Aug. 17, 1943. G. J. MEUER 2,326,874

ELECTRIC SNAP SWITCH

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Fig. 1

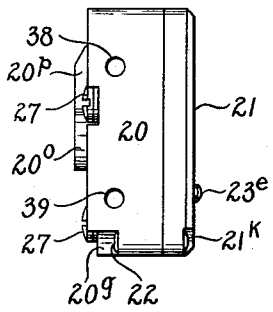


Fig. 4

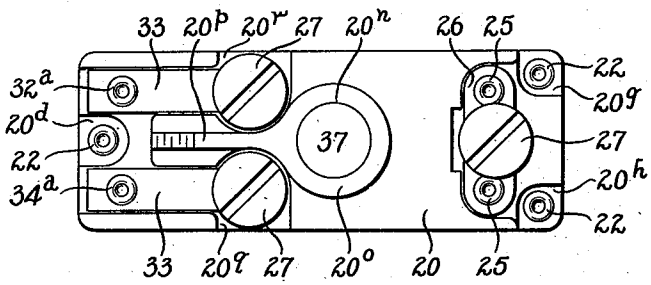


Fig. 2

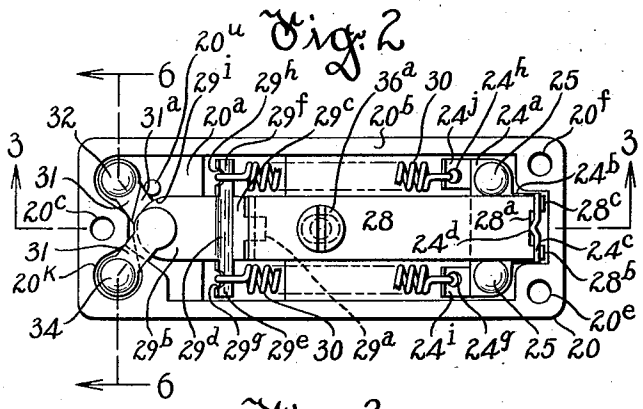


Fig. 5

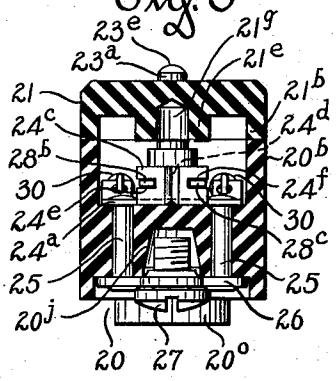


Fig. 3

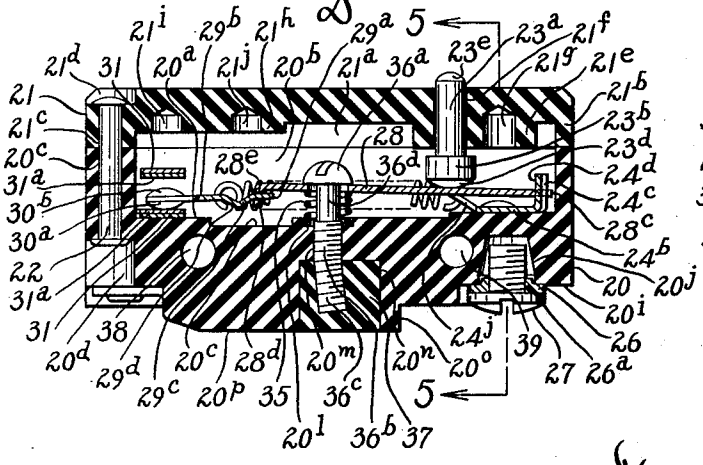
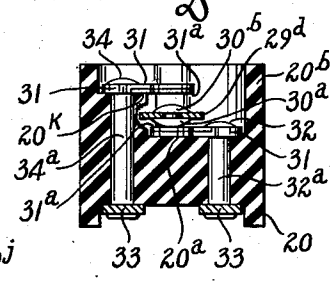


Fig. 6



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Fig. 7

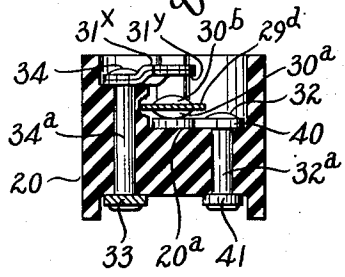


Fig. 8

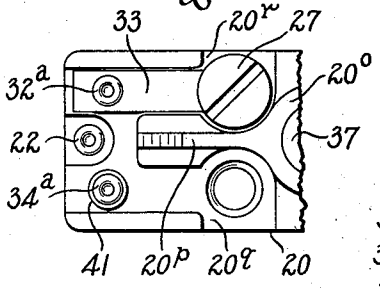


Fig. 9

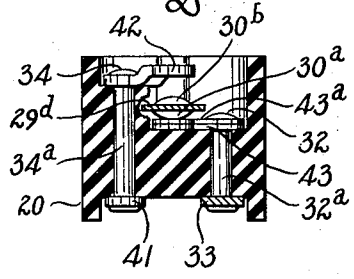


Fig. 10

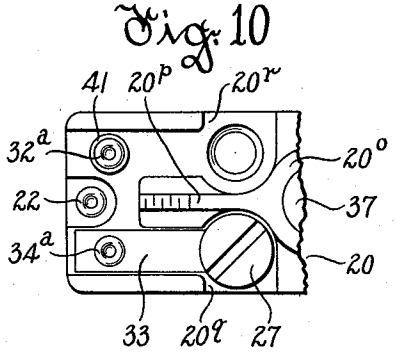


Fig. 11

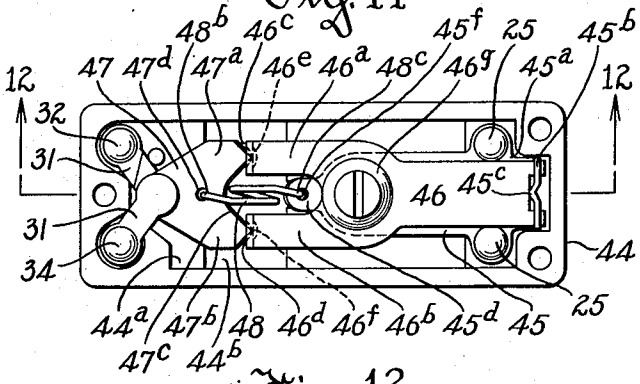


Fig. 12

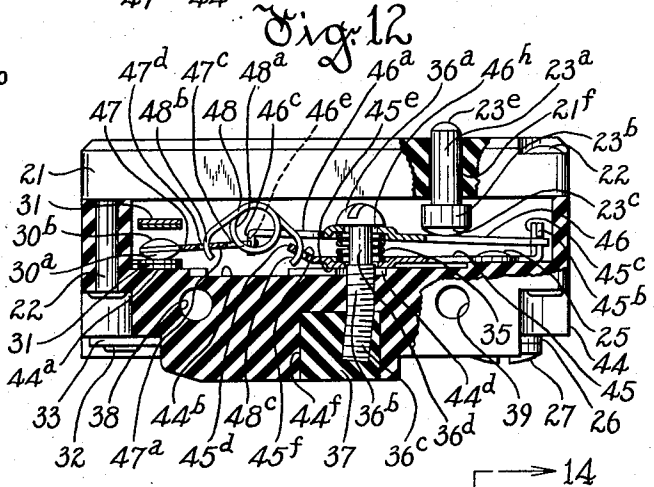
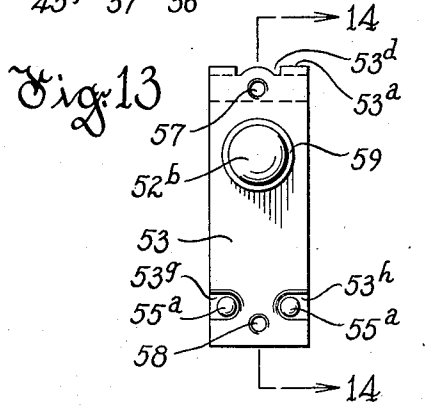


Fig. 13



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Fig. 14

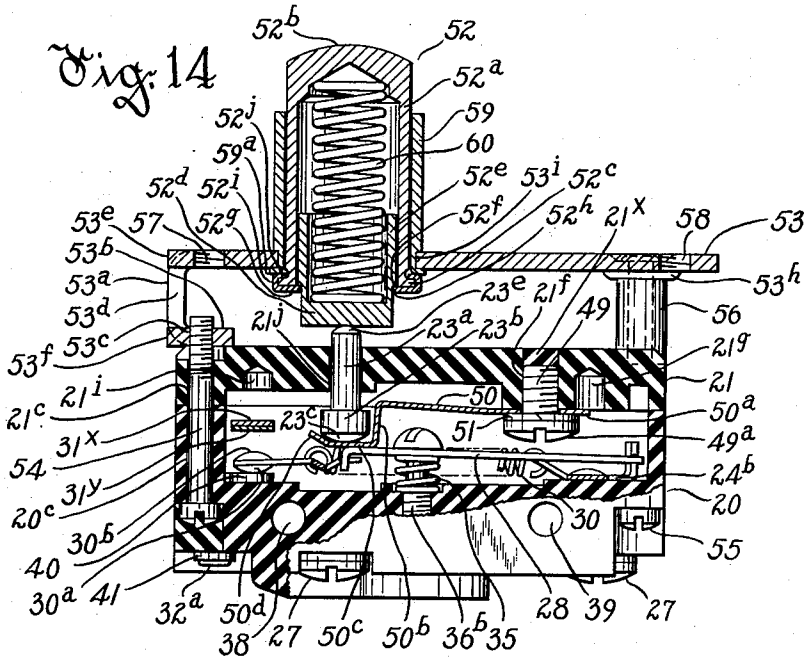


Fig. 15

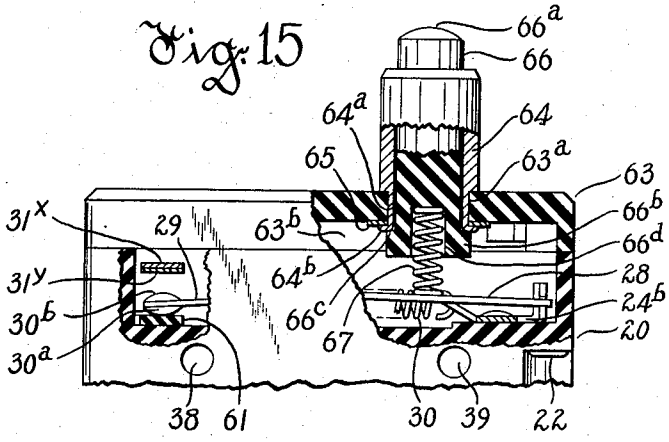


Fig. 16

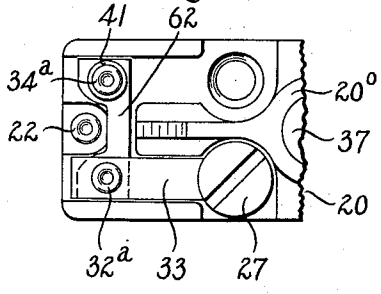
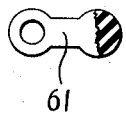


Fig. 17



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UNITED STATES PATENT OFFICE

2,326,874

ELECTRIC SNAP SWITCH

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Application October 20, 1942, Serial No. 462,733

13 Claims. (Cl. 200—67)

This invention relates to improvements in electric snap switches. Although not limited thereto, the invention is particularly applicable to so-called low travel limit switches.

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

Another object is to provide such a switch the parts of which are of rugged and durable construction and not likely to get out of order, while at the same time providing the desired high degree of sensitivity thereof to a force intended to operate the same.

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

Another object is to provide a novel form of insulating and supporting casing for the switch mechanism.

Another object is to provide novel means for effecting adjustment of certain of the switch parts relatively to each other to compensate for possible slight inaccuracies in the size and/or shape of the switch parts.

Another object is to provide novel means for insuring maintenance of the "factory adjustment" of the switch.

Another object is to provide novel forms of alternative switch contacts and stop plates to afford either a large or a small gap between the contactor and the stationary contact or contacts.

Another object is to provide a small number of additional or substitute parts to enable production of a manually operable pushbutton switch having the various desired electrical characteristics aforementioned.

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

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

In the drawings,

Figure 1 is a side elevational view (actual size) of a single pole, double throw (or three-point) low travel limit switch constructed in accordance with my invention, the switch having a relatively small arc gap between the contactor and the respective stationary contacts, as hereinafter described.

Fig. 2 is a top plan view of the switch shown in Fig. 1, with the insulating cover and insulating plunger removed.

Fig. 3 is a sectional view, on the line 3—3 of Fig. 2, with all of the switch parts assembled.

Fig. 4 is a bottom plan view of the switch shown in Figs. 1 to 3.

Fig. 5 is a transverse section, on the broken line 5—5 of Fig. 3.

Fig. 6 is a transverse section, on the broken line 6—6 of Fig. 2.

Fig. 7 is a transverse section similar to Fig. 6, but illustrating a modification wherein only one (upper) stationary contact is employed, the same being specially formed to provide a relatively large arc gap when the contactor is moved to its normally disengaged position.

Fig. 8 is a fragmentary bottom plan view of a switch like that shown in Fig. 7.

Fig. 9 is a transverse section similar to Fig. 7, but illustrating a modification wherein only one (lower) stationary contact is employed, the upper or stop plate being specially formed to provide a relatively large arc gap between the stationary contact and the contactor during momentary disengagement of the latter from the contact.

Fig. 10 is a fragmentary bottom plan view of a switch like that shown in Fig. 9.

Fig. 11 is a top plan view, with the insulating cover and insulating plunger removed, of a modified form of switch mechanism, requiring a slightly modified form of insulating base.

Fig. 12 is a sectional view, on the line 12—12 of Fig. 11.

Fig. 13 is a top plan view, actual size, of a single pole, single throw pushbutton switch of the momentary "on" type, said switch embodying most of the structural features of the switch of Figs. 1 to 6, but modified to provide a relatively large arc gap, and having a different position for the insulating plunger.

Fig. 14 is a sectional view, on the line 14—14 of Fig. 13, illustrating the novel form of the pushbutton and the manner of supporting the same relatively to the switch.

Fig. 15 is a fragmentary view, partly in side elevation and partly in vertical section, of a different form of pushbutton operated snap switch, of the momentary "on" type shown in Fig. 14, the insulating cover member of the switch being modified to provide for attachment of the metal bushing which acts as a support and guide for the pushbutton.

Fig. 16 is a fragmentary bottom plan view of a single pole, single throw switch, including a bus

member or connector which provides for positioning of the wiring terminal member, for the stationary contact, at one side of the bottom surface of the base, if desired for special wiring, and

Fig. 17 is a top plan view of an insulating stop plate or spacer which is employed in a switch like that of Figs. 15 and 16.

Referring first to the low travel limit switch of the snap type shown in Figs. 1 to 6, the numeral 20 designates the base, which is molded to the form illustrated from any suitable insulating material, such as "Bakelite." Base 20 is preferably of relatively long substantially rectangular contour, as shown, and the same is provided in its upper surface with a recess 20^a extending throughout the major portion of the length and width thereof, the peripheral wall 20^b of said recess having a flat upper edge. A molded insulating cover member 21, preferably composed of "Bakelite," has a downwardly opening recess 21^a the flat lower edge of whose peripheral wall is adapted to seat against the upper edge of wall 20^b.

Base 20 and cover member 21 are provided at the midwidth of one end with alined passages 20^c and 21^c to accommodate the shank of a rivet 22 of suitable metal, preferably aluminum, the head of which is positioned in the countersink 21^d in the upper surface of cover 21 and the hollow end of which is upset within the countersink 20^d in the lower face of base 20.

Cover 21 is provided adjacent one end of recess 21^a with an integral centrally located extension 21^e of approximately elliptical form in horizontal cross section, said extension preferably having in its flat lower face substantially flush with the lower face of peripheral wall 21^b. Cover 21 as molded is provided with a passage 21^f of circular form in cross section, which is adapted to accommodate and guide the cylindrical upper end portion 23^a of a plunger having a cylindrical enlargement or head 23^b. The lower end portion 23^c of head 23^b is preferably of convex form, as shown at 23^d (Fig. 3), and the upper end of portion 23^a of the plunger is also preferably of convex form, as shown at 23^e.

Cover 21 is also preferably provided with a recess 21^g extending upwardly a predetermined distance from the lower surface of extension 21^e, for a purpose to be later described.

Cover 21 is provided adjacent the other end of recess 21^a with another integral extension 21^h whose flat lower face is offset upwardly a substantial distance from the lower edge of peripheral wall 21^b. Recesses 21^i and 21^j extend upwardly a substantial distance from the lower face of extension 21^h, and are produced by the operation of molding the cover 21. The recess 21^j is utilized as a guide or template to facilitate drilling of a passage to the outer face of cover 21 when the latter is to be used for another form of switch disclosed herein (see Fig. 14).

Base 21 is provided at its right-hand end (Fig. 2) with a pair of passages 20^e and 20^f, and cover 21 is provided with a pair of passages (not shown) to be alined therewith, a pair of rivets 22 having their heads located in countersinks in cover 21, one of which is shown at 21^k in Fig. 1, and having their hollow ends upset in countersinks 20^g and 20^h in the lower face of base 20 (Figs. 1 and 4). The three like rivets 22 are adapted to hold base 20 and cover 21 firmly in assembled relationship to each other.

The switch mechanism located within base recess 20^a comprises a punched and stamped sheet metal bracket the horizontal portion 24^a of which seats flatwise upon the bottom wall of said recess at one end of the latter. Portion 24^a is of a width only slightly less than the width of recess 20^a, and said portion is provided adjacent opposite ends thereof with perforations alined with passages of corresponding size to accommodate the shanks of rivets 25, 25 of brass, or other metal of good electrical conductivity. The shanks of rivets 25 also penetrate openings of corresponding size formed in a terminal plate 26 located within a countersink 20^i in the lower face of base 20, and the hollow ends of said shanks are upset, as shown in Figs. 4 and 5, to hold portion 24^a and plate 26 in assembled relation to base 20 and in electrically connected relationship to each other. Plate 26 is provided with an extruded and tapped opening 26^a (Fig. 3) to accommodate the shank of a wiring terminal screw 27, base 20 being provided with a recess 20^j to afford clearance for said shank.

Portion 24^a of the bracket is of approximately T-shape (Fig. 2), the relatively narrower extension 24^b thereof being located within the correspondingly narrower portion of recess 20^a, and an end of said extension being bent upwardly at substantially a right angle thereto, as shown at 24^c (Figs. 2, 3, and 5). Said end 24^c is deformed at the mid-point of its width to provide a vertical knife-edge bearing 24^d, and said end is provided with alined, substantially rectangular notches 24^e, 24^f opening to opposite side edges thereof, as best illustrated in Fig. 5.

A flat lever 28 (Figs. 2 and 3) is provided at its right-hand end with a relatively wide rectangular notch 28^a, the intermediate portion of whose inner edge is adapted to abut or bear against the aforementioned vertical knife-edge 24^d (see Fig. 2). Notch 28^a also provides the pair of spaced arms or lugs 28^b and 28^c which respectively fit within the notches 24^e and 24^f aforementioned, thus providing a pivotal support for lever 28.

Lever 28 is provided at its other end with an integral portion 28^d bent downwardly therefrom at approximately a right angle with respect thereto (see Fig. 3), said portion 28^d having a centrally located relatively narrow, substantially rectangular opening 28^e, which is adapted to accommodate the relatively small lug 29^a which is preferably located in the plane of the main body portion 29^b of a punched and stamped sheet metal contactor-carrying member. The portion of said member between lug 29^a and portion 29^b is bent to substantially V-form in cross section, as shown in Fig. 3, the portion 29^c of said V being adjacent lug 29^a, and of a width corresponding to the width of lever 28, whereas the portion 29^d of said V is provided with integral lateral extensions or arms 29^e and 29^f, which are notched at their respective forward edges, as shown at 29^g and 29^h (Fig. 2), to accommodate and assist in retaining the hooked ends of a pair of coiled tension springs 30, 30.

The forward end of portion 29^b is preferably of arcuate contour, as shown at 29^i in Fig. 2, and said end is provided with a perforation (see Fig. 6) to accommodate the shank of a rivet, the somewhat hemispherical head of which is designated by numeral 30^b (Fig. 3), said shank being upset or formed, on the opposite side of portion 29^b, as shown at 30^a. The head 30^b and upset shank 30^a form the tips of the contactor, which is thus provided with a good mechanical and electrical connection with portion 29^b of the carrier. Rivet

30b is preferably composed of silver, or a compound including silver, to provide a contactor of good electrical conductivity, low contact resistance, and long life.

As best illustrated in Fig. 2, the other hooked ends of springs 30, 30 are respectively engaged with the walls of relatively small openings 24g, 24h in lugs 24i and 24j formed integrally with the aforementioned portion 24a.

Inasmuch as the switch of Figs. 1 to 6 is of the single pole, double throw, or three-point, type, I provide a pair of upper and lower stationary contacts 31, 31, which are preferably of identical form; each having opposite end portions of substantially circular contour, with an integral, straight-sided neck portion therebetween. One end of each contact is perforated to accommodate the shank of a rivet—the lower contact 31 seating upon the bottom wall of recess 20a and having the rivet head 32 overlying the perforated end portion thereof; the relatively short shank 32a of which rivet (Fig. 6) penetrates an alined passage formed in base 20 and a perforation in a terminal plate 33, and has its hollow end upset over said plate to secure the latter to the lower face of the base. In like manner the upper contact 31 is seated upon a ledge 20k, offset downwardly from the upper surface of base 20; the head 34 of a relatively longer rivet overlying the perforated end of said upper contact, and the shank 34a of said rivet penetrating an alined passage formed in base 20 (Fig. 6) and a perforation in a second terminal plate 33, and having its hollow end upset over said terminal plate. Terminal plates 33, 33 have extruded and tapped openings (not shown) to accommodate the shanks of a pair of screws 27, 27 to provide for attachment of circuit wires; the lower face of base 20 being provided with recesses (not shown) to provide clearance for the shanks of said screws last mentioned.

The contacts 31, 31 are preferably provided with contact portions or tips of silver or a compound including silver; and in practice I prefer to provide this feature by punching contacts 31 on the bias from a metal strip a portion of which is of bimetallic construction. Thus in Figs. 2 and 3 the silver portions or tips of the contacts are arranged to face each other, and are designated by numerals 31a, 31a; the main body portions of contacts 31, 31 preferably consisting of brass or other suitable metal of lower cost than silver.

In order to bias lever 28 toward its upper extreme position, shown in Fig. 3, I prefer to provide a coiled compression spring 35, whose lower end is seated and centered within a shallow subrecess 20l of circular contour in the bottom wall of recess 20a, the upper end of spring 35 being adapted to press against the lower face of lever 28, to normally throw the latter over center against the bias of springs 30, 30.

The degree of upward displacement of lever 28 is limited by engagement of the upper surface thereof with the lower surface of the head 36a of a screw, lever 28 having a substantially elliptical opening to provide clearance between the same and the screw shank. The portion 36b of the screw shank has threaded engagement with a tapped opening or passage 20m formed in base 20 by the molding operation. Passage 20m extends from the bottom wall of recess 20a through the upper end wall of a relatively large recess 20n (Fig. 3) of cylindrical form which opens to the lower surface of base 20. As shown in Fig. 3, the passage 20m is offset toward the left with respect to the center of recess 20n, for a purpose set forth hereinafter in the description of the device of Figs. 11 and 12.

In a small arc gap switch of the character illustrated in Figs. 1 to 6, the desired "factory" adjustment or positioning of the head 36a of the screw may be effected in a simple manner, as follows: The screw is manually driven in (by the use of a screw driver) until the contactor head or tip 30b is snapped into engagement with the silver tip portion 31a of the upper stationary contact 31; thereafter the screw is withdrawn (the head 36a lifted) to such an extent that the contactor tip 30a is snapped into engagement with the silver tip 31a of the lower stationary contact. Thereafter the screw is further withdrawn by effecting another complete turn thereof, so that the parts are in the relative positions thereof shown in Fig. 3. In order to prevent any further withdrawal of the screw (either accidental or otherwise) I prefer to bend, as illustrated, that portion 36c of the screw shank which projects into recess 20n. Such bending may be effected by inserting a suitable tool, such as a tube to closely fit around the screw shank, and then manually applying a suitable force to effect the desired degree of bending. This definitely prevents upward displacement of the screw.

Also, in order to prevent downward displacement of the screw after adjustment thereof and bending of the exposed lower end of its shank, I prefer to fill the recess 20n with a wax or cement of suitable hardness, toughness and tenacity or adhesiveness, as indicated at 37 in Figs. 3 and 4, the cylindrical body of wax cooperating with the bent end of the screw shank to prevent rotation of the screw in a downward direction.

As shown in Figs. 1, 3 and 4, the recess 20n is surrounded for a portion of its depth by a projecting wall 20o formed integrally with the bottom face of base 20, said integral wall being extended toward the left-hand end of base 20, as shown at 20p to provide a barrier between the pair of screws 27, 27 at said end. The filling of wax within recess 20n is preferably of the same color as the material of base 20 (which is preferably black), wherefore the finished appearance of the lower face of the base is accentuated.

As best illustrated in Fig. 4, the lower face of base 20 is recessed at 20q and 20r to accommodate the terminal plates 33, 33, and recesses (not shown) are also provided to accommodate the shanks of the screws 27, 27 associated with said plates.

As best illustrated in Fig. 3, the bottom wall of recess 20a is further recessed at 20s and 20t to insure adequate clearance for the lever 28, carrier 29b and tension springs 30, 30. In practice the aforementioned adjusting screw is provided with a reduced or neck portion 36d between head 36a and threaded portion 35b of the shank, to avoid interference between the screw shank and the coils of spring 35, and to minimize the required size of the elliptical clearance opening in lever 28.

The switch as a whole may be mounted in any suitable manner, the base 20 being shown as provided with a pair of transverse passages 38, 39 (Figs. 1 and 3) to accommodate the shanks of bolts or screws for attaching the switch to a suitable support.

The manner of operating the switch will be apparent to those skilled in the art, but it may be pointed out that with the parts in the re-

spective positions thereof shown in Fig. 3 the end 25a of the insulating plunger is adapted to be engaged by any suitable or well known form of operating member, such as a lever, cam, or the like (not shown) which is movable toward cover 21 in response to a change in a given condition either controlled or to be controlled by a translating device which is in turn subject to control by the switch. Upon a predetermined degree of inward movement of plunger 23a the end 23d thereof acting against lever 28 causes movement of the left-hand end of the latter so that the point of engagement thereof with lug 29a of the carrier 29b is moved below the plane of engagement of the left-hand ends of springs 30, 30 with arms 29e and 29f of carrier 29b, whereupon the latter snaps upward to effect disengagement of tip 30a from the lower stationary contact and engagement of the tip 30b with the upper stationary contact.

As will be noted, only a relatively short length of plunger 23a projects upwardly beyond cover 21, whereas only a portion of the possible downward movement of the plunger is required to effect the aforedescribed snap operation of the switch. The balance of the downward movement of the plunger is accommodated by the lost motion provided between the switch parts, which will at most merely cause a rocking motion of the contact tip then engaged with a stationary contact without substantially affecting the degree of contact pressure. Excessive inward movement of the plunger 23a will be prevented by engagement of the operating member with the surface of cover 21. Upon release of the operating pressure upon the plunger spring 35 will act automatically to lift lever 28 against the bias of springs 30, so that the carrier 29b will be snapped from the position just described to its normal position shown in Fig. 3.

In the modification shown in Figs. 7 and 8 the parts not illustrated may be identical with the corresponding parts of Figs. 1 to 6, whereas most of the parts shown in Figs. 7 and 8 are identical with those aforedescribed and such identical parts have been given like numerals of reference. However, the switch shown in Figs. 7 and 8 is adapted to provide a large arc gap upon disengagement of the contactor tip 30b from the upper stationary contact; and the switch is of the normally "open" type, wherefore the lower stationary contact is omitted. Instead of a lower contact I prefer to employ a flat sheet metal plate 40 (preferably of cold rolled steel) as shown in Fig. 7. Plate 40 is of the same shape and dimensions as the aforedescribed contacts 31, and serves to insure proper spacing of the contactor tip 30a and its carrier from the bottom wall of recess 20a in the normal or "open" position of the switch parts. The hollow lower end of rivet 32a is upset over a washer 41; one of the terminal plates 27 of Figs. 1 to 6, of course, not being required.

The upper stationary contact 31x of Figs. 7 and 8 is quite similar to the contact 31 aforedescribed, the downwardly facing layer 31y (Fig. 7) of silver or the like extending throughout the entire area of contact 31x and being functionally similar to the layer 31a of contact 31 aforedescribed. Moreover, the intermediate or neck portion of contact 31x is bent upwardly as shown to provide the large arc gap (approximately .062 inch) between the stationary contact and contactor tip 30b in the normal position of the latter illustrated. In a switch like that of Figs. 1 to 6 the relatively small arc gap is equal to approximately .029 inch. Where such large arc gap is provided the screw 36a (Fig. 3) is adjusted in the manner aforedescribed, except that after withdrawing the same to the point at which the contactor is snapped to its lower position, the screw is given two complete turns to further raise the screw head, instead of the one complete turn employed with switches having said small arc gaps.

It will be apparent to those skilled in the art that the switch of Figs. 7 and 8 might be modified by providing a lower stationary contact (similar to 31 of Figs. 1 to 6, but preferably having a silver layer extending throughout its entire area, see Fig. 9), instead of plate 40, and by substituting a wiring terminal plate 33 and screw 27 for washer 41. Such a switch would then be functionally like the switch of Figs. 1 to 6, but would differ therefrom in respect of providing the large arc gap upon movement of the contactor to its alternate positions.

In Figs. 9 and 10 I have illustrated a large arc gap snap switch quite similar to that of Figs. 7 and 8, but of the normally "closed" type, with a special form of stop plate to limit the degree of movement of the contactor to "open" position. Thus the special stop plate 42, which is preferably punched and stamped from a sheet of cold rolled steel, is the same in shape and dimensions as the upper stationary contact 31x of Fig. 7, the upwardly offset stop portion thereof providing the large arc gap when the contactor is disengaged from the lower stationary contact 43. Contact 43 is of the same shape and dimensions as the contacts 31 of Figs. 1 to 6, but, as shown, has the layer 43a of silver or the like extending throughout the entire area thereof. As shown in Figs. 9 and 10 the hollow end of rivet shank 32a is upset over the terminal plate 33, which is provided with a binding screw 27; whereas the hollow end of rivet shank 34a is upset over the metal washer 41.

In the modification illustrated in Figs. 11 and 12 the cover 21 and plunger 23a may be identical with the corresponding parts of Figs. 1 to 6, whereas the base 44 is in most respects like the aforedescribed base 20, but differs from the latter in respect of the shape, dimensions and location of certain of the sub-recesses in the bottom wall of the main recess, designated by numeral 44a. Thus said bottom wall 44a is provided with a sub-recess 44b, and sub-recesses 44c and 44d communicating therewith, the sub-recesses 44b and 44c affording adequate clearance for the adjacent movable elements of the switch mechanism.

The bracket 45 of the switch mechanism is secured to the bottom wall of recess 44a by rivets 25, 25, which have their hollow ends upset over the lower surface of terminal plate 26 (Fig. 12) in the manner aforedescribed, plate 26 having a binding screw 27 associated therewith. A relatively narrow portion 45a of bracket 45 is located within the correspondingly narrower portion of recess 44a, and the end 45b is bent upwardly from portion 45a at substantially a right angle thereto. Said upstanding end is deformed at the mid-point of its width to provide the vertical knife edge bearing 45f, and the same is laterally notched (as described in connection with the device of Figs. 1 to 6) to provide a pivotal bearing for the notched right-hand end of a lever 46.

Lever 46, as best illustrated in Fig. 11, is of substantially Y-shape, the arms 46a and 46b being

spaced from each other in a common plane, and the forward ends thereof being bent downwardly therefrom at approximately a right angle, as shown at 46c and 46d. Each of said ends 46c and 46d is provided a hemispherical depression in the outer or forward face thereof, as indicated in dotted lines at 46e and 46f, to provide bearings for the correspondingly spaced pointed ends of the arms 47a and 47b of a flat, punched sheet metal contactor-carrier 47. Carrier 47 is provided at its forward end with a perforation (not shown) to provide for attachment thereto of a rivet of silver or the like, the head 30b of which is adapted to act as a tip for engagement with the upper stationary contact 31, and the upset shank portion 30a of which is adapted to act as a tip for engagement with the lower stationary contact 31, said contacts having tips or layers of silver, as described in connection with Figs. 1 to 6.

Carrier 47 is cut away at its inner end between arms 47a and 47b, the arcuate edge of said cut away portion being designated by numeral 47c, said cut away providing clearance for the vertical coiled portion 48a of a tension spring 48, one straight arm of which is provided with a hooked or curved end 48b which is adapted to engage the wall of a relatively small circular opening 47d in carrier 47.

The other straight arm of spring 48 is provided with a hooked end 48c adapted to engage the wall of an opening 45c in the upwardly bent relatively narrow forward end or extension 45d of bracket 45. The arms 46a and 46b are spaced sufficiently to provide the necessary clearance between the same and bracket end 45d. Lever 46 is provided with an upwardly embossed or offset portion of circular contour, as shown at 46g, the lower surface of which portion is adapted to accommodate and center the upper end of a coiled compression spring 35, like that of Figs. 1 to 6.

Portion 46g is provided with a relatively large opening 46h (Fig. 12) to provide adequate oscillating clearance between lever 46 and the reduced or neck portion 36d of the adjusting screw, the head 36a of which overlies said lever to limit the degree of upward displacement thereof. The portion 36b of the screw shank has threaded engagement with the tapped opening or passage 44e formed in base 44, it being noted that said opening communicates with the downwardly opening cylindrical recess 44f (Fig. 12) at the right-hand side of the center of the latter. The lower end portion 36c is therefore bent toward the left after adjustment of the screw, as shown in Fig. 12. As shown in Fig. 12 bracket 45 is embossed to provide a downwardly offset recess to receive and center the lower end of spring 35, said offset being perforated to provide clearance for the shank 36b of said adjusting screw. The recess 44f is preferably filled with wax or cement, as indicated at 37, for the purpose hereinabove set forth. The operation of the switch of Figs. 11 and 12 will be obvious from the foregoing description of the operation of the switch of Figs. 1 to 6.

In Figs. 13 and 14 I have illustrated a manually operable pushbutton snap switch of the single pole "on" and "off" type, the same being normally biased to "off" position, wherefore the same is of the momentary "on" type. That is to say, the same is only "on" so long as the pushbutton is sufficiently depressed. The switch mechanism employs the base 20, cover 21, plunger 23a, and most of the other elements of the switch of Figs. 1 to 6, and like parts have been given corresponding numerals of reference. As shown in Fig. 14, however, the cover 21 is modified by drilling the recess 21j to provide a through passage to accommodate the portion 23a of the plunger, whereas the passage 21f is preferably tapped to accommodate the shank 49 of a screw which shank penetrates an opening in the righthand end 50a of a resilient sheet metal member 50, which is preferably composed of phosphor bronze, a lock washer 51 being preferably interposed between head 49a and said portion 50a, and said head 49a acting to clamp member 50 in position.

Member 50 extends toward the left and has a portion 50b (Fig. 14) bent downwardly at substantially a right angle thereto, a portion 50c extending toward the left at substantially a right angle to portion 50b, and the free end thereof being bent upwardly at a slight angle, as shown at portion 23b of the plunger. Portion 50c of member 50 in part overlies a portion of the forward or left-hand end of lever 28, to provide a proper operating connection between the latter and the lower end 23c of the plunger. Member 50 also serves to absorb or neutralize the weight of the pushbutton operating elements now to be described.

The pushbutton, designated in general by numeral 52, is carried by a punched and stamped sheet metal member, the flat main body portion 53 of which is spaced upwardly a predetermined distance from the switch cover 21. The means for spacing portion 53 preferably includes an integral end portion which is bent downwardly as shown at 53a and then inwardly as shown at 53b to overlie the left-hand end of cover 21. Portion 53b is provided with a tapped opening 53c overlying the alined passages 21c and 20c in cover 21 and base 20, the threaded shank of bolt 54 being adapted to take into said tapped opening. In practice an opening 53d is punched in the end portion 53a before bending thereof to provide flat extensions of the portions 53 and 53b, as shown at 53e and 53f, for an obvious purpose.

Portion 53 is provided at its opposite end with a pair of downwardly offset areas 53g and 53h which are respectively provided with tapped openings to accommodate the shanks of a pair of relatively long bolts 55, 55 which extend upwardly through the aforedescribed sets of alined openings in base 20 and cover 21, a pair of tubular spacer members (one of which is shown at 56 in Fig. 14) being interposed between the lower surfaces of offsets 53g and 53h and the bottom walls of the pair of countersinks in the upper surface of cover 21. The ends of said screw shanks are preferably upset over the upper surfaces of offsets 53g and 53h, as shown at 55a, 55a in Fig. 13, to prevent accidental loosening of said bolts.

Portion 53 is provided at opposite ends thereof with tapped openings 57 and 58 to provide for attachment of the switch to a suitable support, as by means of a pair of bolts or screws (not shown).

Portion 53 has formed therein a relatively large circular opening 53i (Fig. 14) which is concentric to the insulating plunger 23a of the switch. A hollow cylindrical tube or bushing 59 has a reduced lower end insertable downwardly with a close fit into opening 53i, said reduced end being spun or upset over the lower face of portion 53, as shown at 59a to rigidly secure tube 59 in assembled position.

The pushbutton 52 consists of a sub-assembly including the cylindrical hollow metal member

52ª having a closed upper end provided with a convex surface 52ᵇ, member 52ª having an outwardly projecting peripheral flange 52ᶜ at its lower end. A relatively heavy coiled compression spring 60 is interposed between the closed upper end of member 52ª and the closed, flat lower end wall 52ᵈ of a hollow metal member 52ᵉ which is adapted for sliding or telescopic movement within member 52ª. Member 52ᵉ is of reduced outside diameter for a predetermined distance above its lower end to provide the peripheral shoulder 52ᶠ; and a sheet metal member 52ᵍ having an opening 52ʰ to slidably accommodate the reduced lower end portion of member 52ᵉ, but of a size to provide a peripheral abutment for the aforementioned shoulder 52ᶠ, has an upstanding peripheral flange 52ⁱ which is bent inwardly over the upper surface of the aforementioned flange 52ᶜ, as shown at 52ʲ. In practice the spring 60 is placed under a predetermined degree of compression prior to or as an incident to inward bending of the portion 52ʲ of the flange of member 52ᵍ.

After thus assembling the parts of pushbutton 52, the latter is inserted upwardly from the lower surface of portion 53 through the bushing 59, the flange 52ᶜ and the spun over portion 52ʲ of flange 52ⁱ abutting against the spun over portion 59ª of bushing 59 to limit the degree of upward movement of the pushbutton assembly.

As will be understood the pushbutton 52 is positioned as shown relatively to portion 53 prior to attachment thereof to the switch by bolts 54 and 55, 55. The arrangement is preferably such that with the parts assembled as shown in Fig. 14 if the complete assembly were inverted there would be no pressure of the pushbutton parts against the plunger 23ª such as to cause any inward displacement thereof. It follows that the resilient member 50 is adapted to function to absorb or compensate for the weight of the parts of pushbutton 52 to avoid any inward displacement of plunger 23ª when the parts are in the normal positions thereof illustrated; whereas member 50 serves also to insure proper cooperation of plunger 23ª with respect to lever 28.

As illustrated in Fig. 14, the switch is preferably adapted to provide a large arc gap, and I may therefore employ an upper stationary contact 31ˣ of the character aforedescribed in connection with Fig. 7, said contact having a layer 31ʸ on its lower surface extending throughout the entire area thereof, to insure a large current carrying capacity. The metal stop member 40 in Fig. 14 may be identical with the corresponding element of the switch of Fig. 7, the rivet 32ª in Fig. 14 being upset over a metal washer 41, as described in connection with Fig. 7.

In the device of Fig. 14, upon manual depression of pushbutton 52 the spring 60 acts to cause movement of the parts 52ª and 52ᵉ as a unit to effect depression of plunger 23ª for operation of the switch mechanism in the manner described in connection with Figs. 1 to 6. Upon continued inward movement of pushbutton 52 the flat end portion 52ᵈ of member 52ᵉ will engage the upper face of cover 21, and thereafter member 52ª will telescope downwardly over member 52ᵉ, against the bias of spring 60, thus providing a relatively large degree of overtravel of pushbutton 52 without endangering any part of the switch mechanism. This arrangement is very desirable in a switch of the character just described.

As shown at 21ˣ in Fig. 14, the portion of passage 21ᶻ not occupied by the shank 49 of the aforementioned screw is preferably filled with a black wax or cement to a plane flush with the upper surface of cover member 21.

In Figs. 15, 16 and 17 I have shown a manually operable pushbutton snap switch of the normally "open" type, the same, in this respect, being functionally like the modified form of switch shown in Figs. 7 and 8, and the same being also like that shown in said earlier figures in respect of the provision of a large arc gap. However, whereas in Figs. 7 and 8 I employ a metal stop plate 40, in the device of Figs. 15 to 17 I prefer to employ an insulating stop plate 61, preferably punched from a sheet of reinforced "Bakelite" or similar material. The reason for this change will be apparent upon comparison of Figs. 8 and 16.

Thus, whereas in Fig. 8 the rivet 32ª is upset directly over the terminal plate 33, in Fig. 16 I interpose a bus member or connector 62 between the rivets 34ª and 32ª, the rivet 34ª being upset over a washer 41, which may, if desired, be of brass, which clamps one end of the bus member in position and provides an electrical connection between said parts, and the rivet 32ª (which penetrates the other end of bus member 62) is upset directly over terminal plate 33; this position of the terminal plate being preferable to that shown in Fig. 8 to facilitate wiring and to insure adequate electrical clearance, in the event that the upper side of the switch (Fig. 16) is attached or clamped to a metal support or panel. Because of the electrical connection afforded by bus member 62 it is obvious that a stop plate 61 of insulation is required, to provide for interruption of the controlled circuit in the normal positions of the several switch parts.

Aside from the differences just mentioned, the base 20 and the parts carried thereby may be like those of the switch shown in Figs. 1 to 6, the corresponding parts illustrated having been given like numerals of reference.

The insulating cover 63 (Fig. 15) differs from the cover 21 aforedescribed primarily in respect of the provision of a relatively large circular opening 63ª which is concentric with that point on lever 28 engaged by the convex end 23ᶜ of the plunger in the device of Figs. 1 to 6. A cylindrical hollow metal bushing 64 has a lower end portion 64ª of reduced diameter which is insertable downwardly through said opening 63ª, the projecting part of said lower end being spun outwardly or upset over the wall of the recess 63ᵇ in cover 63, as shown at 64ᵇ. A metal washer 65 is preferably interposed between said recess wall and the spun over flange 64ᵇ to avoid possible injury to the cover by the spinning operation.

The manually operable pushbutton preferably consists of a substantially cylindrical molded insulating member 66 which slidably fits within and normally projects a substantial distance upwardly beyond the bushing 64. Member 66 is preferably provided with a convex upper end 66ª, and the same is provided with a lower end portion 66ᵇ of relatively larger diameter, to provide a shoulder 66ᶜ which is adapted to abut or seat against the outwardly spun flange 64ᵇ to limit upward displacement of the pushbutton. Member 66 is provided in its lower end with a centrally located substantially cylindrical recess 66ᵈ which accommodates a portion of the length of a coiled compression spring 67, the lower end of said spring being arranged to engage lever 28 at the same point as the lower end 23ᶜ of the plunger in the device of Figs. 1 to 6.

As will be understood pushbutton 66 is inserted upwardly through bushing 64, and the spring 67, in the normal positions of the assembled switch parts is compressed to a slight degree, but not sufficiently to cause any downward displacement of lever 28 from the normal position thereof illustrated. The pushbutton is relatively light, and the weight thereof has little or no depressing effect upon lever 28, because of the counteracting force of the pair of springs 30 and the aforedescribed biasing spring 35 (not shown in Fig. 15).

Thus upon manual depression of pushbutton 66 the spring 67 is first compressed to a degree sufficient to overcome the aforementioned bias of springs 30 and 35, with resultant snap movement of contactor tip 30^b into engagement with the portion 31^v of stationary contact 31^x. Further depression of pushbutton 66 will be compensated for by increased compression of spring 67, whereas the convex surface 66^a of said pushbutton will be substantially flush with the upper end of bushing 64 prior to direct engagement of the lower end of pushbutton 66 with lever 28. In this manner any excessive pressure upon lever 28 or other parts of the switch is effectively prevented.

As illustrated in Fig. 2 the upper stationary contact member 31 has the side edges of its neck portion fitted quite closely between a pair of vertical wall portions which assist in defining the contour of the ledge 20^k upon which said contactor is adapted to seat. In like manner, one side edge of the neck portion of the lower stationary contact 31 fits closely against a vertical wall portion of base 20, whereas the bottom wall of recess 20^a is provided with an integral boss 20^n, shown as of substantially cylindrical form, a portion of the periphery of which is located closely adjacent the other side edge of said neck portion. In this manner properly alined positioning of the silver tip portions of said contacts is initially provided and maintained.

Referring again to Fig. 3, it is desired to point out that the right-hand recess 21^g in cover 21 may be drilled or otherwise formed to provide a passage extending through to the upper face of cover 21, the passage thus formed being adapted to accommodate the plunger 23^a (or a similar actuating element) for engagement with lever 28 at a point more closely adjacent the right-hand, or pivotally supported, end of the latter. With an actuating element so positioned, a greater amount of pressure or force thereon is required to depress lever 28 for actuation of the snap switch mechanism, but at the same time the degree of downward travel or movement of the actuating element is substantially lessened. When cover 21 is so modified, the aforementioned passage 21^f is preferably filled with a black wax or cement to a plane flush with the upper face of cover 21.

In addition to the modification of cover 21 shown in Fig. 14, in respect of recess 21^j, I may also modify said cover by drilling through both recesses 20^i and 20^j (either of the same size or smaller) to provide a pair of passages to accommodate the shanks of a pair of rivets or the like (not shown) which may be utilized to fasten to the upper face of cover 21 one end of a leaf spring having an upwardly curved or bent free end portion overlying the upper end 23^e of plunger 23^a to provide for operation of the latter by means (not shown) well known in this art.

I claim:

1. In an electric snap switch, in combination, an insulating base, a bracket secured thereto, a lever having an open pivotal connection with said bracket, a contactor having an open pivotal connection with said lever, tension spring means attached jointly to said bracket and to said contactor to maintain the aforementioned pivotal connections between said parts and to bias said contactor toward one extreme position or the other according to the position of said lever, a pair of stop members arranged above and below said contactor to limit the throw of the latter in each direction, a coiled compression spring interposed between said base and said lever to bias the latter away from the former, a screw having adjustable engagement with said base, the head of said screw overlying said lever to limit the degree of movement thereof under said spring bias, at least one of said stop members comprising a stationary contact, a wiring terminal element electrically connected with said contact, a wiring terminal element electrically connected with said bracket, said wiring terminal elements being exposed at the lower face of said base, and means comprising a movable member engageable with said lever to effect movement of the latter against said spring bias thereof.

2. In an electric snap switch, in combination, an insulating base, a metal bracket secured to said base, a metal lever having at one end thereof an open pivotal connection with said bracket, a metal contactor having an open pivotal connection with said lever at the other end of the latter, a plurality of stop members arranged in spaced relationship to each other and at opposite faces respectively of said contactor, at least one of said stop members comprising a stationary contact, tension spring means interposed between said bracket and said contactor, said spring means being adapted to bias said contactor into engagement with one or another of said stop members according to the position of said lever, means for limiting the movement of said lever in opposite directions respectively, additional spring means for biasing said lever toward one of its extreme positions, and movable means engageable with said lever between the point of pivotal support thereof and said contactor to effect movement of the former toward its other extreme position against the bias of said additional spring means, said tension spring means being adapted upon such movements of said lever toward opposite extreme positions to effect reverse movements of said contactor with a snap action into engagement with said stop members alternately.

3. In an electric snap switch, in combination, an insulating base, a sheet metal bracket secured to said base, a sheet metal lever having at one end thereof an open pivotal connection with said bracket, a sheet metal contactor having an open pivotal connection with said lever at the other end of the latter, a pair of stop members arranged in spaced relationship to each other and at opposite faces respectively of said contactor, at least one of said stop members comprising a stationary contact, tension spring means interposed between said bracket and said contactor, said spring means being adapted to bias said contactor into engagement with one or another of said stop members according to the position of said lever, means for limiting the movement of said lever in opposite directions respectively,

a coiled compression spring biasing said lever away from said base toward one of its extreme positions, and means including a reciprocable member engageable with said lever between the point of pivotal support thereof and said contactor to effect movement of the former toward its other extreme position against the bias of said additional spring means, said tension spring means being adapted upon such movements of said lever toward opposite extreme positions to effect snap movements of said contactor into engagement with said stop members alternately.

4. In an electric snap switch, in combination, an insulating base, a sheet metal bracket secured to said base, a sheet metal lever having at one end thereof an open pivotal connection with said bracket, a sheet metal contactor having an open pivotal connection with said lever at the other end of the latter, a pair of stop members arranged in spaced relationship to each other and at opposite faces respectively of said contactor, at least one of said stop members comprising a stationary contact, tension spring means interposed between said bracket and said contactor, said spring means being adapted to bias said contactor into engagement with one or another of said stop members according to the position of said lever, means for limiting the movement of said lever in opposite directions respectively, a coiled compression spring biasing said lever away from said base toward one of its extreme positions, means including a reciprocable member engageable with said lever between the point of pivotal support thereof and said contactor to effect movement of the former toward its other extreme position against the bias of said additional spring means, said tension spring means being adapted upon such movements of said lever toward opposite extreme positions to effect snap movements of said contactor into engagement with said stop members alternately, a wiring terminal member mechanically and electrically connected with said bracket, and a wiring terminal member mechanically and electrically connected with said stationary contact, said wiring terminal members being exposed and readily accessible at the lower face of said base.

5. In an electric snap switch, in combination, an insulating base, a sheet metal bracket secured to said base, a sheet metal lever having at one end thereof an open pivotal connection with said bracket, a sheet metal contactor having an open pivotal connection with said lever at the other end of the latter, a pair of stop members arranged in spaced relationship to each other and at opposite faces respectively of said contactor, at least one of said stop members comprising a stationary contact, tension spring means interposed between said bracket and said contactor, said spring means being adapted to bias said contactor into engagement with one or another of said stop members according to the position of said lever, means for limiting the movement of said lever in opposite directions respectively, a coiled compression spring biasing said lever away from said base toward one of its extreme positions, means including a reciprocable member engageable with said lever between the point of pivotal support thereof and said contactor to effect movement of the former toward its other extreme position against the bias of said additional spring means, said tension spring means being adapted upon such movements of said lever toward opposite extreme positions to effect snap movements of said contactor into engagement with said stop members alternately, a wiring terminal member mechanically and electrically connected with said bracket, a wiring terminal member mechanically and electrically connected with said stationary contact, said wiring terminal members being exposed and readily accessible at the lower face of said base, an insulating cover member superimposed upon said base and rigidly and permanently attached thereto, said cover member having an opening formed therein to provide clearance for said reciprocable member, and said cover member and said reciprocable member having parts associated therewith to normally limit the degrees of outward and inward displacement of said reciprocable member and to insure against such a degree of inward movement thereof as would cause injury to the switch parts.

6. In an electric snap switch, in combination, an insulating base, a bracket secured thereto, a lever having an open pivotal connection with said bracket, a contactor having an open pivotal connection with said lever, tension spring means attached jointly to said bracket and to said contactor to maintain the aforementioned pivotal connections between said parts and to bias said contactor toward one extreme position or the other according to the position of said lever, a pair of stop members arranged above and below said contactor to limit the throw of the latter in each direction, a coiled compression spring interposed between said base and said lever to bias the latter away from the former, a screw having adjustable engagement with said base, the head of said screw overlying said lever to limit the degree of movement thereof under said spring bias, at least one of said stop members comprising a stationary contact, a wiring terminal element electrically connected with said contact, a wiring terminal element electrically connected with said bracket, said wiring terminal elements being exposed at the lower face of said base, means comprising a movable member engageable with said lever to effect movement of the latter against said spring bias thereof, said last mentioned means comprising a manually operable pushbutton supported relatively to said base, and said pushbutton having spring means associated therewith to absorb any pressure applied thereto in excess of that required to effect operation of the switch, whereby injury to the latter is prevented.

7. In an electric snap switch, in combination, an insulating base, a bracket secured thereto, a lever having an open pivotal connection with said bracket, a contactor having an open pivotal connection with said lever, tension spring means attached jointly to said bracket and to said contactor to maintain the aforementioned pivotal connections between said parts and to bias said contactor toward one extreme position or the other according to the position of said lever, a pair of stop members arranged above and below said contactor to limit the throw of the latter in each direction, a coiled compression spring interposed between said base and said lever to bias the latter away from the former, a screw having adjustable engagement with said base, the head of said screw overlying said lever to limit the degree of movement thereof under said spring bias, at least one of said stop members comprising a stationary contact, a wiring terminal element electrically connected with said contact, a wiring terminal element electrically connected with said bracket, said wiring terminal elements being ex-

posed at the lower face of said base, means comprising a movable member engageable with said lever to effect movement of the latter against said spring bias thereof, said last mentioned means comprising a manually operable pushbutton supported relatively to said base, said pushbutton having spring means associated therewith to absorb any pressure applied thereto in excess of that required to effect operation of the switch, whereby injury to the latter is prevented, said base having an insulating cover member attached thereto, and said pushbutton having a part engageable with said cover member to positively limit the degree of movement of said movable member relatively to said lever.

8. In an electric snap switch, in combination, a molded insulating base having a recess opening to the upper face thereof, a punched and stamped sheet metal bracket of substantially L-shape in cross section having one arm thereof rigidly and permanently secured to said base, a wiring terminal member mechanically and electrically connected to said bracket and exposed at the lower face of said base, the other arm of said bracket upstanding from said base and having notches formed in opposite side edges thereof, a punched and stamped sheet metal lever having a relatively long flat portion notched at one end to provide a pair of spaced lugs fitting into said bracket notches to provide an open pivotal connection between said parts, said upstanding bracket arm having a vertical knife edge formed thereon and one wall of said lever notch being adapted to bear thereagainst, said lever having a perforated lug bent downwardly therefrom at the other end thereof, a punched and stamped sheet metal contactor having an integral lug adapted to fit loosely into the perforation in said lever lug to provide an open pivotal connection between said parts, said contactor having integral arms extending from opposite side edges thereof, a pair of coiled tension springs having hooked ends respectively engaged with said contactor arms and with said bracket, a pair of spaced stop members respectively arranged above and below the free end of said contactor to limit the degree of movement of the latter in each direction, a coiled compression spring interposed between the bottom wall of said recess and said lever to bias the latter upwardly from said bottom wall, said lever having an opening formed in said flat portion thereof, a screw the shank of which extends downwardly through said opening and is adjustably engaged with a threaded opening in the bottom wall of said recess, a portion of said screw shank being exposed within a recess formed in the lower face of said base, and means associated with said exposed portion of said screw shank to restrain the same against turning in either direction after the desired degree of adjustment thereof has been effected, said last mentioned means including a body of insulating material located within said last mentioned recess in contact with and concealing said portion of the screw shank, at least one of said stop members comprising a stationary contact, and wiring terminal means electrically connected with said contact and exposed at the lower face of said base.

9. In an electric snap switch, in combination, a molded insulating base having a recess opening to the upper face thereof, a punched and stamped sheet metal bracket of substantially L-shape in cross section having one arm thereof rigidly and permanently secured to said base, a wiring terminal member mechanically and electrically connected to said bracket and exposed at the lower face of said base, the other arm of said bracket upstanding from said base and having notches formed in opposite side edges thereof, a punched and stamped sheet metal lever having a relatively long flat portion notched at one end to provide a pair of spaced lugs fitting into said bracket notches to provide an open pivotal connection between said parts, said upstanding bracket arm having a vertical knife edge formed thereon and one wall of said lever notch being adapted to bear thereagainst, said lever having a perforated lug bent downwardly therefrom at the other end thereof, a punched and stamped sheet metal contactor having an integral lug adapted to fit loosely into the perforation in said lever lug to provide an open pivotal connection between said parts, said contactor having integral arms extending from opposite side edges thereof, a pair of coiled tension springs having hooked ends respectively engaged with said contactor arms and with said bracket, a pair of spaced stop members respectively arranged above and below the free end of said contactor to limit the degree of movement of the latter in each direction, a coiled compression spring interposed between the bottom wall of said recess and said lever to bias the latter upwardly from said bottom wall, said lever having an opening formed in said flat portion thereof, a screw the shank of which extends downwardly through said opening and is adjustably engaged with a threaded opening in the bottom wall of said recess, a portion of said screw shank being exposed within a recess formed in the lower face of said base, means associated with said exposed portion of said screw shank to restrain the same against turning in either direction after the desired degree of adjustment thereof has been effected, said last mentioned means including a body of insulating material located within said last mentioned recess in contact with and concealing said portion of the screw shank, at least one of said stop members comprising a stationary contact, wiring terminal means electrically connected with said contact and exposed at the lower face of said base, a recessed molded insulating cover member rigidly secured to said base, said cover member having an opening formed therein, an actuating member reciprocable within said opening and adapted for engagement with said lever, and the length of such actuating member being such as to prevent injury to said switch mechanism upon movement of the upper end of said member to a plane flush with the upper end of said opening in said cover member.

10. In a low travel limit switch, in combination, a molded insulating base, a substantially L-shaped sheet metal bracket having one arm thereof secured flatwise to said base, a sheet metal lever one end of which has an open pivotal connection with the other arm of said bracket, a sheet metal contactor-carrier having an open pivotal connection with the other end of said lever, tension spring means respectively connected with said carrier and said bracket to normally maintain the aforementioned open pivotal connections and to bias said carrier toward one extreme position or the other according to the position of said lever, a pair of stop members arranged in spaced relationship to each other at opposite faces of said carrier, said base being adapted to limit the degree of pivotal movement of said lever in one direction, a coiled compression spring interposed between said base and

said lever to bias the latter toward its other extreme position, a screw the shank of which has threaded engagement with said base, the head of said screw overlying a portion of said lever to limit the degree of movement of the latter away from said base, said base having a recess in its lower face into which a portion of said screw shank projects as an incident to the desired adjustment thereof, said portion of said screw shank being bent within said recess to prevent movement of said screw head away from said base, and a body of self-hardening insulating material located within said recess and engaging the walls of the latter and said bent shank, to prevent inward driving of said screw after the aforementioned adjustment thereof has been effected.

11. In an electric switch, in combination, an insulating base, a metal bracket secured thereto, a sheet metal lever having an open pivotal connection with said bracket, a contactor having an open pivotal connection with said lever, spring means connected jointly with said contactor and said bracket to maintain the aforementioned pivotal connections and to bias said contactor toward one extreme position or the other according to the position of said lever, stop members respectively positioned in spaced relationship to each other at opposite faces of said contactor to limit the throw of the latter in each direction, a spring associated with said lever to bias the free end thereof away from said base, a screw having adjustable engagement with said base, said screw having a head overlying said lever to limit the degree of movement of the latter under the bias of said last mentioned spring, at least one of said stop members comprising a stationary contact, wiring terminal elements respectively electrically connected with each contact and with said bracket, and means comprising a movable member engageable with said lever to effect movement of the latter against the joint action of all of said biasing springs.

12. In an electric switch, in combination, an insulating base, a sheet metal bracket secured to said base, a sheet metal lever one end of which has an open pivotal connection with said bracket, a sheet metal contactor-carrier having an open pivotal connection with the other end of said lever, spring means associated with said carrier and said bracket to normally maintain the aforementioned open pivotal connections and to bias said carrier toward one extreme position or the other according to the position of said lever, a pair of stop members arranged in spaced relationship to each other at opposite faces of said carrier, said base being adapted to limit the degree of pivotal movement of said lever in one direction, additional spring means interposed between said base and said lever to bias the latter toward its other extreme position, a screw the shank of which has threaded engagement with said base, the head of said screw overlying a portion of said lever to predetermine the last mentioned extreme position of the latter, and a portion of the shank of said screw extending through said base and being bent to effectively prevent movement of said screw head away from said base.

13. In an electric switch, in combination, an insulating base, a sheet metal bracket secured to said base, a sheet metal lever one end of which has an open pivotal connection with said bracket, a sheet metal contactor-carrier having an open pivotal connection with the other end of said lever, spring means associated with said carrier and said bracket to normally maintain the aforementioned open pivotal connections and to bias said carrier toward one extreme position or the other according to the position of said lever, a pair of stop members arranged in spaced relationship to each other at opposite faces of said carrier, said base being adapted to limit the degree of pivotal movement of said lever in one direction, additional spring means interposed between said base and said lever to bias the latter toward its other extreme position, a screw the shank of which has threaded engagement with said base, the head of said screw overlying a portion of said lever to predetermine the last mentioned extreme position of the latter, a portion of the shank of said screw extending through said base and being bent to effectively prevent movement of said screw head away from said base, and a body of self-hardening cement adapted to jointly adhere to the bent portion of said screw shank and said base to effectively prevent inward movement of said screw after the aforementioned adjustment of the latter.

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