

TITLE OF THE INVENTION

PUSH SWITCH

BACKGROUND OF THE INVENTION

This invention relates to a push switch, and more particularly to a push switch of the normally closed type of which on-off operation is carried out by pushing and release of a push button.

Also, the present invention is to provide a highly miniaturized or small-sized push switch received in an insulating casing having dimensions as small as 6 mm in length, 12 mm in width and 9 mm in height. For this purpose, in the present invention, a leaf spring simplified in construction and manufactured by micro-precision processing is formed into a contact spring element of an inverted gamma-like (Γ) shape, which is then integrally mounted in a holder, to thereby provide a holder-attached contact spring.

A conventional push button of the normally closed type fails to concurrently satisfy both functional and economical requirements. More particularly, manufacturing of the push button at a low cost causes it to fail to exhibit a satisfactory function; whereas when it is constructed so as to exhibit a satisfactory function, it is rendered expensive. Also, the conventional push button causes a variation in accuracy and performance thereof to be increased. Thus, it is highly desirable to develop a push switch of the normal closed type for on-off operation of an electric circuit in an electronic appliance such as an FD, a DAT or the like by pushing and release of a push button which is highly small-sized into dimensions as small as about 5 to 10 mm in each of length, width and height, is inexpensive, exhibits satisfactory durability even when it is used with high frequency for a long period of time, and exhibits excellent switching performance.

In particular, as described above, the push button is demanded to be highly miniaturized, therefore, a stroke of on-off operation of the switch due to pushing and release of a push button or a distance between a movable contact and a fixed contact is set to be as small as 1 mm or less such as, for

example, about 0.5 mm. Thus, it is required that a variation in stroke is restricted to ± 0.2 mm or less. However, in the conventional push switch, the movable contact is merely formed of a spring material such as a leaf spring or a wire spring by bending and then arranged in a casing of the switch as it is. The conventional push switch causes a variation in manufacturing thereof to be substantially increased, to thereby fail to meet such dimensional requirements as described above.

SUMMARY OF THE INVENTION

The present invention has been made in view of the foregoing disadvantage of the prior art.

Accordingly, it is an object of the present invention to provide a push switch which is capable of being highly small-sized and manufactured at a reduced cost.

It is another object of the present invention to provide a push button which is capable of being kept from being varied in accuracy and performance.

It is a further object of the present invention to provide a push switch which is capable of exhibiting satisfactory durability over a long period of time.

It is still another object of the present invention to provide a push switch which is capable of exhibiting increased switching performance.

In accordance with the present invention, a push switch is provided. The push switch includes a casing including a top plate and a bottom plate having a fixed contact arranged thereon, and a holder-attached contact spring arranged in the casing. The holder-attached contact spring is constructed of a contact spring element, a spring holder and a single push button. The contact spring element is formed into an inverted gamma-like (Γ) shape and includes a head section and a pair of leg sections respectively extending obliquely downwardly and in directions opposite to each other from the head section. One of the leg sections is so constructed that a distal end thereof acts as a contact and the other of the leg sections is so constructed that a distal end thereof acts as a pressing end.

The spring holder includes a pair of side plates

arranged so as to define a recess therebetween in which the head section of the contact spring element is fitted.

The side plates are mounted thereon with a support shaft in a manner to be projected therefrom. The spring holder is provided on a rear portion of an upper section thereof with an arm so as to be projected therefrom. The push button is formed into a shape like a short rod and provided on a lower end thereof with a stopper. Also, the push button is arranged on the top plate of the casing in a manner to be vertically slidable. The holder-attached contact spring is arranged in the casing in a manner to be pivotally movable about the support shaft, so that elasticity of the contact spring element causes the contact of the one leg section and the pressing end of the the other leg section to be pressedly contacted with the fixed contact of the bottom plate of the casing and an inner surface of the bottom plate, respectively, and causes the arm to be pressedly contacted at a distal end thereof with a lower surface of the stopper of the push button, resulting in the push button being kept raised to a stop position.

Also, in accordance with the present invention, two-throw push switch is provided. The two-throw push switch includes a casing of a rectangular shape and including a bottom plate having a fixed contact arranged thereon, two push buttons each including a stopper, and two holder-attached contact springs arranged in the casing in a manner to be rotationally symmetric with each other with a central plate being interposed therebetween. The holder-attached contact springs each include a contact and a pressing end normally kept contacted with the fixed contact and the inner surface of the bottom plate, respectively. Also, the holder-attached contact springs each include an arm which is pressedly contacted at a distal end thereof with a lower surface of the stopper of each of the push buttons.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and many of the attendant advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with

the accompanying drawings; wherein:

FIGURE 1 is a front elevation view partly in section generally showing an embodiment of a push switch according to the present invention;

FIGURE 2 is a plan view of the push button shown in FIGURE 1;

FIGURE 3 is a partially sectional front elevation view of the push switch shown in Fig. 1 in which a push button is pushed down;

FIGURE 4 is a front elevation view showing a holder-attached contact spring;

FIGURES 5A to 5D are a front elevation view, a plan view, a bottom view and a right side elevation view showing a contact spring element, respectively;

FIGURES 6A to 6E are a front elevation view, a plan view, a bottom view, a rear elevation view and a right side elevation view showing a spring holder, respectively; and

FIGURES 7A to 7C are a front elevation view, a plan view and a left side elevation view showing a push button, respectively.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, a push switch according to the present invention will be described hereinafter with reference to the accompanying drawings.

Referring first to FIGURES 1 to 7C, an embodiment of a push switch according to the present invention is illustrated. A push switch of the illustrated embodiment generally includes a casing 10 and a holder-attached contact spring A received in the casing 10. The contact spring A generally includes a contact spring element 7, a spring holder 4 and a single push button 9. The contact spring element 7 is generally formed into an inverted gamma-like (Γ) shape and includes a head section 7a and a pair of leg sections 7b and 7c respectively extending obliquely downwardly and in directions opposite to each other from the head section 7a. The leg sections 7b and 7c are so constructed that distal ends thereof act as a contact 5 and a pressing end 6, respectively. The spring holder 4 includes a pair of lateral or

side plates arranged so as to define a recess 2 therebetween in which the head section 7a of the contact spring element 7 is fitted. The side plates are mounted thereon with a support shaft 1 in a manner to be projected therefrom. Also, the spring holder 4 is provided on a rear portion of an upper section thereof with an arm 3 so as to be projected therefrom.

The push button 9 is formed into a shape like a short rod and is provided on a lower end thereof with a stopper 8. The push button 9 is arranged on a top plate 11 of the casing 10 in a manner to be vertically slidable and projectable into the casing 10.

The holder-attached contact spring A is arranged in the casing 10 in a manner to be pivotally movable about the support shaft 1, so that elasticity of the contact spring element 7 causes the contact 5 of the leg section 7b and the pressing end 6 of the leg section 7c to be pressedly contacted with a fixed contact 12 arranged on an inner surface of a bottom plate 14 of the casing 10 and the inner surface of the bottom plate 14, respectively, and causes the arm 3 to be pressedly contacted at a distal end thereof with a lower surface of the stopper 8 of the push button 9, resulting in the push button 9 being kept raised to a stop position 13.

The embodiment described above includes the single push button and the single holder-attached contact spring, resulting in being constructed into a one-circuit/one-contact structure. However, the present invention is not limited to such a structure.

Now, a second embodiment of a push button according to the present invention will be described hereinafter likewise with reference to FIGURES 1 to 7C.

A push button of the second embodiment is constructed into a two-throw structure such as a one-circuit/two-contact structure or a two-circuit/two-contact structure which is constructed of two push buttons and two holder-attached contact springs.

More specifically, the push switch of the illustrated embodiment includes two holder-attached contact springs A', which

are arranged in a casing 10 of a rectangular shape in a manner to be symmetric with each other with a central plate 15 being interposed therebetween, so that a contact 5 of a contact spring element 7 of each of the springs A and a pressing end 6 thereof are respectively pressedly contacted with a fixed contact 12 and an inner surface of a bottom plate 14 and an arm 3 of a spring holder 4 of each of the springs A is pressedly contacted with a lower surface of a stopper 8 of each of push buttons 9, as seen in FIGURE 2.

In the push switch of the present invention, as described above, the contact spring element 7 of the holder-attached contact spring A formed into an inverted gamma-like (α) shape is fitted in the recess 2 of the spring holder 4 while compressing the leg section 7b of the contact spring element 7 against elasticity of the leg section 7b. Also, the holder-attached contact spring A is arranged in the casing 10 so as to be pivotally movable about the support shaft 1 while keeping the leg sections 7b and 7c (particularly, leg section 7c) of the contact spring element 7 downwardly compressed.

Thus, in the present invention, the contact 5 of the contact spring element 7 is pressedly contacted with the fixed contact 12 while reserving elastic upward force therein, so that the switch is normally closed, resulting in being normally kept turned on. Also, the pressing end 6 is pressedly contacted with the inner surface of the bottom plate 14 and the arm 3 is upwardly forced so as to be pivotally moved about the support shaft 1. This results in the stopper 8 of the push button 9 being pushed up to the stop position 13, so that a distal end of the push button 9 is kept upwardly projected from the the top plate 11, as shown in FIGURE 1.

Then, when the push button 9 is forcedly pushed down, the stopper 8 of the push button 9 pushes down the arm 3 of the holder-attached contact spring A, so that the spring holder 4 may be rotated about the support shaft 1. This causes the leg section 7b of the contact spring element 7 to be upwardly moved, so that the contact 5 may be upwardly separated from the fixed contact 12. This leads to turning-off of the push switch.

The push switch of the present invention permits the above-described separation of the contact 5 from the fixed contact 12 due to pushing-down of the push button 9 to be effectively accomplished due to pushing-down of the push button by only 0.5 mm. Thus, further pressing-down of the push button 9 merely increases a distance of spacing between the contact 5 and the fixed contact 12, as shown in FIGURE 3.

Then, when the push button 9 is released from pressing force, upward elastic restoring force of the contact spring element 7 causes the contact 5 to be pressedly contacted with the fixed contact 12, resulting in the arm 3 pushing up the push button 9 to the stop position 13, so that the push switch may be returned to the original state or normally closed state, to thereby be turned on.

As can be seen from the foregoing, the push switch of the present invention is so constructed that the holder-attached contact spring wherein the contact spring element is integrally mounted in the spring holder is pivotably arranged through the support shaft, resulting in upward elastic force of the contact spring causing the contact and pressing end of the contact spring element to be forcedly contacted with the fixed contact and the inner surface of the bottom plate, respectively, and causing the arm to push up the push button to the stop position. Such construction of the present invention permits the components or parts for the switch to be simplified in construction and the number of parts to be reduced, resulting in the push switch being highly small-sized and exhibiting high performance and increased durability.

In particular, the holder-attached contact spring wherein the contact spring element is integrally mounted in the spring holder while being compressed is arranged in the casing while further compressing the contact spring element. This permits the contact to be forcedly contacted with the fixed contact while constantly keeping elastic force reserved in the contact spring element, to thereby ensure polishing of the contact and fixed contact due to friction therebetween, resulting in providing satisfactory electrical connection therebetween.

Also, this effectively eliminates chattering and permits separation of the contact from the fixed contact or turning-off of the switch to be instantaneously and positively carried out through pivotal movement of the spring holder about the support shaft due to slight pushing-down of the push button.

Further, the present invention realizes a push switch of a basic one-circuit/one-contact structure which is constructed of one push button, as well as that of a two-throw structure such as a one-circuit/two-contact structure, a two-circuit/two-contact structure or the like which is constructed of two push buttons and two holder-attached contact springs while keeping it small-sized and simplified in construction.

While preferred embodiments of the invention have been described with a certain degree of particularity with reference to the drawings, obvious modifications and variations are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A push switch comprising:
 - a casing including a top plate and a bottom plate having a fixed contact arranged thereon; and
 - a holder-attached contact spring arranged in said casing;
 - said holder-attached contact spring including a contact spring element, a spring holder and a single push button;
 - said contact spring element being formed into an inverted gamma-like (Ω) shape and including a head section and a pair of leg sections respectively extending obliquely downwardly and in directions opposite to each other from said head section;
 - one of said leg sections being so constructed that a distal end thereof acts as a contact;
 - the other of said leg sections being so constructed that a distal end thereof acts as a pressing end;
 - said spring holder including a pair of side plates arranged so as to define a recess therebetween in which said head section of said contact spring element is fitted;
 - said side plates being mounted thereon with a support shaft in a manner to be projected therefrom;
 - said spring holder being provided on a rear portion of an upper section thereof with an arm so as to be projected therefrom;
 - said push button being formed into a shape like a short rod and provided on a lower end thereof with a stopper;
 - said push button being arranged on said top plate of said casing in a manner to be vertically slidable;
 - said holder-attached contact spring being arranged in said casing in a manner to be pivotally movable about said support shaft, so that elasticity of said contact spring element causes said contact of said one leg section and said pressing end of said the other leg section to be pressedly contacted with said fixed contact of said bottom plate of said casing and an inner surface of said bottom plate, respectively, and causes said arm to be pressedly contacted at a distal end thereof with a lower surface of said stopper of said push button, resulting in said



push button being kept raised to a stop position.

2. A two-throw push switch comprising:

a casing of a rectangular shape and including a bottom plate having a fixed contact arranged thereon;

two push buttons each including a stopper; and

two holder-attached contact springs arranged in said casing in a manner to be rotationally symmetric with each other with a central plate being interposed therebetween;

said holder-attached contact springs each including a contact and a pressing end normally kept contacted with said fixed contact and said inner surface of said bottom plate, respectively;

said holder-attached contact springs each including an arm which is pressedly contacted at a distal end thereof with a lower surface of said stopper of each of said push buttons.

