June 17, 1952 L. J. KMIECIK 2,601,152

SNAP SWITCH

Filed April 11, 1949

Fig. 1

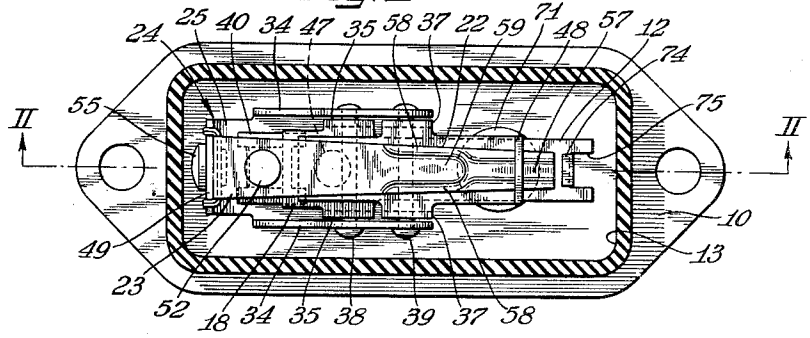


Fig. 2

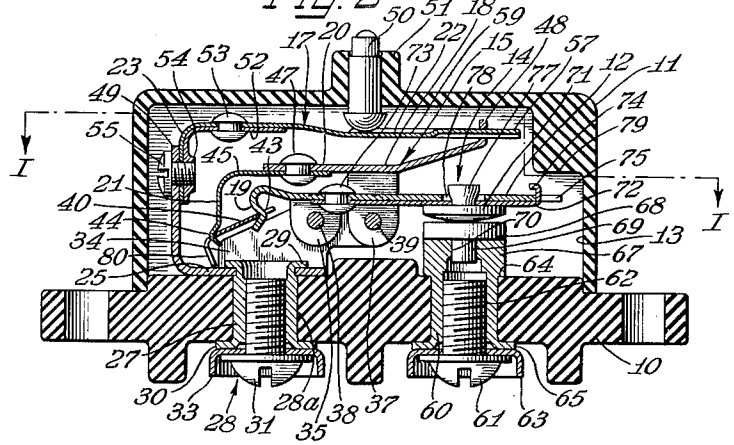


Fig. 3

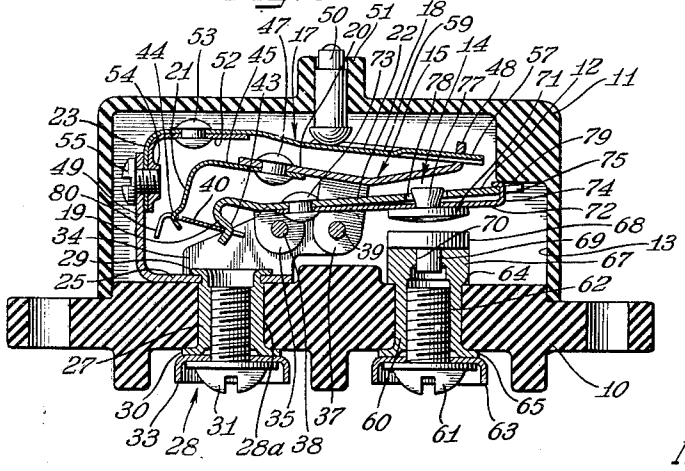
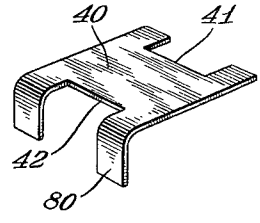


Fig. 4



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SNAP SWITCH

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1 Claim. (Cl. 200—67)

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This invention relates to a snap device such as a snap switch or the like and more particularly concerns improvements in a snap switch or like structure of the kind covered in Leo J. Kmiecik Patent No. 2,454,185 issued November 16, 1948.

In a snap device such as a snap switch of the type covered in my aforesaid issued patent quick responsiveness and high speed operation are highly important practical factors. Simplicity and ease of manufacture, sturdiness and reliability in operation are also important.

It is, accordingly, an important object of the present invention to provide an improved, simple and compact snap device which particularly lends itself to use as a snap switch and includes a novel assembly of operating parts for rapid response and high speed operation with minimum operational deflection of actuating means for the device.

Another object of the invention is to provide in a snap device wherein a pair of angular members are cooperatively disposed for relative rocking movement in operation, improvements in the mounting of such members to increase the speed of operative reaction of the members.

A further object of the invention is to provide in a snap switch or like snap device improvements in various operating parts embodying simplifications and increasing the efficiency thereof.

Still another object of the invention is to provide an improved snap device of increased operating sensitivity.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of a preferred embodiment thereof taken in conjunction with the accompanying drawings wherein:

Figure 1 is a horizontal sectional view through the illustrated embodiment of the invention, taken substantially on the line I—I of Figure 2;

Figure 2 is a vertical sectional view through the illustrated snap switch embodiment taken substantially on the line II—II of Figure 1;

Figure 3 is a vertical sectional view substantially like Figure 2 but showing the mechanism in a different operative relationship; and

Figure 4 is an isometric view of the over center interconnecting member operative between the short legs of the relatively rockable lever members of the assembly.

As shown on the drawings:

A snap device embodying the features of the present invention is especially useful in a snap switch assembly adapted to be housed in a two-part casing which may comprise a base 10 and a hollow cover 11. In an efficient form the casing may be made from any suitable dielectrical material such, for example, as a phenolic condensation product, or the like.

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The cover 11 provides therein a chamber 13 housing the several operating components of the snap assembly including relatively rockable lever members 14 and 15 and an actuating lever member 17. All of the lever members are preferably of generally L-shape. The lever member 14 has a long leg 12 including an intermediate portion 18 and a short leg 19. The lever member 15 has a long leg 20 and a short leg 21. The lever member 17 has a long leg 22 and a short leg 23. The construction and relationship of the lever members is such that swinging of the lever member 17 effects rocking of the lever member 15 and, in turn, relative opposite rocking of the lever member 14.

All of the levers 14, 15 and 17 are preferably mounted upon a common mounting member 24 which may be formed as a sheet metal stamping having a base 25 which is secured to the casing base 10 by means such as an electrical contact terminal body member 27 forming part of a contact terminal assembly 28. The body member 27 is preferably tubular and secured within an aperture 28a in the casing base 10, with an attachment flange 29 turned over into retaining engagement with the supporting member base 25 and a retaining terminal flange 30 at its outer end secured against the outer side of the casing base 10 about the aperture 28. The contact body member 27 is internally threaded and has a terminal screw 31 threaded thereinto and retaining a contact cup washer 33.

For supporting the rockable arms 14 and 15 pivotally, the supporting member 25 has a pair of spaced parallel upstanding arms or ears 34 between which respective pairs of depending ears 35 and 37 on respectively the arm 14 and the arm 15 are received. Pivotal bearing for the ears 35 and 37 is provided by respective pintle pins 38 and 39. Thereby the pivots for the respective rockable levers 14 and 15 are offset from one another, with the pivot for the arm 14 offset in the direction of the short leg 19 of such arm from the pivot for the rocking lever 15. It may also be noted that the pivot ears 37 of the rocking lever 15 are longer than the pivot ears 35 of the rocking lever 14 whereby the lever 15 is supported in superposed spaced relation with respect to its long leg 20 above the long leg 18 of the rocking lever 14. The short leg 19 of the rocking lever 14 is spaced from the

short leg 21 of the rocking lever 20 so that a substantial range of relative rocking of the substantially internested levers 14 and 15 is permitted.

Means are provided to act between the short legs 19 and 21 of the rocking lever members 14 and 15 to function responsive to movement of one of the levers to carry its shorter leg selectively to either side of an aligned position of the short legs of the levers. To this end, the short leg 21 of the rocking lever 15 is longer than the short leg 19 of the rocking lever 14 so that in relative opposite rocking of the levers the end portions of the short legs will move to respective opposite sides of an aligned condition of the end portions of the short legs under the influence of an over center connecting member 40. In a preferred form the over center member 40 comprises a substantially flat plate having the opposite ends thereof notched out as at 41 and 42 and with which are engaged respectively the end portions of the short legs 19 and 21, the short leg 19 being provided for this purpose with channeled terminal portion 43 while the leg 21 is provided with a channeled portion 44. The channeled terminal portions 43 and 44 open toward each other and engage the respective ends of the over center member 40 within the notches 41 and 42, respectively. The length of the member 40 between the engaged portions of the short legs 19 and 21 is slightly greater than the normal spacing between the legs in the aligned condition of the legs so that a condition of stress is generated whenever the short legs 19 and 21 come into alignment, and the over center member 40 therefore acts to move over center by pivoting at its end edges in the channeled terminal portions 43 and 44 of the short legs.

In order to provide for resilient yielding of the cooperating structures to relieve the stress imposed by action of the over center member 40 in the aligned position of the short legs 19 and 21, the over center member 40 may be formed as a resilient spring to absorb all of the stress, or it may be formed as a rigid plate, but it is preferably slightly yieldable or springy, and the major proportion of the resilient yielding occurs in one of the short lever legs, in the present instance the short leg 21 of the rocking lever 15. To this end, the short leg 21 is formed from resilient relatively thin stock, preferably separately from the body of the rocking lever 15 and has an angular connecting flange portion 45 which is secured to the long leg 20 as by means of a rivet 47. Thus, when either of the levers 14 or 15 is rocked the over center member 40 acts to snap the remaining lever rockingly in the opposite direction upon movement of the short legs 19 and 21 beyond center in either direction.

In the present instance, the rocking lever 15 is arranged to be actuated by the actuating lever 17 to effect opposite rocking of the rocking lever 14 as a function of the over center member 40 coacting with the rocking levers. For this purpose, an end portion of the actuating lever 17 is interconnected with the free end portion of the rocking lever 15 by extending through a slotted angular flange 48 at the free terminus of the lever 15. At its opposite end, the actuating lever 17 has the short leg 23 thereof fixedly secured to an upstanding angular supporting leg 49 integral with the base 25 of the supporting member 24.

By preference the actuating lever 17 is in the form of a leaf spring which, by reason of its fixed attachment to the supporting leg 49 normally assumes a biased position adjacent to the roof of the chamber 13 where it is engaged by an operating plunger 50 reciprocably slidably carried in a hollow boss 51 on the cover 11. The outer end of the plunger 50 projects outwardly beyond the outer end of the boss 51 and is thus adapted to be pressed inwardly to flex the actuating spring lever 17 so as to rock the rock lever 15 and cause the over center piece 40 to snap the rock lever 14 in the opposite rocking direction. Release of pressure on the operating plunger 50 allows the spring lever 17 to return of its own resilience to its normally biased position to rock the lever 15 in reverse and thus cause the lever 14 to be snapped back to initial position.

In order to improve the action of the actuating spring lever 17, a stiffening brace or reinforcement is provided for the short leg 23 thereof and the adjacent portion of the long leg 22. Efficient means for this purpose comprises an angular sheet metal member 52 seated within the reentrant corner of the spring lever member and having a leg secured as by means of a rivet 53 to the long leg 22. The remaining leg of the brace member 52 has a hollow tapped boss 54 into which a screw 55 is threaded to attach the assembly to the supporting leg 49, the short leg 23 of the spring lever being clamped by the contiguous tapped boss leg of the member 52 to the supporting leg 49. This not only results in a relatively simple and economical structure but affords a stiffening for the attached end portion of the spring lever 17 so as to increase the resilient bias thereof to normal position.

In addition, the rock lever engaging end portion of the actuating spring lever 17 is preferably substantially stiffened by reinforcing rib embossment thereof, a longitudinal reinforcing rib 57 being formed in the extremity portion which is engaged with the connecting flange 48 of the engaged rock lever. Inwardly from the free end of the spring lever leg 22, the reinforcing rib 57 is forked to provide parallel side marginal ribs 58 defining therebetween a plunger seat area 59. The side ribs 58 terminate just beyond the point where the plunger 50 engages the seating area 59 and the portion of the spring lever leg 22 between the ends of the reinforcing ribs 58 and the adjacent leg of the reinforcing and bracing member 52 is relatively freely flexible. Inasmuch as the amount of flexing required in the leg 22 is very limited the free flexing area of the spring lever leg is ample for the purposes of the snap device and is free from any over stressing such as might cause fatigue failure. Due to the relative stiffness of all other portions of the actuating lever, the lever has a very quick action.

In its rocking movements, the rocking lever 14 functions to make and break an electrical circuit one branch of which is connected to the connector member 30 and another branch of which is connected to a connector stud 60 by means of a screw 61 threaded into an outwardly opening bore 62 coaxially in the stud, the head of the screw being received within a terminal cup 63 similar to the terminal cup 33. The stud 60 is secured in the casing base 10 under the long leg 18 of the make and break lever in appropriately spaced relation to the contact member 27, extending through an appropriate aperture in the casing base with a shoulder 64 engaging against the inner face of the casing base and a retaining flange 65 upset against the outer face of the

casing base to retain the stud fixedly in position. At its inner end the stud 66 has a contact head 67 provided with a deterioration resistant contact tip 68 which is preferably formed with a depending stem 69 press-fitted into an axial aperture or socket 76 in the contact head.

Electrical contact between the make and break lever 14 and the contact tip 68 is effected by means of a contact button 71 mounted on a flexible leaf carrier 72 of substantial length and secured as by means of a rivet 73 to the long lever leg 18 adjacent to the pivoted portion thereof while the opposite end of the leaf is formed with an upwardly and return bent flexure limit flange 74 cooperating with the end of the long leg 18 within a notch 75. The terminal button is conveniently connected with the carrying leaf 72 by means of a stem 77 which, after assembly is spread into interlocking relation at the opposite side of the leaf 72 from the head of the button and about the rim of an appropriate aperture in the leaf. A clearance aperture 78 for the stem 77 is provided in the long leg 18 of the make and break lever. The purpose of mounting the contact button 71 on the flexible carrying leaf 72 is to limit the separation distance when the contacts are separated and also to delay the contact break upon movement of the lever 14 until the lever has accelerated in its contact breaking rocking movement sufficiently to separate the contact button 71 from the contact head 68 at high speed. Engagement of the turned over terminal of the terminal flange 75 with the upper side of the long lever leg 18 limits the flexure separation of the carrying leaf 72 from the adjacent face of the lever leg 18.

Limit upon the distance to which the make and break lever 14 may swing to contact-breaking position is accomplished by the provision of a stop shoulder 79 formed integral with the casing closure cap 11 and opposing the free end portion of the long lever leg 18. By having the turned over terminal of the interengagement flange 74 of the contact carrying leaf engageable with the shoulder 79 relieves the shoulder from tendency to be gouged out by the ends of the lever leg 18 at each side of the notch 75 and permits the lever 14 to be made more economically than if the free end terminal portions thereof were specially formed to present flat contact areas to the shoulder 79.

Strain upon the intermediate rocking lever 15 by action of the over center member 40 in the contact making or closed circuit condition of the snap device is accomplished by the provision of a pair of movement limiting angular legs 60 on the outer end of the over center member 40 which, in the closed circuit condition of the assembly engage as stops against the retaining member base 25 as seen in Figure 2.

From the foregoing it will be apparent that the present invention provides a snap device of unusually compact form and rapid action. Normally the three cooperating levers are in the closed circuit condition of the assembly as seen in Figure 2, being thus maintained by the normal bias of the actuating spring cantilever 17 which draws upwardly on the free end of the intermediate lever 15 and thus maintains the short leg 21 thereof in its downward position so that the over center member 40 acts on the short leg 19 of the make and break lever 14 to hold the same in its upward position and thus the long leg 18 in its downward position wherein the contacts 68 and 71 are in engagement. Upon only slight depression of the operating plunger 50 to effect downward flexing of the long leg 22 of the actuating cantilever and thus downward swinging of the long leg 20 of the intermediate lever 15 and upward rocking of the short leg 21, movement of the short leg 21 past the aligned position of the short legs 21 and 19 occurs and the over center member 40 snaps the make and break lever 14 in reverse rocking movement to snap the switch open, to the position shown in Fig. 3.

Exceptionally short movement to effect this result at high speed results from the offset relationship of the rocking lever pivots wherein the pivot 38 of the make and break lever 14 is located at an increased distance from the contact 68 as compared to the pivot 39 for the intermediate lever 15 with the result that the fulcrum of the lever 14 is as close as practicable to its actuated end, thus rendering the short end of the lever as short as practicable and the long end of the lever as long as practicable so that a small rocking movement of the short end of the lever effects a correspondingly long rocking motion of the long end of the lever. These highly desirable results are reflected throughout the mechanism since the flexing distance of the actuating spring lever 17 is correspondingly reduced and the rocking range of the intermediate lever 15 is correspondingly reduced. This is advantageous in numerous respects among which may be mentioned minimizing strain upon the flexed portion of the actuating lever 17 and thus permitting such spring lever to be conditioned for improved high speed responsive resilience. The limitation upon necessary movement of the various bearing parts reduces wear and thus increases the life of the unit. The overall improved high speed responsiveness of the unit increase the speed of apparatus with which the snap switch unit is used as a control device.

I claim as my invention:

In a snap switch or like device, a first member pivoted on an axis adjacent one end thereof, a movable switch contact carried by said first member adjacent the other end thereof, a stationary switch contact engageable with said first switch contact, a second member in substantially spaced superposed relationship to said first member in open and closed positions of said switch, said second member being pivoted about an axis laterally spaced from and intermediate the pivotal axis of said first member and said switch contacts, over-center spring means between said one end of said first member and the adjacent end of said second member, and actuating means engageable with said second member adjacent the other end thereof to displace said over-center spring means with respect to said adjacent ends of said members to effect actuation of said switch.

LEO J. KMIECIK.

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