March 4, 1958 W. J. KELLEIGH 2,825,778

SWITCH ASSEMBLY

Filed July 3, 1953 3 Sheets-Sheet 1

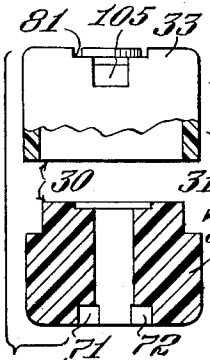


Fig. 2

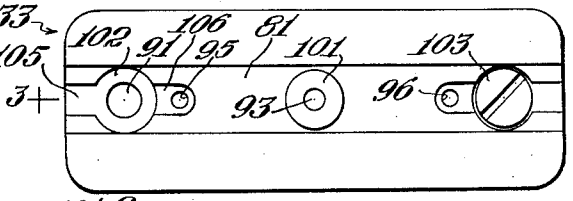


Fig. 1

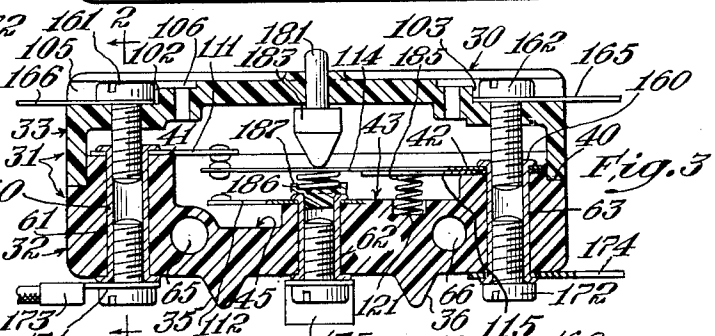


Fig. 3

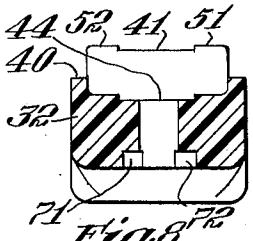


Fig. 8

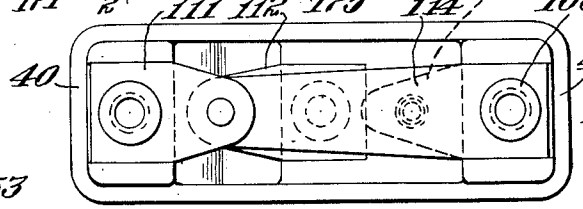


Fig. 4

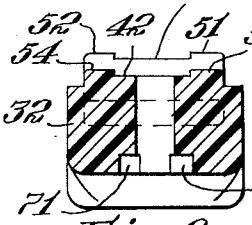


Fig. 9

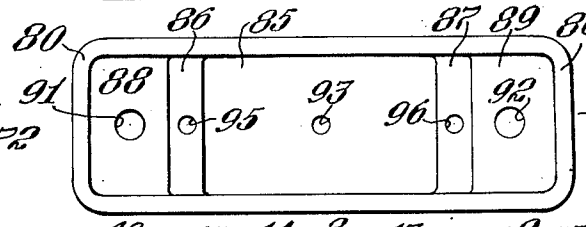


Fig. 5

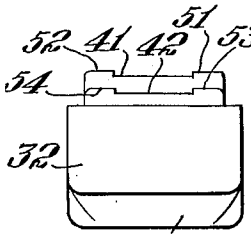


Fig. 10

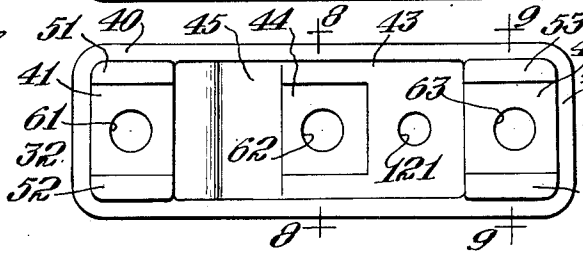


Fig. 6

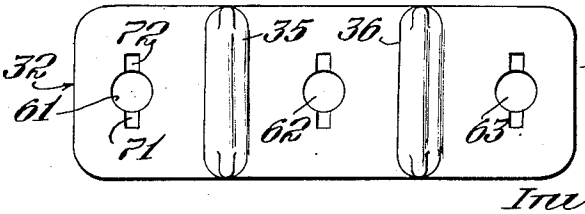


Fig. 7

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SWITCH ASSEMBLY

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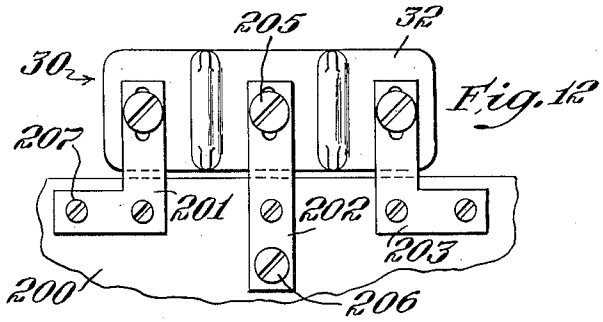


Fig. 12

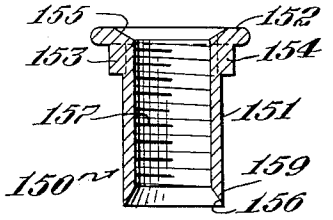


Fig. 11

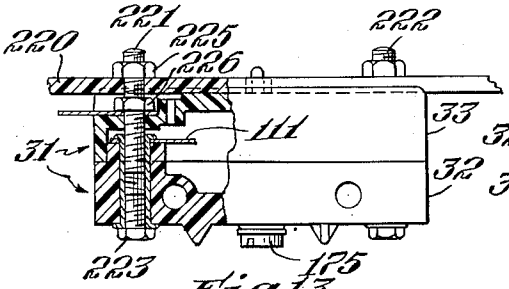


Fig. 13

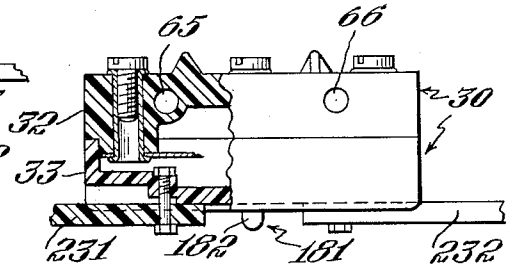


Fig. 14

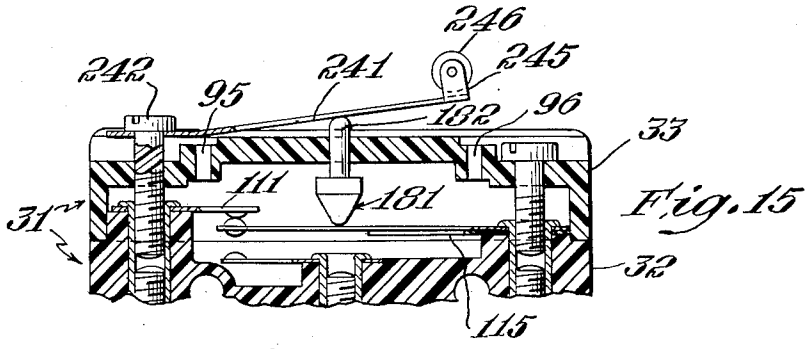


Fig. 15

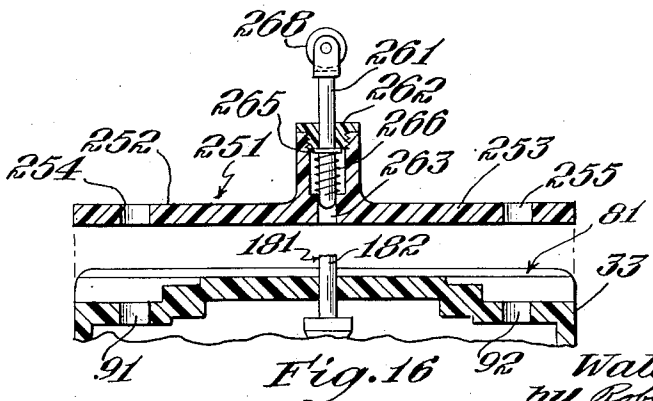


Fig. 16

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SWITCH ASSEMBLY

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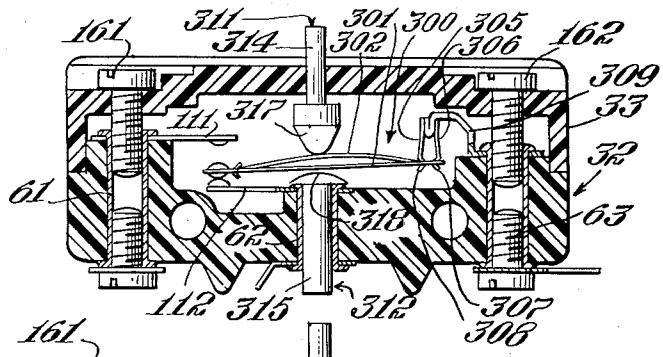


Fig. 17

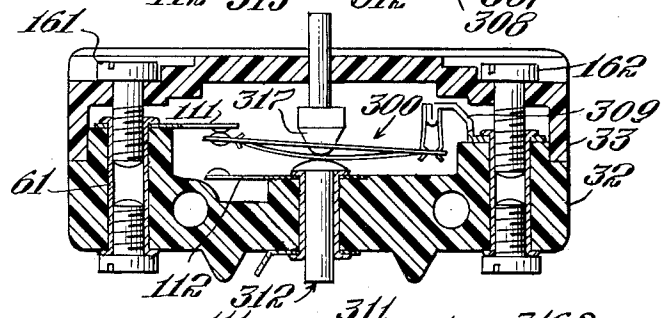


Fig. 18

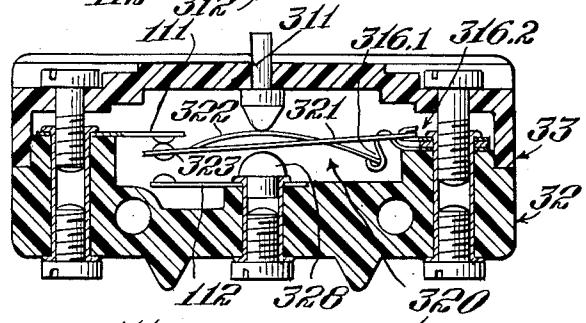


Fig. 19

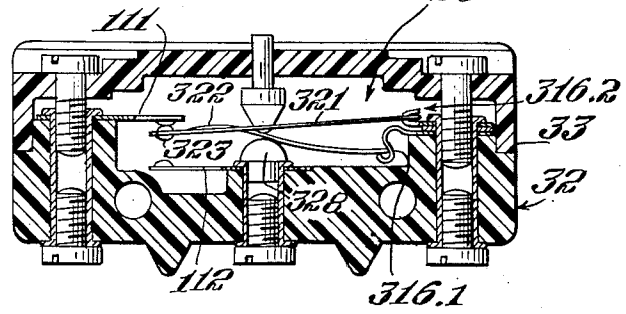


Fig. 20

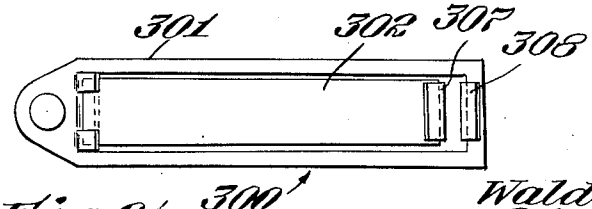


Fig. 21

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United States Patent Office 2,825,778 Patented Mar. 4, 1958

2,825,778

SWITCH ASSEMBLY

Waldo J. Kelleigh, Wayland, Mass., assignor, by mesne assignments, to Electrical Apparatus Company, Inc., Boston, Mass., a corporation of Massachusetts

Application July 3, 1953, Serial No. 365,855

22 Claims. (Cl. 200—67)

This invention relates to switch assemblies of the type carrying a small spring switch within a housing that is provided with an actuating device for the switch and can be conveniently mounted on a supporting structure.

It is one of the principal objects of the invention to provide switching apparatus of the above type, suited for use in a variety of applications requiring compact, light weight and durable construction.

Another object is to provide within a housing of versatile construction a direct acting switch without inherent characteristics of bounce, which has no mechanical lost motion causing an uncontrollably variable time delay as in conventional snap switches, the same housing being however fully practical to accommodate switches of the snap action type.

Further objects are to provide a switch assembly which permits mounting in a variety of ways making it particularly adaptable for many applications and combinations with other apparatus, which permits a variety of good electrical connections which may or may not be used as supports, and which will accommodate either a direct acting slow spring switch or, without alteration or adaptation, a switch of the snap action type. The first mentioned type of switch assembly can be with safety applied to apparatus where precision of electric timing is required and where it is important to insure contact transfer with maximum spring pressure up to the actual make or break. If the assembly is used to accommodate a snap action switch, either snap action of the spring return type or of the reset type can be provided without modification of the housing, the spring blades and actuating elements being in either case rigidly secured to the housing in a manner providing reduction in electrical resistance while providing great mechanical strength and a prolonged life.

The same housing and stationary switch contact springs can be used in either case, with the consequent saving in manufacture, manipulation and installation.

Still further objects are to provide a switch assembly which can be easily mounted on panels or frames or joined to companion switches, and has exceptionally well spaced and accessible terminals which, if desired, can be used as mounting supports.

An electric switch assembly according to the invention comprises an elongated base formed of insulating material, a cover of insulating material fitting the base and defining with the base an enclosed cavity, holes extending through the base and the cover respectively, at each end and intermediate thereof, three internally threaded hollow rivets, one in each of the holes of the base, switch contact members fastened to the base within the cavity by means of the rivets, and screws extending through the end holes of the cover to engage the internal threads of the rivets in the corresponding holes of the base, for fastening the cover to the base.

In another aspect of the invention, the switch assembly comprises a movable switch contact member (either of the slow action type or a composite snap action contact

member) fastened to or with one rivet in one of the end holes of the base, and essentially stationary contact leaves or springs fastened to or with the other rivets, on either side of the movable member.

In a further aspect, the internally threaded hollow rivets receive metal or insulating screws joining base and cover, for mounting the assembly, for fastening terminal devices, and for receiving movable parts such as actuators.

Other objects and aspects of novelty will appear in addition to those contained in the above summary of the invention indicating its nature and substance including some of its objects from the herein presented outline of its mode of operation and practical possibilities together with a description of several typical embodiments illustrating its novel characteristics. These refer to drawings in which

Fig. 1 is the plan view of a switch assembly according to the invention;

Fig. 2 is a cross section, partly along 2—2 of Fig. 3;

Fig. 3 is a cross section on 3—3 of Fig. 1;

Fig. 4 is a plan view of the base with the switch according to Fig. 3;

Fig. 5 is a plan view of the inside of the cover according to Figs. 1 to 3;

Fig. 6 is a plan view similar to Fig. 4 without the switch;

Fig. 7 is a bottom view of the base according to Fig. 1 to 4 and 6;

Fig. 8 is a section on 8—8 of Fig. 6;

Fig. 9 is a section on 9—9 of Fig. 6;

Fig. 10 is a front elevation of the base according to Figs. 1 to 9;

Fig. 11 is an axial section through a hollow rivet such as shown in Fig. 3;

Fig. 12 is the bottom view, similar to Fig. 7, of the base, with mounting terminals;

Fig. 13 is a side elevation, partly in section on lines 3—3 of Fig. 1, through a switch assembly mounted with studs on a panel;

Fig. 14 is an elevation and section similar to Fig. 13, of a switch assembly mounted with the aid of auxiliary holes of the base;

Fig. 15 is a section on 3—3 of Fig. 1 through the cover and part of the base, similar to Fig. 3, showing in addition an actuator spring;

Fig. 16 is a section on 3—3 of Fig. 1 through part of the cover and through an actuator mount;

Fig. 17 is a section on 3—3 of Fig. 1, similar to Fig. 3, but containing a reset type snap action switch in one position;

Fig. 18 is a section similar to Fig. 17 but with the switch in the other position;

Fig. 19 is a section similar to Figs. 17 and 18 but containing a snap action switch of the spring return type in intermediate position;

Fig. 20 is a section similar to Fig. 19 but with the switch in normal position; and

Fig. 21 is a plan view of a snap spring element of the type shown in Figs. 17 to 20.

In Figs. 1 to 10, the switch assembly **30** is shown as having an essentially parallelepipedal housing **31** made of moldable insulating material, with a bottom part or base **32** and a top part or cover **33**.

The outer surface of the bottom part **32** is essentially smooth with the exception of two ribs or barriers **35**, **36** (Figs. 3, 7) on the outside of the bottom wall. The inside of the bottom part has four levels relatively to the circumferential rim **40** which fits the corresponding rim **80** of the top part **33**. The highest and next to highest levels are formed by the extensions **41** and **42** which are higher than **40** (Figs. 3 and 9), and the two lower levels

are formed by surfaces 43 and 45. At a level intermediate 43 and 45 is provided a three sided recess 44 (Figs. 6 and 8) in surface 43. The extensions 42 and 41 have comparatively low lips or edge ridges 51, 52, 53, 54 which are especially well shown in Figs. 6, 9 and 10.

The bottom part or base 32 has three transverse perforations 61, 62, 63 (Figs. 6, 7) and two lateral perforations 65, 66 (Fig. 3). The bottom surface of the base 32 is provided with shallow lateral recesses 71, 72 at the opening of each hole 61, 62, 63, as clearly indicated in Figs. 2 and 7 to 9. These have the purpose of receiving the ears or lugs 153, 154 of the rivets in order to lock them as will be described hereinbelow with reference to Fig. 11.

The top part or cover 33 of the housing 31 has a groove 81 (Figs. 1, 2, 3) running the entire length of its upper surface, and on the inside (Fig. 5) it has two ledges defining three symmetrical levels indicated at 85; 86, 87; 88, 89. The top portion 33 has two transverse holes 91, 92 (Figs. 3, 5) corresponding to and having the same diameter as holes 61 and 62 (Figs. 6, 7) of the bottom part 32. If it is desired to make the cover especially strong, ledges 86 and 87 can be merged into a single surface, in which case only two levels, namely 88—89 and 86—87 will be present.

The top part 33 has also a center hole 93 (Figs. 3, 5) for the shank of an operator 181 to be described hereinbelow and two smaller holes 95 and 96, for auxiliary rivets or screws. At the upper surface of the top or cover part, within the groove 81, is a boss 101 surrounding hole 93, and two counter bores 102 and 103 for holes 91 and 92. Slots 105 lead outwardly from the level of the counterbores, and more shallow recesses 106 opening into counter bore 102, surround holes 95 and 96, as shown in Figs. 1 to 3.

The level 43 of the base 32 has a circular recess 121 (Fig. 6) which can be used to receive an assistance spring to be discussed hereinbelow.

In the embodiment shown in Figs. 3 and 4, the switch assembly contains a slow acting limit switch with two fixed contact springs 111, 112 and a movable contact spring 114. The springs 111, 114 are comparatively wide and fill the above mentioned recesses between lips 51, 52 and 53 and 54 respectively whereas spring 112 of similar width, fits the shallow recess 44 (Figs. 4 and 6).

The switch is assembled by means of special rivets 150 according to Figs. 3 and 11. Prior to assembly, such a rivet has a tubular shank 151, a flange 152, and two lugs 153 and 154 which fit recesses 71, 72 (Fig. 7). It is countersunk at 155 and 156 and has an inside thread 157. Upon assembly, the end 159 is spun or otherwise expanded over the housing surface which is opposite the flange or head 152, as for example indicated at 160 of Figs. 3 and 4.

A secondary switch spring, also called anvil, marked 115 in Figs. 4 and 15, can be inserted below spring 114. It was found that such an anvil essentially prolongs the life of the switch spring proper 114, releasing the stress on its root near the rivet head 160. The anvil also assists in returning switch spring 114 into normal position. This function is similar to that of spring 185 and either spring or both can be used.

Various screws, bolts or other threaded fastening members can be used for assembling the switch or for fastening it to other construction components. As indicated in Fig. 3, screws 161 and 162 can be used to fasten the top part 32 to the bottom part 32. If desired, they can be used for holding terminal strips 165, 166. Screws 171 and 172 can be used for fastening terminal lugs or strips 173, 174, 175 to the base portion 32 (Figs. 3 and 12). In either case, the hollow rivets establish electric connections between the switch contacts and the terminals. If only the base terminals 173, 174, 175 are used, insulating such as nylon screws are used at 161, 162 or

171, 172, providing a fully insulated cover. This possibility is also indicated at 242 of Fig. 15.

Other uses of the hollow rivets will be described hereinbelow.

An actuator of suitable shape, indicated at 181 of Fig. 3 can be inserted in the perforation 93 of top part 33. This actuator can have a narrow portion fitting the hole 93, and a wider portion 183 with a round tip that normally rests on movable contact spring 114.

To operate a switch of this type, actuator 181 is depressed manually or by means of auxiliary gear such as will be described hereinbelow. Contact 114 is thus transferred from spring 111 to spring 112. Upon release of the actuator, contact is reestablished between 111 and 114. If single throw action is sufficient, one of the stationary contact springs 111 or 112 is omitted, in which case the assist springs mentioned below can be advantageously used.

A spring 185 can be lodged in recess 121 (Figs. 3 and 6), and a spring 186 can be similarly inserted into the inside opening of the rivet in hole 62. Spring 185, upon actuator 181 being depressed, changes the leverage of contact spring 114 during operation, thus providing excellent wiping contact with the well known advantages. Spring 186, insulated from its rivet by a button 187 if desired, can serve as an assist spring for contact blade 114, helping to push the head 183 towards the cover 33, when the actuator 181 is in normal, non-depressed condition thus holding it in that position.

In addition to receiving mounting or assembling screws or to holding components such as spring 186 or nylon button 321 of the embodiment according to Figs. 19 and 20, the hollow rivets can serve as guides for movable elements such as actuator 312 of the embodiment according to Figs. 17 and 18.

The spring 186 or an element similar to the button 321 of Figs. 18 to 20 with or without rivet, can serve as a stop for switch blade 114, if blade 112 is omitted for purposes of single throw switching.

It will be noted that the switch contact springs 111, 112 are identical in shape, in the embodiment according to Figs. 3 and 4 as well as in those according to Figs. 17 to 20; this results in considerable savings in tools and assembly work.

The auxiliary transverse holes 106 (Fig. 3) and the lateral holes 65 to 66 (Fig. 3) serve various purposes, some of which will be described with reference to Figs. 12 to 16.

It will be understood that the hollow internally threaded rivets can be combined with screws, contact elements and terminal members of various types, in various positions, especially the use of insulating screws provides wide adaptability without any structural change, merely by using different standard screw components.

Figs. 12 to 16 illustrate the adaptability and versatility of the switch assembly according to the present invention.

Fig. 12 indicates a manner in which the switch assembly 30 can be mounted on an insulated panel 200, by means of supporting terminal strips 201, 202, 203 which are fastened to the switch housing by means of screws 205 engaging the threaded hollow rivets such as 61, 62 and 63 of Fig. 3. The supporting terminals can be fastened to the panel 200 or other supports by means of terminal screws 206 or smaller fastening screws 207.

Fig. 13 shows another way of fastening a switch assembly of the present type to an insulated panel or other support 220. In this case, the screws 161, 162 of Fig. 3 are replaced by a stud 221 with two nuts 225, 226. The element 220 can be strip-shaped, fitting the groove 81 of the top moulding 33, as indicated in Fig. 13. Needless to say, it may also be a panel in which case it will rest on the two elevated rims on either side of groove 81. The nut 226 serves to fasten a terminal strip to the top part of the housing, connecting this terminal strip to the

fixed switch spring **111**. The stud **202** serves the same purpose with regard to movable contact spring **114**. The terminal for the second, fixed, contact spring **112**, may be similar to that shown at **175** of Fig. 3, and indicated with the same numeral in Fig. 13,

Fig. 14 shows the possibility of fastening a switch assembly **30** to a recessed supporting member such as indicated at **231** and **232**, leaving sufficient operating space for the protruding part **182** of actuator **181**. In this instance, bolts through the small holes **95** and **96** indicated in Fig. 5 are utilized to fasten the top part of the housing to supporting members **231** and **232**. The lateral holes **65** and **66** shown in Figs. 3 and 6 can be used in similar manner, for joining or mounting several switch assemblies by means of screws or studs through these holes of several switches or through holes or slots of suitable mounting members.

Fig. 15 illustrates the mounting of an actuator spring **241** on the top part **33** of the switch assembly **30**, by means of a screw **242** corresponding to screw **161** of Fig. 3. The spring **241** fits the groove **81** (Fig. 1) of the top part and normally touches the protruding portion **182** of the actuator **181**. If a contact **111** is used as indicated in Fig. 15, the screw **242** is preferably made of insulating material such as nylon, although spring **241** is not in electrical contact with any switch member. The spring **241** can be provided with a bearing bracket **245** carrying an oilite roller **246**. Suitable actuating equipment such as for example incorporating a cam (not shown) contacting the roller **246** can be mounted on or adjacent to the switch assembly. In that case, the spring **241** can be mounted on the top part **33** by means of the auxiliary holes **95** or **96**, and an actuator frame or base on the top part of the switch assembly by means of screws **161** and **162**.

Fig. 16 shows another type of actuator mechanism comprising a base strip **251** with two side flanges **252** and **253** with holes **254**, **255**, the strip corresponding to groove **81** of top **33**. The two holes **254** and **255** are aligned with holes **91** and **92** of top **33**, and screws **161** and **162** are again used for fastening this actuator mechanism to the switch assembly. As indicated in Fig. 16, an actuator pin **261** can be guided in a nipple **262** and a hole **263** of the actuator. By means of a flange **265** and a spring **266**, the actuator pin carries an oilite roller **268**, similar to part **246** of Fig. 15. The extension **182** of actuator **181** of the switch assembly reaches into hole **263** and is depressed by the normally raised actuator pin **261** when roller **268** is in contact with a transmission link, such as cam or the armature of a solenoid.

Figs. 17 to 20 indicate the possibility of using the switch assembly according to the invention with a snap-action switch instead of the slow acting switch described above with reference to Figs. 3 and 4.

Referring first to Figs. 17 and 18, a reset snap-action switch of the type described and claimed in co-pending application Serial No. 558,227 of January 10, 1956, is mounted within the housing **32**, **33** by means of rivets **61**, **62** and **63** which correspond exactly to the similarly numbered elements of Fig. 3. The movable contact element **300** of this snap switch consists of a frame member **301** and a spring member **302** as shown in Fig. 21. Spring and frame are pivoted on two compensating pivot springs **305** and **306** with hooks or sockets **307**, **308** respectively, mounted on a bracket **309**. The stationary contact springs **111** and **112** correspond to those similarly designated in Fig. 3, and are again fastened between the housing and flanges of their rivets **61** and **62**. Two actuators **311** and **312** are provided, each having a push-button portion **314** and **315** respectively. The snap switch operating points **317** and **318**, accommodated within frame **301**, contact the bent spring member **302** in one or the other position as shown in Figs. 17 and 18 respectively. With the snap-switch in the position of Fig. 17, if the actuator **311** is depressed the spring **302** will be bent downwardly and the frame snaps upwardly just as soon as the spring bow passes the pivot line defined by the pivot points of hooks **307** and **308**. The spring switch thus snaps into the position shown in Fig. 18, and actuator point **318** rests on the downwardly bent spring member **302**. For returning the switch into the previous position, button **312** is pressed and the spring snaps back into the position of Fig. 17.

Figs. 20 and 21 show a spring return snap-action switch incorporated in the switch assembly according to Figs. 1 to 10, replacing the slow action switch shown in Figs. 3 and 4. This embodiment is similar to that shown in Figs. 17 and 19, with the exceptions that a somewhat different spring pivot construction is used and that the actuator **312** is replaced by a resilient stop member such as button **328**. The pivot members **316.1**, **316.2** are in this instance directly fastened to rivet **63**. The snap switch unit proper **320** has a spring **322** which is fixed to the frame **321** at the contact end **323**, as shown in Figs. 19 and 20. When the actuator **311** is pressed with the switch in the position of Fig. 19, the spring **322** bending downwardly as shown in Fig. 20 contacts the button **328** which snaps it immediately back into the initial position. Release of button **311** restores the assembly into the position of Fig. 19. Thus one actuating operation of push-button **311** causes a momentary contact transfer from **111** to **112**, returning the snap element into normal contact with stationary contact **111**.

The pivot members **305**, **306**, **316.1**, **316.2** of Figs. 17 to 21 have the purpose of compensating for the elongation of the spring member **302** or **322** during the snap action. They also provide good wiping contact, with the wiping movement of the frame **301** or **321** and hence of the movable contact points being at right angles to the contact movement and therefore in the most favorable direction. This arrangement has kinematic characteristics which are beneficial in a switch of this type, and it also permits easy assembly in the present housing of general usefulness. It will also be noted that the operating force is in the contact making direction so that the contact pressure is upon operation momentarily increased before contact is broken by the snap movement.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. An electric switch assembly comprising an elongated base formed of insulating material, a cover of insulating material fitting said base and defining with the base an enclosed cavity, holes extending in alignment through the base and the cover respectively, at each end and intermediate thereof, three internally threaded hollow rivets, one in each of said holes of said base, switch contact members fastened to said base within said cavity by the head means of respective rivets, and screws extending through said holes at said ends of the cover to engage the internal threads of the rivets in the corresponding holes of the base, for fastening the cover to the base.

2. Switch assembly according to claim 1 wherein a movable switch contact member is fastened to the rivet in one of said end holes of the base and an essentially stationary switch contact member is fastened to the rivet in one of the other holes of the base.

3. Switch assembly according to claim 1 wherein a movable switch contact member is fastened to the rivet in one of said holes at said ends of the base and two essentially stationary switch contact members are fastened to the rivets in the two other holes on either side of said movable member which contacts one or the other of said stationary members.

4. Switch assembly according to claim 3 wherein said movable contact member is a spring one end of which is fastened to said rivet in one of said holes at said ends,

whereas the other end can be moved between said stationary contact members.

5. Switch assembly according to claim 3 wherein said movable contact member is a snap switch element which includes an essentially rigid frame member extending from said end hole into the space between said stationary contact members, and a snap spring member for propelling said frame member between said stationary contact members.

6. Switch assembly according to claim 5 wherein said frame member is pivoted on one end of a compensating spring whose other end is fastened to said rivet in said end hole.

7. Switch assembly according to claim 5 wherein said snap spring member is pivoted on one end of a compensation spring whose other end is fastened to said rivet in said end hole.

8. Switch assembly according to claim 5 further comprising two actuator members extending through respective ones of said intermediate holes of cover and base, said snap spring member extending between the two actuator members, whereby deflection of the snap spring member by one of the actuator members propels it towards the other actuator member.

9. Switch assembly according to claim 5 further comprising an actuator member extending through one of said intermediate holes and a resilient stop member fastened to the other hole, said snap spring member extending between the actuator member and the stop member, whereby deflection of the snap spring member by the actuator member propels it towards the stop member which propels it back towards the actuator member.

10. Switch assembly according to claim 1 wherein a switch actuator extends through one of said intermediate holes.

11. Switch assembly according to claim 1 wherein a switch actuator extends through said intermediate hole of the cover, and a second actuator extends through the hollow rivet in said intermediate hole of the base.

12. Switch assembly according to claim 1, wherein said base has within said cavity three essentially parallel surfaces at three different levels, the lowest and highest levels at said intermediate hole and one of said end holes respectively, for supporting with the head means of respective rivets two switch contact members, and the intermediate level at the other end hole for supporting with the head means of a rivet a switch contact member extending between the stationary contact members.

13. Switch assembly according to claim 1 further comprising terminal means held between the outside of said base and the head of at least one of said rivets.

14. Switch assembly according to claim 1 further comprising terminal means and a screw for holding the terminal means between its head and the head of one of said internally threaded rivets.

15. Switch assembly according to claim 1 further comprising terminal strip means held between said cover and one of said screws.

16. Switch assembly according to claim 1 wherein said screws are studs screwed into said hollow rivets, and further comprising nuts for fastening said cover to said base, the studs extending beyond the cover for mounting purposes.

17. Switch assembly according to claim 1 wherein said screws are made of insulating material whereby said cover is insulated from said base.

18. Switch assembly according to claim 1 wherein said base has on the outside recesses extending from said holes, and said hollow rivets have lugs fitting said recesses.

19. Switch assembly according to claim 1, wherein said cover has a longitudinal groove containing the outside openings of said holes, for aligning accessories fitting said groove and mounted with screws through said holes.

20. An electrical switch comprising an elongated base formed of insulating material and having a cover defining with the base an enclosed cavity, three spaced hollow internally threaded rivets extending from said cavity through said base to the outer surface thereof, two stationary contact carrying members fastened within the cavity to the base by the head means of the center rivet and one of the end rivets respectively, a movable contact carrying member fastened within the cavity to the base by the head means of other end rivet, screws engaging each of said end rivets for fastening said cover to said base, and an actuator mounted in said cover for operating said movable contact carrying member.

21. Switch according to claim 20 wherein two screws are of nonconducting material and extend through said cover to engage respectively the internal threads of each end to fasten the cover to the base, and three of said fastening screws are terminal screws each of which engages the internal threads of a respective rivet at said outer surface of the base for connecting the switch to an external circuit.

22. An electric switch assembly comprising an elongated base formed of insulating material, a cover of insulating material fitting said base and defining with the base an enclosed cavity having three internal surfaces on different levels at each end and intermediate thereof, holes extending in alignment through the base and the cover respectively, each through a different level, three internally threaded hollow rivets, one in each of said holes of said base, two essentially stationary switch contact members fastened to said base within said cavity between the head of a rivet and said surfaces at the higher and lower levels, a movable switch contact member fastened to said base within said cavity between the head of the third rivet and said surface at the intermediate level, and screws extending through said end holes of the cover to engage the internal threads of the rivets in the corresponding holes of the base, for fastening the cover to the base.

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