April 27, 1937. A. W. KRIEGER 2,078,253

ELECTRIC SNAP SWITCH

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Fig. 1

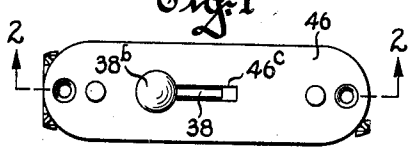


Fig. 2

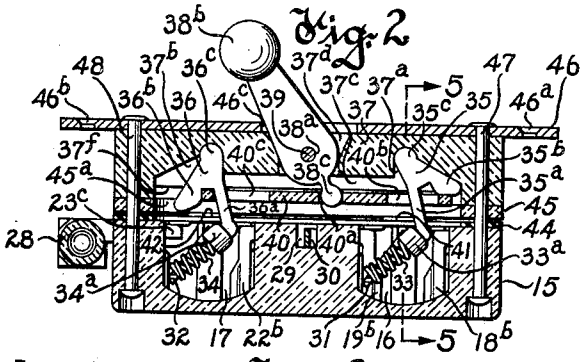


Fig. 3

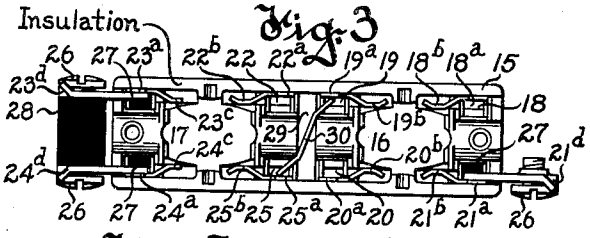


Fig. 4

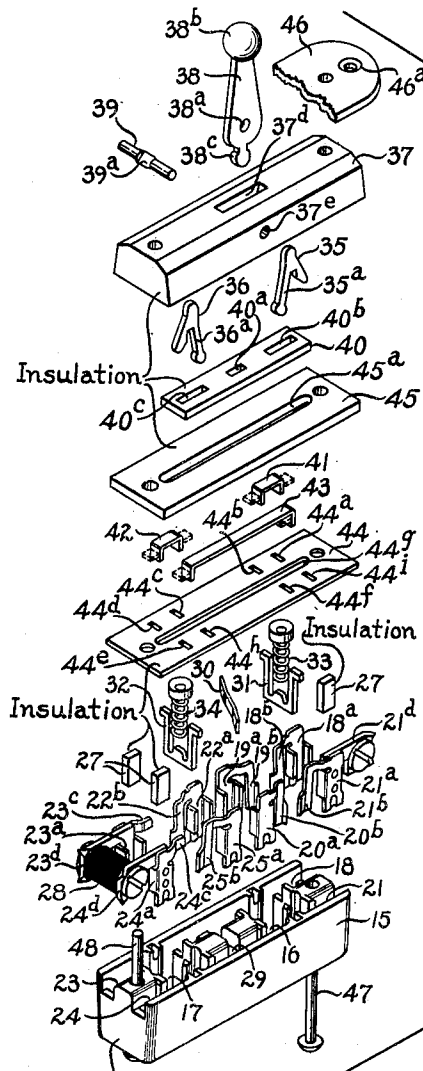


Fig. 5

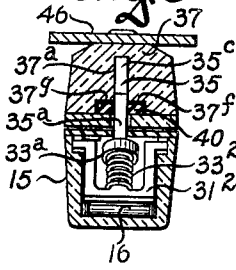


Fig. 6

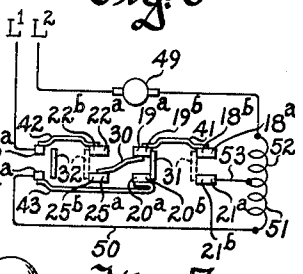


Fig. 7

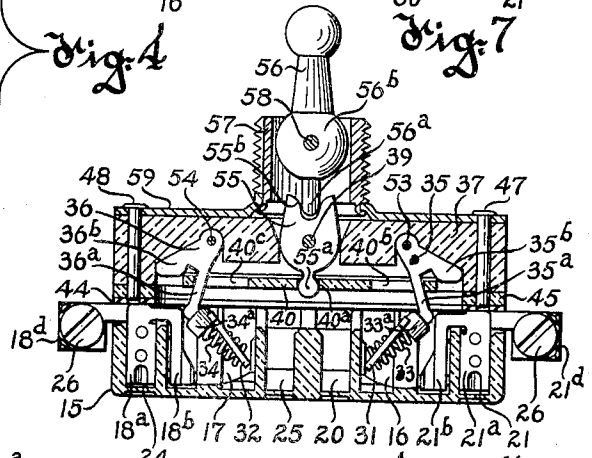
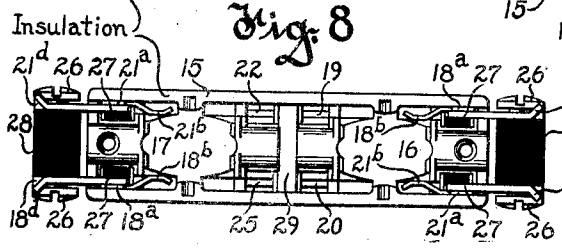


Fig. 8



Inventor
Alvin W. Krieger
By Frank A. Hubbard
Attorney

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Fig. 9

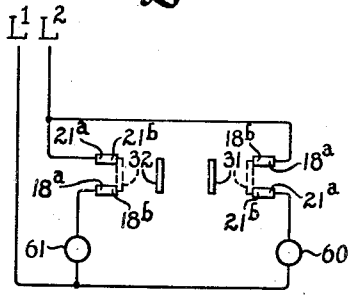


Fig. 12

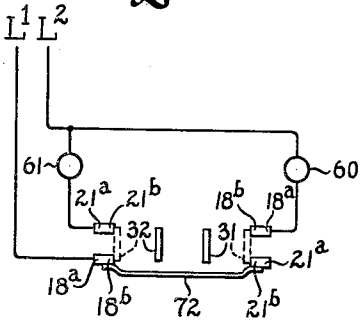


Fig. 10

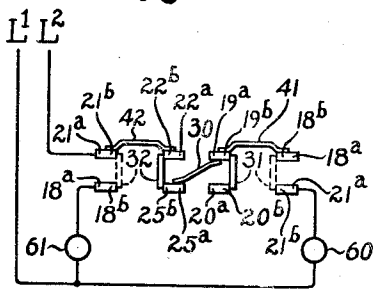


Fig. 13

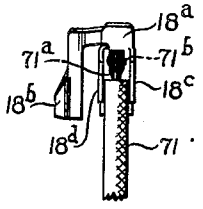


Fig. 14

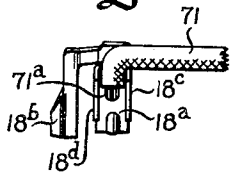
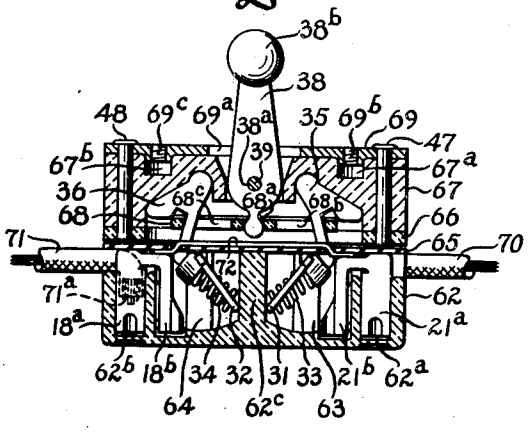


Fig. 11



Inventor
Alvin W. Krieger
By Frank H. Hubbard
Attorney

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UNITED STATES PATENT OFFICE

2,078,253

ELECTRIC SNAP SWITCH

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

Application July 15, 1935, Serial No. 31,402

17 Claims. (Cl. 200—18)

This invention relates to improvements in electric snap switches, and the same relates more particularly to electric snap switches of the three-position type.

An object of the invention is to provide a novel, sturdy, and compact switch mechanism of the aforementioned character.

Another object is to provide a switch mechanism of the aforementioned character of relatively small dimensions but having a relatively high current-controlling capacity.

Another object is to minimize the number of different conducting and insulating parts required in the construction of switches having different electrical circuit-controlling characteristics.

Another object is to provide a snap switch of the aforementioned character having an "off" position corresponding to one extreme position of the operating lever and two "on" positions at one side of said "off" position.

Another object is to provide such a switch having an intermediate "off" position and two extreme "on" positions.

Another object is to provide a three-position switch the stationary and movable contact parts of which are fully enclosed and which are properly insulated from each other in the "off" position of the switch.

Another object is to provide a novel combination of actuating elements for the multiple switch mechanism.

Another object is to improve the details of construction and assembly of the parts and the operation of switch mechanisms of the aforementioned character.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate certain embodiments of the invention which will now be described, it being understood that the embodiments illustrated are susceptible of modification as to certain details of construction thereof without departing from the scope of the appended claims.

In the drawings, Figure 1 is a top plan view, actual size, of a three-position snap switch constructed in accordance with my invention.

Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1,—certain of the parts being shown in elevation.

Fig. 3 is a top plan view of the molded insulating base shown in Figs. 1 and 2 with the stationary contact and terminal elements and one of the bus members shown in position.

Fig. 4 is a perspective view, in separated relation, of the parts of the switch shown in Figs. 1 to 3,—a fragment only of the supporting top plate being illustrated.

Fig. 5 is a vertical sectional view, on the line 5—5 of Fig. 2,—certain of the parts being shown in elevation.

Fig. 6 is a schematic and diagrammatic illustration of the circuit-controlling elements of the switch shown in Figs. 1 to 5 and of the arrangement of circuits to be controlled thereby.

Fig. 7 is a vertical sectional view of a modified form of multiple-circuit controlling switch having an intermediate "off" position and a set of exposed wiring terminal screws at each end thereof.

Fig. 8 is a top plan view of the insulating base shown in Fig. 7, with the opposite end pairs of combined stationary contact and wiring terminal members shown in position.

Fig. 9 is a schematic and diagrammatic illustration of the circuit-controlling elements shown in Figs. 7 and 8 and of a pair of circuits to be controlled thereby.

Fig. 10 is a schematic and diagrammatic illustration of a modified form of the switch shown in Figs. 1 to 6, wherein four pairs of resilient stationary contacts are provided and one of the bus members of Figs. 1 to 6 is omitted to provide a multiple-circuit controlling switch having an intermediate "off" position.

Fig. 11 is a vertical sectional view of a modified form of multiple-circuit controlling switch, which is functionally quite similar to the switches shown in Figs. 7 to 10, but of substantially reduced longitudinal dimensions,

Fig. 12 is a schematic and diagrammatic illustration of the circuit-controlling parts of the switch shown in Fig. 11, and

Figs. 13 and 14 are detail perspective views showing the preferred manner of attaching the wires to the terminal members of Fig. 12.

The switches herein disclosed embody certain features of the switch structures described and claimed in my prior patents, No. 1,905,914, dated April 25, 1933, and No. 1,998,962, dated April 23, 1935. The switch mechanisms herein disclosed are likewise in some respects similar to the switch mechanism described and claimed in the Stevens and Meuer Patent No. 1,781,710, dated November 18, 1930.

Referring first to Figs. 1 to 6, inclusive, the numeral 15 designates a relatively long molded insulating base which is preferably of substantially rectangular contour. Said base is provid-

ed with a pair of relatively large substantially rectangular recesses 16 and 17 arranged in end to end relation and opening to the upper surface of the base. Arranged in spaced relation to the recesses 16 and 17 at the four corners of each of the same are the relatively small substantially rectangular recesses 18 to 21 and 22 to 25 which likewise open to the upper surface of base 15. Adapted for a press fit within the eight relatively small recesses are four right-hand and four left-hand terminal members 18^a, 20^a, 22^a, 24^a and 21^a, 19^a, 25^a, 23^a, respectively. Formed integrally with the respective terminal members (with the exception of the pair 23^a, 24^a at the left-hand end of the base) are resilient stationary contacts 18^b, 19^b, 20^b, 21^b, 22^b and 25^b,—the four contacts first mentioned being located in transversely alined pairs 18^b, 21^b and 19^b, 20^b within recess 16, and the transversely alined pair 22^b, 25^b being located within recess 17. The terminal members 23 and 24 are merely provided with horizontally extending lugs 23^c, 24^c for a purpose hereinafter described.

If it is desired to effect concealed wiring of the switch the bared ends of the respective conductors may be attached to the respective terminal members 23^a, 24^a and 21^a by soldering or brazing (as indicated in dotted lines at the left-hand end of the switch in Fig. 11) prior to insertion of said terminal members within their respective recesses. In Figs. 1 to 4, however, I have shown the aforementioned terminal members as provided with end-wiring terminal elements 23^d, 24^d and 21^d, respectively,—said elements being provided with extruded cylindrical bosses and said members being provided with openings to receive the bosses, which are then upset as indicated in Fig. 4 to mechanically and electrically connect said parts. The terminal elements are tapped to receive the usual binding screws 26. In order to support more rigidly the element 21^d during tightening of screw 26 I prefer to interpose between the same and the wall of recess 21 a small rectangular plate or block 27 of insulation. I have likewise shown a pair of blocks 27 associated with elements 23^d and 24^d, but said blocks may be omitted if desired, due to the use of the cylindrical insulating and reinforcing strut member 28. The form of the stationary contact and terminal members and the form of the recesses which accommodate the same are substantially like those illustrated in my aforementioned Patent No. 1,998,962,—which, however, merely discloses one relatively large recess and four relatively small recesses in the base.

Base 15 is provided in its upper surface with a groove 29 to receive edgewise in a flush relation and with a press fit the bus member 30 the angularly bent ends of which are resiliently biased into engagement with the terminal members 19^a and 25^a, respectively. Recesses 16 and 17 are respectively provided in the opposed side walls thereof with pairs of vertical ribs, as disclosed in my prior patents aforementioned, the upper ends of the pairs of vertical ribs being provided with open pivotal bearings to accommodate the outwardly extending ends of a pair of flat punched sheet metal contactors 31 and 32 of substantially U-shape. Said contactors are formed to provide abutments for the lower ends of coiled compression springs 33 and 34, respectively,—the upper ends of said springs being provided with inverted cup-shaped stamped sheet metal members 33^a, 34^a having concave upper ends to provide proper abutments for the rounded lower ends of the long arms 35^a, 36^a of a pair of actuating levers 35 and 36. Levers 35 and 36, which preferably consist of flat sheet metal punchings, are likewise provided with relatively short arms 35^b and 36^b which are arranged at an acute angle with respect to said long arms.

Levers 35 and 36 are provided with rounded end portions 35^c, 36^c which are adapted to provide for oscillatable support of said levers by the walls of a pair of recesses 37^a and 37^b in a molded insulating member 37,—the walls of said recesses being formed as shown to limit the degrees of oscillatory movement of said levers in opposite directions. The levers 35 and 36 which are of identical form are oppositely arranged with the long arms 35^a and 36^a thereof adjacent to each other, and the side walls of recesses 37^a and 37^b are so closely spaced as to limit the levers 35 and 36 to oscillatory movement in a single plane. Member 37 is also recessed as shown at 37^c, 37^d to receive the flat punched sheet metal operating lever 38 which is likewise limited to oscillatory movement in the aforementioned plane of the levers 35 and 36. Lever 38 is pivoted to member 37 as by means of a pin 39 having an enlarged intermediate portion 39^a which is adapted for a drive fit within the opening 38^a in said lever,—the member 37 being provided with alined transverse openings (one of which is shown at 37^e in Fig. 4) to accommodate pin 39.

The upper end of operating lever 38 is provided with a spherical knob 38^b (which may be attached thereto with a drive fit in a known manner) to facilitate manual operation thereof. The lower end 38^c of lever 38 is of reduced and rounded formation, whereby the same is adapted for driving engagement with the walls of an intermediate rectangular opening 40^a formed in the flat punched plate 40, which is preferably of insulating material. Plate 40 is slidable upon or with respect to the alined flat ledges 37^f, 37^g (Figs. 2 and 5) which are offset inwardly from the lower face of member 37 and which communicate with the aforementioned recesses in said member. Plate 40 is provided adjacent to opposite ends thereof with relatively longer openings 40^b, 40^c which are respectively adapted to accommodate the long arms 35^a and 36^a of levers 35 and 36. The end walls of openings 40^b and 40^c remote from each other are respectively adapted to engage the long arms 35^a and 36^a during movement of plate 40 from its intermediate position toward its extreme left-hand and right-hand positions, as will be obvious.

In Fig. 2 I have shown plate 40 in its extreme right-hand position with consequent right-hand positioning of the long arms 35^a, 36^a of levers 35, 36 and left-hand positioning of contactors 31 and 32. With the parts so positioned the relatively short arm 36^b of lever 36 is engaged with the left-hand end edge of plate 40. Accordingly upon movement of operating lever 38 from its extreme left-hand position (Fig. 2) toward the vertical position thereof plate 40 is slid toward the left to effect clockwise movement of lever 36. When the lower end of lever arm 36^a passes over the pivotal center of contactor 32 the spring 34 will act in a well known manner to effect counterclockwise movement of said contactor with a snap action,—said spring at the same time acting to complete the clockwise movement of lever 36. Lever 38 will be yieldably retained in its intermediate position due to engagement of the remote end walls of openings 40^b,

40c with the outer edges of the arms 35a and 36a of levers 35 and 36 (see Fig. 7).

Upon movement of lever 38 from its intermediate or vertical position toward its extreme right-hand position the outer end wall of opening 40b will, by its engagement with arm 35a, effect clockwise movement of lever 35, and when the lower end of said arm passes over the pivotal center of contactor 31 the spring 33 will act to snap said contactor toward the right. The reverse operation of the switch parts upon movement of operating lever 38 from the extreme right-hand position to its intermediate or vertical position and its further movement to the extreme left-hand position illustrated in Fig. 2 is believed to be apparent.

The switch illustrated in Figs. 1 to 5 is intended to be connected in and to provide for control of the circuits illustrated in Fig. 6. Accordingly I provide three additional bus members 41, 42 and 43,—the bus member 41 being adapted to electrically connect the terminal members 18a and 19a, the bus member 42 being adapted to electrically connect the terminal members 22a and 23a, and the bus member 43 being adapted to electrically connect the terminal members 24a and 20a. Said bus members are each formed of resilient strip metal, such as bronze; and the same are initially provided with downwardly bent end portions (full lines, Fig. 4) which are respectively insertable into pairs of openings 44a, 44b, 44c, 44d and 44e, 44f in a relatively thin flat plate 44 of insulating material. The ends of members 41 and 42 are bent to extend in opposite directions upon the lower face of plate 44 (as shown in dotted lines in Fig. 4 and in full lines in Fig. 2) and the ends of member 43 are bent in a like direction (to the left as shown in dotted lines in Fig. 4). Plate 44 is provided with a longitudinally extending slot 44g to provide clearance for the arms 35a and 36a of levers 35 and 36, as best illustrated in Fig. 2, and said plate is provided with additional openings 44h, 44i to afford a symmetrical arrangement of all the openings with obvious advantageous results.

Interposed between insulating member 37 and plate 44 is a relatively thicker punched plate 45 of insulating material,—plate 45 having a longitudinally extending slot 45a which provides clearance for both the long and short arms of levers 35 and 36. Plate 45 which underlies the aforementioned sliding plate 40 is adapted to retain the latter in proper position relatively to the insulating member 37, and plate 44 which overlies base 15 is adapted to retain the aforementioned stationary contact and terminal members, as well as the contactors 31 and 32 in properly assembled relation.

A supporting top plate 46, formed of metal, is provided at opposite ends thereof with openings 46a, 46b to receive screws (not shown) having countersunk heads for flush attachment of the switch to a suitable support, such as a tool handle or the like. The slot or opening 46c in top plate 46 affords clearance for the operating lever 38,—the degrees of oscillatory movement of the latter being preferably limited by the end walls of the aforementioned opening 37d in member 37. A pair of headed rivets 47 and 48 are adapted to pass through base 15, plates 44 and 45, member 37 and top plate 46, and are upset over the latter to secure the various parts of the switch in assembled relation.

In Fig. 6 I have illustrated diagrammatically the manner in which the aforedescribed switch may be utilized for effecting two-speed control of a vacuum cleaner motor 49 or the like. Thus with the switch parts in the respective positions thereof illustrated in Fig. 2, and in full lines in Fig. 6, the circuit of motor 49 is interrupted. Upon movement of operating lever 38 to its intermediate or vertical position contactor 32 is moved to its dotted line position, Fig. 6, to complete a circuit for relatively slow speed operation of the motor. Said circuit may be traced from line L^1 to terminal member 23a, through bus 42, terminal 22a, contact 22b, contactor 32, contact 25b, terminal 25a, bus 30, terminal 19a, contact 19b, contactor 31, contact 20b, terminal 20a, bus 43, terminal 24a, by conductor 50 through sections 51 and 52 of the series field of motor 49, and thence through the armature of the latter to line L^2.

Upon movement of lever 38 to its extreme right-hand position the contactor 32 remains in the dotted line position thereof illustrated in Fig. 6, and the contactor 31 is moved to the dotted line position thereof illustrated in said figure. Disengagement of contactor 31 from contacts 19b and 20b interrupts the aforedescribed circuit through sections 51 and 52 of the series field, but a circuit is immediately completed through the section 52 and alone,—said circuit extending from line L^1 to terminal 19a, as aforedescribed, thence through bus 41, terminal 18a, contact 18b, contactor 31, contact 21b, terminal 21a, by conductor 53 through said section 52 and the armature of motor 49 to line L^2. Reverse operation of lever 38 first effects movement of contactor 31 from its dotted line position to its full line position (Fig. 6) to effect inclusion of both sections 51 and 52 in series in the motor circuit, and continued reverse operation of said lever then effects movement of contactor 32 from its dotted line position to its full line position to completely interrupt the motor circuit. It will of course be understood that lever 38 may be moved at will in either direction from its intermediate or vertical position, with the controlling effects aforedescribed.

In Figs. 7 and 8 I have shown a modified form of multiple-circuit controlling switch with an intermediate "off" position. Certain of the parts which are identical with those aforedescribed have been given like numerals of reference. Thus I may employ the aforedescribed base 15, the plates 44 and 45, and the insulating member 37. This arrangement likewise includes the contactors 31, 32, springs 33, 34, actuating levers 35, 36 and the slidable insulating plate 40 cooperating with said levers. Levers 35 and 36 may be modified, as shown in Fig. 7, by providing openings therein to receive (with a drive fit, as described in connection with pin 39 associated with lever 38, Fig. 4) the pivot pins 53 and 54, respectively,—the member 37 being provided with transverse openings or passages (not shown) to provide for insertion of said pins and to provide bearings therefor.

A lever 55 is pivotally supported with respect to member 37, as by means of the pin 39,—the lower end 55a of said lever being formed in the manner illustrated for cooperative engagement with the walls of the intermediate opening 40a in plate 40 to effect reciprocatory or sliding movement of the latter. The upper end of lever 55 is provided with a notch 55b having outwardly curved or flared edges for cooperative engagement thereof by the reduced and rounded lower end or projection 56a of a machined lever 56.

Lever 56 is preferably provided with an intermediate spherical enlargement 56b which substantially fills the bore of an externally threaded hollow metal bushing 57. Bushing 57 and enlargement 56b of lever 56 are provided with alined openings to receive the pivot pin 58,—any well known expedient being utilized to prevent endwise displacement of said pin.

Bushing 57 is rigidly secured in the manner illustrated to a metal top plate 59, and the aforedescribed rivets 47 and 48 are utilized to secure the several parts in assembled relation. The bus members aforedescribed are not used in the switch of Figs. 7 and 8. In the relatively small recesses 18 and 21 at the right-hand end of base 15 are the terminal members 18a and 21a with their associated contact portions 18b and 21b located within recess 16. Terminal member 21a has attached thereto the end wiring terminal element 21d having the binding screw 26. In like manner terminal member 18a is provided with an end wiring terminal element 18d having an associated binding screw 26, and the insulating cylindrical reinforcing strut member 28 is employed. The small insulating blocks 27 may be employed as shown, or omitted if desired without substantially affecting the rigidity of the assembled parts. At the left-hand end of base 15 within recesses 24 and 23 is a duplicate, but reversely arranged set of terminal members 18a and 21a having integral contact portions 18b and 21b located within recess 17. The end wiring terminal elements 18d and 21d are arranged as shown in conjunction with their associated insulating strut member 28 and the binding screws 26.

As will be apparent from Fig. 7, the lever 56 in its intermediate or vertical position provides for disengagement of each of the contactors 31 and 32 from its cooperating stationary contacts. Upon counterclockwise movement of lever 56 to its extreme left-hand position, lever 55 is moved in a clockwise direction, with consequent sliding movement of plate 40 toward the left. This effects clockwise movement of lever 35 with resultant snap movement of contactor 31 in a counterclockwise direction into bridging engagement with its cooperating stationary contacts 18b and 21b to complete one of the controlled circuits. Thereafter upon clockwise movement of lever 56 to its vertical position contactor 31 will be disengaged, with a snap action, from its cooperating contacts to interrupt the aforementioned circuit without affecting the condition of the other circuit controlled by the switch. Upon further clockwise movement of lever 56 to its extreme right-hand position the parts will operate in an obvious manner to effect snap movement of contactor 32 into bridging engagement with its cooperating pair of contacts.

In Fig. 9 I have shown schematically and diagrammatically an arrangement of circuits to be commutated by the switch of Figs. 7 and 8. In Fig. 9 the full line positions of contactors 31 and 32 correspond with the positions thereof in Fig. 7, wherein both of the controlled circuits are interrupted. Upon movement of lever 56 from its intermediate position toward the left (Fig. 7) contactor 31 is moved to its right-hand position as shown in dotted lines in Fig. 9,—thus completing a circuit from line L^1 through an electric lamp 60 or similar translating device to line L^2. Upon movement of lever 56 from its intermediate position toward the right contactor 32 is moved to the dotted line position thereof in Fig. 9,—thus completing a circuit from line L^1 through the other electric lamp 61 to line L^2.

In Fig. 10 I have shown schematically and diagrammatically an arrangement of parts which is structurally quite similar to, and which may be made functionally identical with the switch mechanism shown in Figs. 1 to 6. In the switch of Fig. 10 I do not require the aforementioned bus member 43 (Fig. 6), and instead of the terminal members 23a, 24a (Fig. 4), which are specially formed to eliminate or omit the stationary contact portions, I employ at the left-hand end of the switch a reversely arranged duplicate pair 21a, 21b and 18a, 18b of the combined contact and terminal members 18a, 18b and 21a, 21b employed at the right-hand end of the switch. Moreover, it will be noted that the switch of Fig. 10 is provided with an intermediate "off" position, and I have shown the same as adapted to selectively control the circuits of a pair of electric lamps 60 and 61, or similar translating devices.

Thus with the contactors 31 and 32 in the full line positions thereof illustrated in Fig. 10 the circuits of both lamps 60 and 61 will be interrupted. As aforeindicated such positioning of the contactors corresponds with vertical or intermediate positioning of the operating lever. Upon movement of the operating lever to one of its extreme positions contactor 31 is moved with a snap action to the dotted line position thereof in Fig. 10, thus completing a circuit for lamp 60 which may be traced from line L^1 through lamp 60, through terminal 21a, contact 21b, contactor 31, contact 18b, bus 41, terminal 19a, bus 30, terminal 25a, contact 25b, contactor 32, contact 22b, terminal 22a, bus 42, and terminal 21a to line L^2. Thereafter upon return movement of the operating lever to its intermediate position contactor 31 will be disengaged from contacts 18b, 21b to interrupt the circuit of lamp 60.

Upon movement of the operating lever to its other extreme position contactor 32 will be moved with a snap action to the dotted line position thereof illustrated in Fig. 10, thus completing a circuit for lamp 61,—which circuit may be traced from line L^1 through lamp 61, through terminal 18a, contact 18b, contactor 32, contact 21b, and terminal 21a to line L^2. Contactor 32 may of course be returned with a snap action to the full line position thereof illustrated in Fig. 10 without effecting movement of contactor 31 from the full line position thereof aforementioned.

In Figs. 11 and 12 I have shown a modified form of snap switch which is functionally quite similar to the switch illustrated in Figs. 7 to 9,—in that only two pairs of stationary contact and terminal members are employed to provide a multiple-circuit controlling switch having an intermediate "off" position. In this switch the double-armed actuating levers 35 and 36, the operating lever 38, the contactors 31 and 32 and the springs 33 and 34 are identical with the correspondingly designated parts aforedescribed. The two pairs of combined stationary contact and terminal members 18a, 18b and 21a, 21b at opposite ends of the switch are the same as those parts aforedescribed, except that the terminal portions thereof need not be perforated to receive the extrusions or bosses on the aforedescribed end-wiring terminal elements, inasmuch as the bared ends of the terminal wires employed are soldered or otherwise secured directly to the respective terminal portions, as illustrated in dotted lines at the left-hand end of Fig. 11, and as shown in detail in Figs. 13 and 14.

The molded insulating base 62 of Fig. 11 is provided with a pair of relatively large recesses 63 and 64 within which the respective contactors 31 and 32 are adapted for oscillation into and out of bridging engagement with the associated pairs of contact portions 18b, 21b located therewithin. The terminal members are located within pairs of relatively small recesses at opposite ends of base 62,—two of said recesses being shown at 62a and 62b. The recesses 63 and 64 are spaced endwise only to a degree corresponding to the thickness of the intermediate wall or barrier 62c of base 62,—wherefore the latter is of considerably less length than the base 15 aforedescribed. In like manner the insulating plates 65, 66 and 68 and the insulating member 67 are of reduced length, as compared with the corresponding parts 44, 45, 40 and 37 aforedescribed. The openings 68a, 68b and 68c in slidable plate 68 are preferably identical in shape and size with the openings 40a, 40b and 40c in plate 40, but are spaced to a lesser degree endwise from each other. Operating lever 38 functions in its intermediate or vertical position to effect disengagement of both contactors 31 and 32 from their associated pairs of stationary contacts, and to effect bridging engagement of said contactors individually with their associated contacts, depending upon the direction of movement of lever 38 from its intermediate position. Plate 65 has attached thereto in the manner aforedescribed a bus member 72 which is adapted to electrically connect the left-hand terminal member 18a and the right-hand terminal member 21a.

Superimposed upon the insulating member 67 and substantially coextensive with respect to the latter is a metal top plate 69 having a slot or opening 69a to provide clearance for lever 38. Plate 69 is preferably provided with inwardly extruded or otherwise thickened portions surrounding the tapped openings 69b, 69c formed therein,—said openings being adapted to receive the shanks of suitable securing screws (not shown) to provide for concealed mounting of the switch with respect to a tool handle or similar support. Insulating member 67 is provided with recesses 67a, 67b in the top face thereof to accommodate said extruded portions and the shanks of the securing screws. The several parts of the switch are preferably rigidly and permanently secured in assembled relation by the rivets 47, 48 aforedescribed. Two of the circuit wires of the switch are shown at 70 and 71 in Fig. 11,—the attached ends of said wires being concealed within the switch housing as aforeindicated. In each of the switch bases herein disclosed I have shown the bottom walls of the several relatively small recesses as consisting of relatively thin diaphragms which may be readily removed by broaching to provide for accommodation of terminal members of the bottom wiring type, as disclosed in my aforementioned Patent No. 1,998,962. Also as will be apparent, the several switches herein illustrated are provided with end grooves and the same are otherwise arranged to provide for concealed wiring, as specifically illustrated in Fig. 11.

Referring to the diagrammatic illustration of Fig. 12, wherein the contactors are shown in full lines in the respective positions thereof corresponding to intermediate or "off" positioning of lever 38 (Fig. 11), it will be apparent that upon movement of lever 38 to its extreme left-hand position plate 68 will act to effect counterclockwise movement of lever 36 with resultant snap movement of contactor 32 in a clockwise direction, thus completing a circuit for lamp 61,—which circuit may be traced from line L^1 through terminal 18a, contact 18b, contactor 32, contact 21b, and terminal 21a through lamp 61 to line L^2. Also upon movement of lever 38 from its intermediate position to its extreme right-hand position plate 68 will act to effect clockwise movement of lever 35 with resultant snap movement of contactor 31 in a counterclockwise direction, thus completing a circuit for lamp 60,—which circuit may be traced from line L^1 through terminal 18a, bus member 72, terminal 21a, contact 21b, contactor 31, contact 18b, terminal 18a, through lamp 60 to line L^2. As will be apparent from the foregoing description the contactors 31 and 32 may simultaneously occupy the full line positions thereof illustrated in Fig. 12, whereas the arrangement is such that said contactors are restrained against simultaneous occupation of their dotted line positions.

When concealed wiring of the switch is effected, as indicated in Fig. 11, I prefer to initially arrange the wire with the bared end thereof extending upwardly, as shown in detail at 71a in Fig. 13. Said bared end is attached to terminal portion 18a, preferably by spot welding as indicated by the circular dotted line 71b. Wire 71 is bent upwardly, as shown in Fig. 14, to reflex the bared end portion 71a of the wire upon itself and to provide for positioning of a substantial length of the covered portion of the wire between the parallel lugs 18c and 18d formed integrally with the terminal member 18a. The covered portion of the wire is then bent at a right angle to extend outwardly from the switch base 62. This arrangement insures a good snubbing action between the circuit wire covering and the switch base 62 and the terminal member, wherefore the welded connection is relieved of any pulling strains to which the circuit wire may be subjected.

What I claim as new and desire to secure by Letters Patent is:

1. In an electric snap switch, in combination, a molded insulating base having a pair of relatively large substantially rectangular recesses formed therein and opening to the upper surface thereof, said recesses being arranged in end to end relation and the adjacent end walls thereof providing an insulating barrier therebetween, a plurality of stationary contacts located within each of said recesses, a pair of bridging contactors each located within one of said recesses and directly pivotally supported by the walls thereof, said contactors each being movable from one extreme position thereof to the other into and out of bridging engagement with the stationary contacts respectively associated therewith, means for effecting such movements of said contactors with a snap action, said means comprising a pair of oscillatable levers each having an abutment formed thereon, a coiled spring interposed between each abutment and the contactor respectively associated therewith, and common operating means for said levers, said means comprising a slidable member having a lost-motion driving connection with each of said levers, whereby the latter are moved to corresponding extreme positions thereof sequentially upon movement of said slidable member from each extreme position thereof to the other.

2. In an electric snap switch, in combination, a molded insulating base having a pair of relatively large substantially rectangular recesses

formed therein and opening to the upper surface thereof, said recesses being arranged in end to end relation and the adjacent end walls thereof providing an insulating barrier therebetween, a plurality of stationary contacts located within each of said recesses, a pair of bridging contactors each located within one of said recesses and directly pivotally supported by the walls thereof, said contactors each being movable from one extreme position thereof to the other into and out of bridging engagement with the stationary contacts respectively associated therewith, means for effecting such movements of said contactors with a snap action, said means comprising a pair of oscillatable levers each having an abutment formed thereon, a coiled spring interposed between each abutment and the contactor respectively associated therewith, and common operating means for said levers, said means comprising a slidable member having a lost-motion driving connection with each of said levers, whereby the latter are moved to corresponding extreme positions thereof sequentially upon movement of said slidable member from each extreme position thereof to the other, said springs cooperating with said levers to yieldably retain said slidable member in an intermediate position of the latter.

3. In an electric snap switch mechanism, in combination, an oscillatable actuating lever, a flat punched plate arranged for reciprocation in a plane at right angles to the plane of oscillation of said lever, said plate having an opening formed therein at the mid-point of the length thereof, the lower end of said lever being engageable with the walls of said opening to provide a driving connection between said parts, said plate also having an opening formed therein adjacent to each end thereof, a pair of levers each having a long arm and a relatively short arm arranged at an angle to each other, said long arms extending downwardly through the respective end openings in said plate and being angled away from each other into engagement with the respective walls of said end openings remote from each other in the mid-position of said plate, said end openings being sufficiently large to provide for lost motion between said plate and one or the other of said long arms respectively upon movement of said plate to one of its extreme positions, each of said long arms when moved to its inner extreme position being adapted to effect engagement of its associated relatively short arm with the respective end edge of said plate, whereby said pair of levers may be moved sequentially and positively from each extreme position thereof to the other upon given extreme movements of said plate, and spring means individual to the respective levers of said pair to accelerate the movements thereof to each extreme position.

4. In an electric snap switch mechanism, in combination, an oscillatable actuating lever, a flat punched plate arranged for reciprocation in a plane at right angles to the plane of oscillation of said lever, said plate having an opening formed therein at the mid-point of the length thereof, the lower end of said lever being engageable with the walls of said opening to provide a driving connection between said parts, said plate also having an opening formed therein adjacent to each end thereof, a pair of levers each having a long arm and a relatively short arm arranged at an angle to each other, said long arms extending downwardly through the respective end openings in said plate and being angled away from each other into engagement with the respective walls of said end openings remote from each other in the mid-position of said plate, said end openings being sufficiently large to provide for lost motion between said plate and one or the other of said long arms upon movement of said plate to one of its extreme positions, each of said long arms when moved to its inner extreme position being adapted to effect engagement of its associated relatively short arm with the respective end edge of said plate, whereby said pair of levers may be moved sequentially and positively from each extreme position thereof to the other upon given extreme movements of said plate, spring means individual to the respective levers of said pair to accelerate the movements thereof to each extreme position, a pair of pivoted contactors, said spring means being also individual to said contactors respectively, and a plurality of sets of resilient stationary contacts into and out of engagement with which said contactors are adapted to move with a snap action.

5. In an electric snap switch mechanism, in combination, a relatively long one-piece molded insulating base having two rectangular groups of recesses formed therein and opening to the upper surface thereof, each of said groups comprising a relatively large substantially rectangular recess and a relatively smaller substantially rectangular recess at each of the four corners of the latter, terminal members located within the respective relatively smaller recesses and having portions thereof arranged substantially flush with the upper surface of said base, certain of said terminal members having resilient stationary contact portions associated therewith and positioned within the respective relatively large recesses, each of said relatively large recesses having a pair of open bearings formed in the opposite side walls thereof, a pair of flat punched sheet metal contactors each pivotally supported by one of said pairs of bearings, means including coiled compression springs individual to the respective contactors to bias the latter for snap movement thereof from each extreme position to the other, said means also including a single actuating element operable to provide for movement of either of said contactors individually from each extreme position thereof to the other or to alternatively provide for movement of said contactors in like directions sequentially, means including a bus member resiliently biased into engagement with two of said terminal members and insulated from other of the same, and means associated with certain of said terminal members to provide for removable attachment of circuit wires.

6. In a snap switch mechanism of the character described, in combination, a relatively long molded insulating base having a pair of substantially rectangular recesses formed therein in endwise alinement with each other and opening to the upper surface of said base, a pair of relatively small substantially rectangular recesses formed in said base adjacent to each of the opposite ends thereof and spaced endwise from the recesses first mentioned, a terminal member located within each of said relatively small recesses, contact portions formed integrally with said terminal members and positioned in pairs at the ends of said first mentioned recesses remote from each other, each of said first mentioned recesses having a pair of open pivotal bearings formed in the side walls thereof, a pair of flat punched sheet

metal contactors of substantially bail-form in pivotal engagement with said pairs of bearings, a molded insulating member superimposed upon said base, a pair of levers supported by said insulating member for limited oscillatory movement with respect thereto, each of said levers comprising a relatively long arm and a relatively short arm arranged at an angle to each other, said long arms extending downwardly into the first mentioned recesses, a coiled compression spring interposed between the lower end of each of said long arms and one of said contactors, a flat punched plate of insulating material interposed between said base and said insulating member and slidable with respect thereto, said plate having an elongated opening formed therein adjacent to each end thereof and through which the long arms of said levers respectively extend, the respective outer end walls of said openings being engageable with said long arms to effect oscillatory movement of said levers selectively, each of said levers when so moved being adapted to effect positioning of its short arm within the plane of movement of the adjacent end portion of said plate, whereby each of said levers may be moved individually and positively from each extreme position thereof to the other upon movement of said plate between an intermediate position thereof and one of its extreme positions, and a pivoted actuating element having a driving connection with said plate.

7. In an electric snap switch mechanism, in combination, a molded insulating base having a plurality of recesses formed therein and opening to the upper surface thereof, a plurality of stationary contacts located within each of said recesses, a plurality of contactors located within the respective recesses and oscillatable into and out of engagement with pairs of said contacts, a molded insulating member superimposed upon said base, a plurality of actuating elements oscillatably supported by said insulating member, a coiled compression spring interposed between each of said actuating elements and the respective contactors, a flat punched plate of insulating material interposed between said base and said insulating member and slidable with respect thereto, said insulating plate having a positive driving connection with each of said actuating elements to effect movements thereof from each extreme position to the other, said plate also having means affording a predetermined degree of lost motion between the same and each of said actuating elements to thereby provide for operation of certain of the latter during inaction of other of the same, a lever pivotally supported by said insulating member and having a portion thereof extending upwardly through the latter, said lever having a reduced lower end portion, said plate having an opening formed therein to accommodate the lower end of said lever whereby the former is operated by the latter, means including wiring terminal and bus members for affording the desired electrical connections for said contacts, a supporting top plate superimposed upon said insulating member, and a plurality of fastening members penetrating said base, said insulating member and said top plate and adapted to rigidly secure the same in assembled relation to each other.

8. In an electric snap switch mechanism, in combination, a molded insulating base having a pair of relatively large substantially rectangular main recesses formed therein and opening to the upper surface thereof, eight relatively small recesses formed in said base and arranged in spaced relation to said main recesses respectively at the four corners of each of the latter, eight terminal members each having a press fit within one of said relatively small recesses, means associated with the pair of terminals at one end of the base to facilitate attachment of a pair of circuit wires thereto, a pair of bus members for electrically connecting in adjacent pairs one set of four longitudinally alined terminal members, the other set of four longitudinally alined terminal members having a bus member electrically connecting the end terminal member of the pair aforementioned with the third terminal member in said set, a bus member electrically connecting the second terminal member in said last mentioned set with the third terminal member in said first mentioned set, means associated with the fourth terminal member in said last mentioned set to facilitate attachment of a circuit wire, a stationary contact associated with each of the terminal members except the end pair of terminal members aforementioned, whereby three transversely alined pairs of contacts are provided, a flat punched sheet metal contactor oscillatable within each of said main recesses and directly supported by the walls thereof, means including a pair of coiled compression springs each individual to one of said contactors to bias the latter for snap movement thereof from each extreme position to the other, means including a single actuating element operable to provide for movement of either of said contactors individually from each extreme position thereof to the other or to alternatively provide for movement of said contactors in like directions sequentially, said actuating element being adapted upon movement thereof to one extreme position to effect like extreme positioning of both of said contactors whereby the circuits controlled thereby are interrupted, said actuating element being also adapted upon movement thereof to its intermediate position to effect movement of one of said contactors to its opposite extreme position whereby one of the controlled circuits is completed, and said actuating element being adapted upon movement thereof to its other extreme position to effect movement of the other of said contactors to its opposite extreme position whereby another of the controlled circuits is completed.

9. In an electric snap switch mechanism, in combination, a molded insulating base having a pair of relatively large substantially rectangular recesses formed therein and opening to the upper surface thereof, eight relatively small recesses formed in said base and arranged in spaced relation to said main recesses respectively at the four corners of each of the latter, eight terminals each inserted into one of said relatively small recesses, metal members attached to the respective terminals at one end of the base and projecting outwardly from the latter to provide for removable attachment of a pair of circuit wires, a pair of resilient metal bus members for electrically connecting in adjacent pairs one set of four longitudinally alined terminal members, the other set of four longitudinally alined terminal members having a resilient metal bus member electrically connecting the end terminal member of the pair aforementioned with the third terminal member in said set, a resilient metal bus member electrically connecting the second terminal member in said last mentioned set with the third terminal member in said first

mentioned set, a metal member attached to the fourth terminal member in said last mentioned set and projecting outwardly from said base to provide for removable attachment of a circuit wire, a stationary contact associated with each of the terminal members except the end pair of terminal members aforementioned, whereby three transversely alined pairs of contacts are provided, a pair of flat punched sheet metal contactors respectively oscillatable within said main recesses and supported by the walls thereof, a pair of coiled compression springs each individual to one of said contactors to bias the latter for snap movement thereof from each extreme position to the other, means including a single operating lever adapted to provide for movement of either of said contactors individually from each extreme position thereof to the other or to alternatively provide for movement of said contactors in like directions sequentially, said lever being adapted upon movement thereof to one extreme position to effect like extreme positioning of both of said contactors whereby the circuits controlled thereby are interrupted, said lever being also adapted upon movement thereof to its intermediate position to effect movement of one of said contactors to its opposite extreme position whereby one of the controlled circuits is completed, and said lever being adapted upon movement thereof to its other extreme position to effect movement of the other of said contactors to its opposite extreme position whereby said first mentioned circuit is interrupted and the other controlled circuit is completed.

10. In an electric snap switch mechanism, in combination, a molded insulating base having a pair of relatively large substantially rectangular main recesses formed therein and opening to the upper surface thereof, eight relatively small recesses formed in said base and arranged in spaced relation to said main recesses respectively at the four corners of each of the latter, eight terminal members each having a press fit within one of said relatively small recesses, means associated with the pair of terminals at one end of the base to facilitate attachment of a pair of circuit wires thereto, a pair of bus members for electrically connecting in adjacent pairs one set of four longitudinally alined terminal members, a bus member electrically connecting the second terminal member in the other set with the third terminal member in said first mentioned set, means associated with the fourth terminal member in the last mentioned set to facilitate attachment of a circuit wire, a resilient stationary contact associated with each of the terminal members, whereby four transversely alined pairs of contacts are provided, a flat punched sheet metal contactor oscillatable within each of said main recesses and directly supported by the walls thereof, means including a pair of coiled springs each individual to one of said contactors to bias the latter for snap movement thereof from each extreme position to the other, means including a single actuating element operable to provide for movement of either of said contactors individually from each extreme position thereof to the other or to alternatively provide for movement of said contactors in like directions sequentially, said actuating element being adapted upon intermediate positioning thereof to effect movement of said contactors to the extreme positions thereof adjacent to each other whereby the circuits controlled thereby are interrupted, said actuating element being adapted upon movement thereof to one extreme position to effect movement of one of said contactors to its opposite extreme position whereby one of the controlled circuits is completed, and said actuating element being adapted upon movement thereof to its other extreme position to effect movement of the other of said contactors to its opposite extreme position whereby another of the controlled circuits is completed.

11. As an article of manufacture, a flat punched sheet metal actuating lever for an electric snap switch of the toggle type, said lever having an end portion formed to provide for pivotal engagement thereof with a suitable support, said lever having a pair of arms extending from said end portion at an acute angle with respect to each other, one of said arms being relatively longer than the other, the free end of said relatively long arm being formed to provide a spring abutment, and the free end of the relatively short arm being formed to provide for driving thereof in one direction by a reciprocating element of suitable form.

12. In an electric snap switch mechanism, in combination, a pair of flat punched sheet metal actuating levers, each of said levers having a pair of integral arms arranged at an acute angle with respect to each other, one arm of each lever being relatively longer than the other, said relatively long arms being respectively formed to provide spring abutments, the relatively short arms being respectively formed to provide for driving thereof in one direction by a reciprocating actuating element, a molded insulating member having a pair of recesses within which the respective levers are oscillatably supported with the long arms thereof adjacent to each other, said recesses each having end walls arranged at an acute angle greater than the angle of said arms to thereby limit the degrees of oscillatory movement of the respective levers, the aforementioned actuating element comprising a flat punched plate of insulating material having a relatively long substantially rectangular opening formed therein adjacent to each end thereof, the end walls of said openings remote from each other being engageable with the long arms of said levers respectively during movement of said plate to opposite extreme positions, the short arms of said levers being engageable by the respective end edges of said plate during reverse movement of said plate to opposite extreme positions, said plate having an opening formed therein between said first mentioned openings, and a manually operable lever pivotally supported by said insulating member, said last mentioned lever having a reduced end portion engageable with the walls of said last mentioned opening in said plate to effect reciprocation of the latter.

13. In a snap switch mechanism of the multiple-circuit controlling type, in combination, a molded insulating base of substantially rectangular contour having a pair of relatively large recesses formed therein in endwise alinement with each other and opening to the upper surface of said base, a pair of relatively smaller recesses formed in said base adjacent to each of the opposite ends thereof and spaced endwise from the respective recesses first mentioned, a wiring terminal member located within each of said relatively smaller recesses, contact portions formed integrally with said wiring terminal members and positioned in pairs at the remote ends respectively of said first mentioned recesses, each of said first mentioned recesses having a pair of open pivotal bearings formed in the opposite side walls thereof, a pair of flat punched sheet metal

contactors of substantially bail-form in pivotal engagement with said pairs of bearings, a molded insulating member superimposed upon said base, a pair of levers supported by said insulating member for limited oscillatory movement with respect thereto, each of said levers comprising a relatively long arm and a relatively short arm arranged at an acute angle with respect to each other, said long arms extending downwardly into the first mentioned recesses, a coiled compression spring interposed between the lower end of each of said long arms and one of said contactors, said insulating member having a relatively shallow rectangular recess formed in the lower face thereof, a flat punched plate of insulating material located within said recess and slidable therein longitudinally of said insulating member, said plate having an elongated opening formed therein adjacent to each end thereof and through which the long arms of said levers respectively extend, the end edges of said plate being respectively and alternately engageable with the short arms of said levers upon movement of said plate toward opposite extreme positions thereof, said plate also having a substantially centrally located opening formed therein, an operating lever pivotally supported by said insulating member, the lower end of said operating lever being engageable with the end walls of said last mentioned opening to effect sliding movement of said insulating plate.

14. In an electric snap switch mechanism, in combination, a molded insulating member having a recess opening to the lower face thereof, a pair of flat punched actuating levers oscillatably supported within said recess in spaced relation to each other, the walls of said recess being formed to limit said levers to movement in a single plane, each of said levers comprising an integral pair of arms arranged at an acute angle relatively to each other, the walls of said recess being formed to limit the degrees of movement of said levers in opposite directions respectively, said recess including alined longitudinal ledges offset inwardly from the lower face of said member, a flat punched plate of insulating material adapted to seat against said ledges in a relation substantially flush with the lower face of said member and slidable with respect thereto, said plate having an elongated substantially rectangular opening formed therein adjacent to each end thereof, said openings being adapted to accommodate one arm of the respective levers and to afford a lost motion driving connection with each of the latter, said plate also having an opening formed therein between said first mentioned openings, an operating lever pivotally supported by said insulating member, said operating lever having a reduced lower end portion engageable with the walls of said last mentioned opening to effect sliding movement of said plate at will, and an insulating plate underlying said insulating member and adapted to retain said first mentioned plate in assembled position.

15. In an electric snap switch, in combination, a molded insulating base having a pair of relatively large substantially rectangular recesses formed therein and opening to the upper surface thereof, said recesses being arranged in end to end relation and the adjacent end walls thereof providing an insulating barrier therebetween, a plurality of stationary contacts located within each of said recesses, a pair of bridging contactors each located within one of said recesses and directly pivotally supported by the walls thereof, said contactors each being movable from one extreme position thereof to the other into and out of bridging engagement with the stationary contacts respectively associated therewith, means for effecting such movements of said contactors with a snap action, said means comprising a pair of flat punched sheet metal levers oscillatably supported in a common plane, said levers each having an abutment formed thereon, a coiled spring interposed between each abutment and the contactor respectively associated therewith, and common operating means for said levers, said last mentioned means comprising a slidably mounted flat punched plate of insulating material, said plate having a lost motion driving connection with each of said levers.

16. In an electric snap switch, in combination, a pair of metal contactors of substantially bail-form the pivot ends of which are supported in fixed parallel planes, stationary contacts associated with said contactors, said contactors each being movable from one extreme position thereof to the other into and out of bridging engagement with the stationary contacts respectively associated therewith, means for effecting such movements of said contactors with a snap action, said means comprising a pair of flat punched sheet metal levers respectively oscillatable about fixed points and each having an abutment formed thereon, a coiled compression spring interposed between each abutment and the contactor respectively associated therewith, and common operating means for said levers, said means comprising a slidable insulating member having a lost-motion driving connection with each of said levers, whereby the latter are moved to corresponding extreme positions thereof sequentially upon movement of said slidable member from each extreme position thereof to the other, said springs cooperating with said levers to positively but yieldably retain said slidable member in an intermediate position of the latter.

17. In an electric snap switch, in combination, a molded insulating base having a pair of relatively large substantially rectangular recesses formed therein and opening to the upper surface thereof, said recesses being arranged in end to end relation and the adjacent end walls thereof providing an insulating barrier therebetween, said base also having a pair of relatively smaller substantially rectangular recesses formed therein at each of the opposite ends thereof, a plurality of one-piece combined contact and wiring terminal members, the contact portions of said members being located within said relatively large recesses and the wiring terminal portions thereof being located within said relatively smaller recesses, each of said wiring terminal portions having a pair of lugs respectively extending in parallel relation from the vertical side edges thereof to provide a channel to the bottom wall of which a circuit wire may be attached, a pair of bridging contactors each located within one of said relatively large recesses and directly pivotally supported by the opposed side walls thereof, said contactors each being movable from one extreme position thereof to the other into and out of bridging engagement with the contact portions respectively associated therewith, means for effecting such movements of said contactors with a snap action either individually with respect to each other or in a predetermined sequence, said means comprising a pair of pivotally supported flat punched sheet metal levers each having an abutment formed thereon, a coiled compression

spring interposed between each abutment and the contactor respectively associated therewith, common operating means for said levers, said operating means being adapted to insure predetermined positioning of either of said levers during individual operation of the other lever by said means, and said springs cooperating with said levers to positively but yieldably retain said operating means in the extreme or intermediate positions thereof respectively.

ALVIN W. KRIEGER.