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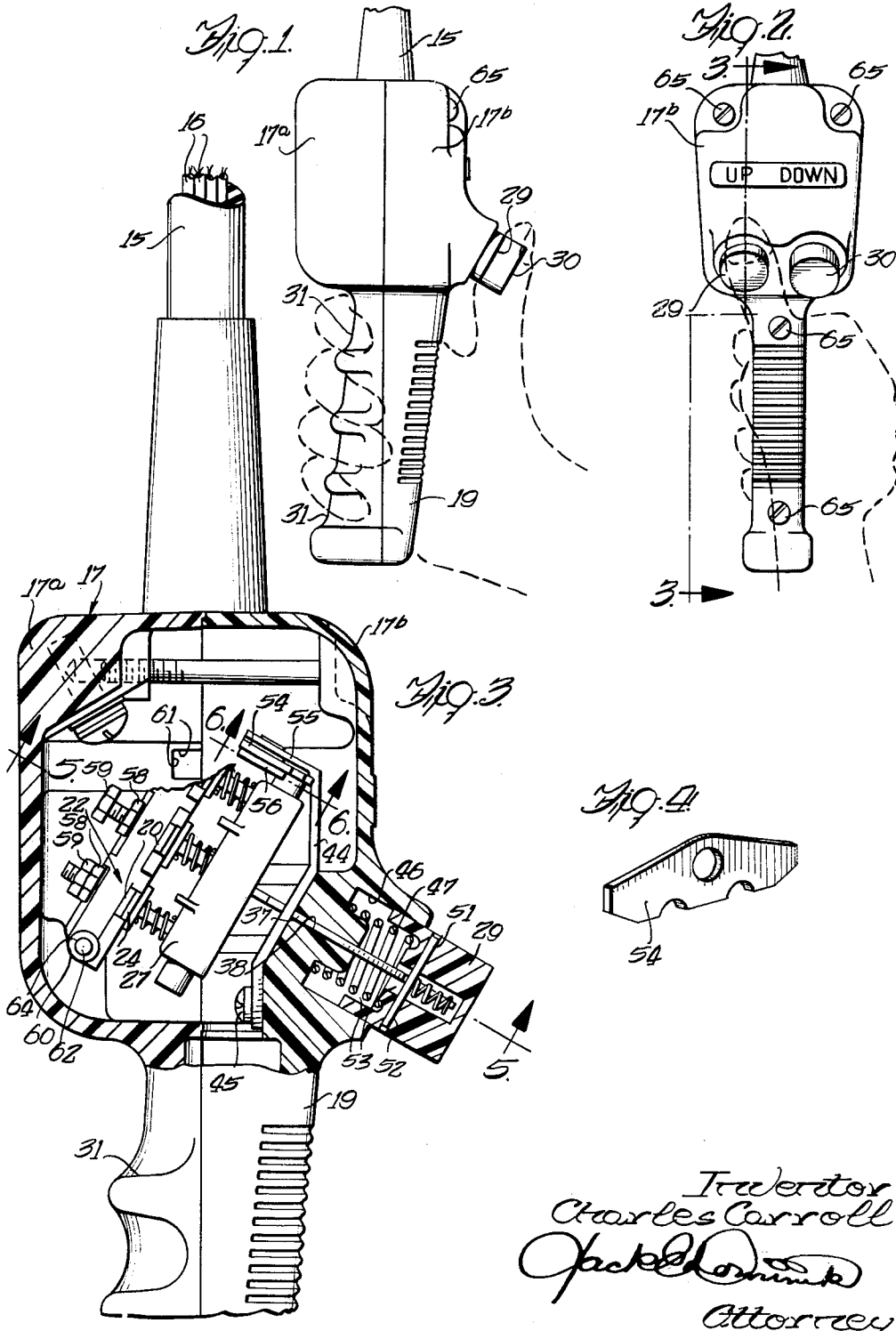
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ELECTRIC SWITCHING MECHANISM

Filed Dec. 5, 1958

3 Sheets-Sheet 1



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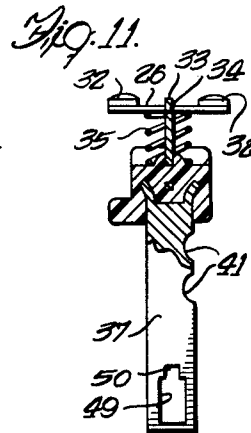
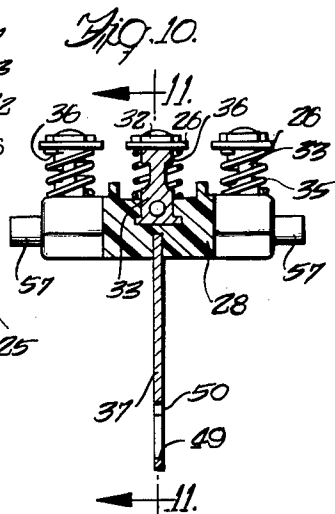
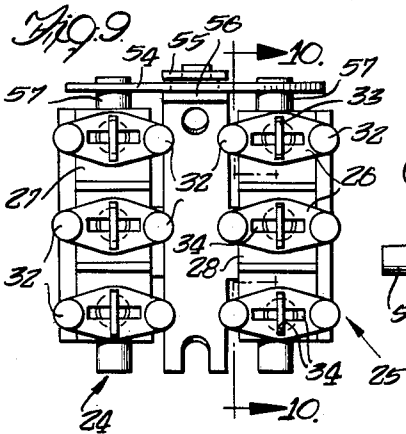
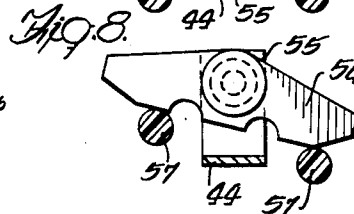
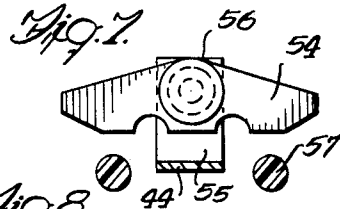
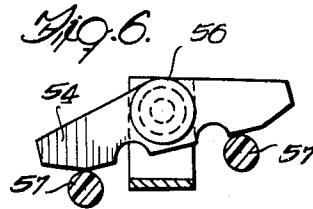
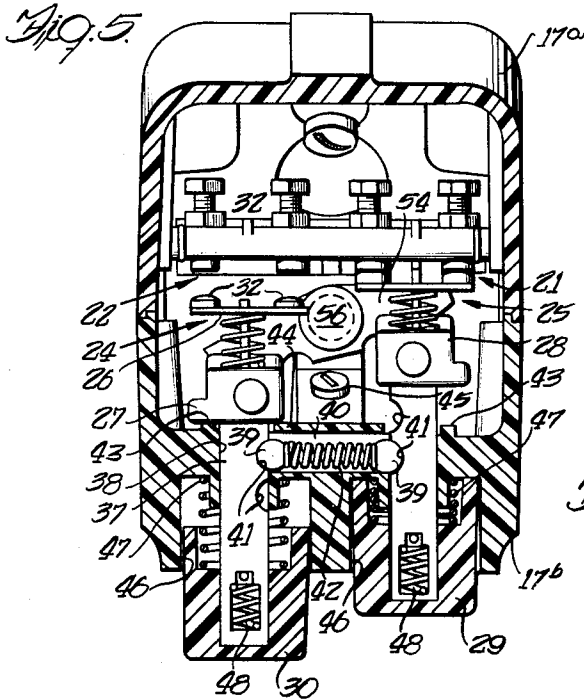
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3,086,090

ELECTRIC SWITCHING MECHANISM

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3 Sheets-Sheet 2



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ELECTRIC SWITCHING MECHANISM

3 Sheets-Sheet 3



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3,086,090

ELECTRIC SWITCHING MECHANISM

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10 Claims. (Cl. 200-5)

This invention relates generally to a manually operable push button switching mechanism and, more particularly, to a multiple contact switching mechanism adapted to be suspended by a cable and to control a reversible electric motor such as used in hoists.

The primary object of the present invention is to provide improved switching mechanism of the above character which may be operated with equal facility by either hand of the operator used alone, in which a positive making and breaking action of the contacts is insured, and which is easy to assemble and adjust for different circuit arrangements especially when considering the large number of contacts and circuit arrangements available.

Another object is to arrange switch actuator elements relative to a handle for the mechanism in a novel manner facilitating operation by only one hand of the operator.

A further object is to mount the switch contacts in a novel manner to simplify assembly of the parts and changes in the connections to the contacts.

Still another object is to achieve the positive making and breaking action of the switch contacts with a snap action provided by a novel arrangement of detents and spring actuating members.

A more detailed object is to achieve the snap action while avoiding stoppage of switch contacts in dead center positions during the circuit breaking by a novel multiple spring arrangement for applying a yieldable force to the switch contacts.

Further and additional objects and advantages of the present invention will be apparent from the following description and drawings in which:

FIG. 1 is a side elevational view of a switching mechanism embodying the novel features of the present invention;

FIG. 2 is a front elevational view of the mechanism;

FIG. 3 is a fragmentary sectional view taken along the line 3-3 of FIG. 2, some of the parts being broken away;

FIG. 4 is a perspective view of the interlock lever;

FIG. 5 is a sectional view taken along the line 5-5 of FIG. 3;

FIGS. 6, 7 and 8 are sectional views taken along the line 6-6 of FIG. 3 and showing the interlock lever in its different positions;

FIG. 9 is a plan view of the movable switch contacts and their supporting parts;

FIG. 10 is a sectional view taken along the line 10-10 of FIG. 9;

FIG. 11 is a sectional view taken along the line 11-11 of FIG. 10;

FIG. 12 is an exploded perspective view of the switch mechanism;

FIG. 13 is an exploded perspective view of one of the push buttons and the parts connected to it.

The switching mechanism shown in the drawings to illustrate the present invention is especially adapted for so-called pendant controls where the mechanism is suspended from a cable 15 containing conductors 16 leading to the apparatus being controlled, for example, a reversible electric motor of a hoist (not shown). Generally, the mechanism comprises a housing 17 of rectangular shape receiving the cable through a hole 18 (FIG. 12) in its upper end and having a handle 19 projecting downwardly from its lower end. The conductors are connected to fixed contacts 20 arranged in rows in two sets 21 and 22

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(FIG. 12) on an insulating plate 23 for engagement separately by two sets 24 and 25 of movable bridging contacts 26 (FIG. 9). Carriers 27 and 28 for the respective sets of bridging contacts have separate actuating mechanisms including individual push buttons 29 and 30 projecting through the housing wall for manipulation from the exterior of the housing. Each push button normally is urged outwardly to an inactive position in which the associated bridging contacts are spaced from the fixed contacts as shown at the left in FIG. 5. When the push buttons are pressed inwardly to active positions as shown in FIG. 3, the bridging contacts engage the fixed contacts.

To enable the operator to manipulate both push buttons 29 and 30 with only one hand and with equal facility using either hand, the present invention contemplates a novel arrangement of the push buttons and their paths of movement in relation to the handle 19. The push buttons thus are laterally spaced apart horizontally adjacent the lower end of one side of the housing 17 and are mounted for movement along parallel paths extending from the housing downwardly and at an angle relative to the handle. With this arrangement, the push buttons are easily pressed in by the print side of the thumb of either of the operator's hands when his fingers encircle the side of the handle opposite the push buttons and the handle is gripped between these fingers and the palm of the hand as shown in dotted outline in FIGS. 1 and 2. If desired, the side of the handle opposite the push buttons may be formed with vertically spaced finger recesses 31 as shown in FIGS. 1 and 3 to facilitate the gripping. Herein, the push buttons project outwardly and downwardly at one lower corner of the housing at an angle of approximately thirty degrees away from the horizontal, the handle also being inclined a few degrees away from the vertical and the push buttons.

The bridging or movable contacts 26 in this instance are formed as elongated flat bars of conducting material such as copper with contact buttons 32 riveted into their opposite ends. In each set of these contacts, there are three such bars mounted in parallel relation on three T-shaped posts 33 (FIGS. 10 and 11) upstanding rigidly from the associated one of the carriers 27 and 28. Intermediate its ends, each bar is formed with cross-slots 34 one longer and one shorter than the cross bar of the supporting T-shaped post. To assemble each contact bar on its post, the bar is advanced onto the post with the longer slot receiving the cross bar of the post. Then, when the contact bar is past the cross bar, the contact bar is turned through 90 degrees to present the short slot in registry with the cross bar as shown in FIG. 9. A spring 35 acts between each contact bar and its carrier to urge the bar outwardly against the post cross bar, the stem of the post being enlarged as indicated at 36 (FIG. 10) adjacent the cross bar so as to fit in the short slot and prevent turning of the contact bar relative to the post. By virtue of this construction and mounting of the contact bars, the bars may be assembled on the posts and disassembled easily so that different numbers of bars may be used as desired; for example, two where a reversing contactor is used with the switching mechanism or six when the mechanism is used to control a single phase motor without a contactor.

Each of the carriers 27 and 28 is formed as a generally rectangular block of molded insulating material, the inner ends of the contact supporting posts 33 being embedded in the block. Also embedded therein is the inner end portion of an elongated flat rod 37 (FIGS. 3, 5, 10 and 11) which extends through a slot 38 in one wall of the housing 17 (FIGS. 3 and 5) and thereby supports the block for reciprocation endwise along the path of the associated push button. Since this path is inclined rela-

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tive to the sides of the housing and with the rod perpendicular to the block and to the plane of the bridging contacts supported on the block as shown, the block and the contact plane similarly extend at an angle relative to the sides and thus diagonally across the interior of the housing.

To insure a positive making and breaking action of the contacts 20 and 26 without arcing, the invention contemplates connecting the guide rods 37 to the push buttons 29 and 30 and mounting the rods and buttons in the housing in a novel manner providing a snap action in the movement of each set of bridging contacts into and out of its active position of engagement with the associated fixed contacts. This is accomplished by yieldably detenting each block in both of its active and inactive positions and applying to the block as it moves out of the active position, a spring force urging the block through a dead center position between the active and inactive positions.

The yieldable detenting is achieved in a simple manner by utilizing two balls 39 (FIGS. 5 and 12) located in a cross recess 40 between the slots 38 for the guide rods 37 and yieldably urged outwardly away from each other and into detent recesses 41 formed in and spaced along adjacent edges of the guide rods. The parallel arrangement of the guide rods and the extension of the cross recess between them makes it possible to utilize a single spring 42 to urge the balls apart. The recesses 41 for each rod are located to receive the associated ball when the bridging contacts 26 are in their respective active and inactive positions contacting and spaced from the fixed contacts 20, each of the carrier blocks 27 and 28 engaging a stop abutment 43 on the housing (FIG. 5) when the rod is in the inactive position. The balls and the spring are retained in their recess by a plate 44 covering the recess and secured to the housing by screws 45.

Each of the push buttons 29 and 30 is of generally cylindrical exterior contour and is slidably received in a correspondingly shaped recess 46 formed in the housing and receiving the guide rod along its axis. Surrounding the guide rod is a coiled spring 47 which acts between the housing and the push button to urge the button outwardly. To provide the desired yieldable force on the guide rod to avoid the same from stopping in its dead center position, an additional or auxiliary spring 48 is interposed between the guide rod and the push button, this spring acting to urge the rod outwardly with respect to the button.

In the present instance, the auxiliary spring 48 for each guide rod 37 is received in a rectangular slot 49 formed in the outer end portion of the rod and having a reduced section 50 at its inner end to receive a pin 51 extending through and having a press fit in a cross bore 52 in the button. This pin serves to hold the parts assembled and is inserted after the guide rod has been extended through its slot 38 in the housing, the main spring 47 has been advanced over the guide rod, the auxiliary spring has been inserted in its slot 49, and the button has been inserted in its recess, the button having a counterbored recess 53 receiving the outer end of the main spring and the auxiliary spring. The latter acts on the guide rod through the outer edge of its slot and on the push button through the cross pin.

Where, as in the case of the hoist, opposing conditions are established by actuation of the different push buttons 29 and 30, it is desirable to prevent simultaneous actuation of the buttons. This is accomplished in a simple manner by the provision of an interlock lever 54 arranged to block movement of each of the sets 24 and 25 of bridging contacts into its active position while the other set is in its active position. To take advantage of parts already available, the lever is fulcrumed intermediate its ends on an upturned extension 55 of the plate 44 which holds the detent balls 39 in their recess, the fulcrum herein being a rivet 56. This extension is located adjacent corresponding ends of the carrier blocks 27 and 28 to

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position the lever for engagement with lugs 57 projecting rigidly from these ends.

When both blocks 27 and 28 are in their inactive positions, both ends of the lever 54 are spaced from the lugs 57 (see FIG. 7). When either block is shifted to its active position, however, the lug thereon raises the adjacent end of the lever so as to lower the other end against the lug on the other block and prevent the latter from shifting into its inactive positions (see FIGS. 6 and 8).

The fixed contacts 20 correspond to the buttons 32 on the bridging contacts 26 in number and in their arrangement in rows so that each button engages a different fixed contact. In this instance, there are twelve fixed contacts arranged in four rows of three each and formed as the heads of bolts extending through and secured to the insulating plate 23 by nuts 58 (FIG. 3). The plate is of generally rectangular shape and, to provide the desired engagement between the fixed and movable contacts, is supported in a plane extending across the interior of the housing and paralleling the planes of the sets 24 and 25 of movable contacts. The conductors 16 in the cable 15 are connected to the fixed contacts by additional nuts 59 threaded on the bolts.

To simplify the assembly of the switching mechanism and changing of the connections to the fixed contacts 20, the fixed contact plate 23 is supported removably in the housing 17 by simple abutting engagement with parts of the housing. The latter thus is formed with abutments 60 and 61 arranged in pairs spaced apart a distance correlated with the dimensions of the plate and facing in opposing directions so as to receive opposite edges of the plate with a wedging fit. One pair of the abutments 60 are of generally V-shape (FIG. 12) and open in the desired plane of the plate to receive one edge of the plate. The opposite edge of the plate then is received in the other abutments 61.

In addition to the wedging fit, the fixed contact plate 23 preferably is held in assembled position within the housing 17 by dividing the latter in two sections 17a and 17b, one of which is formed with the abutments 60 and 61 and the other of which engages parts of the plate along the edge of the section to hold the plate against the abutments. Herein, the housing is split approximately along a central plane paralleling two sides. One pair of abutments 60 projects inwardly toward each other from opposing walls of one section 17a and face diagonally across the section and toward the open side thereof. The other abutments 61 project toward each other from the same opposing walls and define V-shaped recesses opening toward the open side of the housing. To fit against and into the respective abutments, the fixed contact plate has lugs or trunnions 62 and 63 projecting outwardly from oppositely facing walls of the plate at the corners.

The wedge fit is augmented and variations in dimensions are accommodated by fitting over the lugs 62 for the V-shaped abutments 60 rings 64 of resilient material such as rubber which is interposed and compressed between the lugs and the abutments. The other lugs 63 are pressed downwardly into their V-shaped recesses by the edge of the open side of the other housing section 17b when the two sections are assembled in abutting relation as shown in FIG. 3, suitable screws 65 holding the parts in this relation.

Assuming the parts have been assembled as described above, the push buttons 29 and 30 normally are urged by the main springs 47 into their inactive outer positions where the lugs 57 are spaced from the interlock lever 54, the contact blocks 27 and 28 engage the housing stop surfaces 43, and both detent balls 39 are in their inner recesses 41 as shown at the left in FIG. 5. When one push button 29 is depressed, the motion thereof is transmitted directly through the cross pin 51 to the guide rod 37 to shift the latter inwardly and cam the detent ball out of the inner recess. The inward motion of the guide rod continues until the detent ball enters and bottoms in the outer

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recess, such movement having a snap action due to the detenting. At this time, the bridging contacts 26 of the associated set 25 are engaging their fixed contacts 20, the inner end of the push button abuts the bottom of its recess 46, and the adjacent end of the interlock lever is shifted up to lower its other end to engage the lug 57 of the other contact block and hold the other push button 29 in its inactive position. These conditions prevail only as long as manual pressure is maintained on the push button.

Upon release of pressure from the active push button 30, the button starts immediately to shift outwardly from its active position shown at the right in FIG. 5. The guide rod 37, however, tends to remain in the inner position due to engagement of the detent ball in the outer recess. As a result, the auxiliary spring 48 is compressed so that, when the guide rod does start to move and reaches the dead center position with the ball between both recesses, the force of both springs is acting on the guide rod to urge it beyond the dead center position and into the outer inactive position. Outward movement of the rod continues until the contact block engages the stop surface 43. Then, the ball is seated in the inner recess and all of the parts are in their inactive positions.

It will be apparent from the foregoing that, by virtue of the detenting members and the double spring arrangement, the making and breaking actions of the contacts are positive and take place rapidly so as to avoid arcing. This is achieved in a simple manner by locating the detenting parts between the paralleled guide rods 37. Further simplicity is gained by the abutting character of the support for the fixed contact plate 23 and by the use of the detent retaining plate 44 also to support the interlock lever 54. Due to the downward inclination of the paths of the push buttons 29 and 30 along one side of the handle 19, either hand of the operator alone may be utilized to manipulate the buttons easily while retaining full control over the switching mechanism.

I claim as my invention:

1. A push button switch mechanism having, in combination, a housing, a pair of push buttons guided in said housing for movement inwardly and outwardly along generally parallel paths, guide rods adapted for connection to contact elements and guided in said housing for endwise movement along said paths, each of said guide rods having detent recesses spaced along the rod and opening toward the other rod, said housing having a guideway extending transversely between said guide rods and opening at opposite ends adjacent said recesses, detents movable in opposite ends of said guideway and yieldably urged away from each other and into said detent recesses for holding the respective push buttons yieldably in each of an inner position and an outer position, main push button springs each acting between a different one of said push buttons and said housing to urge the button outwardly, each of said buttons having an inwardly opening recess receiving the outer end portion of the associated guide rod and such portion having an elongated slot therein, a pin extending transversely through each of said buttons and said slot in the associated guide rod, second push button springs each extending along a different one of said guide rods in said slot thereof and acting at opposite ends against the associated pin and the outer end of the slot to urge the associated push button outwardly, and abutment surfaces positioned on said housing and said guide rods to engage each other to limit outward movement of said push buttons beyond said outer positions thereof.

2. A push button switch mechanism having, in combination, a housing, a pair of push buttons guided in said housing for movement inwardly and outwardly along generally parallel paths, guide rods adapted for connection to contact elements and guided in said housing for endwise movement along said paths, each of said guide rods having detent recesses spaced along the rod and opening toward the other rod, said housing having a guideway extending transversely between said guide rods and opening

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at opposite ends adjacent said recesses, detents movable in opposite ends of said guideway and yieldably urged away from each other and into said detent recesses for holding the respective push buttons yieldably in each of an inner position and an outer position, main push button springs each acting between a different one of said push buttons and said housing to urge the button outwardly, each of said buttons having an inwardly opening recess receiving the outer end portion of the associated guide rod and such portion having an elongated slot therein, two pins each extending transversely through a different one of said buttons and said slot in the associated guide rod, second push button springs each extending along a different one of said guide rods in said slot thereof and acting at opposite ends against the associated pin and the outer end of the slot to urge the associated push button outwardly, and interlocking mechanism having parts movable with each of said guide rods and interengageable to prevent movement of either of said push buttons into said inner position thereof when the other push button is in its inner position.

3. A push button switch mechanism having, in combination, a housing, a pair of push buttons guided in said housing for movement inwardly and outwardly along generally parallel paths, guide rods adapted for connection to contact elements and guided in said housing for endwise movement along said paths, each of said guide rods having detent recesses spaced along the rod and opening toward the other rod, said housing having a guideway extending transversely between said guide rods and opening at opposite ends adjacent said recesses, detents movable in opposite ends of said guideway and yieldably urged away from each other and into said detent recesses for holding the respective push buttons yieldably in each of an inner position and an outer position, main push button springs each acting between a different one of said push buttons and said housing to urge the button outwardly, each of said buttons having an inwardly opening recess receiving the outer end portion of the associated guide rod and such portion having an elongated slot therein, two pins each extending transversely through a different one of said buttons and said slot in the associated guide rod, and second push button springs each extending along a different one of said guide rods in said slot thereof and acting at opposite ends against the associated pin and the outer end of the slot to urge the associated push button outwardly.

4. A push button switch mechanism having, in combination, a housing, a pair of push buttons guided in said housing for movement inwardly and outwardly along generally parallel paths, guide rods adapted for connection to contact elements and guided in said housing for endwise movement along said paths, each of said guide rods having detent recesses spaced along the rod and opening toward the other rod, said housing having a guideway extending transversely between said guide rods and opening at opposite ends adjacent said recesses, detents movable in opposite ends of said guideway and yieldably urged away from each other and into said detent recesses for holding the respective push buttons yieldably in each of an inner position and an outer position, main push button springs each acting between a different one of said push buttons and said housing to urge the button outwardly, each of said buttons having an inwardly opening recess receiving the outer end portion of the associated guide rod and such portion having an elongated slot therein, and second push button springs each acting at opposite ends between a different one of said buttons and the associated guide rod to urge the push button outwardly with respect to the rod.

5. A push button switch mechanism having, in combination, a housing, a pair of push buttons guided in said housing for movement inwardly and outwardly along generally parallel paths, guide rods adapted for connection to contact elements and guided in said housing for endwise movement along said paths, each of said guide rods having detent recesses spaced along the rod and opening

toward the other rod, detent means mounted in said housing and acting between the housing and said push buttons for holding the respective buttons yieldably in each of an inner position and an outer position, main push button springs each acting between a different one of said push buttons and said housing to urge the button outwardly, each of said buttons having an inwardly opening recess receiving the outer end portion of the associated guide rod and such portion having an elongated slot therein, two pins each extending transversely through a different one of said buttons and said slot in the associated guide rod, second push button springs each acting at opposite ends between a different one of said buttons and the associated guide rod to urge the push button outwardly with respect to the rod, and interlocking mechanism having parts movable with each of said guide rods and interengageable to prevent movement of either of said push buttons into said inner position thereof when the other push button is in its inner position.

6. A push button switch mechanism having, in combination, a housing, a pair of push buttons guided in said housing for movement inwardly and outwardly along generally parallel paths, guide rods adapted for connection to contact elements and guided in said housing for endwise movement along said paths, each of said guide rods having detent recesses spaced along the rod and opening toward the other rod, detent means mounted in said housing and acting between the housing and said push buttons for holding the respective buttons yieldably in each of an inner position and an outer position, main push button springs each acting between a different one of said push buttons and said housing to urge the button outwardly, each of said buttons having an inwardly opening recess receiving the outer end portion of the associated guide rod and such portion having an elongated slot therein, two pins each extending transversely through a different one of said buttons and said slot in the associated guide rod, and second push button springs each acting at opposite ends between a different one of said buttons and the associated guide rod to urge the push button outwardly with respect to the rods.

7. A switch mechanism having, in combination, a housing of generally rectangular shape including a handle projecting rigidly from one end thereof, a switch actuating element projecting from one side of said housing and guided thereon for movement along a path inclined at an angle with respect to such side, said housing being split along a first plane generally parallel to said side to divide the housing into two sections, a first one of which supports said actuating element, and a plate mounted in the other of said sections and supporting contacts for engagement by other contacts movable with said actuating element and disposed in a second plane disposed generally normal to said path of the actuating element, the mounting for said plate comprising two first abutments defining recesses facing generally parallel to said second plane and toward said first section to receive one edge of the plate, a pair of second abutments formed adjacent said first plane and opening toward said first section to receive lugs projecting from said plate at the edge thereof opposite said one edge when the latter fits into said first abutment recesses, and surfaces on said first housing section adjacent said first plane engaging said lugs to retain the same in said second abutments and said one edge in said first abutment recesses.

8. A push button control switch mechanism having in combination, a housing, a pair of spaced push buttons extending from said housing adjacent one edge thereof, a pair of contactor bars attached to said push buttons, a rectangular contact plate, said contact plate having laterally spaced studs adjacent the corners thereof, a pair of opposed yokes in the side walls of the housing to receive one pair of said laterally spaced contact studs located at one edge of said plate, a pair of laterally spaced shoulders on said housing to receive the other pair of said contact plate studs, a pair of resilient mounts fixed to one of said pairs of studs, the spacing of said one pair of studs and said other pair of studs and the spacing of said yoke and shoulder being correlated to provide a jamming fit of the resilient mounts.

9. A switch mechanism having, in combination, a housing of generally rectangular shape including a handle projecting rigidly from one end thereof, a switch actuating element projecting from one side of said housing and guided thereon for movement along a path inclined at an angle with respect to such side, said housing being split along a first plane generally parallel to said side to divide the housing into two sections, a first one of which supports said actuating element, and a plate mounted in the other of said sections and supporting first contacts in a second plane disposed generally normal to said path of the actuating element, a contact carrier connected to and movable with said actuating element toward and away from said plate, and other contacts mounted on said carrier in a plane paralleling said second plane so as to engage said first contacts as an incident to movement of said actuating element.

10. A push button switch mechanism having, in combination, a housing, a pair of push buttons guided in said housing for movement inwardly and outwardly along generally parallel paths, guide rods adapted for connection to contact elements and guided in said housing for endwise movement along said paths, each of said guide rods having detent recesses spaced along the rod and opening toward the other rod, said housing having a guideway extending transversely between said guide rods and opening at opposite ends adjacent said recesses, detent balls movable in opposite ends of said guideway, a single spring in said guideway preloaded to urge both detent balls into their respective recesses for holding the respective push buttons yieldably in each of an inner position and an outer position, spring means acting between each of said push buttons and said housing to urge the button outwardly to said outer position, and means for establishing between each of said guide rods and one of said push buttons a resilient connection permitting relative motion between each guide rod and its corresponding push button.

References Cited in the file of this patent

UNITED STATES PATENTS

626,919	Medary	June 13, 1899
1,186,586	Klein	June 13, 1916
2,348,107	Brongersma	May 2, 1944
2,529,845	Lockwood	Nov. 14, 1950
2,668,200	Glaze	Feb. 2, 1954
2,713,092	Rucks et al.	July 12, 1955