May 21, 1957 P. HUTT 2,793,257

DETENT MEANS FOR PUSH BUTTON SWITCH

Filed Oct. 3, 1955

Fig. 1.

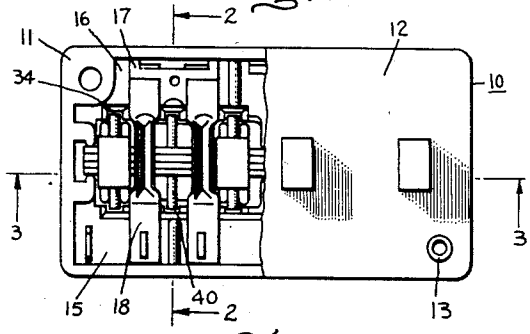


Fig. 2.

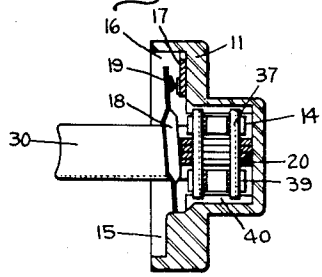


Fig. 3.

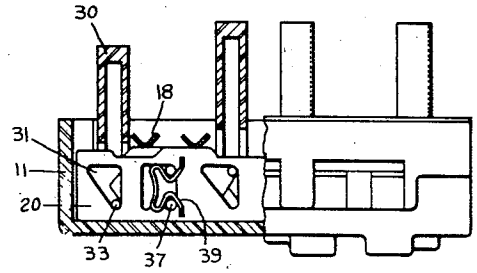


Fig. 4.

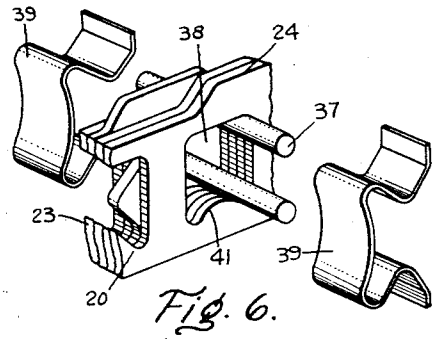


Fig. 5.

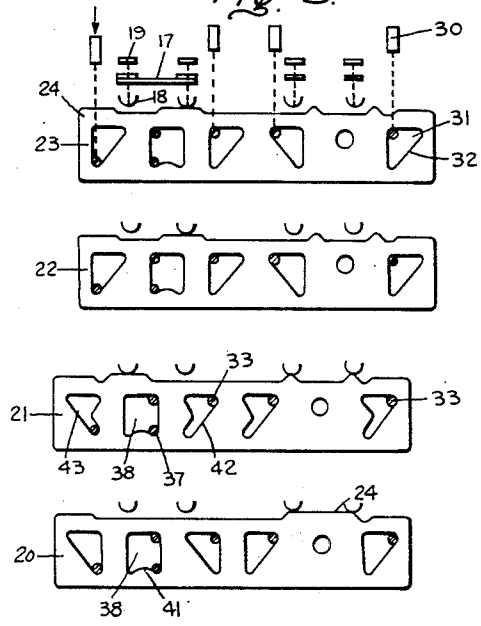
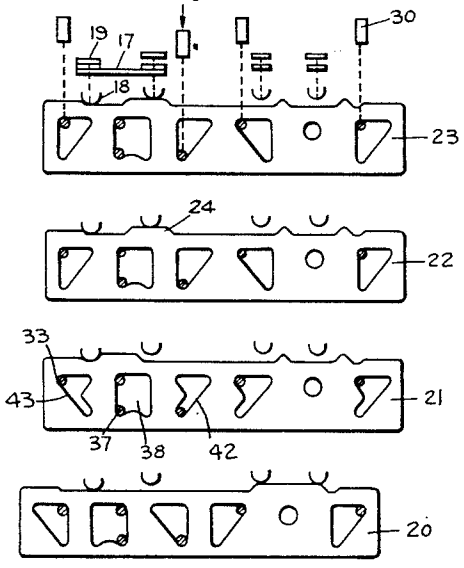


Fig. 6.



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2,793,257

DETENT MEANS FOR PUSH BUTTON SWITCH

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Application October 3, 1955, Serial No. 538,031

3 Claims. (Cl. 200—5)

The present invention relates to a multiple push button switch of the type which includes a plurality of push buttons for actuating sliders to effect the closing of one or more pre-selected electric circuits when one of the buttons is depressed while preventing the simultaneous operation of a second push button through a suitable interlocking mechanism.

This invention is an improvement in the push button switch of the basic Andrews Patent No. 2,431,904 which is assigned to the same assignee as is the present invention, and it is a lower cost substitute for the detent means of the Applicant's copending application, Serial No. 404,627, which was filed on January 18, 1954, and likewise assigned to the same assignee as is the present invention. This application issued on November 8, 1955 as Patent No. 2,723,317.

The push button switch of the Andrews patent has been widely used for many years for controlling the heating elements of electric ranges. In recent years, however, such push button switches have been adapted for the control of other types of electrical equipment such as room air conditioners which involve motor driven apparatus. In such applications, it is frequently necessary that control switches be arranged so that the controlled circuits cannot be inadvertently opened and immediately reclosed. A situation of this kind may, for instance, be involved where a controlled motor is used to drive apparatus so arranged that the motor, when its supply circuit is opened, stops under load and cannot be restarted without undesired operation of circuit protective means unless the load is first disconnected from the motor.

An example of such an application is found in the control of refrigerating compressors as used in air conditioning equipment which may involve a plurality of electric circuits to be controlled. A multiple push button switch of the general type of the switch described in the above-mentioned Andrews Patent No. 2,431,904 is well adapted for such use to select various operating conditions of the equipment. When the air conditioner is used merely for movement of air (into or out of a room), one or more fans are operated. If it is desired to cool the room, then a compressor for the refrigerant must be connected in the operating system. It is an inherent characteristic in some of the room air conditioners now on the market that once the motor for driving the compressor is stopped, it cannot be restarted immediately until an appreciable time has elapsed, in the order of one or two minutes. During this lapse of time, the pressure of the refrigerant on both sides of the compressor is being equalized by a bleeder system. If an attempt is made to restart the compressor immediately after it has been stopped, the compressor motor will stall due to an excessive overload and the circuit protective fuse or breaker will open.

Operating instructions ordinarily furnished with such equipment caution the operator against trying to restart the compressor too soon after it has been stopped. However, it is desirable that control switch mechanisms for

such equipment be arranged to prevent the possibility of inadvertent opening of the compressor motor circuit and its automatic, immediate reclosing.

A difficulty encountered in attempting to use a switch of the type described in the aforesaid Andrews Patent No. 2,431,904 for the control of certain room air conditioners is that such a switch permits the inadvertent opening of its circuits followed by an immediate, automatic reclosing. A light pressure on any of the push buttons other than the one previously depressed is transferred by the mechanism into a force directed toward opening the electrical circuits. When this pressure is released, the circuits would immediately reclose. When initial tests were made with such a switch on a room air conditioner, a casual pressure on the buttons could open the compressor motor circuit and then permit it to close again with the result that the motor would be in a stalled condition, thereby operating the circuit protective means to open the circuit. Obviously this condition could not be tolerated.

One solution of this problem is found in the Applicant's copending application, Serial No. 404,627. However, the subject invention has been made in order to accomplish the same results as the invention in said application by using fewer parts and standard switch housings of smaller size so that the switch could be sold at a lower cost.

Accordingly, the principal object of this invention is to provide a positive action in the nature of a snap action for each of the buttons of a push button switch of the class described by using a simplified detent mechanism.

A further object of this invention is to provide a push button switch with a detent mechanism which may be installed in a standard switch housing in a location normally occupied by one of the push buttons.

A further object of this invention is to provide a push button switch with a detent mechanism that may be positioned in any one of the positions normally occupied by one of the push buttons.

A further object of this invention is to provide a push button switch with a plurality of movable sliders each having an opening for receiving a detent mechanism comprising a pair of guided pins which are normally biased apart.

The present invention as herein described is embodied in a push button switch comprising a hollow housing of insulating material, stationary contacts secured in the housing, and movable contacts cooperatively associated with the stationary contacts. There are a plurality of parallel spring strips secured at their ends to the housing and supporting the movable contacts at their free ends. A plurality of sliders are arranged longitudinally within the housing in side-by-side relationship and below the spring strips so that they are seated on the bottom wall of the housing. Each slider is provided with one or more cam surfaces on its upper edge for alternately engaging certain of the said spring strips to effect the opening and closing of the respective contacts in certain operating positions of the sliders. A series of diagonal working surfaces are likewise formed in each slider to be generally in alignment with but distinct from similar working surfaces in the other sliders. A plurality of push buttons project into the housing and are associated with the diagonal working surfaces of the sliders by vertically-guided pins which are supported transversely on the bottom of each push button. Specifically, the transversely-extending pins of the push buttons are arranged to cooperate with the diagonal working surfaces to operate the sliders to selected operating positions.

The specific invention disclosed herein relates to a detent mechanism which serves to retard the sliding move-

ment of the sliders. This mechanism is installed by providing each of the sliders with a generally square-shaped opening having one or both of its longitudinally-extending edges provided with a detent or convex cam surface. A pair of vertically spaced pins extend through these aligned openings in the sliders and are guided by grooves on opposed walls of the housing in a manner similar to the pin guide means for the push buttons. This pair of detent pins is normally biased apart by a pair of C-shaped springs of strip material having hook ends so that the springs do not become disconnected from the pins. A single spring is mounted on each side of the sliders in order to balance the spring force on the pins. Accordingly, when a push button is depressed, it will act on a diagonal working surface of one or more sliders, thereby tending to move the sliders longitudinally of the housing. In so doing, the convex cam surface will be temporarily blocked by one of the detent pins due to the spring action between the pins until the moving force is great enough to overcome this spring action so that the detent cam surface may move under the pin to the opposite position. The pair of detent pins counterbalance each other so that there is no tendency for the sliders to be forced downwardly and bind on the bottom wall of the housing or upwardly and become jammed with the spring strips of the movable contacts. Since the detent pins are supported in grooves which are similar to those supporting and guiding the push buttons, it is apparent that this detent mechanism may be shifted at will depending upon the location of the detent openings in the sliders in order to attain a preferred spacing of the buttons. Thus, it is only necessary to add an additional push button position to the switch base in order to take advantage of the detent mechanism of this invention.

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.

In the drawing:

Fig. 1 is a top plan view of a push button switch embodying my invention with a portion of the cover removed so that some of the switch parts may be identified.

Fig. 2 is a transverse cross-sectional view taken on the lines 2—2 of Fig. 1.

Fig. 3 is a partial cross-sectional, side elevational view taken on the lines 3—3 of Fig. 1 showing clearly the detent mechanism of this mechanism.

Fig. 4 is a partially exploded isometric view of a portion of the sliders showing the pair of detent pins and the C-shaped spring members of strip material for biasing them apart.

Fig. 5 is a diagrammatic view showing the position of the sliders and the movable and fixed contacts when the left-hand button is depressed.

Fig. 6 is a diagrammatic showing similar to that of Fig. 5 when the button that is second from the left end has been depressed.

Referring in detail to the drawing, and in particular to Figs. 1–3, 10 represents a hollow switch housing comprising a molded base 11 of suitable insulating material and a thin cover plate 12 which is riveted as at 13 to the base to enclose the switch parts. The base is recessed with a deep longitudinal central cavity 14 and relatively shallow side cavities 15 and 16. Fixed contacts 17 are mounted on the side 16 of the base while spring strips 18 of sheet material which carry the movable contacts 19 are fastened at their opposite ends at the side 15 of the base, as is best shown in Fig. 2.

The spring strips 18 carrying the movable contacts 19 are normally biased into engagement with the fixed contacts 17. The positions of the movable contacts are controlled by a group of four sliders 20–23 (Fig. 5) reading from the side 15 to the side 16 which, as shown in Fig. 1, are bunched together in side-by-side relation. The top edge of each slider is formed with a pattern of cam surfaces 24 which are adapted to hold the spring strips 18 and consequently the movable contacts 19 away from the fixed contacts. Looking at Fig. 5, it will be understood that the left-hand contact 19 is held open by the cam surface of the slider 21 while the right-hand contact is held open by both sliders 22 and 23. In considering Fig. 6, the left-hand contact is closed while the right-hand contact is held open by both sliders 22 and 23.

The present invention is shown embodied in a four-position switch having four push buttons 30 which are molded from suitable insulating material, the lower end of which is bifurcated to straddle the sliders 20–23. Each slider is provided with a series of openings 31 having different combinations of diagonal working surfaces 32. There is such an opening 31 for each push button 30 and these openings are generally in alignment as may be visualized from the diagrammatic showings of Figs. 5 and 6. A metal pin 33 extends through the bifurcated end of each push button and through the aligned openings 31 in the sliders. Such pins 33 are guided in vertical grooves 34 on opposite side walls of the cavity 14 in the base. When the cover 12 is fastened over the base, the push buttons 30 extend through close-fitting openings in the cover so that the buttons are guided for straight-line movement by both the pins 33 and the cover 12.

The structure which has been recited above, with particular relation to the reference numerals, is standard switch construction which has been practiced for many years under the teachings of the Andrews Patent No. 2,431,904 and as clearly illustrated in the applicant's before-mentioned copending application, Serial No. 404,627. This basic switch structure has proved to be unsatisfactory for use in motor controlling circuits since a slight pressure on the OFF button would momentarily open the circuit and if the pressure were quickly released before the button were fully depressed, the tendency would be for the circuit to again close to its original position, thereby resulting in the stalling of the motor and the opening of the circuit protective fuse. The present invention was made to eliminate this difficulty by providing the switch with a simulated snap action so that as the movable contacts begin to open or close when a button is depressed, the force built up to provide this result will be initially retarded by a detent mechanism embodying my invention. After this detent mechanism has been overcome, it is suddenly taken out of action so that the force exerted against the button will carry the button to its extreme depressed position.

As seen in Fig. 4, my detent mechanism comprises a pair of detent pins 37 which extend through a square-shaped opening 38 in each of the sliders and are biased apart by the C-shaped spring members 39 of strip material which have hook ends so that they do not become disengaged from the pins, as is best seen in Fig. 3. The detent openings 38 through the sliders are shown in Fig. 5 as being the second opening from the left and they occupy about the same space as do the openings 31 which include the diagonal working surfaces 32. The detent pins 37 are guided in grooves 40 on opposite walls of the housing which are similar to the grooves 34 that support the push button pins 33 for straight-line movement. The lower edge of the detent opening 38 has a convex cam surface 41 so that when the slider moves, the lower detent pin 37 must ride over the convex cam 41 which compresses the springs 39 and retards the movement of the sliders. If the position of the switch in Fig. 5 is taken as the datum plane where the left-hand button is depressed and the switch contacts are open, the operation of the switch will be understood when comparison is made with Fig. 6 showing the condition of the parts when the second button from the left is depressed. In Fig. 6, the sliders 20, 22, and 23 have not moved from their position as shown in Fig. 5. Only slider 21 has shifted to the right since the pin 33 of the button second from the left has operated

on the diagonal working surface 42 and shifted the entire slider to the right. As it moves, the convex cam 41 compresses the springs 39 until the lower detent pin 37 has reached the top of the cam 41. At this point the detent mechanism has very little function although after it moves into its extreme position the pins stand ready to operate as a detent mechanism when the slider moves in the opposite direction. Attention is directed to the fact that in Fig. 5 the diagonal working surface 43 of slider 21 will force the pin 33 and hence the left-hand button vertically upward so that it finishes in the position as shown in Fig. 6.

It will be readily appreciated by those skilled in this art that while I have chosen to illustrate my invention by showing a detent opening having a convex cam surface on the bottom edge of the opening, an alternate arrangement would be to have a similar convex cam surface along the top edge of the opening so that both detent pins move as the sliders are shifted into the various positions. It is likewise conceivable that other elements could be substituted for the pair of detent pins 37 and the C-shaped springs while retaining the basic principle of a spring-biased force acting in a direction transversely of the plane of movement of the sliders to be in engagement with a convex cam surface on the sliders which would tend to snub or retard the movement of the sliders so that the push buttons will have, in effect, a snap action. My invention has been accomplished by merely increasing the size of the switch base by one button position since the detent mechanism may be mounted in the same grooves which serve to support the straight-line movement of the buttons. Thus, there is afforded a possibility to select the placement of the buttons where the detent mechanism may be shifted to any of the button positions depending upon the location of the detent openings.

Modifications of this 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 push button switch comprising a hollow housing, contact means including fixed contacts and movable contacts that are operated by a plurality of sliders, a series of diagonal working surfaces formed on each of the sliders, and means for actuating the sliders comprising a plurality of push buttons projecting into the housing and guided for straight-line movement, each button having pin means for engagement with selected ones of the aligned working surfaces as the button is depressed so as to move said sliders to predetermined contact controlling positions, and detent means for retarding the movement of the sliders comprising a cut-out portion having a convex cam surface in each of the sliders and likewise arranged in alignment with similar cam surfaces on the remaining sliders, and a spring-biased detent pin extending through the sliders and guided for reciprocating movement by fixed wall members of the switch housing to be in engagement with the said convex cams whereby the force of the spring of the detent pin must be overcome before the sliders may shift as a button is being depressed.

2. A multiple push button switch comprising a hollow housing, contact means arranged in the housing including fixed contacts and movable contacts that are controlled by a plurality of longitudinally movable sliders that are arranged in side-by-side relationship, each slider having a series of diagonal working surfaces generally in alignment with, although distinct from, such working surfaces in the other sliders, and means for actuating the sliders comprising a plurality of push buttons projecting into the housing, each button carrying a transverse pin which is guided in grooves on the opposite side walls of the housing and extends through the sliders to operate on the said diagonal working surfaces so as to move the sliders to predetermined contact controlling positions, and detent means for retarding the movement of the sliders comprising an aligned opening in each slider with a convex cam surface extending along at least one of the lengthwise edges and a pair of vertically spaced pins extending through said openings and being supported in opposed grooves in the side walls of the housing, spring means located between the said pair of pins to bias them apart with at least one pin being in engagement with the said convex cam surfaces whereby the convex cam surfaces force the pins together to compress the springs before the sliders may shift to a different position as a button is being depressed.

3. In a push button switch comprising a hollow housing, contact means including stationary contacts secured in said housing, movable contacts cooperatively associated with the stationary contacts, and a plurality of spring strips secured to the housing and supporting the movable contacts, a plurality of sliders disposed within the housing and seated therein, each slider being provided with one or more cam surfaces for alternately engaging certain of the said spring strips to effect the opening and closing of the respective contacts in certain operating positions of the sliders, each slider having a plurality of apertures with diagonal working surfaces, means for actuating the sliders including a plurality of push buttons projecting into the housing and each having a guided pin projecting through an aperture of each slider and positioned to engage certain of said working surfaces to operate the sliders to selected operating positions; the invention comprising detent means to increase the initial resistance to the inward movement of each of the said push buttons so as to provide them with a simulated snap action including a square-shaped opening in each slider with a convex cam surface extending along at least one lengthwise edge thereof, and a pair of pins extending through said openings in the sliders and being supported in grooves in opposite walls of the housing, and a C-shaped spring on opposite sides of the sliders with ends that are engageable with the said pair of pins to bias them apart with at least one pin being in engagement with the said convex cam surfaces whereby the force of the springs must be overcome before the sliders may shift to a different position as a button is being depressed.

References Cited in the file of this patent

UNITED STATES PATENTS

2,228,167	Kimball	Jan. 7, 1941
2,431,904	Andrews	Dec. 2, 1947