Dec. 29, 1964 G. BURY 3,163,741

LOW TRAVEL SWITCH MECHANISM MOUNTING

Filed Dec. 19, 1962

Fig. 1

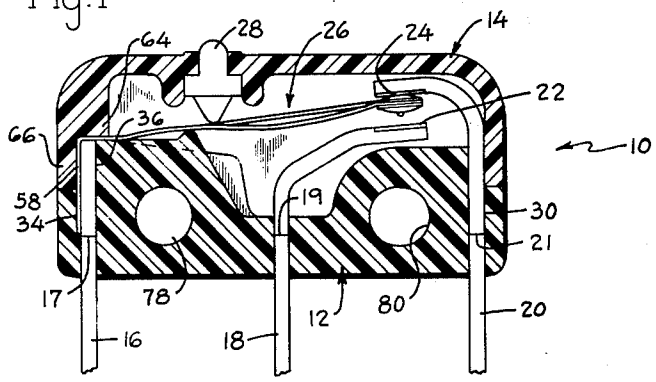


Fig. 2

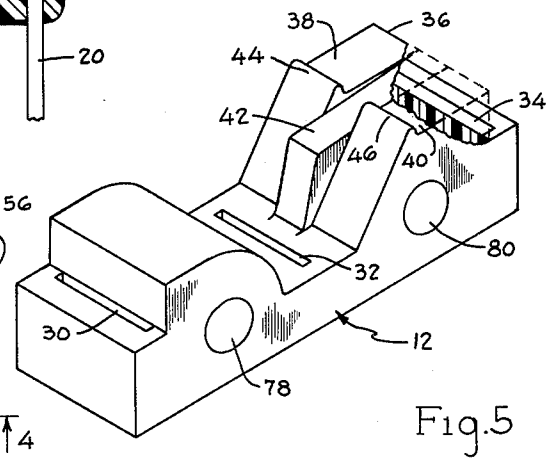


Fig. 3

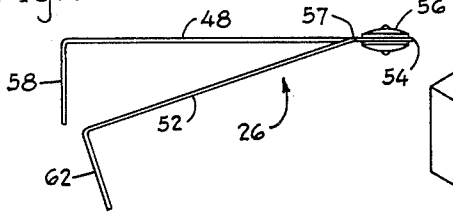


Fig. 4

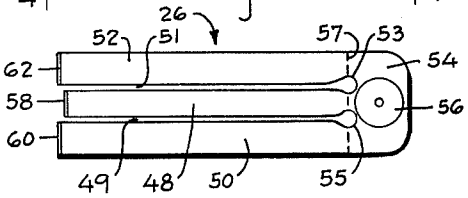


Fig. 5

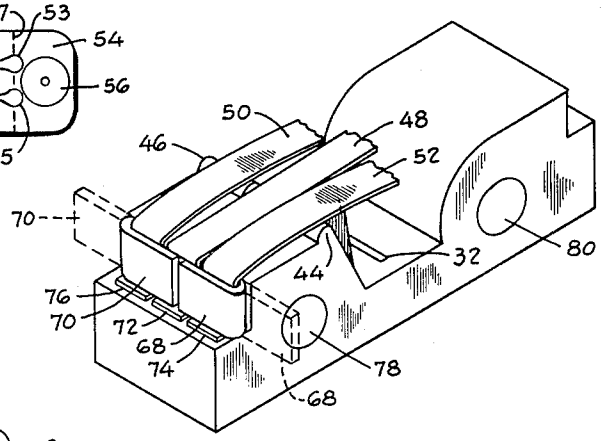
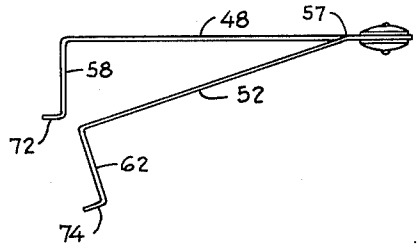


Fig. 6



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LOW TRAVEL SWITCH MECHANISM MOUNTING

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7 Claims. (Cl. 200—168)

This invention relates in general to electrical switches of the low travel type and more particularly to a switch mechanism of the aforenoted type wherein the movable contacts are located for actuation without the use of rivets or other similar fastening means.

This invention is an improvement to the type of switch structure shown in Patent No. 2,840,656 assigned to the same assignee. Switch mechanisms wherein the actuating member is moved an extremely short distance are useful and necessary in a great many diverse installations, and are of particular importance in control functions where movements of a part must be stopped upon reaching a certain location, or when an operation sequence must be controlled by very small movements. One of the major problems in the prior art has been to obtain a very precise, reliable, low travel switch at a very economically satisfactory cost.

The switch in the aforenoted patent has been exceedingly efficacious in that it provides ultraprecision, dimensional stability, and small movement differential coupled with an extremely long life, i.e., it may be cycled in excess of ten million times without failure. The aforenoted switch of the patented type has also been very excellent in that dead-centering and switch teasing have been eliminated. However, while the aforenoted switch represented an improvement in manufacturing costs over prior art types, there are many riveting and fastening operations necessary to provide the aforenoted switch construction which are eliminated by the instant invention which substantially reduces the cost thereof without eliminating the other advantages that accrue to the switch construction.

More particularly, it is an object of this invention to provide an exceedingly economical, high precision switch of the low travel type.

It is a further object of this invention to provide a switch of the aforenoted type wherein the entire switch is assembled with only seven parts, i.e., three terminal means, movable contact means, a two-part casing, and a push button member, all rivets, screw fasteners, and the like having been eliminated.

A still further object of this invention is to provide a movable contact means which is located and deformed into an operative position by simple assembly of the two parts of the casing into their final assembled relationship.

A still further object of this invention is to provide a snap switch of the low travel type wherein the moving switch arm and the spring actuating means therefor are made from a single stamping, and the spring arm and the switch actuating means are initially offset from one another and are held to a uniform length such that the spring means is held under stress by mounting the corresponding ends parallel with each other.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings, wherein:

FIG. 1 is a longitudinal sectional view through the novel switch construction;

FIG. 2 is a perspective view, somewhat diagrammatic in form and partially in section, showing the base portion of the switch casing;

FIG. 3 is a side elevational view of the movable contact means prior to the assembly thereof;

FIG. 4 is a plan view taken along lines 4—4 of FIG. 3

of the movable contact means shown in FIG. 3 prior to the bending of the outboard legs thereof;

FIG. 5 is a semidiagrammatic perspective view showing an alternate arrangement of locating and fixing the movable contact means on the base of the switch; and

FIG. 6 is a view similar to FIG. 3 of the alternate embodiment of movable contact means shown in FIG. 5.

Turning now to the drawings, the switch **10** essentially comprises a two-part casing comprising a base portion **12** and a cover portion **14**, there being three quickly attachable depending terminal means **16**, **18** and **20** extending through the base. The switch casing is preferably made of ammonia-free phenolic and is precision molded into desired shapes and provides excellent protection against corrosion. At the upper end of terminals **18** and **20**, and interiorly of the chamber formed by the two switch halves **12** and **14** are fixed contact means **22** and **24** in the form of fine silver insert contacts. It will be noted that the terminal means **18** and **20** are configured so that the contacts **22** and **24** are disposed in spaced opposed relationship to each other. A movable contact means **26** is actuatable between the fixed contacts **22** and **24** by a suitable low travel push button mechanism in the form of a molded button **28** as shall be explained.

The base portion **12** is formed with a plurality of transverse through apertures **30**, **32** and **34** for quick locking receipt of the terminals **16**, **18** and **20**. There are several ways of locking the terminals such as **16**, **18** and **20** into position in the apertures **30**, **32** and **34**, one convenient way being to form the terminals with shoulders **17**, **19** and **21** which cooperate with complementary shoulders in the through apertures **30**, **32** and **34** in a force fit relationship which locate and seat the respective terminals by a simple push-on relationship.

The base portion **12** is further formed with a vertically aligned portion **36** as viewed in FIG. 1 adjacent to the outboard end of the base and associated with the aperture **34**. A pair of ramp portions **38** and **40** are disposed at substantially right angles to portion **36**, said ramps **38** and **40** being spaced from each other by a central portion **42** which is disposed at an acute angle to portion **36** for purposes hereinafter appearing. Inboard from the corner defined by the confluence of portions **36–38** and **36–40** are a pair of raised shoulders or humps **44** and **46** which cooperate with the movable contact means as shall be described. A relatively open area is formed in the base portion, generally centrally thereof, to provide sufficient room for the various positions of the movable contact means **26** and to afford ease of entry of the fixed contact terminal **18**.

The movable contact means **26** comprises a stamped electrically conductive resilient sheet material member, preferably of beryllium copper or the like, having a central arm portion **48** and two spaced leg portions **50** and **52** separated by blanked-out portions **49** and **51**. As will be apparent, the movable contact means **26** is generally rectilinear in its original shape. The free end portion **54** is formed with a through aperture centrally thereof to receive an enlarged contact means **56**. The spacings **49** and **51** between the center arm **48** and two legs **50** and **52** adjacent to portion **54** merge into bulbous apertures **53** and **55**. It will be noted that apertures **53** and **55** may be in the form of through circular apertures and are preferably made by a circular drill having a diameter larger than the spacings **49** and **51** between the arms and the legs and preferably are done in a manner such that the center line of the apertures **53** and **55** are located on an extension of the inboard edges of arms **50** and **52** respectively. The circular apertures are then merged with the inboard edges to provide the bulbous appearance shown in plan view in FIG. 4. It has been

found that the aforenoted structure provides excellent stress relief.

As can be seen in FIGS. 3 and 4, the arm 48 and the two legs 50–52 are offset from one another and further each is formed with the depending angularly offset portions 58, 60 and 62 as shown. The portions 58, 60 and 62 are of substantially identical length. FIG. 4 is not a true underside plan view of FIG. 3 as aforementioned, but rather is a view prior to the bending of the legs 50 and 52 to the position shown in FIG. 3 along bend line 57. The centers of bulbous blankouts 53–55 are preferably coincident with line 57. Thus, when the legs 50 and 52 are repositioned coplanar with arm 58 in assembly, it will be noted that the arm 48 is shorter in length than the two legs 50 and 52. Thus, when depending portions 58, 60 and 62 are made coplanar by the assembly operation to be described, the arms 50 and 52 assume a serpentine relationship and stress the center arm 48. Due to this stressed relationship of the center arm 48, a very small (on the order of .0005 inch) movement of the plunger is operable to actuate the contact 56 between its desired positions.

As was aforenoted, the two arms 50 and 52 are bent along line 57 and preferably are deformed, prior to assembly, approximately 18° from the plane of arm 48 and portion 54 which are substantially coplanar.

The assembly of the switch is exceedingly simple. More particularly, the terminal 18 is first assembled to aperture 32 by simply inserting same from the top as viewed in FIG. 2 into the force fit receiving aperture therefor. Next the terminal 16 and contact means 26 may be assembled, it being noted that the aperture 34 is large enough to accept the ends 58, 60 and 62 of the movable contact means 26 when they are fitted snugly against the top portion of the terminal 16. Then the terminal 20 is assembled, the last step being assembly of the cover portion 14 containing the movable button 28. As can be seen in FIG. 1, portions 64 and 66 of the cover confine and accurately force the end portions 58, 60 and 62 of the movable contact means 26 into assembled relation so that they snugly engage the terminal 16 and are confined against movement. It will be further appreciated that due to precision molding techniques, the movable contact means may be very accurately located within the casing and that no form of rivets or the like is necessary to locate the movable contact means or to make the connection between terminal 16 and the ends of the movable contact means. Thus, due to the assembly, the contact means 26 is placed in stressed condition for actuation.

It will be apparent that the movable contact means end portions 58, 60 and 62 may be disposed on the inboard side of terminal 16 adjacent to vertical surface 36. This construction, while not shown, is possible with both forms of movable contact means as shown in FIGS. 3–4 and FIG. 6.

The embodiments shown in FIGS. 5 and 6 are substantially similar to the foregoing except that the terminal 16 for the movable contact means may be formed with wing portions 68 and 70 which are initially flat and coplanar with the terminal 16, but then are bent around as shown in FIG. 5 to confine and encapsulate portions 58, 60 and 62, the ends of portions 58, 60 and 62 being formed with short offsets 72, 74 and 76 which fit under the wing portions 68 and 70 in their final position as shown in FIG. 5.

In operation, a very slight movement of the push button 28 will cause the contact to snap over-center between the two fixed contacts 22 and 24. The device is exceedingly simple to assemble, is very economical, and is of high precision nature without requiring expensive manufacturing techniques.

The specific embodiments of the invention herein shown and described are for purposes of exemplification only. Various changes in structure will doubtless occur to those skilled in the art and are to be understood as forming a part of my invention insofar as it follows in the spirit and scope of the appended claims.

What is claimed as the invention is:

1. A snap switch mechanism comprising a movable switch structure having an elongated switch arm and a leg generally parallel thereto, each of said arm and leg being formed with an end portion generally transverse to the respective elongated planes thereof, said leg being initially formed so as to be slightly longer than said arm and both said arm and said leg tending to be substantially flat, means for maintaining a corresponding free end of said arm and of said leg in fixed relationship to one another but free for movement, anchor means comprising terminal means engaging said transverse end portions and being operable to maintain said transverse end portions of said arm and leg respectively coplanar and parallel to each other to thereby place said arm in stressed form, said arm being placed in tension, said leg being placed in compression and assuming a serpentine shape, a fixed contact means toward and away from which said switch structure is snapable, an actuating member engageable with said switch structure for effecting a snapping action, and electrical terminal means connected to said fixed contact means.

2. The snap switch mechanism set forth in claim 1 and further including a second leg similar to said first mentioned leg, said first and second legs being integral with said arm and with one another at the free ends of said arm and legs, and said legs respectively lying on opposite sides of said arm.

3. The switch structure set forth in claim 2 wherein said transverse end portions of said arm and legs are formed with a tip portion disposed generally parallel to the main body portion of said arm and legs, said tip portion being engageable with said anchor means to further aid in the positioning and location thereof in fixed relationship in the assembly.

4. A switch comprising casing means having first and second separable members fittable together to define an interior chamber, button means located in said first member and extending exteriorly thereof for actuation, a pair of quickly insertable fixed contact means having terminals insertable in said second member of said casing and having a contact disposed so as to be in fixed spaced relationship to each other, movable contact means for said switch, third terminal means associated with said movable contact means also mounted on said second casing member, said movable contact means comprising an arm and a pair of spaced legs, each of which are elongated and have a contact carrying end and an anchored end, said arm and legs being coplanar at the contact carrying end and integral with each other, said arm and said legs at said anchored end each being formed with portions transverse to the main portions thereof, said arm being shorter than said legs whereby the transverse portion thereof at the anchored end is, prior to assembly, located closer to said contact carrying end than said transverse portions of said legs, said movable contact means being assembled to said third terminal means by having the transverse portions thereof disposed in coplanar relationship to said third terminal means and held in said position by said third terminal means and portions of said first and second members of said casing means, the location of said transverse portions in fixed coplanar relationship anchoring said arm and legs and simultaneously placing said legs in compression and said arm in tension whereby said button when actuated engages said arm to cause the latter to snap between said fixed contact means.

5. The switch set forth in claim 4 wherein said third terminal means is formed with wing portions which are bendable toward each other to encapsulate said transverse portions of said arm and legs of said movable contact means.

6. The switch structure set forth in claim 4 wherein

said arm and legs are spaced from each other a predetermined distance throughout a major extent of the length thereof, said arm and legs being integrally joined adjacent to said contact carrying end and separated from each other by bulbous aperture portions having a diameter greater than said predetermined distance of spacing, the major portions of said arm and said legs being initially offset from each other, said arm being coplanar with said contact carrying end, said legs being offset downwardly from said arm, said legs being offset about a line intersecting the bulbous aperture portions between said arm and said legs.

7. The switch structure set forth in claim 6 wherein said anchored ends of said arm and legs are formed with

tip portions disposed generally parallel with the major extent of said arm and legs, said tip portions being insertable under the wing portions of said third terminal means when the latter are bent toward each other.

References Cited by the Examiner

UNITED STATES PATENTS

2,743,331 4/56 Lauder et al. ---------- 200—67

FOREIGN PATENTS

853,951 11/60 Great Britain.

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