

PUSH BUTTON SWITCH

FIELD

[0001] Various implementations of the present invention relate to switch field, and more specifically to a push button switch.

5 BACKGROUND

[0002] A push button switch is of a typical switch type, which alternately connects or disconnects a circuit or alternately connects two circuits by the repeated pressing operations on the push button.

[0003] By pressing on the push button, the current push button switch drives the driver and
10 the swing rod to swing around an axis perpendicular to the movement direction of the push button, such that the electrically conductive bridge driven by the swing rod deflects between two positions to connect or disconnect a circuit. This type of push button switch usually drives the elastic element to deform by means of deflection action of the electrically conductive bridge so as to drive the driver to deflect to a further operating position, such that
15 the next pressing operation on the push button can press the driver on the other side of the axis of the swing rod to cause the swing rod and the electrically conductive bridge to swing to a direction reverse to the previous one, thereby switching the on and off state of the circuit.

[0004] The electrically conductive bridge is connected with the elastic element to drive the driver, which causes the elastic element to generate a counterforce on the electrically
20 conductive bridge. The action point of the counterforce is at a position different from the action point where the swing rod drives the electrically conductive bridge to connect or disconnect the circuit, which may result in generating a torque on the electrically conductive bridge during the action of the electrically conductive bridge, such that the surface of the electrically conductive bridge pressed by the moving contact unstably swings with respect to
25 the pressing surface of the stationary contact. As a result, it will generate throbbing gaps between the moving and stationary contacts during the process of closing or opening the moving contact and the stationary contact, thereby generating arc discharge between the gaps and further eroding and damaging the contacts. This will significantly reduce the endurance of the moving and stationary contacts, thereby further lowering the lifetime of the push button
30 switch. Meanwhile, the counterforce acting on the electrically conductive bridge will also affect the stable and reliable quick closing or opening operations of the electrically conductive

bridge with the stationary contact, as well as the performance of the switch. Besides, the above arranged elastic element must go through the swing rod to connect the driver and the electrically conductive bridge, which not only complicates the assembly of the elastic element, but also causes a lower mechanical strength of the swing rod due to the opening. Moreover, the elastic element connected to the electrically conductive bridge will also make the assembly of the electrically conductive bridge more difficult. Finally, because the elastic element is directly connected to the electrically conductive bridge and the elastic element usually is made of metallic material, the elastic element is also charged, which causes the charged pieces to present in a majority of space in the push button switch. This increases the risk of discharging between neighboring pieces and may result in damage of the pieces and electric shock accident on the people contacting the push button.

SUMMARY

[0005] In view of the above reasons, embodiments of the present invention provide a push button switch for solving at least a part of the problems existing in the above existing push button switch.

[0006] According to implementations of the present invention, there is provided a push button switch, comprising: a swing rod swingably supported on a base and having a first side and a second side opposite to each other; a driver connected to the first side of the swing rod and being rotatable between a first limiting position and a second limiting position; an electrically conductive bridge having a moving contact and deflectably coupled to the second side of the swing rod; an elastic element coupled between the driver and the base and drivably connected with the swing rod; and a push button, configured to press the driver at one of the first limiting position and the second limiting position while being pushed, to drive the driver and the swing rod to swing around a swing axis, such that the swing rod drives the electrically conductive bridge to deflect, which causes the moving contact to contact or disengage a stationary contact. The elastic element is configured to be driven by the swing rod to elastically deform when the push button is pushed to cause swing of the swing rod, whereas when the push button is released, the elastic element that is elastically deformed drives the driver to rotate from one of the first limiting position and the second limiting position to the other of the first limiting position and the second limiting position.

[0007] In one embodiment, the swing rod has a first end and a second end in a direction of the swing axis, the driver is connected to the swing rod at the first end of the swing rod, and

the elastic element extends between the first end and the second end of the swing rod on the first side of the swing rod.

[0008] In one embodiment, a first end of the elastic element is drivably connected with the driver, and a second end of the elastic element opposite to the first end is pivotally connected with the base, the swing rod having a connecting piece on the first side, which is drivably connected with the elastic element at a position between two ends of the elastic element.

[0009] In one embodiment, the connecting piece is a shifting fork, which clamps the elastic element at a position between two ends of the elastic element.

[0010] In one embodiment, a length of the elastic element from a connection position with the connecting piece to a connection position with the driver is greater than a length of the elastic element from a connection position with the connecting piece to a pivotal connection position with the base.

[0011] In one embodiment, a first end of the elastic element is drivably connected to the driver, and a second end of the elastic element opposite to the first end is flexibly connected with the base, the elastic element being pivotally connected, at a position between its two ends, to the first side of the swing rod.

[0012] In one embodiment, the base comprises a stop groove in the vicinity of the second end of the swing rod, and the second end of the elastic element extends into the stop groove, such that when the swing rod drives the elastic element to swing, the stop groove at least partially restricts the second end of the elastic element to move along with the swing rod, and the stop groove allows the second end of the elastic element, while the push button being released, rotates relative to the swing rod.

[0013] In one embodiment, a length of the elastic element from a pivotal connection position with the swing rod to a connection position with the driver is greater than a length of the elastic element from a pivotal connection position with the swing rod to a flexible connection position with the base.

[0014] In one embodiment, the driver comprises a driving hole or a driving groove, and a first end of the elastic element extends into the driving hole or driving groove to drivably connect with the driver.

[0015] In one embodiment, the elastic element is a coil spring, a torsion spring, a leaf spring or an elastic wire.

[0016] In one embodiment, the driver is provided with two actuating blocks at two sides of the swing axis, the driver being configured such that when it is at the first limiting position and the second limiting position, the push button, while being pushed, presses a different actuating block in the two actuating blocks to cause the swing rod to swing to different directions.

[0017] In the push button switch according to the embodiments of the present invention, the rotation axis of the driver is perpendicular to the rotation axis of the swing rod, such that the rotation of the driver and the swing of the swing rod do not interfere each other, thereby enhancing reliability of operations of the push button switch, lowering the requirement for manufacture precision of the pieces of the push button switch and reducing the influence of wear on the normal operation of the push button switch.

[0018] The push button switch according to the embodiments of the present invention drives the elastic element to be loaded by the swing rod for further driving the driver to reset, such that the loading of the elastic element will not impact stability of contact or disengagement between the moving and stationary contacts of the push button switch, thereby enhancing stability and reliability of the contact actions and prolonging the lifetime of the contacts.

[0019] In the push button switch according to the embodiments of the present invention, the elastic element is provided at one side of the swing rod and the swing axis of the elastic element is perpendicular to the swing axis of the swing rod, such that the assembly of the push button switch is simplified and the elastic resetting action of the elastic element will not influence the current engagement state of the moving and stationary contacts. Besides, it also causes the elastic element to be uncharged, which makes the push button switch safer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] When the following detailed description to the exemplary embodiments is reviewed with reference to the drawings, these and other objectives, features and advantages will become apparent. In the drawings:

[0021] Fig. 1 is an exploded view of a push button switch according to a first embodiment of the present disclosure;

[0022] Fig. 2 is an enlarged view of the swing rod of the push button switch in Fig.1;

[0023] Fig. 3 is an enlarged view of the elastic element of the push button switch in Fig.1;

[0024] Fig. 4 illustrates a push button switch of Fig. 1 in the first state;

[0025] Fig. 5 illustrates a push button switch of Fig. 1 in the second state;

[0026] Fig. 6 illustrates a push button switch of Fig. 1 in the third state;

5 [0027] Fig. 7 illustrates a push button switch according to a second embodiment of the present disclosure in the first state;

[0028] Fig. 8 illustrates a push button switch according to a second embodiment of the present disclosure in the second state;

[0029] Fig. 9 a push button switch according to a second embodiment of the present disclosure in the third state.

10 **DETAILED DESCRIPTION OF EMBODIMENTS**

[0030] Various implementations of the present invention are now described in details only by way of examples.

[0031] With reference to Fig. 1, it illustrates a push button switch 100 according to the first embodiment of the present invention, wherein the push button switch 100 comprises a base 4, which accommodates: a swing rod 1 swingably supported on the base 4; an driver 2
15 connected to a first side of the swing rod 1 and being rotatable between a first limiting position and a second limiting position; an electrically conductive bridge 3 having a moving contact 31 and deflectably coupled to a second side of the swing rod 1; an elastic element (shown as a torsion spring 5 in Fig. 1) coupled between the driver 2 and the base 4 and
20 drivably connected to the swing rod 1; and a push button 6 for being pushed by a user to press the driver 2, thereby driving the swing rod 1 to act and further driving the electrically conductive bridge 3 to act. Besides, the base 4 also accommodates a push button spring 64 for resetting the push button 6, a retaining spring 9 for maintaining the electrically conductive bridge 3 and the swing rod 1 at an operating position, and a stationary contact 7 and other
25 common structures in the switch. Moreover, the push button switch 100 can also comprise housing parts, such as an upper cover 81, a housing 82, a push button cover 83 and the like, to encapsulate the base 4 of the push button switch 100 and various parts therein.

[0032] Fig. 2 shows the structure of the swing rod 1 in details. The swing rod 1 is generally in the shape of a plate and has a first side 11 and a second side 12 opposite to each
30 other. The swing rod 1 is provided with a rotation shaft thereon, which is swingably

supported on the base 4. The swing rod 1 forms a first end 13 and a second end 14 opposite to each other along a direction of an axis (i.e., swing axis) of the rotation shaft 15. A hole 16 or a shaft is arranged on the first end to pivotally support the driver 2 on the first side 11 of the swinging plate 1, and a limiting block 17 is further provided on the first end to restrict a rotation extreme position of the driver 2. A mounting shaft 18 is arranged on the second end of the first side 11 of the swing rod 1 for pivotally mounting the elastic element on the mounting shaft 18. The elastic element can be, for example, a torsion spring 5 as shown in Fig. 3. The torsion spring 5 includes a looping part 51 and a first arm 52 and a second arm 53 positioned at two opposite sides of the looping part 51, wherein the second arm 53 is shorter than the first arm 52. The looping part 51 of the torsion spring 5 is sleeved on the mounting shaft 18 of the swing rod 1, such that the torsion spring 5 is pivotally supported on the first side of the swing rod 1.

[0033] The looping part 51 of the torsion spring 5 may have a sufficient height, and a support surface 181 that is elevated from the first side 11 of the swing rod 1 may be provided at the bottom of the mounting shaft 18 to support the torsion spring 5, such that when the torsion spring 5 is mounted on the mounting shaft 18, the second arm 53 of the torsion spring 5 is away from the swing axis of the swing rod 1 by a distance. As a result, when the torsion spring 5 swings around the swing axis along with the swing rod 1, the end of the second arm 53 of the torsion spring 5 can generate a sufficient swinging arc length, which is advantageous for the elastic element to drive the driver 2 to act. This will be illustrated in details in the following text.

[0034] Advantageously, the mounting shaft 18 is generally positioned on the swing axis of the swing rod 1, such that the elastic element 5 pivotally mounted thereon can swing to a symmetrical position at two sides of the swing axis along with the swing of the swing rod 1 at the two sides of the swing axis.

[0035] The second side 12 of the swing rod 1 is provided with a swing arm 19 which has a blind hole in the end, in which blind hole a retaining spring 9 is mounted. The electrically conductive bridge 3 is engaged with the retaining spring 9. Openings 191 are arranged on two sides of the blind hole of the swing arm 19, such that when the electrically conductive bridge 3 is engaged to the end of the swing arm 19 via the retaining spring 9, the electrically conductive bridge 3 can deflect relative to the swing arm 19 without being interfered by the swing arm 19.

[0036] The electrically conductive bridge 3 is made of electrically conductive material, such as copper. The bottom of the electrically conductive bridge 3 extends along a straight line and is supported by a conductor in the base 4, so as to deflect relative to the conductor while forming an electrical connection with the conductor. The moving contact 31 on the electrically conductive bridge 3 can be formed on the opposite two sides of the electrically conductive bridge 3 or on only one side, to electrically contact the two stationary contacts 7 or only one stationary contact 7 of the push button switch 100 respectively.

[0037] With reference to Figs. 1 and 4, the upper cover 81 for enclosing the push button switch 100 is removed in Fig. 4 to better reveal its internal structure. A first end (i.e., first arm 52 of the torsion spring 5) of the elastic element 5 (specifically the torsion spring 5 in the example) is drivably connected to the driver 2. To be specific, the driver 2 comprises a drive hole or a drive groove 23, and the first arm 52 of the torsion spring 5 extends into the drive hole or drive groove 23, such that the first arm 52 can rotate by a certain angle in the drive hole or drive groove 23 with respect to the driver 2. Meanwhile, by abutting against side walls of the drive hole or drive groove 23, the first arm 52 pushes the driver 2 to pivot with respect to the swing rod 1, thus establishing a drive connection with the driver 2. It should be understood that the first end of the elastic element 5 can also establish the drive connection with the driver 2 in other ways, as long as the connection allows a certain degree of relative rotation between the first end of the elastic element 5 and the driver 2.

[0038] A second end (specifically the second arm 53 of the torsion spring 5 in the example) of the elastic element 5 opposite to the first end is flexibly connected to the base 4. To be specific, a stop groove 41 is formed on the base 4 at a position adjacent to the second end of the swing rod 1, and the second arm 53 of the torsion spring 5 extends into the stop groove 41. The stop groove 41 can at least partially restrict the movement of the second arm 53 of the torsion spring 5 along with the swing rod 1, and the stop groove 41 allows the second arm 53 of the torsion spring 5 to rotate within a range with respect to the swing rod 1 and the base 4. To increase the rotation range of the second arm 53 of the torsion spring 5, the stop groove 41 is progressively broadened in a direction distal to the swing rod 1, to form a sector-shaped groove, for example, so as to prevent the stop groove 41 from restricting the end of the second arm 53 during the rotation of the second arm 53 of the torsion spring 5. It should be appreciated that the second end of the elastic element 5 can also establish a flexible connection with the base 4 in other ways, as long as the connection at least partially restricts the movement of the second end of the elastic element 5 along with the swing rod 1 and

allows a certain degree of relative rotation between the second end of the elastic element 5 and the base 4.

[0039] Accordingly, the elastic element 5 is pivotally connected, at a position between its two ends, to the first side 11 of the swing rod 1, and the elastic element 5 extends between the first end 13 and the second end 14 of the swing rod 1 (i.e., generally in a direction of the swing axis of the swing rod 1) at the first side of the swing rod 1, such that the rotation axis of the elastic element 5 is perpendicular to the swing axis of the swing rod 1, and the elastic element 5 will not pass through the swing rod 1 and extend to the second side 12 of the swing rod 1. Therefore, there is no need to form an opening on the swing rod 1 to allow the elastic element 5 to pass through, which enhances mechanical strength of the swing rod 1, reduces manufacture complexity of the swing rod 1 and improves convenience of mounting the elastic element 5.

[0040] A pivotal connection point (i.e., the position of the mounting shaft 18) between the elastic element 5 and the swing rod 1 has a longer distance to the driver 2 than the distance to the stop groove 41 on the base 4. Therefore, when the elastic element 5 is respectively connected to the driver 2 and the stop groove 41, a length of the elastic element 5 from the pivotal connection position with the swing rod 1 to the connection position with the driver 2 is greater than a length of the elastic element 5 from the pivotal connection position with the swing rod 1 to the flexible connection position with the base 4, which is favorable for resetting the driver 2 by the elastic element 5. This will be illustrated in details in the following text.

[0041] The driver 2 is provided with two actuating blocks 21 and 22 respectively positioned at two sides of the pivotal axis of the driver 2. When the driver 2 is rotated in a rotating direction to a first limiting position at which the driver 2 touches the limiting block 17 on the swing rod 1, one actuating block 21 of the driver 2 is just aligned with a pressing face 61 on one side of the push button 6 above while the other actuating block 22 staggers a pressing face 62 on the other side of the push button 6. When the driver 2 is rotated in another rotating direction to a second limiting position at which the driver 2 touches the limiting block 17 on the swing rod 1, the other actuating block 22 of the driver 2 is just aligned with a pressing face on the other side of the push button 6 above while the actuating block 21 staggers the pressing face 61 on one side of the push button 6. Accordingly, the two pressing faces 61 and 62 of the push button 6 are not simultaneously aligned with the two actuating blocks 21 and 22 at both the first limiting position and the second limiting position of the

actuating block. Thus, the push button 6 can only apply the torque to the driver 2 from one side of the swing axis of the swing rod 1 at each moment, which is crucial for smooth deflection of the swing rod 1 and switching functionality of the push button switch 100. This will be illustrated in details in the following text.

5 **[0042]** The working process of the push button switch 100 will be illustrated in the following with reference to Figs. 4-6. As shown in Fig. 4, in the initial state before the push button 6 is pushed down, the push button 6 is supported by a push button spring 64 (not shown in Fig. 4), such that the pressing faces 61, 62 do not contact any actuating blocks 21, 22 of the driver 2, or a pressing face 61 just contacts one actuating block 22 without applying
10 force on the actuating block 22. At this time, the swing rod 1 is in a state tilted to the left. At this position, the electrically conductive bridge 3 also tilts to one side, such that the moving contact 31 thereon is also tilted to one side to electrically contact or disconnect from the stationary contact 7.

[0043] In the state of Fig. 4, the driver 2 is not restricted and driven by the push button 6.
15 Instead, it only abuts the limiting block 17 by receiving a slight elastic restoring force from the elastic element 5, thereby being at the second limiting position, or it is free of the elastic restoring force from the elastic element 5 and is just at the position defined by the limiting block 17 and the first arm 52 of the elastic element 5. At this moment, the actuating block 21 staggers the pressing face 61 on the push button 6 and the other actuating block 22 is
20 aligned with the other pressing face 62.

[0044] According to Fig. 5, when the push button 6 is pushed down against the elastic force of the push button spring 64, the pressing face 62 on the right side of the push button 6 first contacts the actuating block 22 that is elevated and aligned with the pressing face 62 due to the left tilt of the swing rod 1. The action of continuing pressing the push button 6 down
25 will apply a downward pressure on the driver 2 as well as the swing rod 1 via the actuating block 22. The action point of the pressure, i.e., the position of the actuating block 22, is at the right side of the swing axis of the swing rod 1. Therefore, the pressure applies a clockwise torque on the swing rod 1, such that the swing rod 1 and the driver 2 together swing around the swing axis to the right. A swing arm 19 on the second side 12 of the swing rod 1
30 will drive, during the swing process, the electrically conductive bridge 3 to swing to another side, such that the moving contact 31 on the electrically conductive bridge 3 changes its position (change to disconnect or connect) with respect to the stationary contact 7, thereby switching the on-off state of the push button switch 100.

[0045] During this process, the driver 2 cannot pivot relative to the swing rod 1 because the driver 2 is pressed by the push button 6 at the actuating block 22. Therefore, one end of the elastic element 5 connected to the driver 2 (i.e., the end of the first arm 52 of the torsion spring 5) remains unchanged with respect to the position of the driver 2 and the swing rod 1, and swings to the right by the same range as the driver 2 and the swing rod 1. Because the connection point between the elastic element and the driver 2 and the pivotal connection point between the elastic element and the swing rod 1 are fixed relative to the swing rod 1, the elastic element 5 cannot rotate around the mounting shaft 18 with respect to the swing rod 1 at this moment. One end of the elastic element 5 connected to the stop groove 41 (i.e., the end of the second arm 53 of the torsion spring 5), after swinging along with the swing rod 1 to the right by a given range, will be blocked by the side wall at the right side of the stop groove 41 and cannot continue to swing towards right. In this way, the two ends of the elastic element 5 have relative displacement therebetween, so the elastic element 5 is forced to elastically deform under the force that presses the push button 6.

[0046] As shown in Fig. 6, when the push button 6 is released from a pressed state, the push button 6 moves upward to its natural state by the action of the elastic restoring force of the push button spring 64, such that the pressing face 62 is out of the contact with the actuating block 22. Because the driver 2 is no longer pressed by the push button 6, the elastic restoring force acting on the driver 2 by the elastic element 5 which has been elastically deformed during the former swing process of the swing rod 1 generates a torque on the driver 2, which causes the driver 2 to rotate counterclockwise with respect to the swing rod 1, such that the driver 2 rotates to the first limiting position at which the driver 2 touches the limiting block 17 from another rotating direction. At this time, the actuating block 22 staggers the pressing face 62 of the push button 6 and the actuating block 21 is aligned with the pressing face 61, so as to be prepared for the next time when the pressing face 61 of the push button 6 pressing another actuating block 21 of the driver 2 to reversely drive the swing rod 1 to swing. During the process of driving the driver to pivot, the elastic element 5 per se also rotates clockwise around the mounting shaft 18 while releasing the elastic restoring force. That is, the end of the second arm 53 of the torsion spring 5 is pushed by the counterforce applied by the right side wall of the stop groove 41 to swing to the left of the stop groove 41, whereas the first arm 52 of the torsion spring 5 swings towards right to drive the driver 2 to pivot, until the driver 2 pivots to the limiting block 17. At this moment, the elastic deformation of the elastic element 5 is generally restored.

[0047] As the space of the switch push button 100 is limited, the distance from the second arm 53 of the torsion spring 5 to the swing axis of the swing rod 1 is extremely small. Therefore, as the swing rod 1 swings, the second arm 53 of the torsion spring 5, even without the restriction of the stop groove 41, can only swing a limited arc length distance around the swing axis of the swing rod 1. By arranging a length of the elastic element 5 from the pivotal connection position with the swing rod 1 to the connection position with the driver 2 greater than a length of the elastic element 5 from the pivotal position with the swing rod 1 to the flexible connection position with the base 4, the pivot of the second arm 53 of the elastic element 5 around the mounting shaft 18 in a small range with respect to the swing rod 1 during restoring the elastic deformation results in a larger range of swinging arc length for the end of the longer first arm 52. Accordingly, the driver 2 can be driven to pivot by a relatively larger range, so as to smoothly reach another limiting position.

[0048] When the push button 6 is pushed again, the pressing face 61 on the push button 6 will contact and press the actuating block 21, so as to drive the driver 2 as well as the swing rod 1 to deflect around the swing axis towards left. The swing arm 19 at the second side of the swing rod 1 will drive the electrically conductive bridge 3 to alter the deflection direction again, such that the moving contact 3 on the electrically conductive bridge 3 changes the relative position to the stationary contact 7 again, thereby implementing the switchover again. Similar to the process described before by Figs. 5-6, the elastic element 5 is still elastically deformed in the swing process of the swing rod 1, and drives the actuating block 2 to rotate when the push button 6 is released again. However, the movement of first arm 53 of the elastic element 5 is restricted by the left side wall of the stop groove 41 this time, which generates elastic deformation and elastic restoring force on the first arm 53 in a direction reverse to that as described before. Besides, when the push button 6 is released, the elastic element 5 will apply a clockwise torque to the actuating block 2 again to rotate the actuating block 2 to the second limiting position as shown in Fig. 4, such that the actuating block 22 is aligned with the pressing face 62 again, thereby being prepared for the next operation of the push button.

[0049] Accordingly, every time the push button 6 is pushed, the electrically conductive bridge 3 deflects under the driving of the swing rod 1, but the deflection direction will alternately change according to the sequence of pushing the push button 6, so as to implement alternate on and off of the push button switch 100. Meanwhile, the elastic element 5 is driven by the swing rod 1 to generate elastic deformation every time, thereby accumulating

energy. Every time the push button 6 is released, the driver 2 is driven by the elastic element 5 from one of the current first limiting position and second limiting position to the other of the first limiting position and second limiting position, so as to be prepared for driving the electrically conductive bridge 3 in a reverse direction when the push button 6 is pressed next time.

[0050] Although the above embodiments describe the present invention by taking the torsion spring 5 as the example of the elastic element, those skilled in the art can understand that other types of elastic elements can be used, including but not limited to, coil spring, leaf spring and the like. By pivotally mounting the various forms of elastic elements on the swing rod 1 and causing the elastic element to elastically deform due to restriction of a part of the base 4 (e.g., stop groove 41) while the swing rod 1 is swinging, the elastic element can drive, by its elastic restoring force, the driver 2 to rotate to another limiting position different from the current limiting position when the push button 6 is released, so as to reach the operating position of the driver 2 which is needed for the next press of the push button 6.

[0051] Figs. 7-9 illustrate a push button switch 100 according to a second embodiment of the present invention. The push button switch 100 according to a second embodiment of the present invention differs from the push button switch 100 of the first embodiment depicted with Figs. 1-6 only in the different coupling manners between the elastic element 5 and the swing rod 1 and the base 4, such that the elastic element 5 is loaded differently.

[0052] As shown in Fig. 7, the push button switch 100 according to a second embodiment of the present invention is explained by taking the coil spring 5' as the elastic element. Distinguished from the first embodiment, the mounting shaft 18 on the swing rod 1 is replaced by a shifting fork 10, which may also be on the swing rod 1 and at the position of the mounting shaft 18 in the first embodiment. The stop groove 41 on the base 4 is substituted by a base fixing shaft 42, which may also be on the base 4 and at the position where the stop groove 41 lies in the first embodiment. One end of the coil spring 5' is drivably connected to the driver 2 in the same manner as the first embodiment, such as extending into the drive hole 23 of the driver 2. A second end of the coil spring 5' opposite to the first end is pivotally mounted on the base fixing shaft 42 of the base 4. Meanwhile, the shifting fork 10 on the swing rod 1 clamps a part of the coil spring 5' between the first end and the second end. Similar to the first embodiment, a length of the coil spring 5' from the connection position with the shifting fork 10 to the connection position with the driver 2 is greater than a length of the coil spring 5' from the connection position with the shifting fork 10 to the pivotal

connection position with the base 4, so as to facilitate driving, by a small range of swinging arc length of the coil spring 5', the driver 2 to pivot at a relatively greater angle to achieve the expected next limiting position. This will be described in the following text.

[0053] In Fig. 7, when the push button 6 has not been pressed yet, the swing rod 1 tilts to the right and causes the electrically conductive bridge 3 (not shown in Fig. 7) to tilt to one side, such that the moving contact 31 on the electrically conductive bridge 3 connects or disconnects from the stationary contact 7. At this time, the driver 2 is at the first limiting position, wherein the actuating block 21 is aligned with the pressing face 61 on the push button 6 while the other drive block 22 staggers the other pressing face 62.

[0054] As shown in Fig. 8, when the push button 6 is pressed, the pressing face 61 of the push button 6 presses the actuating block 21 of the driver 2, such that the driver 2 and the swing rod 1 together swing around the swing axis towards left to drive the electrically conductive bridge 3 (not shown in Fig. 8) to deflect to another side, which causes change of the position relationship (changing to disconnect or contact) between the moving contact 31 and the stationary contact 7. During this process, the driver, which is pressed by the push button 6, cannot rotate relative to the swing rod 1, whereas the shifting fork 10 on the swing rod 1 swings towards left along with the swing rod 1. The swing of the shifting fork 10 will drive the part of the coil spring 5' in contact with the shifting fork 10 to also move to the left. Because the two ends of the coil spring 5' are respectively restricted by the driver 2 and the base fixing shaft 42, the coil spring 5' cannot move to the left along with the swing of the swing rod 1, causing elastic bending of the coil spring 5' between its two ends.

[0055] As shown in Fig. 9, when the push button 6 is released, the restriction over the driver 2 by the push button 6 is removed. The bent coil spring 5' will drive, under the action of its elastic restoring force, the driver 2 to rotate clockwise to reach the second limiting position, such that the actuating block 22 is aligned with the pressing face 62 of the push button 6 and the actuating block 21 staggers the pressing face 61 to be prepared for the next operation. During this process, the coil spring 5' tends to get straight form the bent state under the action of the elastic restoring force. Because the second end of the coil spring 5' is secured by the base fixing shaft 42 and cannot move, the first end of the coil spring 5' is forced to first swing around the contact point between the coil spring 5' and the shifting fork 10 towards left and drives the driver 2 to rotate until the coil spring 5' is restored to a straight-line state. Afterwards, the entire coil spring 5' may continue to swing around the base fixing shaft 42 towards left due to inertia, until the driver 2 is driven to abut against the limiting block 17 on

the swing rod 1 and reach the second limiting position. In this embodiment, because a length of the coil spring 5' from the connection position with the shifting fork 10 to the connection position with the driver 2 is greater than a length the coil spring 5' from the connection position with the shifting fork 10 to the pivotal connection position with the base 4, the first end of the coil spring 5' can generate a displacement much greater than the displacement of a part of the coil spring 5' driven by the shifting fork 10 during the process of elastically resetting from the bent state of the coil spring 5', so as to drive the driver 2 to rotate by an angle large enough to reach the predetermined limiting position.

[0056] In a second embodiment, the shifting fork 10 acts as a connecting piece to drivably connect the swing rod 1 with the elastic element so as to drive the elastic element to deform by means of the swing of the swing rod 1. It should be understood that the shifting fork 10 can also be replaced by other forms of connecting piece, as long as the connecting piece can drive the elastic element to deform by means of the swing of the swing rod 1. For example, the swing rod 1 may be tied to a certain position between the two ends of the elastic element by a rope. Moreover, in the second embodiment, the elastic element can also be in other forms, such as a leaf spring, an elastic wire and the like.

[0057] In the above various embodiments, as the rotation axis of the driver 2 is perpendicular to the swing axis of the swing rod 1, the driver 2 rotates in a deflection plane different from the swing rod 1. Accordingly, the rotation of the driver 2 and the deflection of the swing rod 1 do not interfere with each other, which ensures that the swing rod 1 can fully swing to an operating position in which the electrically conductive bridge 3 electrically contact or disconnect from a respective contact every time and that the driver 2 can sufficiently rotate to the limiting position that supports receiving press of the push button 6 in a reverse direction next time. Thus, the push button switch according to embodiments of the present invention provides reliable switching operations. Meanwhile, because the movement paths of the driver 2 and the swing rod 1 are mutually independent and will not interfere, the requirement for the manufacture precision of driver 2, swing rod 1, and other related pieces of the push button 100 and the assembly accuracy of various pieces does not need to be very high to guarantee the reliable operation of the push button switch 100. Besides, even if the pieces of the push button switch 100 are worn and deformed after repeated use, the operations of the push button switch 100 will not become unreliable or even fail due to the decline of the fitting accuracy.

[0058] In the various embodiments of the present invention, as the elastic element 5 is

loaded by the actions of the swing rod 1 instead of the electrically conductive bridge 3, the counterforce generated by loading the elastic element 5 will not act on the electrically conductive bridge 3. Accordingly, the electrically conductive bridge 3 will only be affected by the unique driving force applied by the swing rod 1, such that the electrically conductive bridge 3 will be more stably and reliably driven to perform quick and neat operation of closing or opening contacts, and unexpected torsion will not be generated on the electrically conductive bridge 3 due to being forced at multiple points, which unexpected torsion will make the contact closing or opening operations bounce and further cause arc discharge to damage endurance of the contact.

[0059] In the various embodiments according to the present invention, because the rotation axis of the elastic element 5 relative to the swing rod 1 is perpendicular to the swing axis of the swing rod 1, i.e., the elastic element 5 is at the first side 11 of the swing rod 1 and generally rotates within a quite small angle range in the vicinity of the swing axis of the swing rod 1, the counterforce generated when the elastic element 5 drives the driver to rotate by the elastic restoring force and rotates itself relative to the swing rod 1 will not apply an significant torque to the swing rod 1, which generally will not influence the current operating position of the swing rod 1. This enables the moving and stationary contacts of the switch push button 100 to be stably maintained in the current state when the push button 6 is released.

[0060] In the various embodiments according to the present invention, the elastic element as a whole is positioned at the first side of the swing rod 1 away from the contact, so there is no need to form an opening on the swing rod 1 to allow the elastic element to pass through and extend into another side of the swing rod 1. Therefore, the assembly of the elastic element becomes easy and the mechanical strength of the swing rod 1 gets higher. Moreover, because the overall elastic element is away from the electric elements (including electrically conductive bridge 3, stationary contact 7 and the like) at the other side of the swing rod 1 and does not directly contact the electric elements, the elastic element per se is not charged, such that the elastic element will not generate arc discharge with other non-electric pieces within the base of the push button switch 100, thereby increasing safety of the push button switch 100.

[0061] The electrically conductive bridge 3 of the push button switch 100 in the above various embodiments can comprise the moving contact 31 at only one side, to connect or disconnect one stationary contact 7 by every pressing of the push button 6, thereby connecting or disconnecting a circuit; or the electrically conductive bridge 3 of the push button switch

100 can comprise moving contacts 31 at both sides, to simultaneously contact a stationary contact 7 and disconnect a stationary contact by every pressing of the push button 6, thereby disconnecting or connecting a further circuit while connecting or disconnecting the circuit at one side.

5 **[0062]** It should be understood that the text describes the push button switch 100 based on its placement orientations shown in the drawings for the purpose of facilitating description. The directions of “up, down, left, right” in the text are depicted based on the positioning. It is obvious that the push button switch can be arranged in various orientations as required. The directional descriptions of “up, down, left, right” between each feature described in the
10 text will correspondingly vary along with the change of the placement orientation of the push button switch 100, but the relative position relationship between each feature will not alter.

[0063] The specification of the present invention has been presented for the purpose of illustration and depiction, but it is not intended for exhaustive listing or restricting to the disclosed forms. Those skilled in the art can contemplate many modifications and
15 alterations. Therefore, the implementations are selected and depicted for better explaining principles and practical applications of the present invention and enabling other personnel in those skilled in the art to understand the following contents. That is, without deviating from the spirit of the present invention, all modifications and substitutions will fall within the protection scope of the present invention defined by the attached claims.

What is Claimed is:

1. A push button switch, comprising:

a swing rod (1) swingably supported on a base (4) and having a first side (11) and a second side (12) opposite to each other;

5 a driver (2) connected to the first side of the swing rod (1) and being rotatable between a first limiting position and a second limiting position;

an electrically conductive bridge (3) having a moving contact (31) and deflectably coupled to the second side of the swing rod (1);

10 an elastic element (5, 5') coupled between the driver (2) and the base (4) and drivably connected with the swing rod (1); and

a push button (6), configured to press the driver (2) at one of the first limiting position and the second limiting position while being pushed, to drive the driver (2) and the swing rod (1) to swing around a swing axis, such that the swing rod (1) drives the electrically conductive bridge (3) to deflect, which causes the moving contact to contact or
15 disengage a stationary contact (7);

wherein the elastic element (5, 5') is configured to be driven by the swing rod (1) to elastically deform when the push button (6) is pushed to cause swing of the swing rod (1), whereas when the push button (6) is released, the elastic element (5, 5') that is elastically deformed drives the driver (2) to rotate from one of the first limiting position and the second
20 limiting position to the other of the first limiting position and the second limiting position, and

wherein the swing rod (1) has a first end and a second end in a direction of the swing axis, the driver (2) is connected to the swing rod (1) at the first end of the swing rod (1), and the elastic element (5, 5') extends between the first end (13) and the second end (14) of the
25 swing rod (1) on the first side (11) of the swing rod (1).

2. The push button switch of claim 1, wherein a first end of the elastic element (5') is drivably connected with the driver (2), and a second end of the elastic element (5') opposite to the first end is pivotally connected with the base (4), the swing rod (1) having a
30 connecting piece on the first side, which is drivably connected with the elastic element (5') at a position between two ends of the elastic element (5').

3. The push button switch of claim 2, wherein the connecting piece is a shifting fork (10), which clamps the elastic element (5') at a position between two ends of the elastic

element (5').

4. The push button switch of claim 2, wherein a length of the elastic element (5') from a connection position with the connecting piece to a connection position with the driver (2) is greater than a length of the elastic element (5') from a connection position with the connecting piece to a pivotal connection position with the base (4).

5. The push button switch of claim 1, wherein a first end of the elastic element (5) is drivably connected to the driver (2), and a second end of the elastic element (5) opposite to the first end is flexibly connected with the base (4), the elastic element (5) being pivotally connected, at a position between its two ends, to the first side (11) of the swing rod (1).

6. The push button switch of claim 5, wherein the base (4) comprises a stop groove (41) in the vicinity of a second end (14) of the swing rod (1), and a second end of the elastic element (5) extends into the stop groove (41), such that when the swing rod (1) drives the elastic element (5) to swing, the stop groove (41) at least partially restricts the second end of the elastic element (5) to move along with the swing rod (1), and the stop groove (41) allows the second end of the elastic element (5), when the push button being released, to rotate relative to the swing rod (1).

7. The push button switch of claim 5, wherein a length of the elastic element (5) from a pivotal connection position with the swing rod (1) to a connection position with the driver (2) is greater than a length of the elastic element (5) from a pivotal connection position with the swing rod (1) to a flexible connection position with the base (4).

8. The push button switch of any of claims 2-7, wherein the driver (2) comprises a driving hole (23) or a driving groove, and a first end of the elastic element (5, 5') extends into the driving hole (23) or driving groove to drivably connect with the driver (2).

9. The push button switch of any of claims 1-7, wherein the elastic element (5, 5') is a coil spring, a torsion spring, a leaf spring or an elastic wire.

10. The push button switch of any of claims 1-7, wherein the driver (2) is provided with two actuating blocks (21, 22) at two sides of the swing axis, the driver (2) being configured such that when it is at the first limiting position and the second limiting position, the push button (6), while being pushed, presses a different actuating block of the two
5 actuating blocks (21, 22) to cause the swing rod (1) to swing to different directions.