

⑫ **EUROPEAN PATENT APPLICATION**

⑲ Application number: 81303843.7

⑮ Int. Cl.<sup>3</sup>: **H 01 H 1/16**  
**H 01 H 23/12**

⑳ Date of filing: 24.08.81

⑳ Priority: 10.09.80 GB 8029211

⑰ Applicant: **LUCAS INDUSTRIES LIMITED**  
**Great King Street**  
**Birmingham, B19 2XF(GB)**

㉓ Date of publication of application:  
31.03.82 Bulletin 82/13

⑱ Inventor: **Lewis, Keith**  
**83 Barden Lane**  
**Burnley Lancashire(GB)**

㉔ Designated Contracting States:  
DE FR GB IT

㉕ Representative: **Carpenter, David et al,**  
**MARKS & CLERK Alpha Tower ATV Centre**  
**Birmingham B1 1TT(GB)**

⑮ Electrical switches with a simplified assembly sequence.

⑮ An electrical switch of the kind including a body (11), an operating member (15) movable relative to the body (11) to operate the switch, fixed electrical contacts (19, 25, 26) on the body (11), a movable electrical contact (32) which cooperates with said fixed contacts and is movable relative thereto by movement of the operating member (15) relative to the body, and resilient means (33) acting between the operating member and the movable contact, wherein the movable contact and said resilient means are carried by the operating member, the operating member (15), the resilient means (33) and the movable contact (32) being interengaged as a sub-assembly wherein the movable contact is capable of movement relative to the operating member within predetermined limits which encompass the necessary range of movement of the movable contact (32) relative to the operating member (15) during operation of the switch.

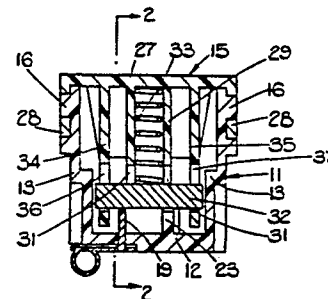


FIG. 1.

EP 0 048 552 A1



This invention relates to electrical switches of the kind including, a body, an operating member movable relative to the body to operate the switch, a fixed electrical contact on the body, a movable electrical contact which co-operates with said fixed contact and is movable relative thereto by movement of the operating member relative to the body, and resilient means acting between the operating member and the movable contact.

A problem of switches of the kind specified is that the need to stress the resilient means between the operating member and the movable contact within the body during assembly makes assembly of the switch a complex and skilled operation. It is an object of the present invention to provide a switch of the kind specified wherein the assembly sequence is simplified.

According to the invention in a switch of the kind specified the movable contact and said resilient means are carried by the operating member, the operating member, the resilient means and the movable contact being inter-engaged as a sub-assembly wherein the movable contact is capable of movement relative to the operating member within predetermined limits which encompass the necessary range of movement of the movable contact relative to the operating member during operation of the switch.

Preferably the interconnection of the operating member and the movable contact includes an apertured element, the aperture providing the required freedom of relative movement.

Desirably the operating member includes a pair of parallel apertured elements and, the movable contact extends transverse to said elements through the apertures of said elements.

One example of the invention is illustrated in the accompanying drawings wherein:

Figure 1 is a transverse sectional view of an electrical switch,

Figure 2 is a sectional view on the line 2-2 in Figure 1,

Figure 3 is an exploded perspective view (not to scale) of the contact arrangement of the switch shown in Figures 1 and 2, and

Figures 4 and 5 are side elevational views respectively of two minor modifications.

The electrical switch illustrated in the drawings is intended to be capable of controlling operation of power operated driven window of a road vehicle, and thus has a central, stable, off position (as shown in the drawings) and first and second unstable operative positions on opposite sides respectively of the central off position. The switch includes a moulded synthetic resin body 11 having a generally square base 12 from which are upstanding four integral walls, one opposite pair of walls being designated side walls 13 and the other opposite pair of walls being designated end walls 14. The body 11 has an open top opposite the base 12 and the side walls 13 are extended upwardly beyond the open top and serve pivotally to support a moulded synthetic resin operating member 15. The upwardly extended portion of each of the side walls 13 includes an integral, outwardly extending cylindrical lug 16, the axes of the lugs 16 being co-extensive, and the lugs 16 being received within corresponding apertures in side walls of the operating member 15 to provide the pivotal mounting of the operating member 15. It will be apparent therefore that the operating member 15 can pivot relative to the body 11 about the axis of the lugs 16 and in use this pivotal, or rocking movement of the operating member 15 causes operation of the electrical contacts of the switch.

The end walls 14 of the body 11 are formed with resilient latches 17 which are spaced below the level of outwardly extending flanges 18 provided at the upper free ends of the end walls 14. In use, in order to mount the switch on a panel, the body 11 is inserted through a correspondingly shaped aperture in the panel until the underside of the flanges 18 abuts the upper surface of the panel. During insertion of the body through the aperture in the panel the latches 17 are flexed inwardly of the body, and spring outwardly, by virtue of their inherent resilience, when the flanges 18 abut the top surface of the panel. The latches 17 thus retain the body in position in the aperture of the panel.

Upstanding from the base is a first fixed electrical contact 19 in the form of a metal strip extending parallel to the planes of the side walls 13. The upper edge of the metal strip defining the contact 19 is in the form of a V-shaped recess so that the contact 19 has first and second oppositely inclined upper edges 21, 22. Spaced laterally of the base from the contact 19, and parallel to the contact 19 is a rib 23 which is integral with the base, and upstanding therefrom. The maximum height of the rib 23 above the base 12 is less than that of the contact 19, and the central region of the upper surface of the rib 23 is formed with a V-shaped notch 24 the surfaces of which are generally coplanar with the edge surfaces 21, 22 of the contact 19. The apex of the notch 24 is aligned with the apex of the recess of the contact 19. At the far side of the rib 23 from the contact 19 and spaced apart from one another in the direction of the length of the rib 23 are second and third fixed electrical contacts 25, 26. The contacts 25, 26 are also in the form of metal plates and the contact 25 has an inclined upper edge coplanar with the edge 21 of the contact 19. Similarly the contact 26 has an inclined upper edge coplanar with the inclined edge 22 of the contact 19. The contacts 25, 26 are spaced apart in the direction of the

length of the rib 23 by a distance substantially equal to the width of the notch 24.

The operating member 15, which is moulded in synthetic resin material, is generally in the form of a flat plate 27 having a downwardly extending peripheral flange 28 which serves to render the plate 27 more rigid. The two opposite portions of the flange 28 which define the side walls of the member 15 are extended downwardly by comparison with the portions which define the end walls, and are apertured to receive the lugs 16. Centrally disposed on the platform 27 of the operating member 15 and integral therewith is a hollow cylindrical spigot 29 which extends at right-angles to the plane of the plate 27 downwardly into the body 11 of the switch. At its lowermost free end the spigot 29 is formed with a pair of axially extending, diametrically opposed, open ended slots 31 through which extends a cylindrical brass roller 32. The roller 32 constitutes the movable contact of the switch and is urged towards the open end of the slots 31 (at the free end of the spigot 29) by a compression spring 33 housed within the spigot 29. Thus the compression spring 33 acts between the roller 32 and the operating member 15 to urge the roller 32 towards the base 12.

Positioned between the spigot 29 and the side walls of the operating member 15 are first and second contact retainers 34, 35. The contact retainers 34, 35 are integral with the operating member 15, and are in the form of planar arms which extend parallel to one another and parallel to the spigot 29 downwardly from the plate 27 towards the base 12 of the body 11. Aligned with the slots 31 are closed ended elongate slots 36, 37 in the contact retainers 34, 35 respectively. The end regions of the roller 32 extend through the slots 36, 37 respectively. The slots 36, 37 are elongate in the direction of the length of the spigot 29 and are of a width slightly greater than the diameter of

the roller 32 so that the roller although guided by the slots 36, 37 can move freely therein. It will be apparent therefore that the roller 32 can be moved from the lower end of the slots 36, 37 against the action of the spring 33, but that when released the roller will return under the action of the spring 33 to a position wherein it is retained by the lower, closed ends of the slots 36, 37.

The switch is assembled in the following manner. The contacts 19, 25, 26 are assembled to the moulded body 11, each of the contacts including a portion which extends through the base 12 and which is secured to a respective external terminal on the exterior of the base 12. The moulded operating member 15, the spring 33, and the roller 32 comprise a sub-assembly which is assembled without reference to the body 11. Thus the spring 33 is introduced into the spigot 29, and is compressed therein while introducing the roller 32 in a lateral direction through the slots 36, 37. As the roller passes through the slots 36, 37 it will of course pass through the slots 31 thus trapping the lightly compressed spring 33 within the spigot 29. Immediately the roller 32 is then released by the operator the spring 33 will push the roller 32 against the closed ends of the slots 36, 37 and thus the operating member 15, the spring 33, and the roller 32 constitute a pre-assembled sub-assembly which can then be offered to the sub-assembly of the body 11 and contacts 19, 25, 26. The arrangement of the side walls 28 of the operating member 15 and the side walls 13 of the body 11 is such that the operating member 15 <sup>can</sup> be snapped into engagement with the body so that the lugs 16 engage as a snap fit in the apertures in the walls 28. It will be recognised that the provision of an operating member and movable contact sub-assembly which can be pre-assembled without reference to the body 11 is a great advantage by comparison with known arrangements where no such sub-assembly exists, and it is necessary to, in some way, hold the movable contact, the spring, and the operating member in position relative to one another while at the same

time assembling the operating member to the body in such a manner that the movable contact and spring remain correctly orientated with respect to the operating member and the movable contact becomes correctly orientated with respect to the fixed contacts of the switch.

The operation of the switch illustrated in the accompanying drawings is as follows. After assembly of the operating member sub-assembly to the body sub-assembly the roller 32 will be engaged adjacent one end with the contact 19 and adjacent its other end with the rib 23, the roller contact 32 being seated under the action of the spring 33 in the V-shaped recesses of the contact 19 and rib 23 respectively. The relative positioning of the components, and the length of the slots 36, 37, is such that in the assembled switch the contact 19 and rib 23 support the roller slightly spaced from the closed, lowermost ends of the slots 36, 37. The relative positioning of the apices of the recesses of the contact 19 and rib 23, and the axis of pivotal movement of the operating member 15 is such that when the roller 32 is seated in the apices of the recesses of the contact 19 and rib 23 then the plate 27 of the operating member 15 is parallel to the panel upon which the body 11 of the switch is mounted in use. Since the roller 32 seats, under the action of the spring 33, in the recesses of the contact 19 and rib 23, then this position of the operating member is a stable position of the operating member relative to the body 11. The spacing between the contacts 25, 26 is such that the roller 32, in the central, stable position of the operating member 15 relative to the body 11, does not touch either of the contacts 25, 26. Thus although the roller 32 engages the contact 19 it does not complete an electrical circuit through the switch. Thus the central, stable position of the operating member 15 is an off position of the switch. Movement of the operating member 15 in a clockwise direction from the central rest position (as viewed in Figure 2)

causes the roller 32 to ride up the edge 21 of the contact 19 and ultimately to engage the inclined edge of the contacts 25 where it projects above the level of the rib 23. However, the incline of the edge 21 of the contact 19 and the incline of the upper edge of the contact 25 is such, in relation to the radius of movement of the contact roller 32 about the axis of pivotal movement of the operating member 15, that as the roller 32 rides up the inclined edge 21 and inclined contact 25 the roller 32 is lifted relative to the spigot 29 and retainers 34, 35 along the length of the slots 36, 37 against the action of the spring 33. Thus the pivoting movement of the operating member 15 to a position wherein the roller 32 bridges the contacts 19 and 25 is accompanied by additional compression of the spring 33 and upon release of the operating member the spring 33 will urge the roller 32 to travel back down the inclined edges of the contacts 19, 25 until it reaches the stable, off position defined by the apices of the contact 19 and rib 23.

Counter clockwise movement of the operating member 15 from the central, off position moves the roller 32 to a second unstable operative position wherein the roller 32 is engaged with the inclined edge 22 of the contact 19 and the inclined edge of the contact 26.

Thus in the first unstable operative position of the operating member 15 achieved by clockwise pivoting movement of the operating member 15 relative to the body 11 the roller 32 bridges the contacts 19 and 25 and thus completes an electrical circuit therebetween. In the central off position of the operating member 15 no contact is completed, and in the second unstable operative position achieved by counterclockwise pivotal movement of the operating member 15 from the central, off position the roller 32 bridges the contacts 19 and 26 to complete an electrical circuit therebetween.

- 9 -

When the switch is used as the control switch for the drive motor of an electrically operated vehicle window the contact 19 is the electrical feed contact, and the contacts 25, 26 are electrically connected to the motor such that the motor runs in one direction when energised by completion of a circuit between contacts 19 and 25, and thus for example causes lifting movement of the window whereas when the motor is energised by completion of a circuit between the contacts 19 and 26 the motor runs in the opposite direction thus lowering the window. In either situation if the operator releases his pressure on the plate 27 of the operating member 15 then the operating member 15 will return to its central off position and movement of the window will cease.

It is to be recognised that the length of the slots 36, 37 and their positioning in relation to the contact 19 and rib 23 in the assembled switch is such that the necessary range of movement of the contact roller 32 against the action of the spring 33 can occur without the contact roller in any way being impeded by the provision of the retainer 34, 35. In essence therefore the retainers 34, 35 have no function other than to retain the roller 32 when the operating member - movable contact sub-assembly is assembled. It is intended that forces transverse to the length of the roller 32 generated by pivotal movement of the operating member 15 are transmitted to the roller 32 by the side walls of the slots 31 of the spigot 29, although the side walls of the slots 36, 37 may assist in this respect.

It will be recognised that the concept of an operating member sub-assembly which can be assembled external to the body of the switch, can be applied to switch configuration other than that shown in the drawings. For example the fact that the switch in the drawings has only a single stable position is not of great consequence, and the concept can be applied to switches having a number of spaced stable

positions. Similarly, although a rocker type operating member is illustrated in the drawings other types of operating member can embody the concept. For example a slider type operating member or a toggle type operating member could embody the concept.

In the construction illustrated in the drawings the slots 36, 37 are closed and in order to assemble the contact roller 32 to the operating member it is necessary to insert the contact roller 32 through the slots 31, 36 and 37 in a direction parallel to the intended axis of pivotal movement of the operating member. It is to be understood however that apertures other than linear slots can be provided if the necessary operational movements of the contact roller 32 relative to the operating member so require. Moreover, in order to facilitate assembly of the contact roller 32 into the slots 36, 37, it may be desirable to break the side walls of the slots to provide an opening into the slot through which the contact 32 may be moved in a direction transverse to its longitudinal axis. For example the slot configurations could be in the form of a T or an L as illustrated in Figures 4 and 5.

## CLAIMS:

1. An electrical switch including a body (11), an operating member (15) movable relative to the body (11) to operate the switch, a fixed electrical contact (19, [25, 26]) on the body (11), a movable electrical contact (32) which co-operates with said fixed contact (19, [25,26]) and is movable relative thereto by movement of the operating member (15) relative to the body (11), and resilient means (33) acting between the operating member (15) and the movable contact (32) characterised in that the movable contact (32) and said resilient means (33) are carried by the operating member (15), the operating member (15), the resilient means (33) and the movable contact (32) being inter-engaged as a sub-assembly wherein the movable contact (32) is capable of movement relative to the operating member (15) within predetermined limits which encompass the necessary range of movement of the movable contact (32) relative to the operating member (15) during operation of the switch.

2. An electrical switch as claimed in claim 1, characterised in that the interconnection of the operating member (15) and the movable contact (32) includes an apertured element (34, [35]), the aperture (36, [37]) providing the required freedom of relative movement.

3. An electrical switch as claimed in claim 1 characterised in that the operating member (15) includes a pair of parallel apertured elements (34, 35) and, the movable contact (32) extends transverse to said elements (34, 35) through the apertures (36, 37) of said element (34, 35).

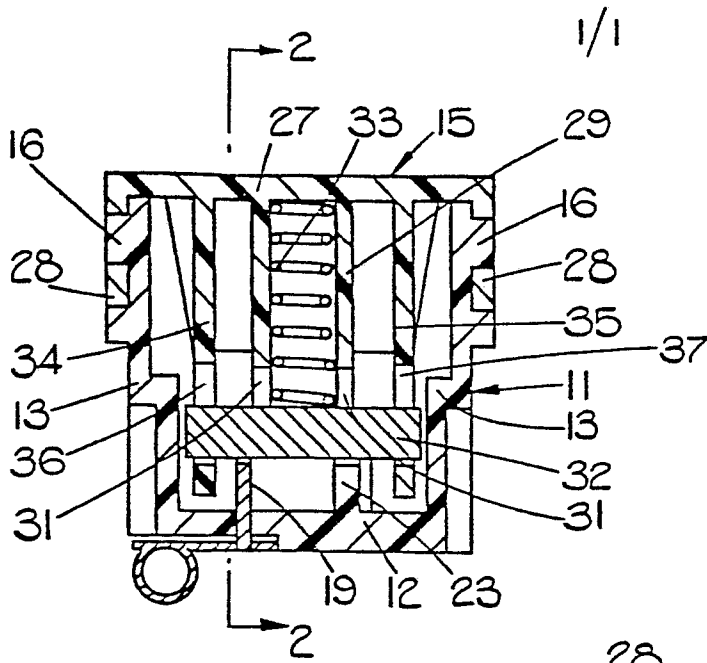


FIG. 1.

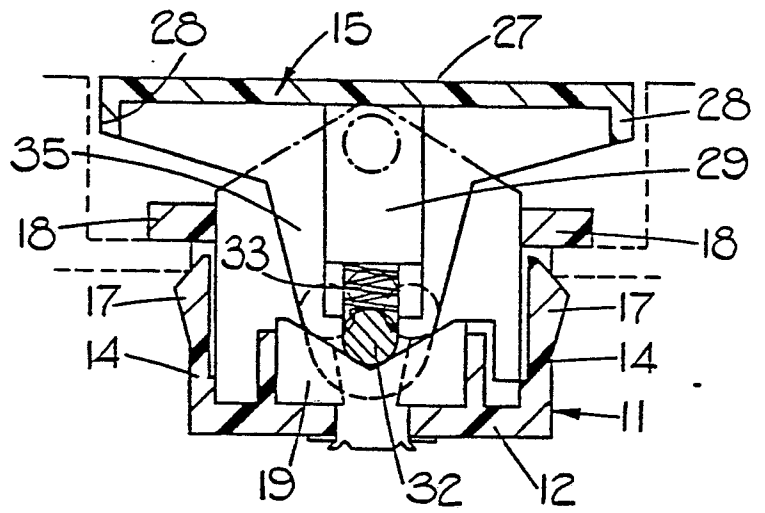


FIG. 2.

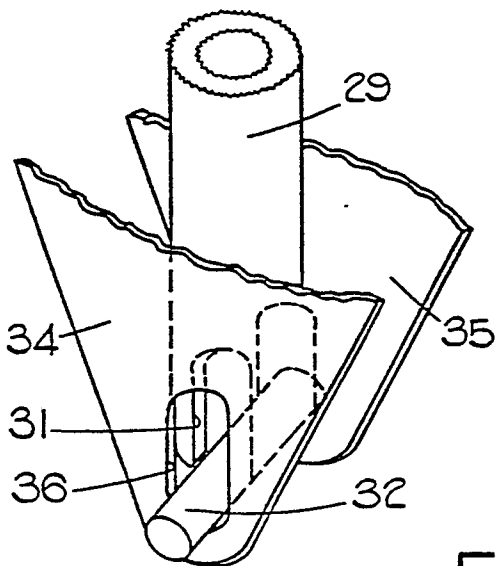


FIG. 3.

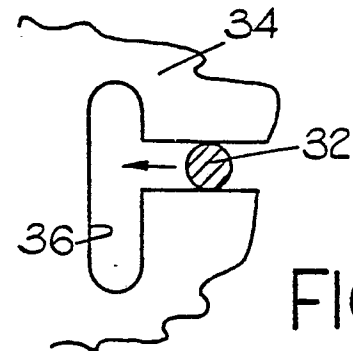


FIG. 4.

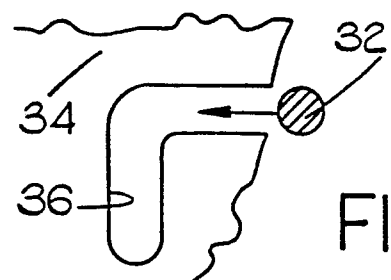
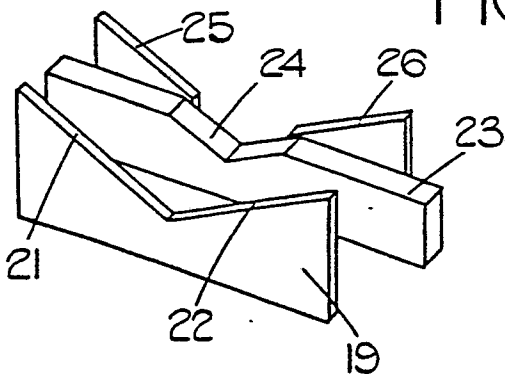


FIG. 5.



DOCUMENTS CONSIDERED TO BE RELEVANT		CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	<p><u>DE - B - 1 640 649</u> (HANS &amp; JOSEF KRONENBERG)</p> <p>* column 4, lines 8-64 *</p> <p>---</p> <p><u>DE - B - 2 646 040</u> (LICENTIA)</p> <p>* column 2, figures 2 and 3 *</p> <p>---</p> <p><u>FR - A - 2 331 874</u> (LUCAS)</p> <p>* page 3, lines 13-40; page 4, lines 1-38 *</p> <p>---</p> <p><u>FR - A - 1 540 923</u> (S.W.F.)</p> <p>* page 2, column 1, paragraphs 4 and 5; figure 5 *</p> <p>---</p> <p><u>GB - A - 915 076</u> (LICENTIA)</p> <p>* page 1, lines 69-85; page 2, lines 1-33 *</p> <p>---</p> <p><u>FR - E - 2 172 252</u> (ISEC)</p> <p>* page 4 *</p> <p>&amp; GB - A - 1 410 893</p> <p>---</p> <p><u>GB - A - 1 117 926</u> (SWF)</p> <p>* page 1, lines 51-84 *</p> <p>-----</p>	<p>1-3</p> <p>1-3</p> <p>1-3</p> <p>1-3</p> <p>1-3</p> <p>1</p> <p>1</p>
		<p>H 01 H 1/16</p> <p>H 01 H 23/12</p>
		<p>TECHNICAL FIELDS SEARCHED (Int. Cl.)</p>
		<p>H 01 H 1/16</p> <p>H 01 H 15/10</p> <p>H 01 H 23/12</p> <p>H 01 H 21/18</p> <p>H 01 H 19/10</p> <p>H 01 H 1/24</p>
		<p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant</p> <p>A: technological background</p> <p>O: non-written disclosure</p> <p>P: intermediate document</p> <p>T: theory or principle underlying the invention</p> <p>E: conflicting application</p> <p>D: document cited in the application</p> <p>L: citation for other reasons</p>
		<p>&amp;: member of the same patent family.</p> <p>corresponding document</p>
<p>The present search report has been drawn up for all claims</p>		
Place of search	Date of completion of the search	Examiner
The Hague	21.12.1981	JANSSENS DE VROOM