May 8, 1962 R. E. SCHWERKE 3,033,953

MINIATURE SNAP SWITCH

Filed June 13, 1960

FIG. 1.

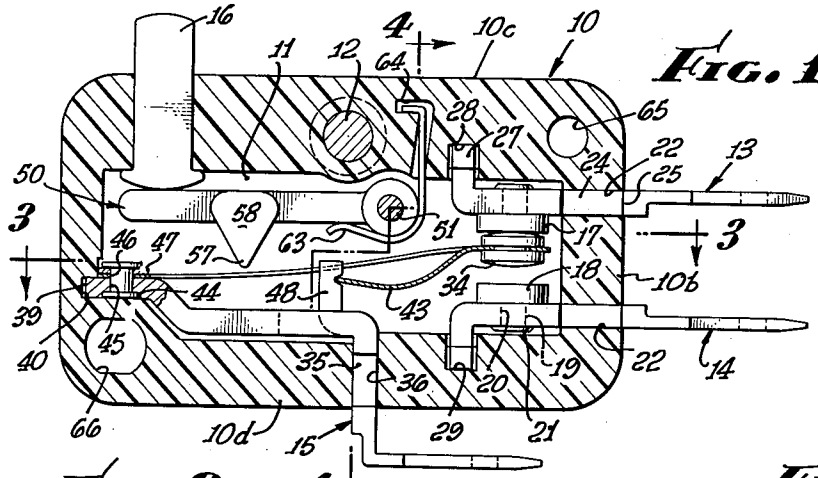


FIG. 2.

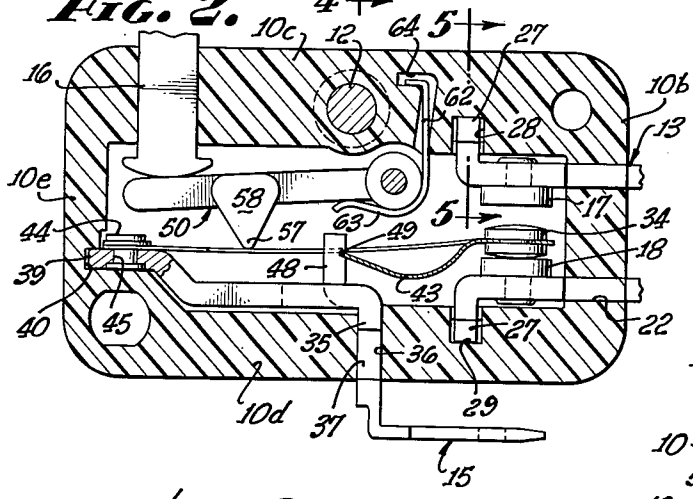


FIG. 3.

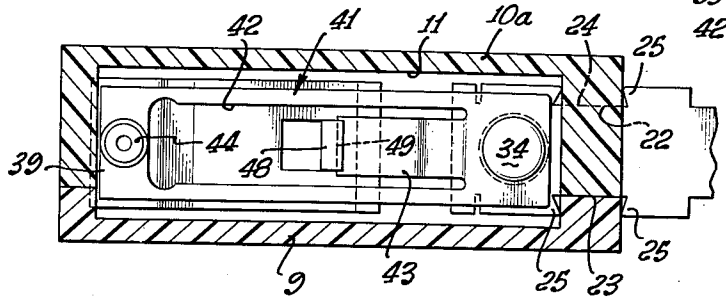


FIG. 5.

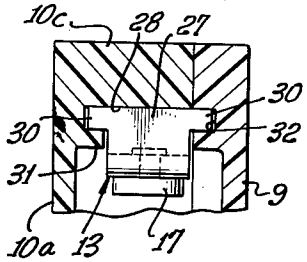
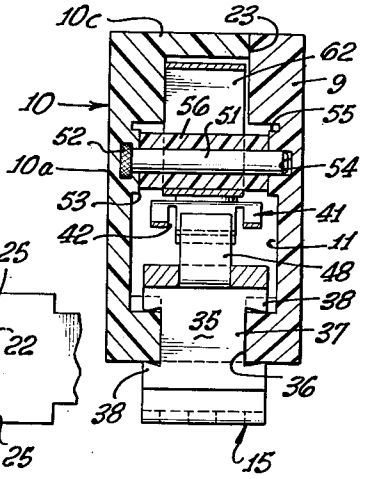


FIG. 4.



INVENTOR.

ROBERT E. SCHWERKE

BY

Flam and Flam

ATTORNEYS.

United States Patent Office 3,033,953 Patented May 8, 1962

3,033,953

MINIATURE SNAP SWITCH

Robert E. Schwerke, Wauwatosa, Wis., assignor to General Controls Co., Glendale, Calif., a corporation of California

Filed June 13, 1960, Ser. No. 35,562
4 Claims. (Cl. 200—67)

This invention relates to a miniature snap switch.

The primary object of this invention is to provide an improved, reliable and simple snap switch of the type utilizing the resilient characteristics of a contact carrying arm for moving the switch to one of two contacting positions.

Prior switch structures of this general character have certain objectionable features. For example, rather complex contact arm structures may be provided, or suspensions for the contact arm may be complex, or the actuating structure may be intricate. One prior art structure utilizes a floating contact arm in which a bowed section is engaged at a stationary fulcrum bracket, and in which the end of the contact arm remote from the contact is movably mounted so as to pass in over center relationship to the fulcrum, thereby achieving snap action. The floating anchor necessitates a complex structure. Thus, since the structure is floating, it must be stabilized against all movement but the desired movement. Since the structure is floating, heat dissipation from the contact to the case is poor. Electrical connection to the contact arm depends upon frictional engagement at knife edges.

Accordingly, the primary object of this invention is to provide a snap switch having a fixed anchor. The shape of the spring arm is itself simplified. It need have no reinforcing or stabilizing flanges. It can be entirely flat. Since the contact arm has a fixed anchor, heat dissipation is much improved. The electrical connection is secure.

Another object of this invention is to provide a snap switch that uniquely utilizes not only the resilient characteristics of an integral spring tab of the contact arm, but also the resilient characteristics of the arm itself in order to achieve a snap acting switch that is normally maintained in one position.

Another object of this invention is to provide an improved snap switch of this general character in which actuating means positively forces the contact away from its normal contacting position. Accordingly, welding or fusing of the contact at the normal position is prevented. In the floating anchor type of prior art devices, the arm first moves about the contact as a pivot point until the over center relationship is achieved. The mere over center relationship will not be enough to move the contact if there is a slight adherence.

Another object of this invention is to make use of a force multiplying pivoted beam having a portion engaging the contact arm at a place spaced from its anchored end. All of the force of the actuating means is used to move the contact.

Another object of this invention is to provide a switch structure of this character that incorporates simple means for changing or controlling the force necessary to move the contact from its normal position to its opposite contacting position. For this purpose, use is made of a simple readily replaceable spring that engages the beam and biases the beam toward released position. The spring may even be removed, if desired, without changing the operation of the switch, except as to force necessary to actuate it.

Another object of this invention is to provide a simple switch in which the fulcrum brackets and other parts are readily and easily assembled with respect to a case and its cover.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose, there is shown a form in the drawings accompanying and forming a part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is an enlarged sectional view of a snap switch structure incorporating the present invention, and showing the parts in assembled relationship;

FIG. 2 is a view similar to FIG. 1, but showing the snap switch in its opposite contacting position;

FIGS. 3 and 4 are sectional views taken along planes indicated by lines 3—3 and 4—4 of FIG. 1; and

FIG. 5 is a sectional view taken along a plane indicated by line 5—5 of FIG. 2.

In FIG. 1 there is illustrated a generally rectangular case 10 having a central shallow generally rectangular cavity 11 in which switch parts are accommodated. The case 10 preferably is molded plastic that has suitable electrical insulation characteristics. The cavity 11 is closed by a cover 9 made of similar material (FIG. 3) that complements the case 10 to form the switch body. A rivet 12 located beyond the cavity 11 holds the case 10 and cover 9 together.

Projecting exteriorly from the case 10 are three elongated brackets or strips 13, 14 and 15 forming accessible terminals of the switch structure. Also projecting exteriorly of the case 10 is a plunger 16 that actuates the switch. The terminal bracket 15 is normally in closed circuit relationship with respect to the terminal bracket 13 and in normally open circuit relationship with respect to the terminal bracket 14. The opposite electrical relationships are the result of inward movement of the plunger 16.

The brackets 13 and 14 are identically formed, and are disposed symmetrically about a median plane extending along the long dimension of the case, or horizontally as viewed in FIG. 1. One of the brackets 13 occupies the upper right hand corner of the cavity 11, and the other of the brackets 14 occupies the lower right hand corner of the cavity. These bracket portions within the cavity respectively mount identical contacts 17 and 18 in spaced opposed relationship.

Each contact has a stem 19 that passes through an aperture 20 in the corresponding bracket. The end of the stem 19 is riveted over, as at 21, to secure it it firmly.

The brackets 13 and 14 are held in place relative to the housing by virtue of a fitted relationship to the case 10 and the cover 9. The central portion of each bracket fits into a corresponding slot or recess 22. The recesses 22 extend through the right hand wall 10*b* of the casing 10, form the case surface 23 abutted by the cover 9 (FIG. 3) to a place short of the bottom or inner wall 10*a* of the case. The brackets each have a necked down portion 24 forming shoulders 25 whereby the brackets interfit the case 10 and cover 9. Thus the bracket 14, for example slidably enters the corresponding case recess 22 by transverse movement via the opening at the case surface 22. The shoulders 25 at the inner side of the bracket 14 (FIG. 4) engage the case wall 10*b* beyond the bottom of the recess 22 and adjacent the inner case wall 10*a*. An interlock is thus formed. The shoulders 25 at the outer or upper side of the bracket 14 form a recess receiving a peripheral rim 26 of the cover 9. The bracket 13 similarly cooperates with the case 10 and cover 9.

The brackets 13 and 14 also have outwardly turned ends 27 that fit grooves 28 and 29, respectively at the upper and lower walls, 10*c* and 10*d*, of the body 10. Each of the bracket ends 27, as illustrated in FIG. 5, are relieved on opposite sides to form pins 30 at the very terminus of the end 27. A projection 31 formed in the body at the inner end of the groove 28 retains the corresponding pin 30 so that the bracket is confined against all but sliding movement relative to the groove 28. A recess 32 formed in the cover 9 receives the opposite pin and completes the confinement of the bracket terminus.

A contact button 34, connected to the terminal bracket 15, in a manner to be hereinafter described, is movable between the contacts 17 and 18 in order to accomplish the switching functions. The bracket 15 has an intermediate offset portion 35 accommodated in a groove 36 in the lower wall of the case 10. The offset portion 35 is necked down, as at 37 (FIG. 4), so that shoulders 38 interlock the case 10 and the rim 26 of the cover 9 as the contact brackets 13 and 14 do.

The inner portion of the bracket 15 beyond the offset 35 projects toward the lower left hand corner of the case recess 11. The inner terminus 39 of the bracket 35 fits a groove 40 formed in the left hand wall 10*e* of the case 10. A companion groove (not shown) of the cover 9 receives the outwardly projecting corner of the bracket terminus 39. The contact bracket 35 is accordingly held in position.

The contact button 34 is mounted upon the end of an arm 41 made of thin beryllium copper or other resilient flexible material having electrical conductive properties. The arm 41 is generally of rectangular outline, as shown in FIG. 3. The center of the spring arm 41 has a cutout 42 that is rectangular except for a cantilever tab 43 located at the end adjacent the contact button 34. The other end of the arm 41 is riveted to the terminus 39 of the terminal bracket 35. For this purpose, a rivet 44 is provided that passes through registering apertures 45 and 46 of the bracket 15 and the spring arm 41. A protective washer 47 is interposed between the spring arm 41 and the corresponding head of the rivet 44. Electrical connection between the button 34 and the bracket 15 is thus established.

Struck upwardly from the contact bracket 35 (see also FIG. 4) is a fulcrum bar 48. The fulcrum bar 48 provides a V-notch 49 that opens toward the tab 43 and the contact button 34. It receives the free end of the tab 43, and is so placed that the tab is substantially bowed whatever may be the position of the arm 41. As shown in FIGS. 3 and 4 the fulcrum bar 48 is of a width small enough to provide clearance with respect to the edges of the arm aperture 41.

The bowed cantilever tab, being of resilient material resists increased bowing, and thus tends to move the contact button 43 as far away from the fulcrum notch 49 as possible, and in either convenient direction from a position a maximum stress or minimum distance.

In the position shown in FIG. 1 the contact button 34 is urged by the action of the spring tab 43 into engagement with the contact 17. The contact 34 in this position is spaced from the position of minimum distance or maximum stress because a straight line forming the anchored end of the arm 41, about which the arm 41 is angularly movable, and passing through the fulcrum notch 49 passes substantially beneath the contact 17. The anchored end of the arm 41 is thus carefully located.

By flexing the arm 41 downwardly, the spring tab 43 can be increasingly flexed until the combined stress in the spring tab 43 and the arm 41 itself is at a maximum. Thereupon, the arm 41 will move to the opposite contact position with snap action derived from the energy stored in the arm 41 and the tab 43. This position of maximum combined stress may be reached when the arm 41 itself bows to a point where it is aligned with the fulcrum notch 49.

In order to flex the arm 41 and thus to move the contact button 34 from the normal position illustrated in FIG. 1, a beam 50 is provided that is preferably molded of plastic material. The beam 50 is pivoted on a pin 51 (FIG. 4) in the case cavity 11 that projects outwardly from the bottom wall 10*a* of the case 10 from a place just below the center of the upper wall 10*c* of the case 10. The pin 51 has a knurled head 52 embedded and thereby anchored in the bottom wall 10*a* of the case 10. A raised circular land 53 surrounding the pin 51 is formed on the inner side of the case bottom wall 10*a*. The outer end of the pin 51 is received in a recess 54 formed in the cover 9. This recess 54 extends inwardly from a raised circular land 55 formed on the inside of the cover 9. The beam 50 has an apertured hub 56 that is journalled upon the pin 51.

The dimension of the hub 56 corresponds to the distance between the lands 53 and 55. Hence, the lands hold the beam 50 suitably in centered relationship in the cavity formed between the case and cover.

The beam extends from the pin 51 along the upper left corner of the case cavity 11. Intermediate the length of the beam 50, a depending projection 58 is integrally formed that has a relatively sharp knife-edge surface 57 engageable with the sides of the spring arm 41 on opposite sides of the cutout 42 and behind the fulcrum bar 48.

As the beam 50 is moved angularly downwardly about the pin 51 as an axis, the arm 41 is caused to flex or bow until the arm 41 snaps to the opposite contacting position as above described.

The plunger 16 is used to operate the beam 50. For this purpose, the plunger 16 which may also be molded of plastic material, is guidingly accommodated in a through aperture 60 in the top wall 10*c* of the body. The lower end of the plunger 16 has a head 61 engageable with the free end of the beam 50. By virtue of the relative placement of the plunger 16 and the edge 57, the force applied to the plunger 16 is multiplied as it is ultimately applied to the arm 41. All of the force is thus effectively and directly used in moving the contact button 34 away from the contact 19. Hence, any tendency for the contacts to stick is directly overcome.

When the arm 41 flexes prior to snap movement away from the contacting position of FIG. 1, it assumes a slightly arced or bowed configuration. This means a shortening of the length of the arm 41, and hence a desirable wiping action between the contact button 34 and the contact 17. To produce wiping action at the opposite contact 18, the end of the arm may be bent downwardly so that upon engagement of the button with the contact 18, the end tends to straighten out.

When the force applied to the plunger 16 is released, the induced flexure of the spring arm 41 is removed and it passes upwardly of the fulcrum point 49. At that point, the bowed tab 43 dominates, so that it, with the residual force or stress of the arm 41, returns the arm 41 to the position illustrated in FIG. 1. When the arm 41 is itself unflexed, there is one and only one stable contacting position, and as illustrated in FIG. 1. The reason for this is that the parts are so located that mere movement of the contact button 34 to the contacting position of FIG. 2 will not carry the arm 41 beyond center with respect to the V-notch 49. The arm 41 must be flexed before this occurs. Hence, the switch normally returns to a distinct position.

The force necessary critically to move the switch is dependent upon the spring characteristics of the arm 41 and the tab 43. In order to introduce an additional bias force that must be overcome before the switch is critically moved, a C-spring 62 is provided. The spring 62 has a central curved part at 63 that embraces the hub portion 56 of the beam 50. One end of the C-spring 62 engages beneath the beam 50, and the opposite end is anchored in an inverted L-shaped groove 64 to which configuration

the C-spring generally conforms. Accordingly, the C-spring biases the beam 50 in a direction away from engagement with the contact arm 41.

The C-spring 62 can be omitted or replaced by another of slightly different spring characteristics. Accordingly, various specifications as to bias forces can readily be met. Holes 65 and 66 at opposite corners of the case serve as a means whereby the switch may be connected to a support or an external actuating arm (not shown).

The inventor claims:

1. In a snap switch. a supporting case having a cavity; an arm in the case cavity made of flexible resilient material, and having a contact at one end; means anchoring the other end of the arm to the case; said arm having an integrally formed spring tab having an unattached end extending generally toward the anchored end of the arm; means connected to the case forming a fulcrum receiving the end of said spring tab; abutment means on opposite sides of said contact and defining opposite limits of movement therefor; at least one of said abutment means being a contact; the arm being so located that when acted upon only by the stress of said spring tab, it exclusively engages one of said abutment means; and releasable means for flexing the arm until the combined stress in the arm and said spring tab moves the arm with snap action toward said other abutment means, comprising a beam pivoted at one end in the cavity and having a part located on the same side of the arm as said one abutment means, said part being opposed to an intermediate portion of said arm, said beam being movable so as to cause the part to engage the arm to flex the arm away from said one abutment means and toward the other abutment means, an actuator guided by the case having one end opposite the beam on the side thereof remote from said arm for engagement therewith at a place spaced from its pivoted end, said actuator having its other end projecting exteriorly of the case for access thereto, said case having provisions for limiting outward movement of said actuator, and biasing means urging the beam against the said one end of said actuator whereby the said actuator forms a stop for movement of the beam in a direction away from said arm.

2. The combination as set forth in claim 1 in which said beam part is located between the plunger and the pivoted end of the beam to provide a force multiplication.

3. The combination as set forth in claim 1 in which said beam biasing means comprises a replaceable spring extending about said one end of said beam and having one end engaging the beam to position it in spaced relationship with respect to said arm, and having its other end confined by a slot in the case.

4. In a miniature snap switch: a case having a cavity therein; a cover for the case; a pair of contact brackets

fitting the case, and each projecting in spaced relationship through one wall of the case into the cavity; opposed contacts mounted on the inner ends of the contact brackets; a third bracket fitting the case and having an inner end located to one side of the opposed contacts; a spring arm anchored to the inner end of said third bracket, and projecting between the opposed contacts; a contact button mounted on the arm for engagement with said contacts upon opposite movement of said arm; said arm having a central cutout portion forming a spring tab extending in a direction toward the anchored end of said arm; said third bracket having an integrally formed fulcrum bar providing a notch engaged by the free end of said spring tab; said anchored end being so located that the spring tab causes the arm, in the absence of external forces, to engage one of said contacts to the exclusion of the other; a pivot pin extending across the cavity and on the same side of the arm as said one contact; a beam having one end pivotally mounted on said pin, said beam extending in superimposed relationship along the arm, said beam having a part opposed to and engageable with said arm at the area of the cutout adjacent the fulcrum bar for flexing the arm in a direction tending to increase the flexure of said spring tab until the combined stress of the arm and the tab snaps the arm so that the button engages the opposite contact; an actuating plunger guided by the case having one end engaging the beam on the side thereof remote from said arm and having its other end accessible exteriorly of the case; said case having means forming a limit to the outward movement of the plunger; and a replaceable substantially right-angled spring extending about the said beam and said one end of said beam, said spring having one end oriented between the beam and the arm and engaging the beam to urge it against the said one end of said plunger, whereby the said plunger forms a stop limiting movement of the beam away from said arm, said spring having its other end provided with a retaining projection received in a slot of the case; said spring normally spacing the beam part from said arm and imposing a bias force on said beam that must be overcome before the said arm is moved to engage the said opposite contact.

References Cited in the file of this patent

UNITED STATES PATENTS

2,354,027	Kaminky	July 18, 1944
2,417,169	Kaminky	Mar. 11, 1947
2,486,033	Kaminky	Oct. 25, 1949
2,627,754	Millard	Feb. 10, 1953
2,701,475	Readeker	Feb. 8, 1955
2,743,331	Lauder	Apr. 24, 1956
2,818,734	Howe	Jan. 7, 1958