

## LEVER SWITCH

### Industrial Field of Application

This invention relates to a lever switch suitable for use as a switch in, for example, an automobile room lamp.

### Prior Art

Examples of this type of lever switch of the prior art are disclosed in Japanese UM Laid-Open No. 2-145742 and its corresponding U.S. Pat. No. 5099095 as well as other US Pat. Nos. 4272662, 4778964, 3858012 and 4000383.

U.S. Pat. No. 5099095 relates to an application of the inventor of the present application, and application on which it is based is the above-mentioned Japanese UM Laid-Open No. 2-145742.

This prior art is a lever switch respectively comprising: an insulating base formed from plastic, hinge bosses formed in opposition to this base, an operating lever that pivots in the holes (indentations) of its hinge pieces that form a pair with the hinge bosses, a thin-walled bridging piece that occupies the lower portion of the hole (indentations) formed in the lower

portion of the operating lever, a roughly U-shaped movable contact piece inserted into this bridging piece and having a pair of opposing contact points about the above-mentioned hole (indentation), and a 1st fixed contact piece and 2nd contact piece attached to the above-mentioned base on both sides of the movable contact piece.

In the above-mentioned prior art, by operating the operating lever by rotating with the above-mentioned hinge bosses serving as the fulcrum, electrical continuity can be established between each of the 1st and 2nd contact pieces with the movable contact piece inserted into the lower bridging piece of this operating lever, thereby enabling the lighting of, for example, a straight tube lamp.

In addition, by tilting the operating lever to interrupt the electrical continuity between each of the fixed contact pieces, a straight tube lamp, for example, can be turned off. In this example of the prior art, however, when performing the switching operation of the operating lever, since there are no means of obtaining a sense of moderation, namely the feel of the timing of the switching operation generally in terms of a clicking action or snapping sensation, only an unreliable switching sensation is able to be obtained, thus having the problem of creating

apprehension over its use. Further, there is a problem that the lamp is turned off when the operating lever is moved even slightly.

Summary of the Invention:

In order to eliminate each of the above-mentioned problems, the object of the invention is to allow the obtaining of a sense of switching moderation, namely to obtain a clicking action both reliably so that the switching is done smoothly without flickering of the lamp and yet to obtain such lever switch inexpensively.

The above-mentioned object of the invention was able to be achieved by providing opposing walls protruding from one surface of an insulating substrate formed from plastic, supporting the inner surfaces of each of these walls and hinge pieces on both sides of an operating lever with a hinge mechanism in pivoting fashion, installing a movable contact piece formed in roughly the shape of the letter "U" from a resilient conductor having a pair of contact points in the lower portion of the above-mentioned operating lever, having fixed contact piece supporting walls plates formed respectively extending from the above-mentioned opposing walls with this movable contact piece in between,

arranging one fixed contact piece on the inner surface of one fixed contact piece supporting wall, and arranging one or a plurality of fixed contact pieces on the inner surface of the other fixed contact piece supporting wall to comprise a lever switch in which each of these fixed contact pieces are led to the outside of the above-mentioned support plates and form a portion of a distribution member; wherein, together with arranging a wide fixed contact piece that forms depressions in the inner surface of one fixed contact piece supporting wall, narrow fixed contact pieces are arranged in opposition to the above-mentioned depressions on the inner surface of the other fixed contact piece supporting wall.

Fig. 1A is an exploded perspective view of the lever switch of the present invention.

Fig. 1B is an exploded perspective view of a lever switch of another embodiment of the present invention.

Fig. 2A is a vertical cross-sectional view of the lever switch of the present invention during assembly and after assembly.

Fig. 2B is a vertical cross-sectional view of the lever switch of another embodiment of the present invention after assembly.

Fig. 3A and 3B are an explanatory drawing showing an operating state of the lever switch of the present invention.

Fig. 4A and 4B are an explanatory drawing showing an operating

state of the lever switch of the present invention.

Fig. 5A and 5B are an explanatory drawing showing an operating state of the lever switch of the present invention.

#### Embodiments of the Invention

First, as shown in Figs. 1A and 2A, in the basic form of the invention, opposing walls 2 and 3 are provided projecting from and integrated into a single unit with the upper surface of insulating base 1 formed from a plastic such as polypropylene or ABS plastic, hinge pieces 5 of operating lever 6 also formed from plastic make contact with hinge bosses 41 formed in opposition to each other on the inner surface of each opposing wall 2 and 3, hinge pieces 5 engage with the above-mentioned bosses with their holes 51a while deflecting inward as shown in Fig. 2A(a), and operating lever 6 is supported in pivoting fashion by the above-mentioned opposing walls 2 and 3 as shown in Fig. 2A(b).

As shown in Figs. 1B and 2B, in another embodiment of the present invention, opposing walls 2 and 3 are provided projecting from and integrated into a single unit with the upper surface of insulating base 1 formed from a plastic such as polypropylene or ABS plastic, hinge bosses 52a of hinge pieces 5 formed on operating lever 6 also formed from plastic make contact with inclined boss guide surfaces 2a and 3a formed in opposition to

each other on the inner surfaces of the upper portion of each opposing wall 2 and 3, hinge bosses 52a engage with hinge holes 4 of opposing walls 2 and 3 after passing over the above-mentioned inclined surfaces 2a and 3a while hinge pieces 5 are deflected inward in opposition to their resiliency, and operating lever 6 is supported in pivoting fashion by the above-mentioned opposing walls 2 and 3 as shown in Fig. 2B.

Furthermore, operating lever 6 may be supported in pivoting fashion by opposing walls 2 and 3 while the upper portions of opposing walls 2 and 3 are deflected outward in opposition to their resiliency.

Locking tabs 6c are formed facing upward as shown in Fig. 1A on the above-mentioned operating lever 6 roughly in the center of bridging piece 6b that occupies the lower portion of hole 6a formed in advance in its lower portion. Movable contact piece 9, formed roughly into the shape of the letter "U" from a resilient conductor strip of phosphor bronze and so forth and having a pair of contact points 9a opposing these locking tabs 6c within the above-mentioned hole 6a, is reliably provided by engaging and locking with locking edges 9b in opposition to its resiliency as shown in Figs. 2A(a) and 2A(b).

In addition, together with arranging wide fixed contact piece 10 as shown Fig. 2A(b) and Fig. 3B, in which are formed depressions 10a, in the inner surface of fixed contact piece guide groove of one fixed contact piece supporting wall 2A of wide fixed contact piece supporting walls 2A and 3A each formed to extend integrated into a single unit as shown in Fig. 1A from the above-mentioned opposing walls 2 and 3 about movable contact piece 9, two narrow fixed contact pieces 11 that oppose the above-mentioned depressions 10a are arranged on the inner surface of the other fixed contact piece supporting wall 3A as shown in Figs. 2A and 3B. Regarding the number of the above-mentioned narrow fixed contact pieces, it may be selected in accordance with the switch circuit used. One or plural fixed contact pieces can be used. A switch having two fixed contact pieces 11 is shown in the drawing, but it can be said, of course, that only one fixed contact piece can be used for an on-off switch.

Moreover, these fixed contact pieces 10 and 11 are led to the outside of the above-mentioned fixed contact piece supporting walls 2A and 3A as shown in Fig. 3(B), and lead portions 10A and 11A serve as distribution members that extend integrated into a single unit. A portion of these lead portions forms the above-mentioned fixed contact pieces 10 and 11, thereby composing the lever switch according to the present invention.

The constitution of the present invention has been described above. Next, the following provides an explanation of the operation of the lever switch of the present invention.

As shown in each of the drawings of Fig. 3 through Fig. 5, in the lever switch of the present invention, by operating while rotating operating lever 6, having a pair of hinge pieces that pivots as shown in Fig. 2A(b) on hinge bosses 41 provided in opposition to each other on opposing walls 2 and 3 formed integral with base 1, in opposition to the resiliency of movable contact piece 9 from the state shown in Figs. 3 to the state shown in Fig. 4 using the above-mentioned hinge bosses 41 as a fulcrum, each of two narrow fixed contact pieces 11 are able to be switched with respect to wide fixed contact piece 10 to establish continuity from the state shown in Fig. 3 to the state shown in Fig. 4 with movable contact piece 9 inserted into lower bridging piece 6b of this operating lever 6, thus enabling, for example, two small and large automobile room lamps to be lit by switching to a state of mutual electrical continuity with respect to a power line. For the switch, the purpose of which is to merely make on -off operation, only one narrow fixed contact piece 11 may be used.

Also, for such switch, only one depression 10a of wide fixed

contact piece 10 may be sufficient.

In performing this switching, the outside of movable contact piece 9 drops into depressions 10a of wide fixed contact piece 10 with a snapping action due its own resiliency, thus enabling the obtaining of a sense of moderation in the switching action, namely a clicking action, and allowing the switching timing to be confirmed by sensation or a by a clicking sound.

Also, if the width of fixed contact piece 11 is designed so that one contact point of movable contact piece 9 is in contact with fixed contact piece 11 to keep the electrical continuity when the other contact point of movable contact piece 9 is positioned at the crest of wide fixed contact piece 10, the electrical continuity can be kept until just before the finishing of a clicking action without interruption of the electrical continuity during the clicking action.

Further, in a changeover switch using two fixed contact pieces 11 as illustrated in the drawing, the flickering of the lamp can be prevented, because electrical continuity is kept at the time of changeover of the switch by designing the gap between these two fixed contact piece 11 to be narrower than the width of contact point of movable contact piece 9a as shown in Fig. 1A and

Fig. 3B.

Next, by further tilting operating lever 6 in the same direction as shown in Fig. 5 to interrupt the continuity between fixed contact pieces 10 and 11, for example, both of the above-mentioned lamps can be turned off.

Furthermore, a sense of moderation in switching at this time can also be obtained in the same manner as during the above-mentioned switching.

The vertical movement and horizontal movement of operating lever 6 is blocked by the entire circumferential surface of holes (or indentation) 51a of hinges 5 that pivot on each hinge boss 41. Thus, operating lever 6 cannot come out of base 1, and movable contact piece 9 cannot be inadvertently pulled from or shifted out of position from locking tabs 6c of operating lever 6 due to the locking action resulting from its own resiliency.

Namely, since the above-mentioned U-shaped movable contact piece 9 is attached to locking tabs 6c of bridging piece 6 formed in operating lever 6 with its locking edges 9b by resiliently making contact and being clamped in position, it is not inadvertently pulled out or shifted out of position by an external force such as the operating stress of operating lever 6,

thus enabling it to reliably establish or interrupt electrical continuity between fixed contact pieces 10 and 11.

Furthermore, holes 51a of hinges 5 of operating lever 6 and hole 6a of the lower portion of operating lever 6 may be in the form of depressions into which hinge bosses 41 enter and a depression into which a portion of movable contact piece 9 enters, respectively.

A constitution of another embodiment is composed so that operating lever 6, having a pair of hinge pieces that pivot as shown in Fig. 2B in hinge holes 42 provided in opposition to each other in opposing walls 2 and 3 of base 1, is operated by rotating using hinge bosses 52a as a fulcrum.

The vertical movement and horizontal movement of operating lever 6 is blocked with the entire circumferential surface of hinge bosses 52a of hinge pieces 5 that respectively pivot in hinge holes (or depressions) 42. Thus, operating lever 6 cannot come out of base 1, and movable contact piece 9 cannot be inadvertently pulled from or shifted out of position from locking tabs 6c of operating lever 6 due to the locking action resulting from its own resiliency.

### Effects of the Invention

As a result of being composed as described above, the present invention demonstrates the following effects.

In performing the switching operation of operating lever 6, the outside of movable contact piece 9 drops into depressions 10a of wide fixed contact piece 10 among two opposing fixed contact pieces 10 and 11 with a snapping action due its own resiliency, thus enabling the obtaining of a sense of moderation, namely a clicking action, when establishing continuity by switching, and allowing the timing by which continuity is established by switching to be confirmed by sensation or a by a clicking sound, thus offering a 1st effect of the present invention.

In addition, since the movable contact piece according to the present invention combines the use of the resilient action for establishing continuity of its inherent resiliency with respect to a fixed contact piece, and the clicking action resulting from the mechanical dropping action with respect to depressions 10a of a fixed contact piece, special-purpose members for obtaining a sense of moderation of the switching timing of operating lever 6, for example depressions in the switch case itself or steel balls or coil springs that drop into these depressions, are not

required at all, thus offering a 2nd effect of the present invention of being economical in terms of both space and cost.

Furthermore, if the width of fixed contact piece 11 is designed so that one contact point of movable contact piece 9 is in contact with fixed contact piece 11 to keep the electrical continuity when the other contact point of movable contact piece 9 is positioned at the crest of wide fixed contact piece 10, the electrical continuity can be kept just before the finishing of a clicking action without interruption of the electrical continuity during the clicking action. Therefore, such a problem that the electrical continuity is interrupted even with a slight movement of the operating lever can be eliminated, thus offering a 3rd effect of the present invention.

In addition, in a changeover switch according to the present invention, the flickering of the lamp can be prevented, because electrical continuity is kept at the time of changeover of the switch by designing the gap between these two fixed contact pieces 11 to be narrower than the width of contact point of movable contact piece 9a, thus offering a 4th effect of the present invention.

## CLAIMS



1. A lever switch comprised by: providing opposing walls 2 and 3 protruding from one surface of an insulating substrate formed from plastic, and supporting the inner surfaces of each of these walls and hinge pieces 5 on both sides of operating lever 6 with a hinge mechanism in pivoting fashion,

installing a movable contact piece 9 formed in roughly the shape of the letter "U" from a resilient conductor having a pair of contact points 9a in the lower portion of said operating lever 6,

having fixed contact piece supporting walls 2A and 3A formed respectively extending from said opposing walls 2 and 3 with said movable contact piece 9 in between,

arranging one fixed contact piece 10 on the inner surface of one fixed contact piece supporting wall 2A, and arranging one or a plurality of fixed contact pieces 11 on the inner surface of the other fixed contact piece supporting wall 3A,

to comprise a lever switch in which each of these fixed contact pieces 10 and 11 are led to the outside of said fixed contact piece supporting walls 2A and 3A and form a portion of a distribution member; wherein,

together with arranging wide fixed contact piece 10 that



forms depressions 10a in the inner surface of one fixed contact piece supporting wall 2A, narrow fixed contact pieces 11 are arranged in opposition to the above-mentioned depressions 10a on the inner surface of the other fixed contact piece supporting wall 3A.

2. A lever switch as set forth in claim 1 wherein a means for supporting in pivotal fashion with the said hinge mechanism supports in pivotal fashion by hinge bosses 41 formed in opposition to each other on the inner surfaces of said opposing walls 2 and 3 in holes 51a of hinge pieces 5 on both sides of operating lever 6.
3. A lever switch as set forth in claim 1 wherein a means for supporting in pivotal fashion with said hinge mechanism supports in pivotal fashion by hinge holes 42 formed in opposition to each other in the inner surfaces of said opposing walls 2 and 3 on hinge bosses 52a formed on hinges 5 on both sides of operating lever 6.
4. A lever switch as set forth in claim 1 wherein a means for installing movable contact piece 9, formed roughly into the shape of the letter "U" with a resilient conductor having a pair of contact points 9a, on the lower portion of the above-



mentioned operating lever 6, forms locking tabs 6c facing upward roughly in the center of bridging piece 6b that occupies the lower portion of hole 6a formed in the lower portion of the above-mentioned operating lever 6, and engaging and locking movable contact piece 9, formed roughly into the shape of the letter "U" with a resilient conductor having a pair of contact points 9a opposing locking clamps 6c within the above-mentioned hole 6a, with its locking edge 9b.

5. A lever switch according to either of Claim 1 to Claim 4 wherein two fixed contact pieces 11 are arranged in the inner surface of said fixed contact piece supporting wall 3A.
6. A lever switch according to Claim 5, wherein the gap between said two fixed contact pieces 11 is narrower than the width of contact point of movable contact piece 9a.