Aug. 2, 1960 W. RIDDELL 2,947,831

SNAP ACTION MECHANISM

Filed March 5, 1958 2 Sheets-Sheet 1

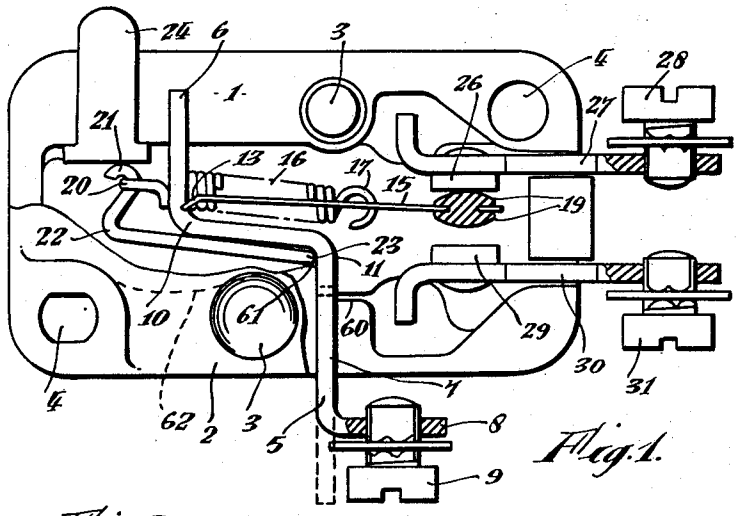
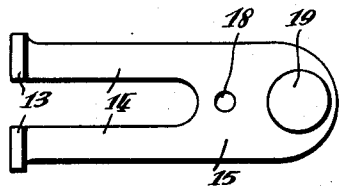


Fig. 1.

Fig. 2.



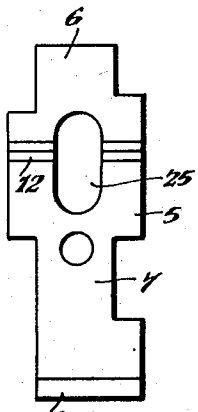


Fig. 3.

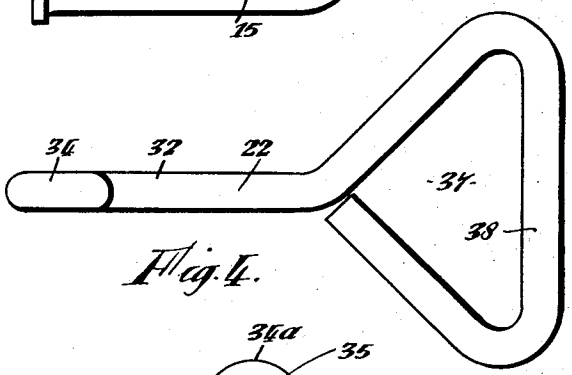


Fig. 4.

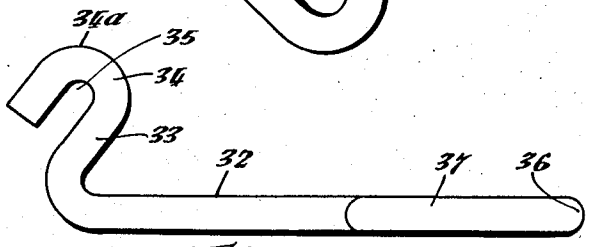


Fig. 5.

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SNAP ACTION MECHANISM

Filed March 5, 1958 2 Sheets-Sheet 2

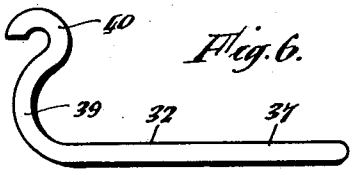


Fig. 6.

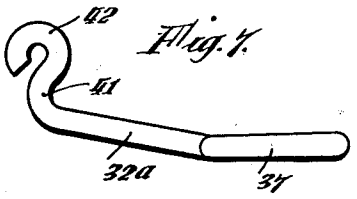


Fig. 7.

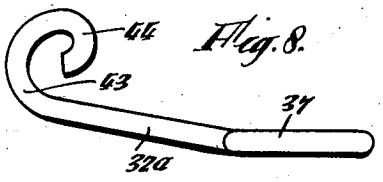


Fig. 8.

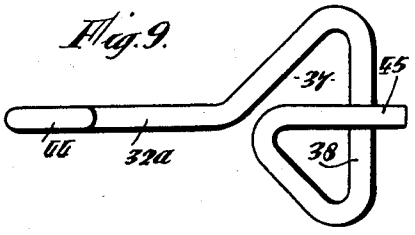


Fig. 9.

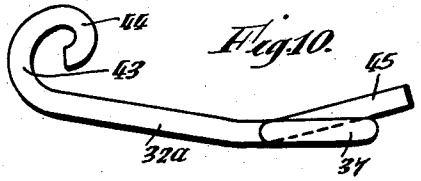


Fig. 10.

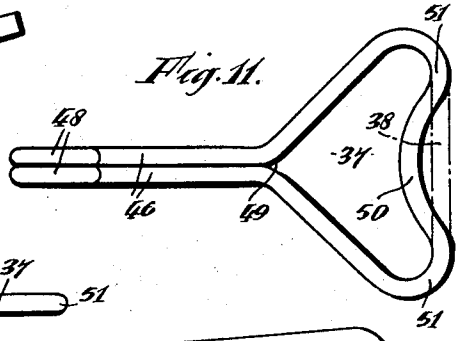


Fig. 11.

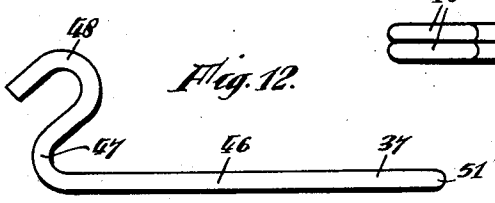


Fig. 12.

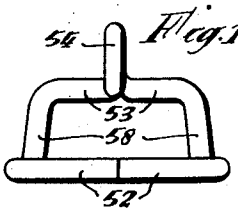


Fig. 15.

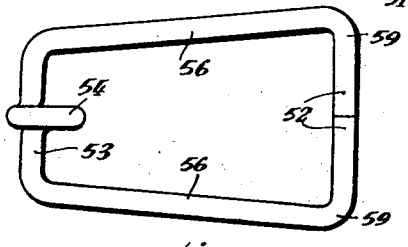


Fig. 13.

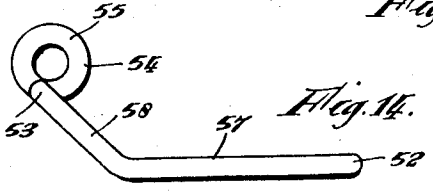


Fig. 14.

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2,947,831

SNAP ACTION MECHANISM

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Claims priority, application Great Britain July 23, 1957

3 Claims. (Cl. 200—67)

This invention relates to snap action mechanisms primarily for electric switches of the type adapted for rapidly making and breaking electrical circuits, and more particularly to switches of this type which are of small and compact construction, capable of operating under relatively heavy electrical loads by application of a light operating force.

In one known type of mechanism for such switches, the snap spring comprises an arm movable about a fulcrum and carrying a contact for engagement with and disengagement from a fixed contact, or with either of an opposed pair of fixed contacts, a tension spring of a kind that is extensible by tension, such as a tension coil spring, and an actuator member whereby the contact arm and the tension spring are relatively displaceable through an aligned attitude so that the tension spring is stressed to cause a snap movement of the contact arm.

In one known arrangement of snap mechanism including tension and compression springs, a fixed fulcrum is provided for the contact arm in a stationary mounting member, and the tension spring extends between a point nearer the contact carrying end of said contact arm and an anchorage on a pivoted actuator member.

The contact carrying arm may in accordance with the knowledge of the art be bifurcated with the pivoted ends of its two limbs in alignment, and a single tension spring disposed between and parallel to said limbs, or alternatively the contact carrying arm may be a single element with a pair of tension springs located parallel to and one on each side thereof, and it will be understood that reference hereinafter to a tension spring includes where the context allows a pair of tension springs as last referred to.

An object of the invention is to provide an improved snap action mechanism of the kind including an extensible tension spring anchored to a pivoted actuator member, whereby the mass and momentum under operation of said member are minimised and the life of the mechanism under frequently repeated operation is substantially increased.

The present invention accordingly provides, primarily in or for a switch of the type above referred to, a snap action mechanism comprising a contact carrying arm movable about a fixed fulcrum and an extensible tension spring anchored by its one end to said arm and by its other end to a pivoted actuator member bearing on a fixed abutment, wherein said actuator member is formed of round-section wire and comprises an abutment transverse to the axis of the spring and adapted to bear upon a fixed fulcrum and a hook or loop constituting an anchorage for said other end of the tension spring.

The wire constituting said actuator member may provide an abutment for engagement by an operating member, such as a plunger or lever displaceable to apply to the actuator member a force tangential to the pivotal axis thereof. An external part of the hook or loop in which the tension spring is anchored may constitute such abutment for the plunger or other operating member.

In smaller embodiments of switch including snap action mechanism as aforesaid, the force exerted by the spring which tends to hold the actuator member in pivotal abutment with a recess serving as its fulcrum is very light, and in the event of the switch suffering an impact, for example, in transport or during use, in such a direction that the momentum of the actuator member tends to displace its pivoted end from the abutting recess, it is possible in the constructions of such switches as hitherto known, for said pivoted end to fail to re-enter said recess (as will hereinafter be more fully described) while the actuator member lodges itself within the body of the switch in such a manner that it is still pivotally movable by the plunger. Thus the switch may still continue to operate, but owing to the disarrangement of the relative disposition of the pivotal points, the operating characteristics of the switch are substantially altered and, particularly, a force many times greater than the normal force is required to operate the switch. This can be a serious fault since the switches are normally housed in permanently closed bodies so that disarrangement can neither be seen nor corrected from the outside, and in the event of the switch being required to be operated by a sensitive device such as a thermostatic element, or a bellows subject to changes of pressure, the switch could fail to act with sufficient speed or to act at all in circumstances where this failure could have serious results.

Another object of the present invention is to provide, in a switch of the kind referred to, means for preventing accidental disarrangement as above mentioned, so that the switch mechanism is positively maintained in its correct relationship and with its correct operating characteristics.

The invention accordingly provides, in a snap action electric switch of the kind referred to, and having a snap action mechanism as aforesaid, an abutment projecting from the interior of the housing so as to serve jointly with the operating member and the spring to ensure correct engagement of the pivotal end of the actuator member with a stationary mounting member.

One form of such abutment may comprise simply an inward projection of the body of the housing alongside the mounting member, for example so as to present an inner wall of said body disposed to be engaged by the actuator member in the position which the latter attains under full angular displacement by operation of the plunger while its pivotal end is still in correct engagement with the mounting member.

An embodiment of a switch of the kind referred to, and various forms of actuator member utilisable therein, according to the invention will be described by way of example with reference to the accompanying drawings, wherein:

Fig. 1 is an elevation on an enlarged scale of said switch, with its cover partly broken away,

Fig. 2 is a plan view of a detail,

Fig. 3 is an elevation of another detail; and, on still more enlarged scales,

Figs. 4 and 5 are respectively a plan view and a side elevation of one form of actuator member,

Figs. 6–8 are elevations of three other forms of actuator members,

Figs. 9 and 10 are respectively a plan view and a side elevation of another form of actuator member,

Figs. 11 and 12 are a plan view and a side elevation of yet another form of actuator member, and

Figs. 13–15 are respectively a plan view, side elevation and end elevation of a different form of actuator member.

The body **1** of the snap action change-over switch shown in Fig. 1 has a cover plate **2** (the greater part of which is broken away to expose the mechanism), this cover being permanently attached to an open side of the

body 1 by means of rivets 3 or other suitable means, for example, adhesive. The body and cover also have at diagonally opposed corners holes 4 through which may pass means for securing the switch to a mounting.

The mechanism comprises a stationary mounting member 5, shown in side elevation in Fig. 1 and in end elevation in Fig. 3, which is suitably secured in the body, as shown by having a tongue 6 at one end located in a recess in one side of the body, and a portion 7 of reduced width located in another recess at the other side of the body, the exposed end 8, which may be bent as shown or extend in the same plane as the part 7, having a screw-threaded aperture in which is located a screw 9 to serve as a common terminal for the switch. In the interior of the switch, between the parts 6 and 7, the member 5 has two substantially right angled bends 10, 11. The corner inside the bend 10 has a groove 12 which affords a pivotal abutment for the aligned ends 13 of two limbs 14 of a bifurcated contact carrying arm 15 (see also Fig. 2). A tension coil spring 16 is located between the arms 14 and anchored by one end 17 in a hole 18 at the roots of the limbs, towards that end of the arm which carries at either side one of a pair of electrical contacts 19. The other end 20 of the spring 16 is anchored in a hook 21 formed at one end of an actuator member 22 which according to the invention is made of wire as will hereinafter be described. The other end 23 of the member 22 abuts the inside corner of the bend 11 in the member 5 to constitute a pivotal bearing from the member 22.

The exterior of the hook 21 serves as an abutment for engagement by a switch operating member, shown as a plunger 24 slidable in a recess in the body 1 of the switch. The tension coil spring 16 passes through a slot 25 located at the middle of the stationary mounting member 5 and extending through the two bends 10 and 11 of said mounting member, as shown in Fig. 3.

The switch when operated acts in well known manner to change over an electrical circuit. The contacts 19 carrried by the arm 15 are adapted to engage with fixed contacts 26, 29 respectively carried by terminal members 27, 30 located in recesses in the switch body 1 and having externally each a screw-threaded aperture in which is located screws 28, 31 serving as the "normally closed" and "normally open" terminals respectively of the switch. Normally, the tension coil spring 16 urges the upper of the contacts 19 into engagement with the fixed contact 26, When the plunger 24 is depressed from the position shown the actuating member is pivoted about its end 23 and the end 20 of the spring 16 is displaced through the plane of the contact carrying arm 15, i.e. through a position of maximum stress, the arrangement being such that under continued movement of the end 20 of the spring the arm 15 moves with a snap action to disconnect the upper moving contact 19 from the fixed contact 26 and engage the lower of these moving contacts with a fixed contact 29, while at the same time the spring 16 is stressed to provide a restoring force which urges the arm 15 with a snap action back to its position as shown when the plunger is released.

The wire actuator member 22 may be made in any of the various forms shown by way of example in Figs. 4–15, each of which is of very light weight and yet sufficiently rigid to perform its required function so that the mass and momentum of the actuator member under operation are minimised and the life of the mechanism under frequently repeated operation (usually hundreds of thousands of times) is substantially increased. Moreover, such an actuator member requires no machining.

All the actuator members illustrated in Figs. 1–15 are shown on a much enlarged scale. In practice the actual length of actuator member is about 0.4", the wire being for example of 22 SWG (.028" diameter).

In the form shown in Figs. 4 and 5, the actuator member 22 is made with a single arm 22 bent to what for convenience of description is called L-form. The shorter limb 33 is made in the form of a hook 34, the interior 35 of which serves as an anchorage for one end 20 of the tension coil spring 16 as shown in Fig. 1, this anchorage being so located that the spring exerts a turning moment about the other end 36 of the actuator member. The exterior 34*a* of the hook 34 serves as an abutment for an operating member, such as the plunger 24 shown in Fig. 1. The end of the member 22 opposite the hook 34 is made in the form of a broad symmetrical triangular bight 37 having a transverse base portion 38 which is adapted to bear pivotally on the stationary mounting member 5, and by reason of its inherently round end surface 36 affords a satisfactory pivotal bearing.

Figs. 6–8 show elevations of modified actuator members each of which in plan has a single arm and a triangular bight 37 as shown in Fig. 4. As shown in Fig. 6 the hooked limb extends from the arm 32 in a smooth curve 39 and its hook 40 is constituted by a reverse curve of smaller radius. In the member shown in Fig. 7 the arm 32*a* is bent upwardly from the plane of the bight 37 and the smoothly curving limb 41 is consequently shorter, again having at its free end a reversely curved hook 4*a* of smaller radius. In Fig. 8 the hooked limb is constituted by a smoothly curving extension 43 of the arm 32*a*, which is again upwardly bent from the plane of the bight 37, and a hook 34 is formed at the end of the portion 43 by a curved portion of smaller radius but extending in the same angular direction.

The modified actuator member shown in Figs. 9 and 10 is similar to that shown in Fig. 8, with the difference that the free end of the wire which constitutes the bight 37 is turned as a tail 45 across the base portion 38, this tail being adapted to be located in the slot 25 in the stationary mounting member 5, as shown in Fig. 3, for constraining the actuator member against vertical movement relative to said mounting member.

The modified actuator member shown in Figs. 11 and 12 is somewhat similar in plan and elevation to that shown in Figs. 4 and 5, the difference being that the two ends of the wire are both brought to the hooked end of the member, which thus comprises a pair of arms 46 and hooked limbs 47 whereon a pair of hooks 48 are formed by reversely curved ends of the wire, the arms 46 and the laterally extending portions 47 and 48 being contiguous from the apex 49 of the triangular bight 37.

As shown in Fig. 11 the base portion 50 of this bight is made wavy or curved to provide a pair of laterally spaced bearings 51, for engaging the stationary mounting member 5. Evidently in an actuator member as shown in Figs. 11 and 12 the base may alternatively be a straight transverse portion 38 like the base portion of the actuator members shown in Figs. 4–10; on the other hand, any of the actuator members shown in Figs. 4–10 may have a wavy base portion to provide spaced bearings as shown in Fig. 11.

A still further modified actuator member is illustrated in Figs. 13–15. This member in plan is shown trapezoidal, or alternatively may be rectangular. The free ends 52 of the single piece of wire from which this actuator member is made are aligned and butted together to form one shorter side which constitutes a transverse bearing, and the opposite shorter side 53 is bent to form a closed loop 54 serving as an anchorage for an end of the tension spring, while its exterior portion 55 also serves as an abutment for the plunger or other operating member of the switch. The two longer sides 56 of the member are bent, having as shown in Fig. 14 portions 57 which together with the transverse ends 52 constitute a flat open bight, and portions 58 extending upwardly at an obtuse angle to the loop 54 so that the member is effectively of L-form. Evidently the portions 52 instead of being aligned may be bent inwards so that the rounded corners 59 constitute two spaced bearings in the manner shown in Fig. 11.

The form of actuator illustrated in Figs. 12–15 is also

capable of modification for use in a switch mechanism having a pair of tension coil springs associated with a contact carrying arm having a single central limb engaging the stationary mounting member, said two coil springs being disposed one on each side of this limb. The actuator member may accordingly be made with two loops such as **54**, one at the upper end of each of the oblique or rising portions **58** of the lateral arms, and the shorter transverse side **53** having an upwardly extending portion, for example being arched, at its middle to provide an abutment for the plunger.

The invention further provides means as aforesaid to prevent accidental disarrangement of the mechanism by displacement of the pivot end **23** of the actuator member **22**. In switches of the type referred to, as hitherto made, the inner wall of the housing **1** has been substantially flat (sometimes with a small boss around a hole for the lower rivet **3**) in the plane of the portion **60** shown in Fig. 1. The actuator members of strip material as hitherto employed have usually been provided with a knife edge engaged in a transverse recess inside the corner **11** of the mounting member **5**, but in the manner hereinbefore described it has been possible for the actuator member under an impact resulting in extension of the spring, to displace its pivotal end from such recess, said end becoming lodged in the corner between the face of the member **5** and a continuation of the inner wall of the housing in line with the portion **60**. For preventing such disarrangement, more particularly since a wire actuator member affords a good pivotal bearing without requiring the provisions of a recess in the member **5**, according to a further feature of the invention the housing **1** is provided with a unitary inward projection **61** alongside the mounting member **5** which co-operates with the bend **11** to constrain the pivotal bight **23** of the actuator member so that it turns about the axis of its transverse portion and is not capable of translatory movement perpendicular to said axis. The projection **61** preferably has a flat oblique wall **62** so disposed that, when the actuator member is turned by depression of the plunger **24**, in the limit position its longer arm (e.g. the arm **32** with the convergent portions of the bight **37** as shown in Figs. 4 and 5) is

in engagement with the wall surface **62**. This arrangement enables omission of an abutment recess in the stationary mounting member **5**, the transverse base portion **38** of the actuator member, which is of course of round section, simply bearing on the surface of said mounting member.

What I claim and desire to secure by Letters Patent is:

1. A snap-action mechanism which includes a housing having an integral inwardly-extending projection; a mounting member carried by said housing adjacent to said projection and bent, inwardly of said projection, so that the limbs of the member on either side of the bend form a crotch with said projection; an actuator member insertable into said crotch and capable of pivotal movement therein, the actuator member bearing against the un-notched surface of the limb carried by the housing and being restrained from lateral displacement by the other limb and by said projection, the actuator member also having a first anchorage at an extremity remote from said pivot; a movable arm having a second anchorage; and a tension spring extending between the two said anchorages.

2. A snap-action mechanism as claimed in claim 1 in which the actuator member is made of material having a circular cross-section.

3. A snap-action mechanism as claimed in claim 1 in which said mounting member is further bent to provide a further limb and in which the movable arm is pivotable about a notch in the further limb.

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