

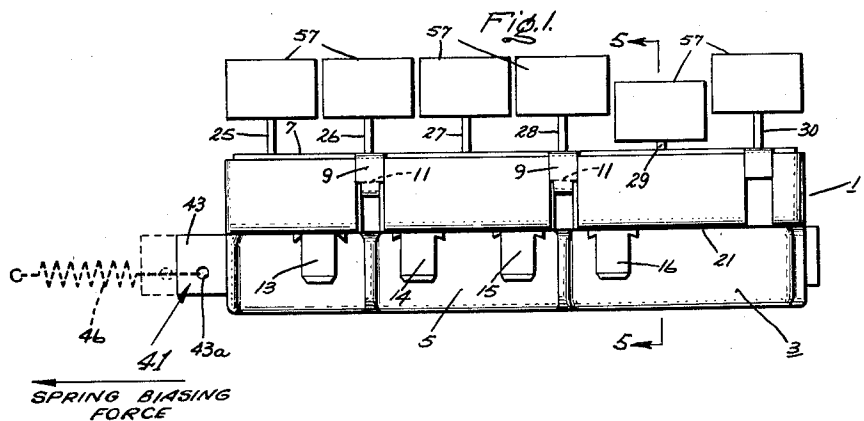
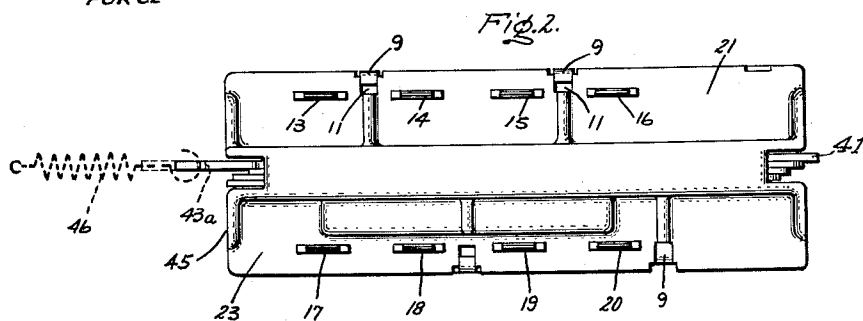
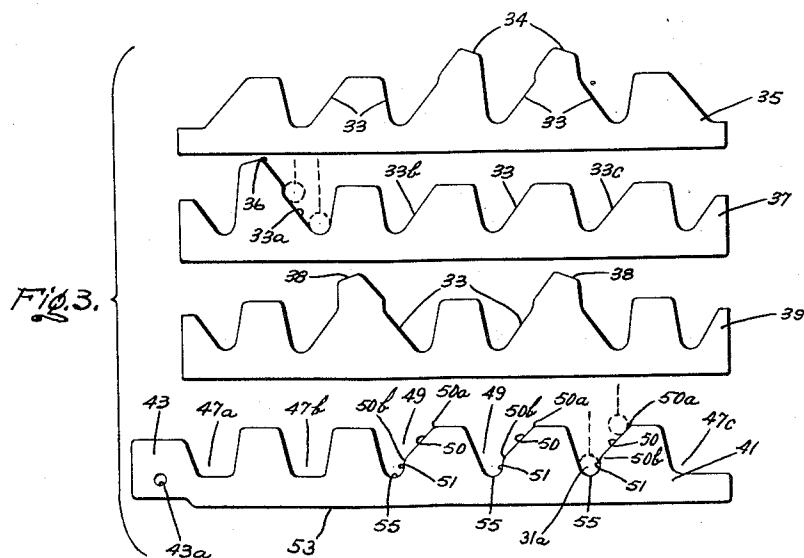
May 28, 1963

P. HUTT
PUSHBUTTON SWITCH WITH MECHANICALLY
ACTUATED EXTENDED SLIDER

3,091,671

Filed Nov. 30, 1959

2 Sheets-Sheet 1



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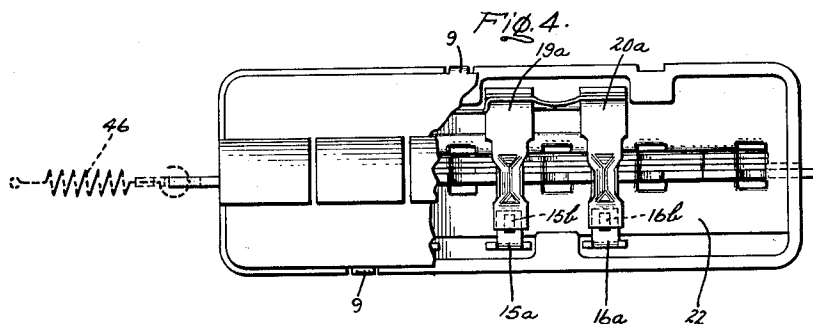
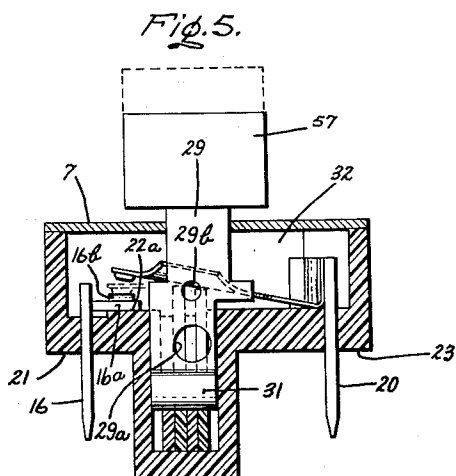
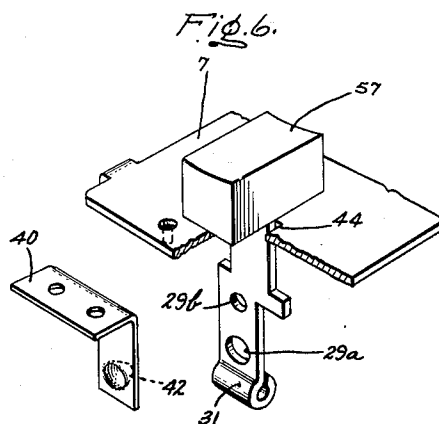
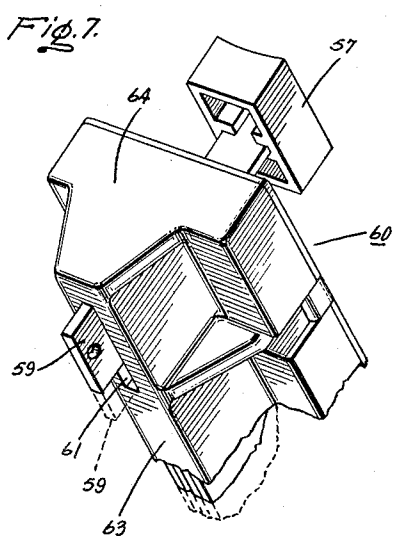
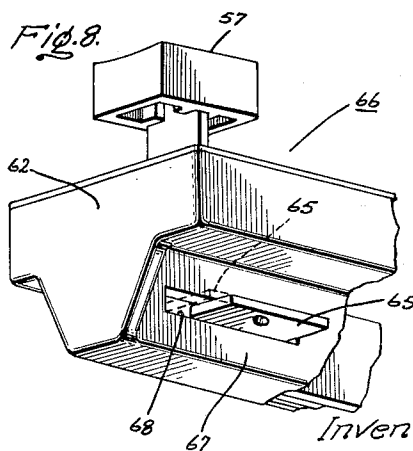
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PUSHBUTTON SWITCH WITH MECHANICALLY ACTUATED EXTENDED SLIDER

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2 Claims. (Cl. 200—5)

This invention relates to a pushbutton switch and particularly a multiple pushbutton switch with a series of manually controlled reciprocating sliders for controlling the operation of several circuits connected through the switch.

Pushbutton switches have been used in great numbers as appliance switches for electric ranges, washing machines, and room air conditioners, etc., to control the circuitry thereof. In many such applications, it would be desirable to increase the versatility of such a switch by providing it with the additional capability of mechanically actuating a device external to the switch, such as a damper on a room air conditioner.

The principal object of the present invention is to provide an improved pushbutton switch with a novel low-cost, and efficient means for mechanically actuating a device external to the switch.

A further object of this invention is to provide an improved multiple pushbutton switch with an extension formed on one of the sliders thereof to mechanically actuate a device external to the switch.

In carrying out my invention, in one form thereof, I apply it to a multiple pushbutton switch with movable sliders. This switch includes a base, and a plurality of pushrods which are mounted thereto to selectively control the relative positions of a plurality of cooperating sliders. Movable contacts are also mounted on the base and they are operated by movement of certain of the sliders in response to depression of the pushrods. By my invention, at least one of the switch sliders has a motion transmitting extension means formed upon it. This extension means extends outwardly from the base and is suitably biased longitudinally by a spring. One or more special actuating recesses are also formed on this slider, and each of these recesses includes an inclined edge for coacting with an associated pushrod, and a vertical edge which is continuous from the inclined edge and forms a seat at the bottom of the special recess. The inclined edge of the recess responds to depression of an associated pushrod to move the slider extension means against its biasing spring and mechanically actuate one or more external devices. The vertical edge forms a seat at the bottom of the special recess to lock the slider extension means in an actuated position when its associated pushrod is depressed. By using a slider which has a motion transmitting means extending outwardly from the switch base and one or more actuating recesses with continuous inclined and vertical edges for coacting with an associated pushrod, mechanical actuation of an external device is efficiently achieved at a minimum cost.

Further aspects of my invention will become apparent hereinafter, and the specification concludes with claims particularly pointing out and claiming the subject matter which I regard as my invention. The invention, however, 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 an improved multiple pushbutton switch embodying my invention;

FIG. 2 is a bottom view of the switch of FIG. 1;

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FIG. 3 is a view showing the configuration of the movable sliders of the switch of FIG. 1;

FIG. 4 is a plan view of the switch of FIG. 1, which is partially broken away to illustrate some of the internal elements of the switch;

FIG. 5 is a cross-sectional view taken substantially on the line 5—5 of FIG. 1;

FIG. 6 is a fragmentary exploded view of the switch of FIG. 1, showing a detent spring and pushrod;

FIG. 7 is a fragmentary perspective view of a switch embodying my invention in one alternate form thereof; and

FIG. 8 is a fragmentary perspective view of a switch embodying my invention in a further alternate form thereof.

Referring in detail to the drawings, and in particular to FIGS. 1 and 2, there is shown a multiple pushbutton switch 1 wherein my invention has been advantageously employed. The switch housing 3 includes hollow base 5 and relatively thin cover plate 7 which cooperate to provide a compact supporting structure for the operating mechanism of the switch. More particularly, offset tabs 9 are formed on the opposite side edges of cover plate 7. The outer ends of these tabs, as seen in FIGS. 1 and 2, are turned downwardly and inwardly against recessed shoulders 11 that are appropriately formed in base 5, to securely affix the cover plate to the base.

On opposite sides of base 5, terminals 13—16 and 17—20 are staked to intermediate bottom walls 21 and 23. (See FIG. 2.) Terminals 13—16 have their inner ends turned inwardly, as exemplified by inner ends 15a and 16a of FIG. 4, so that they bear against an inner longitudinal surface 22 of the base. (See also FIG. 5.) Contacts are attached to each of these inner ends, as exemplified by fixed contacts 15b and 16b of FIG. 4, and these are the fixed contacts for my switch. Terminals 17—20 have movable contact supporting arms attached thereto, exemplified by arms 19a and 20a of FIG. 4. These movable contact arms have movable contacts affixed thereto which cooperate with mating fixed contacts to control circuits connected across the terminals of the switch.

To actuate my switch 1, pushrods 25—30 have been provided. These pushrods extend downwardly through cover plate 7 of housing 3, into the main hollow portion 32 of the base. (See FIG. 5.) Each pushrod has a cylindrically configured actuating portion 31, as best seen in FIG. 6. Portions 31 each cooperate with a group of generally aligned recesses formed in switch actuating sliders 35, 37 and 39. These recesses have inclined working surfaces 33 formed thereon which are engageable with pushrod portions 31 in response to depression thereof. Sliders 35, 37 and 39 are disposed in parallel side-by-side relationship in the well-known manner and they reciprocate longitudinally, to actuate the movable contact supporting arms of the switch. These sliders also extend outwardly from base 5 through suitable apertures formed in recessed ends thereof. Certain upper edges of sliders 35, 37 and 39 are extended upwardly and shaped to provide cam surfaces that engage certain predetermined movable contact arms in response to the relative longitudinal positions of the switch actuating sliders. These cam surfaces are shown in FIG. 3, being identified by reference numerals 34, 36 and 38 for the different sliders, and they selectively engage the movable contact arms to control the opening and closing of the contact pairs of the switch. The inclined working surfaces 33 of the upper edges of the switch actuating sliders are so arranged on the different sliders that only one pushrod may be fully depressed at any one time. As is well-known in the art, the depression of one of the pushrods 25—30 causes the longitudinal movement of one or more of the

switch actuating sliders 35, 37 and 39. This movement returns any previously depressed pushrod to its outermost position and also actuates one or more pairs of contacts of the switch by engagement of certain cam surfaces of the sliders with the movable contact arms.

Each of the switch pushrods 25-30 has a suitable spring biased detent 40, as shown in FIG. 6, which is attached to plate 7 to provide steady and accurate spring biased pushrod positions. Detent 40 has a projection 42 on one of its faces which cooperates with apertures 29a and 29b of each pushrod to spring bias it in its inner and outer positions. Each detent 40 is attached to the underside of plate 7 near an associated pushrod slot 44. Projection 42 enters aperture 29a to releasably retain its associated pushrod in its normal outer position, and it enters aperture 29b which is slightly smaller than aperture 29a to releasably retain the pushrod in its actuated or depressed position.

Turning now to a detailed explanation of an important aspect of my invention, which is the provision in my improved switch of an integral and efficient means for mechanically actuating a device external thereto, it will be noted that, as shown in FIG. 3, I have provided a special slider 41 which is longer than sliders 35, 37 and 39. (See also FIGS. 1 and 2.) Slider 41 is principally a motion transmitting slider, and it includes a motion transmitting projection 43 (FIG. 3) which extends outwardly from end 45 of housing 3 (see FIG. 2). A suitable aperture 43a is formed in projection 43. A coiled spring 46 is attached to aperture 43a to urge projection 43 of slider 41 to the left of its position as shown in full in FIGS. 1 and 2, with a suitable biasing force. This spring 46, of course, may be an integral part of an external device (not shown) which is to be actuated, or it may be an intermediate connection between projection 43 and such a device. Special slider 41 (in the illustrated switch) is slightly thicker than the switch actuating sliders 35, 37 and 39, to enhance its sturdiness and durability, since its principal function in this push-button switch 1 is that of performing mechanical work external of the switch in response to movement thereof.

In this switch 1, slider 41 is provided with clearance recesses 47a, 47b and 47c and three specially configured actuating recesses 49, all of which are formed in the upper edge of the slider. All of these recesses are, of course, in general alignment with the recesses of sliders 35, 37 and 39. Actuating recesses 49 each include an inclined edge 50 which is disposed at an angle of approximately 45° to the direction of longitudinal motion of slider 41, and vertical edge 51 which is continuous therefrom and disposed at an angle of approximately 90° to the direction of motion of slider 41.

Pushrods 27, 28 and 29 each overlie an actuating recess 49 of slider 41. (See FIGS. 1 and 3.) When one of these pushrods is being depressed, the pushrod actuating portion 31 first engages the upper end 50a of inclined edge 50 and moves slider 41 to the right against the biasing force imposed upon it by coil spring 46. In this manner, motion transmitting projection 43 is then moved from its dotted position, as shown in FIG. 1, to the position in full, in response to the depression of any one of pushrods 27, 28 and 29. After portion 31 of the depressed pushrod passes the lower end 50b of inclined edge 50 of each actuating recess 49, it thereupon reaches vertical edge 51 which is continuous from each inclined edge 50. Edge 51 serves to guide pushrod portion 31 abruptly downwardly into and forms part of seat 55. Recess 49 thus curves downwardly and upwardly from the bottom of vertical edge 51 thereof to form seat 55 at the bottom of each recess. Seat 55 serves to lock slider 41 in its inner actuated position when actuating portion 31 of pushrod 27, 28 or 29 is in its innermost position. The particular configuration of actuating recess 49 thus advantageously lends itself to the efficient move-

ment and locking of slider 41 in its innermost actuated position. (See FIG. 1.)

After actuating portion 31 of pushrod 27, 28 or 29 is seated in its locked position in one of seats 55 of its associated actuating recess 49, as exemplified by one dotted pushrod portion 31a in FIG. 3, subsequent depression of any other pushrod of the switch will disengage the locked pushrod. This unlocking operation is effected by movement of one of the inclined working surfaces of a switch actuating slider to, in effect, "cam" the previously depressed locked pushrod to its outermost position. As an example of this, suppose that pushrod 29 is depressed to its innermost position, as it is shown in FIG. 1. Actuating portion 31 of pushrod 29 then enters its associated seat 55, as shown diagrammatically in FIG. 3 by dotted lines, to securely lock projection 43 in its innermost actuating position, as shown in full in FIG. 1. If another pushrod, such as, for example, pushrod 26, is then depressed, since this pushrod overlies clearance recess 47b of slider 41 it has no particular effect thereupon. But during the downward movement of pushrod 26, portion 31 thereof engages working surface 33a of slider 37. (See FIG. 3.) This causes the longitudinal motion of slider 37 to the left of its position as shown in FIG. 3. Working surface 33c of slider 37 thereupon moves to the left to "cam" itself underneath actuating portion 31 of pushrod 29 and thus moves depressed pushrod 29 to its outermost position.

To provide a convenient means for manually depressing pushrods 25 to 30 of my switch, pushbuttons 57 are mounted thereupon.

While I have shown slider 41 as a special slider which has no specific effect upon the movable contacts of the switch, it will be apparent to anyone skilled in the art that suitable predetermined cam surfaces may be formed on certain upper edges of this slider so that it also may be used to actuate movable contacts in response to its movement. In understanding my invention, it shall be additionally apparent to anyone skilled in the art that suitable predetermined inclined working surfaces may be also provided on my special slider for the purpose of serving as actuating and interlocking surfaces for the movement of pushrods cooperating therewith. While the cam surfaces of sliders 35, 37 and 39 have been formed on the top side thereof, it will be understood that these cam surfaces could also be formed on the bottom side of their respective sliders, while still performing the same essential functions as those which they provide in the switch that I have illustrated. By the same token, slider 41 could, of course, be formed with cam surfaces on its bottom side 53 to actuate movable contacts disposed underneath the sliders.

FIG. 7 illustrates a modified form of my invention wherein a switch 60 is provided with a motion transmitting projection 59 formed on the bottom edge of a special slider rather than at one of its ends. Projection 59 is movable within aperture 61 which is formed in the bottom 63 of a suitable switch base 64. Mechanical actuation of an external device adjacent bottom 63 of the switch thus may be achieved in the same manner as previously described for projection 43 of slider 41. Operationally, this modified form of my invention is identical to the arrangement initially described.

FIG. 8 represents a still further modified form of my invention, wherein a switch 66 is provided with a motion transmitting projection 65 formed in a side face of a switch actuating slider. Projection 65 extends outwardly through aperture 68 of the angularly extending side wall 67 of base 62. Mechanical actuation of an external device adjacent side 67 of this switch thus may be obtained in the same manner as previously described for projection 43 of slider 41. Operationally, this modified form of my invention is also identical to the arrangement initially described.

It will be understood that my new and improved push-button switches such as herein illustrated provide a simple and efficient means for economically providing mechanical

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actuation of a device external to a switch, such as the damper of an air conditioner. It should be realized that certain aspects of my invention may be incorporated efficiently and beneficially in other various types of push-button 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 having a means for mechanically actuating an external device, said switch comprising a base, a plurality of pushrods mounted in said base, and a plurality of sliders disposed in parallel side-by-side relationship within said base for cooperation with said pushrods and responsive to movement of said pushrods, contact means including a plurality of movable contacts supported by said base for operation by certain of said sliders, at least one of said sliders having at least one motion transmitting projection extending outwardly from said base and at least one actuating recess, said projection being operatively connected to said external device, said actuating recess comprising an inclined edge disposed at an angle of approximately 45 degrees to the direction of motion of said one slider for coacting with an associated pushrod thereby to move said slider projection to an actuating position in response to depression of said pushrod to mechanically actuate an external device, and a vertical edge continuous from said inclined edge and disposed at an angle of approximately 90 degrees to the direction of motion of said one slider, said vertical edge forming a seat at the bottom of said recess to lock said one slider in said actuated position when said associated pushrod is in its innermost depressed position.

2. A multiple pushbutton switch having a means for mechanically actuating an external device, said switch comprising a base, a plurality of switch actuating pushrods mounted on said base, a plurality of switch actuating

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sliders cooperating with said pushrods and responsive to movement of said pushrods, said sliders being disposed in parallel side-by-side relationship, contact means including a plurality of movable contacts supported by said base, each of said switch sliders including a plurality of inclined edges engageable by certain of said pushrods and at least one cam surface for engaging certain movable contacts of said switch, and a motion transmitting slider disposed in parallel side-by-side relationship with the switch actuating sliders, said latter slider including a motion transmitting projection extending outwardly from said base and at least one actuating recess, said projection being operatively connected to said external device, said actuating recess having an inclined edge disposed at an angle of approximately 45° to the direction of motion of said motion transmitting slider for engagement by an associated pushrod for moving said slider including said projection in response to depression of said pushrod thereby to mechanically actuate an external device, and a vertical edge disposed at an angle of approximately 90° to the direction of motion of said slider, said vertical edge being disposed on the same side of said recess as its associated inclined edge and being continuous from said inclined edge to form a seat at the bottom of said recess to lock said motion transmitting slider in an actuated position when said associated pushrod is in its innermost position, one of said switch actuating sliders having an inclined edge adjacent said inclined edge of said motion transmitting slider for engaging the pushrod associated with said actuating recess upon depression of certain other of said pushrods thereby to unlock said motion transmitting projection.

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