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G. R. BROWN

2,186,818

ELECTRIC SWITCH

Filed Nov. 11, 1937

Fig. 1.

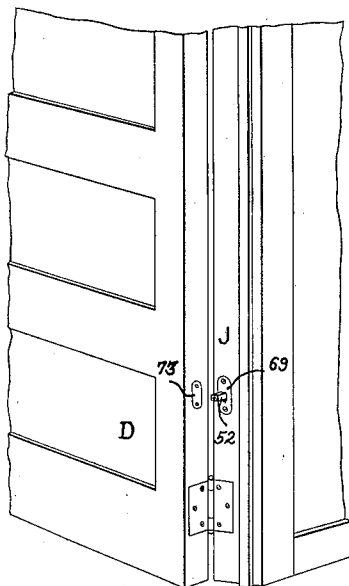


Fig. 2.

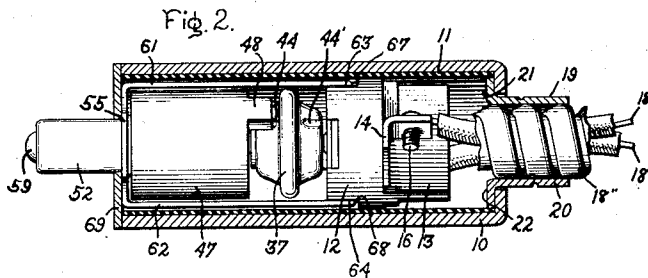


Fig. 3.

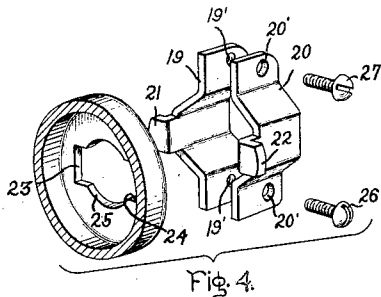
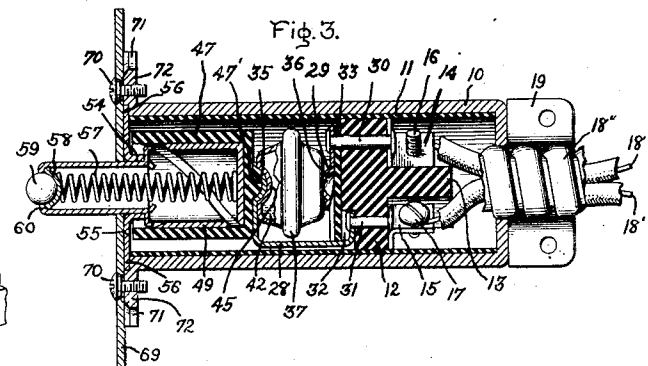


Fig. 4.

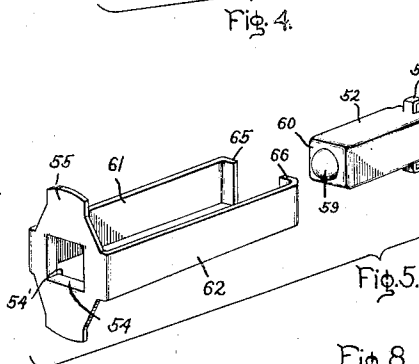
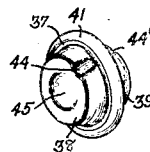


Fig. 5.



Fig. 6.

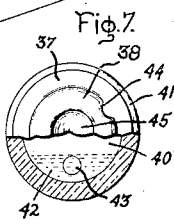


Fig. 7.

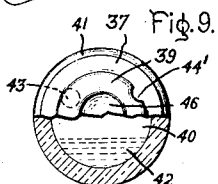


Fig. 8.

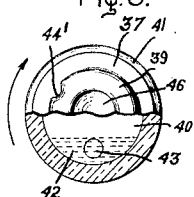


Fig. 9.

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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH

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Application November 11, 1937, Serial No. 173,954

10 Claims. (Cl. 200—54)

This invention relates to electric switches of the type employing liquid contact circuit closers which are rotated to control the flow of current.

It is an object of the invention to provide an improved construction and arrangement of switches of this type in which the circuit closer may be reversed in position to form a switch which is either normally open or normally closed.

Referring to the drawing Fig. 1 is an illustration of the switch applied to a door jamb; Fig. 2 is a plan view of the switch with the housing broken away; Fig. 3 is a cross-sectional view through the switch structure; Fig. 4 is an exploded view of the clamping means for the connecting cable; Fig. 5 is an exploded view of the switch elements; and Figs. 6 to 9, inclusive, illustrate the liquid circuit contact closer and the various positions taken by the circuit closer during operation of the switch as a normally open or a normally closed switch.

The switch comprises a cylindrical housing 10 which may be lined with an insulating shell 11 in order to insulate the switch elements from the housing and the surrounding structure. The housing is made in cylindrical form for ease in mounting the switch. With an ordinary rectangular switch housing it is necessary to mortise the mounting board; with a cylindrical housing, however, it is only necessary to bore a hole and insert the housing in order to mount the switch in operative position thereby effecting a considerable saving in labor costs. Within the housing 10 a base 12 of insulating material is provided having a rearwardly extending projection 13 which serves to separate the terminal angle strips 14 and 15. In order to connect the terminal strips to the conducting wires, terminal screws 16 and 17 are provided. The terminal wires may comprise part of a BX cable having conductors 18 and 18' and a protective armor 18''. In order to clamp the armor to the casing and thus prevent the connections between the conductors and terminals from becoming loosened, opposed clamping members 19 and 20 are placed about the armor immediately adjacent the housing 10. The clamping plates have prongs or projections 21 and 22 extending within slots 23 and 24 formed upon opposite sides of the opening 25 placed in the end of the housing. The clamping prongs grip the end of the housing as the clamping members are tightened about the armor by means of the screws 26 and 27 threaded through openings 19' and 20' formed in the clamping members. In order to hold a liquid circuit closer in operative position, two contact

members 28 and 29 are mounted upon the base 12 and are secured to the terminal strips 14 and 15, respectively, by means of rivets 30 and 31. The contact member 28 is U-shaped, one end of the U being inserted in a recess 32 formed in the base 12 where it is secured to the terminal 15 by the rivet 31. An insulating plate 33 overlies the recess to protect the end of the contact member and is secured to the base by the rivet 30 which connects the contact arm 29 to the terminal strip 14, the contact arm overlying the insulating plate. The contact member 29 and insulating plate 33 are set into a recess 34 formed upon the base, as best shown by Fig. 5. The contact members 28 and 29 are formed with projections 35 and 36 which extend toward each other to engage and hold the liquid circuit closer 37.

The liquid circuit closer 37 comprises a pair of cup-shaped metal terminals 38 and 39 which are separated by an insulating diaphragm 40 which may be formed of refractory material such as a ceramic material. In order to seal the edges of the terminals a glass bead 41 is formed between the metal terminals 38 and 39 and seals the junctions between these terminals and the insulating diaphragm 40. Within the space enclosed by the terminals is a quantity of mercury 42 which forms the conductive medium between the two terminals. In the manufacture of the circuit closer the space enclosed by the terminals is evacuated and filled with hydrogen gas at a pressure of one or more atmospheres, so that the current-carrying capacity of the circuit closer is increased. The insulating diaphragm 40 is provided with an opening 43 shown by Figs. 6 to 9, inclusive, which is submerged in the mercury when the circuit closer is in current-carrying position and which is moved to a position above the mercury when the circuit closer is in open position. The terminals 38 and 39 of the circuit breaker are provided with depressions 44 and 44' which are placed at the same angular position on the circumferences of the terminals. For the purpose of mounting the circuit closer on the contact members, the terminals are provided with depressions 45 and 46 which are engaged by the projections 35 and 36 formed on the contact members. In this manner the circuit closer is mounted for free pivotal movement about the contact members which at the same time make contact with the terminal members of the circuit closer so that the mercury will close the circuit through the contact members as the

opening in the diaphragm is inserted in the mercury.

In order to operate the circuit closer, a cylinder 47 of insulating material is mounted in the switch housing by means of a projection 47' fitting into the recess formed by the projection 35 and has a projection or key 48 engaging one of the depressions 44 or 44' formed in the terminals of the circuit closer. The cylinder 47 is provided with a cup 49 having spiral grooves 50 and 51 formed therein and the cup is inserted within the cylinder 47 and secured thereto by any suitable means. In order to rotate the cylinder 47 upon the projection 47' a rectangular plunger 52 is provided with keys 53 which ride in the grooves 50 and 51 formed in the cup member 49. The plunger is guided and supported upon bearing surfaces 54 formed in a sleeve 55 which is mounted in recesses 56 formed on the front of the housing member. The guiding surfaces 54 take the form of a rectangular opening formed in the sleeve 55 and are adapted to prevent the rectangular plunger 52 from rotating as the keys 53 engage the grooves in the cup-shaped member, as well as providing a support for the plunger. The plunger is held in an extended position by means of a spring 57 which engages the rear of the cup member 49 at one end and bears against a washer 58 at the other end. An anti-friction ball 59 is locked between the washer 58 and the end 60 of the plunger to provide for free relative movement between an operating means and the plunger. The keys 53 engage the inner edges 54' of the bearing surfaces 54 and prevent the plunger from being expelled from the sleeve under the action of the spring 57. To hold the switch elements in assembled relationship, the sleeve 55 is provided with rearwardly extending arms 61 and 62 which coact with the beveled faces 63 and 64 formed on the base member and which are provided at their ends with locking prongs 65 and 66 which engage the recesses 67 and 68 formed in the base member 12. The assembled switch structure is clamped to the housing 10 by a face plate 69 which retains the sleeve 55 in position in the recesses 56 by means of the locking screw 70. In order to mount the housing on a supporting wall or panel, grooves 71 are provided in the extension 72 formed on the housing member 10. These grooves are adapted to be engaged by supporting screws (not shown).

In assembled relationship the spring acts to hold the plunger in extended position. Depression of the plunger will cause rotation of the cylinder and circuit closer and compression of the spring. As the spring is compressed it will exert a force on the rear of the cylinder causing the projection 47' to press the contact 28 toward the contact 29 thereby insuring a good electrical contact between the circuit closer and the contact members as the switch is operated.

One use of the switch is as a door switch to control an electric circuit in response to the opening and closing of a door. This use is illustrated by Fig. 1, the switch being mounted in the door jamb J by means of the extensions 72 formed on the housing. The door D is provided with an abutment plate 73 for cooperation with the plunger 52. Opening and closing of the door will cause the plunger 52 to be extended and depressed, alternately, and thereby cause rotation of the liquid circuit closer. The circuit closer is keyed to the cylinder 47 by means of the key 48' and one of the depressions 44 and 44'.

By properly positioning the depressions 44 and

44' and the opening 3 formed in the diaphragm, it is possible to reverse the liquid circuit closer to provide a switch which is either normally open or normally closed.

Referring to Fig. 6 it will be seen that the depression 44 is formed on a line substantially 60 degrees to the left of the vertical, while the opening 43 is formed on a line substantially 60 degrees to the right of the vertical. The pitch of the spiral grooves 50 and 51 is so designed that depression of the plunger will rotate the cylinder 47 and thereby the circuit closer through an angle of 120 degrees. If now the circuit closer is inserted in the switch to take the position shown by Fig. 6 and the plunger is in extended position, the switch will be normally open. It will be apparent that upon depression of the plunger the circuit closer will move clockwise in the direction shown by the arrow through an angle of 120 degrees to a final position illustrated by Fig. 7. In this position the switch is closed with the opening 43 immersed in the mercury and the plunger is depressed completely within the cup 49. In the event that it is desired to have a switch which is normally closed the circuit closer is removed from between the contacts and is reversed to a position illustrated by Fig. 8, so that the depression 44' on the opposite terminal will be engaged by the key 48 when the switch is in normal position with the plunger extended. It will be apparent that if the switch is now operated by depression of the plunger the circuit closer will be rotated clockwise in the direction shown by the arrow through an angle of 120°, so that the circuit closer will take the position shown by Fig. 9 with the opening in the diaphragm removed from contact with the mercury and the switch in open position. It will thus be apparent that by providing the circuit closer with two depressions 44 and 44' and by placing the diaphragm opening at an angle of 120° from the depressions that a switch is devised which may be operated as a normally open or a normally closed switch by reversing the position of the circuit closer.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric switch, a liquid contact circuit closer, contact means pivotally supporting said circuit closer, a cylinder keyed to said circuit closer, a cup having a spiral groove connected to said cylinder and a plunger having means cooperating with said grooves whereby reciprocation of said plunger will cause rotation of said circuit closer.

2. In an electric switch, a liquid circuit closer having terminal portions, one of said terminal portions having a depression formed therein, a rotatable member having a key engaging said depression, opposed contact means mounting said circuit closer for rotation, an element having a spiral groove engaging said member, and a plunger having means engaging said groove whereby reciprocation of said plunger causes rotation of said circuit closer.

3. In an electric switch, a liquid circuit closer, opposed contacts mounting said circuit closer for rotation about its axis to open or close a circuit, a cylindrical member keyed to said circuit closer, a cup having a spiral groove inserted in said member, a plunger having a projection inserted in said groove, and a spring between said cup and plunger.

4. In an electric switch, a liquid circuit closer, opposed contact members, said contact members

having means pivotally mounting said circuit closer for rotation to open or close a circuit, a cylindrical member keyed to said circuit closer, means having a spiral groove inserted in said cylindrical member, and a plunger having a key coacting with said groove whereby said circuit closer may be rotated upon reciprocation of said plunger.

5. In an electric switch, a liquid circuit closer having terminal portions, angularly aligned depressions formed in said terminals, contact means mounting said circuit closer for rotation to open or close a circuit, rotatable means having a key engaging one of said depressions, a reciprocating plunger, means to translate reciprocation of said plunger into rotation of said means to operate said circuit closer, said circuit closer being reversible in said contacts with said key engaging the other of said depressions whereby said switch may be operated as a normally open or a normally closed switch.

6. In an electric switch, a liquid circuit closer operable upon rotation to open or close a circuit, contacts pivotally mounting said circuit closer, a rotatable member connected to said circuit closer, an element having a spiral groove secured to said member and a plunger having means co-operating with said groove whereby longitudinal movement of said plunger causes rotation of said circuit closer, said circuit closer being connected to said member when said plunger is in normal position so that the circuit through said contacts and circuit closer is in open position, said circuit closer being adapted to be reversed in position so that when said plunger is in normal position the circuit through said contacts and circuit closer is in closed position.

7. In an electric switch, an elongated housing, a base positioned within said housing, a liquid circuit closer, opposed contacts supported by said base and mounting said circuit closer for rotation about its axis to open or close a circuit, a

rotatable member mounted within said housing in axial alinement with said circuit closer and being operatively connected therewith, a reciprocable element mounted in said housing and movable in a direction parallel to the axis of said circuit closer and having a portion extending beyond the confines of said housing, and means interconnecting said element and member whereby movement of said element operates said circuit closer.

8. In an electric switch, a liquid circuit closer having terminal portions, angularly aligned connecting means formed on said terminals, contact means mounting said circuit closer for rotation to open or close a circuit, rotatable means engaging one of said connecting means, a reciprocating element, means to translate reciprocation of said element into rotation of said rotatable means to operate said circuit closer, said circuit closer being reversible in said contacts with said rotatable means engaging the other of said connecting means whereby said switch may be operated as a normally open or a normally closed switch.

9. In an electric switch, a liquid circuit controller, opposed contacts mounting said circuit controller for rotation about its axis to open or close a circuit, means provided with a spiral groove connected to said circuit controller for rotation therewith and a plunger having means engaging said groove whereby reciprocation of said plunger causes rotation of said first-mentioned means and said circuit controller.

10. In an electric switch, a liquid circuit controller, opposed contacts mounting said circuit controller for rotation about its axis to open or close a circuit, an element keyed to said circuit controller and being provided with a spiral groove and a plunger having a projection engaging said groove whereby reciprocation of said plunger causes rotation of said circuit controller.

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