

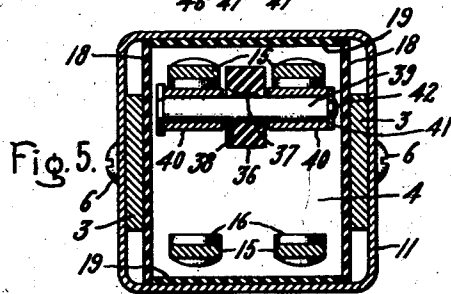
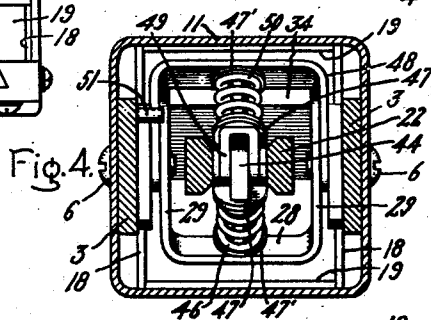
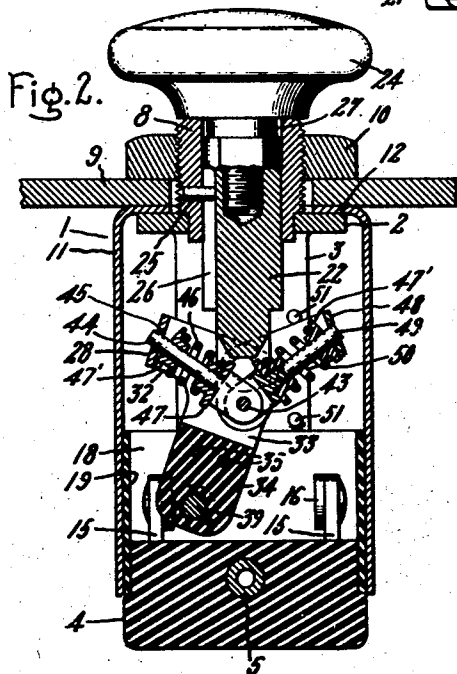
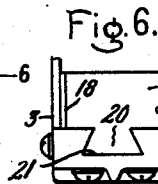
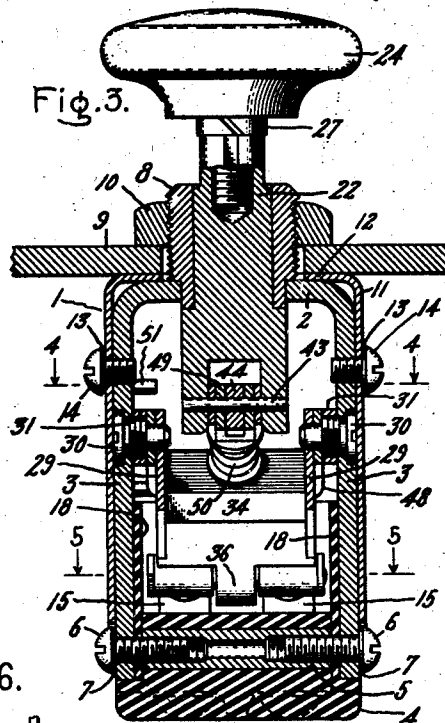
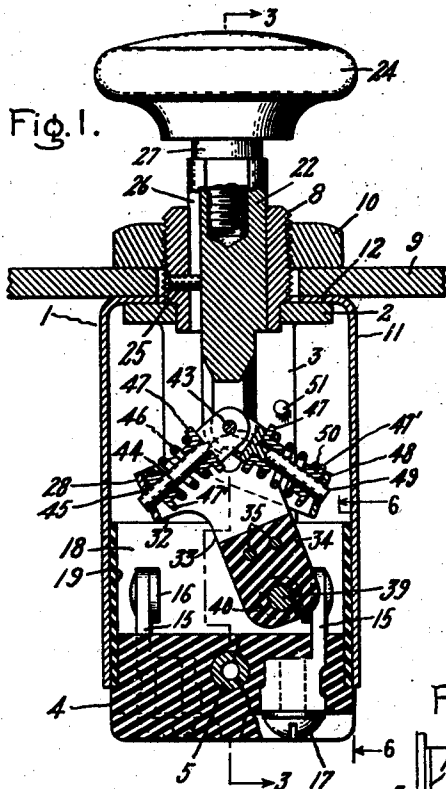
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2,418,005

ELECTRIC SWITCH

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UNITED STATES PATENT OFFICE

2,418,005

ELECTRIC SWITCH

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Our invention relates to electric switches and more particularly to an electric switch of the push-pull type having a snap action.

It is an object of our invention to provide an improved construction and arrangement in switches of the type described in which the switch is composed of relatively few parts, easily assembled, and in which the switch is of rugged construction, well able to withstand continuous vibration. The switch is reliable in operation and insures a firm and even contact between the fixed and movable contacts.

In the accompanying drawing, Fig. 1 is a sectional view through the switch showing the movable contacts in one position; Fig. 2 is a similar sectional view through the switch showing the movable contacts in another position; Fig. 3 is still another sectional view through the switch taken along the line 3—3 of Fig. 1; Fig. 4 is a sectional view taken along line 4—4 of Fig. 3 and showing the snap action mechanism; Fig. 5 is a sectional view taken along line 5—5 of Fig. 3 showing the construction of the movable contacts, and Fig. 6 is a view of part of the switch base looking in the direction of line 6—6 of Fig. 1.

Referring to the drawing, our switch 1 includes a supporting member 2 formed of heavy strip material bent in the form of a U with the arms 3 extending in side by side parallel relationship. A base 4 of any suitable insulating material, such as a phenolic condensation product and filler, is mounted on the supporting member between the arms at a point opposite the bend in the supporting member. As best shown in Fig. 3, a tubular ferrule 5 is molded in the base and is threaded at each end for receiving screws 6 which extend through the arms 3 and fasten them to the base. Lock washers 7 prevent loosening of the screws under excessive vibration. At the end opposite the base, the supporting member 2 is provided with a bushing 8 fastened to the supporting means in any suitable manner, as by brazing. The bushing is adapted to extend through a supporting panel 9, such as the front panel of an instrument board, and a nut 10 is threaded on the bushing to hold the switch 1 in mounted position. An enclosing cover 11 has an inwardly turned edge 12 extending over the bend in the U-shaped supporting member 2 and the cover extends down-

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wardly along the arms 3 into engagement with the base 4 to provide an enclosing housing for the switch structure. As shown in Fig. 3, the cover is fastened in position by lock washers 13 and screws 14 threaded into the arms 3. The arrangement of the cover is such that it may be slipped down over the bushing 8 around the supporting member 2 and then fastened in position by means of the screws 14.

The base 4 carries spaced contact members 15 which, in manufacture, are molded in the base. As shown by Fig. 5, the contacts are arranged in groups of two on opposite sides of the base, the arrangement being such that the contacts of each pair are electrically connected together by a movable contact means to be described later. Each contact member carries a contact button 16 of high conductivity, such as a silver alloy, and each contact is likewise provided with a terminal screw 17 for making an electrical connection therewith.

In order to insulate the contacts 15 from the metal parts of the switch mechanism, and further to provide an enclosing insulating housing at the point where arcing between the fixed and movable contacts is likely to occur, we provide barrier sheets of insulating material 18 and 19. These sheets are arranged around the outside of the base so that the upstanding portions of the contacts are surrounded by an insulating barrier, as shown in Fig. 5. The barrier sheets are made of low cost insulating material, such as fiber or the like. As shown in Fig. 1, they extend upwardly to a considerable extent above the contact buttons 16 to enclose the movable and fixed contacts. As shown in Fig. 6, the plates 19 are provided with dove-tail portions 20 which rest in slots 21 in the base 4 so that the insulating sheet material is anchored in position. The opposing sheets 18 are held against the base beneath the arms 3. This arrangement is shown by Fig. 3. The opposing sheets 19 are held in position on the base by the enclosing side walls of the cover 11, as shown by Fig. 1.

The switch operating mechanism includes a plunger 22 which is mounted to slide in the bushing 8 and which moves up and down in a reciprocating motion when the switch is operated by means of a handle 24. Rotation of the plunger in the bushing is prevented by means of a pin

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25 seated in the bushing and which extends into a slot 26 formed in a side edge of the plunger. The handle 24 is screw threaded to one end of the plunger. A lock washer 27 prevents loosening of the handle on the plunger due to the effects of vibration.

The movable contact mechanism provided for cooperation with the fixed contacts includes a yoke 28. The yoke is formed as a U-shaped member having side arms 29 pivotally supported on the arms 3 of the supporting member 2. The yoke supporting means comprises screws 30 threaded into bosses 31 spotwelded to the arms 3. The screws 30 extend inwardly and, as shown in Fig. 3, are provided with extensions forming bearing surfaces for the arms of the yoke.

The arms of the yoke are provided with angular offset portions 32 and 33 shaped generally as the letter L. A member 34, of insulating material, is carried by the angular portion 33 of the yoke and is staked thereto by means of pins 35. As shown by Fig. 5, the insulating member is provided with an offset extending portion or lug 36 which carries the movable contact means for engaging the fixed contacts. To this end, the offset portion 36 is provided with an opening 37 having bevel surfaces 38 and through which extends a pin 39. The pin carries contact cylinders 40 on opposite ends on each side of the lug. The contact cylinders are tightly mounted on the pin 39 and are held in position by means of washers 41 fastened to the pin by peened over projections 42 on the ends thereof.

It will be apparent from the showing of Fig. 5 that the pin 39 can pivot within a small angle in one plane in the opening in the insulating member by reason of clearance allowed by the bevel surfaces 38. Since the contact bridge cylinders 40 and pin 39 are loosely mounted in the lug 36, it will be apparent that a certain amount of play is obtained between the movable contacts and the fixed contacts. This permits the movable contacts to be seated firmly in position against the fixed contacts and takes care of any slight inaccuracy in alignment of the fixed contacts which might occur due to manufacturing tolerances.

In order to snap the movable contacts into and out of engagement with the fixed contacts, the switch is provided with a snap acting mechanism for operating the yoke 28. To this end, the end of the plunger 22 carries a pivot pin 43. One end of a trigger 44 is pivotally mounted on the pin. The opposite end of the trigger extends through an opening 45 in the angularly extending portion 32 of the yoke and is slidable therein as the plunger is moved up and down past the center line of the pivots supporting the yoke. A compression spring 46 surrounds the trigger 44. One end of the spring engages a washer 47 which, in turn, rests against the pivot end of the trigger. The other end of the spring engages a second washer 47' which bears against the portion 32 of the yoke. As shown in Fig. 1, the washer 47' which engages the yoke has a slightly curved configuration so that as the trigger 44 moves back and forth at an angle across the face of the yoke, the washer 47' will rock on its curved surface. This arrangement prevents any binding of the spring 46 against the metal of the yoke and gives a quicker and freer action of the snap acting mechanism.

To balance the forces exerted on the projecting end of the plunger 22, we provide a second trigger and spring located on the opposite side of the plunger from the trigger 44. This con-

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struction includes a U-shaped stirrup 48 with the arms of the U-being mounted on the bearing screws 30 beneath the arms of the yoke, in the manner shown by Fig. 3. One end of a second trigger 49 is pivotally mounted on the shaft 43 in the end of the plunger and the opposite end extends through an opening in the stirrup 48. A compression spring 50 is located around the trigger 49. Each end of the spring is provided with washers 47 and 47' bearing against the trigger pivot and stirrup, respectively, for the purposes already described. Fixed stops 51 carried by one of the arms 3 limits movement of the stirrup 48.

The movable contact bridge carried by the yoke is adapted to engage either pair of contacts to close the circuit between the individual contacts of each pair. With the plunger extended, the circuit through the right-hand pair of contacts is closed, as shown by Fig. 1. When the plunger is depressed, the pivot 43 carrying the triggers 44 and 49 is moved past the center line of the yoke pivots formed by the screws 30. During movement of the plunger, the triggers slide outwardly through the openings in the yoke and stirrup and the springs 46 and 50 are compressed. As the trigger pivot 43 moves downwardly past the center line of the yoke pivots, the compressed spring 46 is changed in position so that it exerts an upward thrust on the angularly extending portion 32 of the yoke. This causes the yoke to snap over into the position shown by Fig. 2 so that the movable contact engages the left-hand pair of fixed contacts.

By providing a duplicate of the trigger mechanism on opposite sides of the plunger, we are able to obtain a relatively large snap acting force on the yoke and one which holds the movable contacts firmly in engagement with the fixed contacts. This is important in those instances in which the switch is used at locations which are likely to be subject to severe vibration as on aircraft. The chief advantage of the arrangement is that the forces applied to the projecting end of the plunger are equalized. This avoids any binding of the plunger in the bushing and makes the action of the switch very smooth. The construction is one which is compact but yet which is so designed as to provide a large air gap between the contact surfaces and ample contact area. This increases the capacity of the switch. The high speed break action prevents the formation of and arc even at considerable overload.

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

1. An electric switch comprising, in combination, a support including spaced arms, a base disposed between and carried by said arms at their outer ends, fixed contact members carried by said base projecting toward the inner ends of said arms, a reciprocating plunger carried by said support at its inner end and extending between the arms thereof in parallel relation thereto, an L-shaped yoke pivoted between the arms intermediate between their ends with one yoke arm extending toward said fixed contact members, contact means carried by such arm of the L-shaped yoke for cooperating with the fixed contacts, a trigger pivotally mounted on said plunger and slidably engaging the other arm of the L-shaped yoke, and spring means cooperating with said trigger and yoke and operable upon movement of the trigger pivot to one side or the other of the yoke pivot to snap the movable contacts into and out of engagement with the fixed contacts.

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2. An electric switch comprising, in combination, a support including spaced arms, a base of insulating material disposed between and carried by said arms at their outer ends, fixed contact members carried by said base projecting toward the inner ends of said arms, a reciprocating plunger carried by said support at its inner end and extending between the arms thereof, an angular yoke pivoted between the arms intermediate between their ends with one yoke arm extending toward said fixed contact members, contact means carried by such arm of the yoke for cooperating with the fixed contacts, a trigger pivotally mounted on said plunger, said trigger slidably engaging the other arm of the yoke and spring means carried by said trigger, said plunger being movable to move the trigger pivot to one side or the other of the yoke pivot whereby said spring means operates to snap the movable contacts into and out of engagement with the fixed contacts.

3. An electric switch comprising, in combination, a supporting means, fixed contacts mounted thereon, a reciprocating plunger carried by said supporting means, a yoke having spaced arms pivotally mounted on said supporting means between said plunger and fixed contacts, said fixed contacts, plunger and yoke being positioned in substantially axial alignment with a free end of the yoke adjacent to such contacts, contact means carried by such free end of said yoke for cooperating with the fixed contacts, a trigger, one end of said trigger being pivotally mounted on said plunger and the other end slidably engaging the yoke, and spring means carried by said trigger and engaging the yoke, said plunger being movable between the yoke arms to move the trigger pivot to one side or the other of the yoke pivots whereby said spring operates to snap the movable contacts into and out of engagement with the fixed contacts.

4. An electric switch comprising, in combination, a supporting means, fixed contacts mounted thereon, a reciprocating plunger carried by said supporting means, a yoke pivotally mounted on said supporting means, contact means carried by said yoke for cooperating with the fixed contacts, a trigger pivotally mounted on said plunger and slidably engaging the yoke, a stirrup pivoted on said supporting means, a second trigger pivotally mounted on said plunger and slidably engaging the stirrup, and spring means carried by each of said triggers, said plunger being movable to move the trigger pivots to one side or the other of the yoke pivots whereby said spring means operate to snap the movable contacts into and out of engagement with the fixed contacts.

5. An electric switch comprising, in combination, supporting means, fixed contacts mounted thereon, a reciprocating plunger carried by said supporting means, an angular yoke pivoted on said supporting means, one arm of said yoke being provided with contact means cooperating with said fixed contacts, a trigger pivotally mounted on said plunger and slidably engaging the other arm of said yoke, a stirrup pivoted on said supporting means, a second trigger pivotally mounted on said plunger and slidably engaging the stirrup, and separate spring means cooperating with said triggers, the spring means being operable upon movement of the trigger pivots to one side or the other of the yoke pivot to snap the movable contacts into and out of engagement with the fixed contacts.

6. An electric switch comprising, in combi-

nation, supporting means, fixed contacts carried on said supporting means, a reciprocating plunger slidably mounted on said supporting means, a yoke pivotally mounted on said supporting means and having a portion extending to one side of said plunger, contact means carried by said yoke for cooperation with the fixed contacts, a trigger pivotally mounted on said plunger and slidably engaging that portion of the yoke on one side of the plunger, a stirrup pivoted on said supporting means on the other side of said plunger, a second trigger pivotally mounted on said plunger and slidably engaging the stirrup, separate spring means carried by the triggers and adapted to engage the yoke and stirrup respectively, said plunger being movable to move the trigger pivots to one side or the other of the yoke pivots whereby said spring means operates to snap the movable contacts on the yoke into and out of engagement with the fixed contacts.

7. An electric switch comprising, in combination, a supporting means, fixed contacts mounted thereon, a reciprocating plunger carried by said supporting means, a yoke having spaced arms pivotally mounted on said supporting means between said plunger and fixed contacts, said fixed contacts, plunger and yoke being positioned in substantially axial alignment with a free end of the yoke adjacent to such contacts, a member of insulating material carried by said yoke between the free ends of the arms thereof, contact means supported in said insulating material for engaging said fixed contacts, a trigger cooperating with said yoke and plunger and being pivotally mounted on one of these elements for slidable cooperation with the other, and spring means cooperating with said trigger and engaging the yoke, said plunger being movable between the yoke arms to move the trigger to one side or the other of the yoke pivots whereby said spring operates to snap the movable contacts into and out of engagement with the fixed contacts.

8. An electric switch comprising, in combination, a supporting means, fixed contacts mounted thereon, a reciprocating plunger carried by said supporting means, a yoke having spaced arms pivotally mounted on said supporting means on opposite sides of said plunger, a member of insulating material carried by said yoke, contact means supported in said insulating material for engaging said fixed contacts, a trigger cooperating with said yoke and plunger and being pivotally mounted on one of these elements for slidable cooperation with the other, a stirrup having spaced arms pivotally mounted on said supporting means, a second trigger cooperating with said stirrup and plunger, separate spring means carried by said triggers and engaging the yoke and stirrup respectively, said plunger being movable between the arms of the yoke and stirrup to move the triggers to one side or the other of the yoke pivots whereby said spring means operate to snap the movable contacts into and out of engagement with the fixed contacts.

9. An electric switch comprising, in combination, a support having spaced arms, a base of insulating material disposed between and carried by said arms, fixed contact members carried by said base, a reciprocating plunger carried by said support and extending between the arms thereof, a yoke pivoted between the arms, an insulating member carried by said yoke, contact means disposed in said insulating member for cooperation with said fixed contacts, a trigger pivotally mounted on said plunger, said trigger slidably

engaging the yoke, a stirrup pivotally mounted on the spaced arms of said support, a second trigger pivotally mounted on said plunger and slidably engaging said stirrup, separate spring means carried by each of said triggers and engaging the yoke and stirrup respectively, said plunger being movable to move the trigger pivots to one side or the other of the yoke pivots so that the spring means operate to rotate the yoke to move the movable contacts into and out of cooperation with the fixed contacts.

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