

SWITCH

FIELD OF INVENTION

The present invention relates to a switch for switching the flow of electrical power and in particular, but not exclusively it relates to an electrical switch utilising a leaf spring.

BACKGROUND OF THE INVENTION

Electrical switches are widely known, and in particular electrical switches utilising leaf springs to switch the flow of electrical power are known. As an example see US patent no.'s US4,398,071 and US5,053,592, which are both incorporated herein by reference, and which utilise horizontally aligned leaf springs. In this publication, a leaf spring is held at opposed edges between two holding means. An actuating member applies a pushing and/or pulling force on the centre region of the blade of the leaf spring, to cause it to flex between two positions, thereby switching the flow of electrical power through the leaf spring.

A disadvantage of the switching apparatuses shown in the above publications is that the configuration of these switching apparatuses may require an installation space of a particular width or height. This width or height may not always be available.

For the purposes of the invention described and claimed in this specification, the term 'leaf spring' is defined to mean a leaf spring or any resiliently flexible blade that is capable of being resiliently flexed.

Further, for the purposes of the invention described and claimed in this specification, the term 'switching' is defined to mean the establishment or termination of an electrical connection between at least two electrical terminals and/or the diversion of an electrical connection between a set of electrical terminals to another set of electrical terminals.

OBJECT OF THE INVENTION

It is an object of the present invention to provide a switch which overcomes or at least partially ameliorates some of the above mentioned disadvantages or which will at least provide the public with a useful choice.

5 SUMMARY OF THE INVENTION

In a first aspect the invention may broadly be said to consist in an electrical switch suitable for switching an electrical connection, said switch comprising

- a switch body member including a plurality of electrical terminals through which an electrical connection may be established;
- 10 • a resiliently flexible conductive leaf spring with two opposed ends,
 - said leaf spring being held towards its opposed ends in an elastically bowed condition, and
 - said leaf spring being movable between a first bowed condition in which the leaf spring is bowed to one side and a second bowed condition in which the leaf spring is bowed to an
 - 15 opposed side;
- an actuating member,
 - said actuating member being pivotally engaged with the switch body member to be movable relative to the switch body member between a first position and a second position,
 - 20 ○ said actuating member being rigidly engaged with an end of said leaf spring, so that pivoting movement of the actuating member between the first position and the second position causes the leaf spring to move between its first bowed condition and second bowed condition respectively, the leaf
 - 25 spring switching an electrical connection between the terminals.

Preferably, said leaf spring is held towards its opposed ends in an elastically bowed condition between the switch body member and holding formations.

30 Preferably, said leaf spring includes engaging formations for engaging with the holding formations.

Preferably, the holding formations may be on the actuating member.

Alternatively, the holding formations may be on the switch body.

Preferably, the leaf spring is held between the actuating member and a support formation on the switch body member.

5 Alternatively, the leaf spring is held between the holding formations on the switch body member and a support formation on the switch body member

Preferably, the switch body member may include a plurality of electrical terminals.

Preferably, said terminals may be adapted to engage with an electrical cable.

10 Preferably, the actuating member includes a pivot formation which is engaged with complementary holding formations on the switch body.

Preferably, the pivot formation is a pivot axis pin.

Preferably, the holding formations are apertures for receiving the pivot axis.

Preferably, movement of said leaf spring between the first condition and the
15 second condition causes the termination and/or connection of an electrical connection between at least two electrical terminals.

Preferably, movement of said leaf spring between the first condition and the second condition causes the diversion of an electrical connection between two electrical terminals.

20 Preferably, the leaf spring includes a strip of conductive material.

Preferably, the leaf spring is composed of conductive material.

Preferably, the leaf spring includes a connection seating member to facilitate the creation of an electrical connection with the electrical terminals.

Preferably, the leaf spring includes an extension formation for extending the
25 distance of travel of the leaf spring from side to side.

Preferably, the extension formation is a tongue formation which extends from the leaf spring, and which does not bow with the leaf spring as it moves between the first bowed position and the second bowed position.

Preferably, the tongue formation is disposed centrally along the leaf spring.

30 Preferably, the tongue formation and leaf spring are formed from a single sheet of material.

Preferably, the extension formation is pressed out of the leaf spring.

Preferably, the connection seating member is located on the extension formation.

Preferably, the leaf spring is composed of metallic material.

5 Preferably, at least one electrical terminal is configured to make contact with the leaf spring at a region intermediate of the ends of the leaf spring when it is in one of the first bowed condition or the second bowed condition.

Preferably, the support formation is a notch.

10 Preferably, the leaf spring is pivotally engaged to the switch body at the notch in the switch body member.

Alternatively, the support formation is a slot.

Alternatively, the leaf spring is rigidly secured to the switch body in the slot of the switch body member.

15 Preferably, the holding formations may be a slot formation on the actuation member

Preferably, the actuation member is rigidly engaged with an end of the leaf spring by the slot formation.

Preferably, the actuating member is a switch button.

Preferably, the switch body member is a housing.

20 In another aspect the invention may broadly be said to consist in an electrical switch comprising:

- a housing;
- a switch button pivotally engaged with said housing and actuatable to move relative to said housing between a first and second position;
- 25 • a first electrical terminal point held by said housing and a second electrical terminal point held by said housing; and
- an elongate conductive leaf spring located in said housing and including a first end and a second end, and in electrical connection with said second electrical terminal point;
- 30 • said leaf spring being held at its first end in fixed location relative to said housing and held at its second end by said switch button, the

distance between the first end and second end being such that the leaf spring is able to toggle between a first bowed condition and second oppositely bowed condition by the actuation of the switch button;

- wherein in said first bowed condition, said leaf spring is pressed against an electrical contact point that is in electrical connection with said first electrical terminal to establish an electrical connection between said first electrical terminal point and said second electrical terminal point; and
- wherein in a second condition, said leaf spring is displaced away from said electrical contact point establishing a disruption in electrical connection between said first electrical terminal point and second electrical terminal point.

Other aspects of the invention may become apparent from the following description which is given by way of example only and with reference to the accompanying drawings.

As used herein the term “and/or” means “and” or “or”, or both.

As used herein “(s)” following a noun means the plural and/or singular forms of the noun.

The term “comprising” as used in this specification [and claims] means “consisting at least in part of”. When interpreting statements in this specification [and claims] which include that term, the features, prefaced by that term in each statement, all need to be present but other features can also be present. Related terms such as “comprise” and “comprised” are to be interpreted in the same manner.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

The invention will now be described by way of example only and with reference to the drawings in which:

Figure 1: shows a cutaway side view of a first embodiment of an electrical switch in a first position in which an electrical connection is created between two terminals;

Figure 2: shows a cutaway side view of a first embodiment of an electrical switch in a second position in which an electrical connection is terminated between two terminals;

Figure 3: shows an exploded assembly view of the first embodiment of a switch;

Figure 4: shows a cutaway side view of a second embodiment of an electrical switch in which an electrical connection can be diverted between two terminals;

Figure 5: shows a perspective view of a first embodiment of an electrical switch;

Figure 6: shows a side view of a first embodiment of an electrical switch;

Figure 7: shows a schematic view of an alternative embodiment of an electrical switch in which the leaf spring is held between the switch body member at one end and holding formations towards the leaf spring's opposed end;

Figure 8: shows an embodiment of a leaf spring for use in the electrical switch, in both an unbowed and a bowed condition;

Figure 9: shows a cutaway side view of a second embodiment of an electrical switch in which an electrical connection can be diverted between two terminals, and uses a leaf spring that has an extension formation;

Figure 10: shows the switch shown in figure 2, but using a leaf spring that has an extension formation;

Figure 11: shows the switch shown in figure 1, but using a leaf spring that has an extension formation;

Figure 12: shows an embodiment of a leaf spring having a tongue formation for use in the electrical switch, in both an unbowed and a bowed condition; and

Figure 13: shows a leaf spring with an alternative tongue formation, in
5 both an unbowed and a bowed condition.

With reference to the above drawings, an electrical switch according to a first aspect of the invention is generally indicated by the numeral 100.

In one embodiment now described and as shown in figures 1-3, 5, 6, 10 and 11, there is provided an electrical switch 100 suitable for switching an electrical
10 connection between at least two terminals. The switch 100 comprises a switch body in the form of a housing 110, an actuating member in the form of a switch button 120, and a resiliently flexible leaf spring 130.

The housing 110 locates a pair of electrical terminals 116, to which electrical connectors such as electrical cables (not shown) can be connected. As may be seen
15 in figure 3, each terminal set comprises a terminal member 117 with a locking screw 118 for locking an electrical cable (not shown) in engagement with the associated terminal member 117.

The switch button 120 is pivotally engaged with the housing 110 to be movable relative to the housing 110 between a first position and a second position
20 as shown in figures 1 and 2, and as indicated by arrow A. The switch button 120 is pivotally engaged with the housing 110 by means of a pivot axis pin 122 which is received into pivot support formations in the form of apertures 114 on the switch housing 110, and which pivots about a pivot axis 123.

The leaf spring 130 is composed of elastically flexible conductive material,
25 such as steel, and has two opposed ends 131 and 132. The leaf spring includes a connection seating member in the form of a rivet 134 through the leaf spring 130 at an intermediate region midway between its two ends 131 and 132. The rivet 134 facilitates the creation of an electrical connection with the electrical terminals 116.

It is envisaged that the leaf spring 130 could have alternative embodiments,
30 as shown in figures 8 and 12. In the embodiment of a leaf spring shown in figure 12 in a bowed and an unbowed position, it has an extension formation in the form of a

tongue formation 137, for extending the distance of travel of the leaf spring 130 from side to side. In this embodiment, the rivet 134 is located on the tongue formation 137 towards the end of the tongue formation 137. The tongue formation 137 is disposed intermediate of the ends 131, 132 of the leaf spring 130 and extends from the leaf spring 130 when the leaf spring is in a bowed condition. The tongue formation 137 does not bow with the leaf spring 130 as it moves between the first bowed position and the second bowed position. Instead, the tongue formation 137 passes through the plane of the leaf spring 130 and extends outwardly on the side the leaf spring 130 is bowed towards. In this way, the effective distance of travel of the rivet 134 is extended, allowing a smaller leaf spring 130 to be used for the same travel distance.

It is envisaged that the tongue formation 137 may be embodied in many different forms, as shown in figure 13. It is further envisaged that tongue formation 137 such as the ones embodied will be pressed, together with the leaf spring 130, out of a single sheet of metal (not shown).

In the embodiment of a leaf spring 130 shown in figure 8, the rivet 134 acts as both an extension formation and connection seating member.

The leaf spring 130 is held in an elastically bowed condition between a support formation in the form of a notch 112 on the housing 110 at one end 131, and a holding formation, in the form of a slot 124 on the switch button 120 at its other end 132. The notch 112 is composed of electrically conductive material, such as brass or copper or steel, and is preferably part of the lower terminal 116a. The leaf spring 130 is further movable between a first bowed condition (as shown in figure 1) in which the leaf spring is bowed to one side and a second bowed condition in which the leaf spring 130 is bowed to the other side (as shown in figure 2).

The switch button 120 is rigidly fixed to the end 132 of the leaf spring 130 by means of a slot formation 124, so that pivoting movement of the switch button 120 between the first position and the second position causes the leaf spring 130 to move (as shown by arrow B) between its first bowed condition and second bowed condition respectively.

Movement of the leaf spring 130 from its first bowed condition in which an electrical connection is made between the two terminals 116, to its second bowed condition in which no electrical connection is made between the terminals 116 will result in the termination of the electrical connection.

5 A second embodiment of the electrical switch 100 is envisaged (as shown in figure 4 and 9) in which the housing 110 locates three electrical terminals 116 a, b, & c. When the leaf spring 130 is moved from its bowed position shown in figure 4 in this embodiment, an electrical connection is terminated between the terminal 116a and output terminal 116b, and a new electrical connection is created between
10 terminal 116a and the other terminal 116c.

It is envisaged that in an alternative embodiment, the one end 131 of the leaf spring 130 need not be pivotally located in a notch 112, but may be held rigidly in a slot (not shown). This embodiment will still allow the movement of the leaf spring 130 to flex from one bowed position to another oppositely bowed position.

15 It is envisaged that the holding formation holding one of the ends of the leaf spring in an elastically bowed condition need not be on the switch button 120, but may instead be on the housing 110.

Figure 7 shows a schematic view of another embodiment of a switch 100 in which the holding formations are in the form of pins 111 extending from the housing 110. In this embodiment, the leaf spring 130 includes engaging formations
20 136 towards an end 132 disposed distally of the notch 112, which engage with the pins 111. The leaf spring 130 is held in a bowed condition between the housing 110 at the notch 112 and the pins 111. The switch button 120 is rigidly engaged with the end 132 of the leaf spring 130 by the slot formation 124, so that pivoting
25 movement of the switch button 120 causes the movement of the leaf spring 130 from one side to an opposed side, thereby switching an electrical connection between the terminals 116.

Further, in another embodiment, it is envisaged that the leaf spring need not be held at its very ends, but may be held in a bowed condition at holding formations
30 (not shown) towards its ends.

Where in the foregoing description reference has been made to elements or integers having known equivalents, then such equivalents are included as if they were individually set forth.

5 Although the invention has been described by way of example and with reference to particular embodiments, it is to be understood that modifications and/or improvements may be made without departing from the scope or spirit of the invention.

10 In addition, where features or aspects of the invention are described in terms of Markush groups, those skilled in the art will recognise that the invention is also thereby described in terms of any individual member or subgroup of members of the Markush group.

CLAIMS:

1. An electrical switch suitable for switching an electrical connection, said switch comprising
 - 5 a switch body member including a plurality of electrical terminals through which an electrical connection may be established;
 - a resiliently flexible conductive leaf spring with two opposed ends, said leaf spring being held towards its opposed ends in an elastically bowed condition, and said leaf spring being movable between a first bowed condition in which the leaf spring is bowed to one side and a second bowed condition in which the leaf spring is bowed to an opposed side; and
 - 10 an actuating member, said actuating member being pivotally engaged with the switch body member to be movable relative to the switch body member between a first position and a second position, said actuating member being rigidly engaged with an end of said leaf spring, so that pivoting movement of the actuating member between the first position and the second position causes the leaf spring to move between its first bowed condition and second bowed condition respectively, the leaf spring switching an electrical connection between the terminals.
2. An electrical switch as claimed in claim 1, wherein said leaf spring is held towards its opposed ends in an elastically bowed condition between the switch body member and holding formations.
3. An electrical switch as claimed in claim 1, wherein said leaf spring includes engaging formations for engaging with the holding formations.
4. An electrical switch as claimed in claim 2, wherein the holding formations are on the actuating member.
5. An electrical switch as claimed in claim 2, wherein the holding formations are on the switch body member.
6. An electrical switch as claimed in claim 4, wherein the leaf spring is held in a bowed condition between the holding formations on the actuating member and a support formation on the switch body member.

7. An electrical switch as claimed in claim 5, wherein the leaf spring is held between the holding formations on the switch body member and a support formation on the switch body member.
8. An electrical switch as claimed in claim 1, wherein said electrical terminals are adapted to engage with an electrical cable.
9. An electrical switch as claimed in claim 1, wherein the actuating member includes a pivot formation which is engaged with complementary pivot support formations on the switch body.
10. An electrical switch as claimed in claim 9, wherein the pivot formation is a pivot axis pin.
11. An electrical switch as claimed in claim 9, wherein the pivot support formations are apertures.
12. An electrical switch as claimed in claim 1, wherein movement of said leaf spring between the first bowed condition and the second bowed condition causes the termination and/or connection of an electrical connection between at least two electrical terminals.
13. An electrical switch as claimed in claim 1, wherein movement of said leaf spring between the first condition and the second condition causes the diversion of an electrical connection between two electrical terminals.
14. An electrical switch as claimed in claim 1, wherein the leaf spring includes a strip of conductive material.
15. An electrical switch as claimed in claim 1, wherein the leaf spring is composed of conductive material.
16. An electrical switch as claimed in claim 1, wherein the leaf spring includes a connection seating member to facilitate the creation of an electrical connection with the electrical terminals.
17. An electrical switch as claimed in claim 1, wherein the leaf spring includes an extension formation for extending the distance of travel of the leaf spring as it moves between the first bowed position and the second bowed position..
18. An electrical switch as claimed in claim 17, wherein the extension formation is a tongue formation which extends from the leaf spring, and which does not

- bow with the leaf spring as it moves between the first bowed position and the second bowed position.
19. An electrical switch as claimed in claim 18, wherein the tongue formation is disposed centrally along the leaf spring.
- 5 20. An electrical switch as claimed in claim 18, wherein the tongue formation and leaf spring is cut from a single sheet of material.
21. An electrical switch as claimed in claim 17, wherein a connection seating member is located on the extension formation.
22. An electrical switch as claimed in claim 1, wherein the leaf spring is
10 composed of metallic material.
23. An electrical switch as claimed in claim 1, wherein at least one electrical terminal is configured to make contact with the leaf spring at a region intermediate of the ends of the leaf spring when it is in one of the first bowed condition or the second bowed condition.
- 15 24. An electrical switch as claimed in claim 6, wherein the support formation is a notch.
25. An electrical switch as claimed in claim 23, wherein the leaf spring is pivotally engaged to the switch body at the notch in the switch body member.
- 20 26. An electrical switch as claimed in claim 6, wherein the leaf spring is rigidly secured to the switch body by the support formation.
27. An electrical switch as claimed in claim 25, wherein the support formation is a slot.
28. An electrical switch as claimed in claim 4, wherein the holding formation is
25 a slot formation on the actuation member.
29. An electrical switch as claimed in claim 27, wherein the actuation member is rigidly engaged with an end of the leaf spring by the slot formation.
30. An electrical switch as claimed in claim 1, wherein the actuating member is a switch button.
- 30 31. An electrical switch as claimed in claim 1, wherein the switch body member is a housing.

32. An electrical switch comprising:

a housing;

a switch button pivotally engaged with said housing and actuatable to move relative to said housing between a first and second position;

5 a first electrical terminal point held by said housing and a second electrical terminal point held by said housing; and

an elongate conductive leaf spring located in said housing and including a first end and a second end, and in electrical connection with said second electrical terminal point;

10 said leaf spring being held at its first end in fixed location relative to said housing and held at its second end by said switch button, the distance between the first end and second end being such that the leaf spring is able to toggle between a first bowed condition and second oppositely bowed condition by the actuation of the switch button;

15 wherein in said first bowed condition, said leaf spring is pressed against an electrical contact point that is in electrical connection with said first electrical terminal to establish an electrical connection between said first electrical terminal point and said second electrical terminal point; and

20 wherein in a second condition, said leaf spring is displaced away from said electrical contact point establishing a disruption in electrical connection between said first electrical terminal point and second electrical terminal point.