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[21] Appl. No. **756,793**
[22] Filed **Sept. 3, 1968**
[45] Patented **Feb. 16, 1971**
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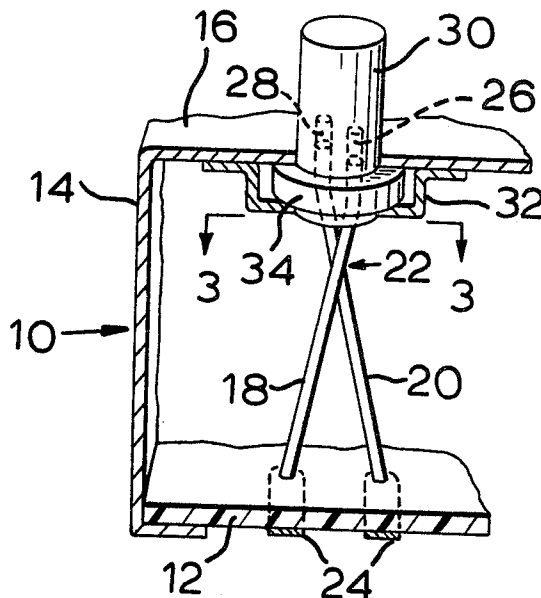
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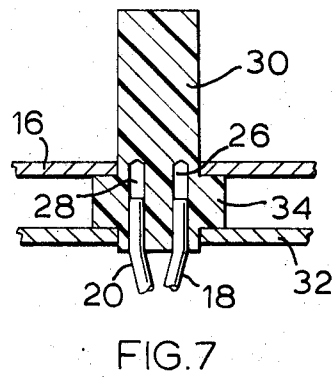
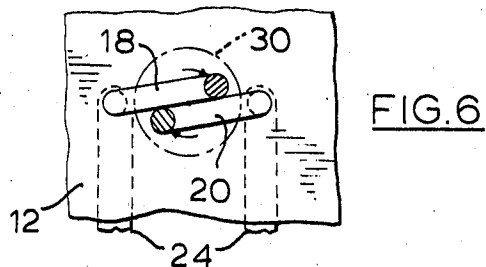
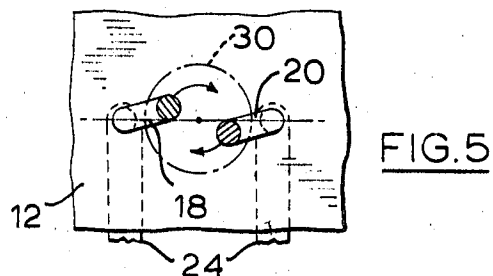
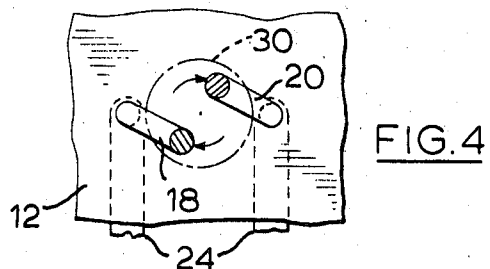
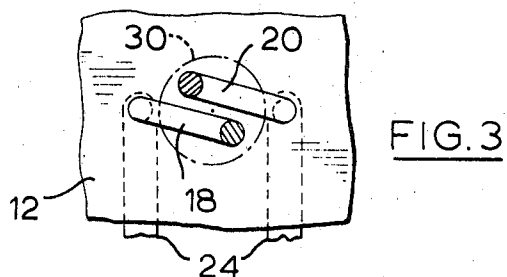
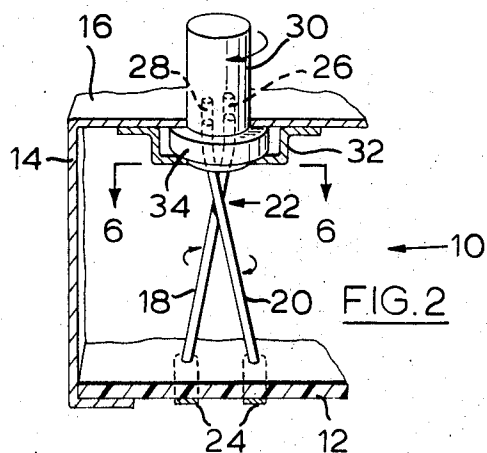
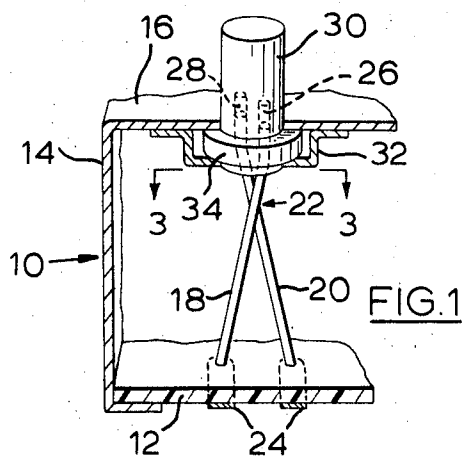
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[54] **RESILIENT CONTACTS FOR ROTARY SWITCH
HAVING AN INTERMEDIATE POSITION OF
UNSTABLE EQUILIBRIUM**
9 Claims, 7 Drawing Figs.

[52] U.S. Cl..... **200/155,**
200/63, 200/67, 200/166
[51] Int. Cl..... **H01h 19/28,**
H01h 19/14, H01h 19/32
[50] Field of Search..... 200/166
(B1), 159 (A), 155, 155.1, 67 (C), 63

ABSTRACT: A switch includes a base member with first and second switch contact elements secured thereto and projecting therefrom. At least one of the elements is movable from a first position in which the elements are disengaged to a second position in which they are engaged. In both positions the elements cross each other when viewed from one angle but are on opposite sides of each other in the two different positions. At least the movable contact element is resilient and passes through a position of unstable equilibrium when moved between the two positions. When attempting to return to the first position after having been moved therefrom through the intermediate position, the movable contact element engages the other contact element.





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RESILIENT CONTACTS FOR ROTARY SWITCH HAVING AN INTERMEDIATE POSITION OF UNSTABLE EQUILIBRIUM

The present invention relates to electrical switches, more especially to electrical switches suitable for use in low power applications.

The switch comprises a pair of switch contact elements secured to and projecting from a base member. At least one of the contact elements, and generally both, is resilient and is movable between positions where the contact elements are disengaged from each other and where the contact elements are engaged with each other, the contact or contacts passing through a position of unstable equilibrium during movement between the aforesaid positions. The contact elements are so oriented in these two positions that they cross each other in the two positions on opposite sides of each other. At least one contact element, and generally both, is deflected during movement from the position where the elements do not engage each other to the position of unstable equilibrium and attempts to return to the original position by dissipation of the spring energy stored within the contact element by this movement. When the contact element is moved through the position of unstable equilibrium, it still attempts to return to its original position, but it is prevented from doing so by engagement with the other contact element.

The invention now will be further described by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation, partly in section, of one embodiment of the invention with the contact elements in non-touching relationship;

FIG. 2 is a side elevation, partly in section, of the switch of FIG. 1 with the contact elements in touching relationship;

FIG. 3 is a section taken along line 3-3 of FIG. 1;

FIG. 4 is a section similar to that of FIG. 3 but with the contact elements rotated to a first intermediate position;

FIG. 5 is a section similar to that of FIG. 3 but with the contact elements rotated to a second intermediate position; FIG. 6 is a section taken along line 6-6 of FIG. 2; and

FIG. 7 is a closeup of an element of the switch of FIGS. 1 and 2.

In the drawings, a switch 10 consists of a base 12 located in a supporting frame 14 having a top wall 16. Mounted in base 12 are two contact elements 18, 20 consisting of resilient, upwardly projecting wires which are inclined to the base and cross each other at a crossover point 22. Contact elements 18, 20 are connected on the underside of base 12 to printed circuit conductors 24. At their upper ends elements 18, 20 are slidably engaged in passages 26, 28 respectively formed in a knob 30. The knob 30 is mounted for rotational movement in a recess formed by the top wall 16 of the frame 14 and by a bracket member 32 which sandwiches a portion 34 of enlarged diameter of the knob 30 between it and the top wall 16.

In operation, the switch is in an "off" position in FIGS. 1 and 3 since the elements 18, 20 do not contact each other at 22, and therefore no circuit is completed between conductors 24. In the position shown in FIGS. 1 and 3 the elements 18 and 20 are relaxed and have no residual spring tension therein. As knob 30 is rotated in a clockwise direction, as indicated by the arrows in FIGS. 4 and 5, the elements 18 and 20 are deflected and ride up in passages 26, 28. Spring energy is stored in the elements by this movement. Considering the position of the elements 18, 20 shown in FIG. 4, if the knob 30 is released, the spring energy will be released, and the elements will again assume their relative location as shown in FIG. 3. Considering the position of the elements 18, 20 shown in FIG. 5, if the knob is released, each of the elements 18, 20 will attempt to assume the position it held in the arrangement of FIG. 3 by release of the spring energy. It is impossible for both elements to assume that position, and, instead, the elements engage each other at the crossover point 22, as seen in FIGS. 2 and 6, thereby completing a circuit between conductors 24. There is residual spring energy in the elements 18, 20 when they are in the position of FIG. 6, since each has failed to assume the at

rest position of FIG. 3, and this spring energy holds the elements in engagement with each other at 22. The position illustrated in FIGS. 6 and 2 thus represents the "on" position of the switch.

To return the switch to its "off" position, i.e., the position shown in FIG. 3, the knob 30 is rotated in an anticlockwise direction. If the knob is released with the elements 18, 20 in the position shown in FIG. 5, the elements will return to the position shown in FIG. 6 by dissipation of a part of the spring energy; whereas, if the knob is released with the elements 18, 20 in the position shown in FIG. 4, the elements will assume the "off" position shown in FIG. 3 by dissipation of all the spring energy stored therein due to the deflection of the elements.

It will be seen from a comparison of FIGS. 1 and 2 that when the switch is in the "off" position, i.e., the position of FIG. 1, the element 20 is nearer to the far side of element 18 than to the near side thereof at the crossover point 22, whereas, when the switch is in the "on" position, the element 20 engages the near side of element 18 at the crossover point 22.

Thus, up to a particular point from the "off" position, release of the knob after rotation towards that point will release the spring energy in such a manner that the contact elements will assume the "off" position shown in FIG. 3, but release of the knob after rotation beyond that point will release the spring energy in such a manner that the contact elements will assume the "on" position shown in FIG. 6. If the knob is rotated to exactly that point, release thereof will have no effect, since the contact elements at that point will be in a state of unstable equilibrium, but the elements will over-toggle to one position or the other by movement thereof from that point.

It will be seen from the foregoing that, while contact elements 18 and 20 always will attempt to return to the position of FIG. 3 when displaced therefrom, once the elements have been displaced to the position thereof shown in FIG. 5, they are unable to spring back in a counterclockwise direction to the position of FIG. 3. Consequently, they attempt to spring to the position of FIG. 3 in a clockwise direction but are prevented from reaching the FIG. 3 position in this direction because of interfering with each other.

It is not essential to the invention that both contact elements be moved by knob 30. Indeed, one of the contact elements may remain perfectly stationary while the other is moved around it.

A switch embodying the present invention is simple in both construction and operation. Having built-in spring action, the operation of the switch is both positive and reliable. The fact that a contact element serves both an electrical function as well as a spring function rather than having two separate members performing these individual functions also is of importance.

In a modified embodiment of the invention openings 26 and 28 may be tapered, being wider at the bottom than at the top. With such an arrangement elements 18 and 20 will be able to move within knob 30 without sliding up and down in the so modified passages 26 and 28.

In another embodiment of the invention one of elements 18 and 20 may extend vertically from base 12 and may have its free end disposed in a centrally located opening in knob 30. In such an embodiment this element will support knob 30 making bracket member 32 unnecessary.

Other embodiments of this invention are possible within the scope of the appended claims.

I claim:

1. A switch comprising: a base member; first and second switch contact elements secured to said base member and projection therefrom; at least one of said contact elements being movable from a first position in which said contact elements are disengaged from each other to a second position in which said contact elements are engaged with each other; said contact elements in said first position being so oriented with

respect to each other that said contact elements cross each other when viewed from one angle with said one contact element being closer to one side of said second contact element than to the opposite side of said second contact element; said contact elements in said second position being so oriented with respect to each other that said contact elements cross each other when viewed from said one angle with said one contact element engaging said opposite side of said second contact element; at least said one contact element being resilient; and means for moving said one contact element between said first and second positions through an intermediate position of unstable equilibrium; said one contact element being deflected during movement thereof from said first position to said intermediate position; said one contact element always attempting to return to said first position by dissipation of spring energy stored in said one contact element during movement thereof from said first position; said one contact element when attempting to return to said first position after movement of said one contact element from said first position through said intermediate position assuming said second position by reason of engagement with said second contact element.

2. The switch of claim 1 wherein both said first and second contact elements are resilient.

3. The switch of claim 2 wherein both said contact elements are connected to said moving means and are movable from said first position to said second position, both said contact elements are deflected during movement thereof from said first position to said intermediate position, both said contact elements always attempt to return to said first position by dis-

sipation of spring energy stored therein during movement from said first position, and both said contact elements engage one another in said second position as they attempt to return to said first position after movement of both said contact elements from said first position through said intermediate position.

4. The switch of claim 1 wherein said first and second contact elements are each resilient wires upstanding from said base member, said wires being inclined towards and crossing each other at a point intermediate their length when viewed from said one angle.

5. The switch of claim 4 wherein said means for moving said one contact element is a knob engaging the free ends of said wires, said knob being adapted for rotational movement about an axis substantially perpendicular to said base member.

6. The switch of claim 5 wherein said free ends of said wires are slidable in said knob.

7. The switch of claim 3 wherein said first and second contact elements are each resilient wires upstanding from said base member, said wires being inclined towards and crossing each other at a point intermediate their length when viewed from said one angle.

8. The switch of claim 7 wherein said means for moving said one contact element is a knob engaging the free ends of said wires, said knob being adapted for rotational movement about an axis substantially perpendicular to said base member.

9. The switch of claim 8 wherein said free ends of said wires are slidable in said knob.

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