Aug. 9, 1966 G. J. BURY 3,265,823

SNAP ACTION SWITCH WITH SHORT MOVEMENT DIFFERENTIAL

Filed Feb. 10, 1964

Fig. 1

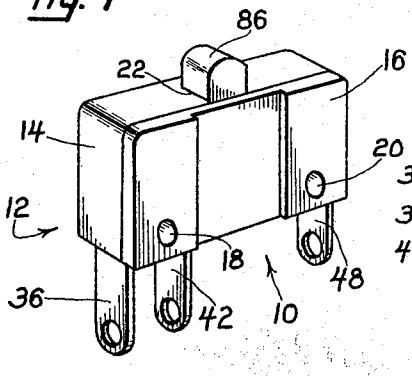


Fig. 2

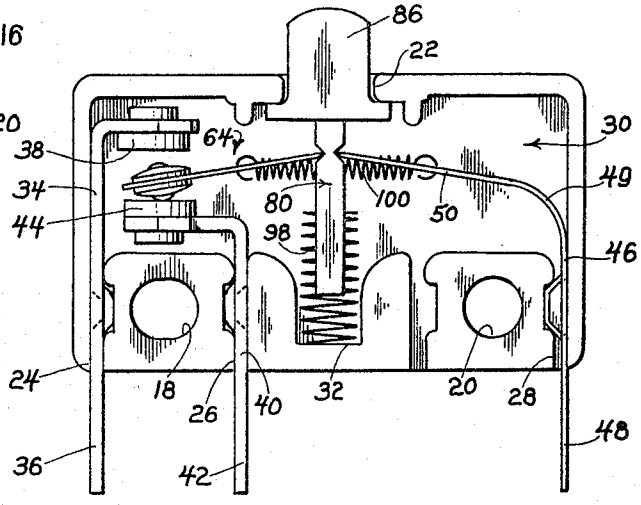


Fig. 3

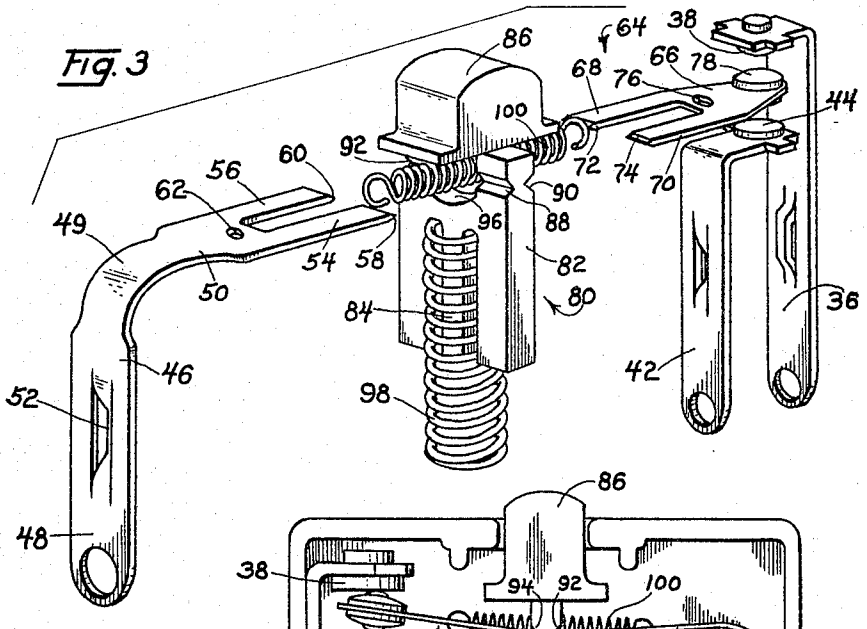
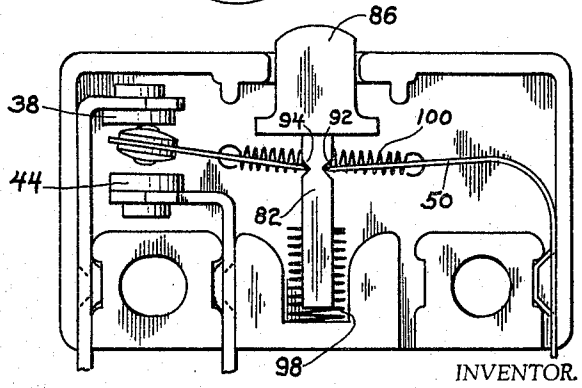


Fig. 4



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SNAP ACTION SWITCH WITH SHORT MOVEMENT DIFFERENTIAL

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This invention is concerned with the electrical switch art and more particularly with a snap switch mechanism having a relatively small movement differential as compared with similar prior art devices.

More specifically, this invention relates to a single pole, single throw switch of the type frequently called a single circuit or single break type of switch of miniature and subminiature size. There are many places in the switch art which require a highly reliable single break type of switch, and the instant mechanism is particularly efficacious in overcoming prior art problems of lack of mechanical reliability, lack of ease of assembly, and lack of versatility in various design parameters, all at an economical cost.

It is a general object of this invention to provide a miniature single break switch mechanism which is exceedingly reliable in that actual test results show that it may be actuated in excess of twenty million times without failure thereof.

It is a further object of this invention to provide a switch design of the above type wherein the contact pressures may be readily changed to meet various design requirements.

A further object of this invention is to provide a single break switch wherein the operating pressures may be readily controlled.

A still further object of this invention is to provide an assembly of the aforementioned type which is characterized as being relatively easy to assemble while maintaining the above characteristics.

It is a further object of this invention to provide a switch of the aforenoted general description wherein the movement differential may be varied within relatively high limits, it being possible to have a relatively short (in the neighborhood of ten to twelve thousandths of an inch) movement differential in order to cause actuation of the switch.

It is a further object of this invention to provide a switch which provides a wiping contact action, which prevents dead centering of the contacts which has a positive snap action where the parts are so arranged as to prevent rattling, which has high vibrational resistance, and which is otherwise well adapted for the purposes for which it is designed.

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

FIG. 1 is a perspective view of the subject switch;

FIG. 2 is a front elevational view of the interior of the switch with the cover portion removed;

FIG. 3 is an exploded perspective view of the components of the switch without the housing; and

FIG. 4 is a view similar to FIG. 2 showing the relative position of the parts in an actuated relationship.

Returning now to FIG. 1 of the drawings, switch mechanism **10** comprises a rectilinear housing means **12** formed of two parts **14** and **16**, the latter being basically a cover member. Two through apertures **18** and **20** serve as mounting holes for receipt of suitable fastening means such as bolts and the like. The housing member **14** is, in and of itself, generally rectilinear in shape and recessed to provide an internal chamber **30**, there being access thereto through a number of apertures such as the

central aperture **22** for receipt of the actuator, and terminal apertures **24**, **26** and **28**. A central well or internal recessed boss **32** is formed in the base of chamber **30** of member **14** directly opposite of the actuator aperture **22** as shown in FIG. 2.

A first fixed terminal member **34** is disposed in the aperture **24** with a portion **36** thereof extending below the housing with a fixed contact **38** mounted on the offset end thereof in chamber **30** as shown in FIGS. 2 and 3. The second fixed terminal means **40** also has a portion **42** extending below the housing, said fixed terminal being disposed in aperture **26** with fixed contact **44** in opposition to and spaced from fixed contact **38**. It is to be noted at this juncture that the parts are here shown on a greatly enlarged scale, i.e., in the neighborhood of five times actual size.)

The common terminal means **46** is of a special construction and serves several functions in addition to the electrical function of providing the common leg of a circuit. More particularly, the terminal means **46** functions in the snap action movement of the movable contact, cooperates with other parts in providing the contact to contact pressures, performs a function in the movement differential required to cause snap action of the contacts, and provides a locating and guiding function relative to the movable actuator as shall become apparent. The common terminal means **46** is of generally L-shaped construction and is preferably made of relatively thin gauge flexible sheet material such as beryllium copper or the like. A portion **48** of member **46** extends below the housing **12** for electrical connection to exterior circuitry and the upper portion **50** is disposed at substantially right angles to the lower portion **48** for engagement with the actuator as shall be discussed. An upset **52** in the lower portion of member **46** cooperates with a suitable complementary channel adjacent aperture **28** in the housing member **14** to provide convenient mounting and location of member **46** relative to the rest of the parts. A necked down portion **49** connects portions **48** and **50** to provide a hinge type action between the upper and lower portion of member **46**. The upper portion of **50** is substantially flat and is configured to provide a pair of spaced arms **54** and **56** having sharpened end portions **58** to **60** respectively. The aperture separating the arms **54** and **56** terminates in the vicinity of the mid portion of the upper portion **50**, there being a small through aperture **62** in the bight portion of the somewhat U-shaped configuration (in plan view) of the upper portion **50** of member **46**. The aperture **62** serves to mount a tension spring **100** as shall be explained.

Movable contact means **64** essentially comprises a generally flat U-shaped member **66** having a pair of spaced arms **68** and **70** having sharpened end portions **72** and **74** connected by a bight portion having a through aperture **76** for connecting the other end of the tension spring **100**. The movable contact **78** is mounted on the end of the bight portion opposite to the arms **68** and **70** for movement between fixed contacts **38** and **44**.

The actuator **80** essentially comprises a metallic member **82** having a pair of apertures defining a central tongue **84** for receiving and trapping a spring member **98** which biases the actuator **80** upwardly. A plastic or other insulating material button **86** is fixedly mounted to the upper portion metallic member **82** for extension through aperture **22** for actuation of the switch. The configuration of button member **86** is such that the skirt portion thereon prevents the button **86** and thus the actuator from going through aperture **22** under the bias of spring **98**. Metal member **82**, adjacent the upper end thereof, is formed with four pivot grooves **88** and **90**, **92** and **94** as shown for receipt respectively of the sharpened end portions **58**, **74** and **60**, **72** on the arms of the

common terminal member and the movable contact carrying member. The tension spring **100** extends between the arms **54**, **56** and **70**, **68** and through an elongated central aperture **96** in member **82**.

When the push button **86** is actuated, the pivotal connection between the oppositely disposed movable contact means **64** and the common terminal means **46** on actuator means **80** passes over center causing contact **78** to move from its normal position in engagement with fixed contact **44** and into engagement with fixed contact **38**. Thus a new circuit is completed through terminal **36**, member **66**, the spring **100** and member **82** through to common terminal means **46** as shown in FIG. 4, of the drawings. Of course, removal of the pressure causes the parts to return to the position shown in FIG. 1 under the bias of spring **98**.

An important feature of the present invention is the very short movement differential required of actuator **80** in causing movement of contact member **64** between its positions as illustrated in FIGS. 2 and 4. In prior art switches, this movement differential would, disregarding frictional forces, be generally equal to the existing contact gap between fixed contact members. A typical example is the switch shown in U.S. Patent No. 2,840,-657 which is assigned to the same assignee of the present invention, and wherein the movement differential required in causing snap action movement of the contact members cannot be less than the distance between generally opposed fixed contacts. (Additional movement on the order of .001 to .002 inch would be necessary in the switch of the present invention as well as the switch in the aforementioned patent to obtain a vertical component with enough force to overcome the friction at contact pivot points and spring anchor points.)

The movement differential of the actuator **80** in the present invention is shorter as compared, for example, with the switch shown in the aforementioned patent. This is due to the fact that the contact member **64** depends primarily on the flexing of portion **50** in the vicinity of flexure point **49**, as it is loaded and released by actuator **80**, rather than its pivotal connection with actuator **80**. This will have the effect of creating a larger movement in the free end of contact member **64** than that which is obtained in the vicinity of actuator **80**. In other words, the free end of contact member **64** will have the greatest vertical movement since it is furthest from the flexure point **89**, whereas the movement of actuator member **80** will be relatively shorter in a vertical sense because it is closer to the flexure point **89**.

The maximum movement possible for the free end of contact member **64** is the distance or contact gap between the fixed contacts **38**, **44**, and this fixes the movement of actuator **80** to a predetermined smaller amount than the contact gap. In the present invention, the movement of actuator **80** is approximately one-half of the contact gap since it is located substantially equidistant the flexure point **89** and the free end of contact member **64**. Thus, it will be apparent that a relatively short movement differential of actuator **80** is required to achieve the snap action movement of contact member **64** between its positions.

The inherent nature of the flexible, resiliently mounted portion **50** of the terminal means **46** enables it to contribute substantially to the biasing action of coil spring **98**. This will not only provide firm contact to contact pressures, but will permit the portion **50** to function in the snap action movement of the movable contact member **64** as it is loaded and unloaded by the actuator **80** when push button **86** is depressed or released. Further, the lower portion **48** of terminal **46** is fixed relative to the housing **14**, and although the upper portion **50** is angularly deflectable, there will be relatively little horizontal movement of portion **50**, and this will enable

the terminal means to provide a locating and guiding function relative to the actuator.

Design flexibility is available with the switch of the present invention much in the same way as the switch shown in the aforementioned patent. For example, contact pressures and contact actuating force can be changed by varying the sizes of tension spring **100** and coil spring **98** respectively. The movement differential of actuator **80** can be varied by changing the location of pivot grooves **88**, **94**, i.e., raising or lowering the grooves to obtain a larger or smaller movement. These changes will not affect the basic operating characteristics of the disclosed switch as will be apparent since they only amount to variations in component parts of the switch without changing their structural cooperation with each other.

From the foregoing it is seen that I have disclosed a single break switch which is exceedingly rugged, is economical, is reliable, provides a wiping action of the contacts upon making and breaking, may be readily changed to various design requirements, and otherwise well adapted for the purposes for which it was designed.

Although a specific embodiment of the invention has been shown and described, it is with full awareness that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and the spirit of the appended claims.

I claim:

1. A snap switch mechanism comprising, actuator means for reciprocal movement between first and second positions, means biasing said actuator means to its first position, pivot means located on said actuator means, first and second fixed contact means disposed in spaced relationship, movable contact means normally engaging one of said fixed contact means and being movable to the other fixed contact means upon movement of said actuator means, said movable contact means comprising a member cooperable with pivot means on said actuator means and mounting the movable contact at the other end thereof, common terminal means comprising a flexible member including a first portion integrally joined to and angularly disposed to a second portion across a resilient hinge section to provide spring loading characteristics thereto, one of said first and second portions having a free end formed with means disposed in pivotal opposition to said contact carrying means on said actuator means, and spring means extending between said contact carrying means and one of the portions of said common terminal means, said resilient hinge section being of sufficient strength to overcome the pivotal movement of said contact means on said actuator means and cause movement of both the flexible member and said movable contact means about said resilient hinge section to provide a relatively small movement differential of said actuator means prior to snap action movement of said movable contact means between said first and second fixed contacts while also contributing to the resilient action of said biasing means.

2. A one circuit snap switch mechanism comprising an insulating support, an actuator mounted in said support for slideable movement from a normal position to a second position, means for slideably moving said actuator relative to said support, spring means to return said actuator from said second position to its normal position, first and second members pivotally coacting with opposite sides of said actuator, said first member being a generally flat U-shaped member extending generally transversely of said actuator having a pair of spaced arms interconnected at one end thereof by a bight portion, a contact mounted on said bight portion, said second member comprising common terminal means having first and second integral portions, said first portion being disposed generally parallel to said actuator and being fixed to said insulating support, said integral second portion being relatively flat and having a pair of spaced arm portions

disposed generally transversely of said actuator and being connected by a bight portion, the area in the vicinity of the juncture of said integral first and second portions having a resilient hinge section, said actuator having generally opposed means to provide a pivot for said spaced arm portions of said first and second members located on the actuator in position between extremes of sliding movement of said actuator, a helical spring stretched between said first and second members and attached to the bight portions thereof, first and second fixed terminal means having portions in opposed spaced relation fixed to said insulating support for cooperation with the contact mounted on said first member, said first and second fixed contacts being disposed substantially about the position of said pivot, said first member snapping from a normal position wherein said contact is engaging one of said fixed contacts to a second position engaging the other of said contacts upon slideable movement of said actuator to carry the pivot of said first and second members on the actuator past a dead center position relative to said first and second members and spring means, said resilient hinge section being of sufficient strength to overcome the pivotal movement of said first member on said actuator and cause movement of said first and second

members about the resilient hinge section to provide a relatively small movement differential of said actuator prior to snap action movement of said first member between the first and second fixed contacts while also contributing to the resilient section of said biasing means, the first and second portions of said second member serving as a common terminal for switching current between said first fixed contact and said common terminal and said second fixed contact and said common terminal.

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