Dec. 1, 1942. W. C. FURNAS ET AL 2,303,833

PUSH BUTTON SWITCH ASSEMBLY

Filed May 31, 1941 3 Sheets-Sheet 1

Fig. 1.

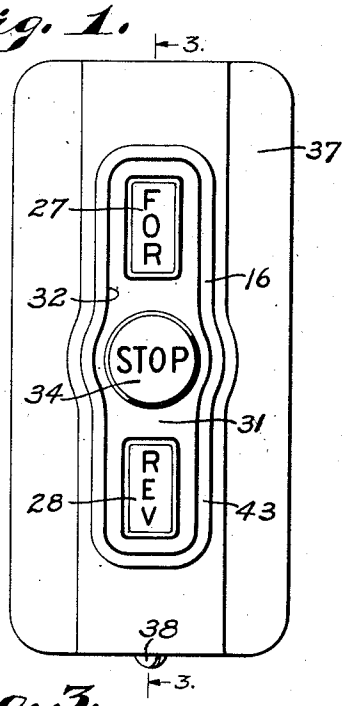


Fig. 2.

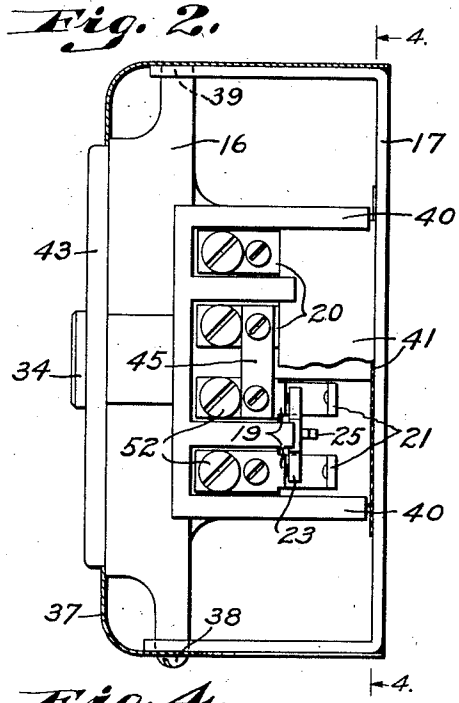


Fig. 3.

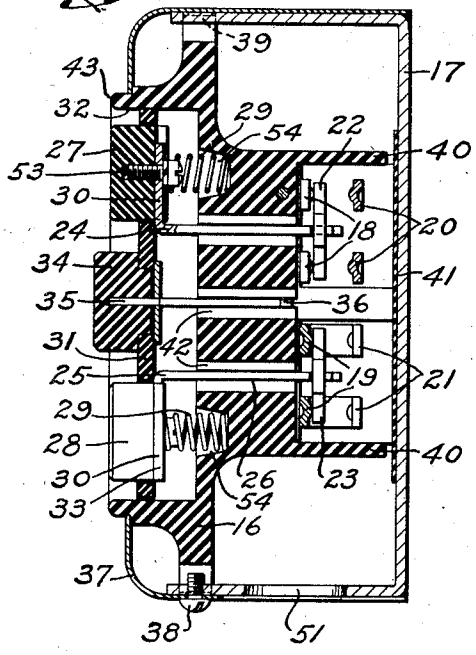
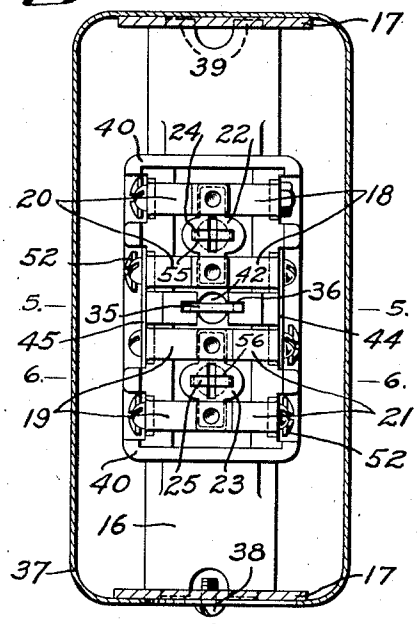


Fig. 4.



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PUSH BUTTON SWITCH ASSEMBLY

Filed May 31, 1941 3 Sheets-Sheet 2

Fig. 5.

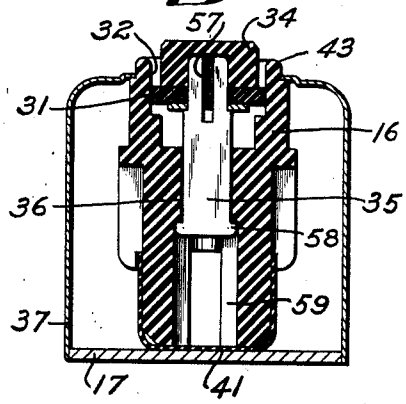


Fig. 6.

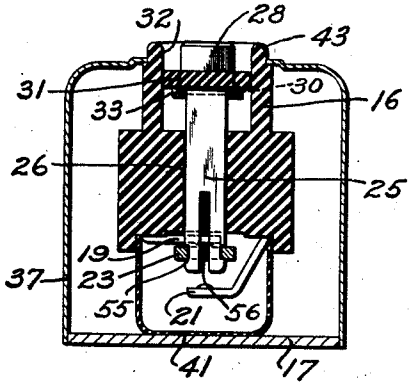


Fig. 7.

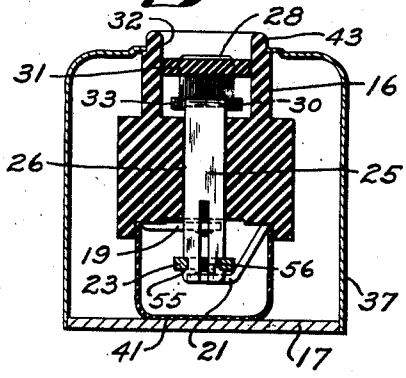


Fig. 8.

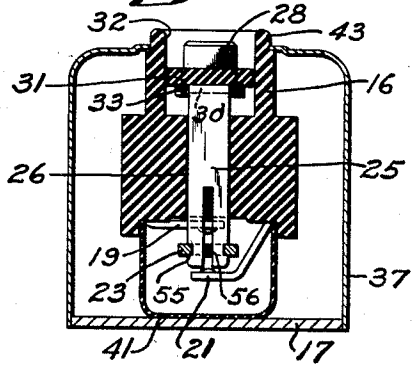
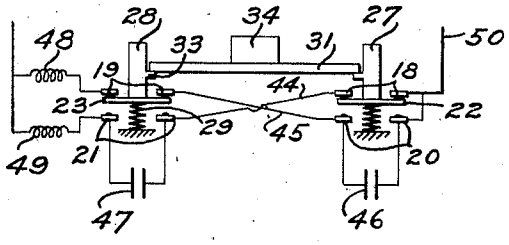


Fig. 9.



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PUSH BUTTON SWITCH ASSEMBLY

Filed May 31, 1941 3 Sheets-Sheet 3

Fig. 10.

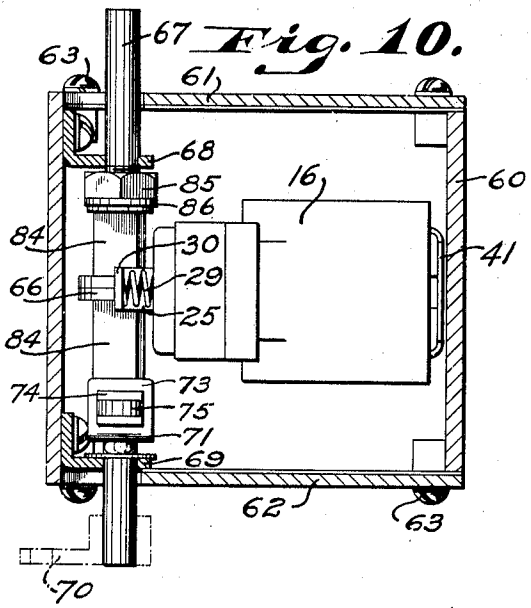


Fig. 13.

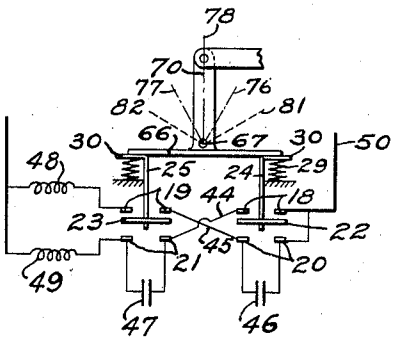


Fig. 11

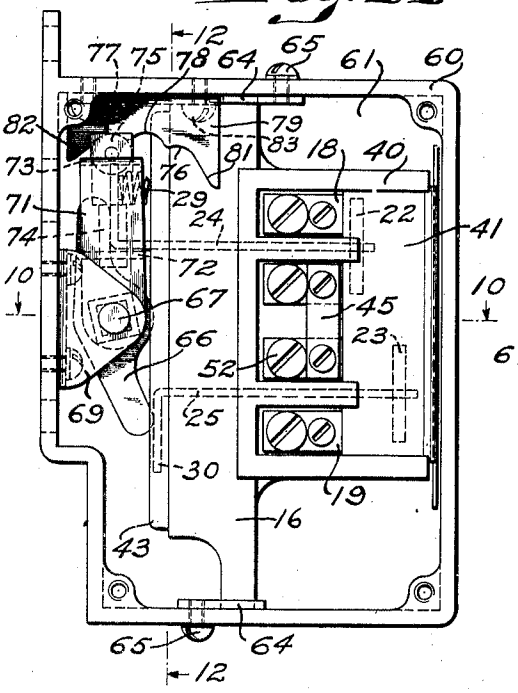
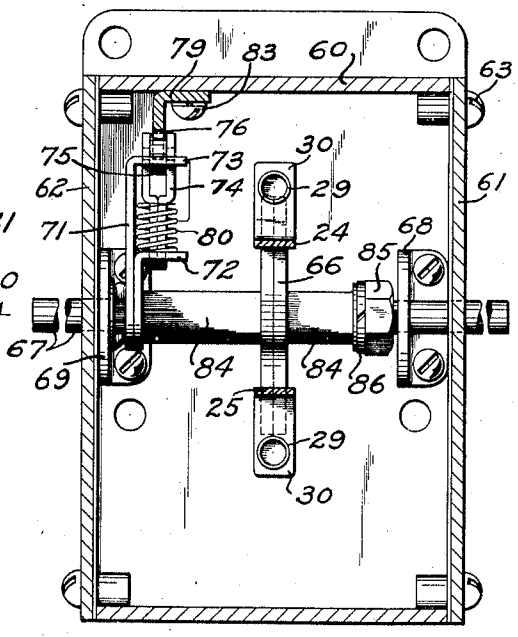


Fig. 12.



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Patented Dec. 1, 1942

2,303,833

UNITED STATES PATENT OFFICE

2,303,833

PUSH BUTTON SWITCH ASSEMBLY

William C. Furnas and Daniel G. Spotts, Batavia, Ill.; said Spotts assignor of his entire right to said William C. Furnas, doing business as Furnas Electric Company, Batavia, Ill.

Application May 31, 1941, Serial No. 396,088

7 Claims. (Cl. 200—5)

Our present invention relates in general to electric switch assemblages, and relates more particularly to various improvements in the construction and operation of push button switches and to improvements in mechanism for effecting actuation of such switches.

Generally defined, an object of the present invention is to provide a new and useful push button switch assembly, which is extremely simple, compact and durable in construction, and which is moreover highly efficient in operation.

Some of the more important specific objects of the invention are as follows:

To provide an improved control switch especially adapted to cooperate with the interlock mechanism of a magnetically actuated reversing switch or the like.

To provide an improved push button switch unit for controlling the operation of reversible electrical devices, and which may be actuated either manually or mechanically.

To provide an improved control switch of the push button type, which can be utilized in conjunction with either single or multiple-phase electrical systems.

To provide an improved switch assemblage having forward and reverse controls operable either independently, or simultaneously with the aid of a common control member.

To provide an improved forward, reverse or stop switch mechanism, which is durable and extremely compact in structure, and wherein the various parts are effectively insulated and protected so as to insure safe operation.

To provide a neat and highly attractive forward and reverse control switch unit which is quickly and conveniently manipulable, and which is also positive in action.

To provide improved mechanism for mechanically and automatically actuating a push button switch assembly having multiple controls associated therewith.

To provide a push button switch for high power service, the various parts of which may be readily constructed and assembled, and which can be conveniently installed in an electrical system.

To provide various improvements in the construction and operation of multiple circuit control push button switches, whereby the cost of construction of such devices is reduced to a minimum, and the efficiency and utility thereof is enhanced to a maximum.

These and other specific objects and advantages of our present improvement will be apparent from the following detailed description.

A clear conception of the various improved features constituting our present invention, and of the mode of constructing and of utilizing push button reverse control and stop switch assemblages built in accordance with the improvement, may be had by referring to the drawings accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the several views.

Fig. 1 is a front view of one of the improved push button switch assemblages showing the forward, reverse, and stop push buttons in elevation;

Fig. 2 is a vertical section through removable housing of the push button switch assembly, showing a side elevation of the contact carrier block and of several sets of contacts;

Fig. 3 is a central vertical section through the improved switch unit, taken along the line 3—3 of Fig. 1 and showing some of the contacts in section while others are shown in elevation;

Fig. 4 is a transverse vertical section through the switch assemblage, taken along the line 4—4 of Fig. 2, near the base of the structure;

Fig. 5 is a central horizontal section through the push button switch, taken through the stop button and along the line 5—5 of Fig. 4;

Fig. 6 is a transverse horizontal section taken along the line 6—6 of Fig. 4 and showing the reverse push button in normal position;

Fig. 7 is a transverse section like that of Fig. 6, but showing the reverse push button pressed down and in action;

Fig. 8 is another similar transverse section, but showing the stop button pressed down and effective to break all circuits.

Fig. 9 is a diagram showing the application of the improved push button switch to an electrical system having magnetically actuated forward and reverse interlock mechanisms associated therewith;

Fig. 10 is a transverse horizontal section through an improved cam mechanism for effecting mechanical actuation of the improved push button switch unit, the section being taken along the line 10—10 of Fig. 11;

Fig. 11 is a side elevation of the improved push button switch and mechanical actuating mechanism therefor;

Fig. 12 is a vertical transverse section through the improved mechanical actuating mechanism, taken along the line 12—12 of Fig. 11; and

Fig. 13 is a diagram similar to that of Fig. 9 but showing the mechanical actuating mechanism applied to the switch mechanism.

While the invention has been shown and described in conjunction with a forward, reverse and stop push button switch disposed in a particular position and especially cooperable with magnetically actuated interlock mechanism, it is not desired to thereby unnecessarily restrict the scope or utility of the improved features, and the switch can obviously be disposed otherwise than vertical as shown.

Referring to Figs. 1 to 9 inclusive of the drawings, the improved push button switch unit shown therein, is especially adapted for cooperation with the magnetically actuated interlock mechanism of a reversing electrical system, and comprises in general a contact support or carrier block 16 formed of insulating material and being rigidly secured to a U-shaped metal supporting bracket or frame 17; sets of upper and lower fixed forward and reverse normally connected or closed contacts 18, 19 respectively, firmly secured to the rear portion of the carrier block 16; sets of upper and lower fixed forward and reverse normally disconnected or open contacts 20, 21 spaced rearwardly from the contacts 18, 19 respectively and being suspended from the block 16; upper and lower forward and reverse movable contacts 22, 23 respectively, carried by upper and lower angular slide bars 24, 25 coacting with parallel slots 26 in the block 16, and being movable between the fixed closed and open contacts by means of forward and reverse buttons 27, 28 respectively; compression springs 29 interposed between the off-set ends 30 of the bars 24, 25 and the block 16, for constantly urging the movable contacts 22, 23 toward the corresponding fixed closed contacts 18, 19; an elongated plate 31 of insulation slidably confined within a recess 32 in the front of the block 16 and being cooperable with shoulders 33 on the opposite sides of the forward and reverse buttons 27, 28 to simultaneously push these buttons rearwardly; a central stop button 34 rigidly attached to the medial portion of the plate 31 and having a central guide and retaining bar 35 cooperable with parallel slots 36 formed in the block 16; and a housing or enclosing cover 37 detachably secured to the frame 17 by a screw 38 and coacting with the block 16 and the frame to conceal the several contacts.

As previously indicated, the contact carrier block 16 is preferably formed of insulating material, and the upper and lower ends of this block are provided with spaced lugs 39 coacting with punched holes in the U-shaped frame 17 so as to rigidly interconnect these elements, see Figs. 2, 3 and 4. The rear portion of the block 16 is provided with integral flanges 40, and a U-shaped insulation shield 41 coacts with the frame 17 and with the flanges 40 to provide an enclosed zone within which the several contacts are normally confined. The sets of parallel slots 26, 36 which are formed in the contact carrier block 16 are preferably separated by circular holes 42 as shown in Figs. 3 and 4, in order to reduce the friction, and the foremost portion of the block 16 adjacent to the recess 32 forms a bead 43 projecting outwardly beyond the cover 37 and functioning to properly position the same.

The adjacent fixed normally closed and open contacts 18, 21 are interconnected by means of a permanent conductor plate 44, and the opposite adjacent fixed normally closed and open contacts 19, 20 are likewise interconnected by means of a permanent conductor plate 45. The open contacts 20, 21 are normally connected to interlock mechanisms or contacts 46, 47 which are respectively operable by means for forward and reverse electromagnet assemblages 48, 49 as shown diagrammatically in Fig. 9; and the main power line 50 may be connected to the outer contacts 18, 20 while the magnet assemblages 48, 49 are connected in series with the outer contacts 19, 21. The conductors may be introduced into the enclosure afforded by the frame 17 and cover 37 through an opening 51, and may be connected to the proper contacts by means of terminal screws 52, see Figs. 2, 3 and 4.

The supporting frame 17, contacts 18, 19, 20, 21, 22, 23, bars 24, 25, 35, and cover 37 may all be formed of sheet metal with the aid of punches and dies; and the push buttons 27, 28, 34 may be formed of moulded insulation the same as the block 16, while the plate 31 may either be formed of moulded insulation or of plate insulation stock. The sliding guide bars 24, 25 which carry the movable contacts 22, 23, have their outer ends 30 bent laterally and secured to the forward and reverse buttons 27, 28 respectively by means of attaching screws 53 within recesses in these buttons, and the springs 29 are retained within confining sockets 54 in the block 16 by these same screws 53. The opposite ends of these contact carrier bars 24, 25 are bifurcated as shown in Figs. 4 and 6, and are provided with notches 55 which are sprung into central slots 56 in the contacts 22, 23 to flexibly suspend the latter and to permit slight lateral rocking thereof. The fixed contacts 18, 19, 20, 21 are all rather rigidly suspended from the block 16, but the movable contacts 22, 23 can rock slightly, so that perfect electrical engagement will be assured between the various contacts during normal use of the switch. The central guide bar 35 which is freely slidable in the slots 36, has its forward end 57 bifurcated and sprung into the stop button 34 and plate 31, while its opposite end is provided with laterally projecting retainer lugs 58 slidable in grooves 59, as shown in Fig. 5. All of the elements of the switch assembly may be conveniently constructed and assembled, and are normally concealed and protected by the housing cover 37 which may however be readily removed for access and inspection purposes.

During normal use of the improved manually operable reversing switch assemblage shown in Figs. 1 to 9 inclusive, and assuming the switch to have been properly introduced in an electrical circuit having magnetically actuated interlocks as shown in Fig. 9, the buttons 27, 28, 34 and the plate 31 will normally be positioned as shown in Figs. 3 and 9 with the movable contacts 22, 23 engaging the fixed closed contacts 18, 19. The springs 29 will normally maintain the elements in such position, and these springs 29 while coacting directly with the buttons 27, 28, also coact indirectly with the plate 31 and stop button 34 through the flanges 33 formed on the opposite sides of the buttons 27, 28.

If it becomes desirable to operate the electrical mechanism for reverse, the reverse push button 28 may be pressed and thereby moved from the position shown in Fig. 6 to that shown in Fig. 7. The movable contact 23 will then engage the normally open contacts 21 and will thereby energize the electromagnet 49, and will cause the interlock contacts 47 to close and become effective. The reversible electrical device which may be an electric motor or any other suitable apparatus,

will then operate in reverse and will continue to so operate as long as the interlock contacts 47 are held in active or closed position by the electromagnet 49, even if the push button 28 is released. When the push button 28 is released, it will return to normal position in engagement with the plate 31, and if the stop button 34 is subsequently pressed, the movable contacts will be shifted to the position shown in Fig. 8 and the electrical circuit through the contacts 47 and electromagnet 49 will be broken since both movable contacts 22, 23 will then be carried out of engagement with all of the fixed contacts. Upon release of the stop button 34, the mechanism will again assume the position shown in Figs. 3 and 9 and will be ready for either subsequent reverse operation or for forward operation.

If it becomes desirable to produce forward operation of the motor or other electrical device, it is only necessary to press the forward push button 27 whereupon the movable contact 22 will be carried into engagement with the fixed normally open contacts 20 and the electromagnet 48 will be energized thereby causing the interlock contacts 46 to close. Upon release of the push button 27, this button will return to normal position by the spring 29, but the interlock contacts 46 and the electromagnet 48 will remain active until the stop push button 34 is again manipulated. When the button 34 is pressed, both movable contacts 22, 23 will again be carried into mid-position as shown in Fig. 8, thereby opening all circuits and de-energizing the electromagnet 48. Upon release of the button 34, the springs 29 will again return all buttons to neutral position as shown in Figs. 3 and 9 and the switch mechanism is again ready for subsequent either forward or reverse operation. If it becomes desirable to produce reverse operation of the motor or other device, while the same is operating in forward direction, it is only necessary to press the reverse push button 28 which then moves from the position shown in Fig. 6 to that of Fig. 7. This actuation causes the movable contact 23 to first disengage the fixed contacts 19 which in turn de-energizes the forward mechanism, and as the movable contact 23 engages the other fixed contacts 21 the reverse mechanism will become effective. The conversion from forward to reverse operation may therefore be effected directly and without first manipulating the stop button 34 by merely pushing the reverse button 28; and such direct conversion from reverse to forward operation can likewise be effected by merely pressing the forward button 27 when the reverse mechanism is in action.

While the manual operation just described may be satisfactory for most uses of the improved push button switch unit, it sometimes becomes desirable to have the improved switch mechanism automatically operable, and such operation may also be effected by utilizing the improved switch actuating assemblage shown in Figs. 10 to 13 inclusive. The mechanically actuated switch unit embodies the same contact supporting block 16 but with the upper retaining lugs 39 removed, and also embodies the same contact assemblage including the fixed normally closed and open contacts 18, 19, 20, 21, and the movable contacts 22, 23 carried by actuating bars 24, 25 slidable in the block 16. However, the supporting frame 17 has been replaced by an approximately rectangular frame 60 provided with removable covers 61, 62 secured to its opposite sides by means of screws 63. The contact carrier block is secured within the frame 60 by means of cleats 64 and other screws 65, and the push buttons 27, 28, 34 as well as the plate 31 have been omitted and replaced by a double cam 66 fixedly mounted upon an oscillatory shaft 67 supported in bearings 68, 69 secured to the frame 60. The upper swinging end of the lever cam 66 coacts with the upwardly offset end 30 of the upper bar 24 which carries the movable contacts 22, while the lower swinging end of this cam 66 coacts with the downwardly offset end of the lower bar 25 which carries the other movable contact 23, and the compression springs 29 constantly maintain the offset bar ends in engagement with the respective ends of the cam lever. The oscillatory cam supporting shaft 67 projects through the covers 61, 62 and one end thereof may be provided with a positioning lever 70 shown in dot-and-dash lines in Fig. 10, and in solid lines in Fig. 13, and this lever 70 may be responsive to various conditions of operation of the reversible electrical motor or other device the operation of which is being controlled. The lever 70 may also be manually operable, and in order to frictionally retain the switch contacts in either neutral or forward or reverse stop position, the shaft 67 is also provided with a rigidly attached bracket or arm 71 having spaced flanges 72, 73 in which a latch bar 74 is slidably confined. The outer end of the bar 74 carries a roller 75 which is frictionally cooperable with forward and reverse spaced holding notches 76, 77 respectively, and with a central stop notch 78 formed in a fixed positioning plate 79 secured to the frame 60. The bar 74 and roller 75 are constantly urged toward the plate 79 by a compression spring 80 embracing the inner bar end and reacting against the flange 72, and the plate 79 also has cam end surfaces 81, 82 located outwardly beyond the holding notches 76, 77 respectively, which permit the shaft 67 to be forcibly swung beyond the hold notches 76, 77 in order to energize the interlock actuating magnets 48, 49, but which also return the roller 75 to hold position without interrupting the interlock circuit, when the actuating force is released. The plate 79 may be adjustably secured to the frame 60 by means of screws 83, and the medial square portion of the shaft 67 on opposite sides of the lever cam 66 is preferably embraced by square insulating sleeves 84 clamped in position by a nut 85 threaded on the shaft and coacting with a lock washer 86.

During normal use of the improved automatically operable reversing switch assemblage shown in Figs. 10 to 13 inclusive, and assuming the switch to have been properly introduced in an electrical circuit having mechanically actuated interlocks as shown in Fig. 13, the actuating lever 70 and the lever cam 66 will normally be in stop position as shown in Fig. 13 with the movable contacts 22, 23 out of engagement with all of the fixed contacts so that the circuit through both sets of contacts will be interrupted. While the retaining notches 76, 77, 78 and the cam surfaces 81, 82 have not actually been shown in the diagram of Fig. 13, the corresponding positions of the lever 70 are shown and are correspondingly numbered.

If it becomes desirable to operate the electrical system in reverse, the lever 70 and the lever cam 66 may be swung in a counter-clockwise direction from the position shown in Fig. 13, thereby first causing the movable contact 22 to engage the fixed contacts 18, and subsequently causing the movable contact 23 to engage the fixed contacts 21. This sequence of actions is produced by the

formation of the notches and cam surfaces on the plate 70, and when the actuating force on the lever 70 is released, the cam 82 will automatically cause the roller 75 to engage the reverse holding notch 77, thereby maintaining the movable contact 22 closed and in engagement with the fixed contacts 18, while permitting the spring 29 to withdraw the other movable contact 23 from the fixed contacts 21. The electro-magnet 40 will remain energized so that the reverse interlock contacts 47 will remain closed as long as the line contacts 18 are engaged by the movable contact 22; and in order to break the reverse interlock circuit, it is necessary to return the lever 70 to neutral position with the roller 75 engaging the notch 76 as shown in Fig. 13, whereupon all circuits will be interrupted.

If it becomes desirable to produce forward operation of the reversible electrical device, the lever 70 should be swung in a clockwise direction from the position shown in Fig. 13, whereupon the movable contact 23 will first engage the fixed contacts 19 to close the line circuit, and the movable contact 22 will subsequently engage the fixed contacts 20 to complete the magnetic circuit and to energize the forward magnet 43, thereby causing the interlock contacts 46 to close. Upon release of the lever 70, the roller 75 will be forced by the cam surface 81 to engage the notch 76 and while the movable contact 22 will be withdrawn from the fixed contacts 20, the other movable contact 23 will remain closed and in engagement with the fixed contacts 19, thereby maintaining the interlock contacts 46 closed until all electrical circuits are subsequently interrupted. Such interruption may be effected by returning the lever 70 to neutral position with the roller 75 in engagement with the notch 76, and from this neutral position the mechanism may be quickly thrown into either forward or reverse position. The lever 70 may also be swung quickly from one extreme position to the other to thereby convert the system directly from forward to reverse operation, or vice versa, without arresting the lever in stop position.

From the foregoing detailed description it will be apparent that the present invention provides an improved push button switch assemblage which is extremely simple, compact and durable in construction, and which is moreover rapid in action and efficient in operation. The improved push button assemblage is especially adapted for use in conjunction with an electrical system having forward and reverse interlocks associated therewith, and can be either manually or automatically actuated to effectively produce the desired results. The improved switch mechanism may obviously be utilized either in conjunction with single or poly-phase electrical systems, and the forward and reverse controls while being interchangeably operable to effect forward and reverse operation, may be simultaneously returned to neutral with the aid of a common control lever or push button. The various elements of the improved switch assembly are effectively insulated and protected in order to insure safe operation, and the improved switch mechanism is especially adapted for use in relatively high power electrical systems wherein absolute assurance against short circuiting is necessary. The various elements of both the switch and mechanical control may obviously be manufactured and assembled at moderate cost, and the units may also be conveniently applied to electrical systems in the manner shown in the several diagrams. The improved switch assemblage has proven highly successful in actual use, and presents an extremely neat and attractive appearance as will be apparent from the drawings.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation, herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

We claim:

1. A switch comprising, a unitary support having recesses in its opposite sides connected by three parallel guide-ways, laterally spaced sets of contacts fixedly mounted in one of said recesses, other similarly spaced sets of fixed contacts mounted in the same recess and being separated from said first mentioned contacts by spaces, independent sets of movable contacts carried within said spaces by bars slidably engaging the two outer guide-ways and penetrating said support, said bars having oppositely outwardly off-set portions remote from said contacts and extending away from each other, spring means coacting with said support and with said off-set portions for constantly urging said movable contacts in one direction, independently operable push buttons co-operable directly with said off-set portions within the other of said recesses for moving said movable contacts in the opposite direction, and another push button located between said independently operable buttons and being slidably mounted within said other recess and cooperable with said off-set portions to simultaneously move said movable contacts.

2. A switch comprising, a unitary support having three laterally separated parallel elongated guide-ways connecting its opposite sides, laterally spaced fixed contacts mounted on one side of said support, other similarly spaced fixed contacts mounted on the same side of said support and being separated from said first mentioned contacts by spaces, two independent movable contacts carried within said spaces by laterally separated parallel bars slidably engaging the two outer guide-ways and penetrating said support, said bars having oppositely outwardly off-set portions remote from said contacts and extending over the opposite side of said support, springs interposed between said support and said off-set portions, independently operable push-buttons coacting with said off-set portions for compressing said springs, and a common actuator for said push buttons coacting with the intermediate guide-way of said support and being simultaneously cooperable with both of said movable contacts.

3. A switch comprising, a unitary support having three parallel guide-ways connecting recesses in its opposite sides, laterally spaced fixed contacts mounted on one side of said support in one of said recesses, other similarly spaced fixed contacts mounted in the same recess of said support and being separated from said first mentioned contacts by spaces, two independent movable contacts carried within said spaces by parallel bars slidably engaging the two outer guide-ways and penetrating said support, said bars having oppositely outwardly off-set portions remote from said contacts and extending over the opposite side of said support within the other of said recesses, springs interposed between said support and said off-set portions, push buttons coacting with said off-set portions within said

other recess for independently moving said bars in one direction, and another push button coacting with the intermediate guide-way between said off-set portions and being slidable in said other recess to simultaneously move said bars.

4. A switch comprising, a unitary support having three parallel guide-ways connecting its opposite sides, laterally spaced fixed contacts mounted on one side of said support, other similarly spaced fixed contacts mounted on the same side of said support and being separated from said first mentioned contacts by spaces, two independent movable contacts carried within said spaces by parallel bars slidably engaging the two outer guide-ways and penetrating said support, said bars having oppositely outwardly off-set portions remote from said contacts and extending over the opposite side of said support, springs interposed between said support and said off-set portions, laterally of said bars, independently operable push buttons coacting with said off-set portions and having peripheral projections, and a plate coacting with the intermediate guide-way and slidable upon said support and being engageable with said button projections to simultaneously actuate the buttons.

5. A switch comprising, a unitary support having three laterally separated guide-ways connecting its opposite sides, laterally spaced fixed contacts mounted on one side of said support, other similarly spaced fixed contacts mounted on the same side of said support and being separated from said first mentioned contacts by spaces, two independent movable contacts carried within said spaces by laterally separated bars slidably engaging the two outer guide-ways and penetrating said support, said bars having oppositely off-set portions remote from said contacts and extending over the opposite side of said support, springs interposed between said support and said off-set portions, independently operable push buttons coacting with said off-set portions and having peripheral projections, a plate coacting with the intermediate guide-way and slidable upon said support and being engageable with said button projections, and another push button coacting with said plate midway between said off-set bar portions for simultaneously actuating said independently operable buttons.

6. A switch comprising, a unitary support having three parallel guide-ways connecting its opposite sides, laterally spaced fixed contacts mounted on one side of said support, independent movable contacts carried by parallel bars slidably engaging the two outer guide-ways and penetrating said support, said movable contacts being cooperable with said fixed contacts and said bars having oppositely off-set portions remote from said contacts and extending laterally thereof over the opposite side of said support, springs interposed between said support and said off-set bar portions, an independently operable push button coacting directly with each of said off-set portions in opposition to the adjacent spring, and a common actuating plate for said push buttons coacting with the intermediate guide-way and being simultaneously engageable with both of said buttons.

7. A switch comprising, a unitary support having three laterally separated guide-ways connecting recesses in its opposite sides, laterally spaced fixed contacts mounted in one of said recesses, independent movable contacts coacting with said fixed contacts and being carried by laterally separated bars slidably engaging the two outer guide-ways and penetrating said support, said bars having oppositely off-set portions in the other of said recesses extending laterally thereof, springs interposed between said support and said off-set portions, a push button coacting directly with each of said off-set portions in opposition to the adjacent spring and eccentrically of the adjacent bar, and a common actuating plate for said push buttons slidable within said other recess and coacting with the intermediate guide-way, said plate being movable in a direction parallel to the direction of extent of said guide-ways to simultaneously actuate both of said push buttons.

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