May 23, 1967 W. SCHENKE 3,321,593

SNAP-ACTION ELECTRIC SWITCH WITH THREE SWITCHING POSITIONS

Filed April 19, 1966

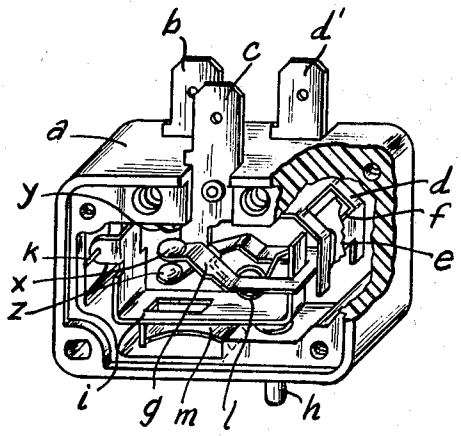

FIG. 1

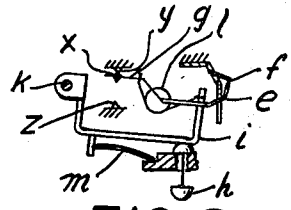

FIG. 2

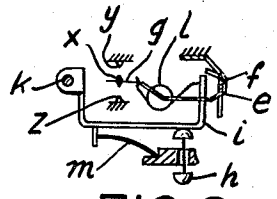

FIG. 3

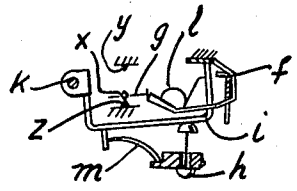

FIG. 4

INVENTOR
WERNER SCHENKE

BY McGlew & Toren
ATTORNEYS

United States Patent Office 3,321,593
Patented May 23, 1967

3,321,593

SNAP-ACTION ELECTRIC SWITCH WITH THREE SWITCHING POSITIONS

Werner Schenke, Wehingen, Germany, assignor to J. & J. Marquardt, Rietheim, near Tuttlingen, Germany

Filed Apr. 19, 1966, Ser. No. 543,615
Claims priority, application Germany, Apr. 21, 1965, Sch 36,912
5 Claims. (Cl. 200—67)

This invention relates to electrical switches with snap-action contacts, such as those known as snap switches or micro-switches and, more particularly, to a novel micro-switch or snap-action switch of the reversing contact type characterized by a stable intermediate "off" position in which both contacts are disengaged.

Snap-action switches, or micro-switches, have a construction and association of elements whereby a snap-action reversal of reversing contacts is provided upon operation of a plunger or other switch operator. However, in the solution of various switching problems, it is necessary to provide, instead of a snap-action reversal of the switch contacts, a stable and well defined intermediate "off" position of the movable reversing contact in which the latter is disengaged from both of the fixed contacts. Nevertheless, the making and breaking of the contacts should be effected in a snap-action manner, as contrasted to the relatively slow contact making and breaking of so-called spring or bridging contacts.

Frequently, there is a need for fast-acting reversing switches which have a fast reversing action with a slowly working applied switching force, and with a defined time for contact reversal. This need is not met by presently known snap-action switches or micro-switches. If the need is attempted to be met, using spring contacts or bridging contacts with a comparatively slow contact make and contact break movement, the known disadvantages of slow contact make and contact break operations are present.

An object of the present invention is to provide a snap-action electrical reversing switch with a clearly defined intermediate "off" position.

Another object of the invention is to provide a snap-action electrical reversing switch with a clearly defined intermediate "off" position and characterized by maximum contact separation.

A further object of the invention is to provide a snap-action reversing electrical switch with a defined intermediate "off" position and characterized by a greatly increased reversing time.

A further object of the invention is to provide a snap-action reversing electrical switch with a defined intermediate "off" position and in which the switch will remain in the "off" position until the switch operating plunger or switch operator is given a further actuating impulse.

Yet another object of the invention is to provide a snap-action reversing switch having a well defined intermediate "off" position and characterized by improved resistance to jolting and shocks in the contact-disengaged intermediate position of a reversing contact.

In accordance with the invention, a snap-action reversing switch having a defined intermediate "off" position is provided, including the usual contact reversing lever which, in a known manner, is actuated by snap-action spring means. However, in the invention switch, this contact reversing lever is pivotal about two rocker bearings adjacent its pivot end which is opposite the free end thereof carrying the reversing contact means. In this manner, and by virtue of the force of the snap-action spring, the reversing lever is first tipped, in a snap-action manner, about a first rocker bearing to disengage the "rest" contact of the switch. As a result of this initial movement, the reversing lever remains supported on both rocker bearings and remains firmly in the intermediate "off" position in which the contact means carried thereby are separated by a maximum from fixed contacts, until the effective position of the snap-action spring, which latter has been further deflected by further movement of the switch operator or plunger relative to the reversing lever, tips the reversing lever, in snap-action manner, about the second rocker bearing until its contact means engages the "work" contact.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view, partly in section, of an embodiment of a snap-action reversing electrical switch in accordance with the invention; and

FIGS. 2, 3 and 4 are somewhat diagrammatic sectional views illustrating the switch of FIG. 1 in the "rest" position, "off" position and "work" position, respectively.

Referring to FIG. 1, the switch includes a frame-like switch housing *a* having an open end which preferably is closed with a transparent cover in order to permit observation of the switching operation. Housing *a*, which is preferably formed of dielectric material, encloses contact carriers having exterior terminals *b* and *c*. A bridge *d* terminates in a terminal *d'* exteriorly of switch housing *a*. Interiorly of housing *a*, bridge *d* is formed with a first rocker bearing *f* and a second rocker bearing *e* spaced from bearing *f*. For example, bearing *f* may be one edge of a substantially rectangular aperture in bridge *b*, and bearing *e* may be the inner edge of a notch in the inner end of bridge *d*.

A contact reversing lever *g* is supported in a current-conducting manner on the two rocker bearings *e* and *f* of bridge *d* as by having an end extending into the aforementioned rectangular aperture and a longer arm extending through the aforementioned rectangular notch. The free end of contact reversing lever *g* carries contact means in the form of a dual contact *x*.

The switch assembly further includes a movable lever *i* which has one end pivotal about a fulcrum *k*, and which is biased to the position shown in FIG. 2 by a leaf spring *m* engaged between an abutment on lever *i* and a ledge on switch housing *a*. A switch operator, in the form of a plunger *h*, is reciprocable axially in housing *a* and has its inner end engaged with lever *i* to pivot the latter about its fulcrum *k*. Lever *i* is connected with contact reversing lever *g* through a snap-action spring *l* having one end engaged with lever *i* and the other end engaged with contact reversing lever *g* near the outer end of the latter.

In the "rest" position of the switch, as shown in FIG. 2, contact *x* on the contact carrier having the terminal *c* is engaged with contacts *y* of contact reversing lever *g* by virtue of the force exerted by snap-action spring *l*. The position illustrated in FIG. 2 constitutes the "rest" position of the switch.

When inward pressure is exerted on plunger *h*, it is transmitted, by the interaction of lever *i* and snap-action spring *l*, to contact reversing lever *g*. The latter is tipped, in a snap-action manner, about the first rocker bearing *f* until it engages with the second rocker bearing *e* and remains firmly in the resulting intermediate position in engagement with both rocker bearings *e* and *f*, as illustrated in FIG. 3. Thereby, contacts *x* and *y* are separated in a snap-action manner, with dual contact *y* being separated its maximum distance from contact *x* and contact *z*, the latter being the contact on the contact carrier having the terminal *b*. This constitutes the "off" position of the switch.

Contact reversing lever *g* remains in the contact-free intermediate "off" position until, after the continuously moving plunger *h* has traveled through a certain portion of its stroke, snap-action spring *l* attains its second effective position. In this second effective position, snap-action spring *l* tips contact reversing lever *g* about the second rocker bearing *e* and in a direction toward contact *z* until contact *y* engages contact *z*. This position is illustrated in FIG. 4 and is the "work" position of the switch. The switch remains closed in the "work" position as long as the actuating force on plunger *h* remains effective. By slowly releasing the operating force exerted on plunger *h*, the above described switching operation is performed in a reverse order, due to the return force of snap-action spring *l* and spring *m*.

The above described switching operation occurs with a relatively slow or step-wise actuation of plunger *h*. The time-travel diagram of plunger *h* determines the dwell time of contact reversal lever *g* and thus the contact reversing time of the switch. The faster the movement of plunger *h*, the shorter the dwell time of contact reversing lever *g* or, in other words, the more similar the operation of the switch is to that of the conventional snap-action or micro-switch.

Depending upon the particular application and design considerations, the rocker bearings *e* and *f* advantageously can be in the form of edges of material, knife edge bearings, or the like.

The switch construction of the invention considerably widens the field of utilization of conventional snap-action or micro-switches, for example in applications where their use has hitherto not been possible due to slow mechanical switch actuation with a pseudo-intermediate position of the reversing contact, and the disadvantages and early burning off of contacts connected with the switch.

A further advantage resides in that, due to the defined stable intermediate "off" position, the invention switch, when actuated by switch wafers or disks, switch slides and switch stepping means, may assume the function of an "off-on" switch. Such a function previously required two conventional snap-action or micro-switches. The actuation means could advantageously be combined unitarily with the switch housing, in the form of an eccentric disk or cam disk rotatable about an axis of rotation. Furthermore, the switch of the invention has the same over-all dimensions, switching capacity and actuating power as conventional snap-action switches or micro-switches.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A snap-action reversing electric switch having two "on" positions and a stable "off" position intermediate its "on" positions, comprising, in combination, first and second fixed contacts; means mounting said fixed contacts in spaced relation to each other; a contact reversing lever having a free end carrying movable contact means selectively engageable with either of said fixed contacts, and an extended pivot end; a pivotally mounted intermediate lever having a free end; a snap-action spring having one end engaged with the free end of said intermediate lever and its other end engaged with said contact reversing lever between the free and pivot ends of the latter; a linearly movable operating plunger engaged with said intermediate lever adjacent the free end of the latter to pivot the same about its pivotal mounting; and mounting means extending along the extended pivot end of said contact reversing lever and in the direction of linear movement of said plunger, said mounting means having a pair of rocker bearings spaced apart in the direction of movement of said operating plunger, said extended pivot end including means pivotally engaging each of said rocker bearing, said mounting means successively engaged by the pivotally engaging means on the extended pivot end of said contact reversing lever as the latter is pivoted between a pair of limiting positions in each of which its movable contact means is engaged with a respective contact; the extended pivot end of said contact reversing lever, during an initial movement of said intermediate lever and said plunger, pivoting about one rocker bearing under the action of said snap-action spring, to snap-disengage said movable contact means from one fixed contact and bear against both rocker bearings in a stable intermediate position with said movable contact means disengaged from and intermediate both fixed contacts; the extended pivot end of said contact reversing lever, during continuation of the movement of said intermediate lever and said plunger, pivoting about the other rocker bearing under the action of said snap-action spring to snap-engage said movable contact means with the other fixed contact.

2. A snap-action reversing electric switch, as claimed in claim **1**, including means biasing said intermediate level to a position maintaining said contact reversing lever with its movable contact means engaged with a selected one of said fixed contacts.

3. A snap-action reversing electric switch, as claimed in claim **1**, in which said contact reversing lever, in its stable intermediate "off" position, has its contact means spaced a maximum distance from both of said fixed contacts.

4. A snap-action reversing electric switch having an intermediate "off" position, comprising, in combination, first and second fixed contacts; means mounting said fixed contacts in spaced relation to each other; a contact reversing lever having a free end carrying movable contact means selectively engageable with either of said fixed contacts, and a pivot end; mounting means mounting the pivot end of said contact reversing lever and having a pair of spaced rocker bearings successively engaged by the pivot end of said contact reversing lever as the latter is pivoted between a pair of limiting positions in each of which its movable contact means is engaged with a respective fixed contact; and switch operating means, including a snap-action spring, operable to pivot said contact reversing lever; said contact reversing lever, during an initial movement of said switch operating means, pivoting about one rocker bearing under the action of said snap-action spring, to snap-disengage one fixed contact and bear against both rocker bearings in a stable intermediate position with its contact means disengaged from both fixed contacts; said contact reversing lever during continuation of the movement of said switch operating means, pivoting about the other rocker bearing under the action of said snap-action spring to snap-engage the other fixed contact; said mounting means for the pivot end of said contact reversing lever comprising a bridge member having a pair of spaced parallel edges constituting said rocker bearings; the pivot end of said contact reversing lever substantially embracing a portion of said bridge member and extending transversely of both of said edges.

5. A snap-action reversing electric switch, as claimed in claim **4**, in which said bridge is formed with a substantially rectangular aperture intermediate its end and

a substantially rectangular notch in one end, said aperture in said notch being separated by an intermediate strip of said bridge and one of said rocker bearings constituting an edge of said aperture and the other of said rocker bearings constituting the inner end of said notch; the pivot end of said contact reversing lever extending transversely through said notch and having its end extending into said aperture.

References Cited by the Examiner

UNITED STATES PATENTS

2,728,826	12/1955	Lauder	200—67
2,790,865	4/1957	Cherry	200—67

ROBERT K. SCHAEFER, *Primary Examiner.*

D. SMITH, JR., *Assistant Examiner.*