

July 29, 1952

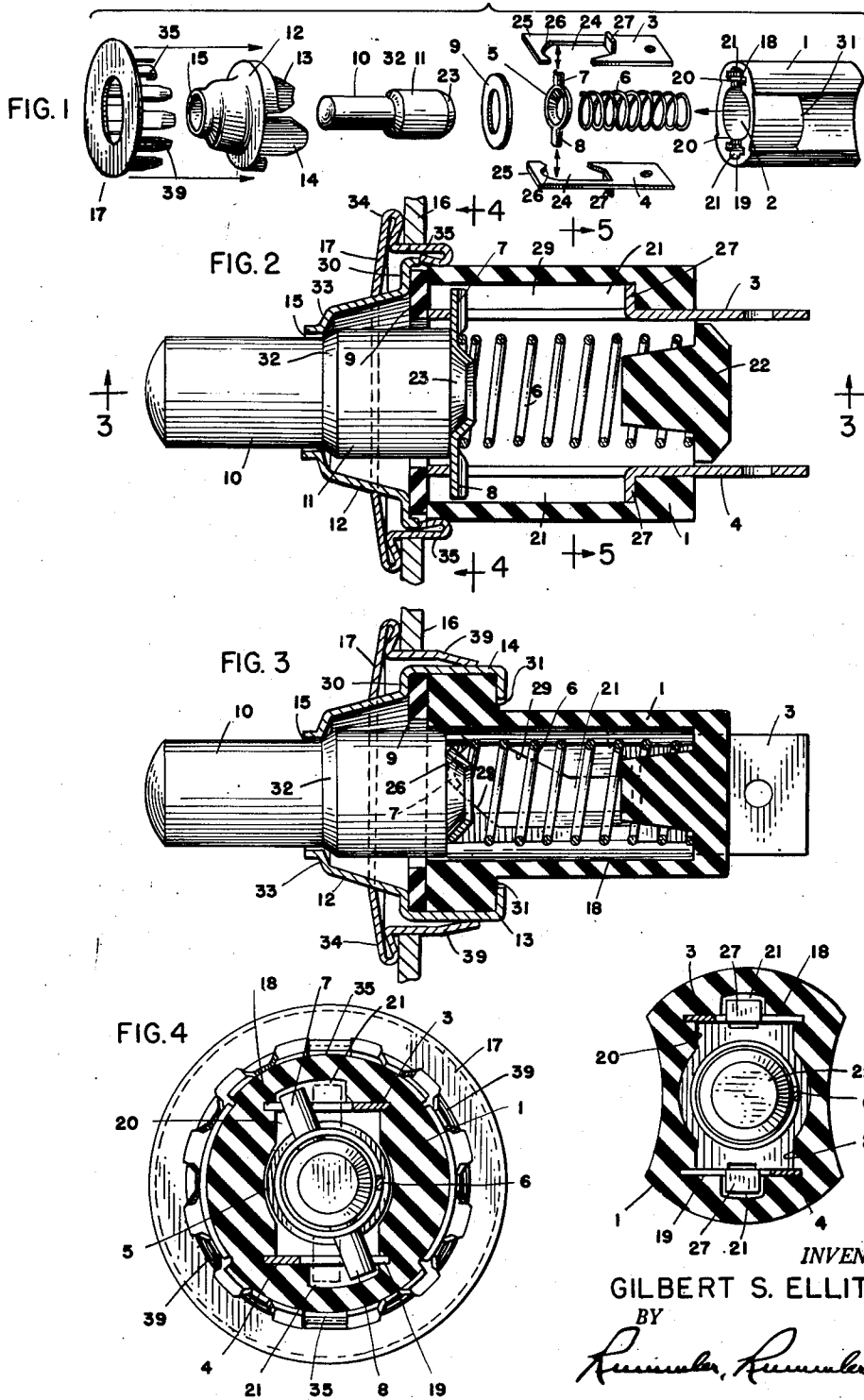
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2,605,375

PLUNGER SWITCH

Filed May 20, 1950

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

FIG. 6

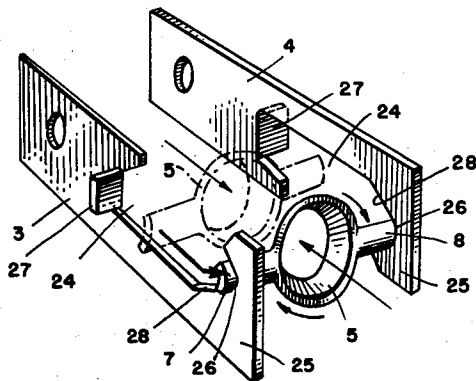


FIG. 7

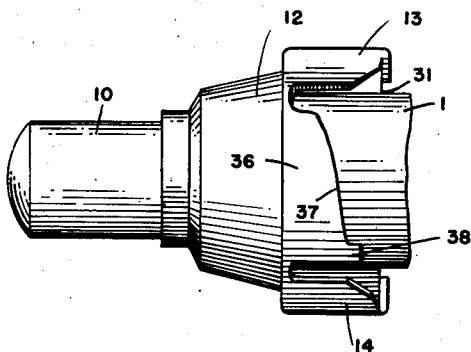


FIG. 8

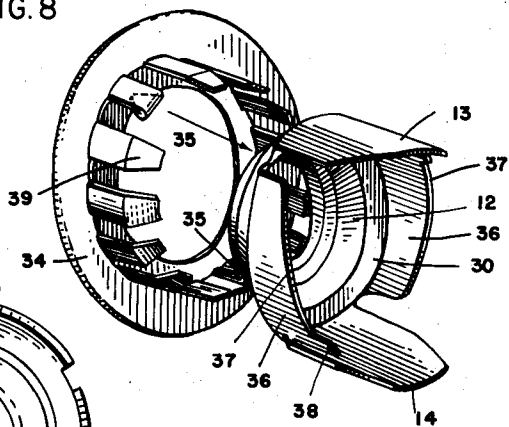
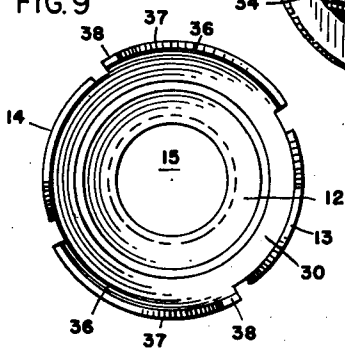


FIG. 9



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PLUNGER SWITCH

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15 Claims. (Cl. 200-159)

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This invention relates to electric switches of the plunger actuated or door operated type, such as that shown in the G. J. Meier Patent No. 2,065,904, dated December 29, 1936, and particularly to improvements in plunger switch constructions of this type.

The main objects of this invention are to provide a simplified plunger switch construction and assembly; to provide an improved plunger switch wherein a wiping engagement of the contactor with the switch terminal contacts is obtained during each operation of the switch; to provide an improved terminal for plunger switches; to provide an improved reciprocating contactor for plunger switches; to provide an improved plunger, contactor, and terminal assembly for plunger switches; and to provide an improved plunger switch assembly adapted for simplified mounting in a wall or panel aperture.

A specific embodiment of this invention is shown in the accompanying drawings in which:

Figure 1 is a perspective view showing the various parts of the improved plunger switch in exploded or separated relation, the parts being shown in the sequence of their assembly.

Fig. 2 is a longitudinal sectional view of the improved plunger switch showing its internal construction and the manner of its mounting in a wall or panel opening.

Fig. 3 is a similar view as taken on line 3-3 of Fig. 2.

Fig. 4 is a transverse sectional view of the improved switch as taken on line 4-4 of Fig. 2.

Fig. 5 is a transverse sectional view of the same as taken on line 5-5 of Fig. 2.

Fig. 6 is a perspective view showing the relationship of the improved switch terminals and contactor element with the parts being shown in outer circuit closing position, the contactor being also shown in dotted outline at an intermediate position.

Fig. 7 is a fragmentary side view of the bonnet end of the improved switch showing the arrangement of the clamping and cam locking arms.

Fig. 8 is a perspective view showing the mounting ring and the improved switch bonnet or clamping member in separated relation, and

Fig. 9 is an end view of the switch bonnet showing the relative arrangement of its clamping and camming arms.

In the form shown in the drawings, my improved plunger switch comprises a body or base 1, molded from a suitable insulating material, either ceramic or plastic, having a central axial opening or passage 2, of generally cylindrical

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contour, extending into the body from one end to substantially the opposite end thereof; a pair of diametrically spaced, parallel, axially extending terminals 3 and 4, suitably mounted within the body 1 and having wire attachment portions projecting outwardly from suitable openings in the rear or closed end thereof; and axial shiftable contactor 5 normally biased toward the open end of the passage 2, by means of a spring 6, and having radially projecting arms 7 and 8 disposed transversely of and adapted to engage the terminals 3 and 4; an insulating washer 9 adapted to fit over the open end of the body 1 and to hold the before-mentioned parts within the same; a plunger 10 having an enlarged body portion 11 adapted to pass through the central opening of the washer 9 and engage the contactor 5; and a clamping bonnet 12 adapted to fit over the plunger 10 and against the washer 9, the clamping bonnet 12 having rearwardly extending lugs or arms 13 and 14, adapted to be clamped inwardly over external shoulders on the body 1, and a central opening 15 adapted to receive the plunger 10. The bonnet opening 15 is of smaller diameter than the plunger body 11, in order to hold the plunger in place as a part of the switch assembly. As shown in Figs. 2 and 3, the switch assembly is adapted to be mounted in a suitable opening in a panel or wall 16, by means of a locking ring 17, which will be later described in detail.

The terminals 3 and 4 of my improved plunger switch are made of flat metal stampings, and as indicated in Figs. 1, 4 and 5, the body or housing 1 is provided with axially extending slots 18 and 19, formed in diametrically opposite portions of the body side wall, which slots extend from end to end of the body 1 and are adapted to receive the terminals 3 and 4 respectively and hold them in fixed, parallel relation. The terminals 3 and 4 are longer than the body 1 and project outwardly from the rearward end thereof, where suitable leads or conductors can be attached.

As shown, each of the slots 18 and 19, opens to the passage 2 on its inner side to provide a channel 20 for the respective contactor arms 7 and 8, which project radially beyond each slot, and each terminal is cut away in its central portion to receive the respective contactor arm and provide an axially extending clearance path therefor. Also an axially extending, inwardly opening, groove 21 is formed in the wall of the base or body 1, on the outer side of each of the slots 18 and 19, which grooves serve as guides

for the contactor arms during their reciprocal movement as will be hereafter described.

The contactor 5 is a cup-shaped member, stamped from a suitable conductor metal, and is disposed with its cupped side facing outwardly, the arms 7 and 8 projecting radially from the margin of the cup rim in diametrically opposite directions. As shown the outer surfaces of the contactor arms are rounded and the arms are of such a length as to extend into the guide grooves 21 when the contactor is assembled in the body or base 1. Also the diameter of the inwardly formed cupped portion is preferably of a size to fit within the end of the helically coiled biasing spring 6, which in turn is of a diameter to be adequately spaced from the terminals 3 and 4 when the spring is fully compressed. Thus the contactor 5 is centrally supported by the spring and at the same time securely holds the upper end of the spring aligned with the axis of the body 1.

The inner or lower end of the compression spring 6 is secured in the base or body 1 by means of a central spring seat and contactor stop 22 which extends axially inward from the bottom of the body. This spring seat is in the form of a truncated cone having a base diameter only slightly less than the inner diameter of the spring 6, so that the spring may be easily seated during assembly, and the diameter of the upper end is preferably at least the diameter of the bottom side of the cupped contactor 5. The height of the spring seat, in the embodiment shown, is such that when the contactor is pressed into the body to the limit of its stroke it will engage the upper end of the spring seat and be stopped before the arms 7 and 8 can contact or engage the lower or inner ends of the cutaway clearance paths in the terminals.

The contactor 5, which is normally held at the upper end of the body 1, with its arms 7 and 8 in engagement with the upper ends of the terminals, by the spring 6, is actuated by the plunger 10, and the inner end 23 of the enlarged body portion 11 of the plunger is preferably shaped to seat squarely in the cupped central portion of the contactor. Thus upon reciprocation of the plunger the contactor is held normal to the axis of its movement and disengagement of the contactor arms from the two terminals is simultaneous. Also, as shown, the cupped center portion of the contactor and the shaped inner end of the plunger are annular in form to permit rotation of one part relative to the other on their common axis.

In the form shown the terminals 3 and 4 are flat sheet metal strips, punched or otherwise formed from a suitable conductor material, adapted to be fitted lengthwise in the body slots 18 and 19, and are of such length as to extend through the body 1 from the front end thereof and project outwardly from the bottom of the body to provide attachment portions for suitable leads or conductors. Each terminal has its central body portion cut away, as at 24, to provide a relatively wide clearance path through which the contactor arms extend and the upper end 25 of each terminal is formed to span the clearance path and provide a seat 26 for the respective contactor arm. The clearance path in the terminal is of greater width than the guide groove 21, formed in the base or body 1, and the length of the clearance path is sufficient to allow a full inward stroke of the contactor 5 without engagement with the terminal, the guide groove confining the contactor movement to a

path in a plane normal to the terminals during the inner portion of the stroke.

As shown, each terminal is secured in the base 1 by means of a lug or tab 27, struck from the body of the terminal at the inner end of the clearance path, standing normal to the plane of the terminal and projecting into the adjacent guide groove. This lug or tab is positioned to seat at the bottom of the guide groove and serves to prevent the terminal being pulled out from the bottom of the body 1. The terminal is held in place at its upper end by means of the washer 9. In a single acting switch, such as that shown, the length of the spring seat 22 is made sufficient to stop the inward movement of the contactor 5 before its arms can engage the lugs 27. However, if a double acting switch is desired, where the circuit between the terminals is to be closed at each end of the plunger - contactor stroke, the length of the spring seat may be shortened to permit such a result.

In order to provide a wiping contact between the terminals and the respective contactor arms, at the upper or outer end of the contactor stroke, the seat 26 of each terminal is offset laterally from the axial plane of the contactor movement, or from the center-line of the terminal, as shown in Fig. 3, and the inner margin 28 of the terminal, at the upper end of the clearance path, is slanted to cross the center-line of the terminal at an angle of approximately 45°. Thus, as the contactor approaches the outer end of its stroke, the arms 7 and 8, which are guided in a plane normal to the terminals by the guide grooves 21, engage the slanted terminal margins 28 before reaching the contact seats 26. The terminals 3 and 4, which are identical in form, are mounted face to face in the base or body 1 so that the slanted inner margins extend in the same angular direction and the wiping contact action is afforded by a slight rotation of the contactor 5 on its axis of reciprocation, as the arms 7 and 8 slide along the slanted margins 28 to reach the seats 26. This is illustrated in Fig. 6 where the contactor 5 is shown in dotted outline at an intermediate position, normal to the terminals, and in solid outline at the rotated seated position.

Such turning action of the contactor 5 is permitted by widening each guide groove 21, on the side toward which the respective arm moves to engage its terminal seat 26, in the upper portion of the path of the contactor. As shown, the margin of the groove 21, between the widened upper portion and the narrow lower portion, is inclined lengthwise with respect to the axis of the body 1, as at 29, and this inclined portion is located inwardly, from the upper end of the body 1, a distance sufficient to permit the contactor to move through about one-half the length of its stroke, in the inward direction, before the contactor arms will be engaged by the sides of the guide groove. Thus when the contactor is moved inwardly by the plunger 10, to open the circuit between the terminals, it will retain its partially turned position and the disengagement of the contactor arms from the terminal seats will be instantaneous. Engagement of the arms with the inclined portions 29, after the switch circuit is opened, will then return the contactor to its central position, normal to the plane of the terminals, so that when the contactor again moves outwardly a rotary wiping contact with the terminals will be had at the circuit closing or outer end of the stroke.

The switch elements are held in assembled re-

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lation by means of the cap or bonnet 12 which fits over the upper or front end of the base 1 and seats on the washer 9, the cap 12 having a radially flanged end portion 30 for that purpose. The clamping lugs 13 and 14 extend axially from the margin of the flanged portion 30, on diametrically opposite sides of the cap, and embrace the sides of the body 1 where shoulders 31 are formed by reducing the transverse thickness of the body as shown in Fig. 3. The cap is secured by turning the ends of the lugs under the shoulders. The plunger 10, which extends through the end opening 15 of the cap, is held in the assembly by means of the shoulder 32, formed by the enlarged portion 11, which is engaged by the inturned end flange 33 surrounding the opening 15.

As shown in Figs. 2, 3, 4 and 8, the plunger switch assembly may be mounted in the opening of a plate or panel by means of the mounting ring or lock ring 17 which fits over the end of the cap or bonnet 12 and which has an annular flange 34, adapted to bear on the outer margin of the opening, and axially extending lock lugs 35 adapted to enter the opening and engage the cap 12. For this purpose the cap 12 is provided with cam arms 36 which extend axially rearward from the flange 30 on diametrically opposite sides of the cap between the clamping arms 13 and 14. The diameter of the cap 12 between the cam arms 36 is greater than that between the clamp arms 13 and 14 by substantially twice the thickness of the arms, as shown in Fig. 9, and each cam arm is provided with an axially inclined margin 37 on which the mounting ring lugs 35 engage and ride to draw the ring and cap toward each other. The lock lugs 35 on the ring 17 are formed by turning the ends of axially extending fingers inwardly upon themselves and the ring is made so that the diameter between the inturned finger ends is substantially the same as the external diameter of the cap 12 across the clamp arms 13 and 14. Thus the ring may be applied with the fingers passing over the cap 12 at any location between the cam arms 36 and the ring and cap are locked together by merely turning the ring in a clockwise direction. A stop 38 is provided at the high end of the inclined cam surface of each cam arm to keep the lock ring lugs from being turned beyond the cam surface 37.

The mounting ring is also provided with a plurality of angularly spaced axially extending spring fingers 39 which are designed to enter the opening in which the switch assembly is mounted and to bear resiliently outward on the edge of the opening to hold the assembly in mounted position. For this purpose the outside diameter across the spring fingers is slightly greater than the diameter of the opening so that a firm frictional grip will be had. Also the ends of the fingers 39 are preferably turned inwardly so as to engage the side surface of the body 1, and the outer surfaces of the clamp fingers, to thereby increase the spring tension of the fingers in their function of frictionally gripping the edges of the opening in which the switch is mounted.

The improved mounting ring arrangement is particularly adapted for easy and rapid mounting of the plunger switch after the wiring connections to the switch have been made. The mounting is effected by passing the switch, plunger first, through the opening in which it is to be mounted, from the rear side thereof; then

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slipping the mounting ring over the plunger and the cap or bonnet and turning the ring to lock it onto the cap; and finally pushing the assembly back into the opening and snapping the mounting ring into place with its flange abutting the outer margin of the opening. Thus the need for screws, threaded bushings and lock nuts or rings, and mounting plates is completely obviated thereby saving considerably in mounting time and cost.

The main advantages of this invention reside in the provision for a wiping contact or engagement between the contactor and the switch terminals whereby pitting and burning at the point of final contact is materially reduced, thereby resulting in more efficient switch action and longer switch life; and in the improved rotating contactor arrangement whereby an efficient wiping action, under direct pressure from the actuating or biasing spring, is obtained.

Other principal advantages are to be found in the improved switch assembly means, and its combination with the simple clamping ring or friction fastener, whereby a plunger switch can be more easily and quickly mounted in a suitable opening of a wall panel, without the need for tools or screw fasteners, and after attachment of the connecting wires has been made.

Although but one specific embodiment of this invention is herein shown and described it will be understood that details of the construction shown may be altered or omitted without departing from the spirit of the invention as defined by the following claims:

I claim:

1. A plunger switch comprising a dielectric body having a passage opening to one end of the body, a plunger extending into said passage and reciprocable therealong, a contactor disposed in said passage and axially shiftable with said plunger, said contactor having a pair of radial arms, a pair of spaced rigid terminals each having a contact portion extending across the path of a respective arm along an acute angle relative to said path in the axial direction of said passage, means normally biasing said plunger and contactor toward the open end of said passage, and a pivotal connection between said contactor and said plunger adapted to permit angular movement of the contactor in a plane normal to the axis of the plunger whereby said contactor arms will slide along the contacting portions of said terminals when engaged therewith.

2. A plunger switch comprising a dielectric body having a passage opening to one end of the body, a plunger extending into said passage and reciprocable therealong, a contactor disposed in said passage and axially shiftable with said plunger, said contactor having a pair of radial arms, a pair of spaced terminals each having a rigid contact portion extending across the path of a respective arm along an acute angle relative to said path in the axial direction of said passage, each contact portion terminating in an angularly offset seat for the respective contact arm, means normally biasing said plunger and contactor toward the open end of said passage, and a pivotal connection between said contactor and said plunger adapted to permit angular shifting movement of the contactor in a plane normal to the axis of the plunger whereby said contactor arms will slide along the contacting portions of said terminals and engage in the respective angularly offset seats.

3. A plunger switch comprising a dielectric

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body having a passage opening to one end of the body, a plunger disposed in said passage and adapted to be moved axially therealong, a contactor movable axially in said passage and having a pair of arms extending radially relative to the axis of said passage, said contactor having connection with said plunger for reciprocal actuation thereby, a pair of spaced terminals, a rigid contact portion on each terminal extending transversely across the path of a respective one of said contactor arms and along an acute angle relative to said path in the axial direction thereof, and resilient means normally biasing said plunger and contactor toward the open end of said passage, said contactor being shiftable angularly on its axis of reciprocation upon engagement with said terminal contact portions.

4. A plunger switch comprising a dielectric body having a passage opening to one end of the body, a plunger disposed in said passage and adapted to be moved axially therealong, a contactor movable axially in said passage and having a pair of arms extending radially relative to the axis of said passage, said contactor having connection with said plunger for reciprocal actuation thereby, a pair of spaced terminals, a rigid contact portion on each terminal extending transversely across the path of a respective one of said contactor arms and along an acute angle relative to said path in the axial direction thereof, and resilient means normally biasing said plunger and contactor toward the open end of said passage, said contactor being shiftable angularly on its axis of reciprocation upon engagement with said terminal contact portions, and the contact portion of each terminal terminating in an angularly offset seat for the respective contact arm.

5. A plunger switch comprising a dielectric body having a passage opening to one end of the body, a cylindrical plunger extending into said passage and movable axially therealong, a contactor disposed at the inner end of said plunger and having a pair of diametrically opposite radial arms, said contactor being axially shiftable in said body with said plunger and rotatable on the plunger axis, a pair of terminals disposed in said passage and each having a rigid slanted contact portion extending across the path of a respective contactor arm, said contact portions being inclined in the same angular direction relative to the respective paths of said arms, and means normally biasing said plunger and contactor toward the open end of said passage.

6. A plunger switch comprising a dielectric body having a passage opening to one end of the body, a cylindrical plunger extending into said passage and movable axially therealong, a contactor disposed at the inner end of said plunger and having a pair of diametrically opposite radial arms, said contactor being axially shiftable in said body with said plunger and rotatable on the plunger axis, a pair of flat elongate terminals each disposed lengthwise in said passage opposite a respective arm and lying in a plane normal to the plane of movement of the arm, each terminal being cut away in its central portion to receive the respective arm and to provide an axially extending clearance path therefor, the margin of the cutaway portion of each terminal adjacent one end thereof being inclined axially across the path of the contactor arm and terminating in an angularly offset contact seat, said inclined margins extending in the same angular direction, and means normally biasing said contactor

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and plunger toward the open end of said body passage.

7. A plunger switch comprising a dielectric body having a central passage opening to the forward end of the body and adapted to receive a reciprocable plunger, a pair of rigid flat metal terminals mounted in said body in parallel relation one on each of diametrically opposite sides of said passage, each terminal being cut away in its central portion to provide an axial clearance path for a contactor arm extending therethrough and reciprocable in a plane normal thereto, a plunger extending into said body passage and movable axially between said terminals, a forwardly facing annular cup-like contactor disposed at the inner end of said plunger and having opposed radial arms extending from its rim and through the clearance paths of said terminals respectively, said plunger having an annular inner end portion adapted to fit into the cupped portion of said contactor and said contactor being rotatable on the axis of said plunger, an axially inclined contact portion adjacent one end of the clearance path of each terminal, said inclined contact portions being diametrically opposite each other and extending across the paths of the respective contact arms in the same angular direction and each terminating in an angularly offset contact seat, and means in said body normally biasing said contactor and plunger toward the forward end of said body.

8. A plunger switch comprising a dielectric body having a central passage opening to the forward end of the body and adapted to receive a reciprocable plunger, a pair of flat metal terminals mounted in said body in parallel relation one on each of diametrically opposite sides of said passage, each terminal being cut away in its central portion to provide an axial clearance path for a contactor arm extending therethrough and reciprocable in a plane normal thereto, a plunger extending into said body passage and movable axially between said terminals, a forwardly facing annular cup-like contactor disposed at the inner end of said plunger and having opposed radial arms extending from its rim and through the clearance paths of said terminals respectively, said plunger having an annular inner end portion adapted to fit into the cupped portion of said contactor and said contactor being rotatable on the axis of said plunger, an axially inclined contact portion adjacent the forward end of the clearance path of each terminal, said inclined contact portions extending across the paths of the respective contact arms in the same angular direction and each terminating in an angularly offset contact seat, and means in said body normally biasing said contactor and plunger toward the forward end of said body where said contactor arms are engaged in said contact seats.

9. A plunger switch comprising a body of insulating material having a plunger passage therein opening to the forward end of the body, a plunger extending into said passage and having an enlarged inner end portion, said plunger being reciprocable along the axis of said passage, a contactor at the inner end of said plunger and reciprocable therewith, said contactor having a pair of angularly spaced radial arms, a pair of terminals mounted in said body from the forward end thereof and disposed alongside the path of the plunger, each of said terminals having a contact portion extending angularly across the path of a respective contactor arm adja-

cent a common end of its movement path, said contact portions being inclined axially in the same angular direction, a spring in said plunger passage normally biasing said contactor and plunger toward the forward end of the passage, a cap member disposed over the forward end of said body and secured thereto, said cap member having an opening through which the outer end of said plunger projects, said cap opening being of less diameter than the inner end portion of the plunger and said cap being adapted to confine the plunger, terminals and contactor, within said body, and a radially flanged mounting ring disposed telescopically over said cap member and having releasable interlocking connection therewith, said mounting ring having a plurality of angularly spaced rearwardly extending spring fingers on its inner margin adapted to frictionally engage the peripheral edge of a panel opening in which the plunger switch is inserted.

10. A plunger switch assembly comprising a switch housing enclosing a plunger actuated switch mechanism and having a reciprocable plunger projecting axially therefrom, a cap secured on the end of said housing and having an opening through which the projecting end of the plunger extends, said cap being adapted to retain the plunger and switch mechanism within the housing, a mounting ring adapted to fit telescopically over said cap and having an inwardly projecting radial flange for engaging said cap endwise, means on said ring adapted to releasably interlock with cooperative means on said cap for securing said ring and cap together, and a plurality of angularly spaced resilient fingers extending rearwardly from the said mounting ring, said fingers being adapted to frictionally engage the peripheral edge of an opening into which the switch housing and mounting ring are inserted rear end first.

11. A plunger switch assembly comprising a switch housing enclosing a plunger actuated switch mechanism and having a reciprocable plunger projecting axially therefrom, a cap secured on the end of said housing and having an opening through which the projecting end of the plunger extends, said cap being adapted to retain the plunger and switch mechanism within the housing, a mounting ring adapted to fit telescopically over said cap and having an inwardly projecting radial flange for engaging said cap endwise, means on said ring adapted to releasably interlock with cooperative means on said cap for securing said ring and cap together, and a plurality of angularly spaced resilient fingers extending rearwardly from said mounting ring, said fingers having inwardly turned ends embracingly engaging said cap and housing, and said fingers being radially yieldable intermediate their ends for frictionally engaging the peripheral edge of an opening into which the switch housing and mounting ring are inserted rear end first.

12. In a plunger switch comprising a hollow body, a plunger reciprocable along a predetermined axis in said body and projecting outwardly therefrom, and spring means normally biasing said plunger in the outward direction, the combination of a contactor axially reciprocable with said plunger and having a pair of angularly spaced radial arms, said contactor being rotatable on the axis of reciprocation, said body having axial guide channels in its inner side wall for receiving said arms and adapted to confine said arms to a predetermined path during a por-

tion only of their reciprocal movement, and a pair of terminals mounted within said body and each having a contact portion disposed across the path of a respective arm, said contact portions being inclined axially in the same angular direction and being located adjacent one end of the path of reciprocation of the contactor beyond the area of influence of said guide channels.

13. In a plunger switch comprising a hollow body, a plunger reciprocable along a predetermined axis in said body and projecting outwardly therefrom, and spring means normally biasing said plunger in the outward direction, the combination of a contactor axially reciprocable with said plunger and having a pair of angularly spaced radial arms, said contactor being rotatable on the axis of reciprocation, said body having axially extending guide channels in its inner wall for receiving said arms and adapted to confine said arms to a predetermined path during a portion only of their reciprocal movement, and a pair of terminals mounted within said body and each having a contact portion disposed across the path of a respective arm, said contact portions being inclined axially in the same angular direction and terminating in an angularly offset contact seat, and said contact portions being located adjacent one end of the path of reciprocation of the contactor beyond the area of influence of said guide channels, and said body having angularly inclined means extending from the end of each guide channel toward the respective contact seat for leading the contactor arms angularly into said channels when the said arms are disengaged from said contact seats.

14. In a plunger switch comprising a body having a plunger passage therein, a plunger reciprocable along the axis of said passage and projecting outwardly therefrom, and means normally biasing said plunger in the outward direction, the combination of a pair of flat parallel axially extending terminals mounted in said body one on each side of said passage and each having a cut-out portion intermediate the ends of the passage to provide an axially extending clearance path for a contact arm projecting there-through and movable in a plane normal thereto, the margins of the cut-out portions of said terminals adjacent a common end thereof being axially inclined in the same angular direction across the said clearance path, a contactor axially reciprocable in said passage with said plunger and rotatable on the axis thereof, said contactor having a pair of oppositely disposed radial arms respectively extending through the clearance paths of said terminals, and said body having guide means registered with the cut-out portion of each terminal and adapted to confine the movement of said contactor arms to a plane normal to the planes of said terminals in that portion of their path beyond the zone of the inclined margins of the terminal clearance paths.

15. A plunger switch comprising a body of dielectric material having a plunger passage therein opening to the forward end of the body, a plunger extending into said passage, said plunger being reciprocable along the axis of said passage, a contactor at the inner end of said plunger and reciprocable therewith, said contactor having a pair of angularly spaced radial arms, a pair of terminals mounted in said body and disposed alongside the path of said plunger, each of said terminals having rigid slanted contact portions extending angularly across the path of

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a respective contactor arm adjacent a common end of its movement path, said contact portions being inclined axially in the same angular direction and said contactor being shiftable angularly on the axis of said plunger upon engagement with said inclined contact portions, means for limiting the angular movement of said contactor, means for reversing the angular movement of said contactor and returning said arms to their axial paths of reciprocatory motion after disengagement of said contactor from the slanted contact portion of said terminals, and means in said plunger passage normally biasing said con-

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tactor and plunger toward the forward end of the plunger passage.

GILBERT S. ELLITHORPE.

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