

Aug. 15, 1967

M. Y. TURNBULL ET AL

3,336,455

PUSH BUTTON OPERATED SWITCH STRUCTURE

Filed May 5, 1965

6 Sheets-Sheet 1

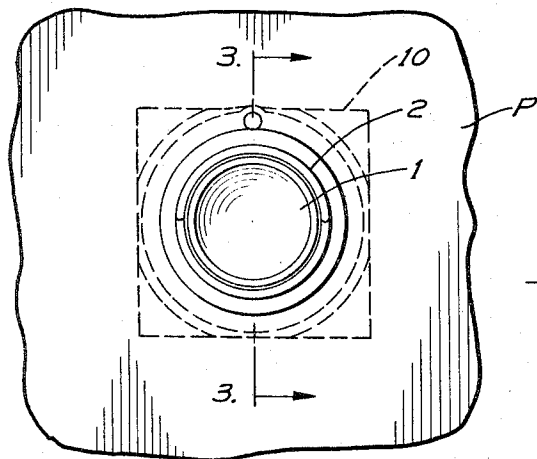


Fig. 1.

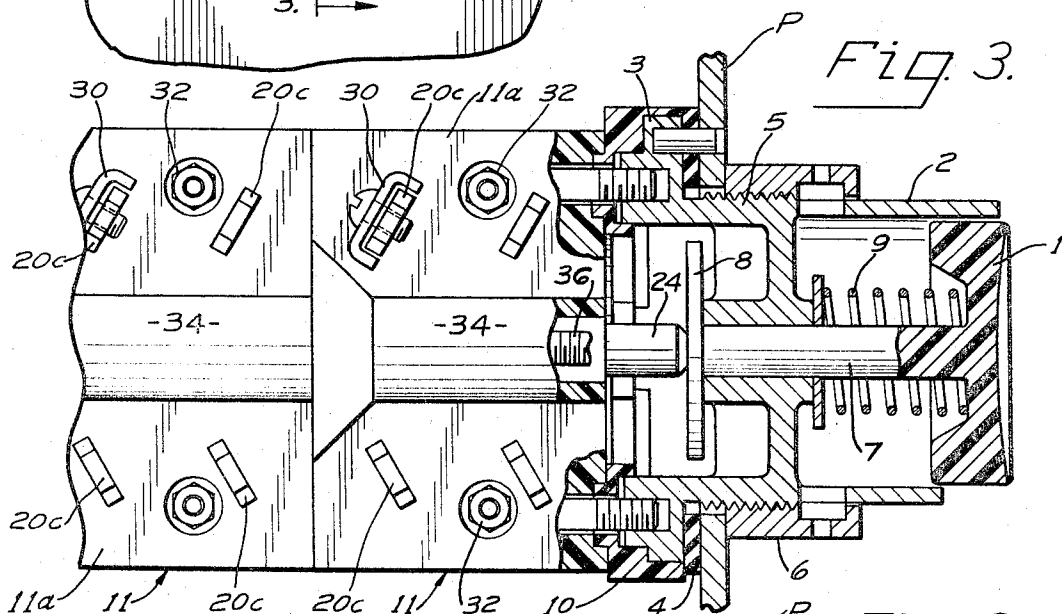


Fig. 3.

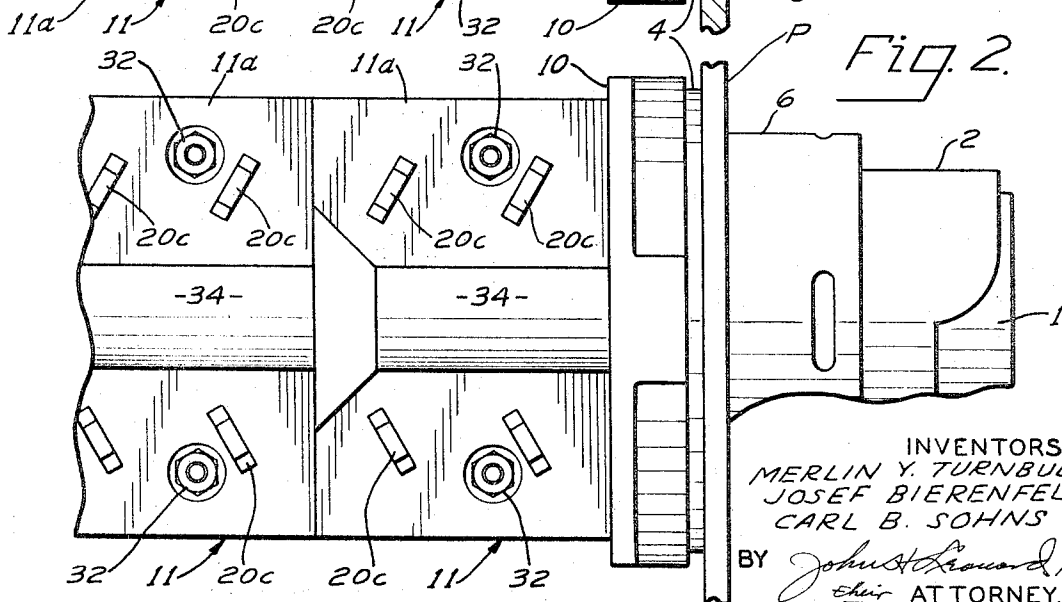


Fig. 2.

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6 Sheets-Sheet 2

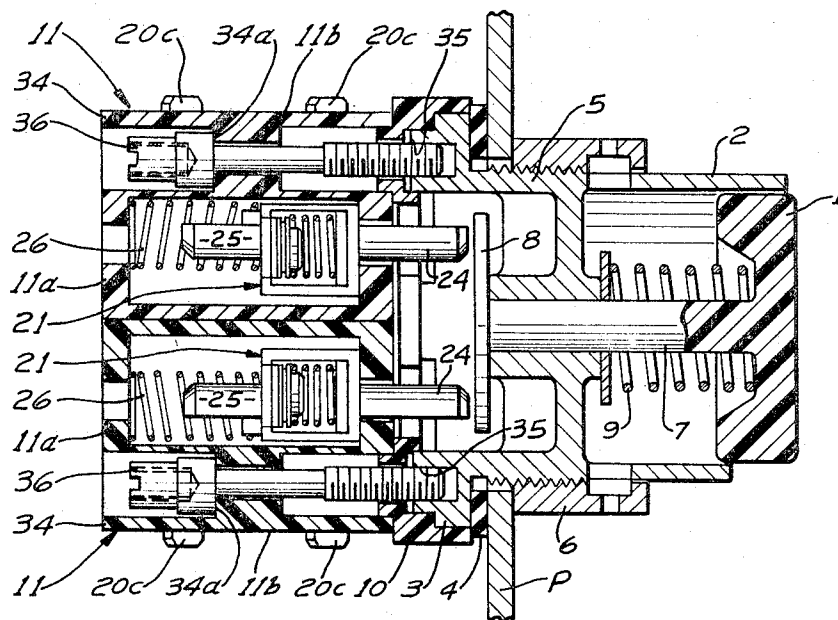


Fig. 6.

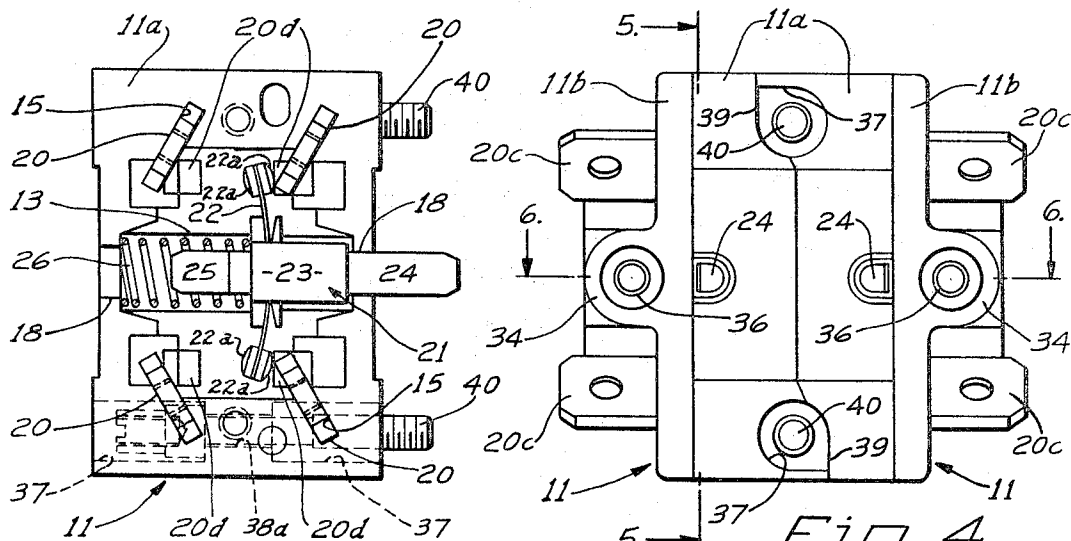


Fig. 5.

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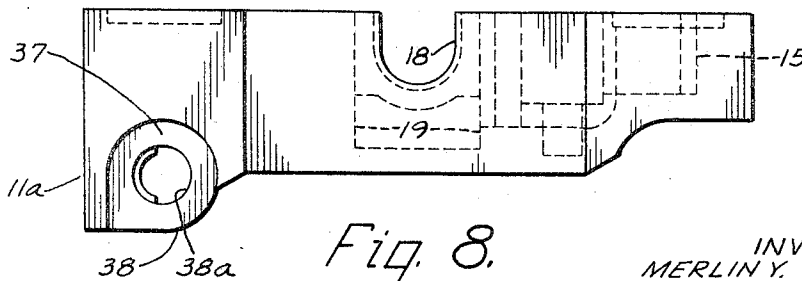
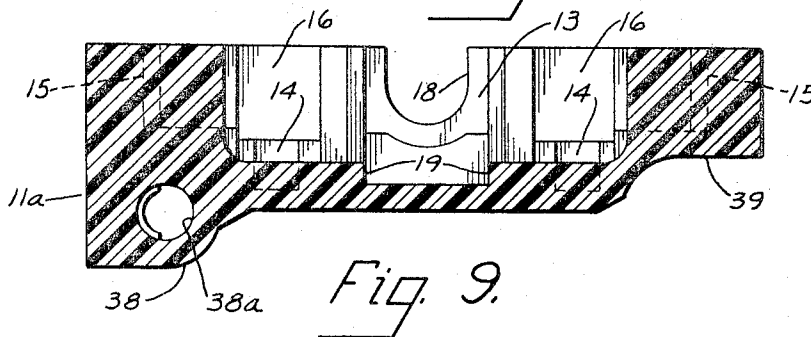
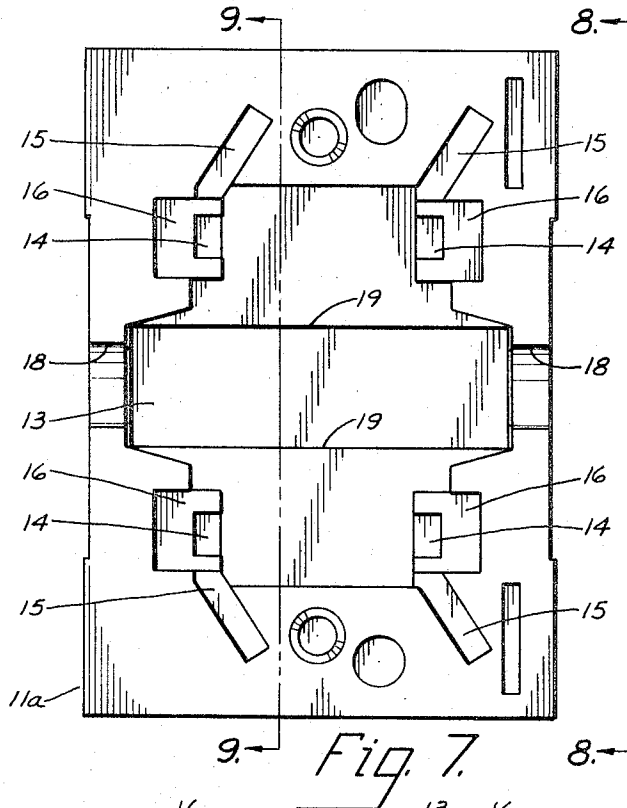
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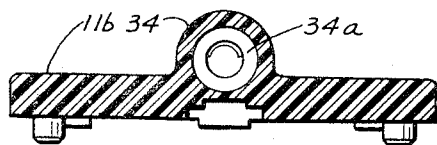
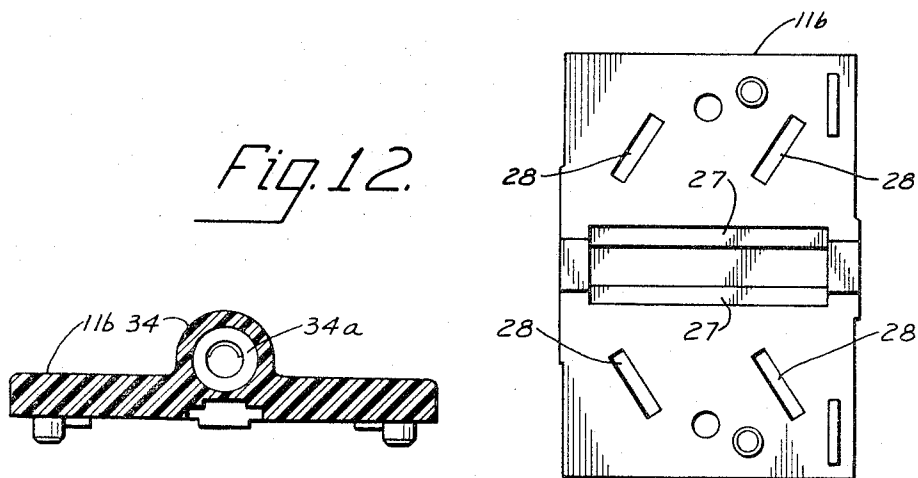
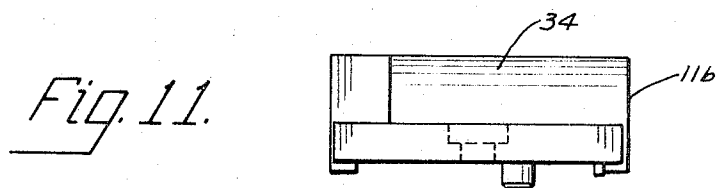
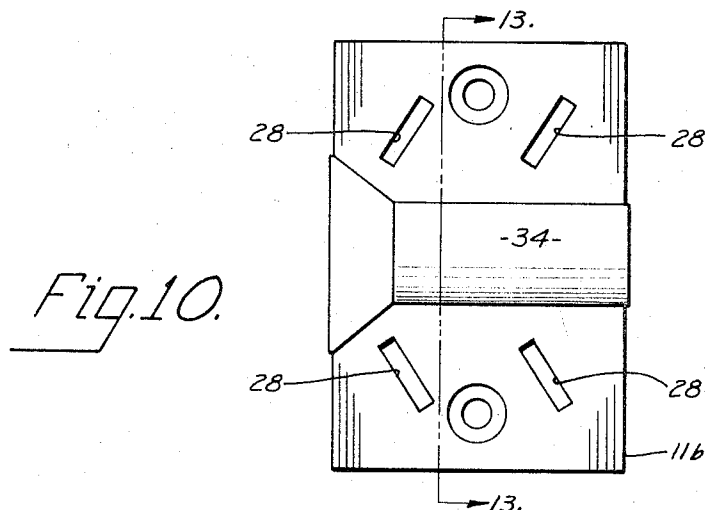
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PUSH BUTTON OPERATED SWITCH STRUCTURE

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PUSH BUTTON OPERATED SWITCH STRUCTURE

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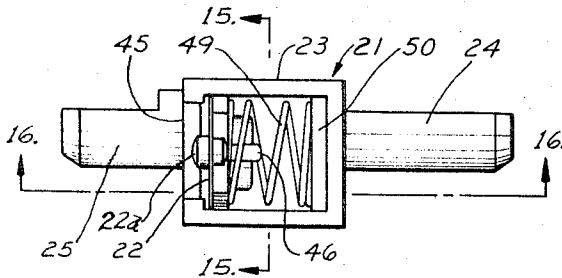


Fig. 14.

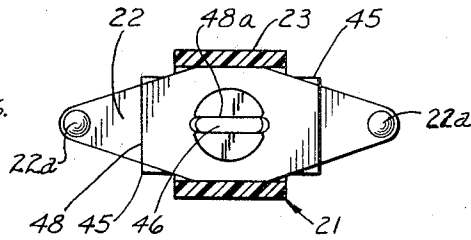


Fig. 15.

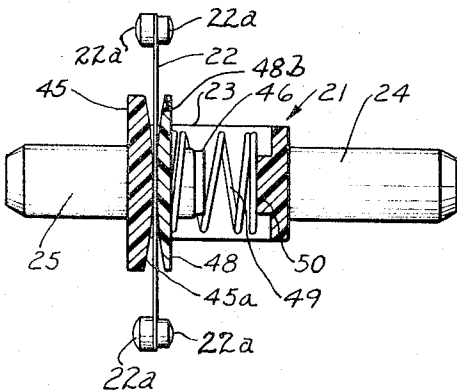


Fig. 16.

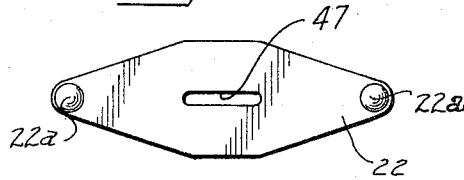


Fig. 16A.

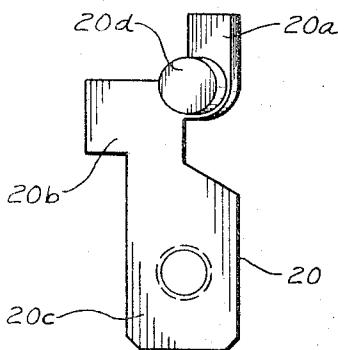


Fig. 17.

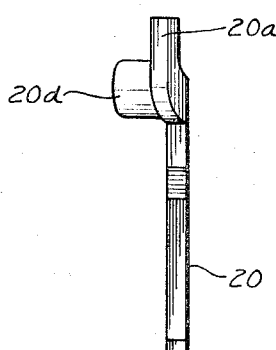


Fig. 18.

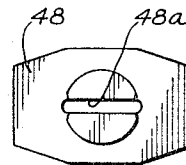


Fig. 16B.

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PUSH BUTTON OPERATED SWITCH STRUCTURE

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6 Sheets-Sheet 6

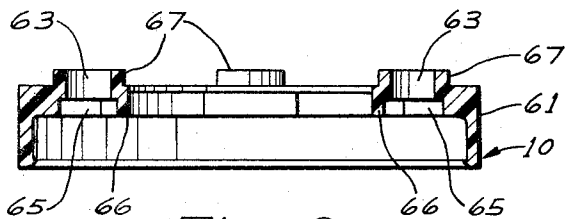


Fig. 20.

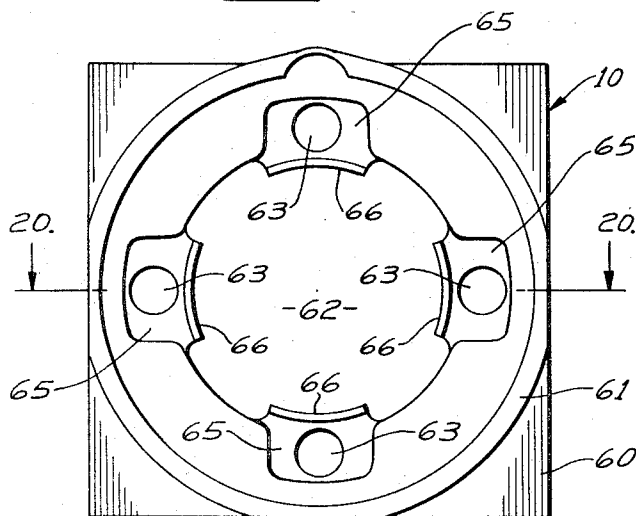


Fig. 19.

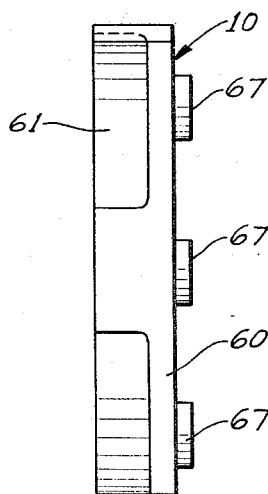


Fig. 21.

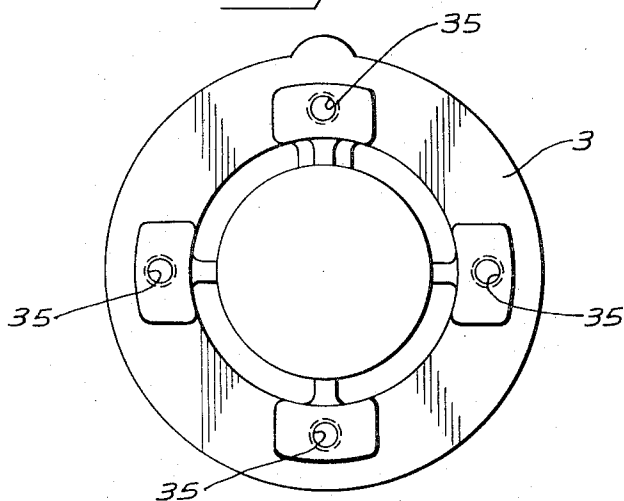


Fig. 22.

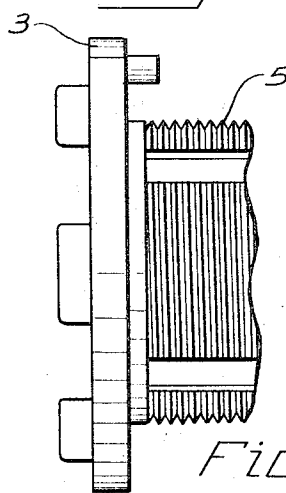


Fig. 23.

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PUSH BUTTON OPERATED SWITCH STRUCTURE
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Company, Park Ridge, Ill., a corporation of Michigan
Filed May 5, 1965, Ser. No. 453,410
8 Claims. (Cl. 200—159)

This invention relates to a push button operated switch structure and particularly to push button switch units of which the parts of the individual units can be positioned with respect to each other for performing different types of operations, in which the individual units themselves can be assembled in various relations to each other for operation by a common push button, and in which the units can be mounted simply and effectively in a multiplicity of pairs and held in assembled relation on a support for operation by a single push button.

More specifically, the invention resides in a movable contact carrier used in the switch unit, and the manner in which the movable contacts are mounted thereon.

Another specific object is to provide units each of which has a plurality of exteriorly exposed terminals for connection to external conductors, the terminals being arranged in oblique relation so as to provide an assembly which required only the smallest possible area affording adequate electrical clearance while affording accessibility to the terminals for connecting the conductors thereto.

Another specific feature resides in an adapter which simplifies the mounting of the switch units and assures the necessary electrical clearance to ground for preselected voltages.

Still another object resides in the combination of units with a common push button whereby the push button can be arranged to operate concurrently a pair of units arranged in face to face relation, or a row of units combined with either unit, or both units, of the pair.

Another specific object is to provide a unit of the character described wherein the movable contact carrier can be changed in position, end for end, so that it can be operated from either end of the unit for reversing normal operation of the unit while retaining the terminals unchanged in position and readily accessible, regardless of the selected operation of the carrier.

Another object is to provide on the switch unit external terminals which are arranged at opposite sides of a barrier extending lengthwise of the unit, the terminals at each side of the barrier being oblique the length of the barrier and the terminals at one side of the barrier diverging from the terminals at the opposite side in the direction endwise of the barrier.

Various other objects and advantages will become apparent from the following description wherein reference is made to the drawings in which:

FIG. 1 is the front elevation of a fragment of a panel with units and an operating push button of the present invention mounted thereon;

FIG. 2 is a left side elevation of the push button, units, and fragment of the panel, illustrated in FIG. 1;

FIG. 3 is a vertical longitudinal sectional view of the push button, units, and panel, and is taken on the line 3—3 in FIG. 1;

FIG. 4 is a front end elevation of a pair of switch units in assembled face to face relation with respect to each other, the push button being omitted for clearness in illustration;

FIG. 5 is a left side illustration of the structure illustrated in FIG. 4, as viewed from line 5—5 of FIG. 4, with the cover portion of the body of the left unit removed to show the interior of the unit;

FIG. 6 is the horizontal, sectional view of the units, taken on the line 6—6 in FIG. 4;

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FIG. 7 is a view similar to FIG. 5, but with the operating parts of the unit removed to show a configuration of the inside of the main body portion;

FIG. 8 is a top plan view of the main body portion illustrated in FIG. 7;

FIG. 9 is a cross sectional view of the main body portion illustrated in FIG. 7 and is taken on line 9—9 thereof;

FIG. 10 is a left side elevation of the left unit illustrated in FIG. 4, with the terminals removed to show the external configuration of the cover portion of the body;

FIG. 11 is a bottom plan view of the cover portion illustrated in FIG. 10;

FIG. 12 is the right side elevation of the cover portion illustrated in FIG. 10, showing the configuration of the interior thereof;

FIG. 13 is a cross sectional view of the cover portion of FIG. 10 and is taken on line 13—13 thereof;

FIG. 14 is an enlarged view of the movable contact carrier of the present invention in the position in which the carrier is shown in FIG. 6;

FIG. 15 is a cross sectional view of the carrier, taken on the line 15—15 of FIG. 14;

FIG. 16 is a longitudinal sectional view of the carrier, taken on the line 16—16 in FIG. 14;

FIG. 16A is a front elevation of the contact illustrated in FIG. 16;

FIG. 16B is a front elevation of the holding washer illustrated in FIG. 16.

FIG. 17 is a front elevation of one of the stationary contacts used in the present unit;

FIG. 18 is a right side elevation of the contact illustrated in FIG. 17;

FIG. 19 is a front elevation of an adapter of the present invention;

FIG. 20 is a horizontal sectional view of the adapter taken on the line 20—20 of FIG. 19;

FIG. 21 is a right side elevation of the adapter illustrated in FIG. 18;

FIG. 22 is a rear elevation of the push button structure of the present invention; and

FIG. 23 is a right side elevation of the push button illustrated in FIG. 22.

Referring to the drawings, the switch units of the present invention are adapted to be operated in multiple by a single switch such as a rotary selector switch having a cam for providing the component of movement for operating the units, or a selector push button, or a simple push button, the specific type of switch used being immaterial so long as it provides a component of movement properly directed for the switch units. For illustration a simple push button is shown and is mounted for reciprocation axially in a suitable housing 2. The housing 2 has flange 3 on the forward face of which is disposed an insulating gasket 4 of rubber or the like. Between the flange the forward end of the housing 2 is a threaded portion 5 which receives a nut 6 for clamping the push button housing on the upright panel P in operating position with its axis horizontal. The push button 1 includes a push rod 7, which extends from the push button 1 to the open rear of the housing 2. The rear end of the rod carries a disc 8 which is arranged to engage the carrier push buttons of two of the units of the present invention. A return spring 9 is provided within the housing 2 for normally urging the push button 1 to the forward or extended position. Two switch units in face to face relation are connected directly to the rear of the flange 3. As will later be described in more detail, a suitable adapter 10 of insulating material is provided for spacing the units the proper distance from the housing 2 and panel P for the desired electrical clearance.

The adapter 10 has a forward face contoured to fit the rear face of the flange 3 and the rear face contoured to fit the forward faces of one of two switch units of the present invention.

Referring specifically to the switch units of the present invention, each unit comprises a hollow body, indicated generally at 11, comprised of a main body portion 11a and a cover portion 11b, both of insulating material. The portions 11a and 11b are detachably secured together, as later described, with their inner faces juxtaposed.

Referring particularly to FIGS. 5 and 7, the main body portion 11a is of molded electrical insulating material and has a cavity, indicated generally at 13 which is open at the inner face of the main body portion 11a. In the wall of the body portion 11a, opposite the open face, are four sockets 14, which at their inner ends open into the cavity 13 toward the open face. Cooperating notches 15 extend generally obliquely in the cavity, and cavity portions 16 are connected with the sockets 14 and notches 15. Each socket 14 and its cooperating notch 15 cooperate to hold a stationary contact in position in the cavity.

The switch unit illustrated is one shown as a double pole, double throw switch employing two pairs of stationary contacts. The main body portion 11a, at its front and rear ends, is provided with aligned passages 18 which extend from opposite ends of the cavity 13 entirely through the end walls of the body portion 11a. Within the cavity, suitable integral longitudinal shoulders or guides 19 are provided and extend endwise parallel to the common axis of the aligned passages 18.

As best illustrated in FIG. 5, stationary contacts 20 are mounted in the cavity, each being held in place by its associated socket 14 and cooperating notch 15. As further illustrated in FIGS. 17 and 18, each contact 20 is provided with a portion 20a adapted to fit in the socket 14, a portion 20b adapted to fit in the notch 15, and with a terminal portion 20c adapted to extend to the exterior of the body 11 through the body portion 11b, and a stationary contact portion 20d for cooperation with movable contact. The contacts are arranged near the ends of the cavity and are arranged in pairs, one pair at one side of the axis of the passages 18 and the other pair at the opposite side of the axis.

Mounted in the guides 19 for reciprocation endwise of the cavity 13 is the movable contact carrier 21 which carries a movable bridging contact 22, having contact portions 22a, for movement to positions for making and breaking contact with the sets of stationary contacts, selectively. The carrier 21 has a central frame portion 23, later to be described, in which the movable contact 12 is carried. At one end, the carrier is provided with a push button 24 which extends through one of the passages 18 for access for operation at the exterior of the body 11. At the other end, the carrier 23 is provided with an extension 25, aligned with the push button portion 24. A return spring 26 is interposed between the cavity wall at the rear of the cavity 13 and the carrier frame portion 23 so as to urge the carrier in a direction endwise along the guides 19 to dispose the push button 24 in its outward or extended position, as illustrated in FIG. 5. The portion 11b of the body is, as mentioned, essentially a cover plate for closing the open side of the cavity 13 and of the passages 18. It also is provided with integral shoulders or guides 27 parallel to the guides 19 which cooperate in guiding the carrier 21 along its path endwise of the cavity 13. The cover portion 11b also has apertures 28 which extend therethrough and accommodate the terminal portions 20c, respectively, of the contacts 20. The terminal portions 20c extend through the apertures to the rear and exterior of the body 11 and at the rear face of the unit carry suitable connectors 30 for securing external conductors thereto, respectively. The portions 11a and 11b are detachably secured together by suitable bolts 32.

The outer face of the cover portion 11b is provided with an integral tubular boss 34 which extends from the

front to the rear thereof and is disposed between the terminal portions 20c of each set or pair of stationary contacts and thus provide an insulating barrier therebetween.

In the form illustrated wherein two pairs of stationary contacts are provided, one terminal portion 20c of each pair is at one side of the boss 34 and the other terminal portion of the same pair is at the opposite side of the boss 34. The bosses 34 have internal shoulders 34a positioned so as to be aligned with suitable internally threaded bosses 35, on the rear face of the flange 3. Suitable bolts 36 are arranged to extend through the bosses 34, respectively, with their heads bearing against the shoulders 34a and with their opposite ends in threaded engagement with internally threaded bosses 35 and the flange 3 for drawing the body 11 firmly against the flange 3, or against the adapter 10 if such is provided therebetween.

At the inner face of the body 11, which is provided by the outer surface of the body member 11a, the recess 37 is provided which extends endwise of the body near one edge. Intermediate its ends, the recess is provided with a boss 38 having a passage 38a extending endwise there-through. The opposite edge of body portion 11a has an additional recess or notch 39 extending endwise thereof. The recess 37 and notch 39 are so arranged that when two duplicate bodies are disposed with their inner faces juxtaposed and with the recess 37 of each overlying the notch 39 of the other, the two bodies fit firmly together. Suitable bolts or screws 40 can then be passed endwise through each aligned recess 37 and notch 39 and the passage 38a of the associated boss 38 and screwed into an associated one of the bosses 35 on the flange 3. Thus each unit is secured by two bolts, one through the passage 34a of the boss 34 and one through passage 38a of the boss 38, fixedly in position with its inner face juxtaposed against the inner face of a duplicate unit.

When the units are so disposed, the terminal portions 20c of each contact are normal to the plane of the outer face of the cover portion 11b of the unit and oblique to the axis of the path of travel of the associated carrier. The terminal portions 20c of the terminals at one side of the boss 34 are parallel to each other and those at the opposite side are parallel to each other. Those at one side, however, converge towards those at the other side in a direction endwise of the units. This oblique arrangement of the external terminal portions 20c renders them and their connectors 30 readily accessible for connecting conductors to the portions.

It sometimes happens, however, that it is desirable to maintain the terminal portions 20c in these positions for ready access and at the same time arrange the switch for reverse operation. For example, in FIG. 5, the switch is normally closed with respect to the contacts 20 at the right and normally open with the contacts 20 at the left. Assume it is desired, while the switch and terminal portions 29 remain in the same position, to reverse the switch operation. It is to be noted that the cavity 13, and guide-ways 19, and the passages 18 are symmetrical about the common axis of the passages 18 and also about an axis at right angles to the common axis in a plane normal to the terminal portions 29. Consequently, all that is necessary to effect the reversal in operation of the switch is to remove the cover portion 11b, to lift out the carrier 23, reverse it end for end relative to the cavity so that the push button 24 is now at the passage 18 to the left in FIG. 5 and the extension 25 is in the passage 18 to the right. Concurrently, the spring 26 is disposed at the opposite end of the path of travel. Next the cover portion 11b is reinstalled. As a result, the movable contact now normally maintains contact with the contacts 20 at the left in FIG. 5 and is normally open with respect to the contacts 20 to the right in FIG. 5. With this arrangement, ready access to the terminals can be obtained for either type of operation, as when the switch is placed close to a wall, for example. Assume some of the switches are installed near a corner wall wherein the terminal portions

are oblique in a direction making them inaccessible by a screw driver for tightening their connectors because of the direction obliquity thereof relative to the direction of operation of the push button and lack of space between the wall and terminal portions. By reversing the carrier and its push button, the unit can be disposed with its terminal portions oblique to the line of travel of the push button but 180° to their original positions so as to be accessible by a screw driver directed toward the wall, where there is ample space for access.

In the form illustrated, it is to be noted that two switch units are shown as directly connected to a single push button or operator 1. In many cases it is desirable to arrange a multiplicity of units, not only side by side, but also end to end, for operation by the same push button 1, as illustrated in FIGS. 2 and 3.

For this purpose, the extension 25 is made of such length that in the normal return position of the carrier 23, as effected by the spring 26, the outer end of the extension 25 is substantially the same distance inwardly of the body 11 from the outer end of the passage 18, adjacent to its end of the guides 19, as the outer end of the push button 24 is from the outer end of the passage 18 in which it is disposed. Consequently, if a number of the units are aligned and connected end to end, then the push button 24 of each can extend into the body of the one next adjacent and engage the extension 25 thereof in end to end relation. Hence, when the push buttons 24 of the pair of units directly connected to the push button 1 are operated thereby as heretofore described, the units connecting such pair in end to end relation are also operated, the force being transmitted from carrier to carrier in this manner for as many units as it is desired to place in alignment endwise. When a number of units are thus arranged in end to end relation, the bolts 36 and 40 may have their head ends internally threaded so that they can be connected together endwise, and thus extend through the entire group of units.

In order to provide an effective mounting for the movable contact 22 in the carrier 21, the central frame portion 23 of the carrier 21 is in the form of a frame which is open transversely of the path of movement of the carrier toward the contacts 20. The frame portion 23 has an end frame member 45, the inner surface 45a of which is slightly curvilinear and convex, being curved about an axis extending transversely of and offset endwise of the carrier from, the axis of the frame opening. Extending inwardly of the frame portion 23 from this surface is an integral fin 46. The movable contact 22 is elongated in a direction parallel to the axis of the frame opening and at its midportion is provided with an elongated slot 47 which accommodates the fin 46 for holding the movable contact 22 in proper position on the frame member 45 while permitting it to rock on the surface 45a. A holding washer 48 is disposed at the opposite face of the movable contact 22, likewise has an elongated slot 48a which accommodates the fin 46. Thus the fin 46 holds both the movable contact 22 and the washer 48 in proper position axially of the frame opening. The washer 48 has a curvilinear surface 48b which is convex toward the surface 45a. A coil spring 49 is interposed between the opposite face of the washer 48 and an end frame member 50. The opposite end frame member is provided with a central boss 51 which is received within the spring 49 to maintain it in proper position. Thus the movable contact 22 is a leaf spring and is mounted for limited rocking movement on the carrier 21, for yieldable movement bodily in one direction endwise of the path of the carrier against the force of the spring 49 to relieve stresses, and for resilient flexure flatwise.

Referring next to the adapter 10, the adapter comprises a relatively flat body 60 of molded insulating material having an external annular flange 61 extending from one face normal to the plane thereof. The body 60 has a central opening 62 and a plurality of bolt holes

63 for receiving the bolts 39 and 40 which bolt the units to the flange 3 of the push button housing 2. The body has suitable aligning sockets 65 which are open at its forward face and are arranged to receive the bosses 35 on the rear face of the flange 3, and to restrain them from movement circumferentially. Suitable internal guide walls 66 are provided adjacent the sockets 65 for assisting in properly centering the adapter relative to the rear face of the flange 3.

The rear face of the adapter body 60 is provided with suitable bosses 67 surrounding the passages 63 extending endwise of the adapter. These bosses 67 are positioned so as to be received in the open ends of aligned bosses 34 and aligned cooperating recesses 37 and 39 at the inner juxtaposed faces of a pair of switch units.

It is to be noted that the contact portions 22a have curvilinear convex contact surfaces for engaging the contact portions 20d. Due to the curvilinear shape of the surfaces 45a and 48a, the shape of the contact surfaces of the portions 22a, the flexure of the contact 22 under the force applied by the push button 24 or the return spring 26 when the surfaces 22a are in contact with either set of contact portions 20d, a wiping action occurs between the surfaces of the portions 22a and 22d.

For example, when such contact is made, the contact 22 flexes to arcuate shape about the surface 45a or 48a, thus moving the portions 22a closer together; thereby causing a positive wiping action which is particularly desirable for low voltage circuits.

The spring 49 limits the pressure on the contacts and relieves opening 22 from overstress when the normally open contacts are built up for sequencing by combining a number of switch units with their push buttons 24 in end to end engagement. The spring 49 acts as an over-travel spring which prevents damage to the leaf spring contact 22 when the push button is moved beyond its normal required range of travel.

Preferably the bosses 67 are of the proper diameter to fit snugly in the open ends of the aligned bosses 34 and the passages formed by adjacent recesses 34 and 39 in the unit, for holding the adapter firmly in position circumferentially of the central opening 62. The central opening 62 is of adequate size so that, when so installed, the push buttons 24 of two switch units with juxtaposed inner faces are exposed through the opening in position to be engaged and operated by the disc 8 of the push button 1.

Having thus described our invention, we claim:

1. In an electric switch,
 - a body of electrical insulating material,
 - a pair of stationary contacts therein, and spaced edge-wise of the body from each other;
 - a carrier disposed between the contacts and mounted for guided movement in a linear path extending endwise of the body,
 - a push button on, and movable with, the carrier and extending out of one end of the body,
 - return means in the body and connected to the carrier;
 - said carrier having a frame portion with a passage therethrough which extends transversely of its path and edgewise of the body;
 - a tongue in the passage on one wall thereof and projecting in a direction transversely of the passage in a direction endwise of the body and path,
 - a flexible metal contact bridge extending through the passage and having a slot therethrough accommodating the tongue and juxtaposed against said one wall of the carrier,
 - and resilient means in the passage urging the bridge against said one wall.
2. A structure according to claim 1 wherein the resilient means is a spring operatively interposed between the bridge and a wall of the passage of the carrier disposed opposite from the bridge.

3. A structure according to claim 1 wherein an insulating washer is provided and has an opening therein, and has a face juxtaposed against the bridge at the face opposite said one wall, the tongue is accommodated in a passage on the washer, and the spring bears against the washer at a wall portion opposite said one face, and said face and one wall each being curvilinear and convex toward the bridge, each about an associated axis extending transversely of said passage.

4. In an electric switch assembly;

a hollow body of insulating material having an inner wall, an outer wall, side walls, and end walls;
a movable contact carrier mounted in the body for movement to and fro in a path extending endwise of the body;

movable contacts on the carrier;

an outer boss on the outer wall and extending endwise of the body path, and

a pair of stationary contacts having terminals, respectively, each terminal with a conductor engaging face disposed externally of the body at said outer face, said conductor engaging face of the pair being arranged one at one side of the boss and one at the other side of the boss, and being oblique relative to a plane extending forwardly and rearwardly of the body and lengthwise of the boss, and being oblique relative to each other;

a recess in the inner wall of the body adjacent one of the side walls and extending endwise of the body and open at the ends of the body;

an inner boss on the inner wall of the body adjacent the other one of the side walls;

the bosses having passages therethrough, respectively, extending endwise of the body and operative to accommodate bolt means for securing the body to a support, and having shoulders, respectively, facing endwise of the body for cooperation with heads of bolt means so accommodated;

a push button on the carrier and extending out of one end of the body and movable with the carrier;

a duplicate switch is provided;

the inner walls of the bodies are complementary so that when the inner walls are juxtaposed with the said one side of one body at said other side of the other body, the inner boss of each body is accommodated in the recess of the other body; and

the recess of each body affords access by bolt means to the passage in the associated inner boss of the other body.

5. The structure according to claim 4 wherein said conductor engaging faces lie in planes which extend generally forwardly and rearwardly of the body and which are convergent in a direction toward the boss.

6. A structure according to claim 4 wherein said first mentioned plane bisects the angle of convergence of the planes of said conductor engaging portions.

7. The structure according to claim 4 wherein the switch is a double pole double throw switch and includes a second pair of stationary contacts having conductor engaging faces arranged as are the conductor engaging faces of the first pair of contacts, and all of the conductor engaging faces at one side of the said plane are parallel to each other, and those conductor engaging faces at the other side of said plane are parallel to each other.

8. The structure according to claim 4 wherein a push button operator is provided and comprises a housing and an operator element mounted therein for movement along a predetermined path, said housing and body being disposed with said one end of the body adjacent one end of the housing with the operator element aligned with the push buttons of the switch assembly for operating the same upon movement of the element along said path, an adaptor plate of electrical insulating material having a forward end contoured for fitting the rear end and rear margin of the housing and having a rear end contoured for fitting said one end of the body, and disposed between the housing and body, bolt means extending through the passages in said bosses and through the adapter and securing the housing and body tightly together with the adapter therebetween and firmly juxtaposed against the housing and body, and said adapter having a preselected thickness for assuring preselected electrical clearance between the housing and body.

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