Dec. 23, 1941. A. W. KRIEGER 2,267,203

ELECTRIC SWITCH

Filed July 25, 1941 3 Sheets-Sheet 1

Fig. 1

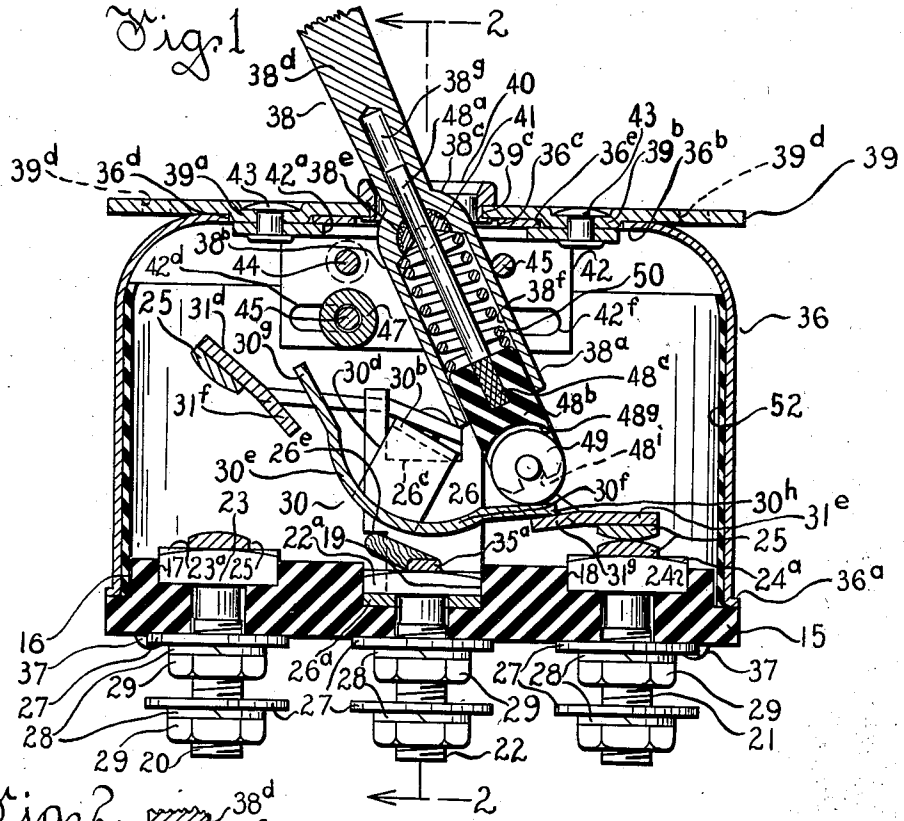


Fig. 2

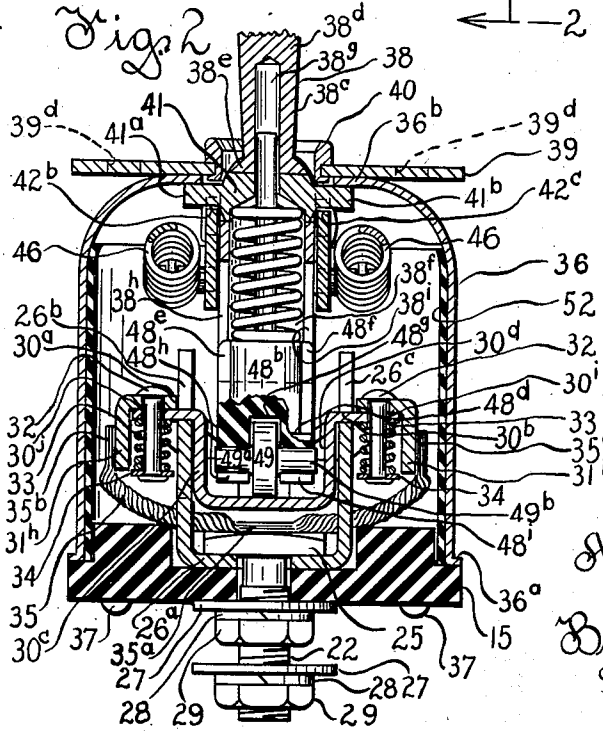
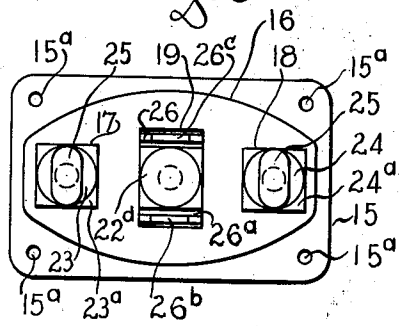


Fig. 3



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ELECTRIC SWITCH

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Fig. 4

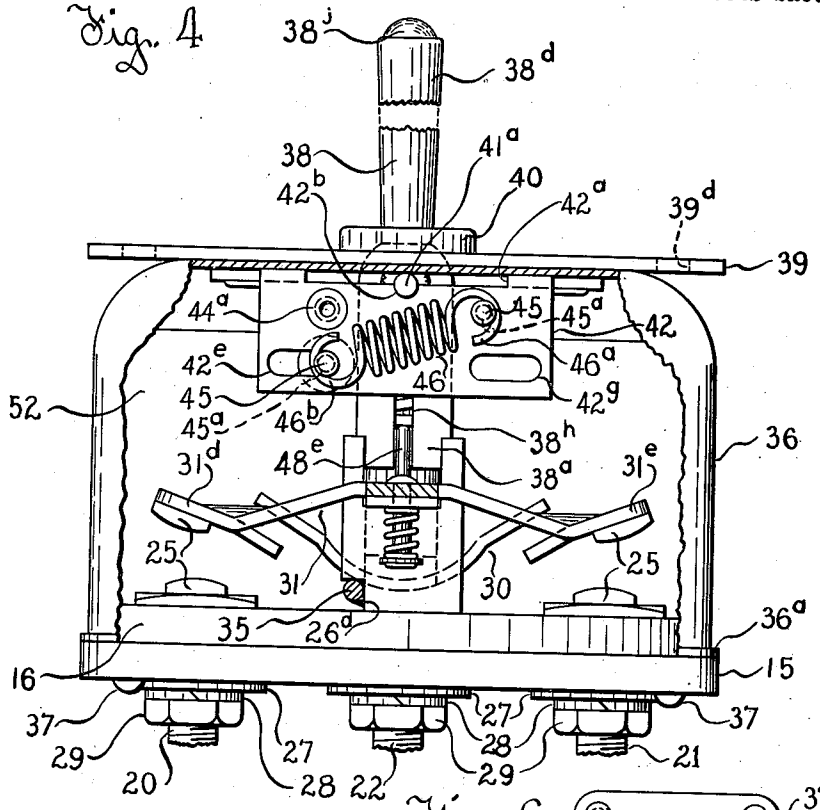


Fig. 6

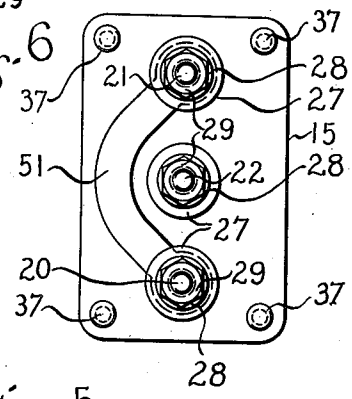
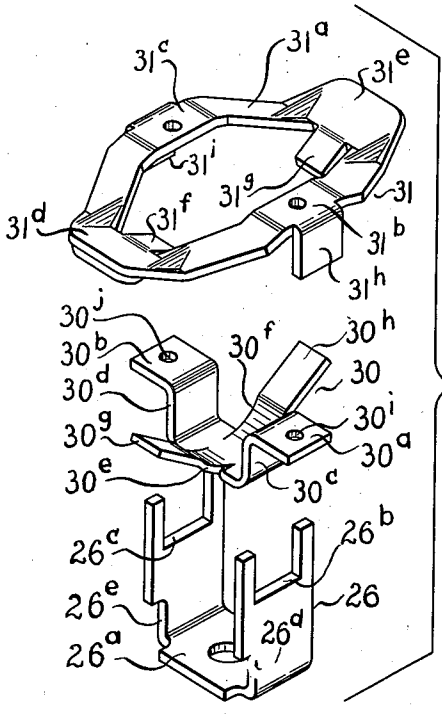


Fig. 5



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ELECTRIC SWITCH

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Fig. 7

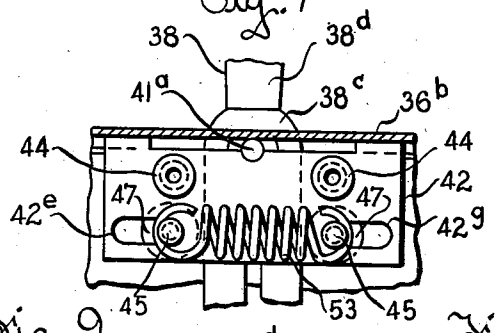


Fig. 8

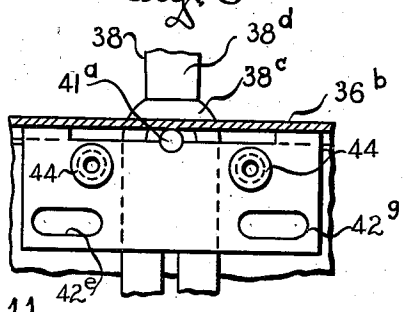


Fig. 9

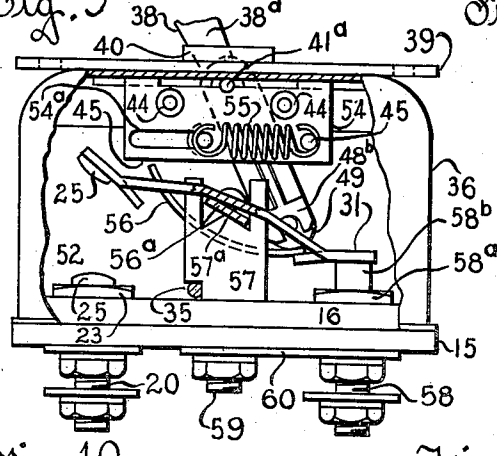


Fig. 11

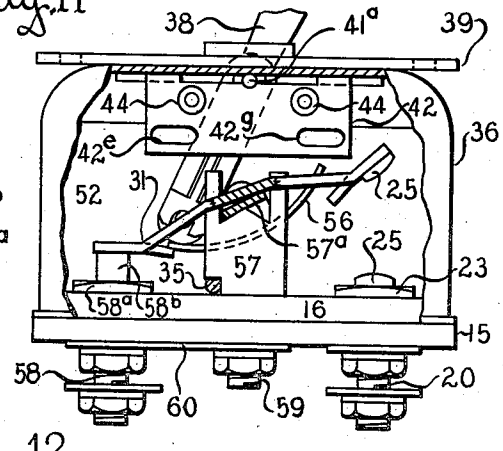


Fig. 10

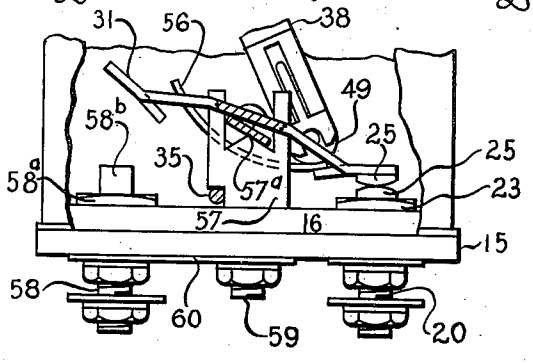
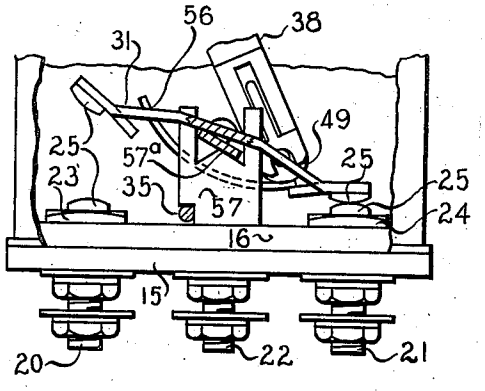


Fig. 12



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Patented Dec. 23, 1941

2,267,203

UNITED STATES PATENT OFFICE

2,267,203

ELECTRIC SWITCH

Alvin W. Krieger, Milwaukee, Wis., assignor to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

Application July 25, 1941, Serial No. 403,960

26 Claims. (Cl. 200—68)

This invention relates to improvements in electric switches, and although not limited thereto the invention relates more particularly to improvements in relatively high capacity switches adapted for airplane use.

A primary object of the invention is to improve the details of construction and operation and to simplify assembly of the parts of switches of the aforementioned character.

Another object is to provide a relatively small switch of the aforementioned high capacity, wherein the various switch parts are of extremely rugged and durable construction.

Another object is to provide stationary and movable contact and terminal members of improved form, together with novel means for insuring proper operation of the movable contact or contacts of the switch.

Another object is to provide a switch operating lever of novel form, together with novel means for pivotally mounting the same.

Another and more specific object is to provide a novel form of oscillatable contactor, and novel means for insuring a good electrical connection between the same and the wiring terminal member associated therewith.

Another object is to provide a minimum number of different switch parts which may be combined in different ways to provide switches having any of a number of different electrical characteristics.

Another and more specific object is to provide (by mere substitution of certain parts) a switch of the double-throw type, either with or without an intermediate "off" position, or, alternatively, a single-throw switch of the two-position type.

Another object is to provide a three-position switch having novel means for affording only momentary positioning of the contactor in one or the other or each of its extreme positions, or a two-position switch wherein the contactor may be biased to one or the other of its extreme positions.

Another object is to provide novel means for housing and supporting the switch mechanism.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate various embodiments of the invention which will now be described, it being understood that the illustrated embodiments are susceptible of modification in respect of certain structural details thereof without departing from the spirit of the invention or the scope of the appended claims.

In the drawings, Figure 1 is an enlarged vertical sectional view (approximately one and one-half times actual scale) of a single-pole, double-throw switch having an intermediate "off" position,—said switch having associated means to bias the contactor out of its left-hand "on" position,—a fragment of the upper end of the operating lever being broken away.

Fig. 2 is a transverse section, substantially on the line 2—2 of Fig. 1.

Fig. 3 is a top plan view (approximately three-fourths of full scale) of the molded insulating base of the switch, showing the stationary contact and terminal members and the intermediate contactor support and terminal member attached thereto.

Fig. 4 is a side elevational view, with a portion of the housing broken away, showing the various switch parts in their intermediate, or "off," position.

Fig. 5 is a detail perspective view, in separated relation, of certain parts of the switch shown in Figs. 1 to 4.

Fig. 6 is a bottom plan view of a modified form of the switch shown in Figs. 1 to 5,—the added bus member of Fig. 6 affording a single circuit controlling switch which provides for momentary closure of the circuit upon movement of the lever in one direction from its intermediate position and non-momentary closure of the circuit upon movement of said lever in the reverse direction from its intermediate position.

Fig. 7 is a fragmentary view, partly in section and partly in elevation, showing a switch which is otherwise like that of Figs. 1 to 5,—but modified to provide for momentary engagement of the contacts upon movement of the lever in each direction from its intermediate position.

Fig. 8 is a fragmentary view similar to Fig. 7, but modified to provide for non-momentary engagement of the contacts upon movement of the lever in each direction from its intermediate position.

Fig. 9 is a view similar to Fig. 4, but showing a two-position, single circuit controlling switch, with associated parts to provide for momentary completion of the controlled circuit upon movement of the lever to one of its two positions.

Fig. 10 is a fragmentary view of a switch which may be otherwise like that shown in Fig. 9, but wherein the contactor is reversed in its relation to the pivotal support, with a corresponding reversal of the contact and terminal elements, to provide for momentary "off" positioning of the contactor.

Fig. 11 is a view similar to Fig. 10, but modi-

fied to provide for non-momentary positioning of the contactor in either its "on" or its "off" position, and

Fig. 12 is a fragmentary view of a double-throw, multiple circuit controlling switch, without an "off" position, which may be of the non-momentary type in either extreme position of the lever, as provided by operating means like that of Fig. 11, or of the momentary contact type in one extreme position of the lever, as provided by operating means like that of Fig. 9.

Referring first to Figs. 1 to 5, wherein I have illustrated a single-pole, double-throw, or three-position, switch adapted for multiple circuit control, and wherein the contactor is normally biased from one of its circuit completing positions to its intermediate "off" position,—the contactor being free from bias toward said "off" position when moved to its other circuit completing position. The numeral 15 designates a base molded from any suitable insulating material, preferably "Bakelite." As best illustrated in Fig. 3, base 15 is of substantially rectangular contour, and the same is provided on its upper surface with a symmetrically arranged integral, flat, raised portion 16 of approximately elliptical contour. Portion 16 is provided with a pair of symmetrically arranged recesses 17 and 18 of square contour and a centrally located rectangular recess 19, the longer dimension of which is arranged at a right angle to the longitudinal center line of said raised portion.

Each of the recesses 17, 18 and 19 has a centrally arranged circular opening to respectively accommodate the downwardly extending threaded shanks 20, 21 and 22 of said terminal members, the square heads of which are shown at 23, 24 and 22a. The heads 23 and 24 fit closely and non-rotatably within the recesses 17 and 18, and are of greater height than the depth of said recesses, so as to project a substantial degree above the surface of projection 16,—the corners of the upper surfaces of heads 23 and 24 preferably being beveled, as shown at 23a and 24a. Each head 23 and 24 preferably has symmetrically positioned thereon (as shown in Fig. 3) and rigidly and permanently attached thereto, as by welding or brazing or in any other suitable manner, a stationary tip 25 of a suitable contact material, such as silver or a composition including silver. Tips 25 are preferably of elliptical contour (Fig. 3) and the upper surfaces thereof are preferably of convex form, as shown in transverse cross section in Fig. 1.

Non-rotatably seated within recess 19 is a U-shaped sheet metal support member 26, preferably brass,—the bottom or connecting portion 26a thereof having a centrally located clearance opening for the aforementioned shank 22 of the terminal member, whereby the head 22a is adapted to seat against said connecting portion 26a to clamp the support 26 in position. As shown in Fig. 1, the depth of recess 19 is preferably greater than the combined thickness of portion 26a and head 22a, so that the upper surface of the latter is slightly below the upper surface of base portion 16. Each of the terminal shanks 20, 21 and 22 has a flat washer 27 and a lock washer 28 strung thereon and a nut 29 threaded thereon, whereby the terminals are rigidly attached to base 15,—each shank also being provided with another set of washers 27 and 28 and a nut 29 to provide for attachment of circuit wires (not shown).

The parallel arms of support 26 (see Fig. 5) are respectively provided with upwardly opening rectangular notches 26b and 26c. A punched and stamped sheet metal actuating element 30 of cruciform has upwardly offset laterally extending arm portions 30a and 30b adapted to seat flatwise against the horizontal bottom edges of the respective bearing notches,—the vertical portions 30c and 30d (Fig. 5) of said arms of the actuating element cooperating with the inner surfaces of the arms of support 26 to prevent accidental lateral displacement of said actuating element. Element 30 includes a second pair of arms located between and extending in opposite directions at right angles to the arm portions 30a and 30b,—said last mentioned arms respectively comprising adjacent arcuate or concave portions 30e and 30f and straight end portions 30g and 30h extending upwardly at a predetermined angle relatively to each other.

As shown in Fig. 2 the arm portions 30a and 30b of the actuating element each extend laterally a substantial distance beyond the arms of support 26, and each arm portion is provided with an opening, as shown at 30i and 30j. The switch contactor comprises a punched and stamped sheet metal member 31, preferably composed of copper or an alloy thereof, such as beryllium copper. As shown, said contactor has a main body portion 31a of substantially elliptical or loop-shape, and of such size as to surround the support 26. The perforated intermediate flat portions 31b and 31c of the contactor are adapted to overlie and normally seat against the aforementioned arm portions 30a and 30b of actuating element 30. A pair of headed rivets 32, 32 have their shanks extended downwardly through the alined openings in portions 31b, 31c and arm portions 30a, 30b; coiled springs 33, 33 (Fig. 2) being telescoped onto the shanks of said rivets and retained under a predetermined degree of compression, as by means of washers 34, 34, which are in turn retained by the upset ends of the rivet shanks.

The opposite ends 31d, 31e of contactor 31 are formed to extend upwardly at a predetermined angle to each other, as best illustrated in Figs. 1 and 4,—said ends having attached to the lower surfaces thereof the contact tips 25, 25 for cooperation with the aforementioned tips of the respective stationary contacts,—the four contact tips of the switch being preferably composed of like material.

End portions 31d and 31e of the contactor have lugs formed integrally therewith and extending inwardly and downwardly therefrom at a slight angle thereto, respectively, as shown at 31f and 31g. The actuating element 30 is so assembled with respect to contactor 31 that the straight end portions 30g and 30h respectively overlie portions of the lugs 31f and 31g, as best illustrated in Figs. 1 and 4. Contactor 31 is provided with a pair of lugs 31h and 31i extending downwardly from the outer edges of the respective portions 31b and 31c, for a purpose to be described.

The springs 33, 33 act to bias contactor 31 toward a centered position relatively to actuating element 30, as shown in Figs. 2 and 4. Prior to positioning of the assembled actuating element 30 and contactor 31 upon support 26, a stranded bare conductor 35, preferably formed of copper, has its mid-portion 35a rigidly attached to the upper surface of head 22a as shown in Figs. 1 and 2, and thereafter the free ends 35b and 35c (Fig. 2) of said conductor are spot welded to the aforementioned lugs 31h and 31i. The

portions of the conductor between the points of attachment thereof are sufficiently slack to permit the necessary amount of relative movement between the actuating element and contactor. In order to minimize the required length of conductor 35, and to restrain the same against possible fouling with respect to element 30, I prefer to provide the arms of support 26 with notches 26d and 26e (Figs. 1, 4 and 5) to accommodate the adjacent portions of the conductor.

The switch housing comprises a relatively deep-drawn or stamped sheet metal member 36 of inverted cup-shape,—member 36 being of a contour, in horizontal cross section, substantially corresponding to, but slightly larger than, the periphery of raised portion 16 of the base, about which it is adapted to fit, as shown in Figs. 1 and 2. Member 36 is provided at its lower end with a horizontal flange 36a adapted to overlie the upper surface of base 15 around the raised portion 16 of the latter,—the peripheral edge of said flange being coincident or flush with the periphery of base 15, as shown in Figs. 1, 2 and 4. Flange 36 and base 15 are provided adjacent to the four corners thereof with alined openings (see the openings 15a in Fig. 3) to accommodate headed rivets 37, the shanks of which are upset over the corner portions of the flange.

The side and end walls of housing 36 are curved inwardly at the upper end portions thereof to merge into the horizontal upper end wall 36b, said end wall being provided with a centrally located circular opening 36c which is adapted to provide clearance for oscillatory movement of an operating lever 38. End wall 36b is also provided with a pair of symmetrically arranged openings 36d and 36e to respectively accommodate the downwardly offset and perforated portions 39a and 39b of a substantially flat sheet metal supporting plate 39. Plate 39 is provided with a centrally located opening 39c alined with opening 36c to provide clearance for lever 38. A bushing 40 of suitable metal such as brass has a reduced end adapted to fit within opening 39c,—said reduced end being upset over the lower surface of plate 39 to secure the bushing thereto. The primary purpose of bushing 40 is to provide a more finished and attractive appearance to the switch as a whole. Plate 39 is provided adjacent to the four corners with perforations shown in dotted lines at 39d, to accommodate suitable rivets or bolts (not shown) adapted to attach the switch as a whole to a panel or other suitable support.

Lever 38 preferably comprises a piece machined from a brass rod of square cross section,—the lower end portion 38a thereof being permitted to remain square; an intermediate portion 38b thereof being turned or cut away to substantially cylindrical form with a substantially dome-shaped upper end 38c; and a handle portion 38d of circular form in transverse cross section formed integrally with and extending upwardly from said portion of dome-shape. Handle portion 38d, as shown, is preferably tapered downwardly to a slight extent from the upper end thereof.

Lever 38 is provided at the point of juncture of the cylindrical portion 38b with the dome-shaped portion 38c with a relatively large diametrically extending drilled opening or passage 38e, which is adapted to receive with a drive fit the straight-knurled (see Fig. 1) cylindrical intermediate portion of a cold rolled steel member 41,—member 41 having reduced laterally extending cylindrical ends or pivot studs 41a and 41b which are adapted to bear against the inner surface of said upper end wall 36b of the housing.

Studs 41a and 41b are held for pivotal movement about a substantially fixed center, as by means of a sheet metal frame 42 of inverted channel-shape,—the upper end wall of said frame being cut away as at 42a (Figs. 1 and 4), to provide oscillatory clearance for lever 38. Frame 42 is adapted to be slid upwardly over the lower end of lever 38; and the parallel sides of the frame are provided at the mid-points of their exposed upper edges with semicircular notches 42b and 42c to underlie and partially surround studs 41a and 41b to maintain a substantially fixed center of oscillation of the latter. The upper end wall of frame 42 is provided with perforated extensions,—which perforations are alined with the aforementioned openings in offset portions 39a and 39b of plate 39 and in the upper end wall 36b of the housing; a pair of headed rivets 43, 43 (Fig. 1) having their shanks inserted downwardly through said openings and upset over the lower surface of the upper end wall of frame 42, to secure the several parts, including lever 38, in assembled relation to the housing.

Frame 42 is provided in its parallel side walls with pairs of alined openings, into one pair of which openings the shank of a headed rivet 44 is inserted to span the channel of said frame,—the shank end of said rivet being upset as shown at 44a in Fig. 4 to retain the same in position. Within the other pair of alined frame openings a pin 45 (Figs. 1 and 4) is inserted,—the opposite end portions of said pin extending a substantial distance beyond the respective side walls of the frame, and each of said end portions is provided with a circular or milled groove (as shown in dotted lines at 45a in Fig. 4). Each groove 45a is adapted to receive the upper looped or hooked end 46a of a coiled tension spring 46,—the lower hooked end 46b of each spring being engaged in a groove 45a of a second pin 45 which penetrates a pair of alined slots 42d and 42e in the side walls of said frame.

Rotatably supported upon the last mentioned pin 45, and positioned between the frame side walls is a cylindrical member or roller 47,—said last mentioned pin 45 and roller 47 being biased by the tension of the pair of springs 46 to automatically effect return of lever 38 to its intermediate or "off" position in the event that said lever is moved in a clockwise direction from said intermediate position thereof and then manually released. On the other hand, in the event of counterclockwise movement of lever 38 to its other extreme position shown in Fig. 1, the springs 46 will have no biasing effect whatever upon said lever. The arrangement is therefore such that momentary engagement of the left-hand contact by the contactor is provided for, whereas non-momentary engagement of the right-hand contact by the contactor is provided for upon oscillatory movement of lever 38 in the reverse direction from its intermediate position.

In practice the frame sides are provided with a second set of alined slots 42f and 42g (Figs. 1 and 4), whereby upon reversal of the positions of the upper pin 45 and rivet 44 in the respective upper openings, and by transferring the lower pin 45 and roller 47 to cooperative relationship with slots 42f and 42g,—with a corresponding reversal of the direction of pull of the springs 46, 46, a switch will be provided wherein momentary engagement of the contactor with the right-hand contact, or, alternatively, non-momentary engagement of

said contactor with the left-hand contact, is afforded.

As shown the lever 38 is drilled from the lower end thereof to provide a relatively large cylindrical cavity or recess 38^f,—a portion of said cavity being formed in the aforementioned steel insert 41. A cylindrical cavity 38^g of relatively smaller diameter is drilled upwardly through the remaining portion of the thickness or diameter of steel member 41 and to a predetermined height in the handle portion 38^d, as shown in Figs. 1 and 2. The lower portion 38^a of square cross section is provided with a kerf affording a pair of alined slots 38^h and 38^i (Figs. 2 and 4) extending throughout the major portion of the height of said square portion.

The composite plunger comprises a rod 48^a formed of any suitable metal, such as brass, adapted to slide within the recess 38^g and has an insulating element 48^b molded onto the lower end portion thereof,—said end portion of the rod being preferably roughened, as shown at 48^c in Fig. 1, to insure a rigid connection between said elements. The upper or main body portion of insulating element 48^b is of cylindrical form and is slidable with the aforementioned recess 38^f,—the lower end portion thereof being enlarged to provide shoulders at the four corners thereof (one of which is shown at 48^d in Fig. 2) to positively limit the degree of upward sliding movement of the plunger within the lever. Said cylindrical portion of element 48^b is provided at diametrically opposite sides thereof with integral vertical ribs 48^e and 48^f which respectively fit between the walls of the slots 38^h and 38^i in lever 38.

The enlarged lower end of insulating element 48^b is recessed as shown at 48^g, 48^h and 48^i in Figs. 1 and 2 to respectively provide rotatable clearance for a metal roller 49 and downwardly opening bearings for the pivot studs 49^a and 49^b formed integrally with the latter. The arrangement is such that roller 49 is adapted to bear against the arm portions 30^e, 30^f, 30^g and 30^h of actuating element 30. A relatively strong coiled compression spring 50 is interposed between the upper end wall of recess 38^f and the upper end of insulating element 48^b to at all times tend to eject the plunger downwardly from the lever 38.

As will be apparent from Fig. 4, the parts are so arranged as to provide for substantially positive retention of the contactor in its intermediate or "off" position. If the springs 46 are omitted the switch parts will likewise act to substantially positively retain the contactor in either of its "on" positions,—the spring 50 acting in each case to afford adequate contact pressure. The switch herein disclosed has a current controlling capacity of 100 amperes, direct current, and is intended primarily for use on airplanes and the like; although the same obviously is adaptable for general use.

In the modification illustrated in Fig. 6, all of the switch parts may be assumed to be identical with the parts of the switch shown in Figs. 1 to 5. However, in Fig. 6 a metal conductor or bus member 51 is interposed between the terminal members 20 and 21 to provide a permanent electrical connection therebetween. The switch is thus adapted for control of a single circuit, one wire of which may be connected to terminal 22 and the other wire may be connected to either of the terminals 20 or 21. With such an arrangement, it will be apparent from consideration of Figs. 1 and 4 that upon counterclockwise movement of lever 38 from its intermediate position the contactor will be engaged with the right-hand stationary contact to complete the circuit and will remain in engagement upon manual release of the lever; whereas upon clockwise movement of the lever the contactor will engage the left-hand stationary contact, to complete the same circuit, but the contactor will move to its intermediate "off" position immediately upon manual release of the lever. The utility of such an arrangement will be apparent to those skilled in the art.

Again considering Fig. 2, it is to be understood that with the switch parts in the respective positions illustrated the springs 33, 33 will normally act upon movement of lever 38 to its intermediate position (with consequent movement of actuator 30 to its intermediate position, as shown in Fig. 4) to effect a corresponding movement of contactor 31 to its intermediate "off" position. However, in the event that the contactor tends to stick or "freeze" to the contact last engaged thereby the full force of spring 50 will be applied, through the actuator 30, to the free end of the contactor to pry the same loose from the stationary contact. Moreover, in the remotely possible event that the contactor is stuck so tightly to the contact as to resist the pressure of spring 50, disengagement of the contactor may be positively effected by manually moving lever 38 to its opposite extreme position, as will be obvious.

In all of the switches herein disclosed I prefer to provide a section of wound "kraft" paper tubing, in which a water resistant glue is employed to unite the layers or laminations of the paper. In practice the tube section is initially of cylindrical form and of the required peripheral dimension,—the same being vertically scored or otherwise weakened at four spaced points, to facilitate bending thereof to the desired cross sectional shape to rather closely surround the raised portion 16 of the base 15 (Fig. 3) and to fit snugly within the housing 36 to provide an insulating lining for the major portion of the height of the latter, as shown at 52 in Figs. 1, 2 and 4. The primary purpose of said insulating lining 52 is to prevent accidental engagement of the stranded wire bus or conductor 35 with said housing.

In Fig. 7 I have fragmentarily illustrated another modification of the multiple circuit controlling switch of Figs. 1 to 5. Substantially all of the corresponding parts of the switch of Fig. 7 may be identical with those aforedescribed,—the substituted and added parts in Fig. 7 being merely adapted to provide for momentary engagement of the contact with the respective contacts in each of the extreme positions of lever 38. Thus in Fig. 7 I employ two rivets 44, 44 to act as stops for lever 38, and in each pair of alined slots 42^d, 42^e and 42^f, 42^g aforedescribed I place a pin 45,—each pin 45 rotatably supporting within frame 42 a metal roller 47 for cooperative engagement with lever 38 when in its respective extreme positions. A pair of like coiled tension springs, one of which is shown at 53, have their hooked ends attached to the grooved ends of pins 45, 45 at the respective outer sides of the frame 42, to normally bias both of said pins toward the inner ends of their associated slots. It is to be understood that the springs 46, 46 aforedescribed might be substituted for the springs 53 of Fig. 7 without any change in the operative characteristics of the switch. As aforeindicated, the switch of Fig. 7 provides for automatic re-

turn of the lever and contactor to intermediate "off" position upon manual release of the lever after movement of the latter to either extreme position.

The switch shown fragmentarily in Fig. 8 may be otherwise like that of Fig. 7, but having the pins 45, 45, rollers 47 and springs 53 omitted, so that the contactor will remain in any one of the three positions to which it has been moved by operation of the lever 38 notwithstanding manual release of the lever.

In Fig. 9 I have shown a modified form of switch of the single-pole, single-throw (or "on" and "off") type, wherein certain parts identical with those aforedescribed may be employed,—such like parts being given corresponding numerals of reference. In Fig. 9 the frame 54 (which is otherwise substantially like the frame 42 aforedescribed) is provided with a pair of relatively long alined slots (one of which is shown at 54a) at the left-hand end thereof to receive one of the pins 45,—said frame being provided at the right-hand end thereof with a pair of alined substantially circular alined openings to accommodate a second pin 45. A pair of coiled tension springs,—one of which is shown at 55,—have their hooked ends attached in the aforedescribed manner to the pins at opposite sides of frame 54, whereby the roller 47 acts upon lever 38 to bias the same in a counterclockwise direction to one of its two extreme positions.

In the switch of Fig. 9 the contactor 31 may be like the contactor aforedescribed, except that no contact tip is attached to the right-hand end thereof. Also in Fig. 9 the actuating element 56 has its arm portions upon which the roller 49 is adapted to bear arranged in the form of a continuous curve, as shown,—said actuating element being otherwise exactly like the actuating element 30 aforedescribed. The sheet metal support member 57 of Fig. 9 is provided in its parallel upstanding arms with upwardly opening bearing notches the bottom walls of which are in the form of upwardly converging edges, as shown at 57a, whereby to provide knife-edge pivotal bearings for the laterally extending arms of actuator 56,—one of said arms being shown in section at 56a. The left-hand terminal member 20 may be identical with that aforedescribed,—the same having a head 23 and contact tip 25 for cooperation with the single tip 25 carried by contactor 31.

The right-hand terminal member 58 in Fig. 9 preferably has formed integrally with the head 58a thereof a substantially rectangular upward projection 58b,—the height of which preferably corresponds to the combined thickness of a pair of contact tips 25 (for which it is substituted). A relatively short bolt 59 is employed to secure the support member 57 to base 15, and a metal strip or bus member is interposed between terminal member 58 and bolt 59 (as shown) to provide a good electrical connection therebetween. If desired, of course, the bolt 59 might be made sufficiently long to provide for proper attachment of a circuit wire thereto,—in which event the member 58 (not then required as a terminal) could be made shorter.

As will be apparent from consideration of Fig. 9, this switch is adapted to provide for completion of the controlled circuit upon movement of lever 38 to its extreme position in a clockwise direction,—the springs 55 acting upon manual release of the lever to rotate the latter in a counterclockwise direction to its other extreme position to effect interruption of the controlled circuit,—thus providing a switch of the momentary "on" type.

The switch shown in Fig. 10 may be assumed to be otherwise identical with that of Fig. 9,—except that in Fig. 10 the contactor 31 is reversed in position with respect to support member 57, and the positions of terminal members 20 and 58 and bus member 60 are reversed with respect to the positions thereof in Fig. 9. As a consequence it will be seen that the switch of Fig. 10 is of the momentary "off" type,—the aforementioned springs acting to automatically effect return of the contactor to "on" position upon manual release of lever 38.

The switch shown in Fig. 11 may be otherwise identical with that of Fig. 10, except that the pins 45 and springs 55 are omitted, so that the contactor 31 will remain in either its circuit completing or circuit interrupting position pending manual movement of lever 38. Although I have shown the frame 42 embodied in the switch of Fig. 11, it is obvious that the aforedescribed frame 54 may be substituted therefor if desired.

The switch illustrated in Fig. 12 is of the single-pole, double-throw type, without an "off" position. The terminal members 20, 21 and 22 and their associated parts may be identical with the corresponding parts of the device of Figs. 1 to 5; whereas the support member 57 and the actuating element 56 are of the character illustrated in Fig. 11. The switch of Fig. 12 may be of the non-momentary type in either extreme position of lever 38 if operating means (without biasing springs) like that of Fig. 11 is employed; or the switch of Fig. 12 may be of the momentary contact type in one extreme position of lever 38, assuming use of the frame 54, pins 45 and springs 55 shown in Fig. 9.

Although I have illustrated various embodiments of my invention, it is believed that various other modifications thereof are obvious, or will readily suggest themselves to those skilled in the art, in the light of the present disclosure.

As shown in Fig. 4, the handle portion 38d of lever 38 may be formed to accommodate, and to provide for attachment of, a luminous tip 38f of well known form.

As aforeindicated, all of the switches herein disclosed are of 100 amperes current controlling capacity. Where the switches are used for control of substantially lower current values, it may be found desirable (for purpose of economy) to omit the stranded conductor 35,—whereas also under such conditions the various parts of the switches may be made of substantially smaller dimensions, as will be obvious.

I claim:

1. In an electric switch, in combination, a substantially U-shaped metal support, an upwardly opening bearing formed in each arm of said support, a punched and stamped sheet metal actuating element of cruciform having a pair of upwardly offset laterally extending arms adapted to seat within the respective bearings, the other pair of arms of said actuating element extending in substantially arcuate form at right angles to the arms first mentioned, a punched and stamped sheet metal contactor of approximately elliptical contour adapted to surround said support and having portions superimposed upon the outer ends of said first mentioned arms, spring means normally acting to retain said last mentioned parts in engagement with each other while yieldably permitting relative move-

ment therebetween, and said contactor having portions underlying portions of said second pair of arms to provide for positive movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter.

2. In an electric switch, in combination, a substantially U-shaped metal support, an upwardly opening bearing formed in each arm of said support, a punched and stamped sheet metal actuating element of cruciform having a pair of upwardly offset laterally extending arms adapted to seat within the respective bearings, the other pair of arms of said actuating element extending in substantially arcuate form at right angles to the arms first mentioned, a punched and stamped sheet metal contactor of approximately elliptical contour adapted to surround said support and having portions superimposed upon the outer ends of said first mentioned arms, spring means normally acting to retain said last mentioned parts in engagement with each other while yieldably permitting relative movement therebetween, said contactor having portions underlying portions of said second pair of arms to provide for positive movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter, a wiring terminal member having an integral part thereof superimposed upon the intermediate portion of said support to clamp the latter in position upon a suitable base, and a stranded bare conductor rigidly attached to said part of the terminal member and to said contactor to insure a good electrical connection therebetween.

3. In an electric switch, in combination, a substantially U-shaped metal support, an upwardly opening bearing formed in each arm of said support, a punched and stamped sheet metal actuating element of cruciform having a pair of laterally extending arms adapted to seat within the respective bearings, the other pair of arms of said actuating element extending in substantially arcuate form at right angles to the arms first mentioned, a punched and stamped sheet metal contactor of approximately elliptical contour adapted to surround said support and having portions superimposed upon the outer ends of said first mentioned arms, means including a pair of coiled compression springs normally acting to retain said last mentioned parts in engagement with each other while yieldably permitting relative movement therebetween, said contactor having portions underlying portions of said second pair of arms to insure movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter, a wiring terminal member having an integral part thereof superimposed upon the intermediate portion of said support to clamp the latter in position upon a suitable base, said contactor having a pair of lugs formed integrally therewith and extending downwardly at points adjacent to said outer ends of the first mentioned arms, and a stranded bare conductor having its intermediate portion rigidly attached to said part of the terminal member, the opposite ends of said conductor being likewise rigidly attached to the respective lugs of said contactor, for the purpose set forth.

4. In an electric switch, in combination, a substantially U-shaped metal support, an upwardly opening bearing formed in each arm of said support, a punched and stamped sheet metal actuating element of cruciform having a pair of laterally extending arms adapted to seat within the respective bearings, the other pair of arms of said actuating element extending in substantially arcuate form at right angles to the arms first mentioned, a punched and stamped sheet metal contactor of approximately elliptical contour adapted to surround said support and having portions superimposed upon the outer ends of said first mentioned arms, spring means normally acting to retain said last mentioned parts in engagement with each other while yieldably permitting relative tilting movement therebetween, said contactor having portions underlying portions of said second pair of arms to insure movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter, a wiring terminal member having an integral part thereof superimposed upon the intermediate portion of said support to clamp the latter in position upon a suitable base, said contactor having a pair of lugs formed integrally therewith and extending downwardly at points adjacent to said outer ends of the first mentioned arms, and a stranded bare conductor having its intermediate portion welded to said part of the terminal member, the opposite ends of said conductor being likewise welded to the respective lugs of said contactor, for the purpose set forth, and the respective arms of said support being notched to accommodate portions of said conductor, to minimize the required length of the latter.

5. In an electric switch, in combination, a substantially U-shaped metal support, an upwardly opening bearing formed in each arm of said support, a punched and stamped sheet metal actuating element of cruciform having a pair of upwardly offset laterally extending arms adapted to seat within the respective bearings, the other pair of arms of said actuating element extending in substantially arcuate form at right angles to the arms first mentioned, a punched and stamped sheet metal contactor of approximately elliptical contour adapted to surround said support and having portions superimposed upon the outer ends of said first mentioned arms, spring means normally acting to retain said last mentioned parts in engagement with each other while yieldably permitting relative movement therebetween, said contactor having portions underlying portions of said second pair of arms to provide for positive movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter, a wiring terminal member having an integral part thereof superimposed upon the intermediate portion of said support to clamp the latter in position upon a suitable base, said contactor having a pair of lugs formed integrally therewith and extending downwardly at points adjacent to said outer ends of the first mentioned arms, and a stranded bare conductor having its intermediate portion welded or otherwise rigidly attached to said part of the terminal member, the opposite ends of said conductor being likewise welded or otherwise rigidly attached to the respective lugs of said contactor, for the purpose set forth, the respective arms of said support being notched to accommodate portions of said conductor, to minimize the required length of the latter, and a combined contact and terminal member underlying one end of said contactor and into and out of engagement with which the latter is adapted to move.

6. In an electric switch, in combination, a substantially U-shaped sheet metal support, an upwardly opening bearing formed in each arm of said support, a punched and stamped sheet metal actuating element of cruciform having a pair of upwardly offset laterally extending arms adapted to seat within the respective bearings, the other pair of arms of said actuating element extending in substantially arcuate form at right angles to the arms first mentioned, a punched and stamped sheet metal contactor of approximately elliptical contour adapted to surround said support and having portions superimposed upon the outer ends of said first mentioned arms, means including a pair of rivets and a pair of coiled compression springs captively associated with said last mentioned parts and normally acting to retain the same in engagement with each other while yieldably permitting relative tilting movement therebetween, said contactor having portions underlying portions of said second pair of arms to insure movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter, a wiring terminal member having an integral part thereof superimposed upon the intermediate portion of said support to clamp the latter in position upon a suitable base, said contactor having a pair of lugs formed integrally therewith and extending downwardly at points adjacent to said outer ends of the first mentioned arms, a stranded bare conductor having its intermediate portion welded to said part of the terminal member, the opposite ends of said conductor being likewise welded to the respective lugs of said contactor, for the purpose set forth, the respective arms of said support at one side thereof being notched to accommodate portions of said conductor, to minimize the required length of the latter, and a pair of combined contact and terminal members respectively underlying the opposite ends of said contactor and into and out of engagement with which the latter is adapted to move selectively.

7. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a lever the handle portion of which is insertable upwardly through said opening, said lever having a pair of laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, an inverted substantially U-shaped sheet metal frame the intermediate portion of the upper end wall of which is cut away to provide for telescopic movement thereof upwardly over the lower end of said lever, the upper edges of the side walls of said frame at the cut away portion thereof each having a substantially semicircular notch to underlie and partially surround the respective pivot studs, for the purpose set forth, said upper end wall of said housing and said frame each having a pair of other openings respectively alined with each other, and a pair of headed rivets penetrating said last mentioned openings and having their shanks upset to permanently secure all of said parts in assembled relation.

8. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a substantially flat sheet metal support plate superimposed upon said upper end wall, said plate having an opening alined with said opening first mentioned, a lever the handle portion of which is insertable upwardly through said alined openings, said lever having laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, an inverted substantially U-shaped sheet metal frame the intermediate portion of the upper end of which is cut away to provide for telescopic movement thereof upwardly over the lower end of said lever, the upper ends of the side walls of said frame having notches to underlie and fit said pivot studs, to thereby restrict said lever to oscillation in a single plane, said plate, said upper end wall and said frame each having a plurality of other openings respectively alined with each other, and a corresponding number of fastening elements penetrating said last mentioned openings and adapted to secure all of said parts in properly assembled relation.

9. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a substantially flat sheet metal support plate superimposed upon said upper end wall, said plate having an opening alined with said opening first mentioned, a lever the handle portion of which is insertable upwardly through said alined openings, said lever having laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, an inverted substantially U-shaped sheet metal frame the intermediate portion of the upper end of which is cut away to provide for telescopic movement thereof upwardly over the lower end of said lever, the upper ends of the side walls of said frame having notches to underlie and fit said pivot studs, to thereby restrict said lever to oscillation in a single plane, said plate, said upper end wall and said frame each having a plurality of other openings respectively alined with each other, a corresponding number of fastening elements penetrating said last mentioned openings and adapted to secure all of said parts in properly assembled relation, said lever being composed of relatively soft metal such as brass, and said housing, frame and pivot studs being composed of relatively hard metal such as steel, for the purpose set forth.

10. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a substantially flat sheet metal support plate superimposed upon said upper end wall, said plate having an opening alined with said opening first mentioned, a lever the handle portion of which is insertable upwardly through said alined openings, said lever having laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, an inverted substantially U-shaped sheet metal frame the intermediate portion of the upper end of which is cut away to provide for telescopic movement thereof upwardly over the lower end of said lever, the upper ends of the side walls of said frame having notches to underlie and fit said pivot studs, to thereby restrict said lever to oscillation in a single plane, said plate, said upper end wall and said frame each having a plurality of other openings respectively alined with each other, a corresponding number of fastening elements penetrating said last mentioned openings and adapted to secure all of said parts in properly assembled relation, said lever having a drilled passage extending transversely therethrough, a steel member having an enlarged intermediate portion adapted for a drive fit within said pas-

sage, and said pivot studs being formed integrally with opposite ends of said steel member.

11. In an electric switch, in combination, an inverted cup-shaped housing formed of relatively hard, wear-resisting metal, said housing having an opening formed in the upper end wall thereof, a manually operable lever formed of relatively soft metal, the handle portion of said lever being insertable upwardly through said opening, said lever having a transverse opening formed therein, a member formed of relatively hard metal having a drive fit within said opening, said member having opposite end portions of cylindrical form extending laterally from said lever and adapted to bear against the lower surface of said end wall, and means including a metal frame underlying said end portions of said member and cooperating therewith to restrict said lever to oscillation about a substantially fixed center.

12. In an electric switch, in combination, an inverted cup-shaped housing formed of sheet steel, said housing having an opening formed in the upper end wall thereof, a machined lever formed of brass or an alloy thereof, the handle portion of said lever being insertable upwardly through said opening, said lever having a drilled opening extending transversely therethrough intermediate the length thereof, a steel member having a straight-knurled intermediate portion adapted for a drive fit into said opening to substantially fill the same, said member having reduced substantially cylindrical end portions adapted to bear against the inner surface of said upper end wall, a sheet metal frame member underlying said cylindrical end portions and adapted to restrict said lever to oscillation about a substantially fixed center, means for rigidly attaching said frame member to said housing, and means carried by said frame member to positively limit the degree of oscillatory movement of said lever in each direction.

13. In an electric switch, in combination, an inverted cup-shaped housing formed of sheet steel, said housing having an opening formed in the upper end wall thereof, a machined lever formed of brass or an alloy thereof, the handle portion of said lever being insertable upwardly through said opening, said lever having a drilled opening extending transversely therethrough intermediate the length thereof, a steel member having a straight-knurled intermediate portion adapted for a drive fit into said opening to substantially fill the same, said member having reduced substantially cylindrical end portions adapted to bear against the inner surface of said upper end wall, a sheet metal frame member underlying said cylindrical end portions and adapted to restrict said lever to oscillation about a substantially fixed center, means for rigidly attaching said frame member to said housing, means carried by said frame member to positively limit the degree of oscillatory movement of said lever in each direction, and spring-operated means associated with said last mentioned means and with said lever to bias the latter out of one or the other of its extreme positions, for the purpose set forth.

14. In an electric switch, in combination, an inverted cup-shaped housing formed of sheet steel, said housing having an opening formed in the upper end wall thereof, a machined lever formed of brass or an alloy thereof, the handle portion of said lever being insertable upwardly through said opening, said lever having a drilled opening extending transversely therethrough intermediate the length thereof, a steel member having a straight-knurled intermediate portion adapted for a drive fit into said opening to substantially fill the same, said member having reduced substantially cylindrical end portions adapted to bear against the inner surface of said upper end wall, a sheet metal frame member underlying said cylindrical end portions and adapted to restrict said lever to oscillation about a substantially fixed center, means for rigidly attaching said frame member to said housing, means carried by said frame member to positively limit the degree of oscillatory movement of said lever in each direction, and spring-operated means associated with said last mentioned means and with said lever to bias the latter out of one or the other or both of its extreme positions, for the purpose set forth.

15. In an electric switch, in combination, an inverted cup-shaped housing formed of relatively hard, wear-resisting metal, said housing having an opening formed in the upper end wall thereof, a manually operable lever formed of relatively soft metal, the handle portion of said lever being insertable upwardly through said opening, said lever having a transverse opening formed therein, a member formed of relatively hard metal having a drive fit within said opening, said member having opposite end portions of cylindrical form extending laterally from said lever and adapted to bear against the lower surface of said end wall, means including a metal frame underlying said end portions of said member and cooperating therewith to restrict said lever to oscillation about a substantially fixed center, said lever having a cavity formed therein and opening to the lower end thereof, the lower portion of said cavity being of relatively large diameter and the upper end portion thereof being of relatively small diameter, and said last mentioned portion extending upwardly through and beyond said hard metal member, for the purpose set forth.

16. In an electric switch, in combination, an inverted cup-shaped housing formed of relatively hard, wear-resisting metal, said housing having an opening formed in the upper end wall thereof, a manually operable lever formed of relatively soft metal, the handle portion of said lever being insertable upwardly through said opening, said lever having a transverse opening formed therein, a member formed of relatively hard metal having a drive fit within said opening, said member having opposite end portions of cylindrical form extending laterally from said lever and adapted to bear against the lower surface of said end wall, means including a metal frame underlying said end portions of said member and cooperating therewith to restrict said lever to oscillation about a substantially fixed center, said lever having a cavity formed therein and opening to the lower end thereof, the lower portion of said cavity being of relatively large diameter and the upper end portion thereof being of relatively small diameter, said last mentioned portion extending upwardly through and beyond said hard metal member, for the purpose set forth, a plunger having a metal portion slidable within said upper end portion of said cavity and an insulating portion slidable within the lower end portion thereof, and a relatively strong coiled compression spring interposed between said insulating portion of said plunger and the upper end wall of said lower portion of the cavity.

17. In an electric switch, in combination, an

inverted cup-shaped housing formed of relatively hard, wear-resisting metal, said housing having an opening formed in the upper end wall thereof, a manually operable lever formed of relatively soft metal, the handle portion of said lever being insertable upwardly through said opening, said lever having a transverse opening formed therein, a member formed of relatively hard metal having a drive fit within said opening, said member having opposite end portions of cylindrical form extending laterally from said lever and adapted to bear against the lower surface of said end wall, means including a metal frame underlying said end portions of said member and cooperating therewith to restrict said lever to oscillation about a substantially fixed center, said lever having a cavity formed therein and opening to the lower end thereof, the lower portion of said cavity being of relatively large diameter and the upper end portion thereof being of relatively small diameter, said last mentioned portion extending upwardly through and beyond said hard metal member, for the purpose set forth, a plunger having a metal portion slidable within said upper end portion of said cavity and an insulating portion slidable within the lower end portion thereof, a relatively strong coiled compression spring interposed between said insulating portion of said plunger and the upper end wall of said lower portion of the cavity, the lower end portion of said lever having a kerf providing opposed slots, and the insulating portion of said plunger having integral ribs respectively engageable with the walls of said slots to restrain said plunger against relative rotation.

18. In an electric switch, in combination, an inverted cup-shaped housing formed of relatively hard, wear-resisting metal, said housing having an opening formed in the upper end wall thereof, a manually operable lever formed of relatively soft metal, the handle portion of said lever being insertable upwardly through said opening, said lever having a transverse opening formed therein, a member formed of relatively hard metal having a drive fit within said opening, said member having opposite end portions of cylindrical form extending laterally from said lever and adapted to bear against the lower surface of said end wall, means including a metal frame underlying said end portions of said member and cooperating therewith to restrict said lever to oscillation about a substantially fixed center, said lever having a cavity formed therein and opening to the lower end thereof, the lower portion of said cavity being of relatively large diameter and the upper end portion thereof being of relatively small diameter, said last mentioned portion extending upwardly through and beyond said hard metal member, for the purpose set forth, a plunger having a metal portion slidable within said upper end portion of said cavity and an insulating portion slidable within the lower end portion thereof, a relatively strong coiled compression spring interposed between said insulating portion of said plunger and the upper end wall of said lower portion of the cavity, the lower end portion of said lever having a kerf providing opposed slots, the insulating portion of said plunger having integral ribs respectively engageable with the walls of said slots to restrain said plunger against relative rotation, a substantially cylindrical metal roller having pivot studs extending axially therefrom, and the lower end of said insulating portion of the plunger being recessed to accommodate a portion of said roller and to provide downwardly opening bearings for said pivot studs.

19. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a lever the handle portion of which is insertable upwardly through said opening, said lever having a pair of laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, a metal frame member rigidly secured to said upper end wall, said frame member having bearing portions underlying said pivot studs to provide a substantially fixed pivotal axis for said lever, the peripheral wall of said housing being of approximately elliptical contour, said housing having a horizontal flange of substantially rectangular contour at the lower end thereof, a molded insulating base having a flat portion against which said flange is adapted to seat, said flange and said base having alined openings at each of the four corners thereof, and a corresponding number of fastening members penetrating said openings and adapted to rigidly and permanently secure said housing and base to each other.

20. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a lever the handle portion of which is insertable upwardly through said opening, said lever having a pair of laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, a metal frame member rigidly secured to said upper end wall, said frame member having bearing portions underlying said pivot studs to provide a substantially fixed pivotal axis for said lever, the peripheral wall of said housing being of approximately elliptical contour, said housing having a horizontal flange of substantially rectangular contour at the lower end thereof, a molded insulating base having a flat portion against which said flange is adapted to seat, said flange and said base having alined openings at each of the four corners thereof, a corresponding number of fastening members penetrating said openings and adapted to rigidly and permanently secure said housing and base having a flat raised portion formed integrally therewith, and a section of wound paper tubing closely surrounding said raised portion and accommodated by the peripheral wall of said housing to provide an insulating lining for the latter.

21. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a lever the handle portion of which is insertable upwardly through said opening, said lever having a pair of laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, a metal frame member rigidly secured to said upper end wall, said frame member having bearing portions underlying said pivot studs to provide a substantially fixed pivotal axis for said lever, the peripheral wall of said housing being of approximately elliptical contour, said housing having a horizontal flange of substantially rectangular contour at the lower end thereof, a molded insulating base having a flat portion against which said flange is adapted to seat, said flange and said base having alined openings at each of the four corners thereof, a corresponding number of fastening members penetrating said openings and adapted to rigidly and permanently secure said housing and base to

each other, said base having a flat raised portion formed integrally therewith, a section of wound paper tubing closely surrounding said raised portion and accommodated by the peripheral wall of said housing to provide an insulating lining for the latter, said base having a stationary contact and a tiltable contactor carried by said base within said housing, the wiring terminal elements of said contact and contactor being exposed upon the outer surface of said base, and a spring-pressed plunger associated with said lever and cooperable with said contactor to effect tilting movement of the latter into and out of engagement with said contact.

22. In an electric switch, in combination, an inverted cup-shaped sheet metal housing having an opening formed in the upper end wall thereof, a lever the handle portion of which is insertable upwardly through said opening, said lever having a pair of laterally extending pivot studs adapted to bear against the inner surface of said upper end wall, a metal frame member rigidly secured to said upper end wall, said frame member having bearing portions underlying said pivot studs to provide a substantially fixed pivotal axis for said lever, the peripheral wall of said housing being of approximately elliptical contour, said housing having a horizontal flange of substantially rectangular contour at the lower end thereof, a molded insulating base having a flat portion against which said flange is adapted to seat, said flange and said base having alined openings at each of the four corners thereof, a corresponding number of fastening members penetrating said openings and adapted to rigidly and permanently secure said housing and base to each other, said base having a flat raised portion formed integrally therewith, a section of wound paper tubing closely surrounding said raised portion and accommodated by the peripheral wall of said housing to provide an insulating lining for the latter, said base having a stationary contact and a tiltable contactor carried by said base within said housing, the wiring terminal elements of said contact and contactor being exposed upon the outer surface of said base, a spring-pressed plunger associated with said lever and cooperable with said contactor to effect tilting movement of the latter into and out of engagement with said contact, said contact and said contactor each being composed of a base metal or a base metal alloy of good electrical conductivity, and each having rigidly and permanently attached thereto a contacting tip composed of silver or silver alloy.

23. In an electric switch, in combination, a substantially U-shaped metal support, a punched and stamped sheet metal actuating element adapted to seat upon said support, a punched and stamped sheet metal contactor adapted to surround said support and having portions superimposed upon the actuating element, spring means normally acting to retain said last mentioned parts in engagement with each other while yieldably permitting relative movement therebetween, and said contactor having portions underlying portions of said actuating element to provide for positive movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter.

24. In an electric switch, in combination, a substantially U-shaped metal support, a punched and stamped sheet metal actuating element adapted to seat upon said support, a punched and stamped sheet metal contactor adapted to surround said support and having portions superimposed upon the actuating element, spring means normally acting to retain said last mentioned parts in engagement with each other while yieldably permitting relative movement therebetween, said contactor having portions underlying portions of said actuating element to provide for positive movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter, a wiring terminal member associated with said support, and a stranded conductor attached to said terminal member and to said contactor to insure a good electrical connection therebetween.

25. In an electric switch, in combination, a manually operable lever formed of relatively soft metal, said lever having a transverse opening formed therein, a member formed of relatively hard metal having a straight-knurled intermediate portion adapted for a drive fit within said opening, said member having reduced, integral opposite end portions of cylindrical form extending laterally from said lever and adapted to provide pivot studs therefor, said lever having a cavity formed therein and opening to the lower end thereof, the lower portion of said cavity being of relatively large diameter and the upper end portion thereof being of relatively small diameter, said last mentioned portion of the cavity extending upwardly through and beyond said hard metal member, a plunger having a metal portion slidable within said upper end portion of said cavity and an insulating portion slidable within the lower end portion thereof, and a coiled compression spring interposed between said insulating portion of said plunger and the upper end wall of said lower end portion of said cavity.

26. In an electric switch, in combination, a substantially U-shaped metal support, the arms of said support each having an upwardly opening rectangular bearing notch formed therein, a punched and stamped sheet metal actuating element having oppositely extending flat arm portions adapted to seat within the respective bearing notches, a punched and stamped sheet contactor having portions thereof superimposed upon said arm portions of the actuating element, means comprising a pair of coiled compression springs associated with said arm portions and said contactor portions to normally maintain the same in engagement while yieldably permitting tilting movement of said actuating element relatively to said contactor under given conditions, and said contactor having portions underlying portions of said actuating element to provide for positive movement of said contactor jointly with said actuating element upon a predetermined degree of tilting movement of the latter.

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