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3,097,273

ADJUSTABLE SNAP ACTION ELECTRICAL SWITCH

Filed June 6, 1961

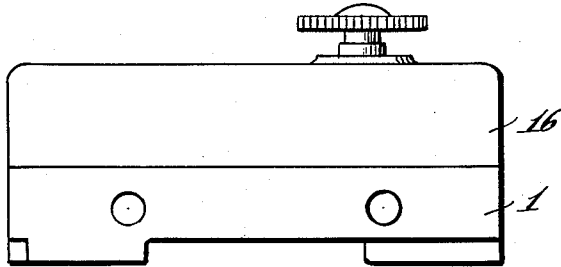


Fig. 1

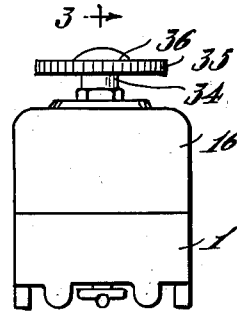


Fig. 2

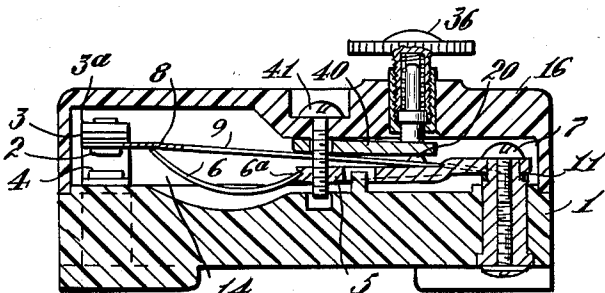


Fig. 3

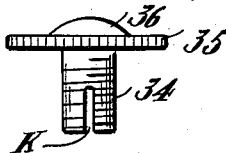


Fig. 4

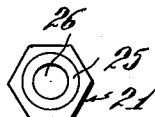


Fig. 6

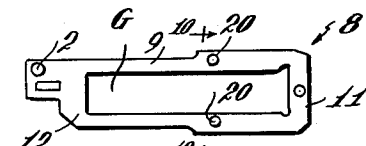


Fig. 9

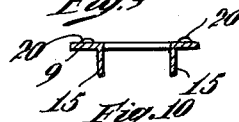


Fig. 10

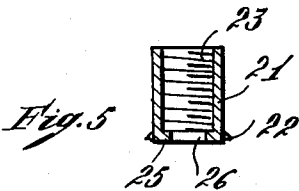


Fig. 5



Fig. 7

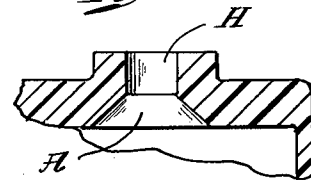


Fig. 11



Fig. 8

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ADJUSTABLE SNAP ACTION ELECTRICAL SWITCH

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8 Claims. (Cl. 200-67)

This invention pertains to electrical switches of the snap-action type, such for example, as that of the patent to McGall, No. 1,960,020, dated May 22, 1934, but more particularly to a switch of the sort disclosed in the patent to Broch, No. 2,729,715, dated January 3, 1956. Such switches have a wide range of utility and the demands of users, as respects operational capabilities of such switches, are likewise various. For example, some users require that the switch control circuit be closed or opened in response to a motion of the switch-actuating pin of the order of 0.001", whereas other users may require a much larger motion of the switch-actuating pin to accomplish the same result, moreover, in some instances it is required that the length of the switch-actuating pin, where it is exposed outside of the switch casing, be substantial, while others require a shorter projection of the actuating pin from the switch casing.

Objects of the invention are to provide a switch having provision whereby its sensitivity, that is to say, the amount of motion of the actuating pin necessary to produce the snap-action may readily be adjusted from a point outside of the switch casing and through a substantial range and, when once adjusted, will retain said adjustment regardless of vibrations or shock to which the switch may be subjected in use. A further object is to provide means whereby the effective length of the actuating pin, exposed outside of the switch casing, may readily be varied without resorting to the use of tools or the substitution of parts.

Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

FIG. 1 is a side elevation, to large scale, of a switch embodying the present invention;

FIG. 2 is an end elevation of the switch of FIG. 1, looking from the right-hand side of the latter view;

FIG. 3 is a vertical section, substantially on the line 3-3 of FIG. 2;

FIG. 4 is a side elevation of an adjustable button to which the force is applied for actuating the switch;

FIG. 5 is an internally screw-threaded sleeve member which is mounted in an opening in the cover of the switch and which receives a threaded hollow shank integral with the actuating button;

FIG. 6 is a bottom view of the sleeve member of FIG. 5;

FIG. 7 is an elevation showing the pin by means of which the actuating force is transmitted to the tensioning spring of the switch;

FIG. 8 is an elevation of the force-transmitting spring;

FIG. 9 is a plan view, to smaller scale, of the tensioning spring of the switch;

FIG. 10 is a section on the line 10-10 of FIG. 9; and

FIG. 11 is a fragmentary section, at the same plane as FIG. 3, showing a portion of the cover of the switch with the switch-actuating complex removed therefrom.

While, as above noted, the present invention relates to a switch of the general type disclosed in the patent to Broch, No. 2,729,715, dated January 3, 1956, the switch, as more specifically here illustrated, by way of example, is shown as comprising certain features disclosed in the copending application of Henry G. Leupold, Serial No.

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837,974, filed on September 3, 1959, now issued as Patent No. 3,019,312, dated January 30, 1962.

Referring to FIG. 1 of the drawings, the numeral 1 designates the base of the switch, which may consist of a generally rectangular, substantially rigid block of an appropriate, dielectric, moldable material such as Bakelite its external dimensions preferably being those which have become a standard for snap-switches of this general type, for instance, of a length of $1\frac{15}{16}$ inches; a width of $\frac{11}{16}$ inch; and a depth (with cover) of $\frac{13}{16}$ inch, with the axis of the actuating button at a distance of approximately one-half inch from one end.

At the left-hand end of the base 1, as viewed in FIGS. 1 and 3, there is a duplex, vertically movable contact 2 which is interposed between the spaced fixed contacts 3 and 4, the upper contact 3 being supported directly above the lower contact 4 by conventional bracket means 3^a fixed to the switch base. A metallic abutment member 5, carried by the base, has at its left-hand end a horizontal V-shaped groove for receiving the stationary end 6_a of a downwardly bowed compression spring 6. The right-hand end of the abutment 5 has an opening therethrough for a screw 7, whereby the abutment is secured to the base 1.

The tensioning element 8 (FIGS. 3, 9 and 10), consists of a piece of very flexible, resilient sheet material, for example copper beryllium alloy of the order of 0.006 inch in thickness; of generally rectangular shape and having a large elongate central opening G, thereby defining a pair of spaced, generally parallel arms 9 connected at their ends by transverse web portions 11 and 12 (FIG. 9). The right-hand web portion 11 has an opening therethrough for the screw 7 and underlies the end of the abutment 5 furthest from the compression spring 6, and is clamped between said end of the abutment and the base by the screw 7. The left-hand web portion 12 of the tension element carries the movable contact 2 interposed between the fixed contacts 3 and 4. Hinge means 14, for receiving the movable end of the compression spring 6, is also provided by the left-hand web 12 at a point spaced from the contact 2.

Intermediate the ends of the tension element 8, but nearer to the clamped web 11 than to the hinge means 14, each arm of the tensioning element has an integral, downwardly directed, elongate stiffening flange 15 (FIG. 9), at right angles to the arm proper, these flanges stiffening that portion of the tensioning element 8 to which the operating force is applied. Each of the arms 9 of the tensioning element is provided (at that portion which is stiffened by the flange 15) with a boss or dimple 20 struck up from the material of the arm and constituting that element of the arm to which the actuating force is applied. While these dimples 20 are here shown as being directly opposite one another, it is to be understood that they may be differently located with respect to each other, or to the force-applying device, so as to compensate for any otherwise unbalanced forces existing in the switch, without departing from the essential spirit of the invention.

The cover 16 of the switch has a hole H (FIG. 11) extending down through it, this hole desirably being of polygonal transverse section, for example hexagonal, the axis of the hole, when the cover is in place, being in that vertical plane which passes through the dimples 20. Within this hole there is arranged a vertically slidable sleeve 21 (FIGS. 5 and 6), externally polygonal, of proper shape and size to fit the hole H. At its lower end the hole H flares downwardly forming an annular beveled surface A (FIG. 11), and the sleeve member 21 has a peripheral enlargement, flange or burr 22 (FIG. 5) at its lower end which engages this beveled surface A thereby to limit upward motion of the sleeve 21 within the hole H in the cover. The sleeve 21 is internally screw threaded,

as shown at 23 (FIG. 5) and at its lower end the sleeve 21 has an inwardly directed flange 25 defining an axial guide opening 26 for a motion-transmitting pin 30 (FIG. 7). This pin has a lower end portion 31 which fits slidably in the opening 26 at the lower end of the sleeve 21 and an integral radial flange 32 of a diameter exceeding that of the hole 26, and which, by engagement of the upper surface of the flange 25, limits downward movement of the pin 30 in the sleeve. The pin 30 also has an upwardly directed shank portion 33, of lesser diameter than the part 31, and which is embraced by a long coiled compression spring S (FIG. 8). Cooperable with the sleeve 21 there is the externally screw-threaded, hollow, elongate, longitudinally split shank 34 of an actuating button (FIG. 4) comprising a disc 35 integral with the shank 34 and having a knurled edge, and an upwardly directed, spherically curved centrally located boss 36. When the parts are assembled, the lower end of the spring S abuts the flange 32 on the pin 30 while its upper end contacts the surface which defines the inner or upper end of the bore in the shank of the shank 34. The shank 34 is longitudinally split at K and is of such normal external diameter that it must be diametrically contracted slightly in order to engage it with the internal screw thread of the sleeve 21. When once so engaged, the parts are under radial stress such as to prevent them from turning accidentally.

In the switch in which the present invention is embodied, and as disclosed in the aforesaid patent, No. 3,019,312, January 30, 1962, a force distributing or balancing element 40 is provided for transmitting the pressure of the actuating pin to the two dimples 20 of the tensioning spring. This element 40 is of triangular shape and consists of a rigid flat piece of dielectric material, one corner of which has a hole through which loosely passes that screw 41 (FIG. 3), by means of which the cover 16 of the switch is secured to the base 1. The lower end 31 of the pin 30 contacts this force-distributing element 40 which, in turn, rests upon the dimples 20 of the tensioning spring.

Since the force for actuating the switch is transmitted through the spring S, it follows that when the spring is fully extended, a relatively longer travel of the button 36, in response to the application thereto of actuating force, is required (in order to depress the part 40 and so snap the switch) than when the spring is more or less compressed. Thus, by rotating the disc 35 with its shank 34 relatively to the sleeve 21, the spring S may be compressed more or less and so, in this very simple way, the switch may be adjusted to respond to a force-applying element whose effective motion lies within a substantial range. Moreover, by turning the disc, the distance of the boss 36 to which the actuating force is applied may be varied relatively to the cover of the switch. There is thus provided ready means for adjusting the boss 36 toward or from an actuating element whose path of motion is limited.

It is evident that the adjustments, thus provided, are such as may be made from the exterior of the switch casing without necessitating the removal of the cover or the employment of two switches, so that, by the present arrangement, adjustments are made possible, which could not have been accomplished with reference to usual prior switches of this type, without the substitution of parts, the removal of the cover, or the employment of two switches.

While one desirable embodiment of the invention has herein been disclosed by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the terms of the appended claims.

I claim:

1. A snap-action switch of the kind which has a case comprising a cover, the case housing a switch spring and a spring-stressing element, the cover having a hole

therein, characterized in having a non-rotatable, internally screw-threaded, elongate sleeve slidable in said hole, a force-receiving element having an externally screw-threaded shank having threaded engagement with the internal threads of the sleeve, said shank having an actuating head at its upper end whereby it may be rotated thereby to move the head toward or from the cover of the case, and means operative to transmit downward motion of said head, relatively to the cover, to the spring-stressing element.

2. A snap-action switch according to claim 1, further characterized in that the shank of the force-receiving element has an axial bore extending upwardly from its lower end but which is closed at its upper end, a vertically slidable pin within the bore of said shank, a coiled compression spring coaxial with said pin having its upper end engaging the closed upper end of the bore in the shank and its other end engaging the pin so as thereby to urge the pin downwardly, and means for transmitting motion from the lower end of the pin to the spring-stressing element.

3. A snap-action switch according to claim 2, further characterized in having means operative to limit upward motion of the internally screw-threaded sleeve relatively to the cover of the case, said sleeve being externally polygonal in transverse section and the hole in the cover being of a shape and size to provide a sliding fit for said sleeve, the pin having an external flange upon which the lower end of the coiled compression spring rests, and the sleeve having an internal flange at its lower end operative to limit downward motion of the pin relatively to the sleeve.

4. A snap-action switch of the kind wherein a casing houses a switch spring, a spring-stressing element, and an actuating device comprising a movable force-receiving part external to and spaced from the outer surface of the switch casing, the actuating device comprising an internally screw-threaded sleeve slidable in an opening in the casing and the force-receiving member having a screw-threaded shank engaging the internal screw threads of the sleeve, an elongate pin having a peripheral abutment which engages an internal radial flange at the inner end of the sleeve, and a coil compression spring which embraces the pin and whose inner end rests upon said abutment and whose outer end engages the inner end of the shank of the force-receiving element.

5. In a snap-action electrical switch of the kind which has a case comprising a cover, a spring-stressing element comprising a pair of narrow, generally parallel arms connected at their ends by transverse webs, and a force-distributing element which bears on both arms of the spring-stressing element, in combination, a spring-actuating device comprising a movable force-receiving part external to the switch casing and which is normally spaced a predetermined distance from the exterior surface of the cover, and means for transmitting motion from said force-receiving element to said force-distributing element, further characterized in that the force-receiving element comprises a non-rotatable sleeve slidable in an opening in the cover of the switch casing, said sleeve being internally screw-threaded and the force-receiving element having an externally screw-threaded shank which engages the internal screw threads of the sleeve, an elongate pin housed within said sleeve and whose lower end contacts the force-distributing element, and a coil spring whose outer end engages the force-receiving member and whose lower end engages the pin whereby downward motion of the force-receiving element is resiliently transmitted to the pin.

6. A snap-action switch according to claim 5, wherein the inner end of the sleeve has an inwardly directed flange and the pin has a peripheral abutment member contacting said flange thereby to limit downward movement of the pin relatively to the sleeve.

7. A snap-action switch according to claim 5, wherein

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the shank portion of the force-receiving element is longitudinally split and the diameter of the shank of the force-receiving element is such that the split portion of said shank must be contracted in order to engage it with the screw threads of the sleeve.

8. A snap-action switch according to claim 5, wherein the force-receiving element comprises a disc member having a knurled edge whereby it may be turned, and a

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central upstanding curved boss designed to receive actuating force.

References Cited in the file of this patent**UNITED STATES PATENTS**

5	2,418,222	Fetter	Apr. 1, 1947
	2,720,563	Williams	Oct. 11, 1955
	2,786,916	Bordelon	Mar. 26, 1957
	2,854,536	Beer	Sept. 30, 1958