

Aug. 13, 1963

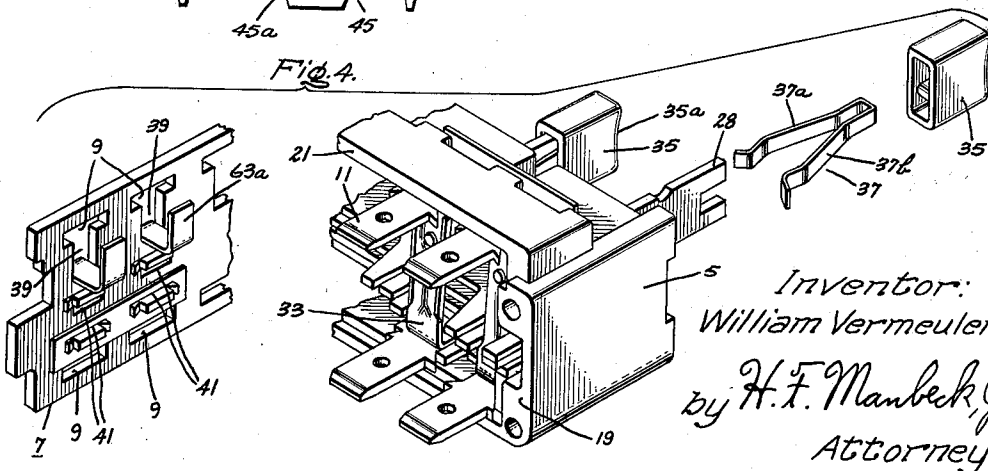
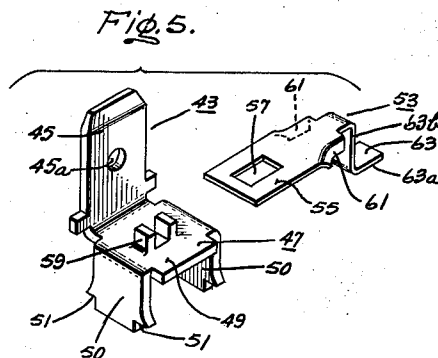
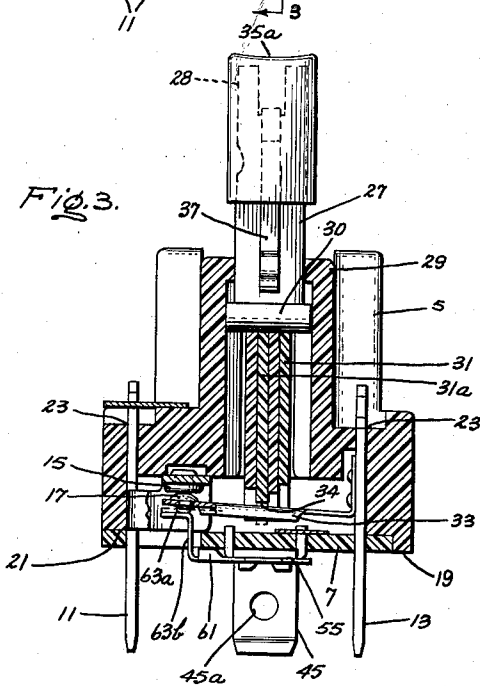
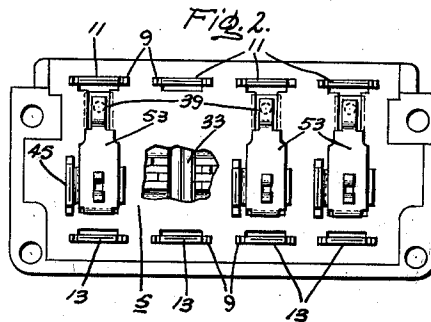
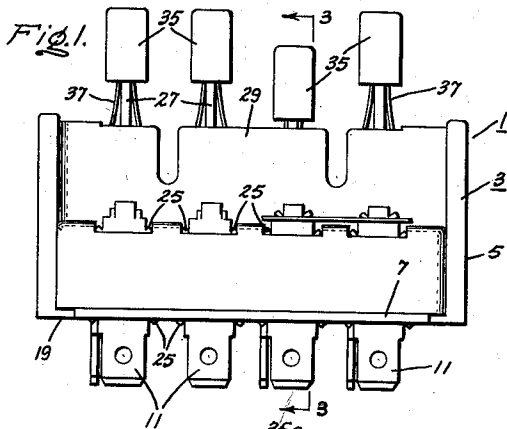
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3,100,822

PUSHBUTTON SWITCH WITH DOUBLE THROW ACTION

Filed Dec. 10, 1959

2 Sheets-Sheet 1



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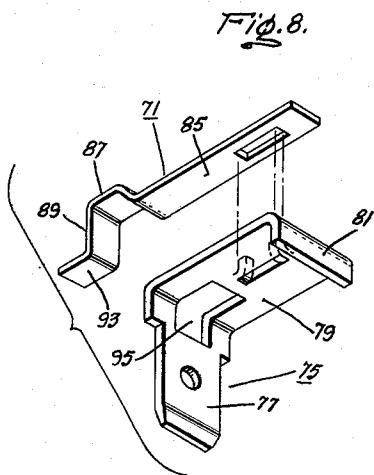
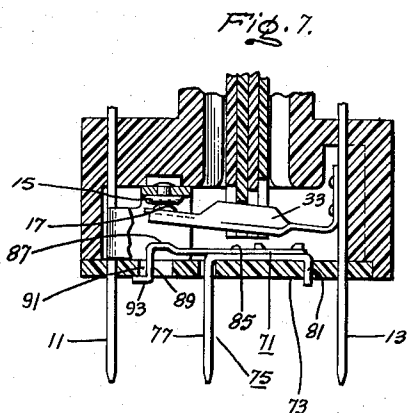
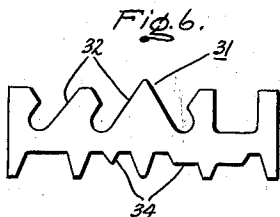
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PUSHBUTTON SWITCH WITH DOUBLE THROW ACTION

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2 Sheets-Sheet 2



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3,100,822

PUSHBUTTON SWITCH WITH DOUBLE THROW ACTION

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6 Claims. (Cl. 200—5)

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FIG. 5 is an exploded view of the cover mounted contact means of FIG. 3 including a terminal and a flexible contact;

FIG. 6 is a side elevational view of one of the sliders of the pushbutton switch embodying my invention;

FIG. 7 is a cross-sectional view, partially broken away, of a switch embodying my invention in alternate form thereof; and

FIG. 8 is an exploded view of the cover mounted contact means of FIG. 7, including a terminal and a flexible contact.

Referring in detail to the drawings, and in particular to FIGS. 1-3, there is shown a pushbutton switch 1 wherein my invention has been advantageously employed. The switch housing 3 comprises hollow base 5 and relatively thin cover plate 7, both of which are formed of suitable insulating material and cooperate to provide a compact supporting structure for the operating mechanism of the switch. Cover plate 7 has two oppositely disposed rows of narrow slots 9 through which terminals 11 and 13 extend. Terminals 11 are connected to and support fixed contacts 15, and terminals 13 are connected to and support movable contacts 17. (See FIGS. 2 and 3.) To mount plate 7 to base 5, bottom 19 of the base provides recessed longitudinal surface 21 (FIG. 4) and various other coplanar recessed surfaces (not shown) upon which corresponding inner surfaces of plate 7 are seated. Cover plate 7 is securely attached to base 5 by the terminals 11 and 13 of the fixed and movable contacts. These terminals each extend through cover plate slots 9 and the aligned or overlying slots 23 in the base 5 (FIG. 3), with appropriate projecting fingers 25 adjacent the outer surfaces of the base and plate being lapped over in the well-known manner to hold the terminals in place and secure together the cover and base.

To actuate switch 1, pushrods 27 extend downwardly through top wall 29 of base 5 into the hollow portion thereof. (FIGS. 1 and 3.) These pushrods have cylindrically configured actuated portions 30 (FIG. 3) which cooperate with various inclined upper working edges 32 of sliders 31. Sliders 31 are disposed in parallel relationship in the well known manner, and reciprocate longitudinally, to actuate movable contact supporting arms 33. The lower edge of each slider, as shown by the slider illustrated in FIG. 6, has one or more cam surfaces 34. Cam surfaces 34 are for alternately engaging certain arms 33 to effect the opening and closing of predetermined contacts in certain operating positions of the sliders. The inclined working surfaces 32 of the upper edges of the sliders are so arranged on the different sliders that only one pushrod may be fully depressed at any one time. As is thus well known in the art, the depression of one of the pushrods 27 causes the longitudinal movement of one or more of sliders 31, and this movement actuates one or more pairs of contacts of the switch by engagement of cam surfaces 34 of the sliders with movable contact supporting arms 33.

Pushrods 27 have bifurcated outer ends 28 for engaging pushbuttons 35. These pushbuttons have a hollow divided inner cavity which is pressed into engagement with the bifurcated outer end of each pushrod. Concave outer surface 35a of each pushbutton serves to provide a curved surface which corresponds to the contour of an operator's finger and which is also pleasing in appearance. Hairpin-shaped detent spring 37 is hung symmetrically over the bifurcated outer end of each pushrod. These springs serve to steady the pushbuttons in their outermost positions while one of the other pushbuttons is being depressed, by the coaction of curved arms 37a and 37b with appropriately configured slots (not shown) formed in the top wall 29 of base 5.

Turning now to a detailed explanation of a salient

This invention relates to a pushbutton switch and particularly a multiple pushbutton switch with a series of manually controlled buttons which may be depressed to control the operation of several circuits operating through the switch.

Pushbutton switches have been used in great numbers as appliance switches for electric ranges, washing machines, and room air conditioners, etc. In many such applications, it is desirable to have double throw contact action in these switches, and the principal object of the present invention is to provide a pushbutton switch with a novel low-cost means for obtaining double throw action.

A further object of this invention is to provide an improved multiple pushbutton switch which has double throw action for one or more of the movable contacts, but does not require any increase in the overall dimensions of the switch as compared with a switch including only single throw action.

In carrying out my invention, in one form thereof, I apply it to a multiple pushbutton switch with movable sliders. Each slider has a series of inclined working surfaces that are acted upon by pushrods, and cam surfaces for engaging movable contact supporting arms of the switch. Depression of one of the pushrods causes coaction thereof with certain inclined surfaces of one or more of the sliders to thus move certain sliders and return the previously depressed pushrod back to its outermost position. At the same time, the cam surfaces of the sliders act upon certain predetermined movable contacts of the switch to move them toward or away from their associated fixed contacts and thus either open or close circuits to the switch. By my invention a flexible contact is provided having one end attached to the cover of the switch. The contact is mounted in such a manner that its free end cooperates with one of the movable contacts to provide an additional pair of cooperating contacts, thereby attaining double throw action for the associated movable contact. With this arrangement of the flexible contact on the cover the double throw action is obtained at a minimum cost without necessitating any increase in size of switch. A means is also provided for limiting the movement of the flexible contact toward the movable contact. This maintains a proper space relationship between the associated flexible and movable contacts when the movable contact is in engagement with its mating fixed contact.

Further aspects of my invention will become apparent hereinafter, and the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which I regard as my invention. The invention, as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front elevational view of a multiple pushbutton switch embodying my invention;

FIG. 2 is a bottom plan view partially broken away of the switch of FIG. 1;

FIG. 3 is a cross-sectional view taken generally on the line 3-3 of FIG. 1;

FIG. 4 is a fragmentary partially exploded view of a portion of the switch, showing part of the open face of the switch base and a portion of the cover plate displaced from its final assembled position;

aspect of my invention whereby double throw action is achieved for certain of the movable contacts, it will be noted that I have formed a plurality of spaced transverse slots 39 in cover plate 7. (See FIG. 4.) Slots 39 intersect certain of the narrow slots 9, through which fixed contact terminals 11 extend, to form T-shaped openings. Slots 39 also overlie the movable contacts 17 associated with these terminals 11. In the illustrated embodiment there are, of course, three slots 39, as shown. Spaced from the bottom of each slot 39, I have also formed in plate 7 of my switch an additional pair of transversely spaced narrow slots 41. (See FIG. 4.) These slots are parallel to the fixed and movable terminal slots 9 and, as will be more fully explained hereinafter, each pair of slots 41 mounts an additional terminal 43.

Terminal 43 is best seen in FIG. 5, and it includes relatively flat blade portion 45 which projects outwardly from the cover. Detent hole 45a is formed in blade 45 for engagement with an associated "quick connecting" terminal. In the illustrated embodiment the blades 45 extend generally perpendicularly to the surface of plate 7 and are disposed crosswise (at right angles to) upstanding blades of terminals 11 and 13, which also project outwardly from the cover. By disposing blade portion 45 perpendicularly to terminals 11 and 13 and spaced therefrom, the connection of bared conductor ends to the terminals is made more convenient. Each terminal 43 also includes an integral U-shaped supporting bracket 47. Bracket 47 includes base 49 which is generally perpendicular to blade portion 45 and rests upon the outer surface of plate 7 when terminal 43 is attached thereto. To attach each terminal 43 to plate 7, bracket 47 includes arms 50 which are fitted into slots 41 of the plate. Each arm 50 is staked to plate 7 by means of barbed outer edges 51 (FIG. 5) which are parted to overlap the ends of each slot 41 and to securely fasten terminal 43 to the plate. Each terminal 43, it thus will be seen, is positioned between a pair of the terminals 11 and 13.

To provide double throw contact action, a flexible contact 53 is attached to each terminal 43. This contact 53 is arranged for cooperation with the movable contact 17 mounted on the adjacent terminal 13. As best seen in FIG. 5, flexible contact 53 comprises supporting portion 55, at one of its ends. Contact portion 55 is affixed to terminal 43 by means of rectangular slot 57 which receives a pair of lanced projecting fingers 59 of terminal base 49. Fingers 59 enter slot 57 and are then swaged to overlap the side edges of the slot and thus secure flexible contact 53 to terminal 43. Contact 53 may be made of any suitable resilient conductive metal such as Phosphor bronze, and is very thin in thickness. (For example, 0.006 inch.) Shoulder flanges 61 (FIG. 5) are formed adjacent the inner end of contact supporting portion 55, and these flanges serve to limit the resilient movement of flexible contact 53 toward movable contact 17. The other end of contact 53 is formed of a narrower width than supporting portion 55, and it includes a resilient L-shaped contact portion 63 which extends through slot 39 into housing 3 to cooperate with movable contact 17. (See FIG. 3.) More particularly the L-shaped contact portion 63 includes long section 63b which is generally perpendicular to plate 7 and extends through the associated slot 39, and short section 63a which actually engages movable contact 17 with which it is associated.

It is important to note at this point that flexible contact 53 is supported by terminal 43 in such a manner that short section 63a of contact portion 63 is resiliently biased to the position shown in full in FIG. 3. In this position, section 63a of flexible contact 53 is spaced the proper gap distance from movable contact 17 when its associated contacts 15 and 17 are in their normally closed position. Shoulder flanges 61 engage the outer surface of plate 7 adjacent slot 39 to limit the resilient movement of flexible contact 53 inwardly. FIG. 3 shows pushrod 27 in a partially depressed position. When pushrod 27 is com-

pletely depressed, slider 31a cams movable contact supporting arm 33 outwardly toward plate 7, to open contacts 15 and 17 and close contacts 17 and 63a.

In other words, each flexible contact 53 may provide control of an additional circuit by the depression of any pushrod which controls the movable contact 17 with which the flexible contact 53 is associated. In manufacturing a pushbutton switch such as this, where the switch size is an important consideration, mounting one or more flexible contacts 53 and associated terminals 43 to the switch cover plate 7 thus efficiently and economically provides a much wider circuit controlling capability without requiring any additional switch size. Flexible contact 53 resiliently pivots about its fixed end adjacent terminal supporting fingers 59 when its associated movable contact is closed thereupon, to provide overtravel for the flexible contact. This overtravel is important in compensating for variations in the positions of movable contact 17 and arm 33 which are introduced by manufacturing tolerances.

FIGS. 7 and 8 illustrate a modified form of my invention wherein flexible contact 71 is supported from inside of cover plate 73 and attached thereto by terminal 75. Terminal 75 is of generally L-shaped configuration and includes blade portion 77, base 79, and turned up end 81. (See FIG. 8.) Base 79 is appropriately positioned between fixed contact terminal 11 and movable contact terminal 13, on the inner face of plate 73. Blade portion 77 and end 81 extend through appropriate slots formed in the cover and are staked thereto to secure terminal 75 to the plate. Flexible contact 71 is fastened to the inner surface of base 79 of terminal 75 in the same manner as contact 53 is secured to terminal 43. Contact 71 includes an elongated flat section 85, upwardly stepped contact portion 87 (viewing FIG. 7), and an L-shaped extension 89, which serves to limit the inward movement of the contact. Extension 89 extends through slot 91 and its end 93 engages the outer surface of plate 73 adjacent the slot to limit the inward movement of contact 71 the desired amount. A slotted area 95 is provided in terminal 75 (see FIG. 8) to permit outward motion of contact 71. Operationally, this modified form of my invention is identical to the arrangement initially described, providing double throw contact action by an additional movable contact supported by the switch cover, and having limited inward movement and overtravel.

It will be understood from the foregoing that my new and improved pushbutton switches such as herein illustrated provide a simple and efficient means for economically providing double throw action and circuitry for any contact pair of a pushbutton switch. It should be realized that certain aspects of my invention may be incorporated efficiently and beneficially in other various types of pushbutton switches.

While in accordance with the patent statutes, I have described what at present are considered to be the preferred embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from my invention, and I, therefore, aim in the following claims to cover all such equivalent variations as fall 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 pushbutton switch comprising a hollow insulating base having at least one open side, actuating means for said switch an insulating cover for closing said open side of said base, at least one fixed contact mounted within said base, at least one movable contact mounted within said base between said fixed contact and said cover thereby to provide a first pair of cooperating contacts for said switch, and a flexible contact one end of which is attached to said cover, a portion adjacent the other end of said flexible contact being arranged for engagement by said movable contact thereby to provide a second pair of cooperating contacts for said switch, and means including

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the cover and said flexible contact for limiting the movement of said flexible contact toward said movable contact to maintain a predetermined distance between said flexible contact and said movable contact when said first pair of contacts are in the closed position.

2. A pushbutton switch comprising a hollow insulating base having at least one open side, actuating means for said switch, an insulating cover for closing said open side of said base, at least one fixed contact mounted within said base, at least one movable contact mounted within said base between said fixed contact and said cover thereby to provide a first pair of cooperating contacts for said switch, and a flexible contact one end of which is attached to said cover from the exterior surface thereof, the other end of said flexible contact being arranged within said base for engagement by said movable contact thereby to provide a second pair of cooperating contacts for said switch, and means for limiting the movement of said flexible contact toward said movable contact by engagement of said flexible contact with said cover to maintain a predetermined distance between said flexible contact and said movable contact when said first pair of contacts are in the closed position.

3. A pushbutton switch comprising a hollow insulating base having at least one open side, actuating means for said switch, an insulating cover for closing said open side of said base, at least one fixed contact mounted within said base, at least one movable contact mounted within said base between said fixed contact and said cover thereby to provide a first pair of cooperating contacts for said switch, a slot formed in said cover opposite said movable contact, and a flexible contact one end of which is attached to said cover on the exterior surface thereof, said flexible contact extending through said slot into said switch base and having a portion near its other end arranged for cooperation with said movable contact within said base thereby to provide a second pair of cooperating contacts for said switch, and means for limiting the movement of said flexible contact toward said movable contact by engagement of said flexible contact with said cover to maintain a predetermined distance between said flexible contact and said movable contact when said first pair of contacts are in the closed position.

4. A pushbutton switch comprising a hollow insulating base having at least one open side, actuating means for said switch, an insulating cover for closing said open side of said base, at least one fixed contact mounted within said base, at least one movable contact mounted within said base between said fixed contact and said cover thereby to provide a first pair of cooperating contacts for said switch, a slot formed in said cover opposite said movable contact, and a flexible contact one end of which is attached to said cover from the exterior surface thereof, the other end of said flexible contact extending through said slot into said switch base and arranged between the movable contact and the cover for cooperation with said movable contact thereby to provide a second pair of cooperating contacts for said switch, at least one flanged shoulder of said flexible contact disposed adjacent said slot and arranged to engage the exterior surface of said cover when said first pair of contacts of said switch are

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in the closed position thereby to limit the movement of said flexible contact toward said movable contact to maintain a predetermined distance between said flexible contact and said movable contact when said first pair of contacts are in the closed position.

5. A multiple pushbutton switch comprising a housing, a plurality of elongated sliders assembled in side-by-side relation for sliding movement within said housing, one edge of each slider being arranged to form cam surfaces thereon, a plurality of movable contact blades engageable with the cam surfaces of the sliders, each blade being fixed at one end to the housing and free to move at its opposite end to make and break contact with a fixed contact of the switch, each slider having inclined surfaces which cooperate with a plurality of pushrods that extend through a wall of the housing, said inclined surfaces being so arranged on the different sliders that only one pushrod may be fully depressed at any one time, and an insulating cover for closing said housing, at least one slot in said cover overlying and adjacent to one of said movable contact blades, at least one flexible contact attached to said cover, a portion of said flexible contact extending through said slot into said switch housing, said flexible contact being arranged within said housing to cooperate with its adjacent movable contact blade and provide double throw action, and means for limiting the movement of said flexible contact toward its associated movable contact blade by engagement of said flexible contact with said cover to maintain a predetermined distance between said flexible contact and said movable contact blade when said blade is in engagement with its associated fixed contact.

6. A pushbutton switch comprising a hollow insulating base having at least one open side, actuating means for said switch, an insulating cover for closing said open side of said base, at least one fixed contact mounted within said base, at least one movable contact mounted within said base between said fixed contact and said cover thereby to provide a first pair of cooperating contacts for said switch, and a flexible contact one end of which is attached to said cover from the interior surface thereof, a portion adjacent the other end of said flexible contact being arranged for engagement by said movable contact thereby to provide a second pair of cooperating contacts for said switch, and means for limiting the movement of said flexible contact toward said movable contact by engagement of said flexible contact with said cover to maintain a predetermined distance between said flexible contact and said movable contact when said first pair of contacts are in the closed position.

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