Jan. 4, 1938. G. J. MEUER 2,104,206

ELECTRIC SNAP SWITCH

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Fig. 1

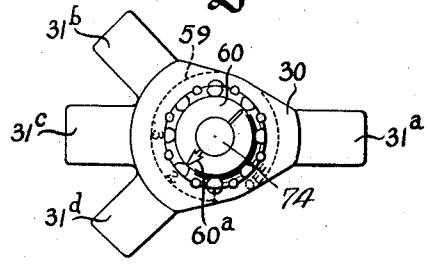


Fig. 2

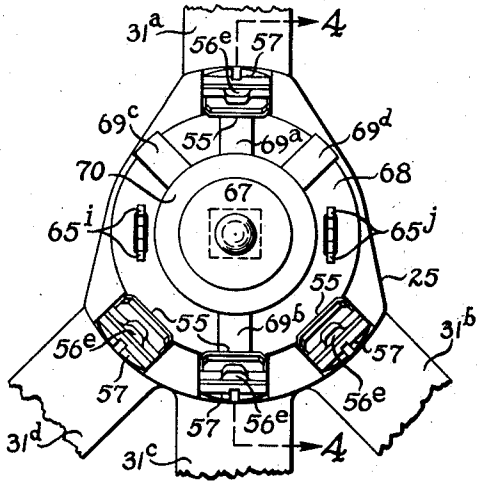


Fig. 3

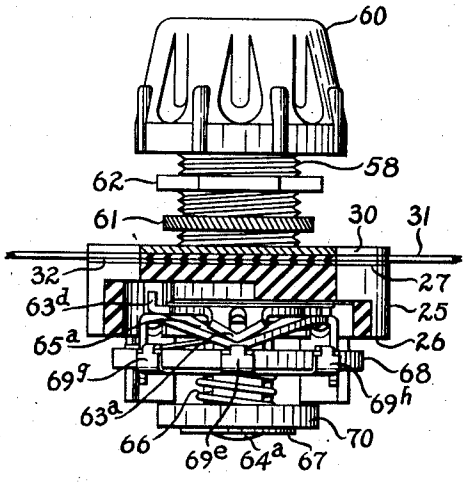


Fig. 4

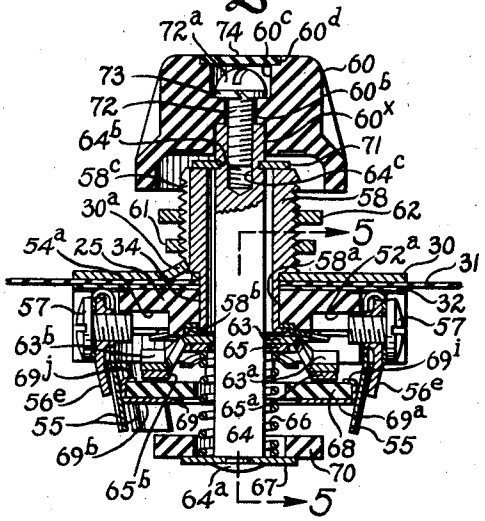


Fig. 5

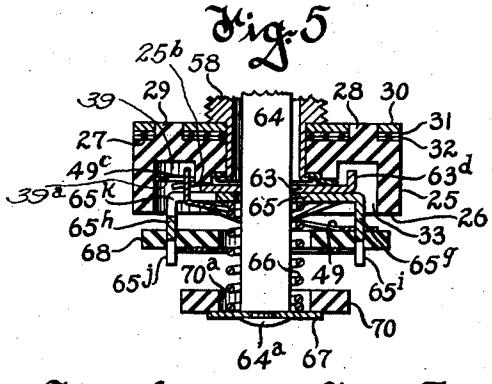


Fig. 6

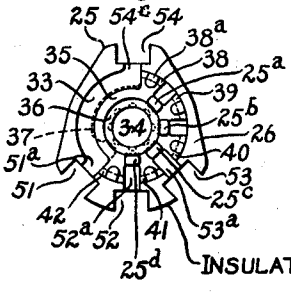
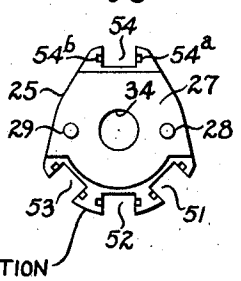


Fig. 7



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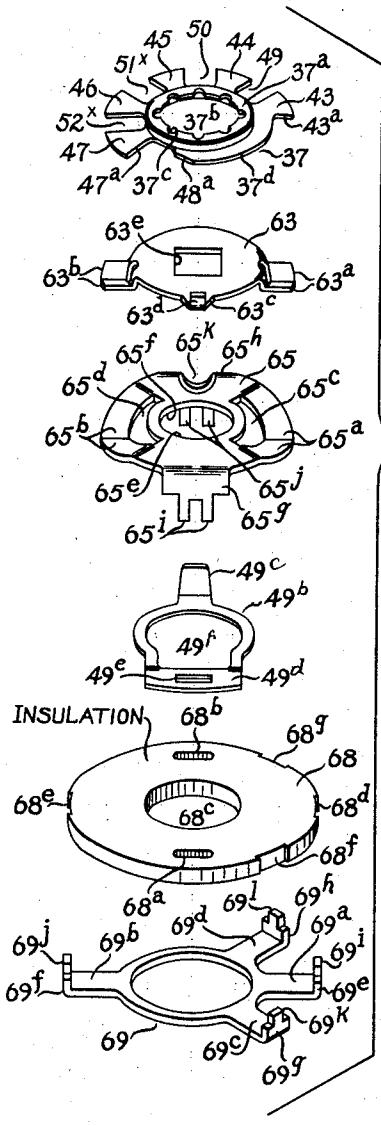


Fig. 8

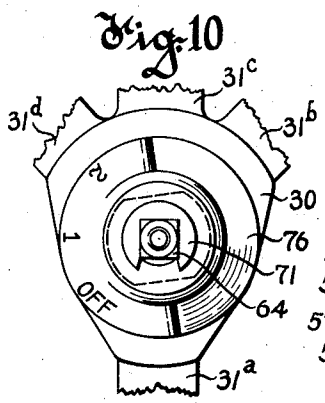


Fig. 10

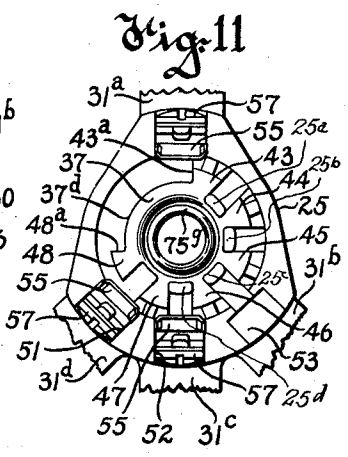


Fig. 11

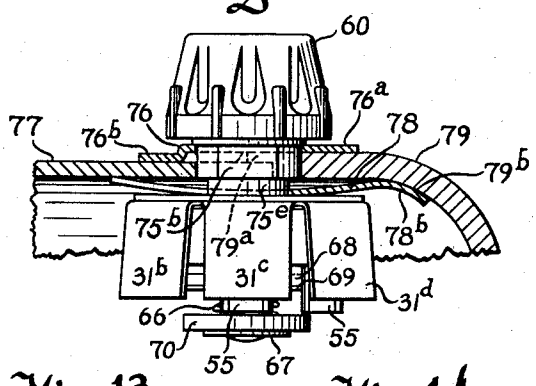


Fig. 12

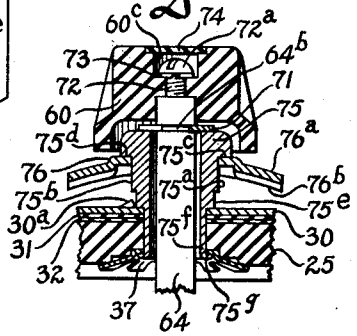


Fig. 13

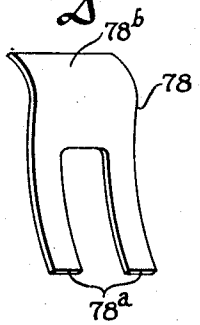


Fig. 14

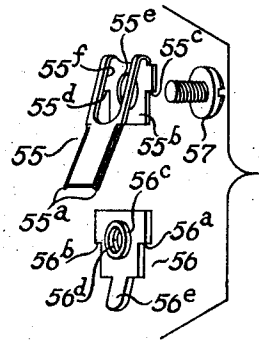


Fig. 9

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Fig. 15

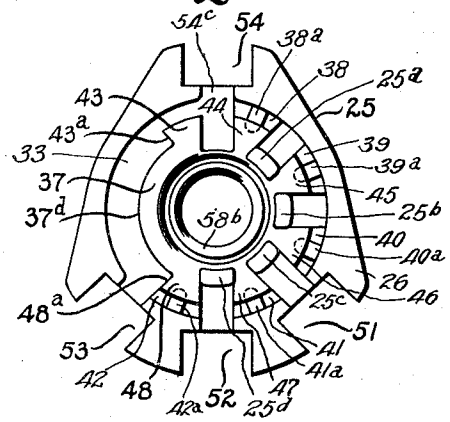


Fig. 16

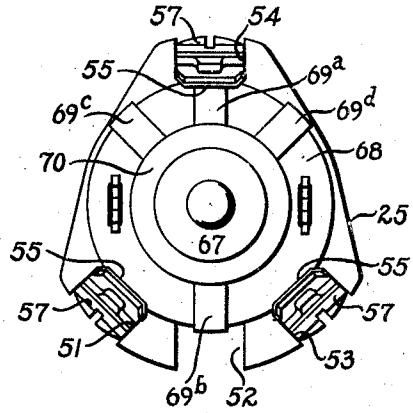


Fig. 17

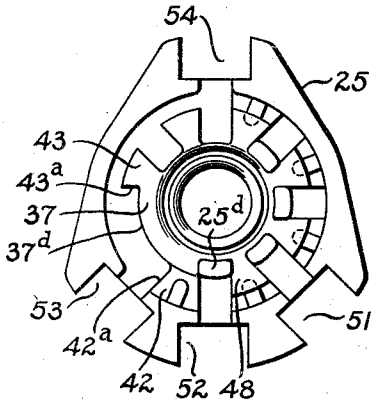


Fig. 18

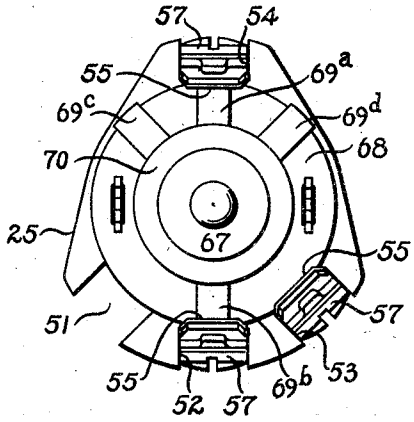
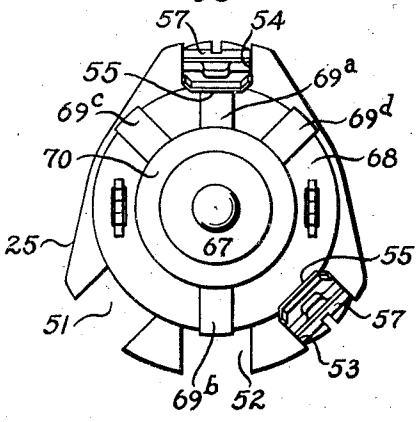


Fig. 19



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Fig. 20

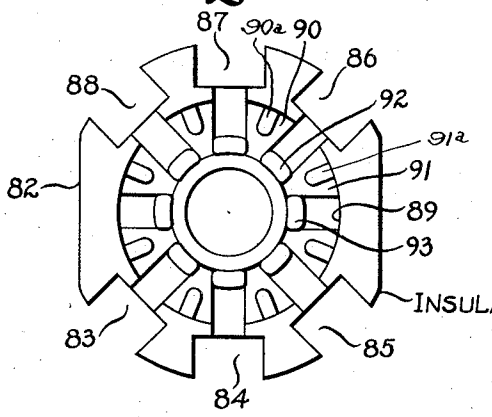


Fig. 21

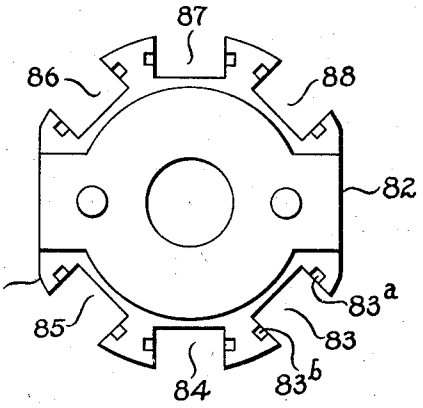


Fig. 22

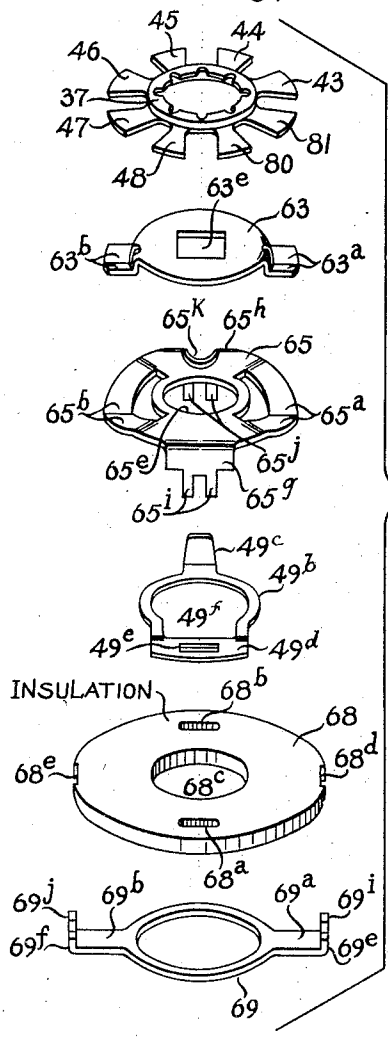


Fig. 23

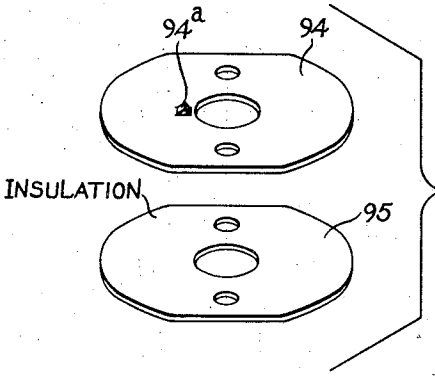
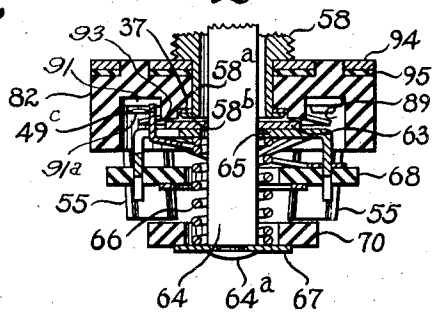


Fig. 24



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Patented Jan. 4, 1938

2,104,206

UNITED STATES PATENT OFFICE

2,104,206

ELECTRIC SNAP SWITCH

George J. Meuer, Milwaukee, Wis., assignor to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

Application December 3, 1935, Serial No. 52,676

20 Claims. (Cl. 200—8)

This invention relates to improvements in electric snap switches, and more particularly to electric snap switches of the rotary type.

A primary object of the invention is to provide a relatively small rotary snap switch of simple, efficient and inexpensive construction.

Another object is to provide a rotary snap switch of the multiple-circuit controlling type which is of small size but of relatively high current carrying capacity.

Another object is to provide for use of a minimum number of different but interchangeable parts to afford a maximum number of switches having different circuit controlling characteristics.

Another object is to provide a switch of the aforementioned character having a novel form of combined stationary contact and terminal members and a novel form of contactor for cooperation therewith.

Another object is to provide an improved and simplified form of snap switch mechanism.

Another object is to provide a switch of the aforementioned character having the parts so designed as to facilitate assembly thereof.

Another object is to provide novel means for supporting and insulating the stationary contact and terminal members of the switch.

Another object is to provide a molded insulating base member adapted for use with all or less than all of a group of switch parts to provide a switch having any one of a number of different circuit controlling characteristics.

Another and more specific object is to provide a novel form of rotary snap switch for multiple speed control of relatively small motors such as those used in food mixing devices and the like.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate a number of different embodiments of my invention which will now be described, it being understood that the embodiments illustrated are susceptible of modification in respect of certain details of construction and arrangement of the parts thereof without departing from the scope of the appended claims.

In the drawings,

Figure 1 is a top plan view (normal size) of a four-position snap switch of the rotary type,—said switch having an off position and three alternative on positions.

Fig. 2 is an enlarged bottom plan view of the switch shown in Fig. 1,—portions of the lugs on the fiber insulating plate being broken away.

Fig. 3 is a side elevational view of the switch, portions thereof, including the insulating base, being cut away for purposes of illustration.

Fig. 4 is a vertical sectional view on the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary vertical sectional view on the line 5—5 of Fig. 4.

Figs. 6 and 7 are, respectively, bottom and top plan views of the molded insulating base of the switch.

Fig. 8 is a perspective view, in separated relation, of certain of the switch parts.

Fig. 9 is a perspective view, in separated relation, of one of the combined contact and terminal units.

Fig. 10 is a top plan view of a three-position rotary snap switch having a modified form of mounting means,—the manually operable knob or handle being omitted for purposes of illustration.

Fig. 11 is a bottom plan view of the switch shown in Fig. 10, certain of the switch parts being omitted.

Fig. 12 is a side elevational view of a switch like that shown in Figs. 10 and 11, and illustrates the manner of mounting the same in concealed relation to a suitable housing or casing.

Fig. 13 is a fragmentary vertical sectional view of the switch shown in Fig. 12 prior to attachment thereof to the housing or support.

Fig. 14 is a perspective view of the spring member shown in Fig. 12 which is employed to clamp the switch to a suitable support.

Fig. 15 is a bottom plan view of the insulating base having a modified arrangement of the ratchet-plate with respect thereto to provide a three-position rotary snap switch, including an intermediate off position.

Fig. 16 is a view similar to Fig. 15, but showing certain of the movable parts of the switch in assembled relation, and showing the desired arrangement of the three combined contact and wiring terminal units.

Fig. 17 is a view similar to Fig. 15 but illustrating a further modified arrangement of the ratchet-plate to provide a rotary snap switch of the two-position, three-point type.

Fig. 18 is a view similar to Fig. 17, but showing certain of the movable parts of the switch in assembled relation, and showing the desired arrangement of the three combined contact and wiring terminal units whereby two alternative on positions are provided.

Fig. 19 is a view similar to Fig. 18, but employing only two combined contact and wiring terminal units arranged as shown to provide a

rotary snap switch having only one on position and one off position,—it being understood that the ratchet plate employed in the switch of Fig. 19 may be identical with that shown in Fig. 17 and arranged in a like manner.

Figs. 20 and 21, are, respectively, bottom and top plan views of a modified form of insulating base to be employed in the production of a switch the bridging contactor of which is rotatable in either direction from any given position thereof,—said switch having three on and two off positions.

Fig. 22 is a perspective view, in separated relation, of certain of the switch parts employed in conjunction with the base of Figs. 20 and 21.

Fig. 23 is a perspective view, in separated relation, of the metal and insulating top plates which may be employed with the base of Figs. 20 and 21, and

Fig. 24 is a fragmentary vertical sectional view of a switch of the character illustrated in Figs. 20 to 23.

Referring first to Figs. 1 to 9, inclusive, the numeral **25** designates a molded insulating base of approximately triangular contour,—the base and apex portions of the triangle, however, being curved about a common center. Base **25**, which is of relatively shallow depth or thickness is provided with a flat lower surface **26** and a substantially flat upper surface **27** parallel thereto,—said upper surface **27**, however, being provided with a pair of substantially cylindrical bosses or projections **28** and **29** (Fig. 7) for interlocking engagement with the walls of openings provided in the metal top plate **30** (Fig. 5) and the relatively thin fiber insulating plates **31** and **32** associated therewith to prevent relative rotary displacement of said parts.

The bottom surface **26** of base **25** is provided with a symmetrically located substantially circular recess **33**, and said base is provided with a cylindrical passage **34** communicating centrally with said recess. The bottom wall of recess **33** is provided with an annular boss or projection **35** surrounding the passage **34**, said boss having an inner offset or shoulder **36** (Fig. 6) to accommodate the correspondingly offset portion **37a** of a punched and stamped sheet metal ratchet-plate **37**. Ratchet-plate **37** is shown in detail in Fig. 8 and the same is arranged within recess **33** in the manner indicated in dotted lines in Fig. 6. Also formed integrally with the bottom wall of recess **33**, and arranged in the plane of said annular boss **35** are five radially enlarged or segment-form bosses **38** to **42**, inclusive, arranged in spaced relation to each other throughcut an arc of approximately 225 degrees. Ratchet-plate **37** (Fig. 8) is provided with five integral radial projections or lugs **43** to **47**, inclusive, which are adapted to overlie the aforementioned bosses **38** to **42**, respectively, for a predetermined portion of the radial length of the latter. Bosses **38** to **42** are respectively provided with slight projections **38a** and **42a** (see Figs. 6 and 15) which underlie the outer ends of lugs **43** to **47** to prevent accidental downward bending or deforming of the latter after assembly of the switch parts. Bosses **38** to **42**, might, of course, be otherwise formed to accomplish the result just mentioned.

Referring to Fig. 11, it will be noted that the ratchet plate **37** is preferably initially provided with a sixth projection or lug **48**. In the switch of Figs. 1 to 9, however, the lug **48** is not required nor desired, and accordingly the same is sheared off or otherwise removed, as indicated at **48a** in Fig. 8. As will be apparent, the ratchet plate **37** of Figs. 1 to 9 is thus provided with a series of four equally spaced radial grooves **49**, **50**, **51x** and **52x** (Fig. 8),—each groove having a pair of parallel side walls for cooperative engagement thereof by a resiliently mounted stop lug **49c** formed integrally with and extending at an angle from the main body portion of a metal member **49b**, hereinafter more fully described.

Base **25** is provided at the large end thereof with a group of three radial notches **51**, **52** and **53** and at the smaller end thereof with a single radial notch **54** (Figs. 6 and 7), said notches, as shown, opening to the upper surface **27** of the base, and the opposite side walls of said notches having vertical grooves the upper ends of which likewise open to said surface **27** and the lower ends of which provide seats for the enlarged or shouldered portions of a corresponding number of combined resilient stationary contact and wiring terminal units which are insertable into said notches from the upper surface **27** of the base. One pair of said grooves is designated at **54a**, **54b** in Fig. 7,—it being understood that the other pairs of grooves are of like form and have similar functions.

The combined resilient contact and wiring terminal units are of like form, and one of the units is shown in detail in Fig. 9. Said unit comprises a reflexed contact element **55** preferably formed of bronze or a similar highly resilient metal or alloy. The lower end portion of element **55** is angled inwardly as shown and the side edge portions thereof are preferably bent or curved rearwardly, as shown at **55a**, to facilitate movement of a contactor into engagement therewith. Element **55** is bent or reflexed to provide the downwardly extending end portion **55b**,—the latter being provided with shoulders **55c**, **55d** adapted to seat within a set of grooves such as indicated at **54a**, **54b**, Fig. 7. Insertable upwardly between the reflexed ends of element **55** is a terminal plate **56** formed of any suitable metal such as brass,—plate **56** having shoulders **56a**, **56b** formed thereon to also seat within grooves, such as **54a**, **54b** when the complete unit is inserted downwardly from the upper surface **27** (Fig. 7) of base **25**. Plate **56** has an opening formed therein by inward extrusion of a flange **56c**, and said opening is tapped as shown at **56d** to receive the shank of a binding screw **57**,—it being noted that contact element **55** is provided with an opening **55e** to provide clearance for the shank of said screw. Moreover, element **55** is provided with a substantially elliptical cut away portion or opening **55f**,—said opening being adapted to facilitate bending of element **55** to the form illustrated, to increase the flexibility thereof, and to provide clearance for the aforementioned shank of the screw **57**.

In practice the combined contact and terminal unit is assembled by threading the shank of screw **57** only a slight distance into opening **56d**, whereupon the unit may be inserted downwardly into one of the notches in base **25** from the upper surface **27** of the latter,—the aforementioned pairs of shoulders **55c**, **55d** and **56a**, **56b** being adapted to seat jointly within the opposed grooves (such as **54a**, **54b**) and against the bottom walls thereof, to provide for positioning of the upper end of the unit in a relation substantially flush with the upper surface **27** of said base. Base **25** (Fig. 6) is formed as indicated at **51a**, **52a**, **53a** and **54c** to accommodate the shanks of the several screws **57**, and when the several units are inserted into their respective

notches in base 25, the screws 57 may be driven in to a greater distance than that aforementioned, whereby the units are temporarily held against separation from the base, as best illustrated in Fig. 4. If desired, of course, the contact and terminal units may be inserted into the base notches prior to attachment of the binding screws.

Upon assembly of the aforementioned units with respect to base 25, the insulating plates 32 and 31 and the metal plate 30 are laid in sequence over the upper surface 27 of the base,—the bosses 28 and 29 being accommodated by the alined openings in said plates, as best illustrated in Fig. 5, whereby the latter are restrained against rotation relatively to the base. Thereupon the reduced lower end 58a of an externally threaded hollow metal bushing 58 is inserted downwardly through alined openings in plates 30, 31 and 32, through the passage 34 in base 25, and through the opening 37b in ratchet-plate 37 (see Fig. 8) and is upset over the offset portion 37a of the latter, as best illustrated at 58b in Fig. 4, whereby the several parts aforedescribed, including the combined contact and terminal units, are rigidly and permanently attached to base 25.

The peripheral wall of the opening 37b in ratchet-plate 37 is preferably notched, as indicated at 37c in Fig. 8, to assist in preventing rotation of bushing 58 with respect thereto after the aforedescribed upsetting operation. Bushing 58 is provided with an exterior vertical groove 58c and the metal top plate 30 has a lug 30a sheared and bent upwardly at a slight angle thereto (see Fig. 4) for interlocking engagement with the side walls of the bushing groove 58c to insure a predetermined fixed position of said groove with respect to said top plate and the base 25 and ratchet plate 37. Any suitable form of indicating plate (such as is shown in dotted lines at 59 in Fig. 1) having an opening to accommodate bushing 58 and a lug to enter the groove 58c may be provided,—said indicating plate being provided with suitable legends corresponding with the off position and the first, second and third on positions of the switch. The operating knob or handle 60 of the switch is provided with an arrow 60a to cooperate with the legends aforementioned to indicate the particular position of the switch mechanism and/or the condition of the electric circuits to be controlled thereby.

It will be noted from Fig. 4 lug 30a is sheared from a point spaced outwardly from the relatively large central opening in plate 30, wherefore said lug extends upwardly only a short distance into the groove 58c, thus minimizing interference of lug 30a with full downward movement of the lower clamping nut 61 associated with bushing 58,—a second or upper clamping nut 62 being likewise preferably provided. If a lug like 30a were sheared from a point coincident with the periphery of the relatively large central opening in top plate 30 it would be necessary to thereafter clip the lug to the length shown to avoid the aforementioned difficulty,—or, as an alternative, it would be necessary to substantially deepen the groove 58c. The arrangement of lug 30a herein shown and described therefore affords a much simpler solution of this particular problem.

The movable parts of the switch mechanism are constructed and arranged in the following manner: An actuating cam plate 63 is adapted to bear against and is rotatable with respect to the ratchet-plate 37, said plate 63 having two sets of double-inclined cam surfaces 63a and 63b arranged as extensions at diametrically opposite points in the periphery thereof. Said pairs of cam surfaces are arranged in downwardly offset relation to the main body of plate 63 and ratchet-plate 37 and the cam surfaces of said pairs converge downwardly from said ratchet-plate. Cam plate 63 is further provided at a peripheral point midway between the pairs of cam surfaces with a lug 63c the outer end portion 63d of which is bent upwardly at substantially a right angle wherefore the same is adapted to clear the peripheral edge portion 37d of ratchet-plate 37 (Fig. 8) but is adapted to engage the edge or shoulder 43a provided by radial lug 43 on plate 37 to limit rotation of plate 63 in one direction and to engage the edge or shoulder 47a provided by radial lug 47 to limit rotation of plate 63 in the reverse direction. Plate 63 is provided with a central opening 63e of non-circular (preferably square) contour to slidably receive the spindle 64 of corresponding form in cross section, to provide for positive driving of plate 63 by said spindle.

A second, or actuated, cam plate 65 is likewise provided at diametrically opposite points in the periphery thereof with sets of downwardly converging double-inclined cam surfaces 65a, 65b, which are normally adapted to seat or nest against the sets of double-cam surfaces 63a, 63b, respectively. The inner edges of said double-inclined cam surfaces 65a, 65b are separated from the main body of plate 65 as by means of arcuate slots or cut-outs 65c, 65d, whereby formation of said cam surfaces is facilitated. Plate 65 is provided centrally thereof with a circular opening 65e of sufficient size to afford rotary clearance between the same and the aforementioned spindle 64, whereas the lower flat surface 65f of plate 65 around said opening 65e is adapted to form an abutment for one end of a coiled compression spring 66 which surrounds said spindle,—the other end of spring 66 being adapted to abut a washer or plate 67 (see Figs. 4 and 5) which is rigidly attached to the lower end of the spindle, as by upsetting or riveting the reduced portion of said end over said washer as indicated at 64a. The opposite end coils of spring 66 are preferably formed to lie in substantially horizontal planes (Figs. 4 and 5), and the spring ends are further flattened by grinding the same in planes at right angles to the length of the spring.

Plate 65 is provided at peripheral points midway between the sets of double-cam surfaces 65a, 65b with arms or extensions 65g, 65h bent downwardly at substantially right angles thereto,—said arms being adapted to abut or seat against the upper surface of a substantially circular insulating disk or plate 68; and said arms having reduced and forked or slotted extensions 65i, 65j adapted to penetrate suitable openings 68a, 68b provided in plate 68. The spaced portions of said extensions are further spread apart edgewise over the lower surface of plate 68 (as best illustrated in Fig. 2), or otherwise bent over said surface to rigidly secure cam plate 65 and insulating plate 68 to each other. During assembly of plates 65 and 68 I interpose between the upper surface of the latter and the arm 65g the flat base portion 49d of the aforementioned resilient metal member 49b, said base portion 49d having a rectangular opening 49e to accommodate the extension 65i of said arm whereby member 49b is clamped in position. The main body portion of member 49b is

bent to extend upwardly at an angle to the base portion 49^d thereof and is provided with an opening 49^f to provide clearance for both the spindle 64 and the spring 66. The vertically extending lug 49^c on member 49^b freely penetrates an opening 65^k provided in cam plate 65 adjacent to the arm 65^h on the latter.

When the cam plate 65 is in normal or nested position with respect to cam plate 63 said lug 49^c of member 49^b will extend upwardly into one or another of the notches 49, 50, 51^x and 52^x, inclusive, provided in ratchet-plate 37, and said lug will engage either wall of the particular notch to prevent rotation of cam plate 65 and the insulating plate 68 attached thereto pending withdrawal of lug 49^c from engagement with the notch wall. The arrangement of the parts is preferably such that upon rotation of spindle 64, and consequently of cam plate 63, through an arc of approximately 45 degrees, the cam plate 65, which is restrained against rotation by cooperative engagement of lug 49^c with the walls of a notch in ratchet plate 37, is forced vertically downward to increase the degree of compression of spring 66 and to simultaneously effect withdrawal of lug 49^c from said notch. When cam plate 65 is thus freed from restraint the spring 66 will force the same to move with a snap action into nesting engagement with cam plate 63, such movement of cam plate 65 obviously comprising rotation thereof through the aforementioned arc of approximately 45 degrees.

During such rotation of cam plate 65 the same also moves vertically upwardly to the normal position thereof as illustrated in Figs. 3, 4 and 5, wherefore the resiliently mounted lug 49^c is positively engaged with the next succeeding notch in ratchet-plate 37. The aforedescribed operation of the switch parts is the same regardless of the direction in which the spindle 64 is rotated,—except, of course, as rotation of the spindle in one direction or the other is limited by engagement of the upstanding lug 63^d on cam plate 63 with one or the other of the stop shoulders 43^a or 47^a on ratchet-plate 37.

The insulating plate 68 is likewise provided with a central opening 68^c to afford clearance for spindle 64 and spring 66, and the same is further provided with a pair of diametrically opposed relatively shallow peripheral notches 68^d, 68^e,—the line between notches 68^d, 68^e being arranged at substantially right angles to a diametric line extending through the aforementioned openings 68^a, 68^b in plate 68. Peripherally spaced from the notch 68^d on opposite sides thereof by arcs or angles of approximately 45 degrees are the notches 68^f and 68^g. The four notches just mentioned are alined with and respectively adapted to accommodate a portion of the thickness of the upwardly bent ends 69^e, 69^f, 69^g, 69^h of the four arms 69^a, 69^b, 69^c and 69^d of a bridging contactor 69. Contactor 69 is adapted to seat flatwise against the lower surface of insulating plate 68,—and the reduced portions 69^i, 69^j, 69^k and 69^l of the aforementioned ends are bent inwardly over the upper surface of plate 68 to rigidly and permanently secure said contactor to said plate (see Fig. 4).

As best illustrated in Fig. 2, the switch parts when assembled provide for cooperation of those portions of the bridging contactor associated with arms 69^a, 69^c and 69^d with the single resilient stationary contact carried at the apex of the substantially triangular insulating base 25,—whereas that portion of the bridging contactor associated with arm 69^b is adapted for cooperation with the set of three resilient stationary contacts carried at the base of the triangle. The position of the bridging contactor 69 in Fig. 2, wherein the contactor portion associated with arm 69^a is engaged with the single stationary contact and the contactor portion associated with arm 69^b is engaged with the middle contact of the aforementioned group of three, may be assumed to provide for second or intermediate speed of a motor controlled by the switch. Upon counter-clockwise movement of the bridging contactor (Fig. 2) through an angle of 45 degrees the contactor portion associated with arm 69^b will be moved into engagement with the right hand contact of the set of three, and the contactor portion associated with arm 69^d will be simultaneously moved into engagement with the aforementioned single contact. This may be assumed to provide for third or high-speed operation of the motor controlled by the switch.

Similarly, upon clockwise movement of the contactor 69 through an angle of 45 degrees from the position thereof illustrated in Fig. 2 the contactor portion associated with arm 69^b will engage the left-hand contact of the group of three and the contactor portion associated with arm 69^c will engage the single contact. This may be assumed to provide for first or slow speed operation of the controlled motor. Another clockwise movement of the contactor 69 through an angle of 45 degrees will effect disengagement of the contactor portion associated with arm 69^b from the left-hand contact of the aforementioned group of three and disengagement of the contactor portion associated with arm 69^c from the aforementioned single contact. This is the off position of the switch. It is true that in the off position of the switch the contactor portion associated with arm 69^d will engage the right-hand contact of the group of three, but no circuit will be completed because all portions of the contactor are then disengaged from the single contact aforementioned.

As best illustrated in Fig. 4 the resilient portions of the four stationary contacts are extended a substantial distance below the lower surface of the insulating base 25. By this arrangement I am enabled to compensate or take care of the axial movement of the bridging contactor 69 as an incident to the aforedescribed cooperative action of the cam plates 63 and 65. Such sliding movement of the contactor with reference to the resilient stationary contacts is advantageous in that it provides for maintenance of the several contacting areas in clean and bright condition; whereas the rotary snap movement of the contactor into and out of engagement with the stationary contacts likewise affords a wiping action therebetween.

Referring to Figs. 2, 4, and 9 it will be noted that I provide the terminal plates 56 with downwardly extending inwardly angled lugs 56^e which overlie the resilient portions 55 of the contacts in the plane of the insulating plate 68 in the normal position of the latter (see Fig. 4). This arrangement provides for limiting inward displacement of the terminal plates due to pressure applied to the terminal screws 57 during wiring of the switch, wherefore excess bending or distortion of the reflexed upper end portions of the resilient contact elements is prevented. A predetermined degree of bias or pressure of the resilient portions 55 of the contacts against the periphery of insulating plate 68 is thus insured.

Also as will be apparent only a very small degree of lateral movement of the resilient portions **55** of the contacts is effected as an incident to engaging and disengaging movement of the bridging contactor. This minimizes vibration of the resilient contact portions during circuit making and/or breaking operations of the switch, wherefore arcing and pitting of the contact surfaces is substantially eliminated and the useful life of the switch parts is greatly increased.

In assembling the spindle **64** with respect to the other switch parts (the knob **60** being removed), the spring **66** is telescoped over the upper end of the spindle, and the lower end of said spring seats against the aforementioned washer **67**. I prefer to likewise telescope over the spindle and the spring an annular insulating ring or washer **70**, the central opening **70**[a] of which is of smaller size than the washer **67**. The purpose of insulating washer **70** is to insure parallel positioning of the plate **68** during movement thereof axially of the spindle, and to assist in properly insulating the current carrying parts of the switch. The spindle **64** is inserted upwardly through the several switch parts until the spring which abuts the washer **67** and the cam plate **65** is compressed to a predetermined degree. A predetermined length of the spindle **64** will then project upwardly beyond the upper end of bushing **58**, and said spindle is provided with a groove **64**[b] (Fig. 4) to receive an open sided washer **71** of known form, said washer being slightly resilient to require a press or snap fit thereof onto the spindle, whereby accidental separation of the washer is prevented. Washer **71** thus serves to restrain the spindle against downward displacement relatively to the bushing **58**, whereby the aforementioned degree of compression of spring **66** is insured.

The knob **60**, which is preferably molded from insulating material of the phenol-formaldehyde condensation type, such as that sold commercially under the trade name of "Bakelite", is provided centrally thereof with a passage the lower end portion **60**[x] of which is of square cross section to accommodate a portion of the upper end of spindle **64** whereby the spindle is constrained to rotate with the knob. Another portion **60**[b] of said passage is of a size only sufficiently large to provide clearance for the shank **72** of a screw which takes into a tapped opening **64**[c] in the upper end of spindle **64**. A third portion **60**[c] of said passage is preferably of circular cross section and of a size to accommodate the head **72**[a] of said screw,—a split lock-washer **73** of known form being interposed between said screw head and the bottom wall of portion **60**[c] to prevent accidental loosening of said screw. Said passage is further provided at its upper end with a countersink **60**[d] into which a disk or plate **74** of celluloid or the like, of a color either like or contrasting with the color of knob **60**, is inserted with a press fit in a relation substantially flush with the upper surface of the knob.

I prefer to make the metal top plate **30** and the insulating plate **32** of the same contour as the base **25**, whereas the insulating plate **31**, which is otherwise of the same contour as said base, is provided with four integral lugs **31**[a], **31**[b], **31**[c] and **31**[d], arranged as best shown in Fig. 1 and initially positioned in the plane of the main body of said plate **31**,—said lugs being bendable downwardly (after wiring of the switch) to assist in properly insulating the wiring terminal screws. In installations where such lugs are not required or desired, they may be readily torn or cut off by hand without disturbing the other parts of the switch unit. Where said lugs are not desired in the switch as initially produced, a plate like **32** may be substituted for the plate **31**; or a single insulating plate twice as thick as the plate **32** may be employed.

While the switch illustrated in Figs. 1 to 9, inclusive, is particularly well adapted for multiple-speed control of a relatively small motor of the character employed in food mixers and the like, various other uses for the switch will at once suggest themselves to those skilled in the art.

In practice (see Fig. 6) I prefer to provide base **25** with a series of four integral bosses **25**[a], **25**[b], **25**[c] and **25**[d] which receive with a fairly snug fit the inner end portions of four of the radial notches provided in ratchet plate **37**. Said bosses assist in restraining the ratchet plate against rotary displacement relatively to base **25**, and the same assist in strengthening the several lugs **43**, **44**, etc., to prevent distortion or bending thereof under the impact of the aforedescribed stop lug **49**[a]. The ends of said bosses are likewise arranged in the plane of the lower surface of ratchet plate **37** to thereby afford a substantially complete circular bearing surface for the cam plate **63** aforedescribed.

Referring now to Figs. 10 to 14, inclusive, wherein I have shown a rotary snap switch the contactor of which is movable from an extreme off position in sequence to two on positions, it will be noted that I am able to employ most of the switch parts aforedescribed, and such like parts have been given corresponding numerals of reference. As heretofore pointed out, however, the radial lug **48** is allowed to remain (see Fig. 11), whereas in the switch of Figs. 1 to 9 lug **48** was removed. Due to the presence of lug **48** the shoulder **48**[a] thereof cooperates with the shoulder **43**[a] on lug **43** to limit the aforementioned lug **63**[d] on cam plate **63** (Fig. 8) to movement through an arc of approximately 135 degrees. Also as shown in Fig. 11 the combined contact and wiring terminal unit is omitted from the radial notch **53** in base **25**. The movable parts of the switch mechanism (including knob **60**, spindle **64**, plate **68**, contactor **69** and the cam plates, not shown) may be identical with the corresponding parts in the switch of Figs. 1 to 9.

Thus assuming assembly of the movable switch parts to the base of Fig. 11 in a manner similar to that illustrated in Fig. 2, it is to be understood that in the off position of the switch the single arm **69**[b] of bridging contactor **69** will be positioned one notch (or 45 degrees) above the left-hand contact of the group of two, and the contact arm **69**[c] of the group of three will be positioned one notch (or 45 degrees) to the right of the single contact. Upon counterclockwise snap movement of the contactor, with reference to Fig. 11, the single arm **69**[b] of the contactor will engage the left-hand contact of the group of two, and the arm **69**[c] of the contactor will simultaneously engage the aforementioned single contact. Upon further counterclockwise snap movement of the contactor the single arm **69**[b] thereof will engage the right-hand contact of the group of two, and the middle arm **69**[a] of the group of three will simultaneously engage the aforementioned single contact. Step-by-step movement of the bridging contactor in the reverse direction with a snap action may be effected

by merely reversing the direction of rotation of the knob **60** and spindle **64**.

The mounting means for the switch of Figs. 10 to 14, preferably comprises a hollow metal bushing **75** the relatively large substantially cylindrical upper end portion of which is provided with a pair of parallel flat sides **75a** and **75b** to accommodate the indicating plate **76** having a correspondingly shaped opening formed therein to prevent relative rotation of said parts, said bushing having horizontal shoulders **75c**, **75d** to prevent upward displacement of plate **76**. Bushing **75** is provided with a portion **75e** of reduced diameter to avoid interference with the lug **30a**, which is a standard part of the metal top plate **30** (Fig. 13), although said lug performs no useful function in the switch of Figs. 10 to 14. The further reduced lower end **75f** of said bushing penetrates the several parts illustrated in Fig. 13 and is upset over the ratchet plate **37**, as indicated at **75g**.

After the switch has been wired and the knob **60** has been attached thereto the same may be assembled by sliding the same laterally into a slot provided in the curved edge of a casing member **77**,—said slot being formed to interlock with the aforementioned flat sides **75a**, **75b** of the bushing to prevent rotation of the latter with respect to said casing section. Thereafter the spring clamping member **78** has its forked end **78a** slid into a position straddling the reduced portion **75e** of the bushing. Thereafter the end portion **79** of the casing is moved into overlapping relationship to the casing part **77**, as shown at **79a** in Fig. 12,—said casing part **79** being likewise notched to accommodate a part of the bushing **75** whereby lateral displacement thereof is prevented. The inwardly curved end portion **79b** of casing section **79** likewise engages the curved end portion **78b** of clamping member **78** to prevent displacement of the latter. Casing sections **77** and **79** are bolted or otherwise rigidly attached to each other in any well known manner.

As shown in Fig. 12 the member **78** is compressed or tensioned to a predetermined degree in the assembled relation of the parts, whereby the switch mechanism is resiliently maintained in proper position. As illustrated in Figs. 12 and 13 the indicating plate **76** has high and low portions **76a** and **76b** to respectively accommodate the different contours of the casing parts **79** and **77**,—said plate **76** being curved in the manner best illustrated in Fig. 13 to conform to the curvature of said casing sections. The mounting means of Figs. 1 to 9 may of course be substituted for that of Figs. 10 to 14, and vice versa, during manufacture of the switches aforedescribed, as will be obvious.

In the switch of Figs. 15 and 16 either of the aforedescribed mounting means may be employed, whereas the switch parts are identical with those described in connection with Figs. 10 to 13, but a slightly different arrangement of certain of said parts is effected. That is to say, the ratchet-plate **37** having lug **48** is employed, but said ratchet-plate is displaced in a counterclockwise direction through a rotary angle of 45 degrees with respect to the arrangement illustrated in Fig. 11. Moreover, as shown in Fig. 16 only three combined contact and terminal units are employed (as in Fig. 11), but one of the group of two units is inserted into radial notch **51** and the other unit is inserted into radial notch **53**,—the middle notch **52** of the group of three being left vacant. With all of the other switch parts arranged as aforedescribed, it will be apparent that in Figs. 15 and 16 I have provided a rotary snap switch having two extreme on positions and an intermediate off position,—the bridging contactor being limited by the means aforedescribed to rotary movement through a total arc or angle of 90 degrees.

In the switch of Figs. 17 and 18 I employ substantially the same parts as in the switch of Figs. 15 and 16. However, in Figs. 17 and 18 the ratchet-plate **37** is displaced in a counterclockwise direction through a rotary angle of 45 degrees with respect to the arrangement illustrated in Figs. 15 and 16, and accordingly the ratchet plate **37** must be further notched or cut away to accommodate the stud or projection **25d**. For this reason the cam plate **63** (Fig. 8) will be limited to movement through a rotary angle of only 45 degrees,—the lug **63d** on cam plate **63** being limited in one direction of rotary movement by engagement thereof with the edge or shoulder **43a** on lug **43** of the ratchet-plate, and said lug **63d** being limited in the other direction of rotary movement by engagement thereof with the shoulder **42a** (Fig. 17) on the aforementioned boss **42**. Therefore in Figs. 17 and 18 the radial notch **51** is left vacant and the group of two combined contact and terminal units are respectively positioned within radial notches **52** and **53** of base **25**. Figs. 17 and 18 therefore illustrate a switch of the three-point type; that is to say, a switch having two alternative on positions with a single wiring terminal common to said on positions,—no off position being provided.

The switch of Fig. 19 is the same as that shown in Figs. 17 and 18, with the exception that only two combined contact and terminal units are employed,—both of the radial notches **51** and **52** in base **25** being left vacant. Thus the switch is shown in off position in Fig. 19, whereas upon snap movement of the contactor in a counterclockwise direction through an angle of approximately 45 degrees the contactor portion associated with the single arm **69b** is engaged with the contact portion **55** of the unit positioned in notch **53**, and the contactor portion associated with arm **69d** is simultaneously engaged with the contact portion of the unit positioned in notch **54**. In Fig. 19 I have thus provided a rotary snap switch of the two-position, or on and off, type. It will be apparent to those skilled in the art that a switch of the character illustrated in Fig. 19 might be provided by employing a contactor comprising only the diametrically opposed arms **69a** and **69b** (with the contactor arms **69c** and **69d** omitted), and with the combined contact and terminal unit transposed from notch **53** to notch **52**. With such an arrangement the peripheral notches in plate **68** which accommodate the bent end portions of the arms **69c** and **69d** would also preferably be omitted.

In the further modified form of switch illustrated in Figs. 20 to 24, inclusive, I am enabled to use many of the parts aforedescribed without any change whatsoever, whereas certain other of the parts aforedescribed may be utilized by slightly modifying the form or construction thereof. Thus the actuated cam plate **65** and the resilient metal member **49** (Fig. 22) are identical with the corresponding parts aforedescribed and perform like functions. The insulating plate **68** is essentially like the plate **68** aforedescribed, except that only the two diametrically opposed peripheral notches **68d** and **68e** are provided. The bridging contactor **69** is

similar to the contactor aforedescribed, except that only the two diametrically opposed arms 69a, 69b and their associated parts are provided for assembly thereof in cooperative relationship to insulating plate 68. The actuating cam plate 63 differs from the corresponding cam plate illustrated in Fig. 8 only in omitting the lug 63c with its bent end portion 63d,—the latter being unnecessary and undesired for the reason that unlimited rotation of the actuating cam plate in either direction is contemplated for the switch of Figs. 20 to 24. The ratchet plate 37 differs from the corresponding part aforedescribed in providing, in addition to the radial lugs or projections 43 to 48, two additional radial lugs 80 and 81,—the radial center lines of all of said lugs being spaced apart through arcs or angles of 45 degrees.

For the switch of Figs. 20 to 24 I provide a special form of molded insulating base 82 (Figs. 20 and 21) which is of symmetrical contour as shown. Base 82 is provided with six radial notches arranged in diametrically opposed groups of three each, and designated by the numerals 83, 84, 85 and 86, 87, 88. Said notches open to the periphery of base 82 and to the upper surface of the latter, and the opposed side walls of each notch are provided with grooves (such as indicated at 83a, 83b) which likewise open to the upper surface of said base. The lower surface of base 82 is provided with a circular recess 89 which is similar to the recess 33 (Fig. 6) except that the radially enlarged or segment-form bosses 90, 91, etc., are equally spaced around the entire bottom wall of recess 89,—a similar complete circular group of projections 92, 93, etc., being provided for reception of and interlocking engagement with the ratchet-plate 37 of Fig. 22. The bosses 90, 91, etc., are provided with projections 90a, 91a, etc., as shown in Figs. 20 and 24. Six combined contact and terminal units of the same character as those aforedescribed are utilized, and the various parts of the switch are assembled in the manner aforedescribed (see Fig. 24). The metal top plate 94 is of a shape corresponding to the contour or periphery of base 82, and a single relatively thick insulating plate 95 is interposed between the top plate 94 and base 82. The externally threaded hollow metal bushing 58 (Fig. 24) may be identical with the part aforedescribed,—the reduced lower end portion 58b thereof being upset over the ratchet-plate 37, as indicated at 58b. Bushing 58 may be provided with a vertical groove (as aforedescribed) to accommodate the lug 94a and to definitely position an indicating plate (not shown) having a lug which is likewise engageable with said groove.

The parts of the switch of Figs. 20 to 24 are preferably so assembled as to provide for positioning of the contactor 69 in either of its off positions (which are spaced apart through an arc of 180 degrees),—care being taken to see that the arrow 60a or similar indicator on knob 60 is cooperatively related to the indicating plate (not shown) to indicate off positioning of the switch mechanism. Between the two off positions on the indicating plate the latter is preferably provided with the legends 1, 2 and 3, to indicate either the first, second and third speeds of the controlled motor (according to the particular scheme of wiring) or to indicate closure of one of three electric circuits to be controlled thereby. It is to be noted in connection with Figs. 20 to 24 that the contactor 69 may be moved in a step-by-step manner with a snap action from any rotary position thereof. This feature is of considerable importance in certain installations or uses of the switch. Another important feature of the switch shown in Figs. 20 to 24 is that a double-break or double-make of the controlled circuit is insured in each instance, thus insuring a relatively high current-controlling capacity of the switch. While I have illustrated a large number of different forms of switches embodying my invention, it is manifest that various other changes will readily suggest themselves to those skilled in the art. Thus by employing a ratchet-plate 37 of sufficiently rigid form and by forming the bosses and projections on the bottom wall of circular recess 89 (Fig. 20) to correspond exactly with the arrangement shown in Fig. 6, it will be apparent that the base 82 might be employed in constructing each and all of the forms of switches herein shown and described. Also it will be understood that any other suitable form of knob or handle may be substituted for the knob 60 shown herein. The various switches shown in Figs. 1 to 19, inclusive, have a standard rating of 5 amperes, 125 volts, or 2 amperes, 250 volts; whereas the switch illustrated in Figs. 20 to 24 has a much higher current-carrying or current-controlling capacity.

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

1. In a rotary snap switch adapted for concealed mounting, in combination, an insulating base, a bushing rigidly attached to said base and projecting from the upper surface thereof, a spindle rotatably supported by said bushing, a bridging contactor rotatable in opposite directions about said spindle, means for effecting rotation of said contactor in either direction with a snap action from a given position thereof, said means comprising a cam plate rotatable with said spindle, a second cam plate rotatable with said contactor, a flat insulating plate to which said contactor and said second cam plate are rigidly attached in insulated relationship to each other, a lug associated with said second cam plate and resiliently biased upwardly toward said base, means comprising a plurality of pairs of shoulders associated with the lower surface of said base, said lug being normally positively engaged with the shoulders of any pair to restrain said contactor and said second cam plate against rotary movement pending release of said lug from said pair of shoulders as an incident to axial movement of said contactor and said second cam plate by said cam plate first mentioned, and a coiled compression spring interposed between the lower end portion of said spindle and said second cam plate, whereby upon release of said lug said second cam plate is biased by said spring to move with a snap action in a direction corresponding to the direction of movement of said cam plate first mentioned, said lug upon release thereof being adapted to positively engage the next succeeding pair of shoulders, whereby said second cam plate is restrained against additional rotary movement in either direction pending a predetermined degree of rotary movement of said cam plate first mentioned.

2. In a rotary snap switch adapted for concealed mounting, in combination, an insulating base, a metal bushing rigidly attached to said base and projecting from the upper surface thereof, a spindle rotatably supported by said bushing, a bridging contactor rotatable in opposite directions about said spindle, means for effecting rota-

tion of said contactor in either direction with a snap action from a given position thereof, said means comprising a cam plate rotatable with said spindle, a second cam plate rotatable with said contactor, a flat punched plate of insulation to which said contactor and said second cam plate are rigidly attached in insulated relationship to each other, a lug associated with said second cam plate and resiliently biased upwardly toward said base, means comprising a plurality of pairs of shoulders associated with the lower surface of said base, said lug being normally positively engaged with any one of said pairs of shoulders to restrain said contactor and said second cam plate against rotary movement pending release of said lug from said pair of shoulders as an incident to axial movement of said contactor and said second cam plate by said cam plate first mentioned, a coiled compression spring interposed between the lower end portion of said spindle and said second cam plate, whereby upon release of said lug said second cam plate is biased by said spring to move with a snap action in a direction corresponding to the direction of movement of said cam plate first mentioned, said lug upon release thereof being adapted to positively engage the next succeeding pair of shoulders, whereby said second cam plate is restrained against additional rotary movement pending a predetermined degree of rotary movement of said cam plate first mentioned, and a plurality of reflexed resilient stationary contacts secured to said base and into and out of engagement with which said contactor is adapted to move, the free end portions of said contacts being extended below said base in planes substantially parallel to the axis of said contactor to accommodate the axial movements of the latter as an incident to circuit commutating operation of the switch.

3. In an electric snap switch, in combination, an insulating base having an opening formed therein, a metal plate rigidly secured to the lower surface of said base and having an opening registering with said base opening, said metal plate having a multiplicity of projections formed integrally therewith and projecting radially therefrom to provide radial notches therebetween, a cam plate having a flat circular portion adapted to seat against said metal plate and rotatable with respect thereto, said cam plate having a pair of downwardly converging double-inclined cams arranged at diametrically opposite ends of said flat portion and offset downwardly from the plane of the latter, a second cam plate having a pair of downwardly converging double-inclined cams adapted for cooperation with the cams aforementioned, a flat plate of insulation to the upper surface of which said second cam plate is rigidly secured, a contactor rigidly secured to the lower surface of said insulating plate and having portions exposed about the periphery of the latter, a metal member also rigidly secured to the upper surface of said insulating plate, said metal member having a lug formed thereon and resiliently biased upwardly into the plane of said metal plate first mentioned when said cam plates are in the normal positions thereof respectively, a spindle penetrating all of said elements and having a driving connection with the cam plate first mentioned, means attached to said spindle adjacent to the upper end thereof to prevent axial displacement thereof in one direction, said spindle having a flange located adjacent to the lower end thereof, a coiled compression spring interposed between said flange and said second cam plate, whereby the latter is biased into engagement with the cam plate first mentioned, said first mentioned cam plate when rotated by said spindle being adapted to effect axial movement of said second cam plate to increase the degree of compression of said spring pending release of said lug from said notched plate, whereupon said second cam plate and the contactor and lug associated therewith are moved with a snap action in the direction of rotation of the spindle to a position wherein said lug engages the next succeeding notch in said metal plate, and a plurality of resilient stationary contacts adapted for cooperation with said contactor, said stationary contacts extending downwardly in the direction of the axis of said spindle to thereby accommodate the axial movement of said contactor as an incident to the axial movement of said second cam plate associated therewith.

4. In an electric snap switch of the rotary type adapted for concealed mounting, in combination, a molded insulating base having a substantially circular recess formed in the lower face thereof, said base having a passage formed therein and opening to said recess substantially centrally of the latter, said recess having a raised portion formed in the bottom wall thereof and surrounding said passage, a metal plate having an opening registering with said passage and adapted to seat against said raised portion, means including a shouldered bushing the lower end of which is upset to secure said plate rigidly and non-rotatably to said base, said metal plate having a plurality of radial notches formed therein, a cam plate having a flat circular portion adapted to seat against said metal plate and rotatable with respect thereto, a second cam plate superimposed upon said first cam plate and adapted for cooperation therewith, said cam plates each having two pairs of downwardly converging double-inclined cam surfaces adapted to nest within each other in the normal positions thereof, an insulating plate of circular contour in fixed spaced relation to the upper surface of which said second cam plate is rigidly secured, a resilient metal member also rigidly secured to the upper surface of said insulating plate, said member having an integral lug penetrating said second cam plate and adapted for positive engagement with the walls of one of the notches in said first mentioned plate when said cam plates are in nested position, spring means for biasing said second cam plate into engagement with said first cam plate, means for effecting rotation of said first cam plate in either direction from a given position thereof, said first cam plate acting to move said second cam plate and said lug whereby the latter is released for rotary movement thereof into engagement with the walls of the next succeeding notch in said first mentioned plate, said spring cooperating with said cam surfaces to effect such movement of said parts with a snap action, a bridging contactor rigidly attached to the lower surface of said insulating plate, and having portions thereof exposed at spaced points about the periphery of said plate, a plurality of resilient stationary contacts located exteriorly of said recess and into and out of engagement with which said contactor is adapted to move, and cooperating means on said metal plate and said first mentioned cam plate to limit the total range of angular movement of the latter.

5. In an electric snap switch of the rotary type, in combination, a molded insulating base having

a substantially circular recess formed in the lower face thereof, said base having a passage formed therein and opening to said recess substantially centrally of the latter, said recess having a raised portion formed in the bottom wall thereof and surrounding said passage, a metal plate having an opening registering with said passage and adapted to seat against said raised portion, means to secure said plate rigidly and non-rotatably to said base, said means comprising a bushing having a reduced portion penetrating said passage and the opening in said plate and upset over the latter, said plate having a plurality of radial notches formed therein, a cam plate having a flat circular portion adapted to seat against said metal plate and being rotatable with respect thereto, a second cam plate superimposed upon said first cam plate and adapted for cooperation therewith, said cam plates each having two pairs of downwardly converging double-inclined cam surfaces adapted to nest within each other in the normal positions thereof, an insulating plate of circular contour in fixed spaced relation to the upper surface of which said second cam plate is rigidly secured, a resilient metal member also rigidly secured to the upper surface of said insulating plate, said member having an integral lug penetrating said second cam plate and adapted for positive engagement with the walls of one of the notches in said first mentioned plate when said cam plates are in nested position, spring means for biasing said second cam plate into engagement with said first cam plate, means for effecting rotation of said first cam plate in either direction from a given position thereof, said first cam plate acting to move said second cam plate and said lug whereby the latter is released for rotary movement thereof into engagement with the walls of the next succeeding notch in said first mentioned plate, said spring cooperating with said cam surfaces to effect such movement of said parts with a snap action, a bridging contactor rigidly attached to the lower surface of said insulating plate and having portions thereof exposed at spaced points about the periphery of said plate, and a plurality of reflexed resilient stationary contacts into and out of engagement with which said contactor is adapted to move, the free ends of said resilient stationary contacts extending downwardly a substantial distance below the recessed face of said base to accommodate the downward movement of said contactor as an incident to the operation of said cam surfaces.

6. In a snap switch of the rotary type, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage formed therein and opening to said recess substantially centrally of the latter, said base having a plurality of peripheral notches formed therein and arranged substantially radially with respect to said passage, the opposed side walls of said notches having grooves formed therein and opening to the upper surface of said base, a plurality of combined resilient contact and wiring terminal members insertable into said notches from the last mentioned surface of said base, the wiring terminal portions of said members being adapted to seat downwardly into said grooves from the upper surface of said base to restrain said members against lateral displacement and endwise movement thereof in a downward direction, wiring terminal screws associated with the respective terminal portions, said base being formed to accommodate the shanks of said screws and having shoulders engaged by the latter to positively restrain said parts against upward displacement with respect to said base, the resilient contact portions of said members extending downwardly beyond the lower surface of said base in planes at substantially right angles to said lower surface, and said notches being formed to accommodate said resilient contact portions when flexed to a predetermined degree as an incident to engagement therewith and disengagement therefrom of a rotatable bridging contactor of suitable form.

7. In a snap switch of the rotary type, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage formed therein and opening to said recess substantially centrally of the latter, said base having a plurality of peripheral notches formed therein and arranged substantially radially with respect to said passage, the opposed side walls of said notches having grooves formed therein and opening to the upper surface of said base, a plurality of combined resilient contact and wiring terminal members insertable into said notches from the last mentioned surface of said base, the wiring terminal portions of said members being adapted to seat downwardly into said grooves from the upper surface of said base to restrain said members against lateral displacement and endwise movement thereof in a downward direction, wiring terminal screws associated with the respective terminal portions, said base being formed to accommodate the shanks of said screws and the heads of the latter being accessible from the exterior of said base, the resilient contact portions of said members extending downwardly beyond the lower surface of said base in planes at substantially right angles to said lower surface, said notches being formed to accommodate said resilient contact portions when flexed as an incident to movement of a rotatable bridging contactor of suitable form into and out of engagement therewith, and an insulating member rigidly secured to the upper surface of said base and adapted to overlie the exposed ends of said terminal portions, whereby said combined contact and wiring terminal members are restrained against endwise displacement in an upward direction.

8. In a snap switch of the rotary type, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage formed therein and opening to said recess substantially centrally of the latter, said base having a plurality of peripheral notches formed therein and arranged substantially radially with respect to said passage, the opposed side walls of said notches having grooves formed therein and opening to the upper surface of said base, a plurality of combined resilient contact and wiring terminal members insertable into said notches from the last mentioned surface of said base, the wiring terminal portions of said members being adapted to seat downwardly into said grooves from the upper surface of said base to restrain said portions against lateral displacement and endwise movement thereof in one direction, wiring terminal screws associated with the respective terminal portions, said base being formed to accommodate the shanks of said screws and the heads of the latter being accessible from the exterior of said base, the resilient contact

portions of said members extending downwardly beyond said lower surface of said base in planes at substantially right angles to said surface, said notches being formed to accommodate said resilient contact portions when flexed as an incident to movement of a rotatable bridging contactor of suitable form into and out of engagement therewith, an insulating member rigidly secured to the upper surface of said base and adapted to overlie the exposed ends of said terminal portions, whereby said combined contact and wiring terminal members are restrained against upward displacement, said insulating member comprising a fiber plate, said plate having a number of integral lugs corresponding to the number of combined contact and wiring terminal members, and said lugs being bent downwardly over the heads of said wiring terminal screws to assist in properly insulating the latter.

9. In a rotary snap switch adapted for concealed mounting, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage extending therethrough and communicating with said recess substantially centrally of the latter, a metal member located within said recess and having an opening registering with said passage, said metal member having a plurality of peripheral notches formed therein, said base having a plurality of recesses formed therein and opening to the periphery thereof, a corresponding number of combined resilient contact and wiring terminal members freely insertable into said last mentioned recesses from the upper surface of said base to a position substantially flush with the latter, an insulating plate overlying the last mentioned surface of said base and said combined contact and terminal members, a metal plate overlying said insulating plate, a hollow metal bushing the reduced end portion of which is adapted to penetrate said plates, said base and said metal member and is upset over the latter to secure all of said parts in assembled relation, wiring terminal screws located within the respective peripheral recesses in said base and accessible from the exterior of the latter, the resilient contact portions of said members extending a substantial distance below the lower surface of said base, a metal cam plate adapted to rotatably seat against said metal member, a second metal cam plate adapted for cooperation with said cam plate first mentioned, a substantially circular insulating plate rigidly secured to said second cam plate in downwardly spaced relation to the lower surface of said base, said circular plate having a plurality of relatively shallow peripheral notches formed therein, a contactor carried by said circular plate and having bent end portions thereof seated within said notches last mentioned, the aforementioned resilient contact portions being normally biased toward said circular plate in all positions of the latter, whereby the bent end portions of said contactor may be moved by said circular plate into and out of engagement with said resilient contact portions, a resilient metal member also carried by said circular plate, said last mentioned member having a lug penetrating said second cam plate to normally engage one or another of the notches in said first mentioned metal member, a spindle adapted to bear within said bushing, said spindle having driving engagement with the cam plate first mentioned, a coiled compression spring interposed between the lower end of said spindle and the second cam plate, whereby upon rotation of said cam plate first mentioned said second cam plate and said lug are moved axially of said spindle against the bias of said spring, said lug when released from said metal member first mentioned being adapted to permit snap movement of said second cam plate into nesting engagement with the cam plate first mentioned, with corresponding movement of said circular plate and the contactor carried thereby, and said lug upon such movement thereof being adapted to positively engage the walls of the next succeeding notch in said first mentioned metal member.

10. In an electric snap switch of the rotary type adapted for concealed mounting, in combination, an insulating base having an opening formed therein, a metal member having an opening registering with said base opening, a hollow metal bushing having a reduced end penetrating said openings from the upper surface of said base and upset over said metal member to rigidly secure said parts in assembled relation, said metal member having a plurality of spaced slots formed therein and extending inwardly from the periphery thereof, a cam plate adapted to seat against said metal member and rotatable with respect thereto, said cam plate having a lug formed integrally therewith and adapted to move about a peripheral edge of said metal member, said peripheral edge having spaced shoulders formed thereon to positively limit movement of said cam plate in opposite directions respectively, a second cam plate normally adapted for nesting engagement with the cam plate first mentioned, a contactor associated with said second cam plate and movable therewith, a resilient metal element also associated with said second cam plate and having a lug penetrating the latter and adapted to positively engage the walls of one of the slots in said metal member in the nested position of said cam plates, a spindle adapted to bear within said bushing, said spindle having clearance from said second cam plate and having a driving connection with said cam plate first mentioned, a coiled compression spring interposed between the lower end portion of said spindle and said second cam plate to bias the latter toward said cam plate first mentioned, the latter being adapted upon a given degree of rotation of said spindle to raise said second cam plate and the lug associated therewith for release thereof, said lug when released being adapted to permit snap movement of said second cam plate and its associated contactor under the bias of said spring into nesting engagement with the cam plate first mentioned, whereupon said lug will positively engage the walls of the next succeeding slot in said metal member, and a plurality of resilient stationary contacts carried by said base and into and out of engagement with which said contactor is adapted to move, said contacts being sufficiently long to accommodate the axial movement of said contactor below the lower surface of said base as an incident to the aforementioned raising of the cam plate associated therewith.

11. In a snap switch adapted for rotation in opposite directions, in combination, a relatively thin flat insulating member of substantially circular contour, said member having a substantially centrally located opening to provide sliding and rotating clearance for an actuating element of suitable form, said member having a plurality of relatively shallow substantially rectangular notches formed in the periphery thereof, a one-

piece sheet metal member extending over one face of said insulating member and having a relatively larger opening concentric with the aforementioned opening in the latter, said sheet metal member having a plurality of arms the radially extending end portions of which are bent at substantially right angles to the main body thereof, said end portions being adapted to seat within and having portions of the thickness thereof accommodated by the respective notches whereby a plurality of peripherally spaced contactor surfaces are provided, said metal member having lugs formed integrally with said bent end portions, and said lugs being bent into engagement with the other face of said insulating member whereby the latter and said metal member are rigidly and non-rotatably attached to each other.

12. In a rotary snap switch, in combination, a flat punched plate of insulating material of substantially circular contour, said plate having a substantially centrally located opening to provide sliding and rotating clearance for an actuating spindle of suitable form, said plate having a plurality of relatively shallow substantially rectangular notches formed in the periphery thereof, a bridging contactor comprising a one-piece sheet metal member extending across the lower face of said plate and having a relatively larger opening concentric with the aforementioned opening in said plate, said sheet metal member having a plurality of arms the radially extending end portions of which are bent at substantially right angles to the main body thereof, said end portions being adapted to seat within and having portions of the thickness thereof accommodated by the respective notches whereby a plurality of peripherally spaced contactor surfaces are provided, said metal member having lugs formed integrally with said bent end portions, said lugs being bent into engagement with the upper face of said plate whereby the latter and said contactor are rigidly and non-rotatably secured to each other, said plate having a pair of diametrically alined openings formed therein on opposite sides of said central opening, a punched sheet metal cam member arranged upon the upper face of said plate, said cam member having a pair of arms bent at substantially right angles thereto, said arms having reduced end portions which are insertable through said pair of openings in said plate and bent over the lower face of the latter to rigidly secure said parts in assembled relation, said cam member having an opening of smaller size than said central plate opening to provide an abutment for a coiled compression spring, said cam member having a pair of diametrically opposed segmental slots formed therein, and the opposed peripheral portions of said cam member defined by said slots being bent to provide two pairs of inclined cam surfaces which converge toward said upper face of the plate.

13. In a rotary snap switch, in combination, a relatively thin flat punched plate of insulating material of substantially circular contour, said plate having a substantially centrally located opening to provide sliding and rotating clearance for an actuating spindle of suitable form, said plate having a plurality of relatively shallow notches formed in the periphery thereof, a bridging contactor comprising a one-piece sheet metal member extending across the lower face of said plate and having a relatively larger opening concentric with the aforementioned opening in said plate, said sheet metal member having a plurality of arms the end portions of which are bent at substantially right angles to the main body thereof, said end portions being adapted to seat within and having portions of the thickness thereof accommodated by the respective notches whereby a plurality of peripherally spaced contactor surfaces are provided, said metal member having lugs formed integrally with said bent end portions, said lugs being bent into engagement with the upper face of said plate whereby the latter and said contactor are rigidly and non-rotatably secured to each other, said plate having a pair of diametrically alined openings formed therein on opposite sides of said central opening, a punched sheet metal cam member arranged upon the upper face of said plate, said cam member having a pair of arms bent at substantially right angles thereto, said arms having reduced end portions which are insertable through said pair of openings in said plate and bent over the lower face of the latter to rigidly secure said parts in assembled relation, said cam member having an opening of smaller size than said central plate opening to provide an abutment for a coiled compression spring, said cam member having a pair of diametrically opposed segmental slots formed therein, the opposed peripheral portions of said cam member defined by said slots being bent to provide two pairs of inclined cam surfaces which converge toward said upper face of the plate, said cam member having an additional opening formed therein adjacent to one of said arms, a resilient metal member interposed between said plate and said cam member and having at one end an integral angular lug extending outwardly through the last mentioned opening in said cam member, the other end of said metal member being formed to provide for clamping thereof between the upper face of said plate and the other arm of said cam member, and said metal member having formed therein an opening at least as large as and alined with the central opening in said plate.

14. In a snap switch adapted for attachment to a panel or similar support, in combination, a molded insulating base recessed from the lower surface thereof to accommodate the switch mechanism, said base being also formed to provide a plurality of recesses opening to the upper surface thereof, said last mentioned recesses having portions thereof opening to the periphery of said base, a plurality of combined contact and wiring terminal members freely insertable into said last mentioned recesses from said upper surface to a position substantially flush with the latter, a metal top plate secured to said upper surface of said base and adapted to overlie the upper ends of said combined contact and wiring terminal members, a relatively thin plate of insulating material interposed between said top plate and the upper surface of said base, said insulating plate having a plurality of lugs formed integrally therewith, terminal screws associated with said combined contact and wiring terminal members and accessible through the peripheral openings in said last mentioned base recesses, and said integral insulating lugs being bent downwardly over said terminal screws to assist in properly insulating the same.

15. In a snap switch adapted for attachment to a panel or similar support, in combination, a molded insulating base recessed from the lower surface thereof to accommodate the switch mechanism, said base being also formed to provide a plurality of recesses opening to the upper surface thereof, said last mentioned recesses having por-

tions thereof opening to the periphery of said base, a plurality of combined contact and wiring terminal members freely insertable into said last mentioned recesses from said upper surface to a position substantially flush with the latter, a metal top plate secured to said upper surface of said base and adapted to overlie the upper ends of said combined contact and wiring terminal members, a relatively thin plate of insulating material interposed between said top plate and the upper surface of said base, said insulating plate having a plurality of lugs formed integrally therewith, terminal screws associated with said combined contact and wiring terminal members and accessible through the peripheral openings in said last mentioned base recesses, said integral insulating lugs being bent downwardly over said terminal screws to assist in properly insulating the same, and said integral insulating lugs being readily removable from said insulating plate by hand after complete assembly of the switch parts.

16. In a snap switch of the rotary type, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage formed therein and opening to said recess substantially centrally of the latter, said base having a plurality of peripheral notches formed therein and arranged substantially radially with respect to said passage, the opposed side walls of said notches having grooves formed therein and extending downwardly a predetermined distance from the upper surface of said base, a plurality of resilient contact members reflexed at the upper ends thereof respectively, terminal members loosely positioned within the respective reflexed portions of said contact members, terminal screws having threaded engagement with said terminal members, said contact and terminal members and screws when partially assembled being insertable as units downwardly from the upper surface of said base and seating within said grooved peripheral notches in a relation substantially flush with said upper surface, the free end portions of said contact members extending downwardly beyond the lower surface of said base and the same being bent to normally extend inwardly beyond the peripheral wall of said first mentioned recess, said terminal screws being located within said notches whereby the same are accessible from the exterior of said base, a metal supporting plate overlying the upper surface of said base and the contact and terminal members associated with the latter, a fiber insulating plate interposed between said metal plate and said upper surface of the base, said plate having a plurality of lugs formed integrally therewith and initially extending outwardly in the plane thereof, and said lugs being bent downwardly over said terminal screws to assist in insulating the latter after attachment of wires thereto.

17. In a rotary snap switch, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage extending therethrough and communicating with said recess substantially centrally of the latter, said base having a group of three peripheral notches formed therein at one side thereof, the radial center lines of said notches being spaced apart at angles of approximately forty-five degrees, said base having a fourth peripheral notch diametrically opposed to the middle notch of the group aforementioned, four sets of combined contact and terminal members insertable within the respective notches from the upper surface of said base to a position substantially flush with said upper surface, an insulating plate overlying said upper surface of the base to retain said combined contact and terminal members in assembled relation, the contact portions of said members being resilient and the same extending downwardly a substantial distance beyond the lower surface of said base and the free ends thereof being normally biased inwardly beyond the periphery of said circular recess, a contactor-carrier comprising a relatively thin flat insulating plate of substantially circular contour arranged in a plane substantially parallel to the lower surface of said base, the circumference of said plate being greater than the circumference of said recess and said plate being interposed between the resilient contact portions aforementioned to definitely tension the latter, a contactor carried by said plate, said contactor comprising a sheet metal member having a group of three arms the radial centers of which are spaced substantially forty-five degrees apart and a fourth arm diametrically opposed to the middle arm of the group aforementioned, each of said arms having an outer end portion bent at substantially a right angle with respect thereto to provide a contactor surface, said plate having peripheral notches to accommodate a part of the thickness of said bent end portions, said metal member having means associated therewith to provide for rigid and permanent attachment thereof to said plate, said contactor having an off position wherein said single contactor surface is disengaged from all of the group of three resilient contact portions and all of said group of three contactor surfaces are disengaged from said single resilient contact portion, said contactor also having three on positions wherein said single contactor surface may be engaged in sequence with said group of three resilient contact portions while said group of three contactor surfaces are simultaneously engaged in sequence with said single resilient contact portion, and associated means for insuring movement of said contactor from each position thereof to another with a snap action.

18. In a rotary snap switch, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage extending therethrough and communicating with said recess substantially centrally of the latter, said base having a group of three peripheral notches formed therein at one side thereof, the radial center lines of said notches being spaced apart at angles of approximately forty-five degrees, said base having a fourth peripheral notch diametrically opposed to the middle notch of the group aforementioned, four sets of combined contact and terminal members insertable within the respective notches from the upper surface of said base to a position substantially flush with said upper surface, an insulating plate overlying said upper surface of the base to retain said combined contact and terminal members in assembled relation, the contact portions of said members being resilient and the same extending downwardly a substantial distance beyond the lower surface of said base and the free ends thereof being normally biased inwardly beyond the periphery of said circular recess, a contactor-carrier comprising a relatively thin flat insulating plate of substantially circular contour arranged in a plane substantially parallel to the

lower surface of said base, the circumference of said plate being greater than the circumference of said recess and said plate being interposed between the resilient contact portions aforementioned to definitely tension the latter, a contactor carried by said plate, said contactor comprising a sheet metal member having a group of three arms the radial centers of which are spaced substantially forty-five degrees apart and a fourth arm diametrically opposed to the middle arm of the group aforementioned, each of said arms having an outer end portion bent at substantially a right angle with respect thereto to provide a contactor surface, said plate having peripheral notches to accommodate a part of the thickness of said bent end portions, said metal member having means associated therewith to provide for rigid and permanent attachment thereof to said plate, said contactor having an off position wherein said single contactor surface is disengaged from all of the group of three resilient contact portions and all of said group of three contactor surfaces are disengaged from said single resilient contact portion, said contactor also having three on positions wherein said single contactor surface may be engaged in sequence with said group of three resilient contact portions while said group of three contactor surfaces are simultaneously engaged in sequence with said single resilient contact portion, and associated means for insuring movement of said contactor from each position thereof to another with a snap action, said last mentioned means including means for limiting said contactor to movement through a total arc of substantially one hundred and thirty-five degrees.

19. In a rotary snap switch, in combination, a molded insulating base having a substantially circular recess formed therein and opening to the lower surface thereof, said base having a passage extending therethrough and communicating with said recess substantially centrally of the latter, said base having a group of three peripheral notches formed therein at one side thereof, said base having a second group of three peripheral notches formed therein at the opposite side thereof, the radial center lines of the notches of each group being spaced apart at angles of approximately forty-five degrees and the radial center lines of the adjacent end notches of the respective groups being spaced apart at angles of approximately ninety degrees, six sets of combined contact and terminal members insertable within the respective notches from the upper surface of said base to a position substantially flush with said upper surface, an insulating plate overlying said upper surface of the base to retain said combined contact and terminal members in assembled relation, the contact portions of said members being resilient and the same extending downwardly a substantial distance beyond the lower surface of said base and the free ends thereof being normally biased radially inwardly toward the passage aforementioned, a contactor-carrier comprising a flat punched plate of insulating material of substantially circular contour arranged in parallel spaced relation to the lower surface of said base, said plate being of larger diameter than said recess and the same being arranged between the aforementioned groups of resilient contact portions to definitely tension the latter, said plate having a pair of diametrically opposed relatively shallow peripheral notches formed therein, a contactor rigidly and non-rotatably attached to said plate, said contactor comprising a sheet metal member having a pair of diametrically opposed arms the respective outer ends of which are bent at substantially right angles thereto to seat within and having a part of the thickness thereof accommodated by said notches in the plate, said contactor having two off positions spaced apart by an angle of approximately one hundred and eighty degrees, said contactor also having three on positions between said off positions, the same being movable in either direction from any one of said on or off positions, said contactor in each instance affording a double-make or double-break in the circuit or circuits controlled thereby, and associated means for insuring step-by-step snap movement of said contactor in either direction from any given position thereof.

20. In a rotary snap switch, the combination with an insulating base having a substantially central opening formed therein, of a plurality of stationary contacts carried by said base and extending below the lower surface of the latter, a spindle mounted for rotary movement within said base opening, a contactor rotatably mounted on said spindle and adapted for movement into and out of bridging engagement with said stationary contacts, a metal plate rigidly attached to the lower surface of said base and having an opening alined with said base opening, said metal plate having a multiplicity of radial notches formed therein, a cam plate adapted to seat against said metal plate and rotatable with respect thereto, said cam plate being interlocked with said spindle for rotation thereby, a second cam plate associated with said contactor and adapted to cooperate with said cam plate first mentioned, a member associated with said second mentioned cam plate and having a lug resiliently biased into the plane of said notched plate when said cam plates are positioned in the normal planes thereof respectively, a coiled compression spring interposed between the lower end of said spindle and said contactor, whereby said cam plates are biased into engagement with each other, said spindle being adapted upon rotation thereof in either direction to effect corresponding rotation of said first mentioned cam plate to effect axial movement of said second mentioned cam plate and the lug associated therewith, whereby said lug is released for snap movement thereof by said cam plates in the direction of rotation of said spindle to the next succeeding notch in said metal plate first mentioned.

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