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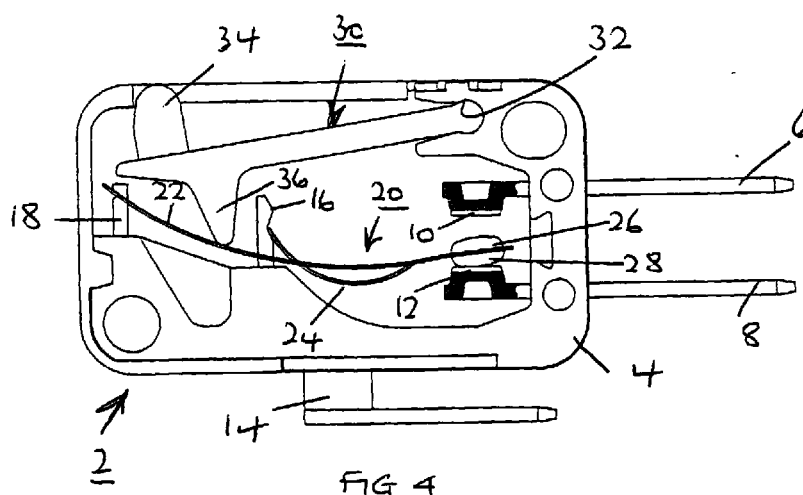
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(54) **Electric switch**

(57) A snap action electric switch includes a snap-action mechanism (20) incorporating a thin leaf spring having three substantially parallel legs (22, 24) the integral one ends of which constitute a contact member (26, 28), at least one of the legs (24) being longitudinally stressed such that, on movement of the or each unstressed leg (22) beyond an overcentre position, the contact member (26, 28) snaps from a rest position to a displaced position, and a lever (30) pivotally mounted in the body member (4) and including abutment means

(36) engaging the or each unstressed leg (22) of the leaf spring such that, on pivoting of the lever (30), the abutment means (36) moves along the arc of a circle to bow the or each unstressed leg (22) whilst at the same time sliding therealong whereby the contact member (26, 28), prior to snap-action, slides on a first fixed terminal member (6), and, subsequent to snap-action, slides on a second fixed terminal member (8) without unduly stressing the leaf spring.



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Description

[0001] This invention relates to electric switches, and more particularly to snap-action electric switches.

[0002] It is well-established practice to provide electric switches incorporating over-centre or snap-action mechanisms which, on depression of an associated plunger, are moved very quickly from a first stable position to a second stable position such that an electric contact member of the mechanism, on said movement, alters the electrical condition of an associated circuit.

[0003] The snap-action mechanisms incorporate some form of spring as the energy store to enable actuation, which springs may be of the extension, compression or torsion type or may comprise a stressed leaf spring, or may comprise a combination of such springs.

[0004] In order to obtain high electrical performance from the mechanism, it is desirable to generate a wiping or rocking motion of the moving contact on the fixed contacts during the opening and closing strokes of the switch thereby to ensure positive engagement between contacts, to prevent sticking together or welding of the contacts, and to avoid the build-up of deposits on the contacts.

[0005] With coil spring mechanisms, this motion can be achieved by the addition of extra components to the switch to produce a double pivot action to the mechanism, but such an arrangement is expensive and results in a complex switch assembly. Although low operating forces can be achieved, this results in reduced electrical performance.

[0006] Leaf spring snap-action mechanisms commonly comprise a thin leaf spring having three parallel legs. In one arrangement the centre leg is longitudinally stressed, the free rear end thereof being urged into pivotal engagement with a fixed anchor member. The rear ends of the two outer legs are fixed against upward and downward movement, while the fronts of the three legs are integral with one another and carry upper and lower contact members.

[0007] On depression of the plunger, said plunger engages the outer legs at points intermediate the fixed anchor member and the rear of the spring, continued depression of the plunger moving the outer legs downwardly below the line of action between the free end of the centre leg and the contact members whereby snap-action of the contact members from an upper position to a lower position occurs to alter the conditions of associated electric circuits.

[0008] On release of the plunger, the inherent resilience of the spring returns the contact members and the plunger from their displaced positions back to their rest positions.

[0009] In a further arrangement, the outer two legs of the leaf spring are longitudinally stressed with the free rear ends thereof being urged into pivotal engagement with a fixed anchor member. The rear end of the centre leg is fixed against upward and downward move-

ment, and again the front ends of the three legs are integral with one another and carry upper and lower contact members.

[0010] Actuation of the mechanism is achieved substantially as detailed above, except that the plunger engages the centre leg which is displaced downwardly relative to the two outer legs until snap-action occurs.

[0011] The plunger is conventionally guided by co-operation with the housing for axial sliding movement therein, and actuation of the snap-action mechanism occurs when the plunger reaches a precise and predetermined axially displaced position within the housing.

[0012] Continued movement of the plunger beyond this precise position can result in the desirable rocking/sliding motion of the moving contact on the fixed contact subsequent to snap-action. However, the linear downward movement of the plunger and the consequential movement of the leaf spring can create extremely high stresses in the leaf spring, which severely limit the mechanical life of the spring or the travel of the plunger must be restricted to prevent damage to the leaf spring.

[0013] Although it is possible to reduce stresses, such a solution involves additional components or return springs, thus adding to the expense and complexity of the switches.

[0014] GB 1231712 discloses a snap-action electric switch the snap-action mechanism of which incorporates a coiled spring. A pivotal actuating lever is provided externally of the switch housing, and includes an operating member projecting into the housing to engage the coiled spring whereby, on pivoting movement of the lever, the spring is depressed to effect snap-action of the mechanism.

[0015] It will be appreciated that the provision of the actuating lever externally of the housing results in a relatively bulky switch, while the pivotal movement of the operating member on engagement with the coil spring not only tends to distort the spring but results in wear of the operating member. As with conventional coil spring mechanisms, the switch blade of the snap-action mechanism of GB 1231712 moves substantially linearly into and out of engagement with associated fixed contacts.

[0016] It would be desirable to be able to provide a snap-action electric switch, and in particular such a switch incorporating a leaf spring mechanism, capable of high mechanical and electrical performance without the necessity for additional springs or other components, without creating undue stresses in the mechanism, and of relatively compact construction.

[0017] Conventional snap-action electric switches commonly comprise a relatively large number of component parts all of which have to be separately assembled to constitute the final switch.

[0018] More particularly, such a switch may include a moulded housing, a plurality of metal terminals, a snap-action mechanism, an operating button and a lid all of which must, in turn, be assembled one with the

others. In particular, the installation of the snap-action mechanism into the housing can be an awkward procedure.

[0019] Conventionally the metal terminals of the switch are located in position by co-operation with opposed sidewalls of the plastics housing and the lid, which co-operation can result in arcing and possible tracking failures via the sidewalls of the housing and/or lid.

[0020] It would be desirable to be able to provide a snap-action electric switch more easily assembled than heretofore and which eliminated the tracking problems of the current arrangements.

[0021] According to the present invention there is provided a snap-action electric switch including a body member, an operating member movable relative to the body member, and a snap-action mechanism movable by the operating member between a rest position and a displaced position, the mechanism comprising a thin leaf spring having three substantially parallel legs the integral one ends of which constitute a contact member, at least one of said legs being longitudinally stressed to urge the other end of the or each unstressed leg into pivotal engagement with a fixed support member and whereby, on movement of the or each unstressed leg beyond an overcentre position by the operating member, the contact member snaps from its rest position engaging a first fixed terminal member to its displaced position engaging a second fixed terminal member, characterised in that the operating member comprises a lever housed within the body member, one end of the lever being pivotally mounted to the body member, abutment means at or adjacent the other end of the lever engaging the or each unstressed leg, depression of the other end of the lever pivoting said lever about the one end thereof whereby the abutment means moves along the arc of a circle centred about the one end of the lever such that the region of engagement of the abutment means with the or each unstressed leg slides along said leg as the other end thereof pivots about the fixed support member, initial depression of the abutment means bowing the or each unstressed leg whereby the contact member slides on the first fixed terminal member, continued depression of the abutment means displacing the or each unstressed leg to effect snap-action of the mechanism and thereafter bowing the or each unstressed leg whereby the contact member slides on the second fixed terminal member.

[0022] It will thus be appreciated that, with such an arrangement and on engagement of the or each unstressed leg of the leaf spring by the abutment means on depression thereof, the or each unstressed leg is bowed as it pivots about the fixed support member without being unduly stressed because of the sliding movement of the abutment means along the leg as opposed to the linear downward movement of operating members in the known switches.

[0023] Preferably the operating member includes

an operating portion on the lever to the side thereof remote from the abutment means and projecting from the body member.

[0024] Conveniently, the snap-action electric switch of the invention comprises a body member of a plastics insulating material of generally L-shape in longitudinal section and including a first end wall and a bottom wall substantially perpendicular to the first end wall, a pair of fixed electrical terminal members moulded in the first end wall to project from the body member, an anchor terminal moulded in the bottom wall of the body member, and a support member, which may be integral with the anchor terminal, moulded in the bottom wall of the body member at an end thereof remote from the first end wall, the snap-action mechanism being mounted on the anchor terminal and the support member to locate the contact member thereof between the fixed terminal members, and the one end of the lever being a press snap fit into a corresponding recess formed in the first end wall of the body member.

[0025] Such a switch effectively comprises three separate components that can be readily and easily assembled, namely a) the body member together with the fixed terminal members, anchor terminal and support member, b) the snap-action mechanism and c) the operating member.

[0026] The switch may be completed by a housing of hollow, box-like shape one end of which is open to enable the previously assembled components to be pushed therein and whereby, on assembly, the first end wall of the body member closes the open end of the housing.

[0027] Clearly the bottom wall of the housing is shaped to accept the anchor terminal projecting from the body member, while the top wall of the housing is apertured to permit the operating member to project therefrom for operating purposes.

[0028] By way of example only, an embodiment of the invention will now be described in greater detail with reference to the accompanying drawings of which:

Figs. 1 to 4 are side views of a switch according to the invention with a side of the housing removed and during various stages of depression of the operating member;

Figs. 5 to 7 are side views of the component parts of a switch of the invention showing the method of assembly, and

Fig. 8 is a side view similar to that of Fig. 1 but showing an alternative operating member.

[0029] Referring to Figs. 1 to 4 of the drawings, the illustrated switch comprises a housing indicated generally at 2 and including a moulded body member 4 of generally L-shape in longitudinal section. A pair of parallel terminals 6,8 are moulded into the end wall of the

body member 4, the terminals 6,8 having contacts 10,12 thereon within the housing.

[0030] An anchor terminal 14 is moulded in the bottom wall of the body member 4 and includes an anchor portion 16 upstanding within the housing 2 with a notched face for reasons which will become apparent, and, integral with the anchor portion 16, a support member 18 upstanding from the free end of the bottom wall of the body member 4 remote from the end wall to be parallel with the anchor portion 16, the face of said support member remote from the anchor portion 16 also being notched.

[0031] The housing contains a snap-action mechanism indicated generally at 20 and comprising a thin leaf spring including three parallel legs the rear ends of the outer ones 22 of which are interconnected.

[0032] The central leg 24 has a free rear end, while the front ends of all three legs are integral with each other and carry upper and lower contacts 26,28.

[0033] The interconnected rear ends of the outer legs 22 are received in the notch in the support member 18 to be pivotally mounted on said member 18, while the free end of the central leg 24 is urged into pivotal engagement with the notch in the anchor portion 16 whereby said leg 24 is longitudinally stressed and bowed.

[0034] The snap-action mechanism 20 as described has a first stable rest position shown in Fig. 1 in which the upper contact 26 engages the top contact 10, thereby completing the electric circuit between the terminals 6 and 14.

[0035] The switch further comprises an operating lever indicated generally at 30. More particularly, a groove 32 is formed in, to extend transversely of, the free end of the end wall of the body member 4, one end of the lever 30 being a push snap-fit into said groove 32 whereby the lever 30 is mounted within the body member 4 to be pivotal relative to the body member 4 about said one end thereof.

[0036] The lever 30 includes an operating button 34 adjacent the other end thereof and projecting upwardly from the housing 2, and a downwardly extending abutment member 36 also adjacent the other end of the lever 30 and positioned to engage the outer legs 22 of the leaf spring between the anchor portion 16 and the support member 18.

[0037] In the rest position of the snap-action mechanism 20, the button 34 projects from the housing 2 as shown in Fig. 1, and the member 36 rests on the legs 22 of the leaf spring.

[0038] It will be appreciated that the pivotal mounting of the lever 30 to the body member 4 at the groove 32 ensures that, on depression of the button 34, the lever 30, together with the button 34 and abutment member 36, pivots about the one end of the lever whereby the button 34, and in particular the abutment member 36 move along an arcuate path centred about the groove 32.

[0039] Thus, on initial depression of the button 34 to the position shown in Fig. 2, the abutment member 36 forcibly engages the outer legs 22 to bow said legs 22 and at the same time sliding therealong. The bowing of the legs 22 results in a consequential rocking movement of the contact 26 on the contact 10 to create a wiping action therebetween without any significant stress being created in the legs 22, which themselves pivot about the notch in the support member 18.

[0040] On further depression of the button 34 to the position shown in Fig. 3, which is beyond the over-centre position of the mechanism 20, the contacts 26,28 are moved under the influence of the stressed central leg 24 to the second stable position shown in Fig. 3 in which the contact 28 engages the contact 12 to complete the electrical circuit between terminals 8 and 14.

[0041] During the snap-action between the two stable positions of the mechanism 20, the interconnected rear end of the outer legs 22 pivots about the notch in the support member 18.

[0042] Continued downward movement of the button 34 beyond the over-centre position to the position shown in Fig. 4 results in the abutment member 36 further bowing the outer legs 22 while continuing to slide therealong. This results in a further rocking movement of the contact 28 on the contact 12 to create a wiping action therebetween, again without unduly stressing the outer legs 22 which are further bowed and continue to pivot about the support member 18.

[0043] Thus it will be appreciated that the pivotal mounting of the rear ends of the outer legs 22 of the leaf spring on the support member 18, together with the sliding movement of the abutment member 36 along the legs 22 during depression of the button 34, which results from the pivotal mounting of the lever 30, provides the desired rocking/wiping action between the fixed and moving contacts to ensure high electrical performance, and at the same time avoids undue stresses being created in the leaf spring, whereby mechanical performance is enhanced.

[0044] Furthermore, the mounting of the lever 30 within the body member 4, with only the operating button 34 projecting from the body member 4 prior to actuation of the switch and said button 34 being substantially flush with the body member 4 subsequent to actuation of the switch, results in an extremely compact configuration to the switch and whereby actuation can be effected by a variety of external operating means such as levers, cams or the like.

[0045] Clearly the precise construction of the switch can vary from that described and illustrated without departing from the scope of the invention. For example, the outer two legs of the leaf spring may be stressed with the rear end of the central leg pivotal on the support member 18.

[0046] The switch of the invention is particularly suited to easier and quicker assembly than heretofore, which can readily be appreciated by referring to Figs. 5

to 7.

[0047] Fig. 5 shows a first component of the final switch which comprises the body portion 4 together with the terminals 6 and 8, and the anchor terminal 14, which includes the anchor portion 16 and the support member 18, moulded therein.

[0048] Fig. 6 shows a second component of the switch, namely the snap-action mechanism 20, mounted to the first component as a first step in the assembly process.

[0049] The third component of the switch, the lever 30, is then snapped into the groove 32 to complete the assembly of the basic switch, which, if required, can be used as shown in Fig. 7 without an outer housing.

[0050] Alternatively, an outer housing 2 of a hollow, box-like shape may be provided one end of which is open to enable the previously assembled components as shown in Fig. 7 to be pushed therein whereby, on assembly, the end wall of the body portion 4 closes the open end of the housing 2 as shown in Figs. 1 to 4. More particularly opposed sides of the body member 4 are each provided with a pair of pegs 38 which are snap fits into corresponding apertures in the sidewalls of the outer housing 2 to retain the body member 4 within the housing 2.

[0051] The bottom wall of the housing 2 is shaped to accept the anchor terminal 14 projecting from the body member 4, while the top wall of the housing 2 is apertured to enable the operating button 34 to project therethrough.

[0052] The moulding of the terminals 6,8 in the body member 4 to locate them positively in position reduces the possibility of tracking between said terminals that occurs in the prior art arrangements, in which the sidewalls of the housing 2 are themselves used to locate the terminals in position. Additionally, the provision of the dovetail recess 40 in the inner face of the end wall of the body member further reduces the tendency for tracking to occur between the terminals 6,8.

[0053] Clearly the precise size and configuration of the housing, 2 can vary depending upon the application of the switch.

[0054] Referring to Fig. 8, there is shown a switch similar to that of Figs 1 to 4, with equivalent components being similarly referenced. However, instead of the operating button 34, the lever 30 of the switch of Fig. 8 includes a ramped portion 34' of generally tapering configuration particularly suited to cam actuation of the switch. It will be appreciated that such an arrangement, which is possible because of the pivoting nature of the lever 30, eliminates the additional pivoting lever normally required with conventional button-operated switches to enable cam actuation thereof.

Claims

1. A snap action electric switch including a body member (4), an operating member (30) movable relative

to the body member (4), and a snap-action mechanism (20) movable by the operating member (30) between a rest position and a displaced position, the mechanism (20) comprising a thin leaf spring having three substantially parallel legs (22, 24) the integral one ends of which constitute a contact member (26, 28), at least one of said legs (24) being longitudinally stressed to urge the other end of the or each unstressed leg (22) into pivotal engagement with a fixed support member (18) and whereby, on movement of the or each unstressed leg (24) beyond an overcentre position by the operating member (30), the contact member (26, 28) snaps from its rest position engaging a first fixed terminal member (6) to its displaced position engaging a second fixed terminal member (8), characterised in that the operating member comprises a lever (30) housed within the body member (30), one end of the lever being pivotally mounted to the body member (4), abutment means (36) at or adjacent the other end of the lever (30) engaging the or each unstressed leg (22), depression of the other end of the lever (30) pivoting said lever (30) about the one end thereof whereby the abutment means (36) moves along the arc of a circle centred about the one end of the lever (30) such that the region of engagement of the abutment means (36) with the or each unstressed leg (22) slides along said leg (22) as the other end thereof pivots about the fixed support member (18), initial depression of the abutment means (36) bowing the or each unstressed leg (22) whereby the contact member (26, 28) slides on the first fixed terminal member (6), continued depression of the abutment means (36) displacing the or each unstressed leg (22) to effect snap-action of the mechanism (20) and thereafter bowing the or each unstressed leg (22) whereby the contact member (26, 28) slides on the second fixed terminal member (8).

2. A switch as claimed in claim 1 in which the operating member includes an operating portion (34, 34') on the lever (30) to the side thereof remote from the abutment means (36) and projecting from the body member (4).
3. A switch as claimed in claim 1 or claim 2 and comprising a body member (4) of a plastics insulating material of generally L-shape in longitudinal section and including a first end wall and a bottom wall substantially perpendicular to the first end wall, a pair of fixed electrical contacts (6, 8) moulded in the first end wall to project from the body member (4), an anchor terminal (14) moulded in the bottom wall of the body member (4), and a support member (18) moulded in the bottom wall of the body member (4) at an end thereof remote from the first end wall, the snap-action mechanism (20) being mounted on the

anchor terminal (14) and the support member (18) to locate the contact member (26, 28) thereof between the fixed contacts (6, 8), and the one end of the lever (30) being a press snap fit into a corresponding recess (32) formed in the first end wall of the body member (4). 5

4. A switch as claimed in claim 3 and further comprising a housing (2) of hollow, box-like shape one end of which is open to enable the previously assembled components to be pushed therein and whereby, on assembly, the first end wall of the body member (4) closes the open end of the housing (2). 10

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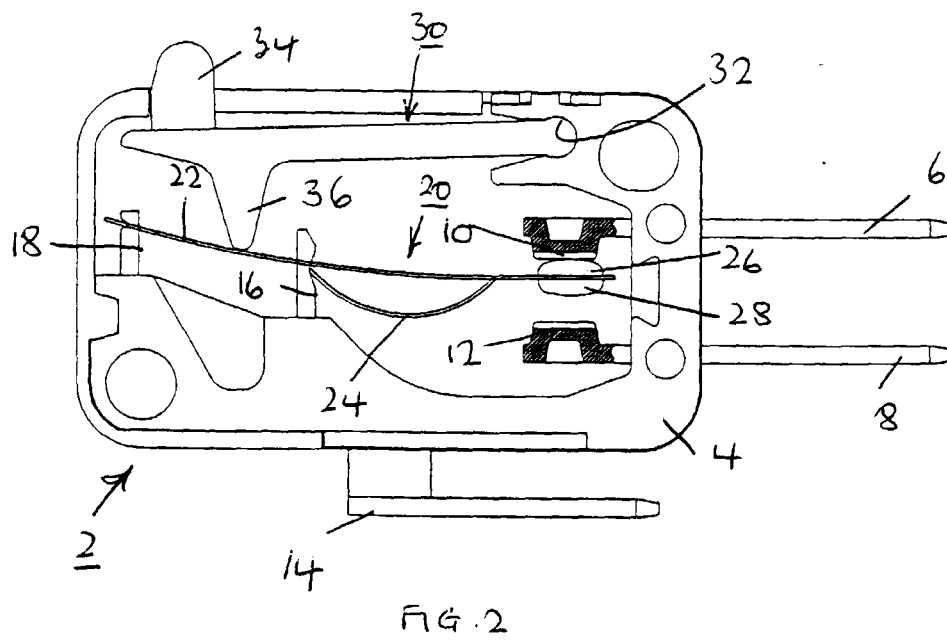
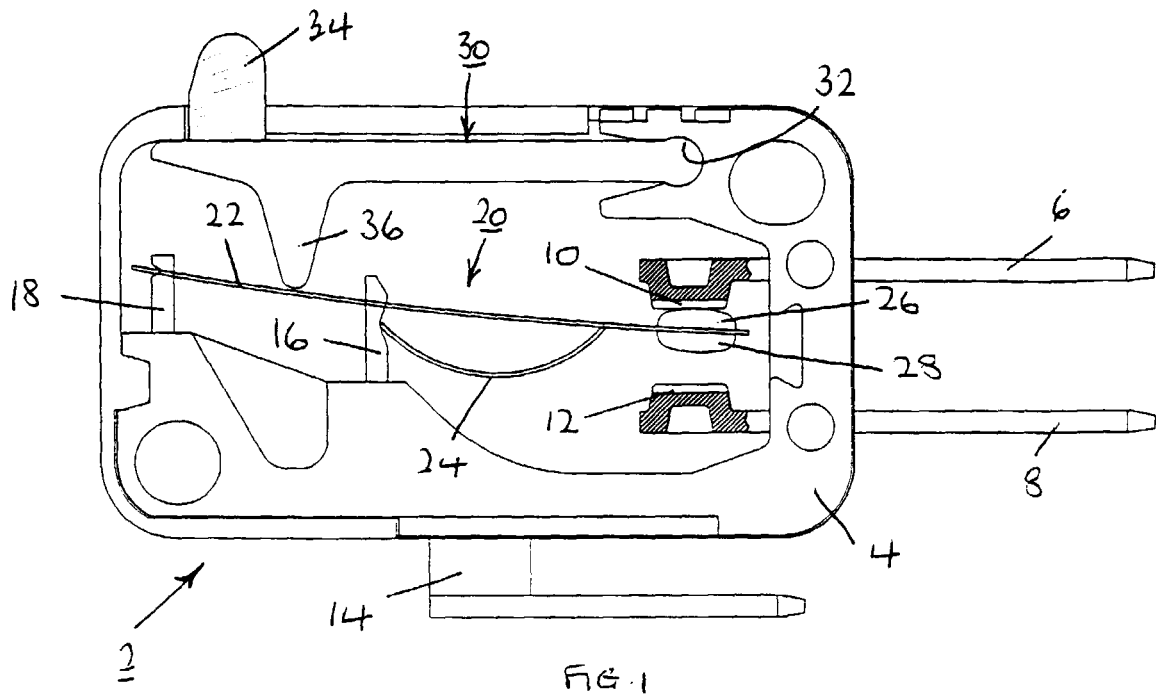
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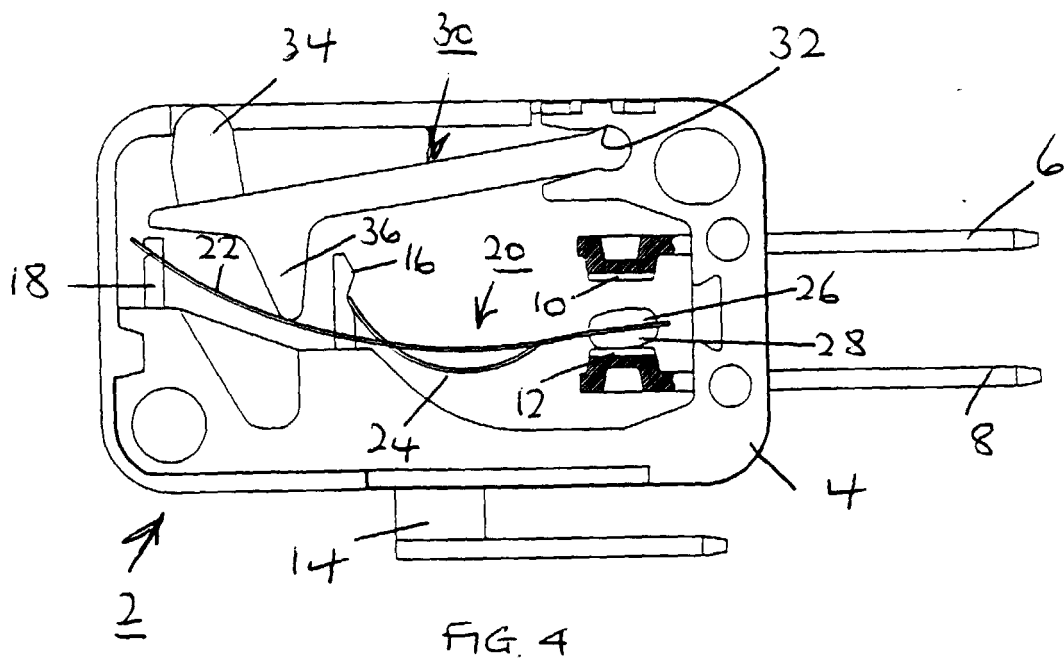
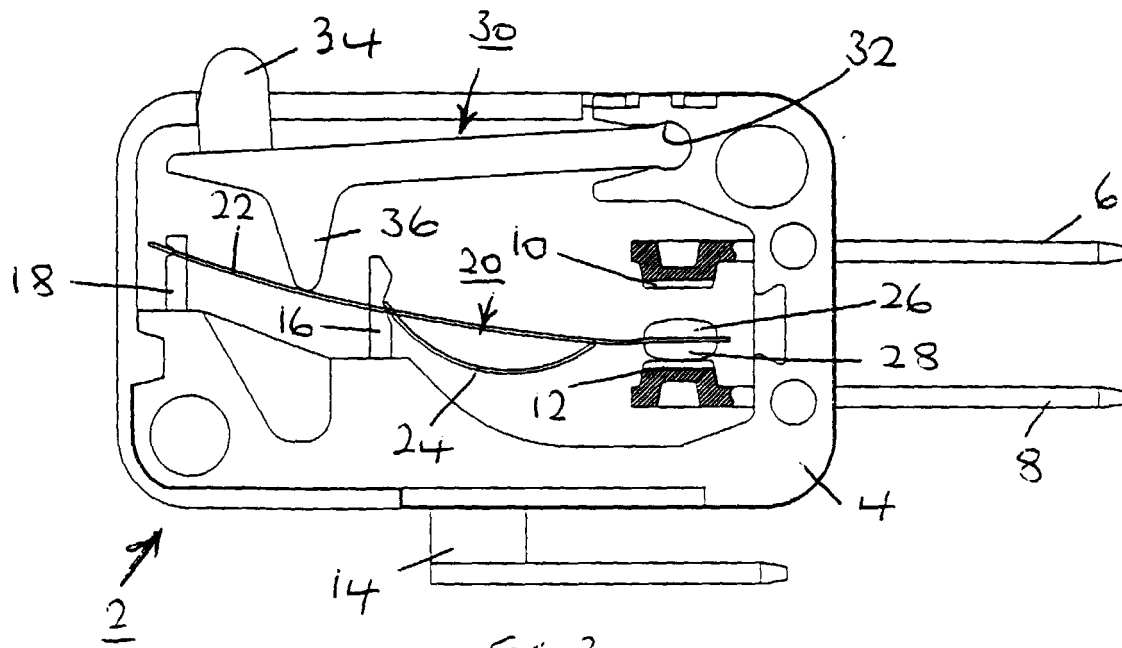
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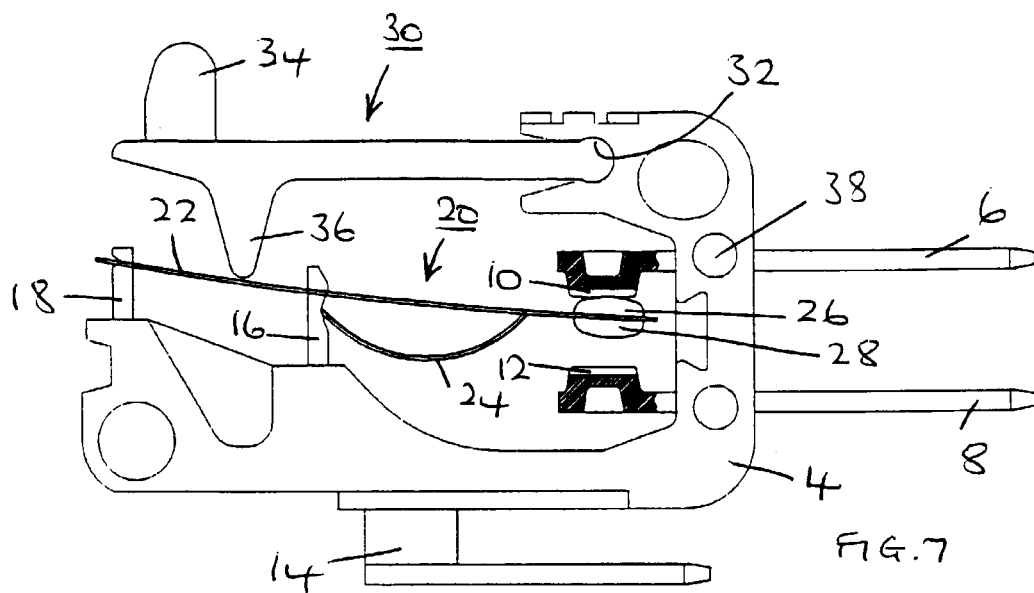
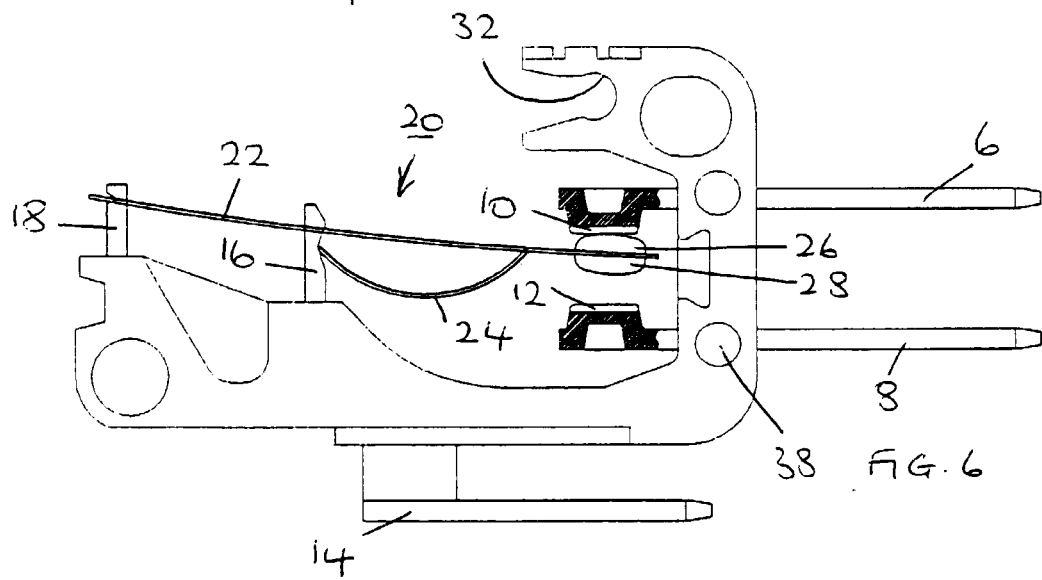
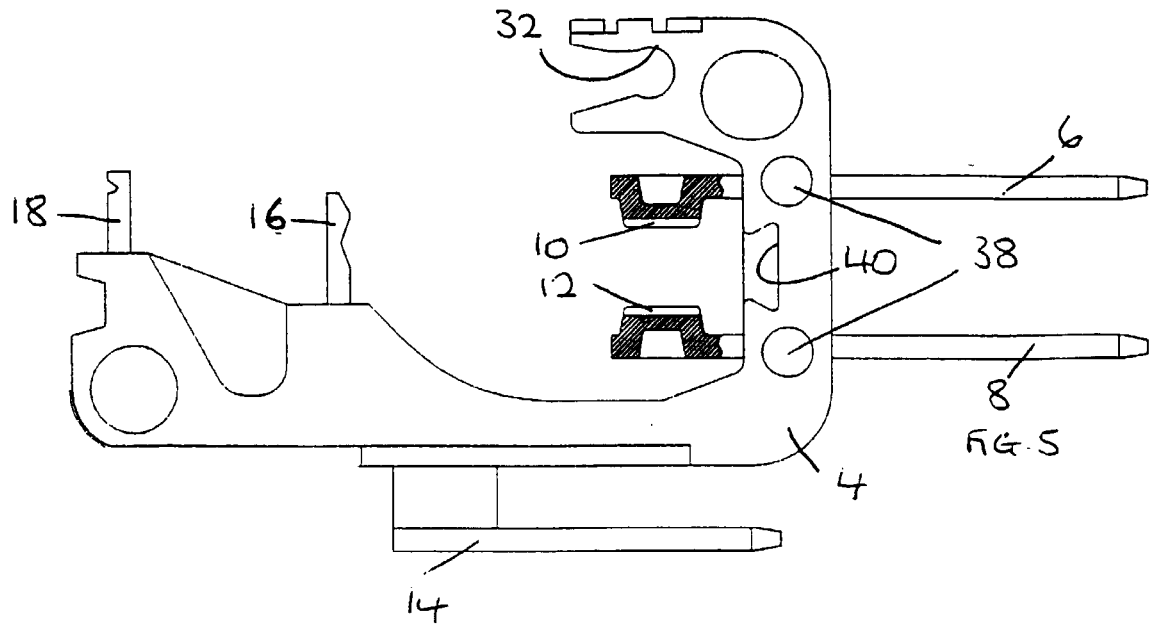
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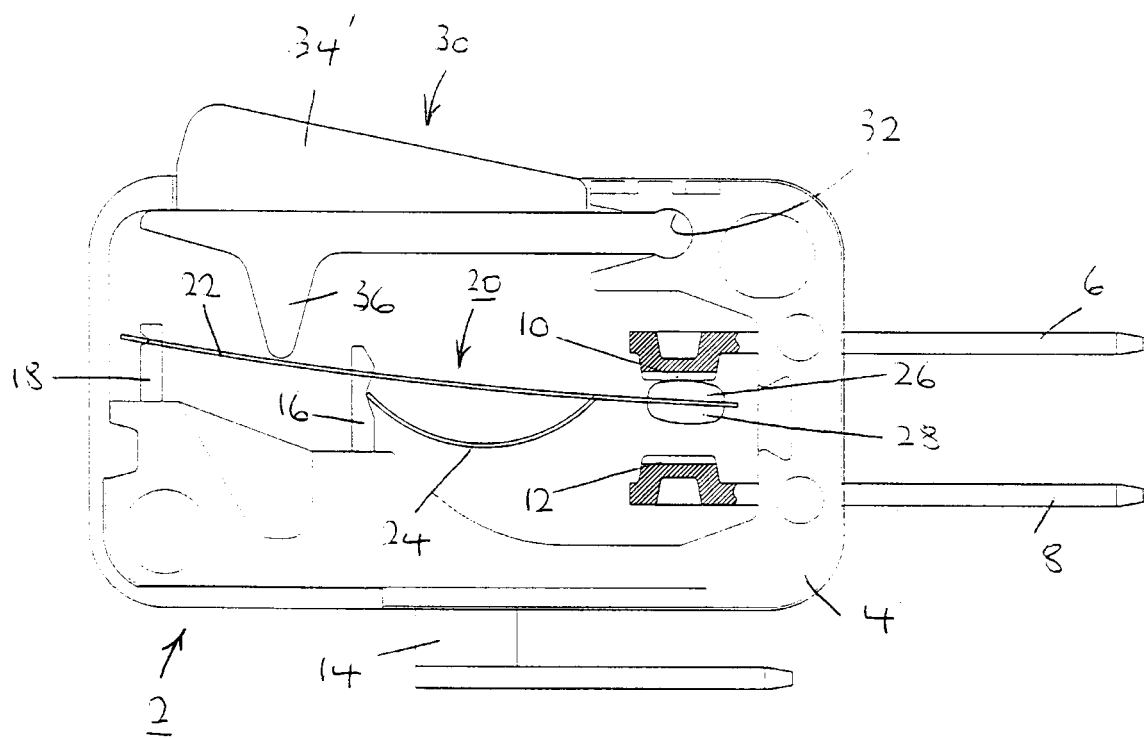


Fig. 8



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 4098

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 July 2000	Examiner Janssens De Vroom, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P4/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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