May 5, 1970 HIROAKI ABE ETAL 3,510,606

SNAP ACTION SWITCH

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FIG. 1

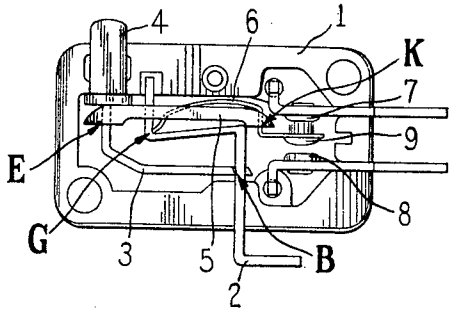


FIG. 2

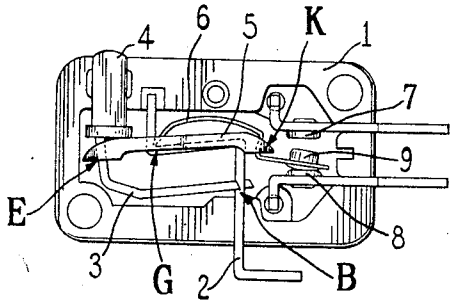
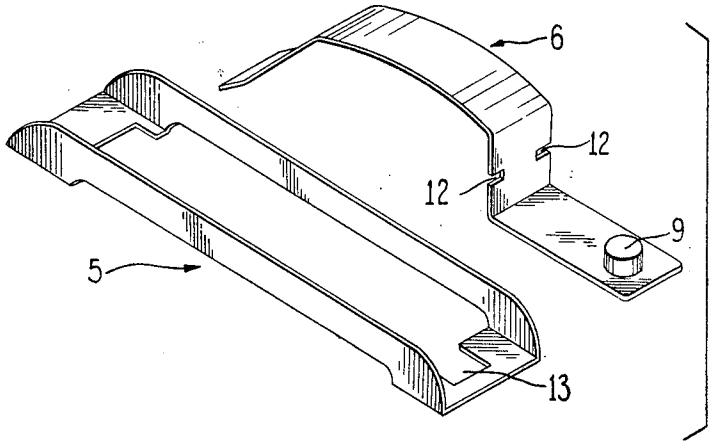


FIG. 3



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Fig. 4

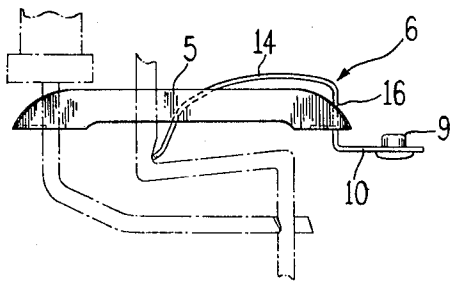
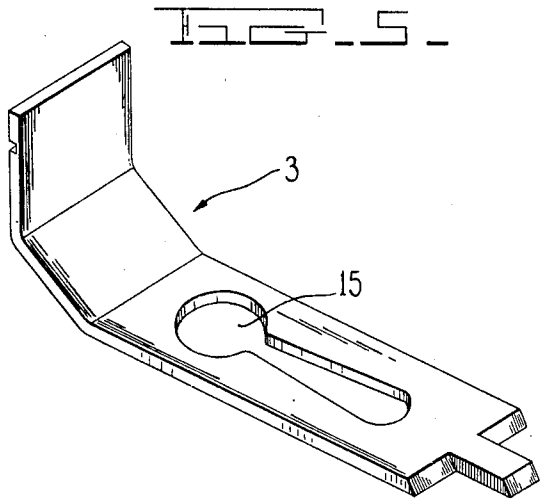


Fig. 5



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SNAP ACTION SWITCH

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U.S. Cl. 200—67 2 Claims

ABSTRACT OF THE DISCLOSURE

A snap action switch having an engaging member pivotally engaged at a common terminal member. One end of tension element is interengaged with the engaging member, and the other end of the tension element is interengaged with an elastic compression element. One end of the compression element is engaged at the common terminal member, and the other end of the compression element has a movable contact which is positioned to face opposed stationary contacts.

The present invention relates to improvements in switches, more particlarly, in switches having snap acting mechanisms.

At present numerous switches having snap acting mechanisms are suggested. For instance, a switch illustrated in the U.S. Pat. No. 2,513,804 which was patented on July 4, 1950, a typical switch of this type, is now extensively used as a useful and practical device. In such a switch, however, since members corresponding to first and second members of the present invention as hereinafter described are integrally formed by one element, such forces as bending, tensile, distorting, compressive forces and the like are in complicated manner applied on the diverging portion of the first and second members during the operation of the switch, whereby inscrutable stress is created at the portion, due to which said portion tends to be broken or the snap action of the switching mechanism is subject to deterioration.

As a means to overcome the above described objections it is suggested that, instead of composing said first and second members into one structure by the same element, said two members be separated beforehand and connected to each other in engagement so as to operate relatedly. However, when the first and second members merely separated are engaged in this manner, the electric circuit including the common terminal member contains at least two engaging portions, thereby the electric resistance being increased, which further develops such a defect fatal to a switch that, upon switching on and off a large electric current, heat is generated in the circuit including the common terminal members, while, upon switching on and off extremely small electric current of several tens of mma., stability of said circuit is impaired.

The principal object of the present invention, therefore, is to provide a useful and practical novel snap action switch in which careful consideration is given to the aforementioned points.

In more detailed description, the object of the present invention is to provide a novel snap action switch which, though the snap acting mechanism mounted therein being composed by assembling two members, has high resistance against vibration and shock impact and which is free from the above described objectionable effects on the circuit including the common terminal member of the switch, while the stability of the characteristic performance of the switch as well as the improvement of the snap action being achieved.

Other objects and advantages of the invention will be

come apparent in the following detailed description with reference to the accompanying drawings in which:

FIG. 1 is a side view of a switch in accordance with the present invention with the cover plate removed;

FIG. 2 is a side view with the cover plate removed, similar to FIG. 1, showing the contacts in the opposite position;

FIG. 3 is a view in perspective of only the first member and second member is disassembled of a switch in accordance with the invention;

FIG. 4 is a side view on an enlarged scale of the first member and second member of a switch in accordance with the invention; and

FIG. 5 is a perspective view on an enlarged scale of the actuating member of a switch in accordance with the invention.

While the present invention will be hereinafter described with respect to a typical embodiment, it is not desired to limit the invention only to the embodiment, but the invention should be considered to include changes, modifications and equivalents without departing from the spirit and scope of the invention as hereinafter claimed.

Now, referring to FIG. 1, a common terminal member **2**, equivalent to the previously described conventional common terminal member is disposed in a switch case **1**, one end of an actuating member **3** being engaged at an engaging point B with said terminal member **2** in pivotally movable manner. And the other end of said actuating member is adapted to receive the pressure from a push button **4**. In order to prevent as much as possible the effects on the related parts when the impact and vibration are exerted on the switch, said actuating member **3** is provided with an opening **15** medially therein as shown in FIG. 5, whereby it is made lighter in total weight. The first member **5** disposed approximately horizontally within the case **1** has its one end engaged with said actuating member **3** at E so as to move relatedly with said actuating member, with the other end thereof left unsupported.

The second member **6** carries at its one end a movable contact **9** facing stationary contacts **7** and **8** and is made of a suitable resilient material which is bent, except for the portion carrying the movable contact **9**, into a large circular arc shape. At a middle portion of said second member **6**, preferably at K of the circular arc portion near the unsupported end, said second member **6** is interrelatedly engaged with the aforementioned first member, while the other end of the second member is engaged at G with the previously mentioned common terminal member **2**. By "interrelated engagement" herein used it is meant that separate two members are interlocked together so as to operate relatedly with respect to the structure, and accordingly it does not embrace joining into a unitary and inseparable piece as welding, bonding or riveting the first and second members. An example of "interrelated engagement" used in the present invention is shown as in FIG. 3 in the manner in which the second member **6** is engaged with the first member, the cuts **12** and **12** formed in both side margins of said second member being caught by both side edges of the opening **13**, but this manner of engagement is by no means limited to such an example.

In the FIG. 1, when the push button **4** is depressed, the pressure is delivered to the actuating member **3**, which supported at an engaging point B, is thereby urged to pivotally move downward. During this pivotal movement, before the engaging point E engaging the first member **5** reaches the dead line, namely the line connecting the engaging point K of the first and second members **5** and **6** to the engaging point G of the second member **6** and the common terminal member **2**, the movable contact **9** is kept in contact with the stationary contact **7**, but when

the point E further moves downward beyond said dead line, the compression acts reversely and brings the movable contact 9 into contact with the other stationary contact 8 with a rapid movement as shown in FIG. 4.

According to the present invention, as apparent in the above description, since the second member acting as a compression element is provided with the movable contact, the electric current which is to flow the circuit including the common terminal member flows through the second member and the engaging point G into the common terminal member where the electric resistance is small, so that the circuit is free from the objectional effects such as heat generation or a possible incident to render it unstable. Further, according to the present invention, as already described, the second member carrying the movable contact and acting as a compression element and the first member acting as a tension element are not formed by the same element into unitary construction but are interrelatedly engaged together at the point K so as to operate relatedly. Therefore, it will be readily understood that, as compared with a conventional type, the position of the dead line can be more definitely determined. That is to say, in the conventional switch, as already described in detail, a portion of the first member acting as a tension element is diverged to thereby form integrally therewith the second member functioning as a compression element, so that, during operation, tensile, compressive, stretching, bending, distorting forces and the like are, in complicated manner, exerted between the two members, particularly, at said diverging portion, thereby inscrutable stress being created at the portion, which further results in such defects that the switch is rendered unstable with respect to the characteristic performance or the snap action is impaired or breakage takes place at the diverging portion. In the present invention, however, the generation of the above described inscrutable stress can be prevented by the aforementioned structure and accordingly the position of the dead line can be definitely determined; the stability of the switching performance, the improvement of the snap action and furthermore the extended service life being thus effected. As a result of the inscrutable stress having been prevented, even when low pressure is applied on the push button 4, it can precisely be perceived to thereby perform the switching properly, so that it has become possible to provide a high-precision switch also for low gram use.

Furthermore, according to the present invention, since the pressure from the push button is not delivered directly to the movable contact mounted on the second member but is delivered thereto through the first member which functions as a tensile element, it is an outstanding feature of the invention that the unexpected slight vibration or impact to be exerted on the push button is absorbed before it reaches the movable contact, whereby a far more stable switch is made obtainable. In other words, the switch in accordance with the present invention is quite advantageous in that it is provided with resistance against impact and vibration.

While the position where the first and second members are engaged each other is not particularly restricted, the engaging portion should preferably be selected close to the unsupported end of the first member. Such positioning provides the first member more extensive movement in the limited space during the switching operation, whereby the dead line can be readily positioned.

Further, according to the invention, the second member is, as particularly clearly shown in FIG. 4, formed in the shape consisting of a flat portion 10 carrying the movable contact, a vertical portion 16 bent upwardly at about right angle therewith and a circular arc portion 14 extending from said portion 16. The unsupported end of the first member 5 is preferably engaged with said vertical portion 16 approximately in interesecting fashion. In accordance with such structure, the repellent force accumulated in the circular arc portion 14 of the second member acts only as tension pulling the first member linearly along its axis as indicated by the arrow in the figure, so that the portion engaging the first and second members can be protected against breakage. Accordingly since the repellent force accumulated in the second member can be delivered without a loss to the first member, and as the first member is pulled always in a definite direction, the position of the dead line can be determined exactly as well as readily, while the stability of the switching performance and the improvement of the snap action can be further effected.

What we claim is:

1. A snap action switch comprising a common terminal member; an actuating member engaging said common terminal member at a first point; a push button provided on said actuating member; a rigid tension member engaged at one end thereof with said actuating member at a second point; an elastic compression member comprising a flat portion provided with a movable contact, a vertical portion extending substantially at a right angle from said flat portion and a substantially circular arc portion extending from said vertical portion, the end of said arc portion being engaged with said common terminal member at a third point, said tension member being interrelatedly engaged with said vertical portion of said compression member at a fourth point; and upper and lower opposed stationary contacts positioned to face said movable contact; whereby when said push button is in an underpressed position said second point is above a dead line between said third and fourth points and said compression member causes said movable contact to contact said upper stationary contact, and when said push button is depressed said actuating member pivots at said first point and said second point is moved below said dead line causing said compression member to rapidly move said movable contact into contact with said lower stationary contact.

2. A snap action as claimed in claim 1, wherein said vertical portion has side cuts therein and said tension member has an opening forming edges thereon, said edges being positioned in said cuts to thereby form said interrelated engagement.

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