

Nov. 15, 1960

C. A. AQUILLON

2,960,580

ROTARY SWITCH

Filed April 10, 1959

2 Sheets-Sheet 1

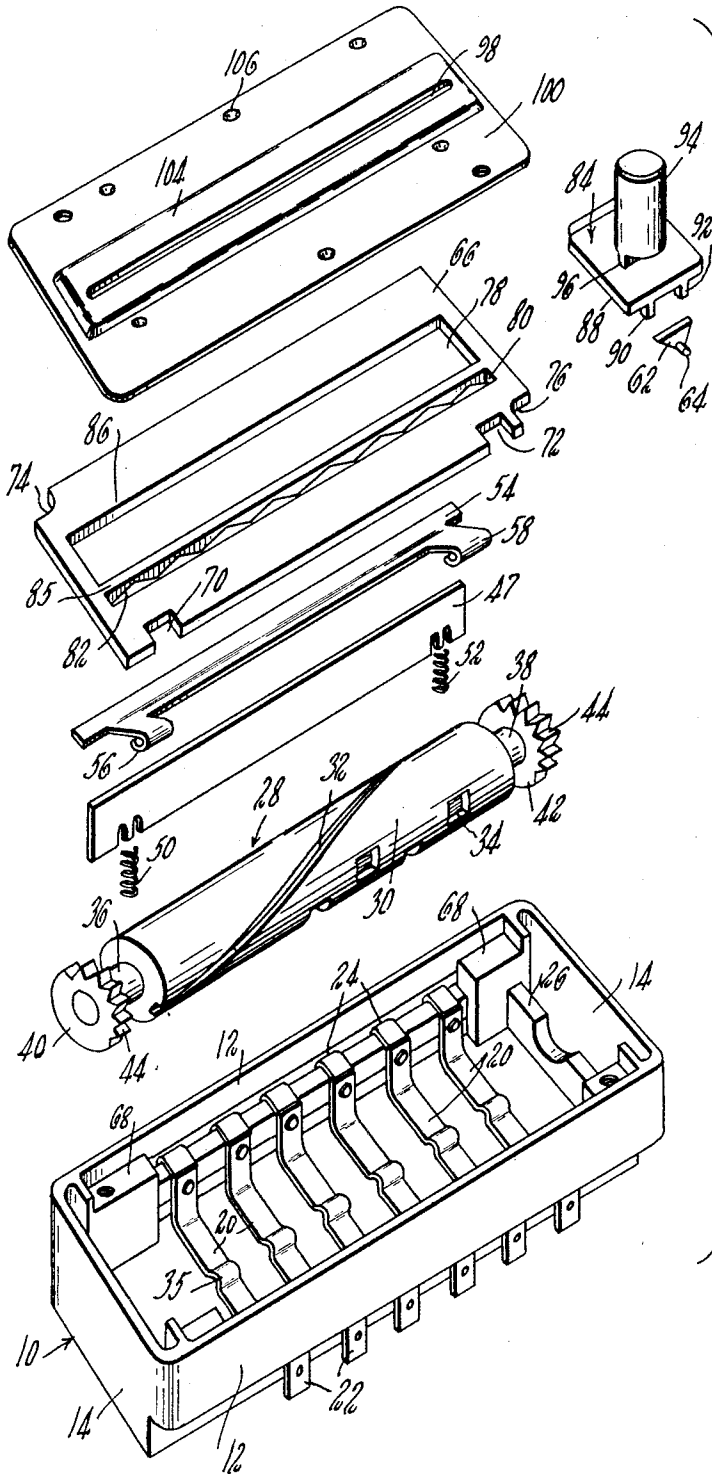


Fig. 1.

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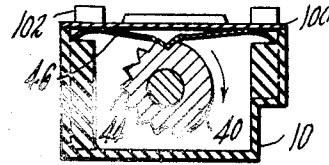
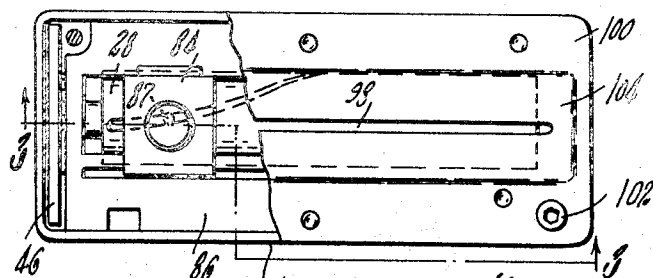


Fig. 4.

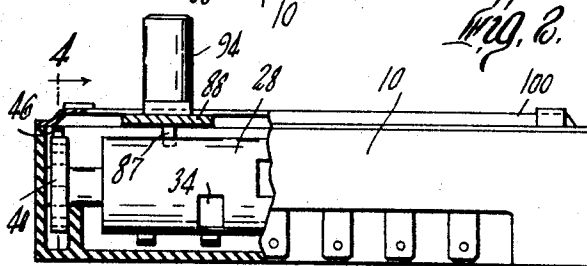


Fig. 2.

Fig. 3.

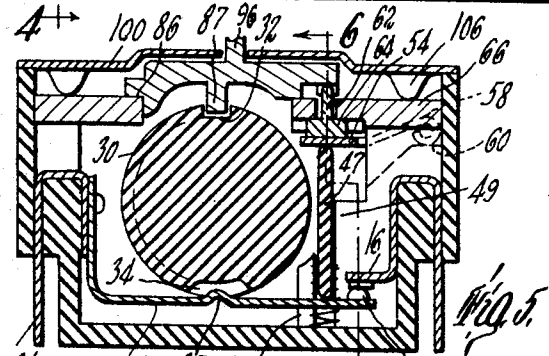


Fig. 5.

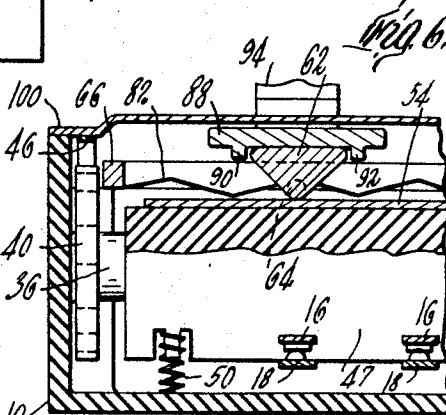


Fig. 6.

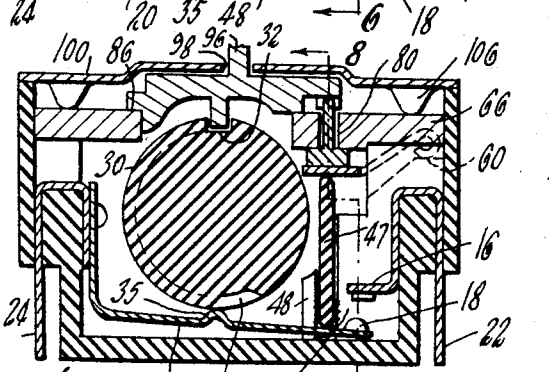


Fig. 7.

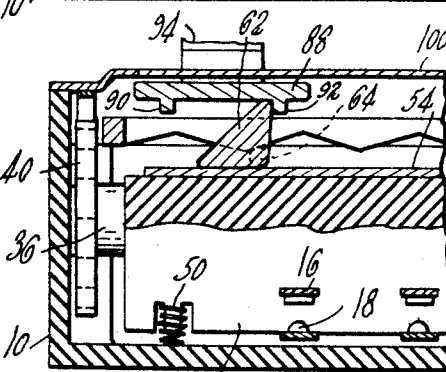


Fig. 8.

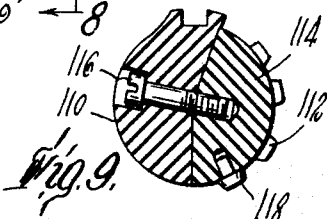


Fig. 9.

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ROTARY SWITCH

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13 Claims. (Cl. 200—6)

This invention relates to slide switches, and more particularly to the type of switch having a plurality of contacts for switching between one or several definite electric circuits upon actuation of a slide member.

Multi-circuit switches are utilized in many applications. Frequently such switches are incorporated in household appliances such as electric ranges in which substantial currents are handled. In such applications it is essential that the control devices be both easily operated and fool-proof such that safe operation by housewives for example is insured. Also it is desirable that the switch design be suitable for adaptation to mass production techniques and that the parts be few in number and be susceptible of easy and inexpensive fabrication. Where the switch is to be utilized in applications involving currents of substantial magnitude it is essential that there be provided suitable protection against short circuits or excessive arcing.

Accordingly, it is an object of the invention to provide an improved easily manipulated and reliable slide switch operating mechanism.

Another object of the invention is to provide an improved type of slide switch which is safe and reliable in operation and simple in construction.

Another object of the invention is to provide an improved slide switch adapted to control several electric circuits and in which switching is permitted between one or more circuits without shorting of the circuits or other improper operation thereof.

The switch according to the preferred embodiment includes a rotary contact actuating element which is adapted to be positioned through the coaction of a slider member, restrained for movement in a longitudinal direction only, and a helical groove disposed in a cylindrical surface of the rotary element. This switch structure provides a compact, substantial and reliable operating mechanism which permits smooth transitions between various circuit connections. A positive positioning means is provided to insure proper location of the rotor element. Further, a novel contact disconnect means positively opens all the circuits during switching operation such that any possibility of short circuits or erroneous circuit connections is eliminated.

Other objects and features of the invention will become apparent from the following description of a preferred embodiment of the invention, in conjunction with the accompanying drawings in which:

Fig. 1 is an exploded view of the principal components of the switch according to the preferred embodiment;

Fig. 2 is a top view of the switch according to the preferred embodiment, with certain parts thereof partially broken away;

Fig. 3 is a sectional side view of the switch along the line 3—3 of Fig. 2;

Fig. 4 is a sectional end view of the switch along the line 4—4 of Fig. 3;

Fig. 5 is a sectional end view through the switch show-

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ing the contact operating mechanism thereof in a first position;

Fig. 6 is a sectional side view of the switch mechanism taken along the line 6—6 of Fig. 5;

Fig. 7 is an end sectional view of the switch showing the contact operating mechanism in a second position;

Fig. 8 is a sectional side view of the switch taken along the line 8—8 of Fig. 7; and

Fig. 9 is a sectional end view of a modified rotary contact actuating element.

Certain principal components of the switch according to the preferred embodiment of the invention are shown in Fig. 1. The slide switch has a base 10 manufactured from plastic or other suitable insulating material. The base has upstanding side walls 12 and end walls 14. A plurality of cooperating contact elements are mounted within the base. These elements include stationary contacts 16 and movable contacts 18. The movable contacts 18 are positioned below the stationary contacts and are mounted on leaf-spring members 20 for movement toward and away from stationary contacts 16. The stationary contacts are provided with terminals 22 which extend downward adjacent one of the side walls. Terminals 24, associated with the movable contacts, extend downward adjacent the opposite side wall. These terminals are secured to the fixed ends of the leaf springs 20.

Disposed within the base adjacent the end walls thereof are support members 26 which are adapted to receive shaft portions of a contact actuating rotor 28. The rotor 28 has a main body 30 having a helical groove 32 disposed therein. This helical groove extends substantially the entire length of the rotor body 30 and advances through approximately 180° over the surface thereof.

Positioned on the rotor body are a plurality of contact actuating members 34. These members are formed as depressions which are adapted to receive corresponding raised portions 35 of the spring members 20. When the rotor is suitably positioned one or more of portions 35 may be positioned within the corresponding depressions such that the associated contacts are closed. When so positioned, the movable contacts are securely located relative to the fixed contacts such that excellent electrical contact is assured. These depressions may be in the form of radially extending grooves if the associated contacts are to be closed in several successive switch positions, for example.

Shaft portions 36 and 38 extend axially from either end of the rotor body. These shaft portions are supported by the bracket members 26 within the base 10. On the outer ends of the shaft portions are discs 40 and 42. These discs have a plurality of notches 44 disposed in the periphery thereof which are adapted to cooperate with a spring 46. The spring is secured in position above each disc when the switch is assembled, as shown in Fig. 4, and in cooperation with the notches the spring acts to provide positive angular positioning of the rotor body.

Also mounted within the base between the contacts and the rotor is a bar 47 which is positioned between guide elements 48 and 49 and is vertically supported on biasing springs 50 and 52. This bar rests on the spring members 20 as shown in Figs. 5 and 7 and is biased upwardly by the springs such that the switch contacts may be closed.

Positioned above the bar 48 is a plate 54 which rests in a horizontal position on the bar and has support portions 56 and 58 extending to one side thereof. The ends of these support portions are curved and rest upon shelves 60 within the base as shown in Fig. 5 such that a pivoting motion of the plate 54 is permitted.

A triangular cam element 62 is adapted to be positioned on the plate 54. This cam element has shaft

portions 64 adjacent one apex and normally it is positioned as shown in Fig. 6.

An intermediate guide member 66 is positioned within the base 10 on suitable support members 68 provided therein. The member 66 has several apertures: cut outs 70 and 72 to provide space for the bearing portions 56 and 58 of the plate 54, and cut outs 74 and 76 to provide space for appropriate securing means; aperture 78 to permit a switch operating member to extend through and into the helical groove for operation of the contact actuating member; and aperture 80 which cooperates with the switch disconnect mechanism.

The aperture 80 has side walls which are formed with irregular surface portions 82 along the bottoms thereof providing detents. These zigzag portions cooperate with the shaft portions of the cam 62 which is adapted to bear against them as shown in Figs. 5 to 8 to position the slider in one of a plurality of discrete positions.

A slider 84 is provided and mounted on the member 66, in sliding relation to the bearing portions 85 and 86 thereof. The slider has a depending portion 87 disposed substantially centrally of its base 88 which cooperates with the helical groove 32 as shown in Figs. 2, 3, 5, and 7. At one edge of the base, such that they are disposed beyond the bearing surface 85, are two depending studs 90 and 92. When the switch is assembled these studs are disposed on either side of the triangular cam 62 as shown in Fig. 6, and drive the cam when the slider is moved.

The slider has a handle portion 94 having a necked portion 96 adjacent the base which cooperates with a slot 98 in the switch cover 100. In this manner the slider is restrained for motion in the longitudinal direction only.

The cover 100 is stamped from suitable material and is secured to the base by means of appropriate fastening members such as bolts 102. The cover has a raised central portion 104 in which the slot 98 is disposed. The slot runs lengthwise of the switch and thus permits sliding movement of the slider in that direction. The cover is also provided with a plurality of depressed portions 106 which bear against the member 66 such that it is maintained securely in position, when the switch is assembled.

The operation of the switch may be understood with reference to Figs. 5 to 8. In a stable position as shown in Figs. 5 and 6, movable contacts 18 are urged toward the fixed contacts 16 by the leaf springs 20 and thus are closed whenever the contact actuating rotor 28 is suitably positioned such that an associated leaf spring raised portion 35 is located within a depression 34. Certain other contacts of the switch are held open as the portions 35 bear against the rotor body surfaces. In the position shown in Figs. 5 and 6 the rotor is secured by the action of the springs 46 against a notch 44 in each disc 40 and 42.

When so positioned the disconnect mechanism comprising the cam 62, the plate 54, and the bar 47 is inoperative. The shaft portion 64 of the cam 62 is urged upwardly by the action of the springs 50 and 52 against bar 47 and plate 54 into a stable position at the peak of the angular detent surface 82 and the opposite surface of the cam is positioned flat against the slider between the studs 90 and 92 as shown in Fig. 6. Thus, the slider is positively positioned in one of a plurality of discrete positions between the ends of said slot corresponding to the plurality of switch positions and appropriate markings may be placed on the cover to indicate these circuits that are closed in a specific, discrete slider position.

The switch structure may carry substantial current such that the rapid movement of the slide 84 through several positions, may produce a number of arcs, created by the rapid sequential opening and closing of the contacts, that exist simultaneously. These simultaneous current paths may result in a total current heavy enough to destroy the switch. Accordingly, disconnect means are provided

for opening all the contacts during movement of the slide 84 such that excessive arcing cannot occur.

The disconnect operation is accomplished by the cam 62 which is tilted by contact with one of the studs 90 and 92 when the slider is moved in either direction to approximately the position shown in Fig. 8. In this position the dimension between the uppermost and lowest surfaces of the cam is increased such that the cam forces the plate 54 and bar 48 downwardly. This depresses all of the leaf springs 20, opening all of the circuits. As long as the slider is moved in one direction the cam is held in tilted position where it maintains the springs depressed such that none of the circuits can be closed.

Upon release of the slider, however, the cam rotates back to its stable position shown in Fig. 6 such that the flat surface contacts the slider. The shaft portion slides up the inclined detent surface toward an apex of surface 82 corresponding to a discrete slider position under the pressure of the biasing springs 50 and 52 thus permitting the bar 48 to rise and to establish those circuits which are to be completed in that position of the switch.

In order for the cam element to positively return to its stable position such that the contacts may be closed, it is desirable that the angle between the sides of the cam at the apex adjacent the shaft be greater than 90° such that the resultant moment will ensure the return of the cam to its proper position, permitting the disconnecting bar to rise to its inoperative position.

Longitudinal motion of the slider 84 rotates the rotor body through coaction of the depending stud 87 with the helical groove 32. As the groove is a smooth and continuous curve, an easy transition between the various switch positions is assured.

Alternatively the rotor body may be constructed in the manner as shown in Fig. 9. In this manner the helical groove is constructed in a first portion 110 and the contact actuating elements 112 are disposed on the second portion 114. The disposition of the contact actuating elements may be changed easily by removing the bolt 116 and replacing the portion 114. Still another modification is in the provision of removable studs 118 in the rotor. A number of holes may be cut in the rotor surface and studs may be inserted in the desired positions. In such an embodiment the contacts may be considered to be normally closed and are opened when the raised portion 35 of the spring 20 contacts a stud 118, while in the embodiment shown in Fig. 1 the switch contacts may be considered normally open and are closed when a portion 35 is positioned in a depression 34.

Although certain preferred embodiments of the invention have been shown and described herein, it is not intended that the invention be limited thereto or to details thereof and departures may be made therefrom within the spirit and scope of the invention as defined in the following claims.

I claim:

1. A slide switch comprising a housing, contact means including a plurality of contact switch actuating members supported within said housing and means for actuating said members, said means including a rotary element disposed in said housing, said rotary element having a plurality of switch actuating portions disposed thereon for actuating corresponding ones of the said switch actuating members and including a helical groove disposed in a surface thereof, a slider supportably positioned relative to said housing and adapted for movement in a substantially straight direction, said slider including a portion adapted to engage said helical groove such that said rotary element may be rotated to actuate said switch members upon movement of said slider, and disconnecting means for opening said contacts during travel of said slider.

2. A slide switch as claimed in claim 1 wherein said rotary element may be rotated through a plurality of pre-selected switch controlling positions and further including

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positioning means for locating said slider in discrete positions corresponding to certain ones of said preselected positions.

3. A slide switch comprising a base, a plurality of stationary contact members secured to said base, a corresponding plurality of movable contact members positioned beneath said stationary contacts, a plurality of parallel springs mounted on said base and adapted to support said movable contacts normally in contact with said stationary contacts and for downward movement away from said stationary contacts to open said contacts, a switch actuating element mounted for rotation within said base, said element having a plurality of actuating portions for engaging said springs to effect opening of the respective contacts in certain operating positions of said element, said rotary element having a helical groove cut therein and extending substantially the entire length of said element and through an angle of 180° about said element, a cover element adapted to fit on said base, said cover having a longitudinal slot therein, a slider disposed within said slot and supported by said cover, said slider having a depending projection adapted to engage said groove in cooperating relationship to rotate said element through a plurality of switch positions, and disconnect means for opening all of said contacts during longitudinal movement of said slider comprising a pair of biasing springs, a bar vertically disposed above said contacts on said springs, a triangular cam element having a shaft portion adjacent one apex, said shaft portion adapted to ride along said bar, said cam element having a flat surface opposite said apex for contact with said slider element, said slider element having two depending cam actuating studs adapted to be positioned on either side of said cam for contacting said cam upon said movement of said slider to rotate said cam such that said bar is forced downwardly for opening all of said contacts during movement of said slider.

4. The slide switch as claimed in claim 3 wherein each of said parallel springs includes a raised portion and said switch actuating element includes a plurality of depressions disposed about its surface, each of said depressions being adapted to receive a corresponding raised portion at an angular position of said switch actuating element whereby the associated movable contact is closed upon its stationary contact.

5. The slide switch as claimed in claim 3 wherein each of said parallel springs includes a raised portion and said switch actuating element includes a plurality of raised stud portions disposed about its surface, and each of said stud portions being adapted to actuate a corresponding raised portion at an angular position of said switch actuating element whereby the associated movable contact is moved away from its stationary contact to open the circuit.

6. The slide switch as claimed in claim 5 wherein said switch actuating element includes a multiplicity of apertures disposed over its surface and each of said stud portions may be selectively and removably secured within an aperture as desired.

7. The slide switch as claimed in claim 3 wherein said switch actuating element includes two parts a first part including said helical groove and a second part including certain of said actuating portions, said parts being adapted to be removably secured together such that said second portion may be changed, thereby changing the order of contact actuation.

8. A slide switch comprising a housing and a cover member therefor, contact means including a plurality of contact switch actuating members supported within said housing and means for actuating said members, said means including a rotary element disposed in said housing, said rotary element having a plurality of switch actuating portions disposed thereon for selectively actuating corresponding ones of the said switch actuating members in a plurality of preselected switch controlling

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positions and including a helical groove disposed in a surface thereof, and a slider supported and positioned by a slot in said cover member and adapted for bodily movement in a straight line therealong, said slider including a portion adapted to engage said helical groove throughout the bodily movement of said slider such that said rotary element may be rotated to actuate said switch members through a plurality of its preselected switch controlling positions upon movement of said slider and having means for locating said slider in a plurality of discrete positions between the ends of said slot corresponding to said preselected switch controlling positions of said rotary element.

9. A slide switch as claimed in claim 8 wherein said means for locating said slider includes detent surface portions on said cover member defining said discrete positions and means movable with said slider resiliently engaging said detent portions to locate said slider.

10. A slide switch as claimed in claim 9 wherein said means movable with said slider includes a triangular cam element having a shaft portion engaging said detent portions and means for resiliently biasing said cam element.

11. A slide switch comprising a base, a plurality of contact members secured to said base, a switch actuating element mounted for rotation within said base, said element having a plurality of actuating portions for engaging said contact members to effect opening of the respective contacts in certain operating positions of said element, said rotary element having a helical groove cut therein and extending substantially the entire length of said element and through substantially 180° about said element, a cover element adapted to fit on said base, said cover having a longitudinal slot therein with an adjacent irregular surface providing detents, a slider disposed within said slot and supported by said cover, said slider having a depending projection adapted to engage said groove in cooperating relationship to rotate said element through a plurality of switch positions, and means locating said slider in a plurality of discrete positions between the ends of said slot comprising a resiliently biased bar adjacent said slot, a triangular cam element having a shaft portion adjacent one apex, said shaft portion adapted to ride along said bar and to engage said detents to locate said slider in a plurality of discrete positions between the ends of said slot corresponding to said plurality of switch positions, said cam element having a flat surface opposite said apex for contact with said slider element, said slider element having two depending cam actuating studs adapted to be positioned on either side of said cam for contacting said cam upon said movement of said slider to position said cam shaft portion in one of said detents.

12. A slide switch as claimed in claim 11 further including a pair of biasing springs for biasing said bar.

13. A slide switch comprising a base, a plurality of stationary contact members secured to said base, a corresponding plurality of movable contact members positioned beneath said stationary contacts, a plurality of parallel springs mounted on said base and adapted to support said movable contacts normally in contact with said stationary contacts and for downward movement away from said stationary contacts to open said contacts, a switch actuating element mounted for rotation within said base, said element having a plurality of actuating portions for engaging said springs to effect opening of the respective contacts in certain operating positions of said element, said rotary element having a helical groove cut therein and extending substantially the entire length of said element and through an angle of 180° about said element, a cover element adapted to fit on said base, said cover having a longitudinal slot therein with an adjacent irregular surface providing detents, a slider disposed within said slot and supported by said cover, said slider having a depending projection adapted

to engage said groove in cooperating relationship to rotate said element through a plurality of switch positions, and disconnect means for opening all of said contacts during longitudinal movement of said slider comprising a pair of biasing springs, a bar vertically disposed above said contacts on said springs, a triangular cam element having a shaft portion adjacent one apex, said shaft portion adapted to ride along said bar and to engage said detents to locate said slider in a plurality of discrete positions between the ends of said slot corresponding to said plurality of switch positions, said cam element having a flat surface opposite said apex for contact with said slider element, said slider element having cam actuating studs for contacting said cam upon said movement of

said slider to rotate said cam such that said bar is forced downwardly for opening all of said contacts during movement of said slider.

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