Dec. 30, 1969 G. M. STOUT 3,487,178

MULTIPLE PUSH ROD SWITCH WITH INTERLATCH AND LOCKOUT MEANS

Filed Aug. 17, 1967 2 Sheets-Sheet 1

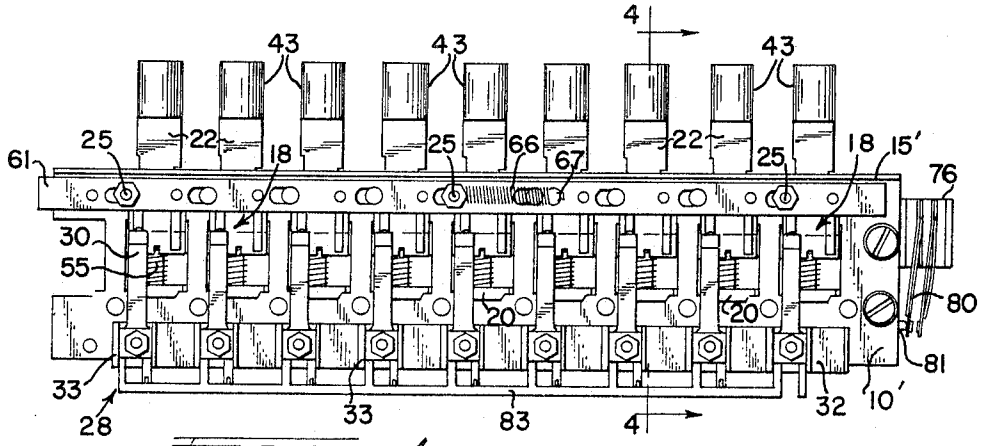


FIG. 1

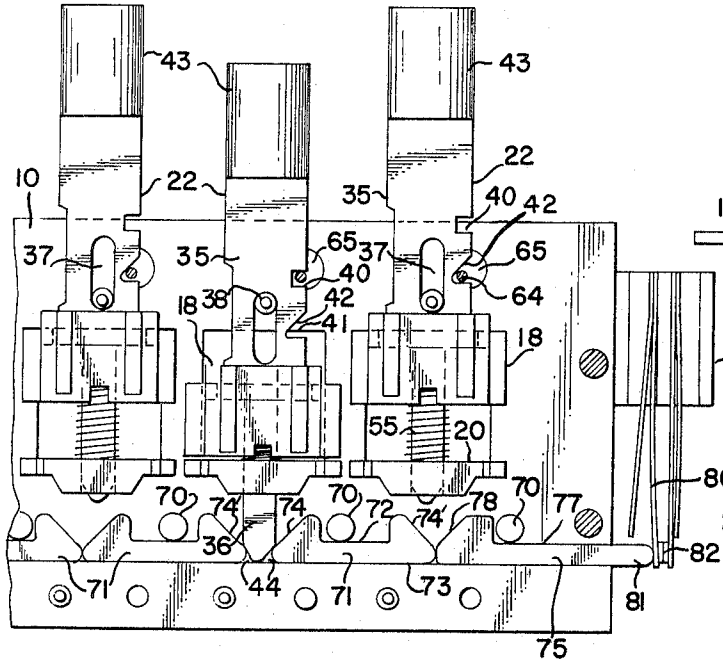


FIG. 3

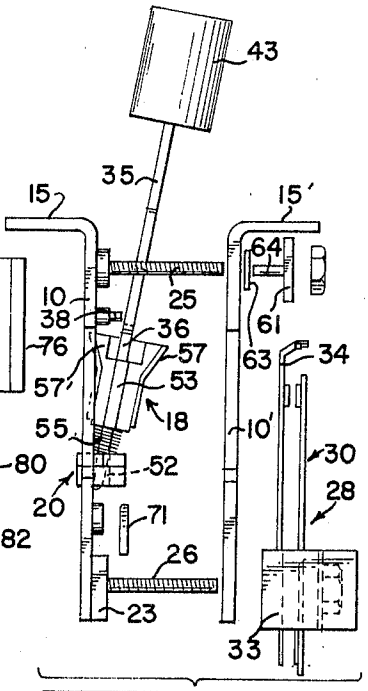


FIG. 6

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MULTIPLE PUSH ROD SWITCH WITH INTERLATCH AND LOCKOUT MEANS

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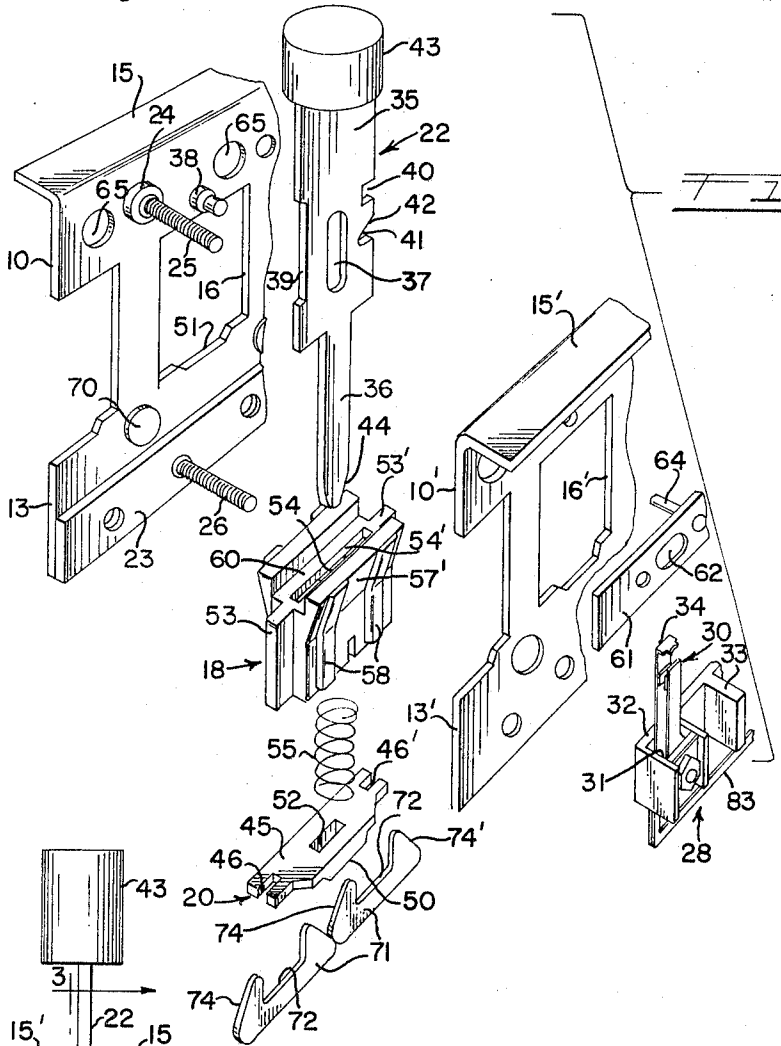


FIG. 5

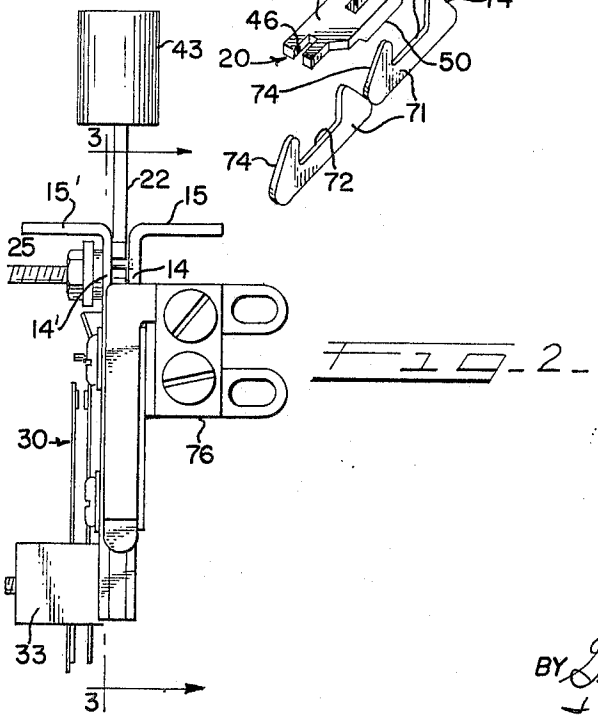


FIG. 2

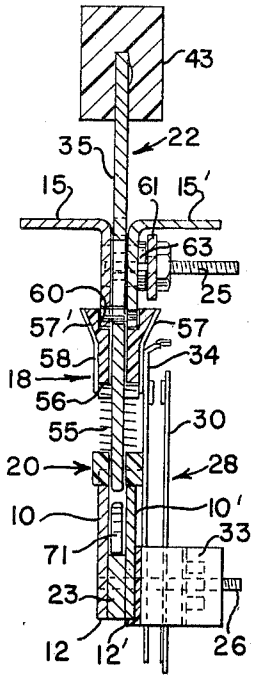


FIG. 4

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MULTIPLE PUSH ROD SWITCH WITH INTERLATCH AND LOCKOUT MEANS

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Int. Cl. H01h 9/26
U.S. Cl. 200—5 11 Claims

ABSTRACT OF THE DISCLOSURE

A multi-station switch assembly for controlling a plurality of circuits which is characterized by a number of plungers slidable in guides between a pair of spaced frame plates and each carrying an actuator for an associated leaf spring contact switch mounted in the path thereof and a series of lockout members disposed in a guideway between the plates for operation by the ends of the plungers to lock the remainder of the plungers against operation when one of the plungers is depressed and also to control an actuator for a key motion sensing switch mounted at the end of the frame plates. The assembly includes a slidably mounted spring-held latch bar associated with the plungers and automatically moved to release position by cam surfaces on the plungers so that depressing one plunger automatically releases a previously depressed plunger for return to raised or non-actuating position by a return spring associated therewith.

This invention relates to electrical switch assemblies and is more particularly concerned with improvements in a multi-station switch having interlatched stations and a lockout mechanism.

Multiple station switch assemblies have heretofore been developed for use where it is desired to provide selective control over a number of operations or control in a continuous sequence of operations. Such switches are increasingly used in home appliances such as electric ranges, washing machines, air conditioners and like equipment. Also there is increasing demand for push-button or push rod gang switches in more complex electric equipment such as communication and instrument gear, computer and office equipment devices and other mechanical equipment employing multiple circuits for the control thereof. In this type switch equipment it is, of course, desirable to provide smooth operating efficient devices which are of simplified structure, easy to maintain in working condition, readily manufacturable and low in cost. Also because of the restricted space in which such devices are frequently mounted, it is desirable that they be easily installed, removed or replaced, easy to wire and that they should have a high degree of functional flexibility and versatility. It is, therefore, an object of the present invention to provide an improved switch assembly of the multiple push button type which is of relatively simple construction, which will operate efficiently and smoothly over a long period with minimum attention, which may be readily manufactured at a relatively low cost and which has other desirable characteristics and advantages.

A more specific object of the invention is to provide an improved multi-station switch which includes a plurality of reciprocably mounted switch actuating push rod members and associated guide members which insure smooth operation of the actuating members and an interlatch arrangement so that when one of the actuating members is depressed a previously depressed actuating member will be automatically released for return to non-actuating position.

Another object of the invention is to provide an improved multiple push button switch wherein a plurality of switch actuating members are mounted for reciprocation between spaced frame plates and guided by means of plastic inserts which are readily assembled with the frame plates so as to facilitate initial assembly and installation and replacement when required and which insure smooth operation of the actuating members.

A further object of the invention is to provide in a gang switch having a plurality of push rod type switch actuating members, a common latch bar with spaced detents thereon for cooperation with camming and latching surfaces on the actuating members so as to lock the individual push rod members in switch actuating position when they are depressed and to automatically release a previously latched member prior to latching the member which is being depressed.

Another object of the invention is to provide in a multiple push rod switch, a latch bar having a series of detents spaced along the same for cooperation with cam and latch details on the push rods, thereby enabling ready variation of operations in a single bank switch by the substitution of different push rod structures without modification of the latch bar.

A still further object of the invention is to provide in a multiple push button switch a contact actuator formed of a rigid plastic material with external ribs for engaging leaf spring contacts which actuator is carried on the push button plungers so as to engage the contacts without abrupt angle changes thereby insuring smooth operation and with the contacts having smooth surface portions intermediate the side edges thereof riding on the ribs so as to be held clear of the adjacent actuator surfaces thereby avoiding undesirable engagement of the edges of the contacts with the latter.

Another object of the invention is to provide a multiple push button switch having a plurality of switch actuating plunger members and lockout slugs cooperating therewith to insure that only one plunger at a time is in depressed position and a switch actuator which is operable through movement of the lockout slugs for controlling a key motion sensing switch mounted at the end of the switch bank.

A further object of the invention is to provide a multiple push rod switch assembly having interlatch and lockout features wherein the lockout feature comprises individual lockout slugs for each push rod which may be readily removed or replaced with modified forms thereof to convert the assembly to other operations.

These and other objects and advantages of the invention will be apparent from a consideration of the push button switch structure which is shown by way of illustration in the accompanying drawings wherein:

FIGURE 1 is a side elevation of a multiple push button switch assembly having interlatch and lockout features which embodies the principles of the invention;

FIGURE 2 is an end view of a switch assembly of FIGURE 1 to an enlarged scale;

FIGURE 3 is a partial section taken on the line 3—3 of FIGURE 2 with one of the push buttons latched in depressed position;

FIGURE 4 is a cross-section taken on the line 4—4 of FIGURE 1 to an enlarged scale;

FIGURE 5 is an exploded perspective view showing the eements at one of the switch assembly; and

FIGURE 6 is an exploded end view illustrating the assembly of the plunger and associated elements with the main support plate.

The switch assembly which is illustrated in the drawings is designed to enable one of a plurality of push button rods or plungers to be depressed from a normal inoperative position to an operative switch actuaing position and at the same time automatically to release or re-

store to inoperative position an associated plunger which has been previously depressed and latched in switch activating position. In addition there is incorporated in the assembly lockout mechanism and a key motion switch actuator which is operated upon depressing any of the plungers. With slight modification the switch assembly may be converted to provide non-locking plunger action or other arrangements by omission or modification of the lockout mechanism and/or the substitution of plungers of different construction.

Referring to the drawings there is illustrated a push button switch assembly having nine switch stations. However, it is understood that the number of stations can be decreased or increased. The assembly comprises two frame plates **10** and **10'** which are of substantially identical construction except for being rights and lefts. The plates **10** and **10'** are of suitable rigid material such as sheet steel and may be stamped or otherwise formed in any desired lengths. The plates include rectangular body portions with bottom edges **12**, **12'**, end edges **13**, **13'** and **14**, **14'** and top flanges **15**, **15'**. When the plates are assembled to form a supporting frame for the switch elements, they are positioned in face to face relation with the flanges **15**, **15'** extending in opposite directions. The flanges **15**, **15'** may have any desired width and may be provided with suitable apertures for mounting the entire structure in a panel or the like. The body of each of the plates **10** and **10'** is provided with a series of closely spaced generally rectangular apertures **16** and **16'** and the apertures **16** are aligned in paired relation with the apertures **16'** when the plates are assembled so as to form guideways for receiving contact actuators **18** and plunger guides **20** associated with plunger or push rod members **22**. When assembled the plates **10** and **10'** are held in spaced relation at the bottom by a spacer bar **23** and at the top by small spacer sleeves **24** carried on spaced clamping bolts **25** which are disposed along the top margin of the body of the plate **10**, the latter constituting in effect the main support plate. The spacing between the plate bodies is slightly greater than the thickness of the plunger member **22** so as to permit free sliding movement of the plunger members **22** in a vertical direction when the frame is disposed with the flanges **15**, **15'** generally horizontal. The frame spacer **23** is apertured to accommodate a series of spaced clamping bolts **26** on which leaf spring contact switch point assemblies **28** are mounted on the outside face of the body portion of the frame late **10'**. Each leaf spring assembly **28** comprises a plurality of sets of stacked contact blades **30** seated in pockets **31** which are formed on an elongate insulating bar **32** by longitudinally spaced partition members **33** with the spaces forming the pockets **31** having a width determined according to the spacing of the bolts **26** each of which is located below a lower corner of an aperture **16** so that when the contact switch assemby **28** is positioned in a pocket **31** the switch blades **30** extend upwardly along the one side of an aperture **16** with the innermost blade **34** positioned for engagement by the contact actuator **18** which is carried on the plunger **22**. The insulating bar **32** and associated partition members **33** may be formed of a suitable rigid plastic having electrical insulating characteristics.

The interlatch plunger **22** is in the form of a flat plate of rigid material, such as, for example, metal cut from a rectangular strip, so as to provide a relatively wide top portion **35** and a narrower bayonet-like or spear-like bottom portion **36**. An elongated aperture **37** is provided in the top portion **35** near the bottom margin thereof and extending on the vertical axis for receiving the guide pin **38** which extends from the innermost face of the main support plate **10** and is centered at the top of the aperture **16**. The top portion **35** of the interlatch plunger **22** is notched out at **39** along the one side edge to provide a relatively long clearance slot when positioned at an aperture **16** adjacent a separating collar **24**. The opposite vertical margin of the plunger top portion **35** is notched at **40** to provide a latching slot and at **41** to provide an outwardly and upwardly inclined cam edge **42** for latch bar operation as hereinafter described. The top portion **35** of the plunger **22** is provided with an operating button **43** on the top surface of which identifying indicia may be placed. The bottom spear-like portion **36** of the plunger **22** has tapered edges **44** which converge to a somewhat rounded point for co-operation with a lockout mechanism which will be described.

A plunger guide **20** is associated with each of the plungers **22** and is in the form of a generally rectangular block of a suitable molded plastic having the necessary dimensional stability. It is provided with a flat top surface **45** and the end portions are bifurcated or slotted at **46** and **46'**, the widths of the slots being slightly greater than the thickness of the material in the plate **10** and the distance between the base of the slots being slightly less than the width of the aperture **16**. The center portion of the guide **20** is thickened as indicated at **50** and when the guide **20** is installed in the frame plate **10**, this thickened center portion is seated in a notched-out portion **51** in the bottom edge of the aperture **16** which is of complementary shape. The guide **20** is adapted for assembly with the base forming main frame plate **10** by positioning the same diagonally in an aperture **16** and engaging opposite edges defining the aperture **16** in the slots **46** and **46'** at the ends of the guide. A vertically disposed aperture **52** is provided in the center of the guide **20** which is adapted to receive in free sliding relation the bottom portion **36** of the plunger **22**. The relative dimensions of the aperture **52** and the plunger portion **36** are such that the plunger portion **36** may be canted therein slightly during assembly and disassembly of the plunger with the plate **10** as illustrated in FIGURE 6 so as to free slot **37** of the pin **38** and permit the plunger **22** and the associated actuator **18** to be maneuvered into or out of proper assembled relation with the base plate **10**.

The contact actuator **18** is in the form of a block which is preferably molded from a rigid plastic material which has dimensional stability. It has a vertical dimension which is substantially less than the corresponding dimension of the aperture **16** so that it may have a predetermined path of vertical movement when installed in the aperture **16**. The over-all length of the actuator **18** is greater than the width of the aperture **16** in the plate **10** and the end portions are reduced in width or thickness so as to provide flange-like extensions **53** and **53'** for positioning between marginal plate portions defining the vertical slides of the apertures **16** and **16'** in the plates **10** and **10'**, with the latter forming tracks for guiding the actuator **18** in its vertical movement. A vertically disposed slot **54** of rectangular cross-section extends through the actuator **18** and receives in sliding relation the bottom portion **36** of the plunger **22**. The slot **54** which is aligned with the space between the plates and centered so as to receive the plunger portion **36**, has a widened portion **54'** at the top in which the bottom edge of the plunger top portion **35** is adapted to seat. The bottom face of the actuator **18** is plain and is adapted to abut the top face **45** of the plunger guide **20** when the plunger **22** is depressed to its lowermost position. A return spring **55** has its uppermost end seated in a pocket **56** (FIGURE 4) provided in the bottom face of the actuator **18**. The spring **55** is carried on the plunger portion **36** and serves to urge the actuator **18** in the direction of its uppermost position. The actuator **18** is widened at the top margin so as to provide outwardly and upwardly inclined surfaces **57** and **57'** along the top margins and spaced rib formations **58** are provided on opposite faces which project outwardly of the surface and which extend near the vertical edges in a position to be engaged by the innermost face of the innermost leaf spring **34** in the stack **30** of each spring contact switch assembly **28**. The top

face of each actuator **18** is cut away to provide a relatively shallow recess or lengthwise extending slot **60** which is of a width sufficient to seat therein the marginal portions of the frame plates **10** and **10'** at the top of the slots **16** and **16'** when the actuator **18** is in its uppermost position.

A latch bar **61** having a series of longitudinally spaced elongated apertures **62** is mounted in sliding relation on the bolts **25** on the outside face of the frame plate **10'**. The apertures **62** are spaced so as to permit limited sliding movement on spacer members **63** on the bolts **25**. Latch pins **64** (FIGURE 3) extend from the latch bar **61** through apertures **65** provided in the main frame plate **10** and engage in the notches **41** in the plungers **22** when the latch bar **61** is in its normal operative position and the plungers **22** are at the uppermost end of their path. The latch bar **61** is held in the position shown in FIGURE 1 by a return spring **66** (FIGURE 1) attached at one end to a pin **67** on the latch bar and at the other latch bar in operative position. When a plunger **22** is initially depressed the inclined surface **42** at the top of the notch **41** engages the latch bar pin **64** and moves the latch bar **61** to inoperative or non-latching position, relative to all of the plungers **22**, against the tension of the return spring **66**. When a plunger **22** is fully depressed as shown in FIGURE 3 the latching notch **40** is positioned to receive the latch bar pin **64** which permits the latch bar **61** to be returned to latching position by the return spring **66**. The movement of the latch bar to non-latching position by engagement of a pin **64** by the cam edge **42** of any one of the plungers **22** automatically releases any previously engaged or latch plunger **22** which is returned to its raised position by the associated return spring **55** so that any previously latched plunger **22** which has been depressed is automatically released by initial depression of any other plunger **22**.

The base or main plate **10** is provided along its lower margin with a series of equally spaced buttons or protrusions **70** which extend inwardly of the innermost face thereof and which are centered between the apertures **16** in the base plate **10**. These stop buttons **70** cooperate with lockout slugs **71** which are formed from generally rectangular strips of rigid metal plate material of a thickness somewhat less than the spacing between the frame plates **10** and **10'** so as to be received in loosely sliding relation in the bottom of said space, as shown in FIGURE 3, with the stop buttons **70** accommodated in a U-shaped slot or recess **72** in the top margin of each lockout slug **71**. The lockout slugs **71** have a straight bottom edge **73** which rides on the top edge of the spacer bar **23** between the frame plates **10** and **10'**. The end edges of each slug **71** are tapered or slanted inwardly in converging planes at **74** and **74'** with the taper or inclination corresponding approximately to the taper **44** on the bottom end of the bottom portion **36** of the plungers **22**. The lockout slugs **71** are positioned so that adjacent ends abut each other and the tapered surfaces are disposed below the plungers **22** so that when a plunger **22** is depressed fully the slugs immediately below the same are cammed apart and the line of slugs is moved so as to block depressing of all of the other plungers **22**. In addition there is provided at the end of the frame plates **10** and **10'** an actuator **75** for a key motion sensing switch **76** which is mounted at the end of the assembly. The actuator **75** is operated by movement of the line of lockout slugs **71** when any plunger **22** is depressed as illustrated in FIGURE 3. The actuator **75** is of plate-like form and of non-conductive material such as a rigid plastic. It has an open slot **77** cut in the top edge for accommodating the end stop button **70**. The innermost edge of the actuator **75** has a tapered or inclined cam portion **78** for co-operation with the tapered edge **44** on the bottom end of portion **36** of the endmost plunger **22**. The switch blade **80** of the switch **76** extends into the path of the end portion **81** of the actuator **75** and the contacts **82** are closed when any one of the plungers **22** is depressed. When the depressed plunger **22** is released for return to an inoperative position by actuation of the latch bar **61**, the spring contact blade **80** returns the actuator **75** to the non-actuating position where it remains until moved by the depression of a plunger **22**.

In assembling the switch, no jigs or fixtures are required. The guide members **20** may be positioned in the apertures **16** in the main plate **10** with the plate edges disposed in the end slots **46** and **46'** after which an actuator **18** and a spring **55** may be assembled on the end portion **36** of each plunger **22** and the latter inserted in the aperture **52**, as indicated in FIGURE 6, so as to fully seat the actuator **18** in the aperture **16**, (FIGURE 4), the plunger **22** being depressed and tilted into position so as to bring the guide pin **38** into the plunger slot **37**. The lockout slugs **71** and switch actuator **75** may be positioned as shown in FIGURE 3 after which the assembly is completed by attaching the plate **10'** with switch assemblies **28** and latch bar **61**. The switch assemblies **28** may have a common bus bar **83** to facilitate wiring. The disassembly of the switch elements merely requires reversing the assembly operations which facilitates repair or modification of the unit after installation. Disassembly may be had without any flying apart of any of the switch elements.

The latch bar **61** may be released by incorporating a plunger member having a suitable cam edge for engaging a pin on the bar or it may be operated by an electromagnet or any other suitable means.

The lockout feature may be modified, for example, by providing a modified lockout slug of sufficient length and having a slot **72** of a length to span two or more of the stops **70** thereby blocking the depressing movement of one or more of the plunger end portions **36**.

I claim:

1. A multiple station switch assembly comprising a pair of rigid plate members disposed in parallel spaced relation so as to form a housing and having aligned apertures in paired relation with the oppositely disposed edge portions forming parallel guideways therein, a plurality of switch means mounted on an outside face of said housing adjacent said apertures, a plurality of switch actuators each mounted in reciprocal sliding relation and being guided by said pair of aligned apertures, push rods slidably connected to each of said actuators which are operaable for manually moving said actuators individually between switch actuating and non-actuating positions, a latch bar mounted on said housing and movable in a path which is normal to the path of movement of said push rods, said latch bar and said push rods having interengaging cam and latch means which co-operate in moving said latch bar between a position for latching said push rods when they are in switch actuating position and a position where said push rods are released for movement of said associated switch actuators to a non-actuating position and lockout means co-operating with said push rods which is operated upon movement of a push rod to a switch actuating position and blocks the movement of the remaining push rods to a switch actuating position.

2. A multiple station switch assembly as set out in claim **1** and the interengaging cam and latch means for moving said latch bar including pins on said latch bar and notches in the side edge of each push rod which are adapted to receive said pins with one of said notches having a cam forming edge for enaging a pin on said latch bar when said push rod is operated so as to shift the latch bar to non-latching position.

3. A multiple station switch assembly as set out in claim **1** and guide inserts for each of said push rods seated in the apertures in said plate members in spaced relation to said switch actuators.

4. A multiple push button switch having a supporting frame member with spaced apertures therein, the oppo-

sitely disposed edges of which form guide tracks, switch actuators mounted on said guide tracks for movement between switch actuating and non-actuating positions, switch means mounted on said supporting frame and disposed in the path of said actuators for operation by the same, reciprocable plunger members slidably connected with said actuators and operable to move said actuators to switch actuating position, inserts forming guides for said plunger members mounted on said guide tracks in spaced relation to said switch actuators, resilient means urging said switch actuators toward a non-actuating position, and means for releasably latching each plunger when it is moved to switch actuating position.

5. A multiple push button switch as set forth in claim **4** and each said switch actuator and associated plunger guide having recesses which are aligned so as to receive portions of a plunger member in sliding relation.

6. A multiple push button switch as set forth in claim **4** and the switch actuators and plunger guides having recesses aligned to receive portions of the plunger members with the resilient means for urging the actuators toward a non-actuating position interposed between each actuator and an associated plunger guide.

7. A multiple push button switch as set forth in claim **4** and said supporting frame member having a guideway formation and U-shaped lockout members movable therein having cam surfaces for engagement therewith of a plunger member when the plunger member is moved toward switch actuating position so as to move the lockout members to block the movement of certain other plunger members.

8. In a switch assembly having a supporting frame member with spaced apertures having oppositely disposed edges which form tracks guiding switch actuators and associated operating plungers, a switch actuator supported by said tracks which is in the form of a generally rectangular block of insulating material with rib-like portions at oppositely disposed side edges engaging said tracks and of a size relative to the size of the apertures to permit movement of said actuator between a switch operating position and a non-operating position by reciprocation of the associated operating plunger and means whereby said switch actuator may be moved laterally of said frame member into seating engagement in the associated aperture.

9. In a switch assembly having a supporting frame member with spaced apertures, the oppositely disposed edge portions of which form tracks for reciprocably mounting a switch actuator carried on a plunger which actuator is mounted for reciprocable movement along the

face of the frame member, a plunger guide insert seated in each of said apertures which is in the form of a generally rectangular block with opposite side edges having grooves encompassing the track forming edge portions of said supporting frame member and of a size relative to the size of the apertures with the guiding portion of said insert receiving an end portion of said plunger.

10. In a switch assembly as set forth in claim **9** and said plunger guide insert having an aperture extending in the direction of movement of the plunger so as to slidingly receive in guiding relation the end of the plunger.

11. A multiple push button switch having a supporting frame member with means thereon forming guide tracks, switch actuators mounted for movement and being guided by said guide tracks between switch actuating and non-actuating positions, switch means mounted on said supporting frame and disposed in the path of said actuators for operation by the same, reciprocable plunger members connected with said actuators and operable to move said actuators to switch actuating position, inserts forming guides for said plunger members mounted on said supporting frame member in spaced relation to said switch actuators, resilient means urging said switch actuators toward a non-actuating position, and means for releasably latching each plunger when it is moved to switch actuating position, and a plurality of lockout members slidably mounted end-to-end on said frame member for movement in a path normal to the path of movement of said plunger members, said lockout members having portions engageable by said plunger members so as to block switch actuating movement of said plunger members and cam surfaces on other portions engageable by said plunger members so as to cam said lockout members to a position for blocking switch actuating movement of an adjoining plunger member, and certain of said lockout members being of a length sufficient to block switch actuating movement of a plurality of said plunger members.

References Cited

UNITED STATES PATENTS

955,134	4/1910	Cadell.
1,105,629	8/1914	Dixon.
3,281,544	10/1966	Bailey et al.

FOREIGN PATENTS

331,619	8/1930	Great Britain.

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M. GINSBURG, Assistant Examiner

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,487,178 December 30, 1969

Glenn M. Stout

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 64, "eements" should read -- elements --; line 71, "actuaing" should read -- actuating --. Column 3, line 48, "late" should read -- plate --. Column 5, line 19, after "other" insert -- end to one of the bolts 25 so as to normally hold the --. Column 6, line 47, "operaable" should read -- operable --; line 69, after "to" insert -- a --.

Signed and sealed this 30th day of June 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents