

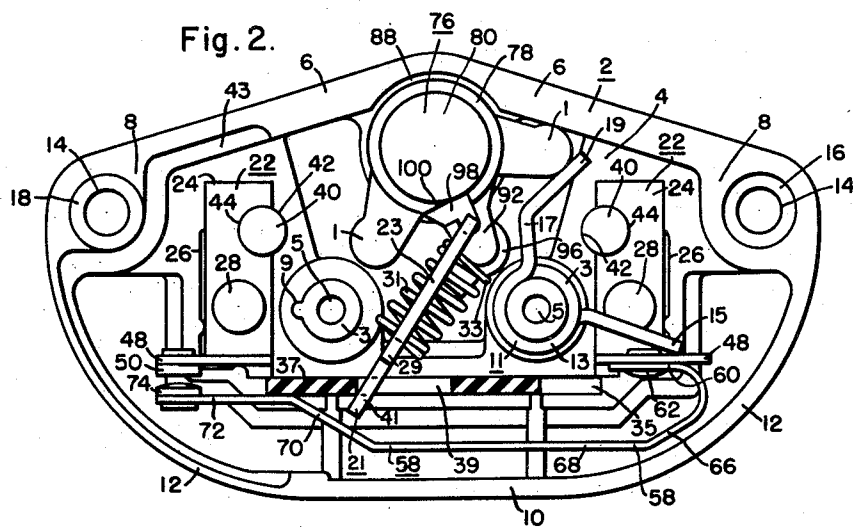
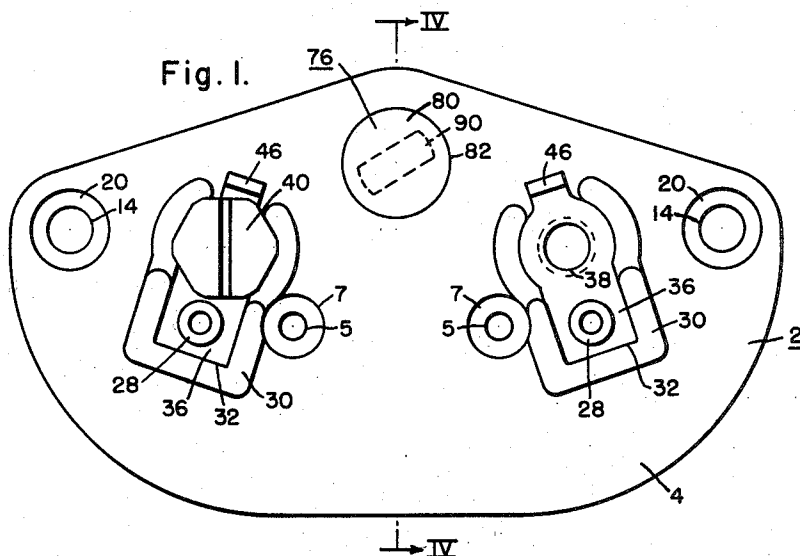
Jan. 6, 1959

O. L. TAYLOR
SWITCH

2,867,700

Filed Aug. 18, 1955

2 Sheets-Sheet 1



WITNESSES

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2 Sheets-Sheet 2

Fig. 4.

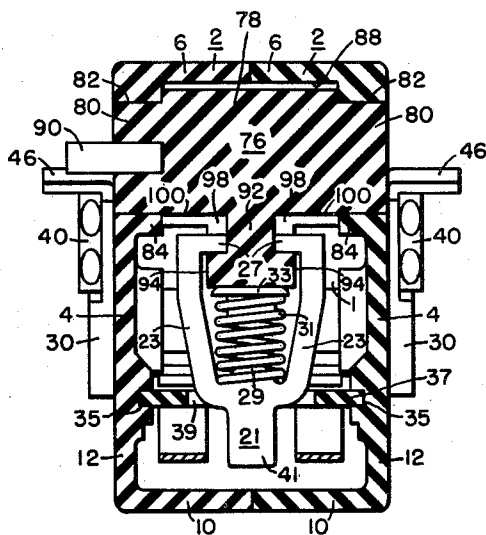
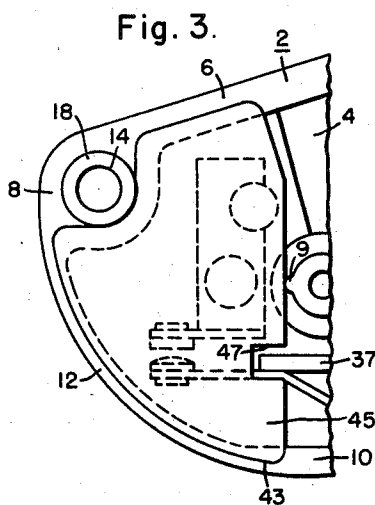
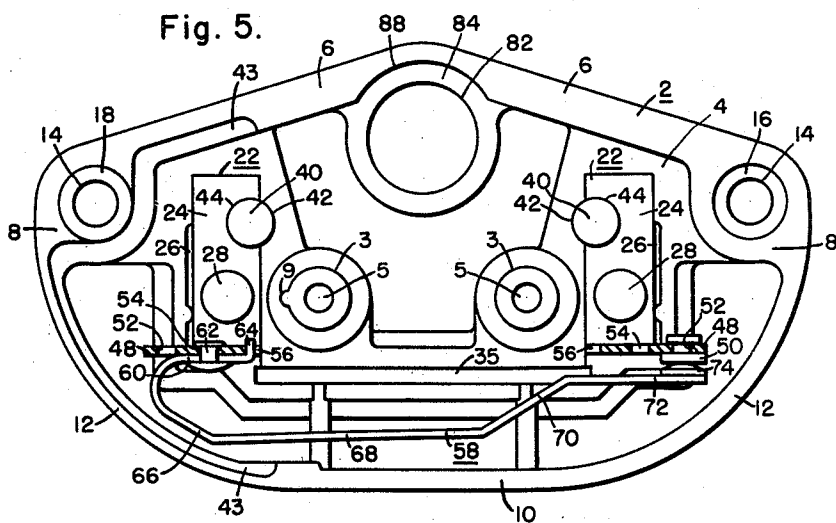


Fig. 5.



2,867,700

SWITCH

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Application August 18, 1955, Serial No. 529,301

12 Claims. (Cl. 200—67)

My invention relates to electric switches and, more particularly, to an electric snap switch where contact actuation can be accurately controlled.

For certain switch applications it is desirable to have an electrical snap switch in which the total travel of the operating means is limited and the point at which the switch contacts open and close with reference to the total travel of the operating means can be accurately controlled. In some applications it is also desirable that such opening and closing of the switch contacts be made within different degrees of the full travel of the operating means. Further, in some applications such as controlling gasoline pumps, such making and breaking of the electrical contacts should be in such a manner that no "teasing" of the contacts can be accomplished once the switch has thrown over to one operating position until the operating handle has reached the actuating position for the other operating position. In gasoline pump applications, an alternating current is normally supplied so that a small contact gap between contacts is desired in order to increase the contact life. However, the force for opening such contacts should be of sufficient magnitude so as to force the contacts apart notwithstanding any tendency of such contacts to stick due to the passage of current therebetween. Heretofore, prior devices of this nature have not incorporated all these safety features or have only obtained such features at a commercially prohibitive cost.

Accordingly, one object of my invention is to provide a new and improved low cost electrical switch which utilizes a sliding cam operated contact system which is driven by a toggle mechanism to obtain positive control of the position of the switch contacts.

A more specific object of my invention is to provide a new and improved low cost electrical switch which utilizes a sliding cam operated contact system, which cam has a large rectangular opening therein and a toggle mechanism to drive such cam which includes a movable member engageable with the sides of the opening in the cam and which opening is of a size to permit lost motion between the cam and the toggle mechanism.

Another object of my invention is to provide a new and improved low cost electrical switch which utilizes a pair of identical cup-shaped housing members.

Another object of my invention is to provide a new and improved low cost electrical switch which is provided with integral means whereby the housings can be assembled with their open sides together in only one relative position.

Still another object of my invention is to provide a new and improved low cost electrical switch which utilizes a novel toggle mechanism whereby the switch contacts may be closed or separated within different degrees of the full angular travel of the operating handle when the handle is moved in opposite directions.

Another object of my invention is to provide a new and improved electrical switch which has a toggle actuating mechanism which incorporates a reciprocating handle

having a spherical seat upon which a helical spring is pivotally supported.

These and other objects of my invention will become more apparent upon consideration of the following detailed description of a preferred embodiment of my invention when taken in conjunction with the following drawings, in which:

Figure 1 is a side elevational view of a double pole double throw switch constructed in accordance with the principles of my invention;

Fig. 2 is a side elevational view of one of the switches shown in Fig. 1 with one half of the housing removed, which illustrates the internal construction thereof and the toggle actuating mechanism;

Fig. 3 is a side elevational view of one end of the housing shown in Fig. 2 illustrating an insulating shield located therein;

Fig. 4 is a cross-sectional view of the switch shown in Fig. 1 taken substantially along the line IV—IV thereof with the movable operating means being shown at its central position; and

Fig. 5 is a side elevational view of the other housing for the switch as shown in Fig. 1 which illustrates the internal construction thereof.

Referring to the drawings, it will be noted that a switch constructed in accordance with the principles of my invention comprises a pair of dished elongated housings 2 of the same construction which are assembled with their open sides together so as to form a hollow chamber therebetween. The housings 2 are formed from any suitable insulating material, such as a phenolic insulating material, and are preferably formed from a molded phenolic insulating material which may readily be provided with the preferred structure hereinafter described. As will become apparent hereinafter, the housings 2 are formed in an identical manner and yet are provided with means whereby they may only be assembled in one relative manner. Referring to Figs. 2 and 5, each housing 2 comprises an elongated base 4 of irregular shape which is symmetrical about its transverse center line and which is provided with upwardly extending side walls around all of its outer edges so as to define an open sided chamber. The side walls of each housing 2 include a pair of upper side wall portions 6 which are inclined to each other and integrally joined at the transverse center line of housing 2, and each of which is integrally joined at its free end to an enlarged generally rectangular boss 8. The side walls of each housing 2 also include a lower side wall portion 10 which extends longitudinally an equal distance on each side of the transverse center line of base 4 with each end thereof integrally joined to a curved side wall portion 12, each of which, in turn, is integrally joined to the lower outer edge of the boss 8 located on the same side of the transverse center line as the side wall 12 connected thereto.

In order to provide means for mounting the assembled switch, each boss 8 is provided with a through circular opening 14. For the purpose of obtaining an interlocking structure, the right boss 8 (Fig. 2) is provided with an inwardly extending circular recess 16 around the opening 14 and the left boss 8 is provided with an outwardly extending circular projection 18 around the opening 14 which is adapted to enter and be located in recess 16 of the other housing 2. Thus, when the pair of housings 2 are assembled together as previously indicated, the projection 18 can only engage the opposite recess 16 of the mating housing 2 which will preclude any other assembly of the housings 2 together. It, of course, will be realized that such interlocking feature of the housings 2 can be interchanged on the bosses 8 and is not limited to the particular location or configuration described. Thereafter, the assembled switch may be located on suitable positioning means, not shown,

extending through the aligned openings 14 in the assembled housings 2. If desired, as shown in Fig. 1, the outer surface of base 4 at each boss 8 may be provided with an inwardly extending circular recess 20 to receive suitable securing means, not shown, to engage the positioning means.

Returning to Figs. 2 and 5, it will be noted that an elongated electrical terminal 22 is secured to the base 4 of each housing 2 inwardly of and adjacent each boss 8 so as to provide a pair of longitudinally spaced electrical terminals. The terminals 22 may be of any suitable electrical conducting material, such as a copper alloy, which may easily be formed as described. Each terminal 22 comprises a rectangular base 24 which is adapted to be received in a suitable rectangular laterally extending recess 26 in the base 4, and which is secured to the base 4 by any suitable connecting means, such as a rivet 28, extending through the aligned openings in base 4 of the housing 2 and the base 24 of the terminal 22.

As shown in Fig. 1, the outer surface of the base 4 is provided with a pair of longitudinally spaced angularly outwardly extending generally U-shaped walls 30 which form a generally rectangular recess 32. Each recess 32 is formed so as to closely receive therein an elongated terminal 36, which terminal may be formed from any suitable electrical conducting material, such as copper or brass, and which may be readily formed with the structure as hereinafter described. It will be noted that the lower end of each recess 32 on the outer surface of the base 4 overlies the lower end of a recess 26 on the inner side of the base 4, so that an opening may be provided in each terminal 36 in alignment with the opening in the terminal 22 and the base 4 thereunder through which the rivet 28 extends so that the rivet 28 may also be utilized to both mechanically and electrically secure each terminal 32 to the terminal 22 thereunder together. Inasmuch as each rivet 28 is utilized for electrical purposes, it is formed from any suitable electrical conducting material which may be readily deformed so as to securely hold the terminals 36 and 22 together, such as copper or brass. In order to increase the electrical conductivity between the terminals 36 and 22, it will be noted that each rivet 28 is provided with an enlarged head on the inner side whereby the area of engagement between the rivet 28 and the terminals 22 is of a fairly large magnitude.

The upper end of each terminal 36 (Fig. 1) is laterally enlarged to provide sufficient material whereby a threaded opening 38, only one of which is shown in Fig. 1, may be provided to receive the threaded shank of a terminal screw 40. The walls 30 are curved outwardly to closely receive the enlarged portion of the terminal 36 therebetween and are also reduced in height at this area to provide clearance for the head of the terminal screw 40 and insure that a good electrical connection may be made between the heads of the terminal screw 40 and the terminals 36. In order that the shank of the screws 40 may extend inwardly of the housing 2, an opening 42 is provided in the base 4 in alignment with each opening 38 in each terminal 36 and the base 24 of each terminal 22 is provided with a partial circular opening 44 which is also in alignment with the opening 38. Inasmuch as the recesses 32 are inclined inwardly with respect to the recesses 26, the openings 44 are located along the opposed inner edges of the base 24 of each terminal 22 adjacent their upper ends. In order to facilitate making electrical connections to the terminals 36, each terminal 36 may be provided with a lug 46 which extends substantially perpendicularly outwardly from the outer surface of the base 4 at the extreme upper end of the terminal 36 between the free ends of the U-shaped walls 30.

As shown in Fig. 5, each terminal 22 is provided at its lower end with an integral arm 48 which extends later-

ally and inwardly of the casing, the lower end of the base 24 thereof and outwardly therebeyond, toward the adjacent curved side wall portion 12. The arm 48 of the right terminal 22 is provided with an electrical contact 50 which may be of any suitable electrical conducting arc-resisting material, such as a silver alloy, and which may be secured thereto in any suitable manner such as by having a shank insertable through an opening 52 adjacent the right end of arm 48 and being riveted thereto. The arm 48 of the left terminal 22 is provided with a central circular opening 54 and an open-ended notch 56 at its extreme right end. As shown, the arms 48 of each terminal 22 are formed identical to each other, although the opening 52 is not utilized in the left arm 48 and the opening 54 and the notch 56 are not utilized in the right arm 48. Such identical formation of the arms 48 is for the purpose of minimizing the tools required to blank the terminals 22, as both of the terminals 22 can be formed by merely changing the direction from which the base 24 extends from the arm 48.

An elongated irregular shaped contact 58 which may be formed from any suitable resilient electrical conducting material, such as a copper alloy, is adapted to extend between the terminals 22 and selectively electrically connect the terminals 22 together. In order to accomplish this purpose, the left end of the contact 58 (Fig. 5) is generally U-shaped with its upper arm 60 secured to the arm 48 of the left terminal 22 in any suitable manner, such as by an electrical conducting rivet 62 extending through the opening 54 of the arm 48 and through an aligned opening in the upper arm 60 of the contact 58. The free end of the upper arm 60 of the U-shaped portion of contact 58 is provided with an upwardly extending projection 64 which is adapted to be located within the notch 56 of the arm 48 of the left terminal 22 so that the contact 58 is laterally aligned with reference thereto and extends properly towards the right terminal 22. The U-shaped end of contact 58 has a lower arm portion 66 which extends angularly downward towards the lower side wall 10 and is extended as an elongated arm portion 68 which extends longitudinally towards the right terminal 22 and slightly upwardly away from the lower side wall 10. The contact 58 is formed at its right end (Fig. 5) so as to provide a connecting portion 70 which extends angularly upward from the lower side wall 10 at a relatively sharp angle thereto and which, in turn, terminates in a longitudinally extending arm 72 which is slightly longer and approximately parallel to the arm 48 of the right terminal 22 adjacent thereto. A contact 74 similar to the contact 50 is secured adjacent the free end of the arm 72 which, due to the configuration and resilient nature of the contact 58, is normally biased upwardly, as shown, into engagement with the contact 50. The contact 58 and its cooperation with terminals 22 in the housing 2 shown in Fig. 2 is identical to that previously discussed except that the contacts 50 and 74 in Fig. 2 are located in the left end of the housing 2, while the contacts 50 and 74 in the other housing 2 shown in Fig. 5 are in the right end of housing 2, so that when the housings 2 are assembled together the separable contacts 50 and 74 within each housing 2 are located in the same end of the assembled switch.

A rotatable operating handle 76 (Figs. 2 and 4) is provided for opening and closing contacts 50 and 74 and comprises an elongated cylindrical portion 78 having cylindrical bearings 80 of somewhat reduced diameter extending outwardly from each end thereof, which bearings 80 are adapted to be located within circular openings 82 in bases 4. The openings 82 are provided inwardly of the upper side walls 6 and are located with their center on the transverse center line of the housings 2. In order to provide additional bearing surface for the bearings 80, each housing 2 is provided with an inwardly extending collar 84 around the opening 82 which engages the end of the cylinder 78 adjacent thereto, so that when

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the housings 2 are assembled together, the cylinder 78 extends perpendicular to each of the bases 4 of each housing 2 and therebetween, and so that the free ends of the bearings 80 are substantially flush with the outer surfaces of the bases 4 of the housings 2. Clearance for the cylinder 78 is provided on the inner surfaces of each side wall 6 by means of partial circular recesses 88 therein. An elongated rectangular rocker shaft 90 is embedded in one of the bearings 80 which extends outwardly therefrom beyond the outer surface of one of the bases 4 of one of the housings 2 when the switch is assembled together, so that the cylinder 78 may be rocked externally of the switch. The rocker shaft 90 may be secured to either of the bearings 80 in any suitable manner, and as will become more apparent hereinafter. As handle 76 is formed of an insulating material, and preferably a molded insulating material, which may be provided with the necessary structure as herein described, the rocker shaft 90 may be embedded in one of the bearings 80. It will also be noted that the bearings 80 are of equal length and the cylinder 78 is located centrally between the collars 84 whereby the rocker shaft 90 may extend through either of the openings 82 in either of the bases 4 as desired.

The cylinder 78 is also provided with a V-shaped projection 92 which extends downwardly from its lower side and which extends longitudinally along the axis of the cylinder 78. The projection 92 is provided, centrally thereof, with a spherical seat 96 which extends outwardly from the sides and bottom rounded edge of the projection 92 in order to provide a pivot support for contact actuating means hereinafter described. In order to secure such contact actuating means to the handle 76, the end of the projection 92 is provided with a generally L-shaped slot 98 having its long leg extending below the cylinder 78 and substantially parallel to the lower side wall 10 when the cylinder 78 is located in its dead center position as shown in Fig. 4. The short leg of the slot 98 extends downwardly towards the spherical seat 96 centrally in the opposed ends of the projection 92. It will also be noted that the long leg of slot 98 undercuts the surface of cylinder 78 at its lower edge 100 in order to provide sufficient clearance for a part of the contact actuating means hereinafter described. The cylinder 78 of the handle 76 is also provided at each of its sides slightly below its horizontal centerline with an elongated angularly outwardly and downwardly extending projection 1 each of which extends longitudinally along cylinder 78 but which terminates short of each end thereof to provide clearance between the projections 1 and the inner surfaces of the casing. The projections are also provided with rounded ends. In order to facilitate molding of the handle 76, it will be noted that the handle 76 except for the shaft 90 is symmetrical about a plane passing laterally through the center of cylinder 78 and except for slots 98 is symmetrical about a plane passing longitudinally through the longitudinal axis of the cylinders 78.

Referring again to Figs. 2 and 5, the housings 2 are provided adjacent each side of their vertical center lines with circular projections 3 which are in horizontal alignment with each other and which extend inwardly of base 4. The projections 3 are of a length so that the inner edge is substantially in the same plane as the inner edges of the side walls 6, 10 and 12 of housing 2. The projections 3 in the housing 2 are located so that when the housings 2 are assembled together the projections 3 are in alignment with each other and extend between opposed inner surfaces of bases 4 of the housing 2. The projections 3 are also provided with central openings 5 of any suitable configuration such as circular whereby when the housings 2 are so assembled, they may be secured together by any suitable means, not shown, extending through the openings 5. If desired, as shown in Fig. 1, each base 4 may be provided with a circular recess 7 at the outer end of each opening 5 whereby such

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securing means may be located below the outer surfaces of bases 4. As shown, the left projection 3 (Figs. 2 and 5) is provided with a rib 9 along one side thereof in order to limit the manner in which the switch may be assembled as hereinafter described.

A coil spring 11 (Fig. 2) which comprises a substantially closed coil 13 with arms extending outwardly therefrom at each of its ends is provided for biasing the handle 76 in either one of two extreme positions. The spring 11 is preferably circular in cross section and may be formed from any suitable resilient material which may function as indicated, such as spring steel wire. The coil 13 has an internal coil diameter so that it may be placed over the right projection 3 and be closely received thereon with one arm 15 adjacent the inner surface of base 4 and extending thereacross so as to engage the upper surface of the arm 48 of the right terminal 22. Due to the rib 9 on the left projection 3 and the close fit of coil 13 on right projection 3, the coil 13 cannot be located on the left projection 3. The other arm of spring 11 is located above base 4 of the housing 2 and is formed so that a portion 17 next to the coil 13 extends outwardly from projection 3 substantially towards the center line of cylinder 78 of handle 76 when free, and so that its outer portion 19 extends substantially tangential to the opening 82 in the base 4 when free. Once the spring 11 is so located on projection 3, it is preferred that the coil 13 be wound so that the portions 17 and 19 of the one arm cause the coil 13 to be wound more tightly when it is moved rightwardly toward arm 15. Although not shown, rightward movement of the upper arm of the spring 11 is initially obtained when the handle 76 is inserted in the housing 2 in which the spring 11 is located. When the handle 76 is so inserted, the right projection 1 (Fig. 2) engages the portion 17 of the upper arm of the spring 11 below the junction of portions 17 and 19, and forces that arm of spring 11 rightwardly until the bearing 80 is aligned and located in the opening 82 in the base 4 of the housing 2. By so locating the handle 76 so that the portion 17 of the spring 11 engages the right projection 1, the spring force of the portion 17 biases the handle 76 in a clockwise direction so that the left projection 1 engages the inner surface of the left upper side wall 6. Rotation of the handle 76 in a counterclockwise direction, by means of the rocker shaft 90, causes the right projection 1 to force the portion 17 of the spring 11 rightwardly until the right projection 1 clears the junction of portions 17 and 19 of the upper arm of spring 11. Once the right projection 1 has so cleared the junction of portions 17 and 19 of the upper arm of the spring 11, the portions 17 and 19 will spring in a counterclockwise direction so that the slanting portion 19 engages the lower inner surface of the right projection 1 and biases the upper surface of projection 1 into engagement with the lower surface of the right side wall 6. At that time, the portion 19 of the spring 11 will bias the handle 76 in a counterclockwise direction and the left projection 1 will be freely located within the housing 2 above the base 4 as shown in Fig. 2.

As shown in Figs. 2 and 4, the actuating means for controlling the contacts 50 and 74 comprises a generally Y-shaped yoke 21 having elongated outwardly extending arms 23 which terminate at their free ends in inwardly extending approximately circular projections 27. The yoke 21 is also provided with a downwardly extending rectangular stem 41 below the arms 23 and a central upwardly extending rounded projection 29 between the arms 23 which is adapted to receive one end of a coil spring 31 therearound. The spring 31 may be formed of any suitable spring material such as steel, and the coils are spaced from each other a sufficient distance so that the spring may be compressed to operate as hereinafter indicated. As shown, an eyelet 33 having a flange extending over the upper coil of spring 31 and a stem extending downwardly therein is located

at the upper end of spring 31 to facilitate the sliding motion of handle 76 with relation to spring 31 as hereinafter described. By such a construction the yoke 21 may easily be secured to the handle 76 by initially placing the spring 31 so that its lower end is located around the projection 29, and placing the eyelet 33 in engagement with the spherical seat 96 on the handle 76. Thereafter, the spring 31 may be compressed by forcing the yoke 21 upwardly until the projections 27 thereon are in alignment with the long legs of the L-shaped slots 98, and thereafter moving the projections 21 so that they enter the short legs of the slots 98. When so assembled, the spring 31 biases the yoke 21 away from the slots 98 so that the yoke 21 may be pivotally rotated about its projections 27 and so that the eyelet 33 may slide over the spherical seat 96.

As shown in Fig. 5, the inner surface of the base 4 of each housing 2 is provided with a narrow rectangular guide recess 35 which is located slightly below the lower surface of the arm 48 of each contact 22 and which extends longitudinally across base 4 slightly outwardly of the opposed inner edges of the arms 48. Inasmuch as the housings 2 are identical, it will be noted (Fig. 4), that when the housings 2 are assembled together as previously indicated a pair of opposed recesses 35 are formed. The recesses 35 are for the purpose of receiving therein a thin rectangular cam plate 37 (Figs. 2 and 4) which may be formed from any suitable insulating material such as sheet phenolic insulating material, as shown in Fig. 2, which is initially located in the recess 35 in the housing 2 in which the handle 76 is initially located and is of a thickness so as to be slidably received in the opposed recesses 35. The cam 37 is also provided with an opening 39 approximately centrally therein which is of any suitable size and configuration, such as rectangular, whereby its longitudinally opposed sides acting as abutments will be engaged by the stem 41 of the yoke 21 in the manner as hereinafter described. When the switch is assembled as shown in Fig. 4, each side of the cam 37 is guided and supported by the opposed recesses 35 in the base 4 and the longitudinal travel therein is limited by the engagement of the outer edges of the cam 37 engaging the ends of recesses 35. It will also be noted that when assembled, the opening 39 is provided with sufficient lateral width to permit the lower portion of the arms 23 and the stem 41 of the yoke 21 to extend therein when the yoke 21 passes through its dead center position.

Once the switch has been assembled as indicated, it will be noted that the separable contacts 50 and 74 of each housing 2 are located at the same end of the assembled switch and are laterally spaced from each other. If desired, in order to provide an arc shield between the spaced pairs of contacts the left end of the housing 2 (Figs. 2 and 5), the latter may be provided with an inwardly open sided notch 43 which extends from the left end of lower side wall 10 along the left side wall 12 and around the left base 8 and partially along the left side wall 6 of Fig. 3 in which an insulating plate 45 may be inserted. The insulating plate 45 may be of any suitable material such as sheet phenolic insulating material which has its outer edges formed to be closely received in the notch 43. Thereafter, when the housings 2 are assembled, the end of one housing 2 without the notch 43 is engaged with the end of the other housing 2 with the notch 43 therein to prevent the plate 45 from being moved laterally within the switch. In order to prevent the plate 45 from being moved longitudinally, it will be noted that it is of a size so that its inner edge engages or is closely adjacent rib 9 on the left projection 3 (Fig. 3). Inasmuch as housings 2 are identical, an unused notch 43 is provided at the other end of the assembled switch which, although not used, permits the housings 2 to be assembled without reference to which end of the housing the switch contacts may be located.

Such independence of the various components of the switch greatly reduces the manufacturing cost of such a device. It will also be noted that the plate 45 is provided with a notch 47 in longitudinal alignment with the opposed recesses 35 whereby the movement of the cam 37 is not restrained by the plate 45.

After assembling the switch and assuming that the handle 76 is positioned as shown in Fig. 2, it will be noted that the stem 41 of the yoke 21 engages the left inner side of the opening 39 in the cam 37 to force the cam 37 leftwardly to the extreme left end of the recesses 35. When cam 37 is so located, it will be noted that its under surface is in engagement with the upper surface of the arms 72 of contacts 58 whereby the contacts 50 and 74 are separated. Thereafter, rotational movement of the handle 76 in the manner previously described in a clockwise direction causes the spherical seat 96 to slide within the eyelet 33 and move downwardly toward the projection 29 so as to cause the spring 31 to be compressed therebetween. As such clockwise movement of the handle 76 progresses, the spring 31 will be compressed as long as the spherical seat 96 is displaced downwardly within the housing 2 and until the spherical seat 96 is in alignment with the axis of the spring 31 and the yoke 21, at which point the spring 31 will have received its maximum compression. Thereafter, further clockwise movement of the handle 76 will cause the spherical seat 96 to move upwardly and away from the spring 31. Inasmuch as at that point the axis of the spring 31 is on the other side of the yoke 21, the force of spring 31 will cause the yoke 21 to be pivotally rotated counterclockwise around the projections 27 in the slots 98. Such rapid release of energy will cause the stem 41 of the yoke 21 to rapidly move about the pivots 27 of the yoke 21 in a counterclockwise direction through the opening 39 in cam 37 to the point where it engages the right side of the opening 39. After the stem 41 of the yoke 21 has engaged the right side of the opening 39 of the cam 37, further displacement rightwardly will cause the cam 37 to be forced rightwardly to the other end of the recesses 35. When the cam 37 is so forced rightwardly, its left end moves off of the upper surface of the arms 72 of the contacts 58 so that contacts 58 bias the contacts 50 into engagement with the contact 74. At such time the left end of the plate 37 will be located above the connecting portions 70 of the contacts 58. After the handle 76 has been so rotated in a clockwise direction, it may thereafter be rotated in a counterclockwise direction, at which time the reverse toggle action will occur causing the cam 37 to be moved leftwardly toward the contacts 50 and 74. In such leftward movement of the cam 37, the left end of the cam 37 engages the portions 70 of the contacts 58 causing the contacts 58 to be forced downwardly until the under surface of the cam 37 again slides over the upper surface of the portion 72 of the contacts 58. From such description, it will be noted that the sides of the opening 39 in the cam 37 and the ends of the recesses 35 are longitudinally spaced apart so that the opposed sides of the opening 39 limit the movement of stem 41 of yoke 21. It will also be noted that the spring 31 functions as a positive index for the handle 76 and in order to obtain a definite indication that the contacts have been opened or closed, the projection 1 leaves the junction of the portions 17 and 19 of the spring 11 at substantially the same time the above described over-center action occurs when the handle 76 is actuated in either direction.

As has been indicated the total angular travel of the handle 76 is limited in a clockwise direction (Fig. 2) by the engagement of the left projection 1 with the inner surface of the left upper side wall 6 and in a counterclockwise direction by the engagement of the right projection 1 with the inner surface of the right side wall 6. In order, however, to obtain opening and closing of

the contacts within different degrees of the total angular travel of the handle 76, the center of the spherical seat 96 is located so as to be closer to one of the projections 1 than to the other. By so locating the seat 96 "off center" with relation to the projections 1, the tripping point of the toggle joint can be varied so as to occur at a smaller angle of handle travel when the handle is moved in the one direction than when the handle is moved in the opposite direction. The particular location of the spherical seat 96, projections 1, and side walls 6 as shown is such when that the handle 76 has a total angular travel of 52°, the switch contacts will be separated within 9° of the total angular travel of the handle 76 in the contact opening direction, and the switch contacts will be closed within 30° of the total angular travel of the handle 76 in the opposite direction. It is to be realized that such tripping point values are purely illustrative of one particular operation of the switch and that the switch can be designed to obtain other desired operating characteristics. Also, it will be noted that with a given handle 76 the tripping point of the switch may be varied by inserting a different cam plate having a differently located opening therein for engaging the stem 41 of yoke 21. Inasmuch as such cam plates are formed from sheet material such substitution may easily be accomplished. Also, if desired, the tripping point may be varied by varying the location of the ends of the recesses 35 in the housing 2.

Although Fig. 4 shows the spherical seat 96, the spring 31 and the yoke 21 in alignment at a central position, it should be noted that in the operation of the switch such a condition will not exist as the spherical seat 96 moves through central position of the handle 76 to a position in alignment with the yoke 21 and slightly therebeyond before the overcenter action occurs. Accordingly, Fig. 4 should be considered in this respect as illustrative only of the construction of the various movable parts. It will be noted that the movement of the stem 41 of the yoke 21 in the manner as previously described causes the cam 37 to open and close the contacts 50 and 74 in each of the housings 2, whereby a pair of electrical circuits extending from the terminal screw 40, the terminal 36, the rivet 28, the terminal 22, the contact 50, the contact 74, the contact 58 to the other terminal 22, the rivet 28, the contact 36 and the terminal screw 40 in the same housing 2. However, it is believed obvious that, if desired, only one circuit need be so controlled by merely eliminating one contact 58. With the construction of the switch as has been described, it will be noted that the cam 37 of a simple form having a simply formed opening 39 therein whereby it may easily be fabricated by simple forming operations. Further, the opposed sides of opening 39 function as stops for the stem 41 of the toggle mechanism. Due to the fact that the opening 39 is fairly large, the stem 41 of the yoke 21 moves a considerable distance before engaging the side of opening 39, whereby a relative small displacement of the cam 37 is obtained as compared to the displacement of the toggle actuator. The disparity in relative motion permits the storing of considerable kinetic energy in the toggle actuator which results in a positive and rapid movement of the cam 37 and, due to the magnitude of such force, any possibility of the cam sticking is substantially eliminated.

The contact cam is driven by an overcenter spring toggle mechanism which differs from the normal toggle switch construction in that the spring driven actuator is pivoted on the handle rather than on the base. This change of pivot location gives much greater control over the actual tripping point of the device in that the angular motion carrying the toggle through its trip point is greater than if the spring driven toggle actuator had been pivoted on the base. Also, due to such larger angular displacement, the available spring force, to drive the insulating contact cam, is higher than if the toggle actuator had been pivoted on the base.

Although I have shown and described a particular

modification of my invention in accordance with the patent statutes, I am aware that other modifications of it are possible without departing from the spirit and scope of my invention. Accordingly, it is desired that my invention be not restricted except insofar as is necessitated by the prior art.

I claim as my invention:

1. An electrical switch comprising a housing of insulating material having two spaced substantially parallel side walls, elongated guide means located on opposed surfaces of said side walls, a movable contact actuating member supported by said guide means for limited movement in opposite directions, spaced abutments on said movable member, an operating member pivotally mounted on said housing, an actuating member pivotally mounted on said operating member with a portion thereof spaced from the pivot axis of said operating member so as to be movable in an oscillatory manner upon movement of said operating member in opposite directions, said portion of said actuating member being engageable with said abutments upon said movement of said operating member so that said movable contact actuating member may be moved in opposite directions on said guide means, at least one fixed contact secured to said housing, a resilient member secured to said housing having another contact secured thereto so as to be movable into and out of engagement with said fixed contact, and said resilient member being formed with a portion thereof located in the path of movement of said movable contact actuating member, so as to be engaged thereby upon appropriate movement thereof to change the relative position of said contacts.

2. An electrical switch comprising a housing of insulating material having two spaced substantially parallel side walls, elongated guide means located on opposed surfaces of said side walls, a movable member supported by said guide means for limited movement in opposite directions, spaced abutments on said movable member, an operating member pivotally mounted on said housing having a portion thereof spaced from its pivot axis which is oscillatably movable upon movement of said operating member in opposite directions, said portion of said operating member being engageable with opposed portions of said abutments upon said movement of said operating member so that said movable member may be reciprocally moved on said guide means, at least one fixed contact secured to said housing, a resilient member secured to said housing having another contact secured thereto so as to be movable into and out of engagement with said fixed contact, and said resilient member being formed with a portion thereof in the path of movement of said movable member so as to be engaged by said movable member to change the relative position of said contacts.

3. An electrical switch comprising a housing of insulating material having two spaced substantially parallel side walls, an elongated recess located on opposed surfaces of said side walls so as to be substantially parallel to each other, a flat plate having its sides located in said recesses so as to be movable therein in opposite directions, an opening in said plate, an operating member pivotally mounted on said housing having a portion thereof spaced from its pivot axis which is reciprocally movable upon movement of said operating member in opposite directions, said portion of said operating member being engageable with opposed edges of the opening in said plate upon said movement of said operating member so that said plate may be reciprocally moved in said recesses, at least one fixed contact secured to said housing, a resilient member secured to said housing having another contact secured thereto so as to be movable into and out of engagement with said fixed contact, and said resilient member being formed with a portion thereof in the path of movement of said plate so as to be engaged by said plate to change the relative position of said contacts.

4. An electrical switch comprising a housing of insulating material having two spaced substantially parallel side walls, elongated guide means located on opposed surfaces

of said side walls, a movable member supported by said guide means for limited movement in opposite directions, an operating member pivotally mounted on said housing having a supporting means extending radially outward from the pivot axis thereof, an elongated actuating member pivotally mounted on said supporting means so that its pivot axis is spaced from the pivot axis of said operating member and having a portion thereof spaced from said supporting means, a spring reacting between said supporting means on said operating member and said spaced portion of said actuating member, and spaced abutments on said movable member for limiting movement of said actuating member with respect to said operating member upon pivotal movement of said operating member in opposite directions so that the line of action of said spring is moved to opposite sides of the pivot point of said actuating member to operate the latter in opposite directions with a snap action, at least one fixed contact secured to said housing, a resilient member secured to said housing having another contact secured thereto so as to be movable into and out of engagement with said fixed contact, and said resilient member being formed with a portion thereof in the path of movement of said movable member, so as to be engaged by said movable member to change the relative position of said contacts.

5. An electrical switch comprising a housing of insulating material having two spaced substantially parallel side walls, elongated guide means located on opposed surfaces of said side walls, a movable member supported by said guide means for limited movement in opposite directions, an operating member pivotally mounted on said housing having a laterally outwardly extending projection, an actuating member having a generally U-shaped portion pivotally mounted on said projection, with the bight of said U-shaped portion being spaced from the outer portion of said projection, a spring reacting between said bight and said outer portion of said projection, and spaced abutments on said movable member for limiting movement of said actuating member with respect to said operating member upon pivotal movement of said operating member in opposite directions so that the line of action of said spring is moved to opposite sides of the pivot point of said actuating member to operate the latter in opposite directions with a snap action, at least one fixed contact secured to said housing, a resilient member secured to said housing having another contact secured thereto so as to be movable into and out of engagement with said fixed contact, and said resilient member being formed with a portion thereof in the path of movement of said movable member, so as to be engaged by said movable member to change the relative position of said contacts.

6. An electrical switch comprising a housing of insulating material having two spaced substantially parallel side walls, elongated guide means located on opposed surfaces of said side walls, a movable member supported by said guide means for limited movement in opposite directions, spaced stop members on said movable member, an operating member pivotally mounted on said housing having a supporting means extending radially outward from the pivot axis thereof, an elongated actuating member pivotally mounted on said supporting means so that its pivot axis is spaced from the pivot axis of said operating member and having a portion thereof spaced from said supporting means, a spring reacting between said supporting means on said operating member and said spaced portion of said actuating member, and spaced abutments on said spaced movable member for limiting movement of said actuating member with respect to said operating member upon pivotal movement of said operating member in opposite directions so that the line of action of said spring is moved to opposite sides of the pivot point of said actuating member to operate the latter in opposite directions with a snap action, at least one fixed contact secured to said housing, a resilient member secured to said housing having another contact secured thereto so as to be movable

into and out of engagement with said fixed contact, and said resilient member being formed with a portion thereof in the path of movement of said movable member so as to be engaged by said movable member and change the relative position of said contacts.

7. An electrical switch comprising a housing of insulating material having two spaced substantially parallel side walls, an elongated recess located on opposed surfaces of said side walls so as to be substantially parallel to each other, a flat plate having its sides located in said recesses so as to be movable therein in opposite directions, an opening in said plate, an operating member pivotally mounted on said housing having a supporting means extending radially outward from the pivot axis thereof, an elongated actuating member pivotally mounted on said supporting means so that its pivot axis is spaced from the pivot axis of said operating member and having a portion thereof spaced from said supporting means on said operating member, a spring reacting between said supporting means on said operating member and said spaced portion of said actuating member, and opposite edges of said flat plate limiting movement of said actuating member with respect to said operating member upon pivotal movement of said operating member in opposite directions so that the line of action of said spring is moved to opposite sides of the pivot point of said actuating member to operate the latter in opposite directions with a snap action, at least one fixed contact secured to said housing, a resilient member secured to said housing having another contact secured thereto so as to be movable into and out of engagement with said fixed contact, and said resilient member being formed with a portion thereof in the path of movement of said flat plate so as to be engaged by said movable member and change the relative position of said contacts.

8. An electrical switch comprising, a housing of insulating material having two spaced substantially parallel side walls, an elongated recess located on opposed surfaces of said side walls so as to be substantially parallel to each other, a flat plate having its sides located in said recesses so as to be movable therein in opposite directions, an elongated opening in said plate, a toggle mechanism pivotally mounted on said housing having an oscillatable free end located so as to extend through said elongated opening in said plate, said toggle mechanism being located with respect to said elongated opening so that said free end thereof engages opposite ends of said elongated opening when the line of action of said toggle mechanism is shifted to opposite sides of the pivot point thereof so as to move said plate in said recesses, and said elongated opening being of a length to limit the travel of said free end and to permit lost motion between said plate and said free end of said toggle mechanism.

9. A two-pole electrical switch comprising a pair of housings of insulating material which are formed to be assembled together to provide two laterally spaced substantially parallel side walls, an elongated recess located on opposed surfaces of said side walls so as to be substantially parallel to each other, a flat plate having its sides located in said recesses so as to be movable therein in opposite directions, an opening in said plate, an operating member pivotally mounted on said housing having a portion thereof spaced from its pivot axis which is oscillatably movable upon movement of said operating member in opposite directions, said portion of said operating member being engageable with opposed edges of said opening in said plate upon said movement of said operating member so that said plate may be reciprocally moved in said recesses, laterally spaced fixed contacts secured to each of said housings respectively, so as to be located between said side walls, laterally spaced resilient members secured to each of said housings respectively, so as to be located between said side walls, each of said resilient members having another contact secured thereto which normally engages the fixed contact secured to the same housing, each of said resilient members being formed with a

portion thereof in the path of movement of said plate so as to be engaged by said plate to change the relative position of said contacts.

10. A two-pole electrical switch comprising a pair of elongated identical cup shaped housings of insulating material which are formed to be assembled together to provide a pair of laterally spaced substantially parallel side walls, an elongated longitudinally extending recess located on opposed surfaces of said side walls so as to be substantially parallel to each other, a flat plate having its sides located in said recesses so as to be movable therein in opposite directions, an opening in said plate, an operating member pivotally mounted on said housing having a portion thereof spaced from its pivot axis which is oscillatably movable upon movement of said operating member in opposite directions, said portion of said operating member being engageable with opposed edges of said opening in said plate upon said movement of said operating member so that said plate may be reciprocally moved in said recesses, a pair of terminals secured to each of said side walls so as to be longitudinally spaced from each other a distance approximately equal to the length of said recesses, each of said terminals having a portion located to one side of said recesses, fixed contacts secured to one of said portions of each of said pair of terminals respectively, elongated resilient electrical conducting members having one of their ends connected to the other of said portions of each of said pair of terminals respectively, each of said resilient members having another contact secured to its other end which normally engages the fixed contact secured to the same housing, and said resilient members each having its said other end formed to extend across said recesses so as to be engageable by said plate and be moved into and out of engagement with said fixed contacts upon reciprocating movement of said plate.

11. An electric switch comprising, a support of insulating material, separable contacts mounted on said support, a contact operating plate mounted for reciprocable movement on said support for opening and closing said contacts in response to movement of the plate in opposite

directions, an overcenter spring toggle mechanism having an operating member pivotally mounted on said support and an oscillatable actuating member received in a relatively large opening in said plate so as to have lost motion with respect to said plate, means limiting movement of said operating member in opposite directions including an indexing spring acting on said operating member to bias it to each of its extreme positions, and means limiting motion of said plate in opposite directions.

12. An electric switch comprising, a support of insulating material, separable contacts mounted on said support, a contact operating plate mounted for reciprocable movement on said support for opening and closing said contacts in response to movement of the plate in opposite directions, an overcenter spring toggle mechanism having an operating member pivotally mounted on said support and an oscillatable actuating member received in a relatively large opening in said plate so as to have lost motion with respect to said plate, means limiting movement of said operating member in opposite directions including an indexing spring acting on said operating member to bias it to each of its extreme positions and having an overcenter point substantially coinciding with the overcenter point of said spring toggle mechanism, and means limiting motion of said plate in opposite directions.

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