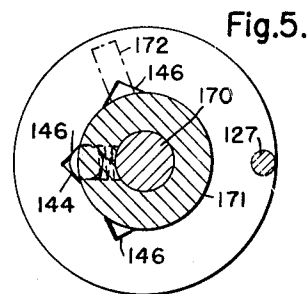
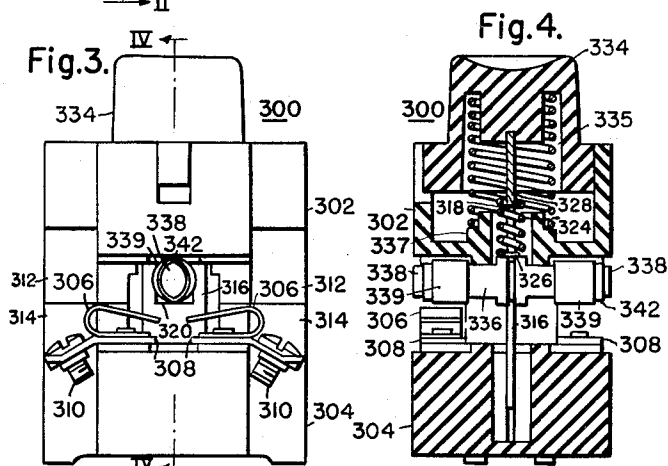
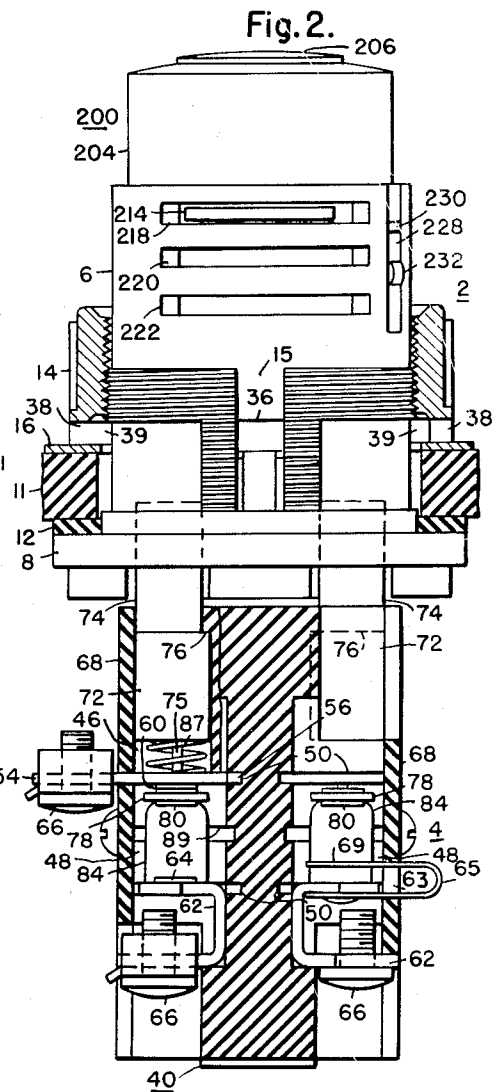


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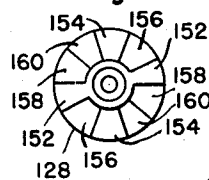
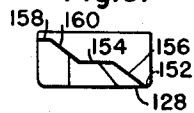
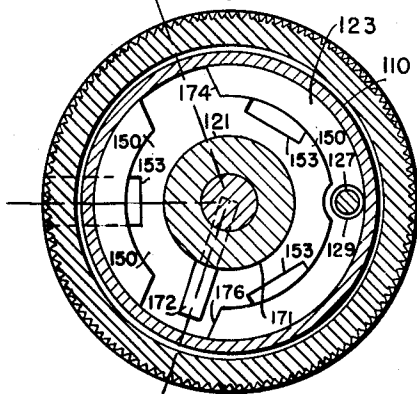
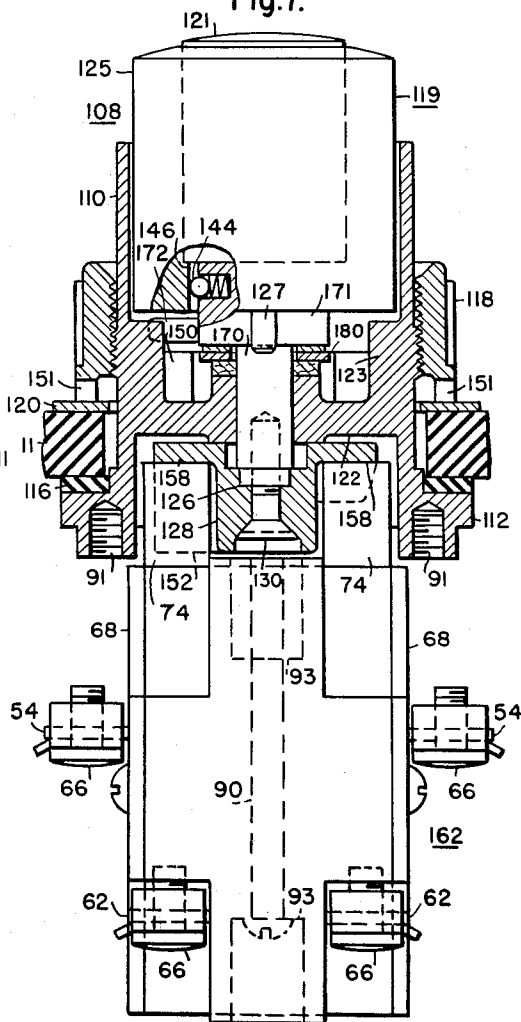
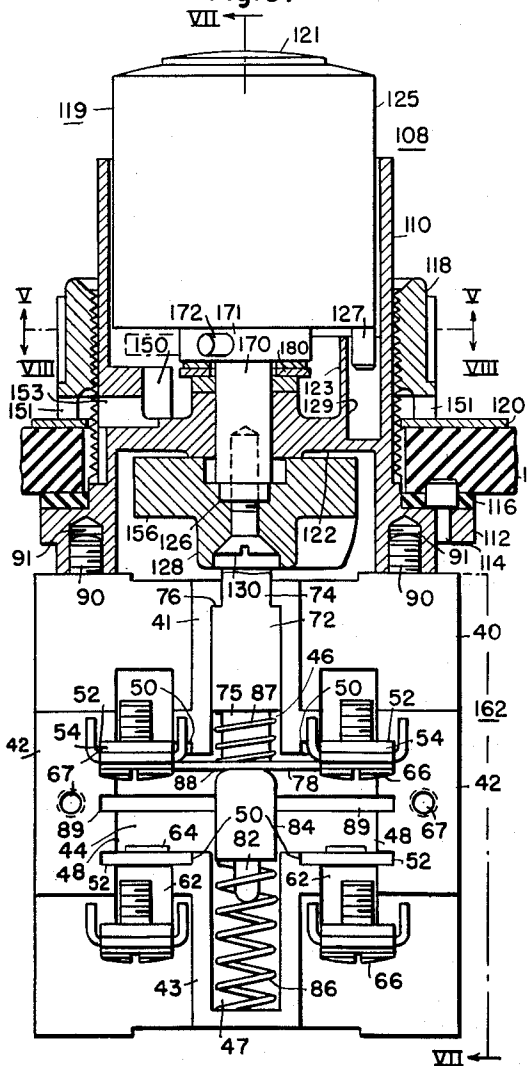


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2,748,210

ELECTRIC SWITCHES

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Application March 19, 1952, Serial No. 277,466

8 Claims. (Cl. 200—44)

This invention relates generally to electric switches, and more particularly to such switches as are commonly employed in circuits for controlling electrical apparatus.

Electric switches of the type described are often of the pushbutton type or they may be of the rotary selector type, and each type of switch is often used in locations where accidental or mistaken alteration of a particular electrical circuit may have serious detrimental consequence.

Accordingly, one object of my invention is to provide a switch of the type described that may be positively secured in a definite selectable position and which position cannot be changed or altered by accident or mistake.

Another object of this invention is to provide novel locking means for a switch.

Still another object of this invention is to provide a switch operating mechanism which may be locked in various definite positions and which positions may readily and definitely be ascertained.

Another object of this invention is to provide a switch operating mechanism which may be locked in definite positions and which may be used with various types of pushbutton switch units.

A more specific object of this invention is to provide a switch operating mechanism which may be used to lock a pushbutton type of switch in any one of three predetermined positions.

Still another more specific object of this invention is to provide a switch operating mechanism of either the pushbutton or rotary type which may be used to lock a pushbutton type of switch in any one of three predetermined positions.

A further object of this invention is to provide a switch operating unit which is separate and independent from the actual switch unit and which may be locked in various positions.

A still further object of this invention is to provide a novel switch unit for controlling various electrical circuits which will provide for a definite circuit making sequence of the controlled circuits.

Another object of this invention is to provide a novel switch unit which will have two normally open circuits, one of which will be established before and disengaged after the other.

Another object of this invention is to provide a novel switch unit which will have two normally open circuits and which will prevent both circuits from being energized at the same instant of time.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of preferred embodiments thereof when taken in connection with the attached drawings in which:

Figure 1 is a side elevation view of a switch constructed in accordance with this invention with the operating unit thereof shown in section, and with the cover plate for the switch unit removed.

Fig. 2 is an end elevation view of the switch shown

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in Fig. 1 looking at the left side of Fig. 1, with the switch unit being shown in section taken substantially on the line II—II thereof.

Fig. 3 is an elevation view of a modified form of switch constructed in accordance with this invention.

Fig. 4 is a sectional view of the modified switch as shown in Fig. 3 taken on the line IV—IV thereof.

Fig. 5 is a transverse section view of the lock unit of the switch shown in Fig. 6 taken substantially on the line V—V thereof.

Fig. 6 is a side elevation view of a modified form of switch constructed in accordance with this invention with the operating unit thereof shown in section and with the cover plate for the switch unit removed.

Fig. 7 is an end elevation view of the modified form of switch shown in Fig. 6 with the operating unit thereof shown in section.

Fig. 8 is a transverse section view of the switch shown in Fig. 6 taken substantially on the line VIII—VIII thereof.

Fig. 9 is a side elevation view of the operating cam employed in the embodiment of this invention shown in Fig. 6.

Fig. 10 is a bottom view of the operating cam as shown in Fig. 9.

The switches disclosed herein comprise two unitary parts including an operating unit which has manually operable switch actuating means, and the switch unit proper which has the switch contacts. The operating unit and switch unit may be secured together in a number of different relations, and the arrangement is such that each unitary part is adapted to be used with a number of different types of the other part. The switch units may be of either single or double arrangement as regards the number of poles, and preferably include contacts which may be interchanged and supported in a variety of different ways. The switch operating units may include different types of pushbutton operating members or rotary selector operating members, or a combination of a pushbutton and rotary operating member, and all of these different types of units have many parts in common.

The operating unit 2 illustrated in Figs. 1 and 2 of the drawings is shown as being assembled with a switch unit 4 in a manner which will be hereinafter described. The operating unit 2 includes a tubular supporting sleeve 6, preferably of a cast metal, and having a flange 8 at the inner end thereof adapted to engage the inner side of a supporting panel 11. The panel 11 may be open at the rear, or enclosed in which case panel 11 may form the front wall of a standard switch box. Preferably, flange 8 of supporting sleeve 6 has a positioning pin 10 secured thereto which is adapted to be received in a recess provided at a predetermined position on the inner side of panel 11. A sealing disc 12 of any desirable moisture-proof compressible sealing material, such as rubber or the like, is interposed between flange 8 of the supporting sleeve and the inner surface of supporting panel 11. The outer end of supporting sleeve 6 is threaded for threadedly receiving a clamping ring 14 which is adapted to secure the sleeve to panel 11 when the clamping ring is drawn up tightly. If desired, a washer 16 having an extended portion at one side may be provided between clamping ring 14 and panel 11, and this washer may carry suitable indicia for proper identification of the switch, and for the operative positions of the switch. Indicator washer 16 preferably is provided with key projections adapted to be received in external grooves 15 in sleeve 6 to properly position washer 16 on the sleeve and prevent relative angular movement.

Supporting sleeve 6 of the switch operating unit is interiorly provided intermediate its ends with a transversely extending web 18 which is centrally apertured for

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slidably receiving an operating rod 20. Operating rod 20 is reduced at its upper end in cross section to provide a locating shoulder 21 upon which is positioned the dished, centrally apertured plate 22 which is secured to the outer end of operating rod 20 by means of screw 23. Operating rod 20 is reduced at its lower end to provide a locating shoulder 25 upon which to position the centrally apertured flat plate 27 which is secured to the inner end of operating rod 20 by means of screw 29. A coil compression spring 24 is interposed between plate 22 and a retainer disc 26 seated on the upper end of a central boss provided on web 18 to normally bias the pushbutton unit to the outer limit of its movement. The part of retainer disc 26 which seats on the boss of web 18 is adapted to engage a sealing disc 28, also of a moisture-proof resilient material, such as rawhide, for sealing any space between operating rod 20 and the opening through web 18. The portion of retainer disc 26 which is engaged by spring 24 is offset into an annular drain recess 34 provided in web 18, and this recess communicates with the exterior of supporting sleeve 6 by means of a plurality of radially extending drain openings 36 (only one of which is shown). In order to permit drainage of liquid through drain openings 36, clamping ring 14 is provided with a plurality of notches 38 in the inner edge thereof, and it will be observed that the extreme inner end of clamping ring 14 is not threaded, but is actually spaced from the outer surface of supporting sleeve 6 to form a drain channel 39 therebetween so that it is not necessary that a notch 38 be lined up opposite each drain opening 36. A more complete and detailed description regarding the "moisture-proof" aspect of this type of unit is contained in my copending application Serial No. 722,938, filed September 9, 1947, now Patent No. 2,669,616, patented February 16, 1954, and assigned to the Westinghouse Electric Corporation the same assignee as in this case.

Operating unit 2 includes a pushbutton 200 which is retractable into the sleeve 6 and is attached to the plate 22 by means of the screws 202. Pushbutton 200 includes a barrel casing 204 having a central aperture in which a rotatable lock plug 206 is positioned. Pin tumblers 208 are positioned within the rotatable lock plug 206 and are cooperable with spring biased tumblers 210 positioned in the barrel casing 204. Inasmuch as the details of this type of lock construction are conventional and do not of themselves form a part of this invention, they are not herein disclosed in complete detail.

The locking mechanism is conventional in its operation in that insertion of a key (not shown) in the key slot 201 lines up the tumblers 208 and 210 so that the lock plug 206 may be rotated. An integral eccentric pin 212 is provided at the lower edge of the lock plug 206 and is positioned within a guide slot 213 of a latch 214. Longitudinally spaced slots 218, 220 and 222 are located in sleeve 6 at one side thereof and are cooperable with the latch 214 to stationarily lock the operating unit at each of three positions. Rotation of the lock plug 206 causes the eccentric pin 212 to rotate and by engagement with guide slot 213 of the latch 214 forces the latch 214 to move laterally in response to rotational movement of the lock plug 206.

In order to prevent the barrel casing 204 from excessive rotation, it is provided with an integral projection 230 which is positioned in a longitudinal slot 228 in sleeve 6. Slot 228 is provided with a locating recess 232 in order that the center locking position may quickly and readily be ascertained when the pushbutton 200 is depressed. The engagement of the projection 230 with the locating recess 232 holds the pushbutton 200 at the center position so that pushbutton 200 may be locked in this position by causing latch 214 to enter slot 220 as heretofore described or left unlocked. The length of slot 228 is predetermined so that full depression of the pushbutton 200 will permit the pushbutton 200 to be locked in such position by causing latch 214 to enter slot 222. In operating the

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switch unit after latch 214 has been retracted and assuming the pushbutton to be at its outermost position, it is necessary for the operator to manually overcome the spring force of spring 24 before the pushbutton 200 may be depressed. Spring 24 normally biases the pushbutton 200 to the outermost limit of its travel (as determined by the engagement of plate 27 with web 18) and in that position the pushbutton may be locked to prevent depression by appropriate rotation of lock cylinder 204 by use of a key to cause latch 214 to enter slot 218. It is obvious that any number of positions at which it is desired to have the pushbutton unit remain without locking could be provided by means of a number of locating recesses similar to recess 232 in the sleeve 6 and, if desired, to be able to lock such additional positions by having corresponding slots similar to slots 218, 220, 222 in sleeve 6.

The switch unit 4 as shown in Figs. 1 and 2 is similar to the switch unit 4 as shown in Figs. 6 and 7 and accordingly identical parts have been given the same reference numerals. For a more detailed description of the various switch units reference is again made to my copending application Serial No. 722,938. Referring to Figs. 1 and 2 it will be observed that the switch unit 4 is a double unit having a base 40 which is identical in structure on both sides. Base 40 is preformed from an insulating material, preferably a molded insulating material and is provided with opposed recessed projections 41 and 43 at one side thereof, and has on the same side another pair of opposed projections 42. All of the projections 41, 42 and 43 are spaced apart so as to provide in effect a recessed space 44 between the inner ends of the several projections. Projection 41 has a recess 46 extending throughout the length of the projection and having an outer reduced portion forming an internal shoulder and projection 43 has a recess 47, the outer end of which is closed. Projections 42 are spaced from opposite sides of projections 41 and 43 to form spaces 48 therebetween. Spaced contact receiving slots 52 are provided at the inner side of each projection 42 for receiving one edge of a contact member with the opposite edge being received in a recess 50 provided in the adjacent corner of projections 41 and 43. It will be observed that in the particular switch construction, as shown in Figs. 1 and 2, various control functions are obtainable by omitting or inserting different types of contact members in the slots 50 and 52. For the purpose of convenience in describing and understanding this invention the base 40 as observed in Fig. 1 and the right side of Fig. 2 will be referred to as the front while the base 40 as observed on the left side of Fig. 2 will be referred to as the back. It is to be understood that the nomenclature "front" and "back" is purely for convenience and is not to be interpreted as a limitation of this invention.

Straight contact members 54 are inserted in the upper slots 50 and 52 of the back switching means while no contact members are inserted in the upper slots 50 and 52 of the front switching means. U-shaped contacts 62 are mounted in the lower slots 50 and 52 of both the front and back switching means. The inner end of each contact 54 is provided at the side adjacent projection 41 with an extension 56 adapted to be seated in a slot 50 provided in space 48 to thereby hold the contact against lateral movement relative to the base in co-operation with slot 52. Each contact 54 is provided with a shoulder (not shown) positioned to be engaged by a cover 68 when secured to base 40, to prevent withdrawal of the contact from slots 50 and 52. Each contact strip 54 is provided with a contact button 60 adapted to be positioned within space 44 and each U-shaped contact 62 on the back of base 40 having one leg carrying a contact button 64 located in the recess 48 provided near the adjacent corner of projection 43. The bight portion of each contact 62 is adapted to engage base 40, with the other leg of each contact strip 62 extending beyond

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projections 42. Such other leg of each contact strip 62, as well as the outer ends of contact strips 54, are provided with terminal screws 66 for the purpose of securing conductors thereto. It is apparent that contact strips 62 are maintained against withdrawal from slots 50 and 52 by engagement of cover 68 with the legs of these contact strips which carry contact buttons 64. Preferably, cover 68 is secured in position by any desired means, such as bolts, or the like, engaged in openings 67 provided in opposite sides of the base 40 of the switch unit.

The switch unit further includes an operating member 72 of insulating material, preferably a molded insulating material, adapted to be received in the recess 46 of base projection 41, and having a reduced operating extension 74 extending through the reduced recess opening at the outer end of projection 41, to provide a shoulder 76 around three sides of operating member 72 which is engageable with the shoulder adjacent the outer end of recess 46 to limit the extent of outward movement of the operating member. A contact supporting strip 75 is secured to the inner end of operating member 72, preferably by being cemented therein, and it is adapted to have a bridging contact bar 78 slidably mounted thereon. Bridging contact bar 78 is provided with contact buttons 80 on opposite sides thereof at each end of the bar, for cooperation with the respective contact buttons of contact strips 54 and 62. Contact supporting strip 75 has a reduced extension 82 on which is slipped a spring supporting sleeve 84, also preferably of an insulating material. A coil compression spring 86 is adapted to be received in recess 47 of base projection 43, and to react between the closed end of this recess and sleeve 84 to normally bias operating member 72 to its outermost position, where the contact buttons of bridging contact bar 78 engage the upper contact buttons 60 of the contacts 54 mounted on the base 40. The upper end of spring supporting sleeve 84 is provided with a transverse notch (not shown) for receiving the lower end of contact supporting strip 75 to space bridging contact bar 78 upwardly a predetermined distance. A coil compression spring 87 which is weak relative to spring 86 is provided on contact supporting strip 75 and reacts between operating member 72 and the contact bridging bar. Preferably, a notch 89 extends across the space between opposed pairs of contacts for the purpose of increasing the creepage distance between each pair of contacts.

It will be observed that the switch unit is preformed to have the various projections, recesses and notches described, so that all of the switch contacts and operating parts may be assembled within the base merely by laying them in their appropriate recesses or slots. Thus contacts 54 and 62 can be merely laid into notches 50, 52, and the entire movable contact assembly comprises parts which are secured together, being merely mounted in telescoping relation and held assembled by biasing spring 86. Moreover, the contacts, including the movable contact bridging bar and operating elements therefor are held against removal from base 40, and against movement from their operative positions relative to the base merely by cover 68.

As shown in Fig. 7, the switch and operating unit are assembled in operative relation by screws 90 extending through connected openings 93 at opposite ends of base 40 of switch unit 4. As shown in Fig. 1, switch unit 4 may be positioned so that screws 90 may threadably engage either pair of opposed threaded sockets 91 provided in the flange 8 of operating unit sleeve 6 as may be convenient. Insofar as operation of the operating unit 2 is concerned, it is immaterial at what angular position the switch unit 4 is secured thereto as circular operating plate 27 of the operating unit 2 will depress both operating extensions 74 of the switch unit 4 when the

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pushbutton 200 is depressed regardless of such angular position.

It is apparent that spring 24 normally biases the operating unit outward and permits spring 86 to bias the operating extension 74 upward. In this position contact buttons 80 of the back bridging bar 78 engage the upper set of stationary contact strips 54 while contact buttons 80 of the front bridging bar 78 are freely supported in space. If desired, the entire unit may be locked in this position by key operating latch 214 so that latch 214 enters slot 218, as heretofore described. Movement of pushbutton 200 is prevented by the engagement of latch 214 with slot 218. If it is desired to break this circuit, the latch 214 is removed by key operation from slot 218 and the pushbutton barrel casing 204 is depressed and turned until positioning latch 230 engages the locating recess 232. Latch 214 is then extended into slot 220 and prevents any further movement of pushbutton 200. It will be noted that positioning latch 230 also prevents pushbutton 200 from rotating. By so depressing barrel casing 204 the biasing force of spring 86 is overcome and the operating member 72 is depressed an equal distance. It is obvious that by the proper selection of distances between contacts 54 and 62 and the distances between slots 218, 220 and 222, the entire unit can be arranged so that full depression of pushbutton 200 will cause the contacts 80 to engage the lower contacts 62, and that partial depression of pushbutton 200 will cause the contacts 80 to be positioned so that they engage neither the upper contacts 54 nor the lower contacts 62. Thus, when the pushbutton 200 is locked in the position determined by slot 220, contacts 80 do not engage any stationary contacts and when pushbutton 200 is locked in the position determined by slot 222 contacts 80 engage the lower contacts 62.

It will be apparent that the back operating member 72 for the switch unit may be depressed by exerting pressure on the outer end of back operating extension 74 to be moved from the position illustrated on the drawings wherein the contact buttons of bridging bar 78 engage the upper set of stationary contact strips 54 to a position where they engage the lower set of stationary contact strips 62, and extension 74 may be moved beyond this position due to the slidable mounting of the bridging contact bar on contact supporting strip 75, with such movement acting to compress spring 87 as well as spring 86. As soon as operating extension 74 is released, spring 86 will return the parts to the position illustrated in the drawings wherein bridging contact bar 78 has its contacts in engagement with the upper set of stationary contacts on base 40.

It will be noted that although the front portion of base 40 is identical to the back portion, the control obtained by the front portion differs due to the elimination of upper contacts 54 and the modification of lower contacts 62. Front lower contacts 62 are positioned directly opposite such back lower contacts but differ from the back lower contacts in that a U-shaped spring contact clip 65, formed from a suitable electrical conducting material, is secured in any desirable manner, such as by riveting, to each of the front contacts 62. U-shaped contact springs 65 may extend through holes 63 in the cover 68 while the upper legs 69 thereof are positioned within space 43. The front bridging contacts 80 will engage the upper portion 69 of the contact springs 65 before the back contacts 80 engage the back contacts 62. Once the springs 65 are engaged by the front contacts 80, they will deflect until the back contacts 80 engage the back contacts 62. Thus, the circuit controlled by the front contacts 62 will be established before the circuit controlled by the back contacts 62. Obviously, upon release of pushbutton 200 the reverse action will occur and the circuit controlled by the back contacts 62 will be disengaged before the circuit controlled by the front contacts 62 due to the spring

action of springs 65 in maintaining contacts with the front contacts 80.

Figures 3 and 4 illustrate another type of switch which controls two normally open circuits, one of which will make before and break after the other. Switch 300 includes an upper insulating supporting structure 302 and a lower insulating supporting structure 304 having confronting contacting end portions 312 and 314 respectively. The supporting structures 302 and 304 may be secured together by tubular rivets or the like (not shown). Lower supporting structure 304 carries two pairs of spaced contacts 308, secured thereto in any desired manner, such as by riveting, with said pairs of contacts being located at opposite sides of the supporting portion 304 in horizontal alignment. Each contact 308 has at its outer end a terminal screw 310 which is threadedly engaged in an aperture formed in the outer ends of contacts 308 for securing an electrical lead wire thereto. As shown, a U-shaped spring clip 306 formed from a suitable electrical conducting material is secured in any desired manner, such as riveting, to each of one pair of contacts 308 in order that one circuit can be made before the other.

A sliding button support plate 316 is mounted for vertical sliding movement in the lower supporting structure 304 and includes a substantially central aperture 318 having a reduced lower portion 320. Aperture 320 is adapted to receive the rectangular reduced portion of a movable contact support 336. Thus, when the device is assembled the movable contact support 336 may be inserted endwise through the enlarged portion 318 of the sliding plate aperture until its reduced portion is brought to a position where the contact support 336 can be moved downwardly into the reduced rectangular aperture portion 320. The support 336 is maintained in this position relative to the sliding plate 316 by means of a coil compression spring 324 which is compressed between the support 336 and the upper end of the aperture 318. A spring positioning knob 326 is provided on the support 336 and a positioning tab 328 is formed integral with the sliding plate 316 at the upper end of the aperture 318 to maintain the spring 324 in position. The upper end of the sliding plate 316 is secured in a hollow pushbutton 334 to anchor the pushbutton and sliding plate 316 for movement together. The pushbutton sliding plate 316 and the movable contact support 336 are maintained in an upward position by a coil compression spring 335 which is compressed between the inner side of the pushbutton 334 and an abutment portion 337 provided on the upper supporting member 302. Upward movement of the pushbutton is limited by engagement of the movable contact support 336 with the upper support member 302. The supporting members 302 and 304, the pushbutton 334 and the movable contact support 336 are all formed of a suitable insulating material, preferably some molded insulated material.

The movable contact support 336 includes outer reduced portions 338 for telescopically receiving the bridging contact members 339. A collar 342 is provided about the ends of the support 336 to prevent movement of the bridging contact 339 off the ends of the support 336. For a more particular description regarding certain features of construction of this type of switch, reference may be made to Patent No. 2,303,512, issued to O. D. Von Mehren and assigned to the same assignee as this application.

In the operation of the switch it is obvious that downward movement of the bridging contact support 336 will cause the bridging contact 339 to descend and engage the spring clip 306 and establish the circuit controlled by such spring clips. Further depression of the pushbutton 334 will also further depress the bridging contact support 336 and the spring clip 306 and cause the bridging contact to engage the contacts 308 and establish the circuit controlled by said contacts. The construction of the moving bridging contacts 339 is such that

limited lateral pivotal movement is permitted with respect to the contact support. By this means any irregularities or disalignment of the spring clips 306 or spring contacts 308 are automatically compensated for. Upon release of the pushbutton it is obvious that the circuit controlled by contacts 308 will be broken before the circuit controlled by spring contact clips 306 as spring clips 306 will deflect upwardly and remain in engagement with the bridging contact member for a predetermined distance.

The switch, shown in Figs. 6 and 7, is of the rotary selector type having an operating unit 108 which is similar in some respect to the operating unit 2 previously described. The operating unit 108 has a supporting sleeve 110 having a flange 112 provided with a positioning pin 114 for cooperation with an aperture in panel 11 similar to supporting sleeve 6 shown in Figs. 1 and 2. Supporting sleeve 110 has a sealing disk 116 provided between its flange 112 and panel 11 and held in compressed condition by a clamp ring 118 engaging the other side of the panel 11 with a washer 120 interposed therebetween. Clamping ring 118 is threaded on the outer end of supporting sleeve 110 so as to secure the supporting sleeve rigidly with respect to the panel. Locking means 119 includes a rotatable lock plug 121 having a lower portion 170 which functions as an operating shaft, and a lock barrel casing 125 positioned within sleeve 110. The operation and construction of this locking means is conventional, being similar to that shown in Figs. 1 and 2, and since it does not in itself form part of this invention, it is not described in detail.

Supporting sleeve 110 is provided with an internal transverse web 122 which is centrally apertured for receiving the lower portion 170 of the lock plug 121. Lock barrel casing 125 is positioned, as hereinafter described, above the extension 123 of the web 122 and is prevented from rotatable movement by engagement of an integral pin 127 in a hole 129 in the extension 123. Lower portion 170 has a reduced inner end 126 of rectangular shape so as to be non-rotatably received in a similar shaped opening provided in an operating cam 128 which is secured to the shaft 170 by a screw 130 extending through a central aperture in the cam and threaded into the inner end of operating shaft 170. Supporting sleeve 110 has an annular drain recess 150 with outwardly extending radial drain openings 153 for draining the interior of the supporting sleeve, and clamping sleeve 118 is notched, as at 151, with the notched portions spaced from the outer surface of supporting sleeve 110 very much in the same manner as the supporting and clamping sleeves previously described in connection with the embodiments of invention shown in Figs. 1 and 2.

Operating cam 128 is shown in Figs. 9 and 10. It will be observed that operating cam 128 consists of ten separate segments with those sections which are diametrically opposite being identical in construction. Operating cam 128 includes high point surfaces 152 connected with intermediate surfaces 154 by sloping surfaces 156. Surfaces 154 are connected with low point surfaces 158 by sloping surfaces 160.

The switch unit 162 shown in Figs. 6 and 7 is similar to the switch unit 4 previously described and shown in Figs. 1 and 2. If desired, switch unit 4 could be utilized with operating unit 108 in place of switch unit 162. As shown in Figs. 6 and 7, switch unit 162 differs from switch unit 4 in that both the front and back contacts are identical in switch unit 162, and in turn are identical with the back contacts shown in Figs. 1 and 2. Inasmuch as switch unit 162 is otherwise similar to switch unit 4, the remaining identical parts are identified by the same reference numerals, and, accordingly, description of such parts will not be repeated.

It will be apparent that with switch unit 162 assembled with operating unit 108, as shown in Figs. 6 and 7,

operating extensions 74 of the switch unit are in engagement with low point surfaces 158 of operating cam 128 of the operating unit. Upon insertion of the key (not shown) in the key slot (not shown) of the rotatable lock plug 121 the lock plug 121 can be rotated in a clockwise direction and operating extensions 74 of the switch unit will be forced down by engagement with sloping surfaces 160 and eventually will seat on intermediate point surfaces 154 where the contacts 80 of bridging contact bar 78 will be at a position intermediate the contacts 60 and 64 of contact strips 54 and 62. Upon continued rotation of the operating handle in the same direction, operating extensions 74 will be forced downwardly a further amount by sloping surfaces 156 of the cam onto high point surfaces 152 wherein the contacts 80 of bridging contact bar 78 will engage the contacts 64 of the contact strips 62. In order to prevent the lock plug 121 from being removed, a collar 171 is attached to the lower portion 170 of the lock plug 121 by means of a projecting pin 172. Pin 172 also functions as a stop bar and may be attached to portion 170 in any suitable manner, such as by riveting, swedging, or thread engagement. This lower portion 170 of the lock plug 121 is positioned upon the web 122 and is maintained away from the web 122 by means of packing material 180. Excessive rotation of the lock plug 121 in a clockwise direction is prevented by the engagement of the bar 172 with the end 174 of extension 123. Obviously rotation of lock plug 121 in a reverse direction back to the position shown in Fig. 6 will cause the contacts to be operated in a reverse manner back to the position shown in this figure. Excessive rotation of the lock plug 121 in this direction is prevented by the engagement of the bar 172 with the end 176 of extension 123. This feature is more particularly illustrated by Fig. 8. Ball detent 144, as more particularly shown in Fig. 5, in cooperation with notches 146 operates to define and hold the lock plug 121 at each of the three positions described.

Inasmuch as the construction of locking means 119 is similar to that shown in Fig. 1, the mechanical structure of the locking means has not been shown. It is to be noted, however, that locking means 119 includes key operable tumblers (not shown) which engage the stationary lock barrel casing 125 upon the removal of the key from the lock plug 121. Locking means 119 is so designed that regardless of which stationary position lock plug 121 may be in, the key may be removed from lock plug 121, thereby causing the tumblers to engage the lock barrel casing 125 and preventing any unauthorized rotation of lock plug 121. If desired, locking means 119 may be constructed so that the key may be withdrawn from lock plug 121 at only one or two predetermined positions rather than all three stationary positions of lock plug 121.

In the various embodiments of the invention described above, it will be apparent that the invention comprises novel forms of switches, each of which comprises separate operating and switch units which may be assembled in a plurality of different relations. The operating units include reciprocable or rotary operating members, and each type may be locked in any desired position to prevent any accidental or unauthorized change in such units. As regards the switch units, these all are identical except as they illustrate the interchangeability and the different types of the stationary contacts. It is believed also apparent that any of the operating units disclosed may be employed with any of the switch units depending upon the circuits to be controlled and the functions desired in connection with that particular circuit.

Having described preferred embodiments of this invention in accordance with the patent statutes, it is desired that the invention be not limited to these particular devices inasmuch as it will be apparent that many changes

and modifications may be made therein without departing from the broad spirit and scope of this invention. Accordingly, it is desired that the invention be interpreted as broadly as possible and that it be limited only as required by the prior art.

I claim as my invention:

1. A switch comprising at least one set of upper stationary contacts, at least one set of lower stationary contacts, movable contact operating means including one or more guided plungers each having a bridging contact movable in response to movement of each of said plungers, a circular outwardly biased pushbutton including a barrel having a key actuated contractible latch laterally movable in response to movement of said key, a plate attached to said pushbutton and movable in direct relation to movement of the said pushbutton, said plate being positioned directly above each of said plungers causing said plungers to move in equal distance as said plate moves, said barrel being positioned within a cylindrical housing having three separate circumferential slots into any one of which said latch may extend and definitely position said barrel, said disk and said plungers in positions corresponding to said slots, said housing having a longitudinal slot therein with a notch in one side of the slot, and said lock barrel having a projection disposed in said slot, said projection entering said notch by applying a turning force on the lock barrel during longitudinal movement of the barrel, thereby positioning said latch opposite the intermediate circumferential slot.

2. A switch comprising a set of spaced upper stationary contacts, a set of spaced lower stationary contacts, movable contact operating means including a guided plunger having a bridging contact movable in response to movement of said plunger, an outwardly biased pushbutton type of lock having a key actuated latch, a plate secured to an integral extension of said lock barrel and positioned directly above said plunger causing said plunger to move an equal distance as said plate moves, said lock barrel being positioned within a cylindrical housing having three separate longitudinally spaced circumferential slots into any one of which said latch may extend and definitely position said lock barrel, said plate and said plunger in positions corresponding to said slots, said housing having a longitudinal slot which is enlarged at one point to provide a locating notch, and said lock barrel having an extended projection positioned within said slot and engageable with said enlargement by applying a turning force on the lock barrel during longitudinal movement of the lock barrel.

3. A switch comprising two sets of spaced upper stationary contacts, two sets of spaced lower stationary contacts, one set of said lower stationary contacts being flat in form, the other set of said lower stationary contacts having depressible current-conducting upwardly extending springs secured thereto, movable contact operating means, guide means therefor, said operating means including two pivoted bridging contacts which are operable to engage said upper stationary contacts and said lower stationary contacts, said operating means including locking means operable to lock said operating means in any one of three positions, said bridging contacts adapted to be moved into engagement with the upper sets of said stationary contacts, the lower sets of said stationary contacts or to a position approximately midway between the said upper and lower sets of said stationary contacts at said three positions, respectively, and one bridging contact being movable in response to movement of said operating means and establishing contact with said lower set of depressible spring contacts before the other bridging contact engages the lower set of flat stationary contacts, said spring contacts being depressed by one bridging contact to permit the other bridging contact to engage the flat contacts.

4. A switch comprising two sets of spaced upper sta-

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tionary contacts, two sets of spaced lower stationary contacts, an outwardly projecting set of deformable current-conducting springs attached to one set of said stationary lower contacts, movable contact operating means, guide means therefor, said operating means including two pivoted bridging contacts which are operable to engage said upper stationary contacts and said lower stationary contacts, said operating means including an operating head operable to lock said operating means in any one of three positions, said bridging contacts being adapted to be moved into engagement with the upper sets of said stationary contacts, the lower sets of said stationary contacts or to a position midway between the said upper and lower sets of said stationary contacts at said three positions, respectively, and one bridging contact being movable in response to movement of said operating means and establishing contact with said set of deformable springs before the other bridging contact engages the other set of lower contacts, said springs being deformed by one bridging contact to permit the other bridging contact to engage the other set of lower contacts.

5. A switch comprising two sets of spaced upper stationary contacts, two sets of spaced lower stationary contacts, one set of said lower stationary contacts being flat in form, the other set of said stationary contacts comprising current-conducting upwardly extending springs secured thereto, movable contact operating means, guide means therefor, an outwardly biased push-button type of lock barrel having a key actuated latch, a plate secured to an integral extension of said lock barrel and positioned above said operating means, said lock barrel and said plate being longitudinally movable causing said operating means to move an equal distance as said plate moves, said lock barrel being positioned within a cylindrical housing having three separate longitudinally spaced circumferential slots into any one of which said latch may extend and definitely position said lock barrel, said operating means including two pivoted bridging contacts which are operable to engage said upper stationary contacts and said lower stationary contacts, said operating means including locking means operable to lock said operating means in any one of three positions, said bridging contacts adapted to be moved into engagement with the upper sets of said stationary contacts, the lower sets of said stationary contacts or to a position approximately midway between the said upper and lower sets of said stationary contacts at said three positions, respectively, and one bridging contact being movable in response to movement of said operating means and establishing contact with said lower set of current-conducting springs before the other bridging contact engages the other set of lower contacts, said springs being biased by one bridging contact to permit the other bridging contact to engage the other set of lower contacts.

6. A switch comprising, an integral base having recesses at opposite sides thereof, spaced sets of spaced stationary contacts mounted in said recesses, two current-conducting U-shaped spring members electrically connected to one of said sets of stationary contacts, the ends of the legs of said U-shaped members being disposed adjacent to the innermost part of one of said recesses, a movable contact operating means, guide means therefor in said base, said operating means including two bridging contacts movable into engagement with said stationary contacts, said bridging contacts being oppositely disposed in opposite recesses, and one of said bridging contacts engaging said

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spring members before the other bridging contact engages the other of said sets of stationary contacts, said spring members being biased by said one bridging contact to permit the other bridging contact to engage the other stationary contacts while moving toward said stationary contacts.

7. A switch comprising, a plurality of spaced sets of spaced stationary contacts, a current-conducting U-shaped spring member having one leg electrically connected to each contact of at least one set of said stationary contacts, the other legs of said U-shaped spring members extending toward each other with juxtaposed ends, a movable contact operating means, guide means therefor, said operating means including bridging contacts disposed at opposite ends of a support member and movable into engagement with said sets of stationary contacts, and one of said bridging contacts engaging the juxtaposed ends of the other legs of said spring members before another bridging contact engages the said stationary contacts, said spring members being biased by said one bridging contact to permit the other bridging contact to engage the other stationary contacts while moving toward said stationary contacts.

8. A switch comprising, an integral base having recesses at opposite sides thereof, an upper group of sets of spaced stationary contacts and a lower group of sets of spaced stationary contacts mounted in said recesses, a movable contact operating means, guide means therefor in said base, said operating means including two bridging contacts movable between said upper and lower stationary contacts for bridging said sets of stationary contacts, said bridging contacts being oppositely disposed in opposite recesses, a plurality of current-conducting U-shaped spring members electrically connected to the contacts of at least one set of said stationary contacts, the ends of the legs of said U-shaped members being disposed adjacent to the innermost part of one of said recesses, said spring members extending toward said bridging contacts so that one of said bridging contacts engages said spring members before another bridging contact engages the other stationary contacts in the same group with said one set of contacts while moving toward said same group of contacts, said spring members being biased by said one bridging contact to permit the other bridging contact to engage the other set of lower contacts.

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