March 18, 1947. J. F. O'BRIEN ET AL 2,417,438

ELECTROMAGNETIC SWITCH

Filed Oct. 30, 1943 2 Sheets-Sheet 1

Fig. 1.

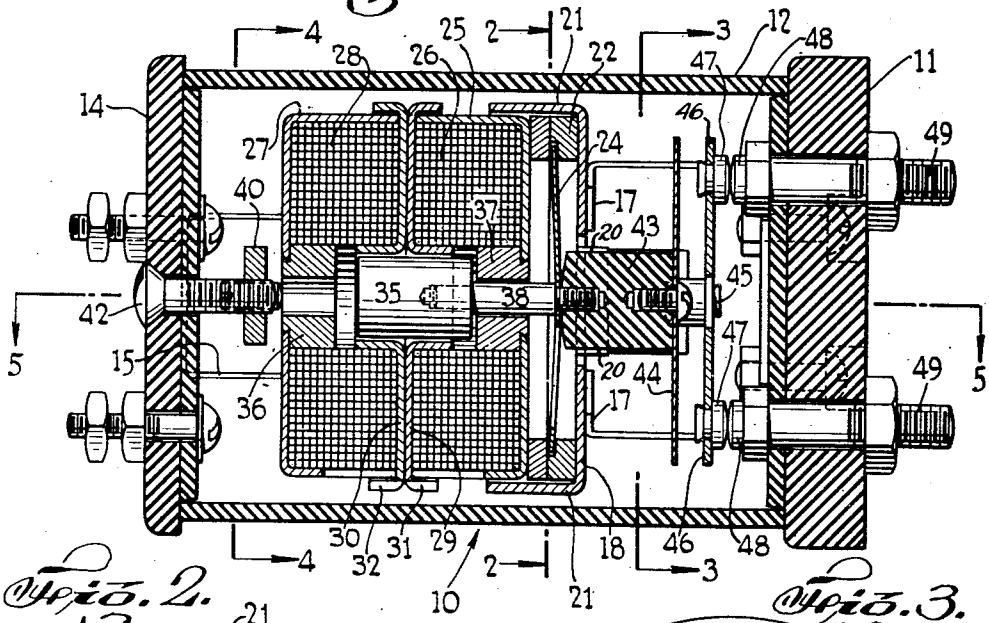


Fig. 2.

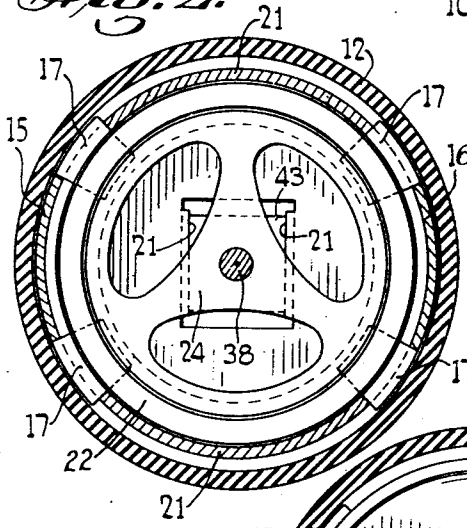


Fig. 3.

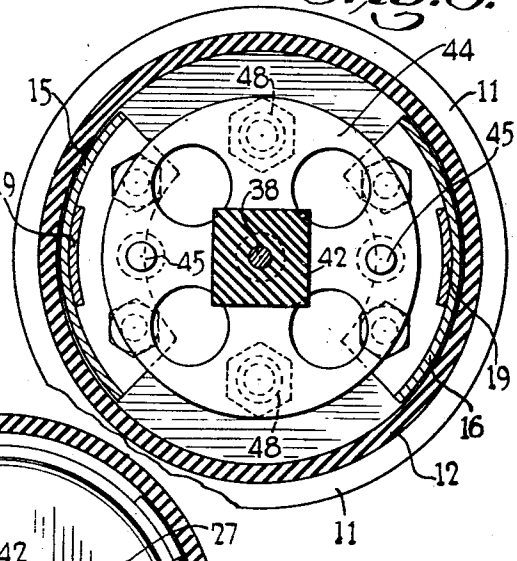
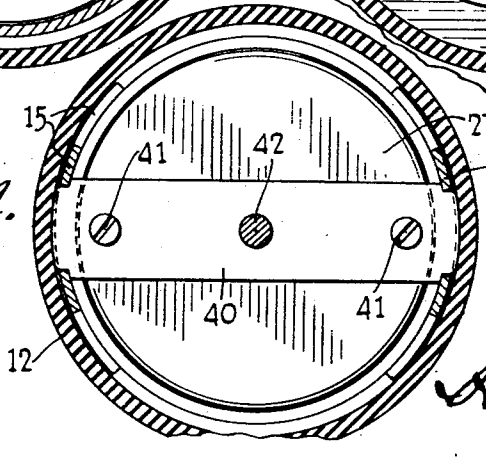


Fig. 4.



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Fig. 5.

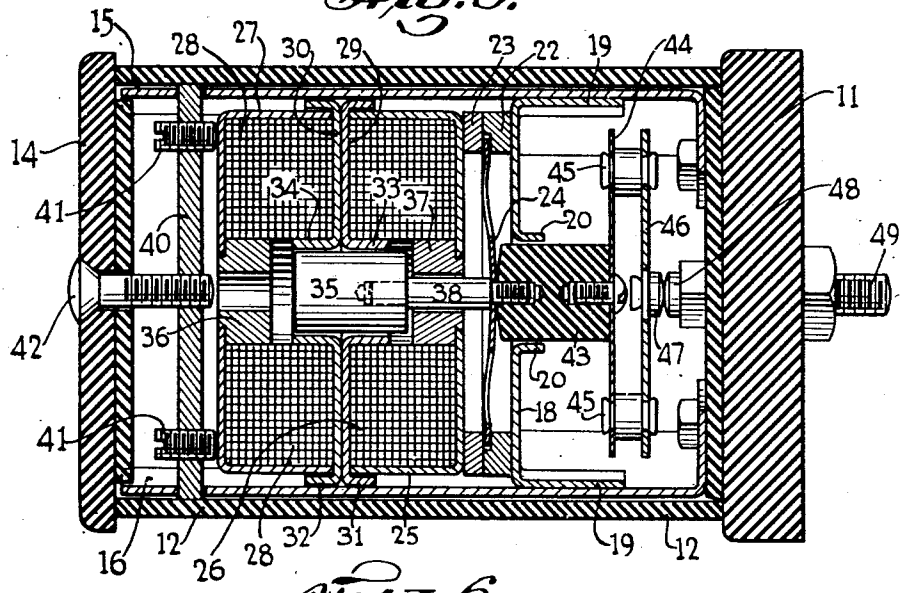


Fig. 6.

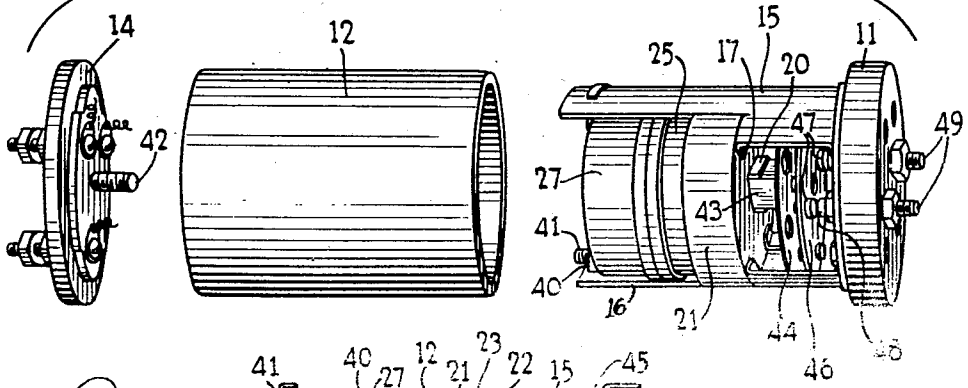
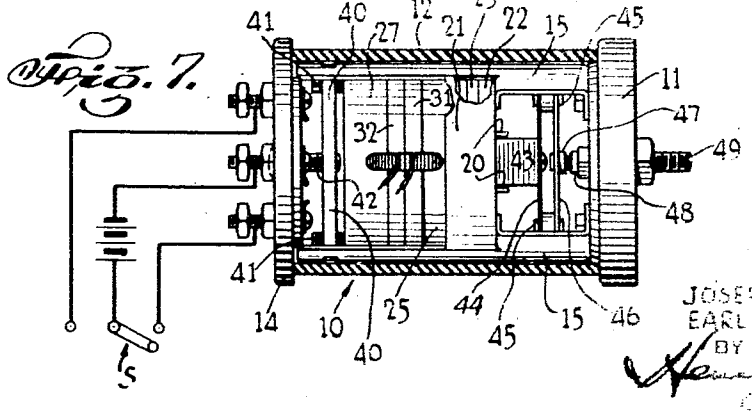


Fig. 7.



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Patented Mar. 18, 1947

2,417,438

UNITED STATES PATENT OFFICE

2,417,438

ELECTROMAGNETIC SWITCH

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Application October 30, 1943, Serial No. 508,298

7 Claims. (Cl. 175—341)

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This invention relates to electromagnetic switches.

It is an object of the invention to provide an improved structural organization of the operating parts of said electromagnetic switch, to insure that all of the respective operating parts are precisely positioned within the electromagnetic switch housing.

It is an object of the invention to provide an electromagnetic switch in which a snap spring or like operating structure, by solenoid induced movement, opens or closes the contacts of the electromagnetic switch, the relative position of the snap spring and the solenoid operator being disposed within the casing in a pre-established dimensional arrangement to insure accuracy of operation.

It is an object of the invention to provide improved means for confining within the housing of a electromagnetic switch, the operating elements thereof.

It is an object of the invention to provide a electromagnetic switch with improved contact structures.

It is an object of the invention to provide an electromagnetic switch having a fixed and a movable contact organization, with improved means for cushioning the engagement between the fixed and movable contact.

It is an object of the invention to provide an electromagnetic switch comprising a plurality of operating parts, with improved means for securing said operating parts within a housing, with a minimum of fastening or attachment means for said operating parts.

It is an object of the invention to provide an electromagnetic switch which is of simple, low cost construction, and which may be assembled, with accurately disposed securement of the operating parts, by means of unskilled labor.

According to a preferred form of the invention, the improved electromagnetic switch comprises an organization of fixed and movable contacts, the movable contacts being brought into or out of engagement with the fixed contacts by solenoid actuators, operating through the agency of a snap spring. Secured to the base of the housing of the electromagnetic switch, on which base the fixed contacts are positioned, are a plurality of side frame members, said members having at a pre-determined location with respect to the base structure, means to receive and position a sub-base which serves as the support for the operating elements of the electromagnetic switch. Positioned upon said sub-base, but not permanently affixed thereto, are a snap spring retainer and a solenoid actuator comprising a pair of individual solenoid cups between which, and in engagement with the rims thereof are located a pair of spacer members having inner peripheral flanges which collectively provide a cylindrical chamber within which a solenoid core is slidably positioned. The respective solenoid cups, within which the operating solenoids are contained, are in stacked relationship one with the other, and may be inserted within the side frame members by the successive placing therein by the workman. Near the outer end of each of said side frame members is an aperture adapted to receive the tongue of a rigid bridge which overlies the outermost solenoid cup in spaced relationship therewith. Said bridge member has any desired plurality of tapped openings which receive set screws or the like, the ends of which bear against the top wall of the outermost solenoid cup. Upon tightening the set screws the respective operating elements are urged one against the other, and in tight relationship with the sub-base which forms the support for the collective operating members.

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The bridge member also affords means of securing an outer casing and a top closure plate to complete the housing of the device.

The movable contacts are carried by a flexible plate operatively associated with the magnetic armature whereby the movable contacts are resiliently supported in a manner affording self-adjustability with respect to the fixed contacts. The flexible disc carrying the movable contacts gives under the impact of the movable contacts against the fixed contacts thereby cushioning the same and dampening "chatter" during the making of the contacts, resulting in improved circuit closing characteristics and enhancing the life of the respective contacts.

A feature of our invention is an improved assembly structure for an electromagnetic switch.

A feature of our invention is an improved contact organization for an electromagnetic switch.

Other features and advantages will hereinafter appear.

Fig. 1 is a sectional view of a preferred form of electromagnetic switch embodying the present invention;

Fig. 2 is a central sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1;

Fig. 5 is another sectional elevation of the device, in closed circuit position, the line of section being on the line 5—5 of Fig. 1;

Fig. 6 is an exploded perspective view of the structure; and

Fig. 7 is a side elevation, partly broken away, of the assembled structure, with the outer casing broken away to illustrate the positioning of the parts; Fig. 7 also shows a typical wiring diagram.

Referring to the drawings, the housing of our improved electromagnetic switch 10 includes a base plate 11, shell 12 and cap 14; these parts are of insulating material. Secured to the base plate 11, as by any desired plurality of screws or rivets, is an open frame comprising side pieces 15, 16 within which the operating elements of the electromagnetic switch are contained and secured. As shown in Figs. 1 and 6, each frame member, at a location suitably above the base, has a pair of ears 17, 17 struck inwardly in a common plane; upon said ears rests a plate 18 which serves as a base for the solenoid and snap spring mounting structure, as later described. Legs 19 of said base 18 extend downwardly between and in engagement with the side edges of the spaced ears 17, 17 of the respective side frame members, and plate 18 is thereby held against rotation without the necessity of welding or like means.

At the center of plate 18 is a square opening, bounded on two opposite sides by downwardly extending guide walls 20, 20.

Two arcuate side walls 21, 21 diametrically placed, extend upwardly from plate 18 to receive and position snap-spring retaining rings 22, 23 and the cup 25 of a solenoid 26, said elements merely being set into position on said base plate 18, without securement thereto. As shown in Fig. 5, ring 22 is shouldered for cooperation with the ring 23 to provide a circular groove within which is confined the rim portion of a snap spring 24.

A second solenoid cup 27 houses a solenoid 28; between the solenoid cups 25 and 27 are a pair of flanged spacer members 29, 30, the outer flanges 31, 32 of which fit snugly between and in contact with the frame side-pieces 15, 16, and the inner cylindrical flanges 33, 34 provide a guide sleeve for a magnetic armature 35, axially slidable therein.

To each of the solenoid cups 25, 27 is attached a pole-piece 36, 37, the axial passage of the latter being concentric with respect to the cylindrical flanges 33, 34, to permit the guided slidable passage of the actuator rod 38, secured to armature 35.

The respective solenoid cups 25 and 27, ring members 29, 30, and pole-pieces 36, 37 are preferably of steel or other magnetic material.

The entire assembly previously described is maintained in proper operative position without individually securing each of the respective elements by means of a bridge 40 which extends between the side frame pieces 15, 16, to pass through a hole adjacent the ends thereof, see Figs. 4 and 5. One or more set screws 41, 41, pass through the bridge 40 to bear against solenoid cup 27, in this manner adjustably holding the respective solenoid cups, cup spacers and snap spring ring members in position against the base plate 18. Walls 21, 21 of plate 18 prevent the rings 22, 23, and solenoid cup 25 from shifting laterally, and the side frame members 15, 16, against which the flanges 31, 32 of solenoid cup spacer rings 28, 30 abut, insure that the solenoid cup 27 is held against movement.

The bridge 40 also serves to hold the cap 14 and casing 12 in position, by the screw 42.

Snap spring 24 has an opening through its center to receive the reduced diameter, threaded, end of the actuatior rod 38, which is secured to a rectangular block 43 of insulation material, the latter passing through the square central opening in plate 18. The walls 20, 20 act as bearing guides for the block 43.

Secured to the other end of the block 43 by means to prevent relative rotation is a preferably flat spring 44 which carries, by means of rivits 45, 45, see Fig. 1, a contact bridge 46 having at diametrically spaced locations contacts 47, 47, said contacts cooperating with contacts 48, 48 fixed to the insulating base 11. Suitable terminal pieces 49 are provided for connection of contacts 48, 48 into the circuit to be controlled.

As Fig. 3 shows, the rivets 45 are at a spacing of 90° with respect to the contacts 47, 47. Such arrangement affords a substantial measure of self-adjustability of contacts 47 with respect to contacts 48, 48, while providing an otherwise rigid supporting structure for said contacts 47.

Referring to Fig. 7, the respective solenoids 26 and 28 are connected into a common circuit for remote control by a momentary-contact switch S, through the illustrated terminals on cap 14. The contacts 47, 48 are in the circuit to be controlled. The solenoid coils may or may not be wound for low voltage actuation, according to preference.

The actuation of solenoid 26 drives the armature to the right as shown in Fig. 5, thereby causing the snap spring 24 to throw into its second position of stable equilibrium as is shown in said figure and bringing the contacts 47 into engagement with the terminal contacts 48. The spring 44 flexes under the impact of the contacts, acting to dampen the engagement of the said contacts and preventing rebound. Desirably, the engagement of the respective contacts is prior to the attainment of full throw position of the snap spring, whereupon said snap spring acts continually to exert a yielding pressure against the spring 44 and in turn against the fixed contacts.

On reverse movement of the armature under the attraction of solenoid 28 the spring 24 snaps to its reverse position of equilibrium to open the contacts 47, 48. The reaction of spring 44 assists in the breaking of the contacts at high speeds.

Whereas we have described our invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made provided they do not depart from the scope of the claims.

We claim:

1. In an electromagnetic switch, the combination of spaced side frame members, a sub-base carried by and between said side frame members, a snap spring, means for mounting said snap spring disposed upon said sub-base and confined between said side frame members, solenoid means for actuating said snap spring, and means for securing said solenoid means within said side frame members, comprising a bridge member disposed across said side frame members adjacent the ends thereof and means associated with said bridge means and said solenoid means for adjustably maintaining said solenoid means in position with respect to said sub-base.

2. In an electromagnetic switch, the combina-

tion of spaced side frame members having ears struck inwardly and in a common plane, a sub-base supported on said ears, said sub-base having legs extending inwardly therefrom in engagement with the said ears to hold said sub-base against rotation, solenoid means supported by said sub-base, means including a bridge member extending across said side frame members adjacent the ends thereof, and set screw means passing through said bridge member and bearing against said solenoid means to maintain the position thereof.

3. In an electromagnetic switch, the combination of a base, side frame members secured to said base in spaced relationship, a sub-base supported by and between said side frame members in fixed position thereon, snap spring supporting means carried on said sub-base, solenoid means operatively associated with said snap spring means and including cup means, said solenoid cup means being disposed one on the other, and means associated with said solenoid cup means and said side frame means for positioning said solenoid cup means therein.

4. In an electromagnetic switch, the combination of a base, side frame members secured to said base in spaced relationship, a sub-base supported by and between said side frame members in fixed position thereon, snap spring supporting means carried on said sub-base, solenoid means operatively associated with said snap spring means and including cup means, said solenoid cup means being disposed one on the other, means associated with said solenoid cup means and said side frame means for positioning said solenoid cup means therein, said means including a member extending across said side frame means adjacent the end thereof, and a screw passing through said member and bearing against the immediately adjacent solenoid cup means.

5. In an electromagnetic switch, the combination of a housing including a base, side frame members secured to said base and extending upwardly therefrom, a sub-base extending between said side frame members at a pre-determined fixed position and individual solenoid cup members positioned one on the other with respect to said sub-base and means associated with said

side frame members and bearing against one of said solenoid cup means to retain said cup means upon said sub-base.

6. In an electromagnetic switch, the combination of a base, spaced side members secured to said base and extending upwardly therefrom, a sub-base positioned between and resting upon elements of said side frame members, snap spring retaining means removably positioned on said sub-base, a rigid solenoid housing disposed between said side frame members and removably positioned upon said snap spring retaining means, a second rigid solenoid housing removably positioned upon the first-named housing, a bridge member extending between and retained by said side frame members, and means interposed between said bridge means and the last-named solenoid housing to hold the respective solenoid housings and snap spring retaining means in position upon said sub-base.

7. In an electromagnetic switch the combination of spaced side frame members, said members having extensions projecting inwardly of said members respectively, means for supporting said spaced side frame members including a base, a sub-base supported upon said extensions and disposed intermediate said spaced side frame members, operator means for said circuit breaker and disposed upon said sub-base, bridge means spanning said side frame members and supported by said side frame members, and securing means interposed between said bridge means and said operator means for stably positioning said operator means upon said sub-base.

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