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SNAP ACTION SWITCH

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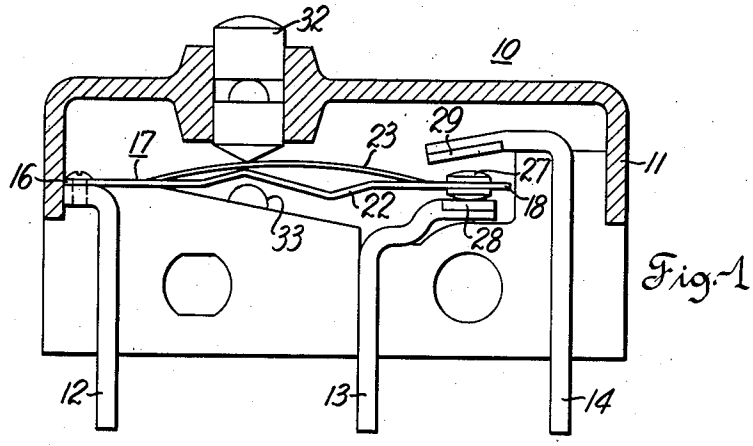


Fig. 1

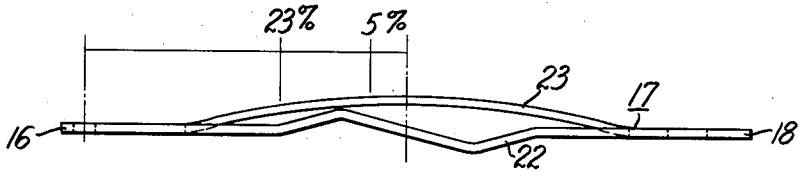


Fig. 2

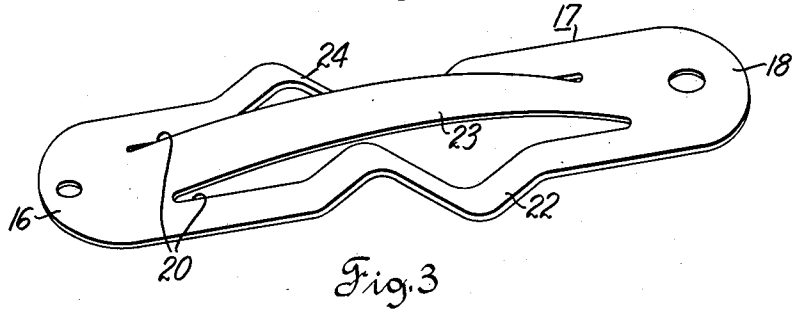


Fig. 3

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SNAP ACTION SWITCH

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This invention relates generally to electric switches. More specifically this invention relates to sub miniature "snap action" switches having very fast action and near perfect reliability.

As the trend continues to smaller electronic equipment such as that used in airplanes, rockets and computers, the need for faster more accurate electric switches becomes more important. "Snap action" switches are ideal for installations requiring reliable, high speed operation. Furthermore, as the sizes of switches becomes smaller and smaller, it becomes more important to have a switch that is easy to manufacture and assemble. Presently, some of the limiting features of "snap action" switches are the amount of pretravel or distance the actuator or plunger moves before the switch snaps from the free position to the operating position and the differential travel which is the distance the actuator moves from the point of snap over to the point where the switch snaps back. Furthermore, the force required to actuate the switch and the resilient force in the switch blade causing it to reset to its orginial position are also very important features. In addition, the pressure on the switch contacts must remain relatively high right up to the instant of snap over to avoid any accidental, premature action of the switch.

Applicant's switch has shorter pretravel time and differential travel time while still maintaining a sufficient force on the movable contacts to prevent accidental displacement of the contacts. This is accomplished by providing a single piece spring blade having both tension and compression members formed therein. The compression member is symmetrical but the plunger or actuator is positioned to engage the compression member on the side away from the movable contact a predetermined distance from the midpoint of the switch blade. In this way the pretravel and differential travel are held to near minimum and the holding force on the contacts remain high until the instant of snap over. Also, the actuating force and reset force of the blade remain close to their most desirable values. Furthermore, the switch blade of this invention is simple, inexpensive to make and very reliable.

Therefore, it is the object of this invention to provide a new and improved snap action switch.

Another object of this invention is to provide a new and improved snap action switch having shorter pretravel and differential travel.

Another object of this invention is to provide a new and improved snap action switch that is simple, inexpensive and yet very reliable.

Other objects and advantages will be apparent from the following description when taken in connection with the accompanying drawings, in which:

FIG. 1 is a cross sectional view of the snap action switch of this invention;

FIG. 2 is a side view of the switch blade of the switch of FIG. 1; and

FIG. 3 is a pictorial view of the switch blade of FIG. 2.

Referring more particularly to the drawings by characters of reference, the switch is shown generally as **10**. The switch has a housing **11** and three contact terminals **12**, **13** and **14**. Terminal **12** is shown connected to one end **16** of a switch blade **17**. The other terminals **13** and **14** are L shaped and their contact ends are in spaced apart relation on either side of the free or movable end **18** of the switch blade **17**.

The switch blade **17** is made of a suitable spring material such as beryllium-copper or other material as is well known in the art. The blade **17** is a thin, generally elongated member having a pair of spaced apart longitudinally extending slots **20** that divide the blade in three legs **22**, **23** and **24**. The legs of the blade are formed in such a way as to provide tension members and compression members. This can be accomplished by elongating one set of legs (such as by cold working) or shortening one set (such as by crimping) to provide a difference in the effective length of the legs. In the drawings the outside legs **22**, **24** are crimped to form tension members. This, of course, causes the middle leg **23** to bow and become a compression member. The switch blade is formed symmetrically about its longitudinal and transverse axis for reasons that will later be explained in detail.

The spring blade **17** is mounted within the casing **11** by having one end **16** attached to the terminal **12** by solder or other suitable means. This end **16** becomes the fixed or stationary contact of the switch. The other end **18** of the blade is provided with a contact **27** and is positioned intermediate the ends of terminals **13** and **14** and becomes the free or movable contact of the switch. As shown in the drawings, the contact **27** on the free end **18** of the blade **17** engages contact **28** on the terminal **13** in the normal position. In this position the blade has been moved past its dead center position but not to its first stable position so as to exert a force on the terminal **13** that it sufficient to prevent an accidental displacement of the contacts. In the operated position the contact **27** engages the contact **29** on the terminal **14**. In this position the blade has not moved far enough to assume a neutral position and hence has to be held in position against the contact by an external force exerted on the switch blade.

A plunger **32** is mounted in the housing **11** in sliding relation relative thereto. As shown in FIG. 1, the plunger is positioned to engage the compression member **23** of the spring blade **17** between the mid point of the blade and the fixed end **16**. Hence the amount of pretravel required to actuate the switch blade is less than if the plunger were positioned to engage the compression member at the peak of its arch. Beneath the blade **17** and in line with the plunger **22** is positioned a fixed support or stopper **33**. The stopper **33** is positioned to allow enough clearance to permit the blade **17** to snap over to its operated position but not to its second stable position. In this position the contact **27** engages the contact **29** of the upper terminal **14** with enough force to prevent accidental displacement of the contacts. The contacts are held in this position by the force of the plunger **32**, and will remain in this position until the resilient force of the switch blade overcomes the force of the plunger and causes the switch blade to snap back to its normal position.

The stopper **33** is positioned to hold to a minimum of the amount of overtravel of the blade and actuator and the amount of differential travel required to allow the blade to snap back to its normal position shown in FIG. 1. The stopper, by limiting the travel of the plunger and blade, also prevents the disengagement of the contact **27** with the contact **29** and the over stressing of the blade by excessive travel of the plunger.

Naturally the nearer the plunger is positioned to the fixed end of the blade the shorter the pretravel and differential travel time becomes. But as the plunger moves toward the fixed end of the blade a greater plunger force is required to operate the switch. Hence, one can not obtain the minimum in the desired length of pretravel because the amount of force required to make the switch operate becomes excessive. Many applications require a sensitive blade that can be actuated by only a few

ounces of pressure. I have found that the best combination of operating characteristics of this switch can be obtained by positioning the plunger between 5 and 23% of the distance from the mid point of the blade to the point where the fixed end of the blade is anchored to its terminal. In this range between 5 to 23% of the distance between the mid point and the point where the fixed end **16** of the blade **17** is attached to the terminal **12** the pretravel, differential travel, actuating force and resilient or reset force of the blade all have desirable values. If the plunger engages the blade closer to its maximum value the reset force is reduced to a dangerously low value. If the reset force is too low it may not break the contact with the upper terminal and hence will not operate properly. If the reset force of the blade is higher it can carry higher currents because it can break the tiny welds that form when the current carrying contacts separate. On the other hand, if the plunger engages the blade at a greater distance than 23%, the actuating force required becomes excessive and the switch is not suitable for many applications requiring very precise control.

When it is desired to operate the switch **10**, the plunger or actuator **32** is depressed until the blade **17** snaps over. The downward travel of the plunger is stopped shortly after the blade snaps by the stopper **35**. As the downward pressure of the plunger is released the reset or resilient force in the blade overcomes the downward pressure and the blade snaps back to its original or normal position.

Since the blade is symmetrical about its mid point it has two identical stable or normal positions. Hence, the contact can be mounted in the switch at either end with the other end becoming the movable end. This will be recognized as a very desirable manufacturing feature.

Although but one embodiment of this invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. A snap action switch comprising a spring blade, a housing enclosing said blade and having a support element formed therein, one end of said blade being attached to said support element, a first terminal adapted to be normally engaged by the other end of said blade, a second terminal spaced from said first terminal, said blade having a pair of longitudinally extending slots symmetrically formed therein, the portion of said blade between said slots being bowed to form a compression member, the peak of the bow being at the mid point of said blade, a blade actuating means located in said housing to engage the bowed portion of said compression member at a point as measured from the midpoint of said blade between 5% and 23% of the distance between the mid point of said blade and its attached end to force said other end of said blade out of engagement with said first terminal and into engagement with said second terminal with a snap action, and a stopper member positioned in line with said actuating means and on the opposite side of said blade.

2. A snap action switch comprising a blade, a support element, one end of said blade being attached to said support element, a first terminal adapted to be normally engaged by the other end of said blade, a second terminal spaced from said first terminal, said blade having a pair of longitudinally extending slots symmetrically formed therein, one portion of said blade adjacent said slots being bowed to form a compression member, the peak of said bow being at the mid point of said blade, a blade actuating means positioned to engage said blade at a point as measured from the midpoint of said blade between 5% and 23% the distance between the mid point of the blade and its attached end.

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