Jan. 29, 1963 C. H. MILLERWISE 3,076,070

SWITCH

Filed Aug. 29, 1958 2 Sheets-Sheet 1

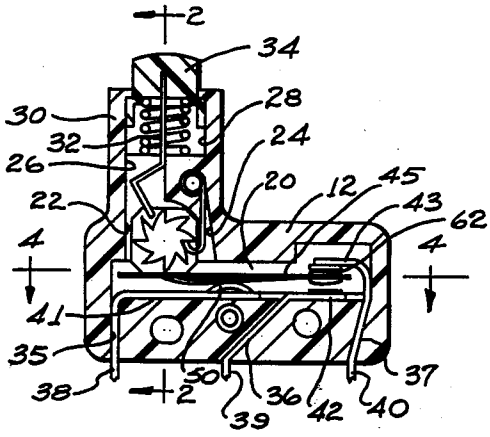

FIG. 1

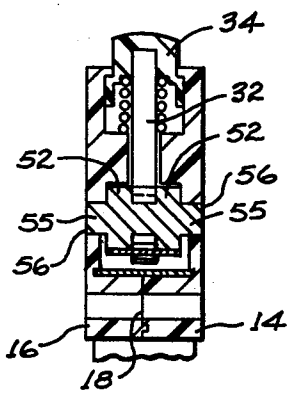

FIG. 2

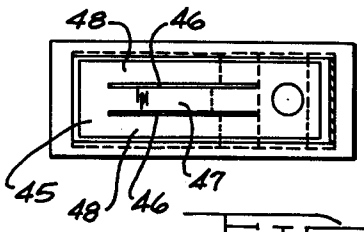

FIG. 4

FIG. 3

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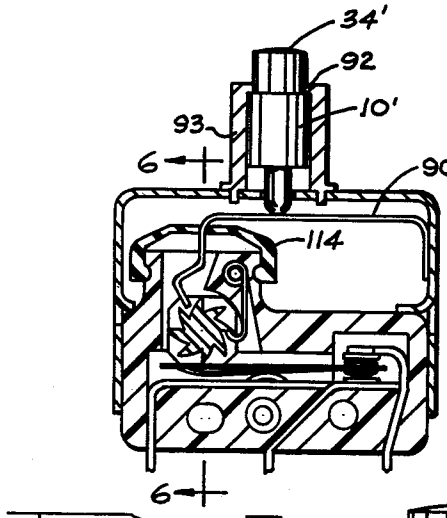

FIG. 5

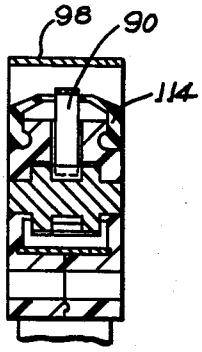

FIG. 6

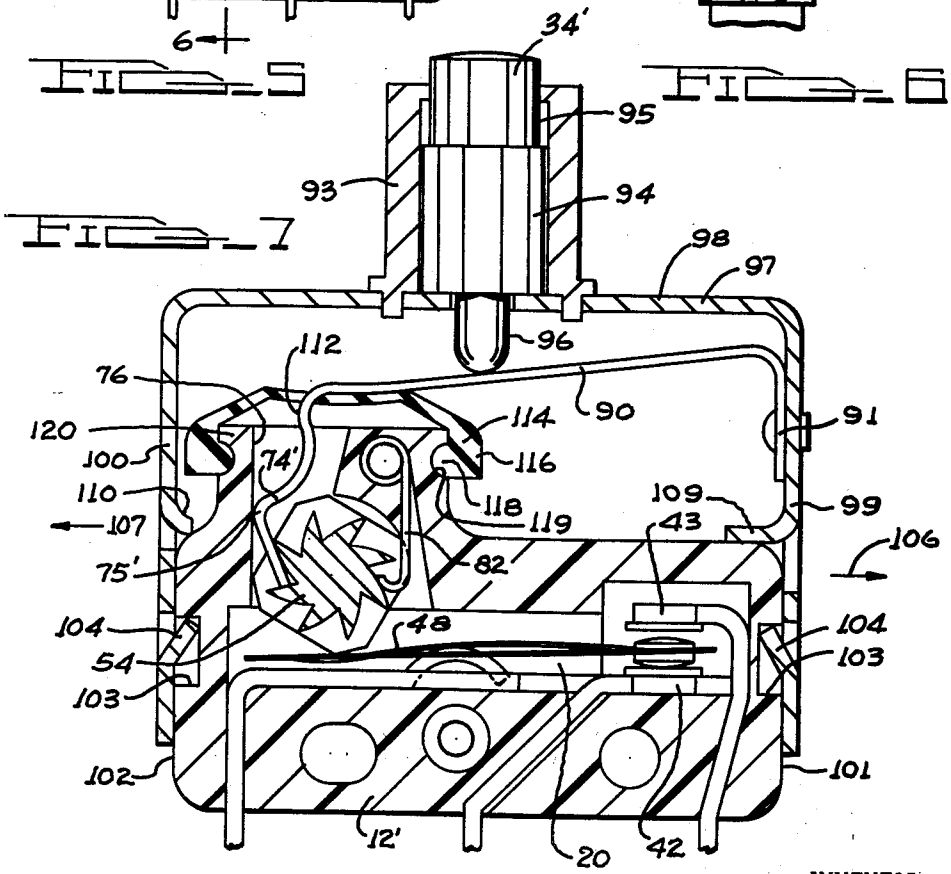

FIG. 7

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SWITCH

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7 Claims. (Cl. 200—67)

This invention relates to a switch construction of the plunger-operated type wherein one depression of the plunger is effective to close one set of switch contacts and the succeeding depression of the plunger is effective to close another set of contacts, the arrangement being such that continued successive plunger depressions are effective to switch the blade from one set of contacts to the other.

One object of the present invention is to provide a switch of the above-described character which is of improved operation without sticking, parts jamming or other malfunctioning.

Another object of the invention is to provide a switch construction of the above-described type wherein the component parts are low-cost mechanisms and wherein the component parts can be quickly and easily assembled together without expensive machinery or intricate skill on the part of the assembler, whereby to provide a switch construction which can be manufactured at a relatively low total cost.

Another object of the invention is to provide a switch construction of the above-mentioned type, wherein the component parts are of such design as to be manufactured with large tolerances without causing the parts to change in operation or otherwise fit together in an undesired relation.

Another object of the invention is to provide a switch construction wherein the component parts are of such design as to be of rugged construction so as to have long life without early failure due to wear or deformation.

Another object of the invention is to provide a switch structure wherein the component parts are relatively rugged in construction while being located together in a relatively compact small-size package, so as to obtain the desired advantages of small size and reliable operation over extended time periods.

Another object of the invention is to provide a switch construction of the above-mentioned type wherein the operating parts of the switch are prevented from clogging, sticking or otherwise not functioning properly due to the presence of dirt or other foreign material within the switch housing.

Another object of the invention is to provide a switch construction wherein the operative parts are sealed against the admission of dirt or other material which would cause clogging of the switch parts.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIG. 1 is a longitudinal sectional view through one embodiment of the invention;

FIG. 2 is a sectional view taken on the line 2—2 in FIG. 1;

FIG. 3 is an enlarged sectional view taken in the same direction as FIG. 1 but showing the switch parts in the position they take when plunger 34 is in a depressed condition;

FIG. 4 is a view taken substantially on line 4—4 in FIG. 1;

FIG. 5 is a sectional view similar to FIG. 1 but taken through a second embodiment of the invention;

FIG. 6 is a sectional view taken substantially on the line 6—6 in FIG. 5;

FIG. 7 is an enlarged view taken in the same direction as FIG. 5 but showing the parts in the positions they occupy when plunger 34' is in the depressed condition.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

In the drawings, particularly FIGS. 1 through 4, there is shown a switch housing 12 formed as a two-piece body of Bakelite, nylon or other dielectric material. Each of the dielectric housing sections 14 and 16 are of similar configuration with the interface-forming surfaces 18 thereof being recessed to provide a blade chamber 20 extending generally longitudinally of the switch housing, a ratchet chamber 22 adjacent one end of chamber 20, a pawl chamber 24 positioned adjacent the chamber 22 and two slideway chambers 26 and 28 formed in a housing projecting portion 30.

Housing members 14 and 16 are provided with slots 35, 36 and 37 for receiving the terminal portions 38, 39 and 40 of metallic contact members 41, 42 and 43. To alternately close the circuit between terminal 38 and the terminals 39 and 40, there is provided an elongated switch blade 45 which is provided with two longitudinal slots 46 (FIG. 4) for defining a central blade section 47 and two edge sections 48. As shown in the drawings, central portion 47 is pre-deformed downwardly out of the plane of the blade so as to put the blade sections 48 under preset tension for normally (FIG. 1) holding the blade in engagement with contact member 43. In order to support the blade 45 within its chamber 20 there is provided on member 41 a humped section 50 which engages the central blade portion 47, it being understood that this humped portion is only of sufficient width to underlie blade portion 47 and not blade portions 48. With the above-described construction a downward force on the left end portions of blade sections 48 is effective to cause the blade sections 48 to move downwardly past the upper extremity of humped portion 50 for allowing the tension force in the blade to snap the blade from its FIG. 1 position to its FIG. 3 position engaged with contact member 42.

In order to provide the downward force on the left end portion of blade 45 there is disposed above the blade a pair of rotary cams 52 which are integrally formed with a ratchet 4. Mounting of the ratchet and cam device for rotary conjoint movement is effected by means of two stub shafts 55 which project from the cams 52 into cylindrical sockets 56 in housing members 14 and 16. It will be noted that cams 52 are provided with four blade deflecting surfaces or lobes 59 spaced greater distances from the cam rotational axis 60 than the four blade release surfaces 61. With this arrangement, when the cams 52 are in their FIG. 1 positions with any of surfaces 61 engaged with the blade sections 48, said sections 48 are caused by the tension forces therein to remain in the elevated position above humped portion 50 for maintaining the blade contact 62 in pressure engagement with member 40. When cams 52 are rotated counterclockwise through ⅛ revolution, blade-deflecting surfaces 59 are caused to engage the blade sections 48 for moving them downwardly as shown in FIG. 3, the

operation being such as to change the direction in which the blade tension force acts so as to develop a downward force component for causing the blade to quickly snap down with a snap action onto contact member 42. In this connection it will be noted that blade deflecting surfaces 59 exert only enough force on the blade to redirect the blade sections 48, the blade snapping force being derived from the pre-set tension in sections 48 due to the pre-bowing of central blade section 47.

It will be noted that cams 52 are each provided with four blade-deflecting surfaces 59 and four blade release surfaces 61, making a total of eight separate blade engaging faces. Ratchet 54 is provided with eight equally spaced teeth 64 so that a ⅛ revolution of the ratchet is required to switch the position of cams 52 until one of its blade engaging faces occupies the position previously occupied by the next preceding face.

In order to rotate ratchet 54 through ⅛ revolution increments there is provided a repetitively strokable force means, shown in FIGS. 1 and 3 as comprised of a plunger 34 and spring arm 32, said plunger being slidably housed within slideway chamber 28. Compression spring 66 normally holds plunger 34 in the elevated FIG. 1 position. However, when plunger 34 is depressed as shown in FIG. 3, spring arm 32 (rigidly carried by the plunger) is caused to pressure against surface 70 of one of the ratchet teeth for moving the ratchet counterclockwise into the FIG. 3 position. It will be noted that spring arm 32 includes a section 72 which slidably engages on a surface 73 formed by slideway chamber 26. Spring arm 32 also includes a generally V-shaped section 74 having an apex portion 75 slidably engaged with the slide surface 76 formed by chamber 26. During downward movement of plunger 34 surfaces 73 and 76 prevent any buckling of the spring arm such as would cause improper rotation of the ratchet or other parts jamming.

When the downward force on plunger 34 is removed spring 66 drives the plunger upwardly so as to cause the extreme lower portion 78 of arm 32 to cam on tooth surface 79, the action being such as to cause a slight clockwise rotation of the ratchet-cam assembly 54, 52. This slight clockwise rotation of the ratchet is however, not sufficient to allow the switch blade contact 80 to move out of pressure engagement with contact 42, since in the FIG. 3 position the switch blade is in a position of slight overtravel with respect to contact 42.

Any excessive clockwise rotation of ratchet 54 is prevented by a pawl member 82 which is conveniently formed from low-cost flat stock with a generally cylindrical portion 84, a generally flat straight portion 86 and a generally hooked portion 88 extending into the space between adjacent ones of ratchet teeth 64. In operation, excessive clockwise rotation of ratchet 54 is prevented by engagement of hooked portion 88 with tooth surface 70. During counterclockwise rotation of ratchet 54 pawl 82 is of course free to pivot counterclockwise about the axis defined by cylindrical portion 84 so as to permit it to move into engagement with pawl chamber surface 87 where it is out of the path of travel of ratchet 54.

The general operation of the FIG. 1 embodiment is such that one depression of plunger 34 is effective to rotate cam device 52 counterclockwise through one eighth revolution so as to cause blade 45 to snap from member 43 to member 42. The next depression of plunger 34 is effective to cause blade 45 to snap from member 42 back to member 43.

Referring to the embodiment shown in FIGS. 5 through 7, it will be noted that said embodiment employs many of the same components as are employed in the FIG. 1 embodiment. Accordingly, similar reference numerals are employed wherever applicable. In this connection it will be seen that the FIG. 5 embodiment is provided with a ratchet 54 which is actuated in a counterclockwise direction by a spring leaf arm or lever member 90 having a mounting portion 91, the stress in member 90

being such that it normally tends to take the FIG. 5 position so as to urge plunger 34' upwardly against a shoulder 92 formed at the upper end of a tubular guide structure 93. Tubular guide structure 93 is carried on a housing structure 97 which comprises a web-forming wall 98 extending substantially parallel to switch blade chamber 20, and two flange-forming walls 99 and 100 extending downwardly into clamping engagement on the opposed end surfaces 101 and 102 of dielectric housing body 12'.

In order to releasably retain housing structure 97 on dielectric housing body 12' the body surfaces 101 and 102 are provided with recesses 103 which lockingly receive struck-out tangs or tabs 104 carried by flanges 99 and 100. It will be seen that tangs 104 prevent upward sliding of housing structure 97 off of dielectric housing body 12'. However, the walls 99 and 100 are to a certain extent flexible so that they may be pulled away from one another in the arrow 106, 107 directions for effecting removal of member 97 from member 12'.

It is desirable that member 90 have a predetermined relation with respect to ratchet 54 so that each downward deflection of member 90 is effective to rotate the ratchet to the desired degree. Accordingly, side walls 99 and 100 of member 97 are provided with struck-in wall portions 109 and 110 which function as stop members for limiting downward movement of member 97 relative to member 12'. Thus members 109 and 110 limit downward movement of member 97, and members 104 limit upward movement of member 97 so as to releasably retain member 97 in a desired relation with respect ot member 12'. In this manner actuator member 90 is caused to have an initial predetermined relation with respect to ratchet 54 whereby each deflection of member 90 by plunger 34' is effective to cause a desired rotation of the ratchet.

It will be noted that spring member 90 is provided with a downwardly turned portion 112 which includes a V-shaped section 74' having an apex 75' adapted to abut and slidably engage guide surface 76 formed in housing body 12'. This sliding engagement between apex 75' and guide surface 76 is effective to guide the member 90 in its downward movement and prevent it from buckling, deforming or otherwise failing in service.

The FIG. 5 construction is intended for installations having dirt accumulations or other materials, which, if allowed to work into the ratchet chamber or switch blade chamber, might cause such clogging as would interfere with the desired operation. Accordingly, the FIG. 5 construction is provided with a sealing member in the form of a flexible cap 114 of rubber or similar material, said cap being provided with an annular flange 116 equipped wtih an inwardly extending bead 118 which engages in an annular groove 119 formed in the projecting portion 120 of the housing body 12'.

In operation of the FIG. 5 embodiment spring member 90 is by its own internal stress normally positioned in the FIG. 5 location. By the application of a downward external force on reduced end portion 95 of plunger 34' plunger portion 96 is caused to drive member 90 downwardly, with a resultant counterclockwise rotation of ratchet 54. As in the FIG. 1 embodiment, this counterclockwise ratchet rotation is effective to move blade sections 48 downwardly so as to snap the blade from the position engaged with member 43 to the position engaged with member 42. Removal of the downward force on plunger portion 95 is effective to allow spring member 90 to be elevated to its FIG. 5 position with a slight clockwise rotation of ratchet 54. However, excessive clockwise rotation of the ratchet is prevented by pawl 82.

Both embodiments of the invention are characterized by trouble-free operation with long service life. Additionally, it will be noted that in both embodiments the various components can be easily and quickly assembled together for rapid assembly of the completed device, thereby contributing materially to low total manufacturing

cost. In this connection it will be seen that only two rivets 122 are required to retain the parts in their assembled positions.

I claim:

1. The combination comprising a dielectric casing structure having opposed stops therein; a snap action switch blade within the casing structure snappable between the stops on the application of a blade-deflecting force thereto; a frame structure, including a web and two flanges extending therefrom along external surfaces of the casing structure; said casing structure having recesses in the external surfaces thereof which are engaged by the flanges; said flanges having detents formed therein to lie within the recesses for releasably locking the frame structure onto the casing structure; guide means carried by the web of the frame structure; a strokable plunger slidably mounted in the guide means for movement toward and away from the casing structure; and a rotary cam-ratchet assembly disposed between the plunger and blade for operation by the plunger; said cam having spaced blade-deflecting lobes thereon, whereby after one plunger reciprocation the switch blade is located in a deflected position and after the next plunger reciprocation the switch blade is located in an undeflected position.

2. In a double throw snap action switch, a housing defining an elongated switch blade chamber, a pair of opposed spaced contacts in one end of said chamber, a pivot contact positioned centrally of said chamber, separate electrical leads connected to said contacts, said contacts and leads being insulated from one another, an elongated switch blade positioned within said chamber and free-floatingly pivoted medially on said pivot contact with one end freely extended between said opposed spaced contacts and the other end free, a cam rotatably journaled in said housing adjacent the other free end of said switch blade and adapted to contact the same, said cam having successive switch depressing and switch release portions engageable with said other end of said blade, a rotatable ratchet operably connected to said cam to alternately move one of said blade depressing and blade release portions into engagement with said other free end of said blade, and said blade being stressed to assume an overcenter bowed configuration, whereby engagement by one of said depressing and release portions causes said one free end of said blade to engage one or the other of said opposed spaced contacts.

3. In a double throw snap action switch, a housing defining an elongated switch blade chamber, a pair of opposed spaced contacts in one end of said chamber, a pivot contact positioned in said chamber and spaced from said pair of contacts, an overcenter-stressed switch blade positioned within said chamber and free-floatingly pivoted medially on said pivot contact with one end freely positioned between said pair of opposed, spaced contacts and the other end free in space and a ratchet-actuated rotary cam engageable with the other free end of said switch blade to move said other free end in a to-and-fro manner, whereby said one free end engages one or the other of said pair of opposed spaced contacts.

4. In a double throw snap action switch, a support, a pair of opposed spaced contacts on said support and connected to first and second electric leads, a pivot contact on said support and spaced from said pair of contacts and connected to a third electric lead, said contacts and said leads being insulated from one another, an elongated switch blade free-floatingly pivoted medially on said pivot contact with one end freely extended between said opposed spaced contacts and the other end free in space, a shaft rotatably journaled on said support adjacent the other end of said blade, said shaft carrying a rotary cam, said cam having successive switch depressing and switch release surfaces engageable with said other free end of said blade, ratchet means for rotating said shaft to alternately move one of said blade depressing and blade release surfaces into engagement with said other end of said blade,

and said blade being stressed to assume an overcenter bowed configuration, whereby engagement by one of said depressing and release portions with said other free end of said blade causes said one free end to engage one or the other of said opposed spaced contacts while maintaining free-floatingly pivoted engagement between a median portion of said blade and said pivot contact.

5. In a double throw snap-action switch, a housing defining an elongated switch blade chamber, a pair of opposed spaced contacts in one end of said chamber, a pivot contact positioned centrally of the length of said chamber, an elongated switch blade positioned within said chamber and free-floatingly pivotally supported medially on said pivot contact with one end freely extended between said pair of spaced contacts and the other end free in space, a rotary cam journaled in said housing adjacent the other end of said switch blade, said cam having four switch depressing surfaces engageable with said other free end and alternately spaced by four switch release surfaces, an 8 toothed rotary ratchet connected to said cam and rotatable therewith, a reciprocable actuator engageable with the teeth of said ratchet to rotate the ratchet and cam ⅛ turn to move one of said depressing and release portions into engagement with said other free end of said blade upon reciprocation of said actuator, a pawl engageable with the teeth of said ratchet restricting reverse rotation, and said blade being stressed to assume an overcenter bowed configuration, whereby engagement by one of said depressing and release portions causes said one free end to engage one or the other of said spaced contacts.

6. In a two-position snap action switch, a housing carrying a pair of opposed spaced contacts and a third pivot contact spaced therefrom, a snap action switch blade free-floatingly pivotally supported intermediate its ends on said third contact and having one end freely extending between said spaced contacts and the other end free in space, said one free end being snappable between said spaced contacts upon application of force to the other free end of said blade, cam means for applying force to said other end of said blade, said cam including an integral rotary ratchet, a frame including a web connecting spaced flanges extending along external surfaces of said housing, said housing having recesses in said external surfaces and said flanges having detents therein engageable with said recesses to releasably lock said frame structure and housing together, a reciprocable plunger mounted on said web for movement toward and away from said housing, ratchet rotating means interposed between said plunger and said ratchet, and means surrounding said ratchet rotating means preventing entry of foreign material into said switch blade chamber.

7. In a double throw snap action switch, a support, a pair of opposed spaced contacts carried by said support, a pivot contact carried by said said support and spaced from said opposed contacts, an overcenter-stressed switch blade having two free ends and a face surface, said face surface being free-floatingly pivotally supported on said pivot contact between said ends and one of the free ends being extended between said opposed spaced contacts, and a ratchet-actuated rotary cam carried by said support and engageable with the other free end of said switch blade to move the other end of said switch blade in a to-and-fro manner, whereby said one free end engages one or the other of said pair of opposed spaced contacts.

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