Aug. 28, 1962 G. A. WÅHLSTRÖM 3,051,810

PUSH BUTTON SWITCH

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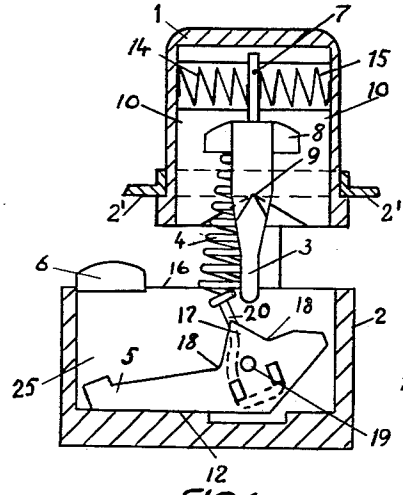


FIG. 1

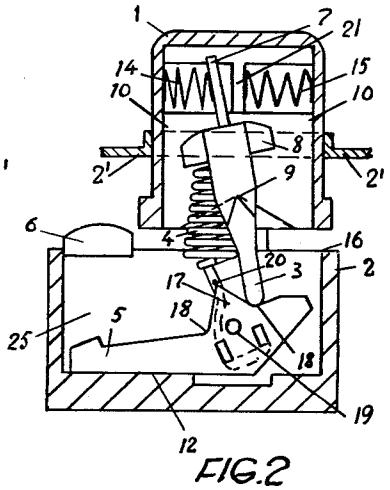


FIG. 2

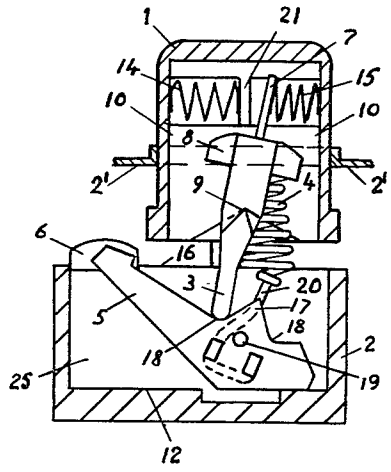


FIG. 3

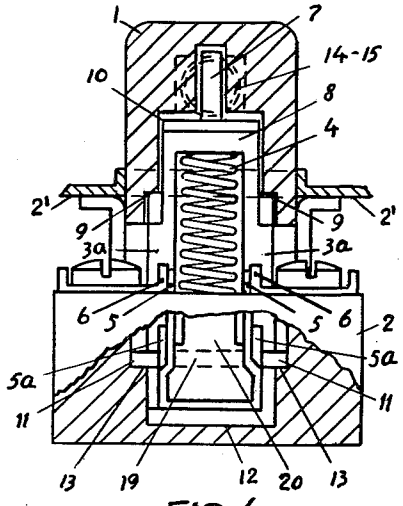


FIG. 4

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FIG.5

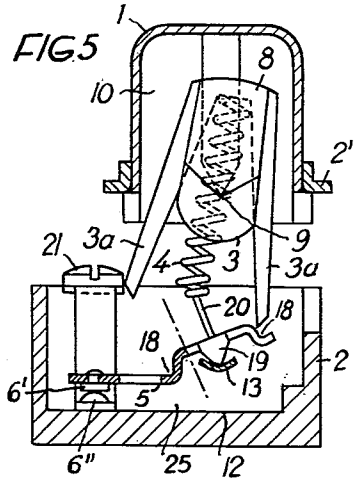


FIG.6

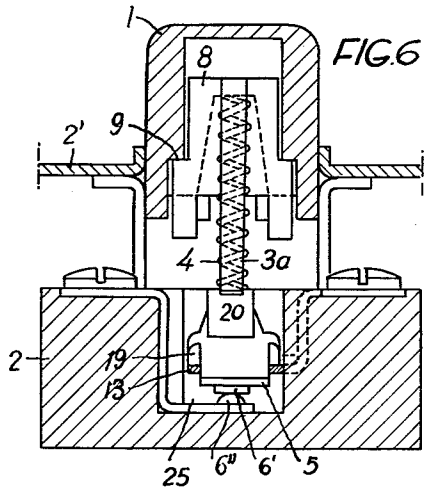


FIG.7

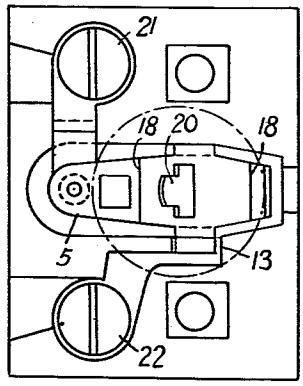


FIG.8

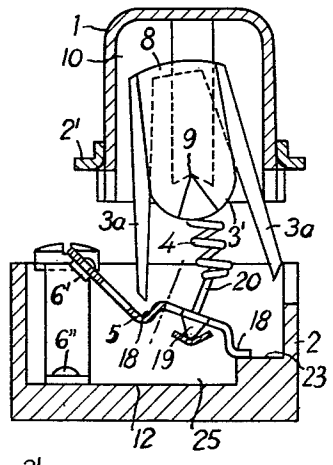
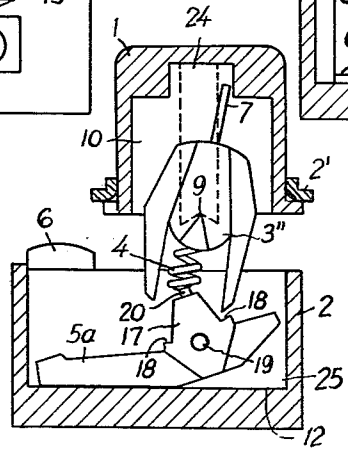


FIG.9



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FIG. 10

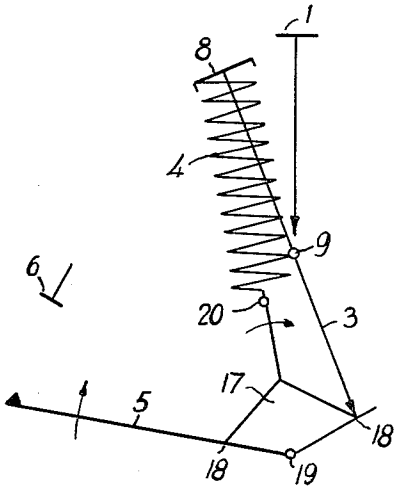


FIG. 11

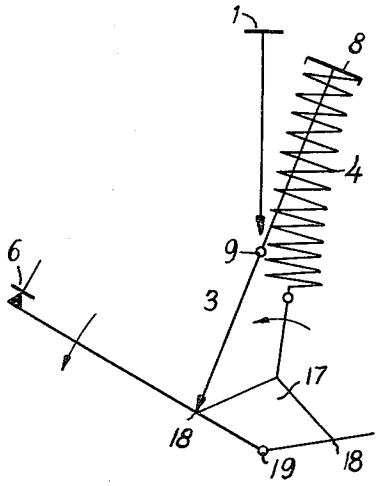


FIG. 12a

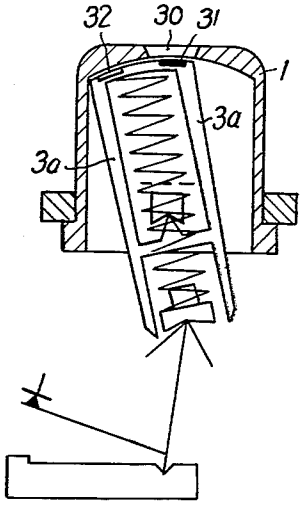
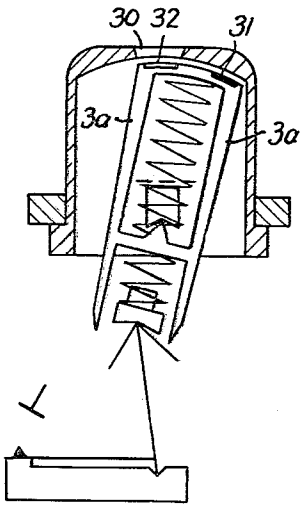


FIG. 12b



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PUSH BUTTON SWITCH

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6 Claims. (Cl. 200—153)

The present invention refers to a push button switch having a swingable contact member adapted to be adjusted or set into two extreme positions for breaking and closing the current, said contact member being formed as a double-armed lever arranged by means of a push button operated actuating member to be set in either of its extreme positions. Such push button switches are known for instance from the Swedish Patent 66,165, the German Patent 452,235 and the Danish Patent 30, 248. Here, the actuating member is mounted at the upper end thereof in the push button and a compression spring is inserted between the pivot axis of the actuating member and the contact member. This construction has the drawback that the initial momentum of the spring is very small so that the contact member sometimes will remain in an intermediate position (dead point).

The present invention has for one object to avoid said disadvantage by an increase of said momentum. This is achieved according to the invention if the actuating member is formed as a two-armed lever, the pivot axis of which located between the ends of said lever being arranged to participate in the movement of the push button, and if one end of the actuating member is adapted to actuate that contact member for setting same into its extreme position a compression spring being inserted between the other end of the actuating member and the contact member.

By this construction the upper end of the compression spring connected with the upper end of the adjusting arm will during a switching movement move in the opposite direction relatively to the movement of the lower end of the compression spring connected with the neutral line of the contact arm, before this end has commenced its movement in connection with the switching movement of the contact member, whereby the effect of the momentum on the contact member becomes greater during the actual switching movement than if the upper end of the compression spring were laterally immovable, as is the case in the known constructions. Furthermore, a pre-tension of the spring is obtained which tends to pull the lower end of the spring in the direction in which said end will move later at the actual switching movement, whereby the momentum acting on the contact arm will still increase. Furthermore, the advantage is attained that the spring and consequently the whole mechanism cannot remain in an intermediate position (dead point) by reason of a too small initial momentum of the spring.

The invention will be described in more detail hereinbelow with reference to the accompanying drawings, which illustrate some embodiments of the invention. FIG. 1 represents a longitudinal section of a switch according to the one embodiment of the invention with a push button in the upper extreme position. FIG. 2 shows the same switch with the push button displaced somewhat downwardly. FIG. 3 shows the switch when the push button is to break the current. FIG. 4 shows a longitudinal section of the switch taken at right angles to the sections of the previous figures with the push button in its upper position. FIG. 5 shows another embodiment of a single circuit push button switch according to the invention. FIG. 6 shows the same switch in a longitudinal section at right angles to that of FIG. 5. FIG. 7 shows the switch viewed from above, wherein parts above the contact member have been removed. FIG. 8 shows an embodiment of the switch with a modified construction of the

mounting of the actuating member. FIG. 9 is a sectional view of another embodiment of the switch according to the invention. FIGS. 10 and 11 show the movable parts of a switch according to the invention in the extreme positions thereof, by way of diagrammatic representation. FIGS. 12*a* and 12*b* illustrate by way of example how the push button and the actuating member of a switch according to the invention can be formed and combined to provide a switch position marking mechanism. In the different figures corresponding parts are designated by the same reference numerals.

In FIGS. 1–4 a switch according to the invention is shown which comprises a push button **1** having an internal space or cavity **10**. An insulating socket **2** has its upper portion **2'** formed as a guide for the push button **1**. An actuating member **3** is pivotably mounted in the lower portion of the push button **1** at the internal side walls thereof, the pivot center **9** being located below the upper end **8** of the actuating member which end is formed so as to accommodate the upper end of a compression spring **4**. Preferably the distances between the pivot **9** and the ends of the actuating member are approximately the same, i.e. the pivot center **9** is provided centrally of the actuating member. The lower end of the compression spring **4** is connected to a contact member **5** arranged in known manner and being mounted on a pivot axis **19** in the internal space **25** of the lower socket member **2**. The contact member consists of two shanks **5***a* (FIG. 4) and a cross bar or cross piece **20**. Fixed contacts **6** are arranged at one side of the lower portion **2** of the socket outside an opening **16**. The spring **4** is so arranged that, when the push button is depressed to effect interruption of the current, in which operation the actuating member and the movable points of attachment of the compression spring **4**, i.e. the upper end **8** of the actuating member and the cross piece **20**, take the positions shown in FIG. 3, a torque is produced moving the contact member **5** into the positions shown in FIGS. 1 and 2 thus breaking the current. In FIG. 4 the arms **5***a* of the contact member **5** at the ends **11** of the pivot axis **19** are mounted on two seats **13**, which are formed in the internal side walls of the socket **2**. The fixed contacts **6**, with which the one end of the contact member **5** cooperates, are secured to the insulating socket over an opening therein. The actuating member **3** cooperates by means of its arms **3***a* (FIG. 4) with the slanting sides of recesses **18** in both arms of the contact member **5**, which is provided with a cam **17** between said arms. When the contact member **5** takes one of its two extreme positions, FIGS. 1 and 2 and FIG. 3, respectively, the cam will be situated in known manner on the one or the other side of the actuating member **3**. When the member arm **3** is depressed from the middle position shown in FIG. 1, the lower end thereof cooperating with the cam **17**, will meet with the one or the other slanting side of the cam depending on in what end position the contact member **5** is set, and will slide along said side, until it reaches the bottom of the recess **18** of the contact member. Further depression of the push button brings the contact member **5** into its other extreme position, so that it will be possible in this manner alternately to effect closing and breaking of the current.

The actuating member **3** is pivotably mounted as at **9** in the internal walls of the hollow push button, and the pivot axis is located straight above the pivot axis **19** of the contact member **5**. When the push button switch is in its position of rest, the actuating member will have to be kept in a definite middle or zero position. The means required for this purpose in view may be constructed in various ways according to the invention. In the form of embodiment according to FIGS. 1–4, the actuating member **3** is provided with an upwardly ex-

tending pin 7, the free end of which being held between two compression springs 14 and 15 clamped between the internal wall of the push button and a pair of abutting plates 21 for the springs, said plates being rigidly connected with said internal wall. The actuating member 3 is constituted by a piece of sheet metal. Said pin 7 is movable laterally in either direction against the action of the compression springs 14 and 15, the movement of the end portions of which is restricted by the plates 21. The compression springs 14 and 15 preferably take the form of helical springs of the same strength.

In the embodiment according to FIGS. 5–8, the contact member 5 is provided on the lower side thereof with an edge 19 resting against a V-formed support 13 in the inner space 25 of a socket member 2. The contact member 5 is made from a bent metal strip and provided at one end thereof with a contact 6′ adapted to make contact with a fixed contact 6″, which at the bottom 12 of the recess 25 is secured to a metal strip having a connecting screw 21 forming the one terminal of the switch. The other terminal is constituted by a connecting screw 22 connected to the support 13.

The lower end of the compression spring 4 is supported by the upper edge of a plate 20 extending at right angles from the pivot axis of the contact member and the upper surface of the contact member. The contact member 5 is provided with downwardly bent portions 18 on both sides of the pivot axis, said downward bends constituting points of abutment for the ends of a pair of legs 3*a* of which the actuating member 3 inter alia consists. The distance between and the length of the legs 3*a* are such that at the two extreme positions of the actuating member one of said legs is always in contact with or immediately adjacent to a downward bend 18 on the contact member 5. The spring 4 is so arranged that when the push button 1 is depressed to break the current, in which operation the actuating member and the two movable ends of the compression spring 4, namely at the upper portion 8 of the actuating member and at the supporting plate 20, initially take the positions shown in FIG. 5, the lower end of the right hand leg 3*a*, FIG. 5, will abut against the corresponding portion 18 of the contact member, so that the contact member 5 is swung into the position shown in FIG. 8 and the current is momentarily interrupted. The socket 2 is provided at the bottom thereof with an abutment 23 restricting the movement of the contact member 5 at the movement of same for interruption. According to FIG. 5 for the mounting of the actuating member 3 serves a pair of downwardly directed edges formed by shoulders in the inner wall of the button and bearing on the center of a pair of upwardly directed V-formed surfaces of the actuating member. In the embodiment according to FIG. 8 the said edges and the V-formed surfaces have changed places, inasmuch as the abutments in the internal walls of the button are formed into downwardly directed V-formed surfaces and the actuating member 3 is provided with a pair of upwardly directed edges.

The embodiment according to FIGS. 5–8 is also suitable to indicate the position of the contact member. In such case the bottom of the push button is provided with a central opening and the upper end surface 8 of the actuating member 3 with for instance a red dot visible in the opening when the switch is closed. The upper end surface 8 may also be provided with the number 0 visible in the opening when the switch is open and for instance with a dash visible when the switch is closed. See further FIGS. 12*a–b*.

In the embodiment according to FIG. 9 the contact member has two shanks 5*a* placed side by side as in the switch shown in FIGS. 1–4, said shanks being connected by means of a cross piece 20 serving at the same time as a support for the spring 4. The contact member cooperates with a pair of fixed contacts 6 arranged on the socket 2. The two legs 3*a* of the actuating member 3″ cooperate with abutments 18 in each arm of the double-armed contact member which is provided with a cam 17 with sloping sides between said arms. At the tilting movement of the contact member the two shanks 3*a* of the adjusting arm will always be on each side of the cam 17. A projection 7 extends from the top of the actuating member 3″, said projection cooperating with the lateral surfaces of a recess 24 provided in the bottom of the button 1, so as to restrict the movement of the actuating member 3″ in both directions.

FIGS. 10 and 11 illustrate the principle of the invention by way of diagrammatic representation. FIG. 10 thus shows the position of the movable parts of the mechanism prior to the closing of the switch, while FIG. 11 shows the position of the parts immediately after the breaking of the switch. The double-armed actuating member 3 is mounted about the pivot axis 9 of the push button 1. The contact member 5 likewise consists of a double-armed lever, which is rotatable about the fixed axis 19 and is provided with the symmetrical cam 17, the lower edges of which are located approximately at the same distance from the axis 19 and are formed as abutments 18. The cross piece 20 of the contact member supports the compression spring 4 which is mounted between the upper end 8 of the adjusting actuating member 3 located above the pivot 9 and the cross piece 20.

In FIG. 10 the push button 1 has been depressed from the position of rest shown in FIG. 1 to an intermediate position to effect closure of the current, and the actuating member 3 has slidden with its lower part along the sloping surface of cam 17 until reaching the ultimate position determined by the abutment 18. The spring 4 is compressed during this movement of the button. At the same time the upper end 8 of the actuating member is swung in a counter-clockwise direction, i.e. is displaced to the left, viewed according to FIG. 10, whereby the operative axis of the spring 4, i.e. the line connecting its supporting points 8 and 20 is brought closer to the pivot axis 19 of the contact member 5. The torque on the axis 19 exerted by the spring 4 to keep the contact member in the off-position will thus become smaller in FIG. 10 than in FIG. 1. Therefore, when the push button is pressed further downwardly from the position shown in FIG. 10, the actuating member will turn the contact member 5 to an unstable position of equilibrium, in which the spring 4 is subjected to its maximum compression, until the operative axis of spring 4 has moved past the axis 19, so that the latter will be on the left of this operative axis, viewed as in FIG. 1. The spring then exerts a torque on the axis 19, which coincides with the torque caused by the actuating member 3, whereby the contact member 5 will be quickly turned by the spring 4 in a clockwise direction so as to effect closure with the fixed contacts 6. The process will be an analogous one, when the contact member 5 is to be turned in a counter clockwise direction according to FIG. 11 for the purpose of contact breaking. During this reversal from contact breaking to contact making, and vice versa, the lever of the momentum caused by the spring 4 on the contact member 5 with respect to the axis 19 becomes successively greater, so that a reliable, positively controlled turning movement of the contact member into its new extreme position will be obtained automatically.

Thus the mechanism according to the invention will in a very simple manner bring about the following functions. In the position of rest of the push button, the contact member is locked effectively by the spring. During the depression of the push button this locking effect is lessened, and the tension of the spring is augmented simultaneously therewith. During the movement of the contact arm the tension of the spring is suddenly reduced and the spring is moved quickly in a manner to effectively lock the contact arm in its new extreme position.

FIGS. 12*a* and 12*b* show by way of example that a

switch position marking system can be provided in the switch according to the invention in a very simple manner. Heretofore it has been very difficult to provide a position marking mechanism in a push button switch. The solution according to the invention consists in forming or providing the upper surface of the actuating member 3*a* with marks indicating two different extreme positions of the switch, said marks being visible through a little window **30** centrally in the top wall of the push button **1**. One of said marks, **31**, may for instance indicate closure of the push button switch and may consist of a dash, a red point or the like. The other mark, **32**, may consist of the figure 0, a point in another colour or the like. Because of the fact that the actuating member takes different positions in the extreme positions of the switch said marks are alternately exposed in said window or other transparent portion of the push button as the switch is operated for closure and interruption of the electric circuit. At least the mark showing interruption of the switch may be made of or coated by a substance having radiation properties so that said mark is visible in the dark.

I claim:

1. A push button switch comprising a swingable contact arm pivotally mounted so as to be set into two extreme positions, for closing and breaking respectively an electrical current, by means of a push button operated actuating member and by spring action, said actuating member being swingably mounted about a pivot axis which is arranged to move with the push button, a push button operating the actuating member, a compression spring inserted between and engaging the contact arm and a point of the actuating member, the distance of which from the pivot axis of the contact arm is greater than the distance between the pivot axis of the actuating member and the pivot axis of the contact arm.

2. A push button as claimed in claim 1, in which the spring is inserted between the actuating member and a point of the contact arm, the distance of which from the pivot axis of the actuating member is less than the distance between the pivot axis of the actuating member and the pivot axis of the contact arm.

3. A push button switch as claimed in claim 1, the actuating member being pivotably mounted in the push button by means of edges arranged to be pressed by the compression spring against recessions in the push button.

4. A push button switch as claimed in claim 1, in which two further compression springs are arranged to move the actuating member into a resting position when the push button returns to its resting position.

5. A push button as claimed in claim 1, in which the actuating member has an end cooperating with the contact arm and the end is formed with two legs which are always situated on each side of the pivot axis of the contact arm and are arranged alternately to actuate the contact arm for moving same into its extreme positions.

6. A push button switch as claimed in claim 1, in which the actuating member is pivotably mounted in the push button and extends in the push button to the top thereof with its one end, said end being provided with switch position indicating marks, which are visible through transparent parts of the top of the push button.

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