

Aug. 8, 1967

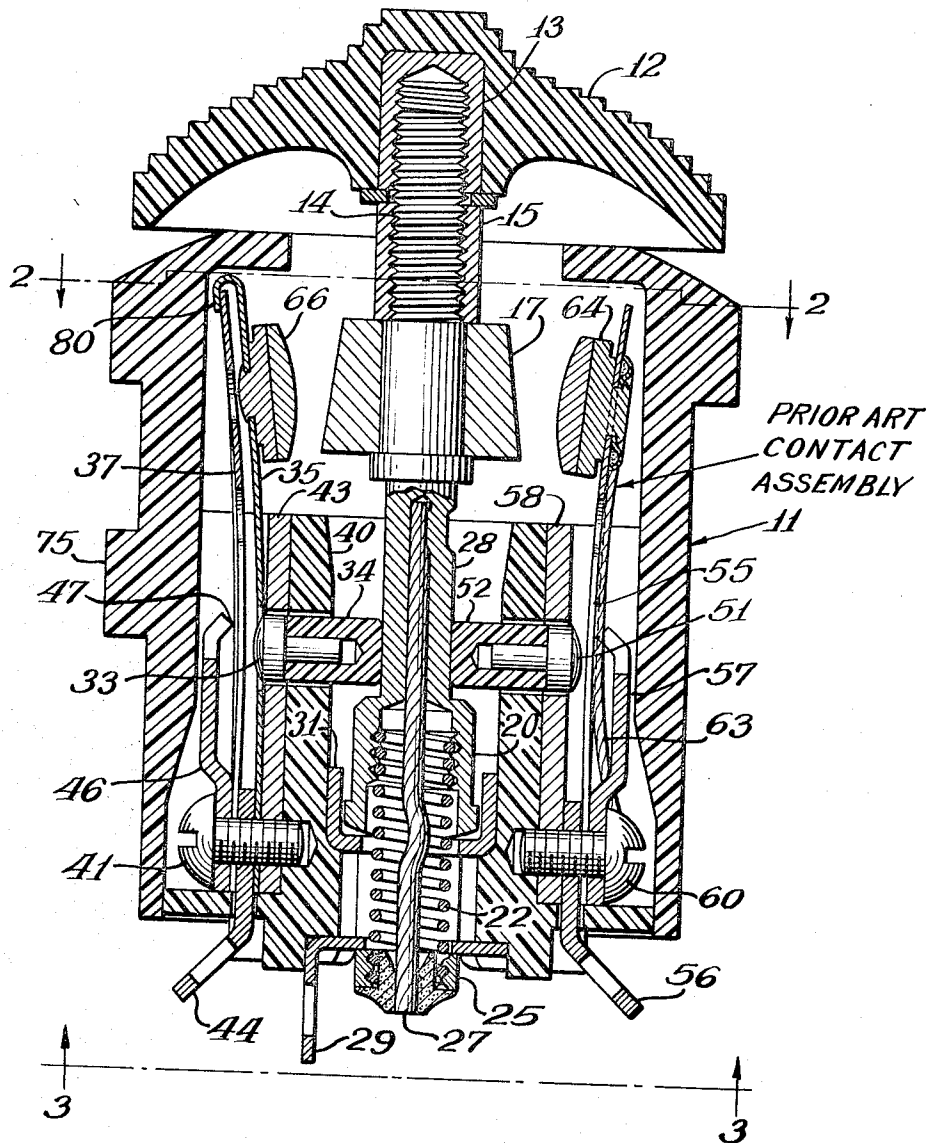
E. DHAENS ETAL
SNAP ACTION SWITCH DEVICE WITH IMPROVED
CIRCUIT BREAKER MECHANISM

3,335,240

Filed March 28, 1966

3 Sheets-Sheet 1

FIG. 1.



Inventors:
Edward Dhaens
Theodore J. Obszarny
Martin Schmidt
By *Bar, Freeman & Molinare*
Attys.

Aug. 8, 1967

E. DHAENS ETAL
SNAP ACTION SWITCH DEVICE WITH IMPROVED
CIRCUIT BREAKER MECHANISM

3,335,240

Filed March 28, 1966

3 Sheets-Sheet 2

FIG. 2.

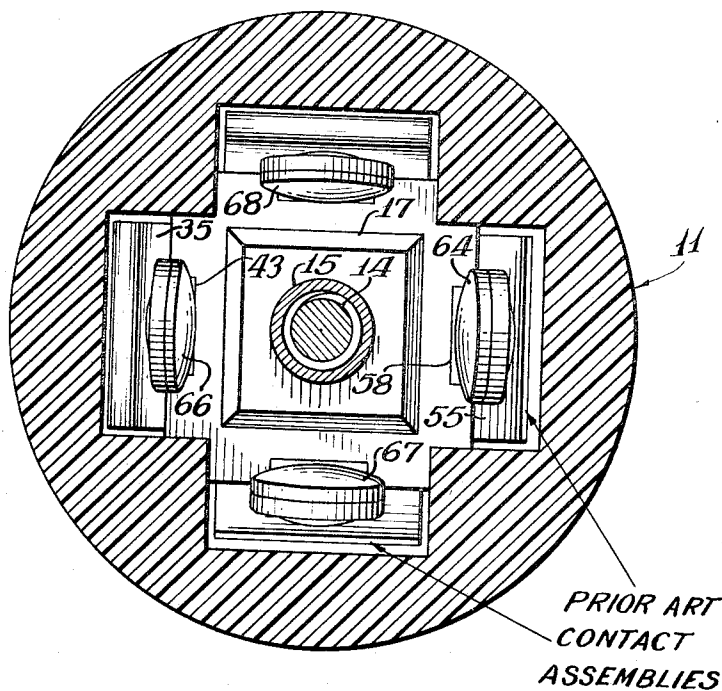
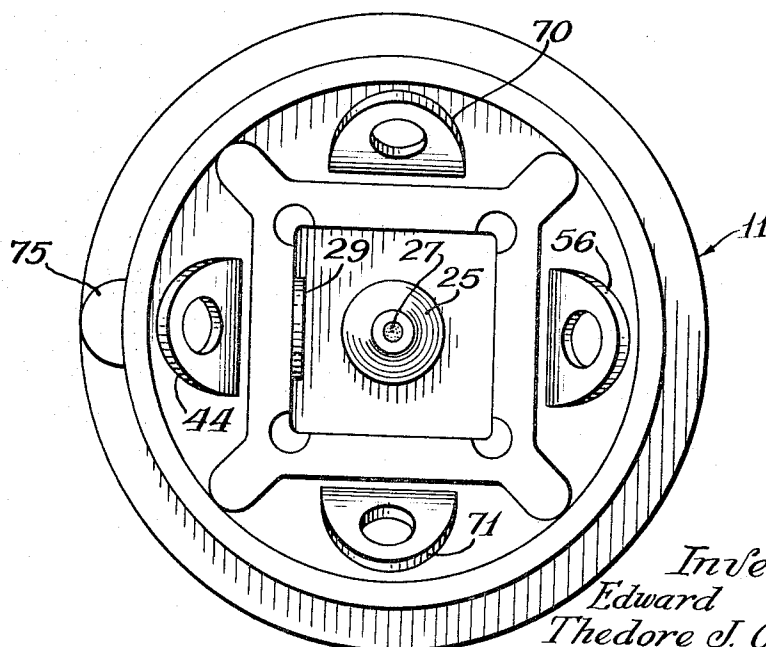


FIG. 3.



Inventors:
Edward Dhaens
Theodore J. Obszarny
Martin Schmidt
By *Beir, Freeman & Molinare*
Attys.

Aug. 8, 1967

E. DHAENS ETAL
SNAP ACTION SWITCH DEVICE WITH IMPROVED
CIRCUIT BREAKER MECHANISM

3,335,240

Filed March 28, 1966

3 Sheets-Sheet 3

FIG. 4.

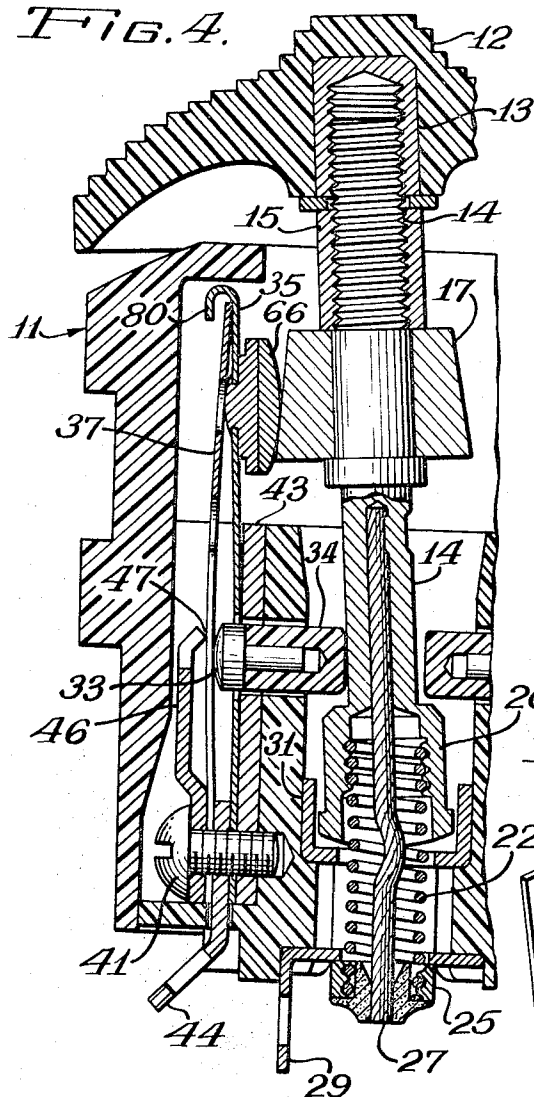


FIG. 5.

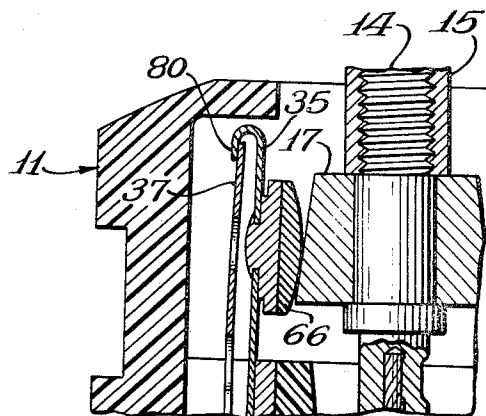


FIG. 7.

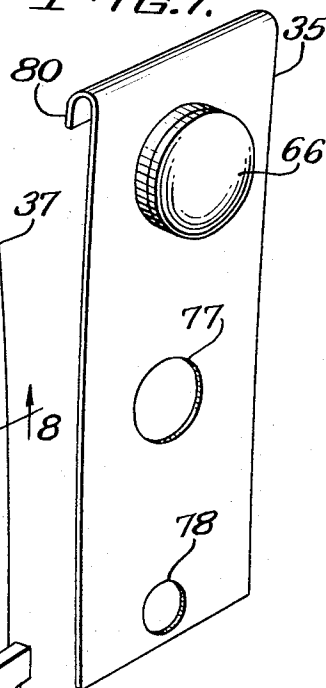


FIG. 6.

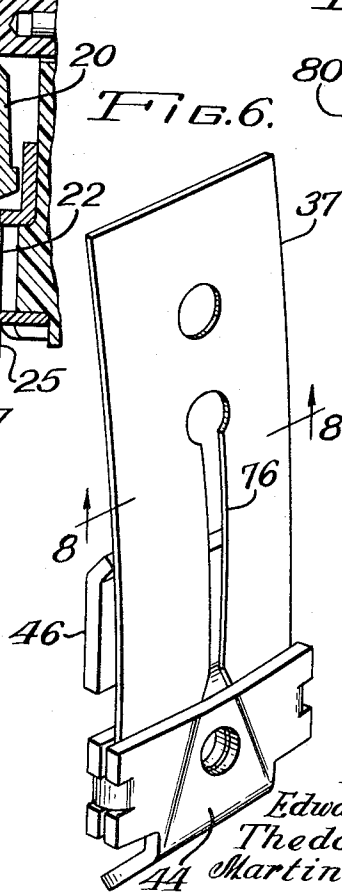
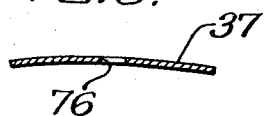


FIG. 8.



Inventors:

Edward Dhaens
Theodore J. Obszarny
Martin Schmidt

By Bair, Freeman & Molinare
Attys.

1

2

3,335,240

SNAP ACTION SWITCH DEVICE WITH IMPROVED CIRCUIT BREAKER MECHANISM

Edward Dhaens, Theodore J. Obszarny, and Martin Schmidt, Chicago, Ill., assignors to Guardian Electric Manufacturing Co., a corporation of Illinois

Filed Mar. 28, 1966, Ser. No. 537,858

5 Claims. (Cl. 200—67)

ABSTRACT OF THE DISCLOSURE

A multi-pole snap action switch including an improvement calculated to eliminate indecisive switch action. That contact member which, in prior art devices, has been affixed to the snap action blade is instead mounted on a highly conductive leaf spring which is parallel with, extends beyond, and is folded over the end of the snap action blade. The folded-over portion of the contact-carrying leaf spring blade thus defines a "lost-motion" gap into which the end of the snap action blade extends. The leaf spring blade is spring loaded to hold the contacts in engagement even though the snap action blade may move slightly before it snaps the switch open.

This invention relates to an improvement in electric switches of the type employing snap-action spring blades.

Snap switches, though simple in construction, possess excellent performance characteristics. Examples of such switches are disclosed in U.S. Patent 2,805,297 which issued to G. J. Campbell on Sept. 3, 1957. Snap switches of this general type have been employed in a wide variety of circuit control applications. These switches normally include a leaf spring blade provided with a longitudinal slot which extends from one end of the blade to a point short of the other end. The bifurcated arms defining the slot are drawn together to stress the blade for snap-action. With one end of such a blade fixedly mounted, the free extending end normally rests in stable equilibrium at a selected off-center position. By applying pressure at an appropriate point on the blade near the slot, the free end of the blade may be made to snap from the previously stable position toward a new position.

In a simple single-pole, normally-open snap switch, it has been the conventional practice to affix one contact to the snap blade itself while the other contact is located such that, when pressure is applied, the stressed blade snaps the two contacts together under substantial pressure to close an electrical circuit. The snap-action is normally accompanied by an audible "click" which serves to notify the operator of the switch that circuit closure has been accomplished.

When the applied pressure is removed, the stressed blade snaps back to its original stable position. The snapping action is accompanied by considerable hysteresis—that is, once sufficient pressure has been applied to cause the blade to be snapped out of its normal stable position, considerably less pressure is required to hold the blade in the new position. As pressure is slowly released, the extended end of the blade may move slightly and open the contacts before the blade makes a return snap to the original position.

This effect, termed "switch teasing," constitutes a serious disadvantage in many applications. As mentioned before, a useful feature of the snap-action switch resides in its capacity to emit an audible "click" at the moment switching is accomplished. Because of the teasing effect, however, partial release of applied pressure, due to inadvertence, may open the circuit without causing the switch to snap back to its original position. Misled by the absence of a return "click," the operator may well be-

lieve that a circuit continues to be energized. When snap switches are used in critical applications, such as aviation control circuits, the failure to provide positive notification of a circuit opening constitutes a particularly serious disadvantage.

In addition, the gap width between the contacts of a "teased" switch may be quite small. This condition may cause serious arcing across the narrow air gap, resulting in damage to the contact surfaces.

It is therefore an object of the present invention to substantially eliminate the teasing effect in snap-action switch.

As noted above, it has been the conventional practice to affix one contact to the stressed snap blade itself. In many applications, it has been found necessary to include auxilliary conductors stretching to the contact on the blade in order to minimize the resistance of the switch and to insure a permanently secure circuit connection to the contact. The provision of a wired contact on the stressed blade has substantially increased the cost and complexity of snap switch assemblies.

It is accordingly a further object of this invention to provide simple and secure low resistance electrical connections to the contacts of a snap-action switch.

In a principal aspect, the present invention takes the form of an improved switching mechanism which is characterized by its substantially total freedom from the teasing effect. According to a first feature of the invention, a first one of a pair of electrical contacts is affixed to a highly conductive mounting member which is under spring tension tending to move the first contact toward the second. An electrical circuit connection is made directly to this mounting member. A snap-action spring blade engages with and moves this mounting member to open the switch contacts.

In a preferred embodiment of the invention, the mounting member is constructed to include a pair of opposing, spaced-apart surfaces which define a gap. A blade which is stressed for snap-action is rigidly affixed at one end and positioned such that the free end thereof extends into this gap, the gap being substantially wider than the width of the blade to permit substantial movement of the blade between the opposing surfaces which define the gap without causing any motion of the spring-loaded contact mounting member. Teasing is thus eliminated by allowing substantial movement of the snap-action blade before the contacts are separated.

These and other objects, features and advantages of the present invention may be more clearly understood by considering the following detailed description. In the course of this description, reference will frequently be made to the attached drawings in which:

FIG. 1 is a cross-sectional view of a five-position switch showing two contact assemblies in detail—one of which employs the principles of the present invention and the other of which, for purpose of comparison, is of a type known in the art;

FIG. 2 is a top cross-sectional view of the five-position switch taken substantially along the lines 2—2 of FIG. 1;

FIG. 3 is a bottom view of the five-position switch of FIG. 1 showing the contact lugs;

FIG. 4 is a fragmentary, cross-sectional view of the multiple-position switch showing the contact assembly according to the present invention in the closed position;

FIG. 5 is a fragmentary, cross-sectional view of contact switch showing the assembly according to the invention and illustrating the manner in which the "teasing" effect is avoided; and

FIGS. 6 and 7 respectively are perspective views of a stressed snap blade and a contact mounting member which may be employed according to the principles of the present invention.

FIG. 8 is a cross-section view of the stressed blade of FIG. 7.

The specific embodiment of the invention shown in FIG. 1 of the drawings is adapted for operation with the thumb and may be mounted within a hand grip of the type shown in U.S. Patent 2,747,057 which issued to T. J. Obszarny on May 22, 1956. The multiple position switch shown includes a cylindrical or barrel shaped body shown generally at 11. The switch is actuated by lateral movements of a button 12. The button 12 includes a plurality of circumferential ridges to provide a friction seat for the thumb. The switch is called a "five-position" switch since it is capable of connecting a conductor to any one of four conductors depending upon the direction in which button 12 is pushed—or, in the central "OFF" position, make no connections at all.

The button 12 includes a metallic threaded liner 13 which engages with the upper end of a threaded shaft 14. A spacer 15 is threaded onto a lower portion of the shaft 14 to provide appropriate vertical positioning of the knob 12. Centrally located on the shaft 14 is a square bottomed contact member 17 formed in the shape of a truncated pyramid. The shaft 14 passes through and extends downwardly from the contact member 17. The lower extremity of shaft 17 includes an enlarged hollow region 20 having a threaded inner surface. A spring 22 is screwed into and mates with this threaded inner surface. At its lower end, the spring 22 mates with the threaded inner surface of a terminal member 25. A conducting wire 27 is swaged into the central portion 28 of shaft 14 and is soldered or otherwise bonded to the terminal member 25 at its lower end to provide an excellent electrical connection between the contact member 17 and the terminal member 25. A downwardly extending lug 29 on the terminal member 25 provides a convenient point for connection of the external circuit.

The deformable spring 22 permits lateral movement of the shaft 19 and returns button 12 to its central position when pressure is removed. The enlarged region 20 of the shaft 14 engages within and is positioned by an annular cup 31 having an open bottom through which the spring 22 and conductor 27 pass. The enlarged region 20 of the shaft 14 is provided with a rounded bottom which rolls easily in the annular cup 31.

When the button 12 is deflected to the left, the shaft 14 engages with and moves a push rod comprising a metal pin 33 and an insulating sheath 34. The pin 33 passes through an aperture in a contact mounting member 35 and bears against a snap-action blade 37. The pin 33 and housing 34 are mounted within an opening in an inner plastic support member 40. The plastic support member 40 includes a threaded hole which receives a mounting screw 41. The contact mounting member 35 is sandwiched between a metal plate 43 and a lug 44, both of which include drilled holes admitting the shaft of screw 41. The metal plate 43 is positioned within a slot in the mounting member 40. The snap-action spring blade 37 is sandwiched between the lug 44 and an angular support member 46 which includes a fulcrum point 47 which bears against the central portion of the blade 37. The lug 44 extends downwardly through an opening in the inner mounting member 40 and is flared outward, as shown in FIG. 3 of the drawings.

A push rod comprising a pin 51 and an insulating sheath 52 passes through an opening in the right hand side of the inner mounting member 40. The metallic pin 51 actuates a contact assembly of the type employed in prior art devices. The disclosure herein of such art switch device is solely for purposes of comparison with the switch device of the present invention. A snap-action spring blade 55 is sandwiched between a lug 56 and an angular member 57, all of which are clamped against a metallic plate 58 by means of a screw 60 which threadably engages the inner mounting member 40.

A copper wire 63 is bonded at its upper end to a con-

tact 64 which is mounted near the extended end of the snap-action blade 55. At its lower end, the wire 40 is soldered or otherwise bonded to the angular member 57 to provide an electrical current path between lug 56 and contact 64. The provision of this added conductor was necessary in the prior art contact assemblies to insure a permanent, low resistance connection to the contact. In the switching arrangement contemplated by the present invention, the mounting member 35 which holds a contact 66 may be made of a highly conductive material such as copper or silver plated spring steel, thus providing an excellent electrical connection between the lug 44 and the contact 66 without requiring additional wire conductors.

As shown in the top view of FIG. 2, the multiple position switch includes the central contact member 17 and four outer contacts 64, 66, 67 and 68. The assemblies holding contacts 66 and 68 employ the principles of the present invention, whereas prior art contact assemblies are employed in conjunction with contacts 64 and 67.

The lug 29 shown in FIG. 3 of the drawings is connected to the central contact member 17 and lugs 44, 56, 70 and 71 are connected to contacts 66, 64, 67 and 70, respectively. A circular key projection 75 extends outwardly from the cylindrical housing 11 to engage with a keyway in the switch holder (not shown) to position the lugs and their respective contacts in an appropriate orientation.

The construction of the contact assembly employing the principles of the present invention is perhaps best shown in the perspective views of FIGS. 6 and 7 of the drawings. The snap-action spring blade 37 includes a longitudinal slot 76 from one end of the blade 37 to a central point on the blade. The bifurcated arms of the blade 37 are drawn together and clamped at an angle to each other by the lug 44 and the angle member 46 as shown in FIG. 6. The blade 37 is thus clamped and stressed for snap-action.

The highly conductive contact mounting member 35 includes a circular opening 77 through which the push rod passes and also includes a circular mounting hole 78 at its lower end. The upper end of mounting 35 is folded back in an arcuate curve such that the downwardly extending flange 80 and the rear face of member 35 provide a pair of opposing, spaced-apart surfaces which define a gap. The snap-action blade 37 is mounted such that its free end extends into this gap. The gap defined by the flange 80 and the rear face of member 35 is substantially wider than the width of the blade to permit movement of the blade between the opposing surfaces of the gap without causing any motion of the mounting member 35.

When the contact assembly contemplated by the invention is in an open position, as shown in FIG. 1 of the drawings, the blade 37 bears against the flange 80 flexing the mounting member 35 away from the central contact 17. The mounting member 35 is under spring tension which tends to move the contact 66 toward the central contact 17 but, in the open position, it is restrained from such movement by the snap-action blade 37.

When the button 12 is deflected toward the left, as shown in FIG. 4 of the drawings, the shaft 14 bears against the insulated sheath 34 and the pin 33 bears against the spring blade 37 in the neighborhood of the slot 76. When the push rod supplies sufficient pressure to the spring blade 37, its upper end abruptly snaps toward the central contact 17. The blade 37 then bears against the mounting member 35 moving the contact 66 into engagement with the contact member 17. It should be noted that the contact member 17 itself moves toward the contact 66.

As pressure is slowly released from the button 12 allowing the contact member 17 to move toward its former central location, the spring tension of mounting member 35 causes the contact 66 to maintain engagement with the contact 17 until the blade 37 makes a return snap to its initial stable position. This effect is shown in FIG. 5 of the drawings. The principles of the present invention

5

thus prevent circuit teasing by maintaining contact closure until the spring blade 37 makes its return snap.

It is to be understood that the embodiment of the invention which has been described is merely illustrative of an application of the principles of the invention. Numerous modifications may be made by those skilled in the art without departing from the true scope and spirit of the invention.

What is claimed is:

1. In a snap action device having a first contact mounted on a shaft, a support for mounting said shaft, and a snap-action spring blade, said blade being substantially parallel to said shaft, the improvement comprising
 10 a second contact mounted on a leaf spring member, said member being biased toward said shaft, being parallel to said shaft and said blade, and being mounted on said support intermediate said shaft and said blade with a portion of its unmounted end folded over the unmounted end of said blade such that the folded portion defines a lost-motion gap within which
 15 said blade can move without moving said leaf spring member, said second contact positioned to communicate with said first contact, said blade being normally biased away from said shaft with a greater relative force than the force biasing said spring member toward said shaft such that said contacts are thereby separated, and
 20 means for causing said snap action blade to flex toward said shaft such that said contacts are made to engage thereby and complete a circuit.

2. A device as set forth in claim 1 wherein said shaft is pivotably mounted on said support and is spring-loaded in a direction tending to disengage said contacts, said de-

6

vice including actuating means coupling said shaft and said snap action blade for flexing said blade in response to the pivotal motion of said shaft.

3. A device as set forth in claim 2 wherein said spring blade is a leaf spring having a longitudinal slot terminating short of the unmounted end thereof, the mounted end thereof comprising means to draw the bifurcated arms of said blade together near the mounted end of said slot thereby creating a snap action blade.

4. A device as set forth in claim 3 wherein said means for coupling said shaft and said snap action blade comprises a push rod mounted perpendicular to and positioned to engage with said shaft and snap action blade, said push rod passing through an opening in said spring member.

5. A device as set forth in claim 4 wherein said device is multiple-pole switching device having said shaft circumferentially surrounded by sets of said biased blade and biased spring members with corresponding biasing means.

References Cited

UNITED STATES PATENTS

2,454,185	11/1948	Kmiecik	200—67
2,515,528	7/1950	Rothwell	200—67
2,540,421	2/1951	Broch	200—67
2,678,974	5/1954	Mason	200—67
2,739,193	3/1956	Mason	200—6

FOREIGN PATENTS

30	1,324,749	3/1963	France.
----	-----------	--------	---------

ROBERT K. SCHAEFER, *Primary Examiner*.

D. SMITH, JR., *Assistant Examiner*.