May 20, 1958 W. E. LEWIS, JR 2,835,753

MULTIPLE PUSHBUTTON SWITCH WITH SNAP ACTION SPRINGS

Filed March 1, 1957

Fig. 1.

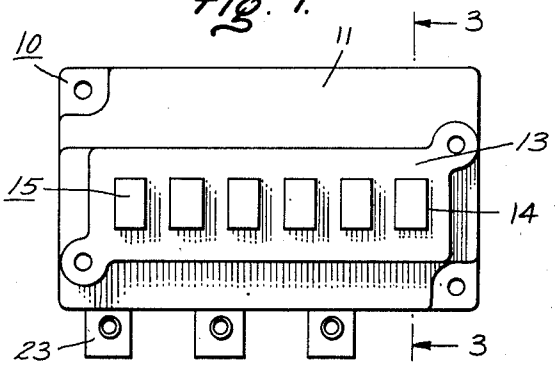


Fig. 3.

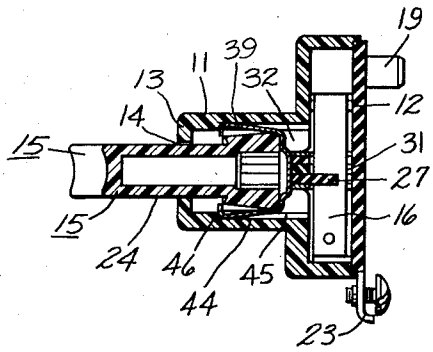


Fig. 2.

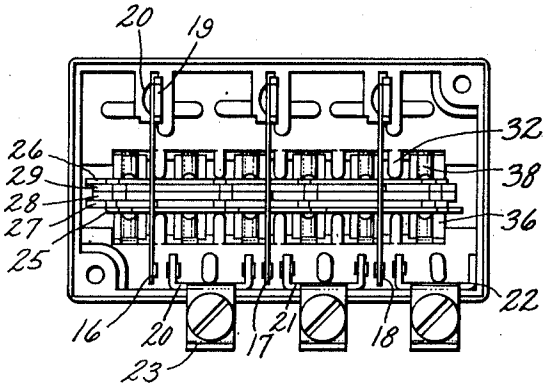
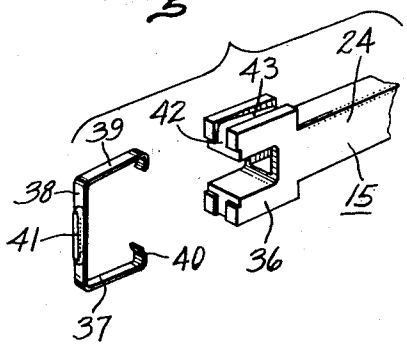


Fig. 4.



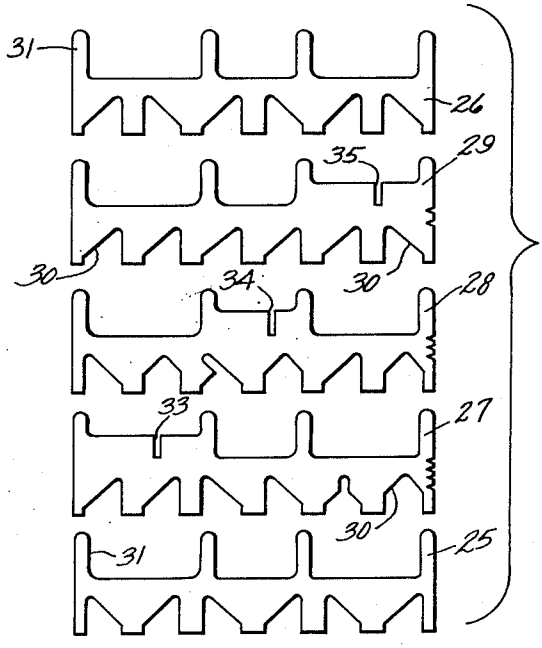


Fig. 5.

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MULTIPLE PUSHBUTTON SWITCH WITH SNAP ACTION SPRINGS

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5 Claims. (Cl. 200—5)

This invention relates to a multiple pushbutton switch and particularly to one having movable sliders for controlling the operation of the movable contacts of the switch. It is important for the movable contacts to make and break the circuit through the fixed contacts of the switch without hesitation so that there will not be at any time a narrow air gap between the movable and fixed contacts which might allow a high voltage arc to jump across the gap and burn the contacts. Since the movable contacts are directly controlled by the sliders which are in turn controlled by the pushbuttons of the switch it has been found expedient to control the movable contacts by controlling the action of the buttons.

The principal object of this invention is to provide a multiple pushbutton switch with quick acting movable contacts by furnishing each of the buttons with a novel detent spring that is capable of locking each button in the "down" or depressed position, and must be unlatched before another button may be fully depressed.

The further object of this invention is to provide a multiple pushbutton switch with a quick acting contact arrangement where a certain heavy pressure must be exerted on a button to depress it in order to overcome the latching action of the detent springs of a previously depressed button.

A still further object of this invention is to provide a novel detent spring and means for attaching the spring to the innermost end of a pushbutton of a multiple pushbutton switch.

This invention is broadly related to the pioneer pushbutton switch patent to Andrews No. 2,431,904, which is assigned to the same assignee as is the present invention. A preferred embodiment of my invention of a multiple pushbutton switch has an insulating housing formed by a recessed base and a removable cover plate, although it should be recognized that this invention is not restricted to such construction. A plurality of pushbuttons extend through openings in one wall of the base while a series of parallel sliders are arranged edgewise in the base with respect to the cover plate for controlling the actuation of the movable contacts of the switch. The innermost end of each button is provided with a detent spring of generally U-shape having a pair of resilient arms that cooperate with shoulders formed on opposed walls of the base for latching the buttons in the "down" or depressed position. Each of the sliders is provided with a series of diagonal cam surfaces which are acted upon by the innermost ends of the pushbuttons for shifting the sliders endwise in the base. However, once a button is fully depressed and held down by the latching arrangement of its detent spring, another button may not be fully depressed until enough force is exerted on that button to overcome the holding force of the detent spring of the depressed button. At the time when the latching force of the detent spring is suddenly overcome, the manual force exerted on the downwardly button is of such amount that it immediately moves that button to its fully depressed position. Meanwhile, the sliders will return the previously depressed button to its outermost position.

My invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Figure 1 is a top plan view of a multiple pushbutton switch embodying my invention.

Figure 2 is a bottom plan view of the switch of Figure 1 with the cover plate removed to show the internal mechanism of the switch.

Figure 3 is a cross-sectional side view taken on the lines 3—3 of Figure 1 through a fully depressed button.

Figure 4 is an isometric view showing one of the pushbuttons and a separate detent spring that is to be mounted thereon.

Figure 5 is a view showing the configuration of the various movable sliders of the switch.

Referring in detail to the drawing and in particular to Figures 1–3 the switch 10 has an insulating housing comprising a recessed base 11 that is closed by a bottom cover plate 12. The wall 13 of the base 11 that is opposite the cover plate 12 has a number of rectangular openings 14 in side-by-side relation for receiving pushbuttons 15 that are manually operated to control the various circuits through the switch.

The electrical switching mechanism is best understood with relation to the bottom plan view of Figure 2. First, there are three movable contacts 16, 17 and 18 of thin strip material arranged in a parallel relation across the bottom of the base and extending from one side to the other. A male terminal 19 is permanently attached to one end of each of the movable contacts, and this terminal end is then rigidly mounted between the molded parts 20 of the base in a well-known manner. Looking at Figure 3, the male terminals 19 extend perpendicularly of the movable contacts and outwardly through the cover plate 12. Fixed contacts 20, 21 and 22 are arranged on the side of the base 11 that is opposite the male terminals 19. These fixed contacts have screw terminals 23 that extend through openings in the cover plate 12 at the edge thereof and lie in substantially the same plane as the cover plate.

Sidewise movement of the movable contacts 16, 17 and 18 will bring them into engagement with the fixed contacts 20–22. The mechanism for affecting this movement represents a series of five movable sliders shown in detail in Figure 5, and interposed between the pushbuttons 15 and the movable contacts as illustrated in Figure 3. There are two outer metal sliders 25 and 26 and three intermediate insulating sliders 27, 28 and 29. These sliders are grouped together and assembled edgewise in the base 11 to lie perpendicular to the cover plate 12. Looking at Figure 5, the lower edge of each slider has a series of diagonal cam surfaces or notches 30 which cooperate with the innermost ends of the pushbutton 15 so that the depression of any one of the buttons will shift the sliders in a predetermined manner. Furthermore, each slider has a series of strut members 31 on the edge opposite the cam surfaces 30 which are adapted to bear against the inner surface of the cover plate 12 in a sliding relationship. Opposed side partitions 32 of Figure 2 are formed in the base 11 to limit the sliders 25–29 to only longitudinal movement.

The outer metal sliders 25 and 26 do not engage the movable contacts 16, 17 and 18; however, they serve as a mechanical interlock to insure that only one pushbutton 15 is fully depressed at any one time. A study of the cam surfaces 30 of the two metal sliders 25 and 26 shows the surfaces of one slider to be inclined in the opposite

direction from such surfaces in the other slider. Accordingly, both metal sliders may shift when an adjacent button is depressed and the "down" button will be forced to its outer position. Slider **27** is coupled with the movable contact **16** by means of a slot **33** in the edge of the slider in which the movable contact is seated. A similar slot **34** is cut in slider **28** for receiving the movable contact **17**. Lastly, a slot **35** in slider **29** receives the movable contact **18**.

All of the pushbuttons **15** are identical so that reference will be made to only one of them as illustrated in Figure 4. The button **15** has a hollow shank portion **24** of generally rectangular cross-section and an enlarged bifurcated end **36** that straddles the sliders **25–29**, as seen in Figure 3. A U-shaped detent spring **37** of thin strip material such as spring steel is assembled to the end **36** of the button to serve as a latching mechanism to hold the button in its depressed position. Spring **37** has a symmetrical shape with a base **38** and two resilient arms **39** with the free ends rolled inwardly toward each other to form latch portions **40**. The base **38** of the spring extends across the bottom of the bifurcated end **36** of the button so that it will engage the diagonal cam surfaces **30** of the sliders. An embossment **41** at the mid-portion of the base **38** has a rounded shape for making line engagement with the cam surfaces.

The spring **37** is designed to snap over the bifurcated end **36** of the button **15** so that it will be carried thereby. The base **38** of the spring fits into a bottom depression **42** of the button, while the arms **39** extend along the sides of the button and within the depressions **43**. Actually, the side depressions **43** are both inclined in a manner to be deeper at the end remote from the bottom depression **42**. The arms **39** of the spring **37** are not parallel, but rather they normally diverge outwardly from the base **38** so that they are actually under compression when assembled between the parallel side walls **44** of the base **11** as seen in Figure 3. The inner surface of each side wall **44** has a shallow groove **45** that extends in the direction of the movement of the button **15** and terminates before it reaches the top face **13** of the base by a distance that is slightly less than the stroke of the button. Thus, shoulders **46** are established on the inner surfaces of the walls **44** within the grooves **45**. The arms **39** of the detent spring flex outwardly into the grooves **45** when a button **15** is in its fully depressed position. In so doing, the rounded latch ends **40** of the arms **39** bear against the shoulders **46** and prevent the outer movement of the button **15**. When manual pressure is exerted against one of the "up" buttons, that button will move downwardly to shift some or all of the sliders thereby exerting pressure against the "down" button to force it to is outermost position. Only when this force is large enough to compress the latching arms **39** from engagement with the shoulders **46** will it be possible for the "down" button to rise. However, when the arms **39** become disengaged from the shoulders **46** the "down" button will move rapidly since its force resisting movement has vanished. Accordingly, the buttons as well as the sliders and movable contacts will have a definite snap action.

The detent springs **37** serve two primary functions; namely, to provide the switch with a snap acting mechanism and also to latch the buttons in their fully depressed position so that the sliders will exert side pressure against the movable contacts to hold them firmly against the fixed contacts. The switch parts are so arranged that the movable contacts do not make or break engagement with the fixed contacts until the detent spring **37** of the "down" button has become disengaged from the shoulders **46** and is rapidly moving to the "up" position. It is only during this rapid movement of the button that the movable contacts change the circuits of the switch. The movable contacts might flex slightly as the sliders begin to shift, but the movable contacts are provided with a definite snap action for both the opening and closing of the switch.

Having described above my invention of a novel pushbutton switch using movable contacts of cantilever construction it will be well recognized by those skilled in this art that by the simple means of detent springs on each of the buttons it is possible to exert positive pressures to hold the movable contacts against the fixed contacts, to provide the movable contacts with a snap acting mechanism, and to hold the "down" button in a fully depressed position with a latching arrangement that requires a certain large downward force on a button before the "down" button will start to rise and permit another button to be depressed. A switch embodying my invention is both inexperience to manufacture and easy to assemble. All of the switch parts are assembled through the open bottom wall of the switch base, and the cover plate is fastened to the base to form a completely enclosed housing of insulating material which is of compact size.

Modifications of my invention will occur to those skilled in this art, and it is to be understood, therefore, that this invention is not limited to the particular embodiments disclosed, but that it is intended to cover all modifications which are within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A multiple pushbutton switch comprising an insulating housing and a series of parallel slides, each slider having diagonal cam surfaces, a plurality of pushbuttons slidably mounted through one wall of the housing, the inner end of each button having means for engaging the cam surfaces of one or more of the sliders to affect the shifting of the sliders, the sliders cooperating with a series of movable contact members for opening and closing the circuits through the switch, and a U-shaped detent spring carried over the inner end of each button in planes transversely of the sliders, the spring having an outwardly divergent resilient arm at each side of the button with an inwardly-turned hook end in locking engagement with the button for holding the spring in place, the opposite walls of the housing adjacent the resilient arms being undercut to form shoulders which oppose the hook ends of the arms of the detent spring, whereby the switch is provided with a snap action since a button may not be fully depressed until the resilient arms of the detent spring of a previously depressed button are deflected to slide by the shoulders.

2. A multiple pushbutton switch comprising an insulating housing with a recessed base and a removable cover plate, a wall of the housing having a plurality of openings each for receiving a manually operable pushbutton that extends inwardly of the housing, and a series of parallel sliders perpendicularly arranged with respect to the cover plate and having diagonal cam surfaces which cooperate with the innermost ends of the pushbuttons so that the buttons are capable of shifting the sliders back and forth with respect to each other, and a group of movable contacts mounted in the base each being engaged by a slider so that the movement of the sliders control the movement of such contacts, and a U-shaped detent spring fitted over the inner end of each button in a plane transversely of the sliders, each spring having a resilient arm at each side of the button with an inwardly-turned latching end that hooks over cooperating shoulders of the button so that the spring is fastened thereby, and opposing walls of the housing adjacent the resilient arms, the walls being undercut to form shoulders that oppose the latching ends of the arms of the detent spring, so that the switch is provided with a snap action since a button may not be fully depressed until the resilient arms of the detent spring of a previously depressed button are deflected to slide by the shoulders of the housing.

3. A multiple pushbutton switch as recited in claim 2 wherein the innermost end of each pushbutton is bifur-

cated to straddle the sliders, and the sliders are notched along one edge thereof to form the diagonal cam surfaces, the base portion of the U-shaped detent spring serving to engage the cam surfaces of the sliders and control the movement thereof.

4. A multiple pushbutton switch comprising a hollow housing, a series of parallel sliders stacked together in a manner edgewise to the bottom wall of the housing, the top wall of the housing containing a plurality of openings, each opening receiving a manually operable pushbutton that extends inwardly of the housing, the top edge of each slider having diagonal cam surfaces that are acted upon by the buttons for shifting the sliders in a predetermined manner, and a group of movable contacts mounted in the housing, each movable contact being joined with one of the said sliders for movement therewith, the inner end of each button being enlarged and bifurcated to straddle the stack of sliders, the bifurcated end of each button having a depression in its bottom and side surfaces for receiving therein a U-shaped detent spring that lies in a plane transversely of the sliders, each spring having a base portion engaging the cam surfaces of the sliders and an outwardly-divergent resilient arm in each side depression of the button, each arm having an inwardly-turned hook end in locking engagement with the button for holding the spring in place, and opposing walls of the housing adjacent the resilient arms, the walls being undercut to form shoulders that oppose the hook ends of the arms of the detent spring, so that the switch is provided with a snap action.

5. A pushbutton switch as recited in claim 4 wherein the depressions in the side surfaces of each button are inclined in a converging manner to be deeper at the end remote from the bottom depression, so as to accommodate the compression of the resilient arms as they slide past the shoulders of the housing.

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