

- [54] **ALTERNATE ACTION SWITCH WITH BINDING PREVENTING ARRANGEMENT**
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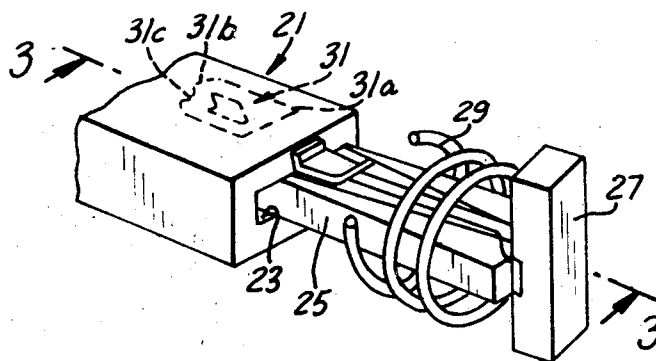
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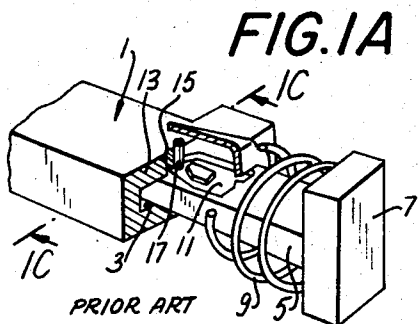
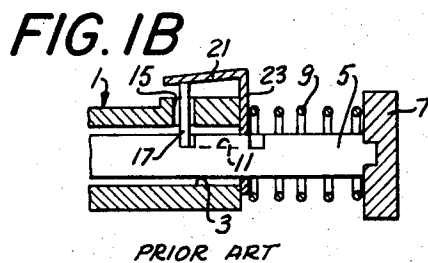
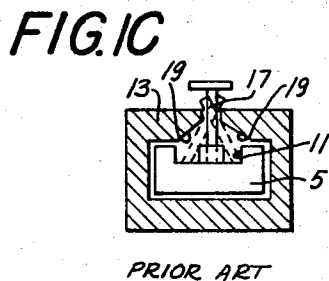
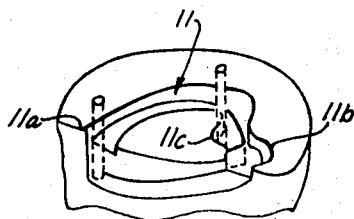
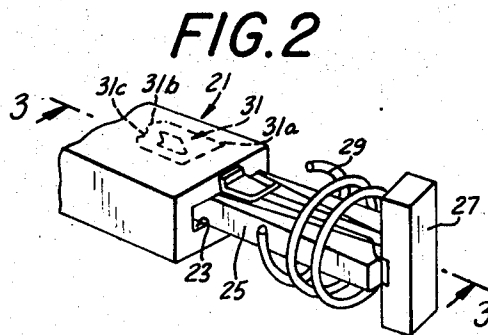
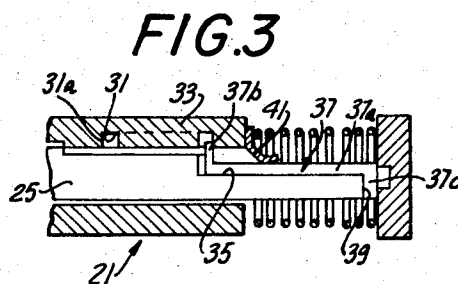
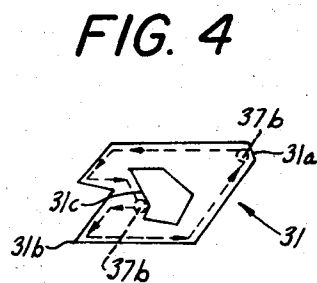
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[57] **ABSTRACT**

A pushbutton switch in which the pushbutton, when pushed, will alternate between an outer position and an inner position, the structure for effecting this movement exerting a minimal frictional force on the pushbutton of the switch as it moves from one operative position to the other and being so arranged as not to take up any more space than the switch proper. A heart-shaped channel is formed on an inner wall of the pushbutton body, a driving member is carried by the push rod and has a part received in that channel so as to operatively coact therewith, and a spring is mounted on an end of the switch body so as to engage and slide over the driving member as the pushbutton moves while at the same time urging the driving member against the push rod. Preferably the push rod is provided with a channel within which the driving member is received, thereby to further minimize the space taken up by the operating parts.

11 Claims, 7 Drawing Figures





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ALTERNATE ACTION SWITCH WITH BINDING PREVENTING ARRANGEMENT

The present invention relates to a pushbutton switch of the type in which one actuation of the switch will cause its push rod to move from an outer to inner position and stay in the inner position, the next actuation of the push rod releasing it from its inner position and causing it to move to its outer position, and so on sequentially.

In the past the structure which has been employed to accomplish this mode of operation has had two major disadvantages. The mechanical interaction of the operating parts has been such as to militate against smooth and easy operation, and the operating mechanism has extended from the body of the switch, thereby causing the switch to occupy more space than would otherwise be the case.

In these prior art structures the push rod of the switch has been provided with a channel essentially of heart-shape, with which a driving member carried by the switch housing is adapted to cooperate. That driving member extends above the switch housing, where it is engaged by a spring carried by the switch housing, that spring urging the driving member down into the channel in the push rod. Because of the heart-shape of that channel, when the push rod is moved the driving member must swing from side to side, and the structure of the switch housing must be relieved in order to permit that movement. The action of the spring on the driving member of the prior art construction causes its end to press against the push rod, thereby exerting a maximal frictional action on the push rod, thereby tending to restrict its freedom of movement. Indeed, sometimes the driving member tends to bite into the push rod, thus tending to stop its motion altogether. The fact that the driving member and spring extend above the switch housing causes the switch assembly as a whole to occupy more space than would otherwise be the case, which is often a disadvantage. The fact that the switch housing must be relieved in order to permit the driving member to tilt from side to side when the push rod is moved weakens the switch housing and makes it more liable to breakage.

The prime objective of the present invention is to provide a push-push type switch which avoids the above disadvantages, and which instead takes up no more space than the switch body itself, exerts only a minimal force on the push rod tending to restrict its freedom of movement, and utilizes an unweakened switch housing.

It is another object of the present invention to provide a pushbutton switch of the type under discussion which is reliable, inexpensive, easy to assemble and easy to operate.

To these ends the housing of the switch of the present invention is provided with an essentially heart-shaped channel on an inside surface of a wall thereof opposite which the push rod is designed to move. The push rod carries a driving member, that member having a part received within the channel in the switch body. That driving member is completely received within a projection of the cross sectional shape of the switch body; indeed, it may be carried within a recess in the push rod provided for that purpose. A spring may be mounted on the switch body to engage and slide over

the driving member as the push rod is moved between its operative positions, that spring also preferably being contained within a projection of the cross sectional shape of the switch housing. In the form here specifically disclosed it may be mounted on the end of the housing from which the push rod projects. The driving member may be essentially of Z-shape, one end of the Z constituting the part which is received in the channel and the other end of the Z being pivotally received in an opening in the push rod, the driving member swinging about that other end of the Z, as the push rod is moved but being supported along substantially its entire length by the push rod as it thus swings.

As a result the structure is exceptionally sturdy, exceedingly easy to assemble and very reliable in operation.

To the accomplishment of the above and to such other objects as may hereinafter appear, the present invention relates to the construction of a push-push type switch as defined in the appended claims and as described in this specification taken together with the accompanying drawings in which:

FIGS. 1A - 1D illustrate a typical prior art construction, FIG. 1A being a three-quarter view partially broken away; FIG. 1B being a fragmentary cross sectional view taken along the axis of the push rod; FIG. 1C being a cross sectional view taken along the line 1C - 1C of FIG. 1A; and FIG. 1D is a schematic perspective view showing the heart-shaped channel and the cooperating driving member;

FIG. 2 is a three-quarter perspective view of a switch made in accordance with the present invention, the push rod being shown in its outer operative position;

FIG. 3 is a cross sectional view taken along the line 3-3 of FIG. 2; and

FIG. 4 is a schematic view showing the cooperation between the heart-shaped channel and the driving member in the switch construction of the present invention.

A conventional push-push type switch, a typical embodiment of which is disclosed in FIGS. 1A - 1D, comprises a hollow case or body 1 which contains appropriate fixed and movable switch contacts (which form no part of the present invention and hence are not here specifically disclosed). The body 1 is provided with an end opening 3 through which a push rod 5 extends, the push rod being movable into and out of the body 1, thereby appropriately to actuate the switch contact assemblies therewithin. The push rod 5 terminates in an operating button 7, and a biasing spring 9 is compressed between the button 7 and the end of the body 1 from which the push rod 5 extends, thereby to bias the push rod 5 outwardly.

The upper surface of the push rod 5 is provided with a channel 11 essentially of heart-shape. That channel 11 faces the top wall 13 of the switch body 1. That wall 13 is provided with an aperture 15 through which a driving member 17 in the form of a pin is adapted to pass. For reasons which will appear, the body wall 13 is relieved at 19, so that the lower portion of the opening 15 is considerably wider than the upper portion thereof. The driving member 17 extends above the upper surface of the wall 13, and is there engaged by arm 21 of spring 23, the spring arm 21 being active to urge the driving member 17 downwardly so that its its

lower tip rests on and slides over the upper surface of the heart-shaped channel 11.

As may be seen particularly from FIG. 1D, when the pushbutton 7 is pushed inwardly the push rod 5 will slide inwardly and the lower end of the driving member 17 will move along the left-hand side of the channel 11 from the point 11a of the heart toward the wide end 11b of the heart, the heart point 11a being directed toward the inside of the switch body 1. During this movement the driving member 17 must swing in a clockwise direction as viewed from the pushbutton 7, from its solid line position to one of its broken line positions shown in FIG. 1C, and it is for this reason that the body wall 13 is relieved at 19. After the push rod 5 has been pushed all the way in, thereby to cause a change in the status of the switch mechanism per se, it is released and the spring 9 tends to move it outwardly. The push rod 5 will move outwardly a small distance, but then the lower end of the driving member 17 will be engaged in the recessed portion 11c of the heart-shaped channel 11, and the push rod 5 will thus be positively retained in its inner position. The next time that the pushbutton 7 is pushed in the lower end of the driving member 17 will be swung to the right, the member 17 pivoting in a counterclockwise direction. When the button 7 is then released the spring 9 will urge the push rod outwardly and the rod will be permitted thus to move, the lower end of the driving member 17 moving along the right-hand side of the channel 11, until the driving member 17 engages the point 11a of the heart, at which time the push rod 5 will be positively retained in its outer position.

Because the spring arm 21 urges the push rod 17 down against the upper surface of the channel 11, free movement of the push rod 5 will be inhibited. The pin 17 will exert a strong frictional force on the rod 5, and may even tend to dig into the latter. Because driving member 17 and the spring 21, 23 extend above the upper surface of the switch body wall 13, more space is needed to accommodate the switch than is required by the switch body 1 alone. Because the switch wall 13 must be relieved at the areas 19, that wall is weakened. Because the switch arm 21 is exposed above the switch body 1, it is more susceptible to damage.

In accordance with the present invention the switch body 21 is provided with an opening 23 through which the push rod 25 is adapted to extend, that rod having at its end a pushbutton 27. A biasing spring 29 is compressed between the pushbutton 27 and the end of the body 21. The push rod 25 is adapted to actuate the actual switching mechanism within the body 21. As thus far described the arrangement is the same as in the prior construction of FIGS. 1A - D.

In the construction of the present invention, as distinguished from that of the prior art, the heart-shaped channel 31 is formed in the undersurface of the top wall 33 of the body 21, and its point 31a is directed toward the pushbutton 27, its wide part 31b being directed toward the interior of the switch body 21.

The driving member 37 is essentially of Z-shape, comprising an elongated body portion 37a, an upwardly directed end portion 37b, and a downwardly directed end portion 37c. The driving member 37 is carried by the push rod 25, preferably in a recess 35 formed in the upper surface of that push rod 25. The

upwardly extending end part 37b of the driving member 37 is received in the heart-shaped channel 31. The elongated body portion 37a of the driving member 37 is supported along its length by the push rod 25. The downwardly extending end portion 37c of the driving member 37 is received within an aperture 39 in the push rod 25, so that the driving member 37 is adapted to move longitudinally with the push rod 25 but to be capable of lateral swinging movement about the axis of the driving member end 37c, the recess 25 being laterally widened in order to permit that movement. A leaf spring 41 is mounted on the end of the body 21 from which the push rod 25 extends. It engages the driving member 37, tends to urge it downwardly into supportive engagement with the push rod 25, and slides over the body portion 37a of the driving member 37 as the push rod is moved in and out.

The cooperation of the driving member part 37b and the heart-shape of the channel 31 in order to provide a push-push type of operation is essentially the same as that described above in connection with the prior art embodiment illustrated in FIGS. 1A - D, as will be apparent from FIG. 4. The specific differences in configuration between the channels of FIGS. 1D and 4 are not of controlling significance; they each represent different shapes which could be used interchangeably in one embodiment or the other. It is to be noted, however, that the orientation of the channel 31 of FIGS. 2 - 4 is opposite to that of the channel 11 of FIGS. 1A - D.

It is significant, however, that in the structure of the present invention, as disclosed in FIGS. 2 - 4, the driving member 37 is not pressed against the bottom of the channel 33, as was the case in connection with the driving member 17 and the channel 11 in the embodiment of FIGS. 1A - D. Indeed, the action of the spring 41 ensures that such driving member engagement with the channel will not take place. Instead, it is the curved side of the driving member part 37b which engages with the smooth side of the channel 31. Thus frictional resistance to the movement of the push rod 25 is minimized, and there is no tendency for the driving member 37 to dig into the channel 31. The driving member 37 is firmly supported along its length, in this respect also being superior to the prior art construction. Neither the spring 41 nor the driving member 37 extend laterally from the switch body 21, and hence the switch assembly can be used in locations where there is not enough space for the prior embodiments to be installed. All of the parts of the construction of the present invention are sturdy, they are all guided and supported as they move, their assembly is easy, and their operation is reliable and safe.

While but a single embodiment of the present invention has been here specifically disclosed, it will be apparent that many variations may be made therein all within the scope of the present invention as defined in the following claims.

I claim:

1. A pushbutton switch comprising a body with a surface, a generally heart-shaped channel in said surface, a push rod located opposite and movable along said surface between first and second operative positions, a driving member carried by said push rod and having a part received in said channel, said biasing means active on said push rod to urge it to said first operative posi-

tion, said heart-shaped channel having the point of the heart pointing generally in the direction from said second to said first operative position, in which said driving member is mounted on said push rod so as to be movable relative to said push rod in a direction substantially perpendicular to the direction of movement of said push rod while being movable with said push rod in the direction of movement of the latter, and in which said push rod is provided with a recess facing said body surface, said driving member being received in and said part of said driving member extending beyond said recess.

2. The pushbutton switch of claim 1, in which said driving member comprises a body extending along said push rod, said part extending up from said body, and a second part extending down from said body, said push rod having an opening into which said second part of said driving member is pivotally received.

3. In the pushbutton switch of claim 1, second biasing means active on said driving member to urge it away from said body surface.

4. The pushbutton switch of claim 3, in which said second biasing means is carried by said switch body.

5. The pushbutton switch of claim 4, in which said driving member comprises a body extending along said push rod, said part extending up from said body, and a second part extending down from said body, said push rod having an opening into which said second part of said driving member is pivotally received.

6. The pushbutton switch of claim 4, in which said biasing means extends from said driving member no farther than said switch body from said driving member extends, and in which said second biasing means slidably engages said driving member.

7. A pushbutton switch comprising a body with a surface, a generally heart-shaped channel in said surface, a push rod located opposite and movable along said surface between first and second operative positions, a driving member carried by said push rod and having a part received in said channel, and biasing means active on said push rod to urge it to said first operative position, said heart-shaped channel having the point of the heart pointing generally in the direction from said second to said first operative position, in which said driving member is mounted on said push rod so as to be

movable relative to said push rod in a direction substantially perpendicular to the direction of movement of said push rod while being movable with said push rod in the direction of movement of the latter, and in which said driving member comprises a body extending along said push rod, said part extending up from said body, and a second part extending down from said body, said push rod having an opening into which said second part of said driving member is pivotally received, and second biasing means active on said driving member to urge it away from said body surface.

8. The pushbutton switch of claim 7, in which said second biasing means is carried by said switch body.

9. The pushbutton switch of claim 8, in which said biasing means extends from said driving member no farther than said switch body extends from said driving member and in which said second biasing means slidably engages said driving member.

10. The pushbutton switch of claim 7, in which said biasing means extends from said driving member no farther than said switch body extends from said driving member, and in which said second biasing means slidably engages said driving member.

11. A pushbutton switch comprising a body with a surface, a generally heart-shaped channel in said surface, a push rod located opposite and movable along said surface between first and second operative positions, a driving member carried by said push rod and having a part received in said channel, and biasing means active on said push rod to urge it to said first operative position, said heart-shaped channel having the point of the heart pointing generally in the direction from said second to said first operative position, and second biasing means active on said driving member to urge it away from said body surfaces, in which said driving member is mounted on said push rod so as to be movable relative to said push rod in a direction substantially perpendicular to the direction of movement of said push rod while being movable with said push rod in the direction of movement of the latter, and in which said driving member comprises a body extending along said push rod, said part extending up from said body, and a second part extending down from said body, said push rod having an opening into which said second part of said driving member is pivotally received.

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