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2,835,754

MULTIPLE PUSHBUTTON SWITCH WITH TORSION SPRING CONTACTS

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Fig. 1.

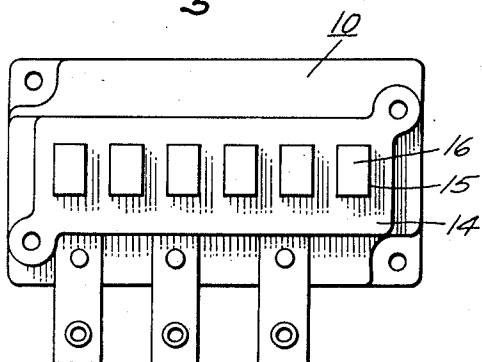


Fig. 2.

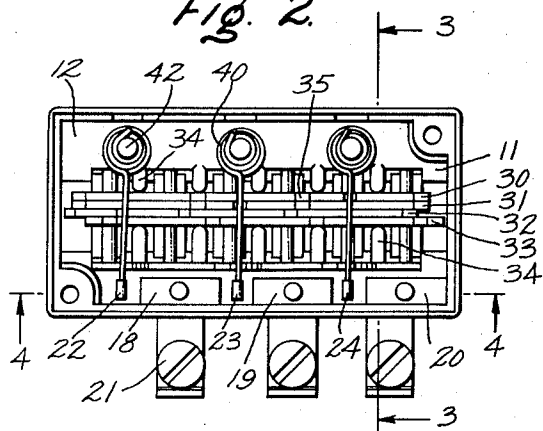


Fig. 4.

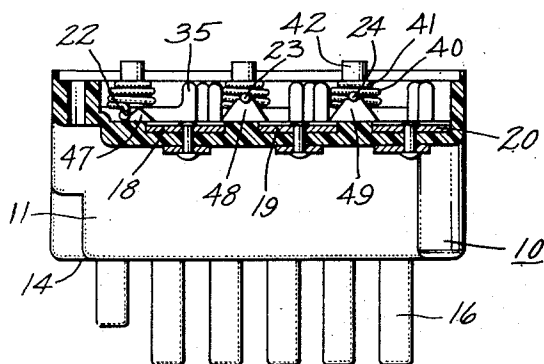


Fig. 3.

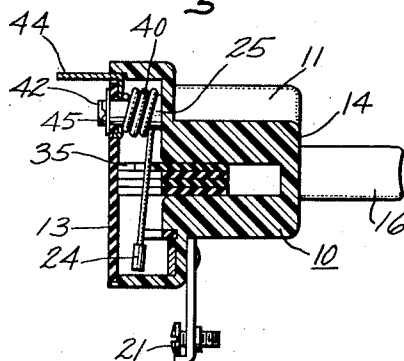
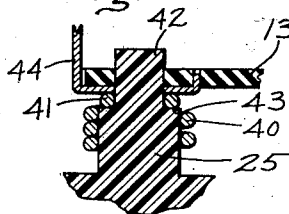


Fig. 5.



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MULTIPLE PUSHBUTTON SWITCH WITH TORSION SPRING CONTACTS

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7 Claims. (Cl. 200—5)

This invention relates to electrical switches having movable contacts in the form of torsion springs, and particularly to multiple pushbutton switches that actuate movable sliders to control the movable contacts of the switch. This invention is an improvement over the basic pushbutton switch design of the Andrews Patent No. 2,431,904 which is assigned to the same assignee as is the present invention.

Most of the prior art multiple pushbutton switches have movable contacts formed by cantilever springs of strip material. When a movable contact is in its open position there is usually a small air gap between it and the fixed contact. Oftentimes an electrical arc is drawn across this gap and damage may be done to both the switch and to the appliance which it controls. Arc flashover is mainly a function of two variables; namely, the amount of the air gap between the movable and fixed contacts, and the time necessary for the movable contact to open and then close the circuit when the switch is actuated. When the switch is for use with alternating current the current and voltage passes through zero one hundred and twenty times per second or once every half cycle so that the arc is easy to extinguish. However, if the movable contact moves so fast that it opens and closes a circuit within less than a half cycle there is danger of flashover and burning of the contacts as if the switch were being used in a direct current circuit.

The principal object of this invention is to provide an electrical switch with movable contacts formed by torsion springs so that the contact pressure can easily be controlled by the shape of the spring.

A further object of this invention is to provide a multiple pushbutton switch with movable contacts in the form of torsion springs where the movable contacts must move through an arcuate path as they alternately engage and disengage the fixed contacts.

A further object of this invention is to provide a multiple pushbutton switch with novel movable contacts in the shape of torsion springs which are mounted in the housing with one end fixed due to pressure exerted by the removable cover of the switch housing.

A still further object of this invention is to provide a multiple pushbutton switch with movable contacts in the nature of torsion springs where the switch housing is of minimum size since the movable contacts move in an arcuate path between circuit changes and the effective opening space between the fixed contacts can be greatly increased without spacing them any further apart than conventional spacing.

The present invention is illustrated as part of a multiple pushbutton switch with an insulating housing formed by a recessed base and a back cover plate, although it should be recognized that this invention is not restricted to such housing construction. A plurality of pushbuttons extend through openings in the front 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

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switch. This part of the switch construction does not form part of the present invention since it is being claimed in my co-pending application Serial No. 643,444, filed March 1, 1957.

The principal novelty of this invention lies in the particular nature of the movable contacts which are formed as torsion springs with a free end moving in an arcuate path from one fixed contact to the other. The fixed end of each spring is coiled around an insulating boss formed in the base. The outermost end of each boss is of reduced diameter to form a shoulder or ledge on which the last turn of the spring is seated. A tab-type terminal is fitted over the boss and in engagement with the last turn of the spring so that the cover plate may be assembled over the terminal to press the terminal against the spring and hold that end of the spring fixed. Fixed contacts are mounted in the base along an opposite side wall with the movable sliders disposed between the fixed and the movable contacts. The free ends of the torsion springs extend across the sliders for engagement with the fixed contacts. Each movable contact is connected with a separate slider by having the spring extend through a notch in one edge of the slider.

Raised cam surfaces are disposed near the gap between each adjacent pair of fixed contacts so that the free end of the movable contact slides over such a cam before it may shift from one fixed contact to the other. In the preferred embodiment of my invention some of these cam members are of inverted W-shape to give the switch a positive off position between the fixed contacts. The cam surfaces provide the switch with flashover protection since the contacts move in an arcuate path between circuit changes. The effective opening space is greatly increased without spacing the fixed contacts any further apart than conventional spacing.

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 front or top plan view of a multiple pushbutton switch embodying my invention.

Figure 2 is a back or 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 2.

Figure 4 is a cross-sectional view showing the nature of the inverted W-shaped cam surfaces between the fixed contacts, this view being taken on the lines 4—4 of Figure 2.

Figure 5 is a partial view in cross-section showing the cooperation between the torsion spring and its supporting boss, and how the cover plate holds the terminal against the fixed end of the torsion spring.

Referring in detail to the drawing and in particular to Figures 1—3, the switch has an insulating housing 10 comprising a recessed base 11 with an open bottom wall 12 that is closed by a cover plate 13 of insulating material. A top wall 14 of the base that is opposite the cover plate 13 has a number of openings 15 for receiving pushbuttons 16 that are manually operated to control the various circuits through the switch. Looking at the bottom view of Figure 2, the three fixed contacts 18, 19 and 20 are shown disposed along one side wall of the base, each having screw terminals 21 that extend outwardly of the housing for connection to lead wires (not shown) from the power supply. Movable contacts 22, 23 and 24 are disposed at the opposite side of the base and are each assembled over a cylindrical boss 25 as shown in Figure 3. Each movable contact is in the form of a torsion spring with a coiled end that has the last turn fixed while the

free end is arranged for engagement with the fixed contacts 18-20 as will be better understood hereinafter.

It should be clear from the showing of Figure 2 that the free ends of the movable contacts 22-24 are capable of sidewise movement for wiping engagement with the fixed contacts. This sidewise movement is provided by a series of movable sliders which in this particular case happens to be four in number, namely, 30, 31, 32 and 33. These sliders are stamped out of sheets of insulating material and are formed with diagonal cam surfaces (not shown) which are engaged by the innermost ends of the pushbuttons to shift the sliders in a predetermined manner for controlling the position of the movable contacts. The nature of the pushbuttons and the particular designs of the sliders 30-33 are not shown here in detail because they do not form a critical part of the present invention. They are generally shown in the beforementioned Andrews Patent No. 2,431,904, as well as the applicant's co-pending application Serial No. 643,444. It is felt sufficient to say that the series of sliders 30-33 are confined between opposed embossments 34 in the switch base and have extensions or feet 35 as shown in Figure 4 in sliding engagement with the inner surface of the cover plate 13.

Turning back to a consideration of the movable contacts 22-24, only one of them will be discussed since they are all identical. Looking at Figures 3 and 5, the movable contact 24 has a coiled end 40 with the last turn 41 being of reduced diameter. The cylindrical boss 25 has a reduced end or stud 42 so that a ledge or shoulder 43 is formed. The coiled end 40 of the torsion spring is placed over the boss 25 and the last turn 41 of the spring drops onto the ledge 43. A tab-type terminal 44 of thin strip material is bent into an L-shape for cooperation with the fixed end of the torsion spring. The base of the terminal is apertured to fit over the stud 42 of the boss 25, while the upright portion of the terminal extends outwardly of the switch housing through an opening in the cover plate 13. The cover also contains apertures for receiving the studs 42 of the bosses 25. This cover plate is held against the base by conventional Tinnerman fasteners 45, which are sometimes referred to as speed-nuts, that clip over the ends of the studs 42 and strongly resist displacement. The contact pressure exerted by the free end of the torsion spring against the fixed contacts may easily be controlled by varying the shape of the coiled end 40 of the spring.

The remaining structure is best understood with relation to Figures 2, 3 and 4. For instance, Figure 4 shows a cross-sectional view of the switch with the three fixed contacts 18, 19 and 20 clearly in sight. Three cam surfaces 47, 48 and 49 are arranged in the base 11 either by being molded therein or stamped from a sheet of insulating material and forced down into a receiving slot. The cam surface 47 is generally in the shape of an equilateral triangle and it cooperates with the movable contact 22 so that it will alternately engage and disengage the fixed contact 18. The other two cam surfaces 48 and 49 are generally in the shape of an inverted W and are arranged between the fixed contacts 18 and 19 and 19 and 20, respectively. The purpose of the inverted W-shape is to give the movable contacts 23 and 24 a positive off position as will be well understood by those skilled in this art. Also understood will be the fact that when a button 16 is depressed one or more of the sliders 30-33 will shift longitudinally of the switch housing to exert a sidewise force against one or more of the movable contacts 22-24. As the free ends of the movable contacts begin to shift they immediately strike the related cam surfaces. As the button moves further the free end of the spring will slide over the cam surfaces and depending upon the amount of movement of the sliders will either stop at the central off position or move on until making engagement with the related fixed contact. If such a button were depressed with an unusually strong

and sudden force the free end of the spring would probably not follow the cam surface very closely but would be in free flight. This again would increase the time of shifting the contacts. This means that even though a button were depressed rapidly the switch would still have a substantial flashover protection because the free end of the spring probably would not change the circuits any faster since the free end would take a longer path and hence a longer time between the contacts.

Having described above my invention, it is clear that I have provided a switch having movable contacts formed of torsion springs where cam surfaces are provided in the switch housing so that the free end of the spring will take an arcuate path when shifting from one switch position to another. This undoubtedly increases the effective opening space between circuit changes without increasing the spacing of the fixed contacts or input terminals any further apart than on present-day switches. Torsion springs have a decided advantages over cantilever springs because the contact pressure can be easily controlled by the shape of the coiled end of the spring. Furthermore, in the preferred embodiment illustrated herein it is possible to use three double throw switch contacts rather than five single throw contacts as is commonly practiced. A multiple pushbutton switch embodying my invention has the advantage that all the parts may be assembled into the recessed base and the complete assembly held together by three spring clip fastening devices fitted over the bosses that support the coiled ends of the torsion springs.

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. An electrical switch comprising a recessed housing with at least two fixed contacts and a movable contact, the movable contact being in the form of a torsion spring that is fixed at one end and has a free end for alternate engagement with the fixed contacts, a fixed cam member of insulating material mounted in the housing between the fixed contacts so that the free end of the movable contact will be deflected out of a straight line path as it is shifted from one fixed contact to the other to increase the length of travel of the movable contact and, hence, the effective time it takes for it to move from one fixed contact to the other.

2. An electrical switch as recited in claim 1 wherein the said cam member is of inverted W-shape so as to provide the switch with a positive off position intermediate the two fixed contacts.

3. A multiple pushbutton switch comprising an insulating housing and a series of parallel sliders, 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, a plurality of fixed contacts along one side wall of the housing, and a plurality of movable contacts on the opposite side wall of the housing with the movable sliders disposed between the fixed and the movable contacts, each movable contact being in the form of a torsion spring that is fixed at one end and has a movable end that extends across the said sliders for making engagement with the fixed contacts of the switch, a different slider being connected to each of the movable ends of the torsion springs so that when the sliders shift due to the depression of a pushbutton the movable end of the torsion spring will make or break connection with the fixed contacts of the switch, and a fixed cam surface formed in the housing in each space separating the fixed contacts whereby the movable end of each torsion spring

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will be forced to take an arcuate path over the cam as the spring is shifted from one fixed contact to the other by its respective slider.

4. A multiple pushbutton switch as recited in claim 3 wherein at least one of the said cam members is in the shape of an inverted **W** so as to provide the related movable contact with a positive off position between the two fixed contacts.

5. A multiple pushbutton switch comprising an insulating housing formed with a recessed base and an insulating cover plate, a plurality of fixed contacts mounted in the base adjacent one side wall thereof, a series of cylindrical bosses adjacent the opposite side wall of the base and extending perpendicularly to the back cover plate, the movable contacts of the switch being in the form of torsion springs having one end coiled and fitting over one of the said bosses while the free end of the spring extends across the base for making engagement with one of the fixed contacts of the switch, the fixed end of each torsion spring being of reduced size and resting on top of a ledge formed by undercutting each boss at the top, and a terminal assembled over the top of the boss and resting against the top turn of the torsion spring, the

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said terminal extending through an opening in the cover so that the cover may be placed over the bosses and fastened to the base.

6. A multiple pushbutton switch as recited in claim 5 wherein a cam surface is formed in the base near the space between each two adjacent fixed contacts so that when the movable end of the torsion spring moves from one fixed contact to the other, it will take an arcuate path around the cam surface.

7. A multiple pushbutton switch as recited in the preceding claim 6 where at least some of the cam surfaces are of inverted **W**-shape to give the switch a positive off position between some of the fixed contacts.

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