Feb. 21, 1961 M. ZANICHKOWSKY ET AL 2,972,663

TOGGLE SWITCH

Filed Feb. 3, 1958

FIG. 1

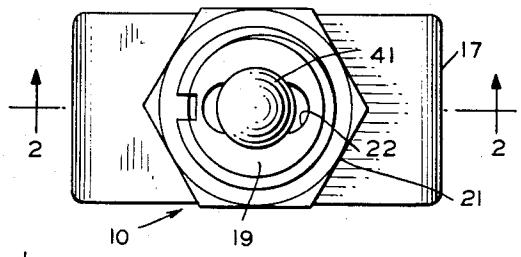


FIG. 2

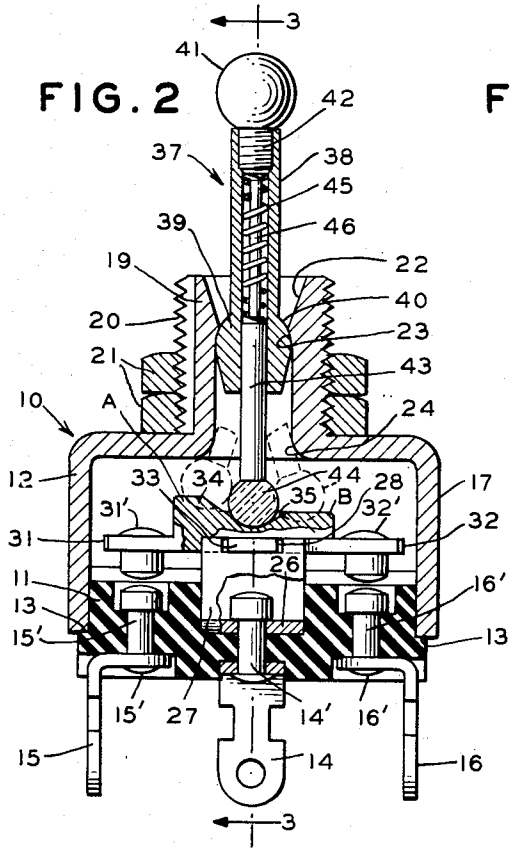


FIG. 3

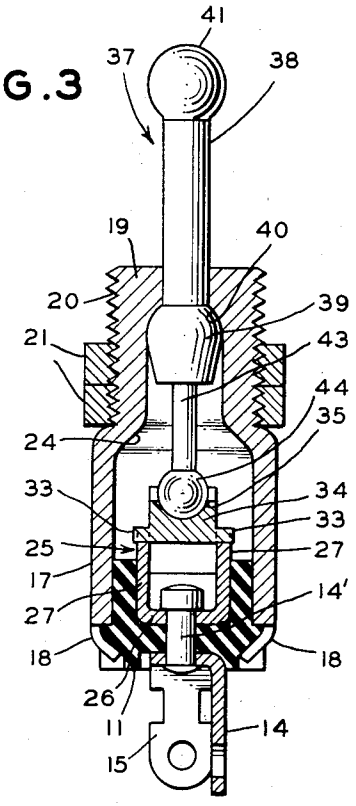


FIG. 4

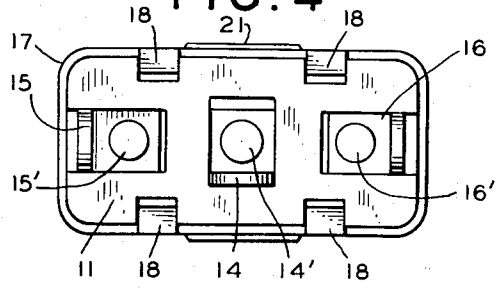
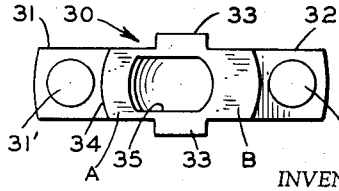


FIG. 5



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TOGGLE SWITCH

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2 Claims. (Cl. 200—67)

This invention relates to toggle switches and in one of its more specific aspects to a toggle switch of the center-off type.

One of the major problems in the design and construction of snap action or toggle switches, particularly those of the momentary type, is the adjustment of their spring loading to insure prompt and positive action.

Another problem is that of assembling the actuating means toggle linkage and its spring means inside the switch housing. This problem is particularly pertinent in the case of very small switches of the sub-miniature type. The moving parts within the switch housing usually include a pivotally mounted member and a spring loaded linkage including two elements loosely joined by a ball and socket connection. It is very difficult to assemble the loose pieces and then insert them in the casing of a very small switch, since the parts are only held together by the housing. It has generally been the practice in the past to stick the loose parts together with a grease and then insert them in the switch housing. This not a positive procedure and quite frequently has to be repeated several times before a successful assembly can be completed.

The present invention overcomes the difficulties experienced in the past in that it provides a toggle switch wherein the housing is first sealed with certain parts positioned therein and other parts, including a rod, are then inserted through a hollow handle which forms part of the switch actuating means. Our construction permits the elements of the actuating means to be readily aligned and positioned with respect to other parts. Moreover, our invention permits the loading on the spring to be readily adjusted from the exterior of the switch, as required.

A toggle switch constructed in accordance with this invention preferably includes a housing comprising a base and a cover or casing secured to the base. The base carries a pair of spaced electrical contacts. Positioned within the housing is a generally U-shaped saddle consisting of a web which is secured to the base and a pair of arms which project into the interior of the housing. Each arm has an end groove. Mounted for rocking movement on the saddle is a rocker unit comprising a cruciform member which includes a pair of oppositely projecting first arms and a pair of oppositely projecting second arms that are normal to the first arms. Each of the second arms registers with a corresponding groove in the saddle and each of the first arms is adapted to contact an electrical contact in response to corresponding rocking movement of the rocker unit.

The switch also includes actuating means for effecting rocking movement of the rocker unit in opposite directions to thereby cause a selected first arm to make contact with a corresponding one of the electrical contacts. The actuating means comprises a tubular handle which is pivotal with respect to the cover and a rod unit slidable in the handle and including an end part that registers with a depression in the cruciform member. Such end

part preferably consists of a hard, wear-resistant insulating material, such as glass. A helical compression spring is positioned within the handle and normally and yieldingly urges the rod unit toward the rocker unit.

The switch is provided with an adjustable means for varying the loading on the spring. This means preferably consists of a ball cap having a threaded extension which engages the handle and is spaced from the rod unit. A floating pin is positioned within the confines of the spring and is adapted to bear at its ends against the other end of the rod unit and the adjustable means to thereby limit compression of the spring in use. The inclusion of the floating pin in the structure prevents damage to the spring due to abuse and eliminates the possibility of the spring acquiring a permanent set due to excessive movement of the hollow handle relative to the rod unit.

A principal object of this invention is to provide an improved toggle switch of the miniature and sub-miniature types.

Another object of the invention is to provide a toggle switch which may be readily assembled.

A further object of the invention is to provide a spring loaded toggle switch wherein the spring loading may be externally adjusted.

A still further object of the invention is to provide miniature and sub-miniature toggle switches which are simple and compact in design, sturdy and durable in construction, reasonable in manufacturing cost and dependable in operation.

The enumerated objects and other objects, together with the advantages of this invention, will be readily understood by persons skilled in the art from the following detailed description and the accompanying drawing which, respectively, describe and illustrate a preferred toggle switch embodying the invention.

In the drawing, wherein like reference characters denote corresponding parts in the several views:

Fig. 1 is a top plan view of a toggle switch constructed in accordance with this invention;

Fig. 2 is a view in cross section taken along line 2—2 of Fig. 1;

Fig. 3 is a view in cross section taken along line 3—3 of Fig. 2;

Fig. 4 is a bottom plan view of Fig. 2; and

Fig. 5 is a top plan view of a rocker unit which is also shown in Figs. 2 and 3.

The illustrated embodiment of the invention includes a housing **10** which consists of a base **11** and a cover or casing **12**. Base **11** is made of a suitable electric insulating material and is formed with an outer annular recess which is defined in part by shoulders **13**. The base carries a plurality of external electrical terminals, namely a central terminal **14** and a pair of end terminals **15** and **16**. The terminals **14**, **15** and **16** are secured to the base by means of corresponding combined rivets and electrical contacts **14'**, **15'** and **16'** which project into the interior of the housing.

Cover **12** comprises a rectangular tubular member **17** having a plurality of tongues **18**. The lower end of tubular member **17** is adapted to register with the outer annular recess of the base and bear against shoulders **13**, as illustrated in Fig. 2. When the parts are in this relative position, tongues **18** are bent inwardly with respect to the bottom of the base, as shown in Figs. 3 and 4, to thereby firmly secure cover **12** to base **11**. Tubular member **17** is provided with a right circular cylindrical tubular extension **19** that is externally threaded, as indicated at **20**. A pair of nuts **21** engage threads **20** and serve to maintain the switch in selected position on a panelboard or other support (not shown). The through opening in extension **19** is defined in part by a downwardly con-

vergent first surface 22 and a rounded second surface 23. The juncture of member 17 and extension 18 constitutes an inner annular shoulder 24.

The switch of this invention includes a U-shaped saddle 25 which, as best shown in Figs. 2 and 3, is disposed in a central recess in base 11. Saddle 25 is electrically conductive and consists of a web 26 and a pair of arms 27 which project into the interior of the housing. Each arm has an upper end groove 28. Combined rivet and electrical contact 14' extends through web 26 and secures the saddle to the base. This element also serves as an electrical connection between the saddle and terminal 14.

A rocker unit 30 is mounted for rocking movement on saddle 25. This unit is best shown in Fig. 5 and comprises a cruciform base or member consisting of a first pair of oppositely disposed arms 31 and 32 and a second pair of oppositely disposed shorter arms 33 which are normal to arms 31 and 32. The cruciform member is made of a suitable electrically conductive metal and its arms 31 and 32 are provided with electrical contacts 31' and 32'. Contact 31' is aligned and adapted to make contact with electrical contact 15' while contact 32' is aligned and adapted to make contact with electrical contact 16' in use, as will be explained further along herein.

Rocker unit 30 has an upstanding boss or block 34 which is integral with the cruciform member and which is formed with a depression or recess 35. Boss 34 is asymetrical and consists of a relatively thick side A and a relatively thin side B to obtain what is commonly termed in the art a "momentary-off-on" switch.

Rocking movement is imparted to the rocker unit by an actuating means 37 which includes a tubular handle 38. This handle has an enlarged lower end portion 39 which is rounded at 40 for contact with rounded surface 23 of extension 19 to permit of pivotal movement of the handle with respect to the cover. Handle 38 carries a cap which consists of a spherical finger grip 41 and a threaded extension 42 which engages a tap in the upper end of the handle. A solid rod 43 is slidable in handle 38 and has a spherical head 44 affixed to its lower end. Rod 43 is preferably made of a suitable metal, such as that available under the trade mark "Kovar." Spherical head 44 is made of glass or other appropriate wear-resistant electrical insulating material which is fused to the lower end of rod 43. As shown in Figs. 2 and 3, head 44 registers with depression 35 of the rocker unit.

There is provided spring means for normally and yieldingly urging rod 43 downwardly and spherical head 44 into registry with the depression in the rocker unit. This spring means preferably consists of a helical compression spring 45 which is positioned within handle 38 and bears at its ends against the upper end of rod 43 and the free end of cap extension 42. Cap 41 and its extension 42 serve as a means for adjusting the loading on spring 45. A relatively thin pin 46 is positioned within the confines of spring 45. This pin is in the nature of a "floating pin" for the reason that it's shorter than the distance between the lower end of extension 42 and the upper end of rod 43. This pin, as stated earlier herein, prevents damage to the spring and prevents its acquiring a permanent set in use.

In assembling the switch, handle 38 is inserted in tubular cover member 19 and rocker unit 30 is mounted on saddle 25. The entire base assembly is inserted in cover member 17 with rod 43 projecting into the handle and its spherical head 44 registering with depression 35 of the rocker unit. The base is then affixed to the cover by bending tongues 18 inwardly, as earlier described. The base may, if desired, be cemented or otherwise sealed to cover member 17 to provide a fluid tight fit therewith.

Spring 45 is next inserted in the handle from the top and pin 46 is inserted in the spring. The adjustable cap is then applied to the upper end of the handle by means of its threaded extension 42. The cap is turned relative to the handle, as required, to obtain the desired loading on the spring.

For the purpose of outlining the operation of the illustrated form of the invention, it is assumed that the switch has been assembled and that its parts are in the relative position shown in the drawing. With the parts so arranged, the switch is in center "off" position since electrical contacts 31' and 32' of the rocker unit are out of contact with electrical contacts 15' and 16', respectively. When handle 38 is pivoted in a clockwise direction relative to the housing, as viewed in Fig. 2, spherical head 44 cooperates with the boss 34 to tilt the rocker unit in a counterclockwise direction relative to saddle 25 to effect contact of electrical contact 31' with electrical contact 15'. This completes the electrical connection between terminals 14 and 15. Due to the configuration of portion A of the boss, such contact is maintained only so long as the handle is held in its extreme clockwise pivotal position. Upon release of the handle, the parts automatically return to the illustrated or "off" position. Thus the contact between contact elements 31' and 15' is "momentary."

When the handle is pivoted in a counterclockwise direction relative to the housing, rod head 44 rides along part B of the rocker unit boss and slightly beyond depression 35. This effects contact between electrical contacts 32' and 16'. Due to the configuration of boss part B, such contact continues after the handle is released. The switch is now in "on" position and forms electrical connection between terminals 14 and 16. The switch may be reactuated to "off" position by returning handle 38 to the illustrated position (Fig. 2).

The parts are so constructed and arranged that pivotal movement of the actuating means relative to the housing is limited by engagement of rod 43 or its spherical head 44 with the shoulder 24 of the cover. This prevents excessive movement of head 44 with respect to either of boss portions A or B.

For an "on-off-on" switch, boss 34 would be symmetrical and both sides thereof would correspond to part B. For a "momentary-off-momentary" switch, boss 34 would be symmetrical and both sides would correspond to part A. In other words, by selecting proper configurations of boss 34, three operatively different types of switches may be obtained.

The herein disclosed switch is a single pole toggle switch. It will be apparent that multiple-pole switches, such as double and triple pole switches, may be constructed in the same manner as the illustrated switch.

It will be apparent from the foregoing that the present invention provides a simple, positive, inexpensive toggle switch and an economical method of assembling the same. The invention also provides convenient means for adjusting the spring loading externally, as required. This is very desirable as the characteristics of the spring will undoubtedly be effected by aging. The spring characteristics may also be somewhat effected by variations in temperature and humidity conditions. A rubber boot may be placed over the handle to provide a moisture-proof seal for the switch.

The present invention is particularly advantageous for the construction of very small switches of the subminiature type due to the fact that the parts may be readily assembled. Switches of this invention have been constructed with a larger base dimension of less than half an inch and other dimensions proportionally small. Hence, by the practice of this invention, very small switches can be constructed which have the same current carrying capacities and voltage ratings as much larger switches, thereby effecting substantial savings in materials and requiring less space on a control panel than conventional switches. This is a very important feature in respect to various types of equipment, such as computers, where it is necessary to mount a great number of switches within convenient reach of a single operator.

From the foregoing, it is believed that the objects, advantages, construction and operation of our present invention will be readily comprehended by persons skilled in the art, without further description. Although the invention has been herein shown and described in a simple and practicable form, it is recognized that certain parts thereof are representative of other parts which may be used in substantially the same manner to accomplish substantially the same results. Therefore, it is to be understood that the invention is not to be limited to the exact details described herein, but is to be accorded the full scope and protection of the appended claims.

We claim:

1. In a toggle switch, a housing comprising a base and a cover secured to the base, a pair of spaced electrical contacts carried by the base, a rocker unit mounted for rocking movement within the housing and adapted to contact said electrical contacts separately, and actuating means for effecting rocking movement of the rocker unit in opposite directions to thereby cause the same to make contact with a selected one of the electrical contacts, said actuating means comprising a tubular handle pivotal with respect to the cover, a rod unit slidable in the handle and bearing at one end against the rocker unit, spring within the handle and normally and yieldingly urging the rod unit toward the rocker unit, adjustable means carried by the handle and spaced from the rod unit for varying the loading on the spring and a floating pin within the confines of the spring and adapted to bear at its ends against the other end of the rod unit and the adjustable means to limit the loading on the spring in use.

2. In a toggle switch, a housing comprising a base and a cover secured to the base, a pair of spaced electrical contacts carried by the base, a saddle comprising a web secured to the base and a pair of arms which project into the housing, each arm having an end groove, a rocker unit mounted for rocking movement on the saddle, said rocker unit comprising a cruciform member

including a pair of oppositely projecting first arms and a pair of oppositely projecting second arms that are generally normal to the first arms, each of the second arms registering with a corresponding groove in the saddle, each of the first arms being adapted to contact an electrical contact in response to corresponding rocking movement of the rocker unit, said cruciform member having a depression formed in the part thereof that is intermediate the arms of each pair of arms, and actuating means for effecting rocking movement of the rocker unit in opposite directions to thereby cause a selected first arm to make contact with a corresponding one of the electrical contacts, said actuating means comprising a tubular handle pivotal with respect to the cover, a rod unit slidable in the handle and including an end part that registers with the depression in the cruciform member, said rod end part comprising a hard, wear-resistant insulating material, such as glass, a helical compression spring within the handle and normally and yieldingly urging the rod unit toward the rocker unit, adjustable means carried by the handle and spaced from the rod unit for varying the loading on the spring and a floating pin within the confines of the spring and adapted to bear at its ends against the other end of the rod unit and the adjustable means to limit compression of the spring in use.

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