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TWO POSITION SWITCH

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2 Sheets-Sheet 1

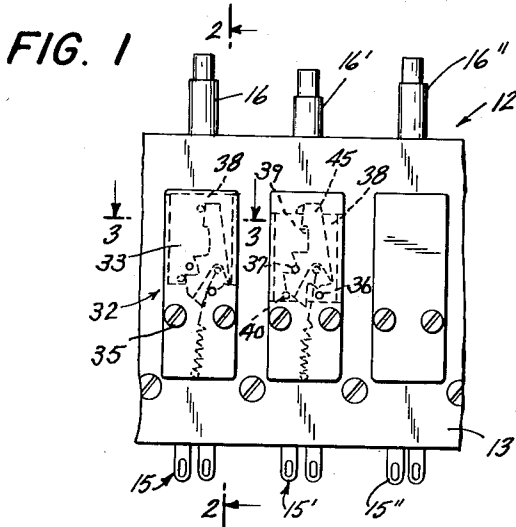
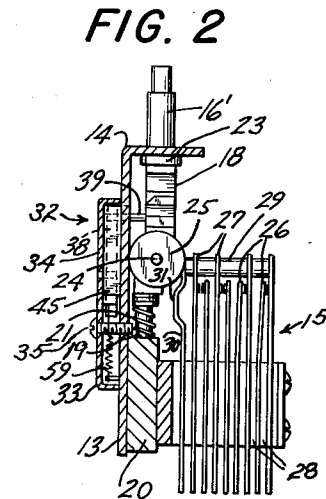
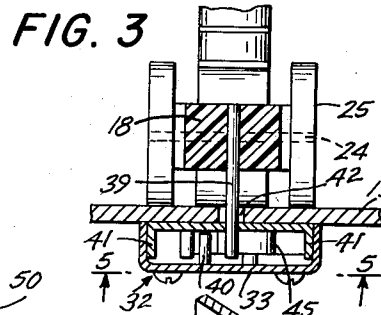
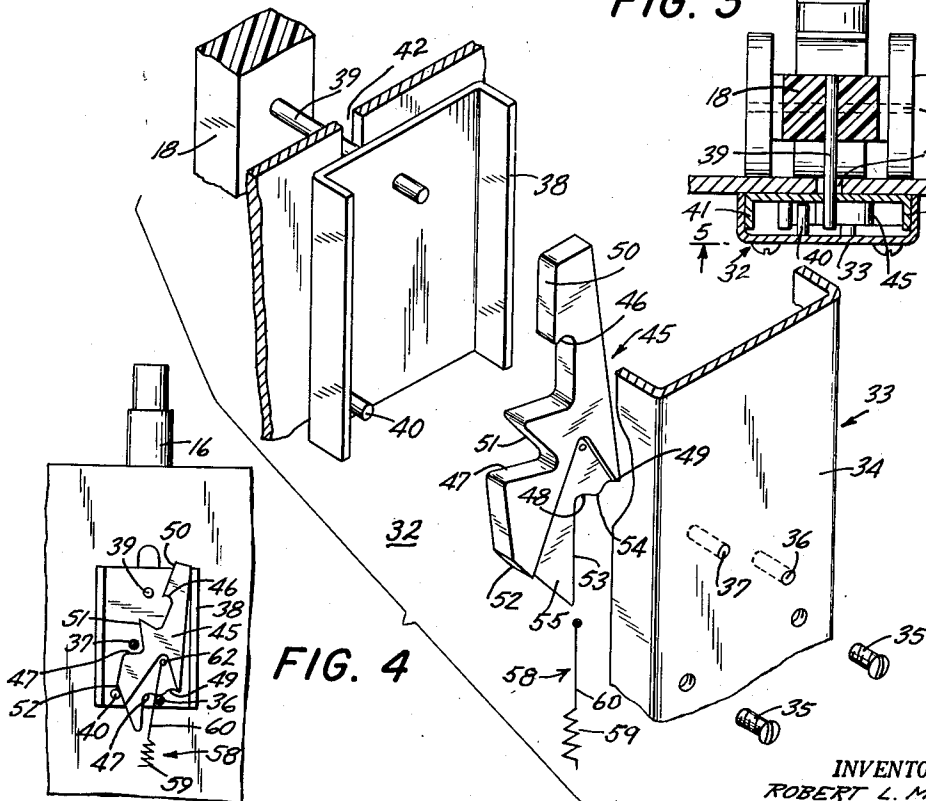


FIG. II

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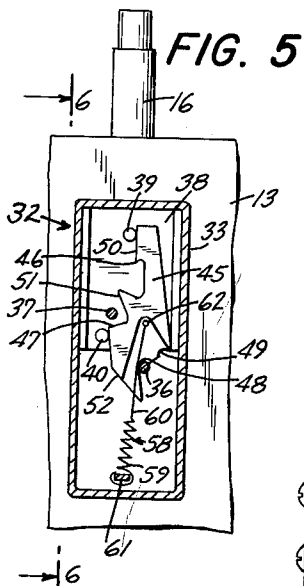
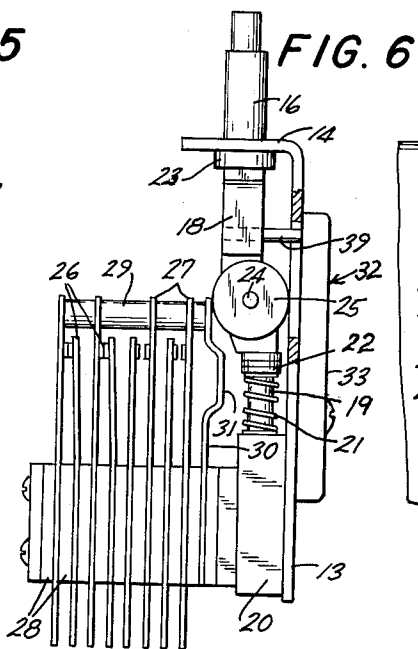
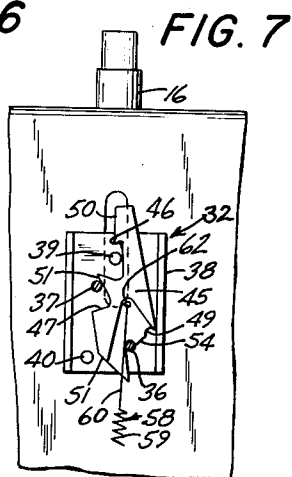
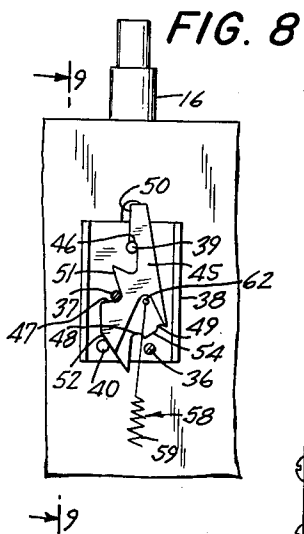
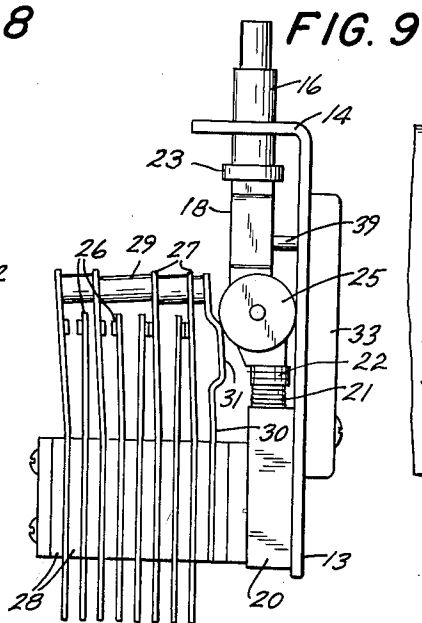
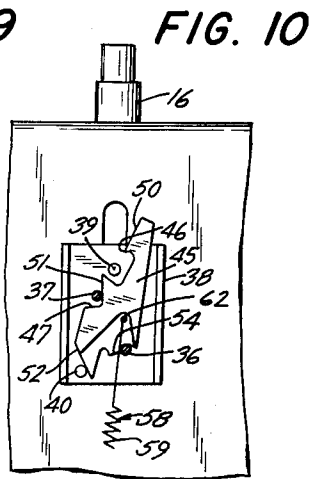
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2 Sheets-Sheet 2



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1

3,024,332

TWO POSITION SWITCH

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The present invention relates to an improved latch mechanism and more particularly a latch mechanism for alternately latching and releasing a reciprocating element upon successive actuations of the element.

While the latching mechanism of the present invention may have other applications, it is particularly useful with push-button switches. Conventional push-button switches have contacts which are engaged when the push-button is depressed and disengaged when the push-button is released. Two position push-button switches have heretofore been provided for closing and holding switch contacts closed and opening the switch contacts on successive actuations of push-buttons. One well known form of two position switch includes two push-buttons, one for closing the contacts and one for opening the contacts. Another known form of two position switch includes a gang of push-button switches with a common latch for holding one push button depressed and actuated to release the depressed push-button when the push-button of another switch is depressed.

One of the objects of the present invention is to provide an improved latching mechanism for alternately latching and releasing a reciprocating element upon successive manual actuations of the element.

Another object is to provide an improved latching mechanism of the type indicated which is particularly resistant to unintentional release of the reciprocating element by shock or vibration.

Another object is to provide a latching mechanism of the type indicated in which the plunger may have any desired length of stroke and a short re-set stroke to release the plunger.

Another object is to provide an improved latching mechanism for the plunger of a push-button switch in which the latching and releasing of the push-button is not affected by a lateral or longitudinal load on the push-button.

Still another object is to provide a latching mechanism of the type indicated which is of relatively simple and compact construction, economical to manufacture and one which is reliable in operation to alternately latch and release a plunger on successive actuations of the plunger.

These and other objects will become more apparent from the following description and drawings in which like reference characters denote like parts throughout the several views. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings,

FIGURE 1 is a side elevational view of a gang of two position push-button switches incorporating the novel latching and releasing mechanism of the present invention;

FIGURE 2 is a transverse sectional view taken on line 2—2 of FIGURE 1 to show one relationship of the switch plunger and mechanism for latching and releasing the plunger;

FIGURE 3 is a sectional view taken on line 3—3 of FIGURE 1 to show the relationship between the plunger of the push-button switch and latch plate of the latching and releasing mechanism;

FIGURE 4 is an enlarged perspective view of the parts of the latching mechanism in extended relation;

2

FIGURE 5 is a sectional view of line 5—5 of FIGURE 3 and showing the position of the latch plate when the push-button is released;

FIGURE 6 is a sectional view taken on line 6—6 of FIGURE 5 to show the position of the switch plunger and contacts in the initial released position of the switch plunger;

FIGURE 7 is a view similar to FIGURE 5 showing the latch plate rocked to latching position upon the depression of the switch plunger;

FIGURE 8 is a view similar to FIGURES 5 and 7 showing the shoulders on the latch plate in latching engagement with the latch pins on the slide and frame upon release of the switch plunger;

FIGURE 9 is a view similar to FIGURE 6 and showing the position of the switch plunger and contacts when the plunger is latched in its other position.

FIGURE 10 is a view similar to FIGURE 8 showing the latch plate moved laterally to engage its other seat with the stationary pivot pin and rocked to releasing position by the next depression of the plunger; and

FIGURE 11 is a view similar to FIGURE 10 showing the floating latch plate being cammed laterally by the abutment pin on the slide to move the latch plate laterally to its initial position illustrated in FIGURE 5 during the return stroke of the plunger.

For purposes of illustration, the latching mechanism of the present invention is shown applied to switches of a gang switch assembly having a supporting frame 12. As shown in FIGURES 1 and 2, the frame 12 is in the form of a metal plate 13 for supporting the elements of the plurality of switches and folded to provide a narrow right angular section 14 for mounting the frame and switch assemblies thereon in a box or on a panel. The plurality of separate switches 15, 15' and 15'' are mounted on one side of the plate 11 in side-by-side relation and each has a push-button 16, 16' and 16'', respectively. While three switches 13 are illustrated in FIGURE 1 any desired number of switches may be mounted on the frame 12, or the frame may mount only a single switch.

As shown most clearly in FIGURE 2, each switch 15 comprises a plunger 18 having the push-button 16 at one end which projects through an opening in the mounting section 14 of the frame and a stem 19 at its other end projecting into a guide opening in a block 20. Block 20 is mounted on one side of frame plate 13 and a spring 21 acts between a shoulder 22 on the plunger 18 and the top of the block 20. Thus, spring 21 yieldingly holds the plunger 18 in one position and a collar 23 on the plunger 18 engages the right angular section 14 of the frame to limit its movement, but yields to permit the plunger to be moved to its other depressed position. Plunger 18 has an axle pin 24 extending therethrough parallel with the frame plate 13 and mounts rollers 25 at its end which roll on the side of the frame plate 13 as the plunger 18 is reciprocated.

Each switch 15 has a plurality of pairs of spring contacts 26 and 27, etc. mounted on the block 20 in spaced relation to each other with insulating spacers 28 therebetween. Contacts 27 are longer than the contacts 26 and are coupled together at their projecting ends by insulating connecting sleeves 29 for movement as a unit relative to the switch contacts 26. A spring arm 30 similar to long contacts 27 is mounted in the block 20 adjacent the plunger 18, connected to the long contacts by a sleeve 29 and has an offset abutment 31 for actuation by the plunger. The rollers 25 on the switch plunger 28, or similar rollers thereon, engage the offset abutment 31 on spring arm 30 and move the plurality of switch contacts 27 relative to the switch contacts 26 when the plunger is manually depressed to operating position and

release the abutment and switch contacts when the plunger is moved to its initial or released position by the spring 21. The pairs of switch contacts 26 and 27 may be normally engaged and actuated to open position when the plunger is depressed, or the switch contacts may be normally closed and moved to open position by the plunger, or certain of the pairs of contacts may be opened while others are closed. The switch as thus far described is a known construction as manufactured by the assignee of the present invention.

In accordance with the present invention an improved latching and releasing mechanism is shown applied to each switch 15 to alternately latch the reciprocating plunger 18 in its depressed operative position and release the plunger for return to its first position upon successive actuations of the push-button 16. In other words, the plunger 18 of each switch 15 is held in alternate "on" and "off" positions by successive reciprocations of its push-button 16. In the illustrated embodiment, the latching mechanism 32 is shown on the opposite side of the frame plate 13 from the plunger 18 and as having a separate slide connected to and actuated by the plunger, but it will be understood that the latching mechanism may be mounted on the same side of the frame plate 11 as the plunger and actuated directly from the plunger.

In the embodiment illustrated the latching mechanism 32 is mounted in a housing 33 having a cover plate 34 parallel with and spaced from the frame plate 13 and a right angular peripheral flange engaging the frame plate. Housing 33 is attached to the frame plate 13 by screws 35. Projecting inwardly from the cover plate 34 of the housing 33 are a pair of pins 36 and 37. Pin 36 constitutes a stationary pivot and the pin 37 constitutes a stationary latching abutment. A shuttle or slide 38 is mounted to reciprocate in the housing 33 and has a pair of pins 39 and 40 projecting therefrom transversely of the housing 33 and parallel with pins 36 and 37. As shown in FIGURE 3 the slide 38 of U-shaped form in cross-section is arranged back to back with the frame plate 13 for sliding movement thereon and has flanges 41 on its edges adjacent the peripheral flange of the housing 33. Pin 39 on slide 38 comprises a combined latch and pivot pin while the pin 40 constitutes an abutment for a purpose as later explained. The slide 38 is connected to the switch plunger 18 by the pin 39 for reciprocation therewith. Pin 39 extends through both the slide and plunger and extends beyond the slide to provide the combined latch and pivot pin. Pin 39 is freely movable in a slot 42 in the frame plate 13 between the plunger 18 and slide 38.

A floating pawl or latch plate 45 is positioned in the housing 33 between the slide 38 and cover plate 34 of housing and the edges of the latch plate are also positioned between the pins 36, 37 and 39, 40 on the housing and slide, respectively. As shown most clearly in FIGURES 1 and 4, the latch plate has opposed latching shoulders 46 and 47 at one side and a pair of laterally spaced pivot seats 48 and 49 below the latching shoulders. The latching shoulders 46 and 47 are formed by notched recesses cut in the edge of the latch plate 45 at one side thereof. The recess in the edge of the latch plate 45 adjacent the lower shoulder 47 forms an abutment shoulder 51 inclined upwardly from the latching shoulder. The latching shoulder 46 is curved to form a hook and the side of the latch plate 45 above the latching shoulder 46 is formed to provide a flat surface 50 extending from the outer edge of the latching shoulder. Below the shoulder 47 the edge of the latch plate has an inwardly and downwardly inclined cam face 52 on a depending tail portion of the plate. The other side 53 of the tail portion of the cam plate of the latch plate 45 forms one side of the pivot seat 48 which is separated laterally from the other seat 49 by an inclined surface 54. As shown in dotted lines in FIGURE 1, the stationary pivot pin 36 projecting inwardly from cover plate 34 of housing 33 underlies the

area of the latch plate 45 having the pivot seats 48 and 49, and the stationary latch pin 37 overlies the side of the latch plate 45 having latching shoulder 47. Latch pin 39 on movable slide 38 is positioned adjacent the side of the latch plate 45 above latch pin 37 to be engaged with and disengaged from the latching shoulder 46 on the latch plate 45, while the abutment pin 40 on the slide is positioned at the side of the downwardly and inwardly inclined cam face 52. Also, the side of the cam plate 45 facing the cover plate 34 of housing 33 has a triangular shaped recess 55 to provide clearance for the end of a spring 58 as next described.

Spring 58 is connected between the housing 33 and latch plate 45 and has a coiled section 59 and a straight section 60 projecting from one end of the coiled section. The end of spring 58 adjacent the coiled section 59 is connected to an abutment 61 in housing 33, see FIGURE 5, and the straight section is positioned on the left hand side of stationary pivot pin 36 in the recess 55 in latch plate 45 with its end secured in a hole 62 in the latch plate above the seats 48 and 49. The hole 62 in latch plate 45 to which the end of the spring 58 is attached is so located relative to the pivot seats 48 and 49 that when the seat 48 engages the pivot pin 36 the straight portion 60 of the spring bears against the side of the pivot pin and tends to rock the latch plate counterclockwise to latching position as shown in FIGURES 5 and 7. When the seat 49 overlies the pivot pin 36, the straight portion 60 of spring 58 is clear of the pivot pin, but applies a downward force on the latch plate 45 to engage the inclined surface 51 with stationary pivot pin 37 and rock the latch plate clockwise as viewed in FIGURE 10, to an unlatching or releasing position. One form of latching mechanism 32 and switch 15 to which it is shown applied having now been described in detail the mode of operation is next explained.

Assuming for purposes of description that the switch 15 is in a first "off" position with the switch plunger 18, slide 38 and latch plate 45 in the relative positions illustrated in FIGURE 5, the plunger 18 and its push-buttons 16 in extended position and the switch contacts 26 released as shown in FIGURE 6. Also, the stationary pivot pin 36 is engaging the pivot seat 48, the straight portion 60 of spring 58 is bearing against the side of pivot pin 36 and tending to rock the latch plate 45 counterclockwise, but the flat edge surface 50 and cam face 52 of the latch plate 45 are bearing against the pins 39 and 40 on the slide 38, as shown in FIGURE 5. In this position of plunger 18, the rollers 25 are disengaged from the abutment 31 on the spring arm 30 connected to the contacts 27 to release the contacts which move to a so-called "off" position of the switch 15.

When the extended push-button 16 is manually depressed from the position illustrated in FIGURE 5 to that illustrated in FIGURE 7, the slide 38 is reciprocated with the plunger 18 through a forward stroke by its connection through the pivot pin 39. Movement of the plunger 18 engages rollers 25 with the abutment 31 on spring arm 30 to move the plurality of connected switch contacts 27 relative to the contacts 26 to a so-called "on" position as illustrated in FIGURE 9. As slide 38 moves relative to the latch plate 45 the pin 40 moves along the inclined cam surface 52 of the latch plate and the pin 39 slides along the flat surface 50 until it overlies the recess portion. Spring 58 then rocks the latch plate 45 to position its shoulder 46 over the latch pin 39 at which time the stationary pin 37 on the housing overlies the latching shoulder 47. Upon release of the push-button 16 the plunger 18 and slide 38 are moved by the spring 21 from the position illustrated in FIGURE 7 to that illustrated in FIGURE 8. As the slide 38 tends to move upwardly the pin 39 on the slide engages the latching shoulder 46 of the latch plate 45 and the pin 37 on housing 33 engages the latching shoulder 47. Thus,

5

the slide 38 and switch plunger 18 and movable switch contacts 27 are latched in an "on" position.

During the upward movement of the push-button 16 and plunger 18 through its short return stroke to engage pin 39 on slide 38 with shoulder 46 on latch plate 45, the spring 58 acts on the latch plate 45 at the right hand side of pin 39 to rock the latch plate clockwise from the position illustrated in FIGURE 7 to the position illustrated in FIGURE 8. Such rocking movement of the latch plate 45 positions the inclined cam face 54 on latch plate 45 over pivot pin 36.

When the push-button 16 is again depressed from the position illustrated in FIGURE 8 to that illustrated in FIGURE 10, the downward movement of the slide 38 releases the latch plate 45 which is moved downwardly by spring 58 and engages the inclined face 51 with stationary pin 37 which immediately rocks the latch plate to releasing position. Continued movement of latch plate 45 engages its inclined face 54 with the stationary pivot pin 36 and cams the latch plate laterally to the left until the pivot pin seats in the pivot seat 49. The combined action of spring 58, the engagement of the inclined surface 54 with pivot pin 36 and the engagement of the pin 40 on slide 38 with the inclined cam surface 52 holds the latch plate in its releasing position, illustrated in FIGURE 10.

Upon release of the push-button 16 and plunger 18, spring 21 moves the plunger 18, slide 38 and latch plate 45 back to their initial "off" position illustrated in FIGURE 5. During the initial movement of plunger 18 through its return stroke the latch plate 45 is held in the releasing position illustrated in FIGURE 10 until pin 39 on slide 38 has passed by the latching shoulder 46. During continued movement of slide 38, the pin 40 on the slide rides along the cam surface 52 on the latch plate 45 and cams the latch plate bodily to the right as illustrated in FIGURE 11 until the pivot seat 48 is engaged with the stationary pivot pin 36. Such lateral movement of the latch plate at the end of the upward movement of the slide 38 shifts the connected end of spring 58 further to the right of the pivot pin 36 so that the straight portion 60 of the spring bears against the side of the pivot pin and rocks the latch plate back to its initial position illustrated in FIGURE 5 and engages the flat surface 50 on the latch plate with the side of the latch pin 39 on the slide 38.

Thus, the switch is alternately latched in "on" position and released for movement to an "off" position by successive actuations of the push-button 16. During the first depression of the push-button 16, the slide 38 is latched to housing. During the next depression of push-button 16, the slide 38 is released by the latch plate for return movement to an "off" position. During such alternate strokes of the push-button 16, the floating latch plate 45 is shifted automatically in one direction and then in the other direction to latch the switch in an "on" position and release the switch for return to its "off" position.

It will now be observed that the present invention provides an improved latching mechanism for alternately latching and releasing a reciprocating mechanism upon successive manual actuations of the element. It will also be observed that the present invention provides a latching mechanism which is particularly resistant to unintentional release of the reciprocating plunger due to shock. It will further be observed that the present invention provides a latching mechanism having any desired length of stroke to an "on" position and a short re-set stroke to release the plunger for return to an "off" position. It will further be observed that the present invention provides an improved latching mechanism for the plunger of a push-button switch in which the latching and releasing of the switch plunger is not affected by the lateral or vertical load on the plunger. It will still further be observed that the present invention provides a latch-

6

ing mechanism of the type indicated which is of relatively simple and compact construction, economical to manufacture and one which is reliable in operation to alternately latch and release a plunger on successive actuations.

While a single embodiment of the invention is herein illustrated and described, it will be understood that changes may be made in the construction and arrangement of the elements without departing from the spirit or scope of the invention. Therefore, without any limitation in this respect, the invention is defined by the following claims.

I claim:

1. A two position push button switch having a frame, switch contacts mounted on the frame, a reciprocating plunger mounted to slide on the frame and having means for relatively moving the contacts in one position and releasing the contacts at another position, a push button for actuating said plunger to said one position, a spring for actuating the plunger to said other position, and mechanism for alternately latching the plunger in said one position and releasing the plunger for movement to its other position on successive actuations of the push button comprising a latching abutment on the plunger for movement therewith, a latching abutment on the frame, a floating latch member having spaced shoulders for engagement with the abutments on the plunger and frame, adjustable pivot means on the latch member and frame comprising a plurality of pivot seats on the latch member spaced from each other laterally with respect to its direction of movement by the plunger, and interengaging means on the plunger and latch member for bodily moving the latch member laterally and thereby adjusting the pivot means to alternately rock the latching member to latching and releasing positions.

2. A two position push button switch comprising a frame, a reciprocating plunger mounted to slide on said frame, switch contacts mounted on said frame and actuated by said plunger at one end of its stroke and released by the plunger at the other end of its stroke, a push button for actuating the plunger in one direction, a spring for actuating the plunger to the opposite direction, and mechanism for alternately latching the plunger at one end of its stroke and releasing the plunger for movement to the other end of its stroke upon successive actuations of the push button comprising a housing on said frame having stationary pivot and latching pins spaced from each other, a slide mounted to reciprocate in said housing and connected to said plunger for movement therewith, said slide having a latching pin, a floating latch member between the slide and housing and having spaced shoulders at one side for latching engagement with the latching pins on the slide and frame and separate spaced seats on its side adjacent the stationary pivot pin, a spring acting between the frame and latch member for rocking the latch member to latching and releasing positions when the separate seats are engaged with the stationary pivot pin, respectively, and means on the slide for actuating the latch member laterally in opposite directions on successive reciprocations of the slide to alternately engage the separate seats with the stationary pivot pin.

3. A two position push button switch comprising a frame, a plunger mounted to slide on said frame, switch contacts mounted on said frame and actuated by said plunger at one position and released by the plunger at another position, a push button for actuating the plunger to said one position, a spring for actuating the plunger to said other position, a push button for actuating the plunger to said one position, a spring for actuating the plunger to its said other position, and mechanism for alternately latching the plunger in said one position and releasing the plunger for movement to its other position upon successive actuations of the push button comprising

a housing on said frame having stationary pivot and latching pins spaced from each other, a slide mounted to reciprocate in said housing and connected to said plunger for movement therewith, said slide having latching and abutment pins projecting therefrom in spaced relation to the pivot and latch pins on the frame, a floating latch member between the slide and housing and between the pins, said latch member having spaced shoulders for engagement with the latching pins on the slide and frame and laterally spaced notches forming separate seats for engaging the stationary pivot pin, a spring acting between the frame and member for rocking the member to latching position when one seat engages the pivot pin and rocking the member to releasing position when the other seat engages the pin, and said latching and abutment pins on the slide moving the latch member laterally in opposite directions during successive actuations of the slide to alternately engage the separate seats with the pivot pin.

4. A two position push button switch comprising a frame, a plunger mounted to slide on said frame, switch contacts mounted on said frame and actuated by said plunger at one position and released by said plunger at another position, a push button for actuating said plunger to said one position, a spring for actuating said plunger to said other position, and mechanism for alternately latching the plunger in said one position and releasing the plunger for movement to its other position upon successive actuations of the push button comprising a housing mounted on the frame adjacent the plunger, a slide in said housing and connected to said plunger, stationary pins projecting from a wall of said housing in spaced relation, a pair of movable pins projecting from said slide, a floating latch plate in said housing between said pins and having opposed shoulders at one side for latching engagement with one pair of pins on the housing and slide, respectively, a pair of laterally spaced seats for pivotal engagement with the other stationary pin on said housing and a cam face between the shoulders and seats, a spring having one end connected to the latch plate for rocking the plate to latching position when one seat engages the pivot pin and rocking the plate to releasing position when the other seat engages the pivot pin, said latch plate rocking on said latching pin on the slide during the initial return movement of the slide to position the other seat on the latch plate for engagement with the pivot pin on the housing during the next actuation of the plunger, and said other pin on the slide engaging the cam face on the latch plate during the next return movement on the slide to move the latch plate laterally and engage the first seat with the pivot pin.

5. A two position push button switch in accordance with claim 2 in which the means on the slide for moving the latch member laterally in one direction comprises the interengaging latch pin on the slide and shoulder on the latch member constituting a pivot for the member, and the spring acting on the latch member at one side of the pivot for rocking the member relative to the stationary pivot to align the other seat therewith.

6. A two position push button switch in accordance with claim 5 in which the means for moving the latch member laterally in the opposite direction is a cam face

on the latch member and an abutment pin on the slide engaging the cam face during the return stroke of the plunger to move the latch member laterally and position the other pivot seat in alignment with the stationary pivot pin.

7. A two position push button switch in accordance with claim 6 in which the latching shoulders on the floating latch plate are formed by recesses in the edge thereof, the recess forming one shoulder having a face extending at an angle to the shoulder, the angular face adjacent the shoulder engaging the abutment pin on the frame to limit the rocking movement of the latch member in one direction, and the cam face on the latch member engaging the abutment pin on the slide limiting the rocking movement of the latch member in the other direction.

8. A two position push button switch in accordance with claim 7 in which the latch member has a rectangular slot in the edge of one side to form one latching shoulder, a notch in said side below the rectangular recess to provide the other latching shoulder and the angularly inclined face adjacent the shoulder, the edge of the latch plate below the shoulder forming the cam face, and the edge of the cam plate beyond the cam face being recessed to provide the spaced seats.

9. A two position push button switch in accordance with claim 2 in which the frame comprises a plate, guide means on one side of said plate for mounting the plunger for reciprocation thereon, the housing being mounted on the other side of said plate from the plunger, the slide mounted to reciprocate on said plate in said housing, the latch pin on the slide connecting the plunger and slide through a slot in the frame plate, and the other latching and abutment pins being mounted on and projecting from the slide and side of the housing opposite the slide.

10. A two position push button switch in accordance with claim 9 in which a plurality of push button switches are mounted on one side of the frame plate, and an alternate latching and releasing mechanism for each switch mounted on the other side of the frame plate.

11. A two stroke latching and unlatching mechanism comprising a frame having stationary pivot and latching pins spaced from each other, a slide mounted to reciprocate on the frame and having a laterally projecting latching pin, a floating latch member between the slide and frame and having spaced shoulders at one side for latching engagement with the latching pins on the slide and frame and laterally spaced seats on the side overlying the pivot pin, a spring acting between the frame and latch members for rocking the latch member to latching position when one seat engages the pivot pin and rocking the member to releasing position when the other seat engages the pin, and means for moving the latch member laterally in opposite directions during successive actuations of the slide to alternately engage the separate seats with the pivot pin.

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