide a raised critical area between the fixed support of said leaf spring and the cut away area, said legs sloping laterally downwardly from their interior edges, means movable through said housing for applying a downward force to said raised area whereby when sufficient force is applied said raised area will snap downwardly and the legs and movable end of said leaf spring will snap upwardly to open or close said contacts, and means within said housing for limiting the movement of the movable end of said leaf spring to prevent said leaf spring from reaching another position of stability whereby said movable end of said leaf spring will return to its normal position upon release of the pressure applied to said raised area.

4. An electrical switch comprising a housing, a leaf spring within said housing and rigidly supported thereon at one end at a position located on the longitudinal axis of said leaf spring, the other end of said leaf spring movable within said housing, said leaf spring formed of a thin sheet of metal relatively wide in respect to its length with part of its center area cut away to provide a single unobstructed slot along the sides of which are stubby side legs of non-uniform width, a relatively narrow flexible continuous cross-bar at the movable end connecting said legs, said cross-bar unsupported and free to flex on reversing movement of said leaf spring, a contact on said cross-bar, the supported end of said leaf spring being of substantially the same width as the contact carrying cross-bar and the side edges of said leaf spring extending at substantially full width sufficiently in the direction of the support to present unsupported corner areas which extend laterally from said support and which are free to flex up and down in cooperative movement with other parts of the leaf spring, a contact affixed to said housing adapted to be engaged by the contact on said cross-bar, said leaf spring permanently deformed to be in the general shape of a very flat truncated cone, pressure applying means operable through said housing, the apex of said cone facing away from said pressure applying means, said pressure applying means adapted to apply pressure to said leaf spring at two opposite symmetrically disposed areas at the bases of said legs whereby when sufficient pressure is applied simultaneously to said areas the movable end of said leaf spring will snap away from its normal open position and the truncated cone formation will partially reverse itself to cause engagement of said contacts, said fixed contact acting as a stop to limit the movement of the movable end of said leaf spring at a position of instability so that when said pressure against said leaf spring is sufficiently reduced said movable end of said leaf spring will snap back to open position as the truncated cone formation reverts to a stable condition.

5. An electrical switch comprising a housing, a leaf spring within said housing and rigidly supported thereon at one end at a position located on the longitudinal axis of said spring, the end portion of said leaf spring laterally adjacent the position at which it is secured on the longitudinal axis extending laterally to an extent substantially equal to the width of the blade to present corner areas which are unsupported and free to flex up or down in cooperative movement with the other parts of the leaf spring, the other end of said leaf spring movable within said housing, said leaf spring formed of a thin sheet of metal cut away in part of its center area to provide a single unobstructed slot along the sides of which are side legs and a relatively narrow flexible cross-bar at the movable end connecting said legs, a contact affixed to said housing and a corresponding contact on said cross-bar adapted to make and break the support with said fixed contact, said leaf spring permanently deformed in the general shape of a very flat cone and having a sensitive area close to said support and means for applying pressure to said sensitive area whereby said leaf spring will be caused partially to reverse itself to change the relationship of said fixed and movable contacts, the direction of movement of said pressure applying means being opposite that of the resulting movement of the free end of said leaf spring.

6. A leaf spring for use in a switch comprising a thin sheet of metal relatively wide in respect to its length, said sheet cut away in its central area to provide a single unobstructed slot with a flexible cross-bar extending across one end thereof, legs connected by said cross-bar extending away therefrom along the sides of said sheet of gradually increasing width, that portion of the sheet beyond said legs and cut-way area being continuous from side to side and of substantially the same width as the cross-bar and extending to a position substantially beyond said cut-away area, an aperture through said sheet on the longitudinal axis at a position where there will be corner areas on both sides of said aperture, said sheet being permanently deformed in the general shape of a very flat truncated cone whereby there will be a raised area between said cut-away area and said aperture and midway of said sides, said spring capable of substantially instantaneous complete reversal of its cone form by the application of sufficient pressure to critical areas with corresponding bending of said cross-bar and said corner areas.

7. A leaf spring for use in a switch, said leaf

spring formed from a thin sheet of metal relatively wide in respect to its length, said sheet being cut away at its interior so as to provide a single unobstructed tapering slot to form a relatively narrow flexible cross-bar extending transversely at one end of said sheet, said leaf spring being of substantially uniform width over its entire length with the sides of one end commencing adjacent the end of said slot and the other ends of said sides terminating a substantial distance beyond the other end of said slot, an aperture through said leaf spring located on the longitudinal axis, said aperture so positioned as to be spaced from the end of said slot and to have corner areas on both sides thereof, said sheet permanently deformed in the shape of a very flat truncated cone whereby upon suitable pressure being applied to sensitive areas of said sheet said cross-bar, tapered legs, and corner

areas will flex in reversed direction from normal to cause substantially instantaneous reversal of the cone formation.

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