



## UNITED STATES PATENT OFFICE

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## ELECTRIC SWITCH

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Our invention relates to electric switches, more particularly to electric switches of the push button type, and has for its object simple and reliable means for securing the switch against operation by severe shocks.

In carrying out our invention, in one form, we provide a latch for locking the switch member together with a push button operating member which when depressed first withdraws the latch to release the switch member, and then operates the switch member to another switching position.

For a more complete understanding of our invention, reference should be had to the accompanying drawing in which Fig. 1 is a side elevation view partly in section of an electric switch embodying our invention; Fig. 2 is a front elevation view of the device shown in Fig. 1; Fig. 3 is a view mainly in section taken along the line 3-3 of Fig. 2 looking in the direction of the arrows but showing the button depressed to release the main plunger; while Fig. 4 is an exploded view showing details of the various parts.

We have shown our invention in one form as applied to a push button switch of the type described and claimed in U. S. Patent 1,853,964, issued on April 12, 1932, to George H. Dorgeloh and Thomas I. Maslin. The device comprises a main operating plunger 10 slidably mounted in an aperture 11 provided for it in a support 12 made of electrically insulating material, preferably a molded compound. A bridging contact member 13 made of suitable electrically conducting material, such as copper, is mounted on the lower end of the plunger 10 in position to engage and electrically connect together stationary contacts 14 and 15 in its raised position or engage stationary contacts 16 and 17 in its lowered position. Normally, the plunger and bridging contact are maintained in their raised position by a helical spring 18, as shown in the drawing. This is a normal position of the switch, and it is an object of our invention to provide latching means for securing the plunger in this raised position against severe shocks.

In accordance with our invention, we provide an auxiliary plunger 19 which is slidably mounted in a suitable aperture provided for it in a metal collar 20 having a central aperture 21 providing a sliding fit for the plunger 10. At its upper end the collar 20 is provided with a counterbore 22 in which the lower end of the spring 18 extends and is seated on the shoulder thereby formed. This collar is thus

secured in position by plunger 10 and the spring 18.

To provide for the latching of the plunger 10, a laterally extending recess 23 is provided in the plunger 10 on its side adjacent the auxiliary plunger into which the inner end of the auxiliary plunger normally extends, as shown in Fig. 1, thereby to latch the main plunger in its raised position.

To provide for the withdrawal of the auxiliary plunger 19 prior to depression of plunger 10 to its other switching position, the operating button or knob 24 which is a hollow cylindrical member having a closed upper end is normally maintained slightly raised with respect to the main plunger 10 by means of a helical spring 25. This spring is considerably weaker than the main spring 18 to provide for depression of the plunger and compression of this spring without appreciable compression of the spring 18. It will be understood that this preliminary movement of the button 24 must be effected without sufficient movement downward of the main plunger 10 to cause the upper wall of the recess 23 to engage the auxiliary plunger 19 and apply a frictional binding action preventing withdrawal of the auxiliary plunger. Preferably as shown the button 24 is made of an electrically insulating molded compound.

As the button 24 is thus initially depressed, cam surfaces 26 and 27 on its lower edge engage the sides of a double link 28 connecting the auxiliary plunger 19 with a pivot bracket 29. Thus it will be observed that the button has a lengthwise extending or upright slot 30, the side walls of which at their lower ends embrace the bracket 29. When the button is depressed, the rounded lower ends 26 and 27 engage respectively cam projections 30a (only one of which is shown) on the two sides of the link 28. This forces the lower end of the link outward, the link moving in a counter-clockwise direction, as seen in Figs. 1 and 3, about its pivot 31 on the bracket 29. Thus, as shown in Fig. 3, when the button has been depressed far enough to engage the upper end of the main plunger, the auxiliary plunger is withdrawn far enough to free the main plunger, i. e., its inner end is withdrawn from the aperture 21. Further depression of the button now moves the main plunger downward and operates the switch in the normal way.

When the button is released, the springs 18 and 25 return the button and main plunger to the positions shown in Fig. 1 whereupon the

auxiliary plunger 19 is moved into the recess 23 by a spring 32 which surrounds the pivot 31 and has its ends bearing on the link 28.

It will be understood that the switch is affected by shocks only to the extent that the main plunger 10 is moved by the shock. Moreover, it is contemplated that the plunger normally will be in its raised position, as shown in Fig. 1, so that shocks tending to move the plunger upward will not affect it. Therefore, the auxiliary plunger must latch the main plunger only against shocks which tend to move the main plunger downward, i. e., against shocks applied to the support 12 in an upward direction. Such shocks, however, also would move the button 24 downward. Actually this movement is relative for it is the support which is moved directly by the shock, the parts tending to remain stationary by reason of their inertia. Thus it might be inferred that the button 24 might be moved by the shock far enough downward to withdraw the auxiliary plunger. This action is prevented, however, by the fact that the button made of a molded compound is much lighter in weight and consequently has much less inertia than the main plunger and other parts carried by the plunger which tend to remain stationary. Moreover, a shock produces a binding or locking action between the main and auxiliary plungers preventing withdrawal of the auxiliary plunger by the button due to the effect of the shock. Thus it will be understood that the main plunger tends to move downward relatively during shock whereby the upper wall of the recess 23 engages the auxiliary plunger with a very substantial force and thus creates enough friction between the auxiliary plunger and the parts engaged by it to prevent its withdrawal.

It will be observed that the button 24 is provided with a bore 33 which is a free sliding fit outside of the collar 20. Also, on its upper end the plunger 10 has secured to it a washer 34 provided with a circumferential flange 35 which is a sliding fit in the bore 33.

We have shown the bridging contact 13 with skewed end contact portions 36 and 37 giving an effective wiping action as described and claimed in the aforesaid Dorgeloh et al. patent. This bridging member is provided with a central aperture 38 through which the plunger 10 extends. On the end of the plunger is a nut 39 provided with an outer cylindrical electrically insulating portion 40 which fits slidably in a guide bore 41 in the support. By means of a helical spring 42 the bridging member normally is forced downward on the plunger 10 against a washer 43 resting on the nut 39. As shown, this spring 42 encircles the plunger 10 and has its upper end bearing against a washer 44 which in turn is seated against shoulders on the plunger 10, these shoulders being formed by making round the lower end of the plunger encircled by the spring and the washer 44 whereas the upper remaining part is square. This square cross section of the plunger has a correspondingly square aperture 11 for it in the support whereby the plunger is held against turning and likewise the collar 20 is provided with a square aperture to secure it against turning on the plunger.

While we have shown a particular embodiment

of our invention, it will be understood, of course, that we do not wish to be limited thereto since many modifications may be made, and we therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A switch comprising a movably mounted switch member including an operating member for said switch member, a first relatively strong spring biasing said operating member to a predetermined position whereby said switch member is biased to a predetermined first switching position, a latch member normally engaging said operating member when said operating member is in said first position thereby to hold said operating member in said position in the event of a shock applied to said switch, a second operating member movably mounted on said first operating member, a second relatively weak spring between said operating members for biasing said second operating member in spaced relation with said first operating member, said second operating member being movable first into engagement with said first operating member by the compression of said second spring without substantial movement of said first operating member against the force of said first relatively strong spring, and means operated by said second operating member during such first movement for moving said latch member to release said first operating member after which said two operating members are movable together to compress said first spring and move said switch member into a second switching position.

2. A switch comprising a movably mounted switch member including an operating member for said switch member, a first relatively strong spring biasing said operating member to a predetermined position whereby said switch member is biased to a predetermined first switching position, a latch member normally engaging said operating member when said operating member is in said first position thereby to hold said operating member in said position in the event of a shock applied to said switch, a second operating member movably mounted on said first operating member, a second relatively weak spring between said operating members for biasing said second operating member in spaced relation with said first operating member, said second operating member being movable first into engagement with said first operating member by the compression of said second spring without substantial movement of said first operating member against the force of said first relatively strong spring, and means operated by said second operating member during such first movement for moving said latch member to release said first operating member after which said two operating members are movable together to compress said first spring and move said switch member into a second switching position, said second operating member being constructed and arranged to have a relatively small inertia to prevent movement of said latch by said second operating member in response to a shock applied to said switch.

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