May 27, 1958 W. F. NOLDEN ET AL 2,836,666

PUSHBUTTON OPERATING MEANS FOR ELECTRIC SWITCHES

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Fig. 1

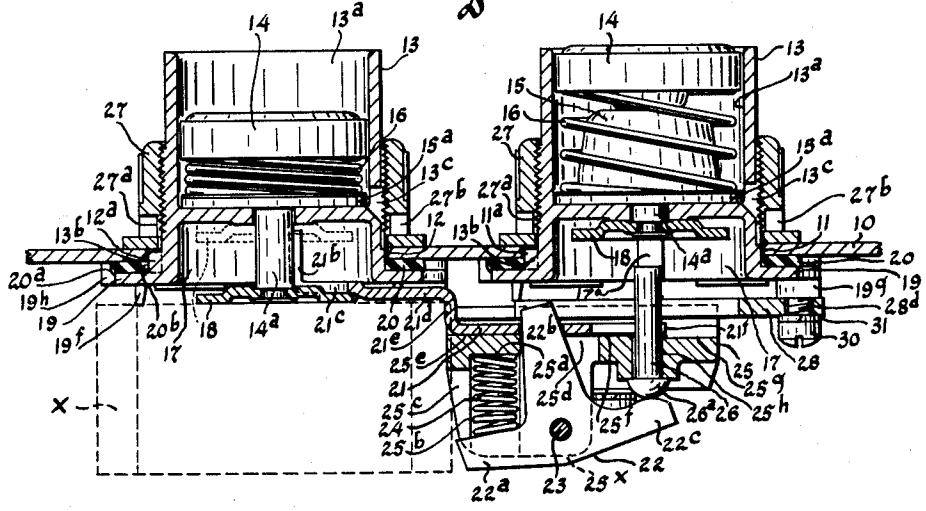


Fig. 2

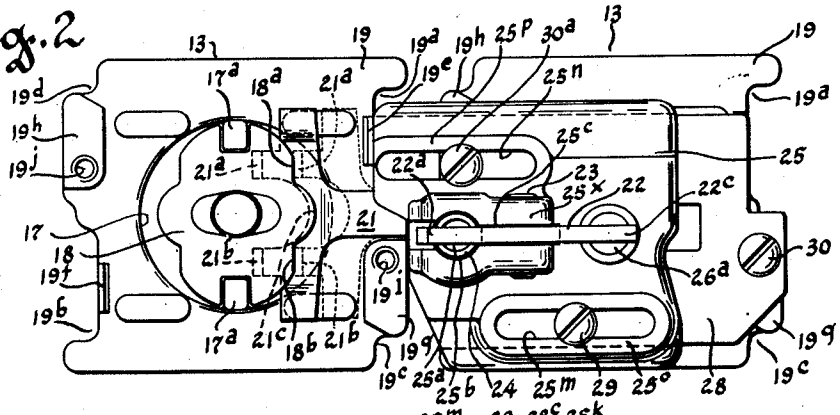
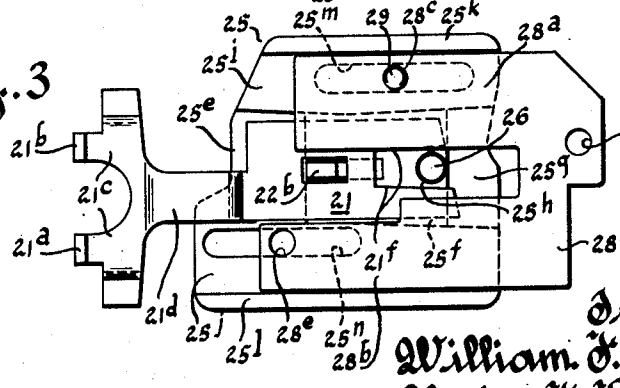


Fig. 3



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PUSHBUTTON OPERATING MEANS FOR ELECTRIC SWITCHES

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Fig. 4

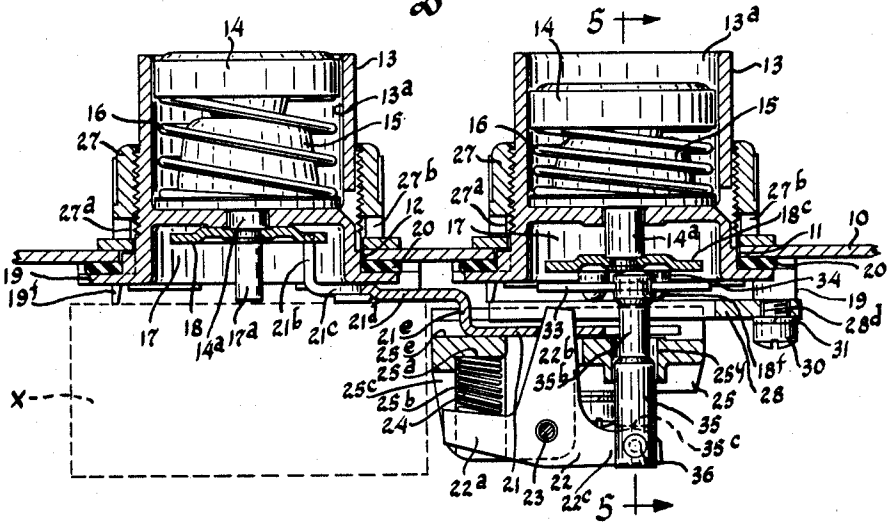


Fig. 5

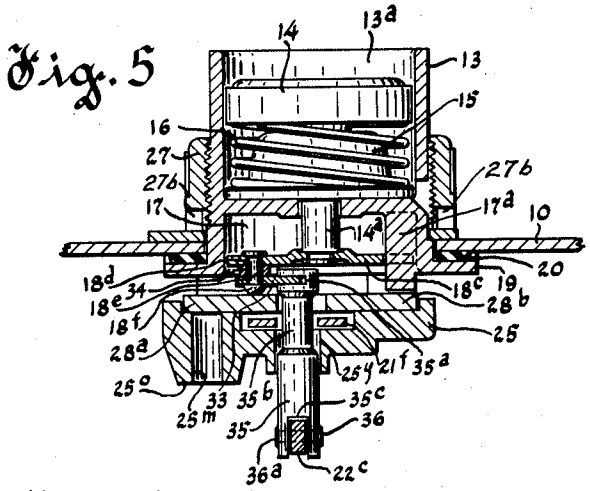
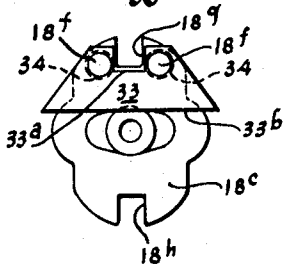


Fig. 6



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PUSHBUTTON OPERATING MEANS FOR ELECTRIC SWITCHES

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Application May 7, 1956, Serial No. 583,177

12 Claims. (Cl. 200—5)

This invention relates to improvements in pushbutton operating means for electric switches; and the invention relates more particularly to a combined latching and releasing mechanism for pushbutton switches of the reciprocating contactor type.

In each form of our invention one pushbutton when depressed is adapted to effect a given commutation of an electric circuit or circuits—as, for example, completion thereof—and for automatically maintaining such circuit condition; whereas upon subsequent depression of the second pushbutton the first mentioned pushbutton is automatically returned to its initial position. Thus the first mentioned pushhbutton may be utilized (and marked) as a "Start" pushbutton, and the second pushbutton may be utilized (and marked) as a "Stop" pushbutton. A switch operating mechanism of this general character is disclosed in Robbins Patent No. 2,357,972, dated September 12, 1944; and assigned to the assignee of this application.

An object of this invention is to improve and simplify the construction, assembly and mode of operation of interlocked pushbutton operating means of the aforementioned character.

Another object is to adapt such means for use with improved and simplified switch mechanisms of the character disclosed and claimed in our prior application, Serial No. 574,828, filed March 29, 1956, for improvements in Electric Switches.

Another object is to provide novel forms of plural pushbutton operating mechanisms for switches of the so-called "maintained contact" type.

Another object is to provide such plural pushbutton controlled switch mechanisms wherein upon depression of one of the pushbuttons, to effect circuit control, such pushbutton will be maintained in its depressed position, pending subsequent depression of the second pushbutton, which effects automatic return of the first pushbutton to its initial position.

Another object is to provide such a switch operating mechanism wherein the second pushbutton, when operated to release the first pushbutton from its depressed position, will itself be maintained in a partially depressed position, pending subsequent depression of said first pushbutton, thus serving as an indicating means.

Another object is to provide means to insure oil-tightness of switch operating means of the aforementioned character.

Another object is to provide simple mechanical interlocking means for a pair of switch operators of the character aforementioned.

Various other objects and advantages of the invention will become apparent from the following description.

The accompanying drawings (all drawn to one and one-half times normal scale) illustrate two embodiments of our invention, which will now be described; it being understood that the embodiments illustrated are susceptible of modification in respect of certain structural details thereof without departing from the spirit and scope of the invention as defined by appended claims.

In the drawings, Figure 1 is a central vertical sectional view (at the left) of a form of pushbutton operating mechanism like that disclosed in our aforementioned application, Serial No. 574,828; with a switch housing positioned therebelow and attached thereto, as indicated in dotted lines; and with a mechanism (at the right) arranged to automatically provide for maintaining the left-hand pushbutton in depressed position, pending depression of the right-hand pushbutton to effect return of the left-hand pushbutton to its normal uppermost position; it being noted that both pushbutton units are removably mounted within suitably spaced openings provided in a panel or other suitable support; the pushbuttons and certain other parts of the complete assembly being shown in side elevation, and the respective positions thereof indicating that the left-hand pushbutton was last operated.

Fig. 2 is a bottom plan view of the assembled parts shown in Fig. 1, but with the mounting panel, or the like, and the insulating housing for the switch mechanism or mechanisms, omitted for clarity of illustration.

Fig. 3 is a top plan view of the latching means shown at the right-hand side of Figs. 1 and 2.

Fig. 4 is a vertical sectional view similar to that of Fig. 1; but illustrating a modified form of latching mechanism, to provide for retention of the right-hand pushbutton in a partially depressed position thereof, after the same has been sufficiently depressed to permit the left-hand pushbutton to return to its normal uppermost position; thus acting as an indicator.

Fig. 5 is a vertical sectional view, on the line 5—5 of Fig. 4; both Figs. 4 and 5 showing the positive mechanical linkage connection between the pushbutton actuated plate or element at the right-hand side of Fig. 4 and the slide member which acts automatically to retain the right-hand pushbutton in the partially depressed position thereof shown in Figs. 4 and 5, after a sufficient degree of depression of said right-hand pushbutton to permit return of the left-hand pushbutton to its upper extreme position (Fig. 4); and which slide also acts automatically to provide for return of the right-hand pushbutton to its upper extreme position upon subsequent depression of the left-hand pushbutton to its alternative switch operating position, wherein it will be latched by the slide member in the manner illustrated at the left-hand side of Fig. 1; and

Fig. 6 is a bottom plan view of the additional plate member attached to the right-hand pushbutton, shown in Figs. 4 and 5, whereby the slide member, in the position thereof shown in Fig. 4, cooperates with the aforementioned linkage connections to positively retain the right-hand pushbutton in the position illustrated in Figs. 4 and 5, pending a sufficient degree of depression of the left-hand pushbutton to permit additional movement of the slide member toward the left, in Fig. 4.

Referring first to that form of our invention shown in Figs. 1, 2 and 3; the numeral **10** designates a panel or similar support, preferably formed of sheet metal. However, any other suitable material, such as insulation, for example, may be utilized to provide a support for the switching units, and the operating means therefor. The panel **10** may be mounted in a vertical or a horizontal position, or in any desired angular position, without affecting the operation of the switching mechanisms or the operating means therefor as disclosed herein.

Panel **10** is provided with a suitable number of properly spaced substantially circular openings, two of which are shown at **11** and **12**, respectively, in Fig. 1. In punching out or otherwise forming the openings **11** and **12** we prefer to provide in the periphery of each of the same a notch, the respective notches being designated by the numerals 11^a and 12^a in Fig. 1.

The cast metal supporting and guiding members **13**, **13** for the pushbuttons **14**, **14** may be, and preferably are, identical with the corresponding parts shown in said prior application, Serial No. 574,828. Each member **13**

is provided with an upper substantially cylindrical recess 13a, to accommodate the pushbutton 14, the dome-shaped flexible rubber sealing member 15, and the coiled compression spring 16 interposed between the circular head of said pushbutton and the peripheral bottom flange 15a of said sealing member. Each member 13 is likewise provided with a lower cylindrical recess 17, to accommodate the movements of the metal rod 14a attached to pushbutton 14, as well as the punched and stamped metal plate 18 permanently attached to rod 14a; said plate 18 being restrained against rotation within its recess 17 by means of a pair of opposite inwardly projecting guide lugs, one of which is shown at 17a in Fig. 1, at the right-hand side of said figure. Plates 18 also serve to limit the degree of outward movement of the respective pushbuttons 14, as shown at the right-hand side of Fig. 1 and at the left-hand side of Fig. 2.

Each member 13 is provided at its lower end with an outwardly facing flange 19; which flange is recessed to accommodate a substantially circular, ring-shaped, flexible rubber washer or gasket 20; which gasket is adapted to be compressed into liquid-tight sealing engagement with the outer surface of the peripheral wall portion of member 13, and with the lower surface of panel 10 as illustrated in Fig. 1. Also, as shown in Fig. 1, each gasket 20 is provided with a portion 20a of somewhat greater width at the left-hand side thereof, and the inner edge of each portion 20a is notched at 20b to accommodate the outwardly projecting integral lug 13b formed on each member 13, to restrain the gaskets 20 against rotary displacement.

The substantially rectangular contour of the flange portions 19 of the cast metal members 13 is best illustrated in Fig. 2; the width of each flange portion 19 in this figure being shown as slightly greater than the vertical dimension, or length, thereof. The opposite vertical sides of said flange portions (Fig. 2) are preferably provided with a pair of diagonally disposed relatively wide indentations or notches 19a and 19b; and with a pair of diagonally disposed relatively narrow indentations or notches 19c and 19d at two corners thereof, as illustrated.

Flange 19 is likewise provided with a pair of diagonally disposed integral lugs or spacers 19e and 19f (Figs. 1 and 2), and a diagonally disposed pair of integral lugs or spacers 19g and 19h of the same spacing length as lugs 19e and 19f, but of substantially greater bearing area at the inner ends of the former. Spacers 19g and 19h are respectively provided with tapped openings 19i and 19j, as shown on the flange portion 19 of the left-hand member 13 in Fig. 2.

As shown, the left-hand metal member 13 in Fig. 2 is adapted to have attached thereto—by fillister-head screws of the character disclosed in said prior application, Serial No. 574,828—one or more switch housings—one of which is indicated in dotted outline at X in Fig. 1; it being understood that two or more of said switch housings may be attached to each other, one below another—for simultaneous operation by means of the left-hand pushbutton 14, as more fully described in said prior application.

Assuming that the left-hand pushbutton 14 of Fig. 1 is in its normal upper extreme position, as shown in Fig. 4—wherein the metal plate 18 is drawn to the dotted line (limit) position thereof illustrated, in Fig. 1—and shown in full lines in Fig. 4; it will be understood that the upwardly projecting end portions 21a and 21b of the forked end 21c of slide member 21 will be at the right-hand positions thereof, respectively, shown in dotted lines in Fig. 2, and in full lines in Fig. 4. That is to say, said end portions 21a and 21b will then be in abutting engagement with the respective spaced right-hand edge portions 18a and 18b (Fig. 2) of metal plate 18; thus retaining the right-hand pushbutton in its partially depressed position, as shown in Fig. 4. Therefore upon inward pressing of the left-hand pushbutton 14 from its outermost position shown in Fig. 4 to the position thereof shown in Fig. 1, said side edge portions 18a and 18b will be moved downwardly along the aforementioned upwardly extending end portions 21a and 21b of forked portion 21c of slide member 21 until the upwardly offset forked portion 21c of slide member 21 is free to move to the extreme left-hand position thereof (shown in full lines in Fig. 1 and in dotted lines in Fig. 2) under the biasing action of the spring-pressed, triple-armed, lever 22, which is pivotally supported by a pin 23 (Figs. 1, 2 and 4). Lever 22 is continuously biased for movement in a counterclockwise direction (Fig. 1) by means of a coiled compression spring 24, shown in Figs. 1, 2 and 4; said spring being interposed between a spring seat or abutment 25a formed on a casting 25, preferably of a zinc alloy, of the form illustrated in Figs. 1, 2 and 3, and the upper edge of left-hand arm 22a (Figs. 1, 2 and 4) of lever 22.

As shown in Figs. 1 and 2, the casting 25 is provided with a substantially cylindrical recess 25b extending downwardly from the abutment 25a and opening to the lower end of an integral extension 25x formed on casting 25; said casting likewise having formed therein a slot 25c which is adapted to permit oscillatory movement of lever 22 about said pin 23, one end of which pin is provided with a head, and the shank end of which is upset, as shown in Fig. 2, to permanently retain the lever 22 in assembled position. The slot 25c includes a portion 25d, Fig. 1, which opens to the flat surface 25e formed on casting 25, to accommodate and provide for oscillatory movement of the relatively long, and tapered, middle arm 22b of lever 22.

After assembly of pin 26, spring 24 and lever 22 to casting 25—by inserting and upsetting the shank end of pin 23—the slide member 21 is seated upon the flat surface 25e of said casting, as shown; whereupon the flat, punched plate 28—best illustrated in Fig. 3—is seated upon the flat surface portions 25i, 25j formed upon the upper face of said casting; said plate 28 being adapted to fit slidably between the upwardly projecting guide shoulder portions 25k and 25l at opposite side edges of said casting. Plate 28 is punched out as shown to provide a pair of leg portions 28a and 28b—at least part of each leg portion overlying a part of slide member 21—to retain the latter in proper position to be driven in each direction by the arm 22b of lever 22.

Plate 28 is provided with a tapped opening 28c which is adapted to receive the shank of a relatively long screw 29—Figs. 2 and 3, which screw shank, before tightening of the same, permits sliding movement of base 25 to the desired point relatively to the right-hand end of flange portion 19 in Figs. 1 and 2—by reason of the relatively long opening 25m, Fig. 2, according to the particular spacing of the cast metal members 13, 13, in Figs. 1 and 2, in a given installation. Such adjustability of casting 25 relatively to plate 28 provides for insuring a proper relationship of slide member 21 with respect to the left-hand casting 13, and the parts associated therewith, as shown in Figs. 1 and 2. Thus, as illustrated in Figs. 2 and 3, the provision of the elongated slots 25m and 25n, affording clearance for the shanks of screws 29 and 30a, respectively, enables adjustment of the parts either substantially closer to each other, or substantially farther apart, depending upon the desired spacing of the aforementioned openings 11 and 12 in a panel 10 or the like.

Also, as shown in Fig. 3, plate 28 is provided with two additional, but unthreaded openings 28d and 28e, which are diagonally spaced from each other a distance corresponding to, and alined with, the threaded openings provided in the bottom projections 19g and 19h in the aforementioned flange 19. As shown in Figs. 1 and 2 a screw 30, having a relatively short shank, is adapted

to pass through the opening 28[d] and take into the aforementioned tapped opening 19[i] in the projection 19[g] on the flange portion 19 of the right-hand cast member 13.

A screw 30[a] (Fig. 2), preferably of the same length as screw 29, has its threaded shank freely insertable through the clearance opening 28[e] provided in plate 28 (see Fig. 3), said shank having threaded engagement with the aforementioned opening 19[j] provided in the downward projection 19[h] of the right-hand flange portion 19 of Fig. 2.

Referring to Fig. 2, it is to be understood that the elongated opening 25[m] is surrounded by a flat-surfaced, relatively high, flange portion 25[o]; whereas the opening 25[n] is surrounded by a similarly flat-surfaced, but substantially lower, flange portion 25[p], to properly accommodate the shanks of the respective screws 29 and 30[a], and to afford seats for the flat-surfaces of the screw-heads, or for suitable lockwashers or the like, such as shown at 31 in Fig. 1.

As will be understood, the purpose of the aforementioned slots 25[m] and 25[n] is to provide for proper positioning of the interlocking elements carried by the right-hand casting 13, in Figs. 1 and 2, notwithstanding various different spacings of the openings 11 and 12 in the panel or mounting member 10 shown in Fig. 1.

The portion 21[d] of slide member 21 is offset upwardly (Fig. 1) from the flat main body portion 21 thereof—as indicated at 21[e]—for sliding movement in a plane parallel thereto, as best illustrated in Fig. 1; it being noted that the surface 25[f] of casting 25, as illustrated in Figs. 1 and 3, is offset downwardly with respect to surface 25[e]; whereas the right-hand end surface 25[g] is further offset downwardly; thus minimizing the resistance to sliding movement of slide member 21, and likewise reducing the amount of material in the casting 25.

As shown in Figs. 1 and 3, the right-hand end of slide member 21 is provided with a cut-out or notched portion 21[f] to afford proper clearance between said slide member 21 and the slidable pushrod or pin 26; which pin 26 is movable downwardly upon downward movement of the right-hand plate 18, as an incident to depression of the right-hand pushbutton 14 (Fig. 1); said pin 26 thereupon acting against the right-hand arm 22[c] of lever 22, whereby the latter is rotated upon pivot pin 23, against the bias of spring 24, the upwardly extending middle arm 22[b] thereupon withdrawing slide member toward the right, to permit the left-hand pushbutton 14 to return to its upper extreme position, under the bias of its associated coiled compression spring 16. As an incident to upward movement of the plate 18 carried by said left-hand pushbutton 14 the switch mechanisms within housing designated X will return automatically to their normal positions, respectively, whether both switch mechanisms are of the normally open type; or both of the normally closed type, or one switch mechanism of each type, as disclosed in said prior application, Serial No. 574,828, filed March 29, 1956.

As shown in Figs. 1 and 2 the shank of pin 26 is movable upwardly or downwardly within an opening 25[h] of suitable size formed in casting 25; said pin preferably having an enlarged head portion 26[a] having a flat upper surface, to limit the degree of upward movement of said pin, and to insure proper driving engagement of said head portion with the right-hand arm 22[c] of lever 22.

The characteristics of the pushbutton elements shown in Figs. 1, 2 and 3 for control of switch mechanisms of the character herein contemplated are believed to be apparent from the foregoing description. However, such operation may be further clarified by assuming that both the left-hand and the right-hand pushbuttons 14, 14 in Fig. 1, are in their normal upper extreme positions, corresponding to the position of pushbutton 14 at the right-hand side of Fig. 1. Under such conditions, of course, depression of the right-hand pushbutton 14 would perform no useful function. On the other hand, if the left-hand pushbutton 14 is first depressed the plate 18 carried thereby will be lowered to the full line position thereof shown in Fig. 1, to effect the circuit commutation provided by operation of one or more switch mechanisms represented diagrammatically at X in said figure, and interlocking engagement of portion 21[c] of slide member 21 with the left-hand plate 18, as illustrated. The circuit condition or conditions thus provided will be maintained pending release of the plate 18 attached to said left-hand pushbutton 14. Such release is effected by merely depressing the right-hand pushbutton 14 to an extent sufficient to effect withdrawal of slide member 21 out of overlapping engagement with said left-hand pushbutton plate 18, whereupon the left-hand pushbutton 14 will be automatically returned to its upper extreme position. Also upon release of the right-hand pushbutton 14 the same will be moved automatically toward its upper extreme position.

As shown in Fig. 1, the supporting and guiding cast metal members 13, 13 are attached to panel 10 by means of the internally threaded mounting rings 27, 27. We prefer to first completely attach the left-hand member 13, Fig. 1, to panel 10, as shown. Thereupon the upwardly extending end portions 21[a] and 21[b] of forked portion 21[c] of slide member 21 are moved into abutting engagement with the right-hand side edge portions of the plate 18 attached to the left-hand pushbutton 14. The right-hand cast metal member 13 may then be clamped or fastened to panel 10, as shown in Fig. 1. The screw 30 (Figs. 1 and 2) which assists in retaining the plate 28 in position may be inserted and tightened, but the screw 30[a] is partially threaded into the diagonally opposite recess 19[j] (not shown) in the flange portion 19 of right-hand cast metal member 13 (Fig. 2), but is not tightened; it being understood that the heads of both screws 30[a] and 29 are sufficiently spaced outwardly from casting 25 as to permit free sliding movement of said casting with respect to plate 28 and said right-hand casting 13. That is to say, the slots 25[m] and 25[n] in casting 25 freely accommodate the threaded shanks of screws 29 and 30[a], to permit slidable adjustment of casting 25 relatively to the other parts of the complete device.

Thereafter the left-hand pushbutton 14 is fully depressed, so that the slide member 21 is free to move toward the left; and the casting 25 is then slid toward the left until said slide member 21 is positioned as shown in Fig. 1. Thereupon the aforementioned screws 29 and 30[a] may be drawn tightly into position.

The parts shown in Figs. 4, 5 and 6 may be assembled and adjusted in a substantially similar manner, except that in the latter form of the invention it is additionally necessary to insure proper interengagement of the plate 33 (Figs. 4, 5 and 6) with the slot or kerf 35[a] in the rod or link 35.

After thus completely assembling the various parts as shown in Figs. 1, 2 and 3, or Figs. 4, 5 and 6, one or more of the switching mechanisms (indicated at "X" in Figs. 1 and 4) may be attached to the flange portion 19 of left-hand cast metal member 13, and to each other, as set forth in our prior application aforementioned.

As shown in Fig. 1, the cylindrical upper end portion 13[a] of each casting 13 is provided with at least two lateral openings, one of which is shown at 13[c], and another such opening (not shown) being spaced therefrom in a counterclockwise direction around cylindrical recess 13[a] at an angular distance corresponding to 90 degrees displacement. Likewise, the mounting ring 27 is internally recessed at the lower edge thereof, as indicated at 27[a] in Fig. 1; and each ring 27 is provided with at least six notches 27[b] in the lower edge thereof; to permit drainage or escape from the cylindrical recess 13[a] of any oil, grease, or other liquid which may happen to enter the same; as more fully explained in our prior application, Serial No.

574,828. The circuit making and breaking parts of the switch mechanisms are thus protected against entrance therein of such foreign matter.

In that form of our invention shown in Figs. 4, 5 and 6 most of the parts are shown as identical with the corresponding parts illustrated in Figs. 1 to 3, inclusive; and said corresponding parts have been designated by the same numerals of reference as in the device of Figs. 1 to 3. Thus the switch controlling plate **18**^{e} shown at the right-hand side of Fig. 4, and in Figs. 5 and 6, may initially be identical with the plate **18** shown at the left-hand side of Fig. 4, and in Figs. 1 and 2. However, as best illustrated in Figs. 5 and 6, plate **18**^{c} is provided with a pair of relatively small punched out openings, one of which is shown at **18**^{d} in Fig. 5, to accommodate the shanks of a pair of relatively small rivets; the shank of one of which is shown at **18**^{e} in Fig. 5; and the heads of which are shown at **18**^{f} in Figs. 4, 5 and 6.

As illustrated in Figs. 4, 5 and 6, the shanks **18**^{e} of the pair of rivets are first passed through suitable openings provided in a flat, punched sheet metal plate **33**, of the substantially trapezoidal form best illustrated in Fig. 6; said plate **33** having a notch or cut-out **33**^{a} therein of slightly greater dimensions than the notch **18**g adjacent thereto. As will be understood the pair of notches **18**^{g} and **18**^{h} (Fig. 6) cooperate with a pair of parallel lugs formed integrally with casting **13**, one of which lugs is shown at **17**^{a} at the left-hand side of Fig. 4; which lugs restrain plate **18**^{c} against rotary movement while permitting reciprocating movement thereof. Plate **33** extends inwardly over a portion of the inner face of plate **18**^{c}, in spaced parallel relationship thereto, as shown at the right-hand side of Fig. 4, and in Figs. 5 and 6; the spacing thereof preferably being provided by a pair of steel washers or rings, each designated by the numeral **34**, which respectively surround the shank portions of rivets **18**^{e}. Alternatively, the plate **18**^{c} may be provided with an integral inwardly offset portion or portions to function in the same manner as the plate **33**. The transversely extending straight inner edge **33**^{b} of plate **33** is adapted to be interposed between and engaged by the upper and/or lower walls of a transverse slot or kerf **35**^{a} provided at one side of the upper end portion of a rod or link **35**; which rod is preferably provided with an intermediate portion **35**^{b} of reduced diameter to insure adequate clearance between the same and slide member **21**. Link **35** is vertically kerfed at the lower end thereof, as shown at **35**^{c} in Figs. 4 and 5, to freely receive the right-hand arm **22**^{c} of lever **22**; and said kerfed portion **35**^{c} and arm **22**^{c} of said lever are provided with alined openings, to jointly receive the shank of a headed pivot pin **36**, the shank end **36**^{a}, for instance, of which may be upset or spun over, to retain said parts in assembled relationship.

As will be apparent, after the various elements are attached to casing **25** (Figs. 4 and 5), the kerfed upper end **35**^{a} of link **35** may be cooperatively engaged with the forward edge portion 33b of plate **33**, whereupon the casting **25** may be attached to the flange portion of the casting **13**, as shown at the right-hand side of Fig. 4.

With an arrangement of parts like that shown in Figs. 4, 5 and 6, for example, it will be apparent that either the right-hand pushbutton **14** or the left-hand pushbutton **14** will be retained in a depressed position at any given time. Thus, if it be assumed that the left-hand pushbutton **14** in Fig. 4 is first manually pressed to its inner extreme position, to effect a desired operation of the parts of the switch mechanism or mechanisms, represented at X in Fig. 4, the slide member **21** will be automatically moved to its extreme left-hand position (corresponding to the position thereof shown at the left-hand side of Fig. 1 of the drawings) to latch said left-hand pushbutton in its depressed position, while releasing the right-hand pushbutton, for return to its outer extreme position, under the bias afforded by springs **24** and **16**, and through the linkage afforded by lever **22**, link **35**, and the aforementioned plate **33**, attached to plate **18**^{c}. The device of Figs. 4, 5 and 6 thus not only indicates the condition of the controlled circuits, but also indicates which pushbutton was last manually operated.

As shown at the right-hand side of Fig. 4, and in Fig. 5, the opening **25**^{y}, in casting **25**, is required to be of somewhat larger diameter in cross section than the opening **25**^{h} shown at the right-hand side of Fig. 1. Thus the casting **25** of Figs. 4 and 5 may initially be identical with that shown in Fig. 1, but having the opening **25**^{h} reamed out or drilled to the diameter thereof shown in Figs. 4 and 5; or the casting **25** of Figs. 4 and 5 may be initially cast to the form thereof illustrated.

We claim:

1. Pushbutton operating means for electric switches comprising, in combination, a cast metal member comprising a flange portion and a portion projecting therefrom, said last mentioned portion having an outwardly opening recess and an inwardly opening recess formed therein with an integral wall portion interposed therebetween, of a flat punched metal plate partially overlying the inner surface of said flange portion and said inwardly opening recess, a second cast metal member overlying the major portion of the inner surface of said flange portion and of said plate, a punched and stamped sheet metal slide member interposed between and slidably movable relatively to said first and second cast metal members and said plate and guided thereby jointly, said second cast metal member having an integral inward extension, said extension having a slot formed therein and at least partially opening to all sides thereof, a one-piece, triple-armed lever positioned within said slot and pivotally supported with respect thereto, spring means engaging one arm of said lever to continuously bias the same for movement in one direction, another arm of said lever having a driving connection with said slide member to normally bias the latter for movement toward one extreme position, and a push-rod reciprocatably movable relatively to said second cast metal member and affording both a driving and a driven connection thereof with the third arm of said lever.

2. Pushbutton operating means for electric switches comprising, in combination, a cast metal member comprising a flange portion and a portion projecting therefrom, said last mentioned portion having an outwardly opening recess and an inwardly opening recess formed therein with an integral wall portion interposed therebetween, a flat punched metal plate partially overlying the inner surface of said flange portion and said inwardly opening recess, a second cast metal member overlying the major portion of the inner surface of said flange portion and the inner surface of said plate, a punched and stamped sheet metal slide member interposed between and slidably movable relatively to said first and second cast metal members and said plate and guided jointly by said second cast metal member and said plate, said second cast metal member having an integral inward extension, said extension having a slot formed therein and at least partially opening to all sides thereof, a flat, punched, triple-armed metal lever positioned within said slot and pivotally supported with respect thereto, spring means engaging one arm of said lever to continuously bias the same for movement in one direction, another arm of said lever having a driving connection with said slide member to normally bias the latter for movement toward one extreme position, a manually operable pushbutton located within the aforementioned outwardly opening recess and spring-biased to a normal outer extreme position, means normally positioned within said inwardly opening recess and connected with said pushbutton, a push-rod interposed between said last mentioned means and the third arm of said lever, and said last mentioned means being adapted for driving engagement with said pushrod.

3. Pushbutton operating means for electric switches comprising, in combination, a cast metal member comprising a flange portion and a portion projecting therefrom, said last mentioned portion having an outwardly opening recess and an inwardly opening recess formed therein with an integral wall portion interposed therebetween, a flat punched metal plate partially overlying the inner surface of said flange portion and said inwardly opening recess, a second cast metal member overlying the major portion of the inner surface of said flange portion and of said plate, a punched and stamped sheet metal slide member interposed between and slidably movable relatively to said first and second cast metal members and said plate and guided thereby jointly, said second cast metal member having an integral inward extension, said extension having a slot formed therein and at least partially opening to all sides thereof, a one-piece, triple-armed, lever positioned within said slot and pivotally supported with respect thereto, spring means engaging one arm of said lever to continuously bias the same for movement in one direction, another arm of said lever having a driving connection with said slide member to normally bias the latter for movement toward one extreme position, a push-rod slidably movable relatively to said second cast metal member and having a driving connection with the third arm of said lever, a manually operable pushbutton located within the aforementioned outwardly opening recess and spring-biased to a normal outer extreme position, and a member normally positioned within said inwardly opening recess and carried by said pushbutton, said member affording a driving connection of said pushbutton with said push-rod.

4. Pushbutton operating means for electric switches comprising, in combination, a cast metal member comprising a flange portion and a portion projecting therefrom, said last mentioned portion having an outwardly opening recess and an inwardly opening recess formed therein with an integral wall portion interposed therebetween, a flat punched metal plate partially overlying the inner surface of said flange portion and said inwardly opening recess, a second cast metal member overlying the major portion of the inner surface of said flange portion and of said plate, a punched and stamped sheet metal slide member interposed between and slidably movable relatively to said first and second cast metal members and said plate and guided thereby jointly, said second cast metal member having an integral inward extension, said extension having a slot formed therein and at least partially opening to all sides thereof, a flat, punched sheet metal, triple-armed lever positioned within said slot and pivotally supported with respect thereto, means comprising a coiled compression spring engaging one arm of said lever to continuously bias the same for movement in one direction, another arm of said lever having a driving connection with said slide member to normally bias the latter for movement toward one extreme position, a manually operable pushbutton located within the aforementioned outwardly opening recess and spring-biased to a normal outer extreme position, a metal member having one end thereof normally positioned within said inwardly opening recess and having a pivoted driving connection with said lever, whereby said metal member and said pushbutton are positively restrained against outward movement when said slide member is positively restrained against movement to one of its extreme positions.

5. In a device of the character described, in combination, a supporting panel having a pair of openings formed therein in any one of a number of spaced relationships to each other, a pair of like metal members each having removable attaching means associated therewith to afford an oil-tight connection between the same and the respective opening in said panel, each of said metal members having an outwardly opening recess and an inwardly opening recess formed therein with a metal wall interposed therebetween, each of said metal walls having an opening formed therein, a pair of relatively short pushbutton members respectively positioned within said outwardly opening recesses, each pushbutton having a metal rod rigidly attached thereto and extending inwardly through its respectively associated wall opening, a dome-shaped, oil-proof, rubber diaphragm extending between each metal wall and the respective rod adjacent the inner surface of its associated pushbutton, a pair of coiled compression springs each having its lower end in engagement with the lower end of one of said diaphragms and its upper end in engagement with the respective inner surface of its associated pushbutton, a punched and stamped sheet metal plate permanently attached to each of said rods within the respective recesses second mentioned, each of said plates acting to positively limit the degree of outward movement of its associated pushbutton under predetermined conditions, as an incident to the biasing effect of their associated springs, a spring-biased slide member continuously engaged with one of said plates, said slide member being normally engaged with a side edge of said last mentioned plate when the pushbutton associated therewith is in its outer extreme position, said slide member being automatically movable into overlying relationship to said plate upon a predetermined degree of inward movement of said pushbutton, whereby the latter is latched against outward movement, and associated means affording initial adjustment of the position of said slide member in accordance with the particular spacing of said pair of panel openings.

6. A device of the character set forth in claim 5, wherein the other pushbutton is adapted upon a predetermined degree of inward movement of the latter to forcibly retract said slide member, whereby said latched pushbutton is free to move to its normal outer extreme position, under the bias of its associated coiled compression spring.

7. A device of the character defined by claim 6, wherein, upon release of said latched pushbutton in the manner set forth, said slide member also acts automatically to restrain said other pushbutton against movement to its outer extreme position, for the purpose set forth.

8. In combination, a supporting panel having a plurality of openings formed therein, at least two of said openings being arranged in any one of a number of preselected spaced relationships to each other, a pair of like cast metal members each having a flange portion formed integrally therewith, each flange portion being adapted to underlie the inner surface of said panel, a rubber-like gasket interposed between each flange portion and the inner surface of said panel to provide an oil-tight connection therebetween, one end portion of each casting extending outwardly a predetermined distance beyond the outer surface of said panel, said last mentioned end portion of each casting being shaped to positively lock the same against rotary displacement within the respective panel opening, said last mentioned portion having an external thread formed thereon, an internally threaded mounting ring for cooperation therewith to secure the same to said panel, a pushbutton positioned within said last mentioned portion and spring-biased to a normal outer position thereof, a metal plate attached to the inner end of said pushbutton and engageable with a part of said casting to positively limit the degree of outward movement of said pushbutton, a punched and stamped sheet metal plate slidably positioned inwardly of said panel and spring-biased for continuous engagement with the plate carried by one of said pushbuttons, said slidable plate in one position thereof engaging a side edge of one of said pushbutton plates to permit relatively free inward movement of its associated pushbutton but automatically moving into overlying latching engagement with such plate upon a predetermined degree of inward movement of its associated pushbutton, means including a plurality of movable members associated with the plate of the

second pushbutton and adapted upon a predetermined degree of inward movement of the latter to positively effect retraction of said slidable plate, whereby said first mentioned pushbutton is free to move to its normal outer extreme position, and means affording initial adjustment of the respective positions of said plurality of movable members in accordance with the particular spacing of said plurality of panel openings.

9. In combination, a supporting panel having a plurality of openings formed therein, at least two of said openings being arranged in any one of a number of preselected spaced relationships to each other, a pair of like cast metal members each having a flange portion formed integrally therewith at one end thereof, each flange portion being adapted to underlie the inner surface of said panel, a rubber-like gasket interposed between each flange portion and the inner surface of said panel to provide an oil-tight connection therebetween, the other end portion of each casting extending outwardly a predetermined distance beyond the outer surface of said panel, said last mentioned end portion of each casting being shaped to positively lock the same against rotary displacement within the respective panel opening, said last mentioned portion having an external thread formed thereon, an internally threaded mounting ring for cooperation therewith to secure the same to said panel, a pushbutton positioned within said last mentioned portion and spring-biased to a normal outer position thereof, a metal plate attached to the inner end of said pushbutton to positively limit the degree of outward movement thereof, a punched and stamped sheet metal plate slidably positioned inwardly of said panel and spring-biased for continuous engagement with the plate carried by one of said pushbuttons, said slidable plate in one position thereof engaging a side edge of said one of said pushbutton plates to permit relatively free inward movement of its associated pushbutton but automatically moving into overlying latching engagement with such plate upon a predetermined degree of inward movement of its associated pushbutton, said second pushbutton when manually released being also adapted to move toward its extreme outer position under its bias and associated means affording adjustment of the position of said slidable plate in accordance with the spacing of said two panel openings aforementioned.

10. In a device of the character described, in combination, a panel member having a pair of openings formed therein in any one of a number of preselected spaced relationships to each other, a pair of like pushbutton supporting members non-rotatably positioned within said openings and otherwise held in fixed positions relatively to said panel and to each other, each of said supporting members having an outwardly opening recess and an inwardly opening recess with a perforated wall portion between said recesses, a pair of pushbutton members respectively positioned within said outwardly opening recesses and spring-biased outwardly with respect thereto, each of said pushbuttons having a metal rod rigidly attached thereto and extending through the perforation in said wall portion, a metal member attached to the inner end of said rod within said inwardly opening recess, said metal member and said inwardly opening recess being cooperatively formed to restrain said metal member against substantial rotary displacement within said recess, the metal member associated with one of said pushbuttons being adapted to control operation of one or more switch mechanisms positioned inwardly of said panel, a spring-biased slide member movable automatically into latching engagement with said last mentioned metal member upon a predetermined degree of inward movement of the pushbutton associated with the latter, to thereby prevent outward movement of said last mentioned pushbutton under its bias, means associated with the other of said pushbuttons and adapted upon a predetermined degree of inward movement thereof to effect retraction of said slide member, whereupon said pushbutton first depressed is free to move to its normal outer extreme position, and associated means affording initial adjustment of the position of said slidable plate to correspond substantially exactly with the spacing of said pair of panel openings first mentioned.

11. In a device of the character described, in combination, a panel member having a pair of openings formed therein in any one of a number of preselected spaced relationships to each other, a pair of like pushbutton supporting members non-rotatably positioned within said openings and otherwise held in fixed positions relatively to said panel and to each other, each of said supporting members having an outwardly opening recess and an inwardly opening recess with a perforated wall portion between said recesses, a pair of pushbutton members respectively positioned within said outwardly opening recesses and spring-biased outwardly with respect thereto, each of said pushbuttons having a metal rod rigidly attached thereto and extending through the perforation in said wall portion, a substantially flat sheet metal plate member attached to the inner end of said rod within said inwardly opening recess, said sheet metal plate member and said inwardly opening recess being cooperatively formed to restrain said sheet metal plate member against substantial rotary displacement within said recess, the sheet metal plate member associated with one of said pushbuttons being adapted to control operation of one or more switch mechanisms positioned inwardly of said panel, an independently spring-biased slide member movable automatically into latching engagement with said last mentioned metal member upon a predetermined degree of inward movement of the pushbutton associated with the latter, to thereby prevent outward movement of said last mentioned pushbutton under its bias, and means including said independently spring-biased slide member and the plate associated with the pushbutton first depressed to positively restrain said other pushbutton against full movement to its normal outer extreme position pending a second depression of said pushbutton first depressed, to thereby positively indicate the sequence in which said pushbuttons were operated.

12. The combination, with a cast metal member comprising a flange portion and a portion projecting therefrom, said last mentioned portion having an outwardly opening recess and an inwardly open recess formed therein with an integral wall portion interposed therebetween, of a flat punched metal plate partially overlying the inner surface of said flange portion and said inwardly opening recess, a second cast metal member overlying the major portion of the inner surface of said flange portion and of said plate, a punched and stamped sheet metal slide member interposed between and slidably movable relatively to said first and second cast metal members and said plate and guided thereby jointly, said second cast metal member having an integral inward extension, said extension having a slot formed therein and at least partially opening to all sides thereof, a triple-armed lever positioned within said slot and pivotally supported with respect thereto, spring means engaging one arm of said lever to continuously bias the same for movement in one direction, a second arm of said lever having a driving connection with said slide member to normally bias the latter for movement toward one extreme position, a manually operable pushbutton located within the aforementioned outwardly opening recess and spring-biased to a normal outer extreme position, and means carried by said pushbutton within said inwardly opening recess, said last mentioned means having a continuous driving connection with the third arm of said lever.

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