# United States Patent [19]

**Barney**

[11] **3,883,704**

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[54] **MULTIPLE PUSHBUTTON SLIDE SWITCH ASSEMBLY WITH LAMINATED SLIDE ACTUATOR MEANS FOR ROD CONTACTS**


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[52] U.S. Cl..... **200/5 EB;** 200/16 A; 200/50 C; 200/153 LA; 200/277

[51] **Int. Cl.** ..... **H01h 9/26**

[58] **Field of Search**..... 200/5, 16 A, 16 C, 16 D, 200/17 R, 18, 50 C, 153 LA, 277; 74/483 PB



[56] **References Cited**

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| 3,582,593 | 6/1971 | Mapelsden | 200/153 LA |
| 3,652,811 | 3/1972 | Barney | 200/5 EB |
| 3,681,547 | 8/1972 | Burch et al. | 200/277 X |



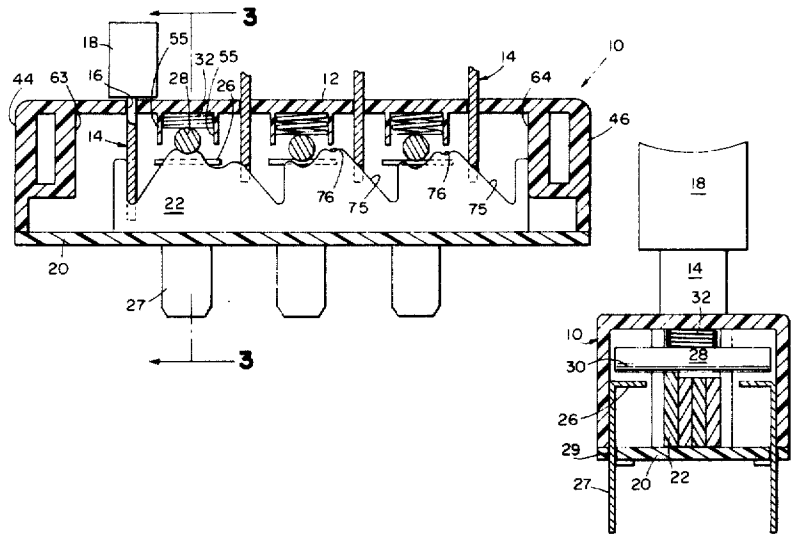
*Primary Examiner*—James R. Scott



[57] **ABSTRACT**

A multiple pushbutton slide switch has a housing, a set of slides, each slide providing actuator camming surfaces and contact camming surfaces, and a plurality of reciprocable slide actuating elements having slide engaging surfaces adjacent the actuator camming surfaces for operating the slides. A plurality of pairs of fixed terminal elements are mounted adjacent the housing on either side of the set of slides, each fixed terminal element having a fixed contact portion. A plurality of rigid bodily movable contact elements are provided, each having a slide contacting midportion for engagement with the contact camming surfaces on the slides. Biasing means biases the movable contact elements toward the fixed contact portions. Each movable contact element has opposite ends reciprocable in and out of contact with the fixed contact portions of a pair of fixed terminal elements.


**4 Claims, 5 Drawing Figures**



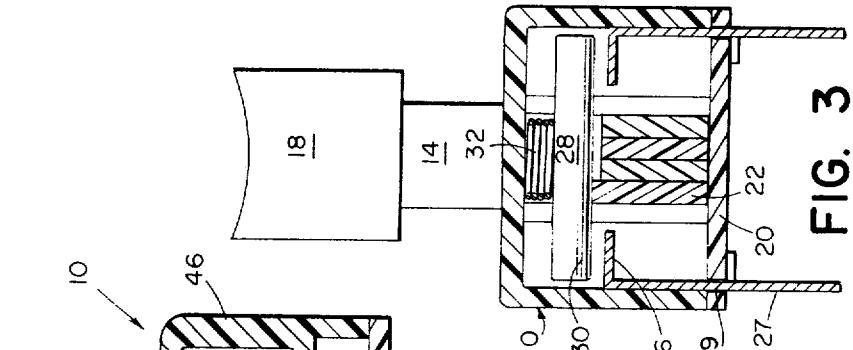


FIG. 3

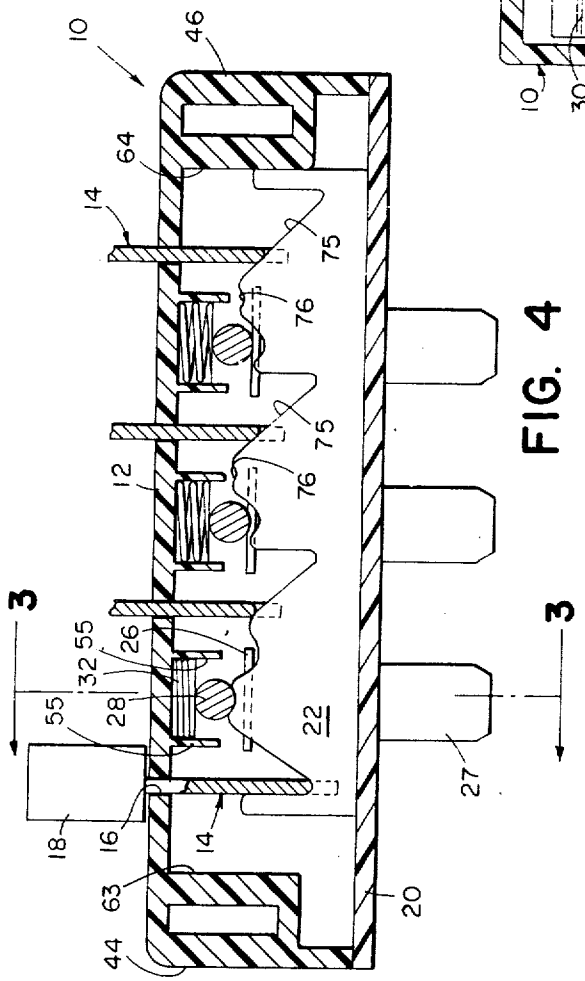


FIG. 4

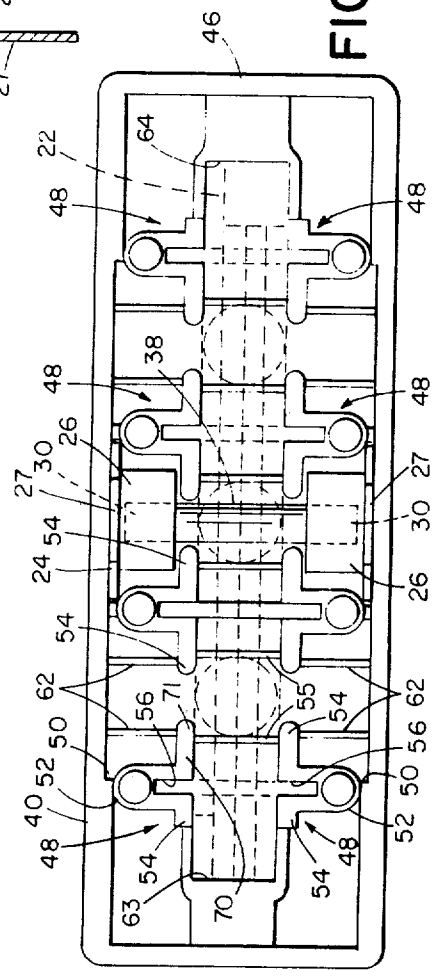


FIG. 2

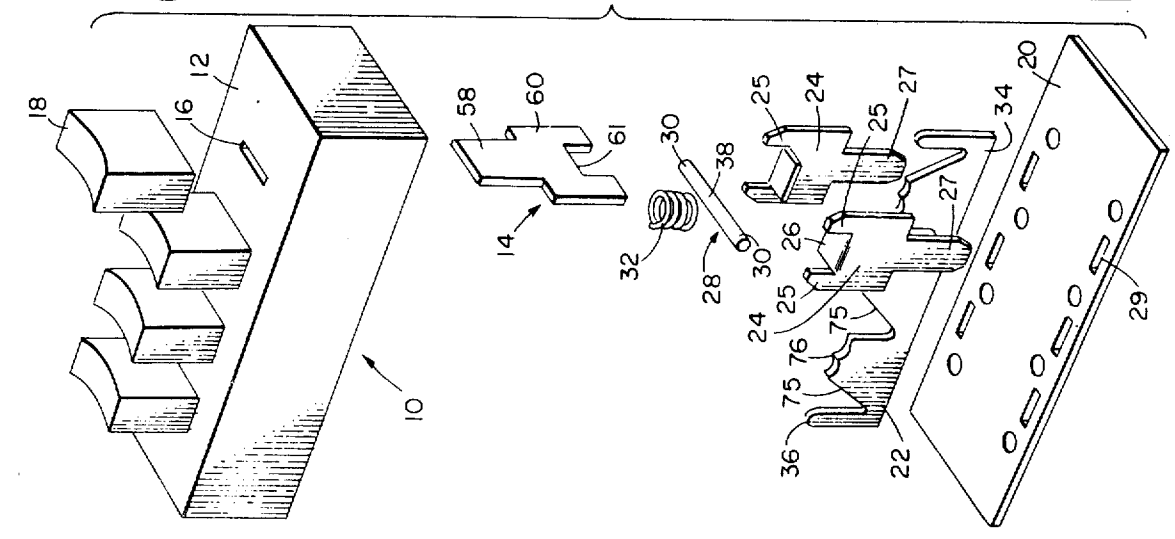


FIG. 1

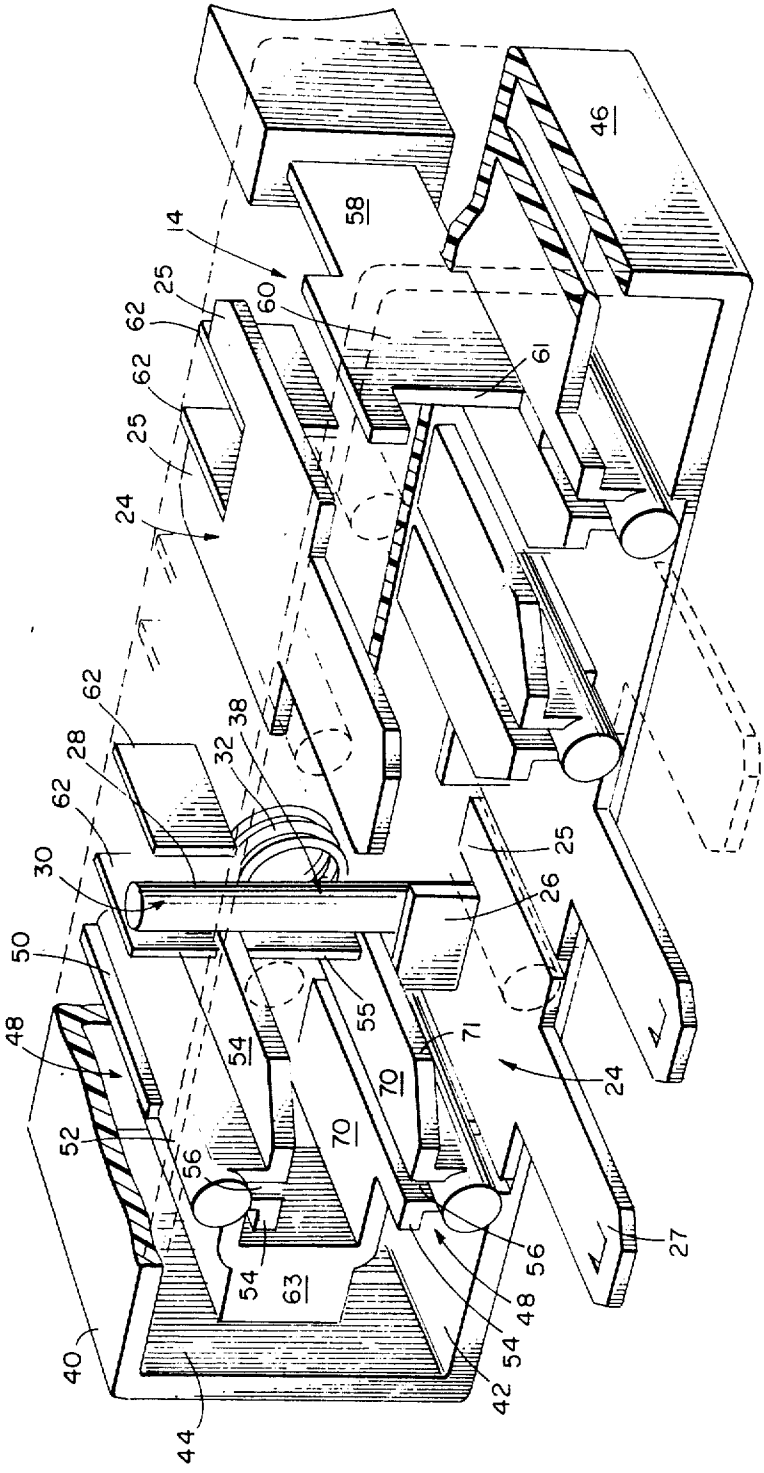

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FIG. 5

# MULTIPLE PUSHBUTTON SLIDE SWITCH ASSEMBLY WITH LAMINATED SLIDE ACTUATOR MEANS FOR ROD CONTACTS

This invention relates to electrical switches. In particular, it relates to pushbutton slide switches in which external pushbuttons are used to operate a set of slides which in turn cause engagement and disengagement of internal switch contacts.

Such switches, as described for example in U.S. Pat. No. 3,652,811, have generally provided a set of slides each having two spaced parallel camming edges. Internal actuators, in response to depression of the pushbuttons, move up and down above the slides and engage the upper camming edges to move the slides longitudinally within the switch housing, while the lower camming edges of the slides engage movable contacts which move up and down below the slides to make and break contact with fixed terminals. Since sufficient vertical space within the housing must be provided for the vertical motions of both the actuators and the movable contacts, the overall vertical dimension of the housing must be correspondingly large. However, in various applications of such switches it would be desirable to provide a switch having a smaller overall vertical dimension and a correspondingly lower profile. For example, in many hand held appliances such as blenders, hair dryers and electric combs, a relatively flat switch housing contributes to the compactness and convenience of the appliance. In many counter top applications space is similarly at a premium and a relatively flat switch housing is desirable.

Furthermore, pushbutton slide switches of the type shown, for example, in U.S. Pat. No. 3,652,811, have fixed and movable terminal portions that are unsymmetric and must be oriented correctly when the switch is assembled. Such correct orientation demands time and attention by the assembler, which increases the cost of manufacturing the switch.

It is therefore an object of this invention to provide a pushbutton slide switch having an overall vertical dimension significantly smaller than that of other such slide switches. It is a further object to provide such a switch that is durable and operates reliably over the switch lifetime. Additionally, it is an object to provide such a switch that is easy to assemble and that is consequently less expensive to manufacture.

According to the invention, a multiple pushbutton slide switch has a housing having an upper wall. A set of slides is provided within the housing, each slide providing actuator camming surfaces and contact camming surfaces. A plurality of slide actuating elements extend through the upper wall and are reciprocable between the upper wall and the slide set, having slide engaging surfaces adjacent the actuator camming surfaces for operating the slides. A plurality of pairs of fixed terminal elements are mounted adjacent the housing on either side of the set of slides, each fixed terminal element having a fixed contact portion. A plurality of rigid bodily movable contact elements are provided, each having a slide contacting midportion for engagement with the contact camming surfaces on the slides. The switch further provides biasing means biasing the movable contact elements toward the fixed contact portions. Each movable contact element has opposite ends reciprocable in and out of contact with the fixed contact portions of a pair of fixed terminal elements.



In preferred embodiments, the multiple pushbutton slide switch has a housing having an upper wall and internal contact guide means. A set of slides is provided within the housing, each having a single camming edge adjacent the upper wall providing both actuator camming surfaces and contact camming surfaces thereon. A plurality of slide actuating elements extend through the upper wall and are reciprocable between the upper wall and the slide set, having slide engaging surfaces adjacent the actuator camming surfaces for operating the slides. A plurality of pairs of fixed terminal elements are mounted adjacent the housing on either side of the set of slides, each fixed terminal element having a fixed contact portion. A plurality of rigid bodily movable contact elements are provided between the slides and the upper wall, each movable contact element having a slide contacting midportion for engagement with the contact camming surfaces and being adjacent a fixed terminal means. The switch further provides biasing means biasing the movable contact elements toward the fixed contact portions. Each movable contact element has opposite ends reciprocable within the housing guide means in and out of contact with the fixed contact portions of a pair of fixed terminal elements. An actuating element actuates a slide by bearing against an actuator camming surface to move the slide and thereby to cause the contact camming surface to move a movable contact element in and out of contact with the fixed contact portions of a pair of fixed terminals. The movable contact elements are reciprocable in side by side relationship with the actuating elements.

Other objects, features, and advantages will appear from the following description of a preferred embodiment of the invention, taken together with the attached drawings thereof, in which:

FIG. **1** is an exploded isometric view of portions of the switch;

FIG. **2** is a plan view from below of a partially assembled switch, with some parts removed for clarity;

FIG. **3** is a cross section of the assembled switch;

FIG. **4** is a longitudinal section of the assembled switch; and

FIG. **5** is an isometric view of portions of the switch seen from below.

Referring now to the drawings, and particularly to FIG. **1**, the pushbutton slide switch of the invention generally includes a housing **10** and a floor **20.** Housing **10** has an upper wall **12** parallel with floor **20,** providing four actuator slots **16.** Housing **10** and floor **20** together contain a set of four slides, of which one representative slide **22** is shown in FIG. **1.** These slides are operated by four actuators, of which one representative actuator **14** is shown in FIG. **1.**

Each actuator **14** includes a narrow upper portion **58** which extends through a slot **16** in upper housing wall **12** to the exterior of housing **10.** A pushbutton **18** is secured to the external end of portion **58** for operation of the switch. Each actuator **14** further has a broadened lower portion **60** including a slide-engaging actuator surface **61,** disposed to engage slides **22** for operation of the switch in response to depression of a pushbutton **18.**

Three fixed terminal means, each comprising a pair of fixed terminals, are mounted in housing **10.** One representative pair **24** and **24** is shown in FIG. **1.** The ends

27 of fixed terminals 24 extend through slots 29 in floor 20 to the exterior of the switch for connection to appropriate electrical circuitry to be controlled by the switch.

According to the invention, a novel mechanism is provided by which slides 22 actuate movable contacts with respect to the fixed terminals, thereby to operate the switch. Each fixed terminal 24 provides a flat horizontal fixed contact portion 26 between a pair of ears 25. A rigid bodily movable rod contact 28 is provided between housing upper wall 12 and flat contact portions 26. Opposite ends 30 of rod contact 28 overlie fixed contact portions 26 of fixed terminals 24 for contact therewith. A compression spring 32 between housing upper wall 12 and rod 28 biases rod 28 toward fixed contact portions 26.

Each slide 22 has a straight lower edge which rides on the inner surface of floor 20, and a single camming upper edge 36 adjacent upper wall 12 of housing 10. Camming upper edge 36 includes actuator camming portions 75 and rod contact camming portion 76. The slide-engaging actuator surface 61 of each actuator 14 engages an actuator camming portion 75 of slide 22, as best seen in FIG. 4. Rod contact camming portions 76 engage the slide-engaging midportions 38 of rod contacts 28 to move rods 28 in and out of contact with fixed contact portions 26.

More in detail, and referring now particularly to FIGS. 2 through 5, housing 10 provides internal structure for positioning the various operative elements of the switch and for guiding their respective motions.

To support such internal positioning structure, housing 10 provides two side walls 40 and 42 and two end walls 44 and 46. Extending inwardly from side wall 40 are four partition structures 48. Four similar partition structures 48 extend inwardly from side wall 42 and are paired with those extending from wall 40. Generally, as will appear in more detail in what follows, each pair of partition structures 48 defines a vertical space perpendicular to slides 22 in which an actuator 14 moves up and down to actuate slides 22. Each two adjacent partition structures 48 retain between them a fixed terminal 24. Each two adjacent pairs of partition structures further define between them a recess for positioning a spring 32 and provide contact guide structure defining a vertical space in which rod contact 28 moves. The rod contact space and the actuator space are side by side. All eight partition structures 48 together define a slide space in which slides 22 move.

Each partition structure 48 includes an elongated rounded shoulder portion 52, extending from upper housing wall 12 toward floor 20, and connected to the supporting side wall, for example to wall 40, by a long narrow neck 50. Two arms 54 extend from each rounded shoulder portion 52, one from each side thereof, parallel to the supporting side wall. Each arm 54 has a flat inner face 70, parallel to the supporting side wall, and an end 71 remote from shoulder 52. The flat inner faces 70 of the arms 54 of all eight partition structures 48 together define two sides of a longitudinal slide space, in which the slides 22 are retained for motion parallel to side walls 40 and 42. Barriers 63 and 64 extend inwardly from end walls 44 and 46 to provide slide travel stops and thereby to define the ends of the slide space. Slides 22 are thus movable parallel with side walls 40 and 42 within a distance limited by barriers 63 and 64.

The two arms 54 extending from each shoulder portion 52 include between them a recess 56 opening toward the interior of housing 10 and extending from upper housing wall 12 toward floor 20. The recesses 56 provided by each pair of opposing partition structures 48 open toward each other and together define a vertical actuator guide space between housing upper wall 12 and slides 22 in which an actuator 14 is reciprocable to actuate slides 22.

Each arm 54 is further directly connected to the supporting side wall by a thin vane portion 62, located near end 71 of arm 54, and extending parallel to end walls 44 and 46 from upper housing wall 12. A fixed contact 24 is positioned between two adjacent partition structures with each ear 25 retained in a slot defined by a shoulder 52, the supporting side wall, neck 50 and vane 62. The neck portions 50 of two adjacent partition structures 48 prevent contact 24 from moving longitudinally within housing 10. The flat fixed contact portion 26 buts against the vane portions 62 of two adjacent partition structures 48 to space contact 24 from the upper housing wall 12.

The opposed arms 54 of the pairs of partition structures 48 are connected by a thin wall 55, extending above and transverse to the slide space defined by the flat inner faces 70 of arms 54. Walls 55 and arm ends 71 together with housing upper wall 12 defined three spring recesses, as best seen in FIG. 2, each of which receives a spring 32.

The four arm ends 71 of adjacent pairs of partition structures 48 together form contact guide means to position a movable rod contact 28 above and transverse to the slide space defined by the flat inner faces 70 of arms 54 and end barriers 63 and 64, as best seen in FIG. 2. Three rigid bodily movable rod contacts 28 are positioned by the eight partition structures 48. Rod contacts 28 are thus reciprocable between fixed contact portions 26 of fixed terminals 24 and housing upper wall 12, biased by spring 32 toward fixed contact portions 26. As seen in FIG. 4, rod contacts 28 alternate with actuators 14 along the length of housing 10. Rod contacts 28 and actuators 14 are reciprocable in a side-by-side relationship.

While the movable rod contact 28 shown in the present embodiment has a cylindrical cross section, this is not essential to the invention and the movable contact may be, for example, a long flat bar, or hexagonal, or any other suitable shape.

To assemble the switch, with floor 20 removed from housing 10, four actuators 14 are inserted through slots 16 in housing upper wall 12, with narrow upper portions 58 extending through wall 12. Pushbuttons 18 are secured to the narrowed portions 58. Three springs 32 are placed in the three spring recesses defined by walls 55, arm ends 71 and housing upper wall 12. Three movable rod contacts 28 are then placed in the positions determined by the contact guide means formed by the arm ends 71 of adjacent pairs of partition structures 48. Fixed terminals 24 are inserted with ears 25 received in slots defined by shoulders 52, necks 50, vanes 62 and the supporting side walls, with flat contact portions 26 butting against vanes 62. A set of slides 22 are then placed in the slide space defined by the flat inner faces 70 of the arms 54 of all eight partition structures 48 together with end barriers 62 and 64. Floor 20 is then attached to housing 10, with ends 27 of fixed terminals 24 extending through slots 29 for connection to exter-

nal circuitry. The floor **20** may be secured to the housing **10** by any appropriate means, as by screws or staking.

It will be noted that all six fixed terminal elements as shown herein are identical and each can be inserted in the housing adjacent either side wall. Thus a particular fixed terminal element is not required to be located left or right of the slide set. The movable rod contacts are symmetrical and may be turned end for end without affecting their operation; thus they need not be oriented left or right for insertion in the housing. The springs may be turned end for end also. The actuators have left and right symmetry and need only be inserted narrow end first. Only the set of slides **22** may be inserted wrongly into the housing and requires attention in assembly. As a result, the switch of the invention requires little time to assemble and is thus inexpensive to manufacture.

When the switch has been assembled, springs **32** bias movable rod contacts toward flat fixed contact portions **26** of fixed terminals **24.** Ends **30** of movable rod contacts **28** overlie flat fixed contact portions **26** for contact therewith. Actuators **14** are depressed by means of pushbuttons **18** to engage actuator camming portions **75** of slide camming upper edges **36,** causing the slides **22** to move longitudinally within the slide space defined by the housing internal structure. As the slides move, contact camming portions **76** of camming upper edges **36** engage the midportions **38** of rod contacts **28** and move selected ones of the rod contacts away from the respective fixed contact portions **26,** against the bias of springs **32.**

The switch of the invention could alternatively be provided with more or fewer than three movable contact and three pairs of fixed terminals, or interconnected fixed terminals, by provision of an appropriate number of slides and actuators limited only by the length of the housing.

Further, by providing fixed terminals of appropriate design, fixed contact portions **26** of fixed terminals **24** could be positioned between housing upper wall **12** and rods **28,** and springs **32** could serve to bias rod contacts **28** away from fixed contact portions **26** rather than towards them. Such an arrangement would still permit the saving in vertical space obtained by positioning the rod contacts to move alternately with the actuators in side-by-side relationship.

What is claimed is:

**1.** A multiple pushbutton slide switch comprising
a housing having an upper wall
a set of slides within said housing, each slide having a single camming edge adjacent said upper wall providing actuator camming surfaces and contact camming surfaces thereon
a plurality of slide actuating elements extending through said upper wall and reciprocable between said upper wall and said slide set, having slide engaging surfaces adjacent said actuator camming surfaces for operating said slides
a plurality of pairs of fixed terminal elements mounted adjacent said housing on either side of said set of slides, each said fixed terminal element having a fixed contact portion
a plurality of bodily movable contact elements each having a slide contacting midportion for engagement with said contact camming surfaces on said slides
biasing means biasing said movable contact elements toward said fixed contact portions
each said movable contact element having opposite ends reciprocable in and out of contact with said fixed contact portions of a said pair of fixed terminal elements.

**2.** A multiple pushbutton slide switch comprising
a housing having an upper wall
a set of slides within said housing, each slide providing actuator camming surfaces and contact camming surfaces
a plurality of slide actuating elements extending through said upper wall and reciprocable between said upper wall and said slide set, having slide engaging surfaces adjacent said actuator camming surfaces for operating said slides
a plurality of pairs of fixed terminal elements mounted adjacent said housing on either side of said set of slides, each said fixed terminal element having a fixed contact portion
a plurality of bodily movable contact elements each having a slide contacting midportion for engagement with said contact camming surfaces on said slides
biasing means biasing said movable contact elements toward said fixed contact portions
each said movable contact element having opposite ends reciprocable in and out of contact with said fixed contact portions of a said pair of fixed terminal elements
said housing further including internal contact guide means, and said movable contact element opposite ends being reciprocable within said guide means.

**3.** A multiple pushbutton slide switch comprising
a housing having an upper wall
a set of slides within said housing, each having a single camming edge adjacent said upper wall providing both actuator camming surfaces and contact camming surfaces thereon
a plurality of slide actuating elements extending through said upper wall and reciprocable between said upper wall and said slide set, having slide engaging surfaces adjacent said actuator camming surfaces for operating said slides
a plurality of pairs of fixed terminal elements mounted adjacent said housing on either side of said set of slides, each said fixed terminal element having a fixed contact portion
a plurality of rigid bodily movable contact elements between said slides and said upper wall, each movable contact element having a slide contacting midportion for engagement with said contact camming surfaces and being adjacent a said fixed terminal means
biasing means biasing said movable contact elements toward said fixed contact portions
each said movable contact element having opposite ends reciprocable in and out of contact with said fixed contact portions of a said pair of fixed terminal elements,
a said actuating element actuating a said slide by bearing against a said actuator camming surface to move said slide and thereby to cause said contact camming surface to move a said movable contact element in and out of contact with the said fixed contact of a said pair of fixed terminal elements.

**4.** The switch of claim **3** wherein
said housing further includes internal contact guide means, and said movable contact element opposite ends are reciprocable within said guide means in side-by-side relationship with said actuating elements.

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