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C. MILLER ET AL

1,944,522

PUSH BUTTON SWITCH CONSTRUCTION

Filed June 21, 1930

Fig. 1.

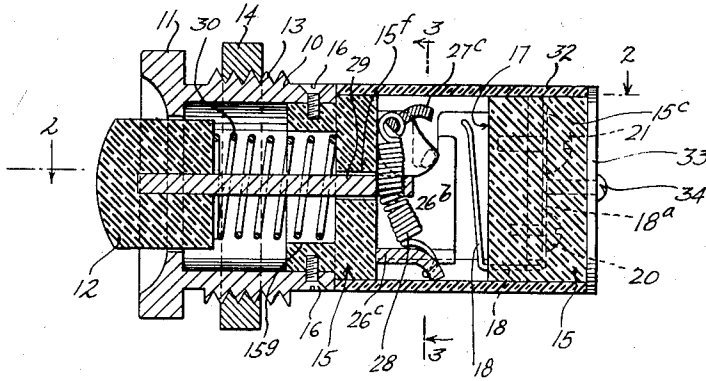


Fig. 2.

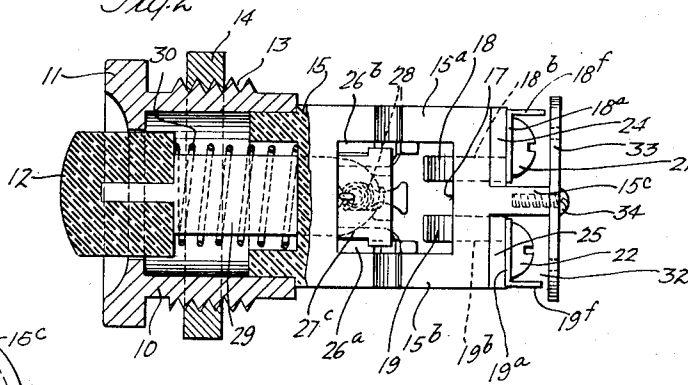


Fig. 3.

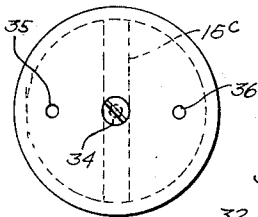


Fig. 4.

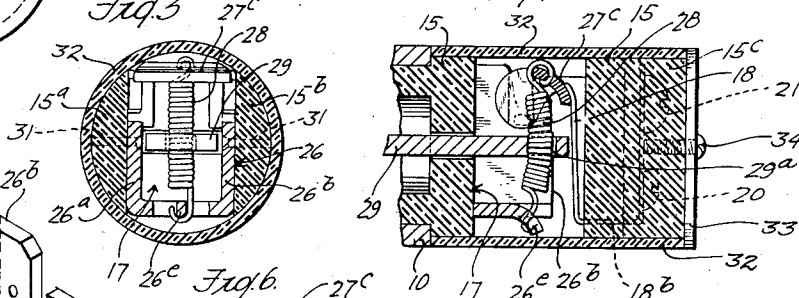


Fig. 5.

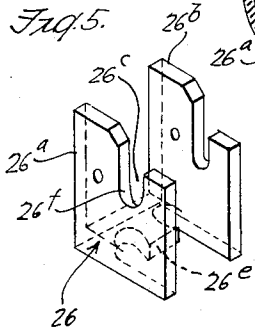
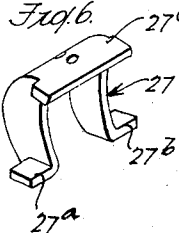


Fig. 6.



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PUSH BUTTON SWITCH CONSTRUCTION

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16 Claims. (Cl. 200—67)

This invention relates to circuit-controlling devices, and more particularly to push button switches.

One of the objects of this invention is to provide a simple and thoroughly practical push button switch construction capable of rapid and inexpensive manufacture, of thoroughly reliable action and of long-continued service in practical use. Another object is to provide a compact push button switch construction having a quick make-and-break action by means of mechanism of simple and rugged construction and the parts of which are capable of rapid manufacture and ease of assembly. Another object is to provide a push button switch construction capable of ready attachment to a wall or conduit box. Another object is to provide a push button switch construction of the above-mentioned character capable of long-continued and dependable operation in circuits of commercial voltages like 110 volts. Another object is to provide a push button switch construction having a quick make-and-break action and operating to maintain the switch in operated condition only so long as the push button remains or is held depressed. Another object is to provide a push button switch construction of the above-mentioned character in which the moving parts may be constructed ruggedly and of relatively heavy material, all without sacrifice of compactness of construction or dependability and simplicity of operation and action. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which is shown one of various possible embodiments of our invention,

Figure 1 is a vertical central sectional view of the assembled push button switch showing the parts in their normal position ready for manual actuation;

Figure 2 is a horizontal sectional view, as seen along the line 2—2 of Figure 1;

Figure 3 is a vertical sectional view, as seen along the line 3—3 of Figure 1;

Figure 4 is a view similar to that of Figure 1 excepting that certain parts are shown in their operated position and certain parts being broken away for greater simplicity of illustration;

Figure 5 is a perspective view of a metal in-

sert acting as a guide for various parts and as a bearing for certain moving parts;

Figure 6 is a perspective view of a contact shoe; and

Figure 7 is an end view of the switch construction as seen from the right in Figure 1.

Similar reference characters refer to similar parts throughout the several views of the drawing.

Referring now again to the drawing and more particularly to Figures 1 and 2, there is shown a metallic sleeve-like member 10 flanged, as at 11, at its left-hand end, as viewed in the drawing, the flanged portion 11 being concaved at its outer face and apertured to receive and guide a push button 12 made of any suitable material, such as hard rubber, bakelite, or the like. The sleeve 10 is exteriorly threaded as at 13 to receive a nut 14 between which and the flange 11 a wall plate, panel, or any other suitable apertured support, may be clamped to hold the assembled push button switch in position.

The sleeve member 10 which, as will be clear from the foregoing, is cylindrical and hollow, has fitted into its right-hand end a substantially cylindrical member generally indicated at 15, made of a suitable solid dielectric material, such as bakelite, hard rubber, or the like, the member 15 being suitably shouldered to abut against the right-hand end of the sleeve 10. Suitable screws 16 passing through the sleeve 10 and threaded into the portion of the member 15 that is received within the sleeve serve to hold the sleeve 10 and the member 15 in assembled relation.

The member 15, generally cylindrical as above noted, is, however, cut away, having in fact a recess 17 (see Figs. 1, 2, 3 and 4) of substantially rectangular cross-section (Fig. 2) and extending substantially transversely to the axis of the member 15, leaving side wall portions 15^a and 15^b (Figs. 2 and 3). Into this recess there extend the spring contact members 18 and 19, the latter being made up of suitable spring sheet metal, such as phosphor bronze or the like, and having portions 18^a and 19^a adapted to rest against the right-hand end face of the member 15 to which they are secured in any suitable manner. Thus the portion 18^a of the spring contact 18 is secured by a small securing screw 20 and by a larger screw 21 which serves also as a binding screw to permit a conductor to be placed in electrical connection with the contact 18. The portion 19^a (Fig. 2) is similarly secured to the right-hand end face of the member 15, the screw 22 serving both to secure the member 19 and permit the fastening

thereto of a conductor, as is clearly shown in Figure 2. The right-hand end portion of the member 15 is cut away to permit the portions 18^b and 19^b of the contacts 18 and 19 to pass from the right-hand end face of the member 15 into the recess 17. The spring contacts 18 and 19 thus extend substantially crosswise of the member 15 but within the open-ended recess 17, and it will be noted that they are of sufficient length to have, due in part to the spring material of which they are made, a good yielding action.

The securing screws above-mentioned, which hold the spring contacts 18 and 19 in place may, if desired, be threaded into the solid right-hand end portion of the solid dielectric material 15, but preferably we secure two metal plates 24 and 25 (Fig. 2) to the end face of the member 15, as by molding the plates 24 and 25 into the material of the member 15 or by the use of pins, screws, or the like. These plates 24 and 25 we preferably make of a substantially heavy plate metal and it is into these plates 24 and 25 that the securing and binding screws above-mentioned are threaded. Thus we are able to provide lasting and rigid threaded parts for receiving particularly the binding screws 21 and 22 which are more frequently manipulated.

Extending centrally and crosswise of the right-hand end face of the solid dielectric member 15 and integrally formed therewith is a flange 15^c of sufficient length in the direction of the axis of the member 15 to form a dependable partition or barrier between the portions 18^a and 19^a of the contact springs, and particularly between the binding screws, thus to insure against the possibility of a crossing of the connecting conductors leading to the binding screws 21 and 22.

Considering now the mechanism coacting with the spring contacts 18 and 19, it is first to be noted that we provide a sheet metal member 26, shown in perspective in Figure 5, adapted to function as a combined guide and support and bearing member for certain of the moving parts of the mechanism. The member 26 is shaped substantially as is clearly shown in Figure 5, being provided with spaced side walls 26^a and 26^b held in spaced relation by a cross-connecting part 26^c which in turn is provided with a lug 26^e. The side walls 26^a and 26^b are of a sufficient length in a vertical direction, as viewed in Figure 5, and are spaced apart sufficiently to be snugly received between the inside faces of the side wall portions 15^a and 15^b (Fig. 3) of the member 15. This latter relation of the parts is clearly shown in Figure 2 and also in Figure 3. Suitable pins 31 (Fig. 3) hold the sheet metal insert 26 in position in the recess 17.

The side walls 26^a and 26^b are recessed (see Fig. 5) at 26^f and 26^g, respectively, to form bearing seats for the bearing members 27^a and 27^b of a contact-bridging or shoe member 27, shown in perspective in Figure 6. The member 27 is generally of a U-shape, having a contact shoe 27^c for coaction with and for bridging the spring contacts 18 and 19.

The contact-bridging member 27, which may be struck up out of sheet metal, is assembled with respect to the insert 26 (Fig. 5) so that the bearing members 27^a and 27^b rest in the bearing seats 26^f and 26^g, the member 27 being thus mounted for oscillation toward and away from the contacts 18 and 19 (see Figs. 1 and 4). The member 27 is held in this assembled relation with respect to the insert 26 by means of a coiled spring 28, one end of which is secured to the contact shoe

portion 27^c and the other end of which is secured to the lug 26^e of the member 26, as is clearly shown in Figures 1, 3 and 4. The range of oscillating movement of the bridging member 27, limited substantially by the walls of the recess 17, is such that it may pass to either side of the substantially vertical plane or line passed through the axis of oscillation of the member 27 and the point to which the lower end of the spring 28, as viewed in Figures 1 and 4, is connected. With this arrangement the spring 28 tends to hold the bridging member 27 in whatever position that it has been moved; in Figure 1 the member 27 is shown swung to the left of the above-mentioned vertical plane or line and in Figure 4 it is shown as swung to the right. This toggle relation between the spring 28 and the bridging member 27 makes certain that the oscillating movements of the bridging member 27 are of a rapid character and take place with a so-called "snap" action, a feature of importance in making and breaking circuits of relatively high potentials, such as ordinary commercial voltages like 110 volts or the like.

Coacting with the toggle members 27 and 28 above-described, however, is a plunger 29 having its left-hand end, as viewed in Figures 1 and 2, suitably secured to the push button 12 and having its right-hand end passed through and guided by an opening 15^f in the member 15, the plunger 29 being of sufficient length to extend into the recess 17 and between the walls 26^a and 26^b of the member 26 (Fig. 3). The plunger 29 has at its right-hand end an opening 29^a (better shown in Fig. 4) through which the coiled spring 28 passes (see also Figs. 1 and 3).

Interposed between the left-hand end of the member 15 and the push button 12 is a coiled spring 30 (Figs. 1 and 2) conveniently extending about the plunger 29 and having its right-hand end preferably seated and held in a recess 15^g in the left-hand end of the member 15. Spring 30 opposes the movement of the push button 12 in a direction toward the right and is of a sufficient strength with respect to the toggle spring 29 to overcome the tension of the latter when in the position shown in Figure 4 and thus to return the parts to and hold them in the position shown in Figure 1.

An open-ended cylindrical shell 32 preferably of solid dielectric material, such as fiber, bakelite, or the like, is snugly received over the member 15 and abuts against the right-hand end of the metallic sleeve member 10 (see Figs. 1 and 4), thus closing the open ends of the recess 17. The shell or sleeve 32 is, furthermore, of a sufficient extent to have its right-hand end, as viewed in Figure 1, terminate substantially in the same plane with the outer edge of the dividing flange or barrier 15^c (Fig. 2) which separates the binding screws 21 and 22 and related parts, thus forming two well defined pockets at the extreme right-hand end of the push button switch construction for snugly housing and receiving the conductors that are connected by the binding screws 21 and 22 to the spring contacts 18 and 19.

In the operation of the device it is first to be noted that the parts normally assume the position shown in Figure 1, in which it will be seen that the spring 30 that yieldingly opposes manual depression of the push button 12 holds the bridging member 27, in coaction with the spring 28, in one of its two positions namely, in that posi-

tion in which it is out of bridging relation to the spring contacts 18 and 19.

Depression of the push button 12 by movement thereof in a direction toward the right, as viewed in Figures 1 and 2, overcomes the tension of spring 30 and effects a bowing of the spring 28 toward the right, as viewed in Figure 1. This latter action is accompanied by such a movement of the member 27 in clockwise direction as will carry the point of connection thereto of the spring 28 to the right of the substantially vertical line or plane passed through the axis of oscillation of the member 27, whereupon the spring 28, supplemented in its action by the force of the manual depression of the push button 12, snaps the contact shoe 27^c into bridging contact with the spring contacts 18 and 19. The yielding action of the latter is such that a good contact pressure is insured while the character of the movement of the contact shoe 27^c with respect to the contact springs is such that a wiping action of relatively large range takes place to insure the keeping of the contact surfaces bright, clean, and free from oxidation or corrosion. Thus the circuit is closed, the parts assuming the position shown in Figure 4, and it remains closed only as long as the push button 12 remains depressed.

Release of the push button 12 permits the spring 30 to move the button 12 and plunger 29 in a direction toward the left, the spring 30 having a strength sufficient to overcome the biasing action of the spring 28 in tending to hold the parts in the position shown in Figure 4. The spring 30 thus effects a bowing of the spring 28 in a direction toward the left, as viewed in Figure 4, a first portion of the retrograde movement of the plunger 29 being accompanied by a relatively slight movement of the point of connection of the spring 28 to the left of the substantially vertical plane or line passed through the axis of oscillation of the member 27, whereupon the bridging member 27 is quickly snapped into the position shown in Figure 1, effecting a rapid break of the circuit with accompanying diminution of arcing. The spring 30 further coacts with the spring 28 in holding the parts in the position shown in Figure 1.

Preferably the movement necessary to achieve alinement of the pivots of the toggle members when moving the bridging member 27 in circuit-opening direction is less than that necessary to achieve alinement of the pivots of the toggle members when moving the bridging member in circuit-closing direction, as will be clear from a comparison of Figures 1 and 4. Also, the contact shoe 27^c and the spring contacts 18 and 19 have a sufficiently great overlapping action so that the actual separation of the shoe from the contacts, and hence the actual breaking of the circuit, does not take place until the snap action achieved by the spring 28 and indeed supplemented by the spring 30 has come into play.

Under certain circumstances of use, we may find it desirable to remove the spring 30 so that the toggle spring 28 may alone act to hold the contact making parts in either position shown in Figure 1, or the position shown in Figure 4, the toggle spring, by reason of its connection with the push button 12 acting to hold the push button 12 in its outermost position (see Figure 1), or in its innermost position. Under these circumstances depression of the push button changes the condition of the circuit in which the contact devices are connected, while to reverse or again change that condition the push

button 12 has to be manually pulled or given a retrograde movement.

We have above pointed out that we may use the screws 21 and 22 (see Figure 2) for clamping the conductors of the circuit to the parts 18^a and 19^a, but we wish it to be understood that we may and preferably do provide upstanding ears 18^f and 19^f respectively integrally formed with the parts 18^a and 19^a for soldering the conductors in place to make the desired electrical connections to the spring contacts 18 and 19.

Preferably, also we prefer to close the pockets hereinbefore mentioned, one on either side of the barrier 15^c; this we may achieve by means of a disc 33 (Figures 1, 2 and 3) made of a suitable insulating material, such as fiber or the like, and preferably of a diameter equal to the outside diameter of the sleeve 32. This disc 33, as is better shown in Figure 7, is removably secured in closing position by means of a screw 34 threaded into the barrier 15, and is provided with suitable apertures 35 and 36 (Figure 7) through which the conductors leading to the respective pockets, one on either side of the barrier 15, may be passed for connection to the binding screws 21, 22, or to the ears 18^f, 19^f.

Thus it will be seen that there has been provided in this invention a push button switch construction in which the various objects hereinabove noted, together with many thoroughly practical advantages, are successfully achieved. It will be seen that the apparatus is well adapted for handling relatively high voltage circuits, such as circuits of usual commercial voltages like 110 volts, that it is exceedingly compact of action, and well adapted for long-continued use. For example, the coating bearing portions of the members 26 and 27 may be made of substantially heavy material to insure against rapid wear. Furthermore, it will be seen that the device is well adapted for rapid and inexpensive manufacture, and well adapted to meeting the varying conditions of hard practical use.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. In push button switch construction, in combination, a substantially cylindrical housing having a pair of contact members mounted adjacent one end thereof and having a plunger movable substantially axially of said housing at the other end thereof, a contact-bridging member mounted substantially intermediate the ends of said housing for oscillation about an axle extending substantially transversely to the axis of said housing, a coiled spring extending crosswise of said housing and coacting with said bridging member for biasing the latter to either side of the axis of oscillation of said member, said plunger having an aperture through which said coiled spring passes, and a spring for biasing said plunger in circuit opening direction.

2. In push button switch construction, in combination, a substantially cylindrical housing having a pair of contact members mounted adjacent one end thereof and having a plunger movable substantially axially of said housing at the other end thereof, a contact-bridging member mounted substantially intermediate the ends of said housing for oscillation about an axis extending

substantially transversely to the axis of said housing, means through which said plunger actuates said bridging member and acting to hold the latter on either side of its axis of oscillation, and means preventing said last-mentioned means from holding said bridging member in circuit-closing position.

3. In push button switch construction, in combination, a substantially cylindrical housing having a pair of contact members mounted adjacent one end thereof and having a plunger movable substantially axially of said housing at the other end thereof, a contact-bridging member mounted substantially intermediate the ends of said housing for oscillation about an axis extending substantially transversely to the axis of said housing, said member being substantially U-shaped and the portion connecting the legs thereof being adapted to bridge said contacts, a coiled spring anchored at one end to said housing and connected at its other end to said portion for biasing said bridging member to either side of its axis of oscillation, said plunger having an aperture through which said spring passes, and a spring operating upon said plunger and of sufficient strength to overcome the biasing action of said coiled spring.

4. In push button switch construction, in combination, a housing of insulating material having supported adjacent one end thereof two contacts, an oscillatable contact-bridging member, a metallic insert carried within said housing and provided with bearing seats for oscillatably supporting said bridging member, a spring connected to said metallic insert and acting upon said bridging member to bias the latter toward contact-bridging position, and a spring-opposed plunger for actuating said bridging member, the spring opposing said plunger having a strength sufficient to overcome the biasing effect of said first-mentioned spring.

5. In push button switch construction, in combination, a member of solid dielectric material having means at the front end thereof for guiding a push button, a push button slidably guided by said guiding means, said member having a recess near its rear end, said recess being exposed through a wall of said member, a metallic insert dimensioned to be received within said recess and provided with spaced bearing recesses, a swinging contact having portions resting in said bearing recesses, a spring connecting said swinging contact and said member and acting in a direction to hold said swinging contact portions in said bearing recesses and forming a toggle with said swinging contact, a relatively fixed contact carried by said member in a position to be engaged by said swinging contact, means anchoring said insert in said recess, said member having a passage leading from said recess toward said guiding means, and means passing through said passage and connecting said push button and said spring whereby actuation of said button actuates said toggle and said swinging contact.

6. In push button switch construction, in combination, a frame of insulating material having a recess therein and an opening entering said recess, said recess having an open end on the side of said frame, a metallic insert laterally insertable through the open end of said recess in the side of said frame and seated in said recess and provided with a pair of reentrant bearing seats, a contact carried by said frame, a circuit-controlling member having a pair of portions

adapted upon bodily movement of said member to enter said bearing seats, a spring secured to said circuit-controlling member and anchored to said frame and forming with the former a toggle, said spring acting upon said member in a direction to hold said portions seated in said bearing seats, and a plunger passing through said opening and engaging said toggle for actuating said member.

7. In push button switch construction, in combination, a metallic shell having means for securing it to a wall or the like and slidably supporting a push button of non-conducting material, a part of insulating material, a contact member carried by said shell but insulated therefrom by said insulating part, a circuit-controlling member movably supported with respect to said shell and having a circuit-closing position and a circuit-opening position with respect to said contact member, means for operating said circuit-controlling member including a metallic plunger operated by said push button and a spring for biasing said circuit-controlling member toward either of its positions, said insulating part having means for guiding said metallic plunger, and means aiding said spring when said circuit-controlling member is in one position and opposing said spring when said member is in its other position.

8. In push button switch construction, in combination, a metallic shell having means for securing it to a wall or the like and slidably supporting a push button of non-conducting material, a part of insulating material, a contact member carried by said shell but insulated therefrom by said insulating part, a circuit-controlling member movably supported with respect to said shell and having a circuit-closing position and a circuit-opening position with respect to said contact member, means for operating said circuit-controlling member including a metallic plunger operated by said push button and a spring for biasing said circuit-controlling member toward either of its positions, said insulating part having means for guiding said metallic plunger, and a spring opposing depression of said push button and having a sufficient strength to overcome the biasing action of said first-mentioned spring when said circuit-closing member assumes a position in response to depression of said push button.

9. In push button switch construction, in combination, a member of solid dielectric material having a recess extending transversely thereof, a sheet metal U-shaped insert set into said recess with the side arms thereof extending lengthwise of said recess and the cross member thereof extending transversely of said recess, said side arms being provided with bearing recesses, a relatively fixed contact, a swinging contact having portions resting in said bearing recesses, a spring connected at one end to said swinging contact and connected at its other end to the cross member of said U-shaped insert and acting in a direction to hold said swinging contact portions in said bearing recesses and forming a toggle with said swinging contact, and means for actuating said toggle.

10. In push button switch construction, in combination, a frame including a part made of solid dielectric material and having a U-shaped metallic insert therein, the side arms of said insert being provided with bearing recesses, a contact, a circuit-controlling member having two portions resting in said recesses, a spring con-

nected at one end to said member and anchored at its other end to the cross part of said U-shaped insert and forming with said member a toggle, and means for actuating said toggle.

5 11. In push button switch construction, in combination, a frame of cylindrical shape carrying contact making and breaking mechanism, said frame terminating in a barrier of solid dielectric material extending substantially diamet-
10 rically across the rear end of said frame, connecting terminals carried by said frame and exposed one on each side of said barrier, a sleeve of solid dielectric material extending about the rear end of said frame to laterally encompass
15 said barrier and said terminals, a disk of solid dielectric material extending across said barrier and overlapping said sleeve, said disk having apertures therein for the passage of conductors therethrough, and means detachably securing
20 said disk in place.

12. In push button switch construction, in combination, a frame of cylindrical shape carrying contact making and breaking mechanism, said frame terminating in a barrier of solid dielectric material extending substantially diamet-
25 rically across the rear end of said frame, connecting terminals carried by said frame and exposed one on each side of said barrier, insulating means detachably secured to said frame for laterally
30 encasing said connecting terminals said insulating means comprising a sleeve-like member received over the exterior of said cylindrical frame and a disk-like member abutting against the rear end of said barrier and against the rear end
35 of said sleeve, and means detachably securing said disk-like member to said frame, whereby said insulating means is detachably secured in place.

13. In push button switch construction, in combination, a frame of cylindrical shape carrying contact making and breaking mechanism, said frame terminating in a barrier of solid dielectric material extending substantially diametrically
40 across the rear end of said frame, connecting terminals carried by said frame and exposed to either side of said barrier, and an insulating disk secured crosswise of said barrier and overlapping said connecting terminals.

14. In push button switch construction, in combination, a frame having a front portion in the form of a metallic sleeve and a rear portion in the form of a cylindrical block of insulation material, the diameter of said block being less than
80 that of said sleeve, switching mechanism carried by said frame, said block terminating in a barrier sub-dividing the rear face of said block into at least two portions, connecting terminals carried by said last-mentioned portions and exposed
85 either side of said barrier, and a sleeve fitted over said insulating block and abutting against said metallic sleeve and having a length sufficient to laterally encase said connecting terminals.

15. In push button switch construction, in combination, a frame having a front portion in the form of a metallic sleeve and a rear portion in the form of a cylindrical block of insulation material, the diameter of said block being less than that of
90 said sleeve, switching mechanism carried by said frame, said block terminating in a barrier sub-dividing the rear face of said block into at least two portions, connecting terminals carried by said last-mentioned portions and exposed either side
95 of said barrier, a sleeve fitted over said insulating block and abutting against said metallic sleeve and having a length sufficient to laterally encase said connecting terminals, and a disk member secured to said block and overlapping the rear
100 end of said second-mentioned sleeve to confine the latter between itself and said metallic sleeve.

16. In push button switch construction, in combination, a member of solid dielectric material having a recess exposed from the side of said member, a sheet metal insert having side walls
110 provided with bearing recesses, a relatively fixed contact, a swinging contact having portions resting in said bearing recesses, a spring connecting said swinging contact and said member and acting in a direction to hold said swinging contact
115 portions in said bearing recesses and forming a toggle with said swinging contact, and a sleeve-like member slipped over said solid dielectric member for closing said recess.

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