April 3, 1956 K. PORLAND 2,740,857

ELECTRIC SWITCH WITH TILTING MOVEMENT

Filed Nov. 18, 1952 2 Sheets-Sheet 1

Fig. 1

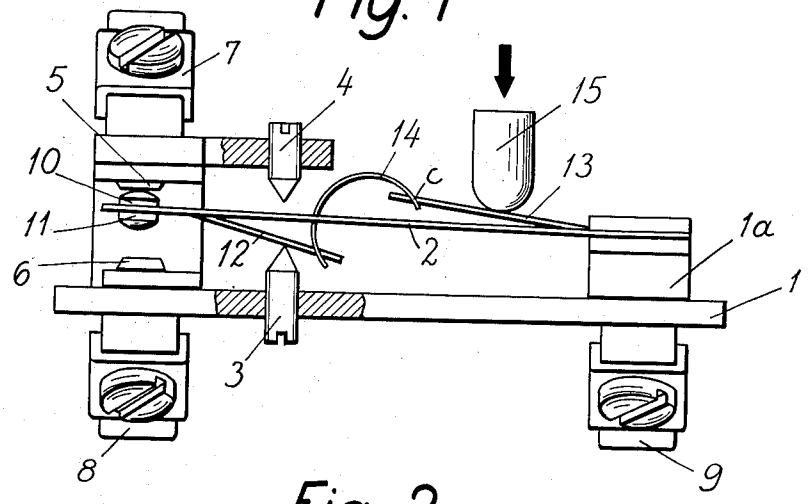


Fig. 2

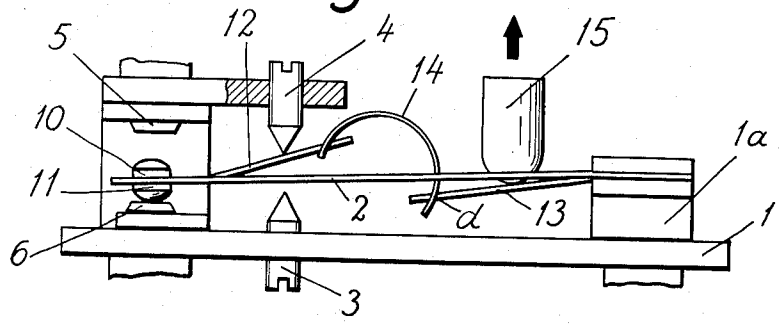
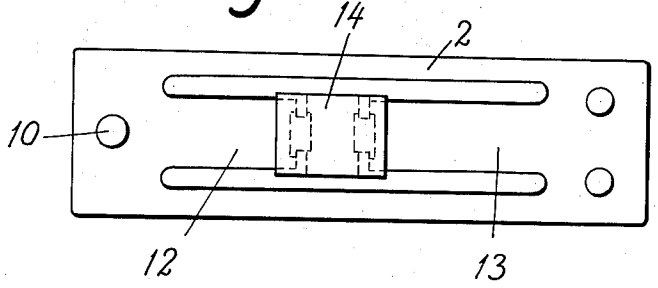


Fig. 3



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Fig. 4

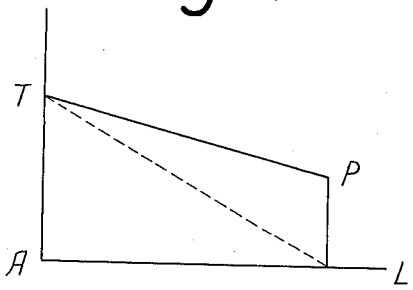


Fig. 5

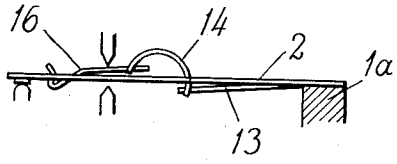


Fig. 7

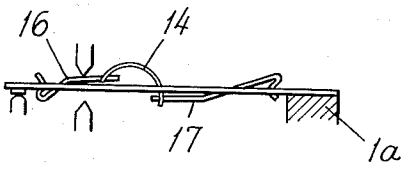


Fig. 6

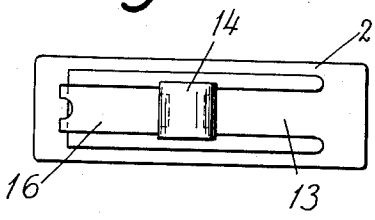


Fig. 8

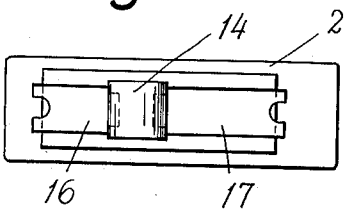


Fig. 9

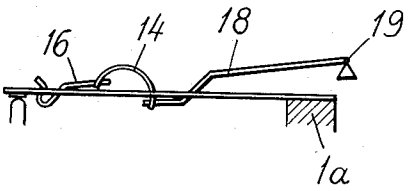
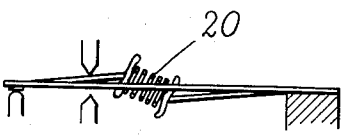


Fig. 10



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ELECTRIC SWITCH WITH TILTING MOVEMENT

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Application November 18, 1952, Serial No. 321,072
Claims priority, application Denmark January 15, 1952
4 Claims. (Cl. 200—67)

This invention relates to an electric switch with tilting movement. At the one end of this switch there is mounted a laminated spring having a first and a second position in which contact is established between one or more contact points disposed on the laminated spring and one or more stationary contact pieces mounted on the frame of the switch. Furthermore, the said switch has a compression spring acting substantially in the longitudinal direction of the laminated spring, the two end points of the said compression spring being fitted between members mechanically connected to the laminated spring or to the frame of the switch. In addition, the switch is provided with a pressure member which may be moved substantially at right angles to the plane of the laminated spring so as to move one end of the compression spring from one side of the plane of the laminated spring to the other, whereby the laminated spring changes instantaneously from its first position to its second position, or reversely.

There are known electric switches of the said kind, characterized by that the contact pressure tends to the same direction as the movement of the compression spring, and in these switches the contact pressure decreases uniformly with the movement of the push button, so that the contact pressure owing to the construction may become very low, in fact as low as nil, without the switch changing its position. This involves the drawback that unsteady electric contact may be liable to occur over a longer period and result in the continued formation of sparks and arcs which will destroy the contact surface in the course of time and cause radio interference. Since such switches are frequently used at places where they cannot be subjected to constant supervision and in districts where radio interference is suppressed by every means, the electric switch disclosed herein constitutes a substantial remedy, since it does not suffer from the said drawbacks, as the contact pressure during the last part of the movement of the push button is subject to initial stress so that it has a final value different from nil and suddenly decreases to nil when the tilting movement has been commenced and no longer can be stopped. Thus, there will be no unsteady contact nor continued formation of sparks and arcs, and the switches will therefore be reliable in operation and not give rise to radio interference.

An electric switch in accordance with the invention is characterized that during the interval immediately before the tilting movement both end points of the compression spring are located on the same side of the plane of the laminated spring. In addition, the compression spring is mechanically connected with the laminated spring in such manner that a member mounted on the last mentioned spring cooperates with a stopping pin, which limits the movement of the laminated spring in the direction of movement of the pressure member and forces the contact point against the contact piece so as to give the contact pressure initial stress.

The movement of the pressure member and the pressure exerted by the contact point against the contact piece tend in opposite directions, and the laminated spring is

caused to tilt when either end points of the compression spring have passed a line through the contact place and the end point of the stopping pin.

In a preferred embodiment in accordance with the invention the said members consist of two tabs of equal or different lengths cut in the laminated spring and projecting from the ends of the spring towards its centre, and the two end points of the compression spring are suspended between the ends of the said two tabs, so that the pressure exerted by the compression spring will force the ends of the tabs away from the plane of the laminated spring. Owing to the action of the pressure member on the one tab it will displace the one end point of the compression spring from one side of the laminated spring to the other.

In another embodiment in accordance with the invention the laminated spring has one tab cut in the spring and projecting from the fixed end of the spring, and a lever mounted pivotably at both ends between the edge of the cutting at the free end of the laminated spring and one end point of the compression spring, the opposite end point of the compression spring being supported by the said tab. In a third embodiment in accordance with the invention the other end point of the compression spring is supported by one end of a lever, the other end of the said lever being pivotably mounted about the edge of the cutting in the fixed end of the laminated spring.

An essential feature of a fourth embodiment in accordance with the invention is that the other end point of the last mentioned lever is mounted so as to be pivotable about a point which is in fixed connection with the frame of the switch.

Further characteristic features in accordance with the invention will be disclosed below where the invention will be further described with reference to the drawing, in which

Figure 1 shows an embodiment of an electric switch according to the invention, viewed from the side, in its first position,

Figure 2 shows the same, in its second position, viewed from the side,

Figure 3 shows the laminated spring and the compression spring, viewed from above,

Figure 4 is a graph showing the contact pressure as a function of the movement of the push button,

Figures 5 and 6 show the essential parts of another embodiment of a switch according to the invention, viewed from the side and from above,

Figures 7 and 8 show the essential parts of a third embodiment of a switch according to the invention, viewed from the side and from above,

Figure 9 shows the essential parts of a fourth embodiment of a switch according to the invention, viewed from the side, and

Figure 10 shows the essential parts of a fifth embodiment in accordance with the invention, viewed from the side.

In the drawing, 1 denotes a frame of an insulating material, in which a laminated spring 2 is fixed at one end to a block 1*a*.

The frame 1 is provided with stopping pins 3 and 4 which in combination with contact pieces 5 and 6 limit the movement of the laminated spring perpendicularly to its plane. The contact pieces are in known manner connected to terminals 7 and 8 for electric cables, if required. The block 1*a* is likewise provided with a terminal 9 for an electric cable or wire. The electric connection through the switch from the terminal 9 to the terminals 7 and 8, respectively, is effected by the laminated spring 2, which has two stable positions of equilibrium, one of which is shown in Figure 1 and the other in Figure 2, and which spring is of electrically conducting material, establishing contact with the stationary contact

pieces 5 and 6 through one or more contact points 10 and 11 projecting at right angles from the free end of the laminated spring. In the embodiment of the invention disclosed in Figures 1 and 2 the laminated spring 2 is provided with two tabs or tongues 12 and 13 of the same or of different lengths, the said tabs being cut in the laminated spring and extending from the ends of the spring towards its centre. In the space between the ends of the two tabs there is mounted a compression spring 14 which in accordance with the invention may be designed as a cylindrical spring plate retained pivotably in known manner by the tabs at projections of the said tabs engaging holes or depressions in the compression spring 14.

The two end points of the compression spring 14 are fixed between the ends of the tabs 12 and 13, so that its pressure, which tends mainly in the longitudinal direction of the laminated spring, forces the said ends slightly away from the plane of the laminated spring. In one position of the switch as disclosed in Figure 1 the tab 12 is held firmly in position against the stopping pin 3 until the contact point 10 rests against the contact piece 5, the tab 12 being acted upon to bend over the end point of the stopping pin 3. In the second position of the switch as disclosed in Figure 2 the tab 12 is similarly held firmly in position against the stopping pin 4 until the contact point 11 rests against the contact piece 6, the tab 12 being acted upon to bend over the end point of the stopping pin 4. In the one position of the switch a push button 15 rests lightly on such side of the tab 13 as is facing in the direction opposite the plane of the laminated spring, and the pressure exerted by the compression spring 14 is counteracted by the bending stress of the tab 13. When the switch is to be acted upon so as to change from its first to its second position, the push button is moved manually or mechanically in the direction of the arrow, that is, the movement of the push button and the pressure exerted by the contact point 10 against the contact piece 5 tend in opposite directions, whereby the switch according to the invention is distinct in operation from the known switch referred to in the foregoing, and the tab 13 hereby moves the one end point *c* of the compression spring 14 from one side of the plane of the laminated spring to the other side.

The compression spring 14 will consequently be somewhat compressed, and its one end point moves from the position indicated at *c*, approaching the position indicated at *d*. Both end points of the compression spring will thereby be located on the same side of the laminated spring i. e. below spring 2, the result of which will be that the contact pressure of the contact point 10 will be subjected to initial stress until the moment when both end points of the compression spring pass a line through the contact place and the end point of the stopping pin. When this occurs, the laminated spring will instantaneously change from its first to its second position as indicated in Figure 2, the contact pressure for the contact between the point 10 and the contact piece 5 suddenly decreasing from the initial stress value *p* to nil as indicated in Figure 4. For comparison Figure 4 shows by a broken line the variation of the contact pressure for the aforesaid known electric switch, and it will be seen from the said figure that the contact pressure in this known switch decreases gradually down to nil, which results in unstable contact with the aforementioned drawbacks.

When the switch has changed to its second position, the contact point 11 rests against the contact piece 6 at a great contact pressure due to the fact that the tab 12 is acted upon so as to bend over the end point of the stopping pin 4. In one embodiment according to the invention the stationary contact pieces in one position of the switch consist of non-contact bearing stops, and it will be obvious to anyone skilled in the art that the contact point 11, or 10, in that case may be dispensed with or be substituted by a stopping head.

If the pressure exerted by the push button 15 against the tab 13 gradually ceases, the one end point of the compression spring 14 will move from the position indicated at *d* to the position indicated at *c*, and the direction of movement of the push button, indicated by the arrow in Figure 2, will again be opposite that of the contact point, in this case the direction of the pressure exerted by the contact point 11. The contact pressure between the contact point 11 and the contact piece 6 will thereby decrease as described in the foregoing until it decreases from the initial stress value *p* to nil as shown in Figure 4 when the switch instantly changes from its second to its first position.

In another embodiment in accordance with the invention shown in Figures 5 and 6, the laminated spring has one tab 13 only, cut in the spring and extending from the fixed end of the spring. A lever 16 is mounted between the edge of the cut in the free end of the laminated spring, so as to be pivotable about the edge of the said cut, and one end point of the compression spring, whereas the other end point of the compression spring is supported by the tab 13.

In a third embodiment shown in Figures 7 and 8 both of the previously mentioned tabs 12 and 13 have been substituted by levers, the tab 12 being substituted by the lever 16 similar to that shown in Figures 5 and 6, but, furthermore, the tab 13 has been dispensed with, and according to the invention the other end point of the compression spring is supported by one end of a lever 17, whereas the other end of the said lever 17 is mounted pivotably about the edge of the cut in the fixed end of the laminated spring.

Furthermore, a fourth embodiment, shown in Figure 9, will now be described. According to this embodiment of the invention the other end point 19 of a lever 18 is mounted pivotably about a point which is in fixed connection with the frame 1 of the switch. The advantage obtained hereby is that the push button acts on a longer lever than in the embodiments disclosed in the foregoing.

It will be obvious to anyone skilled in the art that the embodiments disclosed in Figures 5–9 may be combined with the embodiment shown in Figures 1–3 by the use of the tab 12 in combination with the levers 17 or 16. Furthermore, in an embodiment in accordance with the invention the compression spring may consist of a cylindrical spring plate and in another embodiment it may consist of a helically wound wire or a plate-shaped strip 20, as shown in Fig. 10.

What I claim and desire to secure by Letters Patent is:

1. A snap action mechanism comprising an elongated member of relatively thin spring material having an elongated aperture therein, one end of said member being fixed and the opposite end being movable into either of two positions, a first tongue extending from a fixed point adjacent said fixed end of said member toward the side of said aperture opposite said fixed end, a second tongue extending from said opposite side of said aperture, the adjacent extremities of said tongues being spaced from each other, a pair of abutments fixedly positioned between the ends of said second tongue and situated on opposite sides thereof, a biasing spring extending between and connected to said adjacent extremities to force said tongues to respectively assume positions on opposite sides of the plane of said member and to pivot said second tongue about one of said abutments, thereby to force said opposite end of said member to move in one direction, and actuating means in cooperative relation with said first tongue to move it through said aperture to the opposite side of said member until, under the action of said biasing spring, said second tongue is suddenly moved out of contact with said one abutment and through said aperture and into pivotal contact with the other of said abutments, thereby to force said opposite end of said member to move suddenly in the opposite direction.

2. An electric snap switch mechanism comprising an elongated switch member of relatively thin spring material having an elongated aperture therein and having one end fixed and an opposite end movable into or out of contact with at least one contact positioned at a predetermined distance from a side of said switch member, a first tongue extending from the side of said aperture near said one end of said switch member toward the opposite side of said aperture, a second tongue extending from said opposite side of said aperture, the adjacent extremities of said tongues being spaced from each other, a pair of abutments fixedly positioned between the ends of said second tongue and situated on opposite sides thereof at distances less than said predetermined distance, biasing means comprising a spring extending between and connected to said adjacent extremities to force, said tongues to respectively assume positions on opposite sides of the plane of said switch member and to pivot said second tongue about one of said abutments, thereby to force said opposite end into one position relative to said contact, and actuating means in cooperative relation with said first tongue to move it through said aperture until under the action of said spring said second tongue is suddenly moved out of contact with said one abutment, through said aperture and into pivotal contact with the other of said abutments, thereby to force said opposite end of said switch member to move suddenly into another position relative to said contact.

3. An electric snap switch mechanism comprising a base, an elongated switch member of relatively thin spring material having an H-shaped aperture therein to provide a pair of flexible tongues extending toward each other, one end of said member being movable into contact with either of two contacts positioned at predetermined distances from opposite sides of said switch member, a pair of abutments fixedly positioned between the ends of said switch member and situated at distances less than said predetermined distances on opposite sides of the one tongue which extends from said opposite end, a spring extending between and connected to the adjacent extremities of said tongues to force them to assume respective positions on opposite sides of the plane of said switch member and to pivot said one tongue about one of said abutments, thereby to force said opposite end into engagement with the contact situated on the side of said switch member opposite said one abutment, and actuating means in cooperative relation with the other tongue to move it through said aperture until under the action of said spring said one tongue is suddenly moved out of contact with said one abutment, through said aperture and into pivotal contact with the other of said abutments, thereby to force said opposite end of said switch member to move suddenly into contact with the oppositely positioned contact.

4. An electric snap switch mechanism comprising an elongated switch member of relatively thin spring material having an elongated aperture therein and having one end fixed and the opposite end movable into contact with either of two contacts positioned at predetermined distances from opposite sides of said switch member, a first lever pivoted at one end at a fixed point near the side of said aperture at said one end of said switch member and extending toward the opposite side of said aperture, a second lever pivoted on and extending from said opposite side of said aperture, the adjacent extremities of said levers being spaced from each other, a pair of abutments fixedly positioned between the ends of said second tongue and situated on opposite sides thereof at distances less than said predetermined distances, biasing means comprising a spring extending between and connected to said adjacent extremities to force said levers to respectively assume positions on opposite sides of the plane of said switch member and to pivot said second lever about one of said abutments, thereby to force said opposite end into engagement with the contact situated on the side of said switch member opposite said one abutment, and actuating means in cooperative relation with said first lever to move it through said aperture until, under the action of said spring, said second lever is suddenly moved out of contact with said one abutment, through said aperture and into pivotal contact with the other of said abutments, thereby to force said opposite end of said switch member to move suddenly into contact with the oppositely positioned contact.

References Cited in the file of this patent

UNITED STATES PATENTS

2,425,159	Meyer	Aug. 5, 1947
2,428,172	Miller	Sept. 30, 1947
2,439,747	Nelson	Apr. 13, 1948
2,502,326	Koonz et al.	Mar. 28, 1950
2,521,277	Aubert	Sept. 5, 1950
2,663,770	Cox	Dec. 22, 1953

FOREIGN PATENTS

965,336	France	Sept. 8, 1950
251,998	Switzerland	Nov. 1, 1948